



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

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ADU & VDU TECHNICAL & OPERATION PROCESS SPECIFICATION

常减压蒸馏装置工艺技术操作规程

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2.1 新增及修改内容

2.1.1 新增内容

- 2.1.1.1 新增 3.3.5.6 条款消防专业附件。
- 2.1.1.2 新增 3.4.2.1 条款中废气排放中的加热炉烟气。
- 2.1.1.3 新增 4.1 条款：增加初馏塔底退油线。
- 2.1.1.4 新增 4.2 条款：增加常压塔退油线及常底泵备用渣油泵流程。
- 2.1.1.5 新增 4.3 条款：取消减一线、二线、三线外放单项阀。
- 2.1.1.6 新增 4.4 条款：增加轻烃回收装置稳定石脑油循环回吸收塔流程。
- 2.1.1.7 新增 4.5 条款：V-202 液位控制阀从 P426AB 入口调整至出口。
- 2.1.1.8 新增 4.6 条款：增加常三线至混合蜡油流程。
- 2.1.1.9 新增 4.7 条款：常压中段回流增加开工柴油线。
- 2.1.1.10 新增 4.8 条款：低温重污油与高温重污油之间增加跨线。
- 2.1.1.11 新增 4.9 条款：急冷油、渣油返塔流程需增加根部阀（塔壁有根部阀）。
- 2.1.1.12 新增 4.10 条款：减顶油增加至火炬凝液泵出口流程。
- 2.1.1.13 新增 4.11 条款：含烃尾气增加放空线。
- 2.1.1.14 新增 4.12 条款：加热炉瓦斯末端增加放空至火炬流程。
- 2.1.1.15 新增 4.13 条款：高温缓蚀剂注入点移至见三中返塔控制阀处。
- 2.1.1.16 新增 4.14 条款：初顶回流罐 D-202 切水增加原油带水处理流程。
- 2.1.1.17 新增 4.15 条款：常顶一级油改至稳定石脑油出装置。
- 2.1.1.18 新增 4.16 条款：初顶一级油改进常顶二级空冷。
- 2.1.1.19 新增 4.17 条款：初常顶产品罐撇悬浮物流程。
- 2.1.1.20 新增 4.18 条款：常减压装置增加含油污水撇油流程。
- 2.1.1.21 新增 4.19 条款：混合柴油调和减压渣油流程。
- 2.1.1.22 新增 4.20 条款：增加蜡油水冷器。
- 2.1.1.23 新增 4.21 条款：燃料油并至混合柴油。

2.1.2 修改内容

- 2.1.2.1 修改 3.1.1 条款中对于安全要求的规定。

- 2.1.2.2 修改 3.1.2 条款中对于防止中毒窒息的安全规定。
- 2.1.2.3 修改 3.1.3 条款中对于防止硫化氢中毒的安全规定。
- 2.1.2.4 修改 3.1.4 条款中对于防止静电危害的规定。
- 2.1.2.5 修改 3.1.5 条款中对于液化石油气的安全规定。
- 2.1.2.6 修改 3.1.6 条款中对于操作技术安全的规定。
- 2.1.2.7 修改 3.2 条款中对于设备安全技术的规定。
- 2.1.2.8 修改 3.3.1.1 条款中火灾的定义及分类，新增第五类电气火灾等。
- 2.1.2.9 修改 3.4.1.4 条款中高浓度污水排污要求。
- 2.1.2.10 修改 3.4.2.5 条款中废气排放管理要求。
- 2.1.2.11 修改 3.4.3.1 条款中废固排放管理要求。
- 2.1.2.12 修改 3.6.1 条款中对于停工期间安全注意事项有关管理要求。
- 2.1.2.13 修改 3.6.2 条款中对于停工期间环保注意事项有关管理要求。
- 2.1.2.14 修改 3.6.3 条款中对于重要岗位安全环保注意事项有关管理要求。

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1 Technical & Operation Process Specification 工艺技术规程

1.1 Overview to process unit 装置概况

1.1.1 Brief description to process unit 装置简介

1.1.1.1 Basic information of process unit 装置基本概况

As one of the main process units for Project Phase I, the Atmospheric Distillation and Vacuum Distillation is intended to process the mixed crude of condensate 1#, Brunei light oil, condensate 2# and Qatar oil (in 100:300:70:330), it is designed in a capacity of 8,000kt/a and an on-stream availability of 8,400 h/a. And the Atmospheric Distillation Unit (ADU) is designed in an operation flexibility of 60% to 110%, and the Vacuum Distillation Unit (VDU) is designed in an operation flexibility of 60-120% (based on the vacuum feed, i.e., 2,235.1 ktpa).

本装置是恒逸实业（文莱）有限公司一期主体装置之一，设计加工凝析油 1、文莱轻油、凝析油 2 和卡塔尔混合原油（比例 100:300:70:330），设计年加工能力 800 万吨/年，设计年开工时数 8400 小时，常压蒸馏操作弹性为 60%~110%，减压蒸馏操作弹性为 60~120%（基于减压进料，即 223.51 万吨/年）。

The basic engineering design for the process unit is completed by Sinopec Engineering Incorporation (SEI) and detailed engineering design is completed by Sinopec Luoyang Engineering Co., Ltd. (LPEC).

本装置由中国石化工程建设有限公司（简称 SEI）完成基础设计，由中国石化洛阳工程有限公司（LPEC）完成详细设计。

The process unit mainly consists of crude desalter system, heat exchange system, heater system, atmospheric distillation and vacuum distillation systems. The crude is desalted and sent into the atmospheric and vacuum distillation systems to produce naphtha, jet kerosene, diesel VGO, and vacuum residue (VR) that are used as feedstocks to CCR Pre-hydrogenation Unit, Kerosene Hydrofining Unit, Diesel Hydrofining Unit, Hydrocracking Unit and Flexicoking Unit respectively.

本装置主要由原油电脱盐系统、换热网络系统、加热炉系统、常压蒸馏和减压蒸馏组成，原油经电脱盐脱除盐分以后，分馏出石脑油、航煤、柴油、蜡油和减压渣油等，分别作为重整预加氢、航煤加氢、柴油加氢、加氢裂化、灵活焦化等装置原料。

1.1.1.2 Process route selection and features 工艺路线的选择和特点

The process route is selected and optimized based on basic engineering design completed by

Sinopec Engineering Incorporation (SEI), the plant-wide process flow, product mix and product quality requirements.

本装置由中国石化工程建设有限公司（SEI）完成装置的基础设计，根据全厂总流程规划，结合生产方案和产品质量要求，进行工艺路线选择与优化。

(1) Considering the properties of the crudes and highlighting the principles to reduce footprint, a two-stage high-speed electric desalter system is employed, and it is very flexible to light crudes, and it occupies less footprint so as to facilitate layout. However, it has great restrictions if the properties of the crudes greatly change, and heavy oil, high acid crude or slop is used as the feedstock.

根据原油性质和减少占地原则，电脱盐采用二级高速电脱盐，高速电脱盐对于轻质原油具有较高的适应能力，占地面积小，有利于现场布局，但是对于原油性质变化较大，加工重油、高酸原油，回炼污油等有较大限制。

(2) The main process flow includes: the Pre-dist column - atmospheric heater - Atm. - vacuum heater - Vac. column.

主流程采用-初馏塔-常压炉-常压塔-减压炉-减压塔的流程。

(3) Deep lift technology developed by SEI is used for VDU, the bottom of the Vac. column. 减压蒸馏采用 SEI 深拔技术，减压塔塔底吹汽。

(4) Vapor-liquid flow crossovers are employed for the Pre-Dist. and the Atm. to solve the thermal stress compensation and sloshing (shocking) issue of the large size two-phase flow high temperature piping.

采用汽液两相流动的初馏塔转油线和常压塔转油线，解决大型两相流高温管道的热应力补偿和晃（震）动问题。

(5) Proprietary Vac. column OVHD vapor desulfurization technology developed by SEI is employed, and the desulphurization gas is used as the fuel for the Atm. heater.

减压塔塔顶气采用 SEI 专有技术-减压塔顶气常压脱硫技术，脱硫后作为常压炉的燃料。

(6) Plate columns are used as the Atm. and the Pre-dist column, and full packing column is used as the Vac. column where 6 directional fixed trays are installed at the bottom of the column. 常压塔和初馏塔采用板式塔，减压塔采用全填料塔，减压塔底设有 6 层固舌塔盘。

(7) A combined steam injector and water ring vacuum pump configuration is employed for the Vac. column, and high efficiency condenser is provided at the top of the Vac. column to ensure cooling effect.

减压抽真空采用蒸汽抽真空和水环抽真空组合抽真空技术，塔顶采用高效冷凝器保证冷却效果。

(8) The process unit is designed to process light crude, the yield of naphtha exceeds 26%. A large amount of low-temperature materials increases the difficulty for heat recovery. The plant-wide energy utilization and analysis technology developed by SEI is employed to optimize the heat exchange system, and the design final heat exchange temperature is 285 °C.

本装置加工轻质原油，石脑油的收率超过了 26%，大量的低温物料为热量的回收增加了难度，本装置能量回收采用 SEI 全装置能量利用系统综合分析技术，对换热网络进行优化，设计换热终温为 285°C。

(9) An OVHD two-stage condensing system is designed respectively for the Atm. and the Pre-dist column, and OVHD hot reflux is also designed for the two columns.

常压塔塔顶和初馏塔塔顶均采用两段冷凝，塔顶采用热回流。

(10) Light diesel and heavy diesel are combined and then used as the feedstock to Diesel Hydrofining Unit. As the separation precision is not high, the heavy diesel and Atm. PA2# are drawn from the same tray for the purposes of reducing energy consumption and the height of the Atm..

常二线 and 常三线合并作为柴油加氢原料，分离精度需求不高，从节能和降低常压塔高度考虑，常三线 and 常二中从同一塔盘采出。

(11) In order to achieve high-precision separation of jet kerosene and naphtha, the kerosene stripper is equipped with a reboiler where the Atm. PA2# is used as the heat source.

为实现航煤组分和石脑油的高精度分离，常一线汽提塔设置了重沸器，采用常二中作为重沸器热源。

(12) The products produced from this process unit such as the naphtha, jet kerosene, diesel, gas oil and residues are directly sent into the downstream process units in hot state so as to achieve heat integration among process units.

本装置物料与下游装置主要采用热直供的形式进行供料，稳定石脑油、航煤、柴油、蜡油、渣油等直供二次加工装置，最大限度实现装置之间的热联合。

(13) Air preheater is designed for the heaters. Plate type preheater is used for the high temperature section of the air preheater to reduce the cost, and cast iron plate type preheater is used for the low temperature section of the air preheater to improve the resistance against dew point corrosion.

加热炉设置空气预热器，空气预热器高温段采用板式预热器，降低成本，低温段采用铸铁板式，以提高预热器抗露点腐蚀的能力。

(14) A large number of air coolers are used for the process unit to reduce CCW demand.

本装置大量采用空冷器，以降低装置循环水使用量。

(15) Treated process water from the Sour Water Stripping Unit is used for the desalters to reduce plant-wide water demand.

电脱盐注水采用酸水汽提后的净化水，降低全厂取水量。

1.1.2 Process principles 工艺原理

Distillation is a typical operation for separating liquid mixtures. In this operation, the liquid mixture is heated to partially vaporize, and the separation is performed by utilizing the characteristics of different volatilities of the components in the distillation column, or in other words, the boiling points of the components are used to achieve separation.

蒸馏是分离液体混合物的典型单元操作。这种操作是将液体混合物加热使之部分汽化，在蒸馏塔内利用混合物各组分挥发度不同的特性来实现分离的目的，或者通俗地说是利用其中各组分沸点不同的特性来实现分离。

Crude is a mixture of complex components with different boiling points. The atmospheric and vacuum distillation refers to a process of "cutting" crude into different distillates based on the boiling points of the components in the crude under atmospheric pressure and vacuum conditions. The same volume of distillate may have different boiling ranges, and distillates with different boiling ranges are referred to as fractions. The fraction distilled at a certain temperature is also a mixture, for example, the naphtha fraction distilled at temperature $<200^{\circ}\text{C}$, the diesel fraction distilled at temperature of 200°C to 350°C , and so on. The temperature at which the distillate starts to vaporize is called the "initial boiling point", and the temperature at which 10% of the total volume is distilled out is called "10% point" as so 30%, 50%, 70%, 90%, 95% (98%) points until the mixture is completely vaporized and only non-vaporizable material is left, at which time the temperature is called "dry point" or "end boiling point". The temperature range from initial boiling point to dry point is known as "distillation range".

原油是不同沸点的复杂组分组成的混合物，常减压蒸馏是指在常压和真空状态下，根据原油中各组分的沸点不同，将原油“切割”成不同馏出物的工艺过程。馏出同样体积的馏出物可以有不同的沸点范围，不同沸点范围的馏出物称为馏分。在一定温度下蒸馏出来的馏分也是混合物，例如 $<200^{\circ}\text{C}$ 的石脑油馏分、 $200^{\circ}\text{C}\sim 350^{\circ}\text{C}$ 的柴油馏分等。将馏分油开始汽化的温度称为“初馏点”，蒸出总体积的 10% 时的温度称之为“10% 点”，同样确定 30%、50%、70%、90%、95%（98%）点，直至混合物全部蒸干，只剩下不可汽化的物质，此时温度称为“干点”或“终馏点”。从初馏点到干点这一温度范围称为“馏程”。

The atmospheric and vacuum distillation unit is the first process for a refinery, and it normally includes three sections: electric desalting, atmospheric distillation and vacuum distillation. Atmospheric distillation unit is normally operated to produce feedstock to CCR, kerosene (or jet kerosene to Kerosene Hydrofining Unit), light diesel and heavy diesel. The vacuum distillation unit is operated to produce several lube oil fractions, and feedstocks to FCC Unit or HC Unit, and the vacuum residue can be used for different purposes based on the plant-wide process flow, for example, it can be used as feedstock to Solvent Deasphalting Unit, Coking Unit, Visbreaking Unit or Flexicoking Unit, or it can be directly exported as fuel oil.

常减压蒸馏装置是原油加工的第一道工序，它一般包括电脱盐、常压蒸馏和减压蒸馏三部分。常压蒸馏一般可以切割出重整原料、煤油（或航煤原料）、轻柴油、重柴油等产品，在减压蒸馏中可以切割出几个润滑油馏分、催化裂化或加氢裂化原料，剩下的减压渣油根据生产总流程的安排可有不同用途，如用做溶剂脱沥青原料、焦化、减粘裂化、灵活焦化原料，或直接出厂做燃料油。Based on different product mixes, the atmospheric and vacuum distillation unit can be divided into fuel type, fuel-lube oil type and fuel-chemical type. There is no essential difference in the process for these three different type process units, but there are some differences in the number of sidestreams and the accuracy of distillation. The fuel-lube oil type atmospheric and vacuum distillation unit is designed with many sidestreams, the products are required to be stripped, and the process flow is more complex, while the process flows for fuel type and the fuel-chemical type process units are relatively simple.

根据目的产品的不同，常减压蒸馏装置可分为燃料型、燃料-润滑油型和燃料-化工型三种类型。

这三者在工艺过程上并无本质区别，只是在侧线数目和分馏精度上有些差异。燃料-润滑油型常减压蒸馏装置因侧线数目多且产品都需要汽提，流程比较复杂；而燃料型、燃料-化工型则较简单。

1.1.2.1 Work principle for desalter 电脱盐原理

Crude is extracted from underground, which contains water, salts, mechanical impurities and etc. If water enters the distillation column, it will affect the energy consumption and product quality of the process unit, and they may cause column flooding. If salts enter the distillation system, they will be hydrolyzed to form HCl, resulting in corrosion in the column OVHD condensing system. And salts in the residue will affect the activity of catalyst in the downstream FCC Unit, and even catalyst poisoning. If mechanical impurities enter the subsequent heat exchange systems, they will cause fouling of the heat exchanger, effecting the heat transfer performance. The desalter is main served for dehydration, desalting and removal of mechanical impurities.

原油采自地下，其中含有水分、盐分、机械杂质等，水分进入分馏塔会轻则影响装置能耗、产品质量，重则引起冲塔等事故。盐分进入分馏系统水解生成 HCl，对塔顶冷凝冷却系统形成腐蚀，残留在渣油中会影响下游催化裂化装置的催化剂活性，甚至中毒。机械杂质进入后续换热系统会引起换热器结垢，影响换热效果。电脱盐主要起到脱水、脱盐、脱机械杂质的作用。

The water in the crude exists mainly in a form of a water-in-oil emulsion. There are three main conditions for formation of crude-water emulsion: 1) Two incompatible phases (oil phase and water phase); 2) Other emulsifiers (mechanical impurities such as sand and mud, asphaltenes and resins, oilfield additives added during crude extraction); and 3) Strong mechanical agitation (during crude extraction and transportation). The salts in the crude mainly include the salts dissolved in water and the salts carried by solid impurities. The work principle of desalter is to break the crude emulsion by water and demulsifier injection and under the action of electric field to separate the crude and water, so as to achieve the purpose of dehydration and salt removal.

原油中的水分主要以油包水型乳化液的形式存在，油水乳化液形成主要有三个条件：一是有互不相容的两相（油相和水相）；二是有乳化剂（泥沙等机械杂质、沥青质和胶质、原油开采加入的油田助剂等）；三是较强的机械搅拌作用（原油的开采和输送）。原油中的盐分主要溶解在水中，以及固体杂质等携带部分盐分。电脱盐的原理就是在注水及破乳剂、电场的作用下，破除原油乳状液，使原油和水分离，从而达到脱水、脱盐的目的。

After crude is heat exchanged, it is sent into the desalter where demulsifier and wash water have already been injected. The crude, demulsifier and wash water are mixed by appropriate agitation, and then the mixture is sent into the electric field. Compared with the emulsifier, the demulsifier has higher activity, lower surface tension and wetting effect, it can enter the crude-water interface to replace the emulsifier and reduce the stability of the crude-water interface film. The water droplets in the crude are polarized by the electric field, and the adjacent water droplets are charged by polarization. The polarized water droplets are fused into large water droplets under the actions of "dipole accumulation", "electrophoresis accumulation" and "oscillation accumulation". Crude and water are separated by the difference in specific gravities of crude

and water, and the salts in the crude are thus removed together with the water.

原油经换热后进入电脱盐罐，进入电脱盐罐前注入破乳剂和洗涤水，通过适宜的搅拌，使原油与水、破乳剂等充分混合进入电场。破乳剂具有比乳化剂更高的活性、更低的表面张力及润湿作用，能够进入油水界面，替代乳化剂，降低油水界面膜的稳定性。油中的水滴在电场的作用下极化，相邻的水滴之间因极化而带电，被极化的水滴在“偶极聚积”、“电泳聚积”和“振荡聚积”等作用下，融合成较大的水滴，借助油水比重差使油水分层，油中的盐随水一起脱去。

The operation performance of the desalter depends on the coalescence force and settling velocity of the water droplets.

电脱盐运行的好坏取决于水滴的聚结力和沉降速度。

The coalescence force of water droplets is expressed by the following formula:

水滴的聚结力由下式表达：

$$F = 6KE^2r^2\left(\frac{r}{L}\right)^4$$

Where: F- coalescence force between water droplets, N

式中：F-水滴间的聚结力，N

K-crude dielectric constant, N/m

K-原油介电常数，N/m

E-electric field strength, V/cm

E-电场强度，V/cm

R-water droplet radius, cm

r-水滴半径，cm

L-center distance between water droplets, cm

L-水滴间的中心距离,cm

The settling velocity of the water droplets is derived from Stoke's law:

水滴沉降速度由斯托克定律得出：

$$\mu = \frac{d^2 \times (\rho_1 - \rho_2) \times g}{18 \times \nu \times \rho_2}$$

Where: μ -settling velocity of the water droplets, m/s

其中： μ -水滴沉降速度，m/s

D-water droplet diameter, m

d-水滴直径，m

ρ_1 -specific gravity of water

ρ_1 -水的比重

ρ_2 -specific gravity of crude

ρ_2 -油的比重

ν - crude viscosity, mm²/s

ν -原油粘度 mm²/s

G-gravity acceleration m/s²

g-重力加速度 m/s^2

From the coalescence force formula and Stoke's law, there are several factors affecting the operation performance of the desalter:

从水滴聚结力公式和斯托克定律来看，对电脱盐影响有以下几项因素：

(1) The electric field strength: it is mainly determined by the voltage applied between the electrode plates.

电场强度，主要由加在电极板之间的电压决定。

(2) The amount of water injected: that is, the proportion of water injection. It mainly affects the diameter of the water droplets and the center distance between the water droplets. The higher the proportion of water injection is, the greater the density of water droplets dispersed in the crude, the smaller the distance between the water droplets and the larger the water droplets will be.

注水量的大小，即注水比例。主要是影响水滴直径和水滴间的中心距离。注水比例越高，分散在原油中的水滴分布密度越大，水滴之间的距离越小，形成的水滴就越大。

(3) Crude and water density difference. The greater the crude and water density difference is, the faster the settling speed of water droplets and the better the separation of water droplets will be.

油水密度差。油水密度差越大，水滴的沉降速度越快，越有利于水滴的分离。

(4) Crude density and viscosity: the smaller the crude density and the lower the crude viscosity are, the better the separation of crude and water will be.

原油的密度和粘度，原油密度越小、粘度越低，越有利于油水分离。

(5) Desalter operating temperature Desalter operating temperature mainly affects the crude and water density difference and the crude viscosity. For most crudes, the higher the desalter operating temperature is, the greater the crude and water density difference and the lower the crude viscosity will be.

电脱盐温度。电脱盐温度主要影响油水密度差和原油粘度。对于绝大部分原油，电脱盐温度越高，油水密度差越大，原油的粘度越低。

At present, there are two commonly used desalter technologies: high-speed desalter technology and low-speed desalter technology. Low-speed desalter technology mainly includes AC desalter technology, AC/DC desalter technology, and squirrel cage electrode desalter technology. Among them, AC/DC desalter technology is the most widely used and mature technology. High-speed desalters are proposed for the process unit.

目前应用较为广泛的电脱盐技术有两大类：高速电脱盐技术和低速电脱盐技术。低速电脱盐技术主要有交流电脱盐技术、交直流电脱盐技术、鼠笼式电脱盐技术，其中目前应用最广泛和成熟的电脱盐技术为交直流电脱盐技术。本装置全部采用高速电脱盐技术。

1.1.2.2 Process principles for atmospheric distillation system 常压蒸馏原理

The atmospheric distillation is intended to cut the crude into gasoline, kerosene and diesel via distillation under atmospheric conditions and produce on-spec gasoline, kerosene, diesel and

feedstock to HC Unit.

常压蒸馏的目的主要是通过精馏过程，在常压条件下，将原油中的汽、煤、柴油馏份切割出来，生产合格的汽油、煤油、柴油及部分裂化原料。

Atmospheric distillation is a crude distillation process in nature.

常压蒸馏的原理即为油品精馏原理。

Distillation principle: a phase equilibrium separation process, its important theoretical basis is the vapor-liquid phase equilibrium principle, that is, Raoult's law.

精馏原理：一种相平衡分离过程，其重要的理论基础是汽-液相平衡原理，即拉乌尔定律。

$$P_A = P_{AO} X_A \quad P_B = P_{BO} X_B = P_{BO} (1 - X_A)$$

where,

式中：

P_A, P_B - saturated vapor pressure of components A and B above the solution.

$P_A、P_B$ ——溶液上方组份 A 及 B 的饱和蒸汽压。

P_{AO}, P_{BO} - saturated vapor pressure of pure components A and B.

$P_{AO}、P_{BO}$ ——纯组份 A 及 B 的饱和蒸汽压。

X_A, X_B - mole fraction of components A and B in the solution.

$X_A、X_B$ ——溶液中组份 A 及 B 的摩尔分率。

This law indicates that, at a certain temperature, for an ideal solution composed of components having similar properties and similar molecular sizes (such as methanol or ethanol), the partial pressure of any component in the vapor above the solution is equal to the saturated vapor pressure of this pure component at this temperature multiplying its mole fraction in solution.

此定律表示在一定温度下，对于那些性质相似，分子大小又相近的组份（如甲醇、乙醇）所组成的理想溶液中，溶液上方蒸汽中任意组份的分压，等于此纯组份在该温度下的饱和蒸汽压乘以它在溶液中的摩尔分率。

The distillation process is conducted in a distillation column equipped with many trays. Steam is introduced into the bottom of the column, and column OVHD reflux system is designed. The crude from the heater is sent into the vaporization section of the column in a vapor-liquid mixture state where it is subject to Pre-Dist. vaporization for vapor-liquid separation. The unvaporized heavy oil flows to the bottom of the column, where the light components contained are further distilled off by stripping. The oil vapor rising from the vaporization section is in full contact with the descending liquid reflux on the tray, the heavier components in the vapor phase are condensed, and the lighter components in the liquid phase are vaporized. Therefore, the content of the volatile components in the oil vapor will be partially vaporized by the liquid, so that the volatile components in the liquid phase increases as they diffuse into the vapor phase; the content of the non-volatile components in the oil vapor is partially condensed by the vapor, so that the non-volatile components in the vapor phase increases as they diffuse into the liquid phase. Thus, the vapor phase and liquid phase that contact with each other on the same layer tend to balance. The relation between them can be illustrated by Raoult's law. Distillation can be achieved through many times of such mass and heat exchange.

精馏过程是在装有很多塔盘的精馏塔内进行的。塔底吹入水蒸汽，塔顶有回流。经加热炉加热的原料以汽液混合物的状态进入精馏塔的汽化段，经一次汽化，使汽液分开。未汽化的重油流向塔底，通过提馏进一步蒸出其中所含的轻组份。从汽化段上升的油汽与下降的液体回流在塔盘上充分接触，汽相部分中较重的组份冷凝，液相部分中较轻的组份汽化。因此，油汽中易挥发组份的含量将因液体的部分汽化，使液相中易挥发组份向汽相扩散而增多；油汽中难挥发组份的含量因汽体的部分冷凝，使汽相中难挥发组份向液相扩散而增多。这样，同一层板上互相接触的汽液两相就趋向平衡。它们之间的关系可用拉乌尔定律说明。通过多次这样的质量、热量交换，就能达到精馏目的。

The following figure illustrates the detailed process of vapor-liquid phase exchange on one same tray.

以下是一层塔盘上汽-液交换的详细过程。

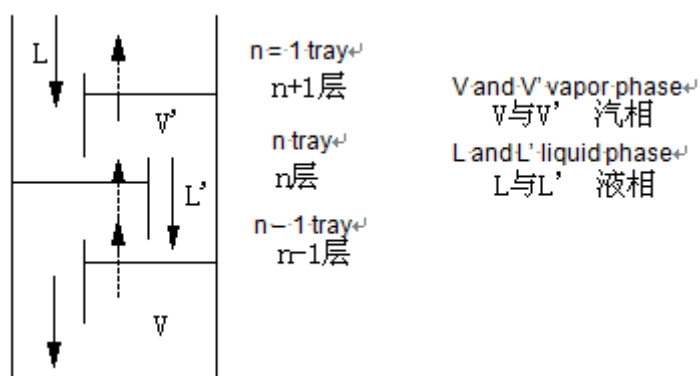


Figure 1 Simplified Process for Vapor-liquid Phase Exchange

图 1 汽-液交换过程简图

As shown in the figure, when the oil vapor (V) rises to No. n tray, it meets the reflux liquid (L) from No. (n+1) tray. As the temperature of the rising oil vapor is high, and the temperature of the descending reflux is low, the high temperature oil vapor is exothermic when it comes into contact with the low temperature reflux, so that the high boiling components contained in the oil vapor are condensed. At the same time, the low temperature reflux absorbs heat and vaporizes the low boiling point components contained in the reflux. Thus, the high boiling point components condensed in the oil vapor and the unvaporized reflux constitute a new reflux (L'). High boiling point components contained in the reflux from No. n tray to No. (n-1) tray are more than those contained the reflux flowing down to No. n tray, while the low boiling point components contained in the oil vapor rising to No. (n+1) tray are more than those contained in the oil vapor rising to No. n Tray.

如图所示，当油汽（V）上升至 n 层塔盘时，与从（n+1）层塔盘下来的回流液体（L）相遇，由于上升的油汽温度高，下流的回流温度较低，因此高温的油汽与低温的回流接触时放热，使其中高沸点组份冷凝。同时，低温的回流吸热，并使其中的低沸点组份汽化。这样，油汽中被冷凝的高沸点组份和未被汽化的回流组成了新的回流（L'）。从 n 层下降为（n-1）层的回流中所含高沸点组份要比降至 n 层塔盘的回流中的高沸点组份含量多，而上升至（n+1）层塔盘的油汽中的低

沸点组份含量要比上升至 n 层的油气中低沸点组份含量多。

Similarly, the oil vapor leaving No. (n+1) tray is also subjected to heat and mass exchange with the reflux from No. (n+2) tray. The feedstock is subject to a slight separation on each tray. Obviously, if there are a large number of trays, the feedstock can be separated into products in high purity.

同样类似地离开 (n+1) 层塔盘的油气, 还要与 (n+2) 层下来的回流进行热量、质量交换。原料在每一块塔盘上就得到一次微量的分离。显然, 如果有极多个塔盘的话, 使原料能分离出纯度很高的产品。

A complete distillation column normally consists of three sections: the upper section is the distillation section, the middle section is the vaporization section, and the lower section is the stripping section.

一个完整的精馏塔一般包括三部分: 上段为精馏段, 中段为汽化段, 下段为提馏段。

1.1.2.3 Process principles for vacuum distillation system 减压蒸馏原理

The vacuum distillation system consists of a Vac. column and an OVHD vacuuming system, it is operated to further cut the gas oil fraction from the atmospheric residue by distillation under vacuum condition so as to produce on-spec feedstock to HC Unit.

减压系统分减压塔和塔顶抽真空系统, 其目的主要是通过精馏过程, 在减压条件下, 进一步将常压渣油中的蜡油馏份切割出来, 生产合格的裂化原料。

(1) Process principles for vacuum distillation

减压蒸馏原理

At a certain temperature, the liquid is in equilibrium with the vapor on its liquid surface, whereby the pressure generated by the vapor is called the saturated vapor pressure that indicates the ability of the molecules in the liquid to vaporize or evaporate away from the liquid. The higher the vapor pressure is, the easier the liquid is to vaporize. The vapor pressure is related to the nature of the material such as molecular weight, chemical structure and also the temperature of the system. For organic compounds, the Antoine equation is often used to calculate the vapor pressure:

在某一温度下, 液体与在其液面上的蒸汽呈平衡状态, 由此蒸汽所产生的压力称为饱和蒸汽压, 蒸汽压的高低表明了液体中的分子离开液体汽化或蒸发的能力, 蒸汽压越高, 就说明液体越容易汽化。蒸汽压的大小与物质的本性如分子量、化学结构等有关, 同时也和体系的温度有关, 对于有机化合物常采用安托因方程式计算:

$$\ln p_{io} = \frac{A_i - B_i}{T + C_i}$$

Where: P_{i0} - vapor pressure of component i

式中: P_{i0} ——i 组份的蒸汽压

T- system temperature

T——系统温度

It can be seen from the above formula that the vapor pressure decreases as the temperature decreases, or the boiling point decreases as the system pressure decreases. Crude is a complex mixture with a wide boiling range. For most crudes in China, the fractions in boiling points within 350-500 °C accounts for about 50% of the total distillate. Crude is easily decomposed under heating conditions, the color of the oil will become darker and the gum content will be increased. Generally, the heating temperature should not be too high. For atmospheric distillation, the heater outlet temperature shall not exceed 370 ° C so as to ensure the product quality, but it is difficult to distillate the fractions in boiling points within 350-500 ° C under atmospheric conditions. However, under vacuum conditions, as the system pressure is lowered, the boiling point of the oil is also lowered, the oil in a higher boiling point can be distilled out at a lower temperature. Therefore, the atmospheric residue is sent into the Vac. column to further lift off the heavier components to increase the product yield and achieve deep lift.

根据上式可以看出，蒸汽压随温度的降低而降低，或者说沸点随系统压力降低而降低。石油是沸程范围很宽的复杂混合物，对我国多数原油来说，其中沸点在 350~500°C 馏份占总馏出物的 50% 左右。油品在加热条件下容易受热分解而使油品颜色变深，胶质增加，一般加热温度不宜太高，在常压蒸馏时，为保证产品质量，炉出口温度一般不超过 370°C，对于 350~500°C 的馏份在常压条件下难以蒸出。但是在真空条件下，由于系统压力降低，油品的沸点也随之降低，因此可以在较低的温度下将沸点较高的油品蒸出，所以对原油进行常压分馏后的油品进行减压分馏，可以进一步将原油中的较重组份拔出，从而提高收率，达到深拔的目的。

(2) Vacuum system

抽真空系统原理

The vacuuming equipment employed in the process unit includes steam ejectors (steam ejection pumps) and mechanical vacuuming equipment (water ring vacuum pump).

本装置采用的抽真空设备包括蒸汽喷射泵和机械抽真空（水环真空泵）。

1) Work principle of steam ejector

蒸汽喷射泵的原理

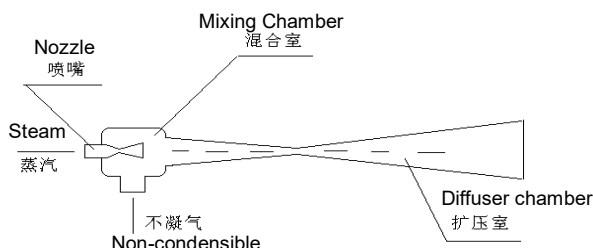


Figure 2 Schematic Diagram of Steam Ejector

图 2 喷射式蒸汽抽真空器原理示意图

When the working steam passes through the Laval nozzle, the flow speed is continuously increased, and the pressure energy is converted into kinetic energy. The steam obtains a very high velocity (1000 to 1400 m/s) at the nozzle outlet, so that the pressure drops sharply and a high vacuum is formed around the nozzle. In the vacuum section, the non-condensable in the

column is sucked into the mixing chamber to mix with the steam and exchange energy, and then enters the diffuser chamber together with the steam. The working steam is decelerated, the non-condensable is accelerated, and finally, the speed of the working steam and the speed of non-condensable get identical. In the rear part of the diffuser, the kinetic energy is converted into pressure energy, the flow speed of the mixed gas is lowered, and the pressure of the mixed gas is increased until the specified discharge pressure is reached.

工作蒸汽经过拉伐尔型（扩缩）喷嘴时流速不断增加，压力能转换为动能。蒸汽在喷嘴出口处可达到极高的速度（1000~1400m/s），因而压力急剧下降，在喷嘴周围形成高度真空。在真空部位，塔内不凝气被吸入混合室与蒸汽混合并进行能量交换，然后一起进入扩压室。工作蒸汽减速，不凝气加速，最后两者速度一致。在扩压管后部动能又转变为压力能，混合气体的流速降低，压力升高直至能满足排出压力的要求。

2) Work principle of mechanical vacuuming equipment

机械抽真空原理

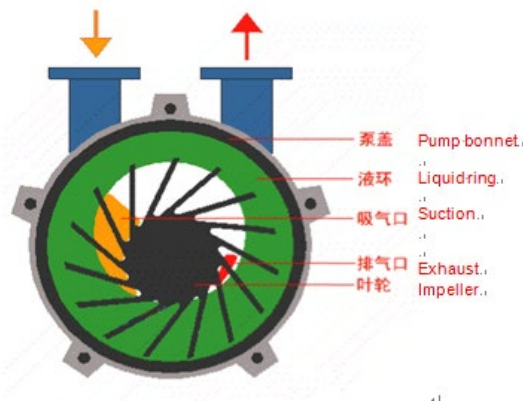


Figure 3 Schematic Diagram of Liquid Ring Vacuum Pump

图 3 液环式机械抽真空泵示意图

The impeller of the liquid ring vacuum pump is eccentrically mounted in the pump cylinder. Prime the pump cylinder to the specified level with liquid (working fluid) before starting the pump. When the impeller rotates, the liquid is thrown to the wall of the pump casing under centrifugal force, forming a rotating liquid ring. As the impeller and the center of the cylinder are eccentrically arranged, a crescent-shaped space is formed between the inner surface of the liquid ring and the impeller hub, it is divided into many chambers in different volumes by the blades, and the volume of each chamber expands and reduces along with the impeller rotation cycle. When the volume of the chamber is gradually enlarged, the gas is sucked from the outside, and when the volume of the chamber is gradually reduced, the originally sucked gas is compressed and discharged. Thus, the volume of the chamber between the blades changes once per revolution of the impeller. The liquid between each two blades reciprocates like a liquid piston to continuously suck and discharge the gas to achieve the purpose of vacuuming.

液环真空泵叶轮偏心地装在泵气缸内。启动前在泵气缸内灌入规定高度的液体(工作液)。当叶轮旋转时，由于离心力的作用，将液体甩至泵体壁，形成一个旋转的液体环。由于叶轮与气缸中心是偏心配置的，所以液环的内表面与叶轮轮毂之间形成一个月牙形空间，它被叶片分成若干容积

不等的小室，每个小室的容积随叶轮转动周期扩大和缩小，当小室容积逐渐扩大，气体由外界吸入，当小室容积逐渐缩小，使原先吸入的气体被压缩而排出。这样，叶轮每转一周，叶片与叶片间的小室容积改变一次。每两叶片间的液体好像液体活塞一样往复运动，连续不断地抽吸气体，达到抽真空的目的。

Steam ejector can achieve a higher degree of vacuum compared with liquid ring vacuum pump. For the Vac. column requiring higher degree of vacuum, only use of liquid ring vacuum pump cannot achieve the required degree of vacuum. However, the liquid ring vacuum pump does not need to consume steam, the cooling load is small (the cooling load is mainly use for the heat generated from gas compression), less CCW is required. Therefore, the liquid ring vacuum pump has the advantages of lower energy consumption than steam ejector. For Vac. column requiring higher degree of vacuum, a combined steam ejector + liquid ring vacuum pump configuration is normally used for the purpose of reducing energy consumption.

蒸汽抽真空较机械抽真空能够获得更高的真空度，因此对于需要高真空的减压塔不能全部采用机械式抽真空。但是机械抽真空不需要消耗蒸汽，冷却负荷较小（冷却负荷主要为气体压缩发热），消耗循环水少，因此采用机械抽真空比蒸汽抽真空具有低能耗的优势。对于真空度要求高的减压塔，一般可采用蒸汽抽真空+机械抽真空的组合式抽真空系统来降低能耗。

For the Vac. column in the process unit, a first stage steam ejector, a second stage steam ejector, a third stage liquid ring vacuum pump and a third stage steam ejector are provided, but the third stage steam ejector is in backup mode during normal operation.

本装置减压塔一级和二级抽真空采用蒸汽抽真空，三级抽真空采用机械抽真空，同时蒸汽抽真空作为备用。

1.1.2.4 Principle of mass transfer and heat transfer 传质传热原理

When the vapor phase and liquid phase are in full contact, the heavy components in the high-temperature vapor phase are condensed and heat is released, and the light components in the descending liquid phase reflux are heated and vaporized, as a result, the rising vapor phase is cooled by the descending liquid phase, the heavy components in the vapor phase are condensed and removed, and the light components in the liquid phase are continuously vaporized and concentrated - this is the mass transfer process.

气液两相充分接触时，高温气相中的重组分被冷凝放热，而下降的液相回流中的轻组分被加热、汽化，结果上升的气相被下降的液相冷却、气相中重组分不断被冷凝除去，液相中轻组分不断汽化而提浓，这就是传质过程。

Heat transfer is a transfer of energy caused by a temperature difference, and heat can be transferred from one part of an object to the other part of the object or transferred from one object to another object. The basic modes of heat transfer include heat conduction, convection heat transfer and radiation heat transfer.

传热是温度差引起的能量转移，热量可以从物体的一部分传到另一部分，或者从这一物体传到另一物体。传热的基本方式有热传导、对流传热和辐射传热。

Heat conduction: when there is a temperature difference inside of an object or between two

directly contacting objects, the high temperature molecules collide with adjacent molecules due to vibration for heat transfer, this process is called heat conduction.

热传导：当物体内部或两个直接接触的物体之间有温度差时，温度高的分子因振动而与相邻的分子相碰撞，借此进行热量传递的方式称为热传导。

Convective heat transfer: in a flowing fluid, heat transfer from one location to another location due to displacement and mixing of fluid particles is called convective heat transfer.

对流传热：在流动的流体中，由于流体质点的位移和混合将热量从一处传到另一处，这种传热方式叫对流传热。

Radiation heat transfer: as the object itself has a certain temperature, it can emit energy into the air in the form of electromagnetic waves, this heat transfer is called radiation heat transfer.

辐射传热：由于物体自身有一定温度，便可向外界以电磁波形式在空中发射能量，这种传热方式称辐射传热。

1.1.2.5 Injection of agents 三注的原理

(1) Lower-temperature corrosion inhibitor

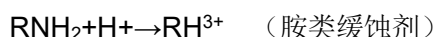
低温缓蚀剂

The low-temperature corrosion inhibitor used in the atmospheric and vacuum distillation unit is a kind of chemical that delays the corrosion in the OVHD condensing system. According to the film formation mechanism, there are mainly two kinds of film formations: adsorption film formation and interface reaction film formation. The inhibitors are classified into water-soluble and oil-soluble inhibitors.

常减压蒸馏装置使用的低温缓蚀剂是一种延缓塔顶冷凝冷却系统腐蚀的物质，按照其成膜机理主要有吸附成膜和界面反应成膜两种，包括水溶性和油溶性缓蚀剂两大类。

The adsorption film formation corrosion inhibitor is generally an organic compound having long alkyl chains and polar groups, where the polar groups can be adsorbed on the surface of the metal of the equipment to form a single-molecular water resistant protective film. This protective film acts on hydrogen ions in the solution to form positively charged ions. The reaction formula is as follows:

吸附成膜型的缓蚀剂一般是一种具有长烷基链和极性基团的有机化合物，剂体上带有极性基团，它能吸附在设备金属的表面上，形成一层单分子抗水性保护膜。这层保护膜和溶液中的氢离子作用，生成带正电荷的离子，其反应式为：



As this type of ions have strong repulsion to hydrogen ions in solution (H^+ after hydrolysis of HCl and H_2S), it prevents the proximity of H^+ to metal equipment, thus slowing the corrosion of HCl and H_2S . For $\text{HCl-H}_2\text{S-H}_2\text{O}$ type corrosion effect, MDEA corrosion inhibitor provides corrosion inhibition. In addition, the surface active effect of the corrosion inhibitor can reduce the binding force between the deposit and the metal surface, making the deposit loose for easy cleaning.

由于这种离子对溶液中的氢离子（ HCl 和 H_2S 水解后的 H^+ ）有强烈的排斥作用，阻止了 H^+ 对金

属设备的靠近，从而减缓了 HCl 和 H₂S 的腐蚀作用，这种胺类缓蚀剂在 HCl-H₂S-H₂O 型的腐蚀作用中，起到了缓蚀的效果。另外，缓蚀剂的表面活性作用能减少沉积物与金属表面的结合力，使沉积物疏松，为清洗带来了方便。

There are many kinds of corrosion inhibitors, and their natures are very different. The protection ability for equipment is affected by many factors. The main factors include: the chemical composition and properties of the corrosion inhibitor, the concentration and temperature at the time of injection, the pH of the column OVHD fluid, the flow speed of the fluid in the piping. In addition, the nature of the crude, the structure of the equipment where corrosion inhibitor is injected and the injection locations also have an impact on the effectiveness of the corrosion inhibitor.

缓蚀剂品种繁多，性质差异很大，对设备的保护能力受多种因素的影响。其主要因素有：缓蚀剂的化学组成及性质，注入时的浓度和温度，塔顶流体的 pH 值，管线内物流的流速等等。此外，原油性质的不同，注入设备的结构与注入部位的是否合理，也对缓蚀剂的效果有所影响。

The injection point of the corrosion inhibitor is on the column OVHD piping, and the stream is required to have an appropriate pH. When pH is too low or too high, the corrosion inhibitor will change and fail. If ammonia water is used as the neutralizing inhibitor, its pH range shall be within 7-9, and if organic MDEA is used as the neutralizing inhibitor, its pH range shall be within 5.5-7.5.

缓蚀剂的注入部位在塔顶馏出线上，要求物流有适当的 pH 值。当 pH 值过低或过高，缓蚀剂会起变化而失效。采用氨水作为中和剂，pH 值范围为 7-9，采用有机胺作为综合剂，pH 值范围为 5.5-7.5。

The type, concentration and dosage of the corrosion inhibitor shall be determined according to the type of crude, the size of the process unit, online corrosion monitoring results and lab analysis results. For different corrosion inhibitors, it is important to properly select the optimum concentration of corrosion inhibitor, because some corrosion inhibitors often do not work when the concentration is lower than a certain value. While for some other corrosion inhibitors, if the concentration is higher than a certain value, it does have no corrosion inhibition effect, but it also aggravates the corrosion to equipment. If the dosage is too large, it sometimes causes oil emulsification and foaming, which will result in off-spec oil products and oil entrained in the water, increasing the operation cost.

根据原油类型、处理量、在线腐蚀监测结果以及试验室的检验结果来选定缓蚀剂的种类、浓度及注入量。对不同的缓蚀剂来讲，选定缓蚀剂的最佳浓度是很重要的，因为某些缓蚀剂，浓度低于某一数值时常常不发生作用；但也有一些缓蚀剂，当浓度高于某一数值时，不仅没有缓蚀作用，反而加剧了设备的腐蚀。如用量过大，有时还会造成油品乳化、发泡等现象，使油品不合格和脱水带油，增加加工损失，经济上也更不合算。

(2) Demulsifier

破乳剂

Demulsifier is a surfactant, which has smaller surface tension and higher surface activity than emulsifier. After demulsifier is injected into crude, it is first dispersed into the crude emulsion,

and then gradually reaches the crude-water interface. As the demulsifier has higher surface activity than the natural emulsifier, so the demulsifier will replace the emulsifier and be adsorbed and concentrated at the crude-water interface so as to change the properties of the original interface, destroy the relatively strong adsorption film, and form a weak adsorption film that is easily damaged.

破乳剂是一种表面活性剂，比乳化剂具有更小的表面张力，更高的表面活性，原油中加入破乳剂后，首先分散在原油乳化液中，而后逐渐到达油水界面，由于它具有比天然乳化剂更高的表面活性，因此破乳剂将代替乳化剂吸附在油水界面，并浓集在油水界面，改变了原来界面的性质，破坏了原来较为牢固的吸附膜，形成一个较弱的吸附膜，并容易受到破坏。

There are two types of demulsifiers used for the desalters: water-soluble and oil-soluble demulsifiers. Nonionic surfactant is mainly used as the demulsifier. The dosage of the demulsifier depends on the nature of the crude, the crude pretreatment made at the oil field, and the salt removal requirements and process conditions, such as the number of desalter stages, the operating temperature, the amount of wash water, and the degree of oil and water mixing. Generally, the oil-soluble demulsifier is added in a concentration from 3 to 20 ppm (for crude processing).

电脱盐破乳剂有水溶性和油溶性两类，主要用非离子型的表面活性剂作破乳剂。破乳剂的用量决定于原油的性质、油田的原油预处理方法以及脱盐的要求和工艺条件，如电脱盐级数、操作温度、洗涤水量以及油水混合的程度。一般来说，油溶性破乳剂的加入量为 3~20ppm（相对于原油处理量）。

As the demulsifier is a surfactant in nature, it has a certain emulsification effect, and the excessive use will aggravate the emulsification of the oil and water, and deteriorate the quality of water drained from the desalter.

由于破乳剂仍然属于表面活性剂，具有一定的乳化作用，使用过量，会加剧油水的乳化，使电脱盐排水水质变坏。

Demulsifiers have selectivity nature. At current, there is no one specific demulsifier available for all crudes. Strictly speaking, demulsifier shall be screened and properly selected for each type of crude so as to optimize the demulsification effect. However, in the actual operation, the selection of the demulsifier is mainly based on the type of oil that is frequently processed.

破乳剂有一定的选择性，目前还没有可针对所有原油的破乳剂。严格地讲每加工一种原油都需要对破乳剂筛选，以求达到破乳效果的最优化。但是在实际的应用过程中，主要根据经常加工的油品类型进行破乳剂选型。

(3) Neutralizing inhibitor

中和剂

Ammonia is used as the neutralizing inhibitor for most of the process units in China for reducing the operation cost. Ammonia is injected into the column OVHD vaporization piping as a neutralizing inhibitor to neutralize HCl and H₂S in the OVHD system for adjusting the pH of the condensate in the OVHD system so as to reduce the corrosion in OVHD system and fully exert the role as a corrosion inhibitor. Ammonia dosage is adjusted by controlling the pH of the

condensate in the reflux drum of the column within 7 and 9.

从降低使用成本出发，中国国内大部分装置使用氨水作为中和剂。氨作为中和剂注入塔顶挥发线，以中和塔顶系统中的 HCl、H₂S，调节塔顶馏出系统冷凝水的 pH 值，以减轻塔顶腐蚀、充分发挥缓蚀剂的作用。通过控制塔顶回流罐冷凝水的 pH 值在 7~9 之间来调节注氨量。

However, ammonia has its inherent disadvantages as a neutralizing inhibitor. The titration curve of ammonia water and sour water is extremely steep, the pH control range is large, it is difficult for stable control, the pH value is high, and it is easy to form scale on the inner wall of equipment and piping, resulting in piping blockage.

但是氨作为中和剂有其固有的缺点，氨水中和酸性水的滴定曲线极陡，pH 值控制范围大，很难稳定控制，pH 值控制高，容易在设备及管道内壁形成盐垢引起垢下腐蚀及堵塞管线等。

Additionally, ammonia has a high vapor pressure, it is difficult to dissolve in water at the dew point of water. When the OVHD oil vapor is cooled to reach the dew point of the water (at 110 °C in the Atm.), liquid water appears, and HCl is first dissolved in the water, so that the pH of the initial condensed water is rapidly lowered, and when the temperature continues to decrease (at 77 °C in Atm.), H₂S begins to dissolve in water. At the OVHD initial condensing zone, the amount of ammonia dissolved is very small, and it is difficult to neutralize the high concentration of HCl in the initial condensed water. For this reason, many organic neutralizing MDEAs are used as neutralizing inhibitors in foreign countries. The properly selected organic MDEAs can be quickly dissolved in the initial condensed water when the initial condensed water occurs in the OVHD of the column, which provide good neutralization at the initial stage when HCl is dissolved in water. Generally, the MDEA salt formed by a good organic MDEA is not hydrolyzed, and can effectively prevent corrosion under scale.

同时氨具有较高的蒸汽压，在水的露点温度很难溶解在水中。当塔顶油气（汽）经冷却达到水的露点（常压塔 110°C）时，液态水出现，HCl 首先溶解在水中，使得初凝水的 pH 值迅速降低，当温度继续降低时（常压塔 77°C），H₂S 开始溶解在水中，在塔顶的初凝区，氨的溶解量很小，很难中和初凝水中的高浓度 HCl。正因如此，国外较多的使用有机中和胺作为中和剂，选择合适的有机胺能够在塔顶出现初凝水时迅速溶解在初凝水中，能够在 HCl 溶解在水里的初期起到较好的中和作用，良好的有机胺形成的胺盐一般不水解，可以有效防止垢下腐蚀。

In terms of the corrosion resistance performance for column OVHD system, the organic MDEA has obvious advantages over the ammonia water, but it has disadvantage, it is expensive and the cost is high.

在塔顶工艺防腐的效果方面，有机胺相较氨水具有明显的优势，其缺点就是价格昂贵，成本较高。

（4）Water injection at the OVHD of the column

塔顶注水

Caustic water is injected for the following purposes:

注碱性水的主要作用是：

1) Rinse off the formed ammonium salt to reduce corrosion under scale;

冲洗掉所生成的铵盐，以减轻垢下腐蚀；

2) Dilute and neutralize partially condensed sour water;

稀释和中和部分冷凝下来的酸性水；

3) By injecting water into the vaporization piping, the vapor in the piping is quenched, and the initial condensing zone is moved forward into the vaporization piping, thereby reducing the corrosion in the condenser. The amount of water injection accounts for about 5% to 10% of the OVHD distillate.

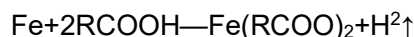
通过在挥发线内注水，使挥发线内气体急冷，把最初冷凝区前移至挥发线中，减轻了后面冷凝器内的腐蚀。循环注水量约占塔顶馏出量的 5%~10%。

(5) High temperature neutralizing corrosion inhibitor

高温缓蚀剂

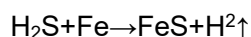
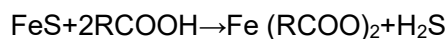
Corrosion in the process unit mainly occurs in high temperature areas mainly due to high temperature naphthenic acid and high temperature sulfur. Naphthenic acid is an organic acid in crude, which has acid characteristics and is more acidic than that of carbonic acid. Under high temperature conditions, naphthenic acid can directly react with metallic iron to form oil-soluble iron naphthenate, causing corrosion to equipment and piping. The chemical reaction equation is shown below:

常减压装置的设备腐蚀主要发生在高温重油部位，主要腐蚀原因是高温环烷酸腐蚀和高温硫腐蚀。环烷酸是石油中的有机酸，具有酸的特性，其酸性比碳酸强。在高温条件下，环烷酸能直接与金属铁发生化学反应生成油溶性的环烷酸亚铁，引起设备和管道的腐蚀。反应如下式表示



When the crude contains a high content of sulfur during the distillation process, a synergistic effect occurs between the naphthenic acid and the sulfur, intensifying corrosion. The naphthenic acid may react with FeS protective film formed on the surface of the metallic iron to form iron naphthenate and hydrogen sulfide. The resulting hydrogen sulfide can further corrode the metal. The chemical reaction equation is shown below:

当原油蒸馏过程中含有较高含量的硫时，环烷酸和硫发生协同效应，腐蚀会加剧。环烷酸可与金属铁表面生成的 FeS 保护膜发生反应，生成环烷酸铁及硫化氢。而产生的硫化氢又可进一步腐蚀金属。反应式如下式表示：



The temperature of the corrosive environment has a great influence on the corrosion rate of naphthenic acid: when the temperature is below 220°C, the naphthenic acid does not dissociate if there is no liquid water in the system, and it is basically non-corrosive; when the temperature range is within 220-270 °C, corrosion increases along with temperature rise; when the temperature range is within 270-280°C, corrosion shows a peak value; when the temperature range is within 280 and 350°C, the corrosion first increases and then decreases along with temperature rise due to partial vaporization of naphthenic acid and flow speed change caused by two-phase flow; when the temperature is at approximately 350°C, corrosion shows a lower peak value due to vaporization of large amount of naphthenic acid and increased vapor phase flow speed; when the temperature range is within 350-425°C, corrosion decreases along with

temperature rise as most of the naphthenic acid has been vaporized; and when the temperature is above 425°C, the naphthenic acid in the liquid phase is substantially vaporized, and the liquid phase oil has no corrosion effect. The rate of corrosion to metallic iron by naphthenic acid varies from material to material. In general, the higher the acid number is, the greater the corrosion rate will be.

腐蚀环境的温度对环烷酸腐蚀速度影响较大：温度范围在 220°C 以下，系统中没有液态水存在时，环烷酸不发生解离，基本上不具有腐蚀性；在 220~270°C 之间，腐蚀性随温度升高而增大；在 270~280°C 之间腐蚀性表现为一个高峰值；在 280~350°C 之间，因受环烷酸部分汽化及两相流动引起的流速变化等影响，环烷酸的腐蚀性表现为随温度升高而先降后升；在 350°C 左右，因环烷酸大量汽化，汽相流速增大，腐蚀性表现为另一个较低的峰值；在 350~425°C 之间，因环烷酸已经大量汽化，腐蚀性表现为随温度升高而降低；在 425°C 以上，液相中环烷酸基本上完全汽化，液相油品已经不具有腐蚀性。在材质不同情况下，环烷酸对金属铁的腐蚀速率也有不同。一般来说，酸值越高，腐蚀速率越大。

The corrosion resistance effect of High temperature neutralizing corrosion inhibitor relies on: (1) Neutralizing the acid in the oil and reducing the acid number in the oil; (2) Forming a protective film on the metal surface to separate the corrosive fluid from the metal, thereby achieving the purpose of corrosion resistance.

高温缓蚀剂的防腐作用在于：(1)中和油中的酸，降低其油中的酸值；(2)在金属表面形成一层保护膜把腐蚀介质与金属隔开，从而达到防腐目的。

The High temperature neutralizing corrosion inhibitor is an oil-soluble corrosion inhibitor made of high molecular weight, high boiling point organic polymers. Its molecular structure has polar groups and non-polar groups. The polar groups can be adsorbed on the surface of the metal material to form an adsorptive protective film at a higher temperature, and at the same time, part of the corrosion inhibitor directly interacts with the naphthenic acid to form a naphthenate. The large molecular weight naphthenate can establish an adsorption balance on the metal surface, and isolate the organic acid such as naphthenic acid from the metal surface to protect the material.

高温缓蚀剂是以高分子量，高沸点有机聚合物为原料制成的油溶性缓蚀剂。其分子结构存在极性基团和非极性基团。极性基团在较高温度时可以吸附在金属材质表面形成吸附性保护膜，同时部分缓蚀剂与环烷酸直接作用，生成环烷酸酯。大分子量的环烷酸酯可以在金属表面建立吸附平衡，将环烷酸等有机酸和金属表面隔离，达到保护材质的目的。

(6) Fouling inhibitor

阻垢剂

The fouling inhibitor for residues is developed based on the fouling mechanism of the residues. It has dispersing function and anti-polycondensation function. The high temperature residue uses some groups provided by the fouling inhibitor to destroy the aromatics molecule polycondensation during the heat exchange so as to prevent polymerization of free radicals and achieves the purpose of suppressing coking. Its main function is to disperse the insoluble suspended matters in the oil, prevent coagulation and precipitation, form inert molecules to

prevent the polymerization reaction, and also increase the corrosion resistance of the metal surface.

渣油阻垢剂是针对渣油的结垢机理研制而成的,它具有分散功能和防止缩聚的功能,高温渣油在换热过程中利用阻垢剂所提供的某些基团来破坏芳香分子的缩聚,防止自由基的聚合,达到抑制结焦的目的。主要作用是对油中的不溶性悬浮物起分散作用,阻止其凝聚、沉淀,对成垢聚合反应形成惰性分子阻止反应,还可以增加金属表面的防腐性能。

1.1.3 Process flow charts for control points 控制点工艺流程图

See PIDs for the process unit (HYBN-01DD-2.1.1-10110PE-DW02-0001-0).

见常减压装置工艺 PID 流程图册 (HYBN-01DD-2.1.1-10110PE-DW02-0001-0)。

1.1.4 Brief description to process flows 工艺流程简要说明

1.1.4.1 Heat exchange process flows of crude 脱前换热流程

The tag numbers for all the equipment and instruments in the process unit are preceded by "1011-", and the tag numbers started with "6" are preceded with "1012-". For simplification purpose, these prefixes are omitted in the description in the following chapters of this document.

本装置所有设备和仪表位号前均加“1011-”,以“6”开头编号的设备和仪表位号前均加“1012-”在本规程中后面的描述中均省略。

The crude from the drum is boosted by the crude pumps and sent to the CDU, where it is diverted into three branches for heat exchange and then combined into two branches.

原油经罐区原油泵升压后进入装置,分三路换热后合并,再合成两路。

(1) Heat exchange process flow for the 1st branch of crude 脱前一路换热流程

The 1st branch is heat exchanged with LVGO PA (2) (E-501A/B), heavy diesel (4) (E-502) and Atm. Dist. OVHD vapor (E-301A).

第一路先后与减顶循 (2) (E-501A/B)、常三线 (4) (E-502)、常顶油气 (E-301A) 换热。

(2) Heat exchange process flow for the 2nd branch of crude 脱前二路换热流程

The 2nd branch is heat exchanged with kerosene (3) (E-503), LVGO PA (1) (E-504) and Atm. Dist. OVHD vapor (E-301B).

第二路先后与常一线 (3) (E-503)、减顶循 (1) (E-504)、常顶油气 (E-301B) 换热。

The 1st branch and the 2nd branch are combined, and then the combined crude is heat exchanged with Atm. top PA (2) (E505) and MVGO (4) (E506).

第一路和第二路合并后与常顶循 (2) (E505)、减二线 (4) (E506) 换热。

(3) Heat exchange process flow for the 3rd branch of crude 脱前三路换热流程

The 3rd branch is heat exchanged with the Atm. top PA (3) (E-507), light diesel (4) (E-508), Atm. Dist. OVHD vapor (E-301C), light diesel (3) (E-509) and Vac. overflash oil (E-510) and then combined with the 1st branch and the 2nd branch, the mixed crude is sent into the desalter at approximately 127 ° C.

第三路先后与常顶循（3）（E-507）、常二线（4）（E-508）、常顶油气（E-301C）、常二线（3）（E-509）、减四线（2）（E-510）换热，换热后一二路合并，合并后原油约 127°C 进入电脱盐系统进行脱盐脱水。

Two-stage high-speed desalters (D-101, D-102) are employed, and a combination of static mixer and mixing valve are used for mixing the crude, demulsifier and water.

电脱盐采用二级高速电脱盐（D-101、D-102），原油与破乳剂和水的混合采用静态混合器与混合阀组合型设备。

1.1.4.2 Heat exchange process flows of desalted crude 脱后换热流程

The desalted crude from the desalter system is divided into three branches.

从电脱盐系统来的脱盐原油分成三路。

（1）Heat exchange process flow for the 1st branch of desalted crude

脱后一路换热流程

The 1st branch is heat exchanged with Atm. top PA (1) (E-521A/B), a Atm. PA2# (4) (E-522), kerosene (1) (E-523A/B), LVGO PA (1) (E-524A/B) and Atm. overflash oil (2) (E-525).

第一路先后与常顶循（1）（E-521A/B）、常二中（4）（E-522）、常一线（1）（E-523A/B）、减一中（1）（E-524A/B）、常四线（2）（E-525）换热。

（2）Heat exchange process flow for the 2nd branch of desalted crude

脱后二路换热流程

The 2nd branch is heat exchanged with kerosene (2) (E-526), VR (1) (E-527A/B), light diesel (2) (E-528), and Atm. PA1# (E-529A/B) and HVGO (4) (E-530).

第二路先后与常一线（2）（E-526）、减渣（1）（E-527A/B）、常二线（2）（E-528）、常一中（E-529A/B）、减三线（4）（E-530）换热。

（3）Heat exchange process flow for the 3rd branch of desalted crude

脱后三路换热流程

The 3rd branch is first heat exchanged with HVGO (5) (E-531A/B), MVGO (3) (E-532), heavy diesel (3) (E-533A/B), LVGO PA (2) (E) -534, light diesel (1) (E-535) and VR (3) (E-536A/B), then combined with desalted crude stream 2# and heat exchanged with heavy diesel (2) (E-537A/B) and MVGO PA (3) (E-538), and finally, these three streams are merged, and the combined crude is sent into the Pre-dist column at approximately 226 °C.

第三路先后与减三线（5）（E-531A/B）、减二线（3）（E-532）、常三线（3）（E-533A/B）、减一中（2）（E-534）、常二线（1）（E-535）、减渣（3）（E-536A/B）换热，换热后与二路合并与常三线（2）（E-537A/B）、减二中（3）（E-538）换热后三路合并，合并后脱盐油约 226°C 进入初馏塔（C-200）。

1.1.4.3 Pre-dist column system 初馏塔系统

The crude from the desalter is heat exchanged to 226 °C and then sent into the Pre-dist column where 22 float valve trays are installed above the feed point and 4 chevron baffles are installed under the feed point. The Pre-dist column is designed with one sidedraw, that is, the Pre-Dist.

sidedraw, and an OVHD two-stage condensing system.

脱盐后原油经换热至 226°C 后进入初馏塔，初馏塔进料位置以上共 22 层塔盘，进料位置以下设 4 层人字挡板。初馏塔设置一条侧线，即初一线，塔顶设置两段冷端冷凝。

(1) Pre-Dist. sidedraw process flow

初馏塔侧线流程

The Pre-Dist.sidedraw is provided mainly for reducing the operation load of the atmospheric heater. As an collecting drum is provided for the Pre-Dist.sidedraw, for the purpose of ensuring the separation precision, an external reflux is designed below the Pre-Dist.sidedraw. The Pre-Dist.sidedraw is drawn from the collecting drum by the Pre-Dist.sidedraw pump (P-201A/B), and it is divided into two streams: one stream is sent to the return piping of Atm. PA1# and then sent into the Atm., and the other stream is recycled back to the Pre-dist column as reflux at a location below the collecting drum (below tray 7#).

设置初一线的目的主要是减轻常压炉的负荷，由于初馏塔初一线设置集油箱，为保证初一线以下塔盘的分离精度，初一线下部设置外回流。初一线从初馏塔集油箱抽出后经初一线泵(P-201A/B)抽出分成两部分，一部分送入常一中返塔线进入常压塔，另一部分作为回流返回初一线集油箱以下（第 7 层塔盘）。

(2) Pre. Dist.n bottom oil process flow

初底油流程

The Pre. Dist.bottom oil are boosted by the Pre-Dist.bottom pump (P-230A/B) and then divided into two streams. One stream is recycled back to the Pre-dist column for the minimum flow control of P-230A/B, and the other steam is further divided into two sub-streams. The first sub-stream is heat exchanged with MVGO PA (2) (E-541), Atm. PA2# (1) (E-542A/B), and Atm. overflash oil (1) (E-543), The second sub-stream is heat exchanged with VR (2) (E-544), heavy diesel (1) (E-545), Vac. overflash oil (1) (E-546) and MVGO PA (2) (1) (E-547A/ B). The two sub-streams are combined and heat exchanged with VR (1) (E-548A/B) to 285 °C and then sent into the atmospheric heater (F-301).

初底油经初底泵(P-230A/B)升压后分两部分，一部分返回初馏塔作为 P-230A/B 最小流量控制，另一部分再二路，第一路先后与减二中(2)(E-541)、常二中(1)(E-542A/B)、常四线(1)(E-543)换热。第二路先后与减渣(2)(E-544)、常三线(1)(E-545)、减四线(1)(E-546)、减二中(1)(E-547A/B)换热。一二路换热后合并与减渣(1)(E-548A/B)换热至 285°C 进入常压炉(F-301)。

(3) Pre. Dist. column OVHD process flow

初馏塔顶流程

An OVHD two-stage condensing process flow is designed for the Pre. Dist. column. The oil vapor from the Pre. Dist. OVHD is sent into the Pre-Dist. 1st air coolers A-201A~F for cooling down to 98°C, and then sent into the Pre-Dist. OVHD reflux drum D-202 for three-phase separation. Uncondensed oil vapor is sent into the Pre-Dist. 2nd air coolers A-202A-D and the Pre-Dist. OVHD trim coolers E-202A-D. The water is drawn from D-202 water boot and self-pressurized into the Pre-Dist. OVHD product drum D-201. The oil is drawn from the bottom of

D-202, and it is divided into two streams by the Pre-Dist. OVHD reflux pump P-222AB. One stream is used as the Pre-Dist. OVHD reflux, and the other stream is sent into the Pre-Dist. 2nd air coolers A-202A~D and the Pre-Dist. OVHD trim coolers E-202A~D, where it is condensed together with the uncondensed oil vapor, and then sent into the Pre-Dist. OVHD product drum D-201 for three-phase separation.

初馏塔塔顶采用两段冷凝流程。油气从初馏塔塔顶馏出后，经过一级冷凝器 A-201A~F 冷却至 98℃ 进入初顶回流罐 D-202 进行三相分离。未冷凝的油气进入二级冷凝器 A-202A~D 和 E-202A~D。水相从 D-202 的水包抽出，自压进入初顶产品罐 D-201。油相从 D-202 罐底抽出，经初顶回流泵 P-222AB 后分两路，一路作为初馏塔塔顶回流，另一路进入二级冷凝器 A-202A~D 和 E-202A~D，与未冷凝的油气一起冷凝后进入初顶产品罐 D-201 进行三相分离。

The non-condensable in D-201 is sent to the Light Ends Recovery Unit where it is pressurized by the compressor and sent into the absorption column. The water phase is drawn from the water boot by the Pre-Dist. OVHD sour water pump P-225AB, and then is sent into the Sour Water Stripping Unit. The oil phase is sent to the Light Ends Recovery Unit via the Pre-Dist. OVHD product pump P-221AB.

D-201 的不凝气送至轻烃回收装置，经压缩机增压后进入吸收塔。水相从水包抽出后，经初顶酸性水泵 P-225AB 送至酸性水汽提装置处理。油相经初顶产品泵 P-221AB 送至轻烃回收装置。

1.1.4.4 Atm. system 常压塔系统

The Pre. Dist. bottom oil are sent into the atmospheric heater for heating up and then sent into the Atm. (C-300) for distillation. The Atm. is equipped with 52 trays, of which 6 trays are provided in the stripping section and 46 trays are provided in the distillation section. The Atm. is designed with 4 sidedraws and it is also designed with three middle refluxs, i.e., the Atm. top PA, Atm. PA1# and Atm. PA2#, for purpose of balancing the vapor-liquid load of the whole column and recovering the excess heat in the column.

初底油在常压炉内加热后进入常压塔（C-300）进行分馏，常压塔设 52 层塔板，其中汽提段设 6 层，精馏段设 46 层常压塔设置四个侧线，为了均衡整个塔的汽液负荷，回收塔内过剩热量，常压塔设置了三个中段回流，常顶循、常一中、常二中。

（1）Atm. OVHD vapor process flow

常顶油气系统流程

The Atm. OVHD vapor is sent into the Crude-Atm.OVHD vapor exchanger (E-301A~C) for heat exchange to 116℃, and then sent into the Atm. OVHD reflux drum (D-302) for three-phase separation. The water phase is drawn from the water boot of D-302 and flows by gravity into the Atm. OVHD product drum D-301. The oil phase is drawn from D-302, and it is divided into two streams via the Atm. OVHD reflux pump (P-322A/B). One stream is sent to the OVHD of the Atm. as reflux, and the other stream together with the uncondensed oil vapor are sent into the Atm. pre. OVHD air cooler (A-301A~H) and the Atm. OVHD trim cooler (E-302A~D) for condensing and cooling down 40 °C and then sent into the Atm. OVHD product drum (D-301) for three-phase separation.

常压塔顶油气经原油常顶油气换热器（E-301A~C）换热至 116°C 进入常顶回流罐（D-302）进行三相分离。水相从 D-302 的水包抽出后自流进入常顶产品罐 D-301。油相从 D-302 抽出后经常顶回流泵（P-322A/B）分为两部分，一部分作为回流送入常压塔顶，另一部分与未冷凝的油气进入常顶空冷器（A-301A~H）、常顶后冷器（E-302A~D）冷凝冷却至 40°C 后进入常顶产品罐（D-301）进行三相分离。

The non-condensable in D-301 is sent via the Atm. OVHD product pump (P-321A/B) to the Light Ends Recovery Unit where it is pressurized by the compressor and sent into the absorption column. The water phase is drawn by the Atm. OVHD sour water pump P-325AB, and then is sent into the Sour Water Stripping Unit.

D-301 分离出来的常顶油经常顶产品泵（P-321A/B）送至轻烃回收装置处理，不凝气进入轻烃回收装置，经压缩机增压后进入吸收塔。水相经常顶酸性水泵 P-325AB 送至酸性水汽提装置。

（2）Kerosene process flow

常一线流程

The kerosene is drawn from tray 38# in the Atm. and sent into the 1st section of the Atm. side stripper (C-301) for kerosene, the stripper is provided with a reboiler (E-311) for stripping service. The kerosene is drawn by kerosene pump (P-301A/B) and sent into E-523A/B, E-526 and E-503 for heat exchange and then divided into two streams, one stream (at 100°C) is sent to the Kerosene Hydrofining Unit and the other stream is sent into A-731A/B and E-731A/B for cooling down 40°C and then sent to the storage.

常一线从常压塔第 38 层塔盘抽出流入常一线汽提塔（C-301 上段），采用重沸器（E-311）汽提，汽提后经常一线泵（P-301A/B）抽出经 E-523A/B、E-526、E-503 换热后分两部分，一部分（100°C）至直供航煤加氢装置，另一部分经 A-731A/B 和水冷 E-731A/B 冷却至 40°C 送至罐区。

（3）Light diesel process flow

常二线流程

The light diesel is drawn from tray 24# and flows into the 2nd section of the Atm. side stripper (C-301) for light diesel. After light diesel is stripped by steam, it is draw by the light diesel pump (P-302A/B), sent into E-535, E-528, E-509 and E-508 for heat exchange, and then combined with heavy diesel.

常二线从常压塔第 24 层塔盘抽出流入常二线汽提塔（C-301 中段）。常二线采用过热蒸汽汽提后，汽提后的常二线经常二线泵（P-302A/B）抽出，经 E-535、E-528、E-509、E-508 换热后，与常三线合并。

（4）Heavy diesel process flow

常三线流程

The heavy diesel is drawn from heavy diesel collectingr drum (between tray 20# and tray 19#) and flows into the 3rd section of the Atm. side stripper (C-301) for heavy diesel, where it is drawn by heavy diesel pump (P-303A/B), sent into E-545, E-537A/B, E-533A/B and E-502 for heat exchange, and then combined with light diesel into mixed diesel. The mixed diesel is divided into two streams, one stream (at 100 ° C) is sent to the Diesel Hydrofining Unit and the other stream is sent into the diesel air cooler (A-733A~D) for cooling down to 40°C and then sent to

the drum.

常三线从常压塔常三线/常二中集油箱（第 20 层和第 19 层塔盘之间）抽出，流入常三线汽提塔（C-301 下段），经常三线泵（P-303A/B）抽出，经 E-545、E-537A/B、E-533A/B、E-502 换热后热料和常二线合并为混合柴油。混合柴油分两部分，一部分（100℃）直供柴油加氢，另一部分经混合柴油空冷器（A-733A~D）冷却至 40℃后送至罐区。

（5）Atm. overflash oil process flow

常四线流程

The Atm. overflash oil is drawn from the Atm. overflash oil collecting drum (between tray 10# and tray 9#) by Atm. overflash oil pump (P-304A/B) and divided into two streams. One stream is sent into E-543 and E-525 for heat exchanger and then sent to E-532 inlet where it is combined with MVGO, and the other stream is recycled back to tray 9# of the Atm. as reflux.

常四线从常四线集油箱（第 10 层和第 9 层塔盘之间）抽出，经常四线泵（P-304A/B）后分两部分，一部分经 E-543、E-525 换热后至 E-532 入口，与减二线合并，另一部分作为内回流返回常压塔第 9 层塔盘。

（6）Atm. top PA process flow

常顶循流程

The Atm. OVHD reflux is drawn from tray 48# via the Atm. OVHD reflux pump (P-310A/B), sent into E-521A/B, E-505 and E-507 for heat exchange, and then recycled back to tray 50# of the Atm..

常顶循从常压塔第 48 层塔盘经常顶循泵（P-310A/B）抽出，经 E-521A/B、E-505、E-507 换热后和返回常压塔第 50 层塔盘。

（7）Atm. PA1# process flow

常一中流程

The Atm. PA1# is drawn from tray 32# of the Atm. by Atm. PA1# pump (P-311A/B), sent into E-529A-D for heat exchanger, and then recycled back to tray 34# of the Atm..

常一中自常压塔第 32 层塔盘经常一中泵（P-311A/B）抽出，经 E-529A-D 换热后返回常压塔第 34 层塔盘。

（8）Atm. PA2# process flow

常二中流程

The Atm. PA2# is drawn from the heavy diesel collecting drum (between tray 20# and tray 19#) by the Atm. PA2# (P-312A/B) and is divided into three streams. The first stream is sent into E-542A/B, E-311, E-640RS and E-522 for heat exchange, and then recycled back to tray 23# of the Atm., the second stream is recycled back to tray 19# of the Atm. as reflux, and the third stream is recycled back to P-312A/B inlet for P-312A/B minimum flow control.

常二中自常压塔常三线/常二中集油箱（第 20 层和第 19 层塔盘之间）经常二中泵（P-312A/B）抽出后分为三部分，一部分经 E-542A/B、E-311、E-640RS（设备名称前加 1012-）、E-522 换热后返回常压塔 23 层塔盘，一部分作为内回流返回至 19 层，一部分返回 P-312A/B 入口，作为 P-312A/B 最小流量控制。

（9）Atm. residue(AR) process flow

常底油流程

The AR are drawn by the Atm. residue pump (P-330A/B) and divided into two streams. One stream is recycled back to the Atm. for the minimum flow control of P-330A/B, and the other stream is sent to the vacuum heater (F-401) where it is sent into the Vac. column (C-400) for distillation.

常压塔底油由常底泵（P-330A/B）抽出后分两部分，一部分返回常压塔作为 P-330A/B 最小流量控制，另一部分送至减压炉（F-401），经加热后进入减压塔（C-400）进行分馏。

1.1.4.5 Vac. column system 减压塔系统

The Vac. column is a full packing micro-wet column, and it is designed with four sidedraws. LVGO MVGO and HVGO are used as the feedstocks to HC Unit, and the Vac. overflow oil is used as the feedstock to the Flexicoking Unit.

减压塔采用全填料微湿式操作，减压塔设有四个侧线，减一、减二、三线作为加氢裂化原料，减四线作为焦化原料。

（1）Vac. column OVHD vacuuming process flow

减顶抽真空系统流程

The Vac. column OVHD vapor is drawn by the Vac. 1st ejector (EJ-411A~C), the Vac. 2nd ejector (EJ-421A~C) and the Vac. 3rd ejector (EJ-431), and then it is sent into the respective condensers (E-411A/B, E-421A/B, E-431A/B) together with the working steam, where it is sent into the Vac. OVHD drum (D-401). In order to reduce steam consumption, a liquid ring vacuum pump (PA-401) is provided in parallel with the Vac. 3rd ejector. During normal operation, the liquid ring vacuum pump is in service, and the Vac. 3rd ejector is in backup mode.

减顶油气经一级减顶抽空器（EJ-411A~C）、二级减顶抽空器（EJ-421A~C）、三级减顶抽空器（EJ-431）抽出，与工作蒸汽一起顺次在各自对应的冷凝器（E-411A/B、E-421A/B、E-431A/B）中冷凝冷却后进入减顶分水罐（D-401）。为降低蒸汽消耗，设机械抽真空泵（PA-401）与三级减顶抽空器并联，正常操作时采用机械抽真空器，三级减顶抽空器备用。

（2）Vac. OVHD gas process flow

减顶不凝气流程

The Vac. OVHD gas is sent into the Vac. OVHD gas desulfuration tower (C-410) and then it is sent into D-862, where it is sent into the atmospheric heater (F-301) as fuel gas.

减顶不凝气经装置内减顶气脱硫塔（C-410）脱硫后，经 D-862 后作为装置自用燃料气送至常压炉（F-301）。

（3）Vac. OVHD oil and Vac. OVHD sour water process flows

减顶油和减顶酸性水流程

The Vac. OVHD oil is drawn by Vac. OVHD oil pump (P-421A/B), it can be combined to the diesel process flow or combined to the light slop process and then sent out of the drum. The Vac. OVHD sour water is drawn by the Vac. OVHD sour water pump (P-425A/B) and sent to the Sour Water Stripping Unit.

减顶油由减顶油泵（P-421A/B）抽出后，可并至混合柴油，也可并至轻污油出装置。减顶酸性水

经减顶含硫污水泵（P-425A/B）抽出后送至酸性水汽提装置。

（4）LVGO process flow

减一线流程

The LVGO is drawn from the LVGO collecting drum via the LVGO PA&PR pump (P-401A/B), sent into E-504 for heat exchange, and then divided into two streams. One stream is combined with MVGO and HVGO to form into VGO. The other stream is sent into E-501A/B for heat exchange and into E-740A/B for cooling down to 50°C, where it is divided into two sub-streams: one sub-stream is recycled back to the Vac. column as column OVHD reflux(LVGO PA), and the other sub-stream is sent into the sealing oil pot D-851.

减一线由减一线及减一中泵（P-401A/B）自减压塔减一线集油箱抽出，经 E-504 换热后分两部分。一部分与减二线、减三线合并为混合蜡油。另一部分（减一中）经 E-501A/B 换热和 E-740A/B 冷却至 50°C。冷却至 50°C 的减一中分为两部分，一部分返回减压塔做为减顶回流，另一部分至封油罐 D-851。

（5）MVGO process flow

减二线流程

The MVGO is drawn from the MVGO collecting drum by MVGO PA&PR pump (P-402A/B), sent into E-524A/B and E-534 for heat exchange and then divided into two streams. One stream is recycled back to the Vac. column as reflux, and the other stream is mixed with Atm. overfalsh oil and sent into E-532 and E-506 for heat exchange, and then combined with LVGO and HVGO to form into VGO.

减二线由减二线及减二中泵（P-402A/B）自减压塔减二线集油箱抽出，经 E-524A/B、E-534 换热后分为两部分，一部分作为减二中回流返回减压塔，另一部分与常四线经 E-532、E-506 换热后与减一线、减三线合并为混合蜡油。

（6）HVGO process flow

减三线流程

The HVGO is drawn from the HVGO collecting drum by the HVGO PA&PR pump (P-403A/B), and then divided into two streams. One stream is recycled back to the top of Section IV of the Vac. column as reflux. The other stream is sent into E-547A/B, E-541 and E-538 for heat exchange, and then divided into two sub-streams: one sub-stream is recycled back to the Vac. column as reflux (vac. 3rd PA), and the other sub-stream is sent into E-530 and E-531A/B for heat exchange, and then combined with LVGO and MVGO to form into VGO. The VGO is divided into two streams, one stream is sent to HC Unit and the other stream is sent to the drum.

减三线由减三线及减二中泵（P-403A/B）自减压塔减三线集油箱抽出后分为两部分，一部分作为内回流返回减压塔第IV段填料顶部。另一部分经 E-547A/B、E-541、E-538 换热后再分为两部分，一部分作为减三中返回减压塔，另一部分经 E-530、E-531A/B 换热后与减一线、减二线合并为混合蜡油。混合蜡油分为两部分出装置，一部分至加氢裂化装置，另一部分至罐区。

（7）Vac. column distillate 4# process flow

减四线流程

The Vac. overfalsh oil flows by gravity into the Vac. overfalsh oil buffer drum D-404 from the Vac.

overfalsh oil collecting drum, where it is drawn by Vac. overfalsh oil pump (P-404A/B), sent into E-546 for heat exchange, and divided into two streams. One stream is recycled back to D-404, and the other stream is sent into E-510 for heat exchange and then combined with VR.

减四线从减四线集油箱自流至减四线缓冲罐 D-404。减四线油再经减四线泵（P-404A/B）抽出，经 E-546 换热后分两部分，一部分返回 D-404，另一部分经 E-510 换热后与渣油合并。

（8）Vacuum residue(VR) process flow

减压渣油流程

The VR is drawn by Vac. residue pump (P-430A/B) and divided into two streams. One stream is recycled back to P-430A/B for minimum flow control. The other stream is sent into E-548A/B and E-544 for heat exchange and then divided into two sub-streams: one sub-stream is recycled back to the Vac. column as quench oil to control Vac. residue temperature, and the other sub-stream is sent into E-526 and E-527A/B for heat exchange and then combined with Vac. overfalsh oil. The VR is divided into two streams and sent out of the process unit, one stream is directly sent to the Flexicoking Unit as feedstock and the other stream is sent to drum.

减压渣油经减压渣油泵（P-430A/B）抽出后分两部分，一部分返回减压塔 P-430A/B 最小流量控制。另一部分经 E-548A/B、E-544 换热后再分为两部分，一部分返回减压塔做急冷油，控制减压塔底温度，另一部分再经 E-526、E-527A/B 换热后与减四线合并。减压渣油出装置分为两部分，一部分直供灵活焦化装置，另一部分至罐区。

1.2 Process indicators 工艺指标

1.2.1 Quality indicators for main feedstock and auxiliary materials 原料及原辅料质量指标

The mixed crude to the process unit is composed of condensate 1: Brunei light oil: condensate 2: Qatar crude = 100:300:70:330. The basic properties of the mixed crude are shown in Table 1. TBP distillation of the mixed crude and the properties of each narrow fraction are shown in Table 2.

本装置加工原料为凝析油 1：文莱轻油：凝析油 2：卡塔尔原油=100:300:70:330。混合原油基本性质见表 1，混合原油的是沸点蒸馏及各窄馏分性质见表 2。

Table 1 Basic Properties of Mixed Crude

Item	Figure	Item	Figure
API	38.42	Light HCs	wt%
Specific gravity (@15.6°C)	0.8328	Ethane	0.02
Total S, wt%	1.05	Propane	0.21
Mercaptan sulfur, ppm	309	Isobutane	0.29
Pouring point, °C	-27	n-butane	1.03
Total nitrogen, ppm	710	l-pentane	1.79
Salt, mgNaCl/l		N-pentane	1.6
Total acid number, mgKOH/g	0.21	Cyclopentane	0.21
Viscosity, cst 50°C	2.7	Total	5.14

表 1 混合原油基本性质表

项目	数值	项目	数值
API	38.42	轻烃组成	wt%
比重 (15.6°C)	0.8328	乙烷	0.02
总硫 wt%	1.05	丙烷	0.21
硫醇硫 ppm	309	异丁烷	0.29
倾点°C	-27	正丁烷	1.03
总氮 ppm	710	异戊烷	1.79
盐含量 mgNaCl/l	-	正戊烷	1.6
酸值 mgKOH/g	0.21	环戊烷	0.21
粘度 cst 50°C	2.7	合计	5.14

Table 2 TBP Distillation of Mixed Crude and Properties of Each Narrow Fraction

S/ N	Boiling Range, °C	Percentage Out of Crude, %(m/m)		Density, g/cm ³ (15.5°C)	Pouring Point °C	Cloud Point °C	Freezing Point °C	S content wt%	Acid number mgKOH/g	Refractive Index 67°C	Kinematic viscosity, mm ² /s			API Gravity
		Each Fraction	Total Yield								38°C	50°C	(100°C)	
1	<100		13.67	0.7224	0	0	0	0.0549	0.021	1.3831	0.51	0.46	0.33	64.37
2	100~120	4.98	18.65	0.7408	0	0	0	0.0659	0.025	1.3928	0.60	0.53	0.36	59.50
3	120~140	3.68	22.34	0.7542	-102	-101	-97	0.1122	0.0378	1.4006	0.70	0.63	0.42	56.11
4	140~160	3.94	26.28	0.7717	-89	-87	-84	0.1517	0.0492	1.4106	0.83	0.73	0.49	51.87
5	160~180	3.98	30.26	0.7892	-80	-78	-75	0.1683	0.0599	1.4207	0.98	0.86	0.55	47.79
6	180~200	3.94	34.2	0.8053	-71	-69	-66	0.1711	0.0731	1.4302	1.19	1.02	0.62	44.22
7	200~220	4.25	38.45	0.8212	-62	-59	-58	0.1717	0.0851	1.4392	1.45	1.23	0.71	40.81
8	220~240	4.72	43.17	0.8352	-51	-50	-48	0.2058	0.1002	1.4474	1.81	1.50	0.83	37.93
9	240~260	4.81	47.97	0.8473	-42	-41	-39	0.2752	0.1285	1.4545	2.31	1.87	0.98	35.51
10	260~280	4.84	52.82	0.8584	-32	-31	-29	0.3819	0.1623	1.4611	2.97	2.34	1.15	33.35
11	280~300	4.74	57.56	0.8676	-21	-20	-17	0.5132	0.2027	1.4665	3.97	3.04	1.39	31.59
12	300~320	4.24	61.8	0.8768	-10	-9	-5	0.6727	0.2582	1.472	5.59	4.11	1.68	29.88
13	320~340	3.97	65.77	0.8847	-1	1	5	0.8321	0.2961	1.4767	7.71	5.45	2.03	28.44
14	340~360	3.19	68.96	0.8958	7	9	13	1.0744	0.3828	1.4833	11.54	7.72	2.51	26.45
15	360~380	2.79	71.76	0.9063	13	16	20	1.291	0.4597	1.4895	17.66	11.22	3.20	24.63
16	380~400	2.77	74.52	0.916	19	22	25	1.3742	0.5053	1.4954	26.98	16.28	4.08	22.97
17	400~420	2.67	77.19	0.9288	25	27	31	1.3366	0.5658	1.5031	49.04	27.52	5.72	20.84
18	420~440	2.62	79.81	0.9391	31	32	36	1.4045	0.6359	1.5092	95.58	49.13	8.15	19.17
19	440~460	2.21	82.03	0.9438	35	36	40	1.6984	0.678	1.5119	148.09	72.54	10.53	18.42
20	460~480	1.81	83.83	0.9463	38	40	43	2.1754	0.6905	1.5132	185.83	89.93	12.47	18.04

Table 2 TBP Distillation of Mixed Crude and Properties of Each Narrow Fraction (Continued)

S/ N	Boiling Range, °C	Percentage Out of Crude, %(m/m)		Density, g/cm ³	Pour ing Point	Cloud Point	Freezi ng Point	S content	Acid number	Refractiv e Index	Kinematic viscosity, mm ² /s			API Gravit y
		Each Fraction	Total Yield	(15.5°C)	°C	°C	°C	w t %	mgKOH/g	67°C	38°C	50°C	100°C	
21	480~500	1.65	85.48	0.9519	41	43	47	2.4232	0.6746	1.5163	290.06	133.92	16.27	17.14
22	500~520	1.51	86.99	0.9593	45	47	51	2.6012	0.6411	1.5204	520.36	223.30	22.35	16
23	520~540	1.39	88.38	0.9665	48	50	54	2.7731	0.5826	1.5243	954.03	380.53	31.29	14.90
24	540~560	1.26	89.64	0.9736	51	53	57	2.9438	0.5015	1.528	1864.84	683.57	44.88	13.84
25	560~580	1.14	90.79	0.9807	55	57	60	3.1223	0.4001	1.5316	3926.45	1310.44	66.92	12.79
26	580~600	0.98	91.77	0.9879	58	60	64	3.3286	0.3038	1.535	9308.63	2780.32	105.42	11.74

表 2 混合原油实沸点蒸馏及各窄馏分性质表

序号	沸点范围℃	占原油%(m/m)		密度 g/cm ³	倾点	云点	冰点	硫含量	酸值	折射率	运动粘度,mm ² /s				API 度
		每馏 分	总收率	(15.5℃)	℃	℃	℃	wt%	mgKOH/g	67℃	38℃	50℃	100℃		
1	<100		13.67	0.7224	0	0	0	0.0549	0.021	1.3831	0.51	0.46	0.33	64.37	
2	100~120	4.98	18.65	0.7408	0	0	0	0.0659	0.025	1.3928	0.60	0.53	0.36	59.50	
3	120~140	3.68	22.34	0.7542	-102	-101	-97	0.1122	0.0378	1.4006	0.70	0.63	0.42	56.11	
4	140~160	3.94	26.28	0.7717	-89	-87	-84	0.1517	0.0492	1.4106	0.83	0.73	0.49	51.87	
5	160~180	3.98	30.26	0.7892	-80	— 78	-75	0.1683	0.0599	1.4207	0.98	0.86	0.55	47.79	
6	180~200	3.94	34.2	0.8053	-71	-69	-66	0.1711	0.0731	1.4302	1.19	1.02	0.62	44.22	
7	200~220	4.25	38.45	0.8212	-62	-59	-58	0.1717	0.0851	1.4392	1.45	1.23	0.71	40.81	
8	220~240	4.72	43.17	0.8352	-51	-50	-48	0.2058	0.1002	1.4474	1.81	1.50	0.83	37.93	
9	240~260	4.81	47.97	0.8473	-42	— 41	-39	0.2752	0.1285	1.4545	2.31	1.87	0.98	35.51	

表 2 (续) 混合原油实沸点蒸馏及各窄馏分性质表

序号	沸点范围℃	占原油%(m/m)		密度 g/cm ³	倾点	云点	冰点	硫含量	酸值	折射率	运动粘度,mm ² /s				API 度
		每馏分	总收率	(15.5℃)	℃	℃	℃	w t %	mgKOH/g	67℃	38℃	50℃	100℃		
10	260~280	4.84	52.82	0.8584	-32	-31	-29	0.3819	0.1623	1.4611	2.97	2.34	1.15	33.35	
11	280~300	4.74	57.56	0.8676	-21	-20	-17	0.5132	0.2027	1.4665	3.97	3.04	1.39	31.59	
12	300~320	4.24	61.8	0.8768	-10	-9	-5	0.6727	0.2582	1.472	5.59	4.11	1.68	29.88	
13	320~340	3.97	65.77	0.8847	-1	1	5	0.8321	0.2961	1.4767	7.71	5.45	2.03	28.44	
14	340~360	3.19	68.96	0.8958	7	9	13	1.0744	0.3828	1.4833	11.54	7.72	2.51	26.45	
15	360~380	2.79	71.76	0.9063	13	16	20	1.291	0.4597	1.4895	17.66	11.22	3.20	24.63	
16	380~400	2.77	74.52	0.916	19	22	25	1.3742	0.5053	1.4954	26.98	16.28	4.08	22.97	
17	400~420	2.67	77.19	0.9288	25	27	31	1.3366	0.5658	1.5031	49.04	27.52	5.72	20.84	
18	420~440	2.62	79.81	0.9391	31	32	36	1.4045	0.6359	1.5092	95.58	49.13	8.15	19.17	
19	440~460	2.21	82.03	0.9438	35	36	40	1.6984	0.678	1.5119	148.09	72.54	10.53	18.42	
20	460~480	1.81	83.83	0.9463	38	40	43	2.1754	0.6905	1.5132	185.83	89.93	12.47	18.04	
21	480~500	1.65	85.48	0.9519	41	43	47	2.4232	0.6746	1.5163	290.06	133.92	16.27	17.14	
22	500~520	1.51	86.99	0.9593	45	47	51	2.6012	0.6411	1.5204	520.36	223.30	22.35	16	
23	520~540	1.39	88.38	0.9665	48	50	54	2.7731	0.5826	1.5243	954.03	380.53	31.29	14.90	
24	540~560	1.26	89.64	0.9736	51	53	57	2.9438	0.5015	1.528	1864.84	683.57	44.88	13.84	
25	560~580	1.14	90.79	0.9807	55	57	60	3.1223	0.4001	1.5316	3926.45	1310.4 4	66.92	12.79	
26	580~600	0.98	91.77	0.9879	58	60	64	3.3286	0.3038	1.535	9308.63	2780.3 2	105.42	11.74	

1.2.2 Design composition and specifications of products and intermediates 产品、中间产品设计组成及指标

Table 3 Properties of Main Products (I)

Item	Specific gravity	Gravity index	Molecular Weight	Properties Factor	Viscosity, mm ² /s		Remarks
	d	API	M		50°C	100°C	
Pri.-Dist OVHD gas			35				To Light Ends Recovery Unit
Pri.-Dist OVHD oil	0.6569	83.92	76	12.67	0.33	0.25	To Light Ends Recovery Unit
Atm.-Dist OVHD gas			33				To Light Ends Recovery Unit
Atm.-Dist OVHD oil	0.726	63.4	101	12.09	0.51	0.36	To Light Ends Recovery Unit
Kerosene	0.8161	41.89	161	11.66	1.19	0.7	To Kerosene Hydrofining Unit
Light diesel	0.8601	33.02	214	11.59	2.61	1.24	To Diesel Hydrofining Unit
Heavy diesel	0.8726	30.66	237	11.6	3.69	1.58	To Diesel Hydrofining Unit
Atm. overflash oil	0.9102	23.97	307	11.59	12.08	3.57	To Hydrocracking Unit
Vac. OVHD gas			36				Self-use
Vac. OVHD oil	0.7631	53.93	122	11.94	0.71	0.46	To Diesel Hydrofining Unit
LVGO	0.8964	26.35	281	11.59	7.37	2.54	To Hydrocracking Unit
MVGO	0.9365	19.59	381	11.59	45.61	7.97	To Hydrocracking Unit
HVGO	0.954	16.82	456	11.67	154.45	17.07	To Hydrocracking Unit
Vac. overflash oil	0.9784	13.13	558	11.72	724.8	46.54	To Flexicoking Unit
VR	1.0179	7.51	819	11.85	4652 (100 °C)	262.1 (150 °C)	To Flexicoking Unit

表 3 装置主要产品性质一

项目	比重	比重指数	分子量	特性因素	粘度 mm ² /s		备注
	d	API	M		50°C	100°C	
初顶气			35				至轻烃回收
初顶油	0.6569	83.92	76	12.67	0.33	0.25	至轻烃回收
常顶气			33				至轻烃回收
常顶油	0.726	63.4	101	12.09	0.51	0.36	至轻烃回收
常一线	0.8161	41.89	161	11.66	1.19	0.7	至航煤加氢
常二线	0.8601	33.02	214	11.59	2.61	1.24	至柴油加氢
常三线	0.8726	30.66	237	11.6	3.69	1.58	至柴油加氢
常四线	0.9102	23.97	307	11.59	12.08	3.57	至加氢裂化

表 3(续) 装置主要产品性质一

项目	比重	比重指数	分子量	特性 因素	粘度 mm ² /s		备注
	d	API	M		50℃	100℃	
减顶气	-	-	36	-	-	-	自用
减顶油	0.7631	53.93	122	11.94	0.71	0.46	至柴油加氢
减一线	0.8964	26.35	281	11.59	7.37	2.54	至加氢裂化
减二线	0.9365	19.59	381	11.59	45.61	7.97	至加氢裂化
减三线	0.954	16.82	456	11.67	154.4 5	17.07	至加氢裂化
减四线	0.9784	13.13	558	11.72	724.8	46.54	至灵活焦化
减渣	1.0179	7.51	819	11.85	4652 (100 ℃)	262.1 (150 ℃)	至灵活焦化

Table 4 Properties of Main Products (II)

ASTM D86	Naphtha			Jet kerosene	Diesel fraction			
	Pri.-Dist OVHD oil	Atm.- Dist OVHD oil	Mixed naphtha	Kerosene	Light heavy	Heavy diesel	Vac. OVHD oil	Mixed diesel
IBP				135.05	159.34	-	-	113.67
5%		45.85	16.96	167.9	221.42	221.41	-	213.91
10%	17.38	59.01	40.69	180.31	240.08	249.93	87.20	239.99
30%	39.95	95.63	63.65	193.16	265.06	288.12	125.07	270.43
50%	48.73	111.59	92.33	205.04	276.43	309.04	151.59	286.10
70%	70.94	128.82	113.06	219.31	288.81	325.02	172.50	304.64
90%	94.73	149.15	142.53	237.71	314.64	349.63	204.55	334.75
95%	105.5	159.24	155.25	246.72	327.13	358.35	224.72	347.39
EBP EBP	120.63	173.78	171.25	261.96	351.46	372.58	272.13	364.78
Freezing point, °C	-	-		-59.15	-	-	-	-
Flash point, °C	-	-	-	42.2	-	-	-	63.1
ASTM D1160	VGO (to HC Unit)					Fuel oil	Feedstock to FCU	-
	Atm. overflash oil	LVGO	MVGO	-	Mixed VGO	Vac. overflash oil	VR	-
IBP	-	186.56	298.25	-	205.98	-	-	-
5%	233.44	244.99	356.84	-	293.37	487.12	531.98	-
10%	294.16	267.31	375.35	446.22	328.63	520.63	563.25	-
30%	367.82	307.19	402.59	477.73	392.90	550.07	619.87	-
50%	393.25	331.29	420.80	497.86	429.10	566.08	689.76	-
70%	416.64	359.28	445.51	518.45	467.63	586.33	785.34	-
90%	459.16	395.80	485.06	545.62	517.48	617.77	-	-
95%	482.34	411.44	503.81	552.93	536.48	-	-	-
EBP	534.75	446.69	535.09	558.68	553.44	-	-	-

表 4 装置主要产品性质二

ASTM D86	石脑油			航煤	柴油馏分			
	初顶油	常顶油	混合石脑油	常一线	常二线	常三线	减顶油	混合柴油
IBP	-	-	-	135.05	159.34	-	-	113.67
5%	-	45.85	16.96	167.9	221.42	221.41	-	213.91
10%	17.38	59.01	40.69	180.31	240.08	249.93	87.20	239.99
30%	39.95	95.63	63.65	193.16	265.06	288.12	125.07	270.43
50%	48.73	111.59	92.33	205.04	276.43	309.04	151.59	286.10
70%	70.94	128.82	113.06	219.31	288.81	325.02	172.50	304.64
90%	94.73	149.15	142.53	237.71	314.64	349.63	204.55	334.75
95%	105.5	159.24	155.25	246.72	327.13	358.35	224.72	347.39
EBP	120.63	173.78	171.25	261.96	351.46	372.58	272.13	364.78
冰点℃	-	-	-	-59.15	-	-	-	-
闪点℃	-	-	-	42.2	-	-	-	63.1
ASTM D1160	减压蜡油(加氢裂化料)					燃料油	焦化原料	-
	常四线	减一线	减二线	减三线	混合蜡油	减四线	减渣	-
IBP		186.56	298.25	356.58	205.98	-	-	-
5%	233.44	244.99	356.84	430.01	293.37	487.12	531.98	-
10%	294.16	267.31	375.35	446.22	328.63	520.63	563.25	-
30%	367.82	307.19	402.59	477.73	392.90	550.07	619.87	-
50%	393.25	331.29	420.80	497.86	429.10	566.08	689.76	-
70%	416.64	359.28	445.51	518.45	467.63	586.33	785.34	-
90%	459.16	395.80	485.06	545.62	517.48	617.77	-	-
95%	482.34	411.44	503.81	552.93	536.48	-	-	-
EBP	534.75	446.69	535.09	558.68	553.44	-	-	-

Table 5 Design Parameters for Main Products

S/N	Main Parameters	Unit	Control Indicator
1	Naphtha (mixed Pre. Dist. OVHD oil and Atm. OVHD oil)		
	ASTM D86 98%	℃	≤175
2	Jet kerosene (kerosene)		
	Freezing point	℃	≤-47
	Flash point	℃	≥38
	Density (@20℃)	kg/m ³	775~830
3	Mixed diesel (mixed light diesel and heavy oil)		
	ASTM D86 95%	℃	≤365
	Flash point	℃	≥55
4	Feedstock to HCU (mixed Atm. overflash oil, LVGO, MVGO and HVGO)		
	ASTM D1160 98%	℃	≤560

表 5 装置主要产品设计指标

序号	主要产品指标	单位	控制指标
1	石脑油（初顶石脑油、常顶石脑油混合）		
	ASTM D86 98%	℃	≤175
2	航煤（常一线）		
	冰点	℃	≤-47
	闪点	℃	≥38
	密度（20℃）	kg/m ³	775~830
3	混合柴油（常二线、常三线、减顶油混合后）		
	ASTM D86 95%	℃	≤365
	闪点	℃	≥55
4	加氢裂化原料（常四线、减一线、减二线、减三线混合后）		
	ASTM D11606 98%	℃	≤560

Table 6 Control Indicators for Feedstocks

S/N	Parameter	Unit	Control Indicator
1	Crude density (@ 15℃)	g/cm ³	0.82~0.85
2	Crude acid number	mgKOH/g	≤0.5
3	S content in crude	%	≤1.05
4	Organic chlorine in crude	mg/kg	≤2
5	Water content in crude	%	≤0.5

表 6 装置原料控制指标

序号	参数名称	单位	控制指标
1	原油密度（15℃）	g/cm ³	0.82~0.85
2	原油酸值	mgKOH/g	≤0.5
3	原油硫含量	%	≤1.05
4	原油有机氯	mg/kg	≤2
5	原油水含量	%	≤0.5

Table 7 Control Indicators for Main Products

S/N	Parameter	Unit	Control Indicator
1	Pre-Dist. OVHD oil dry point	℃	≤175
2	Atm. OVHD oil dry point	℃	≤175
3	Kerosene freezing point	℃	≤-49
4	Kerosene EBP	℃	≤260
5	Kerosene Flash point	℃	≥40
6	Kerosene density (@15℃)	Kg/m ³	776~839
7	Mixed diesel, 95%	℃	≤358
8	Heavy diesel, 95% (feedstock to Diesel Hydrofining Unit)	℃	≤365

Table 7 Control Indicators for Main Products (Continued)

S/N	Parameter	Unit	Control Indicator
9	Mixed VGO EBP	°C	≤560
10	Residual carbon in mixed VGO	m% m%	≤0.3
11	HVGO EBP	°C	≤580
12	Residual carbon in HVGO	wt%	≤2.0
13	Salt content in desalted crude	mg/L	≤3
14	Water content in desalted crude	m%	≤0.3

表 7 装置主要产品控制指标

序号	参数名称	单位	控制指标
1	初顶石脑油干点	°C	≤175
2	常顶石脑油干点	°C	≤175
3	常一线冰点	°C	≤-49
4	常一线终馏点	°C	≤260
5	常一线闪点	°C	≥40
6	常一线密度（15°C）	Kg/m ³	776~839
7	混合柴油 95%	°C	≤358
8	常三线 95%（加氢精制料）	°C	≤365
9	混合蜡油终馏点	°C	≤560
10	混合蜡油残炭	m%	≤0.3
11	减三线终馏点	°C	≤580
12	减三线残炭	wt%	≤2.0
13	脱后含盐	mg/L	≤3
14	脱后含水	m%	≤0.3

1.2.3 Utility specifications 公用工程指标

Table 8 Utility Specifications

S/N	Parameter	Tag No	Unit	Control Indicator
1	1.0MPa steam pressure	PI82001	MPa	≥1.0
2	Process water pressure	PI81103	MPa	≥0.40
3	Nitrogen pressure	PI83003	MPa	≥0.70
4	Fuel gas pressure	PIC86001	MPa	≥0.35
5	Fuel oil pressure	PIC86201	MPa	≥0.50
6	0.5 MPa steam pressure	PI82101	MPa	≥0.35
7	CWS pressure	PI81001	MPa	≥0.40
8	CWS temperature	TI81001	°C	≤33
9	Demineralized water pressure	PI81101	MPa	≥0.70

Table 8 Utility Specifications(Continued)

S/N	Parameter	Tag No	Unit	Control Indicator
10	Stripped water pressure	PI81102	MPa	≥0.60
11	Instrument air pressure	PI83002	MPa	≥0.60
12	Plant air pressure	PI83001	MPa	≥0.60
13	S content in fuel gas	-	mg/m3	≤100

表 8 公用工程指标

序号	参数名称	位号	单位	控制指标
1	1.0MPa 蒸汽压力	PI82001	MPa	≥1.0
2	生产水压力	PI81103	MPa	≥0.40
3	氮气压力	PI83003	MPa	≥0.70
4	燃料气压力	PIC86001	MPa	≥0.35
5	燃料油压力	PIC86201	MPa	≥0.50
6	0.5MPa 蒸汽压力	PI82101	MPa	≥0.35
7	循环水给水压力	PI81001	MPa	≥0.40
8	循环水给水温度	TI81001	℃	≤33
9	除盐水压力	PI81101	MPa	≥0.70
10	净化水压力	PI81102	MPa	≥0.60
11	仪表风压力	PI83002	MPa	≥0.60
12	工厂风压力	PI83001	MPa	≥0.60
13	燃料气硫含量	-	mg/m ³	≤100

1.2.4 Main operating conditions(design) 主要操作条件（设计）

Table 9 Main Operating Conditions

S/N	Parameter	Unit	Figure
1	Desalting temperature	℃	127
2	Vac. column flash evaporation section temperature	℃	211
3	Pre. Dist. column top temperature	℃	132
4	Pre. Dist. column bottom temperature	℃	211
5	Atm. top pressure	MPa	0.11
6	Atm. top temperature	℃	151
7	Atm. flash evaporation section temperature	℃	358
8	Atm. bottom temperature	℃	353
9	Vac. column top pressure	mmHg (a)	18
10	Vac. column flash evaporation section pressure	mmHg (a)	28

Table 9 Main Operating Conditions (Continued)

S/N	Parameter	Unit	Figure
11	Vac. column top temperature	°C	70
12	Vac. column flash evaporation section temperature	°C	388
13	Vac. column bottom temperature	°C	360
14	Final heat exchange temperature	°C	285
15	Atm. heater exit offshoot temperature	°C	359
16	Vac. heater exit offshoot temperature	°C	412

表 9 主要操作条件

序号	参数名称	单位	数值
1	脱盐温度	°C	127
2	初馏塔闪蒸段温度	°C	211
3	初馏塔塔顶温度	°C	132
4	初馏塔塔底温度	°C	211
5	常压塔塔顶压力	MPa	0.11
6	常压塔塔顶温度	°C	151
7	常压塔闪蒸段温度	°C	358
8	常压塔塔底温度	°C	353
9	减压塔塔顶压力	mmHg (a)	18
10	减压塔闪蒸段压力	mmHg (a)	28
11	减压塔塔顶温度	°C	70
12	减压塔闪蒸段温度	°C	388
13	减压塔塔底温度	°C	360
14	换热终温	°C	285
15	常压炉出口分支温度	°C	359
16	减压炉出口分支温度	°C	412

1.2.5 Main design indicators 主要设计指标

Table 10 Main Design Indicators

S/N	Parameter	Unit	Figure
1	Desalting temperature	°C	127
2	Pre. Dist. column top pressure	MPa	0.38
3	Vac. column top pressure	mmHg (a)	18
4	Vacu. column flash evaporation section pressure	mmHg (a)	28

Table 10 Main Design Indicators(continued)

S/N	Parameter	Unit	Figure
5	Final heat exchange temperature	°C	285
6	Atm. heater exit offshoot temperature	°C	359
7	Vac. heater exit offshoot temperature	°C	412
8	Crude salt content after desalter	mgNaCl/L	≤3

表 10 主要设计指标

序号	参数名称	单位	数值
1	脱盐温度	°C	127
2	初馏塔塔顶压力	MPa	0.38
3	减压塔塔顶压力	mmHg (a)	18
4	减压塔闪蒸段压力	mmHg (a)	28
5	换热终温	°C	285
6	常压炉出口分支温度	°C	359
7	减压炉出口分支温度	°C	412
8	原油脱后含盐	mgNaCl/L	≤3

1.2.6 Main process indicators 主要工艺指标

Table 11 Main Process Indicators

S/N	Parameter	Tag No	Unit	Control Indicator
1	Desalting temperature	TI-10101	°C	110~150
2	Pre. Dist. column top pressure	PI-21001	MPa	≤0.38
3	Atm. top pressure	PI-31001	MPa	≤0.15
4	Vac. column top temperature	PI-41001	kPa	≤4.0
5	Pre. Dist. column top temperature	TIC-21001	°C	140~180
6	Vac. column top temperature	TIC-31007	°C	125~180
7	Vac. column top temperature	TIC-41001	°C	≤80
8	Atm. heater manifold outlet temperature	TIC-31005 TIC-31006	°C	(355~370) ±1
9	Vac. heater manifold outlet temperature	THS-40105 THS-40106	°C	(370~390) ±1
10	Vac. heater exit offshoot temperature	TI40105AB TI40106AB	°C	≤410

Table 11 Main Process Indicators (Continued)

S/N	Parameter	Tag No	Unit	Control Indicator
11	Heaters temperature	TI86904~ 86906 TI86915~ 86916	°C	≤800
12	Water injection volume/crude volume	-	m%	4~8
13	Demulsifier injection volume (oil-soluble)		kg/t	≤0.01
14	Oxygen content in heater flue gas	AI86901 AI86902 AI86903 AI86904	v%	≤4 (fuel gas) ≤5 (fuel oil)
15	Pre. Dist. column bottom level	LIC21003	%	40~60
16	Atm. bottom level	LIC31001	%	40~60
17	Vac. column bottom level	LIC41004	%	50~70
18	heater exit offshoot temperature		°C	≤8
19	Air preheater outlet flue gas temperature	TIC86925	°C	120~ 150 (fuel gas) 165~ 175 (fuel oil)
20	Vac. column bottom temperature	TI40904	°C	≤360
21	Pre-dist. OVHD reflux drum level	LIC23001	%	40~60
22	Atm. OVHD reflux drum level	LIC33001	%	40~60
23	Temperature of kerosene to KHT	TI70201	°C	80~110
24	Temperature of kerosene to drum	TI70202	°C	30~50
25	Temperature of mixed diesel to DHT	TI70301	°C	80~110
26	Temperature of mixed diesel to drum	TI70302	°C	40~60
27	Temperature of VGO to HCU	TI71101	°C	115~135
28	Temperature of VR to FCU	TI71201	°C	130~170

表 11 主要工艺指标

序号	参数名称	位号	单位	控制指标
1	脱盐温度	TI-10101	°C	110~150
2	初馏塔塔顶压力	PI-21001	MPa	≤0.38
3	常压塔塔顶压力	PI-31001	MPa	≤0.15

表 11 (续) 主要工艺指标

序号	参数名称	位号	单位	控制指标
4	减压塔塔顶残压	PI-41001	kPa	≤ 4.0
5	初馏塔塔顶温度	TIC-21001	℃	140~180
6	常压塔塔顶温度	TIC-31007	℃	125~180
7	减压塔塔顶温度	TIC-41001	℃	≤ 80
8	常压炉总出口温度	TIC-31005 TIC-31006	℃	(355~370) ± 1
9	减压炉总出口温度	THS-40105 THS-40106	℃	(370~390) ± 1
10	减压炉出口分支温度	TI40105AB TI40106AB	℃	≤ 410
11	两炉炉膛温度	TI86904~86906 TI86915~86916	℃	≤ 800
12	注水量/与原油量	-	m%	4~8
13	注破乳剂量 (油溶性)	-	kg/t	≤ 0.01
14	加热炉烟气氧含量	AI86901 AI86902 AI86903 AI86904	v%	≤ 4 (烧气) ≤ 5 (烧油)
15	初馏塔塔底液位	LIC21003	%	40~60
16	常压塔塔底液位	LIC31001	%	40~60
17	减压塔塔底液位	LIC41004	%	50~70
18	加热炉炉管分支温差		℃	≤ 8
19	空气预热器出口烟气温度	TIC86925	℃	120~150 (烧气) 165~175 (烧油)
20	减压塔塔底温度	TI40904	℃	≤ 365
21	初顶回流罐液位	LIC23001	%	40~60
22	常顶回流罐液位	LIC33001	%	40~60
23	常一线直供航煤加氢温度	TI70201	℃	80~110
24	常一线至罐区温度	TI70202	℃	30~50
25	混合柴油直供柴油加氢温度	TI70301	℃	80~110
26	混合柴油至罐区置温度	TI70302	℃	40~60
27	减压蜡油出装置温度	TI71101	℃	115~135
28	减压热渣出装置温度	TI71201	℃	130~170

1.2.7 Main material balance 主要物料平衡

The process unit is designed in a capacity of processing 8 million tons of crude per year and in an on-stream availability of 8,400 hours per year. The material balance under design conditions is shown in Table 12.

装置加工原油 800 万吨/年，按年加工 8400 小时进行设计，设计工况下的物料平衡见表 12。

Table 12 Main Material Balance

S/N	Description	Distillation Range, °C	%(m/m)	kg/h	t/d	10 ⁴ t/a	Remarks
	Input	-	-	-	-	-	-
1	Crude	-	100	952381	22857.14	800	Crude
	Output:	-	-	-	-	-	-
1	Pre. Dist.OVH D gas	-	0.05	459	11	0.39	To Light Ends Recovery Unit
2	Pre. Dist.OVH D oil	-	8.51	81021	1944.5	68.06	To Light Ends Recovery Unit
3	Atm. OVHD gas	-	0.04	368	8.8	0.31	To Light Ends Recovery Unit
4	Atm. OVHD oil	-	17.95	170920	4102.1	143.57	To Light Ends Recovery Unit
5	Kerosene	165~240°C	16.63	158340	3800.2	133.01	To KHT
6	Light diesel	240~295°C	13.20	125760	3018.2	105.64	To DHT
7	Heavy diesel	295~340°C	9.39	89429	2146.3	75.12	To DHT
8	Atm. Overflash oil	340~382°C	6.30	60000	1440.0	50.40	To HCU
	AR	-	27.94	266084	6386.0	223.51	To VDU
9	Vac. OVHD gas	-	0.03	330	7.9	0.28	Fuel gas after desulphurization
10	Vac. OVHD oil	-	0.11	1065	25.6	0.89	To DHT
11	LVGO	382~424°C	5.45	51917	1246.0	43.61	To HCU
12	MVGO	424~479°C	6.08	57867	1388.8	48.61	To HCU
13	HVGO	479~538°C	4.54	43238	1037.7	36.32	To HCU
14	Vac. Overflash oil	538~565°C	1.66	15857	380.6	13.32	To FCU
15	VR	>565°C	10.06	95810	2299.44	80.48	To FCU
-	Total	-	100	952381	22857.1	800	-
-	ADU Lift	-	72.06	686297	16471.1	576.49	-
-	VDU Lift	-	17.88	170274	4086.6	143.03	-

表 12 主要物料平衡

序号	名称	馏份范围°C	% (m/m)	kg/h	t/d	10 ⁴ t/a	备注
	入方	-	-	-	-	-	-
1	原油	-	100	952381	22857.14	800	原油

表 12 (续) 主要物料平衡

序号	名称	馏份范围℃	% (m/m)	kg/h	t/d	10 ⁴ t/a	备注
	出方:	-	-	-	-	-	-
1	初顶气	-	0.05	459	11	0.39	至轻烃回收
2	初顶油	-	8.51	81021	1944.5	68.06	至轻烃回收
3	常顶气	-	0.04	368	8.8	0.31	至轻烃回收
4	常顶油	-	17.95	170920	4102.1	143.57	至轻烃回收
5	常一线	165~240℃	16.63	158340	3800.2	133.01	航煤加氢原料
6	常二线	240~295℃	13.20	125760	3018.2	105.64	柴油加氢原料
7	常三线	295~340℃	9.39	89429	2146.3	75.12	柴油加氢原料
8	常四线	340~382℃	6.30	60000	1440.0	50.40	加氢裂化原料
	常底油	-	27.94	266084	6386.0	223.51	减压进料
9	减顶气	-	0.03	330	7.9	0.28	脱硫后自用燃料
10	减顶油	-	0.11	1065	25.6	0.89	柴油加氢原料
11	减一线	382~424℃	5.45	51917	1246.0	43.61	加氢裂化原料
12	减二线	424~479℃	6.08	57867	1388.8	48.61	加氢裂化原料
13	减三线	479~538℃	4.54	43238	1037.7	36.32	加氢裂化原料
14	减四线	538~565℃	1.66	15857	380.6	13.32	灵活焦化原料
15	减渣	>565℃	10.06	95810	2299.44	80.48	灵活焦化原料
-	合计	-	100	952381	22857.1	800	-
-	常压拔出	-	72.06	686297	16471.1	576.49	-
-	减压拔出	-	17.88	170274	4086.6	143.03	-

1.2.8 Raw material, utilities and energy consumption indicators 原材料消耗、公用工程消耗及能耗指标

Table 13 Chemical Agent Consumptions

S/N	Project Name	Unit	Annual Consumption	Remarks
1	Demulsifier	t	150	Barrel
2	Neutralization corrosion inhibitor	t	120	Barrel
3	Fouling inhibitor	t	32	Barrel
4	High temperature neutralizing corrosion inhibitor	t	24	Barrel
5	MEDA solution	t/h	16	Piping, continuously

表 13 化工三剂消耗

序号	项目名称	单位	年用量	备注
1	破乳剂	t	150	桶装
2	中和缓蚀剂	t	120	桶装
3	阻垢剂	t	32	桶装
4	高温缓蚀剂	t	24	桶装
5	胺液	t/h	16	管道, 连续进出

Table 14 Water Consumption

S/N	Project Name	Unit	Continuous	Intermittent
1	Softened water	t/h	0	78.82
2	Fresh water	t/h	0	653
3	CWS	t/h	1908.83	1557.93
4	Demineralized water	t/h	0	0
5	Stripped water	t/h	73.82	108.55

表 14 用水量

序号	项目名称	单位	连续	间断
1	软化水	t/h	0	78.82
2	生产水	t/h	0	653
3	循环水	t/h	1908.83	1557.93
4	除盐水	t/h	0	0
5	净化水	t/h	73.82	108.55

Table 15 Electric Power Consumption

S/N	Item	Voltage, V	Equipment Power, kW		Shaft Power	Annual Power Consumption
-	-	-	For operation	For backup	kW	×104kW
1	Pumps	10000	2255	2255	1577	1408.68
-	-	380	1562.5	1562.5	1075.7	903.59
-	-	380	130.5	-	-	Intermittent
2	Air coolers	380	660	-	528	443.52
3	Desalter	10000	960kVA	-	230	192
4	Heaters	10000	738	-	607	509.88
-	-	380	30	-	-	Intermittent
5	Instruments	220	-	-	24	20.16
6	Heating and Ventilation Electricitv	380	-	-	50	42
7	Lighting fixtures	220	-	-	100	42

Table 15(continued) Electric Power Consumption

S/N	Item	Voltage, V	Equipment Power, kW		Shaft Power	Annual Power Consumption
-	-	-	For operation	For backup	kW	×104kW
8	Liquid ring pumps	380	-	-	63.6	53.42
-	Total	-	-	-	4355.3	3615.25

表 15 用电量

序号	使用地点	电压 V	设备容量 kW		轴功率	年用电量
-	-	-	操作	备用	kW	× 10 ⁴ kW
1	机泵用电	10000	2255	2255	1577	1408.68
-	-	380	1562.5	1562.5	1075.7	903.59
-	-	380	130.5	-	-	间断
2	空冷器	380	660	-	528	443.52
3	电脱盐	10000	960kVA	-	230	192
4	加热炉	10000	738	-	607	509.88
-	-	380	30	-	-	间断
5	仪表用电	220	-	-	24	20.16
6	采暖通风	380	-	-	50	42
7	照明	220	-	-	100	42
8	液环泵	380	-	-	63.6	53.42
-	合计	-	-	-	4355.3	3615.25

Table 16 Fuel Consumption

Item	Fuel Oil Only		Fuel Gas Only	
	Heat Value, kJ/kg	41868	Heat Value, kJ/kg	49777
	kg/h	t/a	kg/h	t/a
Atmospheric heater	7236	60783	6086	51125
Vacuum heater	1719	14439	1446	12145
Total	8955	75222	7532	63270

表 16 燃料消耗

使用地点	单烧燃料油		单烧燃料气	
	热值 kJ/kg	41868	热值 kJ/kg	49777
	kg/h	t/a	kg/h	t/a
常压炉	7236	60783	6086	51125
减压炉	1719	14439	1446	12145
合计	8955	75222	7532	63270

Note: the data in this table is sourced from BED. In DED, fuel oil and fuel gas are designed for the Atm. heater, while fuel gas is only designed for the Vac. heater.

注：本表数据为基础设计数据，详细设计时常压炉烧燃料油和燃料气，减压炉只烧燃料气

Table 17 Other Utilities Consumptions

S/N	Project Name	Unit	Continuous	Intermittent
1	0.5MPa steam	t/h	3.45	-
2	1.0MPa steam	t/h	9.426	23.713
3	Plant air	Nm ³ /h	-	800
4	Instrument air	Nm ³ /h	200	-
5	Nitrogen	Nm ³ /h	-	200

表 17 其它公用工程消耗

序号	项目名称	单位	连续	间断
1	0.5MPa 蒸汽	t/h	3.45	-
2	1.0MPa 蒸汽	t/h	9.426	23.713
3	非仪表风	Nm ³ /h	-	800
4	仪表风	Nm ³ /h	200	-
5	氮气	Nm ³ /h	-	200

Table 18 Energy Consumption Indicators

S/N	Item	Consumption		Energy Equivalent Value		Energy Consumption	Remarks
		Unit	Q'ty	Unit	Q'ty	MJ/t	
1	Electric power		3615.3	MJ/kWh	10.89	49.21	-
2	Fresh water	t/h	0	MJ/t	6.28	0	-
3	CWS	t/h	1909	MJ/t	4.19	8.4	-
4	Softened water	t/h	0	MJ/t	10.47	0	-
5	Purified water	t/h	73.8	MJ/t	96.3	7.46	-
6	Wastewater	t/h	99.7	MJ/t	46.05	4.82	-
7	1.0MPa steam	t/h	9.4	MJ/t	3182	31.49	-
8	0.3MPa steam	t/h	3.5	MJ/t	2763	10.01	-
10	Instrument air	Nm ³ /h	200	MJ/Nm ³	1.59	0.33	-

Table 18(continued) Energy Consumption Indicators

S/N	Item	Consumption		Energy Equivalent Value		Energy Consumption	Remarks
		Unit	Q'ty	Unit	Q'ty	MJ/t	
11	Fuel oil	t/h	8.95	MJ/t	41868	393.67	Typical fuel oil
12	Heat transfer out of the plant	MW	-13.956	-	1	-52.75	-
13	Heat-triggered material	MW	-10.615	-	1	-40.13	-
14	Total	-	-	-	-	412.5l	-
-	-	-	-	-	-	(9.85×10 ⁴ kgEo/t crude)	

表 18 装置能耗指标

序号	项目	耗量		能量折算值		能耗	备注
		单位	数量	单位	数量	MJ/t	
1	电	-	3615.3	MJ/kWh	10.89	49.21	-
2	新鲜水	t/h	0	MJ/t	6.28	0	-
3	循环水	t/h	1909	MJ/t	4.19	8.4	-
4	软化水	t/h	0	MJ/t	10.47	0	-
5	净化水	t/h	73.8	MJ/t	96.3	7.46	-
6	污水	t/h	99.7	MJ/t	46.05	4.82	-
7	1.0MPa 蒸汽	t/h	9.4	MJ/t	3182	31.49	-
8	0.3MPa 蒸汽	t/h	3.5	MJ/t	2763	10.01	-
10	仪表风	Nm ³ /h	200	MJ/Nm ³	1.59	0.33	-
11	燃料油	t/h	8.95	MJ/t	41868	393.67	标准燃料油
12	装置外输热	MW	-13.956	-	1	-52.75	-
13	装置热出料	MW	-10.615	-	1	-40.13	-
14	能耗合计	-	-	-	-	412.5l	-
-	-	-	-	-	-	(9.85×10 ⁴ kgEo/t 原油)	

1.3 Emission treatment 三废处理

1.3.1 Wastewater 废水

Wastewater discharged from the process units includes sour water, brine and oily water. The wastewater discharged from the process unit shall be categorized and treated on a principle of separation of non-contaminated and contaminated wastewater.

本装置在生产过程中排出的废水有含硫污水、含盐污水、含油污水。按照清污分流、污污分流的原则对装置排水进行分类处理。

The wastewater streams discharged from the process unit mainly include:

装置废水主要有

1.3.1.1 The sour water from the Pre. Dist. OVHD, Atm. OVHD and Vac. OVHD in design flowrate of 33.39~50.3t/h: it is sent to the Sour Water Stripping Unit, and the main pollutants include sulfide (620mg/l), COD (2500mg/l), petroleum pollutants (150 mg/l) and NH₃-N (620 mg/l).

初顶、常顶和减顶的含硫污水，设计流量 33.39~50.3t/h、送至污水汽提装置，主要污染组份为：硫化物 620mg/l、COD2500mg/l、石油类 150mg/l、氨氮 620mg/l。

1.3.1.2 Brine in design flowrate of 64.7~89.5t/h: the brine from the 2nd stage desalter is recycled to the 1st stage desalter to reduce brine drainage and water demand. The brine from the 1st stage desalter is heat exchanged from 127 °C to 40 °C, then it is sent to the Wastewater Treatment Plant via the sewer chambers. When it is treated and satisfies the discharge standards, it is discharged. The main pollution components include sulfide (20mg/l), COD (1500mg/l), petroleum pollutants (150mg/l) and NH₃-N (100mg/l).

电脱盐的含盐污水，设计流量 64.7~89.5t/h，将二级脱盐切水回注到一级，减少含盐污水的排放量和用水量。一级排水经换热后由 127°C降至 40°C，经下水井排至污水处理场处理，合格后排放。主要污染组份为：硫化物 20mg/l、COD1500mg/l、石油类 150mg/l、氨氮 100mg/l。

1.3.1.3 Oily wastewater includes blowdown wastewater from pump cooling water systems and CWS, wastewater from floor drains, ground flushing water and polluted rainwater in the cofferdam. The oily wastewater from the process unit is sent to the Waste Water Treatment Plant. When it is treated and satisfies the discharge standards, it is discharged. The main pollution components include COD (250mg/l) and petroleum pollutants (150 ~ 200mg/l). Oily wastewater also includes the oily wastewater generated from the ground and the trenches along the pump area in design flowrate of 5~8.5t/h.

含油污水来自机泵冷却水、循环水排污、地漏排水、地面冲洗水和围堰内被污染的雨水。装置排出的含油污水经下水井排至污水处理场处理，合格后排放。主要污染组份为：COD250mg/l、石油类 150~200mg/l。地面以及泵区边沟产生的含油污水，设计流量 5~8.5t/h。

Table 19 Major Pollutants, Their Properties and Hazards

Main Pollutants	Properties	Hazards
Petroleum hydrocarbons	They are low-toxic substances and stable in water. Petroleum hydrocarbons in content of 0.2-0.4mg/L can form oil film on the water surface, which has a slight inhibition effect on water biochemical oxygen consumption process.	After the oil is discharged into the water body, a film is formed on the water surface to prevent the oxygen in the atmosphere from being dissolved in the water, which affects the cleanness of the water body and endangers the survival of the aquatic organism.

Table 19(continued) Major Pollutants, Their Properties and Hazards

Main Pollutants	Properties	Hazards
Sulfide	Hydrogen sulfide is a toxic and colorless substance with rotten egg smell. It is soluble in water, and shows acidity.	It can enter the human body through breathing. It can cause tissue hypoxia, central nervous system poisoning, and even death in severe cases.

表19 主要污染物性质危害

主要污染物	性质	危害
石油烃	属低毒物质，在水中稳定，含量 0.2~0.4mg/L 可在水面形成油膜，对水的生化耗氧过程有轻度抑制作用。	油类排入水体后，在水面形成薄膜，阻止大气中的氧溶于水中，影响水体干净，危害水生物的生存。
硫化物	硫化氢是无色、有臭鸡蛋味的有毒物质。溶于水呈酸性	经呼吸进入人体。可引起组织缺氧、中枢神经中毒、严重时可致死亡。

1.3.2 Waste gas 废气

The waste gas includes the flue gas from the Atm. heater and Vac. heater during operation, and it is directly discharged to the atmosphere via independent chimney. The harmful substances in the flue gas mainly include: SO₂, NO₂, CO, and flue dust.

本装置在生产过程中排出的废气有常压炉、减压炉烟气，通过独立烟囱直接排往大气。烟气中有有害物质主要有：SO₂、NO₂、CO、烟尘。

The waste gas also includes the non-condensable, such as light hydrocarbons generated from sampling, purging and venting, light hydrocarbons leaked from piping, valves and pumps, light hydrocarbons volatilized from oily water chambers. These light hydrocarbons are not desulphurization and generally contain sulfides.

此外还有无组织排放，如：采样、吹扫放空产生的轻烃；管线、阀门、机泵等泄漏出的轻烃；含油污水井挥发出的轻烃。这些轻烃未经脱硫，一般还含有硫化物。

Waste gas treatment is considered in design: desulphurization fuel gas is used as the fuel for the heaters and the heater flue gas is vented into the air via chimney, the column OVHD vapor is compressed and then sent to the Light Ends Recovery Unit, the column OVHD flammable gas, vessel OVHD flammable gas and the flammable gas from the relief valves during startup, shutdown and abnormal operation are sent to the flare system in an enclosed way.

本装置在设计过程中就考虑到废气的处理：加热炉以脱硫燃料气为燃料，烟气通过烟囱排入大气；塔顶产生的气体经压缩机加压后去轻烃回收装置；开停工及不正常操作时塔顶、容器顶安全阀起跳所泄放的可燃气体，均密闭送往火炬系统处理。

Table 20 Waste Gas Emission Volume and Destination

Pollution Source Description	Emission Volume	Emission Mode	Stack Height m	Main Pollutant Content (mg/m ³)			Emission
				SO ₂	NO _x	Flue Dust	Destination
Heater flue gas	160718~1973 24Nm ³ /a	Continuous	80	28.26	200	30	Air

表 20 装置废气排放量及去向

污染源名称	废气量	排放规律	排气筒高度 m	主要污染物排放量 (mg/m ³)			排放
				SO ₂	NO _x	烟尘	去向
加热炉烟气	160718~1973 24Nm ³ /a	连续	80	28.26	200	30	大气

Table 21 Major Pollutants, Their Properties and Hazards

Main Pollutants	Properties	Hazards
Sulfide	It is a colorless, intensely pungent, irritating gas.	It can stimulate the throat and conjunctiva. It can cause cough, chest stress level. When the concentration is above 1000mg/L, it is dangerous even if contact for a short time.
CO	It is a colorless, odorless gas, it is soluble in alcohol, benzene, acetic acid, copper oxide solution but with low solubility in water.	It has an effect on the central nervous system, causing headache, nausea, collapse, paralysis, and coma, even death.
Dust	It is a solid particle, adhering to gas and liquid. The dust in diameter larger than 10μm is classified as fall dust, and the dust in diameter less than 10μm is classified as drifting dust	Pneumoconiosis will occur when inhaled into the lungs. It can cause shortness of breath, chest pain, cough and other accompanied diseases.

表 21 主要污染物性质及危害

主要污染物	性质	危害
硫化物	无色, 强烈辛辣恶臭的刺激性气体。	刺激喉头、眼结膜。引起咳嗽、胸部有紧迫感浓度在 1000mg/L 以上, 即使短间接接触也有危险。
一氧化碳	无色、无味的气体, 能溶于酒精、苯、醋酸、氧化铜溶液中, 在水中溶解度很小。	对中枢神经有影响, 引起头痛恶心、虚脱、痉挛、昏迷可致死亡。
粉尘	是固体微粒、粘附着气体和液体。直径大于 10 μm 为落尘 (降尘), 小于 10 μm 为漂尘	吸入肺部发生尘肺。出现气短、胸痛、咳等症状, 并伴发其他疾病。

1.3.3 Solid waste 固体废弃物

The solid waste generated from the process unit mainly include the oil sludge and spent mineral oil generated during equipment and vessel maintenance and cleaning, they are stored at the specified locations and recycled by special vehicles to reduce pollution to the surrounding environment. No solid waste is generated during normal operation.

本装置固体废弃物主要是在检修时清理设备、容器等产生的油泥等矿物油，均按照体系要求地点存放、专车回收处理，减少对周围环境的污染。正常生产过程不产生固体废弃物。

1.3.4 Noises 噪音

The main noise sources in the process unit include high-power pumps, air coolers, heater burners, and temporary steam venting during startup and shutdown. The sound pressure level is 100dB (A). The noise sources in the process unit are shown in the table below.

装置主要噪声源有大功率机泵、空冷器、加热炉火嘴，及开停工期间短期蒸汽放空等，其声压级为 100dB（A）。装置的噪声源见下表

Table 22 Noise Sources

Noise Source	Height from Ground, m	Indoor/Outdoor	Noise Reduction (Control) Measures	Noise Level after Reduction, dB(A)
Pumps	0.2	Outdoor	Employ low noise motors	80~91
Heaters	4.0	Outdoor	Employ low-noise motors and fans	80~85
Steam venting	15	Outdoor	Employ silencers	100
Air coolers	20	Outdoor	Employ low-noise motors and fans	90~93

表 22 噪声源

噪声源	距地高度 m	室内/室外	减（防）噪措施	降噪后噪声值 dB(A)
机泵	0.2	室外	低噪声电机	80~91
加热炉	4.0	室外	低噪声电机、风机	80~85
蒸汽放空	15	室外	设消声器	100
空冷器	20	室外	低噪声电机、风机	90~93

1.3.5 Environment protection indicators 环保指标

Table 23 Environment Protection Indicators

S/N	Parameter	Unit	Control Indicator
1	Oil content in brine	mg/L	≤200
2	COD of brine	mg/L	≤1500
3	Oil content in the oily wastewater	mg/L	≤300
4	pH value of oily wastewater		6~9
5	Sulfide content in oily wastewater	mg/l	5
6	COD of oily wastewater		800
7	SO ₂ content in heater flue gas	mg/Nm ³	≤100
8	NO _x content in heater flue gas	mg/Nm ³	≤150
9	Dust content in heater flue gas	mg/Nm ³	≤25
10	Ringelman emittance of heater flue gas	Level	≤1

表 23 环保指标

序号	参数名称	单位	控制指标
1	电脱盐切水含油	mg/L	≤300
2	电脱盐切水 pH 值		6~9
3	含油污水含油	mg/L	≤300
4	含油污水 pH 值		6~9
5	含油污水硫化物	mg/l	5
6	含油污水 COD		≤800
7	加热炉烟气 SO ₂	mg/Nm ³	≤100
8	加热炉烟气 NO _x	mg/Nm ³	≤150
9	加热炉烟气烟尘	mg/Nm ³	≤25
10	加热炉烟气林格曼黑度	级	≤1

1.4 Equipment 装置设备

1.4.1 List of Equipment and Their Main Design Parameters 设备一览表及主要设计参数

Table 24 List of Columns and Their Main Design Parameters

S/N	Equipment Tag No	Equipment name:	Process Fluid	Specifications	Pressure (MPaG)		Temperature (°C)		Internal Structure		Shell Material	Volume (m ³)
				Diameter (D) × length (tangent line) × wall thickness (mm)	Design	Operation	Design	Operation OVHD/bottom	Number of trays or number of packing layers	Material		
1	C-200	Pre-dist column	Oil, oil vapor, water vapor	Φ4600/5200×47707×22/24/14+3 (T/T)	0.56/-0.1	0.4	80/250	132/211	22 high efficiency valve tray, 1 accumulator tray, 4 chevron baffles	S31106/Q235	Top and upper shell S11306+Q345R	817
2	C-300	Atm.	Oil, oil vapor	Φ7200×65267×24+3 (T/T)	0.35/-0.1	0.17	80/380	151/353	55 high efficiency valve trays	S30403/UNSN06625	Top and heads: UNSN06625+Q345R, the remaining: S30403+Q345R	2440
3	C-301	Atmospheric side stripper	Oil, oil vapor	Φ3200×46400×14/12+3 (T/T)	0.35/-0.1	0.13-0.15	260/290/330	232/267/302	12+6+0 high efficiency valve trays	S11306/Q235B	S11306+Q345R	190/74/60

Table 24 (continued) List of Columns and Their Main Design Parameters

4	C-400	Vac. column	Oil, oil vapor	Φ5600/9800/5600×50545×20+3/32+3 (T/T)	0.35/-0.1	12mmHg	420	70/360	4 packing layers, 6 high efficiency valve trays	S11306/S31603	S31603+Q345R	2690
5	C-410	Vac. OVHD gas desulfuration tower	Oil, oil vapor	Φ2000×18187×12+3 (T/T)	0.01	0.35/-0.1	90	43/45	2 packing layers	S30403/S11306	S11306+Q245R	381

表 24 塔器一览表及主要设计参数

序号	设备位号	设备名称	介质	规格尺寸	压力(MPaG)		温度(℃)		内部结构		塔体材质	容积(m³)
				直径×高度(切线)×壁厚(mm)	设计	操作	设计	操作上/下	塔板数或填料层数	材质		
1	C-200	初馏塔	油、油气、水蒸气	Φ4600/5200×47707×22/24/14+3 (T/T)	0.56/-0.1	0.4	80/250	132/211	22 层高效浮阀塔盘, 1 层集油箱, 4 层人字挡板	S31106/Q235	顶部及上部壳体 S11306+Q345R	817
2	C-300	常压塔	油、油气	Φ7200×65267×24+3 (T/T)	0.35/-0.1	0.17	80/380	151/353	52 层高效浮阀塔盘	S30403/UNSNO6625	顶部及封头 UNSNO6625+Q345R 其余 S30403+Q345R	2440
3	C-301	常压汽提塔	油、油气	Φ3200×46400×14/12+3 (T/T)	0.35/-0.1	0.13-0.15	260/290/330	232/267/302	12+6+0 层高效浮阀塔盘	S11306/Q235B	S11306+Q345R	190/74/60

表 24 (续) 塔器一览表及主要设计参数

4	C-400	减压塔	油、油气	$\Phi 5600/9800/5600 \times 50545 \times 20+3/32+3$ (T/T)	0.35/- 0.1	12mmH g	420	70/360	四段填料,6 层高 效浮阀塔盘	S11306/S3 1603	S31603+Q345R	2690
5	C-410	减顶气脱硫塔	油、油气	$\Phi 2000 \times 18187 \times 12+3$ (T/T)	0.01	0.35/- 0.1	90	43/45	2 段填料	S30403/S1 1306	S11306+Q245R	381

Table 25 List of Vessels and Their Main Design Parameters

S/N	Tag No	Description	Process Fluid	Specifications	Material	Temperature (°C)		Pressure (MPa·G)		Volume (m ³)
				Diameter (D) × length (tangent line) × wall thickness (δ), mm		Design	Operation	Design	Operation	
1	D-101	1st stage desalter	Crude	$\Phi 4000 \times 30000 \times 12$ (T/T)	Q345R PWHT Q345R + PWHT	170	127	2.2	1.5	360
2	D-102	2nd stage desalter	Crude	$\Phi 4000 \times 30000 \times 12$ (T/T)	Q345R PWHT Q345R + PWHT	170	127	2.2	1.3	360
3	D-110	Desalter feed water	Stripped Water	$\Phi 3000 \times 10302 \times 12$ (T/T)	Q245R	80	40	0.1	Atmospheric pressure	44
4	D-120	Brine drum	Brine	$\Phi 2000 \times 8000 \times$ (T/T)	Q245R PWHT	170	127	2.2	1.5	41.7
5	D-201	Pre-dist. OVHD product drum	Naphtha, oil vapor, water, water vapor	$\Phi 3600 \times 9924 \times 22$ (T/T) Water boot, $\Phi 1400 \times 1200 \times 10+3$ (T/T)	Q245R PWHT S11306+Q245R	80	40	0.9/-0.1	0.3	97
6	D-202	Pre-dist. OVHD reflux drum	Naphtha, oil vapor, water, water vapor	$\Phi 3800 \times 10024 \times 22$ (T/T) Water boot, $\Phi 1000 \times 600 \times 14+3$ (T/T)	Q245R PWHT S11306+Q245R	150/80	98	0.8/-0.1	0.35	60

Table 25 List of Vessels and Their Main Design Parameters (Continued)

S/N	Tag No	Description	Process Fluid	Specifications	Material	Temperature (°C)		Pressure (MPa·G)		Volume (m ³)
				Diameter (D) × length (tangent line) × wall thickness (δ), mm		Design	Operation	Design	Operation	
7	D-301	Atm OVHD product drum	Naphtha, oil vapor, water vapor	Φ4600×10424×22/24 (T/T) Water boot, Φ1400×1400×10+3 (T/T)	Q245R S11306+Q245R	80	40	0.8/-0.1	0.1	163
8	D-302	Atm. OVHD reflux drum	Naphtha, oil vapor, water vapor	Φ4800×11528×24 (T/T) Water boot, Φ1000×1000×22/+3 (T/T)	Q245R PWHT S11306+Q245R	150/80	116	0.75/-0.1	0.1	194
9	D-401	Vac. OVHD drum	Naphtha, oil vapor, water vapor	Φ4200×10224×22 (T/T) Water boot, Φ1600×1600×10+3 (T/T)	Q245R PWHT S11306+Q245R	80	40	0.55/-0.1	0.1	136
10	D-402	Vac. overflash oil drum	Vac. column over-vaporized oil	Φ1600×5718×8 (T/T)	S31603+Q245R	410/80	385	0.35/-0.1	25mmHg (a)	9.7
11	D-410	Decoking Drum	Coke powder, flue gas, water vapor	Φ2000×7141×16 (T/T)	Q245R	475	260	0.35	0.04	18
12	D-821	1.0MPa steam knockout drum	1.0MPa steam	Φ1200×2479×14 (T/T)	Q245R	320	250	1.5	1	1.91
13	D-822	0.5MPa steam knockout drum	0.5MPa steam	Φ800×2183×8 (T/T)	Q245R	250	210	1	0.5	0.54
14	D-831	IA drum	Instrument air	Φ2200×6774×14 (T/T)	Q245R	80	40	1	0.7	22
15	D-832	Instrument sealing liquid drum	Glycerin, water	-	-	-	Ambient temperature		Atmospheric pressure	

Table 25 List of Vessels and Their Main Design Parameters (Continued)

S/N	Tag No	Description	Process Fluid	Specifications	Material	Temperature (°C)		Pressure (MPa·G)		Volume (m³)
				Diameter (D) × length (tangent line) × wall thickness (δ), mm		Design	Operation	Design	Operation	
16	D-841	Flare K.O. drum	Vent oil, gas	Φ3600×9924×22 (T/T) 水包 Φ1200×1200×22 (T/T) Water boot, Φ1200×1200×22 (T/T)	Q245R	320/80	250	0.6/-0.1	0.1	96
17	D-842	Light HC slop drum	Light slop	Φ1600×6874×16 (T/T)	Q245R	120/80	40	1/-0.1	0.9	13
18	D-843	Heavy HC slop drum	Heavy slop	Φ1600×6880×16 (T/T)	Q245R	300/80	100	1/-0.1	0.1	13
19	D-851	Sealing oil pot I	Sealing oil	Φ1800×11489×14 (T/T)	Q245R	80	50	0.6/-0.1	0.1	14.5
20	D-852	Sealing oil pot II	Sealing oil	Φ1800×11489×14 (T/T)	Q245R	80	50	0.6/-0.1	0.01	14.5
21	D-861	HP fuel gas KO drum	Fuel gas	Φ2200×8802×12 (T/T) , provided with heating coil	Q245R	80	40	0.8	0.5	22
22	D-862	Vac. OVHD fuel gas KO drum	Vac. column OVHD vapor	Φ1200×8839×10/14 (T/T)	Q245R PWHT	80	43	0.35(-0.1)/0.8	0.1/0.5	On 3.9 under 2.8

表 25 容器一览表及主要设计参数

序号	位号	名称	介质	规格形式	材质	温度 (°C)		压力 (MPa·G)		容积 (m³)
				直径 D×长度 (切线) ×壁厚 δ mm		设计	操作	设计	操作	
1	D-101	一级电脱盐罐	原油	Φ4000×30000×12 (T/T)	Q345R PWHT	170	127	2.2	1.5	360

表 25 (续) 容器一览表及主要设计参数

序号	位号	名称	介质	规格形式	材质	温度 (°C)		压力 (MPa·G)		容积 (m³)
				直径 D×长度 (切线)×壁厚 δ mm		设计	操作	设计	操作	
2	D-102	二级电脱盐罐	原油	Φ4000×30000×12 (T/T)	Q345R PWHT	170	127	2.2	1.3	360
3	D-110	电脱盐注水罐	净化水	Φ3000×10302×12 (T/T)	Q245R	80	40	0.1	常压	44
4	D-120	含盐污水除油器	含盐污水	Φ2000×8000× (T/T)	Q245R PWHT	170	127	2.2	1.5	41.7
5	D-201	初顶产品罐	石脑油、油气、 水、水蒸气	Φ3600×9924×22 (T/T) 水包 Φ1400×1200×10+3 (T/T)	Q245R PWHT S11306+Q245R	80	40	0.9/- 0.1	0.3	97
6	D-202	初顶回流罐	石脑油、油气、 水、水蒸气	Φ3800×10024×22 (T/T) 水包 Φ1000×600×14+3 (T/T)	Q245R PWHT S11306+Q245R	150/8 0	98	0.8/- 0.1	0.35	60
7	D-301	常顶产品罐	石脑油、油气、 水蒸气	Φ4600×10424×22/24 (T/T) 水包 Φ1400×1400×10+3	Q245R S11306+Q245R	80	40	0.8/- 0.1	0.1	163
8	D-302	常顶回流罐	石脑油、油气、 水蒸气	Φ4800×11528×24 (T/T) 水包 Φ1000×1000×22/+3 (T/T)	Q245R PWHT S11306+Q245R	150/8 0	116	0.75/- 0.1	0.1	194
9	D-401	减顶分水罐	石脑油、油气、 水蒸气	Φ4200×10224×22 (T/T) 水包 Φ1600×1600×10+3	Q245R PWHT S11306+Q245R	80	40	0.55/- 0.1	0.1	136

表 25 (续) 容器一览表及主要设计参数

序号	位号	名称	介质	规格形式	材质	温度 (°C)		压力 (MPa·G)		容积 (m³)
				直径 D×长度 (切线)×壁厚 δ mm		设计	操作	设计	操作	
10	D-402	减压过气化油罐	减压过气化油	Φ 1600×5718×8 (T/T)	S31603+Q245R	410/80	385	0.35/-0.1	25mm Hg (a)	9.7
11	D-410	烧焦罐	焦粉、烟气、水蒸气	Φ 2000×7141×16 (T/T)	Q245R	475	260	0.35	0.04	18
12	D-821	1.0MPa 蒸汽分水器	1.0MPa 蒸汽	Φ 1200×2479×14 (T/T)	Q245R	320	250	1.5	1	1.91
13	D-822	0.5MPa 蒸汽分水器	0.5MPa 蒸汽	Φ 800×2183×8 (T/T)	Q245R	250	210	1	0.5	0.54
14	D-831	净化空气罐	仪表风	Φ 2200×6774×14 (T/T)	Q245R	80	40	1	0.7	22
15	D-832	仪表隔离液罐	甘油、水				常温		常压	
16	D-841	安全阀放空罐	放空油、气	Φ 3600×9924×22 (T/T) 水包 Φ 1200×1200×22 (T/T)	Q245R	320/80	250	0.6/-0.1	0.1	96
17	D-842	轻污油罐	轻污油	Φ 1600×6874×16 (T/T)	Q245R	120/80	40	1/-0.1	0.9	13
18	D-843	重污油罐	重污油	Φ 1600×6880×16 (T/T)	Q245R	300/80	100	1/-0.1	0.1	13
19	D-851	封油罐 I	封油	Φ 1800×11489×14 (T/T)	Q245R	80	50	0.6/-0.1	0.1	14.5
20	D-852	封油罐 II	封油	Φ 1800×11489×14 (T/T)	Q245R	80	50	0.6/-0.1	0.01	14.5
21	D-861	高压燃料气分液罐	燃料气	Φ 2200×8802×12 (T/T)	Q245R	80	40	0.8	0.5	22

表 25 (续) 容器一览表及主要设计参数

序号	位号	名称	介质	规格形式	材质	温度 (°C)		压力 (MPa·G)		容积 (m³)
				直径 D×长度 (切线)×壁厚 δ mm		设计	操作	设计	操作	
22	D-862	减顶燃料气分液罐	减顶气	Φ1200×8839×10/14 (T/T)	Q245R PWHT	80	43	0.35(-0.1)/0.8	0.1/0.5	上 3.9 下 2.8

Table 26 List of Heaters and Their Main Design Parameters

Heater Tag No.			F-301		Vac. heater F-401
Process Fluid			Pre-Dist. bottoms	0.5MPa steam	Atm. bottoms
Operating conditions	Flowrate, kg/h		821104	3450	266205
	Temperature, °C	Inlet	285	148	353
		Outlet	359	380	412
	Heat load, w	Estimated	76960		18480
		Design	92060		27620
Radiation section	Material of heater tube		TP321	-	TP316L
	Type of heater tube		Bare tube	-	Bare tube
	Heater tube specifications (diameter × thickness × length × number of tubes) mm		Φ219.1×8.18×23593.6×128	-	Φ114.3×6.35×10734.8×64 Φ114.3×6.35×10443.9×8 Φ141.3×6.55×10684×24 Φ141.3×6.55×10393.1×8 Φ168.3×7.11×10633.2×24 Φ168.3×7.11×10289.2×8 Φ219.1×8.18×10500×24

Table 26 List of Heaters and Their Main Design Parameters(continued)

Heater Tag No.		F-301		Vac. heater F-401
Convection Section	Material of heater tube	P9	20G	TP316L
	Type of heater tube	Bare tubes: 24 (shield tubes) + stud tubes: 72	Stud tube	Bare tubes: 24+ finned tubes: 64
	Tube specifications	Φ193.7×8.74×26740×96	Φ193.7×8.74×26740×16	Φ114.3×6.35×16340×24
Combustion an efficiency				
	Excessive air coefficient	Demand		
Fuel gas	1.15	6086		1446
Fuel oil, kg/h	-	7236		-
Atomized steam, kg/h	-	10000		-
Burner load, kW	-	Atm. heater: 2400, Vac. heater: 2200		
Number of burners	-	Atm. heater: 48, Vac. heater: 16		
Flue gas outlet temperature, °C	-	140		
Heater efficiency, %	-	92		
Note: the demand for fuel gas and fuel oil refers to the demand for fuel gas or fuel oil only.				

表 26 加热炉一览表及主要设计参数

加热炉编号			F-301		减压炉 F-401
介质名称			初底油	0.5MPa 蒸汽	常底油
操作条件	流量 kg/h		821104	3450	266205
	温度℃	入口	285	148	353
	-	出口	359	380	412
	热负荷 W	计算	76960		18480
	-	设计	92060		27620

表 26 (续) 加热炉一览表及主要设计参数

加热炉编号		F-301		减压炉 F-401
辐射段	炉管材料	TP321	-	TP316L
	炉管型式	光管	-	光管
	炉管规格(径×厚×长×根数)mm	Φ219.1×8.18×23593.6×128	-	Φ 114.3×6.35×10734.8×64 Φ 114.3×6.35×10443.9×8 Φ 141.3×6.55×10684×24 Φ 141.3×6.55×10393.1×8 Φ 168.3×7.11×10633.2×24 Φ 168.3×7.11×10289.2×8 Φ 219.1×8.18×10500×24
对流段	炉管材料	P9	20G	TP316L
	炉管型式	光管 24 根（遮蔽管）+钉头管 72	钉头管	光管 24+翅片 64
	炉管规格	Φ193.7×8.74×26740×96	Φ193.7×8.74×26740×16	Φ 114.3×6.35×16340×24
燃烧与效率				
	过剩空气系数	用量		
燃料气 kg/h	1.15	6086	1446	
燃料油 kg/h	-	7236	-	
雾化蒸气 kg/h	-	10000	-	
燃烧器负荷 kW	-	常压炉 2400，减压炉 2200		
燃烧器数量	-	常压炉 48 台，减压炉 16 台		
排烟温度℃	-	140		
加热炉热效率 %	-	92		
注：燃料气和额、燃料油用量均为单烧时的耗量。				

Table 27 Main Design Parameters of Air Preheater

-	-	Design Case (1)	Design Case (2)	Operating Case (1)	Operating Case (2)
Air side	Inlet flowrate, kg/s	52.23	54.27	41.9	43.35
-	Inlet temperature, °C	27.1	-	-	-
-	Outlet temperature, °C	~315	~239	~285	~208
-	Allowable pressure drop, Pa	1200	1000	-	-
-	Heat absorbed, MW	~15.8	~12	~11.4	~8.3
Flue gas side	Inlet flowrate, kg/s	55.4	57.52	44.5	46.05
-	Inlet temperature, °C	386	388	361	364
-	Outlet temperature, °C	140	210	140	210
-	Allowable pressure drop, Pa	1000	1200	-	-
-	Heat released	~15.8	~12	~11.4	~8.3
Flue gas acid dew point temperature, °C		118		123	
Minimum metal temperature, °C		Acid dew point temperature +8			
Type of air pre-heater		Plate type (304) + cast iron plate type			

表 27 空气预热器主要设计参数

-	-	设计工况（1）	设计工况（2）	操作工况（1）	操作工况（2）
空气侧	入口流量 kg/s	52.23	54.27	41.9	43.35
-	入口温度℃	27.1	-	-	-
-	出口温度℃	~315	~239	~285	~208
-	压降，允许 Pa	1200	1000		
-	吸热量 MW	~15.8	~12	~11.4	~8.3
烟气侧	入口流量 kg/s	55.4	57.52	44.5	46.05
-	入口温度℃	386	388	361	364
-	出口温度℃	140	210	140	210
-	压降，允许 Pa	1000	1200		
-	放热量 MW	~15.8	~12	~11.4	~8.3
烟气酸露点温度℃		118		123	
最低金属温度℃		酸露点温度+8			
空气预热器形式		板式（304）+铸铁板式			

Table 28 List of Heat Exchangers and Their Main Design Parameters

S/N	Tag No	Model	Type	Process Fluid		Material		Temperature (°C)				Pressure (MPa·G)			
								Tube Side		Shell Side		Tube Side		Shell Side	
				Tube Side	Shell Side	Tube Side	Shell Side	Design	Operation	Design	Operation	Design	Operation	Design	Operation
1	E501AB	BES1500-4.0-636-6/25-4I B=250	Floating head type	Crude	LVGO PA	10#	Q345R	67	25/47	143	104/50	3.34	2.15	2.67	0.8
2	E502	BES1100-4.0-320-6/25-6I B=300	Floating head type	Heavy diesel	Crude	10#	Q345R	214	159/82	90	47/70	2.67	0.87	3.34	2.07
3	E503	BES800-4.0-167-6/25-2I B=300	Floating head type	Crude	Kerosene	10#	Q345R	70	25/50	172	144/100	3.34	2.15	2.67	0.91
4	E504	BES1100-4.0-335-6/25-2I	Floating head type	Crude	LVGO	10#	Q345R	92	50/72	163	143/104	3.34	2.08	2.67	0.83
5	E505	BES1200-4.0-402-6/25-2I B=450	Floating head type	Crude	Atm. top PA	10#	Q345R	140	110/120	168	145/131	3.34	1.97	2.67	0.74
6	E506	BES1200-4.0-400-6/25-2I B=200	Floating head type	Crude	MVGO	10#	Q345R	146	120/126	217	172/135	3.34	1.93	2.67	0.85
7	E507	BES1000-4.0-275-6/25-2I	Floating head type	Atm. top PA	Crude	S32205	Q245R	151	131/108	76	75/56	2.67	0.7	3.34	2.15
8	E508	BES900-4.0-162-6/25-2I B=250	Floating head type	Crude	Light diesel	10#	Q345R	89	56/69	171	132/101	3.34	2.07	2.67	0.86
9	E509	BES1100-4.0-330-6/25-4I B=300	Floating head type	Light diesel	Crude	10#	Q345R	204	171/132	144	109/132	2.67	0.88	3.34	2.01
10	E510	BES1000-4.0-273-6/25-2I	Floating head type	Crude	Vac. Overflash oil	S30403	S30403+ Q345R	150	124/130	360	242/133	3.34	1.93	2.67	1.11

Table 28(Continued) List of Heat Exchangers and Their Main Design Parameters

S/N	Tag No	Model	Type	Process Fluid		Material		Temperature (°C)				Pressure (MPa·G)			
								Tube Side		Shell Side		Tube Side		Shell Side	
				Tube Side	Shell Side	Tube Side	Shell Side	Design	Operation	Design	Operation	Design	Operation	Design	Operation
11	E521AB	BES1200-4.0-402-6/25-2I B=450	Floating head type	Atm. top PA	Desalted oil	10#	Q345R	188	168/145	171	122/151	2.67	0.78	3.34	1.05
12	E522	BES1100-4.0-334-6/25-2I B=450	Floating head type	Atm. PA 2#	Desalted oil	10#	Q345R	250	210/202	182	152/162	2.67	0.79	3.34	1
13	E523AB	BES1300-4.0-461-6/25-4I B=200	Floating head type	Desalted oil	Kerosene	10#	Q345R	213	162/193	252	232/172	3.34	0.93	2.67	1.05
14	E524AB	BES1100-4.0-333-6/25-2I B=450	Floating head type	LVGO PA	Desalted oil	S30403	Q345R	279	259/221	239	193/219	2.67	0.9	3.34	0.82
15	E525	BES1000-4.0-255-6/25-6I B=300	Floating head type	Atm. overflash oil	Desalted oil	S30403	S30403+Q345R	249	219/229	349	285/232	2.67	1.17	3.34	0.74
16	E526	BES1000-4.0-268-6/25-4I B=300	Floating head type	Kerosene	Desalted oil	10#	Q345R	232	172/144	157	122/137	2.67	0.96	3.34	1.05
17	E527AB	BES1200-4.0-402-6/25-2I B=300	Floating head type	Desalted oil	VR	10#	Q345R	173	137/153	250	220/165	3.34	0.98	2.67	1.17
18	E528	BES1100-4.0-333-6/25-2I B=200	Floating head type	Desalted oil	Light diesel	10#	Q345R	186	153/166	261	204/171	3.34	0.93	2.67	0.91
19	E529AB /CD	BES1500-4.0-636-6/25-4I B=4500	Floating head type	Atm. PA1#	Desalted oil	10#	Q345R	255	235/180	233	166/213	2.67	0.79	3.34	0.91
20	E530	BES1000-4.0-255-6/25-6I B=450	Floating head type	HVGO	Desalted oil	S30403	Q345R	271	251/222	237	213/217	2.67	0.92	3.34	1.05

Table 28(Continued) List of Heat Exchangers and Their Main Design Parameters

S/N	Tag No	Model	Type	Process Fluid		Material		Temperature (°C)				Pressure (MPa·G)			
								Tube Side		Shell Side		Tube Side		Shell Side	
				Tube Side	Shell Side	Tube Side	Shell Side	Design	Operation	Design	Operation	Design	Operation	Design	Operation
21	E531AB	BES1100-4.0-333-6/25-4I B=200	Floating head type	Desalted oil	HVGO	S30403	S30403+Q345R	251	222/126	155	122/135	3.34	1.05	3.34	1.05
22	E532	BES1100-4.0-328-6/25-4I B=450	Floating head type	MVGO	Desalted oil	10#	Q345R	237	217/172	171	135/151	2.67	0.87	3.34	1.02
23	E533AB	BES1000-4.0-268-6/25-4I B=450	Floating head type	Heavy diesel	Desalted oil	10#	Q345R	245	214/159	187	151/167	2.67	0.9	3.34	0.98
24	E534	BES1000-4.0-402-6/25-2I B=200	Floating head type	Desalted oil	LVGO PA	304L	Q345R	198	167/178	259	221/204	3.34	0.9	2.67	0.88
25	E535	BES1200-4.0-393-6/25-4I B=300	Floating head type	Light diesel	Desalted oil	S30403	Q345R	281	261/204	221	178/201	2.67	0.93	3.34	0.89
26	E536	BES1300-4.0-460-6/25-4I B=250	Floating head type	Desalted oil	VR	S30403	S11306+Q345R	229	201/209	286	250/220	3.34	0.89	2.67	0.93
27	E537AB	BES1200-4.0-402-6/25-2I B=250	Floating head type	Desalted oil	Heavy diesel	S30403	S30403+Q345R	237	213/217	302	245/214	3.34	0.78	2.67	0.93
28	E538	BES1200-4.0-393-6/25-4I B=450	Floating head type	MVGO PA	Desalted oil	S30403	Q345R	281	261/251	243	217/223	2.67	0.96	3.34	0.7
29	E541	BES1000-4.0-275-6/25-2I B=450	Floating head type	MVGO PA	Pre Dist. bottom oil	S30403	S30403+Q345R	311	277/261	246	211/226	1.98	1	2.48	1.75
30	E542AB	BES1400-4.0-542-6/25-4I B=450	Floating head type	Atm. PA 2#	Pre Dist. bottom oil	S30403	S30403+Q345R	322	302/263	290	226/270	1.98	0.89	2.48	1.68

Table 28(Continued) List of Heat Exchangers and Their Main Design Parameters

S/N	Tag No	Model	Type	Process Fluid		Material		Temperature (°C)				Pressure (MPa·G)			
								Tube Side		Shell Side		Tube Side		Shell Side	
				Tube Side	Shell Side	Tube Side	Shell Side	Design	Operation	Design	Operation	Design	Operation	Design	Operation
31	E543	BES1000-2.5-275-6/25-2I B=200	Floating head type	Pre Dist. bottom oil	Atm. overflash oil	S30403	S30403+Q345R	299	270/279	369	349/285	2.48	1.62	1.98	1.18
32	E544	BES1100-2.5-333-6/25-2I B=200	Floating head type	Pre Dist. bottom oil	VR	S30403	S30403+Q345R	241	211/227	360	286/250	2.48	1.75	2.1	1.52
33	E545	BES1000-2.5-274.4-6/25-2I B=250	Floating head type	Pre Dist. bottom oil	Heavy diesel	S30403	S11306+Q345R	254	221/234	322	302/245	2.48	1.72	1.98/0.94	0.94
34	E546	BES1000-4.0-275-6/25-2I B=150	Floating head type	Pre Dist. bottom oil	Vac. overflash oil	S31603	S31603+Q345R	259	234/239	380	360/240	2.48	1.68	2.02	1.12
35	E547AB	BES1200-2.5-402-6/25-2I B=450	Floating head type	Pre Dist. bottom oil	MVGO PA	S30403	S30403+Q345R	291	239/271	331	311/277	2.48	1.64	1.98	1.09
36	E548AB	BES1400-2.5-680-6/19-2I B=250	Floating head type	Pre Dist. bottom oil	VR	S30403	S30403+Q345R	306	275/285	380	360/286	2.48	1.58	2.1	1.58
37	E202A~D	BIU900-1.6-215-6/25-2I B=300	U-tube	Pre. Dist. OVHD vapor	CWS	S30408	Q345R	98	60/40	80	33/43	1.33	0.67	1.06	0.4
38	E301A~C	BIU1500-4.0-710-6/25-2I B=600	U-tube	Atm. OVHD vapor	Crude	TA1	Q345R+TA1	173	153/116	130	70/110	2.67	0.11	3.34	2

Table 28(Continued) List of Heat Exchangers and Their Main Design Parameters

S/N	Tag No	Model	Type	Process Fluid		Material		Temperature (°C)				Pressure (MPa·G)			
				Tube Side	Shell Side	Tube Side	Shell Side	Tube Side		Shell Side		Tube Side		Shell Side	
								Design	Operation	Design	Operation	Design	Operation	Design	Operation
39	E302A~C D	BIU1200-4.0/4.0-290- 3.5/25-2I B=450	U-tube	Atm. OVH D vapor	CWS	S32205	Q245R	116	60/40	80	33/43	1.45	0.06	1.16	0.4
40	E311	BIU1500-4.0/4.0-170- 6/25-2 B=600	U-tube	Atm. PA 2#	Kerosene	S30403	S11306+Q345R	302	263/250	256	223/232	1.39	0.78	1.6	0.08
41	E731AB	BES1000-1.6-278- 6/25-2I B=300&	Floating head type	CWS	Kerosene	10#, and SHY99 is applied on water side	Q345R	80	60/39.9	80	33/43.3	1.28	0.4	1.6	0.6
42	E740AB	BES1000-1.6-287- 6/25-4I B=300	Floating head type	CWS	LVGO PA		Q345R	80	33/43	124	104/50	1.14	0.4	1.43	0.78
43	E743A~D	BES1300-2.5-485- 6/25-2I B=250	Floating head type	CWS	VR		Q245R+PW HT	80	33/43	183	163/90	1.68	0.4	2.1	1.0
44	E411A	AXU1450-1.6-873 58"(1473.2*20)*56"(6 60.4)	U-tube	CWS	Oil vapor, water vapor	S32205	Q245R + normalized	100	33/44	320	210	1.6	0.4	1.6	-0.011

Table 28 List of Heat Exchangers and Their Main Design Parameters (Continued)

S/N	Tag No	Model	Type	Process Fluid		Material		Temperature (°C)				Pressure (MPa·G)			
								Tube Side		Shell Side		Tube Side		Shell Side	
				Tube Side	Shell Side	Tube Side	Shell Side	Design	Operation	Design	Operation	Design	Operation	Design	Operation
45	E411B	AXU52"(1320.8*20)*24" (609.6)	U-tube	CWS	Oil vapor, water vapor		Q245R	100	33/43	300	200	1.6	0.4	1.6	-0.089
46	E421A	AXU31"(787.4)*18"(457. 2)	U-tube	CWS	Oil vapor, water vapor	S32205	Q245R	100	33/43	300	164.8	1.6	0.4	1.6	-0.075
47	E421B	AXU28"(711.2)*18"(457. 2)	U-tube	CWS	Oil vapor, water vapor	S32205	Q245R + normaliz ed	100	33/43	300	164.8	1.6	0.4	1.6	-0.074
48	E431	BEU32"(813)14"(355.6)- 1.6-113-6/25-2I B=	U-tube	CWS	Oil vapor, water vapor	S32205	Q245R+ PWHT	100	33/43	300	232.9	1.6	0.4	1.6	0.013
49	E811AB	BES500-1.6-43-6/25-2I B=150	Floating head type	CWS	Lean MEDA solution	10#, and SHY99 is applied on water side	Q345R	80	33/43	80	55/43	1.2	0.4	1.5	0.6
50	E101A/ B E101A/ B	BES800-4.0-154-6/25-6I B=200	Floating head type	Stripped water	Brine	S22053	Q345R	147	127/77.1	117	40/97	2.3	1.1	2.87	2.18
51	E102A/ B	BES900-2.5-195-6/25-6I B=450	Floating head type	CWS	Brine	S22053	Q345R	97	77/40	80	33/43	1.76	0.4	2.2	1.0

表 28 冷换设备一览表及主要设计参数

序号	位号	型号	型式	介质		材质		温度 (°C)				压力 (MPa·G)			
				管程	壳程	管程	壳程	管程		壳程		管程		壳程	
								设计	操作	设计	操作	设计	操作	设计	操作
1	E501AB	BES1500-4.0-636-6/25-4I B=250	浮头式	原油	减顶循	10#	Q345R	67	25/47	143	104/50	3.34	2.15	2.67	0.8
2	E502	BES1100-4.0-320-6/25-6I B=300	浮头式	常三线	原油	10#	Q345R	214	159/82	90	47/70	2.67	0.87	3.34	2.07
3	E503	BES800-4.0-167-6/25-2I B=300	浮头式	原油	常一线	10#	Q345R	70	25/50	172	144/100	3.34	2.15	2.67	0.91
4	E504	BES1100-4.0-335-6/25-2I	浮头式	原油	减顶循	10#	Q345R	92	50/72	163	143/104	3.34	2.08	2.67	0.83
5	E505	BES1200-4.0-402-6/25-2I B=450	浮头式	原油	常顶循	10#	Q345R	140	110/120	168	145/131	3.34	1.97	2.67	0.74
6	E506	BES1200-4.0-400-6/25-2I B=200	浮头式	原油	减二线	10#	Q345R	146	120/126	217	172/135	3.34	1.93	2.67	0.85
7	E507	BES1000-4.0-275-6/25-2I	浮头式	常顶循	原油	S32205	Q245R	151	131/108	76	75/56	2.67	0.7	3.34	2.15
8	E508	BES900-4.0-162-6/25-2I B=250	浮头式	原油	常二线	10#	Q345R	89	56/69	171	132/101	3.34	2.07	2.67	0.86

表 28 (续) 冷换设备一览表及主要设计参数

序号	位号	型号	型式	介质		材质		温度 (°C)				压力 (MPa·G)			
								管程		壳程		管程		壳程	
				管程	壳程	管程	壳程	设计	操作	设计	操作	设计	操作	设计	操作
9	E509	BES1100-4.0-330-6/25-4I B=300	浮头式	常二线	原油	10#	Q345R	204	171/132	144	109/132	2.67	0.88	3.34	2.01
10	E510	BES1000-4.0-273-6/25-2I	浮头式	原油	减四线	S30403	S30403+Q345R	150	124/130	360	242/133	3.34	1.93	2.67	1.11
11	E521AB	BES1200-4.0-402-6/25-2I B=450	浮头式	常顶循	脱盐油	10#	Q345R	188	168/145	171	122/151	2.67	0.78	3.34	1.05
12	E522	BES1100-4.0-334-6/25-2I B=450	浮头式	常二中	脱盐油	10#	Q345R	250	210/202	182	152/162	2.67	0.79	3.34	1
13	E523AB	BES1300-4.0-461-6/25-4I B=200	浮头式	脱盐油	常一线	10#	Q345R	213	162/193	252	232/172	3.34	0.93	2.67	1.05
14	E524AB	BES1100-4.0-333-6/25-2I B=450	浮头式	减一中	脱盐油	S30403	Q345R	279	259/221	239	193/219	2.67	0.9	3.34	0.82
15	E525	BES1000-4.0-255-6/25-6I B=300	浮头式	常四线	脱盐油	S30403	S30403+Q345R	249	219/229	349	285/232	2.67	1.17	3.34	0.74
16	E526	BES1000-4.0-268-6/25-4I B=300	浮头式	常一线	脱盐油	10#	Q345R	232	172/144	157	122/137	2.67	0.96	3.34	1.05
17	E527AB	BES1200-4.0-402-6/25-2I B=300	浮头式	脱盐油	减渣	10#	Q345R	173	137/153	250	220/165	3.34	0.98	2.67	1.17
18	E528	BES1100-4.0-333-6/25-2I B=200	浮头式	脱盐油	常二线	10#	Q345R	186	153/166	261	204/171	3.34	0.93	2.67	0.91
19	E529AB/CD	BES1500-4.0-636-6/25-4I B=4500	浮头式	常一中	脱盐油	10#	Q345R	255	235/180	233	166/213	2.67	0.79	3.34	0.91

表 28 (续) 冷换设备一览表及主要设计参数

序号	位号	型号	型式	介质		材质		温度 (°C)				压力 (MPa·G)			
								管程		壳程		管程		壳程	
				管程	壳程	管程	壳程	设计	操作	设计	操作	设计	操作	设计	操作
20	E530	BES1000-4.0-255-6/25-6I B=450	浮头式	减三线	脱盐油	S30403	Q345R	271	251/222	237	213/217	2.67	0.92	3.34	1.05
21	E531AB	BES1100-4.0-333-6/25-4I B=200	浮头式	脱盐油	减三线	S30403	S30403+Q345R	251	222/126	155	122/135	3.34	1.05	3.34	1.05
22	E532	BES1100-4.0-328-6/25-4I B=450	浮头式	减二线	脱盐油	10#	Q345R	237	217/172	171	135/151	2.67	0.87	3.34	1.02
23	E533AB	BES1000-4.0-268-6/25-4I B=450	浮头式	常三线	脱盐油	10#	Q345R	245	214/159	187	151/167	2.67	0.9	3.34	0.98
24	E534	BES1000-4.0-402-6/25-2I B=200	浮头式	脱盐油	减一中	304L	Q345R	198	167/178	259	221/204	3.34	0.9	2.67	0.88
25	E535	BES1200-4.0-393-6/25-4I B=300	浮头式	常二线	脱盐油	S30403	Q345R	281	261/204	221	178/201	2.67	0.93	3.34	0.89
26	E536	BES1300-4.0-460-6/25-4I B=250	浮头式	脱盐油	减渣	S30403	S11306+Q345R	229	201/209	286	250/220	3.34	0.89	2.67	0.93
27	E537AB	BES1200-4.0-402-6/25-2I B=250	浮头式	脱盐油	常三线	S30403	S30403+Q345R	237	213/217	302	245/214	3.34	0.78	2.67	0.93
28	E538	BES1200-4.0-393-6/25-4I B=450	浮头式	减二中	脱盐油	S30403	Q345R	281	261/251	243	217/223	2.67	0.96	3.34	0.7
29	E541	BES1000-4.0-275-6/25-2I B=450	浮头式	减二中	初底油	S30403	S30403+Q345R	311	277/261	246	211/226	1.98	1	2.48	1.75
30	E542AB	BES1400-4.0-542-6/25-4I B=450	浮头式	常二中	初底油	S30403	S30403+Q345R	322	302/263	290	226/270	1.98	0.89	2.48	1.68

表 28 (续) 冷换设备一览表及主要设计参数

序号	位号	型号	型式	介质		材质		温度 (°C)				压力 (MPa·G)			
								管程		壳程		管程		壳程	
				管程	壳程	管程	壳程	设计	操作	设计	操作	设计	操作	设计	操作
31	E543	BES1000-2.5-275-6/25-2I B=200	浮头式	初底油	常四线	S30403	S30403+Q345R	299	270/279	369	349/285	2.48	1.62	1.98	1.18
32	E544	BES1100-2.5-333-6/25-2I B=200	浮头式	初底油	减渣	S30403	S30403+Q345R	241	211/227	360	286/250	2.48	1.75	2.1	1.52
33	E545	BES1000-2.5-274.4-6/25-2I B=250	浮头式	初底油	常三线	S30403	S11306+Q345R	254	221/234	322	302/245	2.48	1.72	1.98/0.94	0.94
34	E546	BES1000-4.0-275-6/25-2I B=150	浮头式	初底油	减四线	S31603	S31603+Q345R	259	234/239	380	360/240	2.48	1.68	2.02	1.12
35	E547AB	BES1200-2.5-402-6/25-2I B=450	浮头式	初底油	减二中	S30403	S30403+Q345R	291	239/271	331	311/277	2.48	1.64	1.98	1.09
36	E548AB	BES1400-2.5-680-6/19-2I B=250	浮头式	初底油	减渣	S30403	S30403+Q345R	306	275/285	380	360/286	2.48	1.58	2.1	1.58
37	E202A~D	BIU900-1.6-215-6/25-2I B=300	U型管	初顶油气	循环水	S30408	Q345R	98	60/40	80	33/43	1.33	0.67	1.06	0.4
38	E301A~C	BIU1500-4.0-710-6/25-2I B=600	U型管	常顶油气	原油	TA1	Q345R+TA1	173	153/116	130	70/110	2.67	0.11	3.34	2
39	E302A~C D	BIU1200-4.0/4.0-290-3.5/25-2I B=450	U型管	常顶油气	循环水	S32205	Q245R	116	60/40	80	33/43	1.45	0.06	1.16	0.4
40	E311	BIU1500-4.0/4.0-170-6/25-2 B=600	U型管	常二中	常一线	S30403	S11306+Q345R	302	263/250	256	223/232	1.39	0.78	1.6	0.08
41	E731AB	BES1000-1.6-278-6/25-2I B=300&	浮头式	循环水	常一线	10# 水 侧涂 SHY99	Q345R	80	60/39.9	80	33/43.3	1.28	0.4	1.6	0.6

表 28 (续) 冷换设备一览表及主要设计参数

序号	位号	型号	型式	介质		材质		温度 (°C)				压力 (MPa·G)			
								管程		壳程		管程		壳程	
				管程	壳程	管程	壳程	设计	操作	设计	操作	设计	操作	设计	操作
42	E740AB	BES1000-1.6-287-6/25-4I B=300	浮头 式	循环 水	减顶循		Q345R	80	33/43	124	104/50	1.14	0.4	1.43	0.78
43	E743A~D	BES1300-2.5-485-6/25-2I B=250	浮头 式	循环 水	减渣		Q245R+PWHT	80	33/43	183	163/90	1.68	0.4	2.1	1.0
44	E411A	AXU1450-1.6-873 58"(1473.2*20)*56"(660.4)	U 型 管	循环 水	油气、 水蒸气	S32205	Q245R 正火	100	33/44	320	210	1.6	0.4	1.6	- 0.011
45	E411B	AXU52"(1320.8*20)*24"(609.6)	U 型 管	循环 水	油气、 水蒸气		Q245R	100	33/43	300	200	1.6	0.4	1.6	- 0.089
46	E421A	AXU31"(787.4)*18"(457.2)	U 型 管	循环 水	油气、 水蒸气	S32205	Q245R	100	33/43	300	164.8	1.6	0.4	1.6	- 0.075
47	E421B	AXU28"(711.2)*18"(457.2)	U 型 管	循环 水	油气、 水蒸气	S32205	Q245R 正火	100	33/43	300	164.8	1.6	0.4	1.6	- 0.074
48	E431	BEU32"(813)14"(355.6)-1.6- 113-6/25-2I B=	U 型 管	循环 水	油气、 水蒸气	S32205	Q245R+PWHT	100	33/43	300	232.9	1.6	0.4	1.6	0.013
49	E811AB	BES500-1.6-43-6/25-2I B=150	浮头 式	循环 水	脱硫塔 贫液	10# 水侧涂 SHY99	Q345R	80	33/43	80	55/43	1.2	0.4	1.5	0.6
50	E101A/B	BES800-4.0-154-6/25-6I B=200	浮头 式	净化 污水	含盐污 水	S22053	Q345R	147	127/77.1	117	40/97	2.3	1.1	2.87	2.18
51	E102A/B	BES900-2.5-195-6/25-6I B=450	浮头 式	循环 水	含盐污 水	S22053	Q345R	97	77/40	80	33/43	1.76	0.4	2.2	1.0

Table 29 List of Air Coolers and Their Main Design Parameters

S/N	Tag No	Description	Q'ty (Set)	Process Fluid	Design Conditions		Operating conditions of Tube Side			Number of bundles	Fan Q'ty of Fans	Power, kW
					Temperature (°C)	Pressure MPa	Temperature (°C)		Pressure MPa			
							Inlet	Outlet				
1	A-201A~F	Pre-dist. 1st air cooler	6	Pre Dist. OVHD vapor	200	1.6	132.5	98	0.38	6	6	30
2	A-202A~D	Pre-dist. 2nd air cooler	4	Pre Dist. OVHD vapor	150	1.6	98	60	0.35	4	4	30
3	A-301A~H	Atm. pre OVHD air cooler	8	Atm. OVHD vapor	200	1.6	116	60	0.08	6	8	30
4	A-731AB	Kerosene air cooler	2	Kerosene	150	2.5	99	60	0.45	2	2	30
5	A-733	Mixed diesel air cooler	1	Mixed diesel	150	2.5	95	58	0.45	1	4	30

表 29 空冷设备一览表及主要设计参数

序号	位号	名称	数量 (台)	操作介质	设计条件		管程操作条件			管束数量 (片)	风机 数量	功率 kw
					温度 (℃)	压力 MPa	温度（℃）		压力 MPa			
							进口	出口				
1	A-201A~F	初顶一级空冷器	6	初顶油气	200	1.6	132.5	98	0.38	6	6	30
2	A-202A~D	初顶二级空冷器	4	初顶油气	150	1.6	98	60	0.35	4	4	30
3	A-301A~H	常顶空冷器	8	常顶油气	200	1.6	116	60	0.08	6	8	30
4	A-731AB	常一线空冷器	2	常一线油	150	2.5	99	60	0.45	2	2	30
5	A-733	柴油空冷器	1	混合柴油	150	2.5	95	58	0.45	1	4	30

Table 30 List of Pumps and Their Main Design Parameters

S/N	Tag No	Description	Process Fluid	Rated flowrate, m ³ /h	Density kg/m ³	Minimum continuous flowrate, m ³ /h	Head (mH ₂ O)	Design internal pressure (MPa·G)		Operating temperature °C	Motors	
								Inlet	Outlet		Power KW	Voltage, V
1	P-101AB	Desalter water feed pump	Stripped water	1382	992	25	221	04	2.18	40	132	380
2	P-102AB	Desalter wash recycle pump	Brine	96	946	20	138	1.31	2.59	117	90	380
3	P-110	Desalter wash pump	Brine	217	841	60	81	1.51	2.29	122	75	380
4	P-201AB	Pre-Dist. sidedraw pump	Pre-Dist. sidedraw	180	608	55	27	0.57	0.64	173	15	380
5	P-221AB	PRE-Dist. OVHD product pump	PRE-Dist. OVHD oil	167	633	40	187	0.34	1.51	40	132	380
6	P-222AB	PRE-Dist. OVHD reflux pump	PRE-Dist. OVHD oil	325	597	80	57	0.48	0.81	98	75	380
7	P-225AB	PRE-Dist. OVHD souer water pump	PRE-Dist. OVHD Sour water	12	992	4	59	0.37	0.94	40	15	380
8	P-230AB	PRE-Dist. bottom pump	PRE-Dist. bottom oil	1382	713	700	209	0.44	1.9	211	900	10000

Table 30(continued) List of Pumps and Their Main Design Parameters

S/N	Tag No	Description	Process Fluid	Rated flowrate, m ³ /h	Density kg/m ³	Minimum continuous flowrate, m ³ /h	Head (mH ₂ O)	Design internal pressure (MPa·G)		Operating temperature °C	Motors	
								Inlet	Outlet		Power KW	Voltage, V
9	P-301AB	Kerosene pump	Kerosene pum	295	644	70	150	0.27	1.05	232	132	380
10	P-302AB	Light diesel pump	Light diesel	220	687	53.8	100	0.23	0.93	261	75	380
11	P-303AB	Heavy diesel pump	Heavy diesel #	161	669	53.8	113	0.19	0.94	302	75	380
12	P-304AB	Atm. Overflash pump	Atm. Overflash oil	104.7	688	32.4	149	0.29	1.31	349	75	380
13	P-310AB	Atm. top PA pump	Atm. top PA oil	802	643	256	64	0.38	0.79	165	132	380
14	P-311AB	Atm. PA#1 pump	Atm. PA#1 oil	575	664	140	63	0.38	0.79	235	110	380
15	P-312AB	Atm. PA#2 pump	Atm. PA#2oil	1310	688	407	84	0.33	1.50	302	280	10000
16	P-321AB	Atm. OVHD product pump	Atm. OVHD oil	315	706	100	215	0.07	1.56	40	250	10000
17	P-322AB	Atm. OVHD reflux pump	Atm. OVHD oil	442	661	140	71	0.23	0.69	116	110	380
18	P-325AB	Atm. souer water pump	Atm. Sour water	16	992	4	91	0.06	0.96	40	22	380

Table 30(continued) List of Pumps and Their Main Design Parameters

S/N	Tag No	Description	Process Fluid	Rated flowrate, m ³ /h	Density kg/m ³	Minimum continuous flowrate, m ³ /h	Head (mH ₂ O)	Design internal pressure (MPa·G)		Operating temperature °C	Motors	
								Inlet	Outlet		Power KW	Voltage, V
19	P-330AB	Atm. Residue pump	Atm. Residue	471	762	200	127	0.22	1.17	353	220	10000
20	P-401AB	LVGO PA&PA pump	LVGO	315	819	80	71	0.24	0.83	143	90	380
21	P-402AB	MVGO PA&PA pump	MVGO	385	797	137	96	0.15	0.9	259	132	380
22	P-403AB	HVGO PA&PA pump	HVGO	847.8	790	270	127	0.1	1.09	311	355	10000
23	P-404AB	Vac. Overflash oil pump	Vac. Overflash oil	29	794	9.6	141	0.05	1.12	360	45	380
24	P-421A	Vac. OVHD oil pump	Vac. OVHD oil	3	742	1.8	102	0.01	0.76	40	11	380
25	P-421B	Vac. OVHD oil pump	Vac. OVHD oil	15	742	4	102	0.01	0.76	40	18.5	380
26	P-425AB	Vac. OVHD sour water pump	Vac. OVHD sour water	27	992	4	104	0.01	1.04	40	30	380
27	P-426AB	Vac. OVHD 2nd oil pump	Vac. OVHD 2nd oil	5	800	1.5	29	0.03	0.04	40	3	380
28	P-430AB	Vac. residue pump	Vac. residue	198	846	66	190	-0.03	1.58	360	160	380
29	P-440AB	Rich MEDA pump	Rich MEDA	24	1008	8	94	0.02	0.9	45	30	380
30	P-801AB	OVHD water injection pump	Stripped water	29	992	9	136	0	1.35	40	37	380

Table 30(continued) List of Pumps and Their Main Design Parameters

S/N	Tag No	Description	Process Fluid	Rated flowrate, m ³ /h	Density kg/m ³	Minimum continuous flowrate, m ³ /h	Head (mH ₂ O)	Design internal pressure (MPa·G)		Operating temperature °C	Motors	
								Inlet	Outlet		Power KW	Voltage, V
31	P-841	Oil withdraw pump	Light slop	55	800	20	61	0.02	0.51	120	22	380
32	P-842	Light HC slop pump	Light slop	10	800	4	69	-0.03	0.52	40	15	380
33	P-843	Heavy HC slop pump	Heavy slop	10	850	4	87	-0.04	0.73	80	18.5	380
34	P-851AB	Sealing oil pump I	LVGO	53	858	14	207	0.02	1.8	50	75	380
35	P-852AB	Sealing oil pump II	Mixed diesel	12	750	3.6	150	0.02	1.8	50	22	380
36	PA-801A	Demulsifier pump	Demulsifier	72.6	-	-	None	Atmospheric pressure	3	Ambient temperature	0.55	380
37	PA-801B	Demulsifier pump	Demulsifier	72.6	-	-	None	Atmospheric pressure	3	Ambient temperature	0.55	380
38	PA-801C	Demulsifier pump	Demulsifier	72.6	-	-	None	Atmospheric pressure	3	Ambient temperature	0.55	380
39	PA-802A	Corrosion inhibitor pump	Corrosion inhibitor	10.5	-	-	None	Atmospheric pressure	1.6	Ambient temperature	0.25	380
40	PA-802B	Corrosion inhibitor pump	Corrosion inhibitor	10.5	-	-	None	Atmospheric pressure	1.6	Ambient temperature	0.25	380

Table 30(continued) List of Pumps and Their Main Design Parameters

S/N	Tag No	Description	Process Fluid	Rated flowrate, m ³ /h	Density kg/m ³	Minimum continuous flowrate, m ³ /h	Head (mH ₂ O)	Design internal pressure (MPa·G)		Operating temperature °C	Motors	
							-	Inlet	Outlet		Power KW	Voltage, V
41	PA-802C	Corrosion inhibitor pump	Corrosion inhibitor	10.5	-	-	None	Atmospheric pressure	1.6	Ambient temperature	0.25	380
42	PA-802D	Corrosion inhibitor pump	Corrosion inhibitor	10.5	-	-	None	Atmospheric pressure	1.6	Ambient temperature	0.25	380
43	PA-802E	Corrosion inhibitor pump	Corrosion inhibitor	7.6	-	-	None	Atmospheric pressure	1.6	Ambient temperature	0.25	380
44	PA-803A	HP neutralizing corrosion inhibitor pump	HP neutralizing corrosion inhibitor	26.2	-	-	None	Atmospheric pressure	1	Ambient temperature	0.25	380
45	PA-803B	HP neutralizing corrosion inhibitor pump	HP neutralizing corrosion inhibitor	26.2	-	-	None	Atmospheric pressure	1	Ambient temperature	0.25	380
46	PA-804A	Fouling inhibitor Pump	Fouling inhibitor	10.5	-	-	None	Atmospheric pressure	1	Ambient temperature	0.25	380
47	PA-804B	Fouling inhibitor Pump	Fouling inhibitor	10.5	-	-	None	Atmospheric pressure	1	Ambient temperature	0.25	380

表 30 机泵一览表及主要设计参数

序号	位号	名称	工艺介质	额定流量 (m³/h)	密度 kg/m³	最小连续 流量 (m³/h)	扬程 (mH ₂ O)	设计压力 (MPa·G)		操作温度 (℃)	电机	
								进口	出口		功率 KW	电压 V
1	P-101AB	原油注水泵	净化水	1382	992	25	221	04	2.18	40	132	380
2	P-102AB	循环注水泵	含盐污水	96	946	20	138	1.31	2.59	117	90	380
3	P-110	反冲洗泵	含盐污水	217	841	60	81	1.51	2.29	122	75	380
4	P-201AB	初一线泵	初一线油	180	608	55	27	0.57	0.64	173	15	380
5	P-221AB	初顶产品泵	初顶油	167	633	40	187	0.34	1.51	40	132	380
6	P-222AB	初顶回流泵	初顶油	325	597	80	57	0.48	0.81	98	75	380
7	P-225AB	初顶含硫污水泵	含硫污水	12	992	4	59	0.37	0.94	40	15	380
8	P-230AB	初底油泵	初底油	1382	713	700	209	0.44	1.9	211	900	10000
9	P-301AB	常一线泵	常一线油	295	644	70	150	0.27	1.05	232	132	380
10	P-302AB	常二线泵	常二线油	220	687	53.8	100	0.23	0.93	261	75	380
11	P-303AB	常三线泵	常三线油	161	669	53.8	113	0.19	0.94	302	75	380
12	P-304AB	常四线泵	常四线油	104.7	688	32.4	149	0.29	1.31	349	75	380
13	P-310AB	常顶循环泵	常顶循油	802	643	256	64	0.38	0.79	165	132	380
14	P-311AB	常一中泵	常一中油	575	664	140	63	0.38	0.79	235	110	380
15	P-312AB	常二中泵	常二中油	1310	688	407	84	0.33	1.50	302	280	10000
16	P-321AB	常顶产品泵	常顶油	315	706	100	215	0.07	1.56	40	250	10000
17	P-322AB	常顶回流泵	常顶油	442	661	140	71	0.23	0.69	116	110	380
18	P-325AB	常顶含硫污水泵	含硫污水	16	992	4	91	0.06	0.96	40	22	380

表 30 (续) 机泵一览表及主要设计参数

序号	位号	名称	工艺介质	额定流量 (m³/h)	密度 kg/m³	最小连续 流量 (m³/h)	扬程 (mH ₂ O)	设计压力 (MPa·G)		操作温度 (℃)	电机	
								进口	出口		功率 KW	电压 V
19	P-330AB	常底泵	常底油	471	762	200	127	0.22	1.17	353	220	10000
20	P-401AB	减一线及减一中泵	减一线油	315	819	80	71	0.24	0.83	143	90	380
21	P-402AB	减二线及二中泵	减二线油	385	797	137	96	0.15	0.9	259	132	380
22	P-403AB	减三线及三中泵	减三线油	847.8	790	270	127	0.1	1.09	311	355	10000
23	P-404AB	减四线泵	减四线油	29	794	9.6	141	0.05	1.12	360	45	380
24	P-421A	减顶油泵	减顶油	3	742	1.8	102	0.01	0.76	40	11	380
25	P-421B	减顶油泵	减顶油	15	742	4	102	0.01	0.76	40	18.5	380
26	P-425AB	减顶含硫污水泵	含硫污水	27	992	4	104	0.01	1.04	40	30	380
27	P-426AB	减顶二级油泵	减二线油	5	800	1.5	29	0.03	0.04	40	3	380
28	P-430AB	减底渣油泵	减底渣油	198	846	66	190	-0.03	1.58	360	160	380
29	P-440AB	减顶气脱硫塔底泵	富胺液	24	1008	8	94	0.02	0.9	45	30	380
30	P-801AB	塔顶注水泵	净化水泵	29	992	9	136	0	1.35	40	37	380
31	P-841	退油泵	污油	55	800	20	61	0.02	0.51	120	22	380
32	P-842	轻污油泵	轻污油	10	800	4	69	-0.03	0.52	40	15	380
33	P-843	重污油泵	重污油	10	850	4	87	-0.04	0.73	80	18.5	380
34	P-851AB	封油泵	减一线油	53	858	14	207	0.02	1.8	50	75	380
35	P-852AB	封油泵 II	混合柴油	12	750	3.6	150	0.02	1.8	50	22	380
36	PA-801A	破乳剂泵	破乳剂	72.6			无	常压	3	常温	0.55	380

表 30 (续) 机泵一览表及主要设计参数

序号	位号	名称	工艺介质	额定流量 (m³/h)	密度 kg/m³	最小连续 流量 (m³/h)	扬程 (mH₂O)	设计压力 (MPa·G)		操作温度 (°C)	电机	
								进口	出口		功率 KW	电压 V
37	PA-801B	破乳剂泵	破乳剂	72.6	-	-	无	常压	3	常温	0.55	380
38	PA-801C	破乳剂泵	破乳剂	72.6	-	-	无	常压	3	常温	0.55	380
39	PA-802A	缓蚀剂泵	缓蚀剂	10.5	-	-	无	常压	1.6	常温	0.25	380
40	PA-802B	缓蚀剂泵	缓蚀剂	10.5	-	-	无	常压	1.6	常温	0.25	380
41	PA-802C	缓蚀剂泵	缓蚀剂	10.5	-	-	无	常压	1.6	常温	0.25	380
42	PA-802D	缓蚀剂泵	缓蚀剂	10.5	-	-	无	常压	1.6	常温	0.25	380
43	PA-802E	缓蚀剂泵	缓蚀剂	7.6	-	-	无	常压	1.6	常温	0.25	380
44	PA-803A	高温缓蚀剂泵	高温缓蚀剂	26.2	-	-	无	常压	1	常温	0.25	380
45	PA-803B	高温缓蚀剂泵	高温缓蚀剂	26.2	-	-	无	常压	1	常温	0.25	380
46	PA-804A	阻垢剂泵	阻垢剂泵	10.5	-	-	无	常压	1	常温	0.25	380
47	PA-804B	阻垢剂泵	阻垢剂泵	10.5	-	-	无	常压	1	常温	0.25	380

Table 31 List of Relief valves and Their Main Design Parameters

S/N	Tag No	Installation Location	Q'ty (unit: EA)	Process Fluid	Temperature (°C)	Pressure (MPa·G)			Type or Specification	Inlet/Outlet Diameter	Valve Casing Material
						Operation	Constant Pressure	Back Pressure			
1	PSV-200A~C	C-200 top	3	Vent gas	250	0.38	±0.56	0.2	WFB-30aTC2B-K	8"/10"	WCB
2	PSV-201A/B	D-101	2	Crude	170	1.50	2.20	0.2	WFB-60QCBL	6"/8"	WCB
3	PSV-202A/B	D-102	2	Crude	170	1.30	2.20	0.2	WFB-60QCBL	6"/8"	WCB
4	PSV-203A/B	D-201	2	Vent gas	80	0.30	0.90	0.2	WFB-15PC2B	4"/6"	WCB
5	PSV-300A~E	Top of C-300	2	Vent gas	380	0.11	0.35	0.2	WFXD-15VC2A-K	10"/14"	WCB
6	PSV-301A/B	D-301	2	Vent gas	80	0.03	0.80	0.2	WFB-15QC2B	6"/8"	WCB
7	PSV-400A/B	Top of C-400	2	Vent gas	420	18mmHg (a)	0.35	0.2	WFXD-15QC2A-K	6"/8"	WCB
8	PSV-401A/B	Top of C-401	2	Vent gas	80	0.01	0.55	0.2	WFB-15RC2B	6"/8"	WCB
9	PSV-402A/B	Top of C-410	2	MEDA	90	0.01	0.35	0.2	WFXD-15KP1A	3"/4"	CF8
10	PSV-410A/B	E-411AB	2	CWS	100	0.4	1.2	0	WFF-15DCB	0.75"/1"	WCB
11	PSV-420A/B	E-421AB	2	CWS	100	0.4	1.2	0	WFF-15DCB	0.75"/1"	WCB
12	PSV-430	E-431	1	CWS	100	0.4	1.2	0	WFF-15DCB	0.75"/1"	WCB
13	PSV-703A/B	E-743A~D	2	CWS	80	0.4	1.68	0	WFF-30DCB	0.75"/1"	WCB
14	PSV-801A/B	D-831	2	Vent gas	80	0.7	1	0	WFO-15ECB	1.2	WCB
15	PSV-802A/B	D-842	2	Vent gas	120	0.1	1	0.2	WFB-15LCB	3"/4"	WCB

Table 31 List of Relief valves and Their Main Design Parameters

S/N	Tag No	Installation Location	Q'ty (unit: EA)	Process Fluid	Temperature (°C)	Pressure (MPa·G)			Type or Specification	Inlet/Outlet Diameter	Valve Casing Material
						Operation	Constant Pressure	Back Pressure			
16	PSV-803A/B	D-843	2	Vent gas	300	0.1	1	0.2	WFB-30PCB	4"/6"	WCB
17	PSV-804A/B	D-861	2	Vent gas	80	0.5	0.8	0.2	WFB-15MCB	4"/6"	WCB
18	PSV-805A/B	D-862 (upper section)	2	Vent gas	80	0.5	0.35	0.2	WFXD-15LC2A	3"/4"	WCB
19	PSV-806A/B	D-862 (lower section)	2	Vent gas	80	0.5	0.8	0.2	WFB-15JCB	2"/2"	WCB

表 31 安全阀一览表及主要设计参数

序号	位号	安装位置	数量 (台)	工艺介质	温度 (°C)	压力 (MPa·G)			型号规格	进/出口 径	阀体材 质
						操作	定压	背压			
1	PSV-200A~C	C-200 顶部	3	放空气	250	0.38	0.56	0.2	WFB-30aTC2B-K	8"/10"	WCB
2	PSV-201A/B	D-101	2	原油	170	1.50	2.20	0.2	WFB-60QCBL	6"/8"	WCB
3	PSV-202A/B	D-102	2	原油	170	1.30	2.20	0.2	WFB-60QCBL	6"/8"	WCB
4	PSV-203A/B	D-201	2	放空气	80	0.30	0.90	0.2	WFB-15PC2B	4"/6"	WCB
5	PSV-300A~E	C-300 顶部	5	放空气	380	0.11	0.35	0.2	WFXD-15VC2A-K	10"/14"	WCB
6	PSV-301A/B	D-301	2	放空气	80	0.03	0.80	0.2	WFB-15QC2B	6"/8"	WCB
7	PSV-400A/B	C-400 顶部	2	放空气	420	18mmHg (a)	0.35	0.2	WFXD-15QC2A-K	6"/8"	WCB

表 31 (续) 安全阀一览表及主要设计参数

序号	位号	安装位置	数量 (台)	工艺介质	温度 (℃)	压力 (MPa·G)			型号规格	进/出口 径	阀体材 质
						操作	定压	背压			
8	PSV-401A/B	D-401 顶部	2	放空气	80	0.01	0.55	0.2	WFB-15RC2B	6"/8"	WCB
9	PSV-402A/B	C-410 顶部	2	胺液	90	0.01	0.35	0.2	WFXD-15KP1A	3"/4"	CF8
10	PSV-410A/B	E-411AB	2	循环水	100	0.4	1.2	0	WFF-15DCB	0.75"/1"	WCB
11	PSV-420A/B	E-421AB	2	循环水	100	0.4	1.2	0	WFF-15DCB	0.75"/1"	WCB
12	PSV-430	E-431	1	循环水	100	0.4	1.2	0	WFF-15DCB	0.75"/1"	WCB
13	PSV-703A/B	E-743A~D	2	循环水	80	0.4	1.68	0	WFF-30DCB	0.75"/1"	WCB
14	PSV-801A/B	D-831	2	放空气	80	0.7	1	0	WFO-15ECB	1"/2"	WCB
15	PSV-802A/B	D-842	2	放空气	120	0.1	1	0.2	WFB-15LCB	3"/4"	WCB
16	PSV-803A/B	D-843	2	放空气	300	0.1	1	0.2	WFB-30PCB	4"/6"	WCB
17	PSV-804A/B	D-861	2	放空气	80	0.5	0.8	0.2	WFB-15MCB	4"/6"	WCB
18	PSV-805A/B	D-862 (上 段)	2	放空气	80	0.5	0.35	0.2	WFXD-15LC2A	3"/4"	WCB
19	PSV-806A/B	D-862 (下 段)	2	放空气	80	0.5	0.8	0.2	WFB-15JCB	2"/3"	WCB

Table 32 List of Silencers and Their Main Design Parameters

S/N	Equipment name	Equipment Tag No.	Process Fluid	Q'ty	Operation Temperature ℃	Operation Pressure MPag	Design Temperature ℃	Design Pressure MPag	Vent flowrate t/h	Nozzle specifications	Material
1	0.4MPa steam silencer	SIL-301	Steam	1	380	0.4	420	0.8	5	DN200 PN50	CS+S30408
2	Atm. heater steam silencer	SIL-302A,B	Steam	2	380	0.4	420	0.8	5	DN200 PN50	CS+S30408

Table 32(continued) List of Silencers and Their Main Design Parameters

S/N	Equipment name	Equipment Tag No.	Process Fluid	Q'ty	Operation Temperature °C	Operation Pressure MPag	Design Temperature °C	Design Pressure MPag	Vent flowrate t/h	Nozzle specifications	Material
3	Vac. heater steam silencer	SIL-401A,B	Steam	2	380	0.4	420	0.8	5	DN200 PN50	CS+S30408

表 32 消音器一览表及主要设计参数

序号	设备名称	设备编号	介质	数量	操作温度 °C	操作压力 MPag	设计温度 °C	设计压力 MPag	排放流量 t/h	接管规格	材质
1	过热蒸汽消声器	SIL-301	蒸汽	1	380	0.4	420	0.8	5	DN200 PN50	碳钢+S30408
2	常压炉蒸汽消声器	SIL-302A,B	蒸汽	2	380	0.4	420	0.8	5	DN200 PN50	碳钢+S30408
3	减压炉蒸汽消声器	SIL-401A,B	蒸汽	2	380	0.4	420	0.8	5	DN200 PN50	碳钢+S30408

Table 33 List of Filters and Their Main Design Parameters

S/N	Equipment Tag No	Equipment name:	Q'ty (Set)	Diameter Φ × length, mm	Filtration Fluid	Filtration Precision	Temperature (°C)		Pressure (MPaG)	
							Operation	Design	Operation	Design
1	SR-412A/B	HVGO PA strainer	2	Φ450*650	HVGO	40	252	272	0.7	1.79
2	SR-413A/B	HVGO flushing oil strainer	2	Φ250*500	HVGO	40	311	331	0.7	1.79
3	SR-813A/B	Lean MEDA solution strainer	2	Φ100*300	Lean MEDA solution	10	40	80	0.5	1.5
4	SR-821A/B	Vac. systm steam strainer	2	Φ350*550	1.0MPa Steam	16	250	270	0.9	1.5
5	SR-831A/B	Instrument air filter	2	Φ90*600	Instrument air	3	40	80	0.7	1
6	SR-851A/B	Sealing oil strainer	2	Φ100*300	LVGO	40	50	80	1.8	2
7	SR-852A/B	Sealing oil strainer	2	Φ100*300	Mixed oil	40	50	80	1.8	2
8	SR-861A/B	Fuel oil strainer	2	Φ100*300	Fuel oil	32	120-140	240	0.8	1.6
9	SR-410A/B	LVGO PA strainer	2	Φ200*500	LVGO	40	50	104	0.55	1.43

Table 33(continued) List of Filters and Their Main Design Parameters

S/N	Equipment Tag No	Equipment name:	Q'ty (Set)	Diameter Φ × length, mm	Filtration Fluid	Filtration Precision	Temperature (°C)		Pressure (MPaG)	
							Operation	Design	Operation	Design
10	SR-411A/B	MVGO PA strainer	2	$\Phi 350 \times 550$	MVGO	40	204	224	0.6	1.54

表 33 过滤器一览表及主要设计参数

序号	设备位号	设备名称	数量 (台)	直径 Φ × 长度 (mm)	过滤介质	过滤精度	温度(°C)		压力(MPaG)	
							操作	设计	操作	设计
1	SR-412A/B	减三中过滤器	2	$\Phi 450 \times 650$	减三线	40	252	272	0.7	1.79
2	SR-413A/B	净洗油过滤器	2	$\Phi 250 \times 500$	减三线	40	311	331	0.7	1.79
3	SR-813A/B	贫胺液过滤器	2	$\Phi 100 \times 300$	贫胺液	10	40	80	0.5	1.5
4	SR-821A/B	抽真空蒸汽过滤器	2	$\Phi 350 \times 550$	蒸汽	16	250	270	0.9	1.5
5	SR-831A/B	仪表风过滤器	2	$\Phi 90 \times 600$	仪表风	3	40	80	0.7	1
6	SR-851A/B	封油过滤器	2	$\Phi 100 \times 300$	封油	40	50	80	1.8	2
7	SR-852A/B	封油过滤器	2	$\Phi 100 \times 300$	封油	40	50	80	1.8	2
8	SR-861A/B	燃料油过滤器	2	$\Phi 100 \times 300$	燃料油	32	120-140	240	0.8	1.6
9	SR-410A/B	减一中过滤器	2	$\Phi 200 \times 500$	减一线	40	50	104	0.55	1.43
10	SR-411A/B	减二中过滤器	2	$\Phi 350 \times 550$	减二线	40	204	224	0.6	1.54

2 Operation Guides 岗位操作法

2.1 Scope of operations 岗位管辖范围

The scope of operations includes 8.0 MMTA Atmospheric and Vacuum Distillation Unit, Light Ends Recovery Unit, Acid Gas and LPG Treating Unit, Initial Stormwater Lifting Unit, Oily Wastewater Lifting Unit and Central Control Room.

800 万吨/年常减压蒸馏装置、轻烃回收装置、产品精制装置、初期雨水提升单元、含油污水提升单元,以及中心控制室炼油一部区域。

2.1.1 Scope of operations by the shift foreman 班长岗位管辖范围

Take charge of the equipment operation, process indicator control, operation load adjustment, equipment service and maintenance, and internal and external contact and shift management. 负责当班期间所管辖范围内的设备运行、工艺指标和负荷的调整控制,设备使用及维护保养,及上下内外联系和班组管理。

2.1.2 Scope of operations by panel operators 内操岗位管辖范围

2.1.2.1 Take charge of the operation and management of vessels, columns, piping, pumps, heaters, compressors and instrument systems in accordance with the process and equipment operation specifications, and product quality requirements.

负责所管辖范围内的容器、塔器、管线、机泵、加热炉、压缩机及仪表系统的操作管理,严格遵守工艺、设备操作规程、及产品质量指标,全面完成当班的生产任务。

2.1.2.2 Follow the instructions issued by the Operation Management Department and foreman, strengthen the contact with the Operation Scheduling Department, shift foreman, field operators and related departments, properly adjust DCS system and process indicators to control the product quality and stabilize operation.

服从运行部、班长的工作安排及指挥,加强与调度、班长、外操及相关部门的联系,及时调节 DCS 操作,做好工艺指标和产品质量控制,及平稳生产。

2.1.2.3 In case of process fluctuations, properly adjust DCS system, organize the field operators to take operation actions, and report to the Operation Scheduling Department and Operation Management Department in time if necessary. 工艺出现波动或其它异常时,应立即进行 DCS 操作调整,并组织外操岗位人员进行调整,必要时及时向调度、运行部汇报。

2.1.2.4 Fill in the operation records in time, report the operation of MES to upper management line and make shift handover records. 认真及时填好操作记录,负责上报 MES 内容,做好交接班日志。

2.1.3 Scope of operations by field operators 外操岗位管辖范围

2.1.3.1 Take charge of the routine operation and management of vessels, columns, piping, pumps, heaters, compressors and instrument systems in accordance with the process and equipment operation specifications, process cards and product quality requirements.

负责所管辖范围内的容器、塔器、管线、机泵、加热炉、压缩机等所有设备的日常操作维护管理，严格遵守工艺、设备技术操作规程、工艺卡片及产品质量指标，全面完成当班的生产任务。

2.1.3.2 Strengthen contact with the shift foreman and panel operators, and properly control the vessel level, pressure and temperature. Cooperate with the panel operators to properly control the process indicators to ensure the product quality, and cooperate with the QA/QC Department for sampling.

加强与班长、内操的联系，掌握好容器的液面、压力、温度。配合内操控制好装置的工艺指标，保证产品质量合格，并配合质量检验部做好采样工作。

2.1.3.3 Take charge of the management, use, maintenance and repair of equipment, piping, pumps and lube oil station.

负责所管辖范围内的设备、管线、机泵、润滑油站的管理、使用、维护和保养工作。

Fill in the pump operation records and make shift handover records.

认真及时填好机泵运行记录，做好交接班日志。

2.1.3.4 Follow good housekeeping practice and the standardization requirements.

做好岗位负责区域的卫生和现场规格化工作。

2.2 Post tasks 岗位任务

2.2.1 Responsibilities of shift foreman 班长岗位任务

2.2.1.1 Follow the operation specifications, process indicators, shift handover system, walk-around inspection system, various safety regulations and other instructions issued by the upper management line, take charge of the normal operation, startup and shutdown, and lead the shift members to properly conduct operations and ensure the safety of personnel and equipment, investigate the causes and take actions in time in case of abnormality to complete operation, maintenance and repair tasks.

严格执行操作规程、工艺指标、交接班制度、巡回检查制度、各项安全规定等规章制度及上级指示，负责组织和指挥本班正常生产及开、停工事故处理，带领班组成员完成岗位管辖范围内生产工作，保证人身设备安全，发现异常情况及时查找原因并采取应对措施，确保生产检修任务及各项经济技术指标的完成。

2.2.1.2 Strengthen operation knowledge learning, familiarize with the process and equipment operation, adjust the process parameters according to the product quality indicators, ensure the process unit in safe, stable and economic operation to produce on-spec products. Propose comments and recommendations to improve the operation of process unit and actively engage

in technological innovation.

加强业务学习，熟悉装置工艺流程及设备操作，根据上级下达的产品质量指标调整工艺参数，确保装置安全、平稳、经济运行，生产合格产品。开展合理化建议和技术革新活动。

2.2.1.3 Record the received operation commands and instructions (including time, content, and issuer) in details, and organize the shift members to implement these commands and instructions.

负责将当班期间接收的生产命令和指示(包括受令时间、内容、发令人)详细记录，并切实组织贯彻执行。

2.2.1.4 Have the right to stop and penalize any behaviors in violations of the regulations and commands (instructions) issued by the upper management line, make records and report the violations to the upper management line.

对班内人员违反上级命令（指示）和规章制度的行为，有权制止和处理并做好记录和上报。

2.2.1.5 Take charge of the shift safety technical training, safety induction for new members, routine safety education for all the members, organize the shift members to participate in emergency drilling per the schedule to ensure every member can take proper actions against emergency. Take charge of the internal assessment of the new members before the job. The new members can come to posts only when they are assessed and qualified.

负责班组岗位安全技术培训，新员工的班组安全教育和全班人员日常的安全思想教育，按计划组织班组人员参加应急预案演练，做到人人可以进行现场突发事件的处理。负责本班新员工上岗前的内部考核，考核合格方可上岗。

2.2.1.6 Follow good housekeeping practice and ensure the required tools, instruments and medicines are available.

负责班组责任区域内的环境卫生、设备卫生，保证工器具、仪器、药品齐全。

2.2.1.7 Complete other tasks assigned by department heads.

完成部门领导交办的其它工作。

2.2.2 Responsibilities of panel operators 内操岗位任务

2.2.2.1 Follow the operation specifications, process indicators, shift handover system, walk-around inspection system, various safety regulations and other instructions issued by the shift foreman, verify and confirm the critical parameters and interlocks in time, promptly implement the operation instructions, make process control, stream and energy consumption records, report the operation of MES to the upper management line in time and make shift handover records.

严格执行操作规程、工艺指标、交接班制度、巡回检查制度、各项安全规定等规章制度及班长指示，及时做好重要参数和联锁状态确认，及时查看执行操作指令，认真做好工艺控制及物料、能耗记录，定时汇报和上报 MES 内容，认真填写交接班日志。

2.2.2.2 Familiarize with the operation of DCS system, process flows and operation specifications. Follow all safety operation procedures, prohibit operation violation, and prevent

accidents.

熟练掌握和运用 DCS 系统，熟悉本岗位生产工艺流程及相关操作规程。严格执行各项安全操作规程，严禁违章操作，杜绝事故发生。

2.2.2.3 Monitor the equipment operation, maintain communication with the field operators, and properly adjust the operation and take actions for the abnormal conditions in a timely manner.

监控本岗位设备运转情况，与现场外操人员保持通信联系，及时进行操作调整和异常情况处理。

2.2.2.4 In case of process fluctuations, properly adjust operations immediately, organize the field operators to take actions, and report to the Operation Scheduling Department if necessary.

工艺出现波动或其它异常情况时，应立即进行调整并组织外操岗位人员进行现场操作，必要时向公司调度汇报。

2.2.2.5 Closely monitor the change of feedstock properties, adjust the control parameters per the product quality requirements, ensure the process unit in stable operation, and make all production records.

注意原料性质变化，根据生产质量调整控制参数，做好产品质量工作，确保生产运行平稳，做好各项生产记录。

2.2.2.6 The central control room must be cleaned before shift handover.

交接班前必须将本岗位卫生清扫干净，保持控制室整洁卫生。

2.2.3 Responsibilities of field operators 外操岗位任务

2.2.2.1 Take charge of the field operations per process specifications, operation specifications, process cards, operation instructions issued by the Operation Management Department and Operation Scheduling Department, follow the instructions by the shift foreman and panel operators, monitor the equipment operation, follow the post responsibility system and various management rules.

根据装置工艺规程、操作规程和工艺卡片，以及部门下达的生产任务和调度指令，服从班长和内操指挥，负责装置生产现场操作，监控装置设备运行状况，履行岗位职责，严格执行各项生产管理制度，保证班组生产任务的全面完成。

2.2.2.2 Conduct walk-around inspections in time to investigate any potential issues in advance, report the operation of the process unit to the shift foreman and panel operators, and make operation records on time.

及时对装置进行巡回检查和高远点，查找装置隐患，如实向班长、内操反映装置现场生产工况，真实准点进行操作记录。

2.2.2.3 Coordinate with the sampling activities.

落实当班期间的样品采集工作。

2.2.2.4 Take charge of equipment lubrication and maintenance to ensure the process unit in stable operation.

做好设备润滑保养工作，保证装置平稳生产。

2.2.2.5 Take charge of the receipt and injection of chemical agents, and properly adjust the

chemical dosage based on the lab analysis results and field measurement.

完成现场化工三剂的收付工作，根据化验结果及现场检查，调整三剂的使用量。

2.2.2.6 Follow the labor discipline, properly clean the workplaces, including the equipment packages.

遵守劳动纪律，完成定置管理和工作场所的卫生清理。做好包机卫生工作。

2.2.2.7 Familiarize with the use of fire-fighting equipment and take charge of the guardianship at the maintenance and repair site.

正确掌握消防灭火器材的使用方法，负责检修现场的监护。

2.3 Startup plan 开工方案

2.3.1 Preparations for startup 开工前的准备

2.3.1.1 Prepare and submit the startup plan to the involved departments of the Company for review and countersign. To ensure that the operators can get familiar with the startup plan, organize the operators to study the startup plan, and exMDEA how the operators understand the startup plan. Post the startup plan on the wall one week before startup.

编制好开工方案并经公司有关部门审核、会签。操作人员熟练掌握开工方案，组织开工方案学习考试，开工前 1 周开工方案上墙。

2.3.1.2 Make sufficient operation record forms, shift handover logs, operating condition checklists and walk-around inspection cards available.

准备好操作记录，交接班日志，操作条件确认表、巡检牌。

2.3.1.3 Make sufficient startup oil available. Contact the Production Scheduling Department and the crude storage farm to cut the water from the crude in advance so as to ensure that the water content in the crude is not more than 1%. Make sufficient slop drums and product drums available.

准备好开工用油。与计划调度部、原油罐区联系，提前做好原油切水工作，使原油含水不大于 1%，准备好污油罐和产品罐。

2.3.1.4 Make sufficient chemical auxiliary materials available.

准备好化工辅助材料。

2.3.1.5 Check and confirm that the heaters, which have been maintained, have been dried out, inspected and accepted.

检修完的加热炉烘炉完毕，检查合格。

2.3.1.6 Contact the Production Scheduling Department to confirm the destination of each product before startup.

联系好计划调度部确认开工各产品的走向。

2.3.1.7 Check and confirm that the fire engine access in the process unit is unblocked, and all wastewater drainage chambers are properly lined up, and covered as required.

装置消防通道畅通，排污水井畅通并封盖合格。

2.3.1.8 Make sufficient tools and signs available for startup.

准备好开工用的工具和标识牌。

2.3.1.9 Check and confirm that fire-fighting equipment, gas defense equipment and various safety facilities are complete and in good condition.

消防器材、气防器材及各种安全设施准备齐全、好用。

2.3.2 Procedures for startup 开工步骤

2.3.2.1 Confirm the operating conditions for the process flow of each stream 物料流程条件确认

(1) Confirm that all stream valves at BL of the process unit are closed.

确认各物料在界区的阀门关闭。

(2) Properly line up the process flow of each material per the steam process flow.

按照蒸汽贯通的流程改好各物料的流程。

(3) Check and confirm that the drain valves at low point and the vent valves at high point of all equipment, instruments, control valves and piping are closed.

检查各设备、仪表、调节阀、管道的低点导淋、高点放空全部关闭。

2.3.2.2 Introduce utilities 公用工程物料引入

(1) 1.0MPa steam

1.0MPa 蒸汽

1) Properly line up the main steam process flow, close the isolation valve on each branch, and open the steam trap at the end of the steam header to drain the condensate.

改好蒸汽主流程，各分支隔断阀门关闭，打开主蒸汽线末端疏水器排凝。

2) Drain water via the drain valve on the 1.0MPa steam piping to ISBL, and close the drain valve when steam comes from the drain valve.

1.0MPa 蒸汽进装置界区导淋排水，见蒸汽后关闭。

3) Open the condensate valve from D-821 to the condensate header.

打开 D-821 凝结水至凝结水总管阀。

4) Slowly open the steam valve to ISBL, and vent the air and drain the condensate at the end of the steam header.

缓慢打开蒸汽进装置阀门，在末端赶空气、排凝结水。

5) Contact the instrument staff to put associated instruments (TI82001, PI82001, FI82001) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 TI82001、PI82001、FI82001，检查仪表完好情况。

6) Open the isolation valve on each branch when required.

根据各点用汽情况将隔断阀打开投用。

7) Properly control the steam flowrate to avoid water hammer in the piping.

引蒸汽时，应根据管线水击情况，控制引汽速度。

(2) 0.5MPa steam

引 0.5MPa 蒸汽

1) Properly line up the main steam process flow, close the isolation valve on each branch, and open the steam trap at the end of the steam header to drain the condensate.

改好蒸汽主流程，各分支隔断阀门关闭，打开主蒸汽线末端疏水器排凝。

2) Open the condensate valve from D-822 to the condensate header.

打开 D-822 凝结水至凝结水总管阀。

3) Close the hand valve after the pressure control valve (PIC82102) from 0.5MPa steam piping to 0.4MPa steam piping, and slightly open the vent valve.

关 0.5MPa 蒸汽至 0.4MPa 蒸汽压控阀 PIC82102 后手阀，稍开放空阀。

4) Slowly open the steam valve to ISBL to vent the air and drain the condensate at the end.

缓慢打开蒸汽进装置阀门，在末端赶空气、排凝结水。

5) Contact the instrument staff to put associated instruments (TI82101, PI82101, FI82101) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 TI82101、PI82101、FI82101，检查仪表完好情况。

6) Open the isolation valve on each branch when required.

根据各点用汽情况将隔断阀打开投用。

7) Properly control the steam flowrate to avoid water hammer in the piping.

引蒸汽时，应根据管线水击情况，控制引汽速度。

(3) CCW

循环水的引入

1) Properly line up the main CCW supply and return process flow, and close the valves on each branch.

改好循环水上水、回水主流程，各分支阀门关闭。

2) Open the vent valve before the CCW return valve to OSBL to vent the air.

打开循环水回水出装置阀前排空阀排空气。

3) Slowly open the CCW supply valve to ISBL.

缓慢打开循环水进装置阀门。

4) Contact the instrument staff to put associated instruments (PI81001, FIQ81001, TI81001, TI81002, PI81003) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 PI81001、FIQ81001、TI81001、TI81002、PI81003，检查仪表完好情况。

5) Open the CCW return valve to OSBL to establish CCW circulation.

打开循环水出装置阀门，建立循环水循环。

6) Put the CCW system for pumps into service.

将机泵冷却水投用。

(4) Fresh water

新鲜水的引入

1) Properly line up the main fresh water process flow, and close the valve on each fresh water

branch.

改好新鲜水主流程，装置新鲜水分支阀门关闭。

2) Open the fresh water valve to ISBL.

打开新鲜水进装置阀门。

3) Open the vent valve after the fresh water valve to ISBL to vent the air and drain the water, and when no water comes from the vent valve, close the vent valve and make the vent valve ready for immediate use.

打开新鲜水进装置阀后放空阀排空气放水，水净后关闭，待用。

4) Contact the instrument staff to put associated instruments (FIQ81103, PI81103, TI81103) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 FIQ81103、PI81103、TI81103，检查仪表完好情况。

(5) Purified water

净化水的引入

1) Properly line up the main purified water process flow, and close the valve on each purified water branch.

改好净化水主流程，装置净化水分支阀门关闭。

2) Open the purified water valve to ISBL.

打开净化水进装置阀门。

3) Open the purified water drain valve to drain water, and when water becomes clean, close the drain valve and make the drain valve ready for immediate use.

打开净化水放空阀处排空，水清后关闭排空阀门，系统待用。

4) Contact the instrument staff to put associated instruments into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表，检查仪表完好情况。

(6) DM water

除盐水的引入

1) Contact the Production Scheduling Department to confirm the time when DM water will be introduced.

联系计划调度部确认除盐水的引入时间。

2) Properly line up the main DM water process flow, and close the valve on each DM water branch.

改好除盐水主流程，装置除盐水分支阀门关闭。

3) Open the DM water valve to ISBL.

打开除盐水进装置阀门。

4) Contact the instrument staff to put associated instruments (FIQ81101, PI81101, TI81101) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 FIQ81101、PI81101、TI81101，检查仪表完好情况。

(7) Nitrogen

氮气的引入

1) Properly line up the main nitrogen process flow, and close each branch valve.

改好氮气主流程，各分支阀门关闭。

2) Open the nitrogen valve to ISBL, and vent nitrogen at the end of the nitrogen header.

打开氮气进装置阀门，主线末端放空。

3) Contact the instrument staff to put associated instruments (PI83003, FIQ83003, TI83001) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 PI83003、FIQ83003、TI83001，检查仪表完好情况。

4) Check if the flanges of piping/valves function properly.

检查管线、阀门法兰是否正常。

(8) Plant air (PA)

工厂风的引入

1) Properly line up the main PA process flow, and close the valve on each branch.

改好非仪表风主流程，分支阀门关闭。

2) Open the PA valve to ISBL, open the vent valve at the end of the PA header to vent PA to the atmosphere, and when no PA comes from the vent valve, close the vent valve and make the vent valve ready for immediate use.

打开非仪表风进装置阀门，打开非仪表风末端服务点放空，放空干净后关闭放空，系统待用。

3) Contact the instrument staff to put associated instruments (FIQ83001, PI83001) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 FIQ83001、PI83001，检查仪表完好情况。

(9) Instrument air (IA)

仪表风的引入

1) Properly line up the main IA process flow, and close the valve on each branch.

改好仪表风主流程，各分支阀门关闭。

2) Contact the instrument staff to check each IA user.

联系仪表对各用风点进行检查。

3) Open the IA valve to ISBL, and when IA becomes clean, close the IA valve.

打开仪表风进装置阀门，干净后关闭。

4) Open the hand valves before and after the IA filter to introduce IA to each instrument.

打开仪表风至仪表用风过滤器前后手阀，将仪表风投用到各仪表用点。

5) Contact the instrument staff to put associated instruments (FI83002, PI83002) into service and check these instruments for good operating conditions.

联系仪表配合介质引入，投用相关仪表 FI83002、PI83002，检查仪表完好情况。

2.3.2.3 Steam introduction, purging and pressure test 蒸汽贯通、吹扫、试压

(1) Requirements

要求

1) Each flowmeter shall be bypassed.

各流量计走副线。

2) The bypasses of all water coolers and heat exchangers shall be closed, while the inlet/outlet valves of all water coolers and heat exchangers shall be opened.

水冷器、换热器副线关，进出口阀开。

3) Pressure gauges, which have been calibrated, inspected and accepted, shall be installed, and shall have an accuracy rating of no less than Class 1.5.

安装经计量校验合格后的压力表，精度不低于 1.5 级。

4) Before introducing steam, the residual water in equipment such as piping and heat exchangers shall be drained completely, and the other pass of the heat exchanger shall be lined up and vented to prevent water hammer and pressure buildup.

给汽前放净管线、换热器等内部存水，换热器另一程改通并放空，防止水击和憋压。

5) The condensate in the steam piping shall be drained completely before introducing steam into the steam piping.

引蒸汽贯通时，蒸汽线应先排尽凝结水，再给汽。

6) Steam shall be slowly introduced to the same one process flow as required, rather than multiple process flows.

缓慢给汽，同一流程贯通，不得多点给汽，应严格按照规定的给汽点给汽。

7) When lining up the steam process flow, the drain valves in the steam process flow shall be opened one by one from upstream to downstream.

贯通时应从前往后逐点打开导淋排汽。

8) The utility piping, such as water piping, steam piping and PA/IA piping, shall be first lined up to the respective user, and then pressure tested.

水、蒸汽、风等动力线分别通至各使用点贯通，然后试压。

9) The process piping shall be pressure tested at the highest steam pressure (1.0MPa) if steam is used as the test medium.

工艺管线采用蒸汽试压的，均试至 1.0MPa 蒸汽最高压力。

10) All equipment such as columns and containers shall be pressure tested in strict accordance with the List of Test Pressures for Columns and Drums, and any overpressure is not allowed.

试压时，各塔、容器等严格按照试压表试压，禁止超压。

11) All weld joints, flanges and valves shall be checked for any leakage.

检查焊口、法兰、阀门有无泄漏。

12) Upon completion of pressure test, the steam flow shall be cut off, and all drain valves shall be opened to release the pressure.

贯通试压完毕停汽，打开导淋泄压。

(2) Introduce 0.5MPa steam

引 0.5MPa 蒸汽

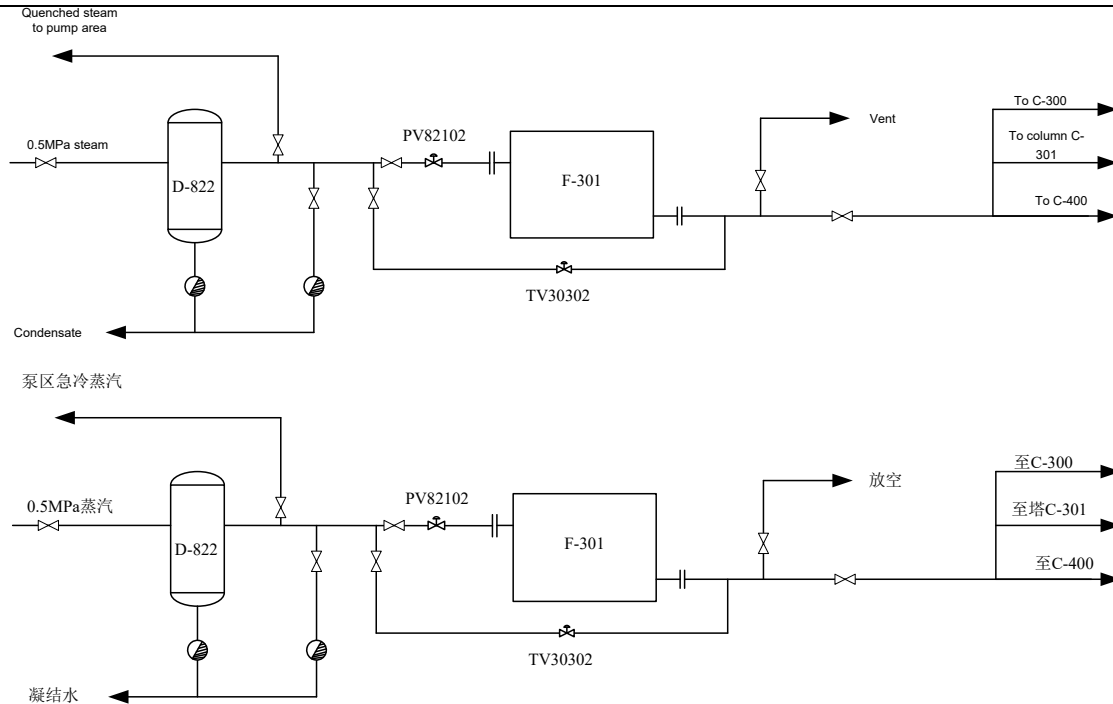


Figure 4 0.5MPa Steam Process Flow Chart

图 4 引 0.5MPa 蒸汽流程图

- 1) Close each branch process flow of 0.5MPa steam system, PV82102 and PV30302.
关闭 0.5MPa 蒸汽各分支流程，关闭 PV82102 和 PV30302。
- 2) Open the drain valve before the 0.5MPa steam valve to ISBL to drain water until steam comes from the drain valve. Open the BL valve to drain water from D-822 until steam comes from D-822.
0.5MPa 蒸汽进装置阀前开导淋排水见汽。开界区阀，在 D-822 排水见汽。
- 3) Open PV82102 and PV30302 to drain water until steam comes from these drain valves.
分别在 PV82102 和 PV30302 导淋排水见汽。
- 4) Introduce steam to the bottom of C-300, C-301 and C-400 respectively.
分别引汽至 C-300、C-301、C-400 塔底。
- 5) Vent steam at the top of F-301.
F-301 炉顶放空排汽。
- 6) Properly control the steam flowrate to avoid water hammer in the piping.
引汽时，控制引汽速度，避免管线水击。
- 7) Close all vent valves and drain valves, and then perform pressure test at the highest steam pressure.
试压时，关闭各蒸汽放空，导淋，试至蒸汽最高压力。

(3) Desalter drum

电脱盐罐

- 1) Perform pressure test for D-101 and D-102 separately.
D-101、D-102 单独试压。
- 2) Close the valves in all process flows associated with D-101 and D-102, and put the relief

valves on the top of D-101 and D-102 into service.

关闭与 D-101、D-102 所有流程的阀门，罐顶安全阀投用。

3) Introduce steam after the crude valve to the desalter drum, vent steam via the desalter drum bottom drain valve, and close the drain valve when steam comes from the drain valve.

从原油进罐阀后给汽，罐底导淋排汽，见汽后关闭导淋。

4) Pressurize the desalter drum to the maximum steam pressure (1.0MPa).

电脱盐罐升至 1.0MPa 蒸汽最高压力。

(4) Pre. Distillation column

初馏塔

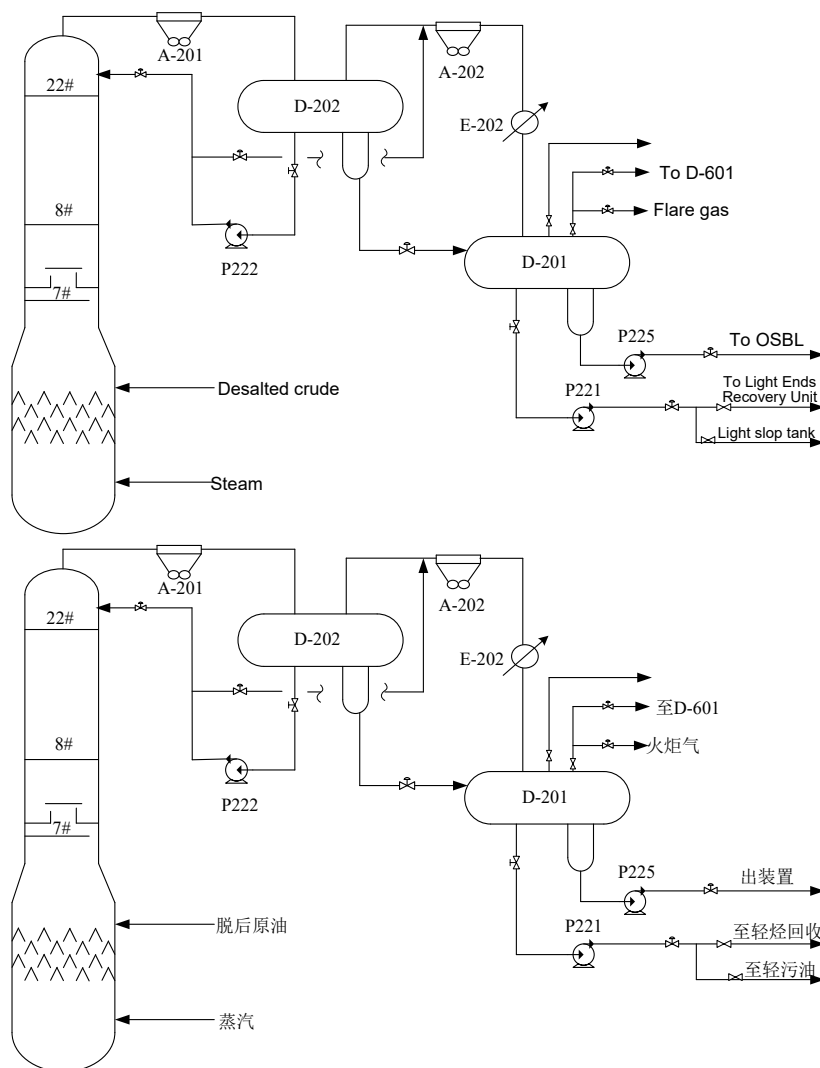


Figure 5 Pre Dist. OVHD Pressure Test Flow Chart

图 5 初馏塔顶试压流程图

1) Perform pressure test for the Pre distillation column jointly with the OVHD condensing/cooling system, reflux drum (D-201) and product drum (D-202).

初馏塔与塔顶冷凝冷却系统、回流罐 D-201、产品罐 D-202 联合试压。

2) Close the Pre-Dist. sidedraw draw valve and reflux valve, the OVHD reflux valve, the crude valve to the column and the column bottom's draw valve.

关闭初一线抽出及回流阀，初顶回流阀，原油进塔阀门，塔底抽出阀。

3) Close all valves associated with the column OVHD chemical injection system.

塔顶三注系统阀门关闭。

4) Put A-201A~F, A-202A~D and (E-202A~D) into service.

初顶空冷 A-201A~F、A-202A~D、水冷却器 E-202A~D 投用。

5) Close all other valves on D-201 except the oil vapor inlet/outlet valve.

D-201 除油气进出阀门以外，其它阀门关闭。

6) Open the oil vapor inlet valve to D-202, and close the non-condensable outlet valve and other valves.

D-202 油气入口阀打开，不凝气出口和其它阀门关闭。

7) Open the vent valves on the top of D-202, D-201 and C-200.

D-202、D-201、C-200 顶部放空打开。

8) Introduce steam at the bottom of the Pre. Dist. column.

初馏塔底部给汽。

9) Close the vent valve on the top of the column when steam comes from the vent valve.

塔顶见汽后，关闭塔顶放空。

10) Close the vent valve on the top of D-201 when steam comes from the vent valve.

D-201 罐顶见汽后关闭放空。

11) Close the vent valve on the top of D-202 when steam comes from the vent valve.

D-202 罐顶见汽后关闭放空。

12) Control the column OVHD pressure by controlling the steam flowrate introduced at the bottom of the column. For the test pressures, see the List of Test Pressures for Columns and Drums.

用塔底给汽控制塔顶压力，压力见试压表。

(5) Atm. (C-300) and Atm. side stripper (C-301)

常压塔 C-300 与汽提塔 C-301

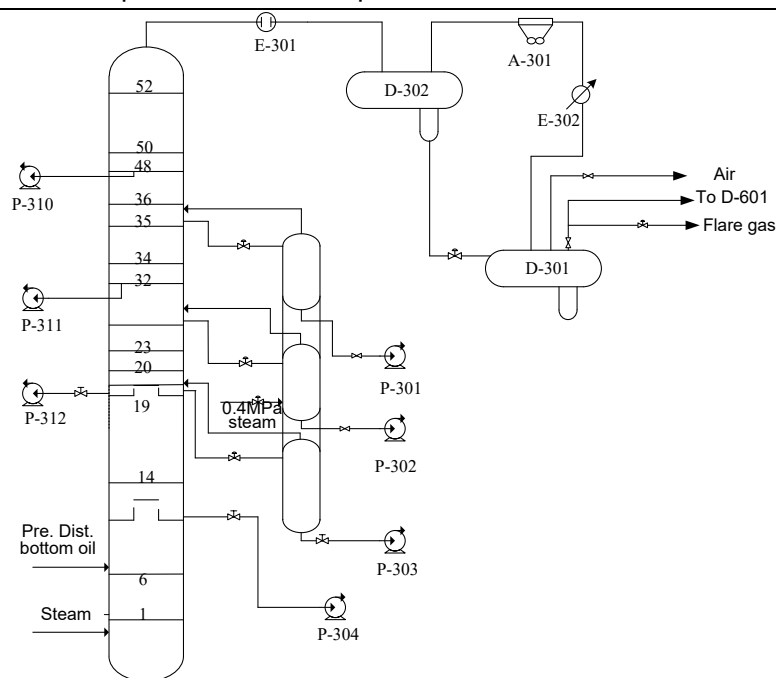


Figure 6 Flow Chart of Pressure Test for Atm. OVHD Systems and Atm. side Stripper

图 6 常压塔顶与汽提塔试压流程图

1) Perform pressure test for C-300 jointly with the column OVHD condensing/cooling system, the Atm. OVHD reflux drum (D-301), the Atm. OVHD product drum (D-302) and the Atm. side stripper (C-301).

C-300 与塔顶冷凝冷却系统、回流罐 D-301、产品罐 D-302、汽提塔 C-301 联合试压。

2) Close all valves associated with the column OVHD chemical injection system.

关闭塔顶三注的所有阀门。

3) Close the Atm. top PA, Atm. PA#1 and Atm. PA#2 draw valves and recycle valves.

关闭常顶循、常一中、常二中的塔壁抽出阀和返塔阀。

4) Close kerosene, light diesel, heavy diesel draw valves from C-301, and close Atm. overflash oil draw valve from C-300.

关闭常一线、常二线、常三线从 C-301 的引出阀，关闭常四线从 C-300 的抽出阀。

5) Close the valves on 8 branches of the atmospheric heater to the Atm..

关闭常压炉八路进常压塔的阀门。

6) Close D-301 and D-302 bottom draw valves.

关闭 D-301、302 罐底抽出的所有阀门。

7) Close C-300 bottom draw valve.

关闭 C-300 底部抽出阀。

8) Line up the process flow between C-300 and C-301.

C-300 与 C-301 之间流程连通。

9) Open the vent valves on the top of C-300, D-301 and D-302, and put all relief valves into service.

C-300、D-301、D-302 顶部放空打开，安全阀投用。

10) Introduce steam at the bottom of the Atm..

常压塔底部给汽。

11) Close the vent valve on the top of the column when steam comes from the vent valve.

塔顶放空见汽后，关闭放空阀。

12) Close the vent valves on the top of D-301 and D-302 when steam comes from these vent valves.

D-301、D-302 罐顶放空阀见汽后，关闭顶部放空阀。

13) Control the column OVHD pressure by controlling the steam flowrate introduced at the bottom of the column. For the test pressures, see the List of Test Pressures for Columns and Drums.

用塔底给汽量控制常压塔的塔顶压力，压力见试压表。

(6) Pressure test for Vac. column (C-400)

减压塔 C-400 试压

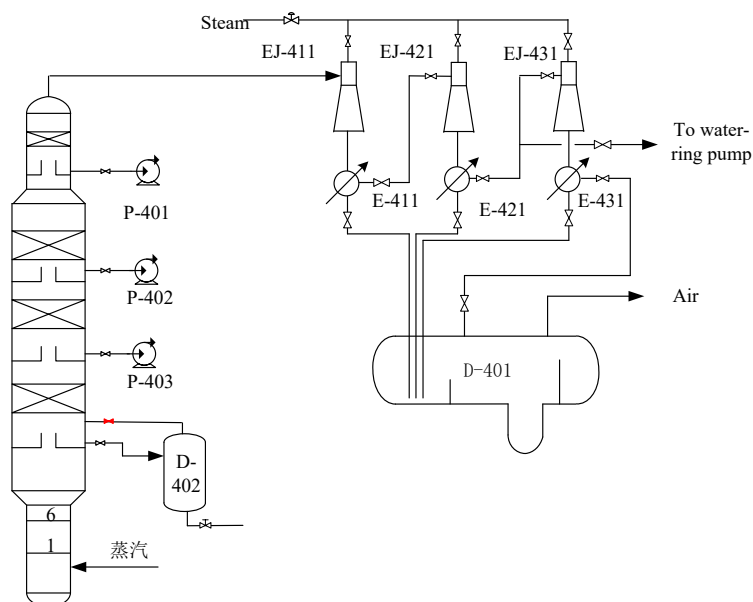


Figure 7 Vac. column Pressure Test Flow Chart

图 7 减压塔试压流程图

1) Perform pressure test for Vac. column (C-400) jointly with the column OVHD vacuuming system, condenser and D-401.

减压塔 C-400 与塔顶抽真空、冷凝器、D-401 等联合试压。

2) Replace the Vac. column OVHD vacuum pressure gauges with positive pressure gauges, and close all negative pressure gauges.

减压塔塔顶真空压力表更换为正压表，负压表全部关闭。

3) Close all valves associated with the column OVHD chemical injection system.

关闭塔顶三注的阀门。

4) Close all sidedraw and reflux draw valves, if no any valve is installed on the column wall, close the valves closest to the column wall.

关闭侧线和中段回流的塔壁阀，塔壁无阀，则关闭离塔壁最近的阀门。

5) Close the valves on 8 branches of the vacuum heater.

关闭减压炉八路阀门。

6) Close the column bottom draw valve.

关闭塔底抽出阀门。

7) Close D-401 bottom draw valves.

关闭 D-401 罐底抽出阀。

8) Line up the column OVHD vacuuming system and condenser per the normal process flow, cut off CCW to the trim coolers, and open the vent valve to drain the residual water completely.

塔顶抽真空及冷凝器按照正常生产流程改通，水冷器循环水关闭，并放空打开，排尽存水。

9) Open the vent valves on the top of C-400 and D-401.

C-400 塔顶和 D-401 罐顶放空打开。

10) Introduce steam at the bottom of C-400, and close the vent valve on the top of C-400 until steam comes from the vent valve.

C-400 塔底给汽，C-400 塔顶见汽后关闭放空阀。

11) Control C-400 pressure by controlling the steam flowrate introduced at the bottom of the column and via the vent valve on the top of D-401. For the test pressures, see the List of Test Pressures for Columns and Drums.

采用 C-400 塔底给汽量和 D-401 罐顶放空控制 C-400 压力。试压压力见试压表。

(7) Vacuuming and air tightness test for Vac. column

减压塔抽真空气密试验

The purpose of vacuuming and air tightness test for the Vac. column is to check if the vacuuming system and associated equipment meet the process requirements, and in the meanwhile, check the Vac. column and associated systems for any leakage.

减压塔抽真空试验的目的是检验抽真空系统及有关设备是否符合要求和满足工艺需要，同时通过抽真空试验，检查减压塔及其系统是否泄漏。

1) Conditions and preparations for vacuuming and airtight test

抽真空及气密试验的条件及准备

①All issues identified during steam introduction, purging and pressure test have been properly resolved.

蒸汽贯通吹扫试正压后，发现的问题全部处理完毕，试压合格。

②Confirm that the process flow of the vacuuming system is OK; introduce CCW into the water coolers.

确认抽真空系统流程无问题；冷却器给上冷却水。

③Install proper vacuum pressure gauges on the Vac. column OVHD system.

减顶系统安装好合格的真空表。

④Make up water to D-401 to establish the water seal, and properly line up the process flow downstream the non-condensable piping.

D-401 补水，建立水封，不凝气后路流程畅通。

⑤Introduce 1.0MPa steam to the vent valves before the 1st stage, 2nd stage and 3rd stage steam injectors, and drain the residual water completely.

引 1.0MPa 蒸汽至一二三级蒸汽喷射器前放空，排净存水。

2) Test methods and procedures

试验操作方法和步骤

①Make ready for vacuuming the Vac. column (for the purpose of vacuuming operation, the vacuuming systems shall be started in a sequence of Vac. 3rd ejector, Vac. 2nd ejector and Vac. 1st ejector).

减压塔准备开始进行抽真空：（抽真空要按照先开三级，再开二级，最后开一级的顺序）

②Start the Vac. 3rd ejector.启动三级蒸汽喷射器抽真空。

③When the Vac. column OVHD vacuum does not obviously rise, start the Vac. 2nd ejector.

当减顶真空度不再有明显上升时，然后开二级抽真空泵。

④When the 2nd ejector is in normal operation, observe the maximum vacuum degree that can be reached at the top of the Vac. column, and start the 1st ejector; observe the maximum vacuum degree that can be reached at the top of the Vac. column, and make good measurement and record.

二级抽真空系统正常后，观察减顶真空度所能达到的最大值，增开一级抽真空；观察减顶真空度所能达到的最大值，并做好检测与登记。

⑤Ensure that the temperature of the atmospheric leg is not higher than 40°C.

保证大气腿的温度不高于 40°C。

⑥If conditions permit, make switchover between the Vac. 3rd ejector and the liquid-ring pump to check the process flow of the 3rd stage vacuuming system.

有条件时将三级蒸汽喷射器与液环真空泵进行切换，以检测三级抽真空的流程。

⑦When the maximum vacuum degree is reached at the top of the Vac. column, stop vacuuming operation (in a sequence of first shutting down the 1st ejector, then shutting down the 2nd ejector, followed by closing the oil vapor inlet valve to the 3rd ejector, and finally cutting off the steam flow or closing the liquid ring vacuum pump inlet valve to stop the liquid ring vacuum pump).

减顶真空度达到最高时，开始停抽真空，（先停一级抽真空蒸汽，后停二级真空蒸汽，关三级蒸汽喷射器油气进口，再停蒸汽或关液环真空泵进口阀再停泵）

⑧Perform air tightness test for the Vac. column for 10h, and if the vacuum is decreased in a rate < 5kPa/h, it deems that the air tightness performance of the Vac. column is acceptable.

进行气密 10 小时，真空度下降<5kPa/h 为气密试验合格。

⑨Upon completion of vacuuming and air tightness test, where the vacuum is to be broken, the vent valve shall not be largely opened to ensure that the vacuum variation rate shall not be greater than 20kPa/h, so as to avoid any damage to the column internals.

试抽真空结束，破真空时，放空不能开的得太大，变化速度不应大于 20kPa/h，以免损坏塔内构件。

（8）Crude heat exchange system

原油换热系统

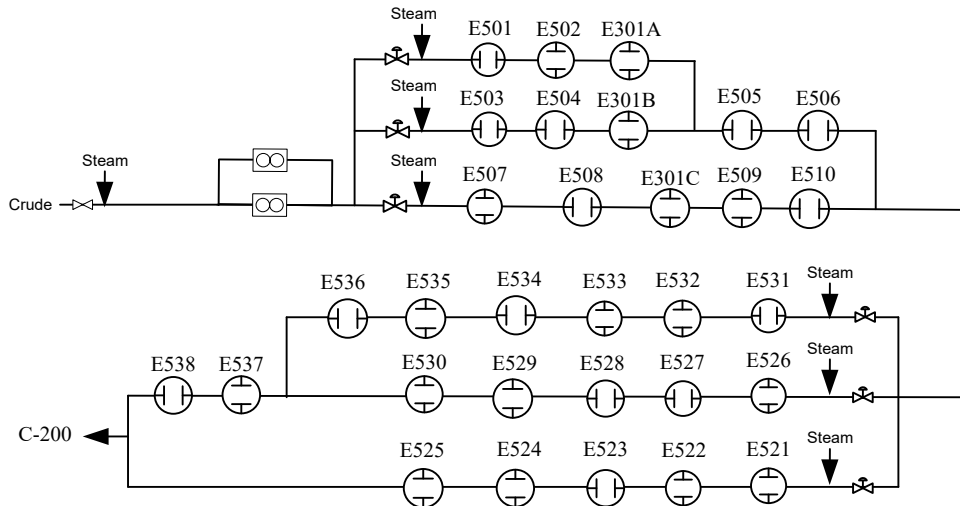


Figure 8 Crude Heat Exchange System Pressure Test Flow Chart

图 8 原油换热系统试压流程图

Steam introduction point: crude valve to ISBL Steam vent point: C-200.

给汽点：原油进装置。排汽点：初馏塔。

1) Bypass the desalter drum.

电脱盐罐走付线

2) Introduce steam to the crude piping before and after the desalter drum one by one, and it is forbidden to introduce steam to all crude piping at the same time.

贯通时脱前原油和脱后原油应逐路给汽，禁止各路同时给汽贯通。

3) Upon completion of steam purging, close all valves to the Pre-dist column.

吹扫完后，关闭至初馏塔的阀门。

4) Perform pressure test at the steam pressure $\leq 0.8\text{MPa}$ and check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.

试压时，蒸汽压力 $\leq 0.8\text{MPa}$ ，检查漏点，发现问题及时联系保运处理。

(9) Pre-Dist. bottom oil

初底油

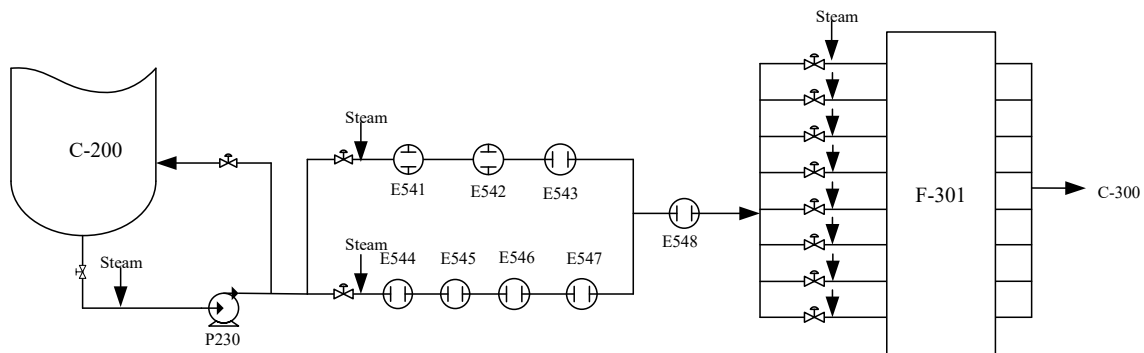


Figure 9 Pre-Dist. oil Pressure Test Flow Chart

图 9 初底油试压流程图

Steam introduction point: after the Pre-Dist. bottoms draw valve and the feed control valves to 8 passes of the Atm. heater. Steam vent point: Pre-Dist., Atm.

给汽点：初馏塔底阀后、常压炉八路调节阀后。排气点：初馏塔、常压塔。

1) Close C-200 bottom draw valve, check and close the steam purge valves of associated equipment such as heat exchangers, piping, control valves and metering instruments, the valves to the slop piping and the vent valves.

关初底油自 C-200 底部抽出阀，检查并关闭各相关换热器、管线、调节阀、计量仪表等设备的蒸汽吹扫阀、去污油线阀和放空阀。

2) Get through the two branches of Pre-Dist. bottom oil process flows one by one using steam, close the outlet valve of the last heat exchanger, and open the drain valve until steam comes from the drain valve.

初底油两路换热流程需逐路贯通，最后一台换热器出口关闭，导淋打开见汽。

3) When steam comes from the drain valve on FIC24102, get through the Pre-Dist. bottom oil recycle piping to the Pre-dist column.

初底油返塔线在 FIC24102 导淋处见汽后往初馏塔贯通。

4) After the two branches of Pre-Dist. bottom oil process flow are passed, drain water via the drain valves at the feed control valves on 8 branches of the Atm. heater until steam comes out. 初底油换热两路流程贯通后，需在常压炉八路调节阀出导淋见汽。

5) Introduce steam to 8 branches of the Atm. heater after the feed control valves, and judge if the steam process flow has passed based on the temperature variation of the heater tubes.

常压炉八路炉管在调节阀后给汽，根据炉管温度变化判断是否贯通。

6) For purpose of pressure test, close the Pre-Dist. bottom oil recycle valve and the feed control valves on 8 branches of the Atm. heater. Perform pressure test at the highest steam pressure. 试压时，关闭初底油返塔阀门和常压炉八路进料调节阀阀门，试压压力为蒸汽最高压力。

7) Perform pressure test for the Atm. heater tubes jointly with the Atm..

常压炉炉管与常压塔联合试压。

10) Atm. top PA

常顶循

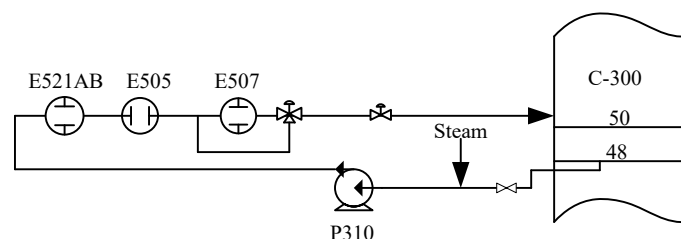


Figure 10 Atm. top PA Pressure Test Flow Chart

图 10 常顶循试压流程图

Steam introduction point: after the Atm. top PA draw valve Steam vent point: Atm.

给汽点：常顶循塔壁抽出阀后。排汽点：常压塔。

1) Close the Atm. top PA draw valve, keep TIC31001 opening at 0%, close the hand valve after FIC31001, and FIC31001 bypass valve, then fully open FIC31001.

关常顶循塔壁抽出阀、TIC31001 开度 0%，FIC31001 后手阀和副线阀关闭、全开控制阀。

2) Introduce steam after the Atm. top PA draw valve until steam comes from the drain valves on equipment such as pumps, heat exchangers and FIC31001.

常顶循抽出阀后给汽点给汽，泵、各换热器、FIC31001 等导淋见汽。

3) After TIC31001 is passed, adjust valve opening to 100%, and get through the bypass of TIC31001.

TIC31001 正线贯通后，阀开度调整为 100%，贯通付线。

4) When steam comes from the drain valve on FIC31001, introduce steam towards the Atm., and judge if the process flow has been passed based on the temperature variation of the end. FIC31001 处导淋见汽后，往常压塔贯通，通过返塔处温度变化判断是否贯通。

5) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage. 试压时，试至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

(11) Atm. PA#1

常一中

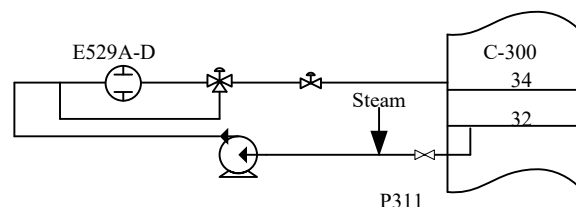


Figure 11 Atm. PA#1 Pressure Test Flow Chart

图 11 常一中试压流程图

Steam introduction point: after the Atm. PA#1 draw valve. Steam vent point: Atm.

给汽点：常一中塔壁抽出阀后。排汽点：常压塔。

1) 1) Close the Atm. PA#1 draw valve, keep TIC31002 opening at 0%, close the hand valve after FIC31003, and FIC31003 bypass valve, and then fully open FIC31003.

关常一中塔壁抽出阀、TIC31002 开度 0%，FIC31003 后手阀和副线阀关闭、全开控制阀。

2) Introduce steam after the Atm. PA#1 draw valve until steam comes from the drain valves on equipment such as pumps, heat exchangers and FIC31003.

常一中抽出阀后给汽点给汽，泵、各换热器、FIC31003 等导淋见汽。

3) After TIC31002 is passed, adjust valve opening to 100%, and get through the bypass valve of TIC31002.

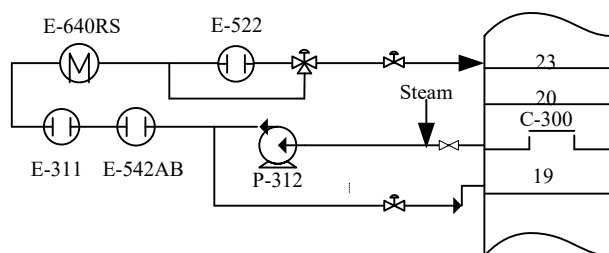
TIC31002 正线贯通后，阀开度调整为 100%，贯通付线。

4) When steam comes from the drain valve on FIC31003, introduce steam towards the Atm., and judge if the process flow has been passed based on the temperature variation of the end. FIC31003 处导淋见汽后，往常压塔贯通，通过返塔处温度变化判断是否贯通。

5) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage. 试压时，试至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

(12) Atm. PA#2

常二中

**Figure 12 Atm. PA#2 Pressure Test Flow Chart****图 12 常二中试压流程图**

Steam introduction point: after the Atm. PA#2 draw valve Steam vent point: Atm.

给汽点：常二中塔壁抽出阀后。排汽点：常压塔。

1) Close the Atm. PA#2 draw valve, keep TIC31006 and TIC31201 opening to 0%, close the hand valves after FIC31004 and FIC31006, and FIC31004 and FIC31006 bypass valves, then fully open FIC31004 and FIC31006.

关常二中塔壁抽出阀、TIC31006 和 TIC31201 开度 0%，FIC31004 和 FIC31006 后手阀和副线阀关闭、全开控制阀。

2) Keep TIC64201 and TIC64202 opening at 100%, get through E-640R and E-640S in turn, that is, the outlet valve of the reboiler that now is not required to be lined up shall be closed.

TIC64201、TIC64202 开度 100%，E-640R 和 E-640S 应轮流贯通，即不贯通时关闭重沸器出口阀。

3) Introduce steam after the Atm. PA#2 draw valve until steam comes from the drain valves on equipment such as pumps, heat exchangers, FIC31004 and FIC31006.

常二中抽出阀后给汽点给汽，泵、各换热器、FIC31004 和 FIC31006 等导淋见汽。

4) When steam comes from the drain valves on FIC31004 and FIC31006, introduce steam towards the Atm., and judge if the process flow has been lined up based on the temperature variation of the end.

FIC31004 和 FIC31006 处导淋见汽后，往常压塔贯通，通过返塔处温度变化判断是否贯通。

5) After each three-way valve is passed, get through the bypass valve of each three-way valve, that is, the opening of the three-way valves shall be up to 100%.

各三通阀正线贯通后轮流贯通付线，即三通阀开度 100%。

6) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.

试压时，试至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

(13) Kerosene

常一线

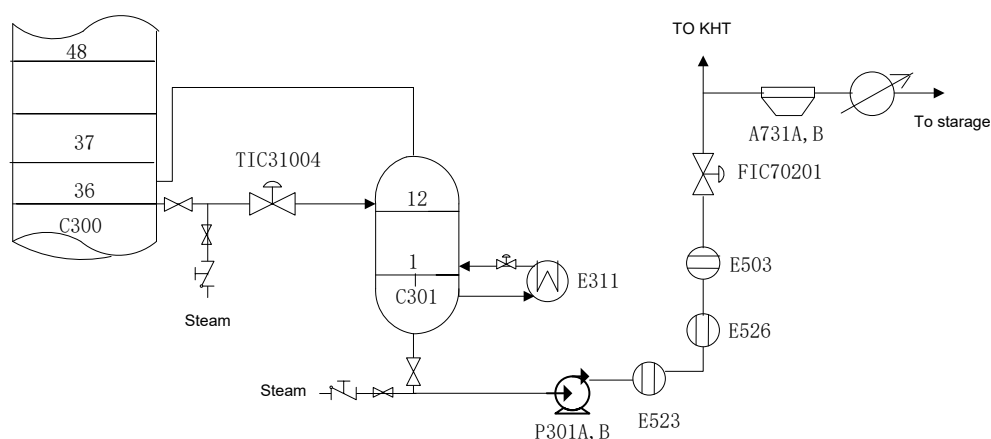


Figure 13 Kerosene Pressure Test Flow Chart

图 13 常一线试压流程图

Steam introduction point: after kerosene draw valve and the kerosene stripper bottom draw valve. Steam vent point: Atm., stripper, drain valve in the kerosene process flow to BL of the drum, and drain valve in the kerosene process flow to BL of KHT.

给汽点：常一线常压塔塔壁抽出阀后、常一线汽提塔抽出阀后。排汽点：常压塔、汽提塔、常一线至罐区和至航煤加氢的界区导淋。

1) Close kerosene draw valve and kerosene stripper draw valve.

关常一线常压塔塔壁抽出阀和常一线汽提塔塔壁抽出阀。

2) Introduce steam after kerosene draw valve, vent steam towards the stripper, and judge if the process flow has been passed based on the temperature variation of the stripper gas phase returning Atm..

常一线自常压塔塔壁抽出阀后给汽，往汽提塔排汽，通过常一线气相返回线温度变化判断是否贯通。

3) Introduce steam after kerosene stripper bottom draw valve, and vent steam via the drain valves on pumps, heat exchangers and control valves, the drain valve in kerosene process flow to BL of KHT, and the drain valve in the kerosene process flow to BL of the drum respectively.

常一线自汽提塔塔底抽出阀后给汽，分别在泵、各换热器、调节阀导淋排汽，常一线至航煤加氢的界区排汽，常一线至罐区的界区排汽。

4) Get through two air coolers in turn while get through kerosene process flow.

常一线贯通时，两台空冷轮流贯通。

5) May introduce steam to kerosene from multiple points by considering the cooling performance of the air coolers, and perform pressure test at the highest steam pressure whenever possible.

试压时，应考虑空冷的冷却作用，常一线可多点给汽，尽量试至最高压力。

6) Perform pressure test the pipes between the Atm. and the kerosene stripper with the columns.

常一线常压塔和汽提塔之间管线与塔联合试压。

(14) Light diesel

常二线

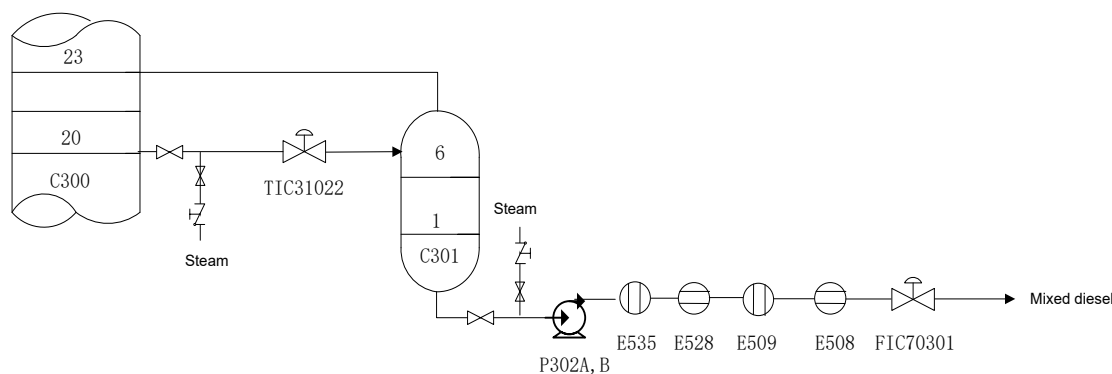


Figure 14 Light diesel Pressure Test Flow Chart
图 14 常二线试压流程图

Steam introduction point: after the Light diesel draw valve and the Light diesel stripper bottom draw valve. Steam vent point: Atm., stripper, drain valve on FIC70301

给汽点：常二线常压塔塔壁抽出阀后、常二线汽提塔抽出阀后。排汽点：常压塔、汽提塔、FIC70301 导淋。

1) Close the Light diesel draw valve and the Light diesel stripper bottom draw valve.

关常二线常压塔塔壁抽出阀和常二线汽提塔塔壁抽出阀。

2) Introduce steam after the Light diesel draw valve, vent steam towards the stripper, and judge if the process flow has been passed based on the temperature variation of the stripper gas phase returning Atm.

常二线自常压塔塔壁抽出阀后给汽，往汽提塔排汽，通过常二线气相返回线温度变化判断是否贯通。

3) Introduce steam after the Light diesel stripper bottom draw valve, and vent steam via the drain valves on pumps, heat exchangers and control valves respectively.

常二线自汽提塔塔底抽出阀后给汽，分别在泵、各换热器、调节阀导淋排汽。

4) Perform pressure test at the highest steam pressure.

试压时，试至蒸汽最高压力。

5) Perform pressure test the pipes between the Atm. and the light diesel stripper with the columns.

常二线常压塔和汽提塔之间管线与塔联合试压。

(15) Heavy diesel

常三线

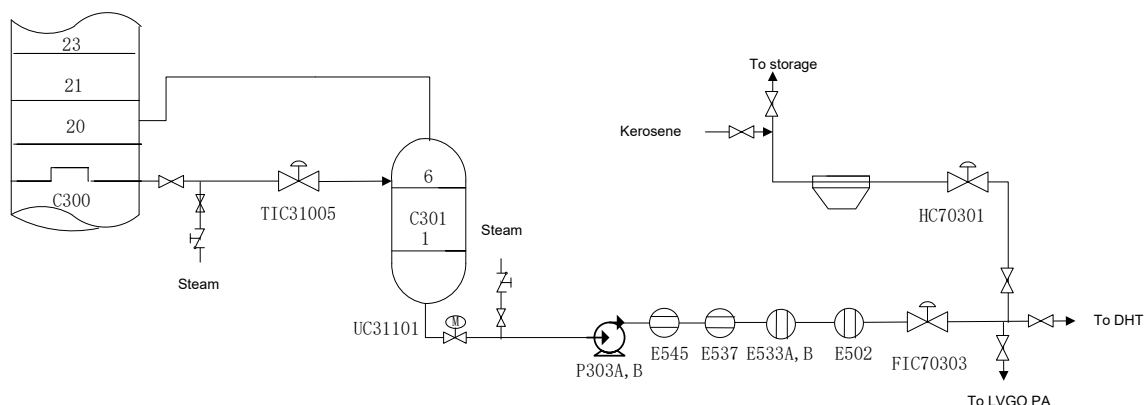


Figure 15 Heavy diesel Pressure Test Flow Chart

图 15 常三线试压流程图

Steam introduction point: after the heavy diesel draw valve and the heavy diesel stripper bottom draw valve. Steam vent point: Atm., stripper, drain valve in the mixed diesel process flow to BL of the drum, and drain valve in the mixed diesel process flow to BL of DHT.

给汽点：常三线常压塔塔壁抽出阀后、常三线汽提塔抽出阀后。排汽点：常压塔、汽提塔、混合柴油至罐区和至柴油加氢的界区导淋。

1) Close the heavy diesel draw valve and the heavy diesel stripper bottom draw valve.

关常三线常压塔塔壁抽出阀和常三线汽提塔塔壁抽出阀。

2) Introduce steam after the heavy diesel draw valve, vent steam towards the stripper, and judge if the process flow has been passed based on the temperature variation of the stripper gas phase returning Atm..

常三线自常压塔塔壁抽出阀后给汽，往汽提塔排汽，通过常三线气相返回线温度变化判断是否贯通。

3) Introduce steam after the heavy diesel stripper bottom draw valve, and vent steam via the drain valves on pumps, heat exchangers and control valves, the drain valve in the mixed diesel process flow to BL of DHT, and the drain valve in the heavy diesel process flow to BL of the drum respectively.

常三线自汽提塔塔底抽出阀后给汽，分别在泵、各换热器、调节阀导淋排汽，混合柴油至柴油加氢的界区排汽，常三线至罐区的界区排汽。

4) Introduce steam to the heavy diesel from multiple points by considering the cooling performance of the air coolers, and perform pressure test at the highest steam pressure whenever possible.

试压时，应考虑空冷的冷却作用，常三线可多点给汽，尽量试至最高压力。

5) Perform pressure test the pipes between the Atm. and the heavy diesel stripper with the columns

常三线常压塔和汽提塔之间管线与塔联合试压。

(16) Atm. overflah oil

常四线

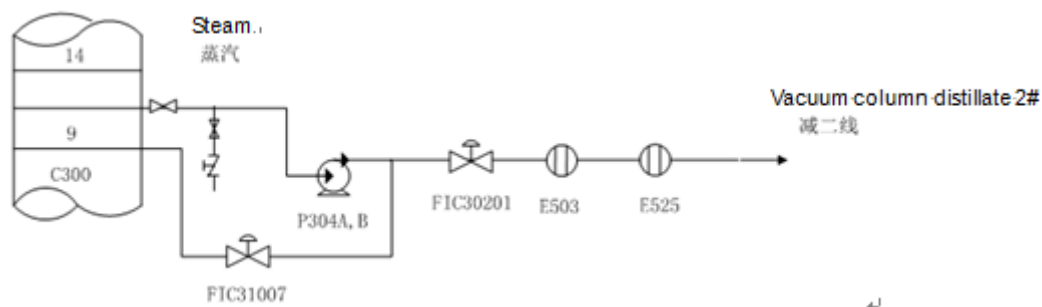


Figure 16 Atm. overflash oil Pressure Test Flow Chart

图 16 常四线试压流程图

Steam introduction point: after the atm. overflash oil draw valve Steam vent point: Atm., drain valve on E-525

给汽点：常四线常压塔塔壁抽出阀后。排汽点：常压塔、E-525 导淋。

1) Close the atm. overflash oil draw valve, the hand valve after FIC31007, and FIC31007 bypass valve.

关常四线常压塔塔壁抽出阀和 FIC31007 后手阀和付线阀。

2) Introduce steam after the atm. overflash oil draw valve, and vent steam via the drain valves on pumps, heat exchangers and control valves respectively.

常四线自常压塔塔壁抽出阀后给汽，分别在泵、各换热器、调节阀导淋排汽。

3) Perform pressure test at the highest steam pressure.

试压时，试至蒸汽最高压力。

(17) Atm. residue to Vac. heater

常底油至减压炉管线

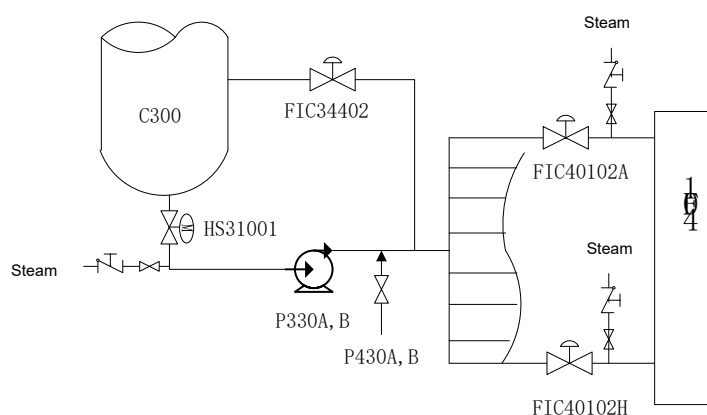


Figure 17 Flow Chart of Pressure Test for AR to Vac. heater

图 17 常底油至减压炉试压流程图

Steam introduction point: after the **AR** draw valve Steam vent point: Atm., Vac. column

给汽点：常底油塔壁抽出阀后。排汽点：常压塔、减压塔。

1) Close HS-31001, FIC34402 and FIC40102A~H bypass valves, and the hand valves after FIC34402 and FIC40102A~H.

关 HS-31001，将 FIC34402、FIC40102A~H 付线阀和后手阀关闭。

2) Introduce steam after HS-31001, and vent steam via the drain valves on P-330AB, FIC34402

and FIC40102A~H.

HS-31001 阀后给汽，分别在 P-330AB、FIC34402、FIC40102A~H 导淋排汽。

3) When steam comes from the drain valve on FIC34402, open the hand valve after FIC34402 to introduce steam towards the Atm..

FIC34402 导淋见汽后，打开后手阀往常压塔贯通。

4) When steam comes from the drain valves on FIC40102A~H, introduce steam towards the Vac. column loop by loop. Make up steam after the control valves, and judge if the process flow has been passed based on the temperature variation of the heater tubes.

FIC40102A~H 导淋见汽后，逐路往减压塔贯通，可在调节阀后补汽，通过炉管温度变化判断是否贯通。

5) Close FIC34402 and FIC40102A~H bypass valves, and the hand valves after FIC34402 and FIC40102A~H, then perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.

试压时，关闭 FIC34402、FIC40102A~H 付线阀和后手阀关闭，试至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

6) Perform pressure test for the heater tubes jointly with the Vac. column.

炉管与减压塔联合试压。

(18) LVGO and LVGO PA

减一线及减一中

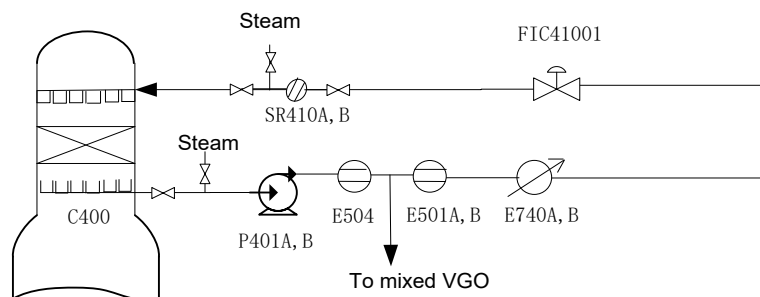


Figure 18 Flow Chart of Pressure Test for LVGO and LVGO PA

图 18 减一线及减一中试压流程图

Steam introduction point: after the LVGO draw valve Steam vent point: Vac. column

给汽点：减一线塔壁抽出阀后。排汽点：减压塔。

1) Close the LVGO draw valve, the hand valve after the LVGO PA strainer, and the valves in the process flow from LVGO to heavy diesel.

关减一线 C-400 塔壁抽出阀，减一中过滤器后手阀，减一线至常三线阀。

2) Introduce steam after the LVGO draw valve, and vent steam via the drain valves on pumps, heat exchangers, control valves and filters.

在减一线塔壁抽出阀后给汽点，在泵、换热器、调节阀、过滤器等导淋排汽。

3) When steam comes from the LVGO PA strainer, introduce steam towards the Vac. column.

减一中过滤器见汽后，往减压塔贯通。

4) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.
试压至蒸汽最高压力, 30min 后, 检查泄漏情况, 发现问题及时联系保运处理。

(19) MVGO and MVGO PA

减二线及减二中

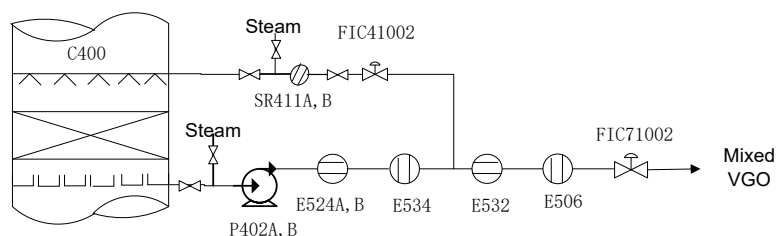


Figure 19 Flow Chart of Pressure Test for MVGO and MVGO PA

图 19 减二线及减二中试压流程图

Steam introduction point: after the MVGO draw valve Steam vent point: Vac. column, FIC71002
给汽点: 减二线塔壁抽出阀后。排汽点: 减压塔、FIC71002。

1) Close the MVGO # draw valve, the hand valve after the MVGO PA strainer and the hand valve after FIC71002.

关减二线 C-400 塔壁抽出阀, 减二中过滤器后手阀, FIC71002 后手阀。

2) Introduce steam after the MVGO draw valve, and vent steam via the drain valves on pumps, heat exchangers, control valves and filters.

在减二线塔壁抽出阀后给汽点, 在泵、换热器、调节阀、过滤器等导淋排汽。

3) When steam comes from the MVGO PA strainer, introduce steam towards the Vac. column. 减二中过滤器见汽后, 往减压塔贯通。

4) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.
试压至蒸汽最高压力, 30min 后, 检查泄漏情况, 发现问题及时联系保运处理。

(20) HVGO and HVGO PA

减三线及减三中

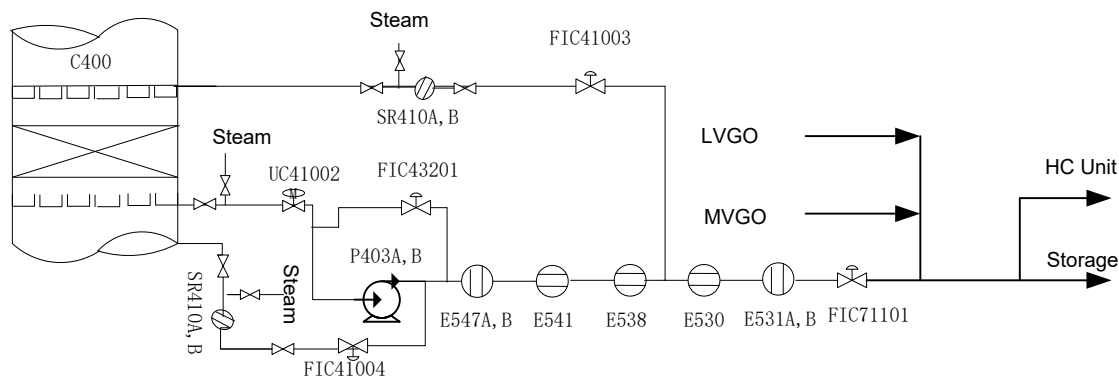


Figure 20 Flow Chart of Pressure Test for HVGO and HVGO PA

图 20 减三线及减三中试压流程图

Steam introduction point: after the HVGO draw valve Steam vent point: vacuum tower, drain

valve on the mixed VGO piping to Hydrocracking Unit, drain valve on the VGO piping to the drum

给汽点：减三线塔壁抽出阀后。排汽点：减压塔、混合蜡油至加氢裂化、混合蜡油至罐区。

1) Close the HVGO draw valve, and the hand valves after the HVGO PA strainer and the HVGO flushing oil.

关减三线 C-400 塔壁抽出阀，减三中过滤器和减三线内回流后手阀。

2) Introduce steam after the HVGO draw valve, and vent steam via the drain valves on pumps, heat exchangers, control valves and strainer s.

在减三线塔壁抽出阀后给汽点，在泵、换热器、调节阀、过滤器等导淋排汽。

3) When steam comes from the hand valves after the HVGO PA strainer and the HVGO flushing oil, introduce steam towards the Vac. column.

减三中过滤器和减三线内回流见汽后，往减压塔贯通。

4) Vent steam via the drain valve on the mixed VGOI piping to BL of HC Unit and the drain valve on the mixed VGO piping to BL of the drum respectively.

混合蜡油至加氢裂化和至罐区，分别在界区的导淋排汽。

5) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage. 试压至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

(21) Vac. overflow oil

减四线

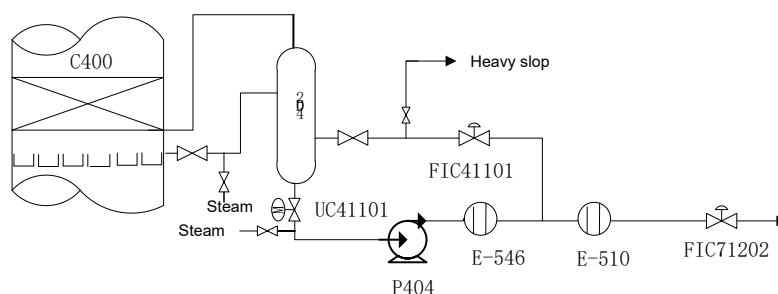


Figure 21 Vac. overflow oil Pressure Test Flow Chart

图 21 减四线试压流程图

Steam introduction point: after the Vac. overflow oil draw valve and D-402 bottom draw valve

Steam vent point: Vac. column, D-402, FIC41101

给汽点：减四线塔壁抽出阀后、D-402 罐底抽出阀后。排汽点：减压塔、D-402、FIC41101。

1) Close the Vac. overflow oil draw valve, D-402 bottom draw valve and the Vac. overflow oil recycle valve to D-402.

关减四线 C-400 塔壁抽出阀，D-402 罐底抽出阀和减四线返回 D-402 阀门。

2) Introduce steam after the Vac. overflow oil draw valve to purge the Vac. overflow oil towards D-402.

减四线塔壁抽出阀后给汽，往 D-402 贯通吹扫。

3) Introduce steam at the bottom of D-402, and vent steam via the drain valves on P-404, heat

exchangers and control valves.

D-402 罐底给汽, P-404、换热器、调节阀等导淋排汽。

4) When steam comes from the drain valve on FIC41101, open the Vac. overflash oil recycle valve to D-402.

FIC41101 导淋见汽后, 打开减四线返回 D-402 阀门进行贯通。

5) Perform pressure test for D-402 jointly with the Vac. column, at the test pressure identical with that for the Vac. column.

试压时 D-402 与减压塔联合试压。试压压力与减压塔相同。

6) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.
减四线其余管线试压至蒸汽最高压力, 30min 后, 检查泄漏情况, 发现问题及时联系保运处理。

(22) VR

减压渣油线

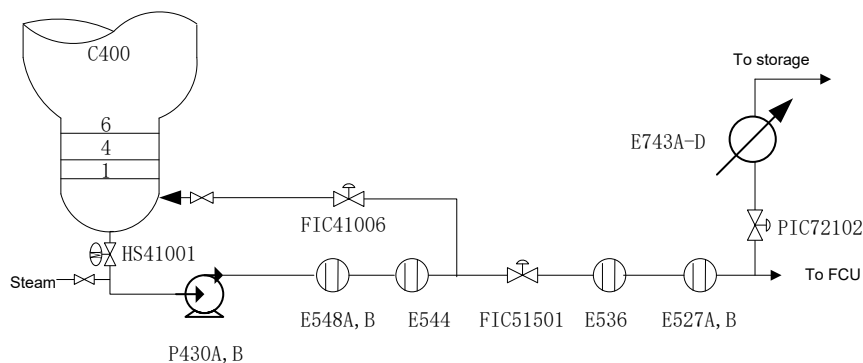


Figure 22 VR Pressure Test Flow Chart

图 22 减压渣油试压流程图

Steam introduction point: after the Vac. residue draw valve Steam vent point: Vac. column, drain valve in the vacuum residue loop to FCU, drain valve in the vacuum residue loop to the drum.

给汽点: 减压塔塔底抽出阀后。排汽点: 减压塔、渣油至灵活焦化、渣油至罐区。

1) Close C-400 bottom draw valve and the quench oil recycle valve.

关 C-400 塔底抽出阀, 急冷油返塔阀门。

2) Introduce steam after Vac. column C-400 bottoms draw valve, and vent steam via the drain valves on pumps, heat exchangers and control valves, the drain valve in the vacuum residue loop to Flexicoking Unit, and the drain valve in the vacuum residue loop to the storage.

C-400 塔底给汽, 在泵、换热器、调节阀、渣油至灵活焦化、渣油至罐区等处导淋排汽。

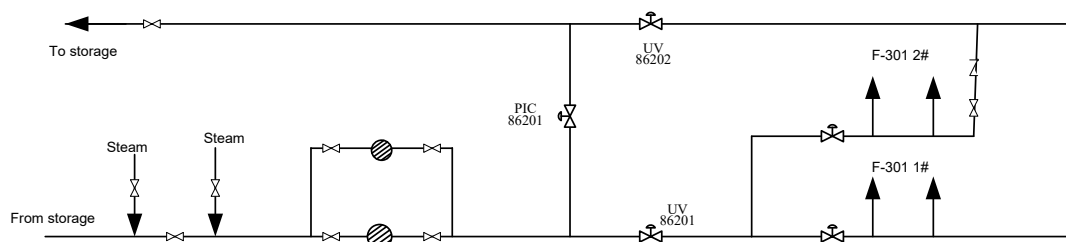
3) When steam comes from the drain valve on FIC41006, open the quench oil recycle valve to purge the vacuum residue loop towards the Vac. column.

FIC41006 导淋见汽后, 打开急冷油返塔阀门, 往减压塔贯通。

4) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.
试压至蒸汽最高压力, 30min 后, 检查泄漏情况, 发现问题及时联系保运处理。

(23) Fuel oil system

燃料油

**Figure 23 Fuel oil System Pressure Test Flow Chart****图 23 燃料油试压流程图**

Steam introduction point: fuel oil valve to ISBL Steam vent point: fuel oil valve to OSBL, each burner

给汽点：燃料油进装置。排汽点：燃料油出装置、各燃烧器。

1) Close the fuel oil valve to ISBL and the fuel oil valve to OSBL.

关燃料油进出装置界区阀。

2) Remove the fuel oil hoses from each burner.

各燃烧器燃料油软管拆下。

3) Introduce steam via the fuel oil valve to OSBL, and vent steam via the drain valve at each control valve, each burner and the fuel oil valve to OSBL.

燃料油进装置给汽，各调节阀导淋、各燃烧器、燃料油装置界区等处导淋排汽。

4) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.

试压至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

(24) Fuel gas system

燃料气系统

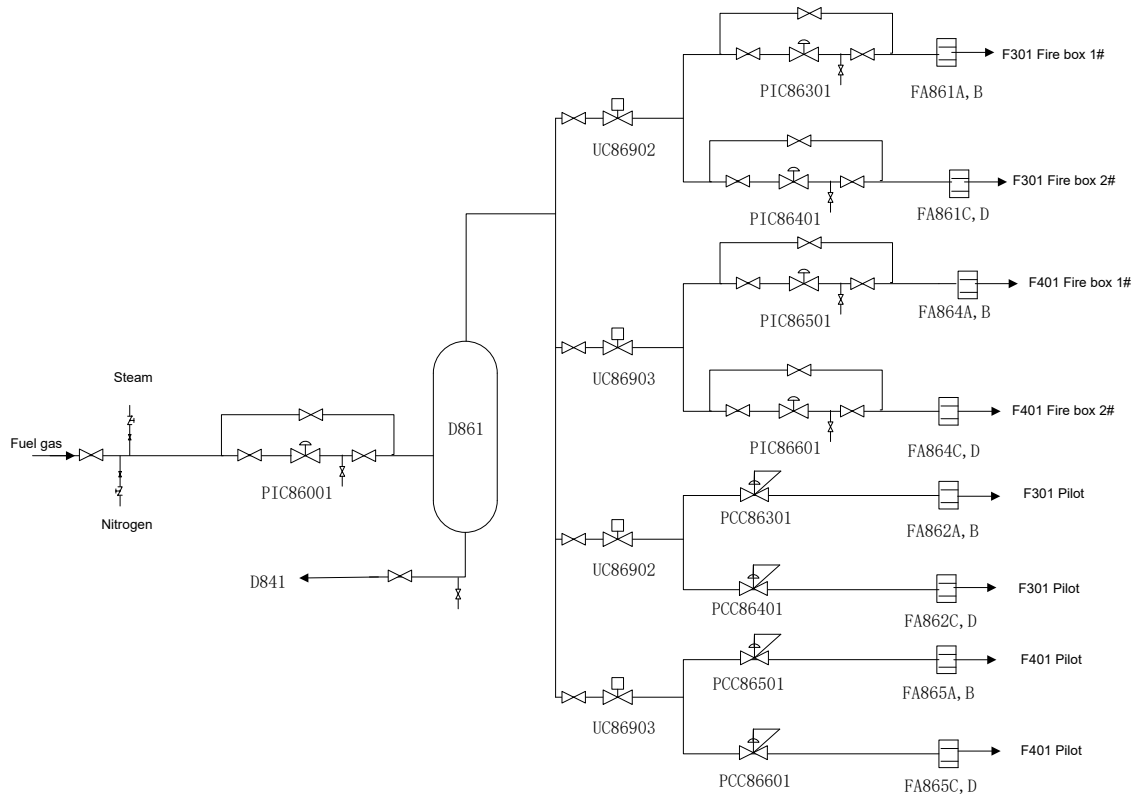


Figure 24 Fuel Gas System Pressure Test Flow Chart

图 24 燃料气系统试压流程图

Steam introduction point: fuel gas valve to ISBL Steam vent point: D-861, each HP fuel gas burner and pilot

给汽点：燃料气进装置。排汽点：D-861、各燃烧器高瓦和长明灯。

1) Close the fuel gas valve to ISBL.

关燃料气进装置界区阀。

2) Remove the hoses from each HP fuel gas burner and pilot.

各燃烧器高瓦和长明灯软管拆下。

3) Introduce steam via the fuel gas valve to ISBL, and vent steam via the drain valve at each control valve, D-861 and each burner.

燃料气进装置给汽，各调节阀导淋、D-861、各燃烧器排汽。

4) Perform pressure test at the highest steam pressure and hold for 30min, then check for leakage. If any leakage is identified, contact the operation support force to eliminate the leakage.

试压至蒸汽最高压力，30min 后，检查泄漏情况，发现问题及时联系保运处理。

(25) Desalter drum relief valve vent piping

电脱盐安全阀放空

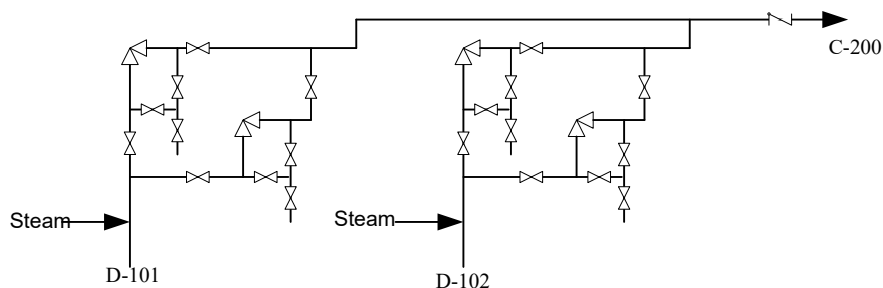


Figure 25 Flow Chart of Pressure Test for Desalter Drum Relief valve Vent Piping

图 25 电脱盐安全阀放空线试压流程图

Steam introduction point: D-101, D-102 Steam vent point: C-200

给汽点: D-101、D-102。排气点: C-200。

1) Purge the desalter drum relief valve vent piping in conjunction with steaming operation for D-101 and D-102 and purging operation for Pre-Dist..

电脱盐安全阀放空线的吹扫应结合 D-101、D-102 蒸煮和初馏塔吹扫时进行。

2) While purging the desalter drum relief valve vent piping, open the crossover in small diameter (DN20) at the inlet/outlet of the relief valve.

吹扫时, 打开安全阀的进出口小跨线 (DN20)。

3) Vent the gas phase from D-101 and D-102 to C-200. And the liquid phase flows to D-101 and D-102 by gravity.

气相从 D-101、D-102 排至 C-200。液相自流至 D-101、D-102。

(26) Flare gas system

火炬气系统

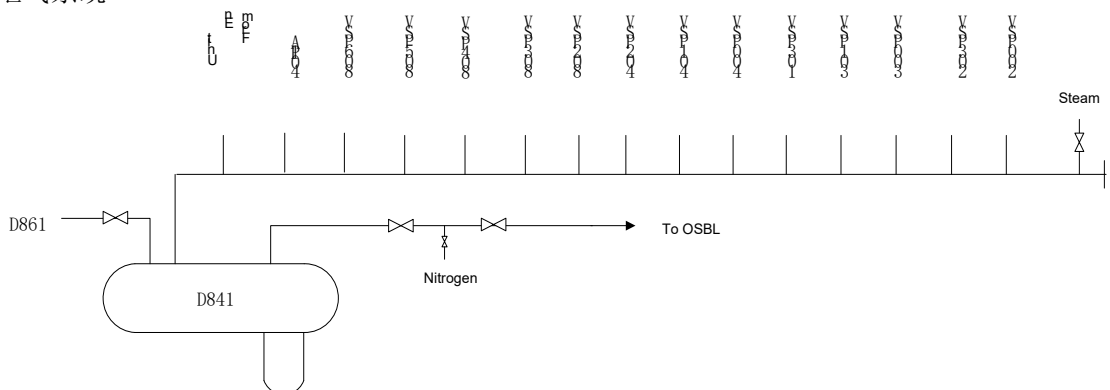


Figure 26 Flare Gas System Pressure Test Flow Chart

图 26 火炬气系统试压流程图

Steam introduction point: equipment at each pressure relief valve Steam vent point: D-841

给汽点: 各安全阀放空处设备。排气点 D-841。

1) Introduce steam to the flare gas system while steam is being introduced to the equipment at each vent point. Open the bypass valves of the relief valves to introduce steam to the flare gas system.

火炬气系统的贯通结合各排放点设备的贯通进行。打开安全阀付线进行贯通。

2) Perform pressure test for the flare gas system depending on the test pressure for D-841 as

defined in the List of Test Pressures for Columns and Drums.

火炬气系统的贯通结合各排放点设备的贯通进行。打开安全阀付线进行贯通。

(27) Sealing oil pot I and sealing oil pot II

封油 I、封油 II

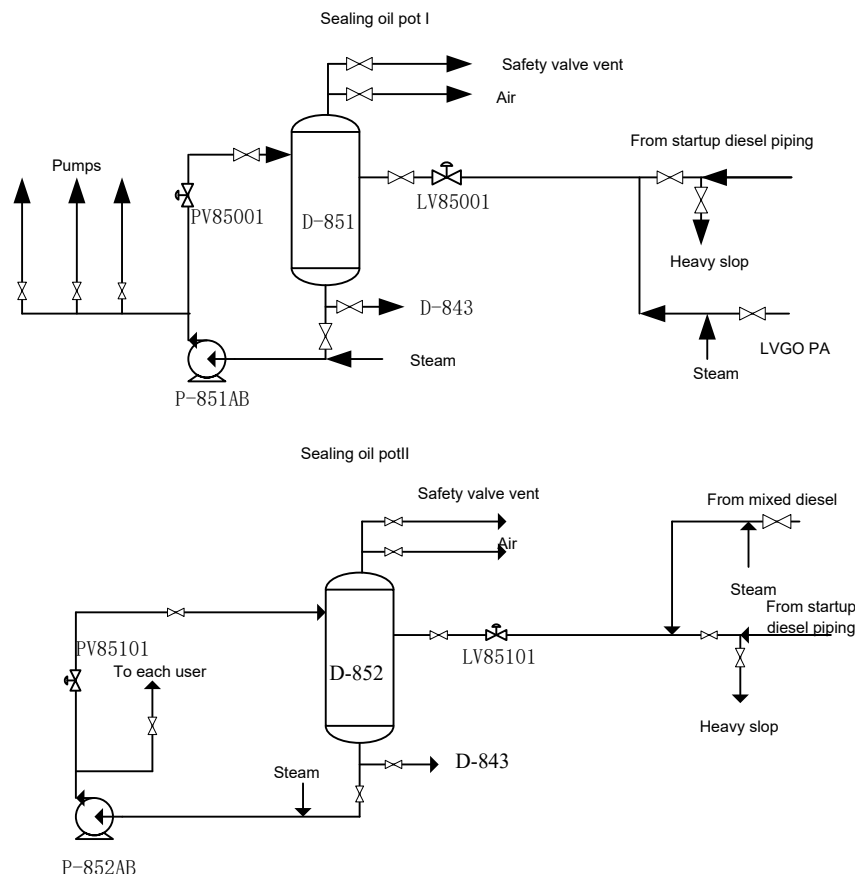


Figure 27 Sealing Oil System Pressure Test Flow Chart

图 27 封油系统试压流程图

Steam introduction point: mixed diesel, LVGO PA, D-852 and D-851 bottom Steam vent point: D-852, D-851, vent point of each user

给汽点：混合柴油、减一中、D-852 和 D-851 罐底。排汽点：D-852、D-851、各用户排放点

1) Open the vent valves at all sealing oil injection points on the pump, and thoroughly purge each branch.

将所有加注封油的机泵注入点放空打开，每根支线均需吹干净。

2) Close all valves in the process flows from LVGO PA to the sealing oil system and from the mixed diesel to the sealing oil system.

关减一中至封油阀，关混合柴油至封油阀。

3) Introduce steam after D-851 and D-852 draw valves to purge the sealing oil system towards each user and the sealing oil pot recycle piping.

由 D-851、D-852 抽出阀后给汽，往各用户和封油罐返回线吹扫贯通。

4) Introduce steam via the valve in the mixed diesel piping to purge the sealing oil system towards D-852; Introduce steam via the valve in the LVGO PA to purge the sealing oil system

towards D-851.

混合柴油给汽，往 D-852 贯通吹扫。减一中给汽，往 D-851 贯通吹扫。

5) Perform pressure test for the sealing oil piping individually at the highest steam pressure; perform pressure test for D-851 and D-852 separately, and for the test pressures, see the List of Test Pressures for Columns and Drums.

封油管线单独试压，试至蒸汽最高压力。封油罐 D-851、D-852 单独试压，试压压力见试压表。

6) Upon completion of pressure test, cut off steam to each steam introduction point, and vent steam via the vent valve at each sealing oil injection point for pressure relief.

试压完后关各给汽点蒸汽，在各封油注入点放空撤压。

(28) Low-temperature heavy slop system

低温重污油

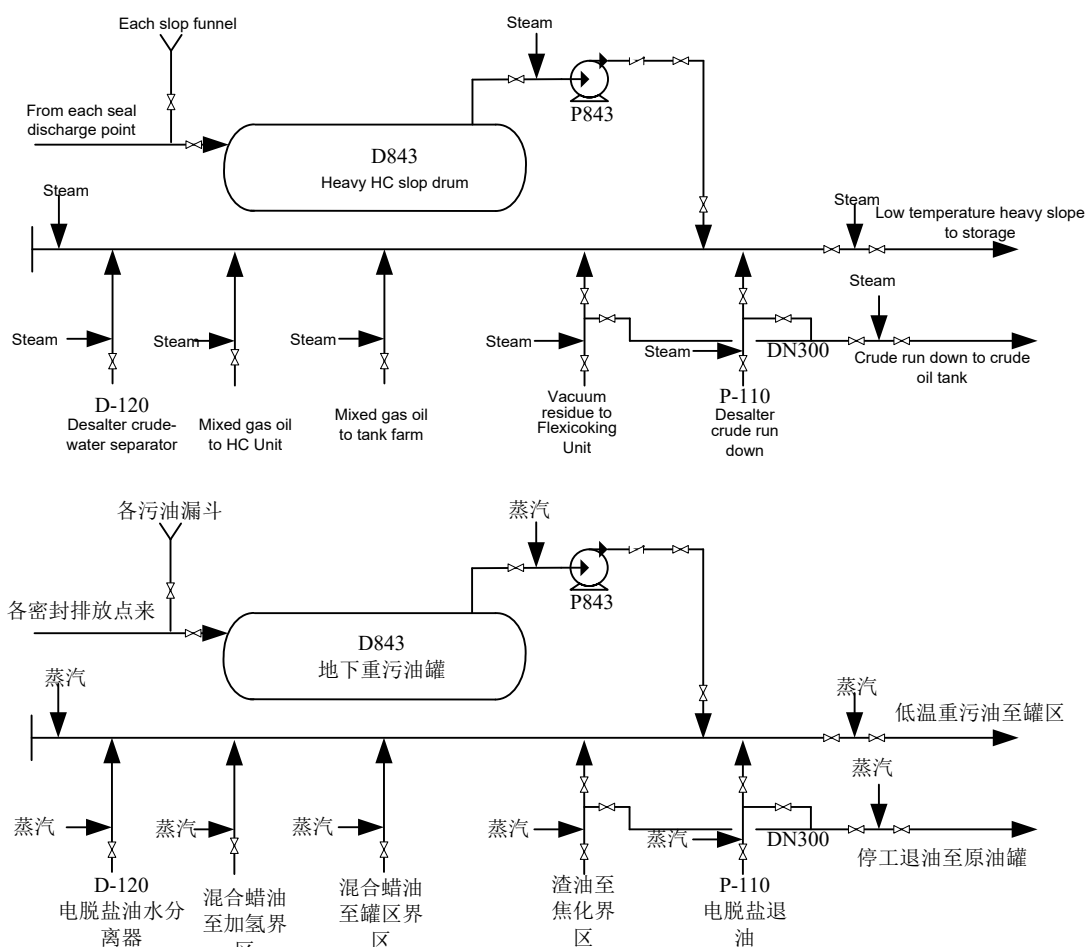


Figure 28 Low-temperature Heavy Slop System Pressure Test Flow Chart

图 28 低温重污油系统试压流程图

Steam introduction point: each vent point on the sealing system, P-843, the end of each low-temperature heavy slop branch
Steam vent point: D-843, vent valve to the storage

给汽点：各密封排放点、P-843、低温重污油线各分支末端。排气点：D-843、至罐区。

1) Purge the low-temperature heavy slop system towards D-843 via each vent point on the sealing system, and open the vent valve on the top of D-843.

低温重污油由各密封排放点往 D-843 贯通吹扫，D-843 顶部放空打开。

2) Introduce steam via P-843 to purge the low-temperature heavy slop system towards OSBL. P-843 给汽，往出装置吹扫。

3) Introduce steam at the end of each low-temperature heavy slop branch to purge the low-temperature heavy slop system towards OSBL.

各分支末端轮流给汽往低温重污油出装置吹扫。

4) Perform pressure test for D-843 individually, and for the test pressures, see the List of Test Pressures for Columns and Drums. And perform pressure test for other piping at the highest steam pressure.

试压时 D-843 单独试压，试压压力见试压表。其余管线试压，试压至蒸汽最高压力。

(29) High-temperature heavy slop system

高温重污油

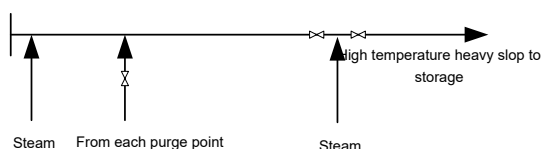


Figure 29 High-temperature Heavy Slop System Pressure Test Flow Chart

图 29 高温重污油系统试压流程图

Steam introduction point: each purge point, the starting point of the high-temperature heavy slop piping
Steam vent point: vent valve to the storage

给汽点：各吹扫点、高温重污油线起始端。排气点：至罐区。

(30) Light slop system

轻污油

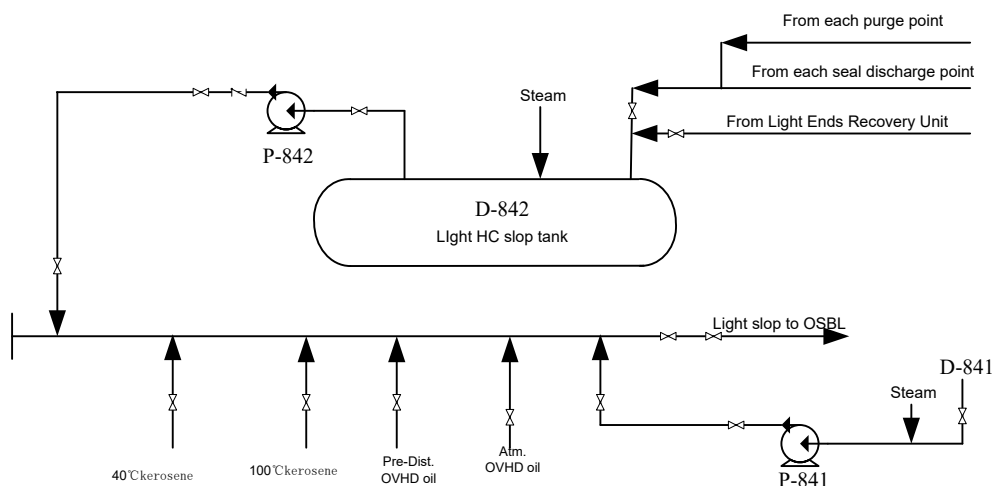


Figure 30 Light Slop System Pressure Test Flow Chart

图 30 轻污油系统试压流程图

Steam introduction point: each vent point on the sealing system, each vent point on the purging system, D-841 bottom, valve in the Kerosene loop, valve in the Pre-Dist. OVHD naphtha loop, valve in the Atm. OVHD naphtha loop
Steam vent point: D-842, light slop piping to OSBL

给汽点：各密封排放点、各吹扫排放点、D-841 底部、常一线、初顶石脑油、常顶石脑油等。排

气点：D-842、轻污油出装置。

1) Introduce steam via each vent point on the sealing system to purge the light slop system towards D-842.

各密封排放点给汽往 D-842 贯通吹扫。

2) Introduce steam via each vent point on the purging system to purge the light slop system towards D-842.

各密封点给汽往 D-842 贯通吹扫。

3) Introduce steam via three valves in turn (such as the valve in the Kerosene loop, the valve in the Pre-Dist. OVHD naphtha loop and the valve in the Atm. OVHD naphtha loop) to purge the light slop system towards OSBL, and vent steam via the BL valve. Afterwards, purge the light slop system towards D-842, and bypass P-842.

常一线、初顶石脑油、常顶石脑油等四个点轮流给汽，往轻污油出装置吹扫，在界区排汽。吹扫结束后往 D-842 吹扫，P-842 走付线。

4) While purging the light slop system towards D-842, open the vent valve on the top of D-842.

各点往 D-842 吹扫时，D-842 顶部放空打开。

5) Perform pressure test for the light slop system individually at the highest steam pressure, while closing the valves to D-842.

轻污油系统管线单独试压，试压时关闭至 D-842 的阀门，试至蒸汽最高压力。

6) Perform pressure test for D-842 individually, and for the test pressures, see the List of Test Pressures for Columns and Drums.

D-842 单独试压，试压压力见试压表。

(31) Vac. OVHD gas system

减顶瓦斯系统

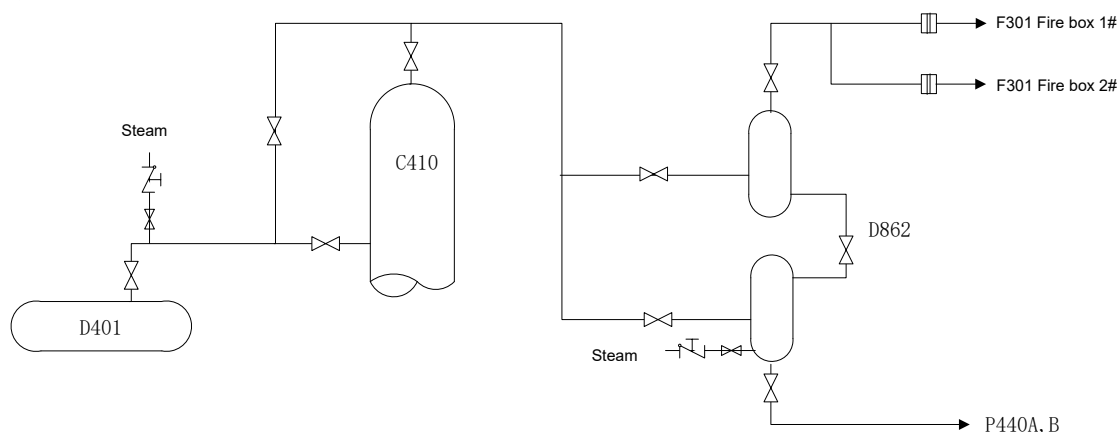


Figure 31 Vac. OVHD Gas System Pressure Test Flow Chart

图 31 减顶瓦斯系统试压流程图

Steam introduction point: D-401 top Steam vent point: C-410, D-862, F-301

给汽点：D-401 罐顶。排汽点：C-410、D-862、F-301。

1) Remove the metal hoses of the LP burners from the Atm. heater.

常压炉低压火嘴的金属软管拆下。

2) Introduce steam at the top of D-401 to purge the Vac. column OVHD gas system towards C-410. When steam comes from the vent valve on the top of C-410, purge the Vac. column OVHD gas system towards D-862. When steam comes from the drain valve at the bottom of D-862, purge the Vac. column OVHD gas system towards each LP burner of the Atm..

D-401 罐顶给汽, 往 C-410 贯通。C-410 塔顶放空见汽后, 往 D-862 贯通。D-862 罐底见汽后分别往常压炉各低压火嘴贯通吹扫。

3) For the purpose of pressure test, bypass C-410. Perform pressure test for the vac. OVHD gas piping individually at the highest steam pressure.

试压时,C-410 走付线, 减顶瓦斯管线单独试压至最高压力。

4) Perform pressure test for C-610 and D-862 depending on the test pressures as defined in the List of Test Pressures for Columns and Drums.

C-610 和 D-862 按照试压表压力试压。

(32) Lean MEDA piping and rich MEDA piping

贫胺液与富胺液线

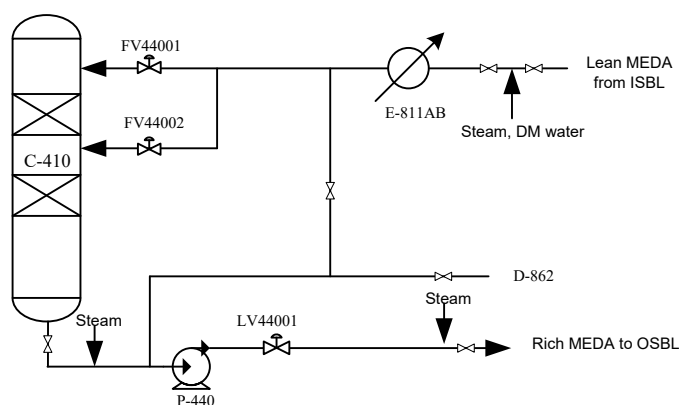


Figure 32 Flow Chart of Pressure Test for Lean MEDA Piping and Rich MEDA Piping

图 32 贫胺液与富胺液试压流程图

Steam introduction point: lean MEDA from ISBL, C-410 bottom, D-862 Steam vent point: C-410, rich MEDA to OSBL

给汽点: 贫胺液进装置、C-410 塔底、D-862。排气点: C-410、富胺液出装置。

1) Introduce steam via the lean MEDA from ISBL to purge the lean MEDA piping towards C-410 through E-811, FV44001 and FV44002 respectively.

贫胺液进装置给汽, 经 E-811、FV44001、FV44002 分别往 C-410 贯通。

2) Introduce steam to D-862 to purge the lean MEDA piping towards P-440 inlet.

D-862 给汽, 往 P-440 入口贯通。

3) Introduce steam at the bottom of C-410 to purge the rich MEDA piping towards OSBL.

从 C-410 塔底给汽, 往富胺液出装置贯通。

4) For the purpose of pressure test, close the lean MEDA valve to C-410. Perform pressure test for the lean MEDA piping jointly with the rich MEDA piping at the highest steam pressure.

试压时, 关闭贫胺液进 C-410 阀, 贫胺液和富胺液联合试压, 试至蒸汽最高压力。

(33) Pre-Dist. OVHD gas piping and Atm. OVHD gas piping

初顶瓦斯、常顶瓦斯

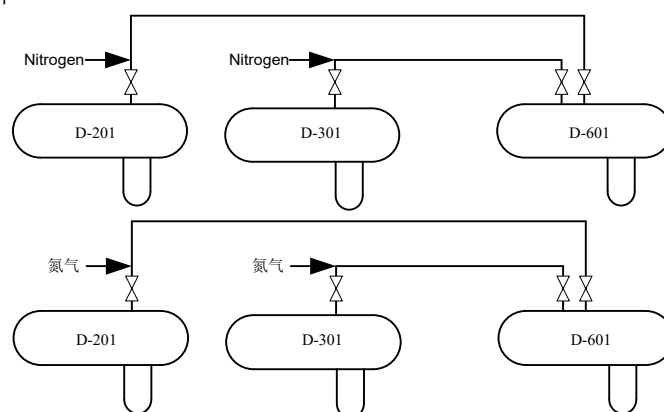


Figure 33 Flow Chart of Pressure Test for Pre-Dist. OVHD gas piping and Atm. OVHD Gas Piping

图 33 初顶瓦斯、常顶瓦斯试压流程图

Steam introduction point: top of D-201 and D-301 Steam vent point: D-601 top

给汽点: D-201 和 D-301 罐顶。排气点: D-601 罐顶。

1) Purge the Pre-Dist. OVHD gas piping and the Atm. OVHD gas system with nitrogen, and vent nitrogen at the top of D-601.

采用氮气对初顶瓦斯和常顶瓦斯进行贯通吹扫, 在 D-601 罐顶排汽。

2) Perform pressure test for the valves at two ends of the drum at the highest nitrogen pressure. Perform pressure test at the highest steam pressure.

试压时, 罐顶两端阀门, 用氮气试压。试压至氮气最高压力。

3) Check each flange face with soap solution can and soap solution.

用喷壶和肥皂水检查各法兰面。

(34) Columns OVHD sour water systems

三顶污水系统

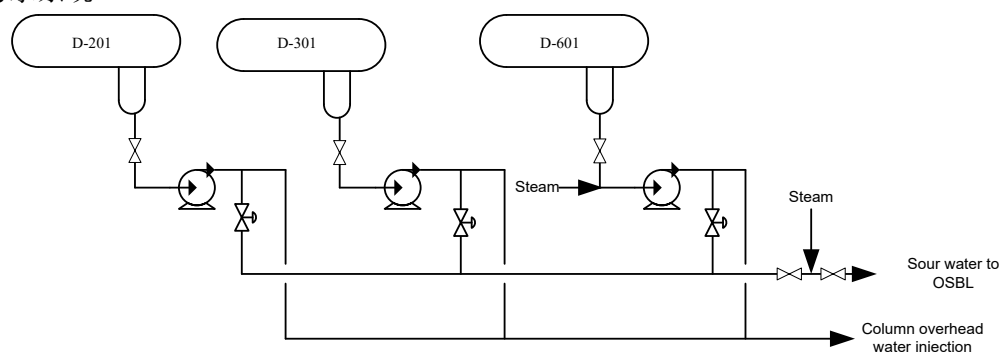


Figure 34 Flow Chart of Pressure Test for Columns OVHD sour water Systems

图 34 三顶污水系统试压流程图

Steam introduction point: sour water piping to OSBL, P-225 inlet Steam vent point: water injection point on the top of each column, P-325, P-225

给汽点: 含硫污水出装置、P-225 入口。排汽点: 各塔顶注水、P-325、P-225。

1) As no steam is available in the sour water piping from D-201 and D-301, it is required to introduce steam via the sour water piping to OSBL, or use the steam from P-425 inlet to purge

the Pre-Dist., Atm. and Vac. column OVHD wastewater system.

由于 D-201 和 D-301 含硫污水线没有蒸汽，需要从含硫污水出装置给汽，或者借用 P-425 入口的吹扫蒸汽进行贯通吹扫。

2) Introduce steam via P-425 inlet to purge the Pre-Dist., Atm. and Vac. column OVHD wastewater system towards P-225 and P-325 respectively. Bypass P-225 and P-325 during purging operation, and vent steam via the drain valves at the bottom of D-201 and D-301.

P-425 入口给汽，分别往 P-225 和 P-325 贯通吹扫。吹扫时，P-225 和 P-325 走付线，在 D-201、D-301 罐底导淋排汽。

3) Introduce steam via the sour water piping to OSBL to purge the Pre-Dist., Atm. and Vac. column OVHD wastewater systems towards the water injection point on the top of each column. 从含硫污水出装置界区给汽，分别往各塔顶注水点吹扫。

4) Perform pressure test at the highest steam pressure.

试压时，压力为蒸汽最高压力。

(35) Desalter drum water injection/cut systems

电脱盐注切水系统

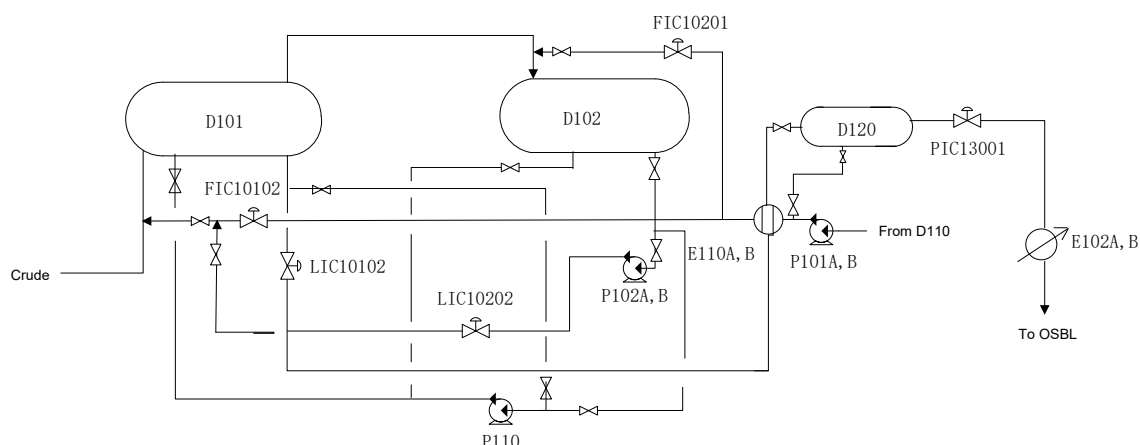


Figure 35 Flow Chart of Pressure Test for Desalter Drum Water Injection/Cut Systems
图 35 电脱盐注切水系统试压流程图

Notes:

说明:

1) Perform pressure test for the cut water piping from the desalter drum with the steam generated from steaming operation for the desalter drum.

利用电脱盐罐蒸汽处理电脱盐切水线。

2) Put the desalter drum cut water cooler (E-102) into service, and line up the process flow from the brine piping to the wastewater treatment plant.

投用电脱盐切水水冷器 E-102，改通含盐污水至污水处理装置流程。

3) Purge the cut water piping from the desalter drum with the steam generated from steaming operation for D-101 and D-102, and control the temperature of the cut water piping to OSBL via E-102. It is strictly forbidden to have the steam to be carried to the brine treatment plant.

利用 D-101、D-102 的蒸汽贯通吹扫电脱盐切水线，通过 E-102 控制出装置温度，严禁将

蒸汽带至含盐污水装置。

4) Perform pressure test for the desalter drum water injection/cut system jointly with the desalter drum.

试压时与电脱盐罐联合试压。

(36) Chemical injection system

三注系统

The chemical injection system is served to inject demulsifier, low-temperature corrosion inhibitor, neutralizing inhibitor, fouling inhibitor and high-temperature corrosion inhibitor. Purge the chemical injection system via each chemical injection pump. For the purpose of pressure test, introduce steam via the chemical injection pump. Perform pressure test for the chemical injection piping individually at the highest medium (nitrogen or steam) pressure.

三注系统包括：注破乳剂、注低温缓蚀剂、注中和剂、注阻垢剂、注高温缓蚀剂。吹扫时，从各注剂泵往吹扫点吹扫。试压时，从注剂泵处给汽，注剂线单独试压，试至介质（氮气或蒸汽）最高压力。

(37) List of Test Pressures for Columns/Drums

各塔罐试压压力表

Table 34 List of Test Pressure for Columns and Drums

Equipment Tag No:	Equipment name:	Operating Pressure (MPaG)	Design Pressure (MPaG)	Relief valve SP (MPaG)	Test Pressure (MPaG)
C-200	Pre. distillation column	0.38	0.56/-0.1	±0.56	0.45
C-300	Atm.	0.11	0.35/-0.1	0.35	0.15
C-301	Atmospheric side stripper	0.11	0.35/-0.1	/	0.15
C-400	Vac. column	18mmHg (a)	0.35/-0.1	0.35	0.1
C-410	Vac. OVHD gas desulfuration tower	0.1	0.35/-0.1	0.35	0.1
D-101	1st stage desalter	1.5	2.2	2.2	Maximum steam pressure, 1.0MPa
D-102	2nd stage desalter	1.3	2.2	2.2	Maximum steam pressure, 1.0MPa
D-120	Brine drum	1.5	2.2	2.2	Maximum steam pressure, 1.0MPa
D-201	Pre-dist. OVHD product drum	0.3	0.9/-0.1	0.9	0.45
D-202	Pre-dist. OVHD reflux drum	0.35	0.8/-0.1	/	0.45
D-301	Atm. OVHD product drum	0.03	0.8/-0.1	0.8	0.15
D-302	Atm. OVHD reflux drum	0.08	0.75/-0.1	/	0.15
D-401	Vac. OVHD drum	0.01	0.55/-0.1	0.55	0.1
D-402	Vac. overflash oil drum	28mmHg (a)	0.35/-0.1	/	0.1

Table 34(continued) List of Test Pressure for Columns and Drums

Equipment Tag No:	Equipment name:	Operating Pressure (MPaG)	Design Pressure (MPaG)	Relief valve SP (MPaG)	Test Pressure (MPaG)
D-821	1.0MPa steam knockout drum	1.0	1.5	/	Maximum steam pressure, 1.0MPa
D-822	0.5MPa steam knockout drum	0.5	1.0	/	Maximum steam pressure, 0.5MPa
D-831	Purified air drum	0.7	1.0	1.0	Maximum IA pressure
D-841	Flare K.O. drum	0.1	0.6/-0.1	/	0.15
D-842	Light HC slop drum	0.1	1.0/-0.1	1.0	0.15
D-843	Heavy HC slop drum	0.1	1.0/-0.1	1.0	0.15
D-851	Sealing oil pot I	0.1	0.6/-0.1	/	0.15
D-852	Sealing oil pot II	0.1	0.6/-0.1	/	0.15
D-861	HP fuel gas KO drum	0.5	0.8	0.8	0.6
D-862	Vac. OVHD fuel gas KO drum	0.5	Upper section, 0.35 Lower section, 0.80	Upper section, 0.35 Lower section, 0.8	0.1

表 34 塔器、容器试压压力一览表

设备位号	设备名称	操作压力 (MPaG)	设计压力 (MPaG)	安全阀定压 (MPaG)	试压压力 (MPaG)
C-200	初馏塔	0.38	0.56/-0.1	0.56	0.45
C-300	常压塔	0.11	0.35/-0.1	0.35	0.15
C-301	常压汽提塔	0.11	0.35/-0.1	/	0.15
C-400	减压塔	18mmHg (a)	0.35/-0.1	0.35	0.1
C-410	减顶气脱硫塔	0.1	0.35/-0.1	0.35	0.1
D-101	一级电脱盐罐	1.5	2.2	2.2	1.0MPa 蒸汽最高压力
D-102	二级电脱盐罐	1.3	2.2	2.2	1.0MPa 蒸汽最高压力
D-120	含盐污水除油器	1.5	2.2	2.2	1.0MPa 蒸汽最高压力
D-201	初顶产品罐	0.3	0.9/-0.1	0.9	0.45
D-202	初顶回流罐	0.35	0.8/-0.1	/	0.45
D-301	常顶产品罐	0.03	0.8/-0.1	0.8	0.15
D-302	常顶回流罐	0.08	0.75/-0.1	/	0.15
D-401	减顶分水罐	0.01	0.55/-0.1	0.55	0.1
D-402	减压过气化油罐	28mmHg (a)	0.35/-0.1	/	0.1
D-821	1.0MPa 蒸汽分水器	1.0	1.5	/	1.0MPa 蒸汽最高压力
D-822	0.5MPa 蒸汽分水器	0.5	1.0	/	0.5MPa 蒸汽最高压力
D-831	净化空气罐	0.7	1.0	1.0	净化风最高压力
D-841	安全阀放空罐	0.1	0.6/-0.1	/	0.15
D-842	轻污油罐	0.1	1.0/-0.1	1.0	0.15
D-843	重污油罐	0.1	1.0/-0.1	1.0	0.15

表 34 (续) 塔器、容器试压压力一览表

设备位号	设备名称	操作压力 (MPaG)	设计压力 (MPaG)	安全阀定压 (MPaG)	试压压力 (MPaG)
D-851	封油罐	0.1	0.6/-0.1	/	0.15
D-852	封油罐	0.1	0.6/-0.1	/	0.15
D-861	高压燃料气分液罐	0.5	0.8	0.8	0.6
D-862	减顶燃料气分液罐	0.5	上段 0.35 下段 0.80	上段 0.35 下段 0.8	0.1

2.3.2.4 Displace steam with nitrogen 系统氮气置换

Steam in the system shall be displaced with nitrogen immediately after the process unit has been purged, lined up and pressure tested. Since Atmospheric and Vacuum Distillation Unit is characterized by large size, long process low, it shall be purged with nitrogen for a long time. To improve the efficiency of purging with nitrogen and save nitrogen consumption, the process unit shall be purged with nitrogen in conjunction with the pressure test. Specifically, upon completion of pressure test, nitrogen shall be immediately introduced into the target systems where the steam pressure is just lower than 0.3MPa during pressure relief, to purge the steam out of these systems.

装置吹扫、贯通、试压结束后，立即组织系统的氮气置换。由于常减压装置系统大，流程长，氮气置换时间长，为提高氮气置换的效率，节约用氮。氮气置换应结合试压工作进行，在试压结束后，系统蒸汽泄压的过程中，试压蒸汽压力低于 0.3MPa 以下时，立即向需要置换的系统加入氮气，以氮气赶蒸汽的方法进行系统置换。

(1) The crude system shall be depressurized immediately after it has been pressure tested with steam. When the pressure of the crude system is decreased below 0.3MPa, introduce nitrogen into the crude system via the control valves of 3 crude streams to the desalter drum, and continue to depressurize the crude system via each pressure relief point. Upon completion of depressurization, close each pressure relief point, and purge the crude system towards the Pre-Dist..

原油系统蒸汽试压结束后，立即泄压，系统压力降至 0.3MPa 以下时，在脱前原油三路调节阀处给氮气，各泄压点继续泄压，蒸汽泄压结束后，关闭泄压点，往初馏塔置换。

(2) The Pre-Dist. bottoms system shall be depressurized immediately after it has been pressure tested with steam. When the pressure of the Pre-Dist. bottoms system is decreased below 0.3MPa, introduce nitrogen after the Pre-Dist. bottoms draw valve, and continue to depressurize the Pre-Dist. bottoms system via each pressure relief point. Upon completion of depressurization, close each pressure relief point, and purge the Pre-Dist. bottoms system towards the Atm. heater and the Atm..

初底油系统蒸汽试压结束后，立即泄压，系统压力降至 0.3MPa 以下时，在初底油抽出阀后给氮气，各泄压点继续泄压，蒸汽泄压结束后，关闭泄压点，往常压炉和常压塔置换。

(3) The Atm. bottoms system shall be depressurized immediately after it has been pressure

tested with steam. When the pressure of the Atm. bottoms system is decreased below 0.3MPa, introduce nitrogen after the Atm. bottoms draw valve, and continue to depressurize the Atm. bottoms system via each pressure relief point. Upon completion of depressurization, close each pressure relief point, and purge the Atm. bottoms system towards the Vac. heater and the Vac. column.

常底油系统蒸汽试压结束后，立即泄压，系统压力降至 0.3MPa 以下时，在常底油抽出阀后给氮气，各泄压点继续泄压，蒸汽泄压结束后，关闭泄压点，往减压炉和减压塔置换。

(4) The vacuum residue system shall be depressurized immediately after it has been pressure tested with steam. When the pressure of the vacuum residue system is decreased below 0.3MPa, introduce nitrogen after the Vac. residue draw valve, and continue to depressurize the vacuum residue system via each pressure relief point. Upon completion of depressurization, close each pressure relief point, and continue to vent the steam at the end of the vacuum residue system.

减压渣油系统蒸汽试压结束后，立即泄压，系统压力降至 0.3MPa 以下时，在减压塔底抽出阀后给氮气，各泄压点继续泄压，蒸汽泄压结束后，关闭泄压点，在渣油末端继续排汽。

(5) After the Pre-Dist. has been pressure tested, introduce nitrogen into the Pre-Dist. via the crude oil system and the Pre-Dist. OVHD gas piping, and discharge nitrogen via the vent valve at the top of D-201, the vent valve at the bottom of C-200, the drain valve on the Pre-Dist. sidedraw pump and the drain valve at the Pre-Dist. sidedraw control valve respectively.

初馏塔试压结束后，从原油系统给氮气，在初顶瓦斯线给氮气。分别在 D-201 罐顶、C-200 塔底放空排气，初一线泵、初一线调节阀导淋等处排气置换。

(6) After the Atm. has been pressure tested, introduce nitrogen into the Atm. via the Pre-Dist. bottom draw valve and the Atm. OVHD gas piping, and discharge nitrogen via the vent valve at the top of D-301, the vent valve at the bottom of C-300, the vent valve in each section of C-301, the drain valve on the Atm. top PA pump, the drain valve on each Atm. top PA heat exchanger and control valve, the drain valve on the Atm. PA#1 pump, the drain valve on each Atm. PA#1 heat exchanger and control valve, the drain valve on the Atm. PA#2 pump, the drain valve on each a Atm. PA#2 heat exchanger and control valve respectively.

常压塔试压结束后，从初底油抽出给氮气，在常顶瓦斯线给氮气。分别在 D-301 罐顶、C-300 塔底放空排气，在 C-301 各段放空排气。常顶循泵、各换热器和各调节阀导淋排气。常一中泵、各换热器和各调节阀导淋排气。常二中泵、各换热器和各调节阀导淋排气。

(7) After the Vac. column has been pressure tested, introduce nitrogen into the Vac. column via the Atm. bottoms draw valve and the vac. OVHD gas piping, and discharge nitrogen via the vent valves at the top of D-401 and D-402, the vent valve at the bottom of C-300, the drain valve on the LVGO pump, the drain valve on each LVGO heat exchanger and control valve, the drain valve on the MVGO pump, the drain valve on each MVGO heat exchanger and control valve, the drain valve on the HVGO pump, the drain valve on each v HVGO heat exchanger and control valve, the drain valve on the vac. overflah oil pump, the drain valve on each vac. overflah oil heat exchanger and vac. overflah oil control valve respectively.

减压塔试压结束后，从常底油抽出给氮气，在减顶瓦斯线给氮气。分别在 D-401 和 D-402 罐顶、C-400 塔底放空排气。减一线泵、各换热器和各调节阀导淋排气。减二线泵、各换热器和各调节阀导淋排气。减三线泵、各换热器和各调节阀导淋排气。减四线泵、各换热器和各调节阀导淋排气。

(8) After the fuel gas system has been pressure tested, introduce nitrogen via the BL valve to purge the fuel gas system towards each burner of the heater.

燃料气系统试压结束后，在界区给氮气，往加热炉各火嘴排气置换。

(9) After the flare gas system has been pressure tested, introduce nitrogen via each relief valve outlet to purge the flare gas system towards the top of the flare gas KO drum (D-841).

火炬气系统试压结束后，在各安全阀出口给氮气，往火炬气分液罐 D-841 罐顶排气。

(10) Take gas sample in C-200, C-300 and C-400, at the end of the fuel gas piping and at the top of D-841 to analyze O₂ content, and if the O₂ content is $\geq 0.5\%$, stop purging with nitrogen.

在 C-200、C-300、C-400、燃料气末端、D-841 罐顶采样分析，O₂ 含量 $\geq 0.5\%$ 时，置换合格，停止置换。

2.3.2.5 Introduce crude to establish cold circulation 引原油，建立冷循环

(1) Properly line up the process flows for startup

改好开工流程

1) Main process flow

主流程

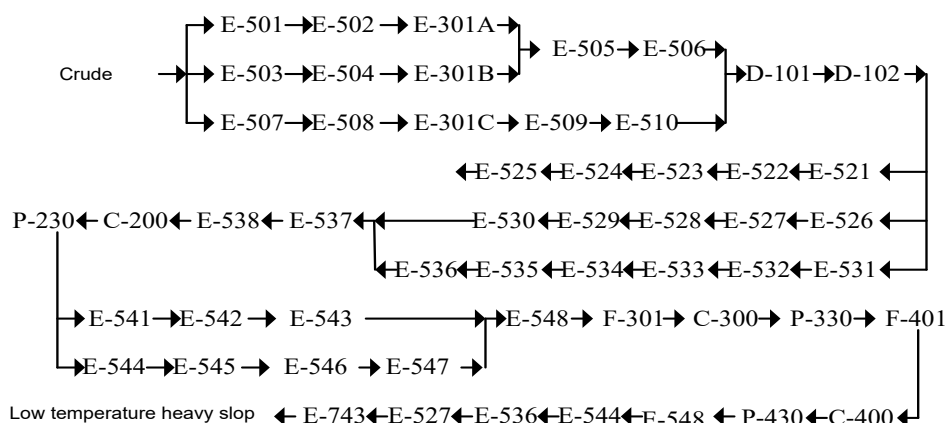


Figure 36 Crude Introduction Flow Chart

图 36 引原油流程图

Properly line up the main process flow per the crude introduction flow, put all control valves and instruments in the main process flow into service, and close the crude valve to ISBL, all valves in the vacuum residue process flow to OSBL, the inlet/outlet valve of each pump, all branch process flows, all vent valves and all drain valves.

按照引油流程改好流程，流程上的所有调节阀、仪表等投用，原油进装置阀门关闭，渣油出装置的所有阀门均关闭，各泵进出口阀关闭。各分支流程、各放空、导淋等全部关闭。

2) Pre-Dist. sidedraw process flow

初馏塔侧线

Properly line up the process flow from Pre-Dist. sidedraw to the Atm. and the reflux process flow. Close the pump inlet and outlet valves, and the valves at the end of the process flows from Pre-Dist. sidedraw to the internal reflux and to the Atm.. Put all control valves and instruments in the process flow into service, and close all branch process flows, vent valves and drain valves.

改通初一线至常压塔和回流流程。泵进出口阀门关闭，初一线至内回流和常压塔末端关闭。流程上的所有调节阀、仪表等投用，各分支流程、各放空、导淋等全部关闭。

3) Pre-Dist. OVHD process flow

初馏塔顶

① Properly line up the Pre-Dist. OVHD process flow .

初馏塔塔顶按照一级、二级冷凝流程改好。

② Close the inlet/outlet valve of each pump.

各泵进出口阀关闭。

③ Close the valve at the end of the sour water process flow from D-202 to D-201, and the sour water piping to OSBL.

D-202 酸性水至 D-201 流程末端关闭。含硫污水出装置关闭。

④ Close the naphtha process flow from D202 to A-202, and properly line up the reflux process flow.

D-202 石脑油至 A-202 关闭，回流流程畅通。

⑤ Close all Pre-Dist. OVHD oil process flows to OSBL. Open the Pre-Dist. OVHD gas process flow to the flare system, and close the Pre-Dist. OVHD gas process flow to Light Ends Recovery Unit.

初顶油出装置的所有流程关闭。初顶气至火炬打开，至轻烃关闭。

⑥ Put all control valves and instruments in the process flow into service, and close all branch process flows, vent valves and drain valves.

流程上的所有调节阀、仪表等投用，各分支流程、各放空、导淋等全部关闭。

⑦ Put the relief valves of all columns and drums into service.

所有塔、罐的安全阀投用。

4) Atm. pumparound process flows

常压中段回流

Properly line up the Atm. pumparound process flows, and close the pump inlet and outlet valves. Put all control valves and instruments in the process flow into service, and close all branch process flows, vent valves and drain valves. Keep the opening of all control valves and three-way valves at 0%.

常压中段流程改好，泵进出阀关闭。流程上的所有调节阀、仪表等投用，各分支流程、各放空、导淋等全部关闭。所有调节阀、三通阀开度为 0%。

5) Atm. distillate process flows

常压侧线

① Put the process flows from kerosene, light diesel and heavy diesel to the stripper into service,

and keep the opening of all control valves at 50%.

常一、二、三线从常压塔至汽提塔流程全部投用，调节阀开度 50%。

②Close the inlet/outlet valve of each pump.

各泵进出口阀关闭。

③Close all valves in the process flows from kerosene to the mixed diesel and to OSBL.

常一线至混合柴油、出装置阀门全部关闭。

④Properly line up the process flows from light diesel and heavy diesel to the mixed diesel. Close all valves in the process flows from the mixed diesel to the sealing oil system and to OSBL.

改好常二线和常三线至混合柴油流程。混合柴油至封油、出装置所有阀门关闭。

⑤Properly line up the process flow from Atm. Overfls oil to MVGO.

常四线改通至减二线流程。

⑥Put all control valves and instruments in the process flow into service, and close all branch process flows, vent valves and drain valves.

流程上的所有调节阀、仪表等投用，各分支流程、各放空、导淋等全部关闭。

6) Atm. OVHD process flow

常压塔顶

①Properly line up the atm. OVHD process flow.

常压塔塔顶按照一级、二级冷凝流程改好。

②Close the inlet/outlet valve of each pump.

各泵进出口阀关闭。

③Close the valve at the end of the sour water process flow from D-302 to D-301, and the sour water piping to OSBL.

D-302 含硫污水至 D-301 流程末端关闭。含硫污水出装置关闭。

④Close the naphtha process flow from D302 to A-301, and properly line up the reflux process flow.

D-302 石脑油至 A-301 关闭，回流流程畅通。

⑤Close all atm. OVHD oil process flows to OSBL. Open the atm. OVHD gas process flow to the flare system, and close the atm. OVHD gas process flow to Light Ends Recovery Unit.

常顶油出装置的所有流程关闭。常顶气至火炬打开，至轻烃关闭。

⑥Put all control valves and instruments in the process flow into service, and keep the opening of all control valves within 10~20%. Close all branch process flows, vent valves and drain valves.

流程上的所有调节阀、仪表等投用，调节阀开度 10~20%。各分支流程、各放空、导淋等全部关闭。

⑦Put the relief valves of all columns and drums into service.

所有塔、罐的安全阀投用。

7) Vacuum sidedraw and pumparound process flows

减压侧线和中段回流

①Properly line up the vacuum sidedraw and pumparound process flows.

改好减压侧线和中段流程

②Close the inlet and outlet valve of all pumps.

所有泵进出口阀关闭。

③Close the valves on all vacuum sidedraw process flows to OSBL.

所有侧线出装置阀门关闭。

④Put all control valves and instruments in the process flow into service, and keep the opening of all control valves within 10~20%. Close all branch process flows, vent valves and drain valves.

流程上的所有调节阀、仪表等投用，调节阀开度 10~20%。各分支流程、各放空、导淋等全部关闭。

8) Vac. OVHD process flow

减压塔顶

①Properly line up the vac. OVHD process flow per the process flow of the vacuuming system, put the 1st stage, 2nd stage and 3rd stage steam ejectors into service, and close the process flow to the water ring vacuum pump.

减压塔顶按照抽真空流程改好，三级投用蒸汽抽真空，至水环泵流程关闭。

②Close all valves in the process flow from the vac. OVHD oil to the mixed diesel, and properly line up the process flow to the light slop drum, and the vac. OVHD sour water header to the sour water treatment plant.

减顶油至混合柴油阀门关闭，至轻污油流程畅通。减顶含硫污水至含硫污水总管畅通。

③Open the vac. OVHD gas process flow to the flare system, and close the vac. OVHD gas process flow to C-410.

减顶气至火炬打开，至 C-410 关闭。

④Close the inlet and outlet valves of all pumps.

所有泵进出口阀关闭。

⑤Put all control valves and instruments in the process flow into service, and close all branch process flows, vent valves and drain valves.

流程上的所有调节阀、仪表等投用，各分支流程、各放空、导淋等全部关闭。

⑥Put the relief valves of all columns and drums into service.

所有塔、罐的安全阀投用。

9) Vac. OVHD gas process flow

减顶气

①Close the vac. OVHD gas process flow from the top of D-401, and properly line up the vac. OVHD gas process flow to the Atm. heater.

减顶气自 D-401 罐顶关闭，改通减顶气至常压炉流程。

②Introduce nitrogen at the top of D-401 to purge the vac. OVHD gas system.

D-401 罐顶给氮气，置换减顶气系统。

10) Flare gas system

火炬气系统

Close the flare gas valve to OSBL, open the vent valve on the top of D-841, and close P-841 inlet/outlet valve.

火炬气出装置阀门关闭。D-841 罐顶放空打开。P-841 进出口阀关闭。

11) Slop process flow

污油流程

Close the BL valves associated with the light slop, high-temperature heavy slop, low-temperature heavy slop and startup diesel.

轻污油、高温重污油、低温重污油、开工柴油等界区阀门关闭。

12) Process flows for water injection to and cut water from desalter drum

电脱盐注水和切水流程。

①Close the stripped water valve to ISBL.

净化水进装置阀门关闭。

②Properly line up the process flow for water injection to D-102, and close all valves to the crude system.

电脱盐注水改好至 D-102 流程，至原油的阀门关闭。

③Properly line up the process flow from D-102 to D-101, and close all valves to the crude system.

D-102 切水改好至 D-101 注水的流程，至原油的阀门关闭。

④Close the oil rundown process flow, and the back-flushing process flow.

退油线流程关闭。反冲洗流程关闭。

⑤Properly line up the process flow from D-101 to D-120, and close the brine piping to OSBL.

D-101 切水至 D-120 流程改通，含盐污水出装置关闭。

⑥Properly line up the slop process flow from D-120 to the light slop drum.

D-120 污油至轻污油流程畅通。

⑦Put all control valves and instruments in the process flow into service, and close all branch process flows, vent valves and drain valves.

流程上的所有调节阀、仪表等投用，各分支流程、各放空、导淋等全部关闭。

⑧Put the relief valves of all columns and drums into service.

所有罐的安全阀投用。

13) Fuel gas process flow

燃料气流程

①Properly line up the fuel gas process flow to each heater, and close the valves on each burner.

改好燃料气至各加热炉流程，各燃烧器阀门关闭。

②Close the fuel gas valve to ISBL.

燃料气进装置阀门关闭。

③Remove the hoses of the burners at the end of the Atm. heater and the Vac. heater.

常压炉和减压炉末端的火嘴软管拆下。

④Introduce nitrogen via the fuel gas valve to ISBL to purge the fuel gas process flow. During purging operation, slightly open D-861 bottom valve to the flare system.

燃料气进装置给氮气置换。置换时 D-861 底部至火炬稍开。

14) Fuel oil process flow

燃料油流程

Properly line up the fuel oil process flow, and close the fuel oil valve to ISBL and the fuel oil valve to OSBL.

改通燃料油流程，燃料油进出装置阀门关闭。

15) Chemical injection system

三注系统

After the process flow of the chemical injection system is properly lined up, close the valve at the chemical injection point.

三注系统流程改好后，注入点阀门关闭。

16) Sealing oil process flow

封油流程

Properly line up the process flows of sealing oil system I and sealing oil system II, and close the LVGO PA and mixed diesel process flows to the sealing oil pots, and the startup slop feed valve.

改好封油 I 和封油 II 引油流程。减一中和混合柴油至封油流程关闭，引开工污油的阀门关闭。

(2) Introduce diesel to displace water in the system

引柴油，系统置换

1) Contact the Production Scheduling Department to line up the startup diesel process flow to the process unit.

联系调度，改通开工柴油进装置流程。

2) Displace the water in atm. top PA pump process flow, atm. PA#1 process flow and atm. PA#2 process flow from top to bottom, and fill with startup diesel.

从上往下置换常顶循、常一中、常二中，保证常压塔三个中段回流水置换干净并充满柴油。

3) Displace the water in LVGO process flow via the startup diesel feed valve and fill with startup diesel, and when LVGO level is up to 80%, start the LVGO pump to establish reflux in the LVGO PA process flow. When the equipment and piping in LVGO PA process flow is full with startup diesel, line up the low-temperature heavy slop piping for run downing the oil to the designated equipment/piping, and close the LVGO PA process flow. Check and confirm that oil comes from the BL valve, then stop the LVGO pump.

从开工柴油进油置换减一线，减一线液位 80%后，启运减一线泵往减一中打回流，减一中的设备和管线充满柴油后，改为低温重污油线退油，关闭减一中，在界区检查减一线，见油后，停运减一线泵。

4) Control the level in LVGO collecting drum at 100%, where excessive diesel will overflow into the MVGO collecting drum. When MVGO level is up to 80%, start the MVGO pump to establish reflux in the MVGO PA process flow. When the equipment and piping in MVGO PA process flow is full with startup diesel, line up the low-temperature heavy slop piping to run down the oil to the designated equipment/piping. Check and confirm that oil comes from the BL valve, then stop the MVGO pump.

减一线集油箱满液位控制，柴油溢流至减二线集油箱。减二线液位 80%后，启运减二线泵往减二中打回流，减二中的设备和管线充满柴油后，改为低温重污油退油。在界区检查减二线，见油后，停运减二线泵。

5) Control the level in MVGO collecting drum at 100%, where excessive diesel will overflow into the HVGO collecting drum. When HVGO level is up to 80%, start the HVGO pump to establish reflux in the HVGO PA process flow. When the equipment and piping in HVGO PA process flow is full with startup diesel, line up the low-temperature heavy slop piping to run down the oil to the designated equipment/piping. Check and confirm that oil comes from the BL valve, then stop the HVGO pump.

减二线集油箱满液位控制，柴油溢流至减三线集油箱。减三线液位 80%后，启运减二线泵往减三中打回流，减三中的设备和管线充满柴油后，改为低温重污油退油。在界区检查减三线，见油后，停运减三线泵。

(3) Introduce crude to establish circulation

引原油，建立循环

1) Open the crude valve to ISBL, and contact the Production Scheduling Department to inform the Port Logistics Department to start the crude pump.

打开原油进装置阀门，联系调度，通知港储部启动原油泵送油。

2) Adjust the flowrate of each crude stream to 3 crude branches at approximately 190t/h.

调节脱前三路流量至每路 190t/h 左右。

3) When the desalter drum has been filled with crude, continue to feed crude to the Pre-dist column (C-200) via the flow control valves (HC-51201, HC-51001 and HC-51401) of 3 desalted crude branches and the desalted crude heat exchanger.

电脱盐装油完成，继续向初馏塔装油，经脱后原油三路流控阀 HC-51201、HC-51001、HC-51401 和脱后原油换热器引油至初馏塔 C-200。

4) Open the vent valves at the bottom of the Pre-dist column and the outlet of the Pre-Dist column bottom pump to cut water, and close these vent valves when crude comes from these vent valves.

初馏塔底放空和初底泵出口放空切水，见油后关闭放空阀。

5) When the level in Pre-dist column is up to 50%, inform the field operators to start the Pre-Dist column bottom pump to feed crude to the Atm..

初馏塔液位装到 50%，通知外操启动初底泵，往常压塔装油。

6) Control the flowrate of each Pre-Dist. Oil branch at 280t/h, and the flowrate in each branch of the Atm. heater at 70t/h. Open the vent valve at the bottom of the Atm. and the vent valve at the outlet of the AR pump to cut water, and close these vent valves when crude comes from these vent valves.

控制初底油流量每路 280t/h。常压炉流量每路 70t/h。常压塔底放空和常底泵出口放空切水，见油后关闭放空阀。

7) When the level in Atm. is up to 50%, start the Atm. residue pump to feed oil to the Vac. column.

常压塔液位装到 50%，启动常底泵向减压塔装油。

8) Control the flowrate in each branch of the Vac. heater at 70t/h. Open the vent valve at the bottom of the Vac. column and the vent valve at the outlet of the VR pump to cut water, and close these vent valves when crude comes from these vent valves.

控制减压炉流量每路 70t/h。减压塔底放空和减底泵出口放空切水，见油后关闭放空阀。

9) When the level in Vac. column is up to 50%, start the VR pump pump to withdraw crude to the low-temperature heavy slop piping.

减压塔液位装到 50%，启动减底泵，往低温重污油线退油。

10) Assign dedicated persons to track wherever crude is fed. Frequently check each platform and heater for leakage, and take proper actions if any leakage is identified.

进油后，油到哪里，人到哪里。各平台、加热炉加强检查，有泄漏及时处理。

11) Control the bottom levels of Pre-dist column, Atm. and Vac. column at approximately 80%. 控制初馏塔、常压塔和减压塔底液位 80%左右。

12) When crude is being withdrawn to the low-temperature heavy slop piping via the VR pump for 1h, contact the Production Scheduling Department to inform the Port Logistics Department to stop the crude pump and close the crude valve to ISBL.

减底泵往低温重污油退油 1 小时后，联系调度，通知港储部停原油泵，关闭原油进装置阀门。

13) Properly establish closed-loop circulation, and close the process flow from the VR to the low-temperature heavy slop.

改通闭路循环流程，关闭减压渣油至低温重污油流程。

14) Control the total circulation flowrate within 350~400t/h, and properly control the flowrate in each heater tube.

按照 350~400t/h 控制总循环量。控制好各加热炉炉管流量。

15) Establish the quench oil circulation in the Vac. column.

建立减压塔急冷油循环。

16) Periodically check the crude-water interface level in the desalter drum, and cut water from the desalter drum on a regular basis.

电脱盐罐定期检查界位，定期切水。

17) Control the bottom levels of Pre-dist column, Atm. and Vac. column within 30~70% to avoid pump evacuation or high-high level. When the level in each column is lower than 40%, contact the Production Scheduling Department to inform the Port Logistics Department to make up crude.

控制三塔塔底液位 30%-70%，防止机泵抽空或液面超高。各塔液位均低于 40%时，联系调度，通知港储部补油。

18) Switch each running column bottoms pump to the standby pump once.

各塔底泵各切换一次。

19) Before firing and warming up the heaters, put the flare gas system into operation. Close the vent valve on the top of each column, line up each column OVHD gas process flow to the flare gas system, and put D-841 into service.

加热炉点火升温前，投用火炬气系统。关闭各塔顶放空，各塔顶气全部改至火炬气系统，D-841 投用。

(4) Fire and warm up the heaters, perform dehydration when the heater temperature is up to and kept at 150°C, and perform hot tightening when the heater temperature is up to and kept at 250°C

点火升温至 150°C 恒温脱水，升温至 250°C 恒温热紧

1) Introduce fuel gas, and fire the Atm. heater and the Vac. heater

引燃料气，常、减压炉点火

① Introduce nitrogen via the fuel gas valve to ISBL to purge the fuel gas system for more than 8h.

燃料气进装置给氮气，燃料气系统置换 8 小时以上。

② Analyze the gas sample taken at the end of the fuel gas piping to ensure that the oxygen content in the gas sample is $\gt 0.5\%$.

燃料气管线末端采样分析，氧含量 $\gt 0.5\%$ 。

③ Contact the Production Scheduling Department to open the fuel gas valve to ISBL for introducing fuel gas to the process unit.

联系调度引燃料气进装置，打开燃料气进装置阀门。

④ Properly control the fuel gas pressure.

控制好燃料气压力。

⑤ Purge D-861 OVHDs and bottoms towards the flare gas system.

D-861 罐顶和罐底往火炬气系统置换。

⑥ Analyze the gas sample taken in the fire box to ensure that the flammable gas content in the gas sample is $\gt 0.2\%$.

采样分析加热炉炉膛气体样，可燃气体含量 $\gt 0.2\%$ 。

⑦ Introduce smothering steam into the fire box.

炉膛吹蒸汽。

⑧ Properly connect the hoses of the burners at critical position.

连接好要点的燃烧器软管。

⑨ To fire the heater, first ignite the pilot, followed by the main burner.

加热炉点火，先点长明灯，后点主火嘴。

2) Warm up the system, and perform hydration when the system temperature is kept constant
系统升温、恒温脱水

① Introduce 0.5MPa steam to the vent valve after the Atm. heater, and close the bottom valve and distillate stripping steam valve of each column.

引 0.5MPa 蒸汽，至常压炉后放空。各塔底和侧线气提蒸汽阀门关闭。

③ Put the VR trim coolers for startup and shutdown into service. And put Pre-Dist., atm. and vac. OVHD water coolers into service.

投用渣油开停工水冷器。投用初顶、常顶、减顶水冷器。

④Fire and warm up the Atm. heater based on the warm-up curve, and control the temperature rise rate at approximately 25°C/h. Fire and warm up the Vac. heater based on the warm-up curve, and control the temperature rise rate at approximately 25°C/h.

常压炉按照升温曲线点火升温。升温速度控制在 25°C/h 左右。减压炉按照升温曲线点火升温。升温速度控制在 25°C/h 左右。

⑤When the crude temperature is up to 100°C, contact the electricians to energize the desalter drums for water removal. When the Atm. heater temperature is up to 150°C, stop warm-up operation, and keep the system temperature at 150°C for 12h for dehydration.

当原油温度到达 100°C时，联系电工给电脱盐罐送电，沉降脱水。当常压炉温度升至 150°C，停止升温，系统恒温 12h 脱水。

⑥While the system is kept at the constant temperature, switch each running column bottoms pump to the standby pump every 2 hours.

恒温期间每 2 小时切换各塔底备用泵 1 次。

⑦Control the bottom levels of Pre-dist column, Atm. and Vac. column within 40~60%. In case that the recycle oil in the system is not enough to maintain balance, contact the crude storage farm to start the crude pump to make up crude.

初馏塔、常压塔以及减压塔液位控制在 40%-60%。系统内循环油不够维持平衡时，联系原油罐区启动原油泵补原油。

⑧Pump the water in D-201, D-202, D-301, D-302 and D-401, if any, to Sour Water Stripping Unit.

D-201、D-202、D-301、D-302、D-401 有水时，通过泵送至酸性水汽提装置。

⑨While the system is kept at the constant temperature, periodically check if the residual water in atmospheric pumparound pumps, Atm. and Vac. column sidedraw pumps is drained completely. Control D-202 and D-302 levels at 60%, where excessive oil shall be sent into the light slop drum.

恒温过程，定期检查常压中段、常压侧线、减压侧线泵，排尽存水。维持好 D-202、D-302 液位，超过 60%的油送至轻污油罐。

⑩Ignite the heater burners in a symmetric manner, and switch over the burners on a regular basis.

加热炉火嘴要对称点，并且定期对火嘴进行切换。

3) Introduce fuel oil to establish fuel oil circulation

引燃料油，建立燃料油循环。

4) Warm up the system to 250°C, and keep the system temperature at 250°C for hot tightening
250°C恒温热紧

①Upon completion of dehydration at constant temperature (150°C), continue to warm up the system in a temperature rise rate of 30°C/h.

150°C恒温结束后，按 30°C/h 的速度继续升温。

②Ignite additional burners depending on the temperature rise of the Atm. heater.

根据加热炉升温情况，增点火嘴。

③When the outlet temperature of the Atm. heater is up to and kept at 250°C, inform the operation support force to perform hot tightening of all high-temperature parts in Atmospheric and Vacuum Distillation Unit.

常压炉出口升至 250°C时，通知保运对常减压装置所有高温部位恒温热紧。

④Check all equipment in the process unit, and if any issue is identified, contact the involved department to take proper actions in a timely manner.

对装置所有设备进行检查，发现问题及时联系处理。

⑤Switch each running column bottoms pump to the standby pump on a regular basis, and in the meanwhile, preheat the standby pump.

定期对各塔底泵进行切换，同时要预热。

⑥When Atm. and Pre-dist column top temperatures are up to 120 °C, establish reflux.

当常压塔、初馏塔塔顶温度达到 120°C，可打回流。

⑦Control, via the OVHD water coolers and air coolers, the Pre-dist column top pressure at $\geq 0.3\text{MPa}$ and the atmospheric top pressure at $\geq 0.3\text{MPa}$.

通过塔顶水冷、空冷等控制好塔顶压力，初馏塔塔顶压力 $\geq 0.3\text{MPa}$ ，常顶压力 $\geq 0.1\text{MPa}$ 。

⑧The field operators shall continue to check all pumparound and sidedraw pumps, and drain the residual water from these pumps on a regular basis.

外操继续检查各中段回流、侧线泵，定期排水。

⑨Fill the Vac. column sidedraw collecting drums with startup diesel. When the Vac. column OVHD temperature exceeds 100°C, put the LVGO PA water cooler into service, and start the LVGO PA&PR pump to establish reflux.

引开工柴油，装满减压侧线集油箱。减顶温度高于 100°C时，投用减一中水冷器，启运减一线泵打回流。

(5) Put the air preheater into service

投空气预热器

1) During hot tightening at constant temperature (250°C), organize to put the air preheater into service.

250°C恒温热紧过程中，组织投用空气预热器。

2) Eliminate the interlocking conditions of the air preheater.

摘除空气预热器联锁。

3) Check and confirm that all quick-open dampers are opened.

检查快开风门，全部打开。

4) Check and confirm that the opening of the butterfly valve at the inlet of the air blower is approximately 20%, and the opening of the frequency converter is up to 50%.

鼓风机入口开度蝶阀开度 20%左右，变频器开度开至 50%。

5) Start the air blower, and gradually open the butterfly valves at both inlet and outlet of the air blower.

启动鼓风机，逐渐开大鼓风机入口蝶阀和出口蝶阀。

6) Further close the secondary damper of each burner, and close the quick-open damper.

调小各燃烧器二次风门，关闭快开风门。

7) Fully close the butterfly valves at both inlet and outlet of the induced draft fan, and fully open the butterfly valves of the flue gas (such as air) preheaters.

引风机入口蝶阀和出口蝶阀全关。全开烟气如空气预热器蝶阀。

8) Start the induced draft fan, gradually open the butterfly valves at both inlet and outlet of induced draft fan, and gradually close the flue gas preheater butterfly valve that is directly routed to the chimney.

启运引风机，逐渐开大引风机入口蝶阀和出口蝶阀，逐渐关小热烟气直排烟囱的蝶阀。

9) Control the temperature of two fire boxes within $-50\sim -20\text{Pa}$, and control the oxygen content in the fire box at approximately 5%.

控制好两炉膛的负压 $-50\text{Pa}\sim -20\text{Pa}$ ，炉膛氧含量 5%左右。

(6) Switch crude process flow to the Atm. distillate process flow

切换原油，开常压侧线

1) Contact the Production Scheduling Department to confirm the destination of each sidedraw at the initial stage of startup and the destination of each on-spec sidedraw.

联系调度，确认开工初期各侧线的去向和合格后各侧线去向。

2) Continue to warm up the Atm. heater, and control the temperature rise rate at approximately 30°C/h .

加热炉继续升温，升温速度控制在 30°C/h 。

3) When the outlet temperature of the Atm. heater is up to 280°C and above, introduce steam to the bottom of the Atm. in a flowrate within $1\sim 1.5\text{t/h}$, and close the 0.5 MPa steam vent valve on the top of the Atm. heater.

常压炉出口温度达到 280°C 以上时，组织常压塔底吹汽，控制吹汽 $1\sim 1.5\text{t/h}$ ，0.5MPa 蒸汽炉顶放空关闭。

4) When the outlet temperature of the Atm. heater is up to 300°C and above, open the Atm. pumparound and distillate process flows.

常压炉出口温度达到 300°C 以上时，组织开常压中段回流和常压侧线。

5) Contact the Production Scheduling Department to inform the storage to send crude, line up the process flow from the VR to the low-temperature heavy slop, and establish open-loop circulation.

联系调度，通知罐区送原油，渣油线往低温重污油线甩油，建立开路循环。

6) Run the atm. top PA pump, the atm. PA#1 pump and the atm. PA#2 pump in turn. Specifically, when the atm. top PA process flow is in normal operation, run kerosene pump; when the atm. PA#1 process flow is in normal operation, open the light diesel process flow; when the atm. PA#2 process flow is in normal operation, open the heavy diesel process flow.

依次开常顶循、常一中、常二中。常顶循正常后，开常一线。常一中正常后，开常二线，常二中正常后，开常三线。

7) During operation of the Atm., control the Atm. top temperature at $\leq 110^{\circ}\text{C}$ to ensure that water can freely drain from the top of the Atm., so as to avoid evacuation in pumps, such as atm. top PA pump.

开常压过程中，控制好塔顶温度，常压塔塔顶温度不得低于 110°C ，防止常压塔水无法从塔顶排出，引起常顶循等机泵抽空。

8) After heavy diesel process flow is lined up, establish the atm. PA#2 lower reflux. Control the quality of heavy diesel.

开常三线后，常二中下回流建立。控制常三线产品质量。

9) Control the temperature of each Atm. distillate from the cooler at $\leq 60^{\circ}\text{C}$.

控制好常压各侧线冷后温度， $\leq 60^{\circ}\text{C}$ 。

10) When the atm. PA#2 process flow is in normal operation, put the kerosene reboiler into service for proper temperature control.

常二中正常后，投用常一线重沸器，控制好温度。

11) Adjust the quality of the Atm. distillate products for compliance with the determined specifications, and adjust the flow direction of the on-spec Atm. distillate products per the orders from the Production Scheduling Department.

调整常压侧线产品质量，合格后根据调度安排调整流向。

12) During operation of the Atm. distillate process flows, increase the crude feed flowrate based on the material balance, to ensure that the feed flowrate to each pass of the Vac. heater shall not be lower than 30t/h.

开常压侧线过程中，应根据物料平衡情况，增加原油进料量，保证减压炉每路进料不得低于 30t/h。

(13) Open the Vac. column distillate process flows

开减压侧线。

1) Before opening the Vac. column distillate process flows, properly control the outlet temperature of the Vac. heater to avoid temperature runaway.

开减压前，控制好减压炉出口温度，防止减压塔超温。

2) Put the LVGO pump into service, and properly control the Vac. column top temperature.

投用减一线泵，控制好减顶温度。

3) When the outlet temperature of the Vac. heater is up to 320°C and above, start the steam ejectors.

减压炉出口温度达到 320°C 以上时，开抽真空器。

4) For the purpose of vacuuming operation, first start the 3rd ejector, followed by the 2nd ejector. When the residual pressure at the top of the Vac. column does not drop any longer, start the 1st ejector.

抽真空时，先开三级抽真空，再开二级抽真空。当塔顶残压不再下降时，开一级抽真空。

5) When oil level is established in the MVGO collecting drum, start the MVGO pump, and open the MVGO PA process flow.

减二线集油箱有油后，启运减二线泵，投用减二中。

6) When oil level is established in the HVGO collecting drum, start the HVGO pump, and open the HVGO PA process flow and the HVGO flushing oil process flow.

减三线集油箱有油后, 启运减三线泵, 投用减三中和减三线内回流。

7) Send LVGO, MVGO and HVGO into the heavy slop piping, and properly control the quality of the Vac. column distillate products.

减压一、二、三线往重污油线送油, 控制好减压侧线。

8) When the Vac. column is in normal operation, determine the destination (drum or Flexicoking Unit) of the VR per the orders from the Production Scheduling Department.

减压正常后, 根据调度安排, 确定渣油去向 (罐区或灵活焦化)。

9) When the color of the Vac. column distillate products meets requirements and the HVGO is sampled, analyzed and accepted, adjust the flow direction of the Vac. column distillates per the orders from the Production Scheduling Department.

减压侧线油色正产, 减三线分析合格后, 根据调度指令调整减压侧线流向。

10) Run the vac. overflash oil pump, send vac. overflash oil into the heavy slop drum for approximately 30min to prevent water from being entrained into the vacuum residue.

开减四线, 减四线先往重污油甩油 30min 左右, 防止将水并入渣油。

11) During startup, depressurize the Vac. column distillate process flows that are opened later accordingly, and properly line up the process flow to the column or the heavy slop drum so as to avoid any leakage caused by vaporization of residual water in the equipment in the presence of heat source.

开车过程, 后开的侧线注意泄压, 保证至塔内或者重污油的流程畅通, 防止因设备内的存水因加热汽化后引起泄漏。

(8) Put Pre-dist column into operation

开初馏塔

1) When the Pre-dist column top temperature exceeds 120°C, start the Pre-Dist. OVHD reflux pump to establish reflux to control the column top temperature.

初顶温度高于 120°C 时, 可启运初顶回流泵打回流, 控制塔顶温度。

2) When D-202 level is up to 60% and above, send naphtha in D-202 into A-202, and send oil in D-201, if any, into the light slop drum.

D-202 液位高于 60% 以上时应将 D-202 石脑油送至 A-202, D-201 有油后送至轻污油。

3) Make up oil to D-202 from D-201 when required.

D-202 油不足时应通过 D-201 补油。

4) Run the Pre-Dist. Sidedraw pump. After the Pre-Dist. Sidedraw pump is started, first establish internal reflux, and then send Pre-Dist. Sidedraw to the atm. PA#1 process flow when the color of Pre-Dist. Sidedraw meets requirements.

开初一线。初一线泵启运后, 先打内回流, 检查油色正常后, 初一线送至常一中。

(9) Introduce quench oil into the Vac. column

减压塔急冷油投用

Adjust the quench oil flowrate depending on the Vac. column bottom temperature.

根据减压塔塔底温度情况，调整急冷油流量。

（10）Inject steam to the bottom of the Vac. column

减压塔塔底注汽

Inject steam to the bottom of the Vac. column in a flowrate of 200~300kg/h at the initial stage, and adjust the steam injection flowrate depending on the vacuum degree in the Vac. column.

投用减压塔塔底注汽，注汽量初期 200-300kg/h，并根据减压塔真空度进行调整。

（11）Put sealing oil system into service

投用封油系统

1) When the mixed diesel meets requirements, introduce the mixed diesel into the sealing oil pot II (D-852), and drain water at the bottom of D-852.

混合柴油正常后，引混合柴油进封油Ⅱ，D-852 底部排水。

2) When D-852 level is up to 50% and above, start P-852 to pump the oil into the heavy slop system.

D-852 液位达到 50%以上时，启动 P-852 往重污油系统甩油。

3) Drain the water at the end of each user. Analyze the water content in sealing oil in D-852, and inject sealing oil when the water content is $\leq 0.2\%$.

各用户末端排水。分析 D-852 封油水含量， $\leq 0.2\%$ 以后注封油。

4) When the LVGO PA process flow is in normal operation, introduce LVGO PA into the sealing oil pot I (D-851), and drain water at the bottom of D-851.

减一中运行正常后，引减一中至封油封油Ⅰ，D-851 底部排水。

5) When D-851 level is up to 50% and above, start P-851 to pump the oil into the heavy slop system.

D-851 液位达到 50%以上时，启动 P-851 往重污油系统甩油。

6) Drain the water at the end of each user. Analyze the water content in sealing oil in D-851, and inject sealing oil when the water content is $\leq 0.2\%$.

各用户末端排水。分析 D-851 封油水含量， $\leq 0.2\%$ 以后注封油。

（12）Put C-410 into operation

投用 C-410

1) Line up D-862 end to the vent valve. Introduce nitrogen at the top of D-401 to purge D-401 through C-410, D-862 and Atm. heater in turn.

D-862 末端改放空。从 D-401 罐顶给氮气，经 C-410→D-862→常压炉置换。

2) Contact the Production Scheduling Department to introduce the lean MEDA into C-410. When the lean MEDA level in C-410 is up to 60%, start P-440 to pump the lean MEDA to Solvent Regeneration Unit to establish MDEA circulation.

联系调度，引贫胺液进装置。C-410 胺液液位达到 60%后启动 P-440 往溶剂再生装置送胺液，建立胺液循环。

3) When C-410 has been purged with nitrogen, take gas sample at the end of LP fuel gas piping of the Atm. heater to analyze oxygen content, and when the oxygen content is $\leq 0.5\%$, line up D-862 to the flare gas system.

C-410 氮气置换结束后，采样分析常压炉低压瓦斯末端氧含量，氧含量 $\leq 0.5\%$ ，可将 D-862 改至火炬气。

4) Stop nitrogen introduction, and introduce the vac. OVHD gas into C-410. Continue to purge D-862 towards the flare gas system to remove all nitrogen from the system.

停氮气，减顶气引至 C-410。继续从 D-862 往火炬气置换，将系统的氮气赶净。

5) Introduce the vac. OVHD gas to the Atm. heater for burning purpose.

引减顶气至常压炉燃烧。

(13) Inject water into desalter drum

电脱盐注水

1) Introduce purified water or DM water into D-110.

引净化水或者除盐水进 D-110。

2) When D-110 level is up to 60%, start P-101 to inject water into D-102. Adjust the mixing strength of D-102 to 60~120kpa.

D-110 液位达到 60%后，启运 P-101 向 D-102 注水。调整 D-102 混合强度 60-120kpa。

3) When the crude-water interface level in D-102 is up to 30%, start P-102 to inject water into D-101. Adjust the mixing strength of D-101 to 60~120kpa.

D-102 界位达到 30%以后，启运 P-102 向 D-101 注水。调整 D-101 混合强度 60-120kpa。

4) When the crude-water interface level in D-101 is up to 30% and above, open the cut water valve of D-101, and put D-120 into service. Properly control the pressure and crude-water interface level of D-120.

D-101 界位达到 30%以上时，D-101 切水开，投用 D-120。控制好 D-120 压力和油水界位。

5) Inject the demulsifier to the crude valve to ISBL.

注破乳剂。破乳剂注至原油进装置处。

(14) Put column OVHD chemical injection system into service

投用塔顶三注系统

1) Start the neutralizing inhibitor pump to inject the properly prepared neutralizing inhibitor to the top of the Pre-Dist., Atm. and Vac. column respectively.

注中和剂。中和剂配置好后，启动中和剂泵分别往初顶、常顶和减顶注中和剂。

2) Start the low-temperature corrosion inhibitor pump to inject the properly prepared low-temperature corrosion inhibitor to the top of the Pre-Dist., Atm. and Vac. column respectively.

注低温缓蚀剂。低温缓蚀剂配置好后，启动低温缓蚀剂泵分别往初顶、常顶和减顶注低温缓蚀剂。

3) Start the water pump to inject water to the top of the Pre-Dist., Atm. and Vac. column respectively.

塔顶注水。启动注水泵，分别往各塔顶注水。

4) Start the fouling inhibitor pump to inject the properly prepared fouling inhibitor to the vacuum residue system.

注阻垢剂。阻垢剂配置好后，启动阻垢剂泵往渣油系统注阻垢剂。

2.3.3 Operation adjustment 操作调整

2.3.3.1 Atm. operation adjustment 常压塔的调整

After the process unit is started up, the operation of the Atm. shall be adjusted as soon as possible to control the product quality and related process parameters.

装置开车正常后，应尽快调整操作，控制好产品质量和相关工艺参数。

(1) Atm. bottom stripping steam adjustment

常压塔底汽提蒸汽的调整

The Atm. stripping steam is an important parameter for controlling the lift of the Atm., and the cut precision of the Atm. and the Vac. column. If the stripping steam is insufficient, the lift of the Atm. will be lower, and some light oil will enter the Vac. column, which affects Vac. column vacuuming operation. In this case, the stripping steam flowrate to the Atm. shall be increased. If the stripping steam flowrate is too high, it will affect the energy consumption, and increase the pressure of the Atm. when the operation load of the Atm. is high. Therefore, it is required to properly adjust the stripping steam flowrate based on the design requirements.

常压塔汽提蒸汽是控制常压塔拔出率、常压塔和减压塔的切割精度的重要参数。汽提蒸汽不足，常压拔出率不足，部分轻油进入减压塔，影响减压抽真空时，应增加常压塔汽提蒸汽量。汽提蒸汽量过大，一是影响能耗，二是在高负荷时，造成常压塔压力上升。应综合考虑，尽量按照设计调整常压塔塔底用量。

(2) Atm. top temperature adjustment

常压塔塔顶温度调整

The Atm. top temperature is adjusted mainly based on the atm. OVHD oil dry point. When the Atm. top pressure is $\geq 0.1\text{MPa}$, the Atm. top temperature shall be $\leq 110^\circ\text{C}$, and when the Atm. top pressure is $\geq 0.1\text{MPa}$, the Atm. top temperature shall be $\leq 120^\circ\text{C}$ to avoid large amount of liquid water formed in the column, resulting in evacuation of the atm. top PA pump and increased corrosion to the column OVHD reflux system.

常压塔塔顶温度主要根据常顶石脑油干点进行控制。常压塔塔顶压力 $\geq 0.1\text{MPa}$ 时，常压塔塔顶温度控制 $\leq 110^\circ\text{C}$ ，常压塔塔顶压力 $\geq 0.1\text{MPa}$ 时，常压塔塔顶温度控制 $\leq 120^\circ\text{C}$ ，防止常压塔内形成大量的液态水，造成常顶循环泵抽空和塔顶的腐蚀加剧。

1) Kerosene quality control

常一线质量的控制

①As kerosene EBP is high, which may cause the jet kerosene freezing point to rise and EBP to decrease, resulting in jet kerosene fraction to enter the diesel fraction. The kerosene EBP shall be adjusted based on kerosene freezing point.

常一线的终馏点高,可能造成航煤的冰点上升,终馏点低,造成航煤馏分进入柴油。应根据航煤的冰点调整常一线的终馏点。

②Properly adjust the operation of the kerosene reboiler to improve the separation precision of kerosene and atm. OVHD oil so as to avoid a large amount of CCR feedstocks remained in the jet kerosene.

调整好常一线的重沸器,提高常一线和常顶油的分离精度,避免大量的重整原料残留在航煤原料中。

2) Atm. PA#2 control

常二中内回流的控制

①Atm. PA#2 and heavy diesel are drawn from the same location where a collecting drum is provided. When heavy diesel draw flowrate fluctuates, it may cause no level in the atm. PA#2 collecting drum. As a result, there is no reflux in trays below the atm. PA#2 collecting drum. Therefore, it is necessary to properly adjust the atm. PA#2 to control the reflux in trays below the atm. PA#2 collecting drum.

常二中和常三线从同一位置抽出,且抽出层设置为集油箱。常三线的抽出量波动时,可能造成常二中的集油箱没有满液位,常二中集油箱以下塔盘没有液相回流。因此需要通过控制常二中的内回流来控制常二中的以下塔盘的液相回流,确保塔盘不干板。

②If the atm. PA#2 reflux flowrate is too high, the atm. PA#2 collecting drum may be emptied, resulting in operation fluctuation of the Atm.. When atm. PA#2 collecting drum is emptied, heavy diesel draw flowrate shall be adjusted.

常二中内回流控制过大时可能造成常二中集油箱抽空,造成常二中泵抽空,常压塔操作波动。当常二中抽空时,应调整常三线抽出量,常二中内回流量。

3) Atm. overflash oil control

常四线的控制

Atm. overflash oil is directly sent to HC Unit as feedstock, so it is critical to properly control the quality of the . As it is difficult to control mist atm. overflash oil entrainment in the distillation column, washing is normally used to control the quality of the last sidestream.

常四线直接出加氢裂化原料,因此必须控制好常四线的质量。由于分馏塔的雾沫夹带是难以绝对避免的,一般都是通过洗涤来控制最后一个侧线的产品质量。

①If atm. overflash oil draw flowrate is insufficient, some light ends will enter the Vac. column, effecting the operation of Vac. column. In this case, atm. overflash oil draw flowrate shall be increased.

常四线抽出量不足,部分轻组分进入减压塔,影响真空度,应增加常四线抽出量。

②If atm. overflash oil shows deep color, it indicates poor washing performance in the trays below atm. overflash oil . In this case, atm. overflash oil reflux shall be increased.

常四线油色深，常四线以下塔盘洗涤效果差，增加常四线内回流。

2.3.3.2 Vac. column operation adjustment 减压塔的调整

(1) Steam injection to Vac. column

减压塔底注汽

The purpose of steam injection at the bottom of the Vac. column is to reduce the partial pressure of oil vapor and increase the lift.

减压塔底注汽的目的是降低油气分压，提高减压拔出率。

(2) Switchover to water ring vacuum pump

水环泵切换

During startup, the three-stage steam ejectors should be operated for the Vac. column for purpose of protecting the equipment. After the process unit is normal operation, it is required to switch over the liquid ring vacuum pump as soon as possible for the purpose of reducing energy consumption.

开工时，从保护设备出发，减压塔三级抽真空宜使用蒸汽抽真空。装置开正常后，应尽快切换为水环真空泵，降低能耗。

(3) Quench oil control

急冷油控制

The function of the quenching oil is to control the temperature of the residue in the bottom of the Vac. column to prevent condensation and cracking of the high temperature residue in the column. The quench oil flowrate shall be properly controlled to reduce the Vac. residue temperature to 360 °C. When the operation load of the process unit is turned down, or light oil yield or residue oil yield is lower, it is required to further reduce the Vac. residue temperature.

急冷油的作用是控制减压塔塔底的渣油温度，主要是防止高温渣油在塔内缩合和裂解。控制急冷油流量，将减压塔塔底温度降低至 360°C。装置低负荷，或者油轻、渣油收率低时，可进一步降低减压塔塔底温度。

(4) Vacuum control

真空度控制

The vacuum in the Vac. column is a key factor affecting the lift. It shall be adjusted as much as possible to ensure that the Vac. column OVHD residual pressure is $\geq 2.5\text{kPa}$.

减压塔真空度是影响减压拔出率的关键因素。应尽量通过调整，保证减压塔顶残压 $\geq 2.5\text{kPa}$ 。

2.3.3.3 Pre-Distillation column operation adjustment 初馏塔的调整

(1) Pre-Dist. sidedraw control

初一线的调整

1) The Pre-Dist. sidedraw is sent into the atm. PA#1, it is required to properly control the Pre-Dist. sidedraw color. Normally, the Pre-Dist. sidedraw is colorless and transparent. If the color is dark, the Pre-Dist. sidedraw draw flowrate shall be properly reduced and the Pre-Dist. sidedraw reflux flowrate shall be increased.

初一线采出后进入到常一中，应严格控制好初一线的油色。初一线油色正常为无色透明，当颜色深后，应适当降低初一线采出，增加初一线的内回流量。

2) If water is entrained in the crude, stop Pre-Dist. sidedraw draw.

原油带水时，应停止初一线的采出。

3) During initial startup, first establish the Pre-Dist. sidedraw reflux process flow. After the oil color is normal, the Pre-Dist. sidedraw is then sent to the atm. PA#1.

初次开初一线时应先打内回流，油品颜色正常后再送至常一中。

(2) Pre-dist column top temperature control

初顶温度控制

Pre-dist column top temperature is an important parameter for controlling the Pre-Dist OVHD oil dry point, and it shall be adjusted based on the Pre-Dist. OVHD naphtha dry point. If water is entrained in the crude, it is required to increase the Pre-dist column top temperature as much as possible to enable the water flow from the Pre-dist column to prevent the water from being brought into the bottom of the column, causing pump evacuation.

初顶温度是控制初顶石脑油干点的重要参数，应根据初顶石脑油干点调整初顶温度。原油带水时应尽量提高初顶温度，将水从初馏塔流出，避免水带至塔底引发塔底泵抽空。

2.3.3.4 Heater operation adjustment 加热炉的调整

Heater operation adjustment mainly includes proper control of negative pressure in the fire box, oxygen content in the fire box, tube temperature and fire box temperature.

加热炉的调整主要是控制好炉膛负压、炉膛氧含量、炉管分支温度和炉膛温度。

(1) If the negative pressure in the fire box is too large, air leakage into the heater will increase, and a positive pressure is formed. The high temperature flue gas will overflow from the heater, it may danger the personnel safety, or even cause back fire in sever case. The negative pressure in the fire box shall be properly controlled by adjusting the frequency converter of the induced draft fan, the opening of the flue gas duct baffles, the induced draft fan inlet butterfly valve, and the preheater inlet butterfly valve.

炉膛负压过大，加热炉漏风增加，形成正压，会高温烟气从炉膛溢出，伤害人员，严重可引起回火。应通过调整引风机变频、各加热炉烟道挡板开度、引风机入口蝶阀、预热器入口蝶阀等控制炉膛负压。

(2) Oxygen content in the fire box If fuel gas is fired, the oxygen content in the fire box shall be controlled at a value $\geq 4\%$, and if fuel oil is fired, the oxygen content in the fire box shall be controlled at a value $\geq 5\%$.

炉膛氧含量。烧燃料气时炉膛氧含量控制 $\geq 4\%$ ，烧燃料油时炉膛氧含量控制 $\geq 5\%$ 。

(3) The temperature of each tube in the same fire box shall be properly controlled, and the tube temperature difference shall be $\geq 8^{\circ}\text{C}$. In the same fire box, the temperature difference at all locations shall be $\geq 30^{\circ}\text{C}$.

加热炉各分支温度应控制平稳，分支温差 $\geq 8^{\circ}\text{C}$ 。同一炉膛内，各部分温差 $\geq 30^{\circ}\text{C}$ 。

(4) Regularly check the level of the fuel gas KO drum to prevent the condensate from being

brought into the heater, resulting in operation fluctuation or accident of heater.

定期检查燃料气分液罐液位，防止凝液带入加热炉引起加热炉波动或者事故。

2.3.3.5 Chemical agent dosage adjustment 三注的调整

The neutralizing inhibitor dosage shall be adjusted based on the pH value of the water cut from the OVHD of the column, the pH value shall be within 5.5~7.5 for organic neutralizing inhibitor, and the pH value shall be within 7 - 9 for ammonia. The low temperature corrosion inhibitor and fouling inhibitor dosage shall be adjusted based on the agreement signed with their suppliers. The water injection at the OVHD of the column shall be 3 to 5% of the column OVHD distillate. 中和剂根据塔顶切水的 pH 值进行调整，注有机中和剂 pH 值 5.5~7.5，注氨水 pH 值 7~9。低温缓蚀剂和阻垢剂等根据供货商的协议调整注入量。塔顶注水量应为塔顶馏出量的 3~5%。

2.4 Normal operation, instruments and control systems, and main instrument performance 正常操作、仪表控制方案及主要仪表性能

2.4.1 Process operations 工艺操作法

2.4.1.1 Principles for adjusting the salt content in the crude from the desalters 电脱盐脱后原油含盐的质量调整原则

For the inorganic salts contained in the crude, some are dissolved in water, and the remaining salts are dispersed in the crude in a crystalline state. The crystalline salts can be dissolved in water, and then water is removed. The crude desalting is such a process that water is injected into the crude to dissolve the salts contained in the crude, and then crude is dehydrated for removing the salts dissolved in water.

原油中所含的无机盐，一部分溶解在水中，另一部分以结晶状态分散在原油中。结晶盐可以用水溶解，再将水脱除。原油的脱盐过程就是通过向原油注水，将原油中的盐溶解水中，再通过脱水，将盐脱除。

Crude dehydration is such a process where heat, chemical injection (demulsifier injection) and electric field demulsification are used to make the small water droplets in the crude condense and grow, and then water is separated from the crude relying on the difference in specific gravities of crude and water. To reduce the salt content in crude, deep dehydration is required. It is an effective way to inject a certain amount of water into the crude to reduce the salt concentration in the crude so as to improve the desalting efficiency.

原油脱水是利用热、化学（注破乳剂）和电场破乳方法使油中的小水滴凝聚长大，借油水比重差使水从油中沉降下来。要降低原油含盐量就要深度脱水，向原油中加入一定数量的水，降低油中的盐浓度（注水），是提高脱盐效率的有效方法。

There are many factors affecting the salt content in the crude from the desalters. The main factors include crude flowrate to the desalters, crude properties, desalting temperature, pressure in desalter drum, mixer pressure drop, water injection amount, crude-water interface, demulsifier

injection dosage, emulsion layer, electric field strength, desalter drum bottom sediments.

影响原油脱后含盐的因素很多，归结起来主要有原油处理量、原油的性质、脱盐温度、电脱盐罐内压力、混合压降、注水量、油水的界位、破乳剂注入量、乳化层、电场强度、罐底沉积物等。

（1）Crude flowrate to desalters

处理量

If the crude flowrate to the desalters exceeds the design flowrate, the residence time of crude in the desalters will be shortened, which will affect the operation and desalting performance of the desalters. Therefore, the crude flowrate to the desalters shall be properly controlled during normal operation.

原油处理量如果超过了设计的原油量，原油在电脱罐的停留时间将缩短，会影响电脱盐的操作，影响电脱盐效果，因此正常操作时应保持合理的原油处理量。

（2）Crude properties

原油的性质

The crude properties are the most critical factor affecting desalting performance. If the crude density is large, and crude and water density difference is small, the settling speed of water drops will be low, and dehydration time needs to be extended. The higher the crude viscosity is, the slower the separation speed of the crude and water will be. The higher the degree of crude emulsification is, the more difficult it will be to break the emulsion. This is especially for the re-run slop. High-speed desalter is more sensitive to changes in the properties of crude. As crude and water stay in high-speed electric field for a very short time, if crude and water cannot be quickly separated in such a short time, it is easy to form water chains in the electric field, resulting in desalter trip, water brought into distillation column.

原油性质是影响电脱盐的最关键因素。原油的密度大，油水的密度差下，油水的沉降速度降低，脱水时间需要延长。原油的粘度越高，油水的分离速度越慢。原油的乳化程度越高，破乳脱水越困难。污油的回炼的电脱盐影响尤为明显。高速电脱盐对原油性质的变化更敏感，由于油水在高速电场中停留时间极短，当油水不能在短时间内进行快速分离，极容易在电场中形成水链，造成电脱盐跳闸，水带入分馏塔。

For crude with higher density and higher viscosity, it shall consider to mix with light crudes to reduce density and viscosity. For highly emulsified crude, the sedimentation and dehydration time shall be extended in storage. It is required to properly control the slop blending ratio to facilitate stable operation of the desalters.

对于密度较大、粘度较高的原油，应考虑与轻质原油混炼，降低密度和粘度。对于高乳化原油，应增加原油在罐区的沉降脱水时间。合理控制污油的掺炼比例，有利于保证电脱盐的稳定运行。

（3）Desalting temperature

脱盐温度

For most crudes, the higher the temperature is, the greater the difference in densities of crude

and water will be, and the better the separation of crude and water will be. As the temperature rises, the crude viscosity is reduced. As a result, the binding force of crude to water is reduced, and the settling speed of the water droplets is increased. Temperature increment is also conducive to reducing the tension at the crude-water interface, which is conducive to demulsification and coalescence. As the temperature rises, the thermal motion of the molecules is intensified, which is conducive to the collision of water droplets. However, if the desalting temperature is too high, it will increase the energy consumption while increase operation pressure of the equipment (the saturated vapor pressure will rise). Too high temperature will result in crude conductivity increment, the power consumption will be increased, and operation stability of the desalters will be affected. The desalting temperature will be controlled with 110 to 140 °C.

对于绝大部分原油，温度越高，油水的密度差就越大，越有利于油水的分离。温度上升，还会降低原油粘度降低，降低油对谁的粘滞力，提高水滴的沉降速度。温度上升还有利于降低油水界面的张力，有利于破乳和聚结。温度的上升，分子的热运动加剧，有利于水滴的碰撞聚并。电脱盐温度过高，一是会增加装置的能耗，二是会增加设备的承压（油品的饱和蒸气压上升）。温度过高，原油的导电率上升，增加电耗，影响电脱盐的稳定性。本装置脱盐温度控制在 110~140°C。

In actual operation, the desalting temperature can be controlled by adjusting the heat exchange load. The temperature of the water injected into the crude shall be increased as much as possible to reduce the temperature drop of the crude.

实际生产中，可调整换热负荷来控制温度；应尽可能的提高注水的温度，降低原油温降。

（4）Pressure in desalter drum

罐内压力

The pressure in the desalter drum must be maintained to be sufficient to inhibit vaporization of the crude. If crude vaporizes, it will result in improper operation. The pressure in the desalter drum must be maintained above the saturated vapor pressure of crude and water at the operating temperature.

罐内压力必须维持到足够以抑制原油的蒸发，如果产生蒸发，将导致操作不正常。罐内压力必须维持到高于操作温度下原油和水的饱和蒸汽压。

（5）Mixer pressure drop

混合压降

The mixer pressure drop is an important parameter to measure the degree of mixing of crude and water. If the mixer pressure drop is insufficient, the crude and water will not be completely mixed, resulting in poor salt washing and dissolving effect by water. If the mixer pressure drop is too large, it may cause excessive emulsification, or the water droplets may be excessively dispersed, which may affect dehydration. In general, the mixing strength required for the crude with large density is lower than that required for the crude with small density. For this process unit, the mixing strength is in a range of 60 to 120 KPa. When the current rises, the mixer

pressure drop shall be appropriately reduced if the water content in the desalter crude rises. When the water content in the desalted crude is not high and the salt content in the desalted crude exceeds the specified value, the mixer pressure drop can be appropriately increased.

混合压降是衡量油水混合程度的重要参数，混合压降不足，油水混合不充分，水对盐的洗涤、溶解效果差。混合压降过大，容易造成过度乳化，或者水滴过度分散，影响脱水。一般情况下，密度大的原油需要的混合强度要比小密度的原油低。对本装置而言，混合强度的操作范围为 60~120KPa。当电流上升时，脱后原油含水上升时，应适当降低混合压降。当脱后含水不高，脱后含盐超标时，可适当增加混合压降。

(6) Water injection amount

注水

If the water injection is insufficient, the contact between crude and water will be insufficient, the dispersion density of water droplets in the crude will be low, resulting in poor washing effect. If the water injection is too large, it will increase the energy consumption and reduce the crude processing capacity of the process unit. For heavy crude, higher water injection flowrate is required. For this process unit, the total amount of water injected into the desalters shall be 3% to 8% of the crude to be processed. In the case where the salt content in the desalted crude is acceptable, the amount of water injection shall be appropriately reduced.

注水量不够，油水接触不充分，油中水滴分散密度低，洗涤效果差。注水量过大，会增加装置能耗，降低装置的原油处理能力。对于重质原油，需要更高的注水量。对本装置而言，电脱盐总的注水量应为原油加工量的 3%~8%。在脱后含盐合格的情况下，应适当降低注水量。

In operation, it is necessary to control the oil content, mechanical impurity content, NH₃-N content in the water injected into the desalters. The pH value of the water injected into the desalter also affects the desalting effect. If the pH value is too high, the crude will be emulsified. 操作中，要控制注水的油含量、机械杂质含量、氨氮含量等。注水的 pH 值也影响脱盐效果，pH 值过高，会引起原油乳化。

(7) Crude-water interface

界位

If the crude-water interface rises, it will reduce the residence time of the crude in the electric field, the emulsified layer will enter the electric field, and the conductivity will increase, resulting in the desalter current to rise and even trip. If the crude-water interface is too low, it will affect the separation of crude and water while reduce the weak electric field strength, which is not conducive to the separation of crude and water in the weak electric field.

界位上升，减少了原油在电场的停留时间，乳化层会入电场，导电率增加，引起脱盐电流升高，甚至跳闸。界位如果过低，一是影响油水的分离，二是会降低弱电场的电场强度，不利于弱电场的油水分离。

Check the crude-water interface at site on a regular basis and verify it with DCS display. Especially when the properties of the crude changes, and the current and voltage will fluctuate,

it is necessary to check the crude-water interface at site.

定期通过现场的油水界位检查管检查油水界位，与 DCS 的显示进行核对。尤其是原油性质变化时，电流电压波动时，需要到现场检查界位。

(8) Electric field strength

电场强度

Electric field strength has a large impact on the desalting performance. The coalescence force of water droplets is proportional to the square of the electric field strength. Increment of electric field strength can increase the coalescence force of water droplets, enabling water droplets to collide with each other to form large water droplets, accelerating crude-water separation, and facilitating desalting operation. However, when electric field strength is increased to a certain extent, and the desalting rate will be no longer increased. It will only increase the power consumption and even cause breakdown, resulting in transformer trip. When processing high-conductivity crude or refinery slop and drum bottom oil, the voltage shall be adjusted to a low level to make the current small. Only appropriate electric field strength can ensure the highest desalting rate.

电场强度对脱盐效率的影响非常大。水滴的聚结力和电场强度的平方成正比，提高电场强度，可提高小水滴的聚结力，使小水滴相互碰撞聚积成大水滴，加速油水分离，有利于电脱盐。但是电场强度提高到一定程度，脱盐率便不再提高，只会增加电耗，甚至发生击穿现象，造成变压器跳闸。当加工高导电性原油或炼厂污油及罐底油时，应将电压调到低档，使电流较小，只有采用合适的电场强度，才能保证最高的脱盐率。

(9) Demulsifier

破乳剂

Compare with emulsifier, demulsifier has stronger activity and lower surface tension. The function of the demulsifier is to replace the emulsifier and come into the crude-water interface film, and reduce the surface tension of the crude-water interface film, so that the water droplets can overcome the resistance of the crude-water interface film and realize coalescence of water droplets. Different crudes have different mechanisms in formation of emulsions. Demulsifier varieties must be adjusted according to changes in the properties of crude.

破乳剂比乳化剂有更强的活性，更低的表面张力，破乳剂的作用是替代乳化剂进入油水界面膜，降低油水界面膜的表面张力，使得水滴能够克服油水界面膜的阻力，实现水滴的聚并。不同性质的原油，形成乳化液的机理不一样，破乳剂品种必须要根据原油性质的变化进行调整。

Demulsifier is a surfactant in nature. When the demulsifier accumulates too much at the crude-water interface, it will increase the difficulty of demulsification. Therefore, it is necessary to appropriately control the demulsifier injection dosage. In general, the injection content of a good oil-soluble demulsifier should be controlled within 2-10ppm, and it should not exceed 15ppm.

破乳剂终究还是表面活性剂，当破乳剂在油水界面膜聚积过多的时候，会增加破乳的难度。因此需要适当控制破乳剂的注入量。一般而言，良好的油溶性破乳剂，加注量控制在 2-10ppm 较为合

适，最高不宜超过 15ppm。

In general, the earlier the demulsifier is added, the more favorable the dispersion of the demulsifier in the crude will be. The demulsifier injection point is normally located at the crude inlet to the process unit, and it may be located at D-101 and D-102 inlets.

一般而言，破乳剂加注越前，越有利于破乳剂在原油中的分散，本装置破乳剂注入点一般在原油进装置，也可在 D-101 和 D-102 入口增加破乳剂。

(10) Backflush

反冲洗

The mechanical impurities in the crude are deposited in the desalter drum, and excessive deposition of mechanical impurities in the desalter drum will reduce the effective volume of the drum. Therefore, the desalter drum shall be periodically back flushed to discharge the impurities deposited in the desalter drum. Weekly backflush is required. Adequate water must be available for backflush operation.

原油中的机械杂质在电脱盐罐内沉积，电脱盐罐内机械杂质沉积过多，会减少电脱盐罐的有效容积。因此要对电脱盐罐进行定期反冲洗，将沉积在电脱盐罐内的杂质排出。本装置每个星期反冲洗一次。反冲洗，必须保证足够的水量。

2.4.1.2 Principles for increasing and decreasing crude flowrate 原油处理量的提、降量工艺调整原则

The crude flowrate shall be increased and decreased based on the operation plan developed by the Operation Scheduling Department to ensure the process unit in stable operation.

原油加工量应按计划调度部的安排进行提降，在配合全厂做好平稳生产的前提下，保证加工任务的完成。

(1) The principles for adjusting the crude flowrate: when crude flowrate is required to increase, first increase the crude flowrate and then increase the temperature, when the crude flowrate is required to be decreased, first decrease the temperature and then decrease the crude flowrate. 提降原油处理量调节原则：提量时先提量再升温，降量时先降温再降量。

(2) Crude flowrate increasing and decreasing rate: normally, the increasing and decreasing rate for each loop shall not be more than 10t per time. After each adjustment and the operation is stabilized for a period of time, observe the level change trend, and make the next adjustment. 原油提降速度：正常操作时原油提降量速度一般每次每一路不超过 10t，每次小调后稳定一段时间，观察液面变化趋势，待系统平稳后再进行调节。

Note: in case of emergency, the decreasing rate can be accelerated as appropriate.

注：在装置出现异常需要降量时，可视情况适当加快降量速度。

(3) The sequence for increasing crude flowrate: manually increase the crude flowrate to the Atm. heater and then the Vac. heater.

原油提量顺序：按常压炉进料量、减压炉进料量、原油量，手动提物料量。

Note: this sequence can be adjusted based on the bottoms levels in the distillation columns.

注：生产中可根据各塔底液面，调整原油提量顺序。

(4) Strengthen the contact with the field operators when increasing the crude flowrate to allow the field operators to adjust the heater burners in time so as to maintain the heater outlet temperature stable and ensure the tube temperature difference meets the process requirements. 提降量时与外操岗位加强联系，及时调节加热炉火嘴，保持炉出口温度平稳及分支温差合格。

(5) Estimate each column sidestream output and column OVHD output based on the material balance, each sidestream yield before crude flowrate increment and decrement, and the specified increasing or decreasing rate. Properly adjust the flowrate based on the operation temperature to ensure product quality and improve the yields. In general, the products are prone to becoming lighter when increasing the crude flowrate, and the products are prone to becoming heavier when decreasing the crude flowrate.

根据物料平衡及提降量前各侧线收率，以及原油提降量的比例，预算各侧线量和塔顶馏出量，结合各部温度及时调整，以保证产品质量和提高收率。一般情况，提量时产品容易轻，降量时产品容易重。

(6) The level in each column shall be maintained stable when increasing or decreasing the crude flowrate to prevent too low or too high level.

提降量过程应注意保持各塔液面平稳，防止各塔液面抽空或过高。

(7) When increasing or decreasing the crude flowrate, properly adjust the column OVHD reflux and pumparound reflux in time based on the heat balance and the specified increasing or decreasing rate to ensure the heat recovery and product quality.

根据热量平衡，以及原油提降量的比例，提降量时应及时调整塔顶回流和中段回流，以确保装置的热量回收和产品质量。

(8) Before increasing or decreasing the crude flowrate, contact the downstream process units in advance for properly lining up the downstream process flows.

提降量时要联系好油品去路，与下游装置提早联系。

(9) When increasing or decreasing the crude flowrate, it is necessary to contact the field operators to strengthen the equipment inspection, especially the operation pressure of the crude heat exchanger, the levels in the Pre-Dist. and Atm. OVHD reflux drums and product drums, the interface in the Vac. column OVHD KO drum, as well as the level changes in the Pre-Dist., Atm., stripper and Vac. column.

提降量中要联系外操加强设备检查，特别是原油换热器压力、初馏塔、常压塔顶回流罐及产品罐、减顶油水分离罐的界位和液面以及初馏塔、常压塔、汽提塔、减压塔液面变化情况。

2.4.1.3 Principles for adjusting process operations when the properties of the crude change 原油性质变化的工艺调整原则

(1) General provisions

总则

When the properties of the crude change or the crude mixing ratio changes, the operation of the whole process unit shall be adjusted accordingly. The general principle is to find out if the crude

becomes relatively light or heavy after the change, and then make proper adjustments on a specific case basis. If the properties of the crude change, it is necessary to contact the lab to obtain crude brief data, crude salt content and water content data to clearly understand the theoretical light end yields and the theoretical total lift before and after the change, and then make proper adjustments. If the crude mixing ratio changes, it is required to calculate the theoretical light end yields and the theoretical total lift before and after the change based on crude mixing ratio, and then make proper adjustments.

当原油性质发生变化或原油混炼比例发生变化时，整个常减压装置的操作都应作出相应的调整，总的原则是弄清变化后原油性质是相对变轻，还是变重，然后根据实际情况采取相应的调整措施。如果是原油单炼性质发生变化，则要联系分析化验索取原油简评数据、原油含盐、含水数据，弄清变化前后原油理论轻收和理论总拔数据，根据变化前后原油的轻重情况，装置各部分再做相应调整；如果是原油混炼比例发生变化，则应根据原油混炼比例计算出变化前后的原油理论轻收和理论总拔数据，判断原油混炼比例变化后轻重情况，装置各部分再做相应调整。

(2) Desalters

电脱盐

When the properties of the crude change or the crude mixing ratio changes, the desalter operation shall be adjusted accordingly. The desalter operation shall be adjusted in time, and the adjustments include desalter temperature, water injection flowrate, demulsifier dosage and voltage. In general, the lighter the crude is, the lower the desalting temperature will be; the heavier the crude is, the higher the desalting temperature will be. The light and heavy changes of crude will also cause changes in the desalting temperature. When the crude becomes lighter, the desalting temperature will increase, and vice versa. The adjustment method: if the temperature is too high, the bypass of the heat exchanger before the desalter can be appropriately adjusted to control the desalting temperature within the specified range; if the temperature is too low, the bypass of the heat exchanger after the desalter can be appropriately adjusted to make the heat move forward to the process flow before the desalter to ensure correct desalting temperature. If the water content in the crude increases, water injection flowrate shall be appropriately reduced to properly control the desalter interface to prevent ultra high current or interface fluctuation.

原油混炼比例或原油性质变化后，电脱盐操作应做相应的变化，要及时对电脱盐操作进行调整，调整包括电脱盐温度、注水量、破乳剂量、电压等。一般而言，原油越轻，电脱盐温度要求相对较低；原油越重，电脱盐温度要求相对较高。原油轻重变化也会引起原油进电脱盐温度的变化，原油变轻时原油进电脱盐温度会升高，反之则降低。调节方法是如果温度过高，则可适当调节脱前换热器的副线，控制电脱盐温度在指标内；如果温度过低，可适当调节一些脱后原油换热器的副线，使热量前移到脱前，以保证脱盐温度。原油含水量增大，应该适当降低注水量，控制好电脱盐界位，防止电流超高或界位波动。

If the salt content in the desalted crude fails to meet the requirements, it is required to properly adjust demulsifier dosage, DP across the mixing valve, the water injection flowrate and the desalter voltage based on the desalter current and voltage changes, the separation of crude

and water, and the salt analysis data to ensure the salt content in the desalted crude acceptable. 根据电脱盐的电流、电压变化情况、油水分离情况以及脱后原油含盐分析数据, 如果脱后含盐不合格, 就需要对破乳剂的注入量、混合阀差压、注水量、电脱盐电压等进行调节, 以确保脱后含盐合格。

(3) Pre-dist column

初馏塔

Consult the crude brief data before and after the crude change. If the crude becomes lighter, the Pre-dist column top pressure rises, the amount of Pre-Disti. OVHD non-condensable increases, the Pre-Disti. OVHD cooling load increases, the cooled OVHD stream temperature rises, the Pre-dist column level decreases, and the Pre-Disti. OVHD distillate increases. As the crude becomes lighter and the partial pressure of oil vapor rises, the column top temperature shall be appropriately increased. In case of rapid rise of column top temperature, the Pre-Disti. OVHD distillate will greatly increase, and the Pre-Disti. OVHD oil dry point will be off-spec. As a result, the Atm. OVHD load will be insufficient and the operation of Atm. will fluctuate. In this case, it is required to put the two Pre-Disti. OVHD pumps into operation to increase the Pre-Disti. OVHD air cooling load so as to lower the temperature of the cooled Pre-Disti. OVHD oil vapor, properly control the Pre-Disti. top temperature and pressure, and the Pre-Disti. OVHD distillate. At the same time, it is necessary to control the Pre-Disti. bottoms level and adjust the feed flowrate to the Pre-Disti. column to ensure the proper Pre-Disti. bottoms level. Normally if the crude becomes lighter, the Pre-Disti. column bottoms level should not be control by adjusting the feed flowrate to the Atm. so as to prevent the heater outlet temperature change, resulting in operation fluctuation of the Atm. and off-spec quality of Atm. products. If the crude changes too much, contact the Operation Scheduling Department to turn down the operation of the process unit.

根据加工原油变化前后的原油简评数据, 如果原油变轻, 初馏塔顶压上升, 塔顶不凝气增加, 塔顶冷却负荷增加, 冷后温度上升, 初馏塔液面下降, 初顶油馏出量增加。由于原油变轻, 油气分压上升, 应适当提高塔顶温度。如果初顶温度上升过快, 导致初顶油馏出量大量增加, 造成初顶油干点不合格, 导致常压塔顶部负荷不足, 造成常压塔的操作波动, 应及时将初顶油双泵运行, 增加初顶空冷, 以降低初顶油气的冷后温度, 控制初馏塔顶温、压力和初顶油的馏出量。同时要注意控制好塔底液位, 调整初馏塔进料量, 保证塔底液位正常, 一般情况下, 原油变轻不宜用常压炉进料量来调整, 以防止炉出口温度改变造成常压操作波动, 影响常压产品质量。如果原油变化太剧烈, 可联系计划调度部降量处理。

If the crude becomes heavier, the Pre-Disti. top temperature will decrease, the cooled Pre-Disti.OVHD stream temperature will decrease, the Pre-Disti. column bottoms level will rise, the Pre-Disti. OVHD oil output will decrease. In this case, the Pre-Disti. column top temperature shall be appropriately lowered. If the Pre-Disti.OVHD oil dry point rises, it is required to lower the Pre-Disti. column top temperature in time.

如果原油变重, 初馏塔塔顶温度下降, 冷后温度下降, 初馏塔塔底液位上升, 初顶油产量降低, 由于原油变重, 油气分压下降, 应适当降低塔顶温度。若干点上升, 应及时降低顶温, 以降低初顶油干点。

(4) Atm. heater

常压炉

The Atm. heater outlet temperature shall be adjusted in time according to the changes of feed flowrate and feed temperature. If necessary, the field operators shall fire more burners or stop some burners to properly control the heater outlet temperature and the fire box temperature. Additionally, the oxygen content and negative pressure in the fire boxes shall be properly controlled within the specified ranges.

常压炉出口温度要根据进料量和进料温度的变化及时进行调整，必要时安排外操在现场对火嘴进行增点或灭火，以控制炉出口温度正常和炉膛温度正常，同时注意控制好炉膛氧含量和炉膛负压在指标范围内。

(5) Atm.

常压塔

The operation of the Atm. shall be adjusted based on the crude brief analysis data before and after the crude change. If the crude becomes lighter, it may cause the Atm. top pressure rise. In this case, the operation load of the cooler for each pumparound may be increase, and the column OVHD reflux may be increased if necessary. Additionally, the column OVHD air coolers may be started or CCW flowrate to water coolers may be increased. Each distillate draw flowrate shall be properly increased based on the sidestream product requirements and their theoretical yields to maximize each sidestream yield, provided that the sidestream product quality can be ensured.

常压塔应根据原油变化前后的原油简评数据进行调整，如果是原油变轻，可能造成常顶压力升高，此时可适当提高常压各中段回流的取热量，必要时可加大塔顶回流量，同时根据压力升高情况将塔顶空冷开启或提高水冷器循环水量。侧线产品要根据产品质量要求和各产品的理论收率适当提高各侧线产品抽出量，在产品质量合格的前提下，最大限度的提高各侧线产品的收率。

If the crude becomes heavier, it may cause Atm. top pressure drop. In this case, the operation load of the cooler for each pumparound may be appropriately reduced, the column OVHD air coolers may be shut down or CCW flowrate to water coolers may be decreased on a specific case basis. Each distillate draw flowrate shall be properly reduced based on the product quality requirements and the theoretical yield of each product. In this case, closely monitor the changes of the heavy diesel draw temperature and quality to avoid the too high lift of heavy diesel due to improper adjustment of each distillate draw flowrate. At the same time, properly control the Atm. bottoms level to avoid rapid level rise.

如果是原油变重，可能造成常顶压力降低。可适当降低常压塔各中段回流的取热量，同时根据压力情况将塔顶空冷部分停用或降低水冷器循环水量。应根据产品质量的要求和各产品的理论收率适当降低各侧线产品的外放，此时应重点注意常三线油品抽出温度和质量的变化，防止各侧线抽出调节不到位而导致常三线拔得过重。同时控制塔底液位，防止液位上升过快。

Steam injection to the bottom of the Atm. shall be also properly adjusted based on the crude change. If the crude becomes lighter and the Atm. OVHD pressure is higher, properly reduce the steam flowrate to the Atm.; otherwise, properly increase the steam flowrate to the Atm..

常压塔底吹汽也应根据原油轻重的变化情况进行相应的调整。如果原油变轻，塔顶压力较高，则应适当降低塔底吹汽量；反之可适当提高塔底吹汽量。

(5) Vac. heater

减压炉

The Vac. heater outlet temperature shall be adjusted in time according to the changes of feed flowrate and feed temperature. If necessary, the field operators shall adjust the burners to properly control the heater outlet temperature and the fire box temperature. Additionally, the oxygen content and negative pressure in the fire boxes shall be properly controlled within the specified ranges. Closely monitor the change of feed flowrate to the Vac. heater. If the feed flowrate is low, properly reduce the Atm. lift to prevent the heater tube from coking due to the low flowrate.

减压炉出口温度要根据进料量和进料温度的变化及时进行调整，必要时安排外操在现场对火嘴调节，以控制炉出口温度和炉膛温度正常，同时注意控制好炉膛氧含量和炉膛负压在指标范围内。注意减压炉进料量的变化，如果进料量偏低，可降低常压塔的拔出率，防止炉管因流速过低而结焦。

(6) Vac. column

减压塔

Each pumparound reflux shall be properly adjusted for the Vac. column to ensure the product quality and total lift. When the crude becomes heavier, the operation load of the Vac. column will increase. Each pumparound reflux and distillate draw flowrate shall be increase to properly control the column top temperature. If the level of the sidedraw collecting tank is high, some low-temperature VGO can be exported. When the crude becomes lighter, the operation load of the Vac. column will be reduced accordingly. Each pumparound reflux shall be properly reduced and each distillate reflux shall be properly controlled to avoid packing coking due to too low flowrate. At the same time, it is necessary to contact the downstream process units in advance to avoid abnormal operation of the downstream process units due to flowrate decrement, and the Vac. residue level shall be properly controlled.

减压塔要根据进料量适当调整各中段回流量，来保证产品质量和总拔出率。当原油性质变重时，减压塔负荷增加，应适当提高减压中段回流和减压侧线的抽出量，控制好减顶温度，如减压塔侧线液面过高，可适当将部分蜡油改冷蜡外甩。当原油性质变轻时，减压塔负荷会相应降低，应适当降低各中段回流量，注意控制好减压内回流量，防止流量过低造成填料结焦。同时要联系好下游装置，防止流量降低而影响该装置的正常操作，塔底液位要根据液位变化情况进行调节，保证控制正常。

(7) Heat exchangers

换热器

When the properties of the crude change, the product yield will change, causing changes in temperature or pressure of the heat exchanger. For large-size heat exchangers, especially plate heat exchangers, special attention shall be paid to changes in temperature and pressure. If the fluctuation is too large, it is easy to cause a leak. Strengthen the inspections during process

adjustment. If issues are identified, contact the involved departments immediately to prevent leakage and fire accidents. At the same time, adjustment shall be made slowly to avoid leakage due to excessive adjustment.

当油品性质改变时，产品收率则进行变化，造成换热器温度或压力变化，对大型换热器特别是板式换热器，要特别注意温度和压力的变化。如果波动过大，容易造成泄漏。装置操作进行调整时要加强巡检，发现问题立即联系进行处理，防止泄漏和火灾事故的发生，同时注意调整操作一定要缓慢，波动幅度不可过大，避免因调节幅度过大造成泄漏着火。

In short, when the properties of the crude change, the operation must be adjusted based on the properties of the crude, but the adjustment shall be made slowly to prevent the operation fluctuation due to excessive adjustment, resulting in an accident. In addition, when the operation exceeds the operational flexibility of the equipment or process, it is necessary to contact the Operation Scheduling Department in time to reduce the crude feed flowrate or switch the crude to ensure normal operation and product quality.

总之，在油品性质变化时，一定要根据油品性质变化对操作进行调节，但是要调节幅度要缓慢，防止幅度过大引起操作波动，造成事故的发生。另外，当操作超过设备或工艺的操作弹性时，要及时联系计划调度部，对原油进行降量或切换原油，以保证操作正常和产品质量合格。

2.4.1.4 Principles for adjusting the operation of Atm. 常压塔工艺调整原则

Atm. is a piece of core equipment in the Atmospheric and Vacuum Distillation Unit, its proper operation is largely involved with product quality, and also plays an import function for stabilizing the operation of process unit. Additionally, the fluctuation in other process units will also impose impact on stable operation of the Atm.. In order to enable the Atm. in stable operation and ensure the product quality, it is required to:

常压塔的操作是常减压蒸馏装置最核心的操作环节，掌握着主要产品的质量控制，对全装置的平稳操作起着重要作用，同时其它单元的波动都会影响着常压塔的平稳操作。要使常压塔操作平稳、质量合格，必须做到：

(1) Stabilize the feed flowrate and feed properties. When the feed changes, adjust the pumparound reflux and distillate draw flowrate in time.

稳定进料量和进料性质。当进料发生变化时，及时调整中段回流量和侧线抽出量。

(2) Stabilizer the column OVHD temperature When the column OVHD temperature changes, the column distillate temperature will suffer a magnifying effect, which may easily lead to off-spec products.

稳定塔顶温度。当塔顶温度发生变化时，侧线抽出温度会呈现放大效果，很容易造成产品不合格。

(3) Stabilizer the column OVHD pressure When the column OVHD pressure changes, the volatility of each component will change, as a result, the product properties will be changed. It is required to properly adjust each distillate temperature to ensure product quality.

稳定塔顶压力。当塔顶压力发生变化时，各组分的挥发度发生变化，改变了产品性质，要调整各侧线的抽出温度，以保证产品质量。

(4) Stabilize the column bottoms level and stabilize steam injection flowrate to the column

稳定塔底液位，稳定塔底吹汽量。

(5) Stabilize each reflux temperature and flowrate, and maintain a good heat balance.

稳定各回流温度和流量，保持好热量的平衡。

(6) The principle for adjusting the pumparound reflux: appropriately increase HT and MT pumparound reflux flowrate to stabilize the column OVHD reflux flowrate. Appropriate pumparound reflux flowrate is judged by on-spec product quality, light oil yield, stable OVHD temperature and flexible adjustment.

中段回流调整原则是适当增加高、中温位的中段回流量稳定塔顶回流量。中段回流量是否恰当以产品质量合格、轻油收率高、塔顶温度稳定且调节灵敏为原则。

2.4.1.5 Principle of controlling the quality of Atm. distillates 常压塔侧线产品质量调整原则

(1) Atm. OVHD oil dry point

常顶油干点

Atm. OVHD oil dry point is determined based on the requirements of the feedstocks to the downstream process units. The dry point is mainly affected by factors such as the column OVHD temperature and pressure, the feed temperature, pumparound reflux flowrate and temperature, the distillate draw flowrate and the flowrate of steam injected into the column.

常顶油干点的指标是根据后续装置对原料的要求而制定的。干点主要受塔顶温度、压力、进料温度、中段回流的流量和抽出返塔温度的变化、侧线抽出量的大小及塔底吹汽量大小等因素的影响。

1) The column top temperature is the main means for adjusting atm. OVHD oil dry point. And column top temperature is controlled by adjusting the column OVHD reflux flowrate and pumparound reflux flowrate.

塔顶温度是调节常顶油干点的主要手段。塔顶温度是通过调节顶回流量和中段回流来控制。

2) When the column top pressure is decreased, vaporization rate of the feed increases, and naphtha dry point will increase, it is required to reduce the column top temperature. However, when the pressure does not change much (fluctuation value is $\geq 0.01\text{MPa}$), the influence of pressure on naphtha dry point can be ignored.

塔顶压力降低时，进料汽化率升高，石脑油干点会升高，应降低塔顶温度。但当压力变化不大时（波动值 $\geq 0.01\text{MPa}$ ），可忽略压力对石脑油干点的影响。

3) The feed becomes lighter, and naphtha dry point decreases. At this point, it is required to increase the column OVHD temperature.

进料性质变轻，石脑油干点下降，应提高顶温。

4) When the column OVHD temperature is increased, vaporization rate of the feed also increases, and naphtha dry point will increase. At this point, it is required to reduce the column OVHD temperature.

进料温度升高，同样汽化率升高，石脑油干点会升高，这时应降低塔顶温度。

5) Reduced pumparound reflux will cause the central heat to move up and naphtha dry point will rise. At this point, it is required to reduce the column OVHD temperature.

中段回流量的减小会使中部热量上移，石脑油干点升高，这时应降低塔顶温度。

6) If the flowrate of steam injected into the bottom of the column is increased, the heavy components will be carried upwards, and the dry point will be raised. At this point, it is required to properly reduce the steam injection flowrate or reduce the column OVHD temperature.

塔底汽提蒸汽量增加，会使重组分被携带上去，干点就会升高，可适当降低塔底汽提蒸汽量或降低塔顶温度。

(2) Sidedraw flash point

侧线闪点

Flash point is a safety indicator. The flash point is related to the light component content. The low flash point indicates that the volatile light component in the distillate has a high content, which means that the initial boiling point and 10%-point temperature in the distillation range are also low.

闪点是油品安全性的指标。闪点的高低与轻组分的含量有关。闪点低，说明侧线中的易挥发的轻组分含量较多，对应着其馏程中初馏点、10%点温度也偏低。

Generally speaking, the actual flash points of light diesel and heavy diesel are relatively high and can meet the requirements, so it is required to control kerosene flash point.

一般来说，常二线、常三线的闪点实际数值较高，均能达到指标，所以要控制的主要是常一线的闪点。

1) Properly increase the column OVHD temperature to increase the distillate flash point.

适当提高塔顶温度，可以提高侧线闪点。

2) Adjust the kerosene reboiler outlet temperature to increase the flash point.

调整常一线重沸器出口温度，提高闪点。

3) Increase kerosene draw temperature to increase the flash point, but it shall be noted that the dry point is also increase at the same time, so this method must be used provided that the on-spec dry point can be maintained.

提高该侧线馏出温度，也可提高闪点，但要注意的是，干点同时也升高了，因此这种手法必须在保证干点合格的前提下进行。

4) When the column top pressure is reduced, the flash point will increase.

塔顶压力降低，闪点上升。

(3) Distillate dry point

侧线干点

The sidedraw dry point is determined by the heavy component content. The high dry point indicates that the volatile heavy component in the distillate has a high content, which means that 90% point and 95% point or KK temperature in the distillation range are also high.

侧线的干点是由油品中的重组分的含量决定的。干点高，说明侧线中的重组分含量较多，对应着其馏程中 90%点、95%点或 KK 温度也偏高。

The dry point temperature is directly related to its sidedraw draw flowrate. When the sidedraw draw flowrate is increased, the dry point will increase. The sidedraw quality interacts with each other, and the sidedraw dry point can also be increased by increasing the upper sidedraw. If the upper sidedraw (including the atm. OVHD oil) flowrate is increased, the sidedraw will become

heavier. The reflux below this sidedraw tray will be reduced, the temperature inside the column is high, the distillation performance is poor, and the overlap between the distillates is increased, lowering the next distillate flowrate.

干点温度和该侧线的馏出量有直接联系。提高侧线馏出量，干点升高。侧线产品质量之间相互影响，也可通过提高上一侧线的馏出量来提高该侧线干点。如果上一侧线（包括常顶石脑油）馏出量增加，馏分变重，则该侧线抽出板以下的内回流量下降，塔内温度高，分馏效果差，侧线产品之间重叠程度增加，降低了下一侧线的馏出量。

2.4.1.6 Principles for adjustment process operation if atm. sidedraw color is getting dark 常压塔侧线油品颜色变色后的调整原则

During normal operation, equipment damage, too high bottoms level or improper operation may cause dark color of Atm. distillates.

正常生产时，设备损坏、塔底液位过高或操作不当会引起常压塔侧线油品颜色变深。

（1）Internal leakage of heat exchanger

换热器内漏

Internal leakage of heat exchanger will contaminate the oil products. Internal leakage of sidestream heat exchanger will cause abnormal color of this distillate. Internal leakage of the pumparound heat exchanger not only affects this pumparound reflux, but also contaminates the upper and lower distillates.

换热器内漏时，会污染油品。侧线的换热器内漏，会造成该侧线的油色异常。中段回流的换热器内漏，不仅影响该中段回流，还会污染其上下侧线。

Generally speaking, the if the oil color at the sidestream pump outlet is normal, but the oil color at BL is abnormal, it indicates internal leakage of the sidestream heat exchanger. If the oil color at the sidestream pump inlet is abnormal, it is necessary to check if the pumparound heat exchanger experiences internal leakage.

一般而言，侧线泵出口油色正常，界区油色异常，则为侧线换热器内漏。如果侧线泵入口颜色异常，则需要排查中段回流换热器是否内漏。

If the atm. OVHD vapor and atm. top PA heater exchangers experience internal leakage, it may cause dark color of the column OVHD oil. If the abnormal color is identified in time, the color of the lower distillate or pumparounds may be normal. At this point, it is required to immediately shut down the leaked heat exchanger, otherwise, it will cause the color of the entire column products to deteriorate.

当塔顶油气和常顶循换热器发生内漏时，可引起塔顶油颜色变深，如发现及时，下部油品颜色可能正常，应立即停止使用有内漏的换热器，否则会引起整个塔产品颜色变坏。

（2）High column bottoms level

塔底液位高

High column bottoms level may cause dark color of the products. If the column bottoms level is high, the vapor phase will carry heavy component oil, it may cause dark color of the lower distillate such as heavy diesel. Sometimes, if the column bottoms level controller fails, the lower

section of the column will be full with oil, as a result, the color of the column bottoms and upper distillate will be getting darker. At this point, it is required to lower the column bottoms level and calibrate the level gauge.

塔底液位高可引起产品颜色变深。塔底液位高，汽相介质携带重组分油，可造成下部侧线油如常三线油颜色变深。有时塔底液位控制失灵，塔下部装满油，引起自最下部油品颜色向上部侧线油品颜色变深变坏，应该立即采取降低塔底液位措施，并校正仪表液位指示。

(3) Improper operation

操作不当

Improper handling can also cause the color of the distillate to deteriorate. If the flowrate of steam injected into the bottom of the column is too high, it will increase gas phase load and mist entrainment, easily resulting in dark color of the lower sidedraw. At this point, it is required to reduce the steam injection flowrate.

操作不当也会引起侧线油品颜色变坏。常压塔底吹汽量过大，气相负荷高，雾沫夹带增加，容易造成下部侧线油品颜色变深，应该降低塔底吹汽量。

If water is entrained in the steam injected into the column, it will cause a large increment of vapor phase load in the Atm., resulting in column flooding.

塔底吹汽带水，会造成常压塔内气相负荷大幅度增加，造成冲塔事故。

If the sidedraw lift is too high, the color of the sidedraw will also become darker. At this point, it is required to properly adjust the lift per product quality requirements.

侧线油品拔得过重，也会造成侧线油品颜色也会变深，此时应按产品质量调整拔出量。

Over-load operation of the Atm. will also cause the color of the oil products to become darker, resulting in on-spec products. At this point, it is required to properly turn down the operation of the process unit.

分馏塔超负荷操作，也会造成油品颜色变深，导致产品不合格，此时必须适当降低装置处理量。

2.4.1.7 Principles for adjusting the operation of Vac. column 减压塔工艺调整原则

(1) Vacuum

真空度

The key point of operation of the Vac. column is to properly control the top vacuum. The degree of vacuum directly affects the vapor-liquid phase load of the entire column. Assuming that other conditions are unchanged, if the degree of vacuum is lowered, the equilibrium relationship between the partial pressure and the temperature of oil vapor in the column will be broken, the boiling point of the oil products will be increased, the vaporization rate will be lowered, and consequently, the yield will be also lowered.

减压塔控制的关键点就是减顶真空度。真空度的高低直接影响着全塔的汽液相负荷的变化。在其它条件不变的情况下，如果真空度降低，打破了塔内油品的油气分压和温度的平衡关系，油品的沸点会升高，汽化率下降，收率也下降。

The factors influencing the degree of vacuum include:

影响真空度的因素有：

1) Column OVHD oil vapor flowrate

塔顶油气量

If the column OVHD oil vapor flowrate is increased, the operation load of the vacuuming system will be increased, as a result, the degree of vacuum will be lowered. Main contribution factors include:

塔顶油气量的提高, 增加了抽真空系统的负荷, 会降低真空度。影响因素主要有:

①Feedstock properties The higher the Vac. heater outlet temperature is, the greater the degree of cracking of the feed will be and the greater the amount of gas phase hydrocarbons produced will be. If deep lift is required, it is a must to increase Vac. heater temperature, a large amount of cracked gas may be generated. If the distillation performance of the Atm. is not good, the diesel components before 350 °C will not be completely lifted, which will bring a relatively large vapor phase load to the Vac. column. If the feed flowrate is increased, more non-condensable will be generated.

进料的性质。减压炉出口温度越高, 进料的裂解程度越大, 产生的气体烃量越大。若减压深拔, 势必会提高减压炉炉温, 可能产生大量的裂解气。如果常压塔的分馏效果不好, 350°C以前的柴油组分没有拔净, 会给减压塔带来相对大的汽相负荷。进料量增加, 不凝气量也会增加。

②If the Vac. column top temperature is high, the column OVHD vapor phase load will be increased, and much light gas oil will enter the ejectors. Therefore, it is necessary to properly control the Vac. column top temperature. Generally, the column top temperature shall be controlled at approximately 75 °C.

减顶温度高, 塔顶汽相负荷增加, 许多轻蜡油组分会进入抽真空系统。因此要控制好塔顶温度, 一般减顶温度控制在 75°C左右。

③The Vac. residue temperature and residence time of VR also effect the non-condensable. If the Vac. residue temperature is too high, and the vacuum residue are prone to cracking, resulting in non-condensing. The longer the residence time of the vacuum residue is, the longer the cracking time will be. Therefore, the bottom of the Vac. column is reduced in diameter to reduce the residence time of the vacuum residue, and quench oil is used to control the temperature of the vacuum residue ≥ 360 °C.

减压塔底温度以及减渣在塔底的停留时间也会影响不凝气量。塔底温度过高, 减渣容易裂化, 产生不凝气。减渣在塔底的停留时间越长, 裂化时间也越长, 因此减压塔底采用缩径以降低减渣的停留时间, 并用急冷油控制塔底温度 ≥ 360 °C。

④In case of leakage of the Vac. column, the air is sucked into the column, causing oil vapor increment. And the air cannot be condensed, causing the column vacuum to drop. As the Vac. column is operated under negative pressure, it is very difficult to detect small leakage. If the leakage is large, you will hear a sharp whistle. Air leakage into the Vac. column can be judged by analyzing the air content in vac. OVHD gas.

减压塔的泄漏, 空气被吸入塔内, 造成油气量增加, 而且空气不能冷凝, 会导致真空度下降。由于减压塔是负压, 发生小的泄漏很难被发现。如果泄漏较大, 会听到尖锐的哨音。减压塔的泄漏量可以通过分析减顶瓦斯中的空气含量的大小来判断。

2) Steam pressure

蒸汽压力

When the steam pressure drops to a certain level, the kinetic energy of the steam after passing through the nozzle is lowered, and the negative pressure of the mixing chamber of the steam ejector is lowered, resulting in insufficient vacuuming capability. In addition, if the steam pressure is too high, and the condenser is not operated to provide sufficient condensation capacity, the degree of vacuum may be lowered or fluctuated.

当蒸汽压力下降到一定程度时, 蒸汽经过喷嘴后的动能下降, 喷射式抽真空器的混合室的负压会降低, 造成抽真空能力不足。另外, 蒸汽压力过高, 如果冷却器冷凝能力不足, 也会导致真空度下降或产生波动。

3) Cooling capacity of the cooling equipment

冷却设备的冷却能力

The cooling capacity has a very large effect on the degree of vacuum. If the cooled temperature is low, the non-condensable is not sufficient, and the load of the next stage steam ejector will be reduced. There are many factors that affect cooling capacity. If the cooler is fouled, the cooling water pressure is low, CCW flowrate will be reduced, if CCW supply temperature is high, the heat cannot be removed. If the cooler is seriously corroded, the baffle is corroded, the non-condensable is short-circuited, and the heat exchange performance will be poor.

冷却能力对真空度的影响也非常大。冷后温度低, 不凝气量少, 下级抽真空器负荷降低。影响冷却能力的因素有很多方面。冷却器结垢, 冷却水压力低, 循环水会减小, 或冷却水上水温度高, 热量带不出去; 冷却器腐蚀严重, 折流板被腐蚀掉, 不凝气走短路, 换热效果变差。

The abnormal operation of the steam ejector is often caused by insufficient cooling capacity. When the steam ejector is in abnormal operation, the vacuum can be seen to fluctuate back and forth on DCS. When it is severe, it will fluctuate in 6-7 kPa, and the obvious uneven sound can be heard at site. At this point, CCW flowrate may be increased to improve the cooling capacity as a normal solution.

喷射式抽真空器“喘”的不正常状态, 很多时候都是由于冷却能力不足造成的。真空泵喘时, DCS上可以看到真空度来回波动, 剧烈时会波动 6~7kPa, 现场可以听到明显的不均匀的声音。这时可增加循环水流量, 提高冷却效果, 一般可以解决喘的问题。

4) Operation status of the steam ejector

喷射式抽真空器的运行状况

The steam ejector is designed for long time operation. The nozzle is susceptible to abrasion by steam, which affects the vacuuming capability. The inner surface of the nozzle is very finely machined, and if scratches are caused by the salt in the steam, the suction capacity will be reduced.

喷射式抽真空器长时间运行, 喷嘴易受蒸汽的磨损, 影响抽空能力。喷嘴的内表面加工很精细, 如果蒸汽结盐会造成划痕, 抽吸能力减小。

5) Non-condensable downstream process flow

不凝气的后路是否畅通

After pressurization by the vacuum system, the non-condensable outlet of the third stage cooler is slightly larger than atmospheric pressure. If the back pressure of the non-condensable downstream process flow is large, the non-condensable cannot be properly discharged (such as the heater burners are blocked), which will greatly affect the degree of vacuum.

经过抽真空系统的增压，三级冷却器不凝气出口是稍稍大于大气压。不凝气的后路如果背压大，造成不凝气排放不通畅，严重影响真空度，如加热炉火嘴堵。

6) Operation status of Vac. column OVHD KO drum

减顶罐的运行状况

If it is difficult to discharge the oil phase or water phase in the column OVHD KO drum, the level in the drum will be full. As a result, the liquid column in the atmospheric leg will rise, and the condensate in the cooler will not be discharged, which will affect the vacuuming operation.

如果减顶罐的油或水外送困难，造成罐内液位满，会使大气腿里的液柱升高，冷却器里的冷凝液排不下来，影响抽真空。

7) Leakage of Vac. column

减压塔的泄漏。

Air is leaking into the system through the holes due to corrosion of the Vac. column wall or vacuum pump cylinder.

由于设备腐蚀使减压塔壁腐蚀穿孔或真空泵筒体穿孔造成空气漏入系统内。

(2) Column OVHD temperature

塔顶温度

The column top temperature is a sign indicating the heat equilibrium in the Vac. column and also a sign indicating the Vac. column OVHD vapor phase load change. It is affected by the feed temperature, feed flowrate, heat removed from distillate and the stripping steam. Column OVHD temperature is mainly controlled by adjusting the column OVHD reflux, it can be also controlled by adjusting the pumparound reflux.

塔顶温度是减压塔热平衡的表征，也是塔顶汽相负荷变化的表征。它受进料温度、进料量、中段回流的取热量、汽提蒸汽的影响。调整手段主要是通过减顶回流来控制，也可以通过中段回流量进行调整。

(3) Pumparound reflux

中段回流

Like the Atm., the purpose of the pumparound reflux is designed for heat removal. For the packing type Vac. column, the pumparound reflux shall not be increased blindly, as excessive reflux will increase the pressure drop and affect the vacuum. Packing is used to reduce the pressure drop from the feed section to the top of the column. Based on the operation data, it is recommended that the Vac. column pumparound reflux should be such adjusted that vapor phase temperature of the accumulator tray is 50 °C higher than the liquid phase temperature.

同常压塔一样，中段回流的目的是取走热量。对于填料型减压塔，中段回流量不能盲目调大，因

为过大的液相回流会增加压降，影响真空度。使用填料降低进料段到塔顶的压降。据资料推荐，减压塔中段回流量的调整应以控制侧线集油箱的汽相温度比液相温度高 50°C 为宜。

(4) Vac. residue level

减底液位

Due to the reduced diameter at the bottom of the Vac. column, the volume is small and the level varies greatly. Care shall be taken to keep the level stable and reduce fluctuations. As the VR heat exchange process flow is the longest flow and the vacuum residue viscosity is very large, the level fluctuation will cause the fluctuation of the pressure of the heat exchanger, which may easily cause leakage and subsequent fire accident.

由于减压塔底缩径，容积较小，液位变化很大。操作中要注意尽量保持液位的稳定，减少波动。因为减渣换热流程最长，且粘度很大，液位的波动会造成换热器压力的变化，容易发生泄漏着火事故。

2.4.1.8 Principles for improving the total lift of the process unit 提高装置总拔出率的工艺调整原则

Light oil yield and total lift are the important signs indicating the technical and operation levels of the process unit, and they are related to the properties of the crude, equipment configuration, product mix, technical level and operation level.

装置轻收和总拔是装置技术、操作水平的重要标志，它的高低跟加工原油性质、装置配置、产品结构、设备技术水平及操作水平等因素有关。

Light oil yield refers to the content of fractions before heavy diesel and above when processing various crudes, and the total lift refers to the content of fractions before heavy gas oil and above when processing various crudes.

轻收是指装置所加工的各类原油的重柴油及以前馏分的含量；总拔是指装置所加工的各类原油的重蜡油及以前馏分的含量。

From the operational point of view, the following aspects shall be highlighted to improve the lift of the process unit:

从操作方面看，提高装置拔出率主要应从以下几个方面下功夫：

(1) Optimize product mix

优化产品结构

Different atmospheric and vacuum distillation units have different process equipment configuration, and have specific operation plan and product mix. The operation plan and product mix are optimized to improve the product yields. It shall not be only limited to the product mix defined in BED, but make effort to optimize the product mix. It is necessary to screen appropriate operation plan based on the process and equipment features of the process unit, and it shall not blindly copy operation experiences from other process units.

不同的常减压蒸馏装置的工艺设备状况不同，都有适合于本装置的生产方案和产品结构。生产方案优化，产品结构合理，产品收率高。不能局限于基础设计所定产品结构，要不断摸索和总结，

优化产品的结构。要根据装置工艺和设备特点进行筛选适宜的加工方案，不可盲目照搬别人经验。

(2) Properly determine the pumaround reflux

合理分配中段回流

It is required to properly determine the pumaround reflux for the purpose balancing the vapor-liquid phase load in the column and improve the distillation accuracy. The principle for adjusting the reflux is to increase the high-high temperature reflux flowrate ratio and make the vapor-liquid phase load distribution in the column uniform, which is beneficial to improve the processing capacity, distillation precision and light oil yield of the whole column.

合理分配中段回流量就是为了平衡塔内汽液相负荷和提高塔分馏精度。调整回流的原则，一是要提高高温位的回流取热比，二是要使塔内汽液相负荷分布均匀，这样有利于提高全塔的处理能力、分馏精度和轻油收率。

During normal operation, high-high temperature pumaround reflux flowrate shall be properly increased on a premise that the on-spec quality of the column OVHD product and distillates is maintained. If the column OVHD temperature can be stably controlled and maintained, it can be considered that ratio of the column pumaround reflux flowrate to the column OVHD reflux flowrate is appropriate.

在生产过程中，原则上应适当增大高温位中段回流流量，具体增大多少，要以塔顶产品和侧线产品质量合格为前提，调节塔顶温度灵敏而又稳定，可认为中段回流取热与塔顶回流取热比例合适。

(3) Properly adjust the flowrate of steam injected into the column to improve the stripping performance

调整塔底吹汽，提高提馏效果

The flowrate of steam injected into the column shall be determined based on the actual operation conditions: if the steam injection flowrate is too small, stripping performance will be poor, and if the steam injection flowrate is too large, energy consumption will be increased.

塔底吹汽量的大小应根据实际操作情况而定：过小，起不到提馏效果，过大则增加装置能耗。

The following methods can be used to judge if the flowrate of steam injected into the column is appropriate:

观察分析常压塔底吹汽量是否合适主要看如下几个方面：

①If the difference between the Atm. feed temperature and the column bottoms temperature is below 5 °C, it indicates that the stripping performance is poor, it is required to increase the steam injection flowrate.

根据常压塔的进料温度和塔底温度差来判断，如果温差在 5°C以下，说明提馏效果差，应开大塔底吹汽量。

②If the Atm. last sidedeaw flowrate is small (calculated based on the crude assessment data) while the Vac. column upper distillate flowrate is large, it can be judged that the steam injection flowrate is small.

如果常压塔最后一个侧线量少（根据原油评价数据计算），而减压塔上部侧线馏出量较多，则可以判断塔底吹汽过小。

③If the vacuum degree of the feed section of the Vac. column is lowered, the heater temperature

is increased (diesel vaporization) under the same conditions as before, and it is also possible that the steam injection flowrate is small.

如果减压塔进料段真空度下降，减压炉比以往相同条件下炉膛温度升高（柴油汽化），也有可能是常压塔底吹汽量小。

④If the atmospheric residue distillation data indicates that the fraction before 350 °C is more than 5%, it is possible that the steam injection flowrate is small.

根据常渣馏程数据，350°C以前馏分大于 5%，可能是常底吹汽量小。

2.4.1.9 Principles for improving the thermal efficiency of the heaters 提高加热炉热效率的工艺调整原则

The thermal efficiency of the heater is related to the flue gas exhaust temperature, the excess air coefficient, the heat dissipation of the heater body and the complete combustion of the fuel. If the flue gas exhaust temperature is lowered by every 17 ° C - 20 ° C, the heater thermal efficiency will be increased by approximately 1%. It is critical to properly operate the air preheating system and reduce the flue gas exhaust temperature to improve the thermal efficiency of the heater. The excess air coefficient is also an important factor affecting the thermal efficiency of the heater. The higher the flue gas exhaust temperature is, the greater the impact will be. The heat dissipation of the heater body accounts for approximately 2% to 4% of the total heat generation by the fuel.

加热炉热效率与排烟温度、过剩空气系数、炉体散热及燃料完全燃烧程度有关。排烟温度每降低 17°C~20°C，则炉效率约提高 1 个百分点。开好空气预热系统，降低排烟温度是提高加热炉热效率的有效措施。过剩空气系数也是影响加热炉热效率的重要因素，排烟温度愈高，其影响也就愈大。炉体散热量约占燃料总发热量的 2%~4%。

（1）Reduce flue gas exhaust temperature

降低排烟温度

1) Under the premise of preventing dew point corrosion, the flue gas exhaust temperature shall be lowered as much as possible.

在保证露点腐蚀的前提下，尽量降低排烟温度。

2) Regularly organize maintenance for the air preheater, clean the scale, and replace the failed components (plates, tubing, etc.).

定期组织空气预热器检修，清洗结垢，更换失效的组件（板片、热管等）。

3) Ensure uniform heater temperature and prevent local overheating and heater tube coking. If the heater tubing is coked, the heat transfer capacity will be reduced, and the heater temperature and the flue gas exhaust temperature will increase accordingly.

精心操作，确保炉膛温度均匀，防止局部过热和炉管结焦。若炉管结焦则传热能力降低，炉膛温度和排烟温度都将随之而升高。

（2）Reduce the excess air coefficient of the heaters

降低加热炉过剩空气系数

1) Properly adjust the baffles and dampers to control the oxygen content in the heater.

调节好“三门一板”，控制好炉膛氧含量。

2) Proper control of the negative pressure in the fire box is an effective means to reduce the leakage of the heater. The negative pressure in the fire box shall be controlled at -50 ~ -20Pa.

控制炉膛负压是降低炉体漏风的有效手段，炉膛负压尽量控制在-50~-20Pa。

3) Conduct routine maintenance for the heater, regularly check and eliminate any leakage at the convection chamber elbow box and air preheater. Block all air leakage points of the heater (such as burners out of service, fire holes, manholes, etc.).

做好加热炉的日常维护，定期排查与整治对流室弯头箱、空气预热器等是否泄漏。堵封加热炉所有漏风点（如停用的火嘴、看火孔、人孔等）等。

(3) Reduce the heat loss of fire box

减少炉壁散热损失

1) Properly control the temperature in the fire box to prevent overheating and burn-through of the heater wall so as to avoid temperature rise of the heater wall and increment of heat loss.

控制炉膛温度，不得超温，以免烧坏炉墙，导致炉壁温度升高，散热损失增大；

2) Conduct maintenance for the heater and strengthen maintenance for lining.

搞好炉子的检修，加强衬里等维护工作。

(4) Properly operate the heater to ensure complete combustion of fuel.

搞好加热炉操作，确保燃料燃烧完全

1) Multiple burners in service, short flames, and no flame impingement to tubes are the standard to judge if the heater is good operation.

多火嘴，短火焰，齐火苗，火焰不扑炉管是衡量加热炉燃烧好坏的重要标准。

2) Control the heater outlet temperature based on the process requirements, frequently perform inspections, investigate the causes and stabilize the operation.

严格按照工艺指标控制炉出口温度，勤检查，细分析，稳调节。

3) Adjust the number of burners and valve opening based on the operation load of the heater. According to the heater load, adjust the number of burners and valve opening in time.

4) Maintain the heater at proper negative pressure, and ensure the flames are in normal shape. The fire box shall maintain proper negative pressure, and the flames shall be clear and bright.

5) The flame is unable and quickly swings, and the flame is dark red, it is necessary to further open the flue gas duct baffle or damper. If the flame is too long, it is required to properly increase the damper or further close the flue gas duct baffle.

火焰无力摆来摆去，颜色暗红时，需增大烟道挡板或风门，若火焰过长，可适当增大风门或关小烟道挡板。

2.4.1.10 Quality control 质量控制

(1) Pre-Dist. OVHD oil dry point

初顶石脑油干点

Naphtha from this process unit is mainly used as the feedstock to CCR Unit. The dry point is a

main quality control indicator for the Pre-Dist. OVHD oil. If the dry point is high, the influence on CCR Unit will be large, and if the dry point is low, the Atm. OVHD load will be increased. Proper adjustment of the pre-distillation column top temperature and pressure is critical to control Pre-Dist. OVHD oil dry point. Normally, if the column top temperature is high and the pressure is low, it will easily result in higher Pre-Dist. OVHD oil dry point; otherwise, the dry point will be low.

本装置石脑油主要用作重整原料。干点是初顶石脑油的主要质量控制指标，干点控制高，对重整影响大，干点低，则增加常压塔顶的负荷。控制初顶石脑油干点的关键是控制好初馏塔顶温度和压力，一般塔顶温度高、压力低，易造成初顶石脑油干点高；反之，干点降低。

Control range: $\leq 175^{\circ}\text{C}$

控制范围： $\leq 175^{\circ}\text{C}$ 。

Control target: per the specified indicators

控制目标：指令指标

Related parameters: column top temperature TIC21001, column top pressure PI21001, Pre-Dist. OVHD reflux temperature TI21005, feed temperature TI21006, column Pre-Dist. OVHD product drum pressure PIC23101 and crude properties.

相关参数：塔顶温度 TIC21001、塔顶压力 PI21001、初顶回流温度 TI21005、进料温度 TI21006、初顶产品罐压力 PIC23101、原油性质等。

Control mode: the column top temperature TIC21001 is mainly controlled manually or automatically by the Pre-Dist. OVHD reflux FIC21001, or by the column top temperature TIC21001 to the Pre-Dist. OVHD reflux FIC21001 cascade control. The column top pressure is controlled by adjusting the first stage cooler after temperature TIC2201 and the product drum top pressure PIC23101.

控制方式：塔顶温度 TIC21001 的调节主要由初顶回流量 FIC21001 手动或自动调节，也可由塔顶温度 TIC21001 与初顶回流量 FIC21001 串级控制。塔顶压力则通过调节一级冷后温度 TIC2201 和产品罐罐顶压力 PIC23101 进行控制。

Adjustment method: lower the column top temperature, the column OVHD naphtha dry point will be reduced, and vice versa. Lower the column top pressure, the column OVHD naphtha dry point will be increased, and vice versa. If the temperature of the feed into the pre-distillation column rises, the column top temperature will rise, and naphtha dry point will rise. It is necessary to increase the reflux flowrate to lower the column OVHD temperature.

调节方法：降低塔顶温度，初顶石脑油干点降低，反之，干点升高。降低塔顶压力，初顶石脑油干点升高，反之，干点降低。初馏塔进料温度上升，塔顶温度上升，石脑油干点上升，需要增加回流量，降低塔顶温度。

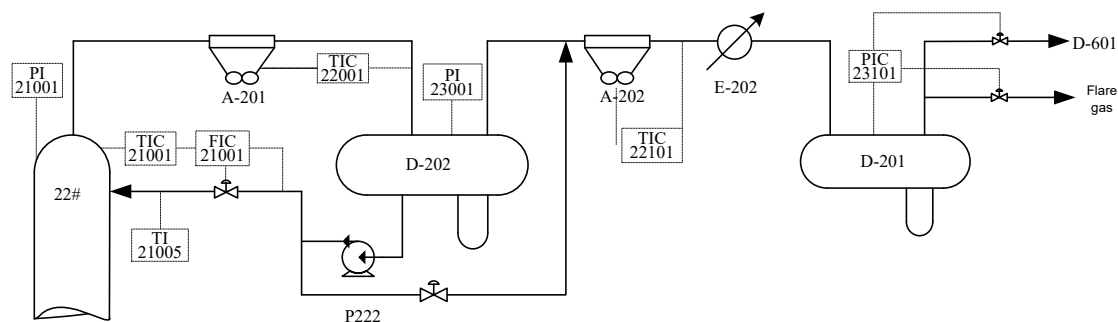


Figure 37 Pre-distillation Column OVHD Process Flow Chart

图 37 初馏塔顶流程图

Table 34 Causes and treatment for abnormal phenomena

表 34 异常现象原因及处理

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
Pre-Dist. OVHD oil dry point is high 初顶石脑油干 点偏高	The column top temperature rises suddenly. 塔顶温度突然升高	1、Increase the column OVHD reflux flowrate to decrease the column top temperature. 2、If the column OVHD temperature rise is caused by shutdown of the column OVHD air coolers, start up the standby air coolers to reduce the column OVHD temperature. 1、提高塔顶回流量，降低塔顶温度； 2、如果是初顶空冷停运造成冷后温度上升，则增开备用空冷降低冷后温度。
	The column top pressure drops. 塔顶压力降低	Increase the column top pressure. 提高塔顶压力
	The crude becomes lighter. 原油性质变轻	Increase the column OVHD reflux flowrate to decrease the column top temperature. 增加塔顶回流量，降低塔顶温度
	Water is entrained in the crude. 原油带水	Switch the column top temperature controller to "Manual" mode to manually control the column top temperature, and take actions per the water entrainment treatment procedures. 将塔顶温度控制改为手动，控制塔顶温度，其它参照原油带水处理。

Table 34(continued) Causes and treatment for abnormal phenomena**表 34（续） 异常现象原因及处理**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
Pre-Dist. OVHD oil dry point is low 初顶石脑油干点偏低	The column top temperature is low. 塔顶温度控制低	1、 Reduce the column OVHD reflux flowrate to increase the column top temperature. 2 、 Reflux temperature is low. Increase the reflux temperature, reduce A-201 frequency, or shut down some fans. 1、降低塔顶回流量，提高塔顶温度； 2、回流温度低。提高回流温度，降低 A-201 变频，或停运部分风机。
	The crude becomes heavier. 原油变重	Reduce the column OVHD reflux flowrate to increase the column top temperature. 降低塔顶回流量，提高塔顶温度
	The feedstock temperature drops. 进料温度降低	Increase the feedstock temperature by adjusting the heat exchange temperature. If the feedstock temperature cannot be adjusted, reduce the reflux flowrate or increase the reflux temperature. 通过调整换热温度，提高进料温度。如无法调节进料温度，则降低回流量，或者提高回流温度

（2）Atm. OVHD oil dry point

常压塔塔顶石脑油干点

Naphtha from this process unit is mainly used as the feedstock to CCR Unit. The dry point is a main quality control indicator for the Atm. OVHD oil. If the dry point is high, the influence on CCR Unit will be large, and if the dry point is low, some naphtha will enter kerosene to lower the naphtha yield. Proper adjustment of the Atm. top temperature and pressure is critical to control the Atm. OVHD oil dry point. Normally, if the column top temperature is high and the pressure is low, it will easily result in higher Atm. OVHD oil a dry point; otherwise, the dry point will be low.

本装置石脑油主要用作重整原料。干点是常顶石脑油的主要质量控制指标，干点控制高，对重整影响大，干点低，则石脑油组分部分进入常一线，降低了石脑油的收率。控制常顶石脑油干点的关键是控制好常顶温度和压力，一般塔顶温度高、压力低，易造成常顶石脑油干点高；反之，干点降低。

Control range: $\leq 175^{\circ}\text{C}$

控制范围： $\leq 175^{\circ}\text{C}$ 。

Control target: per the specified indicators

控制目标：指令指标

Related parameters: column top temperature TIC31007, column top pressure PI31001, column

OVHD reflux temperature TI31008, atm. top PA flowrate FIC31002 and temperature TIC31001 and feed temperature TI31013.

相关参数：常顶温度 TIC31007、常顶压力 PI31001、常顶回流温度 TI31008、常顶循环流量 FIC31002、常顶循环回流温度 TIC31001、进料温度 TI31013

Control mode: the column top temperature TIC31007 is mainly controlled manually or automatically by the column OVHD reflux FIC31001 or the atm. top PA FIC31002, or by the column top temperature TIC31007 to the column OVHD reflux FIC31005 cascade control.

控制方式：塔顶温度 TIC31007 的调节主要由常顶回流量 FIC31001 调节，或由常顶循控制阀 FIC31002 调节常顶循流量，也可由塔顶温度 TIC31007 与常顶回流量 FIC31005 串级控制。

Adjustment method: if the atm. OVHD oil dry point is lower, reduce the column OVHD reflux flowrate and the column top pressure or increase the reflux temperature, or reduce the atm. top PA flowrate and increase the atm. top PA temperature. If the atm. OVHD oil dry point is high, increase the column OVHD reflux flowrate and the column top pressure or lower the reflux temperature, or increase the atm. top PA flowrate or reduce the atm. top PA temperature.

调节方法：常顶石脑油干点低，降低常顶回流量、降低塔顶压力，或提高回流温度，也可以降低常顶循回流量和提高常顶循回流温度。常顶石脑油干点高，增加常顶回流量、提高常顶压力，或降低常顶回流温度，也可以增加常顶循流量，或者降低常顶循回流温度。

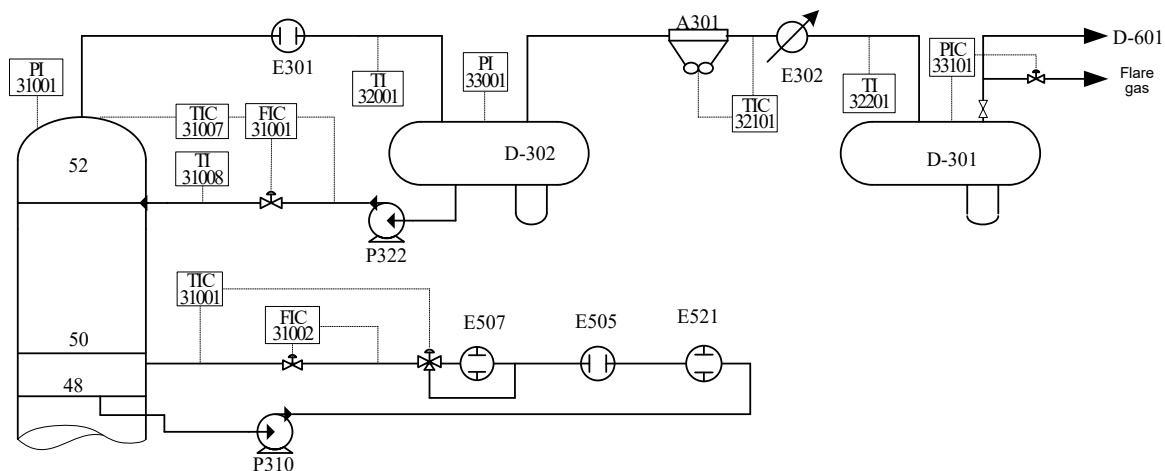


Figure 38 Atm. OVHD Reflux and Atm. Top PA Process Flow Chart

图 38 常压塔顶及常顶循流程图

Table 35 Causes and treatment for abnormal phenomena**表 35 异常现象原因及处理**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The atm. OVHD oil dry point is high 常顶石脑油干点偏高，不合格	The column top temperature rises suddenly. 塔顶温度突然升高	1、Increase the column OVHD reflux flowrate to decrease the column top temperature. 2、The reflux pump fails. Replace the failed reflux pump. 3、The atm. OVHD reflux or atm. top PA control valve fails, cut out of the failed control valve, and manually control. 4、The reflux flowmeter fails Contact the instrument discipline for troubleshooting. 5、The atm. top PA is interrupted. Switch to the standby pump. 6、The atm. OVHD reflux temperature increases due to temperature rise of crude heat exchanger E-301 rises. Adjust the operation of heat exchanger, and increase the column OVHD reflux. 1、提高塔顶回流量，降低塔顶温度； 2、回流泵故障。更换回流泵。 3、常顶回流或常顶循调节阀故障，切出调节阀，手动控制。 4、回流流量计假指示。联系仪表人员处理流量计。 5、常顶循等中断回流故障。切换备用泵。 6、原油 E-301 温度上升，引起回流温度上升。调整换热网络，增加常顶回流量等。
	The column top pressure drops. 塔顶压力降低	Increase the column top pressure. 提高塔顶压力
	The crude becomes lighter. 原油性质变轻	Increase the atm. OVHD reflux flowrate to decrease the column top temperature. 增加塔顶回流量，降低塔顶温度
	Water is entrained in the crude. 原油带水	Switch the column top temperature controller to "Manual" mode to manually control the column OVHD temperature, and take actions per the water entrainment treatment procedures. 将塔顶温度控制改为手动，控制塔顶温度，其它参照原油带水处理。
	The atm. top PA flowrate is small or the atm. top PA temperature is high. 常顶循流量小，或者回流温度高	Adjust the atm. top PA flowrate, or reduce atm. top PA temperature. 调整常顶循回流量，或者降低常顶循回流温度

Table 35(continued) Causes and treatment for abnormal phenomena**表 35（续） 异常现象原因及处理**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
atm. OVHD oil dry point is low 常顶顶石脑油干点偏低	The column top temperature is low. 塔顶温度控制低	1、Reduce atm. OVHD reflux flowrate to increase the column top temperature. 2、Atm. OVHD reflux temperature is low. Increase the reflux temperature. 1、降低塔顶回流量，提高塔顶温度； 2、回流温度低。提高回流温度。
	The crude becomes heavier. 原油变重	Reduce atm. OVHD reflux flowrate to increase the column top temperature. 降低塔顶回流量，提高塔顶温度
	The feedstock temperature drops. 进料温度降低	Increase the feedstock temperature by adjusting the heat exchange temperature. If the feedstock temperature cannot be adjusted, reduce the atm. OVHD reflux flowrate or increase atm. OVHD reflux temperature. 通过调整换热温度，提高进料温度。如无法调节进料温度，则降低回流量，或者提高回流温度
	The atm. top PA flowrate is large, or the atm. top PA temperature is low 常顶循流量大，或者回流温度低	Adjust atm. top PA flowrate, or increase atm. top PA temperature. 调整常顶循回流量，或者提高常顶循回流温度

（3）Kerosene flash point

常一线闪点

Flash point is the main quality control indicator of kerosene. If the flash point is low, the light component content in kerosene will be high, which will increase the OVHD operation load of the fractionator in KHT, resulting in low flash point of jet kerosene. Kerosene flash point is mainly adjusted by kerosene reboiler. And it may be controlled by adjusting the atm. OVHD oil dry point, increasing kerosene draw temperature and reducing the Atm. top pressure.

闪点是常一线的主要质量控制指标。闪点低，常一线轻组分含量高，会增加航煤加氢分馏塔塔顶的负荷，造成航煤的闪点低。常一线闪点主要通过常一线重沸器进行调节。也可以通过调整石脑油干点、提高常一线馏出温度、降低常顶压力等手段进行调节。

Control range: jet kerosene $\geq 40^{\circ}\text{C}$

控制范围：航煤 $\geq 40^{\circ}\text{C}$

Control target: per the specified indicators

控制目标：指令指标

Related parameters: kerosene draw temperature TIC31004, kerosene reboiler temperature

TIC31201, Atm. top temperature TIC31007 and Atm. top pressure PI31001.

相关参数：常一线抽出温度 TIC31004、常一线出重沸器温度 TIC31201、塔顶温度 TIC31007、塔顶压力 PI31001。

Control mode: kerosene flash point is controlled by single loop TIC31201.

控制方式：主要采用 TIC31201 控制常一线闪点，TIC31201 采用单回路控制。

Adjustment method: a kerosene draw temperature increment is constrained by kerosene EBP and jet kerosene freezing point, while atm. OVHD oil dry point and atmospheric top pressure adjustment is constrained by the dry point of the feedstock to CCR Unit. Therefore, kerosene flash point is mainly controlled by adjusting the kerosene reboiler. If the kerosene flash point low, increase the kerosene reboiler outlet temperature.

调节方法：提高常一线抽出温度受限于常一线的终馏点和航煤的冰点，而调整石脑油干点和常顶压力则受限于重整料干点的控制。因此常一线的闪点主要通过常一线重沸器进行调节。常一线闪点低，提高常一线重沸器出口温度。

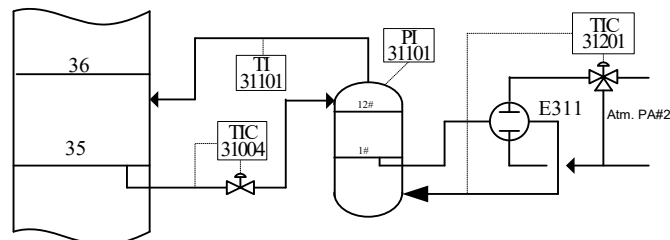


Figure 39 Kerosene Stripping Process Flow Chart

图 39 常一线汽提流程图

Table 36 Causes and treatment for abnormal phenomena

表 36 异常现象原因及处理

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The kerosene flash point is lower than the specified value 常一线闪点低于质量指标	Kerosene reboiler outlet temperature is low 常一线重沸器出口温度低	1、Kerosene draw flowrate is increased Further close the temperature control valve to increase the reboiler outlet temperature. 2、Atm. PA#2 flowrate fluctuates. Stabilize atm.PA#2 flowrate. 3、Atm. PA#2 pump fails. Switch to the standby pump. 4、Atm. PA#2 draw temperature drops. Adjust the bypass of the atm. PA#2 heat exchanger. 1、常一线抽出量增加。关小温控阀，提高重沸器出口温度。 2、常二中流量波动。稳定常二中流量。 3、常二中泵故障。更换备用泵。

Table 36(continued) Causes and treatment for abnormal phenomena**表 36（续）异常现象原因及处理**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The kerosene flash point is lower than the specified value 常一线闪点低于质量指标	Atm. OVHD oil lift is small 常顶石脑油拔出量少	Increase atm. OVHD oil lift. 增加常顶石脑油拔出量。
	Atm. top pressure is too high 常顶压力过高	Reduce Atm. top pressure. 降低常顶压力
	Atm.column top pressure suddenly drops 常压塔顶温度突然降低	1、Reduce the atm. OVHD reflux flowrate and properly adjust the atm. top PA flowrate and the atm. PA#1 flowrate to increase the column top temperature. 2、If atm. top PA control valve fails, switch to manual control and bypass the control valve, contact the instrument discipline for troubleshooting. The panel operators shall give instructions to the field operators to make proper adjustment with reference to the previous reflux flowrate. 1、降低塔顶回流量，调整常顶循和常一中量，提高塔顶温度； 2、如果是常顶循控制阀故障，则控制阀改手动走副线，联系仪表进行处理。室内参照以前回流量安排室外调整到位。

（4）Kerosene EBP

常一线终馏点

It mainly reflects the distribution of heavy components in the jet kerosene and a main quality control indicator for jet kerosene, which mainly affects the freezing point and smoke point of jet kerosene. In general, if the kerosene draw temperature is high and draw flowrate is large, it tends to cause the end point to rise, and vice versa.

主要反映了航煤馏程的重组分分布情况，是航煤的主要质量控制指标，主要影响航煤的冰点、烟点等指标。一般而言，常一线抽出温度高、抽出量大，易造成终馏点上升；反之，常一线馏点下降。

Control range: $\geq 260^{\circ}\text{C}$ 控制范围： 260°C 。

Control target: per the specified indicators

控制目标：指令指标。

Related parameters: kerosene draw temperature TIC31004 and kerosene flowrate FIC70201.

相关参数：常一线抽出温度 TIC31004、常一线流量 FIC70201

Control mode: kerosene EBP is controlled by single loop TIC31004.

控制方式：采用控制 TIC31004 的方式控制常一线终馏点，TIC31004 采用单回路控制。

Adjustment method: if kerosene EBP is low, increase kerosene draw temperature and kerosene flowrate, otherwise, reduce kerosene draw temperature TIC31004 and kerosene flowrate.

调节方法：常一线终馏点低，提高常一线抽出温度，增加常一线流量；常一线终馏点高，降低常一线抽出温度，降低常一线流量。

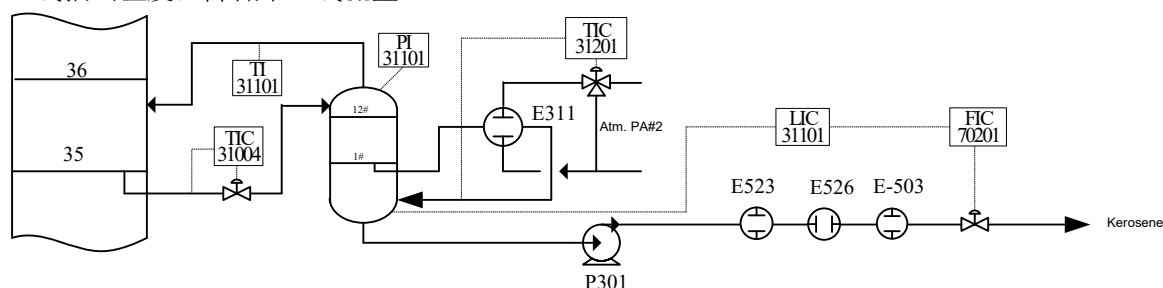


Figure 40 Kerosene to OSBL Process Flow Chart

图 40 常一线出装置流程图

Table 37 Causes and treatment for abnormal phenomena

表 37 异常现象原因及处理

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
FBP of kerosene is high 常一线终馏点高	Internal leakage of reboiler 重沸器内漏	Cut the leaked reboiler out of service for repair 切除内漏重沸器处理。
	The column is flooded. 分馏塔冲塔	Reduce the temperature and the flowrate, and take actions per flooding emergency treatment procedures. 降温、降量，按冲塔事故处理。

Table 37(continued) Causes and treatment for abnormal phenomena**表 37（续） 异常现象原因及处理**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
FBP of kerosene is high 常一线终馏点高	The column top temperature rises suddenly. 塔顶温度突然升高	1、Increase the atm. OVHD reflux flowrate to decrease the column top temperature. 2、If atm. top PA pump experiences evacuation, switch to the standby pump and contact the bench works to repair. 3、If atm. top PA control valve fails, switch to manual control and bypass the control valve, contact the instrument discipline for troubleshooting. The panel operators shall give instructions to the field operators to make proper adjustment with reference to the previous reflux flowrate. 1、提高塔顶回流量，降低塔顶温度； 2、如果常顶循泵抽空，则切换备用泵，联系钳工进行处理； 3、如果常顶循控制阀故障，则控制阀改手动走副线，联系仪表进行处理。室内参照以前回流量安排室外调整到位。
	Kerosene flowrate suddenly increases 常一线馏出量突增	Reduce kerosene flowrate in time, if the control valve fails, contact the instrument discipline for troubleshooting. 及时降低常一线馏出量，如控制阀失灵，及时联系仪表处理。
	Kerosene temperature suddenly increases 常一线馏出温度突然升高	Increase the reflux flowrate in time to reduce Kerosene temperature. 及时增大回流量，降低常一线馏出温度。

（5）Heavy diesel 95% point**常三线 95%点**

95% point is mainly used to control the distillation range of the finished diesel. As the heaviest diesel component, heavy diesel 95% point is a key indicator for controlling 95% mixed diesel. Generally speaking, if heavy diesel draw temperature and flowrate are high, it tends to cause heavy diesel 95%-point rise, and vice versa.

成品柴油馏程主要控制 95%点，作为最重的柴油组分，常三线的 95%点控制是控制混合柴油 95%的关键指标。一般而言，常三线抽出温度高、抽出量大，易造成常三线 95%点上升；反之，常三

线 95%点下降。

Control range: $\geq 365^{\circ}\text{C}$

控制范围: 365°C 。

Control target: per the specified indicators

控制目标: 指令指标。

Related parameters: heavy diesel draw temperature TIC31005, heavy diesel draw flowrate FIC70303, atm. PA#2 internal reflux flowrate FIC31004, and atm. PA#2 flowrate FIC31006.

相关参数: 常三线抽出温度 TIC31005、常三线流量 FIC70303、常二中内回流流量 FIC31004、常二中回流流量 FIC31006。

Control mode: heavy diesel 95% point is controlled by single loop TIC31005.

控制方式: 采用控制 TIC31005 的方式控制常三线终馏点, TIC31005 采用单回路控制。

Adjustment method: if heavy diesel 95% point is low, increase heavy diesel draw temperature and heavy diesel flowrate, otherwise, reduce heavy diesel draw temperature and a heavy diesel flowrate.

调节方法: 常三线 95%点低, 提高常三线抽出温度, 增加常三线流量; 常三线 95%点高, 降低常三线抽出温度, 降低常三线流量

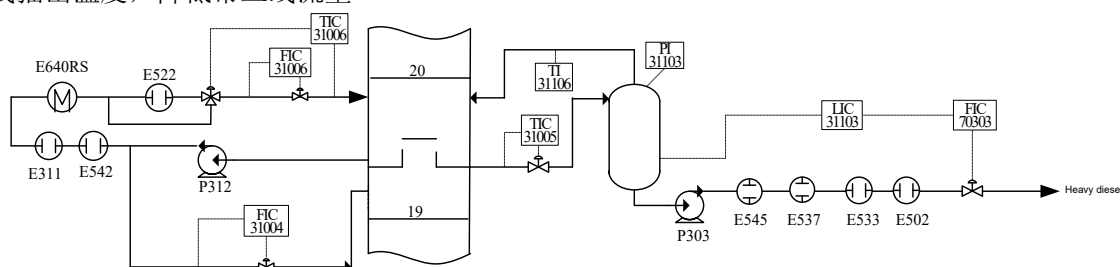


Figure 41 Atm. PA#2 and Heavy diesel Process Flow Chart

图 41 常二中及常三线流程图

Table 38 Causes and treatment for abnormal phenomena

表 38 异常现象原因及处理

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
Heavy diesel 95% point is high 常三线 95%点高	Heavy diesel draw temperature is high 常三线抽出温度高	Reduce heavy diesel draw temperature 降低常三线抽出温度
	The column is flooded. 分馏塔冲塔	Reduce the temperature and the flowrate, and take actions per flooding emergency treatment procedures. 降温、降量, 按冲塔事故处理。
Heavy diesel 95% point is high	Heavy diesel draw flowrate suddenly increases 常三线抽出量突然增加	Stabilize heavy diesel draw flowrate 稳定常三线流量

Table 38(continued) Causes and treatment for abnormal phenomena**表 38（续）异常现象原因及处理**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
	Atm. PA#2 internal reflux flowrate is too low, distillation performance is poor 常二线拔得过多	Increase atm. PA#2 internal reflux flowrate 适当降低常二线流量
Heavy diesel 95% point is low 常三线 95%点低	Heavy diesel draw temperature is low 常三线抽出温度低	Increase heavy diesel draw flowrate 提高常三线抽出量
	Heavy diesel lift is low 常三线拔出量低	Increase heavy diesel lift 增加常三线拔出量
	Atm. PA#2 lift is low 常二线拔出量低	Increase atm. PA#2 lift 增加常二线拔出量

（6）HVGO EBP**减三线终馏点**

The mixed VGO EBP is an important control indicator of the feed oil to HC Unit. If the mixed VGO EBP is high, the contents of residual carbon and heavy metals will increase, which will affect the operation of HC Unit, if the mixed VGO EBP is lower, some VGO will enter VR, which will increase the heavy oil yield. As the heaviest component of the mixed VGO, HVGO EBP is a key indicator for controlling the mixed VGO EBP. Generally speaking, the higher the temperature of the gas phase under the collecting drum of HVGO is, the greater VGO draw will be, and VGO EBP will increase; otherwise, VGO EBP will drop.

混合蜡油终馏点是加氢裂化原油的重要控制指标，混合蜡油终馏点高，残碳、重金属等指标上升，影响加氢裂化的运行，混合蜡油终馏点低，部分蜡油进入渣油，增加装置重油收率。减三线作为最重的混合蜡油组分，其终馏点是控制混合蜡油终馏点的关键指标。一般而言，减三线集油箱下气相温度越高、减三线抽出量越大，减三线终馏点上升；反之，减三线终馏点下降。

Control range: 560>°C

控制范围：560>°C。

Control target: per the specified indicators

控制目标：指令指标。

Related parameters: the temperature of the gas phase under the collecting drum of HVGO TIC41008, HVGO flowrate FIC71101, HVGO flushing oil flowrate FIC41004 and the residual pressure of the gas phase under the collecting drum of HVGO PI41005.

相关参数：减三线集油箱下气相温度 TIC41008、减三线流量 FIC71101、减三线内回流流量

FIC41004、减三线集油箱下气相残压 PI41005。

Control mode: HVGO EBP is controlled by TIC41008 in cascade with FIC41004.

控制方式：采用控制 TIC41008 的方式控制减三线终馏点，TIC41008 与 FIC41004 采用串级路控制。

Adjustment method: if HVGO EBP is lower, increase the temperature of the gas phase under the collecting drum of HVGO so as to increase HVGO flowrate; if HVGO EBP is high, reduce the temperature of the gas phase under the collecting drum of HVGO so as to reduce HVGO flowrate.

调节方法：减三线终馏点低，提高减三线集油箱下气相温度，增加减三线流量；减三线终馏点高，降低减三线集油箱下气相温度，降低减三线流量。

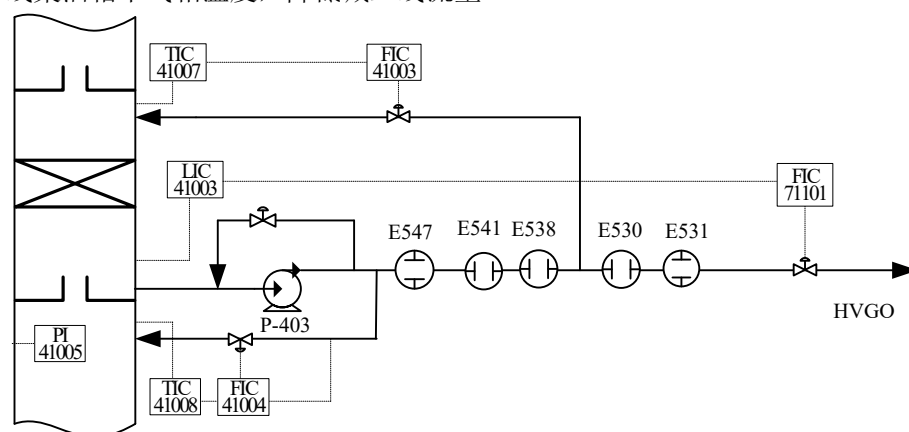


Figure 42 HVO and HVGO PA Process Flow Chart

图 42 减三线及减三中流程图

Table 39 Causes and treatment for abnormal phenomena

表 39 异常现象原因及处理

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
HVGO EBP is high 减三线 终馏点高	the temperature of the gas phase under the collecting drum of HVGO is high 减三线集油箱下气相温度高	Increase HVGO flushing oil flowrate to reduce the temperature of the gas phase under the collecting drum of HVGO 增加减三线内回流，降低减三线集油箱下气相温度
	Poor separation performance due to coking and corrosion of the packing section of vac. overflash 减四线段填料结焦、腐蚀等分离效果差	Replace the packing during maintenance 择机检修，更换填料
	The operation load of the Vac. column is increased, and adjustments are not made in time 减压负荷增加，调整不及时	Properly adjust the HVGO flushing oil flowrate 调整减三线内回流

Table 39(continued) Causes and treatment for abnormal phenomena

表 39（续）异常现象原因及处理

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
HVGO EBP is low 减三线终馏点低	Reduce HVGO flushing oil flowrate to increase the temperature of the gas phase under the collecting drum of HVGO 减三线集油箱下气相温度低	Reduce the reflux in the third line and increase the temperature of the gas phase under the third line collector 降低减三线内回流，提高减三线集油箱下气相温度
	The level gauge of the HVGO fails, resulting in full level 减三线液位计异常，满液位控制	Repair the level gauge 检修液位计
	The operation load of the process unit is low, the v HVGO flushing oil is constrained by the minimum reflux limit 装置低负荷运行，减三线内回流受最小回流限制	The HVGO flushing oil is properly controlled per the minimum reflux flowrate 减三线内回流按照最小回流控制
	The accumulator tray of HVGO leaks due to corrosion. 减三线集油箱腐蚀等造成漏液	Repair and replace collecting drum during maintenance 择机检修，更换集油箱
	The residual pressure under the collecting drum of HVGO is high, or the vacuum top vacuum is broken 减三线集油箱下残压高，或塔顶真空度破坏	Identify the causes of vacuum breaking, and make adjustments based on the causes identified. 查明真空度破坏原因，根据影响原因作出调整

2.4.2 Equipment operations 设备操作法

2.4.2.1 Operation of centrifugal pumps 离心泵的操作

(1) Key inspections to pumps

机泵检查重点

1) Check the pump inlet and outlet pressure, current, sealing oil pressure, bearing oil level or oil mist lubrication, oil ring lubrication, CCW flowrate, bearing temperature, and the sound and vibration of each part on a frequent basis.

经常对各机泵的进出口压力、电流、封油压力、轴承箱油位或油雾润滑、油环带油情况、冷却水畅通情况、轴承温度、声音、各部位振动情况检查。

①Roller bearing temperature shall be $\gt 70^{\circ}\text{C}$.

滚动轴承温度 $\geq 70^{\circ}\text{C}$ 。

②Motor casing temperature shall be $\geq 85^{\circ}\text{C}$, and motor current shall not exceed 95% of the rated current.

电机外壳温度 $\geq 85^{\circ}\text{C}$ ，电机电流不超过额定电流的 95%。

③or the bearings with rotational speed of 1500 rpm, vibrating shall be $\geq 0.09\text{mm}$, for the bearing with rotational speed of 3000 rpm, vibrating shall be $\geq 0.06\text{mm}$.

转速为 1500 转/分的轴承，振动 $\geq 0.09\text{mm}$ ，转速为 3000 转/分的轴承，振动 $\geq 0.06\text{mm}$ 。

2) Check the pumps (including the pump casings, coupling guards, motor casings, pump bases, valves and piping, and inlet and outlet pressure gauges) and the surrounding sanitation on a frequent basis.

经常检查机泵（包括泵体、对轮罩、电机外壳、泵座、阀门管线、进出口压力表等）及其周围卫生。

3) Strictly implement the lube oil “three-stage filtration” and “five-fixations” systems, and change the lube oil and grease according to the regulations on a regular basis, and make records.

严格执行润滑油的“三级过滤”和“五定”制度，按规定定期更换润滑油和润滑脂，并作好记录。

4) Fill in the related parameter and records in an accurate, detailed and timely manner, and hand them over to the next shift.

认真、准确、详细、及时做好有关参数的填写、记录和交接班工作。

5) If the centrifugal pump experiences evacuation, further close the pump outlet valve, investigate the causes, adjust the pump outlet flowrate in time to avoid pump evacuation for a long time.

发现离心泵抽空应及时关小出口阀，查找原因，及时调节上量，严禁离心泵长时间抽空。

6) Strictly implement the barring system for the standby pumps, and rotate the standby pumps per specified intervals.

严格执行备用机泵盘车制度，按规定时间盘车。

7) The hot oil pump shall be kept in hot standby state, and ensure CCW availability so that the hot oil can be operated when required.

热油泵要保持泵体预热，并给好冷却水，达到随时可以切换使用的要求。

(2) preparations for pump start

启动前的准备工作

1) Properly line up and confirm the process flow before starting the pump.

开泵前要做好联系工作，并确认流程畅通。

2) Check and confirm the pump cover, and inlet and outlet piping, auxiliary piping, valves, flanges, pressure gauges are in good conditions, the outlet and inlet vent valves are closed, and each steam valve is closed.

检查泵体大盖及出入口管线、附属管线、阀门、法兰、压力表等处是否完好，出、入口排空阀是否关闭，各蒸汽阀处于关闭状态。

3) Check and confirm that the pump, motor and coupling are in good conditions, the anchor bolts are complete and tightened.

检查泵、电机及联轴器防护罩、地脚螺栓是否齐全，有无松动。

4) Check and confirm that the pump inlet and outlet valves are in good conditions. And check and confirm that the pressure gauges are in good conditions, and the pressure tap valve is opened.

检查泵出、入口阀门各部件是否齐全。检查各压力表是否完好，引压阀打开。

5) Fill the specified lube oil into the bearing housing of the pump to 1/2~2/3 of the marks based on the three-level filtration requirements, and then check and confirm there is no leakage from the oil retainers or oil seal. Note: for the oil mist lubricated pumps, check and confirm that the oil mist lubrication system is in good conditions.

按三级过滤的要求向轴承箱内加入规定牌号的合格润滑油，油面至油标的 1/2~2/3 处，加油后检查挡油环或油封有无泄漏。注意事项：油雾润滑机泵要检查机泵油雾润滑系统是否正常。

6) Put CCW system into operation, check and confirm that the CCW system is properly lined up and CCW flowrate shall be properly adjusted.

投用冷却水，检查水路是否畅通，同时调节好水量。

7) Slightly open the inlet valve slightly to prime the pump, slowly open the pump outlet drain valve to vent the gas in the pump, close the drain valve, check the seal for leaks, and finally, fully open the pump inlet valve is everything is OK.

稍开入口阀，对泵体充液，缓慢开泵出口排污阀将泵内气体排尽，关闭排污阀，并检查密封有无泄漏，检查一切正常后全开入口阀。

8) Rotate the pump to check if the rotor is rotating evenly and if there is abnormal sound in the pump casing. If the rotor is seized or abnormal sound is generated, do not start the pump, but contact the maintenance staff for troubleshooting in time.

盘车检查转子是否轻重均匀，泵体内是否有异常声音，如盘车较紧或有异常声音，不能开泵，应及时与维修人员联系。

9) Check and confirm the flushing system works properly.

检查自冲洗系统正常。

10) Check and confirm the warm-up system of the hot oil pump is in good conditions.

确认热油泵预热充分。

11) Supply power to the motor, and now the pump is ready for operation.

电机送电待用。

(3) Hot oil pump warm-up

热油泵预热

1) Put CCW system into operation before warm-up.

预热前要给好各部位冷却水。

2) Properly line the pump slop process flow, slightly open the pump outlet warm-up crossover valve, and close the crossover valve after the crossover is filled with oil.

改通泵污油线流程，稍开泵出口预热跨线阀，跨线充油后关跨线阀。

3) Open the pump inlet valve slightly, drain the water and gas in the pump into the slop piping. After the temperature of the drain valve is close to the oil temperature, close the pump drain

valve.

稍开泵进口阀，将泵内存水和气体排去污油线，排污阀温度接近油温后，关泵排污阀。

4) When warming up the standby pump, contact the panel operators to observe and observe the pump for radial runout and evacuation.

备用泵预热时要联系内操，并观察运行泵是否有晃量或抽空现象。

5) Open the pump inlet valve, and slowly open the pump outlet warm-up crossover valve.

打开泵进口阀，慢慢开泵出口预热跨线阀。

6) Gradually increase the circulation of oil in the pump, and the warm-up temperature rise shall be controlled at approximately 50 °C/h.

逐步增加泵内油品循环量，预热升温速度控在 50°C/h 左右。

7) After the temperature rises to the normal warm-up temperature, rotate the pump per the requirements and enable the pump ready for service. (During warming up, it is strictly prohibited to rotate the pump if the warm-up temperature is not up to the normal temperature)

待温度上升至正常预热温度后，按要求盘车备用。（预热升温期间，未到正常温度严禁盘车）

8) During warming up, the circulation of oil in the pump shall not be too large to avoid pump evacuation or leakage/reverse rotation due to too fast temperature rise.

预热时泵内油品循环量不要过大，以免造成运转泵抽空或因为升温过快产生泄漏或倒转。

9) It is advisable to continuously warm up the pump until the difference between the temperature at the pump casing flange and the temperature of the process fluid is not more than 40 °C. Warm-up shall be uniform to avoid hot upper section and cold lower section, hot front section and cold rear section or local heating.

连续预热至泵体法兰处的温度与输送介质温度相差不大于 40°C 为宜。预热要均匀，不能上热下冷或前热后冷或局部受热。

10) Adjust the sealing oil pressure to ensure that the sealing oil pressure is 0.05~0.15Mpa higher than the inlet pressure.

调好封油，确保封油压力比入口压力高 0.05~0.15Mpa。

11) After sufficient warm-up, the pump can be started or put into normal standby state. For pumps that do not require maintenance during normal operation, the first 4 steps can be omitted during warm-up.

经过充分预热后，方可以启动或投入正常备用。对正常运行不须检修的泵，预热时可以省略前 4 步。

(4) Start of centrifugal pump

离心泵的开泵

1) Contact the panel operators and inform them that the pump is to be started.

联系内操，告知准备启动机泵。

2) First close the warm-up valve of the hot oil pump.

热油泵先关预热阀。

3) Press the start button to start the pump, monitor the changes of current indicator reading and the pump outlet pressure indicator reading, and check the seal for any leakage. Check and

confirm that the running sound of the pump is normal. Check the pump for abnormal vibration, and check the temperature rise of each rotating point. If over-current is identified for the motor or any abnormal sound is identified for the pump, stop the pump immediately and investigate the causes.

按启动电钮启动机泵，注意电流指示和泵出口压力指示的变化，检查密封的泄漏情况。机泵的运转声响是否正常。检查机泵的振动情况和各运转点的温度上升情况，若发现电流超负荷、机泵有杂音或其他不正常现象，应立即停泵查找原因。

4) Slowly and evenly open the outlet valve after the pump is normally started, and monitor the changes of current indicator reading and the pump outlet pressure indicator reading.

启动正常后缓慢均匀地打开出口阀门，并观察电流及泵出口压力变化情况。

5) Adjust the sealing oil injection flowrate.

调整封油的注入量。

6) After the pump is put into normal operation, observe the pump for 3 to 5 minutes at site and confirm that the pump operation (oil level, temperature, vibration, cooling water, outlet pressure, etc.) is normal before leaving.

泵投用正常后，要在现场观察 3~5 分钟，确认机泵运行（油位、温度、振动、冷却水、出口压力等）正常后方可离开。

7) After the pump is started, notify the panel operators and make records.

泵开启后，通知内操，并作好记录。

(5) Shutdown of centrifugal pumps

离心泵的停泵

1) Contact the panel operators to prepare for shutting down the centrifugal pump.

联系内操，做好停泵准备。

2) Slowly close the pump outlet valve, and press the stop button to shut down the pump.

缓慢关闭泵出口阀，按停电按钮。

3) If the pump is served as a standby pump after shutdown, reduce CCW flowrate and sealing oil flowrate.

若停运后作为备用泵，关小冷却水及封油。

4) After the hot oil pump is shut down, it is necessary to resume the pump into warm-up state for startup when required.

热油泵停运后要恢复预热备用。

(6) Switchover of centrifugal pumps

离心泵的切换

1) Check the condition of the standby pump according to the preparation procedure for pump normal startup, and confirm that the standby pump is ready for startup.

按正常开泵准备程序检查备用泵的情况，确认备用泵达到开泵条件。

2) Contact the panel operators to prepare for pump switchover.

联系内操准备切换泵。

3) Press the start button to start the pump (the warm-up must be stopped for the hot oil pump),

monitor the changes of motor current indicator reading and pump outlet pressure gauge reading, and check the seal for leakage.

按启动电钮启动机泵（热油泵要先停预热），注意电流指示和泵出口压力指示的变化，检查密封的泄漏情况。

4) After the standby pump is started, gradually open the outlet valve of the standby pump while gradually close the outlet valve of the running pump until the outlet valve of the standby pump is fully opened and the outlet valve of the running pump is fully closed, check and confirm that the standby pump is in normal operation, stop the running pump after 10 minute observation.

确认泵上量后，缓慢打开备用泵出口阀，同时逐渐关小原运行泵出口阀，直至备泵出口阀开至满足工艺要求后，原运行泵出口阀全关为止，并检查备用泵运行正常，观察 10 分钟时间后在将原运行泵停掉。

5) The running pump shall be stopped based on the operating procedure for pump shutdown.

原运行泵停泵后，按正常停泵步骤处理。

Note: When switching over the pump, properly control the flowrate and pressure as much as possible to avoid large fluctuations.

注意事项：切换时,要注意尽量控制好流量压力，避免大波动。

（7）Steps and conditions for pump emergency shutdown

紧急停泵的条件及步骤

1) Conditions for pump emergency shutdown

紧急停泵的条件

①The pump generates sever noise, experiences severe vibration and the mechanical seal experiences sever leakage.

有严重噪音、振动剧烈、机械密封严重泄漏。

②Pump evacuation cannot be eliminated.

泵抽空无法消除。

③Bearing temperature is high and continues rapid rising.

轴承温度过高继续快速上升。

④Unexpected conditions occur such as power failure, motor overheating, smoke, fire, explosion.

出现停电、电机过热、冒烟、着火等意外情况。

2) Steps for pump emergency shutdown

紧急停泵步骤

①Press the pump stop button and quickly close the outlet valve. If the pump cannot be accessible, contact the electrician to turn off the power.

按停泵按钮，迅速关闭出口阀，若无法靠近机泵，则联系电工断电。

②If conditions permit, start the standby pump quickly.

如条件允许，应迅速启动备用泵。

③Follow the normal procedure for pump startup and shutdown.

其余步骤按正常开停泵步骤操作。

（8）Common failures and troubleshooting for pumps

泵的常见故障处理

1) Bearing temperature is high 轴承温度过高

Table 40 Causes and actions for Bearing temperature is high**表 40 轴承温度过高原因及处理**

Causes 原因	Actions 处理
a)Oil less or bad a)润滑油不足或变质。 b)CCW flowrate or sealing oil flowrate is insufficient or interrupted b) 冷却水或封油不足或中断。 c)Water is intruded into the bearing housing c)轴承箱进水。 d)Bearing is damaged d)轴承损坏。 e)The pump and motor are not concentric. e)机泵同心度不正。 f)The axial force is too large f)轴向力过大。 g)Ambient temperature is too high g)环境温度过高。 h)Pump is in over-load operation h)超负荷运转。	a)add or change oil a)增加或者更换润滑油。 b)Increase CCW flowrate or sealing oil flowrate. b)加大冷却水或封油。 c>Contact the mechanical maintenance staff for troubleshooting. c)联系机修处理。 d>Contact the mechanical maintenance staff to replace the bearing. d)联系机修更换轴承。 e>Contact the mechanical maintenance staff for alignment. e)联系机修找正。 f>Contact the mechanical maintenance staff for troubleshooting. f)联系机修处理。 g)Further open CCW flowrate or take external cooling measures. g)开大冷却水或采取外部冷却措施。 h)Adjust the pump outlet flowrate.

2) Leakage of mechanical seal 机械密封泄漏

Table 41 Causes and actions for Leakage of mechanical seal**表 41 机械密封泄漏原因及处理**

Causes 原因	Actions 处理
a)The type of mechanical seal is not properly selected or the mechanical seal is improperly installed a)机封选型或安装不当。 b)The pressure of flushing fluid for the mechanical seal is low b)机封冲洗介质压力低	a)Select or install the machine seal as specified. a)按规定选用或安装机封。 b)Adjust the pressure of the flushing fluid for the mechanical seal per requirements b)按规定调节机封冲洗介质压力

Table 41(continued) Causes and actions for Leakage of mechanical seal**表 41（续） 机械密封泄漏原因及处理**

Causes 原因	Actions 处理
c)The flushing fluid contains impurities c)机封冲洗介质含杂质 d)The pump and motor are not concentric. d)机泵不同心。 e)Bearing is abraded, resulting in rotor eccentric. e)轴承磨损，造成转子偏心。 f)The mechanical seal is damaged. f)机封损坏。 g)Pump experiences severe evacuation. g)泵严重抽空。 h)Warm-up speed for the pump is too fast. h)泵预热速度过快。	c)Ensure the quality of the flushing fluid for the mechanical seal c)确保机封冲洗介质质量 d)Contact the mechanical maintenance staff for alignment. d)联系机修找正。 e)Contact the mechanical maintenance staff to replace the bearing. e)联系机修更换轴承。 f)Contact the mechanical maintenance staff for troubleshooting. f)联系机修处理。 g)Switch to the standby pump, and contact the maintenance staff to replace the mechanical seal. g)切换备用泵，联系机修更换密封。 h)Strictly control the warm-up speed for the pump. h)严格控制预热速度。

3) Severe vibration 振动超标

Table 42 Causes and actions for Severe vibration**表 42 振动超标原因及处理**

Causes 原因	Actions 处理
a)Anchor bolts are loosened a)地脚螺栓松动 b)The impeller is loose or there is debris in the impeller b)叶轮松动或叶轮内有杂物 c)Pump and motor are not concentric c)机泵不同心 d)Bearing clearance is too large or the bearing is damaged d)轴承间隙过大或损坏	a)Contact mechanical maintenance staff or an electricians to tighten the anchor bolts. a)联系机修或电工紧固地脚螺栓。 b)Contact the mechanical maintenance staff for troubleshooting. b)联系机修处理。 c)Contact the mechanical maintenance staff for alignment. c)联系机修找正。 d)Contact the mechanical maintenance staff for repair. d)联系机修检修。

Table 42(continued) Causes and actions for Severe vibration**表 42（续） 振动超标原因及处理**

Causes 原因	Actions 处理
e) Pump experiences evacuation e) 抽空或汽蚀	e) Investigate the cause and eliminate it in time. e) 查找原因，及时消除。
f) Flowrate fluctuation is large f) 流量波动大	f) Stabilize the operating case. f) 稳定工况。
g) Inlet and outlet piping generates too large stress g) 出入口管线产生过大应力	g) Try to eliminate the stress. g) 设法消除应力

4) Pump evacuation

泵抽空

Table 43 Causes and actions for Severe vibration**表 43 振动超标原因及处理**

Causes 原因	Actions 处理
a) Inlet vessel level is too low or inlet pressure is not sufficient a) 入口容器液位过低或入口压力不够	a) Adjust the inlet vessel level in time a) 及时调整入口容器液位
b) Gas is intruded into the inlet and outlet piping b) 入口管线窜汽	b) Check, replace valve or install blind b) 检查更换阀门或加盲板
c) The opening of the outlet pipe valve is too small to generate vortex vaporization c) 出口管路阀门开度过小产生涡流汽化	c) Properly open large the outlet pipe valves c) 适当开大出口管路阀门
d) Hot oil pump is not properly warmed up or the warm-up speed is too fast d) 热油泵预热操作不当或速度过快	d) Check the warm-up condition, pause the warm-up, and then slowly recover d) 检查预热情况，暂停预热，然后缓慢恢复
e) The impeller is detached or there is debris in the impeller e) 叶轮脱落或叶轮内有杂物	e) Contact the mechanical maintenance staff for troubleshooting. e) 联系机修处理
f) The clearance between the impeller engagement is too large f) 叶轮配合部分间隙过大	f) Contact the mechanical maintenance staff for repair f) 联系机修检修

Table 43(continued) Causes and actions for Severe vibration**表 43（续） 振动超标原因及处理**

Causes 原因	Actions 处理
g)The sealing oil flowrate is too large, or water is entrained in the sealing oil. g)封油过大或封油带水	g)Reduce the sealing oil flowrate, and remove the water from sealing oil pot g)封油调小，封油罐脱水
h)CCW sleeve is perforated. h)冷却水套穿孔	h>Contact the mechanical maintenance staff for troubleshooting. h)联系机修处理

5) Motor current is high 电机电流升高

Table 44 Causes and actions for Motor current is high**表 44 电机电流升高原因及处理**

Causes 原因	Actions 处理
a)The bearing of the motor or pump is damaged. a)电机或泵的轴承损坏。	a)Stop pump to replace the bearing. a)换泵更换轴承。
b)The rotating parts experience friction. b)转动部件有摩擦。	b)Check and repair. b)检查修理。
c)The specific gravity or flowrate of the process fluid becomes larger. c)输送介质比重流量变大。	c)Investigate the cause and then rectify. c)查找原因处理。
d)Ammeter is damaged. d)电流表坏。	d>Contact electrician for troubleshooting. d)联系电工处理。

2.4.2.2 Operation of metering pumps 计量泵的操作

(1) Preparations before pump start

开泵前的检查

1) Check and confirm that the anchor bolts are tightened and the grounding wire is installed properly.

检查地脚螺栓有无松动，接地线安装是否良好。

2) Check the pump outlet piping and accessories such as the pressure gauge are in good conditions.

检查泵出口管线，压力表等附件完好。

3) Check and confirm the lube oil is on-spec, and the oil level shall be kept at 1/2~2/3.

检查润滑油合格，油面应保持在 1/2~2/3 处。

4) Check and confirm the level in the material drum is normal (pump shall not be started if the level is too low).

检查物料罐液位是否正常（液位过低不能启动）。

5) Adjust the stroke of the metering pump to the "0" position.

调整计量泵的行程至“0”位处。

6) Check and confirm that the pump inlet and outlet piping are unblocked, and the pump inlet and outlet valves are opened.

检查泵进、出口管线是否畅通，打开泵进、出口阀门。

（2）Start the pump

开泵

1) Start the pump to run with the stroke set at the "0" position.

泵电机，冲程在“0”位处运转。

2) Slowly adjust the pump stroke to the demand range based on the operation requirements.

根据生产要求，慢慢调整泵行程至需求范围。

3) Check if the pump outlet pressure is normal and the flowrate is stable.

检查泵出口压力是否正常，流量是否稳定。

4) Note: when starting the metering pump, closely monitor the change of pump outlet pressure to prevent pressure buildup in the pump casing.

注意事项：启动计量泵时，应密切关注泵出口压力的变化，严防憋压。

（3）Stop the pump

停泵

1) Adjust the pump stroke to the "0" position.

将泵行程调整至“0”位处。

2) Press the pump stop button to stop the running pump.

按停泵按钮停下运行泵。

3) Close the outlet valve.

关闭出口阀。

（4）Switch over the pump

泵切换

1) Prepare for pump start.

做好开泵前的检查准备工作。

2) Start the standby pump per standby pump start procedures.

按开泵步骤启动备泵。

3) Increase the stroke of the standby pump, while reduce the stroke of the running pump to minimize the flow fluctuation during switchover.

一边调大备泵行程，一边调小原运转泵行程，尽量减少切换时引起的流量波动。

4) When the stroke of the running pump is adjusted to "0" position, stop the running pump.

当原运转泵行程调至“0”位时，停原运转泵做备用。

2.4.2.3 Operation of magnetic pumps 磁力泵的操作

（1）Working principles of magnetic pump

磁力泵工作原理

The magnetic pump is also called a magnetic drive pump, which is mainly composed of a pump head, a magnetic drive (magnetic cylinder), a motor, and a connecting base plate. The magnetic actuator is composed of an outer magnetic rotor, an inner magnetic rotor and a non-magnetic magnetic isolation sleeve. When the motor drives the outer magnetic rotor to rotate, the magnetic field can penetrate the air gap and the non-magnetic material, and drive the inner magnetic rotor connected with the impeller for synchronous rotation to achieve synchronous transmission of power, and converts the dynamic sealing structure prone to leakage to a static leakage structure with zero leakage. As the pump shaft and the inner magnetic rotor are completely enclosed by the pump casing and the isolation sleeve, the issues such as spill, overflow and leakage are completely solved.

磁力泵也叫磁力驱动泵，主要由泵头、磁力传动器（磁缸）、电动机、连接底板等几部分零件组成。磁力泵磁力传动器由外磁转子、内磁转子及不导磁的隔离套组成当电动机带动外磁转子旋转时，磁场能穿透空气隙和非磁性物质，带动与叶轮相连的内磁转子作同步旋转，实现动力的无接触同步传递，将容易泄露的动密封结构转化为零泄漏的静密封结构。由于泵轴、内磁转子被泵体、隔离套完全封闭，从而彻底解决了“跑、冒、滴、漏”问题。

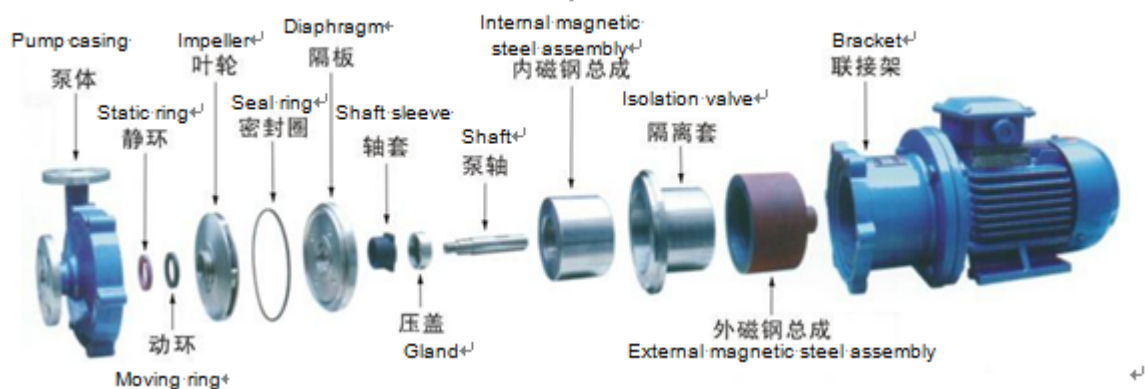


Figure 43 Structure of Magnetic Pump

图 43 磁力泵结构图

(2) Preparations for magnetic pump start

启动前准备工作

1) Check the components of the pump outlet and inlet piping, such as valves, flanges, anchor bolts and pressure gauges, ensure they are in good conditions, check and confirm that the bolts are tightened, and the pump casing and the surrounding area are clean and tidy.

检查泵出、入口管线的各部件，如阀门、法兰、地脚螺丝、压力表等，看是否齐全好用，螺栓是否紧固到位，确保设备本体以及周边卫生干净整洁。

2) Contact the electrical, instrument, and maintenance staffs to conduct a comprehensive inspection to confirm that the pump is ready for start (including the power supply line, instrument signal are normal).

联系电气、仪表、维修进行全面检查，确认是否具备启动条件（包括电源线路、仪表信号等是否

正常)。

3) Before priming the pump, disconnect the pump inlet piping and outlet piping, flush the inlet piping with clean water or other clean liquid, check if the inlet filter is clogged, and ensure that there are no solid particles and residual rust in the inlet piping. Rust prevention measures shall be taken for the carbon steel piping, otherwise it will seriously affect the operation of the magnetic pump and even damage the components inside the pump.

灌泵前，断开泵入口与进口管路联接，对进口管道用清水或其他干净液体进行冲洗，检查入口过滤器是否堵塞，确保入口管路没有固体颗粒物和残留铁锈，碳钢管道应做好防锈措施，否则会严重影响磁力泵的运行甚至损坏泵内零部件。

4) Contact the instrument staff to check the pump related instruments (such as evacuation alarm, flow indication, temperature indication, pressure indication). After confirming the instruments work properly, contact the field operators to properly line up the process flow and introduce the process fluid into the pump inlet valve.

联系仪表配合内操检查泵相关仪表（如抽空报警、流量指示、温度指示、压力指示）回讯是否正常，确认无误后，联系外操现场改好流程，引介质至入口阀前。

5) Slightly open the pump inlet valve, open the pump outlet vent valve, rotate the pump to drain the water and vent the gas in the pump casing. When process fluid comes out of the vent valve, fully open the pump inlet valve.

缓慢打开泵入口阀，打开泵出口放空阀，注意盘车，排净泵内存水和气体，见介质后关闭放空阀，泵入口阀全开。

6) Contact the electrician to supply power and sign on the power supply permit.

联系电工送电，并在送电票上签字确认。

Note: incomplete gas venting may cause damage to the internal sliding bearing due to dry running; if the temperature of the process fluid exceeds 93 °C, the pump shall be warmed up and then started.

注意事项：不完全的排气可能造成启动时内部滑动轴承的干运转而损坏；如果输送介质温度超过93°C时，应在运转泵前先预热。

(3) Start steps

启动步骤

1) If the pump is operated in no-load condition, it will result in damage to bearing and magnetism loss of magnetic body. Therefore, this type of pump is strictly prohibited to run in no-load condition.

磁力泵空负荷运行将导致轴承损坏、磁性体失磁，故本类泵严禁空负荷运行。

2) Make sure that the inlet valve is fully opened and the outlet valve is fully closed (for the process fluid prone to vaporization, open the outlet valve as soon as possible after the pump is started to prevent overheating and evacuation).

确保入口阀已经打开，全关出口阀（对于易汽化介质泵启动后应尽快开出口阀，以防过热抽空）。

3) Start the motor and open the outlet valve until the flowrate is unto the required flowrate. Special attention shall be paid to the outlet pressure immediately after the pump is started. If the

outlet pressure cannot be achieved within a short period of time (generally within 10 s), immediately stop the motor. Re-vent the pump and re-start the pump (pump outlet pressure = pump inlet pressure + pump head $\times$ specific gravity of process fluid). If the pump continues to operate, it will cause damage to the internal sliding bearing and the magnetic rotor failure due to too high temperature rise. The pump operation must be closely monitored during the first commissioning.

启动电机，打开出口阀直到工艺操作需要的流量，需要特别注意的是开泵后立即关注出口压力，如果不能在很短的时间内（一般在 10s 内）达到排放压力，则立即关闭电机，重新排气灌泵并启动（泵出口排放压力=泵入口压力+泵扬程 $\times$ 介质比重），如果继续运转，将会造成内部滑动轴承损坏，磁转子温升过高而失效，因此在泵初次调试期间务必对运转工况进行监视。

4) The panel operators shall closely monitor the pump evacuation alarm. If abnormality is identified, the pump shall be stopped immediately.

内操关注泵抽空报警显示情况，若发现异常应立即停泵检查。

5) Use portable vibrometer to measure the vibration, record the vibration values, and compare the measured values with the previous data. Use the listening rod to judge the fault location based on experience.

用便携式测振仪测试并记录振动值，与以往数据对比，并用听针根据经验判断故障位置。

6) Check and confirm that the temperature of the cylinder liner is not higher than 100 °C. If the pump is equipped with a temperature detector for the isolation sleeve, check if the temperature of the isolation sleeve is consistent with the previous data to prevent the magnetic rotor from overheating and damage due to the failure of the circulation loop.

检查缸套温度不大于 100°C，若泵配有隔离套温度检测器时，检查隔离套温度与以往是否一致，防止循环回路故障而导致的磁转子超温而损坏失效。

7) Check if the pressure difference between the inlet and outlet of the pump is normal during operation to prevent the pump from operating under abnormal conditions.

运行期间应对泵进出口压差是否正常进行检查，防止异常情况下操作泵。

8) During the process operation, closely monitor the component changes of the process fluid to the pump inlet and the change of the level in the vessel before the pump.

工艺操作中，应时刻关注泵入口工艺介质组分的变化和泵前容器液位的变化。

(4) Monitoring and protection SP

监控保护值的设定

The magnetic pump will be idle in the absence of liquid in the pump chamber or the magnetic pump will experience stall due to seize of the inner rotor component, causing slip of inner and outer magnetic rotors. In this case, the motor will be in a light load state. The light load protection function of the motor current or power protector can avoid the demagnetization failure of the magnetic rotor due to heating. The SP of the light load shall be 90% of the power or current value when the pump outlet valve is fully closed during operation and the pump outlet pressure is normal.

磁力泵在泵腔内无液体的情况下空转或内部转子部件因卡住而发生堵转，造成内外磁转子打滑，

此时电机处于轻载状态。使用电机电流或功率保护器的轻载保护功能避免磁转子因发热而退磁失效，轻载荷的设定值，以运转时泵在出口阀门关死，并在泵出口压力正常的情况下所测得的功率或电流值的 90% 为准。

1) Switchover of the pumps

机泵之间的切换

①Magnetic pumps are normally switched over every month

磁力泵一般为一个月切换一次。

②Make preparations for starting the standby pump per the preparation procedures for pump start.

按开泵前的准备步骤做好开备用泵的一切准备工作。

③Start the standby pump, slowly open its outlet valve, close the outlet valve of the running pump. After confirming that the standby pump is in normal operation, close the outlet valve of the running pump, and press “Stop Pump” button of the running pump.

启动备用泵，缓慢开出口阀，关闭待停泵出口阀，确认开泵运行正常，待停泵出口阀关闭后，按下待停泵的“停泵”按钮。

2) Stop the pump

停运

①Close the outlet valve of the running pump (in the case of the outlet valve closed, the pump shall not run continuously for more than 2 minutes to prevent the magnetic drive failure due to overheating).

关闭待停泵出口阀（在出口阀关闭的情况下，泵连续运转时间不得超过 2min，以防磁力传动器过热而失效）。

②Stop and lock the pump to avoid accidental start.

停机并锁死避免意外启动。

③If the pump is shut down for a long time, the pump chamber shall be completely drained.

长期停机时，泵腔内应排放干净。

④When the pump is used for the salt and caustic liquids that are prone to crystallization, if the pump is shut down for a longer time, the pump shall be completed drained and washed by clean water. Inject clean water to flush the internal sliding bearings and the gap between isolation sleeves for a short time.

对于输送盐、碱等易结晶的液体，停机时间较长时应排放干净，并用清水冲洗干净，通过注入清水并短时间清洗内部滑动轴承及隔离套间隙处。

⑤When the temperature is low in winter and the liquid in the pump chamber may be solidified, if the pump is shut down, the liquid in the pump shall be directly drained, or provide proper reflux through the pump chamber to maintain a temperature that the liquid in the pump chamber will not solidify.

冬季温度较低会导致泵腔内液体凝固时，停机时应直接排放干净泵内液体，或用适当回流通过泵腔维持不凝固的温度。

3) Maintenance and troubleshooting

维护及故障处理

①During operation, check for abnormal noise, vibration and bearing temperature, check the pump and piping for leakage, check the seal chamber for leakage, and check if the temperature at each point is normal by comparing with the design valve on a daily basis.

每天运行期间检查，检查异常噪音、振动和轴承温度；检查泵和管道是否泄漏；检查密封腔是否泄漏；检查各处温度与正常值比较是否有异常。

②If the pump inlet piping and drum drum are made of carbon steel, the isolation sleeve should be opened once a year to clean the iron scraps adhering to the surface of the inner magnetic rotor.

泵入口管道、储罐为碳钢材料时，每年应打开隔离套一次，清理内磁转子表面粘附的铁屑。

③The pumps designed with graphite bearings shall be disassembled once a year to check the abrasion. Replace the bearing if it exceeds or is to exceed the maximum allowable clearance, shows obvious abrasion signs, and is partially damaged.

对于采用石墨轴承的泵，一般每年应拆开检查一次磨损情况。超过或即将超过最大允许间隙规定、有明显磨痕、局部损坏时应更换。

2.4.2.4 Operation of liquid ring pumps 液环泵的操作

(1) Preparations for pump start

开液环泵前的准备

1) Contact the electrician to supply power to the pump.

联系电气，水环泵电机送电。

2) Line up the working fluid piping from the KO drum to the water ring vacuum pump, put the working fluid water cooler into operation, and supply CCW.

改通工作液自分液罐至水环泵流程，投用工作液水冷器，并给上循环水。

3) Close the vent valves of the water ring vacuum pump and the KO drum.

关闭水环泵和分液罐各排空阀。

4) Line up the condensate process flow to the vacuum OVHD 2nd stage pump P-426 and the process flow from P-426 to D-401 process, put the level adjustment valve into service, open the P-426 inlet valve, and close the outlet valve.

改好凝液至二级减顶油泵 P-426 流程，P-426 至 D-401 流程，投用液位调节阀，P-426 入口阀开，出口阀关。

5) Put the dry gas seal of the water ring vacuum pump into service.

投用水环泵的干气密封。

6) Check and put the instruments such as flow meters and level gauges into operation.

检查并投用流量计、液位计等仪表。

7) Fill the KO drum with the working fluid (DM water), and supply the working fluid to the water ring vacuum pump. open the vent valve at the bottom of the water ring vacuum pump, and close the vent valve when water comes from the valve.

分液罐补满工作液（除盐水），并引工作液至水环泵，水环泵底部放空见水后关闭。

8) Line up the non-condensable process flow from the water ring vacuum pump outlet KO drum to D-401.

改通水环泵出口分液罐不凝气至 D-401 流程。

9) Open the water ring vacuum pump outlet valve and the inlet and outlet bypass valve, and fully close the pump inlet valve.

水环泵出口阀和进出口付线阀打开，入口阀全关。

10) Cut out the water ring vacuum pump interlock.

将水环泵联锁摘除。

(2) Start the water ring vacuum pump

启动液环泵

1) Start the motor, check and adjust the working fluid flowrate.

启动电机，检查并调节工作液流量

2) Gradually open the inlet valve of the water ring vacuum pump and introduce steam to the water ring vacuum pump.

逐步打开水环泵入口阀，引气至水环泵。

3) Gradually close the inlet and outlet bypass valves of the water ring vacuum pump.

逐步关闭水环泵进出口付线阀。

4) Observe the change of vacuum degree of the water ring vacuum pump and the change of the working fluid flowrate. If the inlet vacuum of the water ring vacuum pump gradually rises, and the flowrate of the working fluid gradually increases, this indicates that the water ring vacuum pump operates normally.

观察水环泵真空度变化和工作液流量变化。水环泵入口真空度逐渐上升，工作液流量逐渐增大，说明水环泵工作正常。

5) After the condensate level is established, start P-426 to send the condensate into D-401, and control the condensate level according to the process card.

凝液有液位后，启动 P-426，将凝液送至 D-401，按照工艺卡片控制凝液液位。

6) After the inlet valve of the water ring vacuum pump is fully opened, use the bypass to control the inlet vacuum of the water ring vacuum pump.

水环泵入口阀全开后，用付线控制水环泵入口真空度。

7) After the pump is started, check the pump lubrication and cooler and confirm they are in normal operation.

启动后对泵润滑、冷却器检查，确认正常。

8) After confirming the outlet flowrate and pressure of the liquid ring pump are normal, put the interlock into service.

确认液环泵出口流量、压力稳定后，投用联锁。

(3) Stop the water ring vacuum pump

停液环泵

1) Before stopping the water ring vacuum pump, check if the corresponding equipment in the system is ready for pump shutdown.

停机前应检查系统中各相应设备能否进入停车步骤。

2) Close the inlet valve of the water ring vacuum pump, then stop the motor and close the working fluid makeup valve.

关闭水环泵入口阀，然后停电机，关闭工作液补液阀。

3) Close the outlet valve of the water ring vacuum pump. If the pump is shut down for a long time, open the drain valve at each low point to drain the water.

关闭出口阀门。如长时间停机，打开各低点排水阀放尽积水。

2.4.2.5 Operation of shell and tube heat exchangers 管壳式换热器操作

As the sizes of the heat exchangers are large, higher requirements are imposed to the operation of the heat exchangers. The general operating principle for large heat exchangers: operations shall be stable to prevent large fluctuations in temperature and pressure. In order to ensure the normal operation of the heat exchangers and prevent any leakage incidents, the following operation procedures are defined for the heat exchangers:

由于换热器的大型化，给换热器的操作也提出了更高的苛刻度。对大型换热器的总的操作原则是：操作要平稳，要严防温度、压力的大幅波动。为了保证换热器的操作正常，不发生泄漏着火事故，将换热器的操作规定如下：

(1) Preparations before heat exchanger startup

使用前的检查准备工作

1) Check and confirm that the electrostatic earthing protection system of the heat exchanger is in good conditions.

检查换热器静电接地是否良好。

2) Check and confirm that the anchor bolts and the bolts of each connecting flange are tightened (a gap shall be provided at the sliding end).

检查地脚螺栓及各连接法兰螺栓是否松动（滑动端应留有间隙）。

3) Check and confirm that the inlet and outlet valves and valve hand wheels are in good conditions.

检查出入口阀门是否完好，手轮是否齐全好用。

4) Check the shell surface of the heat exchanger for any defects such as deformation, cracks, rust and pits.

检查换热器壳体表面有无变形、碰伤裂纹、锈蚀麻坑等缺陷。

5) Check and confirm that the instruments such as the temperature and pressure gauges in good conditions.

检查温度、压力表等仪表是否好用。

6) The heat exchanger can be put into service only after it is pressure tested and accepted.

试压合格后，方可投用。

(2) Start up the shell and tube heat exchangers

管壳式换热器的投用

1) Completely drain the water from the heat exchanger, supply steam for warm-up and pressure

test, and note that steam must be supplied to the shell side and the tube side at the same time.

放尽换热器内存水，进行蒸汽贯通、预热，试压，注意管壳程必须同时进行。

2) Before putting the heat exchanger into service, first check the enclosed drain valve and confirm it is fully closed to prevent oil spill.

投用前，应首先检查密闭排污阀，是否关严，以免造成跑油。

3) When starting up the heat exchanger, first introduce cold oil and then hot oil to avoid leakage due to sharp deformation of the equipment.

启用换热器应先引冷油，后引热油，以免设备急剧变形造成泄漏。

4) Slowly introduce oil, open the enclosed cold oil drain valve, slightly open the cold oil outlet valve to slowly warm up the heat exchanger, the temperature rise shall be controlled at approximately 50 °C/hour. When oil flows from the enclosed drain valve, close the drain valve immediately, slightly open the cold oil inlet valve to introduce cold oil, and further open the cold oil out valve based on the temperature of the heat exchanger, and then open the inlet valve to properly adjust the temperature rise until the inlet and outlet valves of the heat exchanger are fully opened.

开始引油时要缓慢，打开冷油密闭排污阀，微开冷油的出口阀对换热器进行缓慢升温，升温速度大致控制在 50°C/小时，当密闭排污阀过油后，立即关闭密闭排污阀，微开冷油入口阀过量，冷油入口阀开后，根据换热器温度将适当开大冷油出口阀，再开入口阀调节升温速度。直至冷油的换热器的入口阀和出口阀全开。

5) Slowly introduce hot oil to avoid sharp rise of the pressure in the equipment due to sudden vaporization of a small amount of residual water in presence of the hot oil, so as to avoid damage to the equipment. Open the enclosed hot oil drain valve, slightly open the hot oil outlet valve, the temperature rise is controlled at approximately 50 ° C/hour. When oil flows from the enclosed drain valve, close the drain valve. Slightly open the hot oil inlet valve to introduce hot oil, and further open the hot oil out valve based on the temperature of the heat exchanger, and then open the inlet valve to properly adjust the temperature rise until the inlet and outlet valves of the heat exchanger are fully opened.

引热油时更应缓慢，防止少量存水突然受热汽化造成压力剧增，损坏设备。打开热油密闭排污阀，微开热油的出口阀，升温速度大致控制在 50°C/小时，当热油通过密闭排污阀后，关闭排污阀门。然后微开热油的入口，根据换热器温度上升情况适当开大热油出口阀，再开入口阀调节升温速度；直至热油的换热器的入口阀和出口阀全开。

6) Slowly close the cold oil bypass and the hot oil bypass by several steps until the heat exchanger bypass is fully closed.

缓慢关闭冷油端副线和热油端副线，要分多次缓慢调整。直至换热器副线全关。

7) Closely monitor the system for the pressure changes and leakage during startup of the heat exchanger. If any issue is identified, change to the bypass. After the heat exchanger is put into service, conduct detailed inspections and make records. Only after confirming that the heat exchanger is in normal operation, the operators can then leave. At the initial operation of the heat exchanger, strengthen walk-around inspections so as to identify any leakage in time.

投用过程中要注意系统压力变化、有无泄漏。若有问题时，改走副线。设备投用后作详细检查，无异常情况后方可离开，并做好记录。同时在投用初期一定要加强巡检，防止泄漏。

(3) Shut down the shell and tube heat exchangers

管壳式换热器的停用

1) First open the hot oil bypass valve, and then close the hot oil inlet and outlet valves.

先开热油线的副线阀，确认副线畅通后关闭热油进、出口阀。

2) Then open the cold oil bypass valve, and then close the cold oil inlet and outlet valves.

再开冷油线的副线阀，确认副线畅通后关闭冷油进、出口阀。

3) Purify the piping both sides

然后两侧同时进行吹扫

(4) Precautions

注意事项

1) The downstream process flow shall be properly lined up to avoid pressure buildup in the heat exchanger.

操作过程中要确保后路的畅通，严防换热器憋压。

2) Frequently check the pressure temperature changes and the heat exchanger for any leakage.

经常检查压力、温度变化情况以及换热器是否有泄漏情况。

3) Frequently check the flange joints at the head covers, the channel covers and the enclosed drain valves for any leakage.

应经常检查大头盖、管箱、密闭排污阀等法兰连接处有无泄漏。

4) The operating pressure and temperature of the equipment shall not exceed the design values. When adjustments are required, adjustments must be slow, the change of the operating pressure and temperature of the heat exchanger shall be closely monitored to prevent leakage of the heat exchanger due to large pressure and temperature fluctuations.

设备的操作压力、温度不能超标，当操作变化时，对操作调整一定要缓慢，特别要注意换热器操作压力、温度的变化情况；防止压力和温度波动较大而造成换热器泄漏。

5) Take actions to the issues identified in a timely manner, report to the upper management line and make records.

发现问题及时进行处理、汇报并记录。

2.4.2.6 Operation of shell and tube coolers 冷却器的操作

(1) Startup of shell and tube coolers

管壳式冷却器的启用

1) Slowly open the CCW outlet valve, open CCW vent valve of the cooler, and then further open the inlet valve.

慢慢开启冷却水出口阀，然后打开冷却器冷却水的排水放空阀排气，再慢慢开大入口阀。

2) Slowly introduce hot oil to avoid sharp rise of the pressure in the equipment due to sudden vaporization of a small amount of residual water in presence of the hot oil, so as to avoid damage to the equipment. First slightly open the enclosed hot oil drain valve, slowly open the hot oil

outlet valve, and then slowly open the hot oil inlet valve. When the air is vented, immediately close the enclosed drain valve. When the heat exchanger is full of oil, slowly close the bypass valve.

引热油时更应缓慢, 防止少量存水突然受热汽化造成压力剧增, 损坏设备。先微开热油密闭排污阀, 慢慢开热油的出口阀, 然后慢慢开热油的入口, 当空气排尽后, 立即关闭密闭排污阀, 待换热器充满油过量后, 缓慢关闭副线。

3) After oil is introduced into the cooler, adjust the CCW outlet valve to achieve the required oil cooling temperature. Closely monitor the piping and equipment to avoid solidification and blockage due to too cold temperature of the heavy oil. At the same time, closely monitor the operation of the coolers to avoid cooler fouling or damage to the cooler due to water vaporization caused by too high temperature if CCW flowrate is too small.

冷却器进油后, 以循环水出口阀开度来调节所需的油品冷却温度, 要防止重油因冷后温度过低, 管线设备凝死; 同时, 也要防止给水太少, 温度过高造成冷却器结垢、水汽化而损坏设备。

(2) Shutdown of shell and tube coolers

管壳式冷却器的停用

1) Open the hot oil bypass valve, and then close the hot oil inlet and outlet valves.

开热油副线阀, 确认副线畅通后关闭热油进、出口阀。

2) Open the CCW vent valve, and gradually close the CCW inlet and outlet valves.

打开循环水放空阀, 然后逐渐关闭循环水进、出口阀。

3) Complete drain the water from the cooler, when the temperature of the hot oil drops to approximately 80 °C, use steam to purge the cooler shell.

将水放尽, 待热油的温度下降到 80°C 左右, 再用蒸汽对冷却器壳程进行吹扫。

(3) Precautions:

注意事项

1) Frequency check if the oil is entrained in CCW, if the cooler experiences fouling and water vaporization due to too high temperature.

经常检查冷却水是否带油, 排水温度是否过高而引起结垢和汽化。

2) Check if the oil cooling temperature is within the control indicator.

油品冷却温度是否在控制指标之内。

3) Check the flange joints at the head covers, the channel covers and the enclosed drain valves for any leakage.

检查大头盖、管箱、密闭排污阀等法兰连接处是否有泄漏现象。

4) The operating pressure and temperature of the equipment shall not exceed the design values. When adjustments are required, closely monitor the changes of operating pressure and temperature of the cooler.

设备的操作压力、温度不能超标, 当操作变化时, 特别要注意换热器操作压力、温度的变化;

Take actions to the issues identified in a timely manner, report to the upper management line and make records.

发现问题及时进行处理、汇报并记录。

2.4.2.7 Operation of reboilers 重沸器的操作

(1) Startup of the reboilers

重沸器的投用

1) First introduce cold oil: drain the water from the column before supplying oil into the column. After oil is supplied into the column, the oil will enter the reboiler. Note that the enclosed drain valve at the shell side shall be first opened, and then close the drain valve when oil comes from the valve.

先投冷油：在塔内进油前先排尽积水，当塔内进油后就有冷油进入重沸器内，注意先把壳程密闭排污阀打开，当密闭排污过量后，即可关闭；

2) Closely monitor the temperature at the location where oil return piping to the column. When the temperature continues to rise to a stable value, it indicates that the shell side is filled with cold oil.

注意壳程返塔测温点处温度，当温度持续上升到一个平稳值后，说明壳程已充满冷油；

3) Introduce hot oil: first open the upper and lower enclosed drain valves on the tube side to drain the water, and close the drain valves when oil comes from the valves. Waring: hot burn!

投用热油：先打开管程上下密闭排污阀，放尽存水；进热油后密闭排污过量即可关闭该阀，注意防止烫伤。

4) After opening the inlet and outlet valves on the reboiler tube side, slowly open the control valve on the oil supply piping, and gradual close the bypass control valve. At this point, the temperature of the oil in the oil return piping to the column will rise. and close the small heat bypass control valve. At this point, the temperature of the shell return column will rise. When the temperature continues to rise to a stable value, it indicates that siphon flow has been established in the shell side.

注意打开重沸器管程进、出口阀后，缓慢开大热源正线控制阀，关小热旁路控制阀，此时壳程返塔温度将上升，当升到一定值后，说明壳程已形成虹吸流动。

(2) Shutdown of the reboilers

重沸器的停用

1) Gradually close the control valve on the oil supply piping, and slowly open the bypass control valve.

逐渐关小热源正线控制阀，开大热旁路控制阀；

2) Close the inlet and outlet valves on the tube side.

关闭管程进、出口阀；

3) After the hot oil is properly cooled down, completely drain the oil.

当热油适度冷却后，放尽所有存油。

2.4.2.8 Operation of air coolers 空冷器的操作

(1) Startup of air cooler fans

空冷风机的启动

1) Before starting the air cooler fan, check and clear any objects and inflammable materials around the air coolers, check and confirm that the fan and belts are in good conditions, use hands to rotate the fan to confirm that the fan can be freely rotated without friction, and check and confirm that the grounding wire is securely fixed.

空冷风机启动前，要检查清除空冷器周围的东西和易燃物；检查风机和皮带是否完整无缺；用手盘动风机自如、无摩擦碰撞；检查接地线是否脱落。

2) After confirming that there are no objects and operators in the fan, jog the motor to confirm that the rotating direction is correct, then press the button to start the motor. Open the inlet and outlet valves.

确认风机内无人无物后，点动电机确认转向正确后，再按动电钮启动电机，打开进、出口阀。

3) Closely monitor the operation of the fan: such as bearing temperature, vibration, and belt tightness. If the belt is loose, switch over the air cooler fan to ensure the column OVHD temperature and the after-cooler temperature are stable, and contact the mechanical maintenance staff for repair.

注意检查风机运行情况：如轴承温度、振动情况、皮带有无脱落。若皮带松，应切换空冷风机，以保证塔顶压力和冷后温度稳定，并联系机修检修。

4) Check the air cooler channel, tube bundle, plugs, inlet and outlet flanges for leakage, and check the baseplate for severe vibration.

检查空冷器管箱、管束、丝堵、进出口法兰有无渗漏现象；支座振动是否过大。

(2) Shutdown of the air coolers

空冷器的停用

1) Press the button to stop the motor.

按电钮停运电机。

2) Closely monitor the changes of temperature and pressure of the related process equipment, and make adjustments accordingly.

停运过程中应注意相关工艺设备的温度、压力的变化，并做相应调整。

(3) Walk-around inspections

巡检内容

1) Check if the motor temperature is too high, the bearing temperature shall not be higher than 65 °C, and check and confirm that motor is in normal operation.

检查电机温度是否过高，轴承温度不大于 65°C，电机运行是否正常。

2) Check each seal point such as the flanges, channels and tube bundle plugs for any leakage.

检查各法兰、管箱和管束的堵头等密封点上有无泄漏。

3) Adjust the number of the air coolers in operation to control the outlet temperature within the specified indicator.

根据工艺要求调节空冷运转的数量，将出口温度控制在指标范围内。

4) Check and confirm that the belt is properly tightened. If the belt is loose, stop the fan, cut off the power supply, and contact the mechanical maintenance staff for repair.

检查皮带松紧是否正常。皮带松，应停风机，断电后并联系机修检修。

5) Check the operation of the fan: such as bearing temperature, vibration, and belt tightness.

检查风机运行情况：如轴承温度、震动情况、皮带有无脱落等。

2.4.2.9 Operation of plate and shell heat exchangers 板壳式换热器的操作

The normal operation, startup and shutdown of the plate and shell heat exchanger, both the plate side and shell side shall be even operation and deactivation of the equipment, pressurization, depressurization, temperature increase and temperature decrease shall be equally made, the pressure difference between the shell and the shell shall not exceed 0.6 MPa at any time.

设备按照压差设计，设备正常操作及投用、停用期间，板程与壳程应均衡升降压及升降温；任何时候板壳程间的压差均不得超过 0.6MPa。

(1) Startup

投用

1) Confirm that all vent valves or drain valves of the heat exchanger are closed.

确认换热器所有放空或排污阀门处于关闭状态。

2) Slowly open the hot and cold flow outlet valves of the heat exchanger.

缓慢打开换热器冷热流出口阀门。

3) Slowly open the cold flow inlet valve of the heat exchanger, slowly introduce stream, and open the vent valve.

缓慢打开换热器冷流进口阀门，缓慢引入物料，打开排气阀排气。

4) Slowly open the hot flow inlet valve of the heat exchanger, slowly introduce stream, and open the vent valve.

缓慢打开换热器热流进口阀门，缓慢引入物料，打开排气阀排气。

5) It is strictly forbidden to quickly open the valves when introducing streams to prevent the fluid impact to the plate.

引入物料时严禁急开阀门，防止流体冲击板束。

6) During initial operation, strengthen inspection to check if the thermal expansion of the equipment is restricted. Observe the pressure and temperature changes of the shell side and plate side to ensure the pressure and temperature of the shell side and plate side are slowly and steadily increased, and the temperature rise shall not exceed 60 °C/h.

首次投用，应加强检查设备热膨胀是否受到限制约束。观察板壳程的压力变化，温度变化，应确保板壳程温度及压力缓慢平稳升高，温升速度不超过 60°C/h。

7) if the pressure difference is reduced and the phase mixing is identified, completely isolate the equipment from the system for thorough inspection.

操作中一旦发现压差减小、混相等迹象，应将设备从系统中完全隔离，作彻底检查。

(2) Shutdown

停用

1) When the equipment is to be shut down, first close the hot flow inlet valve and then close the cold flow inlet valve. Valves shall be slowly closed, it is strictly forbidden to quickly close the

valves to prevent the fluid impact to the plate.

设备停用时，应首先关热流进口阀门，然后关闭冷流进口阀门；切断物料时应缓慢进行，严禁急关阀门，防止流体冲击板束。

2) Monitor pressure and temperature changes of the shell side and plate side and ensure that the temperature and pressure are slowly and smoothly reduced.

监视板壳程的压力变化，温度变化，应确保板壳程温度及压力缓慢平稳降低。

(3) Cleaning

清洗

When the heat transfer capacity of the equipment is reduced, the equipment shall be cleaned.

设备传热能力下降时，应对设备进行清洗。

1) When conditions permit, nitrogen purge is recommended.

当条件许可时，建议选用氮气吹扫。

2) The pressure of HP water shall be controlled below 0.6 MPa, the temperature shall be controlled below 80 °C, and the Cl⁻ content shall not exceed 25 mg/L.

清洗高压水的压力应控制在 0.6MPa 以下，温度控制在 80°C 以下，控制 Cl⁻ 含量不超过 25mg/L。

3) Use steam to simultaneously purge the plate side and shell side, the positive and negative pressure difference must be controlled below 0.6 MPa, and the purging temperature shall be controlled below 150 °C.

蒸汽吹扫应板、壳同时进行，严格控制正负压差低于 0.6MPa，扫线温度低于 150°C。

4) During purging and cleaning, the pressure and temperature shall be slowly raised and lowered.

吹扫、清洗过程中，同样应缓慢升降压、升降温。

(4) Precautions

注意事项

1) The flowrate shall be adjusted slowly to avoid water hammer.

应缓慢调节流量，避免出现水击。

2) Before starting the pump, the plate heat exchanger shall be first bypassed. After the pump outlet pressure and flowrate are normal, put the plate heat exchanger into service.

开泵前，板式换热器应先走副线，待泵出口压力、流量正常后，再缓慢投用板式换热器。

3) Before purging the piping, the plate heat exchanger shall be first cut out, and it shall be purged separately.

在吹扫管线前，应将板式换热器切出，然后单独吹扫该设备。

2.4.1.11 Operation of heaters 加热炉操作

(1) Heater dryout

加热炉烘炉

1) Purposes of heater dryout

烘炉目的

①The inner lining, refractory bricks and fix box of newly constructed heater contain a lot of water.

Heater dryout can slowly remove the moisture accumulated in the heater wall during the masonry construction, and enable that refractory cement is sufficiently dehydrated and sintered. If the moisture is not removed, the heater temperature will rise rapidly when the heater is started, the water will evaporate rapidly, causing the brick joint to expand and cracks. In severe cases, the heater wall collapses, so the heater that has just been built or repaired must be dried out.

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。

②Commission the process piping of the fuel gas system, fuel oil system and steam system, the process equipment and the automatic control 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。

③Assess the operation performance of the all oil burners and gas burners.

考核全部加热炉油火咀，瓦斯火咀的使用效果。

④Assess the performance of the various components of the heater under heated condition.

考核炉体各部件在受热状态下的性能。

2) Construction quality inspection and acceptance before heater dryout

烘炉前的施工质量的验收

①Strictly follow the construction quality inspection and acceptance requirements to check the construction quality of the parts of the heater, the equipment of the fuel system, the equipment of the air preheater system, the process piping and the instruments.

对施工质量进行严格验收，对加热炉的零部件、燃料系统所属设备、空气预热器系统所属设备、工艺管线和仪表等进行全面验收。

②Check the condition of the expansion joint of the heater wall masonry (brick seams).

检查炉墙砌筑（砖缝）烟道膨胀缝情况。

③Check the insulation and thermal conductivity of the heater.

检查炉体保温及导热质量情况。

④Check the installation of the heater tubes, return elbows, hangers, explosion-proof door, guide tubes, fire window and burners.

检查炉管、回弯头、吊挂、防爆门、导向管、看火窗、火咀安装情况。

⑤Check if the movable parts of the heater can be freely moved (such as flue gas duct baffle and air damper) and open the flue gas duct baffle to one-third position.

检查炉区活动部件是否灵活好用（如烟道挡板、风门等）并将烟道挡板打开三分之一。

⑥Check the fire box for any debris.

检查炉膛内有无杂物。

⑦Check and confirm that each measurement and control instrument is in good conditions.

检查各测量和控制仪表是否灵敏好用。

⑧Contact the Operation Scheduling Department to introduce high pressure gas into the process unit.

联系调度引高压瓦斯进装置。

⑨Prepare the ignition tools and fire-fighting equipment.

准备好点火工具及消防器材。

⑩Steam pressure test for the heater tubes is completed.

炉管蒸汽贯通试压完毕。

3) Inspections to heater dryout process flow

烘炉流程的检查

①Properly line up F-301 and F-401 process flow, and change the position of the F-301 and F-401 heater tube outlet spectacle blinds.

F-301、F-401 进料流程改好，F-301、F-401 炉管出口 8 字盲板是否调头。

②Properly line up the fuel gas, fuel oil and atomization steam process flows, remove the blinds to prepare to introduce fuel gas, fuel oil and atomized steam.

燃料气、燃料油、雾化蒸汽流程是否畅通，拆除盲板改好流程准备引燃料气、燃料油和雾化蒸汽。

4) Inspections to heater before dryout

烘炉前加热炉检查

①Check and confirm that the man holes are closed.

人孔是否都已封闭。

②Check and confirm that the flue gas duct baffles and air duct butterfly valve are in good conditions, and mark the open and close directions at 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。

③Check and confirm that the burners are in good conditions, and use steam to purge the burners.

炉内燃烧器是否齐全完整好用，并用蒸汽吹扫检查。

④Supply power to the air blowers and induced draft fans, fill oil into the barring gear and make preparations to put CCW system into service.

鼓、引风机送电、盘车加油，给上冷却水做好备用工作。

⑤Check and confirm that each test instrument is properly installed at the correction position.

各检测仪表安装完毕位置准确。

⑥Introduce steam and drain condensate.

引蒸汽并排尽冷凝水。

⑦Use nitrogen to purging the fuel gas system, oxygen content shall be $\leq$ 0.5%.

氮气置换燃料气系统，含氧量 $\leq$ 0.5%。

⑧The fuel gas KO drum is ready for service, and introduce the fuel gas and drain the condensate.

燃料气分液罐具备投用条件，引燃料气并切除凝缩液。

⑨Introduce fuel oil to establish fuel oil circulation.

引燃料油，建立燃料油循环。

⑩Prepare the dryout record forms and curves, and contact the instrument staff to prepare the instruments ready for service. Prepare the ignition tools, clean the site.

准备好烘炉记录和烘炉曲线,联系仪表做好仪表投用准备工作。准备好点火用具,现场清扫干净,无杂物。

5) Heater dryout

烘炉

①Use plant air to drain water

工厂风顶水

A Introduce plant air to F-301 and F-401 inlet control valves.

将工厂风引到 F-301、F-401 进料控制阀。

B First drain the water in the piping from the vent pipe, and then use plant air to drain the water in the tubes pass by pass from the bottoms of C-300 and C-400.

先从放空线排尽管线存水,再一路一路的用工厂风把管内存水顶干净,顶水由 C-300、C-400 底放空切除。

②Use steam to warm up the heater

蒸汽暖炉

A After water is drained, stop plant air supply, and change the position of each spectacle blind at each heater outlet.

工厂风顶水完毕后停工厂风,加热炉炉管各分支出口“8”字盲板掉头。

B Line up the process flow from each tube to the silencer.

改通各炉管至消音器的流程

C Introduce 1.0Mpa steam to the heater feed valve of the heater to drain the steam condensate.

将 1.0Mpa 蒸汽改到加热炉进料阀处,排净蒸汽冷凝水。

D Introduce the steam to heater tube one by one, and use the thermocouple at the heater four-pass manifold to judge if the heater tubes are unblocked.

炉管给汽,注意缓慢,一路一路的给,通一路再给下一路,用炉四路出口热电偶测量温度来判断是否畅通。

E After the heater tubes are purged, open the flue gas duct baffle to 1/3 position and open the air duct butterfly valve to 1/2 position. The baffle and valve shall not be fully closed.

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。

F When the upper temperature of the heater rises to 130 ° C, prepare for firing the heater.

当炉膛上部温度升到 130°C后,准备点火烘炉。

③Heater dryout

点火烘炉

A Check and confirm that the fuel gas process flow is properly lined up, first purge with steam and the purge with nitrogen for air freeing, and then introduce fuel gas into D-861 where the fuel gas is sent to each burner.

检查燃料气流程并经确认用蒸汽吹扫,氮气置换以后,将燃料气引进 D-861 切液以后引到各火咀处。

B Take samples from the fire boxes of F-301 and F-401, analyze the total hydrocarbon content. If the total hydrocarbon content is $\geq 0.2\%$, it is allowed to fire the heater.

采集 F-301、F-401 炉膛气体，分析总烃含量，总烃含量 $\geq 0.2\%$ ，可点火。

C Open the flue gas duct baffle, open the snuffing steam to the heater, fire the heater after 10 minutes when steam comes from 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。

D Further close the flue gas duct baffle, supply air into the heater, first the fire the fuel gas pilot and then fire the fuel gas burners. Firing shall not be too large to prevent rapid temperature rise, and the burners shall be symmetrically fired.

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

E After the fuel gas burners are fired, fire more fuel gas burners or fuel oil burners based on the heater dryout temperature rise curve.

燃料气点火后，根据烘炉曲线升温，增点燃料气火嘴或燃料油嘴。

F Fire the burners as many as possible, the flames shall be short and bright, and the spare burners shall be switched over frequently.

火嘴尽量多点，火焰短齐明亮，备用火嘴定期切换使用。

G After the burners are fired, put the air preheater into operation to dry the cold and hot air ducts.

点火嘴后开空气预热器，烘冷热风道。

6) Heater dryout curve

烘炉曲线

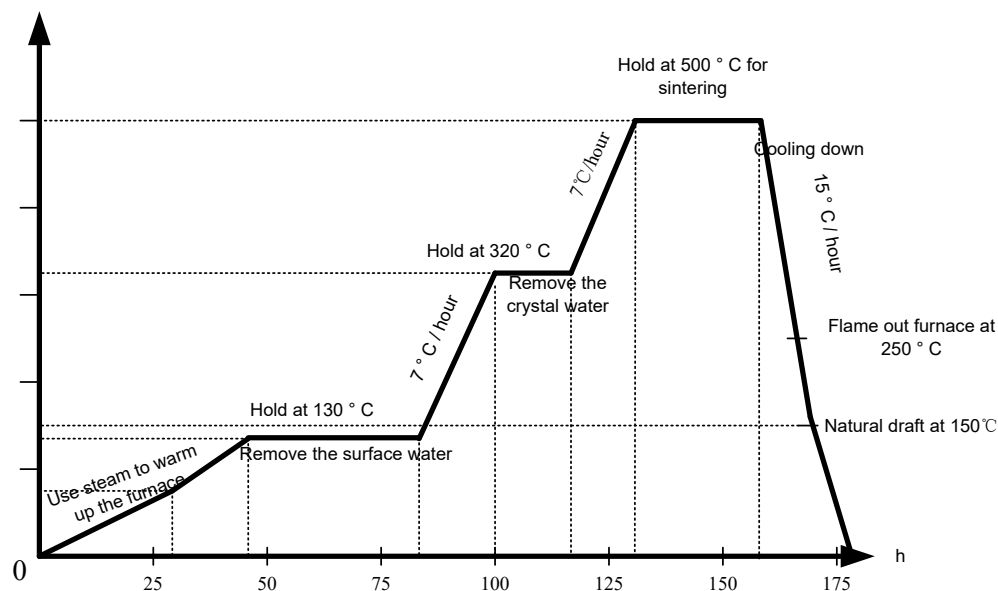


Figure 44 Heater Dryout Curve

图 44 加热炉烘炉曲线图

Note: the heater dryout curve is normally provided by the supplier of the heater lining. If the supplier does not provide the dryout curve, this curve shall be used for heater dryout.

说明：烘炉曲线一般由加热炉衬里供应商提供，供应商未提供烘炉曲线而需要烘炉时，按照此烘炉曲线烘炉。

7) Precautions:

烘炉注意事项

①The newly constructed heater shall be naturally ventilated and dried for more than 10 days.

新建炉子应有 10 天以上自然通风干燥。

②Before supply steam into to the heater tubes, complete drain the condensate to avoid water shock. Slowly introduce steam, if water shock occurs in the tubes, reduce the steam flowrate, even stop steam supply to prevent damage to the insulation of the heater wall.

烘炉前向炉管内通蒸汽时，一定要放净冷凝水，以防水击，给汽一定得缓慢，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。

③Strictly control the heater outlet temperature, and the steam flowrate into the heater tubes can be adjusted after a slight timeout at 400 °C.

严格控制炉出口温度，400°C以后温度稍超时可调节炉管内的蒸汽量。

④Steam flowrate, fuel oil flowrate, fuel gas flowrate, air dampers and fuel gas duct baffles may be used as the means for adjusting the temperature of the fire box. During the temperature hold period, the temperature of the fire box shall be controlled within ± 8 °C, large fluctuation is not allowed.

蒸汽量、燃料油量、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 °C，不可波动太大。

⑤All fire nozzles must be piloted in turn. Any piping related to the heater must be cut off or blinded.

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。

⑥Strengthen inspections during heater dryout to prevent pressure buildup, and temperature shall be increased slowly. In case of any abnormality, report to the involved departments immediately.

烘炉过程，应加强检查，防止憋压，升温时均匀缓慢，如意外立即汇报部门。

⑦If the heating time is short, the temperature hold period shall be extended in accordance with the time period specified in the dryout plan.

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。

⑧When the temperature is up to 500 °C, hold at this temperature for one day, then the reduce the temperature to 250 °C and close the fuel to the burners. Close all the baffles and dampers so that the heater temperature drops slowly. During temperature hold period, the fuel gas burner and pilot hoses shall be all removed to prevent accident due to internal leakage of fuel gas valves.

温度到 500°C恒温一天，然后降温至 250°C熄灭炉火，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。

⑨After the burners are taken out of service, the fuel gas supply must be cut off, and the fuel oil valve to the heater must be closed.

炉子熄火后一定要切断瓦斯，燃料油进炉子阀门一定要关死。

⑩When the heater temperature drops to 100 °C, open the manhole and flue gas duct baffle for

natural ventilation and cooling. To this point, heater 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。

8) Inspection after heater dryout

烘炉后检查

①Check the lining for cracks and shedding, check the steel frame and hangers for any bending, check the tubes for any deformation and sinking, and check the fire box for any cracks.

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。

②Take sample from the refractory material in the heater, if the water content is less than 7‰, it is considered that the heater dryout is acceptable.

取炉内耐火材料分析水分低于 7 ‰即认为合格。

③If the cracks in the lining of the heater are large, they must be repaired. In particular, it is required to check if the steel structure is exposed. If it is exposed, report it to the upper management line immediately for treatment.

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

(2) Coke burning

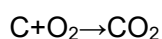
蒸汽烧焦

1) Coke burning theory

烧焦原理

Coke in heater tubes is cracked, crushed and combusted by hot steam and air shock at the specified temperature, the products from combustion and the unburned coke powder are carried away with high-speed gas flow. The main chemical equation for coke burning is shown below:

炉管内的焦在一定温度下，受到高温蒸汽和空气冲击而崩裂，粉碎和燃烧，燃烧后的产物和未燃烧的焦粉一起被气流带走，烧焦的主要化学方程式是



The flow chart is shown below:

其流程如下：

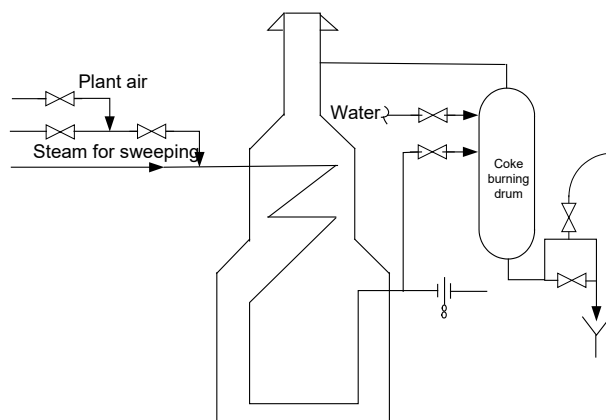


Figure 45 Coke Burning Flow Chart

图 45 烧焦流程图

2) Preparations for coke burning

烧焦准备

①After the heater is shut down, use steam to completely purge the heater tubes, and then change the position of the heater outlet spectacle blind to isolate the tubes from the other parts.

加热炉停炉后，用蒸汽将炉管全部吹扫干净，然后把炉管出口 8 字盲板掉头与其它部分隔离开。

②Connect the heater outlet crossover to the coke burning vent drum, and properly line up the steam - coke burning system.

将炉出口转油线与烧焦放空罐连接，按蒸汽—空气烧焦系统改好流程。

③Make the steam (pressure shall not be less than 0.7MPa), plant air (pressure shall not be less than 0.4MPa), fuel and water available.

准备好蒸汽（压力不少于 0.7MPa），非仪表风（压力不小于 0.4MPa），燃料及水。

④Introduce steam to the heater inlet, and , and check if the process flow to the decoking drum is properly lined up.

从炉入口处通蒸汽贯通，检查各路去烧焦罐是否通畅。

⑤Contact the instrument staff to put the instruments into service, such as the flowmeters, fire box outlet thermometer, and the fuel oil and fuel gas pressure control valves.

联系仪表投用所需仪表，如回路流量，炉膛四路出口温度，燃油，燃气压控阀等。

3) Coke burning

烧焦

①Introduce steam into the superheated steam tubes of the Vac. heater and then vent the steam. Introduce steam into the inlets of the convection sections of the two heaters, and fire the heaters to increase the temperature.

减压炉过热蒸汽管通蒸汽放空，两炉从对流管入口通蒸汽贯通后，点火升温。

②When the temperature of the fire box is lower than 500 ° C, the temperature rise shall be controlled at 50 ° C/h, and when the temperature of the fire box is up to 500 ° C, the temperature rise shall be controlled at 30 ° C/h.

炉膛温度低于 500°C 时，升温速度为 50°C/h，炉膛温度达到 500°C 时，升温速度为 30°C/h。

③When the temperature of the fire box is up to 500 ° C, start CCW supply to the decoking drum. When the temperature of the fire box is up to 530 ° C, inject a large amount of steam. At this point, the coke expands and contracts, and then sheds, the coke particles are carried into the decoking drum with steam flow.

当炉膛温度达到 500°C 时烧焦罐给水冷却，炉膛温度升至 530°C 时，大量吹入蒸汽，此时焦发生胀缩崩裂，脱落后，焦粒随蒸汽吹至烧焦罐。

④When the temperature of the fire box is up to 550 ° C, keep the temperature constant and reduce steam injection flowrate, and properly introduce air for combustion. At this point, the outlet temperature of the heater may be appropriately raised. Open the vent valve of the decoking drum, and the flue gas from the decoking drum is black.

炉膛温度升至 550°C 时，恒温减小蒸汽量，适当通空气燃烧，此时炉出口温度可适当上升，打开烧焦罐放空阀，烟气发黑。

4) Judgment for normal coke burning

烧焦正常的判断

①The heater tubes are reddish, if color is pink, it means the temperature is too high, the air flowrate shall be properly reduced and the steam flowrate shall be increased.

炉管赭红色，如呈桃红色，说明温度过高，适当减少空气量，加大蒸汽量。

②The size of the coke powder from the outlet of the decoking drum shall not be larger than 2 mm. if the size of the coke powder is too large, the coke powder will easily block the heater tubes, resulting in damage to the heater tubes.

由烧焦放空罐出口吹出的焦粉不大于 2 毫米，太大易造成炉管堵塞，烧坏炉管。

③The flue gas from the vent valve of the decoking drum shall be black.

放空并冒出的烟应为黑色。

④Coke burning shall be conducted pass by pass, and the tube pass that is not burnt shall be shielded by steam. When the tubes become black, it indicates that the coke in tubes has been burnt. The coke burning sequence shall be from the front tube to the back tube. After all the tubes are burnt to red, steam injection may be stopped. At this point, keep the maximum temperature of the fire box, and introduce a large amount of air for 5 minutes (for the purpose of checking if the coke has been burned) and then use steam to purge the coke particles in the heater tubes until the materials blown from the heater tubes is free of black ash but they are red ash. Burn the coke pass by pass.

烧焦速度以每次烧一路为好，其它几路蒸汽掩护，炉管发黑，说明焦子已烧完，烧焦的炉管依次由前而后，全部红过后，可以停通蒸汽，保持当时炉膛最高温度，大量通汽五分钟（目的是检查焦子是否已烧完）然后改用蒸汽吹扫炉管内的焦粒，直到炉管内吹出物无黑灰而且是红灰为止，一路烧完以后改烧另一路。

⑤After coke burning for each pass is completed, stop air injection, introduce steam for cooling down and then gradually reduce the steam flowrate into the tubes. When the temperature of the fire box is higher than 400°C, temperature drop shall be controlled at 30 °C/h, when the temperature of the fire box is reduced below 400 °C, temperature drop shall be controlled at 40 °C/h after 400 °C, and when the temperature of the fire box is reduced to 350 °C, take the heater burners out of service.

每一路炉管烧焦完后，关闭空气，通蒸汽降温，逐渐减少炉管蒸汽量，降温速度在 400°C 以前为 30°C/h，降至 400°C 以后为 40°C/h，炉膛温度降至 350°C 时熄灭。

⑥When the temperature of the fire box is reduced to 250 °C, open the flue gas duct baffle and the manhole for natural ventilation, stop steam injection into the heater tubes, stop CCW to the decoking drum to allow the natural cooling down of the decoking drum.

炉膛温度降至 250°C 打开烟道挡板，人孔自然通风门，炉管停止通蒸汽，烧焦罐可停水，自然冷却。

⑦When the temperature of the fire box drops to the ambient temperature, open the heater tube plugs and check the coke burning in the heater tubes.

待温度降至常温后，拆开炉管堵头，检查炉管烧焦情况。

5) Precautions:

烧焦注意事项

①During coke burning, the temperature of the fire box and the convection chamber shall be uniform, introduce steam into the superheated steam tubes of the convection chamber and vent the steam, the flame distribution shall be uniform and symmetrical without impingement to the tubes.

烧焦过程应注意炉膛，对流室温度各点要均匀，对流室过热蒸汽管要通蒸汽放空，火焰分布均匀、对称、不扑炉管。

②Steam shall be used as the main stream during coke burning, it is not allow to control the heater outlet temperature by adjusting the air flowrate.

整个烧焦过程要以蒸汽烧焦为主，空气燃焦为辅，不能用空气调节炉出口温度。

③After coke burning is completed for all tubes, use compressed air to purge the tubes.

全部烧焦后，要用压缩风将炉管吹一遍。

④If the size of coke particles is too large, properly increase the steam flowrate.

如果烧焦的焦粒大大可适当开大蒸汽量。

⑤Slowly increase the air flowrate, and additionally, the heater tubes shall be periodically purged with a large flowrate of steam to remove loose coke and ash during coking burning.

通入空气量应缓慢增加，在整个过程中，还应定期用大流量的蒸汽吹扫炉管以除去松散的焦和灰渣。

⑥It is required to strictly control the temperature rise and cooling speed.

要严格控制好升温速度和冷却速度。

⑦It is required to properly adjust the air flowrate into the heater and the opening of the flue gas duct baffle.

要调节好入炉风量与烟道挡板开度。

⑧Check the vent valve of the decoking drum, if the vent valve is blocked, stop coke burning immediately, eliminate the blockage, and then continue coke burning.

要注意检查烧焦罐排空畅通情况，如发现堵塞，要立即停止烧，待处理完后继续烧焦。

(3) Fire heater

点火

1) Inspections before heater startup

开工检查

①Check the insulated refractory wall for damage, remove the oil leaked and other debris in the heater.

检查耐火保温炉壁是否有损坏，除掉炉膛内的漏油和其它杂物。

②Check the snuffing steam pipe for corrosion and burnt-down, especially the heater wall around the snuffing steam pipe for burnt-down.

检查消防蒸汽接管是否有腐蚀和烧坏现象，特别提靠近消防蒸汽接管周围的炉墙有无烧坏现象。

③Check and confirm that the inspection, cleaning and safety of the heater burners are in compliance with the requirements.

检查加热炉火嘴的检修、清扫、安全是否符合要求。

④Check and confirm the fire box, explosion-proof door, fire window, fire hole and the seal plate are in good conditions, fuel gas manifold valve and each fuel gas burner valve are fully closed, and fire-fighting equipment and supplies are available. Check and confirm that the piping and valves of the heater are in good conditions.

检查炉膛、防爆门、看火窗及看火孔、封板是否齐全完好，各瓦斯总阀、各火嘴瓦斯阀是否关严，消防器具是否齐全。检查加热炉所属管线、阀门等是否完好。

⑤Check and confirm that the flue gas duct baffle, the inlet and outlet butterfly valves of the air blower, induced draft fan and preheater, and air damper are in good conditions, the indicated opening and the switch directions are correct, and the fans have been tested.

检查烟道挡板，鼓风机、引风机和预热器的进出口蝶阀，风门等是否灵活好用，指示开度和开关方向与实际是否相符，风机试运合格。

⑥Check and confirm that all instruments (including pressure gauges) are correctly installed without damage.

检查所有仪表（包括压力表）是否齐全，有无损坏和安装不妥。

⑦Check and purge each burner, high pressure fuel gas piping, low pressure fuel gas piping, high and low pressure fuel gas drum, fuel oil piping and atomizing steam piping, and then close each burner fuel gas valve, fuel oil valve and atomizing steam valve.

检查并扫通各火嘴、高压瓦斯线、低压瓦斯线、高低压瓦斯罐、燃料油线、雾化蒸汽线，然后关闭各火嘴瓦斯阀、燃料油阀、雾化蒸汽阀。

⑧Check and remove the fuel gas burner, pilot, fuel oil and atomizing steam metal hoses under each burner.

检查并拆下各燃烧器底下的瓦斯火嘴、长明灯、燃料油、雾化蒸汽金属软管。

⑨Prepare the firing tools (ignition torch, utility lighter, match and fire mask).

准备好点火器具（点火枪、点火棒、火柴及防火面罩）。

2) Introduce fuel and steam

引燃料和蒸汽

①Introduce fuel gas per the following steps:

按照以下步骤引燃料气。

A Properly line up the fuel gas process flow, and close the valve at BL.

改好燃料气流程，界区阀门关闭。

B Introduce nitrogen to purge the fuel gas system. Take samples at the end of the fuel gas system, when the oxygen content is less than $<0.5\%$, stop nitrogen.

引氮气吹扫燃料气系统。采样分析燃料气系统末端采样分析氧气含量 $<0.5\%$ ，停氮气。

C Check and confirm that the hand valves for the main fuel gas burners and pilot are closed. Put the fuel gas pressure control valve into service, and close the fuel gas to the heater temperature control valve and the emergency shut-off valve.

检查各火嘴燃料气主火嘴和长明灯两道手阀关闭。燃料气压控阀投用，燃料气至各加热炉温控阀、紧急切断阀等关闭。

D Contact the Operation Scheduling Department to introduce fuel gas into D-861, and purge towards the flare gas system. If the flare gas system is not put into service, vent at high point for air freeing. When venting at the high point, properly control the purging speed, and use flammable gas detector to check the fuel gas. When the flammable gas detector generates alarm, close the vent valve.

联系调度，引燃料气进 D-861，往火炬气系统置换，如火炬气系统未投用，则在高点放空置换。采用高点放空置换时，控制置换速度，并采用可燃气体报警仪监测，报警后关闭。

②Introduce the fire box steam to the heater and drain the water from the fire box.

引炉膛蒸汽到炉前并脱净存水。

③Introduce the atomizing steam to the heater, confirm that the atomizing steam pressure is normal, and drain the condensate to ensure that the atomizing steam does not carry water.

引雾化蒸汽至炉前，确认雾化蒸汽压力正常，排凝检查，确保雾化蒸汽不带水。

④Introduce fuel oil per the following steps:

按照以下步骤引燃料油。

A Properly line up the fuel oil process flow. Check and confirm that each burner fuel oil valve is fully closed.

改好燃料油流程。炉前各火嘴燃料油手阀完全关闭。

B Put the fuel oil flowmeter and control valve into operation, and the valve is opened to 10%.

投用燃料油流量计，调节阀等，阀位开度 10%。

C Contact the Operation Scheduling Department to introduce fuel oil to the process unit, open the fuel oil valves to/from the process unit.

联系调度准备引燃料油进装置，打开燃料油进、出装置阀门。

D Contact the Operation Scheduling Department to inform the storage to supply fuel oil.

联系调度，通知罐区送燃料油。

E Controls the fuel oil pressure within 0.6 MPa to 0.8 MPa.

控制燃料油压力在 0.6MPa~0.8MPa。

3) Fire the heater

加热炉点火

①Preparations

准备工作

A Take sample from the fire box to analyze the explosive gas content, the total hydrocarbons content shall be <0.2%.

炉膛采样分析爆炸气合格总烃<0.2%。

B Open the chimney butterfly valve, adjust the opening of the flue gas duct baffles of the two heaters, and control the negative pressure of the fire boxes within -30Pa~-10Pa.

打开直排烟囱的蝶阀，调整两炉烟道挡板开度，控制炉膛负压-30Pa~-10Pa。

C Quickly and fully open the air dampers, and slightly open the secondary air damper for each burner.

快开风门全开，各火嘴二次风门稍开。

D Introduce steam into the fire box, stop steam injection after 10 minutes when steam comes from the chimney.

炉膛吹入蒸汽，待烟囱见汽 10min 停汽。

E Make the utility lighter available.

准备好点火棒。

②Infinite the pilot

点长明灯

A Remove the pilot head from the burner and connect it to the metal hose.

将长明灯枪头从燃烧器取下，与金属软管连接好。

B. After the pilot is ignited with the utility lighter, insert the head of the pilot into the burner.

用点火棒将长明灯点燃后，长明灯枪头插入燃烧器。

C Ignite other pilots one by one. Adjust the flame of the pilot to normal.

逐一点燃其它长明灯。调整长明灯火焰正常。

③Fire the fuel gas burners

点燃料气主火嘴

A After the pilots are ignited, directly open the main burner fuel gas valves to ignite the main burners.

在长明灯点好的情况下，可直接打主火嘴瓦斯阀门，点燃主火嘴。

B When igniting the burners, adjust the burner air damper based on the burning condition of the burners, and contact the panel operators to adjust the opening of the flue gas duct baffle to ensure proper flame of the burners.

在点火嘴的同时，应根据火嘴燃烧情况调节火嘴风门，并联系内操调节烟道挡板开度，使火嘴火焰正常；

C The panel operators adjust the operating parameters of the heater to normal.

内操调节加热炉各操作参数至正常。

④Ignite the fuel oil burners

点燃料油火嘴

A After firing the fuel gas burners, fire the fuel oil burners.

燃料气火嘴已点好时，可点燃料油火嘴。

B Open the atomizing steam valve to purge the fuel oil burner, and the close the atomizing steam valve after purging.

打开雾化蒸汽，吹扫燃料油火嘴，吹扫后，关闭雾化蒸汽。

C First open the atomizing steam valve, then open the fuel oil hand valve and confirm that the fuel oil burners have been fired.

先打开雾化蒸汽阀，再开燃料油手阀，确认燃料油火嘴已点燃。

D Adjust the combustion condition of the fuel oil burners, adjust the air damper in time, and confirm that the fuel oil burners burn well.

调整燃料油火嘴燃烧状况，及时调整风门，确认燃料油火嘴燃烧良好。

E Properly control the fuel oil and atomization steam pressure, adjust the opening of the flue

gas duct baffle in time, and control the negative pressure and oxygen content in the fire box.

控制好燃料油与雾化蒸汽压力，及时调整烟道挡板开度，控制好炉膛负压和氧含量。

④Precautions for firing the heater

加热炉点火注意事项

When igniting the fuel gas burners:

点燃料气火嘴时：

A Before igniting the fuel gas burners, introduce steam into the fire box, stop steam injection after 10 minutes when steam comes from chimney.

点火前开大蒸汽向炉膛吹扫，炉膛吹入蒸汽，烟囱见汽 10min 停汽。

B Open the flue gas duct baffle to 30%, open the quick opening damper, and then ignite the burners one by one. The ignited burners shall be evenly distributed, and the heater temperature rise shall be $\geq 100^{\circ}\text{C/h}$.

将烟道挡板开 30%，打开快开风门，然后逐一点燃火嘴，注意火嘴分布均匀，控好炉膛温度上升速度 $\geq 100^{\circ}\text{C/h}$ 。

C Properly control the heater negative pressure and the secondary damper opening to prevent the flameout of ignited burners. If all the burners are completely flamed out, take sample from the fire box for analysis, and then re-ignite the burners.

控制炉膛负压和二次风门开度，防止已点火嘴熄灭。如炉膛火嘴全部熄灭，应采样分析炉膛气体样，并合格后再重新点火。

D While igniting the burner, the operator shall not directly face towards the fire watch window or the burner base to avoid injury by the backfire. After the burner is ignited, a dedicated person shall be assigned to frequently check the conditions of the burner to prevent flameout.

点火时，操作人员要偏对看火窗或火嘴底盘，以防回火伤人，火嘴点燃后，要由专人负责，加强检查，防止熄火。

When igniting the fuel oil burners:

点油火嘴时：

A The fuel oil burners must be ignited in a symmetrical and evenly distributed sequence, and the idle burners shall be periodically switched.

油火嘴必须按对称均匀分布的顺序点火嘴，闲置火嘴定期切换。

B Properly adjust the air duct damper and the flue gas duct damper to regulate the negative pressure and the oxygen content in the heater chamber.

及时调整风门和烟道挡板开度，确认炉膛负压和氧含量在合适的范围内。

C Check and confirm that the wall temperature and heater temperature are not too high, and the process fluid in the heater tubes does not drift.

严格检查，管壁温度、炉膛温度不能超高，炉管工艺介质不能偏流。

D While igniting the burner, the operator shall not directly face towards the fire watch window or the burner base to avoid injury by the backfire. After the burner is ignited, a dedicated person shall be assigned to frequently check the conditions of the burner to prevent flameout.

点火时，操作人员要偏对看火窗或火嘴底盘，以防回火伤人，火嘴点燃后，要由专人负责，加强

检查，防止熄火。

E After the fuel oil burners are taken out of service, purge the burners in time.

油火嘴在停烧后，要及时进行吹扫。

5) Precautions for temperature rise

升温操作注意事项

①The rapid temperature rise of the flue gas will adversely affect the refractory lining, the temperature rise must be lower than 100 ° C/h, and the temperature of the two fire boxes shall be $\geq 800^{\circ}\text{C}$.

烟气的快速升温会对耐火衬里带来不利影响，其速率必须低于 100°C/h，并确保两炉膛温度 $\geq 800^{\circ}\text{C}$ 。

②The temperature rise curve shall be controlled to be a uniform oblique line shape.

控制升温曲线为均匀的斜线状。

③When it is required to increase the number of main burners, the corresponding air dampers and flue gas duct baffles shall be opened accordingly to adjust the combustion state.

当要增加主火嘴时，要相应的开大风门和烟道挡板，调节燃烧状态；

④After all the burners are ignited, adjust the hand valve of each burner to keep the flame shapes consistent.

当所有火嘴全部点燃后，调节各火嘴手阀，使火焰形状保持一致。

⑤When the outlet temperature of the two heaters is up to the expected operating temperature, put the heater outlet temperature control to auto mode, and put the fuel gas flowrate into cascade control mode.

当两炉出口温度达到预期的操作温度时，将炉出口温度设定自动，燃料气流量投用串级控制。

(4) Shut down the heater

停炉

1) Normal shutdown

正常停炉

①Shut down the air preheater (the waste heat recovery system).

停运空气预热器（余热回收系统）

A Remove the air preheater interlock in the SIS system.

在 SIS 系统中摘除空气预热器联锁。

B Open the bypass butterfly valve of the air preheater, and the flue gas from the heater is directly sent into the chimney.

打开空气预热器的旁路蝶阀，加热炉热烟气直排烟囱。

C Stop the induced draft fan by pressing the fan stop button at site or in the central control room.

按现场或者中控室辅操台引风机停机按钮，停运引风机。

D Press the reset button of the fan interlock in SIS system to open the F-301 and F-401 quick opening dampers.

SIS 系统内按鼓风机联锁中的复位按钮，打开 F-301、F-401 快开风门。

E Stop the induced draft fan by pressing the fan stop button at site or in the central control room.
按现场或者中控室辅操台鼓风机停机按钮，停运鼓风机。

F Adjust the secondary damper of the heater.

调整加热炉二次风门。

G Close the preheater inlet and outlet butterfly valves.

关闭预热器进出口蝶阀。

②Shut down the heater

停加热炉

A When the heater is normally shut down, the heater shall be cooled down first. Change the temperature control valve of the heater from auto mode to manual mode, and gradually close the fuel gas and fuel oil control valves to reduce the outlet temperature of the heater. The heater cooling rate shall be controlled at $\geq 30^{\circ}\text{C}$.

正常停炉时，应先加热炉降温。将加热炉的温控阀由自动改为手动，逐渐关小燃料气和燃料油调节阀，降低加热炉出口温度。加热炉降温速度控制在 $\geq 30^{\circ}\text{C}$ 。

B Stop the low pressure fuel gas burners. Change the desulphurization vacuum OVHD fuel gas to the flare gas system, close the valve to the heater, and close the pilot gas (high pressure fuel gas).

停运低压燃料气火嘴。将脱硫减顶瓦斯改至火炬气，关闭至加热炉阀门，关闭引射气（高压燃料气）。

C Determine if it is required to flame out the fire burners based on the opening of the heater fuel gas and the fuel oil valves. When the opening of the fuel gas and the fuel oil valves is less than 50%, gradually flame out the burners at the site.

根据加热炉燃料气和燃料油的开度，确定是否熄灭火嘴。当燃料气和燃料油的调节阀阀位低于 50% 以下时，到现场逐渐熄火。

D When flaming out the burners, first flame out the fuel oil burners and then the fuel gas burners. After the fuel oil burners are flamed out, use steam to purge the fuel oil burners immediately.

熄火时先熄燃料油，后熄燃料气。燃料油熄火后，立即用蒸汽吹扫燃料油火嘴。

E When flaming out the fuel gas burners, start from the first fuel gas burner in the heater. Keep the last burner.

燃料气熄火时，应先从加热炉燃料气第一个火嘴开始熄火。保留最后一个火嘴。

F Close the fuel gas valve to the process unit, supply nitrogen into the fuel gas piping at the BL of the process unit (properly control the valve opening) to purge the remaining fuel in the fuel gas system to the heater to be burned.

关闭燃料气进装置阀门，燃料气界区给氮气（控制阀门开度），将燃料气系统的剩余燃料全部顶至加热炉烧掉。

G When flaming out the last burner, assign a dedicated operator for observation. After the fuel gas is burned out, and the last burner is out, close the fuel gas hand valve immediately.

息至最后一个燃料气火嘴时，加热炉现场应留人观察。燃料气烧完，最后一个火嘴熄火后，立即关闭燃料气手阀。

H After the fuel oil and the fuel gas burners are out, both hand valves at site must be closed.

燃料油和燃料气火嘴熄火后，现场的两道手阀都必须全部关闭。

I Further increase the flowrate of nitrogen into the fuel gas system, and line up the fuel gas system to the flare gas system.

开大燃料气进装置界区的氮气，燃料气系统往火炬气系统置换。

2) Emergency shutdown

事故停炉

1) Shut down the heater for maintenance for the following cases

在下列情况下需停炉维修

Table 45 Causes and Abnormality

表 45 原因及现象

Abnormality 现象	Causes 原因
1、The process feed is abnormal and cannot maintain the operation 1、工艺进料不正常，无法维持运转	The feed piping (pump piping) fails 进料管线（泵管道）上有故障
	Coking is formed in the heater tubes. 炉管内结焦
2、The heater tubes are severely overheated, and adjustment cannot make any effect 2、炉管严重过热，调整无效	Feed is insufficient or feed flowrates to the passes are uneven 由于进料量不足或各路严重不均
	Coking is formed in the heater tubes. 炉管内结焦
	Flame touches the tubes 火焰触及炉管
	Burning strength of the burners is too strong 烧嘴燃烧过强

②Emergency shutdown is required for the following conditions.

在下列情况下需紧急停炉。

Table 46 Emergency shutdown Abnormality

表 46 停炉现象

S/N 序号	Abnormality 现象
1	Explosion or fire in the heater 加热炉内发生爆炸或着火
2	Heater tube rupture 加热炉炉管破裂
3	Severe leakage of fuel gas, hydrogen, liquefied gas in the process unit 装置内严重泄漏瓦斯、氢气、液化气等易爆气体
4	Server fire in the process unit 装置内发生重大火灾
5	During emergency response 事故处理状态
6	Any emergency shutdown required by the process conditions 工艺条件要求紧急停炉

3) Heater emergency shutdown procedure

加热炉紧急停炉程序

If the heater explodes (or catches fire) and the tube is ruptured, emergency shutdown procedure is required.

如果加热炉发生爆炸（或着火），炉管破裂，需要启动紧急停炉程序。

①Close all the fuel systems.

切断所有燃料系统。

②Stop the process fluid to the heater.

停该炉的工艺介质。

③Introduce snuffing steam into the fire box.

炉膛内通入消防蒸汽。

④Close all first and secondary air dampers.

关闭所有一、二次风门。

⑤Stop the air blower and induced draft fan.

停引风机和空气鼓风机。

⑥Open the bypass butterfly valve of the air preheater, close the inlet and outlet butterfly valve of the air preheater, and change the hot flue gas to the atmosphere. The other operations are the same as the normal shutdown procedures.

打开空气预热器旁路蝶阀，关闭空气预热器的进出口蝶阀，热烟气改排大气，其它操作与正常停炉相同。

(5) Daily operation of the heater

加热炉的日常操作

In order to reduce the fuel consumption, improve the thermal efficiency, extend the service life, and avoid unnecessary failure of the heater, the most important thing is to properly operate the heater.

要使加热炉燃料消耗少、热效率高，使用寿命长，避免不必要的加热炉故障，最重要的就是要正确操作加热炉。

1) Combustion control of the burners

火嘴的燃烧控制

Most of the failures of the heater are caused by improper combustion control; therefore, control, maintenance and management must be strengthened to ensure:

加热炉的大多数故障是因燃烧控制不当而引起的，必须加强控制、维护和管理，保证：

①The shape of the flame shall be stable, multiple burners shall be put into service and the flames shall be short and at the same height.

火焰形状应稳定，要求多火嘴、短火焰、齐火苗。

②The flames shall not touch any tubes.

火焰不应触及任何管壁。

③Fuel pressure and temperature shall be appropriate.

燃料压力和温度应适当。

④There shall be no air leakage in the bellows or heater.

风箱或炉内不得有漏气。

⑤Burners shall not be accumulated with carbon and blocked.

烧嘴口不得积碳和堵塞。

⑥The air ratio shall be adjusted via the air dampers to maintain optimum combustion. If the air ratio is excessive, the thermal efficiency will be low, the pressure in the heater will increase, and the flames will be flamed out.

应通过风门调节空气比，以保持最佳燃烧。如果空气比过量，热效率就会低，炉内压力增高，火焰就会熄灭。

⑦Fuel gas shall not carry condensed oil, proper drain the fuel gas KO drum, and strengthen inspections to the internal and external tracing system.

燃料气不能带凝缩油，加强瓦斯分液罐排凝和内外伴热的检查。

⑧As fuel pressure and temperature can cause abnormal combustion, it is necessary to check if the fuel meets the requirements according to the fuel burner instructions.

由于燃料压力和温度会引起不正常燃烧，因此需按燃料烧嘴说明，检查燃料是否符合要求。

The burner screens shall be cleaned regularly, usually every month.

火嘴滤网需定期清扫，一般一月一次。

2) Flame judgment and adjustment

火焰的辨别及调节

①Normal flame, golden yellow for fuel oil burners and blue for fuel gas burners.

正常燃烧的火焰，燃料油火嘴应为金黄色，燃料气火嘴应为兰色。

②Elongated blue flame: abnormal, it is usually caused by excessive air, further close the air damper.

拉长的兰色火焰：不正常，一般是空气过量，关小风门。

③Bright drifting flame: abnormal, it is usually caused by insufficient air, increase air flowrate.

光亮发飘的火焰：不正常，一般是空气量不足，应增加。

④Re to black drifting flame: abnormal, it is caused by insufficient air, increase air flowrate.

红黑发飘的火焰：不正常，空气量不足，应增加。

⑤Long and sharp flame: abnormal, it may be caused by blocked burner, clean the burner.

长而尖的火焰：不正常，可能是喷嘴堵塞应清洗。

⑥Flame in irregular shape: burner is coked or blocked.

火焰不成形状：燃烧器喷嘴结焦或堵塞。

⑦A Draw force is too large, re-adjust the negative pressure. B Fuel gas burner is blocked, clean the burner.

熄火：A 抽力过大，应重新调整负压。B 瓦斯喷嘴堵塞应清洗。

⑧A Draw force is too large, the fire box is in positive pressure, re-adjust to negative pressure. B The air flowrate is insufficient, increase the air flowrate. C The fuel gas burner is burned out, replace it. D Burning speed exceeds the adjustment range, reduce the burning speed. E Re-

ignite the burners without purging after the burners are stopped. F Fuel gas pressure fluctuates greatly.

回火：A 抽力不够，炉膛正压，重新调整负压。B 空气量不足，应增加。C 瓦斯喷头已烧坏，更换。D 燃烧速度超过了调节范围，应降低速度。E 火熄灭未吹扫即点火。F 瓦斯压力大幅度波动。

2) Fire box pressure

加热炉炉膛气压

If the fire box is in positive pressure, the flue gas will come from the gap of the heater body, the ignition holes of the burners, the observation holes and the fire window, causing heat loss and personnel injury due to back fire, so the fire box shall be maintained at proper negative pressure. If the negative pressure in the fire box is too large, a large amount of air will be leaked into the heater, causing high oxygen content in the flue gas and reduced thermal efficiency. Generally, the negative pressure in the fire box is controlled within -5 to -3 mm H₂O (-50 to -30 Pa).

加热炉炉膛正压，热烟气从炉体的缝隙、燃烧器点火孔、观察孔、看火窗等漏出，造成热量损失，而且容易造成回火伤人，因此炉膛应保持适当负压，过高的负压会造成炉体漏风严重，烟气氧含量高，造成加热炉热效率降低。一般而言炉膛负压控制在-5~-3mmH₂O（-50~-30Pa）为宜。

The fire box shall be always maintained at negative pressure. The causes for positive pressure in the fire box include:

炉膛应始终保持负压，造成炉膛正压的原因如下：

①The amount of excess air is large.

过剩空气量大。

②Flue gas duct baffles are not properly opened and closed.

烟道挡板开、关不当。

③Flue gas duct induced draft fan fails, resulting in insufficient draw force.

烟道引风机故障，抽力不足。

④Liquid is entrained in the fuel gas, resulting in causing excessive flue gas.

瓦斯带液，造成烟气量过大。

⑤The operation load of the heater is too high.

加热炉负荷过高。

3) Heater tube surface temperature

炉管表面温度

The heater tube wall temperature is an important parameter to measure the heat intensity on the surface of the heater tube. For the shaped heater tubes, if the wall temperature is too high, it means that the service life of the heater tubes is shortened. Therefore, the heater tube surface temperature shall be monitored by the tube skin thermocouples and by visually checking the color of the tube and records shall be made.

炉管壁温是衡量炉管表面受热强度的重要参数，对于定形炉管来说，壁温超高，意味着炉管使用寿命的缩短，所以，炉管表面温度应通过炉管表皮热偶及目测炉管颜色进行检查，并加以记录。

The heater tube wall temperature is properly controlled by the main means of ensuring uniform combustion of each burner, stable flames, no flame impingement to the tubes, no flow drift in

the tubes and no over-load operation of the heater.

控制炉管壁温不超温，主要是控制加热炉各火嘴燃烧均匀，不偏烧；火焰稳定，不舔炉管；炉管内物料流量不超六；加热炉不超负荷运行等。

4) Heater outlet temperature

加热炉出口温度

Heater outlet temperature is a process parameter that must be strictly controlled according to process requirements. The stable heater outlet temperature directly reflects the level of heater operation. The main factors affecting the heater outlet temperature and their adjustment methods are listed below.

炉出口温度是必须按工艺要求严格控制的工艺参数。炉出口温度的平稳程度，直接体现着炉子操作水平的高低。下面列出影响炉出口温度的主要因素及调节方法。

Table 46 The main factors and adjustment methods

表 46 主要因素及调节方法

Influencing factor 影响因素	Adjustment method 调节方法
The fuel gas pressure fluctuates 瓦斯压力波动	Stabilize the fuel gas pressure to the original value 将各炉瓦斯量稳定在原来的量上
Fuel gas composition changes 瓦斯组分变化	Increase or decrease the fuel gas flowrate based on the temperature change of the fire box 根据炉膛温度的变化增加或减少瓦斯量
The negative pressure in the fire box changes 炉膛负压变化	Properly adjust the air duct damper and the flue gas duct baffle to stabilize the negative pressure in the fire box 调节供风和烟道挡板稳定负压
Fuel combustion is insufficient 燃料燃烧不充分	Increase the air flowrate 增大供风量
Burners are blocked 喷嘴堵塞	Clean the burners 清扫火嘴
Oil entrained in the gas 瓦斯带油	Drain the fuel gas KO drum, check the tracing system, and flame out several burners if this case is severe 瓦斯分液罐排凝，检查伴热，严重时可灭掉几个火嘴
The weather conditions change 天气变化	Increase or decrease the fuel gas flowrate on a specific case basis. 根据情况增加或减少瓦斯量
Flame arrestor is coked and blocked 阻火器结焦堵塞	Switch over the flame arrestors and clean the blocked flame arrestor 切换阻火器清洗
The instrument fails. 仪表失灵	Contact the instrument staff to calibrate the instruments 联系仪表校表
Feed flowrate fluctuates 进料量波动	Stabilize the feed flowrate and adjust the flue gas flowrate 稳定进料量，调节瓦斯量
Feed temperature changes 进料温度变化	Stabilize the feed temperature and adjust the flue gas flowrate 稳定进料温度，调节瓦斯量

Table 46(continued) The main factors and adjustment methods**表 46（续）主要因素及调节方法**

Influencing factor 影响因素	Adjustment method 调节方法
Feed composition change 进料组分变化	Adjust the fuel gas flowrate based on the feed composition change 依据轻重情况调节瓦斯量
Water entrained in feed 进料带水	Dehydrate the feed, and increase the fuel gas flowrate 加强脱水，增加瓦斯量

5) Fire box temperature

炉膛温度

The fire box temperature is the highest temperature of the heater, and it is also the most sensitive temperature. In the operation, the heater temperature shall be stabilized by reference to the change of the fire box temperature, and the heater temperature shall be $\geq 800^{\circ}\text{C}$ to prevent the heater burnt-down. If the temperature difference of the fire box shall not exceed 30°C , multiple burners shall be put into service and the flames shall be short and at the same height so as to properly control the fire box temperature.

炉膛温度是加热炉的最高点温度，也是变化最灵敏的温度，在操作中可参考炉膛温度的变化来稳定炉出口温度，同时还要严格控制炉膛温度 $\geq 800^{\circ}\text{C}$ ，以防烧坏炉子。炉膛温差不超过 30°C ，应采取多火嘴、短火焰、齐火苗的操作法，控制炉膛明亮。

6) Other requirements

其它注意事项

①Slowly open or close the flue gas duct baffle to avoid the flue gas pressure fluctuating sharply. 开关烟道挡板时，动作要缓慢，以免烟道气压力急剧波动。

②The temperature of the flue gas in the radiant section shall not be too high, otherwise, it will cause fouling and coking on the tube wall.

辐射段的烟气温度不能过高，如果太高，会引起管壁结垢、结焦。

③Closely monitor the process fluid pressure, and the gradual change of the tube surface temperature and color to prevent coking in the heater tubes.

需注意工艺介质压力和炉管表面温度、颜色的逐渐变化，防止炉管内结焦。

④Frequently check the current and operation of the air blower motor and induced draft fan motor. 应经常检查鼓、引风机电机的电流、运转情况。

⑤When the air blower fails, quickly open the flue gas duct baffle to the atmosphere, and close the flue gas manifold baffle.

当鼓风机出现故障时要迅速打开各炉通大气烟道挡板，关闭集合烟道挡板。

⑥When the air blower fails, immediately change to natural ventilation and properly increase the opening of the secondary air damper.

当鼓风机出现故障时，要立即改为自然通风并将二次风门适当开大。

2.4.1.12 Operation of desalters 电脱盐的操作

(1) Crude feeding and power supply steps for desalter drums before normal startup

正常开工时电脱盐罐的装油与送电步骤

1) Non-load test shall be made for the desalter drum before crude is fed into the desalter drum. After the internal inspections to the desalter drum are completed, close the manhole of the desalter drum.

电脱盐罐进油前进行空载实验。电脱盐罐内部检查结束后，关闭电脱盐罐人孔。

2) Contact the electrical and instrument staffs to remove the low level interlock switch. Supply power to the desalter drum, and check the secondary voltage and current of the desalter drum. Normally, there is a current value at the point when power supplied. After power is supplied, there is no current value, and the voltage is the highest.

联系电气和仪表人员，摘除低液位联锁开关。电脱盐罐送电，检查电脱盐罐二次电压和电流，正常应该是送电瞬间，有电流值，送电正常后无电流值，电压最高。

3) After the non-load test of the desalter drum, close the manhole of the desalter drum, and perform pressure test for the desalter drum. Upon completion of pressure test, put the desalter drum into operation.

电脱盐罐空载实验结束后，封闭电脱盐罐人孔，电脱盐罐试压。试压结束后，组织电脱盐罐投用。

4) Check the desalter drum process flow, confirm that the water cut, water injection, back flush and crude rundown process flows are closed, the valve of the interface sightglass is closed, the relief valves are put into service, the bypass valve of the desalter drum is closed, and the inlet and outlet valves of the desalter drum are opened, and the mixing valve is fully opened.

检查电脱盐罐流程，切水、注水、返冲洗、退油等流程关闭，现场界位看样管阀门关闭，安全阀投用，电脱盐罐付线阀关闭，进出电脱盐罐阀门打开，混合阀全开。

5) Open the desalter drum OVHD vent valve.

电脱盐罐顶部放空打开。

6) Supply crude into the desalter drum.

原油进电脱盐罐，装油。

7) Open the desalter drum bottom drain valve to check if there is water. If there is water, drain the water and then close the drain valve.

电脱盐罐底部就地排水口打开，检查，有水排掉，水排完后，关闭底部排水阀门。

8) Open the desalter drum OVHD vent valve. When crude flows from the vent valve, close this valve. And the crude will flow into the next desalter drum or the Pre-Dist..

顶部放空检查，见油后，关闭顶部放空。油进入下一个电脱盐罐或者初馏塔。

9) During startup of the desalter drum, when the temperature of the desalter drum rises to 100 °C, contact the electrician to supply power to the desalter drum.

开过程中，电脱盐罐温度上升至 100°C时，联系电气人员，电脱盐罐送电。

(2) Crude feeding and power supply steps for desalter drums after maintenance is made during normal operation

正常生产期间，电脱盐罐检修后的装油与送电步骤

1) During the normal operation of the process unit, if the desalter drum fails, cut it out for maintenance.

装置正常生产过程中，出现电脱盐故障，切出进行检修。

2) Put the desalter drum into service after the maintenance. Conduct non-load test and pressure test for desalter drum. The test method is the same as that for normal startup of the desalter drum.

检修结束后组织电脱盐罐投用。组织电脱盐罐空载实验和试压。方法与正产开车期间，电脱盐罐投用的步骤相同。

3) After hydraulic test, remove the blinds installed during the maintenance. Check the desalter drum process flow. The process flow before desalter drum is put into service: the crude inlet and outlet valves of the desalter drum are closed, the water cut, water injection, back flush and crude rundown process flows are closed, the demulsifier injection valve is closed, the bottom drain valve and interface sightglass valve are closed, the mixing valve is fully opened, and the desalter drum OVHD vent valve (to atmosphere) is opened.

水压实验结束后，拆除检修期间加装的盲板。检查电脱盐流程，投用前流程为：原油进出电脱盐罐的阀门关闭，切水、注水、返冲洗、退油等流程关闭，注破乳剂点关闭，底部放空和看样管关闭，混合阀全开，顶部放空阀（大气）打开。

4) Line up the water injection process flow to the desalter drum, and water injection valve is not opened. Introduce purified water into the desalter water injection drum.

改好需要投用的电脱盐注水流程，注水点阀不开。电脱盐注水罐引净化水。

5) Start the water injection pump or backflush pump to fill water into the desalter drum.

启动注水泵或者反冲洗泵，往电脱盐罐装水。

6) Check the desalter drum OVHD vent valve. When water flows from the vent valve, stop the water injection pump or backflush pump, close the vent valve, water injection valve or backflush valve.

电脱盐罐顶部放空检查，见水后，停运注水泵或者反冲洗泵，关闭放空阀，注水阀或者反冲洗阀。

7) Cut water at the bottom of the desalter drum and feed crude at the top of the desalter drum. When the interface in the desalter drum drops to approximately 20-40%, stop water cut. Open the desalter drum inlet valve. Close the bypass valve of the desalter drum.

电脱盐罐底部切水，顶部进油。当电脱盐罐界位下降至 20-40%左右时，停止切水。打开原油进电脱盐罐的阀门。关闭电脱盐罐付线。

8) Contact the electrician to supply power to the desalter drum.

联系电气人员，电脱盐罐送电。

9) After the power is supplied, fill water into the desalter drum.

送电正常后，安排电脱盐罐注水。

(3) Inject water into desalter drum

电脱盐注水

1) Wait 30 minutes after the desalter drum is powered and the demulsifier is injected until the

operating temperature meets the requirement and the current is stable, then water can be injected.

电脱盐罐已送电并注破乳剂 30 分钟，待操作温度达到要求和电流稳定后，可注水。

2) Line up the desalter water injection process flow, fill water from E-101 to the 2nd stage desalter drum D-102, and put the water injection control valve into service. Line up the water injection process flow from D-102 to D-101, put D-102 cut water valve into service, water injection root valves of D-101 and 102 are not opened.

改好电脱盐注水流程，注水 E-101 后至二级电脱盐罐 D-102，投用注水调节阀。改好 D-102 至 D-101 的注水流程，D-102 切水调节阀投用，D-101、102 注水根部阀不开。

3) Line up the desalter drum water cut process flow.

改好电脱盐罐切水流程。

4) Introduce the purified water into desalter water injection drum (D-110), open the drum bottom outlet valve to introduce water into the pump casing.

引净化入电脱盐注水罐 (D-110)，打开罐底出口阀门，将水引入泵体。

5) Start the desalter water injection pump P-101 to fill water into D-102, and water injection volume is controlled at approximately 5%.

启动脱盐注水泵 P-101 往 D-102 注水，注水量控制在 5% 左右。

6) After the interface in D-102 is above 30% (based on the field interface sightglass, such as DCS indication), start P-102 to fill water into D-101. Put D-102 interface control instruments into service.

D-102 界位达到 30% (以现场界位检查管为准，如 DCS 显示) 以上后，启动 P-102 往 D-101 注水。投用 D-102 的界位控制仪表。

7) When the interface in D-101 is above 30%, put D-101 interface controller into service for normal water cut.

D-101 界位达到 30% 以上时，投用 D-101 界位控制仪表，D-101 正常切水。

8) Put D-120 interface controller into service, the drum OVHD oil phase is sent into the flare gas KO drum.

投用 D-120 油水界位仪表，顶部油相排至火炬气分液罐。

9) Put D-120 pressure controller into service to drain water into the wastewater treatment plant. 投用 D-120 压力控制，往污水处理装置排水。

10) After water injection, the panel operators properly control D-101 and 102 mixer pressure drop within 0.04 ~ 0.12MPa. Adjust the water injection flowrate and the mixer pressure drop based on the process card.

注水后，内操控制 D-101、102 混合压降，正常控制在 0.04~0.12MPa。按照工艺卡片调整注水量和混合压降。

(4) Backflush operation

反冲洗操作方法

The desalter drum shall be back flushed at least every week during operation. A large amount

of water is injected into the bottom of the desalter drum by the backflush pump, and the backflush water is sprayed from the nozzle at a high speed to agitate the sediment deposited on the bottom of the drum. The sediment is discharged out of the drum with water drain.

电脱盐罐在运行过程中,至少每周一次反冲洗。通过反冲洗泵,将大量的水注入到电脱盐罐底部,反冲洗水从喷头高速喷出,搅动罐底部沉积的泥沙。泥沙随着排水排出罐外。

Backwash range: D-101, D-102, D-120. First back flush the 2nd stage desalter drum D-102, then the 1st stage desalter drum D-101, and finally the desalter cut water oil skimming drum D-120.

反冲洗范围: D-101、D-102、D-120。反冲洗时,应先洗二级电脱盐罐 D-102,再洗一级电脱盐罐 D-101,最后洗电脱盐排水除油器 D-120。

1) The desalter drum is changed from cycle inject water mode to single-stage water injection mode, that is, D-102 cut water is directly changed to the desalter cut water piping, and D-101 water injection is changed from D-102 cut water to purified water. Start the water injection pump P-101 to fill water into D-101 and 102 respectively. As the total water injection flowrate is increased, if the purified water flowrate is insufficient, DM water can be filled into D-110 or water injection flowrate to each drum can be reduced.

电脱盐罐由循环注水改为单级注水,即将 D-102 切水直接改至电脱盐切水线, D-101 注水由注 D-102 的切水改为注净化水。注水泵 P-101 分别注 D-101、102。因总注水量增加,如净化水不足,可增加除盐水进 D-110,或者降低单罐注水量。

2) Change the desalter cut water oil skimming drum D-120 to bypass. During backflush, the desalter cut water is not sent into D-120.

电脱盐切水除油器 D-120 改走付线,反冲洗期间,电脱盐切水不进 D-120。

3) Line up D-102 backflush process flow, that is, D-102 cut water is sent to the backflush pump P-110 where it is sent into D-102. That is, D-102 cut water is recycled back into D-102.

改好 D-102 反冲洗流程,即 D-102 切水进反冲洗泵 P-110, P-110 反冲洗水进 D-102。即 D-102 切水循环回 D-102。

4) Control the backflush water flowrate within 100~200t/h. It is preferred to increase the backflush water flowrate as much as possible. Closely monitor the influence of backflush on the desalter drum. If the electric current of the desalter drum rises significantly during backflush, the backflush water flowrate shall be properly reduced.

控制反冲洗水量 100~200t/h。反冲洗水量越大越好。注意反冲洗对电脱盐罐的影响,如反冲洗时电脱盐罐电流明显上升,则适当降低反冲洗水。

5) In order to improve the backflush efficiency of the desalter drum, lower interface in the desalter drum shall be maintained.

为提高反冲洗电脱盐罐反冲洗效率,电脱盐罐界位应适当低控。

6) Locally check the water drained from the desalter drum, if the water is clear and free of impurities, it is considered that backflush is completed and accepted. Close D-102 backflush valve.

就地检查电脱盐罐排水,水质清澈无杂质,反冲洗结束。关闭 D-102 反冲洗阀。

7) Switch D-101 cut water to P-110 inlet, and close D-102 cut water valve to P-110.

P-110 入口改为 D-101 切水, 关闭 D-102 切水至 P-110 阀门。

8) Open D-101 backflush valve. The backflush method for D-101 is the same as that for D-102.

打开 D-101 反冲阀门。D-101 反冲洗方法与 D-102 相同。

9) After D-101 backflush is completed and accepted, close D-101 backflush valve and stop P-110.

D-101 反冲洗结束后, 关闭 D-101 反冲洗阀, 停运 P-110。

10) The desalter water injection is changed from single-stage water injection mode to cycle inject water mode.

电脱盐注水由单级注水改为循环注水。

11) Open D-120 outlet valve to line up the desalter water injection pump P-101 to D-120. It is preferred to increase the backflush water flowrate as much as possible, but it shall not affect the desalter water injection and drainage. If it is difficult to drain water, D-120 pressure shall be properly reduced.

打开 D-120 出口阀, 将电脱盐注水泵 P-101 至 D-120 的反冲洗线打开。反冲洗水量越大越好, 以不影响电脱盐注水和排水畅通为准。如排水不畅, D-120 压力应适当降低。

12) Locally check the water drained from D-120, if the water is clear and free of impurities, it is considered that backflush is completed and accepted. Close D-120 backflush valve, open the desalter cut water valve to D-120, and close D-120 bypass valve.

检查 D-120 就地切水水质, 清澈无杂质则停止反冲洗。关闭 D-120 反冲洗阀, 打开电脱盐切水进 D-120 阀门, 关闭 D-120 的付线。

(5) Shutdown steps for desalter drum

电脱盐罐的停用步骤

When the desalter drum is to be shut down, the total amount of slop shall be minimized provided that safe operation can be maintained.

电脱盐罐停运时, 在确保操作安全的情况下, 应最大限度减少污油总量。

1) The desalter water injection is changed from cycle inject water mode to single-stage water injection into D-101, and stop D-101 and D-102 water cut. Fully open the desalter drum mixing valve.

电脱盐注水由循环注水, 改为单注一级电脱盐 D-101, 停止 D-101 和 D-102 切水。电脱盐罐混合阀全开。

2) Open the bypass valve of D-101 and close the valve of crude into D-101. Fill water into D-101 to displace all the crude accumulated in D-101 into D-102.

打开 D-101 的付线阀, 关闭原油进 D-101 的阀门。D-101 采用注水顶油的方式将罐内存油全部顶至 D-102。

3) Stop the power supply to D-101, check the interface in the desalter drum to determine the water flowrate.

D-101 停电, 现场检查电脱盐界位, 判断顶水速度。

4) When the interface in D-102 rises significantly, it indicates that all the crude in D-101 has been displaced into D-102.

D-102 界位明显上升时，说明 D-101 水顶油结束。

5) Stop P-101 so as to stop water fill into D-101. Close the D-101 crude outlet valve.

停运 P-101，D-101 停止注水。关闭 D-101 原油出口阀门。

6) Open the bypass valve of the desalter drum D-102. Considering that water may accumulated in D-102 bypass during long term operation, after the bypass valve is opened, water may be directly carried into the Pre-Dist.. Therefore, it is required to slowly open the bypass valve of D-102, and observe the changes in operation of the Pre-Dist..

打开电脱盐罐 D-102 付线。考虑在长期运行过程中，D-102 的付线可能有水沉积，改付线打开后，水会直接进入初馏塔，造成初馏塔带水。因此 D-102 付线打开时，应缓慢，注意观察初馏塔的操作变化。

7) After the bypass valve of D-102 is fully opened, close D-102 inlet valve. Re-start P-101 to fill water into D-102.

待 D-102 付线全部打开后，关闭 D-102 的入口阀。重新启运 P-101 往 D-102 注水。

8) Stop power supply to D-102.

D-102 停电。

9) When DCS indicates that the interface in D-102 does not rise any more, locally check the interface. When the last interface sightglass is filled with water, stop P-101 so as to stop water fill into D-102.

当 DCS 显示界位不再上升后，需到现场检查 D-102 的界位。当最上一根电脱盐界位看样管为水后，停运 P-101，D-102 停止注水。

10) Close D -102 outlet valve.

关闭 D-102 出口阀。

11) Open D-101 cut water valve to send the water cut from D-101 into water cooler E-102 where it is sent into the wastewater treatment plant. If the drum OVHD pressure drops and water cannot be drained, use steam to pressurize D-101 until water in D-101 is completely drained. Conduct D-101 boil out.

打开 D-101 切水阀门，将 D-101 切水经水冷器冷 E-102 却后排至污水处理场，如罐顶压力降低，水排不出时，D-101 罐顶可使用蒸汽加压。直至 D-101 水排完。组织 D-101 蒸煮。

12) Open D-102 cut water valve, and drain the water accumulated in D-102 into the desalter water cooler E-102 where it is sent into the wastewater treatment plant. If the drum OVHD pressure drops and water cannot be drained, use steam to pressurize D-102.

打开 D-102 切水阀，将 D-102 罐的存水通过电脱盐切水水冷器 E-102 冷却后排至污水处理场。如罐内压力降低，水排不出时，D-102 罐顶可使用蒸汽加压。

13) Cut water from D-102, locally check the interface. When the last sightglass is filled with oil, stop water cut from D-102.

D-102 切水时，检查现场界位，当最后一根看样管见油后，停止 D-102 切水。

14) Line up the crude rundown process from D-102 to P-110, start the pump to send the water

and crude in D-102 to the storage via the high temperature heavy slop piping.

改通 D-102 至 P-110 的退油流程，用泵将 D-102 的存水和油经高温重污油线送至罐区。

15) Before sending the crude in desalter drum to the storage, contact the Operation Scheduling Department to inform the storage to put the heavy slop cooler into service so as to ensure the temperature of the slop into the drum does not exceed the specified temperature.

往罐区退油时，应联系调度，通知罐区投用高温重污油进罐水冷器。确保进污油罐不超温。

16) After the crude in D-102 is sent into the storage, conduct D-102 boil out.

D-102 退油结束后，组织 D-102 蒸煮。

17) During desalter shutdown, adjust the interface in D-120 to 100% at the end of crude displacement by water, and the drum OVHD oil phase is all sent into the flare gas KO drum.

停运电脱盐过程中，D-120 的界位在顶水末期将界位调至 100%，将顶部的油相全部顶至火炬气分液罐。

2.4.1.13 Operation of steam vacuum pumps and liquid ring vacuum pumps 抽真空操作

(1) Preparations for startup of vacuum pumps

抽真空前的准备工作

1) Properly line up the Vac. column OVHD oil vapor downstream process flow from D-401 OVHD to the flare gas system.

改通减顶气后路流程，D-401 顶部至火炬气，确保畅通。

2) Line up the Vac. column OVHD 1st stage, 2nd stage and 3rd stage vacuuming process flows and put the condenser into service.

改通塔顶一级、二级、三级抽真空流程，投用冷凝器。

3) Put D-401 water seal into service.

D-401 给上水封。

4) Before introducing the steam to the steam vacuum pump, drain the water from the steam vacuum pump.

将蒸汽引至抽真空器前，排尽存水。

5) Establish Vac. column OVHD reflux, and the Vac. column OVHD temperature shall be $\geq 80^{\circ}\text{C}$.

建立减顶回流，减顶温度 $\geq 80^{\circ}\text{C}$ 。

(2) Startup steps for the vacuum pumps

真空泵的启动步骤

1) Slowly open the steam valve of the 3rd stage vacuum pump. Put the vacuum gauge in each section of the Vac. column into service.

缓慢打开三级真空泵蒸汽阀。投用减压塔各段的真空表。

2) When the vacuum is no longer significantly increased, open the steam valve of the 2nd stage vacuum pump.

待真空度不再有明显上升时，开二级真空泵蒸汽阀。

3) When the vacuum is no longer significantly increased, open the steam valve of the 1st stage vacuum pump

待真空度不再有明显上升时，开一级真空泵蒸汽阀。

4) After the oil phase level in D-401 is up to 50%, start the Vac. column OVHD oil pump to send the oil into light slop system.

D-401 油相液位达到 50%后启运减顶油泵往轻污油送油

5) After the water phase interface in D-401 is up to 50%, start the Vac. column OVHD sour water pump to send the sour water into the Sour Water Stripping Unit.

D-401 水相界位达到 50%后启运减顶含硫污水泵往酸性水汽提装置送水。

(3) Precautions:

注意事项

1) Before introducing steam, the water accumulated in the piping must be drained. Slowly introduce steam, and the temperature of the cooled Vac. column OVHD oil vapor shall not be too high.

给蒸汽之前必须排净管线存水，给蒸汽时必须缓慢进行，不能一下子开得过大，并注意冷后温度不能过高。

2) Check the operation of D-401 to prevent oil spill or overflow.

检查 D-401 的运行情况，防止跑油或冒罐。

3) Properly line up the process flow from the Vac. column OVHD oil vapor to the flare gas system.

减顶气至火炬的后路要畅通。

(4) Inspections to the vacuuming systems

抽真空系统的检查

1) Check the change of the steam pressure.

检查抽真空蒸汽压力的变化情况。

2) Check the operation of the cooler to ensure that the temperature of the cooled Vac. column OVHD oil vapor is $\geq 60^{\circ}\text{C}$.

检查冷却器的运行、冷却情况，保证减顶油冷后温度 $\geq 60^{\circ}\text{C}$ 。

3) Check the equipment of the vacuuming system for any leakage.

检查真空系统设备有无泄漏情况。

4) Check the atmospheric leg for normal operation.

检查大气腿畅通情况。

5) Properly control the oil phase level and the water phase interface in D-401, the level and interface shall not be too high or too low.

控制好 D-401 的油相液位和水相的界位，严禁液位过高或偏低。

(5) Preparations for shutdown of vacuum pumps

停真空泵前准备工作

1) Change the Vac. column OVHD oil vapor from D-401 to flare gas system, and close D-401 gas to column C-410.

将减顶瓦斯从 D-401 改至火炬气，关闭 D-401 瓦斯至 C-410 塔。

2) Introduce nitrogen at the top of D-401 to purge C-410 and D-862 towards the flare gas system.

从 D-401 罐顶给氮气往火炬气系统置换 C-410 和 D-862。

3) If the 3rd stage water ring vacuum pump is in operation, cut it out of service and switch over to the 3rd steam vacuum pump to prevent damage to the water ring vacuum pump during shutdown.

如三级抽真空运行的是水环真空泵，为避免停工过程中损坏水环真空泵，应将水环真空泵切换为蒸汽抽真空。

(6) Shut down the vacuum pumps

停用真空泵

1) First close the steam valve of the Vac. column OVHD 1st stage vacuum pump, then the steam valve of the 2nd stage vacuum pump, and finally stop the 3rd stage vacuum pump.

停真空泵先关减顶一级真空泵的蒸汽阀，然后关二级真空泵的蒸汽阀，最后停三级抽真空。

2) After 1st stage vacuum pump and the 2nd stage vacuum pump are stopped, close the vacuum gauge in each section of the Vac. column to prevent damage to the vacuum gauge due to positive pressure.

一级和二级抽真空停运后，关闭减压塔各段的真空表，防止正压后损坏真空表。

3) After 1st stage vacuum pump and the 2nd stage vacuum pump are stopped, further reduce the pressure of the steam to the 3rd stage vacuum pump to 0.3-0.4 MPa so as to slowly break the vacuum of the Vac. column, in the meanwhile, prevent the gas from being reversed into the Vac. column.

一级二级抽真空停运后，三级抽真空蒸汽压力关小至 0.3~0.4MPa，减压塔缓慢破真空的同时，防止气体倒串至减压塔。

(7) Switchover of the 3rd stage vacuum pumps

三级抽真空的切换操作

1) Switch the steam vacuum pump EJ-431 to the water ring vacuum pump

蒸汽抽真空泵 EJ-431 切换为水环抽真空泵

A Check and commission the auxiliary systems of the water ring vacuum pump, put the water cooler into operation and make up the working fluid as required based on the startup procedures for water ring vacuum pump (refer to water ring vacuum pump operation in this standard).

按照水环真空投用的步骤，做好水环真空泵辅助系统的检查和投用，水冷器投用和工作液补水工作（参见本规程中水环泵操作方法）。

B Open the water ring vacuum pump outlet KO drum non-condensable valve to D-401. Open the water ring vacuum pump inlet and outlet bypass valves. Note that the water ring vacuum pump inlet valve shall be closed before start. Also note that the water ring vacuum pump inlet valve shall be slowly opened to prevent liquid accumulated in the piping before the inlet valve, causing high level trip of the water ring vacuum pump outlet KO drum.

打开水环真空泵出口分液罐不凝气至 D-401 流程。打开水环泵出入口的付线，启运前水环泵入口阀应关闭。注意开水环泵入口阀时应缓慢，防止入口阀前管线存液，造成水环泵出口分液罐液位连锁。

C Start the water ring vacuum pump. Check and confirm that the instruments and motor are in normal operation.

启运水环泵。检查仪表、电机等运行正常。

D Open the inlet valve of the water ring vacuum pump and gradually close the bypass valve.

打开水环泵入口阀，逐渐关小付线阀。

E Close the 2nd stage vacuum pump outlet non-condensable valve to the 3rd stage vacuum pump. Stop the steam to the 3rd stage vacuum pump. Close the condenser non-condensable valve to D-401 and the condenser E-431 outlet valve to atmospheric leg, and stop CCW supply to E-431.

关闭二级抽真空不凝气进三级蒸汽抽真空阀门。停运三级抽真空蒸汽。关闭冷凝器不凝气进 D-401 的阀门和冷凝器 E-431 至大气腿阀门，停 E-431 循环水。

2) Switch the water ring vacuum pump to steam vacuum pump EJ-431

水环真空泵切换为蒸汽抽真空泵 EJ-431

A Line up the process flow from E-431 non-condensable to D-401, open the atmospheric leg valve.

改好 E-431 不凝气至 D-401 流程，打开大气腿阀门。

B Put water cooler E-431 into operation and supply CCW.

投用 E-431 水冷器，给上循环水。

C Before introducing steam to the steam vacuum pump, drain the water from the steam vacuum pump.

蒸汽引至 EJ-431 前，排尽生存水。

D Open the steam valve of EJ-431, open the 2nd stage steam vacuum pump EJ-421 non-condensable valve to EJ-431.

开 EJ-431 蒸汽，开二级抽真空 EJ-421 不凝气进 EJ-431 阀门。

E Close the inlet valve of the water ring vacuum pump, and the panel operators shall gradually open the inlet and outlet bypass valves of the water ring vacuum pump based on the inlet vacuum of the water ring vacuum pump until the water ring vacuum pump inlet valve is fully closed and the bypass valves are fully opened.

关闭水环泵入口阀，关闭过程中，内操应根据水环泵入口真空度情况，逐渐打开水环泵进出口付线阀。直至水环泵入口阀全关，付线阀全开。

F Stop the water ring vacuum pump.

停运水环真空泵。

2.4.1.14 Operation of chemical injection systems 注剂系统的操作

(1) Operation of demulsifier injection

注破乳化剂的操作

1) After the oil-soluble demulsifier barrels are arrived at the site, they shall be placed neatly and shall not block the fire accesses.

桶装油溶性破乳化剂拉到现场后，按要求定置摆放整齐，不能堵塞消防通道。

2) Use pneumatic diaphragm pump to inject the demulsifier into the demulsifier drum.

用气动隔膜泵将破乳剂收入破乳剂储罐内。

3) After the demulsifier is injected into the demulsifier drum, add diesel into the demulsifier drum per the mixing ratio.

收完破乳剂后，按照配剂比例要求，往破乳剂储罐内加入柴油。

4) Then start the diaphragm pump to mix the demulsifier and diesel in the drum for 1 hour.

启动隔膜泵改为循环流程，启运启动隔膜泵，对储罐内的破乳剂和柴油进行循环搅拌 1 小时。

5) Properly line up the process flow downstream the demulsifier injection point. Inject demulsifier at the location where crude is sent into the process unit.

改好注剂的后路流程，确保畅通。破乳剂注原油进装置处。

6) Start the injection pump per the operation procedure for the metering pump.

按照开计量泵的操作法分别启动注剂泵。

7) Adjust the demulsifier dosage based on the calibrated dosage rate, and follow the dosage temporarily determined by the operation department.

采用标定注调整破乳剂的加注量，注入量按照部门临时指令执行。

8) When injecting the demulsifier into the drum, it is strictly forbidden to allow any water entrained in the demulsifier to avoid emulsification of the oil-soluble demulsifier, reducing its effect.

破乳剂在收剂过程中，严禁混有水，以免造成油溶性破乳剂乳化，影响其效果。

(2) Operation of corrosion inhibitor injection

注缓蚀剂的操作

1) After the oil-soluble corrosion inhibitor barrels are arrived at the site, they shall be placed neatly and shall not block the fire accesses.

桶装油溶性缓蚀剂拉到现场后，按要求定置摆放整齐，不能堵塞消防通道。

2) Use pneumatic diaphragm pump to inject the corrosion inhibitor into the corrosion inhibitor drum.

用气动隔膜泵将缓蚀剂收入破乳剂储罐内。

3) After the corrosion inhibitor is injected into the corrosion inhibitor drum, add diesel (Kerosene) into the corrosion inhibitor drum per the mixing ratio.

收完缓蚀剂后，按照配剂比例要求，往缓蚀剂储罐内加入柴油（常一线）。

4) Then start the diaphragm pump to mix the corrosion inhibitor and diesel in the drum for 1 hour.

启动隔膜泵改为循环流程，启运启动隔膜泵，对储罐内的缓蚀剂和柴油进行循环搅拌 1 小时。

5) Properly line up the process flow downstream each column OVHD demulsifier injection point. 改好各塔顶注剂的后路流程，确保畅通。

6) Start each column OVHD injection pump per the operation procedure for the metering pump. 按照开计量泵的操作法分别启动各塔顶注剂泵。

7) Adjust the corrosion inhibitor dosage based on the calibrated dosage rate, and follow the dosage temporarily determined by the operation department.

采用标定注调整各塔顶缓蚀剂的加注量，注入量按照部门临时指令执行。

8) When injecting the oil-soluble corrosion inhibitor into the drum drum, it is strictly forbidden to allow any water entrained in the corrosion inhibitor to avoid emulsification of the oil-soluble corrosion inhibitor, reducing its effect.

油溶性缓蚀剂在收剂过程中，严禁混有水，以免造成油缓蚀剂变质，影响其效果。

(3) Operation of the fouling inhibitor injection

注阻垢剂的操作

1) After the fouling inhibitor barrels are arrived at the site, they shall be placed neatly and shall not block the fire accesses.

桶装阻垢剂拉到现场后，按要求定置摆放整齐，不能堵塞消防通道。

2) Use pneumatic diaphragm pump to inject the fouling inhibitor into the fouling inhibitor drum drum.

用气动隔膜泵将阻垢剂收入阻垢剂储罐内。

3) After the fouling inhibitor is injected into the fouling inhibitor drum drum, add diesel into the demulsifier drum drum per the mixing ratio.

收完阻垢剂后，按照配剂比例要求，往阻垢剂储罐内加入柴油。

4) Then start the diaphragm pump to mix the fouling inhibitor and diesel in the drum for 1 hour.

启动隔膜泵改为循环流程，启运启动隔膜泵，对储罐内的阻垢剂和柴油进行循环搅拌 1 小时。

5) Properly line up the process flow downstream the demulsifier injection point. The fouling inhibitor is injected into the bottom of the Vac. column, and the residue draw piping.

改好注剂的后路流程，确保畅通。阻垢剂注减压塔塔底，渣油抽出线。

6) Start the injection pump per the operation procedure for the metering pump.

按照开计量泵的操作法启动注阻垢剂泵。

7) Adjust the demulsifier dosage based on the calibrated dosage rate, and follow the dosage temporarily determined by the operation department.

采用标定注调整破乳剂的加注量，注入量按照部门临时指令执行。

8) When injecting the fouling inhibitor into the drum drum, it is strictly forbidden to allow any water entrained in the fouling inhibitor to avoid emulsification of the fouling inhibitor, reducing its effect.

阻垢剂在收剂过程中，严禁混有水，以免造成阻垢剂乳化，影响其效果。

(4) Operation of neutralizing inhibitor injection

注中和剂的操作

1) After the neutralizing inhibitor barrels are arrived at the site, they shall be placed neatly and shall not block the fire accesses.

桶装中和剂拉到现场后，按要求定置摆放整齐，不能堵塞消防通道。

2) Use pneumatic diaphragm pump to inject the neutralizing inhibitor into the neutralizing inhibitor drum drum.

用气动隔膜泵将中和剂收入中和剂储罐内。

3) After the neutralizing inhibitor is injected into the neutralizing inhibitor drum, add diesel into the neutralizing inhibitor drum per the mixing ratio.

收完中和剂后，按照配剂比例要求，往中和剂储罐内加入柴油。

4) Then start the diaphragm pump to mix the neutralizing inhibitor and diesel in the drum for 1 hour.

启动隔膜泵改为循环流程，启运启动隔膜泵，对储罐内的中和剂和柴油进行循环搅拌 1 小时。

5) Properly line up the process flow downstream the demulsifier injection point. The neutralizing inhibitor is injected into the top of each distillation column.

改好注剂的后路流程，确保畅通。中和剂注各分馏塔塔顶。

6) Start the injection pump per the operation procedure for the metering pump.

按照开计量泵的操作法启动注中和剂泵。

7) Adjust the neutralizing inhibitor dosage based on the calibrated dosage rate, and each column OVHD pH valves.

采用标定注调整中和剂的加注量，注入量按各塔顶 pH 值控制要求进行调整。

8) When injecting the neutralizing inhibitor into the drum, it is strictly forbidden to allow any water entrained in the neutralizing inhibitor to avoid emulsification of the neutralizing inhibitor, reducing its effect.

中和剂在收剂过程中，严禁混有水，以免造成中和剂乳化，影响其效果。

2.4.3 Routine maintenance of equipment 设备日常维护

2.4.3.1 Routine maintenance of rotating equipment 动设备日常维护

(1) Routine maintenance by field operators

外操日常维护

1) Check if the pump inlet/outlet pressure and pump motor current are normal.

检查泵进、出口压力，电流是否正常。

2) Check the rotating parts such as the bearing and coupling of pump and motor for any abnormal noise.

机泵、电机的轴承及联轴器等其它转动部件是否有杂音。

3) Measure and confirm that the bearing temperature is within the specified range, the bearing temperature rise shall not exceed the ambient temperature plus 40°C, and the maximum bearing temperature shall not exceed 80°C.

检查轴承温度在指标范围内，轴承温升不超过环境温度 40°C，最高不超过 80°C。

4) Check the pump vibration, and confirm that the pump is operating in zone A or B. If the pump is required to be operated in Zone C for a short time, record its operation. Each shift shall measure and record the pump vibration in the Zone C Machine and Pump Operation Log. For vibration intensity classification, see Table 1.

检查泵的振动情况，确认在 A 或 B 区运行，C 区短暂运行的要做好监护运行记录，每班现场测量并记录在《C 区机泵运行记录本》中，振动烈度评定等级表见表 1。

5) Check if the bolts of the pump casing and the bolts of system piping and baseplate support are loosened.

检查泵体螺栓以及与系统管道、底座支撑等螺栓是否松动。

6) Check if the earthing wiring for the motor and operation column is in good conditions.

检查电机及操作柱接地线是否完好。

7) Perform standby pump priming, lubricating, preheating and regular barring to ensure the standby pump is ready for operation at any time when required.

做好备用泵的灌泵、润滑、预热、定期盘车等工作，做到可随时启动。

8) Check the integrity of safety accessories such as pressure gauges, check valves, strainers, and coupling guards.

检查压力表、单向阀、过滤网、联轴器护罩等安全附件的完好性。

9) Follow good housekeeping practice and standardization requirements, and check if there is overflow, spill, dripping or leakage of process fluid, lube oil, sealing oil and tracing steam piping.

做好设备卫生和规格化工作，检查输送介质、润滑油、封液、伴热蒸汽等是否存在跑、冒、滴、漏现象。

10) Check the level and quality of oil in the bearing housing, check and confirm that the oil sightglass and oil cup are marked with red lines, and their inner and outer surfaces are clean.

轴承箱油位、油质的检查，油标、油杯红线齐全，内外洁净清晰。

11) Check if the inlet and outlet valves are fully opened.

检查出入口阀门是否全开。

12) During operation, inspections shall be made for the following auxiliary systems/equipment if provided:

如果有下列辅助设备，在使用期间应进行检查：

①Lube oil system: lube oil level shall be between the two red lines (1/2~2/3) of the sightglass, and the lube oil is clean.

润滑：油位在视窗的双红线之间（1/2~2/3），油质干净。

②CCW system: check and confirm the flowrate and temperature of CCW system meet the requirements.

冷却：检查冷却介质循环正常，流量、温度符合要求。

③Seal flush system: check and confirm that the pressure, level, temperature and flowrate of the seal flush system meet the requirements.

密封冲洗：检查冲洗介质循环正常，压力、液位、温度和流量符合要求。

④Check the leakage of the pump mechanical seal. Allowable leakage: light oil pump: ≤ 6 drops/minute, heavy oil pump: ≤ 5 drops/minute.

检查机械密封的泄漏情况。允许值为：轻油泵 ≤ 6 滴/分钟，重油泵 ≤ 5 滴/分钟。

⑤Check and confirm that the breathing valve on the bearing housing is unblocked, and the sightglass is clean.

检查轴承箱上呼吸阀畅通，视窗干净。

(2) Routine maintenance by panel operators

内操日常维护

1) Check if the pump outlet flowrate and pressure are normal.

检查泵出口流量、压力是否正常。

2) If online monitoring systems are provided for bearing temperature and vibration, check if the data is normal, and the field operators and panel operators shall verify the records for consistence.

轴承温度、振动有在线监测系统的，数据是否正常，内外操做好核对记录。

3) Check if the pressure and level in the seal liquid drum of the seal system are normal.

辅助密封系统封液罐的压力、液位是否正常。

(3) Regular maintenance

定期维护保养

1) Replace the lube oil every 6 months. Replace the lube oil in the pump to be cut into operation prior to pump switchover, and the oil replacement interval shall not be longer than 180 days.

定期换油：6 月一次，定期切换前更换切入运行泵润滑油，换油周期不大于 180 天。

2) Regular greasing for motors: greasing for motors depends on the specific operating conditions at the site, and shall follow the greasing cycles specified by the Electrical Department.

电机定期加脂：视现场运行状况加脂，执行电气部加脂周期。

3) Regular switchover: follow the Management Rules for Barring and Switchover of Standby Machines and Pumps.

定期切换，按以下原则对备用机泵进行定期切换，按《备用机泵盘车和定期切换管理制度》执行：

① Regular periodic switchover: refers to the periodic switchover of standby equipment that is allowed by the process and equipment operation conditions. Switchover shall be made every three months.

常规定期切换：是指具有备用设备，且工艺和设备条件允许进行切换操作的设备，备用设备每三个月切换一次。

② Special periodic switching: refers to the periodic switchover of standby equipment that is not allowed by the process and equipment operation conditions but special and necessary protection measures shall be taken by the operators when switchover is intended to be performed. Switchover shall be made every six months.

特殊定期切换：是指具有备用设备，但工艺和设备条件不允许进行常规的切换操作，需要由设备工艺人员采取特殊的和必要的防范措施才能进行切换的设备，半年切换一次。

③ Periodic switchover is not applicable to the machines, air cooler fans and pneumatic diaphragm pumps that are in intermittent operated due to process reasons. For a few machines that may cause system fluctuations during switchover, periodic switchover may not be performed. When the plant or unit is shut down, such machines shall be switched over or commissioned during shutdown or startup, and the reasons shall be indicated the List of Barring Frequency and Switchover Cycles for Standby Machines.

因工艺原因间歇运行的机泵、空冷风机、气动隔膜泵不执行定期切换，对极少数切换时容易引起系统波动的机泵，可以不执行定期切换，当装置或者单元停车时，在开停车过程中应安排备用机泵的切换或试运，同时在《备用机泵盘车频次和切换周期一览表》中注明原因。

(4) Regular repair

定期维修

1) Regular repair cycles Repair cycles shall be managed per the service lives of mechanical seal and bearing, mechanical seal service life is 25000h, and bearing service life is normally 50,000h.

定期检修周期。维修周期按机械密封和轴承使用寿命管理，机械密封使用寿命 25000h，轴承使用寿命一般 50000h。

2) Regular repair items

定期检修项目

①Check and replace the mechanical seal and bearings (the roller bearings must be replaced for the between bearing pumps when the mechanical seals are replaced, but the roller bearings are not required to be replaced for the overhung pumps when the mechanical seal are replaced.)
检查更换机械密封、轴承（双支撑泵更换密封时滚动轴承必须更换，悬臂泵单更换密封则不必更换滚动轴承）。

②Disassemble the pump and check each part for any abrasion, corrosion and erosion. Perform NDE for the pump shaft and impeller if necessary.

解体检查各零部件的磨损、腐蚀和冲蚀情况。泵轴、叶轮必要时进行无损探伤；

③Check and clean the bearings and oil seals, and measure and adjust the clearance of the bearings and oil seals.

检查清理轴承、油封等，测量、调整轴承油封间隙。

④Check and measure the circular runout and clearance of each part of the rotor, and perform dynamic balance check if necessary.

检查测量转子的各部圆跳动和间隙，必要时做动平衡校验。

⑤Check and correct the straightness of the shaft.

检查并校正轴的直线度。

⑥Measure and adjust the axial movement of the rotor.

测量并调整转子的轴向窜动量。

⑦Check the pump casing, foundation, anchor bolts and the inlet and outlet flanges for any misalignment to prevent additional stress from being applied to the pump casing, and perform re-alignment when required.

检查泵体、基础、地脚螺栓及进出口法兰的错位情况，防止将附加应力施加于泵体，必要时重新配管。

⑧Check, repair or replace the coupling, and check the alignment of the driver and pump.

检查、修理、更换联轴器及驱动机与泵的对中情况；

⑨Eliminate any general defects that occur during operation.

处理在运行中出现的一般缺陷。

⑩Check and clean CCW system, sealing oil system and lube oil system.

检查清理冷却水、封油和润滑等系统。

2.4.3.2 Routine maintenance of heaters 加热炉日常维护

(1) Routine maintenance

日常维护保养

1) Routine maintenance by field operators

外操日常维护

① Check and confirm that the pressure gauges (including vacuum gauges) and the thermometers of the heater are in good conditions, and their readings are correct.

检查加热炉现场压力表（包括真空表）、温度计是否完好，指示是否正确。

②Check if the burners and fuel oil (gas) system is coked and blocked, and the combustion is normal; check if the pilots are normally ignited; check if the fuel oil burners or fuel gas burners are damaged or in abnormal combustion, and adjust, clean or replace the defective burners in time after the burners are taken out of service; close the air dampers and steam valves of the standby burners per the Heater Management Regulation.

燃烧器、燃料油（气）系统是否结焦堵塞、燃烧是否正常，长明灯是否正常点燃；对油枪或瓦斯枪发现损坏或不正常燃烧、熄灭应及时调整、清理或更换等；对备用的燃烧器应关闭风门、汽门，按《加热炉管理制度》执行。

③Check the heater fire window, fire hole, ignition hole, explosion-proof door, manhole door and elbow box for air leakage. Check if the heater steel frame and the steel plates are securely sealed, and if the temperature exceeds the specified value.

检查加热炉看火窗、看火孔、点火孔、防爆门、人孔门、弯头箱是否严密，防止漏风。检查炉体钢架和炉体钢板是否完好严密，是否超温。

④Check the radiation tubes for any abnormalities such as local over-burning, cracking, bulging and bending, check if the inner wall lining of the heater is detached, if the internal components of the heater are abnormal, and if the instrument monitoring system is in normal operation.

检查辐射炉管有无局部过烧、开裂、鼓包、弯曲等异常现象，检查炉内壁衬里有无脱落，炉内构件有无异常，仪表监测系统是否正常。

⑤Check and confirm that the burner air flowrate adjustment system and the air dampers are in good conditions, the air blower and induced draft fan of the waste heat recovery system are in normal operation, and the snuffing steam system is in good conditions.

检查燃烧器风量调节系统、风门挡板是否灵活好用，余热回收系统的引风机、鼓风机是否正常运行，蒸汽灭火系统是否完好。

⑥The heater provided with soot blower shall be discharged at least every day, and check if the soot blower is in normal operation. Contact the mechanical maintenance staff to replace the damaged soot blower. If steam soot blower is used, completely drain the water before operation of the soot blower.

有吹灰器的加热炉，每天至少吹灰一次，并检查吹灰器有无故障，是否灵活好用，对损坏的吹灰器应联系修复；使用蒸汽吹灰器的，吹灰前必须先彻底疏水。

⑦Check the operation of the air blower and induced draft fan, check if the equipment vibration meet the requirements, if the level in the lube oil sightglass of the bearing housing is within the allowable range, and make up or replace the lube oil in time if it is below the specified level. The lube oil shall be replaced every six months. If standby air blower and induced draft fan are provided, they shall be switched over every three months.

检查加热炉鼓、引风机的运行情况，查看设备振动运行参数是否合格，轴承箱润滑油看窗液位是否在允许范围内，低于规定液位及时补充或更换。且每半年润滑油更换一遍；对有备用的每三个月切换一次。

2) Routine maintenance by panel operators

内操日常维护

Check the operation of the heater based on the process parameters indicated by DCS system. The details are as follows:

随时根据 DCS 系统上的工艺参数对加热炉运行情况进行检查，具体内容如下：

①Properly control the process parameters of the heater per the operation specifications, check the heater process fluid, fuel gas (oil) and steam systems, including flowrate and pressure control, check if the flowrate, pressure and temperature readings are correct, check if the temperature of radiation chamber, convection chamber and air preheater is normal, and check if the vacuum and the oxygen content of the radiation chamber are within the specified range. If any abnormality is identified, investigate the causes and make adjustment in time.

应严格按操作法做好加热炉工艺操作控制，检查加热炉工艺介质、燃料气（油）、蒸汽进出料系统，包括流控、分支流控、压控及流量、压力、温度的指示是否正常、有无偏流等；检查辐射式、对流室、空气预热器相关部位温度是否正常，以及辐射室真空度、氧含量是否在规定范围内。情况异常必须查明原因并及时调整处理。

②The heater shall be operated strictly according to the operation procedures and control indicators. Over-temperature, over-pressure and over-load are forbidden, and too low load operation (below 60% of the design load) shall be minimized.

加热炉操作运行要严格按操作法和控制指标进行，严禁超温、超压、超负荷运行，尽量避免过低负荷运行（指低于设计负荷的 60%）。

③The CO content in the flue gas is shall be $\leq 100\text{mg/m}^3$, NO_x content shall be $\leq 100\text{mg/m}^3$, SO_2 content shall be $\leq 100\text{mg/m}^3$.

烟气中 CO 含量 $\leq 100\text{mg/m}^3$ ； $\text{NO}_x \leq 100\text{mg/m}^3$ ， $\text{SO}_2 \leq 100\text{mg/m}^3$ 。

④The oxygen content in the flue gas from the top of the convection chamber shall be controlled within 2% to 4% for the gas fired heater, and shall be controlled within 3% to 5% for oil fired heater. The oxygen content in the flue gas shall be judged by the reading of zirconium analyzer. If the analysis value provided by QA/QC Department and the heater effect monitored value differ greatly from the reading from the on-line zirconium analyzer, contact the Instrument Control Department to check and verify the operation of the zirconium analyzer, and report the treatment

results to the Mechanical and Power Department.

对流室顶部烟气中的氧含量，燃气加热炉应控制在 2%~4%；燃料油加热炉应控制在 3%~5%；加热炉日常运行氧含量以氧化锆为准，当质量检验部化验分析值、炉效监测值与在线氧化锆显示值差别较大时，及时联系仪表控制部进行校核并向机械动力部反馈处理信息。

3) Regular maintenance

定期维护保养

①The management personnel of the Operation Department shall check the heater operation every week and make records for filing.

运行部管理人员每周进行一次加热炉运行情况和问题检查，并做好记录备案

②The technical personnel of the Operation Department shall develop the monthly heater operation report and fill out the heater thermal efficiency monitoring list before 5th of the month, and this date will be postponed in case of holidays.

运行部设备技术人员每月编写本装置加热炉运行情况分析报告，并于 5 日前完成系统中“加热炉热效率监测汇总表”的填报，节假日顺延。

③The Instrument Control Department shall calibrate the heater zirconium analyzers at least every quarter, make records, and report the calibration results to the Operation Department for filing.

仪控部每季度至少对加热炉使用的所有氧化锆校验一次，并做好记录，及时将校验结果反馈运行部备案。

④The technical personnel of the Operation Department shall use the thermal efficiency meter to conduct an actual measurement of the heater thermal efficiency every month, and properly adjust the operation of the heaters based on measurement results to ensure the average thermal efficiency of the heaters is up to the specified indicator. The thermal efficiency of the heater in size of 10MW and above shall be higher than 90%, and the thermal efficiency of the heater in size below 10 MW shall be up to the design value.

运行部技术人员每月用热效率仪对加热炉热效率进行一次实际监测，根据监测情况对加热炉的运行情况进行调整，保证加热炉正常运行时平均热效率达到规定指标：热负荷在 10MW 及以上的加热炉的热效率应达到 90%以上；热负荷在 10MW 以下的加热炉的热效率应达到设计值。

⑤Analyze the fuel gas (oil) to the heater every week to ensure that the fuel quality is controlled within the specified range.

每周对加热炉燃料气（油）进行分析，保证加热炉燃料控制在指标范围内。

⑥Measure the dew point temperature of the heater every year, and then properly determine the flue gas outlet temperature based on the measurement result.

每年对加热炉露点温度进行一次测定，根据测定结果确定合理的排气温度。

⑦Use thermal imager to check the temperature of the heater tubes and the heater body every quarter, and adjust the operation of the heater to avoid local over-heating.

每季度通过热成像仪对加热炉炉管、炉体进行测量，对局部超温情况进行调整。

4) Regular repair

定期维修

①Regular repair cycles**定期维修周期**

Generally, the heater repair cycle shall be kept peace with the turnaround of the process unit, and the repair cycle for the special heaters shall follow the design repair cycles.

一般加热炉检修周期与装置开停工周期同步，特殊加热炉按设计使用周期执行。

②Regular repair cycles**定期维修项目**

A Check the refractory lining in the fire box for any cracks or looseness, and check the tubes for any abnormal conditions such as deformation and bulge.

炉膛内部耐火衬里有无裂缝、松动，盘管有无鼓包变形等异常情况。

B Check the pressure components inside and outside the heater for looseness.

检查炉内外受压元件有无松动。

C Check if the safety accessories are complete, sensitive and reliable.

检查安全附件是否齐全、灵敏、可靠。

D With regard to the tubes for hydrogen service, the tubes prone to coking, the tubes experienced severe oxidization and scale peel-off, and the tubes that have been in continuous operation for more than 3 years, their weld seams shall be radiographically checked and metallurgically tested if necessary.

临氢炉管、易结焦介质炉管、表面氧化剥皮严重的炉管、连续运行 3 年以上的炉管，焊缝应做射线检查，必要时做金相检查。

E Spot check the wall thickness of the heater tubes, and check and measure the construction of the main components in the heater.

抽查炉管壁厚，检查、测量炉内主要部件的结构情况。

F Clean the tubes that are prone to coking.

对易结焦的加热炉进行清焦处理。

G Check the inner and outer surfaces of the heater, the joints, and the elbows for corrosion or erosion and abrasion.

检查加热炉内外表面、接管、弯头处有无介质腐蚀或冲刷、磨损等现象。

H Check the heated surface of the air preheater for corrosion and ash accumulation, and check the tubesheets and seal parts for corrosion, damage or leakage. Check the soot blower nozzles for corrosion, damage or blockage by ash.

检查空气预热器受热面腐蚀和积灰情况；管板及密封件腐蚀损坏、漏风漏烟情况。吹灰器喷管腐蚀损坏和积灰堵塞情况。

I Check the radiation chamber, the convection chamber, the flue gas duct, the chimney, other heated surfaces, the hanger supports and the refractory lining.

对辐射室、对流室、烟风道和烟筒内的炉管及其它受热面、炉内吊挂支承件、耐火衬里等进行检查。

2.4.4 Shutdown and maintenance requirements for special equipment 特殊设备的停工处理

及维护要求

There is no special equipment in this process unit.

本装置无特殊设备。

2.4.5 General description to instrument systems 仪表系统通用部分说明

The process of this unit is designed in continuous operation, and most of process streams are flammable and explosive, and some streams are corrosive; therefore, selection of instruments must satisfy explosion-proof, corrosion resistant and control requirements. The design of the instruments and control systems must be characterized by safety, reliability, advanced technology, excellent performance and reasonable economics. The instruments and control systems shall meet the process operation requirements, and achieve centralized control, smooth operation, safe production, flexible and efficient performance, long-term reliability, easy maintenance and unified management to guarantee the production capacity of the process unit, improve product output and quality, reduce energy consumption, and maximize economic benefits.

本装置工艺过程为连续生产，工艺介质多为易燃易爆，部分介质具有腐蚀性，自控设备的选型严格符合防爆、防腐及控制要求。仪表及控制系统设计需具备安全可靠、技术先进、性能优良、经济合理等特点，充分满足工艺过程的操作要求，实现集中控制、平稳操作、安全生产、灵活高效、长期可靠、维护方便、统一管理，充分发挥工艺装置的生产加工能力，提高产品产量和质量，降低能耗，尽最大能力获取经济效益。

2.4.5.1 Automatic control level 自动控制水平

The automatic control level for the process unit shall be designed based on the process and technologies used in the unit and the overall design level of the project. The main control systems include distributed control system (DCS), safety instrumented system (SIS), intelligent device management system (IDM), fire and gas detection system (FGS).

本装置的自动控制水平根据装置工艺过程及项目的总体设计水平进行设计，主要的控制系统包括分散控制系统（DCS），安全仪表系统（SIS），智能设备管理系统（IDM），火灾和可燃气体及有毒气体检测系统（FGS）等。

The main process detection and control variables of this process unit are displayed, adjusted, recorded, alarmed in DCS system. The operating status of electrical equipment such as main pumps in the process unit is displayed in DCS system. Conventional automatic control is employed for the process unit, and mature and stable complex control is also designed based on the characteristics and requirements of different processes to realize safe, stable, accurate and flexible process automatic control.

本装置主要工艺检测和控制变量都在 DCS 进行显示、调节、记录、报警等操作。各装置及单元内的主要机泵等电气设备的运行状态均在 DCS 进行显示。自动控制方案主要采用常规自动控制，

并根据不同工艺过程的特性及要求采用成熟、稳定的复杂控制，实现安全、稳定、准确、灵活的过程自动控制。

The control system cabinets are installed in the field rack room (FAR-1), and the operator stations of the control systems are installed in the central control room, which are connected by armored redundant optical cables. This process unit shares one field rack room (FAR-1) with Acid Gas and LPG Treating Unit and the Light Ends Recovery Unit. For particularly important emergency stop buttons, they are installed on the auxiliary consoles in the central control room, and the signals will be hardwired to the remote I/O units installed in cabinets of the central control room.

本装置将控制系统机柜放置在现场机柜室（FAR-1）内，控制系统的操作站放置在中心控制室内，二者通过铠装冗余光缆连接。本装置与产品精制装置、轻烃回收装置共用一个现场机柜室（FAR-1）。对于特别重要的紧急停车按钮等，将设置在中心控制室的辅助操作台上，信号采用硬线与安装在中心控制室机柜间内的远程 I/O 单元连接。

2.4.5.2 Instruments and control systems 自动控制方案

Most of the control loops in this process unit employ single-loop fixed-value control, and some employ complex control such as cascade control that is performed by DCS system. The main cascade control options are as follows:

本装置的大部分控制回路采用单回路定值控制，部分采用串级等复杂控制，由 DCS 控制系统完成，主要控制方案如下：

（1）Cascade control is employed for the Pre-Dist. bottom level to the flowrate of 3 crude branches.

初馏塔塔液位与脱前原油三路流量串级控制。

（2）Cascade control is employed for the 1st stage desalter pressure to the flowrate of 3 desalted crude branches.

一级电脱盐罐压力与脱后原油三路流量串级控制。

（3）Cascade control is employed for the Pre-Dist. top temperature to the Pre-Dist. OVHD reflux flowrate.

初馏塔塔顶温度与塔顶回流量组成串级控制回路。

（4）Cascade control is employed for the Atm. top temperature to the atm. OVHD reflux flowrate. 常压塔塔顶温度与塔顶回流量组成串级控制回路。

（5）Cascade control is employed respectively for kerosene, light diesel, heavy diesel and atm. overflash oil level to the kerosene, light diesel, heavy diesel and atm. overflash oil flowrate.

常一、二、三、四线液位分别与常一、二、三、四线流量组成串级控制回路。

（6）Cascade control is employed for the Atm. bottoms level to the flowrate of 8 branches into the Vac. heater.

常压塔塔底液位与减压炉八路进料流量组成串级控制回路。

（7）Cascade control is employed respectively for the temperature of gas phase under the collecting drums of LVGO, MVGO and HVGO to the flowrate MVGO PA, HVGO PA and HVGO

flushing oil.

减一、二、三线集油箱下气相温度分别与减二中、减三中、减三线内回流流量组成串级控制回路。

(8) Cascade control is employed respectively for the LVGO,MVGO and HVGO level to the corresponding LVGO,MVGO and HVGO flowrate.

减一、二、三线液位分别与减一、二、三线流量组成串级控制回路。

(9) Cascade control is employed for the vac. column top temperature to the LVGO PA flowrate. 减压塔顶温度与减一中流量组成串级控制回路。

(10) Cascade control is employed for the manifold outlet temperature of Atm. heater fire boxes 1# and 2# to the corresponding fire box fuel oil flowrate or fuel gas pressure.

常压炉 1#炉膛和 2#炉膛炉管总出口温度分别与该炉膛的燃料油流量或者燃料气压力组成串级控制回路。

(11) Cascade control is employed for the manifold outlet temperature of Vac. heater fire boxes 1# and 2# to the corresponding fire box fuel gas pressure.

减压炉 1#炉膛和 2#炉膛炉管总出口温度与该炉膛的燃料气压力组成串级控制回路。

(12) Cascade control is employed for the Vac. residue level to the vacuum residue flowrate. 减压塔液位与减压渣油流量组成串级控制回路。

2.4.6 Main Process Interlock Description 主要工艺操作仪表逻辑控制说明

2.4.6.1 Control for desalter drum pressure 电脱盐压力压力控制

As an important control indicator for the desalter system, the desalter drum pressure is also deemed as an important indicator for controlling the crude system in stable operation.

电脱盐罐压力是电脱盐系统的重要控制指标，也是原油系统稳定控制的重要指标。

Control range: 1.0~1.7MPa

控制范围：1.0~1.7MPa

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: flowrates of 3 crude streams from the desalter drum, mixer pressure drop, and cut water flowrate from the desalter drum

相关参数：脱后原油三路流量、混合压降、电脱盐切水量。

Control mode: the desalter drum pressure control interlock (PHS10101) is cascaded to the flow controllers (FIC51001, FIC51201, FIC51401) of 3 crude streams from the desalter drum. Specifically, the higher value of D-101 OVHD pressure (PIC10101) and D-102 OVHD pressure (PIC10201) is taken as the SP of PHS10101.

控制方式：电脱盐罐压力 PHS10101 与脱后原油三路流量 FIC51001、FIC51201、FIC51401 串级控制。其中 PHS10101 取 D-101 罐顶压力 PIC10101、D-102 罐顶压力 PIC10201 中高值。

Adjustment method: when the reading of PHS10101 is greater than the SP, open FIC51001, FIC51201 and FIC51401 to increase the flowrates of 3 crude streams from the desalter drum; when the reading of PHS10101 is less than the SP, close FIC51001, FIC51201 and FIC51401

to reduce the flowrates of 3 crude streams from the desalter drum.

调节方法：当 PHS10101 高于设定值时，FIC51001、FIC51201、FIC51401 阀开，增加脱后原油三路流量；当 PHS10101 低于设定值时，FIC51001、FIC51201、FIC51401 阀关，降低脱后原油三路流量。

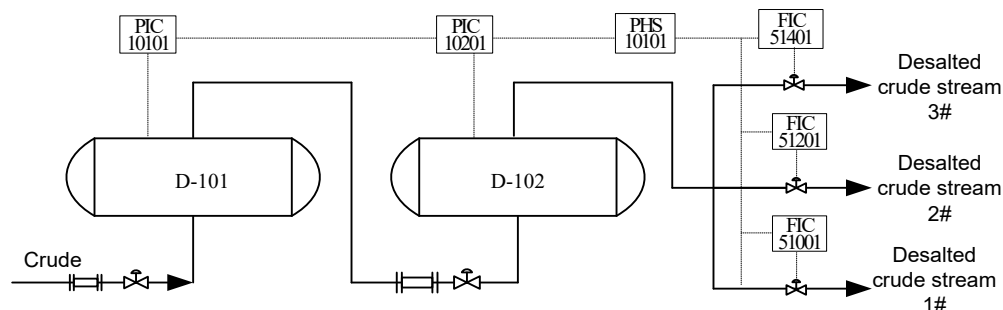


Figure 46 Desalter Drum Pressure Control Flow Chart

图 46 电脱盐压力控制流程图

Table 47 abnormal phenomena reasons and treatment method

表 47 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The desalter drum pressure (PHS10101) rises.	The control valve fails and is fully closed. 调节阀故障全关	Switch to the bypass valve for control, and check and repair the failed control valve. 采用付线控制，调节阀检修
	The crude flowrate to the desalter drum increases. 脱前原油流量增加	Increase crude flowrate from the desalter drum, or reduce the crude flowrate to the desalter drum. 增加脱后原油流量，或者降低脱前原油流量
	The water injection flowrate increases greatly. 注水量大幅度增加	Keep the water injection flowrate stable. 稳定注水量
	The pressure in the desalter drum cut water oil skimmer rises, and the cut water piping of the desalter drum is blocked. 脱盐切水除油器压力上升，电脱盐切水不畅	Decrease the pressure in the desalter drum cut water oil skimmer. 降低除油器压力
	The mixer pressure drop is adjusted greatly. 混合压降大幅度调整	Keep the mixer pressure drop stable. 稳定混合压降

Table 47(continued) abnormal phenomena reasons and treatment method**表 47（续） 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The desalter drum pressure (PHS10101) rises. 电脱盐压力 PHS 10101 上升	Water is entrained in the crude to cause increased back pressure of the crude from the desalter drum.原油带水, 造成脱后原油背压上升	Stop injecting water into the desalter drum, increase cut water flowrate from the desalter drum, and stabilize the operation of the Pre-Dist..电脱盐停注水, 增加电脱盐切水, 稳定初馏塔操作。
The desalter drum pressure (PHS10101) drops. 电脱盐压力 PHS10101 下降	The control valve fails and is fully opened.调节阀故障全开	Switch to the bypass valve for control, and check and repair the failed control valve.采用付线控制, 调节阀检修。
	The cut water flowrate from the desalter drum fluctuates.电脱盐切水波动	Keep the cut water flowrate from the desalter drum stable.稳定电脱盐切水
	The mixer pressure drop is adjusted greatly.混合压降大幅度调整	Keep the mixer pressure drop stable.稳定混合压降
	The pressure of the desalter drum cut water oil skimmer is low.除油器压力控制低	Adjust the pressure of the desalter drum cut water oil skimmer.调整除油器压力

2.4.6.2 Control for crude-water interface level in desalter drum 电脱盐罐油水界位控制

The oil-level interface level is deemed as an important control parameter of the desalter drum. If the crude-water interface level in the desalter drum is high, the emulsion layer with high water content may enter the electric field to cause increased electric current in the desalter drum even trip; if the crude-water interface level in the desalter drum is low, the oil content in the cut water from the desalter drum may increase, and the strength of the weak electric field may decrease to affect normal operation of the weak electric field. Radio frequency admittance interface level controller is employed in the process unit to monitor the crude-water interface level in the desalter drum.

油水界位控制是电脱盐罐的重要参数。界位控制高, 高含水乳化层进入电场, 电脱盐罐电流上升, 甚至跳闸, 界位控制低, 电脱盐切水含油上升, 且弱电场电场强度下降, 影响弱电场的运行。本装置电脱盐界位采用射频导纳界位仪监测界位。

Control range: 20~60%

控制范围：20～60%

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: water injection flowrate, cut water flowrate, desalter drum temperature, thickness of emulsion layer, crude density or conductivity

相关参数：注水量、切水量、电脱盐温度、乳化层的厚度、原油的密度或者导电率。

Control mode: two crude-water interface level controllers (LIC10101 and LIC10102) are provided for desalter drum 1# (D-101). The higher value of LIC10101 and LIC10102 is taken as the SP of LHS10102. Single loop control is employed for LHS10102. Also, two crude-water interface level controllers (LIC10201 and LIC10202) are provided for desalter drum 2# (D-201). The higher value of LIC10201 and LIC10202 is taken as the SP of LHS10202. Single loop control is employed for LHS10202.

控制方式：电脱盐罐 D-101 设置两套油水界面监测仪 LIC10101、LIC10102，LHS10102 取 LIC10101、LIC10102 二者的高值，LHS10102 采用单回路控制。电脱盐罐 D-102 设置两套油水界面监测仪 LIC10201、LIC10202，LHS10202 取 LIC10201、LIC10202 二者的高值，LHS10202 采用单回路控制。

Adjustment method: when the reading of LHS10102 is greater than the SP, open LV10102 to increase the cut water flowrate from the desalter drum; when the reading of LHS10202 is less than the SP, close LV10102 valve to reduce the cut water flowrate from the desalter drum.

调节方法：当 LHS10102 高于设定值时，LV10102 阀开，增加电脱盐切水量；当 LHS10202 低于设定值时，LV10102 阀关，降低电脱盐切水量。

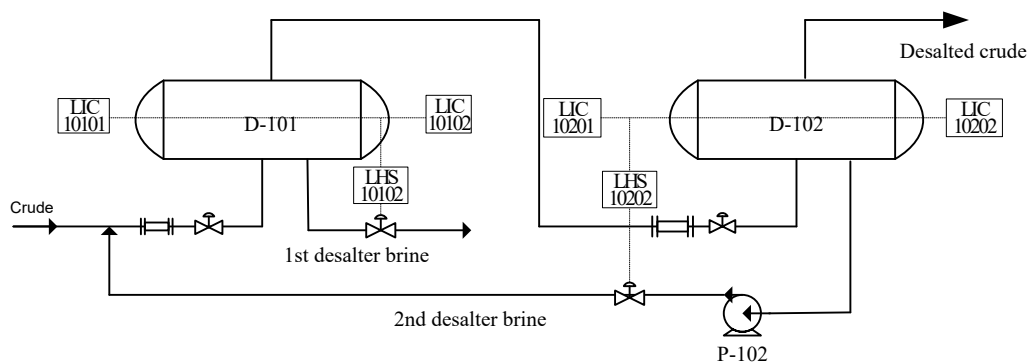


Figure 47 Flow Chart of Control for Oil-Water Interface Level in Desalter Drum

图 47 电脱盐界位控制流程图

Table 48 abnormal phenomena reasons and treatment method**表 48 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The crude-water interface level (LHS10102 or LHS10202) in the desalter drum rises. 电脱盐界位 LHS10102、LHS10202 上升	The control valve fails and is fully closed. 调节阀故障全关	Switch to the bypass valve for control, and check and repair the failed control valve. 采用付线控制，调节阀检修
	The emulsion layer is being thickened. 乳化层增厚	Check the actual crude-water interface level at the site, and adjust the crude-water interface level depending on the electric current. 检查现场实际界位，结合电流调整界位
	The crude properties change. 原油性质变化	Check the actual crude-water interface level at the site, and adjust the crude-water interface level depending on the electric current. 检查现场实际界位，结合电流调整界位
	The water injection flowrate is increased. 注水量增加	Keep the water injection flowrate stable. 稳定注水量
	Instrument failure 仪表故障	Check and repair the failed instruments. 检查仪表，组织检修
The crude-water interface level (LHS10102 or LHS10202) in the desalter drum drops. 电脱盐界位 LHS10102、LHS10202 下降	The control valve fails and is fully opened. 调节阀故障全开	Switch to the bypass valve for control, and check and repair the failed control valve. 采用付线控制，调节阀检修。
	The emulsion layer is being thinned. 乳化层减薄	Check the actual crude-water interface level at the site, and adjust the crude-water interface level depending on the electric current. 检查现场实际界位，结合电流调整界位
	The crude properties change. 原油性质变化	Check the actual crude-water interface level at the site, and adjust the crude-water interface level depending on the electric current. 检查现场实际界位，结合电流调整界位
	The water injection flowrate is reduced. 注水量减少	Keep the water injection flowrate stable. 稳定注水量
	Instrument failure 仪表故障	Check and repair the failed instruments. 检查仪表，组织检修

2.4.6.3 Control for mixer pressure drop of D-101 and D-102 D-101、D-102 混合压降控制

The mixer pressure drop is deemed as an important control parameter of the desalter drum. A suitable mixer pressure drop facilitates the intimate mixing of crude and water. Low mixer pressure drop may cause non-intimate mixing of crude and water to affect the desalination performance of the desalter drum, and high mixer pressure drop may cause over-emulsification of oil and water to affect the demulsification performance of the desalter drum. Static mixers and mixing valves are employed in this process unit to control the mixer pressure drop of the desalter drum, and the total pressure difference between the static mixer and the mixing valve is taken as the SP of the mixer pressure drop.

混合压降控制是电脱盐运行的重要参数。合适的混合压降，有利于原油和水的充分混合。混合压降低，油水混合不充分，水洗盐效果差，混合压降高，可能造成油水过乳化，不利于电脱盐破乳。本装置混合压降采用静态混合器和混合阀控制，压降至取静态混合器和混合阀的总压差。

Control range: 40-120kPa

控制范围：40-120kPa

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: crude flowrate

相关参数：原油流量。

Control mode: single loop control is employed for the mixer pressure drop controller (PDIC10102) of desalter drum 1# (D-101) and the mixer pressure drop controller (PDIC10202) of desalter drum 2# (D-102).

控制方式：电脱盐罐 D-101 混合压降 PDIC10102 和电脱盐罐 D-102 混合压降 PDIC10202 均采用单回路控制。

Adjustment method: when the reading of PDIC10102 or PDIC10202 is greater than the SP, open PDV10102 or PDV10202; when the reading of PDIC10102 or PDIC10202 is less than the SP, close PDV10102 or PDV10202.

调节方法：当 PDIC10102、PDIC10202 高于设定值时，PDV10102、PDV10202 阀开；当 PDIC10102、PDIC10202 低于设定值时，PDV10102、PDV10202 阀关。

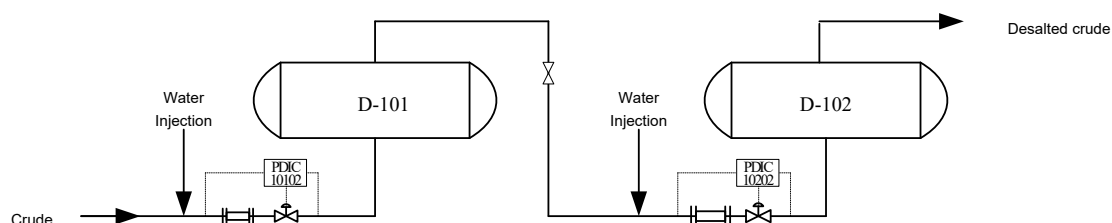


Figure 48 Flow Chart of Control for Mixing Pressure Drop of Desalter Drum

图 48 电脱盐混合压降控制流程图

Table 49 abnormal phenomena reasons and treatment method**表 49 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The mixer pressure drop (PDI C10102 or PDI C10202) rises. 混合压降 PDIC10102、PDIC10202 上升	The control valve fails and is fully closed.调节阀故障全关	Switch to the bypass valve for control, and check and repair the failed control valve.采用付线控制，调节阀检修
	The crude flowrate increases.原油流量上升	Further open the mixing valve accordingly to stabilize the mixer pressure drop.适当开大混合阀，稳定压降
	Improper operation 操作不当	Further open the mixing valve to stabilize the mixer pressure drop.开大混合阀，稳定压降
The mixer pressure drop (PDI C10102 or PDI C10202) drops. 混合压降 PDIC10102、PDIC10202 下降	The control valve fails and is fully opened.调节阀故障全开	Switch to the bypass valve for control, and check and repair the failed control valve.采用付线控制，调节阀检修。
	The crude flowrate is reduced.原油流量下降	Further close the mixing valve accordingly to stabilize the mixer pressure drop.适当关小混合阀，稳定压降
	Improper operation 操作不当	Further close the mixing valve to stabilize the mixer pressure drop.关小混合阀，稳定压降

2.4.6.4 Control for water flowrate to desalter drum 电脱盐注水量控制

Proper water flowrate to the desalter drum is deemed as an important parameter for controlling the desalination performance of the desalter drum. Low water flowrate to the desalter drum may cause insufficient dispersion density of water droplets in the crude to affect the desalination performance of the desalter drum, and large water flowrate to the desalter drum may cause increased energy consumption by the process unit and reduced processing capacity of the process unit. Generally, the heavier the crude is, the greater the water flowrate to the desalter drum will be required.

控制合适的注水量，是控制原油脱盐效果的关键参数。注水量低，水滴在原油中的分散密度不够，洗盐效果差，注水量大，增加装置能耗，同时降低装置的处理能力。一般原油越重，需要的注水量越大。

Control range: 3~8% (percentage in crude)

控制范围：3~8%（占原油比例）

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: crude flowrate, crude-water interface level

相关参数：原油流量、油水界位。

Control mode: generally, water is injected into the desalter drum in a circulating manner, that is, the purified water is injected into D-102 inlet via P-101, where the water is mixed with the crude, and the water separated is sent back to D-101 inlet via P-102. The water flowrate to D-102 is controlled by the single loop flow controller (FIC10201), and the water flowrate to D-101 is controlled by D-102 crude-water interface level controller and generally changes with the fluctuation of the crude-water interface level in D-102. In case that the desalter system functions improperly such that the cut water from D-102 deteriorates and is not suitable to be injected into D-101, single-stage water injection method shall be employed for D-101 and D-102, that is, the purified water is injected into D-101 inlet and D-102 inlet respectively via P-101, and the water separated from D-101 and D-102 respectively is directly discharged to the wastewater treatment plant. Single loop control is employed for FIC10101 and FIC10201.

控制方式：电脱盐注水一般采用循环注水模式，即净化水通过 P-101 注至 D-102 入口，与原油混合，D-102 分离出来的水通过 P-102 回注至 D-101 入口。循环注水的模式，D-102 注水量 FIC10201 采用单回路控制，D-101 注水量由 D-102 的界位控制，一般随着 D-102 界位的波动而波动。当电脱盐运行不好，D-102 切水水质恶化，不适合做 D-101 注水时，D-101、D-102 采用单级注水，即净化水由 P-101 分别注至 D-101 和 D-102 入口，D-101 和 D-102 的切水直接外排至污水处理装置，FIC10101 和 FIC10201 采用单回路控制。

Adjustment method: when it is required to increase the water flowrate to the desalter system, further open FIC10101 and FIC10201; when it is required to reduce the water flowrate to the desalter system, further close FIC10101 and FIC10201.

调节方法：当需要增加电脱盐注水量时，开大 FIC10101 和 FIC10201；需要降低电脱盐注水量时，关小 FIC10101 和 FIC10201。

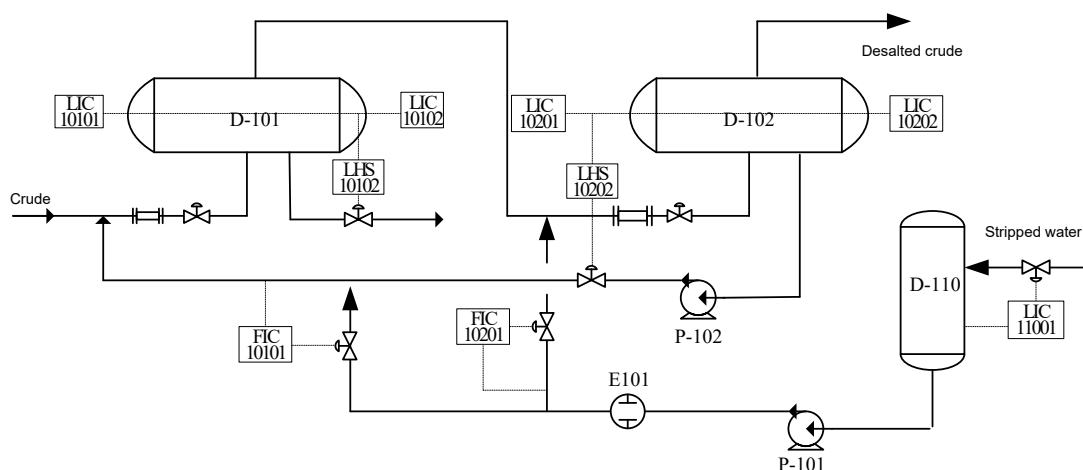


Figure 49 Flow Chart of Control for Water Flowrate to Desalter Drum

图 49 电脱盐注水控制流程图

2.4.6.5 Control for crude-water interface level and pressure in desalter drum cut water oil skimmer 电脱盐除油器油水界位和压力控制

The main control parameters of the desalter drum cut water oil skimmer include crude-water

interface level and pressure.

电脱盐切水除油器的主要控制参数为油水界位和除油器压力。

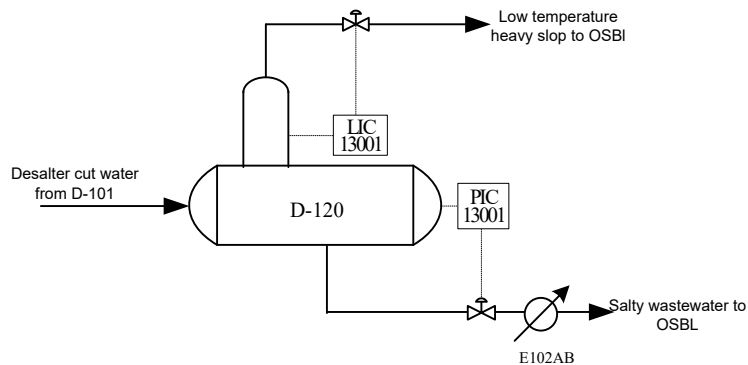


Figure 50 Flow Chart of Control for Oil-Water Interface Level and Pressure in Desalter Drum Cut Water Oil Skimmer

图 50 电脱盐除油器界位压力控制流程图

Control range: 50 ~ 80% (LIC13001), 0.5 ~ 1.0MPa (PIC13001)

控制范围: LIC13001 控制范围 50~80%, PIC13001 控制范围 0.5~1.0MPa。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: cut water flowrate from the desalter drum, oil content, oil removal quantity

相关参数: 电脱盐切水量、含油量、除油量。

Control mode: single loop control is employed for LIC13001 and PIC13001.

控制方式: LIC13001 和 PIC13001 均采用单回路控制。

Adjustment method: when the reading of LIC13001 rises, further open LV13001; when the reading of LIC13001 drops, further close LV13001. When the reading of PIC13001 rises, further open PV13001; when the reading of PIC13001 drops, further close PV13001.

调节方法: LIC13001 上升, 开大 LV13001; LIC13001 下降, 关小 LV13001。PIC13001 上升, 开大 PV13001; PIC13001 下降, 关小 PV13001。

2.4.6.6 Control for Pre-Dist. bottom level 初馏塔塔底液位控制

As an important indicator for controlling material balance in the process unit, the Pre-Dist. bottom level shall be controlled stable to serve as one of the bases for ensuring the whole Atmospheric and Vacuum Distillation Unit in stable operation. Two differential pressure type level controllers (LIC21002 and LIC21003) are provided for the Pre-Dist..

初馏塔液位是装置物料平衡的重要控制指标。初馏塔液位的稳定控制是整个常减压装置稳定运行的基础之一。初馏塔设置了两套差压式液位计 LIC21002 和 LIC21003。

Control range: 40~60%

控制范围: 40%~60%

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: crude flowrate to the process unit, feed flowrate to the Atm. heater

相关参数：原油进装置流量、常压炉进料流量。

Control mode: the Pre-Dist. bottom level control interlock (LHS21003) will act depending on the higher value of LIC21002 and LIC21003. LHS21003 is cascaded to the flow controllers (FIC50101, FIC50102, FIC50103) of 3 crude streams to the desalter drum.

控制方式：初馏塔液位 LHS21003 高选 LIC21002 和 LIC21003，LHS21003 与脱前原油三路流量 FIC50101、FIC50102、FIC50103 组成串级回路控制。

Adjustment method: when the reading of LHS21003 rises, further close FIC50101, FIC50102 and FIC50103 to reduce the crude flowrate to the process unit; when the reading of LHS21003 drops, further open FIC50101, FIC50102 and FIC50103 to increase the crude flowrate to the process unit.

调节方法：LHS21003 上升，关小 FIC50101、FIC50102、FIC50103，降低原油进装置流量；LHS21003 下降，开大 FIC50101、FIC50102、FIC50103，增加原油进装置流量。

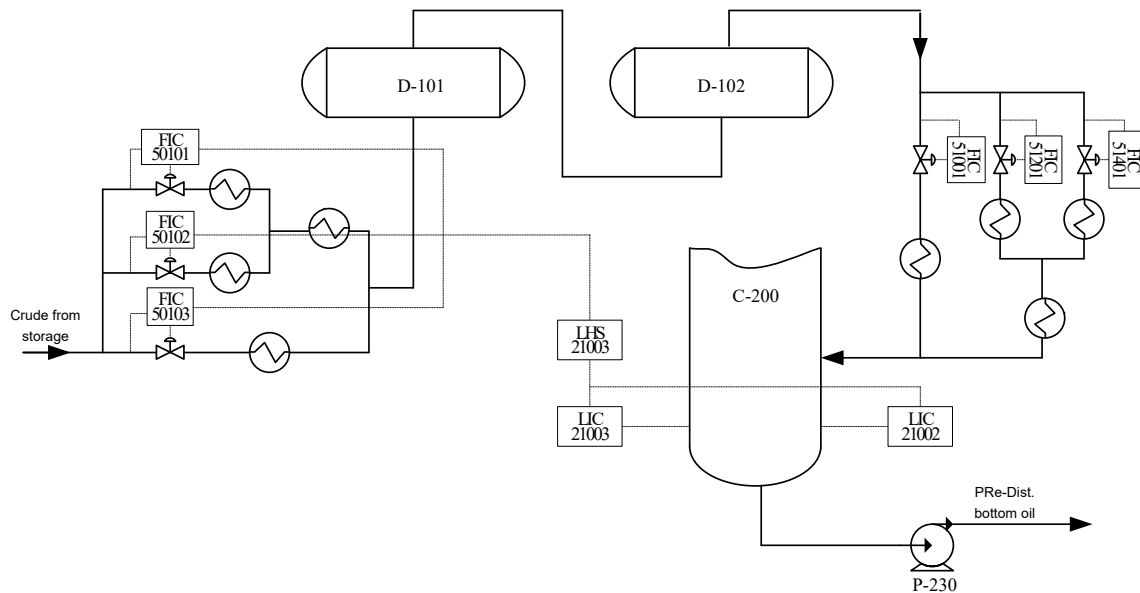


Figure 51 Pre-Dist. Bottom Level Control Flow Chart

图 51 初馏塔塔底液位控制流程图

Table 50 abnormal phenomena reasons and treatment method**表 50 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Pre-Dist. bottom level rises rapidly. 初馏塔底液位快速升高	The crude becomes heavier, and the vaporization capacity of the Pre-Dist. becomes smaller. 原油变重, 初馏塔汽化量变小	Reduce the flowrates of 3 crude streams to the desalter drum, or increase the feed flowrate to the Atm. heater. 降低脱前原油三路流量, 或者增加常压炉进料流量
	The feed flowrate to the Pre-Dist. column increases suddenly. 初馏塔进料量突增	Control the feed flowrate to the Pre-Dist. stable. 平稳控制初馏塔进料量。
	The Pre-Dist. column bottom level gauge fails. 初馏塔底液位计故障	Contact the instrument maintenance staff for troubleshooting. 联系仪表处理液位计
	The water flowrate to the desalter drum increases suddenly. 电脱盐注水突增	Investigate the involved causes, and keep the water flowrate stable. 查明电脱盐注水突增原因, 平稳注水量。
	The cut water flowrate from the desalter drum reduces suddenly. 电脱盐注水突降	Control the cut water flowrate stable. 平稳控制切水量
	The Pre-Dist. column bottoms pump (P230) fails. 塔底泵 P230 故障	Switch to the standby pump, and contact the maintenance staff for troubleshooting. 切换至备用泵运行, 联系维修处理。
	The control valve fails. 控制阀失灵	Switch to the bypass valve for control, and repair the failed control valve. 控制阀改副线控制, 调节阀维修。

Table 50(continued) abnormal phenomena reasons and treatment method**表 50（续） 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Pre-Dist. column bottom level drops rapidly.	The Pre-Dist. column bottom level gauge fails. 初馏塔底液位失灵	Check the actual Pre-Dist. column bottom level, and contact the instrument maintenance staff for troubleshooting. 检查初底实际液位，联系仪表人员处理
	The feed flowrate to the Pre-Dist. column reduces suddenly. 初馏塔进料量突降	Control the feed flowrate to the Pre-Dist. column stable. 平稳控制初馏塔进料量。
	The feed flowrate to the Atm. heater increases suddenly. 常压炉进料突增	Control the feed flowrate to the Atm. heater stable. 平稳控制初馏塔进料量。
	The water flowrate to the desalter drum reduces suddenly. 电脱盐注水突降	If the water flowrate to the desalter drum reduces suddenly, investigate the involved causes, and keep the water flowrate stable. 若电脱盐注水突降，查明电脱盐注水突降原因，平稳注水
	The cut water flowrate from the desalter drum increases suddenly. 电脱盐切水突增	Control the cut water flowrate stable. 平稳控制切水量。
	The crude becomes lighter. 原油性质变轻	If the crude becomes lighter, reduce the feed flowrate to the Atm. heater. 若原油性质变轻，降低常压炉进料量。
	The control valve fails. 控制阀失灵	Switch to the bypass valve for control, and repair the failed control valve. 控制阀改副线控制，调节阀维修。

2.4.6.7 Control for Pre-Dist. top temperature 初馏塔塔顶温度控制

As an important operating parameter of the Pre-Dist. column, the Pre-Dist. top temperature (TIC21001) is served as the main means for controlling the dry point of the Pre-Dist. OVHD oil. The Pre-Dist. OVHD temperature is adjusted mainly depending on the flowrate and temperature of the Pre-Dist. OVHD reflux. Generally, large Pre-Dist. OVHD reflux flowrate and low Pre-Dist.

OVHD reflux temperature could result in low Pre-Dist column top temperature, while small Pre-Dist. OVHD reflux flowrate and high Pre-Dist. OVHD reflux temperature could result in high Pre-Dist. top temperature.

初顶温度 TIC21001 是初馏塔的重要操作参数，是控制初顶石脑油干点的主要手段。初顶温度主要通过初顶回流量及回流温度调节。一般初顶回流量大及回流温度低，会导致初顶温度低；反之，初顶温度高。

Control range: 125~170%

控制范围：125~170℃

Control target: per the specified indicators

控制目标：指令指标

Related parameters: Pre-Dist. OVHD reflux flowrate, Pre-Dist. OVHD reflux temperature, Pre-Dist column feed temperature

相关参数：初顶回流流量、初顶回流温度、初馏塔进料温度

Control mode: the Pre-Dist column top temperature is controlled by the Pre-Dist column top temperature controller (TIC21001) that is cascaded to the Pre-Dist. OVHD reflux flow controller (FIC21001).

控制方式：初馏塔顶温度由初顶顶温 TIC21001 与初顶回流 FIC21001 组成串级回路控制。

Adjustment mode: when the reading of TIC21001 rises, increase the reading of FIC21001; when the reading of TIC21001 drops, decrease the reading of FIC21001.

调节方式：TIC21001 上升，增加 FIC21001；TIC21001 下降，降低 FIC21001。

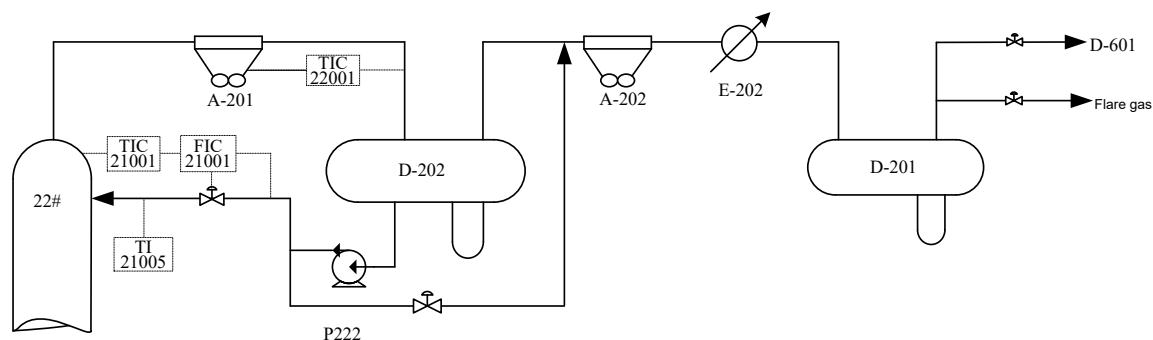


Figure 52 Pre-Dist Column Top Temperature Control Flow Chart

图 52 初馏塔塔顶温度控制流程图

Table 51 abnormal phenomena reasons and treatment method**表 51 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Pre-Dist. top temperature rises rapidly. 初馏塔顶温度快速升高	The Pre-Dist. OVHD reflux flowrate reduces rapidly. 初顶回流量快速降低	Further open FIC21001 control valve to increase the Pre-Dist. OVHD reflux flowrate. 开大 FIC21001 控制阀开度, 提高初馏塔顶回流量。
		If FIC21001 fails, switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. FIC21001 故障, 则改付线控制, 联系仪表处理。
		If the Pre-Dist. OVHD reflux pump fails, switch to the standby pump, and check and repair the failed pump. 初顶回流泵故障, 切换备用泵, 故障泵检修。
	The temperature (TI21006) of the feedstock to the Pre-Dist. rises quickly. 初馏塔进料温度 TI21006 快速升高	Further open FIC21001 control valve to increase the Pre-Dist. OVHD reflux flowrate. 开大 FIC21001 控制阀开度, 提高初馏塔顶回流量。
		Investigate the causes of quickly increased feed temperature, and stabilize the temperature of the feedstock to the Pre-Dist.. 查明进料温度快速升高原因, 平稳初馏塔进料温度。
	The weather conditions change after the rain. 天气变化引起 (如雨天雨停后)	Adjust the temperature of the Pre-Dist. OVHD oil from the cooler via variable frequency air coolers. May start additional air cooling fans in extreme conditions. Increase the Pre-Dist. OVHD reflux flowrate. 通过变频空冷器调节初顶冷后温度, 极端情况下可增开部分风机。增加初顶回流量。
The Pre-Dist. top temperature drops rapidly. 初馏塔顶温度快速降低	The crude becomes lighter, and the column OVHD distillate flowrate increases. 原油变轻, 塔顶馏出量增加。	Increase the Pre-Dist. OVHD reflux flowrate, and properly increase the column top temperature SP. 增加塔顶回流流量, 塔顶温度设定值可适当控高。
	The Pre-Dist. OVHD reflux flowrate increases rapidly. 塔顶回流量快速增加	Further close FIC21001 control valve to reduce the Pre-Dist. OVHD reflux flowrate. 关小 FIC21001 控制阀开度, 降低初馏塔顶回流量。 If FIC21001 fails, switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. FIC21001 故障, 改付线控制, 联系仪表处理。

Table 51(continued) abnormal phenomena reasons and treatment method**表 51（续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Pre-Dist. top temperature drops rapidly. 初馏塔顶温度快速降低	The crude becomes heavier, and the column OVHD distillate flowrate reduces. 原油变重，塔顶馏出量减少	Reduce the Pre-Dist. OVHD reflux flowrate, and properly decrease the column top temperature SP. 减少塔顶回流流量，塔顶温度设定值可适当控低。
	The weather conditions change, causing rapid change of the reflux temperature. 天气变化引起回流温度快速变化	Adjust the temperature of the Pre-Dist. OVHD oil from the cooler via variable frequency air coolers. May stop some air cooling fans in extreme conditions. Reduce the Pre-Dist. OVHD reflux flowrate. 通过变频调节初顶冷后温度，极端情况下可停运部分风机。减少初顶回流量。
	Water is entrained in the Pre-Dist. OVHD reflux. 初顶回流带水	If water is entrained in the Pre-Dist. OVHD reflux, take actions per the treatment procedures for water entrainment in Pre-Dist. OVHD reflux. 若初顶回流带水，参照异常现象初顶回流带水处理。
	Water is entrained in the crude. 原油带水	If water is entrained in the crude, take actions per the treatment procedures for water entrainment in crude. 若原油带水，参照异常现象原油带水处理。
	The temperature of the feedstock to the Pre-Dist. drops quickly. 初馏塔进料温度快速降低	Further close FIC21001 control valve to reduce the Pre-Dist. OVHD reflux flowrate. 关小 FIC21001 控制阀开度，降低初馏塔顶回流量。 Investigate the causes of quickly decreased feed temperature, and stabilize the temperature of the feedstock to the Pre-Dist column. 查明进料温度快速降低原因，平稳初馏塔进料温度。

2.4.6.8 Control for Pre-Dist column top pressure 初馏塔塔顶压力控制

As one of the important control indicators for the Pre-Dist column, the Pre-Dist column top pressure could produce obvious influence on the dry point of the Pre-Dist OVHD oil, the lift of the Pre-Dist column and the Pre-Dist column bottom level. Control for the Pre-Dist column top pressure (PI21001) is achieved by controlling the Pre-Dist OVHD product drum (D-201) top pressure (PIC23101). The Pre-Dist OVHD product drum (D-201) top pressure (PIC23101) shall be properly controlled, as it could not only affect the Pre-Dist

t column top pressure, but could also affect the Pre-Dist OVHD gas flowrate.

初馏塔顶压力是初馏塔的重要控制指标之一，对于初顶石脑油干点的控制，初馏塔拔出率和塔底液位都有明显的影响。初馏塔塔顶压力 PI21001 是通过控制初顶产品罐 D-201 罐顶压力 PIC23101 来实现的。PIC23101 控制高低，不仅影响到初馏塔塔顶压力，而且影响到初顶气的流量。

Control range: $\leq 0.38\text{MPa}$ (PI21001)

控制范围：PI21001 控制 $\leq 0.38\text{MPa}$

Control target: per the operating instructions

控制目标：操作指令

Related parameters: Pre-Dist. feed temperature, crude properties, Pre-Dist. OVHD reflux temperature, temperature of the Pre-Dist. OVHD naphtha from the cooler, back pressure of D-601

相关参数：初馏塔进料温度、原油性质、初顶回流温度、初顶石脑油冷后温度、D-601 背压等

Control mode: PI21001 is controlled by PIC23101, and single loop double-split control is employed for PIC23101.

控制方式：PI21001 通过 PIC23101 控制，PIC23101 单回路双程控制。

Adjustment method: when the reading of PI21001 rises, reduce the reading of PIC23101 accordingly; when the reading of PI21001 drops, increase the reading of PIC23101 whenever possible to enable the light hydrocarbon components as much as possible to be dissolved in the Pre-Dist. OVHD oil. When the reading of PIC23101 rises, first open PV23101A. If the reading of PIC23101 is still relatively high when the opening of PV23101A is up to the maximum value, open PV23101B. When the reading of PIC23101 drops, first close PV23101A. If the reading of PIC23101 is still relatively low when the opening of PV23101B is up to the minimum value, close PV23101B.

调节方法：当 PI21001 上升时，可适当降低 PIC23101。当 PI21001 下降时，应尽量提高 PIC23101，应将尽量多的轻烃组分溶解在初顶油中。当 PIC23101 上升时，先开 PV23101A，当 PV23101A 开至最大后，PIC23101 仍然偏高，则开大 PV23101B。当 PIC23101 下降时，先关 PV23101A，当 PV23101B 关至最小后，PIC23101 仍然偏低，则关小 PV23101A。

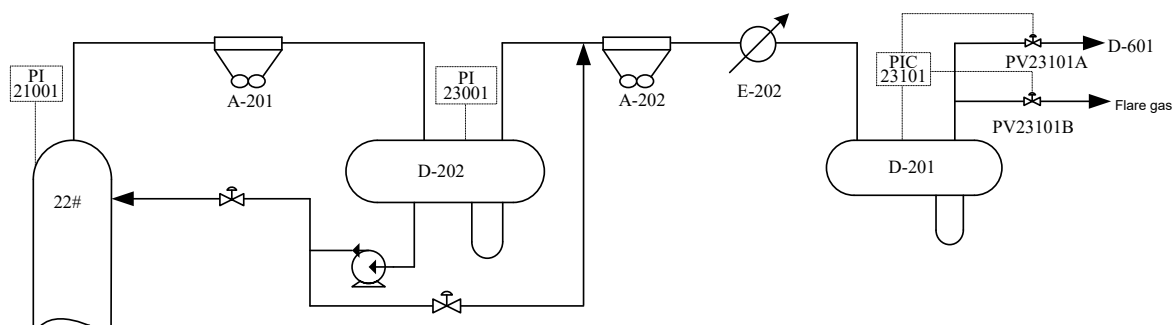


Figure 53 Pre-Dist. Top Pressure Control Flow Chart

图 53 初馏塔塔顶压力控制流程图

Table 52 abnormal phenomena, reasons and treatment method**表 52 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Pre-Dist. top pressure rises rapidly. 初馏塔塔顶压力快速上升	The crude becomes lighter, and the column OVHD distillate flowrate increases. 原油变轻, 塔顶馏出量增加	Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. May open the gas valve on D-201 top to the flare system in extreme conditions. 增开塔顶空冷风机, 调节风机变频, 极端情况下可开 D-201 罐顶瓦斯至火炬。
	The air cooling fan (A-201/202) fails. 空冷 A-201、202 故障	Contact the maintenance staff to check and repair the failed air cooling fan. If the pressure cannot be lowered by releasing pressure to the flare gas system, reduce the operation load of the process unit. 联系检修故障空冷风机, 在往火炬气泄压无效的情况下, 应降低装置负荷。
	Water is entrained in the crude. 原油带水	Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. May open the gas valve on D-201 top to the flare in extreme conditions. 增开塔顶空冷风机, 调节风机变频, 极端情况下可开 D-201 罐顶瓦斯至火炬。
	Water is entrained in the reflux. 回流带水	Decrease the crude-water interface level in the reflux drum. Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. May open the gas valve on D-301 top to the flare in extreme conditions. 降低回流罐界位。增开塔顶空冷风机, 调节风机变频, 极端情况下可开 D-201 罐顶瓦斯至火炬。
	The weather conditions change after the rain. 天气变化, 如雨后	Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. 增开塔顶空冷风机, 调节风机变频。
	Abnormal operation in Light Ends Recovery Unit 轻烃回收装置异常	Switch the Pre-Dist. OVHD gas to the flare gas system. 初顶气改火炬气
	The control valve fails. 调节阀故障	Switch to the bypass valve for control, and check and repair the failed control valve. 改付线控制, 调节阀检修。
The Pre-Dist. top pressure drops rapidly. 初馏塔塔顶压力快速下降	The crude becomes heavier. 原油变重	Stop some air cooling fans on the top of the column, adjust the frequency converters of the air cooling fans. 停运部分塔顶空冷风机, 调节风机变频
	The weather conditions change after the rain. 天气变化, 如下雨	Stop some air cooling fans on the top of the column, adjust the frequency converters of the air cooling fans. 停运部分塔顶空冷风机, 调节风机变频
	The control valve	Switch to the bypass valve for control, and check and

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
	fails. 调节阀故障	repair the failed control valve. 改付线控制, 调节阀检修。

2.4.6.9 Control for Pre-Dist. OVHD reflux drum level and Pre-Dist. OVHD product drum level 初馏塔回流罐和初顶产品罐液位控制

If the Pre-Dist. OVHD reflux drum level (LIC23001) and the Pre-Dist. OVHD product drum level (LIC23101) are low, there is a potential risk of evacuation in the reflux pump in case of system fluctuation; if the Pre-Dist. OVHD reflux drum level (LIC23001) and the Pre-Dist. OVHD product drum level (LIC23101) are high, there is a potential risk of overflow from the drum, resulting that the liquid is entrained in the gas phase to the downstream equipment.

初顶回流罐液位 LIC23001 和产品罐液位 LIC23101 控制低, 在系统波动时, 存在回流泵抽空的风险; 液位高, 在系统波动时, 存在满罐的风险, 也会造成气相带液至下游设备。

Control range: 30~70%

控制范围: 30~70%。

Control target: per the operating instructions

控制目标: 操作指令

Related parameters: Pre-Dist. OVHD oil flowrate, temperature of the Pre-Dist. OVHD oil from the cooler

相关参数: 初顶石脑油流量、冷后温度。

Control mode: single loop control is employed for LIC23001 and LIC23101.

控制方式: LIC23001 和 LIC23101 均采用单回路控制。

Adjustment method: when the reading of LIC23001 rises, further open LV23001; when the reading of LIC23001 drops, further close LV23001. The adjustment method for LIC23101 is identical with that for LIC23001.

调节方法: 当 LIC23001 上升时, 开大 LV23001。当 LIC23001 下降时, 关小 LV23001。LIC23101 调节方法与 LIC23001 相同。

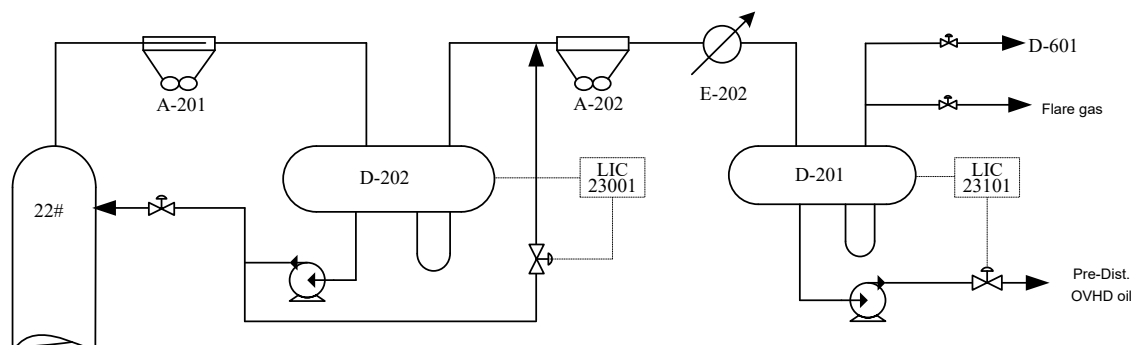


Figure 54 Flow Chart of Control for Pre-Dist. OVHD Reflux Drum Level and Pre-Dist. OVHD Product Drum Level

图 54 初馏塔回流罐和初顶产品罐液位控制流程图

2.4.6.10 Control for crude-water interface levels in Pre-Dist. OVHD reflux drum and Pre-Dist. OVHD product drum 初馏塔回流罐和初顶产品罐油水界位控制

If the crude-water interface level (LIC23002) in the Pre-Dist. OVHD reflux drum and the crude-water interface level (LIC23102) in the Pre-Dist. OVHD product drum are too high, the water content in the oil phase may increase; if the crude-water interface level (LIC23002) in the Pre-Dist. OVHD reflux drum and the crude-water interface level (LIC23102) in the Pre-Dist. OVHD product drum are too low, oil may be easily entrained in the sour water. If the reading of LIC23002 is too high, this may easily cause water entrainment in the reflux, and if the reading of LIC23002 is too low, this may easily cause water entrainment in the sour water. Where water is entrained in the crude, this will contribute to greatly increased sour water quantity at the top of the Pre-Dist., therefore, it is required to strictly control the crude-water interface levels in the reflux drum and the product drum, drain the sour water from the Pre-Dist. to OSBL in a timely manner, so as to avoid water entrainment in the reflux or prevent a lot of water from entering Light Ends Recovery Unit.

初顶回流罐界位 LIC23002 和初顶产品罐界位 LIC23102 控制过高, 则油相含水增加; 控制过低, 则酸性水容易带油。LIC23002 控制过高, 则容易造成回流带水, 而 LIC23102 控制过低, 还容易造成酸性水带油。当原油带水时, 造成初馏塔塔顶酸性水大幅度增加, 要严控回流罐和产品罐界位, 及时将酸性水排出装置, 避免造成回流带水, 或者大量水进入轻烃回收装置。

Control range: 40~60%

控制范围: 40~60%

Control target: per the operating instructions

控制目标: 操作指令

Related parameters: single loop control is employed for LIC23002 and LIC23102.

相关参数: LIC23002 和 LIC23102 均采用单回路控制。

Adjustment method: when the reading of LIC23002 rises, further open LV23002; when the reading of LIC23002 drops, further close LV23002. The adjustment method for LIC23102 is identical with that for LIC23002.

调节方法: 当 LIC23002 上升时, 开大 LV23002。当 LIC23002 下降时, 关小 LV23002。LIC23102 调节方法与 LIC23002 相同。

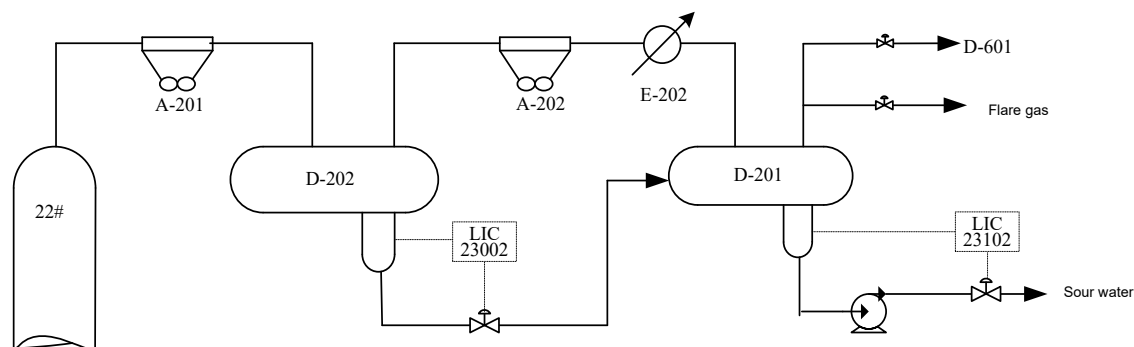


Figure 55 Flow Chart of Control for Oil-Water Interface Levels in Pre-Dist.

OVHD Reflux Column and Pre-Dist. OVHD OVHD Product Drum

图 55 初馏塔回流罐和初顶产品罐油水界位控制流程图

2.4.6.11 Control for Pre-Dist. sidedraw level and Pre-Dist. sidedraw internal reflux flowrate 初一线液位和初一线内回流流量控制

The p Pre-Dist. sidedraw is designed to mainly reduce the operation load of the Atm. heater. If the Pre-Dist. sidedraw # level is at 100%, it means that Pre-Dist. sidedraw has not been extracted completely, this may increase the operation load of the Atm. heater; if the Pre-Dist. sidedraw level is at 0%, this could not only cause damage to the pump, but could also cause dried trays below the Pre-Dist. sidedraw collecting drum. As an collecting drum is provided for Pre-Dist. sidedraw, the liquid-phase reflux flowrate in the trays below the Pre-Dist. sidedraw collecting drum must be controlled depending on the Pre-Dist. sidedraw internal reflux flowrate to eliminate any dried tray, while the quality (color) of Pre-Dist. sidedraw shall also be controlled depending on the Pre-Dist. sidedraw internal reflux flowrate.

设置初一线的目的主要是降低常压炉的负荷，初一线满液位控制，则初一线未完全采出，常压炉负荷增加，初一线液位空，则会造成泵损坏，也会造成初一线集油箱以下塔盘干板。由于初一线设置了集油箱，当集油箱控制液位时，必须通过初一线内回流来控制初一线集油箱以下塔盘的液相回流，不至于干板，同时控制初一线产品质量（油色）

Control range: 20~80% (LIC21001). No control range is defined for FIC21003, and the reading of FIC21003 will be adjusted mainly depending on the color of Pre-Dist. sidedraw and the feed flowrate to the Atm..

控制范围：LIC21001 控制 20~80%。FIC21003 无控制范围，主要根据初一线油色和常压塔进料进行调整。

Control target: per the specified indicators

控制目标：指令目标

Related parameters: Pre-Dist column feed temperature, Pre-Dist. OVHD product drum pressure, Pre-Dist. OVHD oil flowrate

相关参数：初馏塔进料温度、初顶产品罐压力、初顶油流量

Control mode: the p Pre-Dist. sidedraw level controller (LIC21001) is cascaded to the Pre-Dist. sidedraw flow controller (FIC24201). Single loop control is employed for FIC21003.

控制方式：初一线液位 LIC21001 与初一线流量 FIC24201 组成串级控制。FIC21003 采用单回路控制。

Adjustment method: when the reading of LIC21001 rises, further open FV24201 to increase the Pre-Dist. sidedraw flowrate; when the reading of LIC21001 drops, further close FV24201 to reduce the Pre-Dist. sidedraw flowrate. When the reading of FIC21003 rises, further close FV21003; when the reading of FIC21003 drops, further open FV21003.

调节方法：LIC21001 上升，开大 FV24201,增加初一线流量；LIC21001 下降，关小 FV24201,降低初一线流量。FIC21003 上升，关小 FV21003；FIC21003 下降，开大 FV21003。

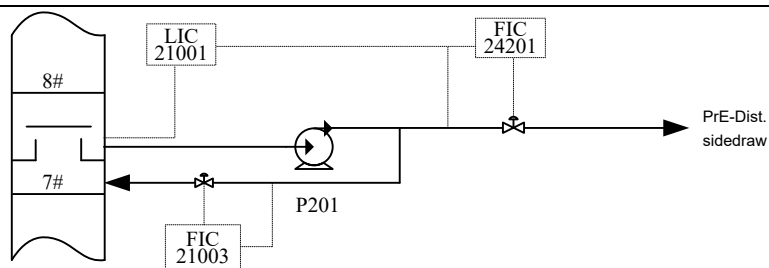


Figure 56 Flow Chart of Control for Pre-Dist. Sidedraw Level and Pre-Dist. Sidedraw Internal Reflux Flowrate

图 56 初一线液位和初一线内回流流量控制流程图

2.4.6.12 Control for Atm. level 常压塔液位控制

As the important indicator for controlling material balance in the process unit, the Atm. level shall be controlled stable to serve as one of the bases for ensuring the whole Atmospheric and Vacuum Distillation Unit in stable operation. Unstable Atm. level could easily cause both fluctuated feed flowrate to the Vac. heater and fluctuated temperature of the Vac. heater, affecting long-term stable operation of the process unit. Two differential pressure type level controllers (LIC31001 and LIC31002) are provided for the Atm..

常压塔液位是装置物料平衡的重要控制指标。常压塔液位的稳定控制是整个常减压装置稳定运行的基础之一。液位控制不稳，容易造成减压炉进料和炉温波动，不利于装置的长周期运行，常压塔设置了两套差压式液位计 LIC31001 和 LIC31002。

Control range: 40~60%

控制范围：40%~60%

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: feed flowrate to Atm. heater, feed flowrate to Vac. heater, atm. overflash oil level, Atm. heater outlet temperature

相关参数：常压炉进料流量、减压炉进料流量、常四线液位、常压炉出口温度。

Control mode: among two Atm. level controllers (LIC31001 and LIC31002), one can be selected for control purpose, while the other is for reference and comparison. The Atm. level controllers are cascaded to the flow controllers (FIC40102A~H) for the feed to 8 passes of the Vac. column.

控制方式：常压塔液位 LIC31001 和 LIC31002，可选择其中之一作为控制对象，另一以为作为参考、比较，常压塔液位与减压炉八路进料流量 FIC40102A~H 组成串级回路控制。

Adjustment method: when the Atm. level rises, further close FIC40102A~H to reduce the feed flowrate to the Vac. heater; when the Atm. level drops, further open FIC40102A~H to increase the feed flowrate to the Vac. heater. In case that the Atm. level fluctuates greatly to cause significant fluctuation of the feed flowrate to the Vac. heater, switch the Atm. level controller to "Manual" mode.

调节方法：当常压塔液位时上升，关小 FIC40102A~H，降低减压炉进装置流量；当常压塔液位时下降时，开大 FIC40102A~H，增加减压炉进装置流量。当常压塔液位大幅度波动，引起减压

炉进料量大幅度波动时，常压塔液位应改为手动控制。

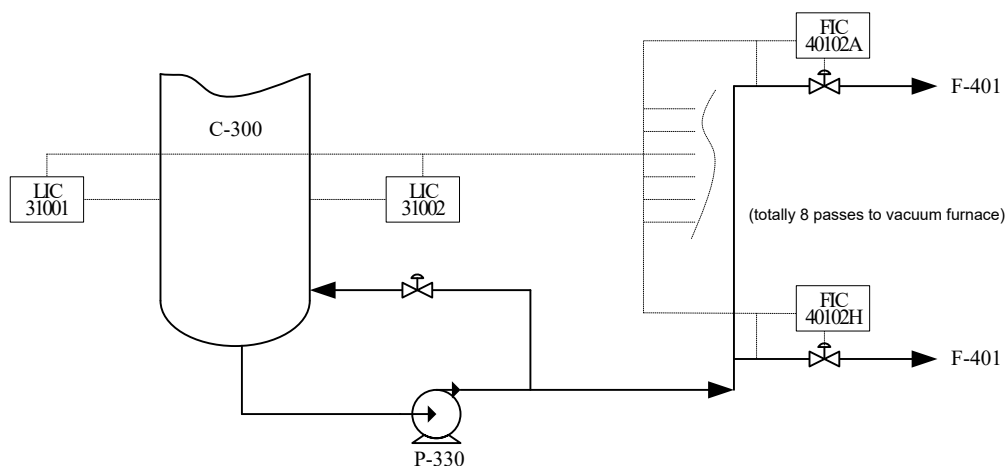


Figure 57 Atm. Level Control Flow Chart

图 57 常压塔液位控制流程图

Table 53 abnormal phenomena, reasons and treatment method

表 53 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. bottom level rises rapidly. 常压底液位快速升高	The crude becomes heavier, and the vaporization capacity of the Atm. becomes smaller. 原油变重，常压汽化量变小	Reduce the flowrates of 3 crude streams to the desalter drum, or increase the feed flowrate to the Vac. heater. 降低脱前原油三路流量，或者增加减压炉进料流量
	The feed flowrate to the Atm. increases suddenly. 常压塔进料量突增	Control the feed flowrate to the Atm. stable. 平稳控制常压塔进料量。
	The Pre-Dist. level fluctuates. 初馏塔液位波动	Keep the operating conditions stable. 平稳操作
	The Atm. pressure rises rapidly. 常压塔压力迅速上升	Investigate the involved causes to decrease the column OVHD pressure. 查明原因，降低塔顶压力。
	The Atm. distillate 4# level is up to full level. 常四线由控制变为满液位	Control the Atm. distillate 4# level stable. 稳定控制常四线液位
	The Atm. distillate or pumparound pump experiences evacuation. 常压侧线或者中段泵抽空	Switch to the standby pump, and contact the maintenance staff for troubleshooting. 切换至备用泵运行，联系维修处理。

Table 53 (continued) abnormal phenomena, reasons and treatment method**表 53 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. bottom level rises rapidly. 常压底液位快速升高	The Atm. distillate draw flowrate reduces. 常压侧线抽出量降低	Stabilize the Atm. distillate draw flowrate. 稳定侧线抽出量
	The Atm. distillate 4# internal reflux flowrate increases. 常四线内回流增加	Stabilize the Atm. distillate 4# internal reflux flowrate. 稳定常四线内回流流量
	The column bottoms pump (P330) fails. 塔底泵 P330 故障	Switch to the standby pump, and contact the maintenance staff for troubleshooting. 切换至备用泵运行, 联系维修处理。
	The control valve fails. 控制阀失灵	Switch to the bypass valve for control, and repair the failed control valve. 控制阀改副线控制, 调节阀维修。
	The Atm. bottom level gauge fails. 常压塔底液位失灵	Check the actual Atm. bottom level, and contact the instrument maintenance staff for troubleshooting. 检查常底实际液位, 联系仪表人员处理
	The feed flowrate to the Atm. reduces suddenly. 常压塔进料量突降	Control the feed flowrate to the Atm. stable. 平稳控制常压塔进料量。
	The feed flowrate to the atm. heater increases suddenly. 常压炉进料突增	Control the feed flowrate to the atm. heater stable. 平稳控制常压炉进料量。
	The Pre-Dist. level fluctuates greatly. 初馏塔液位大幅度波动	Stabilize the Pre-Dist. level, and reduce the feed flowrate to the Vac. heater accordingly. 稳定初馏塔液位, 适当降低减压炉进料

Table 53 (continued) abnormal phenomena, reasons and treatment method**表 53（续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. bottom level drops rapidly. 常压底液位快速降低	The cut water flowrate from the desalter drum increases suddenly. 电脱盐切水突增	Control the cut water flowrate stable. 平稳控制切水量。
	The crude becomes lighter. 原油性质变轻	If the crude becomes lighter, reduce the feed flowrate to the Vac. heater. 若原油性质变轻，降低减压炉进料量。
	The control valve fails. 控制阀失灵	Switch to the bypass valve for control, and repair the failed control valve. 控制阀改副线控制，调节阀维修。

2.4.6.13 Control for Atm. top temperature 常压塔塔顶温度控制

As an important operating parameter of the Atm., the Atm. top temperature (TIC31007) is served as the main means for controlling the dry point of the atm. OVHD oil. The Atm. top temperature is adjusted mainly depending on the flowrate and temperature of the atm. OVHD reflux. Generally, large atm. OVHD reflux flowrate and low atm. OVHD reflux temperature could result in low Atm. top temperature; otherwise, the Atm. top temperature will be high.

常顶温度 TIC31007 是常压塔的重要操作参数，是控制常顶石脑油干点的主要手段。常顶温度主要通过常顶回流量及回流温度调节。一般常顶回流量大及回流温度低，会导致常顶温度低；反之，常顶温度高。

Control range: 135~170%

控制范围：135~175℃

Control target: per the specified indicators

控制目标：指令指标

Related parameters: atm. OVHD reflux flowrate, atm. OVHD reflux temperature, Atm. feed temperature

相关参数：常顶回流流量、常顶回流温度、常压塔进料温度

Control mode: the Atm. top temperature is controlled by the Atm. top temperature controller (TIC31007) that is cascaded to the atm. OVHD reflux flow controller (FIC31001).

控制方式：常压塔顶温度由常顶顶温 TIC31007 与常顶回流 FIC31001 组成串级回路控制。

Adjustment mode: when the reading of TIC31007 rises, increase the reading of FIC31001; when the reading of TIC31007 drops, decrease the reading of FIC21001.

调节方式：TIC31007 上升，增加 FIC31001；TIC31007 下降，降低 FIC31001。

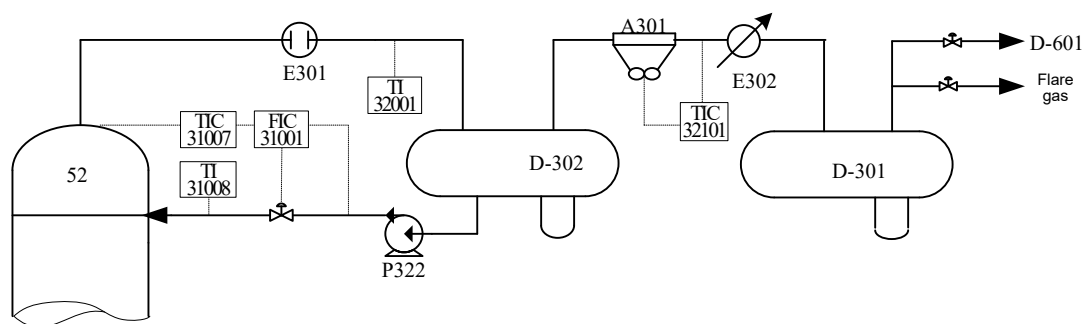


Figure 58 Atm. OVHD Temperature Control Flow Chart

图 58 常压塔塔顶温度控制流程图

Table 54 Abnormal phenomena, reasons and treatment method

表 54 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. top temperature rises quickly. 常压塔顶温度快速升高	The atm. OVHD reflux flowrate reduces rapidly. 常顶回流量快速降低	Further open FIC31001 control valve to increase the atm. OVHD reflux flowrate. 开大 FIC31001 控制阀开度，提高常压塔顶回流量
		If FIC31001 fails, switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. FIC31001 故障，则改付线控制，联系仪表处理。
		If the atm. OVHD reflux pump fails, switch to the standby pump, and check and repair the failed pump 常顶回流泵故障，切换备用泵，故障泵检修
	The temperature of the feed to the Atm. rises quickly. 常压塔进料温度快速升高	Further open FIC31001 to increase the atm. OVHD reflux flowrate. 开大 FIC31001 控制阀开度，提高常压塔顶回流量。

Table 54 (continued) Abnormal phenomena, reasons and treatment method**表 54（续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. top temperature rises quickly. 常压塔顶温度快速升高	The temperature of the feed to the Atm. rises quickly. 常压塔进料温度快速升高	Investigate the causes of quickly increased feed temperature, and stabilize the temperature of the feed to the Atm. 查明进料温度快速升高原因，平稳常压塔进料温度。
	The atm. OVHD reflux temperature rises. 常顶回流温度上升	Remove some atm. OVHD heat exchangers from service, and increase the atm. OVHD reflux flowrate. 如常顶换热器部分停用。增加常顶回流。
	The crude becomes lighter, and the column OVHD distillate flowrate increases. 原油变轻，塔顶馏出量增加。	Increase the atm. OVHD reflux flowrate, and properly increase the column top temperature SP. 增加塔顶回流流量，塔顶温度设定值可适当控高。
The Atm. top temperature drops quickly. 常压塔顶温度快速降低	The atm. OVHD reflux flowrate increases rapidly. 塔顶回流量快速增加	Further close FIC21001 control valve to reduce the atm. OVHD reflux flowrate. 关小 FIC31001 控制阀开度，降低常压塔顶回流量。
		If FIC31001 fails, switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. FIC31001 故障，改付线控制，联系仪表处理。
	The crude becomes heavier, and the column OVHD distillate flowrate reduces. 原油变重，塔顶馏出量减少	Reduce the column OVHD reflux flowrate, and properly decrease the column top temperature SP. 减少塔顶回流流量，塔顶温度设定值可适当控低。
	The atm. OVHD reflux temperature drops. 常顶回流温度下降	Put additional atm. OVHD vapor heat exchangers into service, and reduce the atm. OVHD reflux flowrate. 如增投塔顶油气换热器。降低常顶回流。

Table 54 (continued) Abnormal phenomena, reasons and treatment method**表 54（续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. top temperature drops quickly. 常压塔顶温度快速降低	Water is entrained in the atm. OVHD reflux. 常顶回流带水	Decrease the crude-water interface level in the reflux drum, and reduce the atm. OVHD reflux flowrate. 降低回流罐界位，降低塔顶回流。
	The temperature of the feed to the Atm. drops rapidly. 常压进料温度快速降低	Further close FIC31001 to reduce the atm. OVHD reflux flowrate. 关小 FIC31001 控制阀开度，降低常顶回流量。
		Investigate the causes of quickly increased feed temperature, and stabilize the temperature of the feed to the Atm. 查明进料温度快速降低原因，平稳常压塔进料温度。

2.4.6.14 Control for Atm. top pressure 常压塔塔顶压力控制

As one of the important control indicators for the Atm., the Atm. top pressure could produce obvious influence on the dry point of the atm. OVHD oil, the lift of the Atm. and the Atm. bottom level. Control for the Atm. top pressure (PI31001) is achieved by controlling the atm. OVHD product drum (D-301) top pressure (PIC33101).

常压塔顶压力是常压塔的重要控制指标之一，对于常顶石脑油干点的控制，常压塔拔出率和塔底液位都有明显的影响。常压塔塔顶压力 PI31001 是通过控制常顶产品罐 D-301 罐顶压力 PIC33101 来实现的。

Control range: $\leq 0.15\text{MPa}$ (PI21001)

控制范围：PI21001 控制 $\leq 0.15\text{MPa}$

Control target: per the operating instructions

控制目标：操作指令

Related parameters: Atm. feed temperature, crude properties, atm. OVHD reflux temperature, temperature of the atm. OVHD oil from the cooler, back pressure of D-601

相关参数：常压塔进料温度、原油性质、常顶回流温度、常顶石脑油冷后温度、D-601 背压等

Control mode: PI31001 is controlled by PIC33101, and single loop control is employed for PIC33101.

控制方式：PI31001 通过 PIC33101 控制，PIC33101 单回路控制。

Adjustment method: generally, the atm. OVHD product drum (D-301) top pressure is controlled depending on the back pressure of D-601. When the Atm. top pressure (PI31001) rises to a point that will affect the dry point of the atm. OVHD oil and the lift of the Atm., if it could not be lowered by regulating the capacity of the Atm. OVHD variable frequency fans, the SP of

PIC33101 shall be reduced accordingly to reduce the Atm. top pressure (PI31001) while discharging a portion of atm. OVHD gas to the flare gas system.

调节方法：常顶产品罐 D-301 塔顶压力一般通过 D-601 背压控制，当 PI31001 压力上升影响到常顶油干点和常压侧线拔出率时，在通过调节常顶变频风机无效时，应通过降低 PIC33101 来降低 PI31001，此时可适当降低 PIC33101 的设定值，通过常顶气往火炬气部分排放的方式降低塔顶压力。

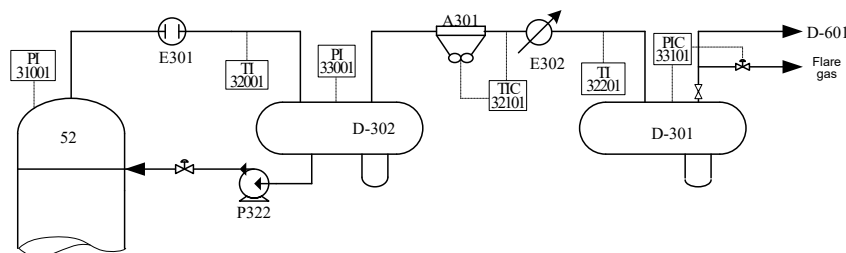


Figure 59 Atm. Top Pressure Control Flow Chart

图 59 常压塔塔顶压力控制流程图

Table 55 Abnormal phenomena, reasons and treatment method

表 55 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. top pressure rises rapidly. 常压塔顶压力快速上升	The crude becomes lighter, and the column OVHD distillate flowrate increases. 原油变轻，塔顶馏出量增加	Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. May open the gas valve on D-301 top to the flare in extreme conditions. 增开塔顶空冷风机，调节风机变频，极端情况下可开 D-301 罐顶瓦斯至火炬。
	The air cooling fan (A-301) fails. 空冷 A-301 故障	Contact the maintenance staff to check and repair the failed air cooling fan. If the pressure cannot be lowered by releasing pressure into the flare gas system, reduce the operation load of the process unit. 联系检修故障空冷风机，在往火炬气泄压无效的情况下，应降低装置负荷。
	Water is entrained in the crude 原油带水	Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. May open the gas valve on D-201 top to the flare in extreme conditions. 增开塔顶空冷风机，调节风机变频，极端情况下可开 D-201 罐顶瓦斯至火炬。
	Water is entrained in the reflux. 回流带水	Decrease the crude-water interface level in the reflux drum. Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. May open the gas valve on D-301 top to the flare in extreme conditions. 降低回流罐界位。增开塔顶空冷风机，调节风机变频，极端情况下可开 D-201 罐顶瓦斯至火炬。

Table 55 (continued) Abnormal phenomena, reasons and treatment method**表 55（续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions 处理方法
The Atm. top pressure rises rapidly. 常压塔顶压力快速上升	The weather conditions change after the rain. 天气变化，如雨后	Start additional air cooling fans on the top of the column, and adjust the frequency converters of the air cooling fans. 增开塔顶空冷风机，调节风机变频。
	Abnormal operation in Light Ends Recovery Unit 轻烃回收装置异常	Switch the atm. OVHD gas to the flare gas system. 初顶气改火炬气
	The control valve fails. 调节阀故障	Switch to the bypass valve for control, and check and repair the failed control valve. 改付线控制，调节阀检修。
The Atm. top pressure drops rapidly. 初馏塔塔顶压力快速下降	The crude becomes heavier. 原油变重	Stop some air cooling fans on the top of the column, adjust the frequency converters of the air cooling fans. 停运部分塔顶空冷风机，调节风机变频
	The weather conditions change after the rain. 天气变化，如下雨	Stop some air cooling fans on the top of the column, adjust the frequency converters of the air cooling fans. 停运部分塔顶空冷风机，调节风机变频
	The control valve fails. 调节阀故障	Switch to the bypass valve for control, and check and repair the failed control valve. 改付线控制，调节阀检修。

2.4.6.15 Control for atm. OVHD reflux drum level and atm. OVHD product drum level 常压塔回流罐和产品罐液位控制

If the atm. OVHD drum level (LIC33001) and the atm. OVHD product drum level (LIC33101) are low, there is a potential risk of evacuation in the reflux pump in case of system fluctuation; if the atm. OVHD reflux drum level (LIC33001) and the atm. OVHD product drum level (LIC33101) are high, there is a potential risk of overflow from the drum, resulting that the liquid is entrained in the gas phase to the downstream equipment.

常顶回流罐液位 LIC33001 和产品罐液位 LIC33101 控制低，在系统波动时，存在回流泵抽空的风险；液位高，在系统波动时，存在满罐的风险，也会造成气相带液至下游设备。

Control range: 30~70%

控制范围： 30~70%。

Control target: per the operating instructions

控制目标：操作指令

Related parameters: atm. OVHD oil flowrate, temperature of the atm. OVHD oil from the cooler
相关参数：常顶石脑油流量、冷后温度。

Control mode: single loop control is employed for LIC33001 and LIC33101.

控制方式：LIC33001 和 LIC33101 均采用单回路控制。

Adjustment method: when the reading of LIC33001 rises, further open LV23001; when the reading of LIC33001 drops, further close LV33001. The adjustment method for LIC33101 is identical with that for LIC23001.

调节方法: 当 LIC33001 上升时, 开大 LV33001。当 LIC33001 下降时, 关小 LV33001。LIC33101 调节方法与 LIC33001 相同。

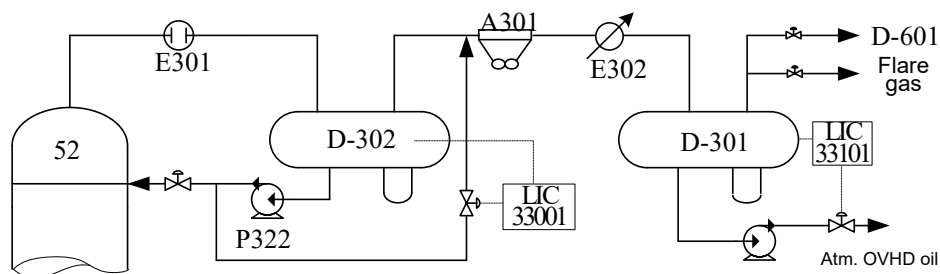


Figure 60 Flow Chart of Control for Atm. OVHD Reflux Drum Level and Atm. OVHD Product Drum Level

图 60 常压塔回流罐和产品罐液位控制流程图

2.4.6.16 Control for crude-water interface levels in atm. OVHD reflux drum and atm. OVHD product drum 常压塔回流罐和产品罐界位控制

If the crude-water interface level (LIC33002) in the a atm. OVHD reflux drum and the crude-water interface level (LIC33102) in the atm. OVHD product drum are too high, the water content in the oil phase may increase; if the crude-water interface level (LIC33002) in the atm. OVHD reflux drum and the crude-water interface level (LIC33102) in the a atm. OVHD product drum are too low, oil may be easily entrained in the sour water. If the reading of LIC33002 is too high, this may easily cause water entrainment in the reflux, and if the reading of LIC23002 is too low, this may easily cause water entrainment in the sour water.

常顶回流罐界位 LIC33002 和常顶产品罐界位 LIC33102 控制过高,则油相含水增加;控制过低,则酸性水容易带油。LIC33002 控制过高,则容易造成回流带水,而 LIC33102 控制过低,还容易造成酸性水带油。

Control range: 40~60%

控制范围：40~60%。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: sour water flowrate

相关参数：含硫污水流量。

Control mode: single loop control is employed for LIC33002 and LIC33102.

控制方式: LIC33002 和 LIC33102 均采用单回路控制。

Adjustment method: when the reading of LIC33002 rises, further open LV33002; when the reading of LIC33002 drops, further close LV33002. The adjustment method for LIC33102 is identical with that for LIC33002.

调节方法: 当 LIC33002 上升时, 开大 LV33002。当 LIC33002 下降时, 关小 LV33002。LIC33102 调节方法与 LIC33002 相同。

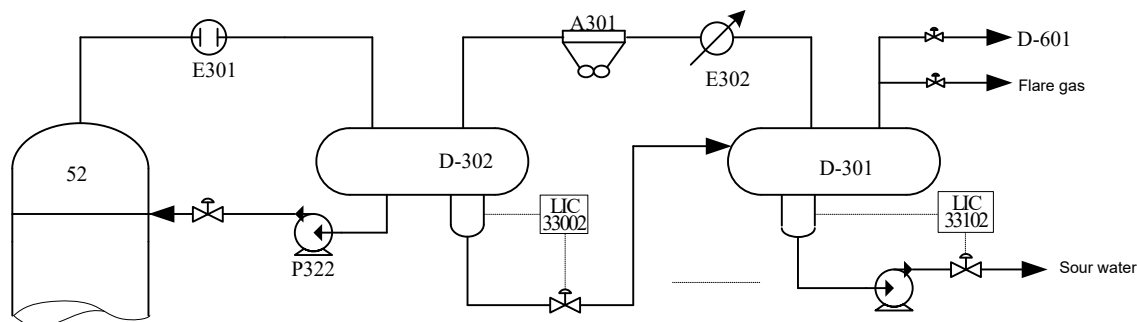


Figure 61 Flow Chart of Control for Oil-Water Interface Levels in Atm. OVHD Reflux Drum and Atm. OVHD Product Drum

图 61 常压塔回流罐和产品罐界位控制流程图

2.4.6.17 Control for the temperature of atm. top PA, atm. PA#1 and atm. PA#2 常顶循、常一中、常二中回流温度控制

The Atm. pumparound temperature is deemed as an important parameter for controlling the heat demand in each section of the Atm.. Generally, the heat exchange in the Atm., the flowrate of each distillate product and the distillation accuracy of the Atm. are controlled by adjusting the flowrates and temperatures of the Atm. pumparounds. In general, low temperature difference and large reflux flowrate could facilitate the improvement of the distillation accuracy, but may increase the operation load of the column, as such, it is required to increase the diameter and height of the column. Therefore, the flowrates and temperatures of the Atm. pumparounds shall be adjusted mainly based on the distillate product quality and the product mix. Consistent control modes are employed for the atm. top PA temperature controller (TIC31001), the atm. PA#1 temperature controller (TIC31002) and the atm. PA#2 temperature controller (TIC31006).

常压中段回流的温度控制是控制常压塔各段取热的重要参数, 一般通过调节中段回流温度和中段回流流量来控制常压塔内的热值交换, 控制各侧线产品的流量和分馏精度。一般而言, 低温差、大回流有利于分馏精度的提高, 但是会增加分馏塔的负荷, 增加塔径和高度。因此常压中段回流温度 and 回流流量主要根据侧线产品质量和生产方案进行调整。常顶循回流温度 TIC31001、常一中回流温度 TIC31002、常二中回流温度 TIC31006 控制方式一致。

Control range: no control range is defined. The reference SPs of TIC31001, TIC31002 and TIC31006 are 108°C, 180°C and 202°C respectively.

控制范围: 无控制范围, 设计参考至 TIC31001 为 108°C、TIC31002 为 180°C、TIC31006 为 202°C。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: Atm. OVHD reflux flowrate, Atm. PA1# flowrate, Light diesel flowrate

相关参数: 常顶循流量、常一中流量、常二中流量。

Control mode: single loop control is employed for TIC31001, TIC31002 and TIC31006.

控制方式: TIC31001、TIC31002、TIC31006 均采用单回路控制。

Adjustment method: Take the Atm. OVHD reflux temperature controller (TIC31001) as an example: when the reading of TIC31001 rises, further open TV31001 to increase the flowrate through the bypass valve of the temperature control valve, so as to reduce the heat load of the heat exchanger; when the reading of TIC31001 drops, further close TV31001 to reduce the flowrate through the bypass valve of the temperature control valve, so as to increase the heat load of the heat exchanger.

调节方法: 以常顶循回流温度控制为例。当 TIC31001 上升时, 开大 TV31001, 增加温控阀付线流量, 降低换热器的取热。当 TIC31001 下降时, 关小 TV31001, 减少温控阀付线流量, 增加换热器的取热。

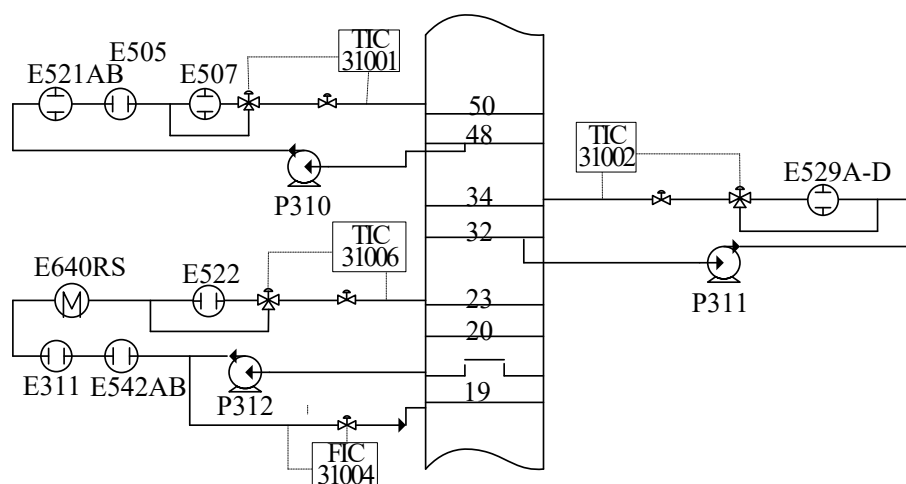


Figure 62 Flow Chart of Control for Atm. top PA Temperature and Atm. PA#1 and Atm. PA#2 Temperatures

图 62 常顶循、常一中、常二中回流温度控制流程图

2.4.6.18 Control for atm. top PA flowrate and atm. PA#1 flowrate 常顶循、常一中回流流量控制

The Atm. pumparound temperature is deemed as an important parameter for controlling the heat demand in each section of the Atm.. Generally, the heat exchange in the Atm., the flowrate of each distillate product and the distillation accuracy of the Atm. are controlled by adjusting the flowrates and temperatures of the Atm. pumparounds. In general, low temperature difference and large reflux flowrate could facilitate the improvement of the distillation accuracy, but may increase the operation load of the column, as such, it is required to increase the diameter and height of the column. Therefore, the flowrates and temperatures of the Atm. pumparounds shall be adjusted mainly based on the distillate product quality and the product mix. Consistent control modes are employed for the atm. top PA flow controller (FIC31002) and the atm. PA#1 flow controller (FIC31003).

常压中段回流的流量控制是控制常压塔各段取热的重要参数, 一般通过调节中段回流温度和中段

回流流量来控制常压塔内的热值交换，控制各侧线产品的流量和分馏精度。一般而言，低温差、大回流有利于分馏精度的提高，但是会增加分馏塔的负荷，增加塔径和高度。因此常压中段回流温度和回流流量主要根据侧线产品质量和生产方案进行调整。常顶循流量 FIC31002、常一中流量 FIC31003 控制方式一致。

Control range: no control range is defined. For purpose of operation at 100% load, the reference SPs of FIC31002 and FIC31003 are 368t/h and 272t/h respectively.

控制范围: 无控制范围，100%负荷时，设计参考值 FIC31002 为 368t/h、FIC31003 为 272t/h。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: atm. top PA temperature, atm. PA#1 temperature

相关参数: 常顶循回流温度、常一中回流温度。

Control mode: single loop control is employed for FIC31002 and FIC31003.

控制方式: FIC31002、FIC31003 均采用单回路控制。

Adjustment method: Take the Atm. OVHD reflux flow controller (FIC31002) as an example: when the reading of FIC31002 rises, further open FV31002; when the reading of FIC31002 drops, further close FV31002.

调节方法: 以常顶循流量控制为例。当 FIC31002 上升时，开大 FV31002。当 FIC31002 下降时，关小 FV31002。

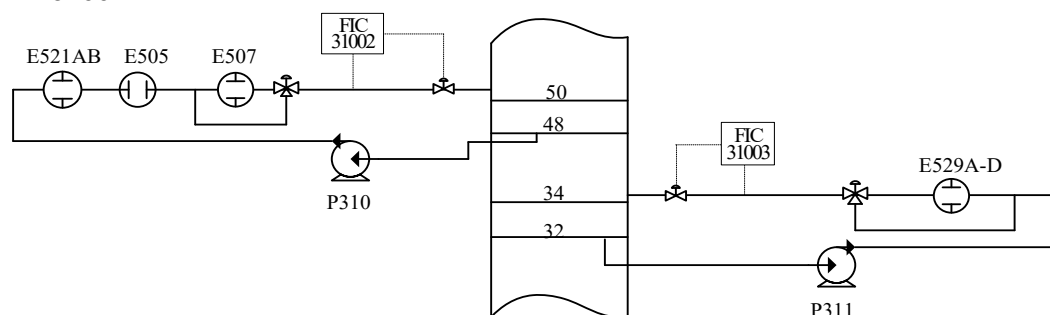


Figure 63 Flow Chart of Control for Atm. top PA Flowrate and Atm. PA#1 Flowrate

图 63 常顶循、常一中回流流量控制流程图

2.4.6.19 Control for atm. PA#2 flowrate and atm. PA#2 internal reflux flowrate 常二中回流流量和内回流流量控制

The significance and method of control for the atm. PA#2 flowrate are identical with that for the atm. top PA flowrate and the atm. PA#1 flowrate, however, the design of the a atm. PA#2 in this process unit is somewhat different from that in the conventional atm. and vac. distillation units, for example, the atm. PA#2 and the heavy diesel are drawn from the same position in the Atm., and an collecting drum is provided for atm. PA#2, and in the meanwhile, an internal reflux is designed for atm. PA#2 to control the heavy component content in heavy diesel. Specifically, atm. PA#2 is designed to mainly control the light component content in heavy diesel, and the atm. PA#2 internal reflux is designed to mainly control the heavy component content in heavy

diesel.

常二中回流流量的控制意义和方式与常顶循、常一中相同，但是本装置常二中设计时与常规的常减压有所不同，常二中与常三线在同一位置抽出，且增设了集油箱，同时为了控制常三线的重组分，增设了常二中内回流。常二中主要控制常三线的轻组分，常二中内回流主要控制常三线的重组分。

Control range: none

控制范围：无指标。

Control target: per the operating instructions

控制目的：操作指令。

Related parameters: heavy diesel draw temperature, heavy diesel flowrate

相关参数：常三线抽出温度、常三线流量。

Control mode: single loop control is employed for the atm. PA#2 flow controller (FIC31006) and the atm. PA#2 internal reflux flow controller (FIC31004).

控制方式：常二中流量 FIC31006 和常二中内回流流量 FIC31004 均采用单回路控制。

Adjustment method: when the readings of FIC31006 and FIC31004 are higher than the SP, further close FV31006 and FV31004; when the readings of FIC31006 and FIC31004 are lower than the SP, further open FV31006 and FV31004. During process operation, increased atm. PA#2 flowrate will increase the amount of liquid phase in the heavy diesel collecting drum, however, increased atm. PA#2 internal reflux flowrate will reduce the amount of liquid phase in the heavy diesel collecting drum. In the process of operation control, the level in the atm. PA#2 collecting drum may become empty due to poor material balance, so as to cause evacuation in the atm. PA#2 pump. As no level indicator is provided for the Light diesel accumulator tray, the following two aspects shall be based to judge if the level in the atm. PA#2 accumulator tray is emptied: the heavy diesel temperature control valve is gradually opened; the sound of evacuation is generated from the atm. PA#2 pump, and the atm. PA#2 flowrate and the atm. PA#2 internal reflux flowrate fluctuate greatly. In case that the level in the atm. PA#2# collecting drum is emptied, first switch the heavy diesel temperature control valve to "Manual" mode and close it, then further close the atm. PA#2 internal reflux control valve. If it is required to quickly restore the atm. PA#2 flowrate to normal operation, switch the atm. PA#2 temperature control valve to "Manual" mode and further close it.

调节方法：FIC31006 和 FIC31004 高于设定值时，关小 FV31006 和 FV31004；FIC31006 和 FIC31004 低于设定值时，开大 FV31006 和 FV31004。在操作中，增加常二中流量会增加常三线集油箱的液相，但是增加常二中内回流流量会减少常三线集油箱的液相，在控制过程中，可能出现因平衡问题，造成常二中集油箱空，而出现常二中泵抽空的问题。由于常二中集油箱并没有液位指示，判断集油箱抽空主要从两个方面进行判断：常三线温控阀越开越大；常二中泵有抽空声音，常二中流量和常二中内回流流量大幅度波动。出现常二中集油箱抽空时，应优先将常三线温控阀改为手动控制，并管线阀门，其次是关小常二中内回流阀门，如需要快速恢复常二中，可将常二线温控阀打手动后并关小。

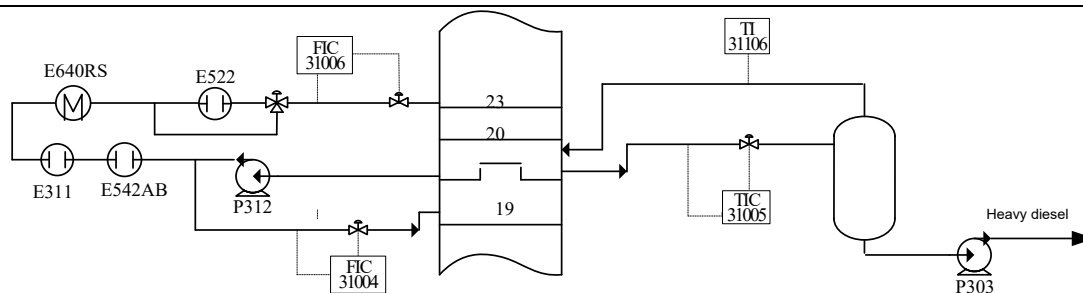


Figure 64 Flow Chart of Control for Atm. PA#2 Flowrate and Atm. PA#2 Internal Reflux Flowrate

图 64 常二中回流流量和内回流流量控制流程图

2.4.6.20 Control for kerosene reboiler outlet temperature 常一线重沸器出口温度控制

As the important indicator for controlling the properties of the feedstock to KHT, the flash point of kerosene is controlled mainly via the kerosene stripper and reboiler. The operation cost of the reboiler is higher than that of the steam stripper. Where kerosene is to be used as the feedstock to KHT, high requirements are proposed for the freezing point of the jet kerosene, and if steam stripping method is employed, this may cause increased freezing point of the jet kerosene, therefore, reboiling method is employed in this process unit to control the flash point of kerosene. In general, if the outlet temperature of the kerosene reboiler is increased, the light component content in kerosene will become less, and the flash point of kerosene will increase.

常一线的闪点是控制航煤原料的重要控制指标。控制常一线的闪点主要通过控制常一线汽提和重沸两种手段，采用重沸器方式的操作成本高于蒸汽汽提。当常一线作为航煤原料时，对冰点要求高，采用汽提容易造成航煤冰点上升，因此本装置采用了重沸的方式控制常一线的闪点。一般而言，提高常一线重沸器出口温度，常一线的轻组分变少，闪点上升。

Control range: 220~240°C

控制范围：220~240°C。

Control target: per the operating instructions

控制目的：操作指令。

Related parameters: kerosene flowrate, atm. PA#2 flowrate

相关参数：常一线流量、常二中流量。

Control mode: single loop control is employed for the kerosene reboiler outlet temperature controller (TIC31201).

控制方式：常一线重沸器出口温度 TIC31201 采用单回路控制。

Adjustment method: when the reading of TIC31201 is higher than the SP, further open TV31201 to increase the flowrate in the bypass of the reboiler; when the reading of TIC31201 is lower than the SP, further close TV31201 to reduce the flowrate in the bypass of the reboiler.

调节方法：当 TIC31201 高于设定值时，开大 TV31201，增加重沸器付线流量；当 TIC31201 低于设定值时，关小 TV31201，减少重沸器付线流量。

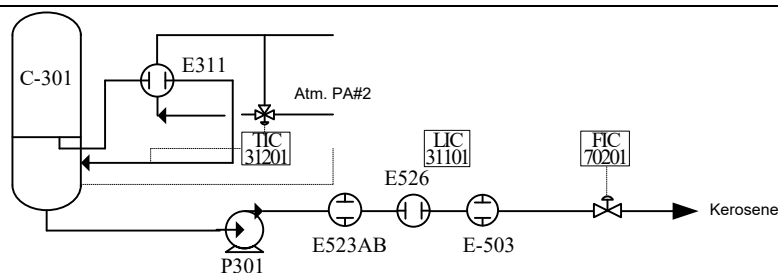


Figure 65 Kerosene Reboiler Outlet Temperature Control Flow Chart

图 65 常一线重沸器出口温度控制流程图

2.4.6.21 Control for kerosene, light diesel and heavy diesel draw temperatures 常一线、常二线、常三线抽出温度控制

Kerosene draw temperature (TIC31004), light diesel draw temperature (TIC31022) and a heavy diesel draw temperature (TIC31005) are deemed as the important indicators for controlling the heavy component content in and the draw flowrate of each distillate. Where the draw temperature of each distillate rises, the draw flowrate of and the heavy component content in each distillate will increase accordingly.

常一线抽出温度 TIC31004、常二线抽出温度 TIC31022、常三线抽出温度 TIC31005 是控制各侧线重组分和抽出量多少的重要指标，当抽出温度上升时，该侧线的流量和重组分含量均增加。

Control range: no control range is defined. The reference SPs of TIC31004, TIC 31004 and TIC 31004 are 208°C, 270°C and 302°C respectively.

控制范围：无控制范围。设计参考值 TIC31004 为 208°C、TIC31004 为 270°C、TIC31004 为 302°C。

Control target: per the operating instructions

控制目的：操作指令。

Related parameters: kerosene, light diesel and heavy diesel flowrates, atm. top PA flowrate, atm. PA#1 and atm. PA#2 flowrates, atm. top PA temperature, atm. PA#1 and atm. PA#2 flowrates

相关参数：常一线、常二线和常三线流量，常顶循、常一中二和常二中流量，常顶循、常一中二和常二中回流温度。

Control mode: single loop control is employed for TIC31004, TIC31022 and TIC31005.

控制方式：TIC31004、TIC31022、TIC31005 均采用单回路控制。

Adjustment method: take the kerosene draw temperature controller (TIC31004) as an example: when the reading of TIC31004 is greater than the SP, further close TV31004; when the reading of TIC31004 is less than the SP, further open TV31004.

调节方法：以常一线为例。当 TIC31004 高于设定值时，关小 TV31004；当 TIC31004 低于设定值时，开大 TV31004。

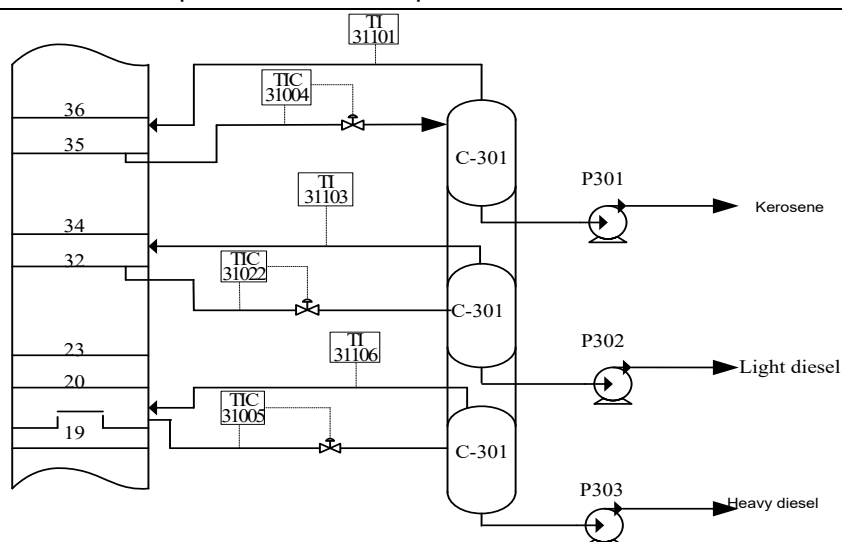


Figure 66 Flow Chart of Control for Atm. Distillates 1#, 2# and 3# Draw Temperatures

图 66 常一线、常二线、常三线抽出温度控制流程图

2.4.6.22 Control for the levels of kerosene, light diesel and heavy diesel 常一线、常二线、常三线液位控制

The Atm. liquid level of sidedraw is deemed as an important indicator for ensuring stable operation of the process unit. If the Atm. liquid level of sidedraw fluctuates, this may cause dramatically fluctuated operation load of the pump, affecting long-term stable operation of the equipment. More importantly, as the Atm. distillates will be directly fed to the downstream process unit, if the Atm. liquid level of sidedraw fluctuates, this may cause fluctuated Atm. distillate flowrate, affecting stable operation of the downstream process unit. Kerosene level controller (LIC31101), light diesel level controller (LIC31102) and heavy diesel level controller (LIC31103) are characterized by same control mode, same adjustment method and same control range. Hereinafter, take the kerosene level controller (LIC31101) as an example for illustration.

常压侧线的液位是装置平稳运行的重要指标，液位波动，机泵负荷波动大，不利于设备的长周期运行，更重要的是，本装置常压侧线至下游装置以直供的方式为主，液位波动，造成流量的波动，不利于下游装置的平稳运行。常一线液位 LIC31101、常二线液位 LIC31102、常三线液位 LIC31103 控制方式相同，调节方式相同，控制范围一样，以下以常一线为例进行说明。

Control range: 30~70%

控制范围: 30~70%

Control target: per the operating instructions

控制目标: 操作指令

Related parameters: kerosene flowrate, light diesel flowrate, heavy diesel flowrate

相关参数: 常一线流量、常二线流量、常三线流量

Control mode: the kerosene level controller (LIC31101) is cascaded to the kerosene flow

controller (FIC70201).

控制方式：常一线液位 LIC31101 和常一线流量 FIC70201 组成串级回路控制。

Adjustment method: when the reading of LIC31101 rises, further open FV70201 to increase the kerosene flowrate; when the reading of LIC31101 drops, further close FV70201 to reduce the kerosene flowrate.

调节方法：当 LIC31101 上升时，开大 FV70201，增加常一线流量。当 LIC31101 下降时，关小 FV70201，降低常一线流量。

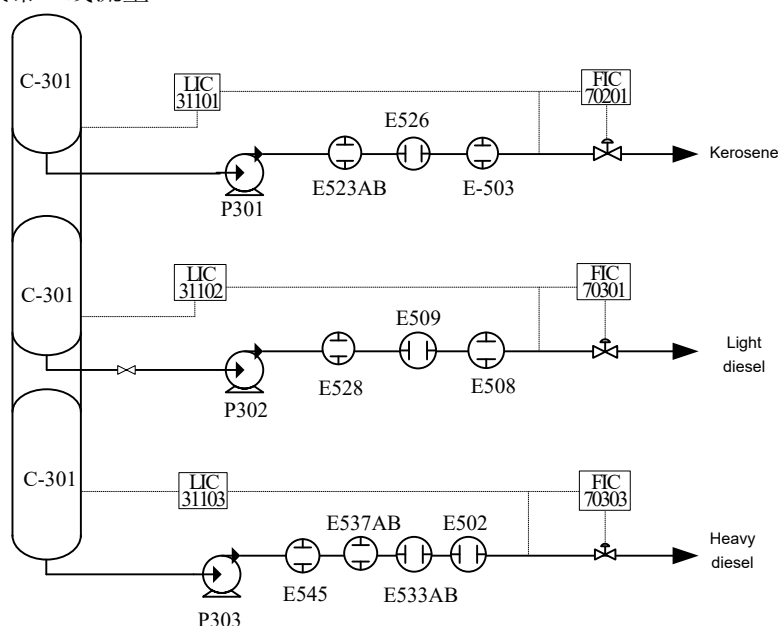


Figure 67 Flow Chart of Control for Kerosene, Light Diesel and Heavy Diesel Levels

图 67 常一线、常二线、常三线液位控制流程图

2.4.6.23 Control for atm. overflash oil level and atm. overflash oil internal reflux flowrate 常四线液位及内回流流量控制

Due to the presence of mist entrainment, an over-vaporization rate is designed to ensure the quality of the lowest distillate product from the distillation column. Atm. overflash oil produced from the Atm. is just the atm. over-vaporized oil that is used to control the quality of heavy diesel. Where atm. overflash oil is not to be drawn from the Atm., it will be run down to the bottom of the Atm., where it enters the vac. heater and vac. column, thus increasing the operation loads of the vac. heater and the vac. column. In order to reduce the operation loads of the vac. heater and the vac. column, the atm. overflash oil draw process is designed, where atm. overflash oil is drawn and heat exchanged, then directly converged into MVGO as the feedstock to Hydrocracking Unit. As atm. overflash oil is not sent to the vac. column but directly used as the feedstock to Hydrocracking Unit, the residual carbon and metal contents in atm. overflash oil shall also be controlled. Therefore, an internal reflux is designed for atm. overflash oil. When the residual carbon and metal contents in atm. overflash oil increase, the atm. overflash oil

internal reflux flowrate shall be increased. The field operators can judge, depending on the color of atm. overflash oil, if the atm. overflash oil internal reflux flowrate is OK.

由于雾沫夹带的存在,设计过气化率是为保证分馏塔最下一个侧线产品质量。常四线就是常压塔控制常三线产品质量的常压过汽化油。当常四线不抽出时,常四线油回到常压塔底油,进入减压炉和减压塔,这会增加减压炉和减压塔的负荷。为降低减压炉和减压塔的负荷,本装置设计了减四线抽出,并经过换热后直接并至减二线作为加氢裂化原料。由于常四线不是进入减压塔,而是直接作为加氢裂化原料,常四线同样需要控制残碳、金属含量等指标。因此常四线增加了内回流。当常四线残碳、金属含量上升时应增加常四线内回流流量。外操可从检查常四线颜色判断,常四线内回流是否适当。

Control range: 30~70% for atm. overflash oil level, and no specified indicators are determined for the atm. overflash oil internal reflux flowrate.

控制范围: 常四线液位 30~70%, 常四线无指标范围。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: atm. overflash oil flowrate, Atm. feed temperature

相关参数: 常四线流量、常压塔进料温度。

Control mode: the atm. overflash oil level controller (LIC31103) is cascaded to the atm. overflash oil internal reflux flow controller (FIC34201). Single loop control is employed for FIC34201.

控制方式: 常四线液位 LIC31103 和常四线流量 FIC34201 组成串级回路控制。常四线内回流流量为单回路控制。

Adjustment method: when the reading of LIC31103 rises, further open FV34201; when the reading of LIC31103 drops, further close FV34201. When the reading of FIC34201 is greater than the SP, further close FV34201; when the reading of FIC34201 is less than the SP, further open FV34201.

调节方法: 当 LIC31103 上升时, 开大 FV34201; 当 LIC31103 下降时, 关小 FV34201。当 FIC34201 高于设定值时, 关小 FV34201; 当 FIC34201 低于设定值时, 开大 FV34201。

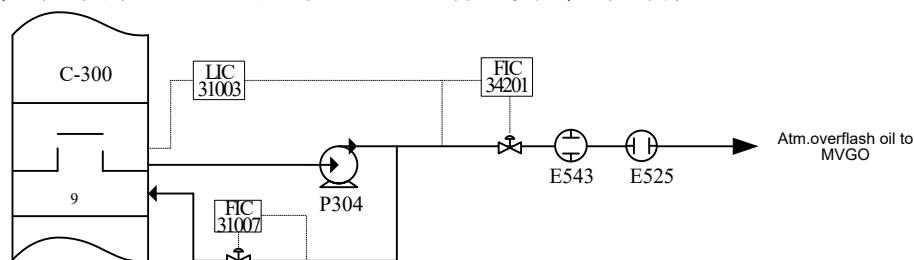


Figure 68 Flow Chart of Control for Atm. Overflash Oil Level and Atm. Overflash Oil Internal Reflux Flowrate

图 68 常四线液位及内回流流量控制流程图

2.4.6.24 Control for kerosene pressure at BL of process unit 常一线界区压力控制

As the feedstock to KHT, kerosene is directly fed to KHT. To ensure the stability of the feedstock to KHT, it is required to control the pressure of kerosene to KHT at BL of AVD. During normal

operation, most of kerosene is directly fed to KHT, and the remaining portion is sent to the drum. The pressure of drum is lower than that of the feedstock drum drums in KHT, the pressure of kerosene to KHT shall be controlled stable by opening/closing the kerosene valve to drum.

常一线作为航煤加氢的原料，与航煤加氢装置热直供，为确保航煤加氢装置进料稳定，需要控制常减压装置界区常一线至航煤加氢装置的压力。正产运行时，常一线大部分直供航煤加氢装置，剩余部分至罐区。罐区压力低于航煤加氢原料罐，通过开关常一线至罐区的阀门，稳定常一线至航煤加氢的压力。

Control range: none

控制范围：无指标范围。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: kerosene level, kerosene flowrate

相关参数：常一线液位、常一线流量。

Control mode: single loop control is employed for PIC72001.

控制方式：PIC72001 采用单回路控制。

Adjustment method: when the reading of PIC72001 is greater than the SP, further open PV72001 (DN80); when the reading of PIC72001 is less than the SP, further close PV72001. During normal operation, HV70201 (DN200) shall be fully closed. In case of abnormal operation, e.g., the kerosene flowrate increases abnormally, or it is difficult to send kerosene to KHT because the kerosene draw valve is closed due to operation fluctuation in KHT, open HV70201 to increase the kerosene flowrate to drum.

调节方法：当 PIC72001 高于设定值时，开大 PV72001（DN80）；当 PIC72001 低于设定值时，关小 PV72001。正常生产时，HV70201（DN200）应全部关闭，当生产异常，如常一线流量异常增加，或者航煤加氢因生产波动关阀，造成常一线外放困难时，打开 HV70201，增加至罐区流量。

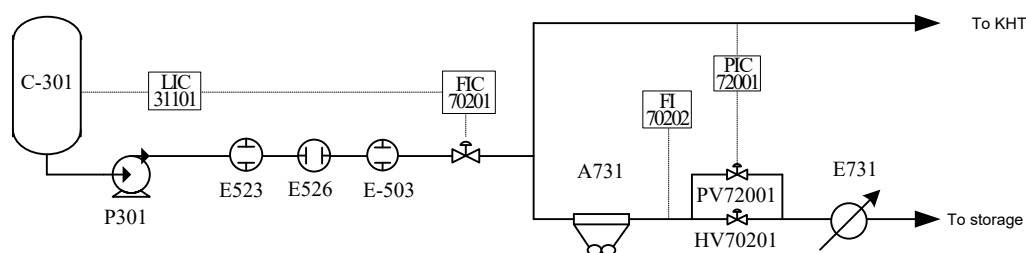


Figure 69 Flow Chart of Control for Kerosene Pressure at BL of Process Unit

图 69 常一线界区压力控制流程图

2.4.6.25 Control for Vac. column bottom level 减压塔塔底液位控制

As an important control indicator of the Vac. column, the Vac. column bottom level shall be controlled stable to ensure stable supply of the feedstock to the downstream process unit, and facilitate long-term stable operation of the heat exchangers and pumps in Atmospheric and Vacuum Distillation Unit.

减压塔底液位时减压塔的重要控制指标，减压塔底液位稳定控制是保证下游装置供料稳定的基础，

同时也有利于保障常减压的换热器、机泵的长周期运行。

Control range: 30~80%

控制范围：30~80%。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: vacuum residue flowrate, feed flowrate to the Vac. column

相关参数：减压渣油流量、减压塔进料流量。

Control mode: two level controllers (LIC41004 and LIC41005) are provided at the bottom of the Vac. column. The Vac. column bottom level controllers (LIC41004 and LIC41005) are cascaded to the vacuum residue flow controller (FIC51501). Among two Vac. column bottom level controllers (LIC41004 and LIC41005), one can be selected for control purpose, while the other is for reference and comparison.

控制方式：减压塔塔底设置了两套液位监测仪表 LIC41004 和 LIC41005，减压塔底液位与和减压渣油流量 FIC51501 组成串级回路控制。在控制时可以选择 LIC41004、LIC41005 之一作为控制指标，另一液位作为参考和对比。

Adjustment method: when the reading of LIC41004 or LIC41005 is greater than the SP, further open FV75150; when the reading of LIC41004 or LIC41005 is less than the SP, further close FV751501.

调节方法：当 LIC41004 或者 LIC41005 高于设定值时，开大 FV75150；当 LIC41004 或者 LIC41005 低于设定值时，关小 FV751501。

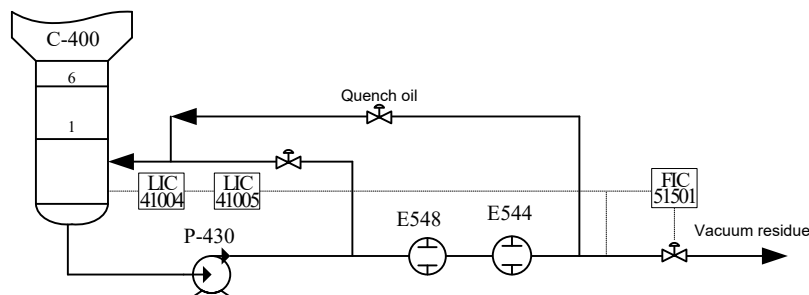


Figure 70 Vac. column Bottom Level Control Flow Chart

图 70 减压塔塔底液位控制流程图

2.4.6.26 Control for Vac. column top temperature 减顶温度控制

The Vac. column top temperature (TIC41001) may produce great influence on the Vac. column OVHD vacuuming system. When the Vac. column top temperature rises, the amount of Vac. column OVHD gas phase will increase to cause increased operation loads of Vac. column OVHD vacuuming system and cooling system and decreased Vac. column top vacuum degree. Therefore, proper Vac. column top temperature is deemed as one of key parameters for ensuring stable operation of the Vac. column OVHD vacuuming system.

减压顶温度 TIC41001 对减压塔抽真空影响较大, 当减顶温度上升时, 减顶气相增加, 增加减顶抽真空和冷却负荷, 减顶真空度下降。因此控制合适的减顶温度是保证减压塔抽真空的稳定的关键参数之一。

Control range: 50~80°C

控制范围: 50~80°C。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: LVGO PA flowrate, LVGO PA temperature, steam flowrate to heater tubes, steam flowrate to the bottom of Vac. column

相关参数: 减一中流量、减一中温度、炉管注汽流量、塔底吹汽流量。

Control mode: the Vac. column top temperature controller (TIC41001) is cascaded to the LVGO PA flow controller (FIC41101).

控制方式: 减顶温度 TIC41001 与减一中流量 FIC41101 组成串级回路控制。

Adjustment method: when the reading of TIC41001 is greater than the SP, further open FV41101; when the reading of TIC41001 is less than the SP, further close FV41101. And additionally, it is favorable for controlling the Vac. column top temperature by decreasing the LVGO PA temperature (by adjusting the water cooler E-740).

调节方法: 当 TIC41001 高于设定值时, 开大 FV41101; 当 TIC41001 低于设定值时, 关小 FV41101。另外降低减一中回流温度 (调节水冷器 E-740), 有利于控制减顶温度。

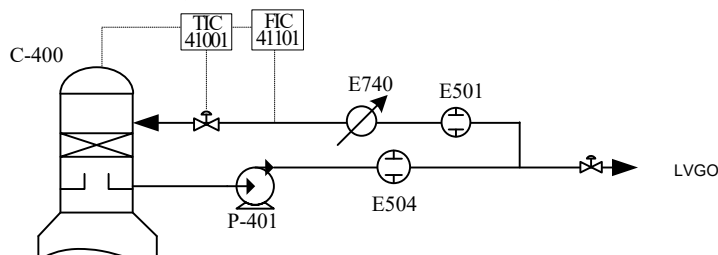


Figure 71 Vac. column Top Temperature Control Flow Chart

图 71 减顶温度控制流程图

2.4.6.27 Control for level and crude-water interface level in vac. OVHD drum 减顶分液罐液位和界位控制

Control range: 40~60%

控制范围: 40~60%。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: vac. OVHD oil flowrate and vac. OVH sour water flowrate

相关参数: 减顶油流量和减顶含硫污水流量。

Control mode: single loop control is employed for the level controller (LIC42501) and the crude-water interface level controller (LIC42502) of vac. OVHD drum (D-401).

控制方式: 减顶分液罐 D-401 液位 LIC42501 和减顶分液罐 D-401 界位 LIC42502 均采用单回路

控制。

Adjustment method: when the reading of LIC42501 or LIC42502 is higher than the SP, further open LV42501 or LV42502; when the reading of LIC42501 or LIC42502 is lower than the SP, further close LV42501 or LV42502.

调节方法：当 LIC42501 或 LIC42502 高于设定值时，开大 LV42501 或 LV42502；当 LIC42501 或 LIC42502 低于设定值时，关小 LV42501 或 LV42502。

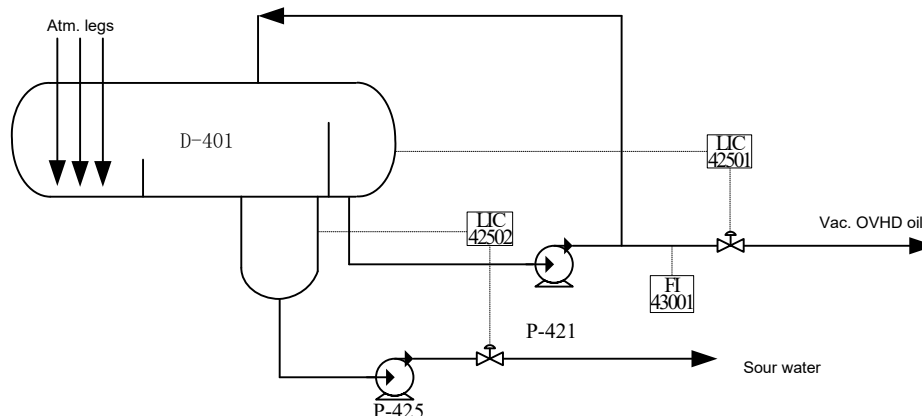


Figure 72 Flow Chart of Control for Level and Oil-Water Interface Level in vac. OVHD Drum

图 72 减顶分液罐液位和界位控制流程图

2.4.6.28 Control for LVGO, MVGO and HVGO levels 减一线、减二线、减三线液位控制

The LVGO level (LIC41001), the MVGO level (LIC41002) and the v HVGO level (LIC41003) shall be controlled stable to facilitate stable supply of the feedstock to Hydrotreating Unit and protection of the head exchangers and pumps in Atmospheric and Vacuum Distillation Unit.

减一线液位 LIC41001、减二线液位 LIC41002、减三线液位 LIC41003 的稳定控制，有利保障下游加氢裂化装置的进料稳定，同时对于保护常减压的换热设备、机泵等有利。

Control range: 30~80%

控制范围：30~80%。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: LVGO, MVGO and HVGO flowrates, LVGO PA, MVGO PA and HVGO PA flowrates, HVGO PA internal reflux flowrate, residual pressure at the top of Vac. column

相关参数：减一线、减二线、减三线流量，减一中、减二中、减三中、减三线内回流流量，减压塔顶残压。

Control mode: LVGO level controller, MVGO level controller and HVGO level controller are characterized by same control mode and same adjustment method. Hereinafter, take the LVGO level controller (LIC41001) as an example: The LVGO level controller (LIC41001) is cascaded to the LVGO flow controller (FIC71103).

控制方式：减一线、减二线、减三线液位控制方式和调节方法相同，以减一线为例进行说明。减

一线液位 LIC41001 与减一线流量 FIC71103 组成串级回路控制。

Adjustment method: when the reading of LIC41001 is greater than the SP, further open LV41001; when the reading of LIC41001 is less than the SP, further close LV41001. In addition, in case that the HVGO level is emptied, the HVGO flushing oil flowrate shall be reduced at the first priority to ensure re-establishment of the HVGO level as soon as possible. In case that any liquid level of sidedraw is emptied, it can be restored as soon as possible by enabling its upper liquid level of sidedraw to reach 100% level in addition to adjustment of the pumparound flowrates.

调节方法: 当 LIC41001 高于设定值时, 开大 LV41001; 当 LIC41001 低于设定值时, 关小 LV41001。另外, 当减三线液位抽空时, 应为确保减三线液位尽快恢复, 应优先降低减三线内回流流量。各侧线液位抽空时, 除可调节中段回流以外, 还可以将上一侧线短暂满液位控制, 以尽快回复抽空的侧线液位。

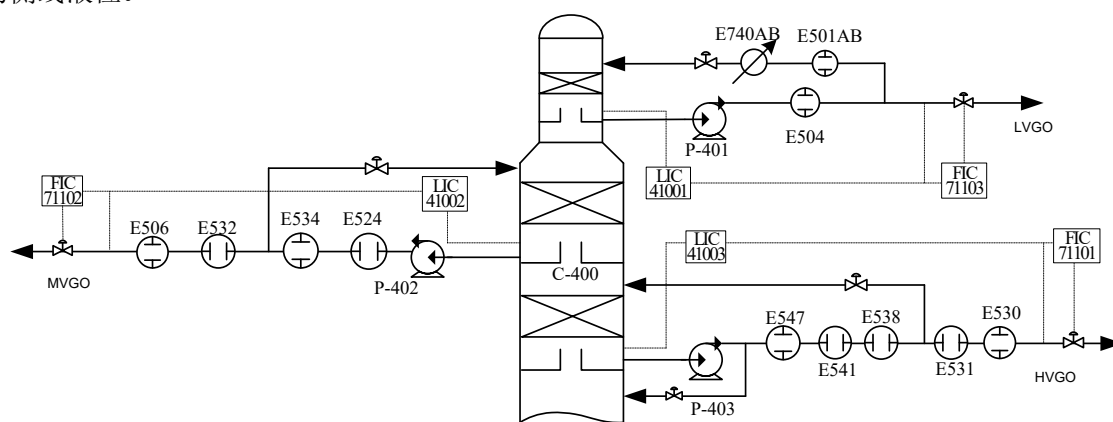


Figure 73 Flow Chart of Control for LVGO, MVGO and HVGO Levels

图 73 减一线、减二线、减三线液位控制流程图

2.4.6.29 Control for temperature of gas phase under the LVGO collecting drum 减一线集油箱下气相温度控制

The temperature (TIC41005) of gas phase under the LVGO collecting drum is deemed as an important indicator for controlling the heavy component content (FBP) in LVGO and the light component content in MVGO.

减一线集油箱下气相温度 TIC41005 是控制减一线重组分(终馏点)和减二线轻组分的重要指标。

Control range: none

控制范围: 无控制范围。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: MVGO PA flowrate

相关参数: 减二中流量。

Control mode: TIC41005 is cascaded to the MVGO PA flow controller (FIC41002).

控制方式: TIC41005 与减二中流量 FIC41002 组成串级回路控制。

Adjustment method: when the reading of TIC41005 is greater than the SP, further open FV41002; when the reading of TIC41005 is less than the SP, further close FV41002.

调节方法: 当 TIC41005 高于设定值时, 开大 FV41002; 当 TIC41005 低于设定值时, 关小 FV41002。

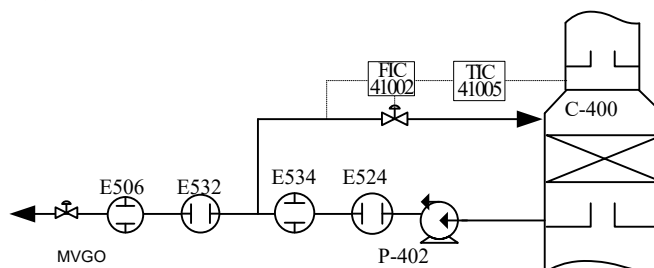


Figure 74 Flow Chart of Control for Temperature of Gas Phase below LVGO Collecting Drum

图 74 减一线集油箱下气相温度控制流程图

2.4.6.30 Control for temperature of gas phase under the MVGO collecting drum and of gas phase under the HVGO collecting drum 减二线集油箱下气相温度和减三线集油箱下气相温度控制

The temperature (TIC41007) of gas phase under the MVGO collecting drum is deemed as an important indicator for controlling the heavy component content (FBP) in MVGO collecting drum and the light component content in HVGO. The temperature (TIC41008) of gas phase under the HVGO collecting drum is deemed as an important indicator for controlling the heavy component content (FBP) in HVGO.

减二线集油箱下气相温度 TIC41007 是控制减二线重组分(终馏点)和减三线轻组分的重要指标。

减三线集油箱下气相温度 TIC41008 是控制减三线重组分(终馏点)的重要指标。

Control range: none

控制范围: 无控制范围。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: HVGO PA flowrate, HVGO flushing oil flowrate

相关参数: 减三中流量、减三线内回流流量。

Control mode: TIC41007 is cascaded to the HVGO flow controller (FIC41003), and TIC41008 is cascaded to the HVGO internal flow controller (FIC41004).

控制方式: TIC41007 与减三中流量 FIC41003 组成串级回路控制。TIC41008 与减三线内回流流量 FIC41004 组成串级回路控制。

Adjustment method: when the reading of TIC41007 or TIC41008 is higher than the SP, further open FV41003 or FV41004; when the reading of TIC41007 or TIC41008 is lower than the SP, further close FV41003 or FV41004.

调节方法: 当 TIC41007 或 TIC41008 高于设定值时, 开大 FV41003 或 FV41004; 当 TIC41007 或 TIC41008 低于设定值时, 关小 FV41003 或 FV41004。

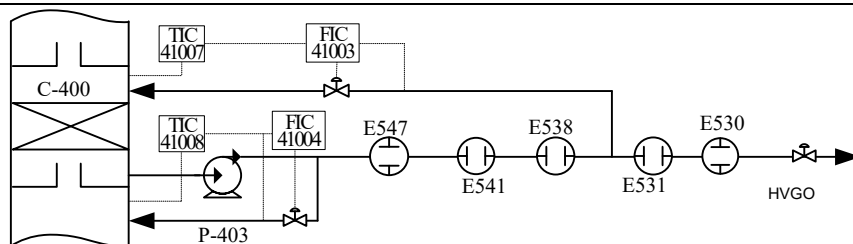


Figure 75 Flow Chart of Control for Temperature of Gas Phase below MVGO Collecting Drum and of Gas Phase below HVGO Collecting Drum

图 75 减二线集油箱下气相温度和减三线集油箱下气相温度控制流程图

2.4.6.31 Control for vac. overflow oil level 减四线液位控制

Control range: 30~80%

控制范围：30~80%。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: vac. overflow oil flowrate

相关参数：减四线流量。

Control mode: the vac. overflow oil level controller (LIC41001) is cascaded to the vac. overflow oil flow controller (FIC71202).

控制方式：减四线液位 LIC41101 与减四线流量 FIC71202 组成串级回路控制。

Adjustment method: when the reading of LIC41101 is greater than the SP, further open FV71202; when the reading of LIC41101 is less than the SP, further close FV71202.

调节方法：当 LIC41101 高于设定值时，开大 FV71202；当 LIC41101 低于设定值时，关小 FV71202。

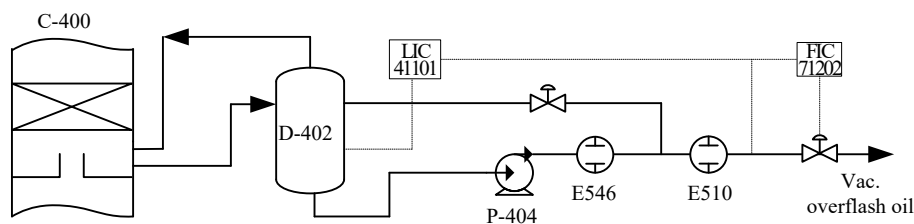


Figure 76 Vac. Overflow Oil Level Control Flow Chart

图 76 减四线液位控制流程图

2.4.6.32 Control for vac. overflow oil draw temperature 减四线抽出温度控制

Control for the vac. overflow oil draw temperature is mainly aimed to prevent vac. overflow oil from residing in D-402 for a long time to eliminate coking and cracking. Vac. overflow oil from the heat exchanger shall be recycled back to D-402 so as to reduce the vac. overflow oil draw temperature.

控制减四线抽出温度的目的主要是防止减四线在 D-402 内停留时间长，易结焦、裂解等，将换热后的减四线油循环回 D-402，从而降低减四线抽出温度。

Control range: 340~360°C

控制范围：340~360°C。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: vac. overflash oil quench oil flowrate

相关参数：减四线急冷油流量。

Control mode: the vac. overflash oil draw temperature controller (TIC41101) is cascaded to the vac. overflash oil quench oil flow controller (FIC41101).

控制方式：减四线抽出温度 TIC41101 与减四线急冷油流量 FIC41101 组成串级回路控制。

Adjustment method: when the reading of TIC41101 is greater than the SP, further open FV41101; when the reading of TIC41101 is less than the SP, further close FV41101.

调节方法：当 TIC41101 高于设定值时，开大 FV41101；当 TIC41101 低于设定值时，关小 FV41101。

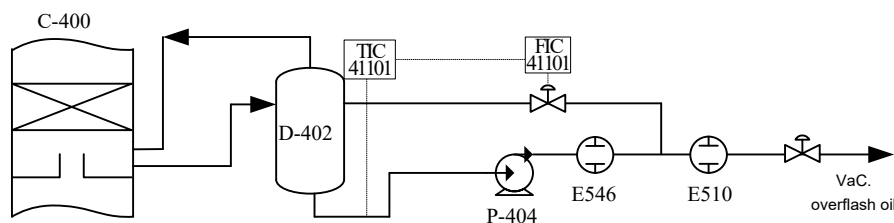


Figure 77 Vac. Overflash Oil Draw Temperature Control Flow Chart

图 77 减四线抽出温度控制流程图

2.4.6.33 Control for VR draw temperature 减压塔底抽出温度控制

As both increased feed temperature and increased asphaltene content in the VR are seen in the Vac. column where deep lift technology has been employed, this contributes to a tendency of more cracking and condensation coking reactions occurred in the VR e. Therefore, it is deemed as an effective means to suppress coking of the VR by reducing the temperature of the VR. In this process unit, the VR draw temperature is controlled by recycling the heat exchanged VR back to the Vac. column as quench oil.

因减压实施深拔后，减压塔进料温度上升，减压渣油中沥青质含量上升等，减压渣油裂解和缩合结焦的趋向增加，降低减压塔底渣油温度是抑制减压渣油结焦的有效手段。本装置通过将换热后的减压渣油循环回减压塔作为急冷油，控制减压渣油抽出温度。

Control range: 350~360°C

控制范围：350~360°C。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: VR flowrate, quench oil flowrate, quench oil temperature

相关参数：减压渣油流量、急冷油流量、急冷油温度。

Control mode: the VR draw temperature controller (TIC41103) is cascaded to the quench oil flow controller (FIC41106).

控制方式：减压渣油抽出温度 TIC41003 与急冷油流量 FIC41006 组成串级回路控制。

Adjustment method: when the reading of TIC41003 is greater than the SP, further open FV41006; when the reading of TIC41003 is less than the SP, further close FV41006.

调节方法：当 TIC41003 高于设定值时，开大 FV41006；当 TIC41003 低于设定值时，关小 FV41006。

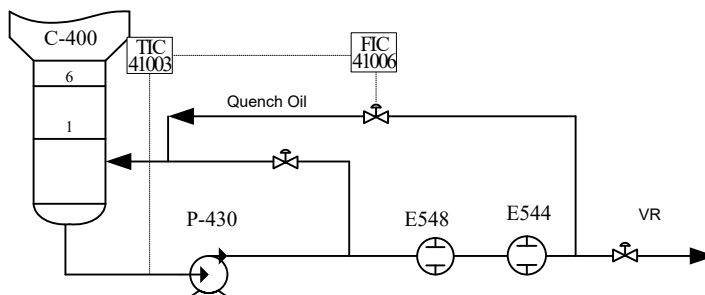


Figure 78 VR Draw Temperature Control Flow Chart

图 78 减压塔底抽出温度控制流程图

2.4.6.34 Control for mixed VGO pressure at BL of process unit 混合蜡油界区压力控制

As the feedstock to Hydrocracking Unit, most of mixed VGO is directly fed to Hydrocracking Unit, and the remaining portion is sent to the drum. In order to ensure the stability of the feedstock to Hydrocracking Unit, it is required to control the pressure (PIC72101) of the mixed VGO to Hydrocracking Unit at BL of Atmospheric and Vacuum Distillation Unit.

混合蜡油作为加氢裂化装置原料，大部分混合蜡油热直供给加氢裂化，部分进入罐区，为确保加氢裂化装置进料稳定，需要控制常减压装置界区混合蜡油至加氢裂化装置的压力 PIC72101。

Control range: none

控制范围：无指标范围。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: LVGO, MVGO and HVGO levels, LVGO, MVGO and HVGO flowrates

相关参数：减一线、减二线、减三线液位，减一线、减二线、减三线流量。

Control mode: single loop control is employed for PIC72101.

控制方式：PIC72101 采用单回路控制。

Adjustment method: when the reading of PIC72101 is greater than the SP, further open PV72101 (DN80); when the reading of PIC72101 is less than the SP, further close PV72101.

During normal operation, HV71101 (DN250) shall be fully closed. In case of abnormal operation, e.g., the LVGO flowrate increases abnormally, or it is difficult to send the mixed VGO to Hydrocracking Unit because the mixed VGO draw valve is closed due to operation fluctuation in Hydrocracking Unit, open HV70201 to increase the mixed VGO flowrate to the drum. As mixed VGO is in large quantity, control of stable LVGO, MVGO and HVGO levels is essential for stabilizing the pressure of mixed VGO at BL of the process unit. When LVGO, MVGO and HVGO levels fluctuate greatly, switch PIC72101 to "Manual" mode.

调节方法：当 PIC72101 高于设定值时，开大 PV72101（DN80）；当 PIC72101 低于设定值时，关小 PV72101。正常生产时，HV71101（DN250）应全部关闭，当生产异常，如减压侧线流量异常增加，或者加氢裂化因生产波动关阀，造成混合蜡油外放困难时，打开 HV70201,增加至罐区流量。混合蜡油物料多，减一线、减二线、减三线液位的稳定控制对于稳定混合蜡油界区至关重要，当液位发生大幅度波动时，应改手动控制。

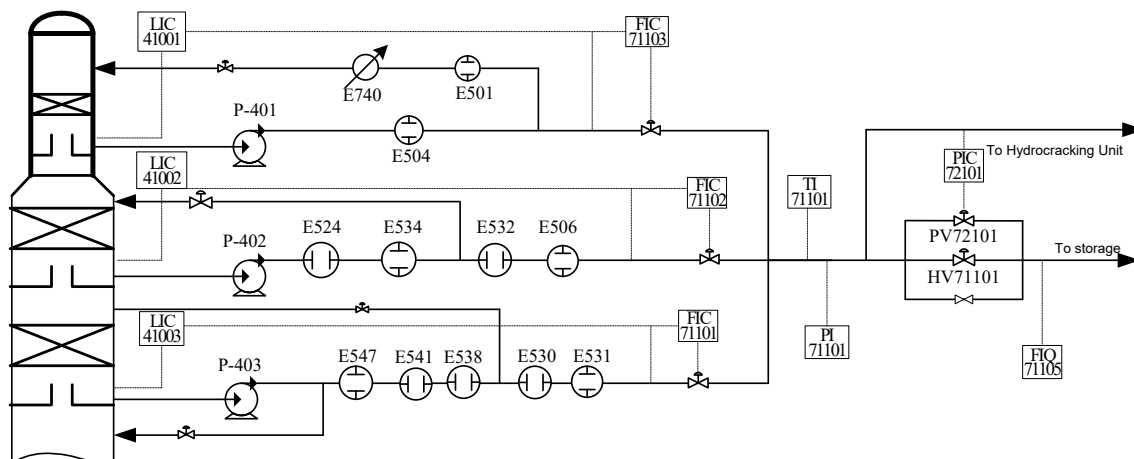


Figure 79 Flow Chart of Control for Mixed VGO Pressure at BL of Process Unit

图 79 混合蜡油界区压力控制流程图

2.4.6.35 Control for VR pressure at BL of process unit 减压渣油界区压力控制

As the feedstock to Flexicoking Unit, most of VR is directly fed to Flexicoking Unit, and the remaining portion is sent to the storage. In order to ensure the stability of the feedstock to Flexicoking Unit, it is required to control the pressure (PIC72102) of the VR to Flexicoking Unit at BL of Atmospheric and Vacuum Distillation Unit.

减压渣油作为灵活焦化装置原料，大部分渣油热直供给灵活焦化装置，部分进入罐区，为确保灵活焦化装置进料稳定，需要控制常减压装置界区减压渣油至灵活焦化装置的压力 PIC72102。

Control range: none

控制范围：无指标范围。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: Vac. column bottom level, VR flowrate

相关参数：减压塔底液位，减压渣油流量。

Control mode: single loop control is employed for PIC72102.

控制方式：PIC72102 采用单回路控制。

Adjustment method: when the reading of PIC72102 is greater than the SP, further open PV72102; when the reading of PIC72102 is less than the SP, further close PV72102.

调节方法：当 PIC72102 高于设定值时，开大 PV72102；当 PIC72102 低于设定值时，关小 PV72102。

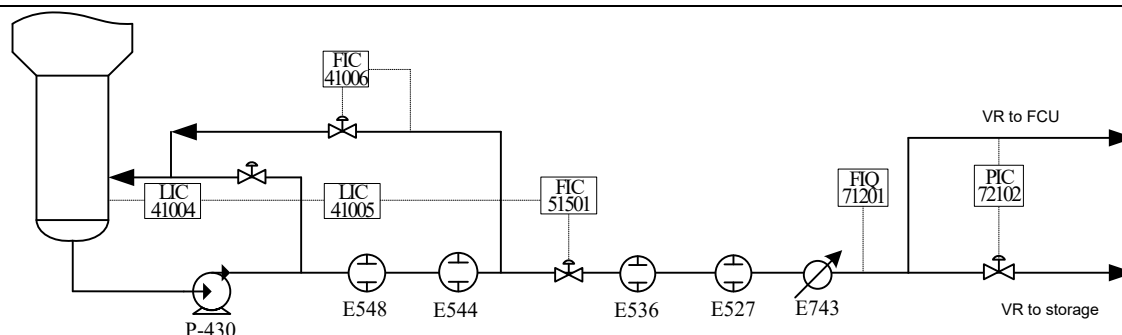


Figure 80 Flow Chart of Control for VR Pressure at BL of Process Unit

图 80 减压渣油界区压力控制流程图

2.4.6.36 Control for water ring pump inlet pressure 水环真空泵入口压力控制

The inlet pressure of the water ring pump is deemed as an important indicator for controlling the vacuum degree of Vac. column, while stable vacuum degree facilitates stable operation of the Vac. column.

水环真空泵入口压力控制是控制减压塔真空度的重要指标，而真空度的平稳有利于减压塔的平稳运行。

Control range: 10~25kPa (water ring pump inlet pressure controller PIC42411) (vacuum degree: 75~90kPa)

控制范围：水环泵入口压力 PIC42411 控制 10~25kPa（真空度 75~90kPa）。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: working fluid flowrate, vac. OVHD secondary oil level, E-421AB outlet temperature, working fluid temperature, D-401 pressure

Control mode: when the inlet pressure of the water ring pump is lower than the SP (the vacuum degree is higher than the SP), open PV42411; when the inlet pressure of the water ring pump is higher than the SP (the vacuum degree is lower than the SP), close PV42411.

相关参数：工作液流量、减顶二级油液位、E-421AB 出口温度、工作液温度、D-401 压力。

控制方式：当水环泵入口压力低于设定值（真空度高于设定值）时，打开 PV42411，当水环泵入口压力高于设定值（真空度低于设定值）时，关小 PV42411。

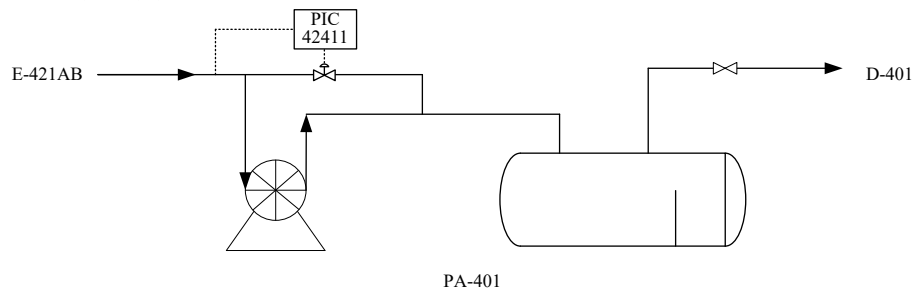


Figure 81 Flow Chart of Control for Water Ring Pump Inlet Pressure

图 81 水环泵入口压力控制流程图

2.4.6.37 Control for C-410 bottom level and lean MEDA flowrate C-410 塔底液位和贫胺液流量控制

The lean MEDA flowrate in vac. OVHD gas desulfurization tower (C-410) is deemed as an important parameter for controlling the vac. OVHD gas desulfurization performance. C-410 bottom level and the lean MEDA flowrate, which are correlated with each other, are two important parameters for controlling MDEA balance in C-410.

减顶气脱硫塔 C-410 贫液流量是控制减顶气脱硫效果的重要参数, C-410 塔底液位与贫液流量相关, 两个参数是控制 C-410 胺液平衡的重要参数。

Control range: no control range is defined for the lean MEDA flow controllers (FIC44001 and FIC44002), and the control range of C-410 bottom level controller (LIC44001) is within 30~70%.
控制范围: 贫胺液流量 FIC44001、FIC44002 无控制指标, C-410 塔底液位 LIC44001 控制范围 30~70%。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: lean MEDA flowrate, rich MEDA flowrate

相关参数: 贫胺液流量、富胺液流量。

Control mode: single loop control is employed for lean MEDA flow controllers (FIC44001 and FIC44002) and C-410 bottom level controller (LIC44001).

控制方式: 贫胺液流量 FIC44001、FIC44002 和 C-410 塔底液位 LIC44001 均采用单回路控制。

Adjustment method: when the reading of FIC44001 or FIC44002 is greater than the SP, further close FV44001 or FV44002; when the reading of FIC44001 or FIC44002 is less than the SP, further open FV44001 or FV44002. When the reading of LIC44001 is higher than the SP, further open LV44001; when the reading of LIC44001 is lower than the SP, further close LV44001.

调节方法: 当 FIC44001、FIC44002 高于设定值时, 关小 FV44001、FV44002; 当 FIC44001、FIC44002 低于设定值时, 开大 FV44001、FV44002。当 LIC44001 高于设定值时, 开大 LV44001; 当 LIC44001 低于设定值时, 关小 LV44001。

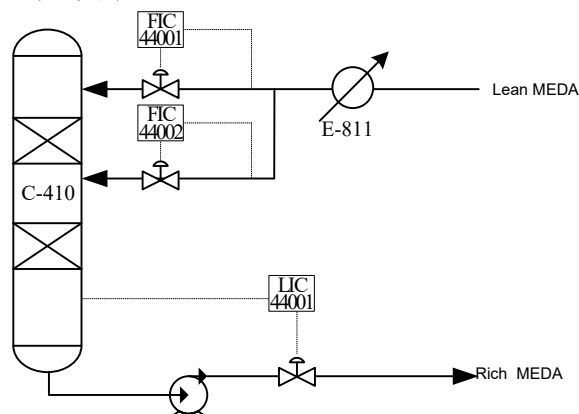


Figure 82 Flow Chart of Control for C-410 Bottom Level and Lean MEDA Flowrate

图 82 C-410 塔底液位和贫胺液流量控制流程图

2.4.6.38 Control for pump minimum flowrate 泵最小流量控制

As lighter crude is sourced as the feedstock to this process unit during design, the actual flowrates of some pumps may greatly differ from those rated flowrates in case that the operation load of the process unit and the properties of the crude to be processed vary. Therefore, minimum flow controllers are provided at the inlets and outlets of some pumps (including Pre-Dist. bottom pump P-230, atm. residue pump P-330, vac. residue pump P-430, atm. PA#2 pump P-312 and HVGO pump P-403) to ensure stable operation of these pumps, and they are characterized by same control mode and same adjustment method. Hereinafter, take P-430 as an example for illustration.

本装置设计原油较轻，部分机泵在装置负荷变化、实际加工原油性质变化时，流量与设计的额定流量偏差较大，为确保机泵的稳定运行，部分机泵增设了进出口循环的最小流量控制，包括初底油泵 P-230、常底油泵 P-330、减底油泵 P-430、常二中 P-312、减三线泵 P-403，其控制方式和调节方法相同。以 P-430 为例进行说明。

Control range: $\leq 700\text{m}^3/\text{h}$ (499t/h) (P-230), $\leq 407\text{m}^3/\text{h}$ (271t/h) (P-312), $\leq 200\text{m}^3/\text{h}$ (152t/h) (P-330), $\leq 270\text{m}^3/\text{h}$ (213t/h) (P-403), $\leq 100\text{m}^3/\text{h}$ (85t/h) (P-430)

控制范围：P-230 $\leq 700\text{m}^3/\text{h}$ (499t/h)，P-312 $\leq 407\text{m}^3/\text{h}$ (271t/h)，P-330 $\leq 200\text{m}^3/\text{h}$ (152t/h)，P-403 $\leq 270\text{m}^3/\text{h}$ (213t/h)，P-430 $\leq 100\text{m}^3/\text{h}$ (85t/h)。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: vac. residue flowrate (FIC51501), quench oil flowrate (FIC43301)

相关参数：渣油流量 FIC51501、急冷油流量 FIC43301。

Control mode: single loop control is employed for FIC41006.

控制方式：FIC41006 采用单回路控制。

Adjustment method: when the reading of FIC41006 is greater than the SP, further close FV41006; when the reading of FIC41006 is less than the SP, further open FV41006.

调节方法：当 FIC41006 高于设定值时，关小 FV41006；当 FIC41006 低于设定值时，开大 FV41006。

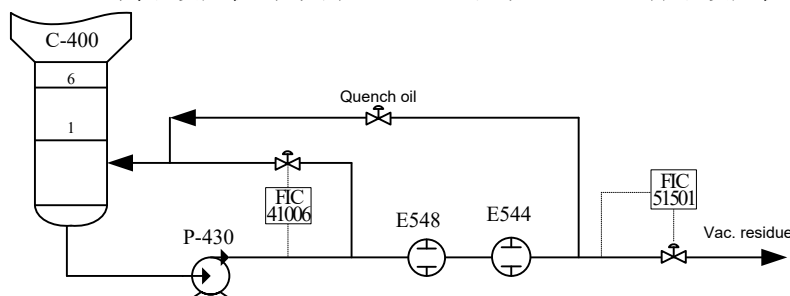


Figure 83 Pump Minimum Flowrate Control Flow Chart

图 83 泵最小流量控制流程图

2.4.6.39 Control for Atm. heater tubes confluence temperature 常压炉出口温度控制

The confluence temperature of the Atm. heater tubes is the key control parameter for the Atm.

heater and the Atm.. At the specified lift for the Atm., the higher the confluence temperature of the Atm. heater tubes and the larger the over-vaporization rate of the Atm. are, the better the distillation performance the upper part of the feed section will be, however, the energy consumption will be higher accordingly. In addition, if the confluence temperature of the Atm. heater tubes is too high, this does not facilitate the safe operation of the Atm. heater; if the confluence temperature of the Atm. heater tubes is too low, it is difficult to ensure satisfactory distillation performance for heavy diesel, while a part of light components could be carried into the vac. column, affecting normal operation of the vac. column. During process operation, the outlet temperature of the Atm. heater shall be properly controlled depending on the properties of the crude and the quality of Heavy diesel. The confluence temperature of the Atm. heater tubes will be mainly affected by the feed flowrate to the Atm. heater, the final heat exchange temperature, the fuel gas flowrate and fuel oil flowrate to the Atm. heater, and the properties of the feedstock to the Atm. heater. During process operation, it is required to make comprehensive analysis on various factors for adjusting the outlet temperature of the Atm. heater in a timely manner.

常压炉出口温度是常压炉和常压塔的关键控制参数，在常压塔拔出率一定时，常压炉出口温度越高，过气化率越大，进料段上部分馏效果越好，但相应的能耗也越高，此外常压炉出口温度过高也不利于常压炉的安全生产；常压炉出口温度过低，则难以保证常三线的分馏效果，同时会将部分轻组分带至减压塔，影响减压塔的操作。在实际生产过程中，应根据原油的性质和常三线产品的质量情况合理控制常压炉出口温度。常压炉出口温度主要受常压炉进料量、换热终温、常压炉燃料气和燃料油流量、常压炉进料性质影响。操作中要综合分析各项因素，及时调节常压炉出口温度。

Control range: 355~365°C

控制范围：355~365°C。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: fuel oil flowrate, fuel gas flowrate, Pre-Dist bottom oil flowrate

相关参数：燃料油流量、燃料气流量、常压炉炉管流量。

Control mode: the Atm. heater (F-301) is divided into two independent fire boxes, and each fire box includes 4 branches. The confluence temperature (TIC30106) of 4 branches in fire box 1# and the confluence temperature (TIC30105) of 4 branches in fire box 2# are controlled respectively. TIC30106 is cascaded to the fuel oil flow controller (FIC86303) or the fuel gas pressure controller (PIC86301) for fire box 1#, and TIC30105 is cascaded to the fuel gas oil flow controller (FIC86403) or the fuel gas pressure controller (PIC86401) for fire box 2#.

控制方式：常压炉 F-301 分两个独立的辐射室炉膛，每个炉膛四路炉管，1#炉膛炉管总出口温度 TIC30106 和 2#炉膛 TIC30105 分别控制，TIC30106 与 1#炉膛的燃料油流量 FIC86303 或者燃料气压力 PIC86301 组成串级控制回路，TIC30105 与 2#炉膛的燃料油流量 FIC86403 或者燃料气压力 PIC86401 组成串级控制回路。

Adjustment method: when the reading of TIC30106 is greater than the SP, further close

FV86303 or PV86301; when the reading of TIC30106 is less than the SP, further open FV86303 or PV86301. When the reading of TIC30105 is greater than the SP, further close FV86403 or PV86401; when the reading of TIC30105 is less than the SP, further open FV86403 or PV86401.

调节方法：当 TIC30106 高于设定值时，关小 FV86303 或者 PV86301；当 TIC30106 低于设定值时，开大 FV86303 或者 PV86301。当 TIC30105 高于设定值时，关小 FV86403 或者 PV86401；当 TIC30105 低于设定值时，开大 FV86403 或者 PV86401。

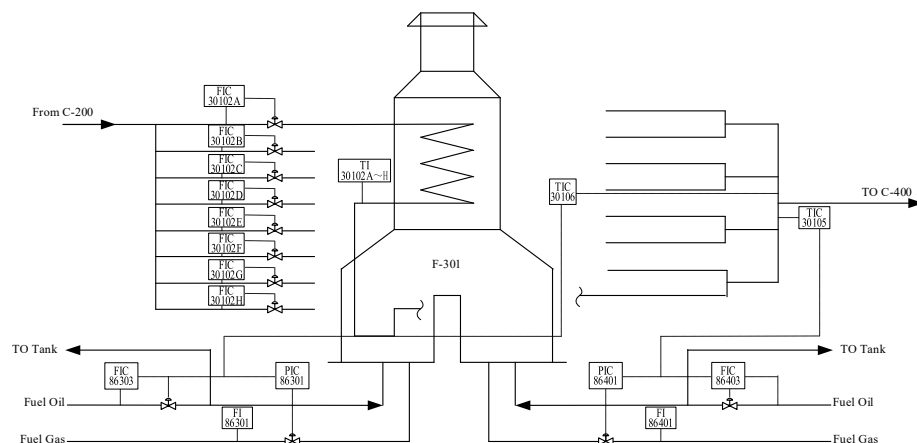


Figure 84 Atm. heater Tubes Confluence Temperature Control Flow Chart

图 84 常压炉出口温度控制流程图

Table 56 Abnormal phenomena, reasons and treatment method

表 56 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Atm. heater tubes outlet temperature rises rapidly. 常压炉出口温度快速升高	The fuel gas pressure (PIC86001) rises rapidly. 燃料气压力 PIC86001 快速升高	Switch the fuel gas pressure controller from "Auto" mode to "Manual" mode, further close PIC86001 to reduce the pressure. 将燃料气压力自动控制改手动，关小 PIC86001 开度，降低压力
	The fuel oil pressure (PIC86201) rises rapidly. 燃料油压力 PIC86201 快速上升	Switch the fuel oil pressure controller from "Auto" mode to "Manual" mode, further close PIC86201 to reduce the pressure. 将燃料油压力自动控制改手动，关小 PIC86201 开度，降低压力

Table 56 (continued) Abnormal phenomena, reasons and treatment method**表 56 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Atm. heater tubes outlet temperature rises rapidly 常压炉出口温度快速升高	The feed flowrate to the Atm. heater reduces rapidly. 常压炉进料量快速变小	If the feed flowrate to the Atm. heater reduces, slowly increase the opening of the control valve. 如果常压炉进料量下降, 缓慢提高阀位开度
		If the flow control valves (FV30102A~H) fail, contact the instrument maintenance staff for troubleshooting, and the field operators shall adjust the opening of the hand valves with reference to the readings of the Pre-Dist. flowmeters. 若控制阀 FV30102A~H 失灵, 联系仪表处理, 外操对照一次表调节手阀开度
		If the feed pump P-230A/B experiences evacuation, first switch to the standby pump, and then take actions per the response procedures for pump evacuation. 如果进料泵 P-230A/B 抽空, 首先切换备用泵, 然后参照泵抽空异常处理
	F-301 fuel gas /fuel oil control valve fails. F-301 燃料气、燃料油控制阀失灵	Switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. 失灵的调节阀改付线控制, 联系仪表维护人员检修
	The composition of the fuel gas changes, or oil is entrained in the fuel gas. 燃料气组成变化或带油	If the composition of the fuel gas changes, properly adjust the fuel gas flowrate. If oil is entrained in the fuel gas, frequently cut the liquid from D-861, and open trace steam to D-861. 如果燃料气组成变化, 适当调整燃料气用量, 如果燃料气带油, 加强 D-861 切液, 开蒸汽 D-861 伴热

Table 56 (continued) Abnormal phenomena, reasons and treatment method**表 56 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Atm. heater tubes outlet temp. drops rapidly. 常压炉出口温度快速降低	The fuel gas pressure (PIC86001) drops rapidly. 燃料气压力 PIC86001 快速降低	If the fuel gas pressure (PIC86001) is low, increase the fuel gas pressure, and if the control valve (PV86001) fails, contact the instrument maintenance staff for troubleshooting. 如果燃料气压力 PIC86001 低, 提高燃料气压力; 若控制阀 PV86001 失灵, 联系仪表处理
	The fuel oil pressure (PIC86201) rises rapidly. 燃料油压力 PIC86201 快速上升	Switch the fuel oil pressure controller from "Auto" mode to "Manual" mode, further close PIC86201 to reduce the pressure. 将燃料油压力自动控制改手动, 关小 PIC86201 开度, 提高压力
	The feed flowrate to the Atm. heater increases rapidly. 常压炉进料量快速增大	If the feed flowrate to the Atm. heater increases rapidly, further close FV30102A ~ H to reduce the feed flowrate. 如果进料量快速变大, 关小 FV30102A~H, 降低进料量
		If the flow control valves (FV30102A~H) fail, contact the instrument maintenance staff for troubleshooting, and the field operators shall adjust the opening of the hand valves with reference to the readings of the Pre-Dist. flowmeters. 控制阀 FV30102A~H 失灵, 联系仪表处理, 外操对照一次表调节手阀开度
	The air preheating system fails. 空气预热系统故障	If the air preheating system fails, take actions per the treatment procedures for failed air preheating system. 如果空气预热系统故障, 参照空气预热系统异常处理
	The composition of the fuel gas changes. 燃料气组成变化	If the composition of the fuel gas changes, properly adjust the fuel gas flowrate. 如果燃料气组成变化, 适当调整燃料气用量

Table 56 (continued) Abnormal phenomena, reasons and treatment method**表 56 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Atm. heater tubes confluence drops rapidly. 常压炉出口温度快速降低	The flue gas duct damper or the air duct damper is improperly adjusted. 烟道挡板或通风门调节不当	If the flue gas duct damper or the air duct damper is improperly adjusted, make adjustment in a timely manner to properly control the negative pressure in the fire box and the oxygen content in the flue gas. 如果烟道挡板或通风门调节不当, 及时进行调整, 控制好炉膛负压及烟气氧含量
	F-301 fuel gas/fuel oil control valve fails. F-301 燃料气、燃料油控制阀失灵	Switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. 失灵的调节阀改付线控制, 联系仪表维护人员检修
The Atm. heater tubes confluence changes greatly. 常压炉出口温度大幅变化	The fuel gas or fuel oil pressure varies greatly. 燃料气、燃料油压力大幅变化	Control the fuel gas or fuel oil pressure stable. 平稳控制燃料气、燃料油压力
	The feed flowrate to the Atm. heater varies greatly. 常压炉进料量大幅变化	Control the feed flowrate to the atmospheric Atm. heater stable. 平稳控制常压炉进料量
	F-301 fuel gas/fuel oil control valve fails. F-301 燃料气、燃料油控制阀失灵	Switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. 控制阀改付线控制, 联系仪表处理
	The composition of the fuel gas changes. 燃料气组成变化	If the properties of the fuel gas change, properly adjust the fuel gas flowrate. 如果燃料气性质变化, 适当调整燃料气用量

2.4.6.40 Control for Vac. heater tubes confluence temperature 减压炉出口温度控制

The confluence temperature of the Vac. heater tubes is the key control parameter for the Vac. heater and the vac. column. At the specified lift for the vac. column, the higher the confluence temperature of the Vac. heater tubes and the larger the over-vaporization rate of the Vac. heater are, the better the distillation performance the upper part of the feed section will be, however, the energy consumption will be higher accordingly. In addition, if the confluence temperature of the Vac. heater tubes is too high, this does not facilitate the safe operation of the Vac. heater; if

the confluence temperature of the Vac. heater tubes is too low, this may reduce the lift of the vac. column. During process operation, the confluence temperature of the Vac. heater tubes shall be properly controlled depending on the properties of the crude, FBP of HVGO and 5% point of the VR. The confluence temperature of the Vac. heater tubes will be mainly affected by the feed flowrate to the Vac. heater, the Atm. bottom temperature, the fuel gas flowrate and fuel oil flowrate to the Vac. heater, and the properties of the feedstock to the Vac. heater. During process operation, it is required to make comprehensive analysis on various factors for adjusting the outlet temperature of the Vac. heater in a timely manner.

减压炉出口温度是常压炉和常压塔的关键控制参数，在减压塔拔出率一定时，减压炉出口温度越高，过气化率越大，进料段上部分馏效果越好，但相应的能耗也越高，此外减压炉出口温度过高也不利于减压炉的安全运行；减压炉出口温度过低，则减压塔拔出率降低。在实际生产过程中，应根据原油的性质和减三线终馏点和减压渣油 5%点合理控制减压炉出口温度。减压炉出口温度主要受减压炉进料量、常压塔底温度、减压炉燃料气和燃料油流量、减压炉进料性质影响。操作中要综合分析各项因素，及时调节减压炉出口温度。

Control range: 375 ~ 390°C, to be controlled in conjunction with the temperature (TI40103A ~ H: ≤410°C) of each branch from the Vac. column.

控制范围: 375~390°C，结合减压分支温度 TI40103A~H (≤410°C) 进行控制。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: fuel oil flowrate, fuel gas flowrate, flowrate in Vac. heater tubes

相关参数: 燃料油流量、燃料气流量、减压炉炉管流量。

Control mode: the Vac. heater (F-401) is divided into two independent fire boxes, and each fire box includes 4 branches. For fire box 1#, two confluence temperature controllers (TIC40105A and TIC40105B) are provided (each confluence temperature controller is served for 2 branches), and a Vac. heater tubes confluence temperature control interlock (THS40105) is provided and will act depending on the higher value of TIC40105A and TIC40105B. THS40105 is cascaded to the fuel gas pressure controller (PIC86501) for fire box 1#. For fire box 2#, two confluence temperature controllers (TIC40106A and TIC40106B) are provided (each confluence temperature controller is served for 2 branches), and a Vac. heater tubes confluence temperature control interlock (THS40106) is provided and will act depending on the higher value of TIC40106A and TIC40106B. THS40106 is cascaded to the fuel gas pressure controller (PIC86601) for fire box 2#.

控制方式: 减压炉 F-401 分两个独立的辐射室炉膛，每个炉膛四路炉管，1#炉膛每两路炉管设置一个温度控制 TIC40105A 和 TIC40105B，并采用高选控制 THS40105 (TIC40105A 和 TIC40105B 测量值高的一个进行控制)，THS40105 与 1#炉膛的燃料气压力 PIC86501 组成串级控制回路。2#炉膛每两路炉管设置一个温度控制 TIC40106A 和 TIC40106B，并采用高选控制 THS40106，THS40106 与 2#炉膛的燃料气压力 PIC86601 组成串级控制回路。

Adjustment method: when the reading of TIC30106 is greater than the SP, further close FV86303 or PV86301; when the reading of TIC30106 is less than the SP, further open FV86303

or PV86301. When the reading of TIC30105 is greater than the SP, further close FV86403 or PV86401; when the reading of TIC30105 is less than the SP, further open FV86403 or PV86401.

调节方法：当 TIC30106 高于设定值时，关小 FV86303 或者 PV86301；当 TIC30106 低于设定值时，开大 FV86303 或者 PV86301。当 TIC30105 高于设定值时，关小 FV86403 或者 PV86401；当 TIC30105 低于设定值时，开大 FV86403 或者 PV86401。

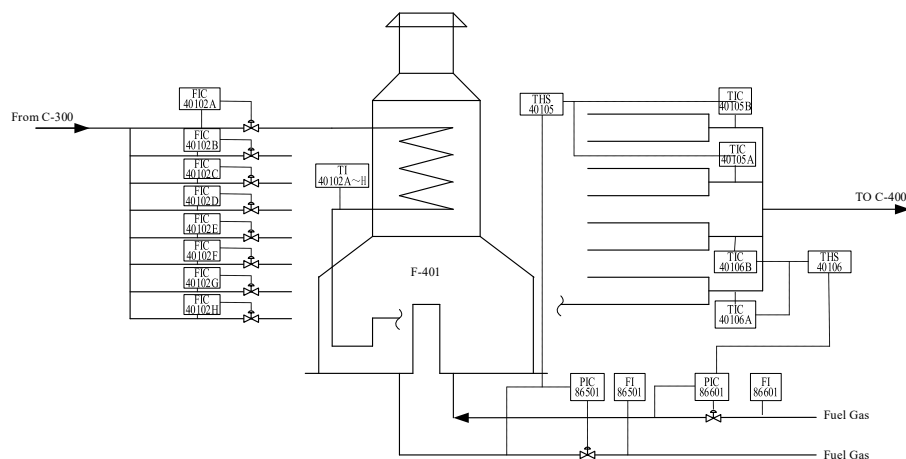


Figure 84 Vac. heater Tubes Confluence Temperature Control Flow Chart

图 84 减压炉出口温度控制流程图

Table 57 Abnormal phenomena, reasons and treatment method

表 57 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Vac. heater tubes outlet temperature rises rapidly. 减压炉出口温度快速升高	The fuel gas pressure (PIC86001) rises rapidly. 燃料气压力 PIC86001 快速升高	Switch the fuel gas pressure controller from “Auto” mode to “Manual” mode, further close PIC86001 to reduce the pressure. 将燃料气压力自动控制改手动，关小 PIC86001 开度，降低压力
	The feed flowrate to the Vac. heater reduces rapidly. 减压炉进料量快速变小	If the feed flowrate to the Vac. heater reduces, slowly increase the opening of the control valve. 如果减压炉进料量下降，缓慢提高阀位开度

Table 57 (continued) Abnormal phenomena, reasons and treatment method**表 57 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Vac. heater tubes outlet temperature rises rapidly. 减压炉出口温度快速升高	The feed flowrate to the Vac. heater reduces rapidly. 减压炉进料量快速变小	If the flow control valves (FV40102A~H) fail, contact the instrument maintenance staff for troubleshooting, and the field operators shall adjust the opening of the hand valves with reference to the readings of the Pre-Dist. flowmeters. 若控制阀 FV40102A~H 失灵, 联系仪表处理, 外操对照一次表调节手阀开度
		If the feed pump P-330A/B experiences evacuation, first switch to the standby pump, and then take actions per the response procedures for pump evacuation. 如果进料泵 P-330A/B 抽空, 首先切换备用泵, 然后参照泵抽空异常处理
	F-401 fuel gas control valve fails. F-401 燃料气控制阀失灵	Switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. 失灵的调节阀改付线控制, 联系仪表维护人员检修
	The composition of the fuel gas changes, or oil is entrained in the fuel gas. 燃料气组成变化或带油	If the composition of the fuel gas changes, properly adjust the fuel gas flowrate. If oil is entrained in the fuel gas, frequently cut the liquid from D-861, and open trace steam to D-861. 如果燃料气组成变化, 适当调整燃料气用量, 如果燃料气带油, 加强 D-861 切液, 开蒸汽 D-861 伴热

Table 57 (continued) Abnormal phenomena, reasons and treatment method**表 57 （续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The Vac. heater tubes confluence temperature drops rapidly. 减压炉出口温度快速降低	The fuel gas pressure (PIC86001) drops rapidly. 燃料气压力 PIC86001 快速降低	If the fuel gas pressure (PIC86001) is low, increase the fuel gas pressure, and if the control valve (PV86001) fails, contact the instrument maintenance staff for troubleshooting. 如果燃料气压力 PIC86001 低, 提高燃料气压力; 若控制阀 PV86001 失灵, 联系仪表处理
	The feed flowrate to the Vac. heater increases rapidly. 减压炉进料量快速增大	If the feed flowrate to the Vac. column increases rapidly, further close FV40102A ~ H to reduce the feed flowrate. 如果进料量快速变大, 关小 FV40102A~H, 降低进料量
		If the flow control valves (FV40102A~H) fail, contact the instrument maintenance staff for troubleshooting, and the field operators shall adjust the opening of the hand valves with reference to the readings of the Pre-Dist. flowmeters. 控制阀 FV40102A~H 失灵, 联系仪表处理, 外操对照一次表调节手阀开度
	The air preheating system fails. 空气预热系统故障	If the air preheating system fails, take actions per the treatment procedures for failed air preheating system. 如果空气预热系统故障, 参照空气预热系统异常处理

Table 57 (continued) Abnormal phenomena, reasons and treatment method**表 57 （续）异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
	The composition of the fuel gas changes. 燃料气组成变化	If the composition of the fuel gas changes, properly adjust the fuel gas flowrate. 如果燃料气组成变化, 适当调整燃料气用量
	The flue gas duct damper or the air duct damper is improperly adjusted. 烟道挡板或通风门调节不当	If the flue gas duct damper or the air duct damper is improperly adjusted, make adjustment in a timely manner to properly control the negative pressure in the fire box and the oxygen content in the flue gas. 如果烟道挡板或通风门调节不当, 及时进行调整, 控制好炉膛负压及烟气氧含量
	F-401 fuel gas control valve fails. F-401 燃料气控制阀失灵	Switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. 失灵的调节阀改付线控制, 联系仪表维护人员检修
The Vac. heater tubes confluence temperature changes greatly. 减压炉出口温度大幅变化	The fuel gas pressure varies greatly. 燃料气压力大幅变化	Control the fuel gas pressure stable. 平稳控制燃料气压力
	The feed flowrate to the Atm. heater varies greatly. 常压炉进料量大幅变化	Control the feed flowrate to the Atm. heater stable. 平稳控制常压炉进料量
	F-401 fuel gas/fuel oil control valve fails. F-401 燃料气、燃料油控制阀失灵	Switch to the bypass valve for control, and contact the instrument maintenance staff for troubleshooting. 控制阀改付线控制, 联系仪表处理
	The composition of the fuel gas changes. 燃料气组成变化	If the properties of the fuel gas change, properly adjust the fuel gas flowrate. 如果燃料气性质变化, 适当调整燃料气用量

2.4.6.41 Control for fuel gas pressure 燃料气压力控制

Control of stable fuel gas pressure is essential for ensuring stable operation of the heaters.

燃料气压力平稳控制对于加热炉的稳定运行至关重要。

Control range: 0.35~0.5MPa

控制范围：0.35~0.5MPa。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: fuel gas flowrate

相关参数：燃料气流量。

Control mode: single loop control is employed for PIC86001.

控制方式：PIC86001 采用单回路控制。

Adjustment method: when the reading of PIC86001 is greater than the SP, further close PV86001; when the reading of PIC86001 is less than the SP, further open PV86001.

调节方法：当 PIC86001 高于设定值时，关小 PV86001；当 PIC86001 低于设定值时，开大 PV86001。

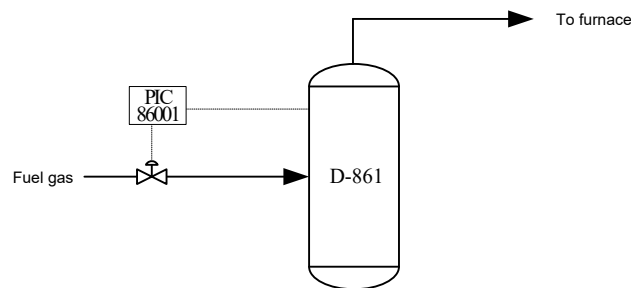


Figure 85 Fuel Gas Pressure Control Flow Chart

图 85 燃料气压力控制流程图

2.4.6.42 Control for fuel oil pressure 燃料油压力控制

Control of stable fuel oil pressure is essential for ensuring stable operation of the Atm. heater.

燃料油压力平稳控制对于常压炉的稳定运行至关重要。

Control range: 0.6~1.0MPa

控制范围：0.6~1.0MPa。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: fuel oil flowrate

相关参数：燃料油流量。

Control mode: single loop control is employed for PIC82001.

控制方式：PIC82001 采用单回路控制。

Adjustment method: when the reading of PIC86201 is greater than the SP, further open PV86201; when the reading of PIC86201 is less than the SP, further close PV86201.

调节方法：当 PIC86201 高于设定值时，开大 PV86201；当 PIC86201 低于设定值时，关小 PV

86201。

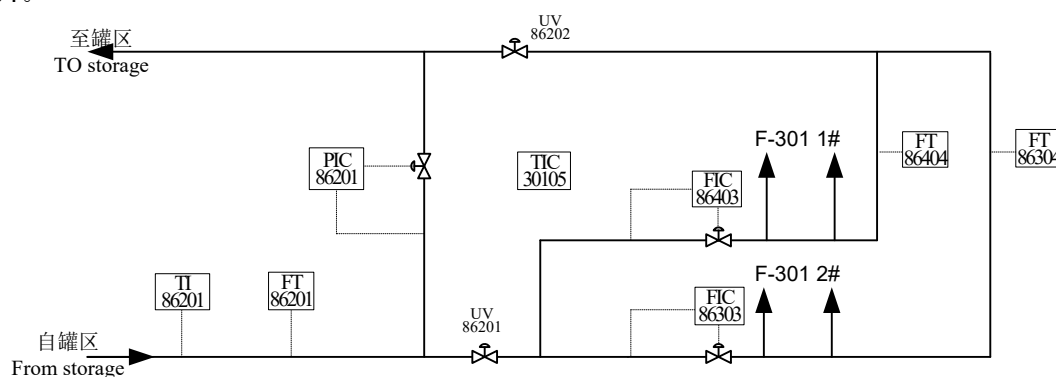


Figure 86 Fuel Oil Pressure Control Flow Chart

图 86 燃料油压力控制流程图

2.4.6.43 Control for pressure difference between fuel oil and atomizing steam in Atm. heater 常压炉燃料油、雾化蒸汽压差控制

The pressure difference (PDI86305 and PDI86405) between fuel oil and atomizing steam in the Atm. heater is deemed as an important parameter for controlling the atomization performance of the fuel oil burners. Proper pressure difference can ensure complete burning of the fuel oil burners.

常压炉燃料油与雾化蒸汽压差 PDI86305、PDI86405 是控制燃料油火嘴雾化效果的重要参数，合适的压差能够保证燃料油火嘴充分燃烧。

Control range: $\geq 0.08\text{MPa}$

控制范围: $\geq 0.08\text{MPa}$ 。

Control target: per the operating instructions

控制目标: 操作指令。

Related parameters: fuel oil pressure, steam pressure

相关参数: 燃料油压力、蒸汽压力。

Control mode: single loop control is employed for PDI86305 and PDI86405.

控制方式: PDI86305 和 PDI86405 采用单回路控制。

Adjustment method: when the reading of PDI86305 or PDI86405 is greater than the SP, further close PDV86305 or PDV86405; when the reading of PDI86305 or PDI86405 is less than the SP, further open PDV86305 or PDV864051.

调节方法: 当 PDI86305 或 PDI86405 高于设定值时, 关小 PDV86305 或 PDV86405; 当 PDI86305 或 PDI86405 低于设定值时, 开大 PDV86305 或 PDV86405。

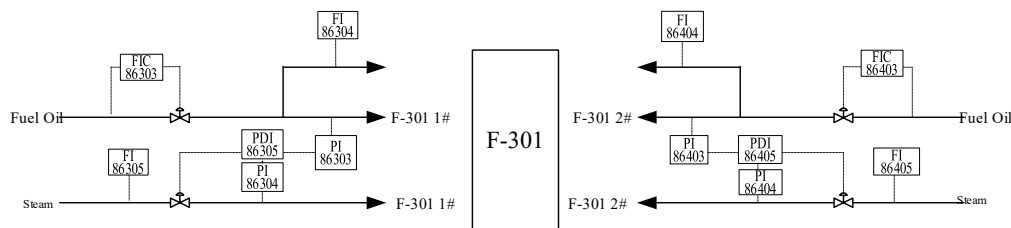


Figure 87 Flow Chart of Control for Pressure Difference between Fuel Oil and Atomizing Steam in Atm. heater

图 87 常压炉燃料油、雾化蒸汽压差控制流程图

2.4.6.44 Control of negative pressure in fire box of heater 加热炉炉膛负压

The negative pressures (PIC86908 for atm. heater; PIC86918 for vac. heater) in the fire box of heater are deemed as the main control parameters for the heater. If the negative pressure in the fire box is too small, this may lead to poor burning performance of the burners, flashed flame and even positive pressure in the fire box, such that the operators may be injured by the backfire from the fire box during walk-around inspection; if the negative pressure in the fire box is too large, this may cause high oxygen content in the flue gas to reduce the thermal efficiency of the heater. During process operation, the operators shall adjust the opening of the flue gas duct damper of the heater in a timely manner depending on the oxygen content in the fire box and the burning performance of the burners.

加热炉炉膛负压（常压炉 PIC86908，减压炉 PIC86918）是加热炉的主要控制参数，炉膛负压过小时会导致加热炉火嘴燃烧不好，火焰发飘，严重时容易造成炉膛正压，操作员巡检时容易回火伤人；炉膛负压过大时会造成加热炉烟气氧含量超标，加热炉热效率下降。生产过程中，操作人员应根据加热炉氧含量和火焰燃烧情况实时调节加热炉烟道挡板开度、调节引风机转速。

Control range: -20~-80Pa

控制范围：-20~-80Pa

Control target: -30Pa

控制目标：-30Pa

Related parameters: opening of the butterfly valves (HV86908AB、HV86918AB) on the flue gas duct, opening of induced draft fan inlet butterfly valve (HC86909), rotational speed of K-802。

相关参数：烟道挡板蝶阀 HV908AB、HV86918AB 的开度，引风机入蝶阀 HC86909 的开度,引风机转速。

Control mode: the negative pressure in the fire box is manually adjusted by the butterfly valves (PV86908AB、PV86918AB) on the flue gas duct and the induced draft fan inlet butterfly valve (HC86909).

控制方式：炉膛负压采用烟道挡板蝶阀 PV86908AB、PV86918AB 和引风机入口蝶阀 HC86909 采用手动进行调节。

Adjustment method: when the negative pressure in F-301 is high, further close PV86908AB, when the negative pressure in F-301 is low, further open PV86908AB. When the negative pressure in F-401 is high, further close PV86918AB; when the negative pressure in F-401 is low,

further open PV86918AB. When the negative pressure in both F-301 and F-401 is higher or lower, adjust the induced draft fan inlet butterfly valve HC86909 at the same time, or adjust rotational speed of K-802

调节方法: 当 F-301 炉膛负压高时, 关小 PV86908AB, 当 F-301 炉膛负压低时, 开大 HC86901、PV86908AB。当 F-401 炉膛负压高时, 关小 PV86918AB, 当 F-401 炉膛负压低时, 开大 PV86918AB。当 F-301 和 F-401 均较高或者较低时, 可以同时调节引风机入口蝶阀 HC86909, 或者调整引风机的转速。

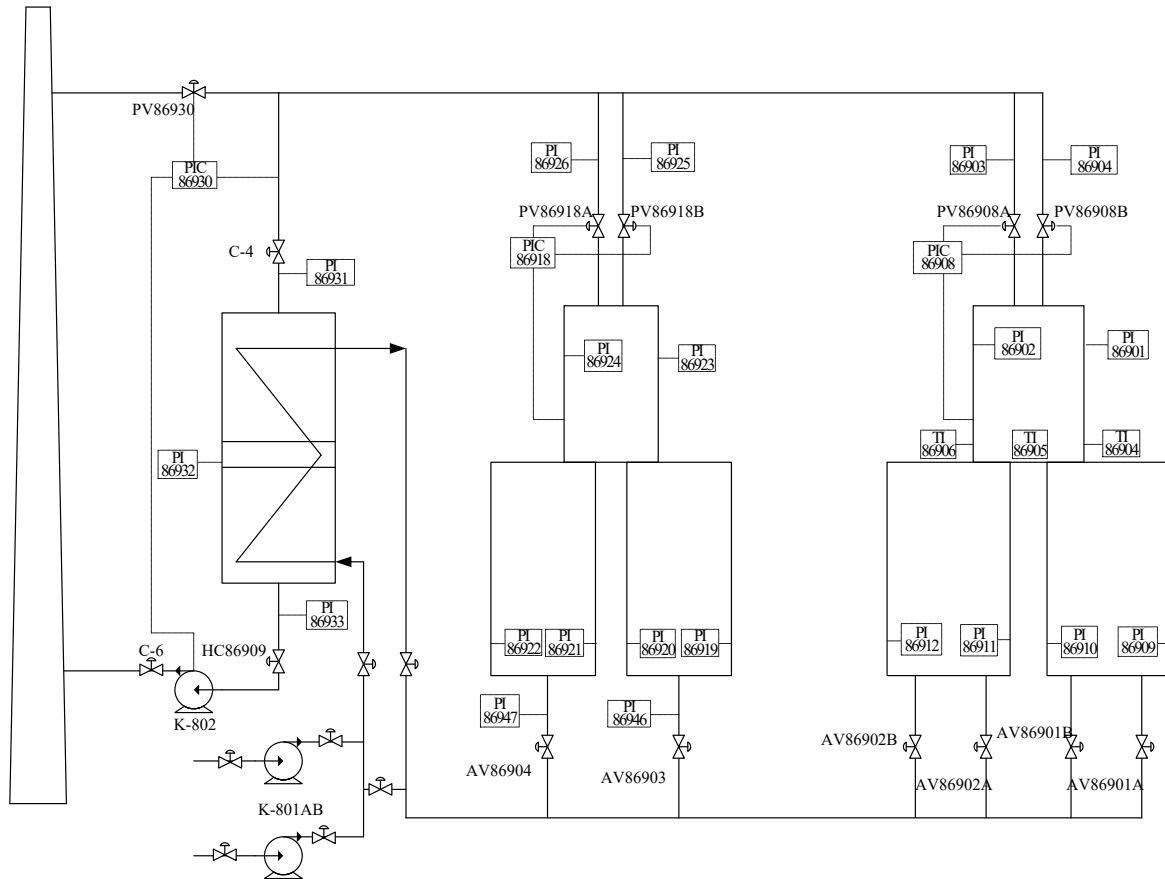


Figure 88 Flow Chart of Control for Negative Pressure in Heater Chamber

图 88 加热炉炉膛负压控制流程图

Table 58 Abnormal phenomena, reasons and treatment method**表 58 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The negative pressure in the fire chamber rises. 炉膛负压上升	The air flowrate to the heater reduces. 入炉空气量下降	Further open the butterfly valves (AV86901AB、AV86902AB、AV86903、AV86904) on the air duct to properly control the oxygen content in the fire box. If the oxygen content is normal, adjust PV86908AB、PV86918AB, rotational speed of K-802 and HC86909. 开大两炉氧含量挡板 AV86901AB、AV86902AB、AV86903、AV86904, 控制好氧含量。如氧含量正常, 应调节 PV86908AB、PV86918AB、引风机转速、HC86909。
	The flue gas duct damper fails. 烟道挡板出现故障	Take actions per the treatment procedures for failed flue gas duct damper. 按照烟道挡板出故障处理。
	The operation load of the heater reduces. 加热炉负荷下降	Properly adjust the flue gas duct damper in a timely manner depending on the operation load variation. 应及时根据负荷变化, 调节好烟道挡板
	The negative pressure indicator fails. 负压表指示失灵	Contact the instrument maintenance staff for troubleshooting. Adjust the negative pressure indicator based on the reading of the field pressure gauge. 联系仪表处理, 根据现场表进行调节
The negative pressure in the fire chamber changes greatly. 炉膛负压大幅变化	The air flowrate to the heater varies greatly. 入炉空气量大幅变化	Control the air flowrate to the heater stable to properly control the oxygen content. 平稳控制入炉空气量, 控制好氧含量。
	The flue gas duct damper fails. 烟道挡板出现故障	Take actions per the treatment procedures for failed flue gas duct damper. 按照烟道挡板出故障处理。
	The negative pressure indicator fails. 负压表指示失灵	Contact the instrument maintenance staff for troubleshooting. Adjust the negative pressure indicator based on the reading of the field pressure gauge. 联系仪表处理, 根据现场表进行调节。

Table 58 (continued) Abnormal phenomena, reasons and treatment method**表 58 (续) 异常原因及处理方法**

Abnormalities	Causes	Response actions:
The negative pressure in the fire chamber drops. 炉膛负压下降	The air flowrate to the heater increases. 入炉空气量上升	Further close the butterfly valves (AV86901AB、AV86902AB、AV86903、AV86904) on the air duct to properly control the oxygen content in the fire box. If the oxygen content is normal, adjust PV86908AB、PV86918AB, .rotational speed of K-802 and HC86909. 关小两炉氧含量挡板 AV86901AB、AV86902AB、AV86903、AV86904, 控制好氧含量。如氧含量正常, 调节 PV86908AB、PV86918AB、引风机转速、HC86909。
	The flue gas duct damper fails. 烟道挡板出现故障	Take actions per the treatment procedures for failed flue gas duct damper. 按照烟道挡板出故障处理。
	The Induced draft fan fails. 引风机故障	Take actions per the treatment procedures for failed induced draft fan. 按引风机故障处理。
	The negative pressure indicator fails. 负压表指示失灵	Contact the instrument maintenance staff for troubleshooting. Adjust the negative pressure indicator based on the reading of the field pressure gauge. 联系仪表处理, 根据现场表进行调节。
	The operation load of the heater increases. 加热炉负荷上升	Properly adjust the flue gas duct damper in a timely manner depending on the operation load variation. 应及时根据负荷变化, 调节好烟道挡板
	Liquid is entrained in the fuel gas. 燃料气带液	Drain the condensate from the HP fuel gas KO drum in a timely manner, and put the heat tracer and heating coil of the HP fuel gas KO drum into service. 高瓦分液罐及时排凝, 并且将其伴热及加热盘管投用。

2.4.6.45 Control for oxygen content in the heater 加热炉氧含量

A key control parameter of the heater, the oxygen content in the heater directly reflects the excess air quantity in the heater. The higher the oxygen content and the larger the excess air quantity are, the lower the efficiency of the heater will be. In addition, if the oxygen content in the heater is too high, scales on the surface of the heater tubes may be easily peered off to accelerate corrosion to the heater tubes under the action of oxidation; if the oxygen content in the heater is too low, incomplete combustion may occur to reduce the efficiency of the heater

and even have black smoke to be emitted from the chimney. Therefore, the oxygen content in the heater shall be properly controlled by adjusting the opening of the flue gas duct dampers and air supply butterfly valves of the heater depending on the negative pressure in the fire box and the burning performance of the burners.

加热炉氧含量是加热炉的关键控制参数，它直接反映了加热炉的空气过剩情况，氧含量越高，空气过剩量越大，加热炉热效率越低，此外氧含量过高还容易造成炉管氧化剥皮，加速炉管的氧化腐蚀；氧含量过小会导致燃烧不完全，炉效率降低，严重时烟囱冒黑烟。加热炉氧含量要根据炉膛负压情况和火焰燃烧情况，合理调节烟道档板和加热炉供风蝶阀。

Control range: 2~4% (for fuel gas); 2~5% (for fuel oil)

控制范围：烧燃料气时 2~4%，烧燃料油时 2~5%。

Control target: per the operating instructions

控制目标：操作指令。

Related parameters: negative pressure in fire box of heater, pressure of the main air duct (PIC86940), pressure of the secondary air duct (PI86942~86947)

相关参数：炉膛负压、主风道压力 (PIC86940)、二级风道压力 (PI86942~86947)

Control mode: the oxygen content in the heater (AIC86901, AIC86902, AIC86903, AIC86904) is automatic controlled by the butterfly valves (AV86901AB、AV86902AB、AV86903、AV86904) on the air duct.

控制方式：加热炉氧含量 (AIC86901、AIC86902、AIC86903、AIC86904) 采用风道蝶阀 AV86901AB、AV86902AB、AV86903、AV86904 自动控制。

Adjustment method: when the oxygen content in the heater rises, further close the corresponding butterfly valves on the air duct; when the oxygen content in the heater drops, further open the corresponding butterfly valves on the air duct. And additionally, the oxygen content in the heater can be adjusted by regulating the opening of the air blower inlet butterfly valve at the same time.

调节方法：加热炉氧含量上升时，应关小相应的风道蝶阀开度，加热炉氧含量下降时，应开大相应的风道蝶阀开度。可同时结合鼓风机入蝶阀调整加热炉氧含量。

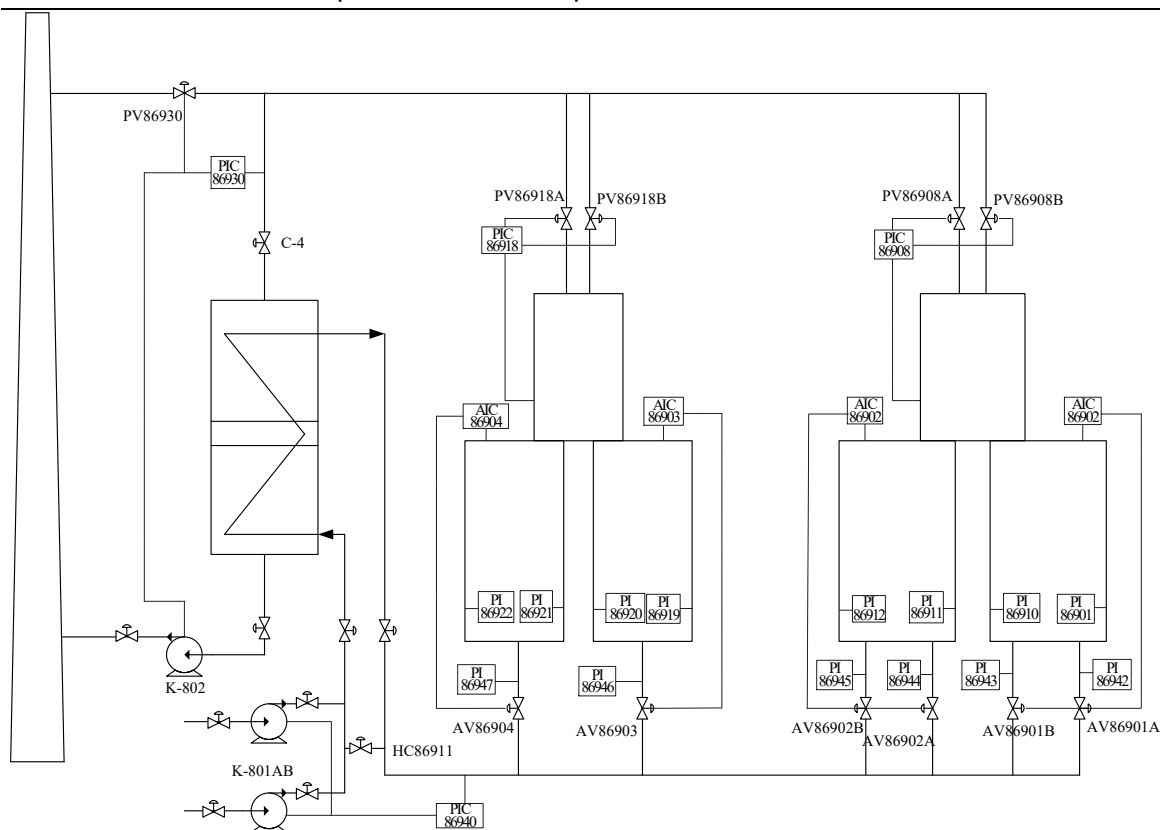


Figure 89 Flow Chart of Control for Oxygen Content in Heater

图 89 加热炉氧含量控制流程图

Table 59 Abnormal phenomena, reasons and treatment method

表 59 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The oxygen content in the heater rises rapidly. 加热炉氧含量快速上升	The butterfly valve on the air duct fails. 风道蝶阀故障	Further close the butterfly valve on the air duct to properly control the oxygen content in the heater, and contact the instrument maintenance staff for troubleshooting. 关小风道蝶阀开度，控制好氧含量，联系仪表处理。
	The air blower inlet butterfly valve fails. 鼓风机入口蝶阀故障	Further close the air blower inlet butterfly valve to properly control the oxygen content in the heater, and contact the instrument maintenance staff for troubleshooting. 关小鼓风机入口蝶阀开度，控制好氧含量，联系仪表处理。

Table 59 (continued) Abnormal phenomena, reasons and treatment method**表 59 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The oxygen content in the heater rises rapidly. 加热炉氧含量快速上升	The fuel flowrate to the heater reduces. 入炉燃料流量降低	Investigate the involved causes, and take proper actions in a timely manner. 查找燃料量降低的原因，及时处理。
	The operation load of the heater reduces, but the oxygen content in the heater has not been adjusted in a timely manner. 加热炉负荷降低，调整不及时	Properly adjust the oxygen content in the fire box depending on the operation load of the heater. 根据负荷调节好加热炉炉膛氧含量
	The oxygen content indicator fails. 氧含量表指示失灵	Contact the instrument maintenance staff for troubleshooting. Properly increase the air flowrate to the fire box to ensure that no smoke is generated whenever possible. 联系仪表处理，炉膛供风应适当增加，尽量确保不冒烟。
The oxygen content in the heater drops rapidly. 加热炉氧含量快速下降	The butterfly valve on the air duct fails. 风道蝶阀故障	Further open the butterfly valve on the air duct to properly control the oxygen content in the heater, and contact the instrument maintenance staff for troubleshooting. 开大风道蝶阀开度，控制好氧含量，联系仪表处理
	The air blower inlet butterfly valve fails. 鼓风机入口蝶阀故障	Further open the air blower inlet butterfly valve to properly control the oxygen content in the heater, and contact the instrument maintenance staff for troubleshooting. 开大鼓风机入口蝶阀开度，控制好氧含量，联系仪表处理。
	The fuel flowrate to the heater increases. 入炉燃料流量增大	Investigate the involved causes, and take proper actions in a timely manner. 查找燃料油增大的原因，及时处理。

Table 59 (continued) Abnormal phenomena, reasons and treatment method**表 59 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The oxygen content in the heater drops rapidly. 加热炉氧含量快速下降	The operation load of the heater increases, but the oxygen content in the heater has not been adjusted in a timely manner. 加热炉负荷上升, 调整不及时	Properly adjust the oxygen content in the fire box depending on the operation load of the heater. 根据负荷调节好加热炉炉膛氧含量
	Liquid is entrained in the gas. 瓦斯带液	Drain the condensate from the gas KO drum in a timely manner, and put the heat tracer and the heating coil of the gas KO drum into service. 瓦斯罐及时切液, 并且将其伴热及加热蒸汽投用。
	The oxygen content indicator fails. 氧含量表指示失灵	Contact the instrument maintenance staff for troubleshooting. Properly increase the air flowrate to the fire box to ensure that no smoke is generated whenever possible. 联系仪表处理, 炉膛供风应适当增加, 尽量确保不冒烟。
The oxygen content in the fire box fluctuates greatly. 加热炉氧含量大幅度波动	The butterfly valve on the air duct and the air blower inlet butterfly valve fail. 风道蝶阀和鼓风机入口蝶阀故障	Manually adjust the opening of butterfly valves on the air duct and the air duct dampers to properly control the oxygen content in the heater, and contact the instrument maintenance staff for troubleshooting. 手动调好风蝶阀和挡板的开度, 控制好氧含量, 联系仪表处理。
	The fuel flowrate to the heater fluctuates. 入炉燃料流量波动	Investigate the involved causes, and take proper actions in a timely manner. 查找燃料流量的原因, 及时处理。

2.4.6.46 Control for vac. column top vacuum degree 减压塔顶真空度控制

As a key operating parameter of the vac. column, the vac. column top vacuum degree will produce direct influence on the normal operation of the vac. column. If the vac. column top vacuum degree is too low, this may cause reduced lift and increased VR quantity. The vac. column top vacuum degree is deemed as one of the key parameters to measure the operating conditions of the vac. column. High vacuum degree is essential for the process unit to achieve deep lift. The vacuum degree is the difference between the atmospheric pressure and the absolute pressure (residual pressure) of the Vac. column.

减压塔顶真空度是减压塔的关键操作参数，减顶真空度控制的好坏直接影响整个减压塔的操作。减压塔顶真空度过低会导致，减压拔出率降低，渣油量增加。减压塔真空度是衡量减压运行情况的关键参数之一，装置要实现深拔，高真空是必不可少的。真空度是大气压与减压塔绝对压力（残压）的差值。

Control range: $\geq 4.0\text{kPa (a)}$

控制范围： $\geq 4.0\text{kPa (a)}$ 。

Control target: $\geq 2.5\text{kPa (a)}$

控制目标： $\geq 2.5\text{kPa (a)}$ 。

Related parameters: Vac. heater tubes confluence temperature, steam pressure, column top temperature, back pressure of the vac. OVHD gas.

相关参数：减压炉出口温度、抽真空蒸汽压力、塔顶温度、减顶气背压。

Adjustment method: as the vac. column top vacuum degree may be affected by many factors, it shall be adjusted mainly depending on the vac. column top temperature, the steam pressure in the vacuuming system, the temperature of the stream from each condenser, the back pressure of the vac. OVHD gas, and the operation load of the process unit. In general, it is favorable for achieving a high vacuum degree in the Vac. column by reducing the vac. column top temperature, the temperature of the stream from each condenser and the back pressure of the Vac. column OVHD gas. Excessively high or low steam pressure is not favorable for vacuuming operation, specifically, low steam pressure, insufficient power energy, high steam pressure and high temperature of the stream from the condenser may all cause poor vacuum degree at the top of the Vac. column and even "reverse steam flow".

调节方法：影响减压真空度的因素很多，需要根据不同的情况进行调节，主要从控制减压塔顶温度、抽真空压力、各级冷凝器的冷后温度、减顶气的背压、装置的负荷等。一般而言，降低减顶温度、各级冷凝器冷后温度、减顶气背压等，有利于实现减压塔高真空。蒸汽压力过高和过低均不利于抽真空，蒸汽压力低，动力不足，蒸汽压力过高，冷凝器冷后温度高，均可能造成减顶真空度差，甚至“倒汽”。

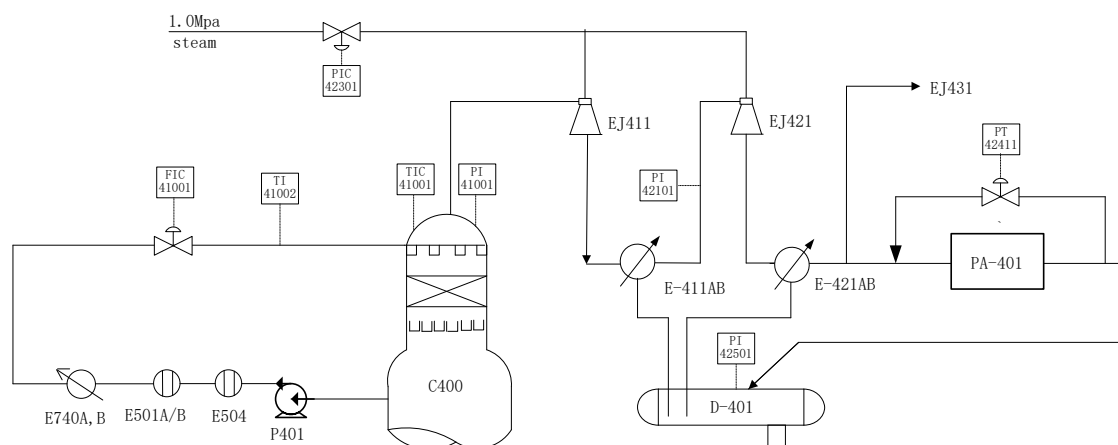


Figure 90 Flow Chart of Control for Vac. column OVHD Vacuum Degree

图 90 减压塔顶真空度控制流程图

Table 60 Abnormal phenomena, reasons and treatment method

表 60 异常原因及处理方法

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The vac. column top vacuum degree decreases rapidly. 减压塔顶真空度快速降低	The Vac. heater tubes confluence temperature rises rapidly. 减压炉出口温度快速升高	Stabilize the Vac. heater tubes confluence temperature. 稳定减压炉出口温度
	The steam pressure (PIC-42301) in the vacuuming system decreases rapidly. 抽真空蒸汽压力 PIC-42301 快速降低	If the steam pressure (PIC-42301) in the vacuuming system is low, contact the Production Scheduling Department to adjust the 1.0MPa steam pressure. 如果抽真空蒸汽压力 PIC-42301 低,联系计划调度部调整 1.0MPa 蒸汽压力。
	The column top temperature (TIC-41001) rises rapidly. 塔顶温度 TIC-41001 快速升高	Decrease the temperature of the LVGO PA from the water cooler, and increase the LVGO PA flowrate. 降低减一中水冷器冷后温度,增加减一中流量。

Table 60 (continued) Abnormal phenomena, reasons and treatment method**表 60 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The vac. column top vacuum degree decreases rapidly. 减压塔顶真空度快速降低	The temperature of the oil vapor from the cooler in the vacuuming system is high. 抽真空系统油气冷后温度高	Increase CCW flowrate to decrease the temperature of the oil vapor from the cooler. 开大循环水量，降低冷后温度。 If the temperature of CCW to the process unit is high, contact the Production Scheduling Department to adjust CCW temperature; if CCW pressure is low, contact the Production Scheduling Department to adjust CCW pressure. 如循环水进装置温度高，联系计划调度部调整循环水温度；如循环水压力低，联系计划调度部调整循环水压力。
	The back pressure of the downstream process flow is high. 后路背压高	If the process flows downstream the non-condensable piping is blocked, switch the non-condensable to the LP fuel gas piping system. 如果不凝气后路不畅，不凝气改到低压瓦斯管网。 If the screw compressor for non-condensable service fails, switch the non-condensable to the LP fuel gas piping system, and contact the maintenance staff to repair the screw compressor for non-condensable service. 如果不凝气螺杆压缩机故障，不凝气改到低压瓦斯管网，联系处理不凝气螺杆压缩机。
	D-401 water seal is damaged. D-401 水封破坏	Make up water to D-401 to establish the water seal. D-401 补水，建立水封。
	The steam ejector fails or steam intrudes into the steam ejector. 抽真空器故障或抽真空器串汽	If the steam ejectors (EJ-411 and EJ-421) malfunction, adjust the operation; if the steam ejectors (EJ-411 and EJ-421) fail, shut down the steam ejectors for maintenance; if EJ-1431 fails, switch to the liquid ring vacuum pump. 如果抽真空器 EJ-411、EJ-421 故障，调整操作，若失效，停工检修；如果 EJ-1431 故障，切换至液环真空泵。

Table 60 (continued) Abnormal phenomena, reasons and treatment method**表 60 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The vac. column top vacuum degree decreases rapidly. 减压塔顶真空度快速降低	The liquid ring vacuum pump PA-401 fails. 液环真空泵 PA-401 故障	Switch the 3rd stage liquid ring vacuum pump to the steam ejector. 三级抽真空切换至蒸汽抽真空。
	The temperature of the steam to the steam ejector is low and steam carries water. 抽真空蒸汽温度低带水	If the temperature (TI42301) of the steam to the steam ejector is low and steam carries water, frequently cut water from the steam ejector. 如果抽真空蒸汽温度 TI42301 低带水, 加大蒸汽切水。
	The Vac. column bottom level is too high. 塔底液位过高	Reduce the Vac. column bottom level. 降低减压塔液位。
	The Vac. column OVHD system leaks. 减压系统泄漏	If the Vac. column OVHD system leaks, find out the leakage point for repair in a timely manner. 如果系统泄漏, 查找漏点及时处理。
	The steam flowrate (FIC-41005) purged to the bottom of the Vac. column becomes larger. 塔底吹汽量 FIC-41005 变大	If the steam flowrate (FIC-41005) purged to the bottom of the Vac. column becomes larger, reduce the steam flowrate purged to the bottom of the Vac. column; if the control valve fails, contact the instrument maintenance staff for troubleshooting. 如果塔底吹汽量 FIC-41005 变大, 减小塔底吹汽量; 如果控制阀失灵, 及时联系仪表处理。
	The Vac. column bottom temperature is high. 减压塔底温度高	If the Vac. column bottom temperature is high, adjust the quench oil flowrate to decrease the Vac. column bottom temperature. 如果塔底温度高, 调整急冷油量, 降低减压塔底温度。

Table 60 (continued) Abnormal phenomena, reasons and treatment method**表 60 (续) 异常原因及处理方法**

Abnormalities 异常现象	Causes 原因	Response actions: 处理方法
The vac. column top vacuum degree decreases rapidly. 减压塔顶真空度快速降低	The Vac. column pumparound flowrate reduces or no pumparound is available in the Vac. column. 中段回流量降低或没有量	If the LVGO PA flow controller (FIC-41001), the MVGO PA flow controller (FIC-41002) or the Vac. column pumparounds 3# flow controller (FIC-41003) fails to cause reduced flowrate, take actions per the treatment procedures for reduced LVGO PA, 2# and 3# flowrates. 如果减一中、减二中、三中回流控制阀 FIC-41001、FIC-41002、FIC-41003 失灵流量降低, 参照减一中、减二中、三中回流量小处理。
		If the LVGO PA, 2# and 3# filters are blocked, first switch to the standby filters, then contact the maintenance staff to clean these blocked filters. 如果减一中、减二中、三中回流过滤器堵, 切换过滤器, 联系清理。
		If the distillate pumps (P-401, P-402 and P-403) experience evacuation, take actions per the response procedures for Vac. column distillate pump evacuation. 如果各侧线泵 P-401、P-402、P-403 抽空, 参照异常现象减压侧线泵抽空处理。
	The lift of the Atm. reduces or the operation load of the Vac. column is too large. 常压拔出率降低或减压塔负荷太大	If the operation load of the Vac. column is large, reduce the operation load accordingly. 如果减压塔负荷大, 适当降低负荷
		If the lift of the Atm. reduces, optimize the operating conditions of the Atm. to increase the lift of the Atm. 如果常压拔出率降低, 优化常压操作, 提高常压拔出率。
	The vacuum pressure gauge fails. 真空度仪表故障	If the vacuum pressure gauge fails, contact the instrument maintenance staff for troubleshooting in a timely manner. 如果真空度仪表指示失灵, 联系仪表及时处理。

2.4.7 Description to interlock control logic 装置自保的逻辑控制规程

2.4.7.1 Control logic for some emergency shutdown interlocks for material leakage 部分物料泄漏紧急切断联锁控制逻辑

Some emergency shutdown interlocks for material leakage are provided in this process unit to shut down the involved pumps and cut off material to/from the leakage point in case that the material leakage may cause major accidents such as fire.

本装置设置了部分物料泄漏引起事故的紧急切断联锁逻辑控制，在发生泄漏引发着火等重大事故时，实现相关机泵的停运和切断泄漏部位的前后物料。

(1) Interlock control logic for pneumatic emergency isolation valves

气动紧急隔离阀联锁逻辑控制

Pneumatic emergency isolation valves are provided at the Pre-Dist. OVHD reflux drum (D-202) bottom, the Pre-Dist. OVHD product drum (D-201) bottom, the Atm. distillate 2# draw port on C-301, the Atm. OVHD reflux drum (D-302) bottom, the Atm. OVHD product drum (D-301) bottom and the Atm. distillate 2# draw port on C-400. In case of an emergency, take actions per the following steps (take the emergency isolation valve at D-202 bottom as an example).

装置在初顶回流罐 D-202 罐底、初顶产品罐 D-201 罐底、C-301 塔常二线抽出口、常顶回流罐 D-302 罐底、常顶产品罐 D-301 罐底、C-400 塔减二线抽出口设置了气动紧急隔离阀。当发生紧急事故时，采用以下步骤进行操作（以 D-202 罐底紧急隔离阀为例）。

1) The field operator presses the Field Hard Push Button to Close Valve (HK-23001) to close UV-23001 and stop P-222AB.

外操现场启动关阀硬按钮 HK-23001，关闭 UV-23001，停运 P-222AB。

2) When the Field Hard Push Button to Close Valve (HK-23001) cannot be pressed, the panel operators press the SIS Soft Push Button to Close Valve to close UV-23001 and stop P-222AB. 当现场关阀无法启动时，内操在 SIS 系统启动 SIS 关阀软按钮，关闭 UV-23001，停运 P-222AB。

3) When it is required to resume normal operation after the emergency conditions are eliminated, the panel operators press the SIS Soft Push Button for Reset to open UV-23001.

当相关事故消除，需要恢复运行时，内操在 SIS 系统启动 SIS 复位软按钮，打开 UV-23001。

4) The field operators start P-222A/B at the site.

外操现场启动 P-222AB。

Table 61 SIS Interlock Number**表 61 SIS 连锁位号**

S/N 序号	Field Hard Push Button to Close Valve 现场关阀硬按钮	SIS Soft Push Button to Close Valve SIS 关阀软按钮	SIS Soft Push Button for Reset SIS 复位软按钮	Position of Emergency Isolation Valve 紧急隔离阀位置	Tag No. of Emergency Isolation Valve 紧急隔离阀编号	Tag No. of Process Pump 工艺泵编号
1	HK-23001	HS-23001	RS-23001	D-202 bottom D-202 罐底	UV-23001	P-222AB
2	HK-23101	HS-23101	RS-23101	D-201 bottom D-201 罐底	UV-23101	P-221AB
3	HK-31102	HS-31102	RS-31102	Light diesel draw port on C-301 C-301 常二线抽 出	UV-31102	P-302AB
4	HK-33001	HS-33001	RS-33001	D-302 bottom D-302 罐底	UV-33001	P-322AB
5	HK-33101	HS-33101	RS-33101	D-301 bottom D-301 罐底	UV-33101	P-321AB
6	HK-41003	HS-41003	RS-41003	MVGO draw port on C-400 C-400 减二线抽 出	UV-41003	P-402AB

(2) Interlock control logic for motor operated emergency isolation valves

电动紧急隔离阀连锁逻辑控制

Motor operated emergency isolation valves are provided at the Pre-Dist. bottom, the Atm. bottom, the vac. column bottom, the atm. overflash oil draw port on the Atm., the atm. PA#2 draw port on the Atm., the heavy diesel draw port on the stripper, the HVGO draw port on the vac. column and the vac. overflash oil draw port on D-402. In case of an emergency, take actions per the following steps (take the emergency isolation valve at the Pre-Dist. bottom as an example).

装置在初馏塔塔底、常压塔塔底、减压塔塔底、常压塔常四线抽出口、常压塔常二中抽出口、汽提塔常三线抽出口、减压塔减三线抽出口、D-402 减四线抽出口设置等部位设置了调动紧急隔离阀。当发生紧急事故时，采用以下步骤进行操作（以初馏塔底紧急隔离阀为例）。

1) The field operators press the Field Hard Push Button to Close Valve (HK-21001) to close XMV-21001 and stop P-230AB.

外操现场启动关阀硬按钮 HK-21001，关闭 XMV-21001，停运 P-230AB。

2) When the Field Hard Push Button to Close Valve (HK-21001) cannot be pressed, the panel operators press the SIS Soft Push Button to Close Valve (HS-21001) to close XMV-21001 and stop P-230AB.

当现场关阀无法启动时，内操在 SIS 系统启动 SIS 关阀软按钮 HS-21001，关闭 XMV-21001，停运 P-230AB。

3) When it is required to resume normal operation after the emergency conditions are eliminated, the panel operators press the SIS Soft Push Button for Reset (RS-21001) to open XMV-21001.

当相关事故消除，需要恢复运行时，内操在 SIS 系统启动 SIS 复位软按钮 RS-21001，打开 XMV-21001。

4) The field operators start P-222A/B at the site.

外操现场启动 P-230AB。

Table 62 SIS Interlock Number

表 62 SIS 连锁位号

S/N 序号	Field Hard Push Button to Close Valve 现场关阀硬按钮	SIS Soft Push Button to Close Valve SIS 关阀软按钮	SIS Soft Push Button for Reset SIS 复位软按钮	Position of Emergency Isolation Valve 紧急隔离阀位置	Tag No. of Emergency Isolation Valve 紧急隔离阀编号	Tag No. of Process Pump 工艺泵编号
1	HK-21001	HS-21001	RS-21001	C-200 bottom C-200 塔底	XMV-21001	P-230AB
2	HK-31001	HS-31001	RS-31001	C-300 bottom C-300 塔底	XMV-31001	P-330AB
3	HK-31002	HS-31002	RS-31002	Atm. overflash oil draw port on C- 300 C-300 常四线	XMV-31002	P-304AB
5	HK-31101	HS-31101	RS-31101	Heavy diesel draw port on C- 300 C-300 常三线抽 出	XMV-31101	P-303AB
6	HK-41001	HS-41001	RS-41001	C-400 bottom C-400 塔底	XMV-41001	P-430AB

Table 62 (continued) SIS Interlock Number**表 62 (续) SIS 连锁位号**

S/N 序号	Field Hard Push Button to Close Valve 现场关阀硬按钮	SIS Soft Push Button to Close Valve SIS 关阀软按钮	SIS Soft Push Button for Reset SIS 复位软按钮	Position of Emergency Isolation Valve 紧急隔离阀位置	Tag No. of Emergency Isolation Valve 紧急隔离阀编号	Tag No. of Process Pump 工艺泵编号
7	HK-41002	HS-41002	RS-41002	HVGO draw port on C-400 C-400 减三线抽 出	XMV-41002	P-403AB
8	HK-41101	HS-41101	RS-41101	Vac overflash oil draw port on D- 402 D-402 减四线抽 出	XMV-41101	P-404AB

2.4.7.2 Interlock control logic for heaters 加热炉自保连锁控制逻辑**(1) Interlock control logic for pilots of Atm. heater**

常压炉长明灯自保连锁

The interlock systems for the pilots of the Atm. heater will be actuated when the following conditions are met:

当达到以下条件时，常压炉长明灯自保连锁启动：

1) When the pressure indicators (PI86307A/B/C) of the fuel gas to the pilot in fire box 1# of the Atm. heater indicate low-low pressure ($\leq 0.03\text{MPa}$, 2oo3).

至常压炉 1#炉膛长明灯燃料气压力 PI86307ABC 低低 ($\leq 0.03\text{MPa}$ ，三取二)。

2) When the pressure indicators (PI86407ABC) of the fuel gas to the pilot in fire box 2# of the Atm. heater indicate low-low pressure ($\leq 0.03\text{MPa}$, 2oo3).

至常压炉 2#炉膛长明灯燃料气压力 PI86407ABC 低低 ($\leq 0.03\text{MPa}$ ，三取二)。

3) When the field operators press the Field Hard Push Button (HK-86002) for the pilots of the Atm. heater.

外操启动常压炉现场长明灯操作柱 HK-86002。

4) When the panel operators press the SIS Emergency Shutdown Push Button (HS-86002) for the pilots of the Atm. heater.

内操启动 SIS 系统常压炉长明灯紧急停车按钮 HS-86002。

Interlock actions:

连锁启动结果：

1) Close the fuel gas shutoff valve (UV-86002) for the pilots of the Atm. heater.

关闭常压炉长明灯燃料气切断阀 UV-86002。

2) Close the main fuel gas shutoff valve (UV-86001) of the Atm. heater.

关闭常压炉主燃料气切断阀 UV-86001。

3) Close the LP fuel gas shutoff valve (UV86101).

关闭低压燃料气切断阀 UV86101。

4) Close the tail gas shutoff valve (UV86005).

关闭双脱尾气切断阀 UV86005。

When it is required to restart the Atm. heater after the interlocking conditions are eliminated:

当联锁条件消除，需要重新启动常压炉时：

1) The field operators close the pilot hand valve, main fuel gas hand valve, LP fuel gas hand valve and tail gas hand valve of each burner of the Atm. heater at the site.

外操关闭常压炉现场每台燃烧器的长明灯、主燃料气、低压燃料气、双脱尾气的手阀。

2) The panel operators press the Reset Push Button (RS-86002) for the pilots of the Atm. heater via SIS system.

内操在 SIS 系统启动常压炉长明灯复位按钮 RS-86002。

3) The field operators fire the Atm. heater according to the heater firing procedure.

外操按照加热炉点火程序点火。

(2) Interlock control logic for fuel oil burners of Atm. heater

常压炉燃料油自保联锁

The interlock systems for the fuel oil burners of the Atm. heater will be actuated when the following conditions are met:

当达到以下条件时，常压炉燃料油自保联锁启动：

1) When the pressure indicators (PI86308A/B/C) of the fuel oil to fire box 1# of the Atm. heater indicate low-low pressure ($\leq 0.3\text{MPa}$, 2oo3).

至常压炉 1#炉膛燃料油压力 PI86308ABC 低低 ($\leq 0.3\text{MPa}$ ，三取二)。

2) When the pressure indicators (PI86408A/B/C) of the fuel oil to fire box 2# of the Atm. heater indicate low-low pressure ($\leq 0.3\text{MPa}$, 2oo3).

至常压炉 2#炉膛燃料油压力 PI86408ABC 低低 ($\leq 0.3\text{MPa}$ ，三取二)。

3) When the pressure difference indicator (PDI-86306) between atomizing steam and fuel oil indicates low-low pressure difference ($\leq 0.04\text{MPa}$).

雾化蒸汽与燃料油压差 PDI-86306 低低 ($\leq 0.04\text{MPa}$)。

4) When the field operators press the Field Hard Push Button (HK-86201) for the fuel oil burners.

外操启动现场燃料油操作柱 HK-86201。

5) When the panel operators press the SIS Emergency Shutdown Push Button (HS-86002) for the fuel oil burners.

内操启动 SIS 系统燃料油紧急停车按钮 HS-86002。

6) When the pressure indicators (PISA86905A/B/C) at the top of fire box 1# of the Atm. heater indicate high-high pressure ($\geq 200\text{Pa}$, 2oo3).

常压炉 1#炉膛辐射室顶部压力 PISA86905ABC 高高 ($\geq 200\text{Pa}$ ，三取二)。

7) When the pressure indicators (PISA86906A/B/C) at the top of fire box 2# of the Atm. heater indicate high-high pressure ($\geq 200\text{Pa}$, 2oo3).

常压炉 2#炉膛辐射室顶部压力 PISA86906ABC 高高 ($\geq 200\text{Pa}$, 三取二)。

8) When the temperature indicators (TISA86907A/B/C) at the top of fire box 1# of the Atm. heater indicate high-high temperature ($\geq 960^{\circ}\text{C}$, 2oo3).

常压炉 1#炉膛辐射室顶部温度 TISA86907ABC 高高 ($\geq 960^{\circ}\text{C}$, 三取二)。

9) When the temperature indicators (TISA86908A/B/C) at the top of fire box 2# of the Atm. heater indicate high-high temperature ($\geq 960^{\circ}\text{C}$, 2oo3).

常压炉 2#炉膛辐射室顶部温度 TISA86908ABC 高高 ($\geq 960^{\circ}\text{C}$, 三取二)。

10) When the feed flow controllers (FIC30102A~D) on the passes to fire box 1# of the Atm. heater indicate low-low flowrate ($\leq 35\text{t/h}$, 2oo4).

常压炉 1#炉膛分支进料流量 FIC30102A~D 低低 ($\leq 35\text{t/h}$, 四取二)。

11) When the feed flow controllers (FIC30102E~H) on the passes to fire box 2# of the Atm. heater indicate low-low flowrate ($\leq 35\text{t/h}$, 2oo4).

常压炉 2#炉膛分支进料流量 FIC30102E~H 低低 ($\leq 35\text{t/h}$, 四取二)。

12) When the temperature indicators (TI30103AA ~ AC) on pass A of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 A 路分支温度 TI30103AA~AC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

13) When the temperature indicators (TI30103BA ~ BC) on pass B of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 B 路分支温度 TI30103BA~BC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

14) When the temperature indicators (TI30103CA ~ CC) on pass C of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 C 路分支温度 TI30103CA~CC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

15) When the temperature indicators (TI30103DA ~ DC) on pass D of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 D 路分支温度 TI30103DA~DC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

16) When the temperature indicators (TI30103EA ~ EC) on pass E of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 E 路分支温度 TI30103EA~EC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

17) When the temperature indicators (TI30103FA ~ FC) on pass F of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 F 路分支温度 TI30103FA~FC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

18) When the temperature indicators (TI30103GA ~ GC) on pass G of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 G 路分支温度 TI30103GA~GC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

19) When the temperature indicators (TI30103HA ~ HC) on pass H of the Atm. heater indicate high-high temperature ($\geq 400^{\circ}\text{C}$, 2oo3).

常压炉 H 路分支温度 TI30103HA~HC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

Interlock actions:

联锁结果:

1) Close the fuel oil shutoff valve (UV-86201) of the Atm. heater.

关闭常压炉燃料油切断阀 UV-86201。

2) Close the atomizing steam shutoff valve (UV-86301) of fire box 1# of the Atm. heater.

关闭常压炉 1#炉膛雾化蒸汽切断阀 UV-86301。

3) Close the atomizing steam shutoff valve (UV-86401) of fire box 2# of the Atm. heater.

关闭常压炉 2#炉膛雾化蒸汽切断阀 UV-86401。

When it is required to restart the Atm. heater after the interlocking conditions are eliminated:

当联锁条件消除，需要重新启动常压炉时:

1) The field operators close the fuel oil hand valve and atomizing steam hand valve of each burner at the site.

外操关闭常压炉现场每台燃烧器的燃料油和雾化蒸汽手阀。

2) The panel operators press the Reset Push Button (RS-86002) for the fuel oil burners via SIS system.

内操启动 SIS 系统燃料油复位按钮 RS-86201。

3) The field operators fire the Atm. heater according to the heater firing procedure.

外操按照燃料油点火程序点火。

(3) Interlock control logic for main fuel gas burners of Atm. heater

常压炉主燃料气自保联锁控制逻辑

The interlock systems for the main fuel gas burners of the Atm. heater will be actuated when the following conditions are met:

当达到以下条件时，常压炉主燃料气自保联锁启动:

1) When the pressure indicators (PI86306A/B/C) of the main fuel gas to fire box 1# of the Atm. heater indicate low-low pressure ($\leq 0.01\text{MPa}$, 2oo3).

至常压炉 1#炉膛主燃料气压力 PI86306ABC 低低 ($\leq 0.01\text{MPa}$, 三取二)。

2) When the pressure indicators (PI86406A/B/C) of the main fuel gas to fire box 2# of the Atm. heater indicate low-low pressure ($\leq 0.01\text{MPa}$, 2oo3).

至常压炉 2#炉膛主燃料气压力 PI86406ABC 低低 ($\leq 0.01\text{MPa}$, 三取二)。

3) When the field operators press the Field Hard Push Button (HK-86001) for the main fuel gas burners.

外操启动常压炉现场主燃料气操作柱 HK-86001。

4) When the panel operators press the SIS Emergency Shutdown Push Button (HS-86002) for main fuel gas burners.

内操启动 SIS 系统常压炉主燃料气紧急停车按钮 HS-86001。

5) When the level indicator (LI86001) of the fuel gas KO drum (D-861) indicates high-high level.

燃料气分液罐 D-861 液位 LI86001 高高。

6) When the feed flow controllers (FIC30102A~D) on the passes to fire box 1# of the Atm. heater indicate low-low flowrate ($\leq 35\text{t/h}$, 2oo4).

常压炉 1#炉膛分支进料流量 FIC30102A~D 低低 ($\leq 35\text{t/h}$, 四取二)。

7) When the feed flow controllers (FIC30102E~H) on the passes to fire box 2# of the Atm. heater indicate low-low flowrate ($\leq 35\text{t/h}$, 2oo4).

常压炉 2#炉膛分支进料流量 FIC30102E~H 低低 ($\leq 35\text{t/h}$, 四取二)。

8) When the pressure indicators (PISA86905A/B/C) at the top of fire box 1# of the Atm. heater indicate high-high pressure ($\geq 200\text{Pa}$, 2oo3).

常压炉 1#炉膛辐射室顶部压力 PISA86905ABC 高高 ($\geq 200\text{Pa}$, 三取二)。

9) When the pressure indicators PISA86906A/B/C) at the top of fire box 2# of the Atm. heater indicate high-high pressure ($\geq 200\text{Pa}$, 2oo3).

常压炉 2#炉膛辐射室顶部压力 PISA86906ABC 高高 ($\geq 200\text{Pa}$, 三取二)。

10) When the temperature indicators (TISA86907A/B/C) at the top of fire box 1# of the Atm. heater indicate high-high temperature ($\geq 960^\circ\text{C}$, 2oo3).

常压炉 1#炉膛辐射室顶部温度 TISA86907ABC 高高 ($\geq 960^\circ\text{C}$, 三取二)。

11) When the temperature indicators (TISA86908A/B/C) at the top of fire box 2# of the Atm. heater indicate high-high temperature ($\geq 960^\circ\text{C}$, 2oo3).

常压炉 2#炉膛辐射室顶部温度 TISA86908ABC 高高 ($\geq 960^\circ\text{C}$, 三取二)。

12) When the temperature indicators (TI30103AA ~ AC) on pass A of the Atm. heater indicate high-high temperature ($\geq 400^\circ\text{C}$, 2oo3).

常压炉 A 路分支温度 TI30103AA~AC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

13) When the temperature indicators (TI30103BA ~ BC) on pass B of the Atm. heater indicate high-high temperature ($\geq 369^\circ\text{C}$, 2oo3).

常压炉 B 路分支温度 TI30103BA~BC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

14) When the temperature controllers (TI30103CA ~ CC) on pass C of the Atm. heater indicate high-high temperature ($\geq 369^\circ\text{C}$, 2oo3).

常压炉 C 路分支温度 TI30103CA~CC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

15) When the temperature indicators (TI30103DA ~ DC) in branch D of the Atm. heater indicate high-high temperature ($\geq 400^\circ\text{C}$, 2oo3).

常压炉 D 路分支温度 TI30103DA~DC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

16) When the temperature indicators (TI30103EA ~ EC) on pass E of the Atm. heater indicate high-high temperature ($\geq 400^\circ\text{C}$, 2oo3).

常压炉 E 路分支温度 TI30103EA~EC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

17) When the temperature indicators (TI30103FA ~ FC) on pass F of the Atm. heater indicates high-high temperature ($\geq 400^\circ\text{C}$, 2oo3).

常压炉 F 路分支温度 TI30103FA~FC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

18) When the temperature indicators (TI30103GA ~ GC) on pass G of the Atm. heater indicate high-high temperature ($\geq 400^\circ\text{C}$, 2oo3).

常压炉 G 路分支温度 TI30103GA~GC 高高 ($\geq 400^\circ\text{C}$, 三取二)。

19) When the temperature indicators (TI30103HA ~ HC) on pass H of the Atm. heater indicate high-high temperature ($\geq 400^\circ\text{C}$, 2oo3).

常压炉 H 路分支温度 TI30103HA~HC 高高 ($\geq 400^{\circ}\text{C}$, 三取二)。

Interlock actions:

联锁结果:

1) Close the main fuel gas shutoff valve (UV-86001) of the Atm. heater.

关闭常压炉主燃料气切断阀 UV-86001。

2) Close the LP fuel gas shutoff valve (UV86101).

关闭低压燃料气切断阀 UV86101。

3) Close the tail gas shutoff valve (UV86005).

关闭双脱尾气切断阀 UV86005。

When it is required to restart the Atm. heater after the interlocking conditions are eliminated:

当联锁条件消除, 需要重新启动常压炉时:

1) The field operators close the main fuel gas hand valve, LP fuel gas hand valve and tail gas hand valve of each burner at the site.

外操关闭现场常压炉每台燃烧器的主燃料气、低压燃料气、双脱尾气的手阀。

2) The panel operators press the Reset Push Button (RS-86001) for the main fuel gas burners via SIS system.

内操在 SIS 系统启动常压炉主燃料气复位按钮 RS-86001。

3) The field operators fire the Atm. heater according to the heater firing procedure.

外操按照加热炉点火程序点火。

(4) Interlock control logic for pilots of Vac. heater

减压炉长明灯自保联锁

The interlock systems for the pilots of the Vac. heater will be actuated when the following conditions are met:

当达到以下条件时, 减压炉长明灯自保联锁启动:

1) When the pressure indicators (PI86504A/B/C) of the fuel gas to the pilot in fire box 1# of the Vac. heater indicate low-low pressure ($\leq 0.03\text{MPa}$, 2oo3).

至减压炉 1#炉膛长明灯燃料气压力 PI86504ABC 低低 ($\leq 0.03\text{MPa}$, 三取二)。

2) When the pressure indicators (PI86604A/B/C) of the fuel gas to the pilot in fire box 2# of the Vac. heater indicate low-low pressure ($\leq 0.03\text{MPa}$, 2oo3).

至减压炉 2#炉膛长明灯燃料气压力 PI86604ABC 低低 ($\leq 0.03\text{MPa}$, 三取二)。

3) When the field operators press the Field Hard Push Button (HK-86002) for the pilots.

外操启动现场长明灯操作柱 HK-86004。

4) When the panel operators press the SIS Emergency Shutdown Push Button (HS-86004) for the pilots.

内操启动 SIS 系统长明灯紧急停车按钮 HS-86004。

Interlock actions:

联锁启动结果:

1) Close the fuel gas shutoff valve (UV-86004) for the pilots of the Vac. heater.

关闭减压炉长明灯燃料气切断阀 UV-86004。

2) Close the main fuel gas shutoff valve (UV-86003) of the Vac. heater.

关闭减压炉主燃料气切断阀 UV-86003。

When it is required to restart the Vac. heater after the interlocking conditions are eliminated:

当联锁条件消除，需要重新启动常压炉时：

1) The field operators close the pilot hand valve and main fuel gas hand valve of each burner at the site.

外操关闭现场每台燃烧器的长明灯、主燃料气的手阀。

2) The panel operators press the Reset Push Button (RS-86004) for the pilots via SIS system.
内操在 SIS 系统启动长明灯复位按钮 RS-86004。

3) The field operators fire the Vac. heater according to the heater firing procedure.

外操按照加热炉点火程序点火。

(5) Interlock control logic for main fuel gas burners of Vac. heater

减压炉主燃料气自保联锁控制逻辑

The interlock systems for the main fuel gas burners of the Vac. heater will be actuated when the following conditions are met:

当达到以下条件时，减压炉主燃料气自保联锁启动：

1) When the pressure indicators (PI86503A/B/C) of the main fuel gas to fire box 1# of the Vac. heater indicate low-low pressure ($\leq 0.01\text{MPa}$, 2oo3).

至减压炉 1#炉膛主燃料气压力 PI86503ABC 低低 ($\leq 0.01\text{MPa}$ ，三取二)。

2) When the pressure indicators (PI86603A/B/C) of the main fuel gas to fire box 2# of the Vac. heater indicate low-low pressure ($\leq 0.01\text{MPa}$, 2oo3).

至减压炉 2#炉膛主燃料气压力 PI86603ABC 低低 ($\leq 0.01\text{MPa}$ ，三取二)。

3) When the field operators press the Field Hard Push Button (HK-86003) for the main fuel gas burners.

外操启动现场减压炉主燃料气操作柱 HK-86003。

4) When the panel operators press the SIS Emergency Shutdown Push Button (HS-86003) for the main fuel gas burners.

内操启动 SIS 系统减压炉主燃料气紧急停车按钮 HS-86003。

5) When the level indicator (LI86001) of the fuel gas KO drum (D-861) indicates high-high level.
燃料气分液罐 D-861 液位 LI86001 高高。

6) When the feed flow controllers (FIC40102A~D) on the passes to fire box 1# of the Vac. heater indicate low-low flowrate ($\leq 10\text{t/h}$, 2oo4).

减压炉 1#炉膛分支进料流量 FIC40102A~D 低低 ($\leq 10\text{t/h}$ ，四取二)。

7) When the feed flow controllers (FIC40102E~H) on the passes to fire box 2# of the Vac. heater indicate low-low flowrate ($\leq 10\text{t/h}$, 2oo4).

减压炉 2#炉膛分支进料流量 FIC40102E~H 低低 ($\leq 10\text{t/h}$ ，四取二)。

8) When the temperature indicators (TISA86917A/B/C) at the top of fire box 1# of the Vac. heater indicate high-high temperature ($\geq 980^\circ\text{C}$, 2oo3).

减压炉 1#炉膛辐射室顶部温度 TISA86917ABC 高高 ($\geq 980^\circ\text{C}$ ，三取二)。

9) When the temperature indicators (TISA86918A/B/C) at the top of fire box 2# of the Vac. heater indicate high-high temperature ($\geq 980^{\circ}\text{C}$, 2oo3).

减压炉 2#炉膛辐射室顶部温度 TISA86918ABC 高高 ($\geq 980^{\circ}\text{C}$, 三取二)。

10) When the pressure indicators (PISA86915A/B/C) at the top of fire box of the Vac. heater indicate high-high pressure ($\geq 200\text{Pa}$, 2oo3).

减压炉炉膛辐射室顶部压力 PISA86915ABC 高高 ($\geq 200\text{Pa}$, 三取二)。

11) When the temperature indicators (TI40103AA ~ AC) on pass A of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 A 路分支温度 TI40103AA~AC 高高。 ($\geq 420^{\circ}\text{C}$)

12) When the temperature indicators (TI40103BA ~ BC) on pass B of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 B 路分支温度 TI40103BA~BC 高高。 ($\geq 420^{\circ}\text{C}$)

13) When the temperature indicators (TI40103CA ~ CC) on pass C of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 C 路分支温度 TI40103CA~CC 高高。 ($\geq 420^{\circ}\text{C}$)

14) When the temperature indicators (TI40103DA ~ DC) on pass D of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 D 路分支温度 TI40103DA~DC 高高。 ($\geq 420^{\circ}\text{C}$)

15) When the temperature indicators (TI40103EA ~ EC) on pass E of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 E 路分支温度 TI40103EA~EC 高高。 ($\geq 420^{\circ}\text{C}$)

16) When the temperature indicators (TI40103FA ~ FC) on pass F of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 F 路分支温度 TI40103FA~FC 高高。 ($\geq 420^{\circ}\text{C}$)

17) When the temperature indicators (TI40103GA ~ GC) on pass G of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 G 路分支温度 TI40103GA~GC 高高。 ($\geq 420^{\circ}\text{C}$)

18) When the temperature indicators (TI40103HA ~ HC) on pass H of the Vac. heater indicate high-high temperature ($\geq 420^{\circ}\text{C}$).

减压炉 H 路分支温度 TI40103HA~HC 高高。 ($\geq 420^{\circ}\text{C}$)

Interlock actions: close the main fuel gas shutoff valve (UV-86003) of the Vac. heater.

联锁结果: 关闭减压炉主燃料气切断阀 UV-86003。

When it is required to restart the Vac. heater after the interlocking conditions are eliminated:

当联锁条件消除, 需要重新启动减压炉时:

1) The field operators close the main fuel gas hand valve of each burner at the site.

外操关闭现场减压炉每台燃烧器的主燃料气手阀。

2) The panel operators press the Reset Push Button (RS-86003) for the main fuel gas burners via SIS system.

内操在 SIS 系统启动减压炉主燃料气复位按钮 RS-86003。

3) The field operators fire the Atm. heater according to the heater firing procedure.

外操按照加热炉点火程序点火。

(6) Interlock control logic for flue gas waste heat recovery system

烟气余热回收系统自保联锁控制逻辑

1) Shutdown interlocks for air blower and induced draft fan

鼓风机、引风机停运联锁

①Running state of air blower K-801A (shutdown) → stop air blower K-801A at the auxiliary console.

鼓风机 K-801A 运行状态（停运）→辅操台鼓风机 K-801A 停机。

②Running state of air blower K-801B (shutdown) → stop air blower K-801B at the auxiliary console.

鼓风机 K-801B 运行状态（停运）→辅操台鼓风机 K-801B 停机。

③Running state of induced draft fan K-802 (shutdown) → stop air blower K-802 at the auxiliary console.

引风机 K-802 运行状态（停运）→辅操台鼓风机 K-802 停机。

2) Interlock control logic for quick-open dampers

快开风门联锁逻辑

The interlock systems for the quick-open dampers of the heaters will be actuated when the following conditions are met:

当达到以下条件时，加热炉快开风门联锁启动：

①When the pressure indicators (PI86938A/B/C) on the main hot air duct indicate low-low pressure ($\leq 100\text{Pa}$, 2oo3).

主热风道压力 PI86938ABC 低低 ($\leq 100\text{Pa}$, 三取二)

②The air blower push buttons are released.

停鼓风机按钮。

Interlock actions:

联锁结果：

①Open the quick-open dampers of the Atm. heater. (Tag No.: UV-86901A/B~86912A/B, totally 24 dampers).

常压炉快开风门打开。（UV-86901AB~86912AB 共 24 台）。

②Open the quick-open dampers of the Vac. heater. (Tag No.: UV-86913~86920, totally 8 dampers).

减压炉快开风门打开。（UV-86913~86920 共 8 台）。

Reset the quick-open dampers:

快开风门复位：

①The panel operators press the reset push buttons of the air blower at the auxiliary console.

内操辅操台启动鼓风机复位按钮。

②Close the quick-open dampers of the Atm. heater. (Tag No.: UV-86901A/B~86912A/B, totally 24 dampers).

常压炉快开风门关闭。(UV-86901AB~86912AB 共 24 台)。

③Close the quick-open dampers of the Vac. heater. (Tag No.: UV-86913~86920, totally 8 dampers).

减压炉快开风门关闭。(UV-86913~86920 共 8 台)。

3) Preheater outlet flue gas temperature high-high interlock

预热器出口烟气温度超高联锁逻辑

The flue gas temperature high-high interlock for the flue gas waste heat recovery system will be actuated when the following conditions are met:

当达到以下条件时, 烟气余热回收系统烟气超高自保联锁启动:

①The preheater flue gas outlet temperature indicators (TI86922A/B/C) indicate high-high temperature ($\geq 235^{\circ}\text{C}$, 2oo3).

预热器烟气出口温度 TI86922ABC 高高 ($\geq 235^{\circ}\text{C}$, 三取二)。

②The induced draft fan is shut down.

停运引风机。

Interlock actions: de-energize the induced draft fan K-802.

联锁结果: 至电气停运引风机 K-802。

2.4.7.3 Interlock control logic for desalter drums 电脱盐罐联锁控制逻辑

Energizing/de-energizing interlocks, which function depending on the readings of the low level indicators, are provided for the desalter drums (D-101 and D-102), and they are mainly served to ensure that the desalter drums will be energized when they are filled with oil, to prevent any accident caused by vaporization of oil and water in the energized desalter drum that is not full.

装置电脱盐罐 D-101 和 D-102 设置低液位开关停送电联锁, 主要是保证电脱盐罐装满油的情况下送电, 防止在电脱盐罐未装满时, 罐内油水汽化, 在送电的情况下发生事故。

(1) When the low level indicator (LI91501 or LI91502) of the Pre-Dist. desalter drum (D-101) indicates low-low level (LL=0, 1oo2), de-energize the Pre-Dist. desalter drum (D-101).

当一级电脱盐罐 D-101 低液位开关 LI91501、LI91502 低低时 (LL=0, 二取一), 至电气停一级电脱盐罐 D-101。

(2) When the interlocking conditions for low-low level as indicated by LI91501 or LI91502 are eliminated, press the Reset Push Button (RS-D101) of the Pre-Dist. desalter drum, and energize the Pre-Dist. desalter drum.

当 LI91501、LI91502 低低联锁条件消除时, 启动一级电脱盐罐复位按钮 RS-D101, 至电气恢复一级电脱盐罐送电。

(3) When the low level indicator (LI91503 or LI91504) of the secondary desalter drum (D-102) indicates low-low level (LL=0, 1oo2), de-energize the secondary desalter drum (D-102).

当二级电脱盐罐 D-102 低液位开关 LI91503、LI91504 低低时 (LL=0, 二取一), 至电气停二级电脱盐罐 D-102。

(4) When the interlocking conditions for low-low level as indicated by LI91503 or LI91504 are eliminated, press the Reset Push Button (RS-D102) of the secondary desalter drum, and

energize the secondary desalter drum.

当 LI91503、LI91504 低低联锁条件消除时，启动二级电脱盐罐复位按钮 RS-D102，至电气恢复二级电脱盐罐送电。

2.4.7.4 Automatic startup interlocks for U/G slop drum pumps 地下污油罐污油泵自启动联锁

(1) Automatic startup interlocks for light slop drum (D-842) pump

D-842 轻污油泵 P-842 自启动联锁

1) When D-842 level indicator (LI84002) indicates high-high level ($\geq 60\%$), energize P-842.

D-842 液位 LI84002 高高 ($\geq 60\%$)，至电气启动 P-842。

2) When D-842 level indicator (LI84002) indicates low-low level ($\leq 20\%$), de-energize P-842.

D-842 液位 LI84002 低低 ($\leq 20\%$)，至电气停运 P-842。

(2) Automatic startup interlocks for heavy slop drum (D-843) pump

D-843 重污油泵 P-843 自启动联锁

3) When D-843 level indicator (LI84001) indicates high-high level ($\geq 60\%$), energize P-843.

D-843 液位 LI84001 高高 ($\geq 60\%$)，至电气启动 P-843。

4) When D-843 level indicator (LI84001) indicates low-low level ($\leq 20\%$), de-energize P-843.

D-843 液位 LI84001 低低 ($\leq 20\%$)，至电气停运 P-843。

2.4.7.5 Automatic startup interlocks for sealing oil pot pumps 封油泵自启动联锁

(1) Automatic startup interlock for sealing oil pot I pumps (P-851A/B)

封油 I 封油泵 P-851AB 自启动

When the pressure of sealing oil pot I is lower than 1.0 MPa, start the standby pump (P-851A/B).

当封油 I 系统压力低于 1.0MPa 时，启动备用的 P-851AB。

(2) Automatic startup interlock for sealing oil pot II pumps (P-852A/B)

封油 II 封油泵 P-852AB 自启动

When the pressure of sealing oil pot II is lower than 1.0 MPa, start the standby pump (P-852A/B).

当封油 II 系统压力低于 1.0MPa 时，启动备用的 P-852AB。

2.4.8 Interlock control logic diagrams for process unit 装置自保的联锁逻辑控制图

The interlock control logic diagrams for the process unit are developed and printed as an individual volume.

装置自保联锁逻辑控制图单独印制成册。

2.4.9 Interlock control logic diagrams for machine units 机组自保的逻辑控制图

No large machine units are provided in this process unit.

本装置无大机组。

2.4.10 DCS system DCS 控制系统

The process of this unit is designed in continuous operation, and most of process streams are flammable and explosive, and some streams are corrosive; therefore, selection of instruments must satisfy explosion-proof, corrosion resistant and control requirements. Technically advanced and proven, reliable and economic instruments and control systems with high performance and powerful technical supports shall be selected to meet control requirements for the process unit. The automatic control level for the process unit shall be designed based on the process and technologies used in the unit and the overall design level of the project, and the principles for instruments and control systems include distributed control, central operation and central management so as to provide a basis for setting up the plant-wide information management system.

本装置工艺过程为连续生产，工艺介质多为易燃易爆，部分介质具有腐蚀性，自控设备的选型严格符合防爆、防腐及控制要求。装置选用的自控设备具有技术先进、质量可靠、经济合理、具备成熟的使用经验和良好的技术支持，满足大型石化装置对自动化仪表的需要。装置的自动控制水平根据装置工艺过程及全厂控制系统的总体设计水平设计，控制系统设置原则为分散控制、集中操作、集中管理、并为全厂的信息管理建立基础。

A separate FAR is provided in this process unit, it is shared with 2350 KPTA Light Ends Recovery Unit. The operator stations, printers, data drum devices, and other operating terminals of DCS/SIS system are all installed in the central control room (CCR). The DCS/SIS system cabinet, safety barrier cabinet, power distribution cabinet and auxiliary instrument cabinet are installed in the FAR.

本装置内设置独立的现场机柜间，该机柜间与 800 万吨/年常减压蒸馏装置和 235 万吨/年轻烃回收装置共用。DCS/SIS 系统的操作站、打印机、数据存贮设备及其它操作终端等均集中在管理控制中心（CCR）。装置 DCS/SIS 系统机柜、安全栅柜、配电柜及辅助仪表柜等安装在现场机柜间内。

Distributed control system (DCS) is used as the process control system for this process unit, and all the detection and control signals in the process units (excluding the equipment packages) are sent into DCS in CCR to control the process operations via the signal detection, process control, process alarm, data recording and information processing systems. The operating status of the main machines in the process unit is displayed in DCS. Other related systems are designed with communication links with DCS. DCS is designed with network interface with the plant information management system.

本装置的过程控制系统采用分散控制系统（简称 DCS），装置（不包括机组）的全部检测、控制信号都进入 DCS，通过 DCS 进行信号检测、过程控制、过程报警、数据记录、信息处理等系统控制，在中心控制室进行生产操作。装置内主要机泵设备的运行状态均在 DCS 上显示。其他相关系统与 DCS 都有通讯联系。DCS 设有与工厂管理系统的网络接口。

This process unit shares a central control room with other process units to facilitate operation, management, resource sharing, and investment saving. Therefore, the same DCS system is

employed for this process unit and other process units to facilitate centralized processing of the plant-wide computer data and centralized management of production. The control system cabinets are installed in FAR that is shared by the Light Ends Recovery Unit, and the operator stations are installed in CCR.

本装置与其它生产装置共用一个中心控制室，以便于操作、管理、资源共享、节省投资，因此本装置与其他装置采用同一种 DCS 系统，便于实现全厂计算机数据的集中处理和生产的集中管理。本装置将机柜放置在现场机柜室的机柜间内，机柜室与常减压，轻烃回收装置共用，操作站集中放置在中心控制室。

2.4.10.1 HIS (operator Station) startup HIS（操作员站）启动

It is very important to start the operation and monitoring functions of HIS before startup of the process unit. The specific instructions for starting HIS are as follows.

在装置开始操作和监控之前，启动 HIS 的操作和监控功能是非常重要的。HIS 的具体启动说明如下。

(1) Turn on the computer and input CENTUM.

打开电脑输入 CENTUM。

(2) Click [Start] → [YOKOGAWA CENTUM] → [HIS UTILITY].

点击[开始]→[YOKOGAWA CENTUM]→[HIS UTILITY]。

(3) Enter the user name and password.

输入用户名和密码。

2.4.10.2 HIS monitors and operation keyboard HIS 监视器及操作键盘说明

(1) Monitors

监视器

The multi-monitor function is to connect two monitors to one operator station (HIS) and display the operation and monitoring window on each monitor. In this way, two monitors can be used as a large virtual desktop area. Windows XP multi-monitor function shall be used.

多监视器监控的功能将两台监视器连接到一个操作员站（HIS），并且在每个监视器上显示操作和监控窗口。这样，两台监视器就可以按一个大的虚拟桌面区域来处理。进行多监视器监控时需要利用 WindowsXP 的多监视器功能。

There are two types of monitors in a multi-monitor monitoring environment: one is the Pre-Dist. monitor and the other is the secondary monitor. The Pre-Dist. monitor and the secondary monitor can perform the following display operations: ① The cursor can be moved freely between the Pre-Dist. monitor and the secondary monitor; ② The windows between the Pre-Dist. monitor and the secondary monitor can be changed over (switched and exchanged); ③ The windows can be called by the specified monitor; ④ The window can be deleted by specifying the corresponding monitor. Each monitor is designed with screen printing function.

在多监视器监控环境中共有两类监视器：一类是主监视器，另一类是辅助监视器。主监视器和辅助监视器可以执行以下显示操作：①光标可以在主监视器和辅助监视器间自由移动；②主监视器

和辅助监视器间的窗口可以转换（切换和交换）；③通过指定显示窗口的监视器可以对窗口进行调用；④通过指定相应的监视器可以将窗口删除；每个监视器都可以执行屏面打印功能。

Operation keyboard

操作键盘

(2) Each HIS is equipped with a Yokogawa operation keyboard rather than a standard PC keyboard. The dust-proof and anti-drip keyboard employs flat keys as required for their functions, so that one-off contact operation can be performed. This keyboard will be used as the standard keyboard for plant operations.

每个 HIS 都将配备一个 Yokogawa 操作键盘而不是标准的 PC 键盘。防尘和防滴键盘按其功能所需设置的是平键，这样就可以进行一次接触操作。该键盘将成为工厂操作的标准键盘。

2.4.10.3 Toolbar 工具栏

The toolbar is a window that contains buttons that can activate other types of windows. It is displayed in front of the system information window.

工具栏是一个包含可激起其他多种类型窗口的按钮的窗口。显示在系统信息窗口的前面。



2.4.10.4 Descriptions to process windows 过程窗口的说明

(1) Flow chart window It displays the flow chart of the equipment or control status that has been made by the user. This window displays the real-time process status and displays the process data field and an indicator with a dynamic curve. The original data in the flow chart is indicated by the color change of the target when the regulator in different states.

流程图窗口。显示用户做好的装置或控制状态的流程图。该窗口可显示实时的过程状态，并显示过程数据栏及带有动态曲线的指示器。随着调节器在不同状态下，改变目标对象的颜色来确定流程图的原始数据。

(2) Logic diagram window It shows the logic diagram defined by the logic diagram generator and the completion status of the logic circuit.

逻辑图窗口。显示的是用逻辑图产生器定义的逻辑图及逻辑电路的完成状态。

(3) Sequence table window It shows the detailed sequence or the logic programmed in the sequence table function block, and the operational status of the sequence program.

顺序表窗口。显示的是在顺序表功能块中编程的详细顺序或逻辑及该顺序程序的操作状态。

(4) Control graphics window It shows the function blocks defined by the control graphics generator and the status and progress of those function blocks.

控制图形窗口。显示的是在控制图形产生器中定义的功能块及那些功能块的状态及进展状况。

2.4.10.5 Instrument control panel 仪表控制面板

(1) Change the operation mode

改变模块的操作模式

Click on the module mode display area with the mouse, it will display the module mode, and the operation mode will be altered by changing the operation dialog module.

用鼠标点击模块模式显示区域即会显示模块模式，改变操作对话框模块的模式就会改变。

There are three basic control modes:

共有三种基本的控制模式：

1) MAN: manual. 2) AUT: automatic. 3) CAS: cascade.

MAN: Manual 手动。2) Atraumatic 自动。3) CAS:Cascade 串级。

The functions of these three buttons are the same as those of the keys with the same marks on HIS operation keyboard.

这三个按钮的功能和 HIS 操作键盘上有相同标记的按键的功能相同。

(2) Controlled output value indicator, set value indicator

受控输出值指示器，设定值指示器

The indicator on the left side of the panel indicates the measured value (MV). The indicator on the right side of the panel indicates the set value (SV).

面板左边指示器是指示输出值（MV）。面板的右边指示器是指示设定值（SV）。

The indicator color changes depending on the operating state of the instrument panel (MAN, AUT, CAS) and the state of the operation keyboard TARGETKEY. It is red when the indicator is controllable by the operator. It is yellow when the indicator is not controllable by the operator.

指示器颜色根据仪表面板的操作状态（MAN、AUT、CAS）和操作键盘 TARGETKEY 的状态改变。当指示器为操作员可以控制时，它为红色。当指示器为操作员不可以控制时，为黄色。

(3) Change MV and SV

改变 MV 和 SV

Only MV can be adjusted in manual mode, and only SV can be adjusted in automatic mode.

在手动模式时只有 MV 可以被调整，在自动模式时只有 SV 可以被调整。

(4) A small increase or decrease in SV, MV

少量的增减 SV, MV

Click on SV or MV indicator on the instrument panel and the following dialog box will appear.

Press and hold UP/DOWN button to increase or decrease the value of SV or MV.

在仪表面板上点击 SV 或 MV 的指示器，就会出现下面对话框。按住 UP/DOWN 键 SV 或 MV 的值就会增减。

(5) Attributes of tag

位号的属性

The tag has three main attributes that affect its monitoring and operational characteristics.

位号有三个主要的属性，会影响它的监控和操作特征。

1) Level of importance

重要性的等级

The level of importance of the tag is defined by tag mark during engineering configuration. A tag mark has a function block corresponding to it, reflecting its level of importance. The table below shows their relationship and the effect of changing the panel on the operation.

位号的重要等级在工程组态时通过位号的标记（TAG MARK）做好定义。一个位号标记就有一个功能块和它对应，反映它的重要等级(IMPORTANT LEVEL)。下表显示它们的关系和改变面板对操作的影响。

2) Safety integrity level

安全等级

Definition Builder in the function block assigns a security level for the function block. The security category of the user name and the security level of the corresponding function block will limit the operation and monitoring of the function block. The following table shows the relationship between the user type and the security level of the function block in operation and monitoring.

在功能块的 Definition Builder 每个位号都分配一个功能块的安全等级。根据用户名的安全类别和相应功能块的安全等级，对功能块的操作和监控有限制作用。下表为用户类型和功能块的安全等级在操作与监控中的联系。

Monitoring is a process to observe the breakdown windows and the tags in the control panel.

监控即可以观察到细目窗口和控制面板的位号。

Operation is a process to change MV, SV, control mode and alarm set value.

操作就是可以改变该点的 MV,SV,控制模式，报警设定值等

3) Alarm processing levels

报警处理等级

The alarm processing level of the tag is defined in the definition configuration of the function module. When the tag changes the alarm state, there are four alarm levels that give different actions.

在功能模块的定义组态中，定义位号的报警处理等级。当位号改变报警状态时，有四种给出不同动作的报警等级。

When an alarm occurs, the alarm object will flash; when the alarm is acknowledged, it will stop flashing.

当报警时，报警的对象就会闪烁；当报警被确认时，就会停止闪烁。

There are three different blinking actions when the alarm state is restored.

当报警状态恢复时，有三种不同的闪烁动作。

4) Lock type

锁定类型

When the alarm is restored, the alarm will continue flashing until the alarm is acknowledged.

当报警恢复时，报警的闪光会继续，直到报警被确认。

5) Non-lock type

非锁定类型

When the alarm is restored, the alarm will stop flashing regardless the alarm is acknowledged or not.

当报警恢复时，报警的闪光是停止的，不管报警是否被确认。

6) Self-confirmation type

自确认类型

When an alarm is generated, the alarm is assumed to have been acknowledged, so the alarm object does not flash.

当报警产生时，认为报警已被确认，因此报警对象不闪烁。

(6) Tracking

跟踪

A function module has two tracking functions.

一个功能模块有两种跟踪功能。

1) Output tracking. For a cascade controlled circuit, when the downstream open circuit returns to closed state, the output value will change significantly.

输出跟踪。对于一个串级回路，当下游开路又恢复到闭合时，输出值就会剧烈的变化。

In order to prevent this situation, force the output value equal to the set value of the downstream controller (tracking value), so that the output value does not jump when the mode is switched over to ensure control quality is stable.

为了防止此类情况发生，强迫输出值等于（跟踪）下游控制器的设定值，这样当模式切换时，输出值不会发生跳动，使控制质量很平稳。

2) Input tracking When switching from manual mode to automatic mode in a controller, a large deviation will occur, which makes the output value larger. Measurement tracking or input tracking is to make the set value and the measured value coincide during manual operation so as to avoid the control action jump when the mode is switched to the automatic mode.

输入跟踪。在一个控制器中当从手动模式切换到自动模式时，会产生一个很大的偏差，这样使输出值也变大。测量跟踪或输入跟踪就是在手动操作时让设定值和测量值一致，当模式切换到自动模式时避免控制动作跳动。

2.4.10.6 Process alarm and system alarm window 过程报警及系统报警窗口

The process alarm information and the ANNUNCIATOR notification information are displayed in the information display area of the process alarm window, and the newly generated alarm is displayed at the top. Up to 200 alarm messages can be displayed. When the number of messages exceeds 200, the first stored information that has been confirmed will be deleted. If there is no acknowledged alarm message, the old unacknowledged alarm message will also be deleted.

过程报警信息和 ANNUNCIATOR 通告信息显示在过程报警窗口的信息显示区域，最新产生的报警显示在最上面。最多可显示 200 条报警信息。当信息超过 200 条时，已被确认过的最先存储的信息会被删除。如果没有已被确认的报警信息，旧的未被确认的报警信息也会被删除。

The latest system alarm information is displayed at the top of the system alarm information window.

最新的系统报警信息，显示在系统报警信息窗口的最上面。

Up to 100 system alarm messages can be stored. The system alarm information is deleted from the first acknowledged alarm message. When there is an unacknowledged alarm message, the first unacknowledged alarm message stored will be deleted.

最多存储 100 条系统报警信息。系统报警信息从最先被确认的报警信息开始删除。当有未被确认的报警信息，从最先存储的未被确认的报警信息开始删除。

2.4.10.7 Trend function 趋势功能

(1) Main functions

功能

HIS trend recording function is designed to obtain the process data from the FCS, and display and record the trend of the obtained data in a graphical form. The trend recording function has a three-layer structure:

HIS 的趋势记录功能从 FCS 获得过程数据，并以曲线图的形式显示获得数据的变化趋势记录功能。趋势记录功能有三层结构：

1) Trend module A module contains 16 trend groups. One HIS contains 50 trend modules (CS3000). 20 trend modules can be defined as rotary trend or batch trend. The remaining 30 modules can be defined as trend blocks for other stations. The trend format and sampling cycles are defined in each trend module.

趋势模块。一个模块含有 16 个趋势组。一个 HIS 含有 50 个趋势模块（CS3000）。20 个趋势模块可被定义成 rotary trend（回转趋势） or batch trend（批量趋势）的模式。余下的 30 个模块定义成其他站的趋势块。趋势格式和采样周期在每个趋势模块里定义。

2) Trend window A trend window has 8 trend pens. There are 800 trend windows (CS3000) per HIS.

趋势窗口。一个趋势窗有 8 个趋势笔。每个 HIS 有 800 个趋势窗口（CS3000）。

3) Trend point window. The trend point window can be activated from the trend window. Each trend point window displays a trend pen. Each HIS has 6400 trend point windows (CS3000).

趋势点窗口。从趋势窗口中能够激起趋势点窗口。每个趋势点窗口显示一支趋势笔。每个 HIS 有 6400 个趋势点窗口（CS3000）。

(2) Trend acquisition function

趋势采集功能

The trend acquisition function periodically collects process data from the FCS based on the definition of the data, the type of acquisition, the sampling cycles, and the recording time. The acquired data can be displayed in the trend window and trend point window.

趋势采集功能根据数据的定义，采集的类型，采样周期和记录时间，周期性的从 FCS 采集过程数据。采集的数据可以在趋势窗口和趋势点窗口显示。

1) Target trend data All data, such as PV, MV, SV and FV, can be process target data for trend acquisition.

目标趋势数据。所有的数据，例如 PV,MV,SV 和 FV 都可以是趋势采集的过程目标数据。

2) Sampling cycles and recording range of trend data. The sampling cycle of the process data

is defined in each trend block. The sampling cycle is divided into:

趋势数据的采样周期和记录范围。过程数据的采样周期在每个趋势块中定义。采样周期分为：

1 second, 10 seconds, 1 minute, 2 minutes, 5 minutes and 10 minutes. The sampling cycle is defined as 1 second or 10 seconds for only two trend blocks.

1 秒、10 秒、1 分、2 分、5 分和 10 分。只有两个趋势块的采样周期被定义为 1 秒或 10 秒。

(3) Trend data display function

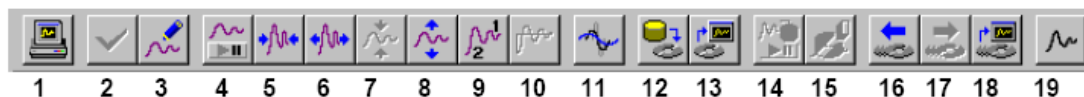
趋势数据显示功能

The collected trend data is displayed in the trend window. In the trend window, the current data and the previous data can be displayed.

采集到的趋势数据在趋势窗口内显示出来。在趋势窗口内，可显示现在的数据和以前的数据。

(4) The constitution of the trend window

趋势窗口的组成



The functions of buttons numbered from 1 to 19 are: hard copy, confirmation, trend pen assignment, stop/restore display, reduce time axis, expand time axis, reduce data axis, expand data axis, trend pen serial number, display/delete reference information, display initialization, store data, read data, stop/restore acquisition, start acquisition, previous long-cycle data, next long-cycle data, read long-period data, and redisplay.

1~19 个按钮的功能分别为：硬拷贝、确认、趋势笔的分配、停止/恢复显示、减少时间轴、扩大时间轴、减小数据轴、扩大数据轴、趋势笔序号、显示/删除参考信息、显示初始化、存储数据、读取数据、停止/恢复采集、开始采集、以前的长周期数据、下一个长周期数据、读长周期数据、重新显示。

(5) Trend point window

趋势点窗口

The trend point window is to display one of 8 trend pens in the trend data distribution table to the trend window. When the process data is assigned to the trend window, the trend point window is automatically generated. When selecting the trend pen in the trend window, it will activate the trend point window.

趋势点窗口就是把趋势数据分配表 8 个趋势笔中的一个显示到趋势窗口。当过程数据赋到趋势窗口，趋势点窗口自动生成。在趋势窗口中选择趋势笔，就会激起趋势点窗口。

If you want to call a window of the trend points, double click the point name of any one of the eight pens in the trend graph.

如果要调用趋势点的一个窗口，双击趋势图中 8 笔当中的任意 1 笔的点名

2.4.10.8 Historical information report window and system overview window 历史信息报告窗口及系统总貌窗口

The historical information report window displays the overview of the historical information, and

the historical information report includes the types of the alarm information and the historical operation information. Use the toolbar to activate the historical information report window.

历史报告信息窗口显示历史信息的总貌，历史报告包括报警信息的类型和操作员操作历史信息。使用工具栏激活历史报告窗口。

The system overview window displays the overview status of the communication bus and the various stations. In the drop-down menu, click [System Status Display] to display this window.

系统状态总貌窗口显示通讯总线和各种站的状态总貌。在下拉菜单中，点击[System Status Display]即显示该窗口。

2.4.10.9 Overview of FGS 装置火气系统总貌图

The overview of FGS shows the geographical overview of the main process facilities that are divided into different FGS areas, one indicator light is provided in each area to represent the FGS in this area. Click on an area, FGS detector arrangement for this area will be displayed. In the event of fire or leakage of flammable or toxic gases in the process unit, the representative indicator symbol of the process unit will change to the alarm color and will flash continuously. After the alarm is acknowledged, the symbol will remain stable and will return to normal color when the status returns to normal.

火气系统总貌图显示的是包括主要过程装置的地理总貌，分成不同的 FGS 区域，每个区域都有一个指示灯代表该区域的公共火气报警。点击某个区域时，就会调用该区域的 FGS 探测器布置。如果发生了火灾，可燃或有毒气体在装置中出现，装置的代表符号将变成报警的颜色，并不断闪烁。报警得到确认后，该符号将保持稳定，当状态恢复正常后，将变回到正常颜色。

The buttons shown in the overview can be used to call the plant overview window, MOS overview graphics and UZ overview graphics.

总貌图中显示的按钮可用于：调用工厂总貌窗口，MOS 总貌图形和 UZ 总貌图形。

2.4.11 SIS system SIS 控制系统

TRICONEX's Tricon system is used as the safety instrumented system of the project, which is integrated by Beijing Consen Automation Control Co., Ltd. (CONSEN).

PMB 石油化工项目采用 TRICONEX 的 Tricon 系统作为本项目的安全仪表系统，由北京康吉森自动化设备技术有限责任公司(CONSEN)集成。

The control system supplier is responsible for providing SIS system hardware, software, technical services, engineering services, software configuration, system integration, factory acceptance test (FAT), packaging and shipment, open package inspection, installation instructions, field testing, site acceptance test (SAT)), and startup and operation SIS system.

控制系统供货商负责提供 SIS 系统的硬件、软件、技术服务、工程服务、软件组态、系统集成、工厂验收(FAT)、包装运输、开箱检验、安装指导、现场测试、现场验收(SAT)及装置开工 SIS 系统投运。

2.4.11.1 Description to system architecture 系统结构说明

(1) System overall architecture SIS consists of controllers, I/O racks, operator stations, engineer stations/SOE stations, and network equipment. The remote I/O racks, operator stations, engineer stations/SOE stations are installed in the central control room, and the controllers, engineer station/SOE station are installed in FAR.

系统总体结构。SIS 由控制器、IO 机架、操作员站、工程师站/SOE 站及网络设备构成。远程 IO 机架、操作员站、工程师站/SOE 站设置在中心控制室，FAR 内设置控制器、工程师兼 SOE 站。

(2) Communication with DCS SIS uses redundant RS485 to communicate with DCS so as to send the required SIS parameters to DCS for display.

与 DCS 通讯。SIS 采用冗余的 RS485 与 DCS 通讯，将需要的 SIS 参数送入 DCS 中显示。

(3) Engineer station/SOE station Two engineer stations/SOE stations, one A4 black and white laser printer, and one A4 color laser printer are provided in the central control room for debugging and high-speed data acquisition and analysis. In FAR, each SIS system is equipped with one engineer station/SOE station, and one A4 black and white laser printer.

工程师站/SOE 站。在中心控制室内配置 2 台工程师站/SOE 站，1 台 A4 黑白激光打印机，1 台 A4 彩色激光打印机，用于调试和高速数据采集及分析等。在现场机柜室，每个 SIS 系统配置 1 台工程师兼 SOE 站，1 台 A4 黑白激光打印机。

(4) Operator station. In the central control room, one operator station is provided for each SIS. The operator stations are provided with the entire software package, including TRIVIEW or Intouch software based on the Windows platform.

操作员站。在中心控制室，每套 SIS 系统配置 1 台操作员站。操作员站配置整套软件，包括基于 Windows 平台的 TRIVIEW 或 Intouch 软件。

(5) Clock synchronization A standard clock source signal (from GPS clock server provided by DCS system supplier) is provided in the central control room in accordance with the SNTP protocol for RJ45 interface. The clock synchronization signal from RJ45 interface of the clock server is connected to the core switch of SIS system located in the central control room. All SIS controllers and host computers of SIS network in the central control room will realize clock synchronization via SNTP protocol.

时钟同步。在中心控制室提供一个符合 SNTP 协议 RJ45 接口的标准时钟源信号(来自 DCS 系统供货商集成提供的 GPS 时钟服务器)。该时钟服务器 RJ45 接口的时钟同步信号连接到 SIS 系统位于中心控制室内的核心交换机上。中心控制室 SIS 网络内的所有 SIS 控制器和上位机将通过 SNTP 协议实现时钟同步。

2.4.11.2 Main control functions and configuration features 主要控制功能和配置特点

SIS hardware is based on TMR fault-tolerant TRICON controllers, which meets the requirements of IEC61508 SIL1-3 and is certified by TUV AK5-6. The main control functions include: plant interlock protection, related alarms and records, instrument status monitoring, screen monitoring, operation and trend recording via the operator station, online diagnostic maintenance and high-speed historical process data analysis via the engineer station/SOE station.

SIS 硬件基于 TMR 冗余容错的 TRICON 控制器, 满足 IEC61508 SIL1-3 要求, 通过 TUV AK5-6 级安全认证。主要功能包括: 工厂联锁保护; 相关报警和记录; 仪表状态监控; 通过操作员站可实现画面监控、操作和趋势记录; 通过工程师/SOE 站可对系统实现在线诊断维护和高速过程历史分析。

2.5 Shutdown Plan 停工方案

2.5.1 Preparations and inspections before shutdown 停工前的准备与检查

2.5.1.1 Shutdown requirements 停工要求

(1) Before shutdown, the measures for shutdown, shutdown plan and measures for safe operation shall be developed. And additionally, personnel participating in shutdown operation shall get familiar with the shutdown plan.

停工前组织措施落实, 停工方案落实, 安全工作落实。参与人员熟悉装置的停工方案。

(2) All activities shall be organized in strict accordance with the shutdown plan and the shutdown schedule to ensure that the process unit is shut down on schedule in a safe and orderly manner.

严格按照停工方案步骤、停工网络时间要求组织各项工作, 做到停工安全、正点、有条不紊。

(3) The operation load of the process unit shall be turned down in such a way that no off-spec products could be produced in the process unit, or no temperature runaway, overpressure, water hammer, oil overflow, oil intrusion, fire or explosion could occur in the process unit. During shutdown, the turndown speed shall be properly controlled, and the product quality shall be adjusted based on the principle of "Try to Yield Light Products rather than Heavy Products" to minimize slop amount.

降量不出次品, 不超温, 不超压, 不水击, 不跑油, 不串油, 不着火, 不爆炸。停工过程中要注意控制好降量速度, 注意控制好产品质量, 按“宁轻勿重”的原则调节产品质量, 做到少出污油。

(4) The residual oil in each column or container shall be run down to the storage whenever possible, and it is strictly forbidden to discharge a large amount of residual oil into the wastewater drainage chamber. All oil product piping to OSBL must be kept unblocked.

退油时, 各塔和容器内存油尽量送往罐区, 严禁大量排入下水井。各种油品出装置线必须保持畅通。

(5) After shutdown, blinds shall be installed at specified positions, and shall be managed by dedicated persons.

停工后在规定部位加好盲板, 盲板实行专人管理。

(6) After shutdown, all pressure gauges and jacketed thermometers shall be removed for inspection.

停工后把所有压力表、套管式温度计拆下, 拆下压力表集中进行检验。

(7) The manholes of the columns, drums and containers shall be opened as required for ventilation and cooling down. Any person is not allowed to enter any column, drum or container

unless the explosive gas content in the column, drum or container is analyzed and accepted.
塔、罐、容器按规定开人孔，通风冷却，做好爆炸气体分析，合格后方可入内。

(8) As sulfur content in the feedstock to the process unit is high, corresponding countermeasures shall be taken for each column or container to avoid spontaneous combustion of ferrous sulfide during shutdown.

装置原料中硫含量较高，停工过程中各塔、容器应有相应对策，防止硫化亚铁自燃,应充分保。

(9) Safety and environmental protection management shall be strengthened, and it is strictly forbidden to discharge the residual oil and wastewater in a random manner.

加强安全和环保管理，严禁残油和污水乱排乱放。

(10) During purging operation after shutdown, it is strictly forbidden to conduct any hot work in the process unit.

停工扫线期间，装置内严禁动火。

2.5.1.2 Preparations and inspections before shutdown 停工前的准备与检查

(1) Develop the shutdown plan, organize the operators to study the shutdown plan, exMDEA how the operators understand the shutdown plan, and make records.

编制好停工方案，并组织操作人员学习考试，并做好记录。

(2) Prepare water flushing/purging checklists, blind distribution drawings, blind checklists and shutdown schedules as required, arrange enough operators to engage in purging operation after shutdown, post the shutdown plan on the wall in CCR. Upon completion of purging operation, the superintendent shall sign in the water flushing/purging checklists for confirmation.

准备好顶水、扫线明细表、盲板分布图、盲板明细表、停工网络图，安排好停工吹扫人员，并在中控室张贴上墙，扫线结束后负责人签字确认。

(3) Check and confirm that the utility systems are in normal operation.

确认装置公用工程系统运行正常

(4) Check and confirm that the screwed stems of all valves in the process unit have been lubricated.

确认装置内所有阀门丝杆已浇润滑油

(5) Check and confirm that the level in each column or container is normal, and all pumps are running properly.

确认各塔、容器液位正常，机泵运转正常

(6) Put all safety valves, which have been car sealed, into service.

安全阀投用、打铅封

(7) Maintain good communication between different departments, such as Production Scheduling Department, oil storage, electrical staff, instrument staff and lab, and contact the involved persons to line up the feedstock piping to ISBL/the product piping to OSBL, the off-spec product piping and the rundown piping.

调度、油品罐区、电气、仪表、化验等单位做好联系工作，产品进、出线，不合格线，退料线联系贯通。

(8) Make sufficient smothering steam for fire extinguishing service and tools for shutdown service (such as fire-fighting equipment, gas masks and explosion-proof wrenches) available, take proper measures to protect the operators who may expose to MDEA/alkali against injury, and make sufficient personal protective equipment (such as face masks, plastic gloves and etc.) available.

各消防蒸汽备用，备好消防器材、防毒面具、防爆扳手等停工用具。做好胺碱作业防护工作，准备劳保防护用品（面罩、塑胶手套等）。

(9) Determine agent demand accordingly to ensure that it can be secured just before shutdown, so as to minimize the amount remained in the drums.

统筹安排好三剂的配置，做到停工前够用即可，尽量减少罐内剩余量。

(10) Confirm that sufficient loess, asbestos cloth, iron rings, wood chips, tapes needed for purging operation, wires, and empty vats are available.

确认准备足黄土、石棉布、铁圈、木屑、吹扫胶带、铁丝、空大桶。

(11) Check and confirm that all lighting fixtures in the process unit are in good condition.

确认装置照明完好。

(12) Walkie-talkies and their chargers are complete and in good condition.

对讲机及充电器齐全好用。

(13) Make sufficient FeS passivation agent available.

准备好 FeS 钝化剂。

2.5.2 Shutdown steps 停工步骤

2.5.2.1 Shut down the desalter system 停电脱盐

Shut down the desalter system 2 days before process unit shutdown. For the methods to shut down the desalter system, see 2.4.1.11.

停工前两天，停运电脱盐系统。电脱盐停运方法见 2.4.1.11。

2.5.2.2 Shut down the chemical injection system 停三注系统

Before shutting down the chemical injection system, determine the neutralizing inhibitor, corrosion inhibitor, fouling inhibitor and demulsifier levels for availability just before process unit shutdown, so as to avoid any waste.

停三注前，应根据停工安排，提前筹划好中和剂、缓蚀剂、阻垢剂、破乳剂的液位，以够用至停工前为准，避免浪费。

2.5.2.3 Shut down the column OVHD gas scrubbing system 停塔顶气脱硫

(1) Line up the Pre-Dist. OVHD gas and Atm. OVHD gas process flows to the flare gas system, and close all valves to Acid Gas and LPG Treating Unit.

初顶气、常顶气改至火炬，关至产品精制装置阀门。

(2) Line up the Vac. OVHD gas process flow from D-401 to the flare gas system, and close all

valves to C-410.

减顶气从 D-401 改至火炬气，关至 C-410 塔阀门。

(3) Line up the sweet Vac. OVHD gas process flow to the flare gas system, and close all valves to the heaters.

脱硫减顶气改至火炬气，关至加热炉阀门。

(4) Cut off lean MEDA to C-410, and send C-410 bottom MEDA to OSBL.

停 C-410 贫胺液，C-410 塔底胺液全部送出装置。

(5) Introduce nitrogen to D-401 to purge C-410 and D-862 towards the flare gas system.

从 D-401 给氮气往火炬气系统置换 C-410 和 D-862。

(6) Switch water-ring vacuum pump for the 3rd ejector.

减压塔三级抽真空改成蒸汽抽真空。

2.5.2.4 Turn down the operation load of the process unit, cool down the process unit, and close distillate process flows 装置降量、降温、停侧线

(1) Contact the Production Scheduling Department to line up all direct process flows (such as naphtha, kerosene, mixed diesel, mixed VGO and VR process flow) to the drum.

Reduce the feed flowrate to each branch of the Atm. heater in a rate of 40t/h, while the temperature shall not be decreased.

联系调度将石脑油、常一线、混合柴油、混合蜡油、减压渣油等直供的全部改为进罐区。

常压炉每路以 40t/h 的速度降量，降量过程不降温。

(2) When the feed flowrate to each pass of the Atm. heater is reduced to 60t/h, stop reducing the feed flowrate, and start to decrease the tubes confluence temperature of the Atm. heater and the Vac. heater in a rate of 40°C/h.

常压炉流量降至 60t/h 后停止降量，常压炉和减压炉开始以 40°C/h 降温。

(3) Decreasing the tubes confluence temperature of the Atm. heater and the Vac. heater shall be controlled by the panel operators at first. When the opening of the fuel oil and fuel gas control valves is less than 50%, the panel operators may arrange the field operators to gradually stop the burners, i.e., first stop the fuel oil burners, followed by the fuel gas burners. Purge the fuel oil burners with atomized steam immediately after they are stopped.

加热炉降温时，先以内操控制为主，燃料油和燃料气控制阀开度在 50% 以下时，可安排外操逐步熄灭火嘴。熄火时，先熄灭燃料油火嘴，后熄灭燃料气火嘴。燃料油火嘴熄灭后，立即用雾化蒸汽扫线。

(4) During cooling down, shut down the sealing oil system, and close the sealing oil injection point on each pump.

降温过程停运封油系统，关闭各机泵注封油点。

(5) When the tubes confluence temperature of the Atm. heater is decreased to 300°C and the tubes confluence temperature of the Vac. heater is decreased to 330~340°C, shut down the air preheater, and directly discharge the heater flue gas to the chimney. Stop injecting fuel gas into the tubes of the Vac. heater, and stop introducing steam to the bottom of the Vac. column.

常压炉出口温度降至 300°C，减压炉出口温度降至 330-340°C时，停运空气预热器，加热炉烟气改为直排。停减压炉炉管注气、停减压塔塔底吹汽。

(6) When the tubes confluence temperature of the Vac. heater is decreased to 300°C, shut down the 1st and the 2nd ejectors. When the tubes confluence temperature of the Vac. heater is further decreased to 280°C, reduce the steam flowrate to the 3rd ejector.

减压炉出口温度降至 300°C停运一、二级抽真空，降至 280°C时，关小三级抽真空蒸汽。

(7) Stop sending the Vac. column distillates to OSBL depending on the Vac. column liquid level of sidedraws. Make sure that the Vac. column liquid level of sidedraws are not emptied before closing the Vac. column pumparound process flow.

根据减压塔侧线液位情况，停减压侧线外送。确保停减压中段回流前侧线液位不空。

(8) After the Vac. column distillate process flows are closed, contact the Production Scheduling Department to line up the process flow from the VR to the high-temperature heavy slop, and put the VR water coolers into service.

减压侧线停运后，联系调度，将渣油改至高温重污油线，投用渣油水冷器。

(9) Close the HVGO flushing oil process flow, the HVGO PA process flow, the MVGO PA process flow and LVGO PA process flow in turn depending on the column top temperature.

根据塔顶温度情况，依次停运减三线内回流、减三中、减二中和减一中。

(10) When the tubes confluence temperature of the Atm. heater is decreased to 280°C, stop introducing steam to the bottom of the Atm., and vent the superheated steam at the top of the Atm. heater.

常压炉出口温度降至 280°C以下时，停常压塔底吹汽，过热蒸汽在炉顶改放空。

(11) Close the Atm. PA#2 process flow, the Atm. PA#1 process flow and the Atm. top PA process flow in turn depending on the column top temperature.

根据塔顶温度情况，依次停常二中、常一中、常顶循。

(12) After the Atm. liquid level of sidedraws are emptied, stop the Atm. distillate pumps.

常压侧线液位抽空后，停常压侧线泵。

(13) After closing the Atm. PA#2 process flow and the Atm. PA#1 process flow, close the Pre-Dist. sidedraw process flow.

常二中、常一中停运后，停运初侧线。

(14) Properly control the level in Pre-Dist. OVHD reflux drum (D-202), Pre-Dist. OVHD product drum (D-201), Atm. OVHD reflux drum (D-302) and Atm. OVHD product drum (D-301) respectively. Control the column top temperature within normal range. When Pre-Dist. top temperature and Atm. top temperature are lower than 100°C, stop column OVHD reflux pumps. 控制好初顶回流罐 D-202、产品罐 D-201 和常顶回流罐 D-302、产品罐 D-301 液位。控制好塔顶温度不超温。当初顶温度和常顶温度低于 100°C停运塔顶回流泵。

2.5.2.5 Stop heaters, and line up circulation loop 加热炉熄火，改循环

(1) After all distillate process flows and pumparound process flows are closed, stop the heaters. 所有侧线、中段回流停运后，加热炉熄火

1) First stop the fuel oil burners, and then purge the fuel oil burners with atomized steam immediately after the fuel oil hand valves are closed.

熄火时，先熄燃料油火嘴，关闭燃料油手阀后，立即用雾化蒸汽扫燃料油火嘴。

2) When all fuel oil burners have been stopped, contact the Production Scheduling Department to inform the storage to stop fuel oil circulation.

所有燃料油火嘴熄完后，联系调度，通知罐区停燃料油循环。

3) When the fuel gas burners are to be stopped, remain the last burner (at the end of the fuel gas coil) of the Atm. heater and the Vac. heater respectively in ignition state, close the fuel gas valve to ISBL, and introduce nitrogen via the BL valve to displace the fuel gas.

熄燃料气火嘴时，常压炉和减压炉保留最后一个火嘴（燃料气盘管末端），关闭燃料气进装置阀门，界区给氮气置换。

4) When the last burner is remained in ignition state, the heaters must be attended by dedicated persons until the last burners stop naturally, then close the fuel gas hand valves, fully open the flue duct dampers, and ventilate the heaters for cooling down.

熄至最后一个火嘴时，加热炉必须留人看守，直至最后一个火嘴自然熄灭后，关闭燃料气手阀。全开烟道挡板，加热炉通风冷却。

5) When the fuel gas burners of the heaters have been stopped, all hand valves of heaters must be closed.

加热炉燃料气火嘴熄灭后，加热炉所有手阀必须全部关闭。

(2) When the tubes confluence temperature of the Vac. heater is decreased below 250°C, contact the Production Scheduling Department to inform the storage to stop the crude pump, close the crude valve to ISBL, establish closed-loop circulation, and close all valves in the VR process flow to OSBL.

减压炉出口温度降至 250°C 以下时，联系调度，通知罐区停运原油泵，关闭原油进装置阀门，装置开闭路循环，关闭渣油出装置阀门。

(3) Continue to cool down the heaters until the tubes confluence temperature of the Vac. heater falls below 150°C, then stop circulation.

加热炉继续降温，至减压炉出口温度降至 150°C 以下时，停循环。

2.5.2.6 Withdraw oil to drum, displace with diesel and conduct cleaning equipments and piping 退油，柴油置换及清洗

(1) Contact the Production Scheduling Department to line up the light slop piping, low-temperature heavy slop piping and high-temperature heavy slop piping.

联系调度，改好轻污油线、低温重污油线 and 高温重污油线。

(2) Return all Atm. distillates and residual oil in column OVHD KO drum to the light slop drum. 常压侧线、塔顶分液罐的存油全部退至轻污油罐。

(3) Return all Vac. column distillates to the high-temperature heavy slop piping.

减压侧线退至高温重污油线。

(4) Return all residual oil in each column to the low-temperature heavy piping, while controlling

the oil rundown temperature within 90°C.

各塔内存油全部退至低温重污油线。往低温重污油退油时，控制好退油温度，不得超过 90°C。

(5) Upon completion of oil withdraw operation, contact the Production Scheduling Department to introduce diesel to displace the oil in Vac. column distillate process flows, crude process flow, desalted crude process flow, Pre-Dist bottom oil process flow, Atm. heater, Atm. residue process flow, Vac. heater and VR process flow.

退油结束后，联系调度引柴油置换减压侧线、脱前原油线、脱后原油线、初底油线和常压炉、常底油和减压炉、减压渣油等流程。

1) Introduce diesel to the Vac. column via the startup diesel piping through the LVGO PA process flow. When diesel level is established in the LVGO collecting drum, start the LVGO pump to send the oil back to the high-temperature heavy slop piping. Check and confirm that diesel comes from the BL valve, line up the LVGO PA process flow, and close the process flow from LVGO to high-temperature heavy slop.

从开工柴油线引柴油经减一中进入减压塔，减一线有液位后，启运减一线泵往高温重污油线退油。界区检查置换情况，界区见柴油后，改为投用减一中，关闭减一线至高温重污油。

2) When diesel level is established in the MVGO collecting drum, start the MVGO pump to send the oil back to the high-temperature heavy slop piping. Check and confirm that diesel comes from the BL valve, line up the MVGO PA process flow, and close the process flow from MVGO to high-temperature heavy slop.

减二线集油箱有液位后，启运减二线泵高温重污油线退油。界区检查置换情况，界区见柴油后，改为投用减二中，关闭减二线至高温重污油。

3) When diesel level is established in the HVGO collecting drum, start the HVGO pump to send the oil back to the high-temperature heavy slop piping. Check and confirm that diesel comes from the BL valve, line up the HVGO PA process flow, and close the process flow from HVGO to high-temperature heavy slop. Continue to circulate HVGO PA for 1h, then close the HVGO PA process flow, and line up the HVGO flushing oil process flow to displace the oil in HVGO flushing oil process flow for 10min before stopping the HVGO pump.

减三线集油箱有液位后，启运减三线泵高温重污油线退油。界区检查置换情况，界区见柴油后，改为投用减三中，关闭减三线至高温重污油。减三中继续循环 1h 后，关减三中，改减三线内回流，置换 10min 后停减三线泵。

4) When diesel level is established in the Vac. overflash oil buffer drum (D-402), start the Vac. overflash oil pump to send the oil back to the low-temperature heavy slop piping through the VR piping. When diesel level is established in the last heat exchanger in the Vac. overflash oil process flow, stop the Vac. overflash oil pump.

减四线油缓冲罐 D-402 有油后，启运减四线泵，经渣油线往低温重污油退油。减四线最后一台换热器见柴油后，停减四线泵。

5) After all Vac. column distillates have been displaced with diesel, line up the startup diesel circulation loop, and displace, with startup diesel, the oil in crude process flow, desalted crude process flow, Pre-Dist. Bottom oil process flow, Atm. heater, Atm. residue process flow, Vac.

heater and VR process flow one by one.

减压侧线置换完后，将柴油改至开工循环线，逐路置换脱前原油、脱后原油线、初底油、常压炉、常底油、减压炉和渣油线。

6) Upon completion of displacement with startup diesel, close the startup diesel piping to ISBL, and start Vac. residue pump, Atm. residue pump and Pre-Dist. Bottom oil pump in turn to clean the system by closed-loop circulation.

柴油置换结束后，停开工柴油进装置，依次启运减底泵、常底泵和初底泵，闭路循环清洗。

7) After closed-loop circulation is conducted for 4h, line up the process flow from the vac. residue to the low-temperature heavy slop to run down the oil to the low-temperature heavy slop system, and stop the Pre-Dist. Bottom oil pump when the level in Pre-Dist. is emptied, the Atm. residue pump when the level in Atm. is emptied, and the Vac. residue pump when the level in Vac. column is emptied.

闭路循环 4 小时后，渣油线改至低温重污油线退油，初馏塔液位抽空后停初底泵、常压塔液位抽空后停常底泵、减压塔液位抽空后停减底泵。

2.5.2.7 Run down oil to the designated equipment/piping, and conduct purging operation 退油，吹扫

(1) Precautions during purging operation

吹扫时注意事项

1) When oil has been withdrawn, conduct closed-loop purging at the first priority: purge Pre-Dist. sidedraw towards the Atm., purge Atm. top PA and Atm. PA#1 and Atm. PA#2 towards the Atm., purge kerosene, light diesel and heavy diesel towards the Vac. column, and purge LVGO, MVGO and HVGO towards the Vac. column.

退油吹扫时，应优先考虑密闭吹扫：初一线往常压塔吹扫，常顶循、常一中、常二中往常压塔吹扫，常一线、常二线、常三线往减压塔吹扫，减压一线、二线、三线往减压塔吹扫。

2) The steam pressure shall be $\leq 0.8\text{MPa}$ during purging operation.

扫线时，确保蒸汽压力 $\leq 0.8\text{MPa}$ 。

3) All flowmeters, control valves and pumps shall be bypassed during purging operation, and shall be purged for 15~30min at the end stage of purging operation for the involved process flows.

扫线时，流量计、调节阀、机泵等改为付线，所在流程吹扫末期，流量计、调节阀和机泵吹扫，吹扫时间 15-30min。

4) Prior to steam introduction, steam condensate must be completely drained from the system. Steam shall be slowly introduced to the system to prevent water hammer.

给汽前一定要放尽蒸汽冷凝水，并缓慢给汽，防止水击。

5) The reflux piping shall be first purged, followed by the sendout piping; the heavy oil piping shall be first purged, followed by the light oil piping.

应先扫回流线，后扫外送线；先扫重油线，后扫轻油线。

6) Purging operation shall be conducted per the purge flow to prevent oil from intruding into the

steam.

吹扫时应按扫线流程走，严防油串入蒸汽中。

7) The heavy oil piping shall be closed repeatedly for pressure buildup. After the main process flow is lined up, the heavy oil piping shall be purged in segments, and the pressure difference between piping segments shall be not less than 0.6MPa for better purging effect.

重油管线要反复憋压，且主流程打通后，重质油要分段进行，压差应不小于 0.6 MPa，这样才能达到较好的扫线效果。

8) All piping (such as connection piping, bypass, spare piping and dead-ended piping), control valves and pumps (standby pumps) shall be purged thoroughly.

扫线时所有的连通线、副线、备用线、盲肠等管线，控制阀、泵（备用泵）都要扫净，不允许留有死角

9) During purging operation, it is absolutely prohibited to drain oil via the vent valve at each low point. The vent valve at each low point can only be opened when checking the purging performance, and shall be closed in a timely manner.

扫线过程中绝不允许在各低点放空排放油，各低点放空只能在检查扫线情况时开，并要及时关闭。

10) Upon completion of purging operation, all purge valves shall be closed in a timely manner, and steam and condensate in the equipment/piping shall be drained completely.

扫线完毕要及时关闭扫线阀门，放尽设备、管线内的蒸汽和冷凝水。

11) Light oil piping shall be flushed with water before purging with steam, and it is strictly forbidden to directly purge the light oil piping with steam. And additionally, it is forbidden to purge the light oil piping with IA and PA.

轻油管线扫线前先用水顶，然后再扫线，严禁用蒸汽直接扫线。禁止用仪表风、非仪表风扫线。

12) While introducing steam to the column pumparound process flows and purge the column pumparound process flows towards the column, the steam flowrate to the column pumparound process flows shall be not too large so as to prevent damage to the column internals or severe vibration at the top of the column.

中段回流给汽往塔内吹扫时，给汽不能太大，防止损坏塔内件或者引起塔顶出现剧烈振动。

13) During purging operation, pressure variation in the Vac. column shall be closely monitored for lining up the vent piping in a timely manner to prevent overpressure.

吹扫过程中要密切注意减压塔内压力变化，及时改通放空流程，防止超压。

14) Detailed records shall be made for purging operation after process unit shutdown, including steam introduction points, time when steam is introduced and cut off, and name of operators.

停工扫线时给汽点、给汽停汽时间及操作员姓名等均要做好详细记录，落实责任。

15) During steaming operation, the steam flowrates to Pre-Dist., Atm. and Vac. column shall be not too large to avoid column internals from being overturned.

初馏塔、常压塔、减压塔塔蒸塔时，蒸汽量不要过大，严防吹翻塔内件。

16) While steaming Pre-Dist., Atm. and Vac. column, steam shall be introduced to the piping that are connected with these columns, such as feedstock piping and recycle piping.

蒸塔时各塔进料线、回流入塔线等与塔相通的管线均需同时给汽。

17) The Atm. shall be steamed together with the stripper.

常压塔蒸塔时，汽提塔与常压塔同时蒸塔。

18) The drain valves at the bottom of columns shall be opened and kept unblocked to prevent damage to equipment due to water hammer generated from residual water.

三塔底及汽提塔三段底排凝阀需打开保持畅通，以免存水产生水击而损坏设备。

19) As the column pressure is $\geq 0.1\text{MPa}$ during steaming operation, the neutralizing inhibitor piping, corrosion inhibitor piping and water piping shall be flushed with water prior to steaming operation.

蒸塔时塔压 $\geq 0.1\text{MPa}$ ，注中和剂、注缓蚀剂、注水线要在蒸塔前水顶排空。

20) Column OVHD heat exchangers/coolers and reflux drums shall be purged with steam while steaming the columns. At the final stage of steaming operation, the vent valves at the inlet of LVGO PA, 2#, 3# and 4# pumps shall be opened to drain the condensate.

塔顶冷换设备及塔顶回流罐在蒸塔的同时进行蒸吹，减压塔在蒸塔后期打开减一、二、三线、减四线在泵进口放空排凝。

(2) Purging of crude and desalted crude process flow

脱前原油和脱后原油系统吹扫

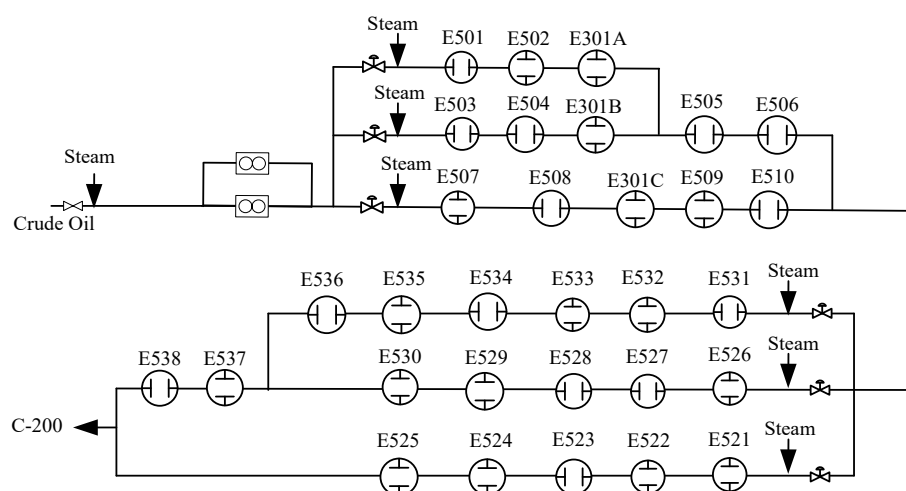


Figure 91 Flow Chart of Purging for Crude and Desalted Crude Process Flow

图 91 脱前原油和脱后原油系统吹扫流程图

Notes:

说明:

1) Close the control valves on both 1st crude branch and 2nd crude branch. Introduce steam after the control valves on 1st crude branch and 2nd crude branch.

脱前原油三路，关闭第一路、第二路调节阀。从调节阀后给汽。

2) Introduce steam via the crude valve to ISBL to purge the crude 3rd branch towards the desalted crude process flow.

从原油进装置处给汽吹扫，经脱前原油第三路往脱后原油吹扫。

3) Close the control valves on both 2nd desalted crude branch and 3rd desalted crude branch.

Introduce steam after the control valves on 1st desalted crude branch and 2nd desalted crude branch.

脱后原油三路，关闭第二路、第三路调节阀。从调节阀后给汽。

4) Purge the oil and vapor generated from 3 crude branches via the 3rd desalted crude branch toward Pre-Dist..

脱前原油三路扫线的油气经脱后原油第一路往后吹扫。

5) Employ blast purge method. Build up pressure for the 1st crude branch, the 2nd crude branch and the 3rd crude branch at E-301A, E-301B and E-510 respectively. When one crude branch piping is being purged, the other two crude branches shall be closed for pressure buildup.

扫线时，应采用爆破式吹扫，脱前原油第一、二、三路分别在 E-301A、E-301B、E-510 处憋压。

其中一路吹扫时，其它两路憋压。

6) Build up pressure for the 1st desalted crude branch, the 2nd desalted crude branch and the 3rd desalted crude branch at E-525, E-530 and E-536 respectively. When one crude branch is being purged, the other two crude branches shall be closed for pressure buildup.

脱后原油第一、二、三路分别在 E-525、E-530、E-536 处憋压。其中一路吹扫时，其它两路憋压。

(3) Purging of Pre-Dist bottom oil piping and Atm. heater

初底油及常压炉吹扫

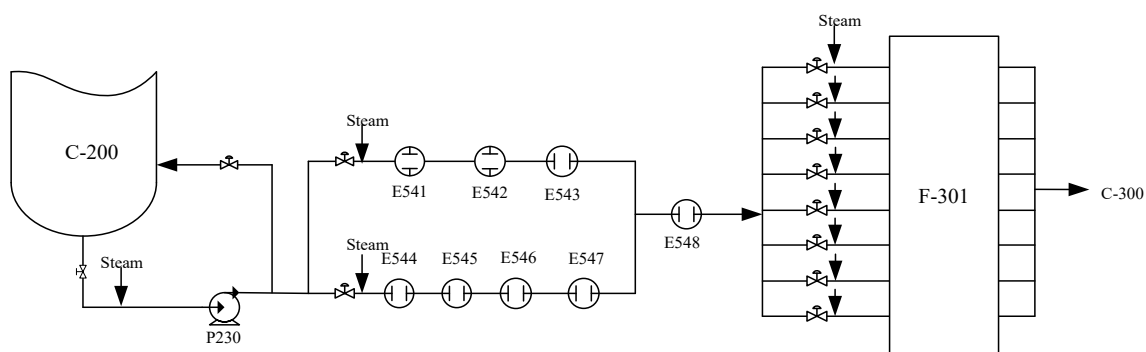


Figure 92 Flow Chart of Purging for Pre-Dist Bottom Oil Piping and Atm. heater

图 92 初底油及常压炉吹扫流程图

Notes:

说明:

1) Close the feed control valves to 7 branches(A total of 8 branches) of the Atm. heater, and introduce steam after the feed control valves to purge the Atm. heater towards the Atm..

关闭常压炉七路炉管调节阀，从调节阀后给汽，往常压塔吹扫。

2) Close the control valves in two Pre-Dist bottom oil branches, and introduce steam after the control valves to purge the Pre-Dist bottom oil piping towards the Atm. through one branch of the Atm. heater.

关闭初底油两路调节阀，从调节阀后给汽，经常压炉其中一路往常压塔吹扫。

3) Introduce steam via the Pre-Dist bottom oil draw valve to purge the minimum reflux piping of the Pre-Dist bottom pump towards the Pre-Dist column, and drain the Pre-Dist column bottoms

via the drain valve at the bottom of the Pre-Dist column to heavy HC slop drum.

初馏塔底抽出给汽，往初底泵吹扫最小回流线，从塔底排至地下污油罐。

4) When purging the Pre-Dist bottom oil heat exchanger, it is required to build up pressure in E-543 and E-547 respectively.

初底油换热器吹扫时，分别在 E-543 和 E-547 憋压。

5) As the steam introduction points for 8 branches of the Atm. heater are located after the feed control valves, the steam generated from the Pre-Dist bottom oil heat exchanger at the end stage of purging operation shall be used to purge the 8 branches of the Atm. heater in turn.

由于常压炉八路炉管给汽点在调节阀后，应在初底油换热器吹扫末期，利用初底油换热系统的蒸汽，常压炉八路炉轮流憋放压。

(4) Purging of Atm. residue and Vac. heater

常底油及减压炉吹扫

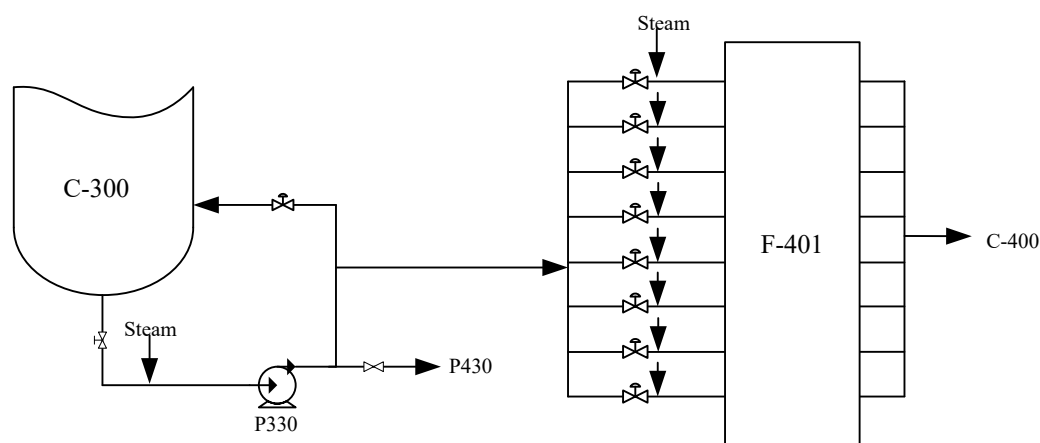


Figure 93 Flow Chart of Purging for Atm. Residue and Vac. heater

图 93 常底油及减压炉吹扫流程图

Notes:

说明:

1) Close the feed control valves on the 8 branches of the Vac. heater, and introduce steam after the feed control valves to purge the Vac. heater tubes towards the Vac. column.

关闭减压炉八路炉管调节阀，从调节阀后给汽，往减压塔扫线。

2) Introduce steam via the Atm. residue draw valve to purge the minimum reflux piping of the Atm. pump towards the Atm..

从常压塔塔底给汽，吹扫常底泵最小回流线。

3) Introduce steam from P-430 to purge the connecting piping from Atm. residue pump(P-330) to the Vac. residue pump (P-430) towards the Atm. heater.

常底泵至减底泵出口跨线，从 P-430 端给汽，往常压炉吹扫。

4) As the steam introduction points for 8 branches of the Vac. heater are located after the feed control valves, introduce steam via the Atm. residue draw valve or P-330 to purge 8 branches of the Vac. heater in turn.

由于减压炉八路炉管给汽点在调节阀后，减压炉八路炉轮流憋放压时，从常压塔塔底或者 P-330 给汽。

(5) Purging of Vac. overflow oil and vac.residue process flow

减四线和减压渣油吹扫

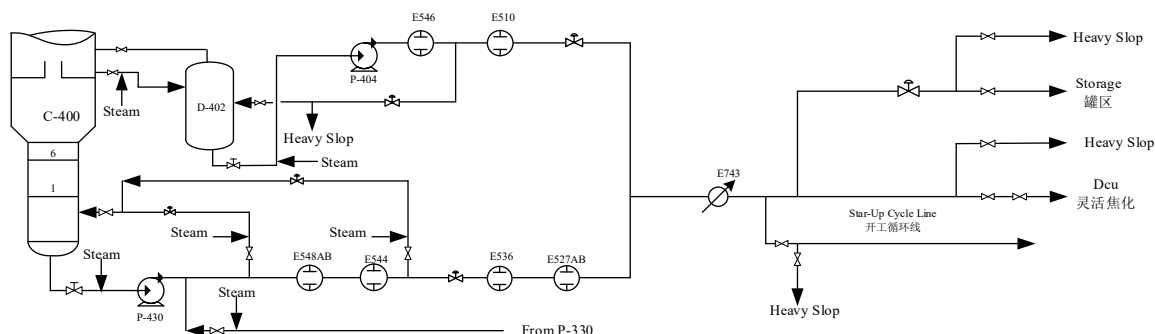


Figure 94 Chart of Purging for Vac. Overflow oil and Vac. Residue Process Flow

图 94 减四线和减压渣油吹扫流程图

Notes:

说明:

1) When purging the vacuum residue system, line up the process flow from the vacuum residue to the high-temperature heavy slop, close the CCW valves of the vacuum residue water cooler (E-743), and open the drain valves on CCW piping.

渣油线扫线时，渣油至重污油线改为高温重污油线，停运渣油水冷器 E-743。

2) Introduce steam via the Vac. overflow oil draw valve to purge the Vac. overflow oil towards D-402, and keep the gas phase balance piping from D-402 to the Vac. column unblocked.

减四线自减压塔塔壁抽出给汽，往 D-402 吹扫，D-402 至减压塔的气相平衡线保持畅通。

3) When oil level is established in D-402, start P-404 to send the oil into the heavy slop drum of drum.

D-402 有油后，先启动 P-404 将油送至重污油罐。

4) When oil level in D-402 is emptied, close D-402 draw valve, and introduce steam after D-402 draw valve to purge D-402 towards the vacuum residue piping.

D-402 油送尽后吹扫，关闭 D-402 抽出阀，从阀后给汽，往渣油线吹扫。

5) At the end stage of purging operation for the Vac. overflow oil process flow, introduce steam to purge the quench oil piping directly towards the heavy slop piping from the end of quench oil piping.

减四线吹扫末期，吹扫减四线急冷油线，直接从末端往重污油吹扫。

6) Purge the minimum reflux piping of the Vac. residue pump and the Vac. column bottom quench oil piping towards the Vac. column. while starting the Vac. residue pump withdraw oil to drum.

先往减压塔吹扫减底泵最小回流线和减底急冷油线。并启动减底泵送油。

7) Upon completion of purging operation for the minimum reflux piping of the Vac. residue pump and the Vac. column bottom quench oil piping, introduce steam at the bottom of the Vac. column

to purge the vacuum residue process flow to drum.

减底泵最小回流线和减底急冷油线吹扫结束后，从减压塔底给汽，吹扫渣油线。

(6) Purging of Pre-Dist. sidedraw process flow

初一线吹扫

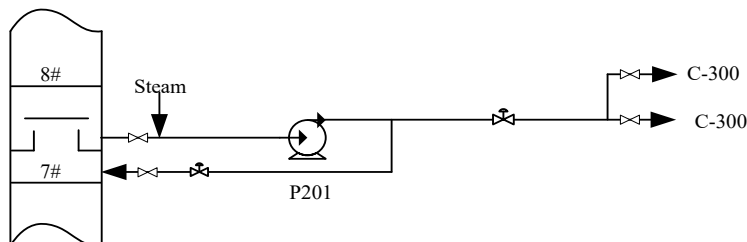


Figure 95 Pre-Dist. Sidedraw Purging Flow Chart

图 95 初一线吹扫流程图

Notes:

说明:

Introduce steam via the Pre-Dist. side draw valve to first purge the Pre-Dist. sidedraw internal reflux loop, followed by the Pre-Dist. sidedraw loop to the Atm..

初一线从塔壁给汽，先吹扫初一线内回流，再吹扫至常压塔线。

(7) Purging of Atm. OVHD reflux loop

常顶循吹扫

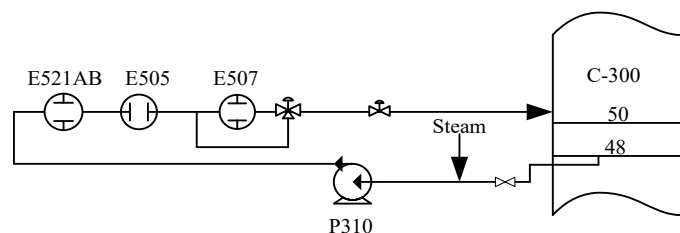


Figure 96 Atm. OVHD Reflux Loop Purging Flow Chart

图 96 常顶循吹扫流程图

Notes:

说明:

1) Introduce steam via the Atm. side draw valve to purge the Atm. OVHD reflux loop towards the Atm..

常顶循从塔壁给汽，往常压塔吹扫。

2) Fully close the bypass valve of the three-way valve during purging operation. Purge the bypass valve of the three-way valve at the end stage of purging operation.

吹扫时，三通阀付线全关。吹扫末期，吹扫三通阀付线。

(8) Purging of Atm. PA1# loop

常一中吹扫

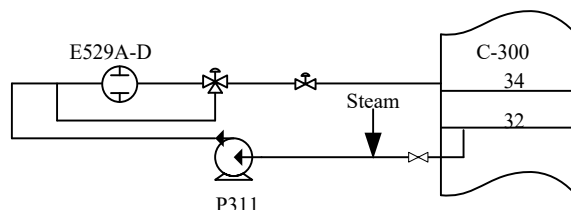


Figure 97 Atm. Pumparound Stream 1# Loop Purging Flow Chart

图 97 常一中吹扫流程图

Notes:

说明:

1) Introduce steam via the Atm. side draw valve to purge the Atm. PA1# loop towards the Atm..
常一中从塔壁给汽，往常压塔吹扫。

2) Fully close the bypass valve of the three-way valve during purging operation. Purge the bypass valve of the three-way valve at the end stage of purging operation.

吹扫时，三通阀付线全关。吹扫末期，吹扫三通阀付线。

(9) Purging of Light diesel loop

常二中吹扫

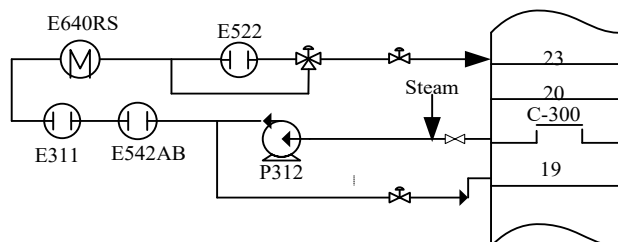


Figure 98 Atm. Pumparound Stream 2# Loop Purging Flow Chart

图 98 常二中吹扫流程图

Notes:

说明:

1) Introduce steam via the Atm. side draw valve to purge the Light diesel loop towards the Atm..
常二中从塔壁给汽，往常压塔吹扫。

2) Fully close the bypass valve of the three-way valve during purging operation. Purge the bypass valve of the three-way valve at the end stage of purging operation.

吹扫时，三通阀付线全关。吹扫末期，吹扫三通阀付线。

3) The stabilizer reboiler (E-640RS) in Light Ends Recovery Unit shall not be purged together with the Light diesel loop, while it shall be purged at the time when it is being steamed upon completion of water flushing operation.

轻烃回收装置的稳定塔重沸器 E-640RS 不并入常二中扫线。该换热器在稳定塔水洗结束，蒸塔时单独给汽扫线。

4) The Kerosene reboiler (E-311) shall be purged together with the Light diesel loop.

常一线重沸器 E-311 并入常二中扫线。

(10) Purging of Kerosene, 2# and 3# loops

常一、二、三线吹扫

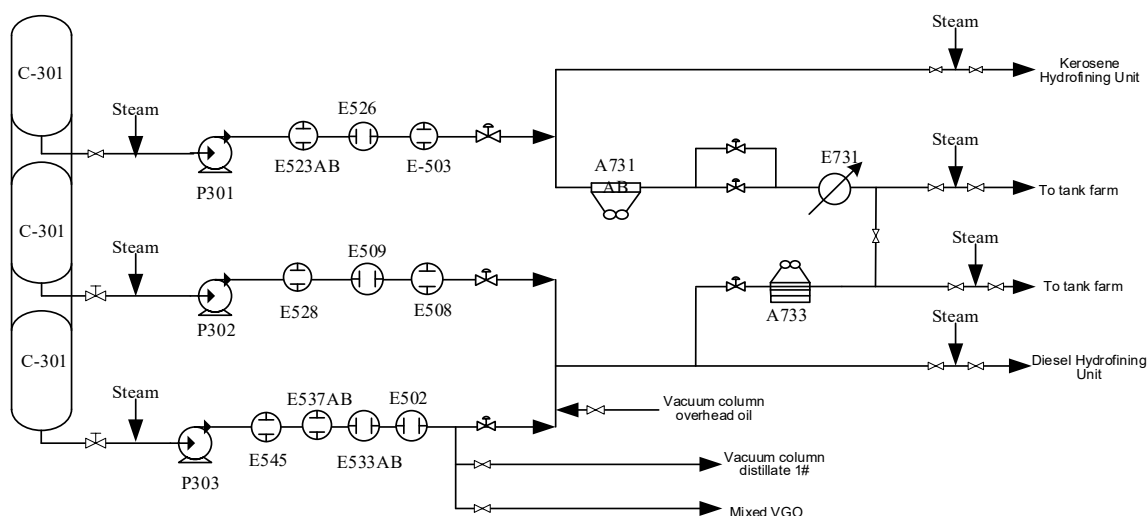


Figure 99 Flow Chart of Purging for Atm. Distillates 1#, 2# and 3# Loops

图 99 常一、二、三线吹扫流程图

Notes:

说明:

1) Purge the Atm. distillates 1#, 2# and 3# loops towards the Vac. column through the loop from Heavy diesel to the mixed gas oil and the HVGO flushing oil loop.

常一线、常二线、常三线往减压塔吹扫，经常三线至混合蜡油线、减三线内回流进入减压塔。

2) Steam introduction point: Kerosene draw valve, Atm. distillate 2# draw valve, Heavy diesel draw valve, valve in the Kerosene process flow to Kerosene Hydrofining Unit or storage, and valve in the mixed diesel process flow to Diesel Hydrofining Unit or storage.

给汽点：汽提塔常一线、常二线抽出、常三线抽出，常一线至航煤加氢、罐区，混合柴油至柴油加氢、罐区。

3) During purging operation, stop the air cooling fans, and drain CCW from the water coolers.

扫线时，空冷风机停运，水冷器循环水排干净。

(11) Purging of Atm. distillate 4# loop

常四线

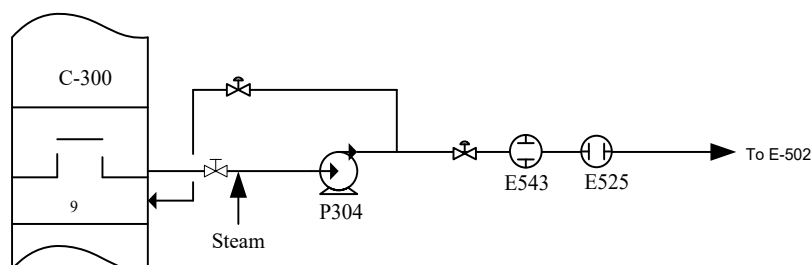


Figure 100 Atm. Distillate 4# Loop Purging Flow Chart

图 100 常四线吹扫流程图

Notes:

说明:

1) Introduce steam via the Atm. side draw valve to first purge the Atm. distillate 4# internal reflux loop.

常四线从塔壁给汽，先吹扫常四线内回流线。

2) Upon completion of purging operation for the Atm. distillate 4# internal reflux loop, purge the Atm. distillate 4# loop towards the Vac. column through the MVGO loop.

内回流线吹扫结束后，经减二线往减压塔吹扫。

3) May also introduce steam to E-525 and E-543 to purge towards the Atm. distillate 4# internal reflux loop, while closing E-525 outlet valve and bypass valve. Upon completion of purging operation for the Atm. distillate 4# loop, purge the MVGO loop.

也可以从 E-525 和 E-543 处给汽，关闭 E-525 出口阀和付线阀，往常四线内回流吹扫。常四线吹扫结束后，再往减二线吹扫。

(12) Purging of Vac. column distillates 1#, 2# and 3# loops

减一、二、三线吹扫

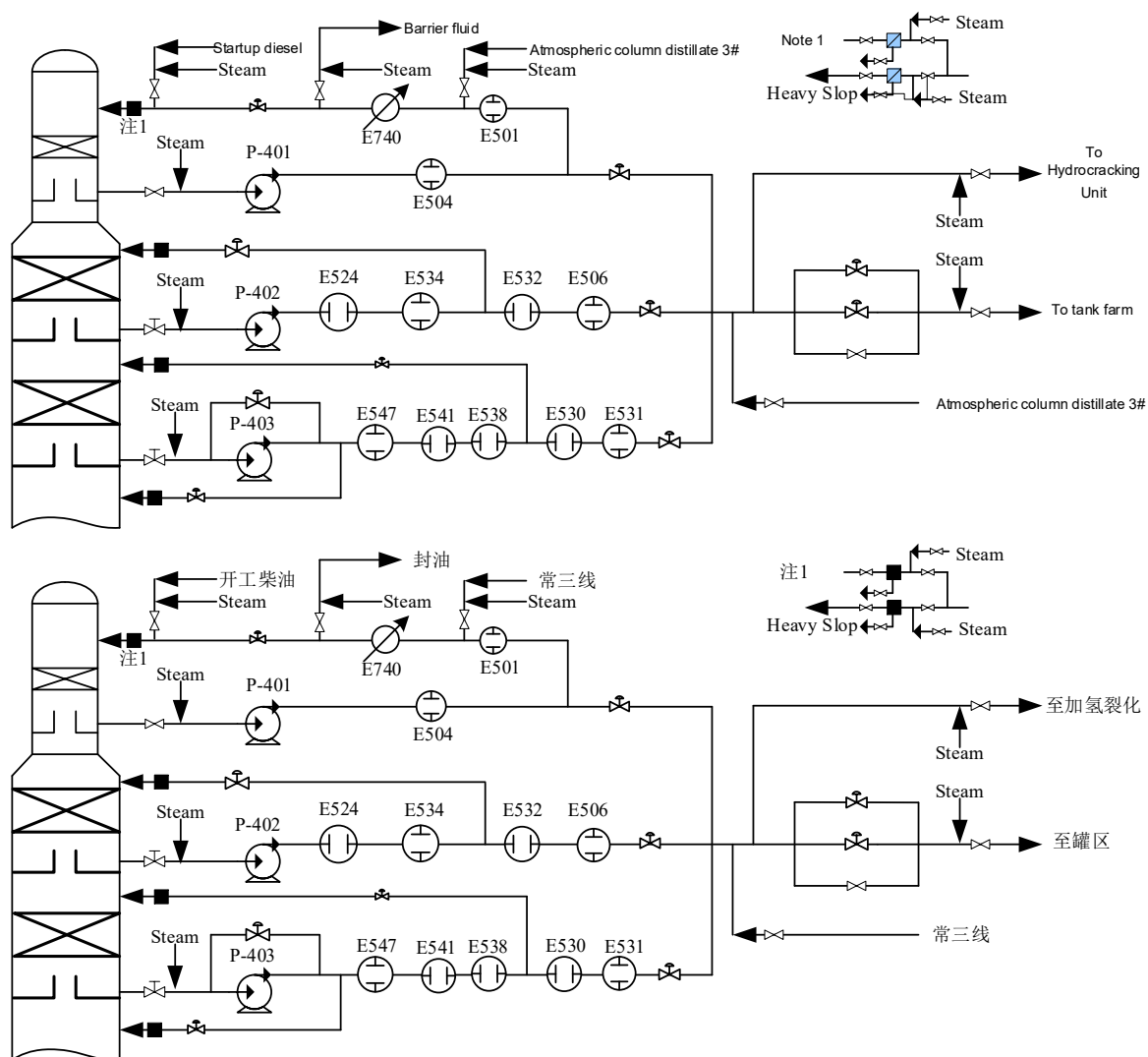


Figure 101 Flow Chart of Purging for Vac. column Distillates 1#, 2# and 3# Loops

图 101 减一、二、三线吹扫流程图

Notes:

说明:

1) Introduce steam to the LVGO PA loop via the Vac. column side draw valve and to the LVGO PA loop via the valve on the filter, to purge towards the HVGO flushing oil loop.

减一线从减压塔塔壁给汽, 减一中从过滤器处给汽, 往减三线内回流吹扫。

2) Introduce steam to the MVGO loop via the Vac. column side draw valve and to the MVGO PA loop via the valve on the filter, to purge towards the HVGO flushing oil loop.

减二线从减压塔塔壁给汽, 减二中从过滤器处给汽, 往减三线内回流吹扫。

3) Introduce steam to the HVGO loop via the Vac. column side draw valve and to the HVGO PA loop via the valve on the filter, to purge towards the HVGO flushing oil loop.

减三线从减压塔塔壁给汽, 减三中从过滤器处给汽, 往减三线内回流吹扫。

4) Introduce steam to the mixed gas oil loop via the BL valve, to purge towards the HVGO flushing oil loop.

混合蜡油从界区给汽, 往减三线内回流吹扫。

5) Purge the loops from startup diesel to LVGO PA, from LVGO PA to sealing oil and from Heavy diesel to makeup LVGO PA in conjunction with purging operation for the startup diesel loop, the sealing oil loop and the Heavy diesel loop.

开工柴油线至减一中、减一中至封油线、常三线至减一中补油线, 分别结合开工柴油线、封油线、常三线吹扫时吹扫。

(13) Purging of Pre-Dist. OVHD system

初顶系统

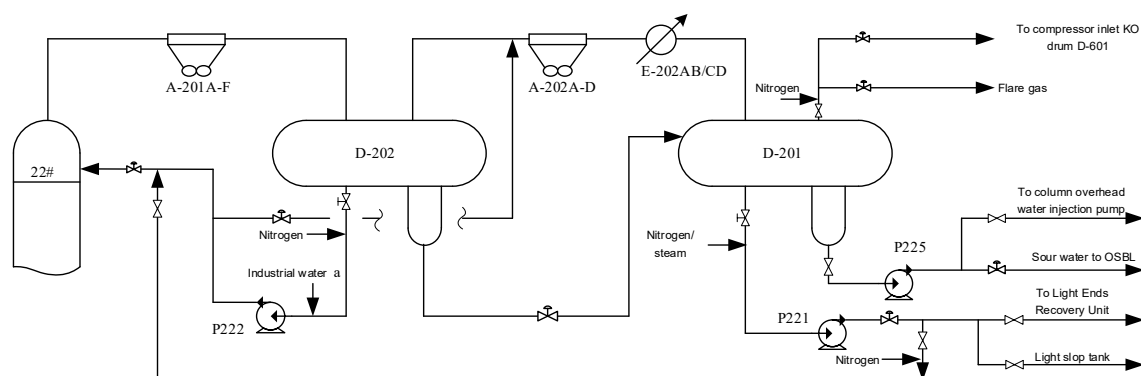


Figure 102 Pre-Dist. OVHD System Purging Flow Chart

图 102 初顶系统吹扫流程图

Notes:

说明:

1) Purge the Pre-Dist. OVHD air coolers, water coolers and KO drums in conjunction with steaming operation for the Pre-Dist..

初馏塔塔顶空冷器、水冷器和分液罐结合初馏塔蒸塔处理。

2) During column steaming operation, put all air coolers and water coolers into service, send the drum OVHD gas to the flare gas system, send the condensate to Sour Water Stripping Unit, and send the oil into the light slop drum.

蒸塔时，各空冷、水冷器投用，罐顶气至火炬气系统，冷凝水送至酸水汽提装置，油送至轻污油罐。

3) At the end stage of steaming operation, reduce the steam flowrate to the column, and then shut down the air coolers, drain CCW from the water coolers, line up D-201 OVHD gas piping to the vent valve, and steam the column OVHD air coolers, water coolers and KO drums.

蒸塔末期，关小蒸塔蒸汽后，停运空冷器，水冷器循环水排尽。D-201 罐顶改至放空，蒸煮塔顶的空冷器和水冷器、分液罐等。

4) Upon completion of steaming operation, supply water to P-222 inlet to pump water into D-201 via the cut water piping of D-202.

蒸煮结束后，从 P-222 入口给水，先通过 D-202 切水线，往 D-201 置换。

5) Start P-222 to pump water to the top of the Pre-Dist. (in conjunction with water flushing operation for the Pre-Dist.). After the reflux water is filled in the reflux piping, supply water to A-202.

启运 P-222 往初馏塔塔顶顶水（结合初馏塔洗塔）。回流线顶水后，往 A-202 顶水。

6) Fill water into D-201 via the cut water piping of D-202, and start P-221 to pump water to the light slop drum and Light Ends Recovery Unit.

通过 D-202 的切水线往 D-201 装水，启运 P-221 往轻污油和轻烃回收顶水。

7) Start P-225 to pump water to the sour water piping and the column OVHD water piping.

启运 P-225，酸性水和塔顶注水线顶水。

8) Upon completion of water flushing operation, drain the residual water in the bottom of D-201 and D-202, and drain the oil (if any) into the U/G light slop drum.

顶水结束后，D-201、D-202 罐底排尽存水，有油则排至地下轻污油罐。

9) Introduce steam via D-201 bottom draw valve to purge D-201 towards Light Ends Recovery Unit, Pre-Dist. OVHD reflux loop, D-202 and A-202 respectively. Drain the oil into the U/G light slop drum.

从 D-201 罐底常底油抽出阀后给蒸汽，分别往轻烃回收、初顶回流、D-202、A-202 等方向吹扫。油排至地下轻污油罐。

(14) Purging of Atm. OVHD system

常顶系统

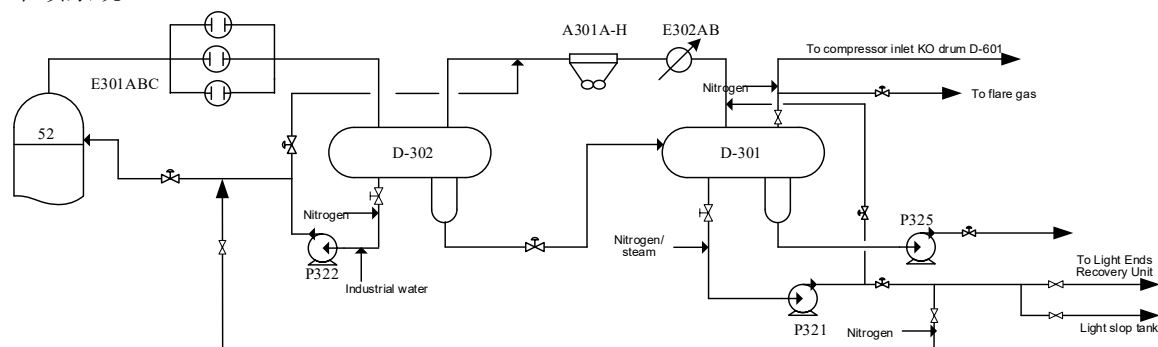


Figure 103 Atm. OVHD System Purging Flow Chart

图 103 常顶系统吹扫流程图

Notes:

说明:

1) Purge the Atm. OVHD heat exchangers, air coolers, water coolers and KO drums in conjunction with steaming operation for the Atm..

常压塔塔顶换热器、空冷器、水冷器和分液罐结合常压塔蒸塔处理。

2) During column steaming operation, put all air coolers and water coolers into service, send the drum OVHD gas to the flare gas system, send the condensate to Sour Water Stripping Unit, and send the oil into the light slop drum.

蒸塔时，各空冷、水冷器投用，罐顶气至火炬气系统，冷凝水送至酸水汽提装置，油送至轻污油罐。

3) At the end stage of steaming operation, reduce the steam flowrate to the column, and then shut down the air coolers, drain CCW from the water coolers, line up D-301 OVHD gas piping to the vent valve, and steam the column OVHD heat exchangers/coolers and KO drums.

蒸塔末期，关小蒸塔蒸汽后，停运空冷器，水冷器循环水排尽。D-301 罐顶改至放空，蒸煮塔顶的冷换设备、分液罐等。

4) Upon completion of steaming operation, supply water to P-322 inlet to pump water into D-301 via the cut water piping of D-302.

蒸煮结束后，从 P-322 入口给水，先通过 D-302 切水线，往 D-301 置换。

5) Start P-322 to pump water to the top of the Atm. (in conjunction with water flushing operation for the Atm.). After the reflux water is filled in the reflux piping, supply water to A-301.

启运 P-322 往常压塔塔顶顶水（结合常压塔洗塔）。回流线顶水后，往 A-301 顶水。

6) Fill water into D-301 via the cut water piping of D-302, and start P-321 to pump water to the light slop drum and Light Ends Recovery Unit.

通过 D-302 的切水线往 D-301 装水，启运 P-321 往轻污油和轻烃回收顶水。

7) Start P-325 to pump water to the sour water piping and the column OVHD water piping.

启运 P-325，酸性水和塔顶注水线顶水。

8) Upon completion of water flushing operation, drain the residual water in the bottom of D-301 and D-302, and drain the oil (if any) into the U/G light slop drum.

顶水结束后，D-301、D-302 罐底排尽存水，有油则排至地下轻污油罐。

9) Introduce steam via D-301 bottom draw valve to purge D-301 towards Light Ends Recovery Unit, Atm. OVHD reflux loop, D-302 and A-301 respectively. Drain the oil into the U/G light slop drum.

从 D-301 罐底常底油抽出阀后给蒸汽，分别往轻烃回收、常顶回流、D-302、A-301 等方向吹扫。油排至地下轻污油罐。

(15) Purging of Vac. column OVHD system

减顶系统

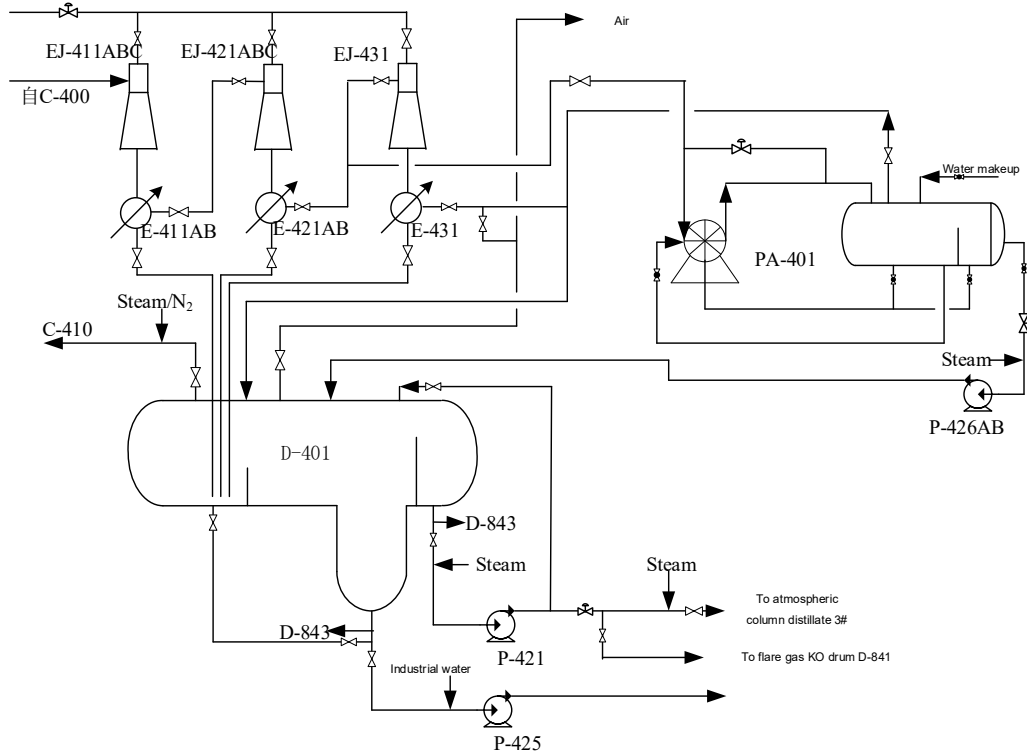


Figure 104 Vac. column OVHD System Purging Flow Chart

图 104 减顶系统吹扫流程图

Notes:

说明:

1) Purge the Vac. column vacuuming system and condensing system with the steam generated from steaming operation for the Vac. column. Put the Vac. column OVHD condenser into service while steaming the Vac. column. Line up D-401 OVHD gas piping to the flare gas system. While steaming the column, send the water to Sour Water Stripping Unit, and run down the oil to the slop system.

减顶抽真空及冷凝系统利用减压塔蒸塔汽处理，减压塔蒸塔时，塔顶冷凝器投用。D-401 罐顶至火炬气。蒸塔时，水往酸水汽提装置外送，油往污油系统退油。

2) At the end stage of steaming operation, reduce the steam flowrate to the Vac. column, cut off CCW to the condenser, and line up D-401 OVHD gas piping to the vent valve.

蒸塔末期，减少减压塔给汽，停冷凝器循环水。D-401 罐顶改放空。

3) Upon completion of steaming operation, purge the Vac. column OVHDs system with steam. 蒸塔结束后，蒸汽吹扫减顶油系统扫线。

4) Introduce steam via the valve in the Vac. column OVHDs loop that is connected to the Heavy diesel loop and D401 bottom draw valve, to purge towards D-401 and D-841 respectively.

从减顶油并常三线处给汽，从 D-401 罐底减顶油抽出阀后给汽，往 D-401 吹扫，往 D-841 吹扫。

5) Introduce steam via P-426 to purge towards D-401 and the water ring pump outlet KO drum respectively.

从 P-426 给汽，分别往 D-401 和往水环泵出口分液罐吹扫。

6) Drain the oil into U/G heavy slop drum (D-843) during purging operation.

吹扫时，往 D-843 地下重污油罐排油。

(16) Purging of fuel oil system

燃料油

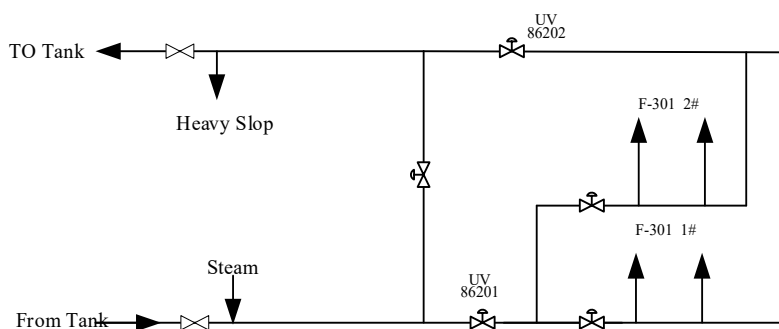


Figure 105 Fuel Oil System Purging Flow Chart

图 105 燃料油系统吹扫流程图

Note: Introduce steam via the fuel oil valve to ISBL to purge the fuel oil system towards the heavy slop system.

说明：燃料油从进装置处给蒸汽，往重污油吹扫。

(17) Purging of fuel gas system

燃料气

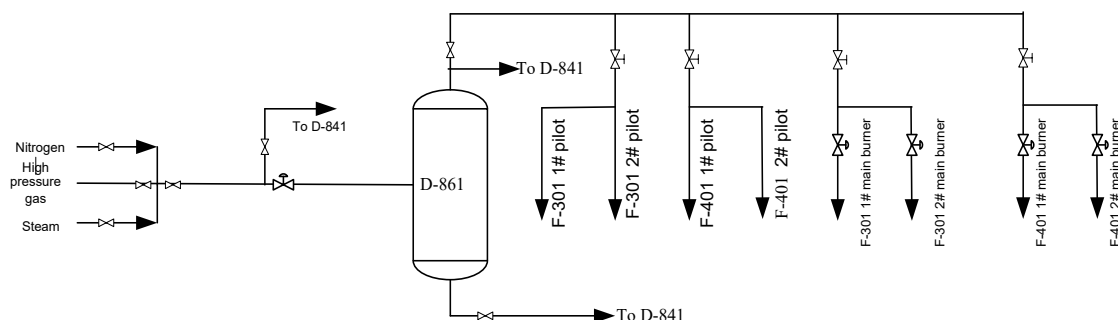


Figure 106 Fuel Gas System Purging Flow Chart

图 106 燃料气系统吹扫流程图

Notes:

说明：

1) When the heaters have been stopped, close the fuel gas hand valves of all burners, and remove the hoses of all burners.

加热炉熄火后，关闭所有火嘴的燃料气手阀，拆除软管。

2) After closing the fuel gas valve to ISBL, introduce nitrogen after the fuel gas valve to ISBL to purge the fuel gas system towards the flare gas system through the pressure control valves and the valves on both top and bottom of D-861 for 8h. 置换 8 小时。

关闭燃料气进装置界区阀后，从阀后给氮气，分别在压控阀、D-861 罐顶、D-861 罐底往火炬气置换吹扫。置换 8 小时。

3) Upon completion of displacement with nitrogen, introduce steam via the BL valve to purge

the fuel gas system. Vent steam at the top of D-861. When the fuel gas system has been steamed for 24h, vent steam from the burners at the end of the heaters.

氮气置换结束后，从界区给蒸汽，吹扫。在 D-861 罐顶放空排汽。蒸汽蒸煮 24 小时后，在加热炉末端火嘴排汽吹扫。

(18) Purging of sealing oil pot I

封油 I

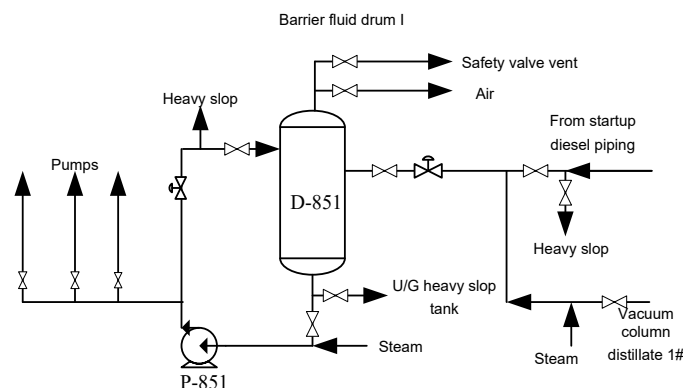


Figure 107 Seal Oil Drum I Purging Flow Chart

图 107 封油 I 系统吹扫流程图

Notes:

说明:

1) Introduce steam via the valve in the LVGO PA loop to purge towards sealing oil pot I (D-851), vent steam at the top of D-851, and drain D-851 bottom oil into the U/G slop drum.

从减一中给汽，往 D-851 吹扫，D-851 罐顶排汽，D-851 罐底油排至地下污油罐。

2) Introduce steam at the bottom of D-851 to first purge towards D-851, and vent steam at the top of D-851.

从 D-851 罐底给汽，先往 D-851 吹扫，在 D-851 罐顶部排汽。

3) When purging of the sealing oil header has been completed, vent steam at each sealing oil user.

封油主线吹扫结束后，在封油各用户末端排汽。

(19) Purging of sealing oil pot II

封油 II

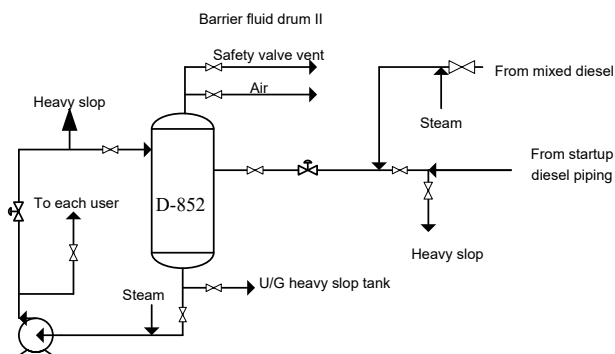


Figure 108 Seal Oil Drum II Purging Flow Chart**图 108 封油Ⅱ系统吹扫流程图**

Notes:

说明:

1) Introduce steam via the valve in the mixed gas oil loop to purge towards sealing oil pot II (D-852), vent steam at the top of D-852, and drain D-852 bottom oil into the U/G slop drum.

从混合蜡油处给汽，往 D-852 吹扫，D-852 罐顶排汽，D-852 罐底油排至地下污油罐。

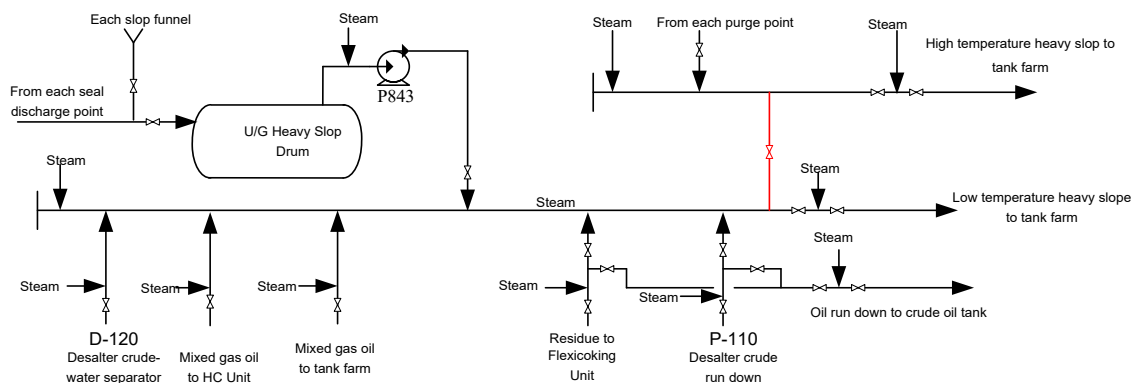
2) Introduce steam at the bottom of D-852 to first purge towards D-852, and vent steam at the top of D-852.

从 D-852 罐底给汽，先往 D-852 吹扫，在 D-852 罐顶部排汽。

3) When purging of the sealing oil header has been completed, vent steam at each sealing oil user.

封油主线吹扫结束后，在封油各用户末端排汽。

(20) Purging of high-temperature heavy slop system and low-temperature heavy slop system
高温重污油与低温重污油

**Figure 109 High-Temperature Heavy Slop System Purging Flow Chart****图 109 重污油系统吹扫流程图**

Notes:

说明:

1) Purge both high-temperature heavy slop system and low-temperature heavy slop system towards the high-temperature heavy slop piping, and do not purge high-temperature heavy slop system and low-temperature heavy slop system towards the low-temperature heavy slop piping and run down oil at a temperature above 100°C to the designated equipment/piping.

高温重污油和低温重污油线时，统一往高温重污油线吹扫。禁止往低温重污油吹扫和温度超过 100°C 退油。

2) Introduce steam via the vent valve on each low-temperature heavy slop piping and the BL valve of the low-temperature heavy slop system to purge both high-temperature heavy slop system and low-temperature heavy slop system towards the high-temperature heavy slop piping. 吹扫时从各低温重污油排放点给汽，低温重污油界区给汽，往高温重污油吹扫。

(21) Purging of light slop system and startup diesel/off-spec diesel piping

轻污油、开工柴油/不合格柴油

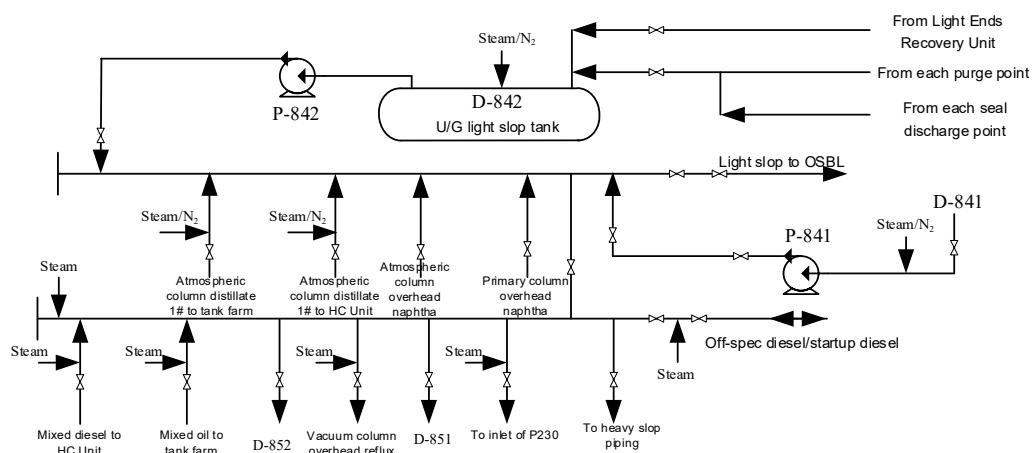


Figure 110 Light Slop System Purging Flow Chart

图 110 轻污油系统吹扫流程图

Notes:

说明:

1) The light slop system and off-spec diesel piping shall be purged upon completion of purging operation for the purge/drainage equipment associated with the light oil system and off-spec diesel piping.

需要轻污油系统、不合格柴油线吹扫、排放的设备吹扫置换结束后，安排轻污油系统、不合格柴油置换、吹扫。

2) Drain water to D-842 via each drain valve, clean the piping, and start P-842 to pump water to the light slop piping.

从各排放点排水至 D-842，清洗管线，启动 P-842，往轻污油线顶水。

3) Fill water to the light slop piping via the Atm. OVHD naphtha loop and the Pre-Dist. OVHD naphtha loop to displace all residual oil in the light slop piping whenever possible.

从常顶石脑油、初顶石脑油线往轻污油线系统顶水，尽量将管线中的存油置换干净。

4) Upon completion of water flushing operation, introduce steam via the valves in the Kerosene process flow to the storage and Kerosene Hydrofining Unit, the Pre-Dist. OVHD naphtha drum (D-201) bottom valve, the Atm. OVHD naphtha drum (D-301) bottom valve, D-841 bottom valve, the valves in the mixed diesel process flow to the storage and Diesel Hydrofining Unit, D-852 bottom valve, D-851 bottom valve, P-230 and the valve in the Vac. column OVHD reflux process flow, to purge the light slop system towards the high-temperature heavy slop piping.

顶水结束后，常一线至罐区和航煤加氢装置给汽，初顶石脑油 D-201 罐底给汽，常顶石脑油 D-301 罐底给汽，D-841 罐底给汽，混合柴油至罐区和柴油加氢装置给汽，D-852、D-851 罐底给汽，P-230 处给汽，减顶回流处给汽。往高温重污油线吹扫。

(22) Purging of oil rundown piping from desalter drum

电脱盐退油线

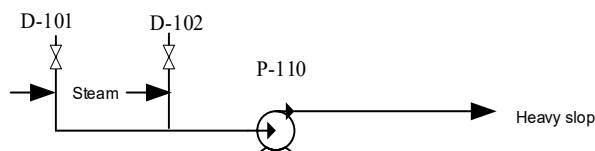


Figure 111 Flow Chart of Purging for Oil Return Piping from Desalter Drum

图 111 电脱盐退油线吹扫流程图

Notes: Introduce steam via the valves at the bottom of D-101 and D-102 to purge the oil rundown piping from desalter drums towards the heavy slop piping.

说明：电脱盐退油线从 D-101、D-102 罐底给汽点给汽，往重污油线吹扫。

(23) Purging of Vac. column OVHD gas desulfurization system

减顶气脱硫系统

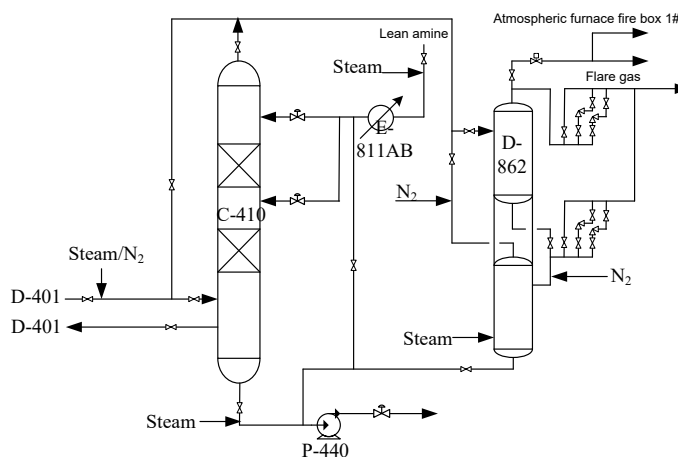


Figure 112 Vac. column OVHD Gas Desulfurization System Purging Flow Chart

图 112 减顶气脱硫系统吹扫流程图

Notes:

说明：

1) Fill DM water to displace the lean MDEA in the process unit, and start P-440 to send the lean MDEA back to MDEA Regeneration Unit.

贫胺液进装置用除盐水顶胺液，启运 P-440 往胺液再生装置退胺液。

2) Introduce nitrogen at the top of D-401 to purge D-401 towards the flare gas system through C-410 and D-862.

D-401 罐顶给氮气，经 C-410、D-862 往火炬气置换。

3) After lean MDEA is displaced with DM water and C-410 and D-862 are purged with nitrogen, introduce steam at the top of D-401 and the bottom of D-862 to steam C-410 and D-862, and vent steam at the top of D-862.

胺液置换结束，C-410 和 D-862 氮气置换结束后，从 D-401 罐顶和 D-862 罐底给蒸汽蒸煮 C-410 和 D-862，并在 D-862 顶部放空。

(24) Purging of desalter system

电脱盐系统

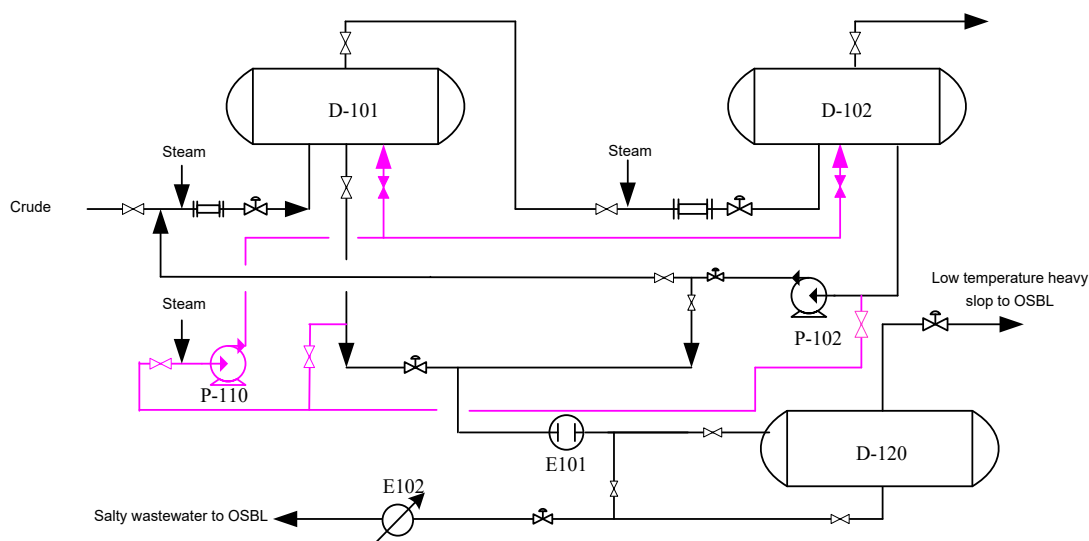


Figure 113 Desalter System Purging Flow Chart

图 113 电脱盐系统吹扫流程图

Notes:

说明:

1) Close the desalter drum inlet and outlet valves. Introduce steam via the inlet piping to D-101 and D-102. Vent steam via the vent valves on the top of D-101 and D-102.

电脱盐罐原油进出阀门关闭。从 D-101、D-102 入口原油线给汽，D-101、D-102 罐顶放空排汽。

2) Purge the cut water piping of D-101 and D-102 as well as D-120 with the steam generated from steaming operation for D-101 and D-102. Open the cut water piping of D-101 and D-102 to drain water to the wastewater treatment plant through E-101, D-120 and E-120 in turn. Put E-102 into service to control the temperature of cut water to OSBL.

D-101、D-102 切水线及 D-120 采用电脱盐罐蒸汽处理。打开 D-101、D-102 切水线，往 E-101→D-120→E-120 往污水处理装置排放。并投用 E-102 循环水，控制出装置温度。

3) Steam the desalter drums for 24h. Inspect the water sample taken from the brine piping to OSBL, and if water becomes clear, stop steaming operation, otherwise, continue to steam the desalter drums.

电脱盐罐蒸煮 24 小时。含盐污水出装置处放样检查，水质清澈，则蒸煮结束，否则，继续蒸煮。

(25) Purging of piping after relief valve system

安全阀系统阀后管线

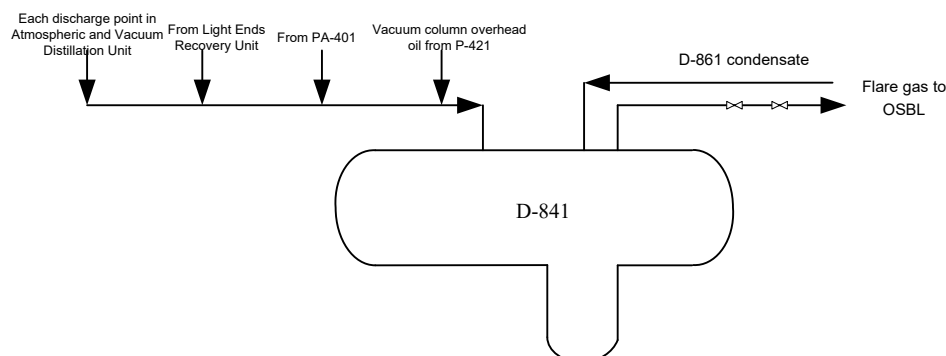


Figure 114 Flow Chart of Purging for Piping after Relief valve System**图 114 安全阀系统吹扫流程图**

Notes:

说明:

1) When all other systems in the process unit have been thoroughly purged such that it is not required to discharge any waste gas to the flare gas system, start to purge the flare gas system. 装置其它系统置换吹扫干净，不需要往火炬气系统排放时，安排火炬气系统的置换。

2) While steaming the flare gas system, close the flare gas valve to OSBL, and open the vent valve on the top of D-841 to vent steam.

火炬气系统蒸煮时，关闭火炬气出装置阀门，D-841 罐顶放空打开排汽。

3) At the end stage of steaming operation for all columns and drums, purge the steam generated from steaming operation for the columns and drums into the flare gas piping.

各塔、罐在蒸煮末期，利用塔罐蒸煮的蒸汽往火炬气管线排放。

4) While steaming the fuel gas system, purge the steam generated from steaming operation to the flare gas system from both top and bottom of D-861.

燃料气系统蒸煮时，从 D-861 罐顶和罐底部往火炬气系统置换吹扫。

5) Introduce steam via the Vac. column OVHD pump (P-421) to purge towards the flare gas system.

减顶油泵 P-421 给汽往火炬气系统置换。

6) Introduce steam via P-426 to purge towards the flare gas system through the liquid ring pump outlet KO drum.

P-426 给汽，通过液环泵出口分液

Purge OVHDs and bottoms towards the flare gas system.

7) 罐往火炬气置换。

(26) Steaming and water flushing for Pre-Dist. (C-200)

初馏塔 C-200 蒸塔、洗塔

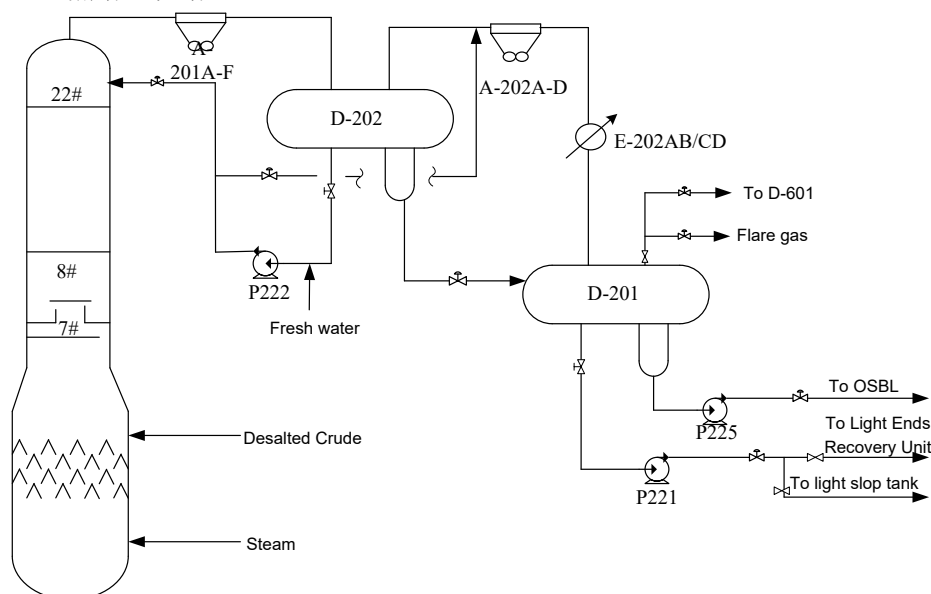


Figure 115 Pre-Dist. Steaming and Water Flushing Flow Chart**图 115 初馏塔 C-200 蒸塔、洗塔流程图**

Notes:

说明:

1) Steam the Pre-Dist. in conjunction with purging operation for the crude piping. At the end stage of purging operation for the crude piping, reduce the steam flowrate to the crude piping, and introduce steam at the bottom of the Pre-Dist..

初馏塔蒸塔应结合原油线扫线进行。原油扫线末期，关小原油线扫线蒸汽，初馏塔塔底给汽。

2) Put the column OVHD cooling system into operation to control the column OVHD pressure and temperature, and send D-201 OVHD gas to the flare gas system.

塔顶冷却系统投用，控制塔顶压力很冷后温度，D-201 罐顶气至火炬气。

3) When the column has been steamed for 8h, open the vent valve at column bottom and the vent valve on the Pre-Dist. sidedraw pump to drain water and vent steam.

蒸塔 8 小时后，塔底放空、初一线机泵放空导淋排水和蒸汽。

4) Further reduce the steam flowrate, stop the column OVHD air cooling fans, and cut off CCW flow to the water coolers. Control the column OVHD pressure within the specified range, and vent steam at the top of D-201. After the flare gas valve to OSBL is closed, line up the flare gas system, vent steam at the top of the flare gas drum, and steam the flare gas system.

关小蒸汽，停运塔顶冷却风机和水冷器循环水。控制塔顶压力不超压，D-201 罐顶放空。火炬气出装置阀门关闭后，可改至火炬气系统，在火炬气罐顶放空，蒸煮火炬气系统。

5) Send the condensate generated from column steaming operation to Sour Water Stripping Unit, and sent the oil into the light slop drum.

蒸塔的冷凝水送至酸水汽提装置，油送至轻污油。

6) After the column is steamed for 24 hours, supply water to P-222 inlet and fill water into D-202, and then start P-222 to flush the column via the column OVHD reflux piping.

蒸塔 24 小时后，P-222 入口给水，D-202 装水，装水后启运 P-222，通过塔顶回流洗塔。

7) Control the column OVHD temperature at a temperature no lower than 60 °C, while washing the column to clear off the dirty substances generated during column steaming operation. And in the meanwhile, decrease the temperature in the column to create a favorable condition for chemical cleaning.

洗塔时控制塔顶温度不得低于 60°C，冲洗分馏塔内蒸煮的脏物。同时降低塔内温度，为化学清洗创造条件。

(27) Steaming and water flushing for Atm. (C-300) and stripper (C-301)

常压塔 C-300 和汽提塔 C-301 蒸塔、洗塔

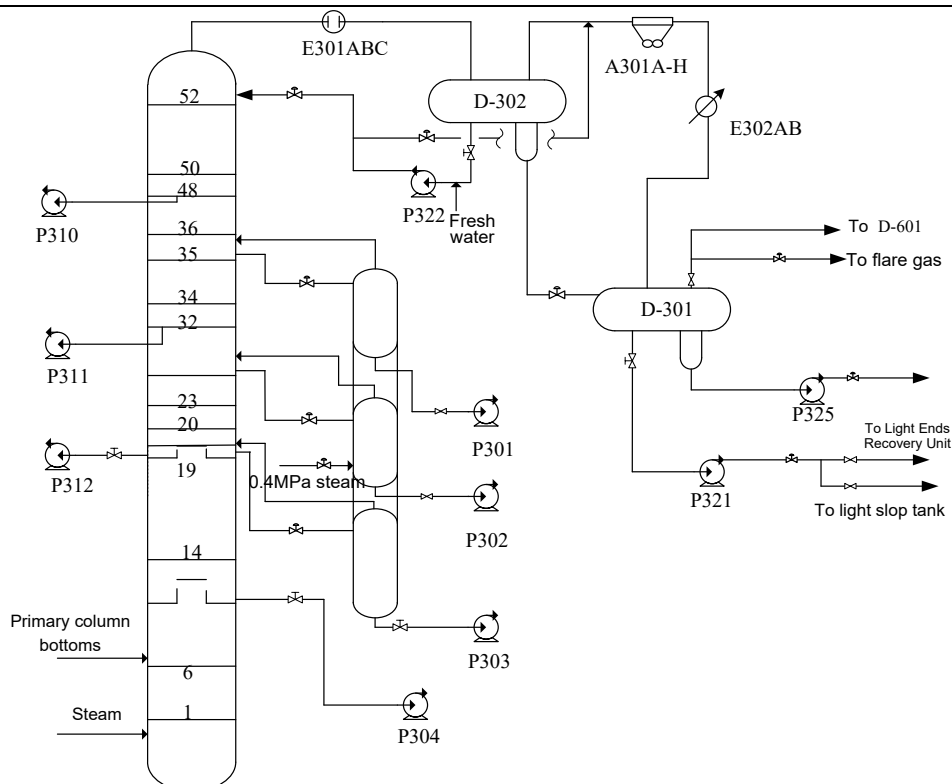


Figure 116 Flow Chart of Steaming and Water Flushing for Atm. (C-300) and Stripper (C-301)

图 116 常压塔 C-300 和汽提塔 C-301 蒸塔、洗塔流程图

Notes:

说明:

1) Steam the Atm. in conjunction with purging operation for the Atm. heater. At the end stage of purging operation for the Atm. heater, reduce the steam flowrate to the Atm. heater, and introduce steam at the bottom of the Atm..

常压蒸塔应结合常压炉扫线进行。常压炉扫线末期，关小常压炉扫线蒸汽，常压塔底给汽。

2) Put the column OVHD cooling system into operation to control the column OVHD pressure and temperature, and send D-301 OVHD gas to the flare gas system.

塔顶冷却系统投用，控制塔顶压力很冷后温度，D-301 罐顶气至火炬气。

3) When the column has been steamed for 8h, open the vent valve at the bottom of the Atm., the vent valve at the bottom of the stripper and the vent valve on each pumparound pump to drain water and vent steam.

蒸塔 8 小时后，常压塔底放空、汽提塔塔底、各中段回流机泵放空导淋排水和蒸汽。

4) Further reduce the steam flowrate, stop the column OVHD air cooling fans, and cut off CCW flow to the water coolers. Control the column OVHD pressure within the specified range, and vent steam at the top of D-301. After the flare gas valve to OSBL is closed, line up the flare gas system, vent steam at the top of the flare gas drum, and steam the flare gas system.

关小蒸汽，停运塔顶冷却风机和水冷器循环水。控制塔顶压力不超压，D-301 罐顶放空。火炬气出装置阀门关闭后，可改至火炬气系统，在火炬气罐顶放空，蒸煮火炬气系统。

column, the vent valve on each distillate pump and the vent valve at D-402 bottom to drain water and vent steam.

蒸塔 8 小时后，减压塔底放空、各侧线机泵、D-402 罐底放空导淋排水和蒸汽。

4) Further reduce the steam flowrate, cut off CCW flow to the column OVHD water coolers. Control the column OVHD pressure within the specified range, and vent steam at the top of D-401. After the flare gas valve to OSBL is closed, line up the flare gas system, vent steam at the top of the flare gas drum, and steam the flare gas system.

关小蒸汽，停运塔顶水冷器循环水。控制塔顶压力不超压，D-401 罐顶放空。火炬气出装置阀门关闭后，可改至火炬气系统，在火炬气罐顶放空，蒸煮火炬气系统。

5) Send the condensate generated from column steaming operation to Sour Water Stripping Unit, and sent the oil into the light slop drum.

蒸塔的冷凝水送至酸水汽提装置，油送至轻污油。

6) When the column has been steamed for 24h, supply water to P-401 inlet, then start P-401 to flush the column via the column OVHD reflux piping.

蒸塔 24 小时后，P-401 入口给水，启运 P-401，通过塔顶回流洗塔。

7) Control the column OVHD temperature at $\leq 60^{\circ}\text{C}$, while washing the column to clear off the dirty substances generated during column steaming operation. And in the meanwhile, decrease the temperature in the column to create a favorable condition for chemical cleaning.

洗塔时控制塔顶温度不得低于 60°C ，冲洗分馏塔内蒸煮的脏物。同时降低塔内温度，为化学清洗创造条件。

(29) Cleaning and passivation for the Pre-Dist.

初馏塔的清洗、钝化

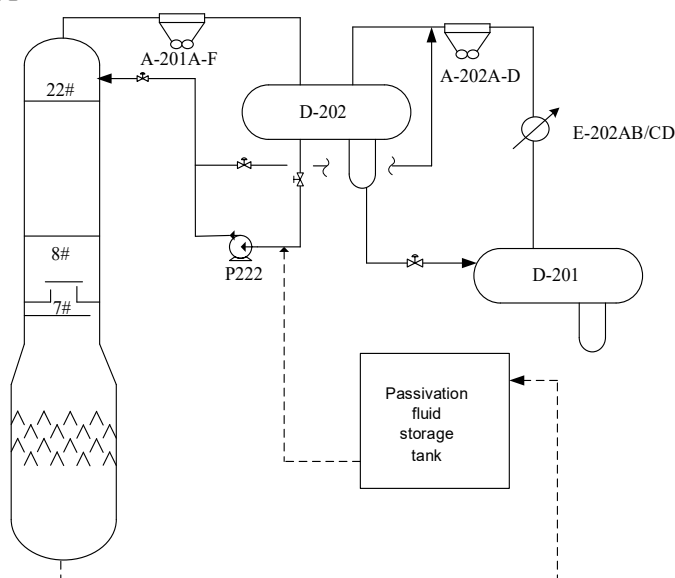


Figure 118 Pre-Dist. Cleaning and Passivation Flow Chart

图 118 初馏塔的清洗、钝化流程图

Note: as a conventional cleaning scheme for passivation, it is for reference only. The passivation methods shall be based on those defined in the technical agreement or determined by the supplier and the technical department. In case of low-sulfur crude as feedstock, the Pre-Dist.

may not be passivated when the process unit is shut down.

说明：本方案为钝化的常规清洗方案，仅作为参考，钝化方法应以技术协议和供应商与技术部门讨论确定的技术方案为准。加工低硫原油，则停工时，初馏塔可不钝化。

1) All equipment shown in the figure shall be passivated and cleaned.

图中所画设备需要钝化清洗。

2) Connect the temporary piping (indicated by dashed line) as shown in the figure.

按图中接好临时管线(虚线)。

3) The passivation solution that is properly prepared based on the technical agreement shall be first dumped into the drum drum, and then sent into the Pre-Dist. via the Pre-Dist. OVHD reflux pump to establish the circulation from the column top to the column bottom.

钝化液按照技术协议配置好后倒入储槽，通过初顶回流泵打入常压塔。建立塔顶至塔底的循环。

4) Clean and passivate the column for more than 4h, and make up new passivation solution based on the color change of the circulating liquid.

清洗钝化 4 小时以上，根据循环液的颜色变化，补充新钝化液。

5) Upon completion of passivation operation, connect the temporary piping to transfer the passivation solution in the column into A-201 and A-202 through the column OVHD water piping, and close A-201 and E-202 outlet valves. Soak A-201, A-202 and E-202 with passivation solution for 8h, then open A-201 and E-202 outlet valves to send the passivation solution into D-202 and D-201.

钝化结束后，接入临时线，将塔内的钝化液通过塔顶注水线打入 A-201 和 A-202，关闭 A-201 和 E-202 出口阀。浸泡 A-201、A-202 和 E-202。浸泡 8 小时后，打开 A-201 和 E-202 出口阀，将钝化液放至 D-202、D-201 浸泡。

(30) Cleaning and passivation for Atm.

常压塔的清洗、钝化

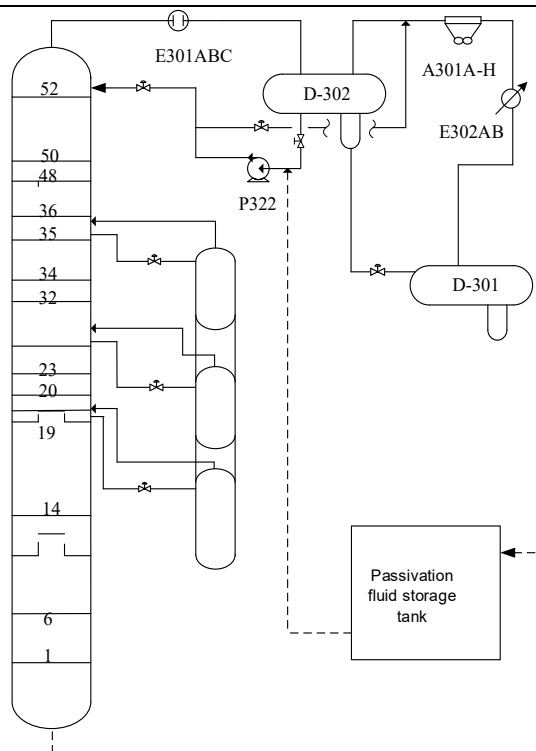


Figure 119 Atm. Cleaning and Passivation Flow Chart

图 119 常压塔清洗、钝化流程图

Note: as a conventional cleaning scheme for passivation, it is for reference only. The passivation methods shall be based on those defined in the technical agreement or determined by the supplier and the technical department.

说明：本方案为钝化的常规清洗方案，仅作为参考，钝化方法应以技术协议和供应商与技术部门讨论确定的技术方案为准。

1) All equipment shown in the figure shall be passivated and cleaned.

图中所画设备需要钝化清洗。

2) Connect the temporary piping (indicated by dashed line) as shown in the figure.

按图中接好临时管线(虚线)。

3) The passivation solution that is properly prepared based on the technical agreement shall be first dumped into the drum drum, and then sent into the Atm. via the Atm. OVHD reflux pump to establish the circulation from the column top to the column bottom.

钝化液按照技术协议配置好后倒入储槽，通过常顶回流泵打入常压塔。建立塔顶至塔底的循环。

4) Clean and passivate the column for more than 8h, and make up new passivation solution based on the color change of the circulating liquid.

清洗钝化 8 小时以上，根据循环液的颜色变化，补充新钝化液。

5) Upon completion of passivation operation, connect the temporary piping to transfer the passivation solution in the column into E-301 and E-302 through the column OVHD water piping, and close E-301 and E-302 outlet valves. Soak E-301, A-301 and E-302 for 8h, then open E-301 and E-302 outlet valves to send the passivation solution into D-302 and D-301.

钝化结束后，接入临时线，将塔内的钝化液通过塔顶注水线打入 E-301 和 3-202，关闭 E-301 和

3-202 出口阀。浸泡 E-301、A-301 和 E-302。浸泡 8 小时后，打开 E-301 和 E-302 出口阀，将钝化液放至 D-302、D-301 浸泡。

(31) Cleaning and passivation for the vacuum tower

减压塔的清洗、钝化

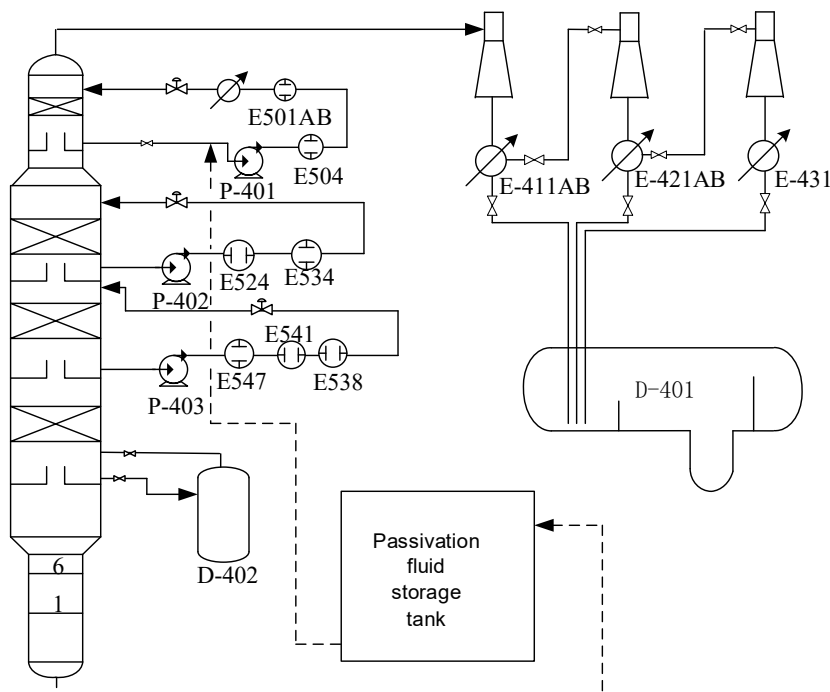


Figure 120 Vac. column Cleaning and Passivation Flow Chart

图 120 减压塔的清洗、钝化流程图

Note: as a conventional cleaning scheme for passivation, it is for reference only. The passivation methods shall be based on those defined in the technical agreement or determined by the supplier and the technical department.

说明：本方案为钝化的常规清洗方案，仅作为参考，钝化方法应以技术协议和供应商与技术部门讨论确定的技术方案为准。

1) All equipment shown in the figure shall be passivated and cleaned.

图中所画设备需要钝化清洗。

2) Connect the temporary piping (indicated by dashed line) as shown in the figure. Bypass LVGO PA, 2# and 3# heat exchangers and LVGO PA, 2# and 3# heat exchangers, and close the inlet and outlet valves of these heat exchangers. Close the valve on the Vac. column to D-402.

按图中接好临时管线(虚线)。减一、二、三线 and 减一、二、三中的所有换热器改为付线，并关闭换热器进出口阀。减压塔至 D-402 的阀门关闭

3) The passivation solution that is properly prepared based on the technical agreement shall be first dumped into the drum drum, and then sent into the Vac. column via P-401 to establish the circulation from the column top to the column bottom.

钝化液按照技术协议配置好后倒入储槽，通过 P-401 打入减压塔。建立塔顶至塔底的循环。

4) Clean and passivate the column for more than 8h, and make up new passivation solution

based on the color change of the circulating liquid.

清洗钝化 8 小时以上，根据循环液的颜色变化，补充新钝化液。

5) During passivation operation, start P-402 and P-403 to establish reflux in the column, so as to improve the distribution pattern of the passivation solution and ensure that the packing is fully passivated.

钝化过程中，为提高钝化液的分布效果，确保填料得到充分的钝化，应启动 P-402、P-403 打回流。

6) At the end stage of cleaning operation, open the valve from Vac. column to D-402 to fill passivation solution into D-402 for soaking.

清洗末期，打开减压塔至 D-402 的阀门，D-402 装钝化液进行浸泡。

7) Close the valves on the atmospheric legs of E-411, E-421, and E-431.

E-411、E-421、E-431 的大气腿阀门关闭。

8) Upon completion of passivation operation, connect the temporary piping to transfer the passivation solution in the column into E-411, E-421 and E-431 through the column OVHD water piping. Soak E-411, E-421 and E-431 for 8h, and then open the valves on the atmospheric legs of E-411, E-421, E-431 to send the passivation solution into D-401 for soaking.

钝化结束后，接入临时线，将塔内的钝化液通过塔顶注水线打入 E-411、E-421、E-431。浸泡 8 小时后，打开 E-411、E-421、E-431 大气腿阀门，钝化液装到 D-401，继续浸泡。

(32) Cleaning and deodorization for Vac. column OVHD gas desulfurization column

减顶气脱硫塔的清洗、除臭

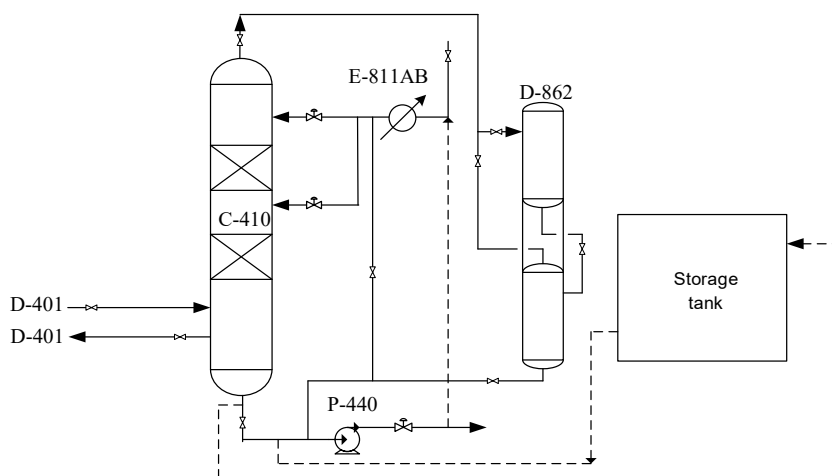


Figure 121 Vac. column OVHD Gas Desulfurization Column Cleaning and Deodorization Flow Chart

图 121 减顶气脱硫塔的清洗、除臭流程图

Note: as a conventional cleaning scheme for passivation, it is for reference only. The Chemical cleaning and deodorization methods shall be based on those defined in the technical agreement or determined by the supplier and the technical department.

说明：本方案为钝化的常规清洗方案，仅作为参考，钝化方法应以技术协议和供应商与技术部门讨论确定的技术方案为准。

1) All equipment shown in the figure shall be passivated and cleaned.

图中所画设备需要清洗、除臭。

2) Connect the temporary piping (indicated by dashed line) as shown in the figure.

按图中接好临时管线(虚线)。

3) The deodorization solution that is properly prepared based on the technical agreement shall be first dumped into the drum drum, and then pump into the Vac. column OVHD gas desulfurization column (C-410) via P-440 to establish the circulation from the column top to the column bottom.

清洗除臭液按照技术协议配置好后倒入储槽，通过 P-440 打入 C-410。建立塔顶至塔底的循环。

4) Clean the column for more than 8h. While cleaning the column, it is required to clean the lean MDEA water cooler and both upper and lower reflux piping.

清洗循环 8 小时以上。清洗时贫胺液水冷器和上下回流均需要清洗。

5) Upon completion of cleaning operation for the Vac. column OVHD gas desulfurization column, add the cleaning solution to the upper section of D-862 for soaking. When the upper section of D-862 has been fully soaked, open the connection valve between the upper section and the lower section of D-862 to drain the cleaning solution to the lower section of D-862 for soaking.

清洗结束后，清洗液加入到 D-862 上段浸泡，上段浸泡结束后打开上下两段连通阀，将清洗液排至 D-862 下段浸泡。

2.6 Judgment, cause analysis and actions for abnormalities and incidents 异常现象及事故的判断、原因分析和处理方法

2.6.1 Response principles 处理原则

The measures to be taken in the event of an accident vary from accident to accident, but the general principle shall be in the following priority order: firstly, to ensure personal safety; secondly to ensure equipment safety; to rescue materials and products; to avoid serious damage to the upstream and downstream equipment, storages and utilities; and avoid impact on the environment.

装置发生事故时需采取的措施因各事故的不同而有所差别，但总的原则应按下列优先顺序进行事故处理：首先保证人身安全；其次保证设备安全；抢救物料和产品；避免严重损害装置上下游、罐区及公用工程；避免对环境造成冲击。

In addition, the following principles shall be followed during response to accident:

此外在事故处理过程中还应遵循下列原则：

2.6.1.1 The principle of calm and careful organization

沉着冷静、周密组织的原则。

In case of accident, the operators, especially the shift foreman, must first calm down, never panic, yell and scream, and quickly organize operators to investigate the causes and location of the accident and accurately judge the accident. Then, report to the upper management line,

Operation Scheduling Department and fire brigade in a timely manner. Accurately determine the state of the accident, arrange operators to take all measures, and arrange the operators to operate the equipment at the fall-back state.

生产事故发生后，操作人员尤其是班长，首先要镇静自若，绝不可惊慌失措，大喊大叫，到处乱跑，要迅速组织人员根据事故的现象查明事故原因、部位，做到判断准确。然后一方面安排人员及时向上级领导、调度、消防队汇报，一方面准确的判断出事故的状态，安排人员采取一切措施，按照事故处理的退守状态，安排人员退守到合适的状态进行操作，全权处理事故。

2.6.1.2 The principle of ensuring the safety of the personnel and equipment, controlling the development of the situation and quickly restoring to production.

保证人身、设备安全，控制事态发展，迅速恢复生产的原则。

(1) The principle of following the rules and regulations. In the process of responding to accidents, strictly follow the operating procedures, rules and regulations, and safety regulations. 照章办事的原则。在处理事故的过程中，严格遵守操作规程、规章制度，执行安全规定。

(2) The principle of proper balance control. As a basis for responding to the accident, properly control the material balance, heat balance and pressure balance. The temperature and pressure shall not exceed the specified values. In case that the temperature and pressure exceed the specified values, reduced the feedstock flowrate, reduce the operation load of the reboiler, startup the air coolers, vent the oil vapor into the flare system, and stop the pumps. Properly control the levels in the columns and drums, especially the column bottoms levels. If the level is low, it will result in pump evacuation, at this point, reduce the pumping flowrate or stop the pump. If the level is high, it will result in column flooding, at this point, increase the pumping flowrate, reduce the feedstock flowrate until the feedstock is stopped. High level in the drums may result in oil carry-over or spill, adjustment shall be made in time.

掌握平衡的原则。把物料、热平衡和压力平衡三大平衡作为事故处理的基础，控制各处温度不超标；控制好各处压力不超标，一旦超标，降进料量、再沸器撤温、开空冷、放火炬，停泵撤压；控制塔罐液面不超标，尤其注意塔底液面，低则机泵易抽空、抽噎，应及时降抽出量或停泵；高则冲塔，要及时提大抽出量，降进料量，直至切断进料，罐液面超标易带油或溢出油品，扩大事态，应及时调整。

2.6.2 Main incidents requiring emergency shutdown 需紧急停工的主要事故

Emergency shutdown is required for the following cases.

出现以下情况的按紧急停工处理。

2.6.2.1 If a major accident occurs in the process unit, and it cannot be eliminated and it continues to expand.

若装置发生重大事故，经努力处理仍不能排除并继续扩大。

2.6.2.2 Fire or explosion accident in other process unit severely endangers the safety operation of this process unit.

其它装置发生火灾爆炸事故，严重威胁本装置的安全运行。

2.6.2.3 Heater tube is burnt down, the column catches a fire due to oil leakage, or explosion and major fire occur on other coolers, heat exchangers and machines.

炉管烧穿，塔漏油着火或其它冷换设备及机动设备发生爆炸及重大的火灾事故。

2.6.2.4 The important pumps cannot be repaired and the standby pumps cannot be started, such as crude pump, Pre-Dist. bottoms pump, Atm. bottoms pump and Vac. residue pump.

重要机泵无法修复而备用泵又开不起来，如原油泵、初底泵、常底泵、减底泵等。

2.6.2.5 Power outage lasts for a long time, the steam, instrument air and CCW systems are interrupted.

较长时间停电、停蒸汽、停仪表风、停循环水。

2.6.2.6 Crude supply and fuel supply are interrupted for a long time.

原油、燃料较长时间中断。

2.6.2.7 The Vac. residue process flow is blocked to OSBL for a long time.

渣油后路较长时间不通。

2.6.3 Emergency shutdown procedures 紧急停工处理方法

Report the Operation Scheduling Department, describe the causes, notify the fire brigade if necessary, keep calm, make correct judgments, and deal with the accident decisively to prevent the accident from expanding.

请示计划调度部，说清原因，必要时通知消防队，保持镇静，做出正确判断，果断处理，以防扩大事故。

2.6.3.1 Change the Vac. OVHD gas to the flare gas system, close the valve to the heater, and vent the tail gas into the air.

减顶气改至火炬，关闭至加热炉阀门，再生尾气改放空，关闭至加热炉阀门。

2.6.3.2 Close the fuel supply to the heater. The panel operators manually activate the heater shutdown interlock, closes the emergency shutoff valves of the fuel gas and the fuel oil into the heater, and then closes the control valves of the fuel gas and fuel oil into the heater. Close the emergency shutoff valve of the pilots.

加热炉熄火。内操启动加热炉停炉联锁，关闭燃料气、燃料油进炉紧急切断阀后，再关闭燃料气、燃料油的进炉调节阀。关闭长明灯紧急切断阀。

2.6.3.3 The panel operators manually activate the air blower and induced draft fan shutdown interlocks, and change the heater to natural ventilation.

内操启动停鼓风机、引风机联锁，加热炉改自然通风。

2.6.3.4 The field operators come to site to close the secondary hand valves of the heater fuel gas, fuel oil and pilots. Introduce steam into the fire box of the heater.

外操到现场关闭加热炉的燃料气、燃料油、长明灯的二次手阀。加热炉吹炉膛蒸汽。

2.6.3.5 Stop the feed to the process unit. The panel operators inform the storage to stop the crude pumps, and the field operators stop the Pre-Dist. bottom pump, Atm. residue pump and Vac. residue pump.

切断装置进料。内操通知罐区停运原油泵，外操因此停运初底泵、常底泵、减底泵。

2.6.3.6 Close the steam into the Atm., Vac. column and heater tubes, and vent the superheated steam at the top of the heater. (Note that at least two steam valves shall be closed to prevent internal leakage of the valves. In case of high level in column, the oil will intrude into the OVHD of the heater, causing secondary accident).

关闭常压塔、减压塔塔底吹气，关闭炉管注气，过热蒸汽炉顶改放空。（注意吹汽阀门应关闭两道以上，防止阀门内漏，塔液位装高后，油品反窜炉顶引发次生事故）。

2.6.3.7 The field operators stop the Atm. Column sidedraw pumps, Pre-Dist. sidedraw and Vac. Overflash oil pumps, and panel operators close the Vac. column distillate valves to OSBL, close the HVGO flushing oil and close the Vac. column pumparound reflux based on the column top temperature.

外操停运常压侧线、初一线、减四线等机泵，内操关闭减压侧线出装置阀门、关闭减三线回流，中段回流根据塔顶温度停运。

2.6.3.8 Change the Pre-Dist. OVHD gas and Atm. OVHD gas to the flare system rather than to the compressor. The operators in the Light Ends Recovery Unit adjust the number of compressors in operation based on the operation load of this unit.

初顶瓦斯和常顶顶瓦斯改放火炬，停去压缩机。轻烃回收装置根据负荷调整压缩机的运行台数。

2.6.3.9 Change the column OVHD naphtha to the off-spec gasoline drum rather than to the Light Ends Recovery Unit. After the interruption of the Atm. naphtha, the light hydrocarbon feed flowrate is greatly reduced, and the absorbent supply is interrupted. P-630B shall be started to send a part of stabilized naphtha to the absorption column as absorbent. After the shutdown in Atm.PA#2, the stabilization column shall be shut down, and the stabilized naphtha shall be changed to light slop drum.

塔顶石脑油改不合格汽油，停去轻烃回收。常减压石脑油中断后，轻烃进料大幅度降低，吸收剂中断，应启动 P-630B 将稳定石脑油改部分循环回吸收塔做吸收剂。常二中停运后，稳定塔不开，则应将稳定石脑油改至轻污油罐。

2.6.3.10 Close LPG valve to the Acid Gas and LPG Treating Unit, and the saturated LPG shall be handled per the operation procedures for interruption of feedstock to Acid Gas and LPG Treating Unit.

液化气关闭至产品精制装置阀门，产品精制装置按照饱和液化气进料中断处理。

2.6.3.11 Break the vacuum of the Vac. column: stop the steam to the 1st and 2nd ejectors, if the 3rd ejectors is in operation, reduce the steam pressure to 0.3-0.4 MPa, if the water ring vacuum pump is in operation, then the panel operators shall open its inlet and outlet bypass valves to control slowly breaks the vacuum.

组织减压破真空，停一、二级蒸汽抽空器蒸汽，三级如开蒸汽喷射泵，则将三级蒸汽压力调至 0.3-0.4MPa，如开水环真空泵，则内操通过开进出口付线，控制缓慢破真空。

2.6.3.12 The field operators shall check the valves at BL, all steam valves to OSBL shall be closed.

外操检查界区，所有停外出的物料界区阀门全部关闭。

2.6.3.13 Stop water injection to the desalters. Stop other auxiliary systems. Stop the sealing oil pump and close all the injection points of sealing oil.

停电脱盐注水。停其它辅助系统。停封油泵，关各封油加注点。

2.6.4 Emergency response steps 事故处理方法

2.6.4.1 The Atm. residue pump is on fire 常底泵着火

High temperature heavy oil pump on fire due to leakage is a common accident of Atmospheric and Vacuum Distillation Unit. In case of small fire:

高温重油泵泄漏着火是常减压装置较为常见的事故。当常压塔底泵着火，火势较小时：

(1) Press the emergency shutdown" push button on the field control panel. The field operators shall close pump the inlet and outlet valves (MOVs). If the inlet and outlet valve cannot be closed, the panel operators shall close the emergency shut-off valve at the bottom of the Atm., the feed control valve of the Vac. heater and the minimum reflux control valve of the Atm. residue pump. 应紧急按停着火机泵的按钮。外操关闭着火机泵的进出口阀（电动阀），如无法关闭着火机泵的进出口阀，内操关闭常压塔底紧急切断阀和减压炉进料调节阀，常底泵最小回流控制阀等。

(2) If the interlock is in service, the Vac. heater will be flamed out by the interlock due to interruption of feed to the Vac. heater.

在联锁投用的情况下，因减压炉进料中断，减压炉连锁熄火。

(3) Report the fire accident to the management line, and the use snuffing steam, fire water and fire extinguishers and supplies to put out the fire (the field operators shall properly select the extinguishing medium based on the actual situation on site).

汇报后应就近采用灭火蒸汽、消防水、灭火器等灭火（外操应根据现场实际情况选择）。

(4) The shift foreman shall immediately arrange the operators to come to the Vac. heater and the Atm. residue pumps.

班长立即安排人员，分两路，一路至减压炉，一路至常底泵处。

(5) The operators come to the Vac. heater shall check if the pilots are flamed out. If the pilots are not flamed out, close the fuel gas valve of each burner of the heater, and then re-ignite after the Atm. residue pump is restored to normal operation. If all the pilots are flamed out, open the snuffing steam to the fire box of the Vac. heater and close the fuel gas valve of each burner.

至加热炉的人员检查减压炉长明灯是否熄灭，如长明灯未熄灭，关闭加热炉每个火嘴的燃料气阀门，待常底泵恢复正常后重新点火。如长明灯全部熄灭，打开减压炉炉膛的灭火蒸汽，向炉膛吹蒸汽，关闭加热炉上每个燃烧器的燃料气阀门。

(6) The operators come to the Atm. residue pump. Close the inlet and outlet valves of the pump, start the standby pump to restore the feed to the Vac. heater.

至常底泵人员。关闭着火机泵的进出口阀，启运备用泵，恢复减压炉的进料。

(7) The panel operators shall close the Vac. column distillate valves based on the liquid level of sidedraw to avoid the distillates are not emptied, and closely monitor the Vac. column distillate internal reflux (the reflux shall be completely closed to avoid the HVGO from being emptied).

The panel operators shall ensure the Vac. column liquid level of sidedraw is normal and the pumparound reflux is not interrupted.

内操根据减压侧线的液位，关闭侧线外放，确保减压侧线不抽空，注意减三线内回流（应全部关闭，防止减三线抽空。内操主要是应保证减压塔的侧线液位正常，确保中段回流不中断。

(8) When the Vac. residue level is low, fully close the vacuum residue valve, further open the quench oil and circulation valves to avoid evacuation of the vacuum residue pump.

减压塔底液位低，应全部关闭减压渣油外放，通过开大急冷油、循环线等确保渣油泵不憋量。

(9) When all the outlet streams are closed, inform the Operation Scheduling Department to take the emergency measures for the downstream process units.

所有物料停止外放时，应通知调度，保证下游装置能够及时采取应急措施。

(10) The level in the Pre-Dist. and Atm. will rise in short time, and the panel operators shall adjust and reduce the flowrate of the crude into the process unit.

短时间内初馏塔、常压塔液位会装高，内操应根据实际情况调整原油进装置量，减少原油进装置。

(11) After the Atm. residue pump is restored to normal operation, the panel operators shall properly control each stream balance for the Atm..

常压塔底泵恢复正常后，内操重点控制好各塔物料平衡。

(12) The field operators shall ignite the heater burners according to the heater firing procedure. When all the pilots are flamed out, inform the lab to take samples from the fire box and analyze the total hydrocarbons content in normal conditions. Open the snuffing steam into the fire box, observe the chimney, and ignite the pilots after 10 minutes when steam comes from the chimney. If not all the pilots are flamed out, then ignite the pilots that are flamed out.

外操组织加热炉点火。长明灯全熄时，常规情况下，应立即通知化验人员对炉膛测爆（分析总烃），应急情况下，向炉膛吹扫灭火蒸汽，观察烟囱，冒蒸汽 10 分钟以后，组织点火。长明灯如未全熄，应立即组织点火。

(13) Make adjustments to restore the pump into normal operation.

调整操作恢复正常。

When the field operators find that the fire is large, the operators cannot get close. The emergency shutdown procedures shall be followed.

当外操发现火势较大，人员无法靠近时。应按紧急停车程序进行组织。

(1) Report the Operation Scheduling Department and other involved department leaders, and activate fire alarm. And the organize emergency response at site.

汇报调度、部门领导，报火警。汇报完后立即组织现场应急处理。

(2) Close the valve closest to the fire location to cut off the stream. If the inlet and outlet valves of the pump cannot be closed, inform the panel operators to close the emergency shut-off valve at the bottom of the Atm., the feed control valve of the Vac. heater and the minimum reflux control valve of the Atm. residue pump. Organize the operators to extinguish the fire.

关闭离着火部位最近的阀门，切断着火部位的物料。如着火机泵进出口阀门无法关闭，应通知内操关闭常压塔底紧急切断阀、减压炉进料调节阀和常底泵最小回流控制阀等。现场组织人员灭火。

(3) For other steps, follow 2.6.3: Emergency shutdown procedures.

其它步骤见 2.6.3 紧急停工处理方法。

2.6.4.2 Residual heat exchanger is on fire due to leakage 渣油换热器泄漏着火

In case that the residue heat exchanger is on fire due to leakage:

渣油换热器泄漏着火:

(1) If the leakage is small, the operators can get close, and immediately use fire water to extinguish the fire, bypass the heat exchanger, and close the inlet and outlet valves of the heat exchanger.

如泄漏较小, 人员可靠近, 应立即用消防水等灭火, 将着火的换热器改付线, 关闭换热器进出口阀。

(2) If the leakage is large, it is difficult to extinguish the fire. Stop the residue pump immediately, and close the residue pump outlet valve, the quench oil control valve and the minimum flow control valve of the residue pump, and the residue level control valve. Extinguish the fire when the leakage of the residue heat exchanger is reduced. Bypass the heat exchanger, close the inlet and outlet valves of the heat exchanger, and start the residue pump to restore the production.

如果泄漏较大, 灭火较为困难, 应立即停运渣油泵, 关闭渣油泵出口阀、急冷油调节阀和渣油泵最小流量控制阀、渣油液位调节阀等。等渣油换热器泄漏减小时, 灭火。将着火的换热器改付线, 关闭换热器进出口阀, 启运渣油泵恢复生产。

(3) In case that the residue heat exchanger leaks too much, the fire cannot be controlled, stop the residue pump immediately, and the upstream and downstream valves on the heat exchanger process flow to control the fire. For other steps, follow 2.6.3: Emergency shutdown procedures.

如渣油换热器泄漏过大, 火势无法控制。则应立即停运渣油泵, 关闭着火换热器流程上的前后阀门, 控制火势。其它步骤见 2.6.3 紧急停工处理方法。

2.6.4.3 Heater tubes are on fire due to leakage 加热炉炉管泄漏着火

(1) The Atm. heater tubes are on fire due to leakage:

常压炉炉管泄漏着火:

1) Close the feed to the heater. Stop the Pre-Dist. bottom pump and close the feed control valve of the Atm. heater.

关闭着火加热炉的进料。停初底泵、关常压炉进料调节阀。

2) First change the Vac. OVHD gas to the flare gas system, and then change the regenerator tail gas to vent into the air.

先将减顶气改火炬气, 再生尾气改放空后。

3) Put out the flame in atm. heater The panel operators activate the interlock valve of the Atm. heater, close the fuel gas and the fuel oil valves to the heater, and then close the emergency shutoff valves of the pilots.

常压炉熄火。内操启动常压炉联锁阀门, 关闭燃料气和燃料油进炉阀门, 再关闭长明灯紧急切断。

4) Field operators close the secondary hand valves of the heater fuel gas, fuel oil and pilots.

Introduce smothering steam into the heater chamber.

外操关闭常压炉燃料气、燃料油和长明灯的二手机阀。炉膛吹入灭火蒸汽。

5) For other steps, refer to "2.6.3: Emergency Shutdown Procedures".

其它步骤见 2.6.3 紧急停工处理方法。

(2) The Vac. heater tubes are on fire due to leakage:

减压炉炉管泄漏着火:

1) Stop the Atm. residue pump and close the feed control valve of the Vac. heater.

停常底泵, 关减压炉进料调节阀。

2) Put out the flame in Vac. heater. The panel operators activate the interlock valve of the Vac. heater, close the fuel gas and the fuel oil control valves to the heater, and then close the emergency shutoff valves of the pilots.

减压炉熄火。内操启动减压炉联锁阀门, 关闭燃料气进炉调节阀阀门, 再关闭长明灯紧急切断。

3) Field operators close the secondary hand valves of the heater fuel gas, fuel oil and pilots.

Introduce smothering steam into the heater chamber.

外操关闭减压炉燃料气和长明灯的二手机阀。炉膛吹入灭火蒸汽。

4) For other steps, follow 2.6.3: Emergency shutdown procedures.

其它步骤见 2.6.3 紧急停工处理方法。

2.6.4.4 Distillation columns are on fire due to leakage 分馏塔泄漏着火

If the distillation columns (Pre-Dist., Atm., Vac. column) are on fire due to leakage, the actions to be taken are different for the section on the fire. And different emergency measures shall be taken based on the specific leakage location, leakage size, and fire intensity.

分馏塔(初馏塔、常压塔、减压塔)泄漏着火, 不同部位处理方法不一致, 应根据具体泄漏部位, 泄漏大小, 火势大小等, 采取不同应急措施。

(1) The column bottom level gauge cracks and leaks, and the outlet valve cannot be closed.

塔底液位计破裂泄漏, 无法关闭引出阀

1) When the fire is small, organize the field operators to extinguish the fire. If it is impossible to extinguish the fire, fire water shall be used to cover the fire, and then follow the steps specified in 2.6.3: Emergency Shutdown Procedures. If the fire can be extinguished, proceed to the following steps.

视火势大小时, 组织现场灭火。如无法灭火, 则现场用消防水掩护, 同时按照 2.6.3 紧急停工处理方法进行处理。如能够灭火, 则继续下面的处理方法。

2) Take measures to reduce the operating pressure of the column, such as changing the column OVHD gas to the flare gas system and reducing the feed flowrate to the process unit.

采取方法, 降低塔的操作压力, 如泄漏塔的塔顶瓦斯改火炬, 降低装置进料等。

3) After the column level is lowered by the panel operators, the field operators shall wear the fire-proof suits to close the outlet valve of the level gauge.

内操拉低液位至引出阀下以后, 穿好防烫服后, 关闭液位计的引出阀。

4) If the outlet valve cannot be closed, the unit shall be immediately shut down, and then follow

the steps specified in 2.6.3: Emergency Shutdown Procedures.

如引出阀无法关闭，应立即组织装置紧急停车，按照 2.6.3 的方法处理。

(2) The instrument tap leaks

仪表引出接管泄漏

1) If the fire is small, immediately organize the operators to extinguish the fire.

如火势较小，立即组织着火部位灭火。

2) Take measures to reduce the pressure and level at the leaked location.

采取措施降低泄漏部位的压力和液面。

3) Make effort to block the leakage point, and take proper measures on a specific case basis.

组织泄漏部位堵漏，并视堵漏情况确定后续处理方法。

4) If the fire caused by the leakage is too large to be extinguished, activate fire alarm immediately.

如泄漏引起的火势太大，无法扑灭，则应立即报火警。

5) Properly cover the fire location, accessories and equipment.

现场组织着火部位及附件设备的掩护。

6) Take actions per "2.6.3: Emergency Shutdown Procedures".

按照 2.6.3 紧急停车处理方法进行处理。

(3) Column body leakage

塔本体泄漏

1) If the column body is on fire, activate fire alarm immediately.

如塔本体着火，应立即报火警。

2) If the leakage point is low, use fire water to extinguish and cover the fire immediately.

泄漏部位较低，则立即采用消防水进行灭火、掩护。

3) If the leakage point is high, and HP fire water is unable to reach the fire location, organize the operators to use fire water to cover the equipment near and under the fire location to prevent the fire from expanding.

如泄漏部位较高，及时在消防水加压的情况下，仍然无法达到着火部位时，应组织人员采用消防水掩护着火部位附近及下方的设备，防止事故扩大。

4) For other steps, follow 2.6.3: Emergency shutdown procedures.

按照 2.6.3 紧急停车处理方法进行处理。

2.6.5 Plant power supply interruption 装置停电

2.6.5.1 Accident phenomenons (main phenomenons) 事故现象（主要现象）

(1) Indoor lighting is out of power supply, only power supply to DCS system is available;

室内照明停电，只有 DCS 有电；

(2) Each flow meter reading drops rapidly;

装置各流量指示迅速下降；

(3) Lighting fixtures in the process are all out of power supply;

装置照明指示全无；

(4) All the machines and equipment in the process unit stop operation.

装置内设备停止运转。

2.6.5.2 Accident causes and cause confirmation 事故原因及原因确认

(1) the substation for the process unit fails.

本装置变电所故障。

(2) The power supply lines are interrupted due to storms, typhoons and lightning.

暴风雨、台风、雷电等造成供电线路中断。

(3) External power supply grid fails.

外供电故障。

(4) Other objective and human causes.

其它的客观、人为原因。

2.6.5.3 Main response procedures 事故处理的主要步骤

Contact the Operation Scheduling Department to investigate the causes of the power outage and the approximate power outage time. Organize the operators to respond to the accident.

联系计划调度部，查明装置停电的原因和大概的停电时间。组织岗位人员进行事故处理。

(1) Steps for short-term power outage (voltage dip):

短时间停电（晃电），处理步骤：

1) Check the bottom pump, and start the pumps that are not automatically started as soon as possible.

检查塔底泵，未自启动的尽快恢复启动。

2) Contact the crude storage farm to start the crude pump.

联系原油罐区启动原油泵。

3) Check each distillate pump, pumparound pump and air cooler fan, and start the pumps and air coolers.

检查各侧线、中段回流泵，各空冷风机，停运的机泵和风机，恢复启动。

4) Check the heater. If the pilots are not flamed out, immediately organize the operators to fire the heater.

检查加热炉，如长明灯未熄火，立即组织加热炉点火。

5) If the pilots are flamed out, close the fuel gas and fuel oil valves to the heater, and open the snuffing steam to the heater, fire the heater after 10 minutes when steam comes from the chimney.

如长明灯熄灭，关闭燃料气、燃料油等进炉阀门，炉膛吹入消防蒸汽，烟囱见气 10 分钟后，恢复加热炉点火。

6) Restore the operation and adjust the process parameters to normal values.

恢复操作，调整工艺参数至正常。

7) Start the air blower and induced draft fan, and put the air preheater system into operation.

开鼓、引风机，投空气预热器系统。

8) Restore other stopped auxiliary systems.

恢复其它停运的辅助系统。

(2) Steps for long-term power outage per the emergency shutdown procedures

长时间停电，装置按照紧急停工处理

1) Change the column OVHD gas to the flare gas system, and then change the regenerator tail gas to vent into the air.

塔顶瓦斯改去火炬系统，再生尾气改放空。

2) Put out the flame in atm. heater, introduce snuffing steam into the fire box, stop the air blower and induced draft fan, and change the heater to natural ventilation.

加热炉熄火，炉膛吹消防蒸汽，停鼓风机、引风机，加热炉改自然通风。

3) Stop the steam into each column, and change the superheated steam to vent into the air.

停各塔底吹汽，将过热蒸汽改放空。

4) Close the desalter cut water outlet valve to OSBL, and the water injection pump outlet valve to prevent oil loss.

关闭电脱盐切水出装置阀和注水泵出口阀，防止跑油。

5) Slowly break the vacuum of the Vac. column, and restore it to atmospheric pressure, and keep the liquid seal for D-401.

减压缓慢停真空，恢复常压，D-401 要保持液封。

6) Close each material outlet valve to OSBL.

关闭各物料出装置阀门。

7) If the Light Ends Recovery Unit is also out of power supply, the emergency actions to be taken for the Light Ends Recovery Unit shall follow the emergency procedures for power interruption. If the Light Ends Recovery Unit is not out of power supply, change the stabilization column OVHD gas to flare system. Change the stabilized naphtha to light slop drum, start P-630B to recycle some naphtha back to the absorption column as absorbent.

如轻烃回收装置也停电，则轻烃回收也按照停电预案处理。如轻烃回收装置未停电，则稳定塔顶瓦斯改至火炬。稳定石脑油改轻污油，启运 P-630B，稳定石脑油部分循环回吸收塔做吸收剂。

8) If the Acid Gas and LPG Treating Unit is out of power supply, follow the emergency procedures for power supply interruption developed for the Acid Gas and LPG Treating Unit. If the Acid Gas and LPG Treating Unit is not out of power supply, close the Atm. OVHD gas valve to the Acid Gas and LPG Treating Unit to maintain the operation of Acid Gas and LPG Treating Unit.

产品精制装置如停电，则按照产品精制装置停电预案处理。如未停电，则关闭初常顶瓦斯进产品装置阀，维持产品精制装置生产。

9) Stop the heavy oil cooler, such as LVGO PA water cooler.

关闭重油冷却器，如减一中水冷器。

10) Close the sealing oil injection point.

关闭封油注入点。

11) Stop the chemical injections on the column OVHD.

停注破乳剂及塔顶三注。

12) Close the outlet valve of each centrifugal pump and restart the pump after the power supply is resumed.

关闭各离心泵出口阀门，待来电后重新启动。

2.6.6 Instrument air/plant air supply interruption 装置停风

2.6.6.1 Accident phenomenons (main phenomenons) 事故现象（主要现象）

(1) Instrument air pressure dramatically drops.

仪表风压力急剧下降。

(2) Instrument air flowrate rapidly drops.

仪表风流量迅速下降。

(3) Instrument control valves fails.

装置仪表控制阀调节失灵。

2.6.6.2 Accident causes and cause confirmation 事故原因及原因确认

The Air Separation Unit fails or the instrument air system fails.

空分装置发生故障或仪表风系统发生故障。

2.6.6.3 Main response procedures 事故处理的主要步骤

Contact the Operation Scheduling Department in time to understand the cause of the accident and the length of the instrument air outage. Quickly organize the operators to take actions.

及时联系计划调度部了解事故原因和停风时间的长短。迅速组织岗位力量进行事故处理。

(1) The instrument air is interrupted but the plant air is not interrupted.

仪表风中断，工厂风未中断

1) There is a crossover between the instrument air and the plant air. After the instrument air is interrupted, close the instrument air inlet valve to ISBL immediately and open the crossover.

本装置仪表风和工厂风之间设置有跨线。仪表风中断后，应立即关闭仪表风进装置阀门，打开跨线。

2) The panel operators shall make proper adjustments based on the operation of each control valve.

内操根据各调节阀动作情况，做好相关调整。

3) The field operators shall fire the heater to resume production.

外操组织加热炉点火，恢复生产。

(2) Both the instrument air and plant air interruption

仪表风中断，工厂风中断

1) First change DCS related automatic control instrument from automatic mode to manual of treatment mode, and monitor the changes of various measurement parameters in the process unit.

先将 DCS 有关自控仪表由自动改为手动，并监视装置内各测量参数的变化。

2) For the instrument air close valve, use the rear hand valve to control its opening, and for the instrument air opening valve, use the bypass valve to control its opening. Properly adjust the flowrate with reference to the original current of each pump, each sidedraw outlet temperature and liquid level of sidedraw. If variable frequency pump is used, the bypass valve of the instrument air opening valve shall be fully opened, and use the frequency inverter to adjust the flowrate.

对于风关阀，用后手阀控制开度，对于风开阀用副线阀控制开度，参照各泵原来电流，各侧线馏出口温度和侧线液面调节流量，如为变频泵，则风开阀全开副线，用变频器调节流量。

3) If each column bottom level is too low, it will result in pump evacuation, and if the level is too high, slop will be generated.

严防各塔底液位过低引起塔底泵抽空，过高使产品出污油。

4) If the level in D-201, D-202, D-301 and D-302 is too high, water will be entrained in the reflux, resulting in column flooding, if the level is too low, oil will be entrained in the cut water.

严防 D-201、D-202、D-301、D-302 界位过高引起回流带水，导致冲塔事故，界位过低引起切水跑油。

5) If the column liquid level of sidedraw is too low, it will result in pump evacuation. In this case, properly reduce the distillate flowrate to properly control the level.

严防侧线液位过低引起机泵抽空，适当降低侧线外放，侧线可满液位控制。

6) Strictly prevent the pump from tripping due to excessive outlet flowrate and excessive current.

严防机泵因排量过大，电流过大而跳闸。

7) If the heater is flamed out, immediately organize the operators to fire the heater. If the pilots are flamed out, then ignite the pilots immediately. If the pilots are flamed out, introduce the snuffing steam into the fire box, and fire the heater per the firing procedures for new heater. When igniting, first close the two hand valves of the fuel gas and fuel oil to each burner, and then open the fuel gas and fuel oil bypass valves.

如加热炉熄火，则应立即组织人员点火。长明灯未熄，立即点火。长明灯已熄，则炉膛吹入蒸汽后，按照新炉点火程序点火。点火时，应先关闭每一个火嘴的燃料气、燃料油的两道手阀后，再开燃料气和燃料油付线阀。

(3) If the instrument air is interrupted for a long time, follow the steps specified in 2.6.3: Emergency shutdown procedures.

若长时间停风，按紧急停工处理，处理步骤：见 2.6.3

2.6.7 Steam supply interruption 装置停汽

2.6.7.1 1.0MPa steam supply interruption 装置停 1.0MPa 蒸汽

(1) Accident phenomenons (main phenomenons)

事故现象（主要现象）

1) 1.0MPa steam pressure and flowrate rapidly drop.

1.0MPa 蒸汽压力及流量迅速下降。

2) C-400 vacuum drops (or residual pressure rises).

塔 C-400 真空度下降（或者残压上升）。

3) The atomizing steam to the Atm. heater is interrupted, the atomization of fuel oil is poor, the chimney emits black smoke, and the heater outlet temperature drops.

常压炉雾化蒸汽中断，烧燃料油，炉内雾化不好，烟囱冒黑烟，炉出口温度下降等。

(2) Accident causes and cause confirmation

事故原因及原因确认

1) The boiler fails and cannot supply steam.

锅炉发生故障，不能正常供汽。

2) 1.0MPa steam piping network fails or the valve fails.

1.0MPa 蒸汽管网故障或阀门故障。

(3) Main response procedures

事故处理的主要步骤

1) Report to the on-duty persons and leaders of the Production Scheduling Department and the Operation Department to organize the operators to respond to the accident.

向计划调度部、运行部值班和领导汇报，组织岗位力量进行事故处理。

2) If the steam is interrupted for a long time, turn down the vacuum system to maintain the product; if the steam is interrupted for short time, reduce the operation load.

如长时间停汽，则按降量停减压系统维持生产；如短时停汽降量维持生产。

3) Close the steam to the 1st and 2nd ejectors, if the 3rd ejector is in operation, switch it over to water ring vacuum pump.

关闭减压塔一、二级抽真空蒸汽，三级抽真空如运行的是蒸汽抽真空，应切换为水环真空泵。

4) Stop the fuel oil burners of the Atm. heater, and put the fuel oil only in circulation mode.

常压炉停燃料油火嘴，燃料油只循环。

5) Gradually reduce the crude flowrates. Turn down the operation of the process unit.

原油两路流量逐步降量。装置降至最低负荷运行。

6) When the residue level is high, start the two residue pumps for the operation at the same time, and further close the quench oil flowrate.

渣油外放困难时，应启动两台渣油泵同时运行，关小急冷油流量。

7) Stop the Vac. column distillates, fully close HVGO reflux, and maintain the column pumparound reflux. If the LVGO level is emptied, switch Heavy diesel to LVGO immediately, and properly control the Vac. column OVHD temperature.

减压侧线停止外放，减三线内回流全关，维持好中段回流。如减一线液位抽空，应立即将常三线补入减一线，控制好减顶温度。

8) Properly control heater outlet temperature. As the Vac. column distillates are stopped, the desalter operating temperature, the inlet temperature of the Pre-Dist. and the outlet temperature of the heat exchanger will be greatly reduced, consideration shall be given to stop water injection into the desalter. As the operation load of the Atm. heater is increased, the outlet temperature of the Vac. heater shall be properly controlled, which shall not be too low.

控制加热炉出口温度。因减压侧线停运，脱盐温度、初馏塔进塔温度、换热终温均会大幅度下降，应考虑电脱盐停注水。常压炉负荷增加，减压炉应适当控制出口温度，不可过低。

9) If the residue outlet temperature rises too fast and affects the safety of the storage, the residue water cooler shall be put into operator to control the temperature of the residue into the storage.
渣油外放温度如上升过快，影响罐区安全，应投用渣油水冷器，控制渣油外放温度。

10) Close the steam injection into the Vac. heater tubes and the bottom of the Vac. column.
关减压炉炉管注气和减压塔底汽提蒸汽。

11) Close the sealing oil into the standby pump, properly reduce the sealing oil into the operating pumps. Maintain the Heavy diesel to the LVGO for avoidance of empty to ensure the sealing oil to the operating pumps.

关闭备用泵的封油，运行泵的封油可适当关小，常三线维持补油确保减一线液位不抽空，从而确保机泵封油用油。

12) Change the Vac. OVHD gas into the flare gas piping network.
减顶瓦斯改进火炬管网。

2.6.7.2 0.5MPa steam supply interruption 装置停 0.5MPa 蒸汽

(1) Accident phenomenons (main phenomenons)

事故现象（主要现象）

1) Steam pressure and flowrate drop rapidly.

蒸汽压力及流量迅速下降。

2) Superheated steam temperature rises.

过热蒸汽温度上升。

3) The Atm. OVHD pressure drops, and the distillate temperature drops.

常压塔塔顶压力下降，侧线抽出温度下降。

(2) Accident causes and cause confirmation

事故原因及原因确认

1) The boiler fails and cannot supply steam.

锅炉发生故障，不能正常供汽。

2) Steam piping cracks or the valve fails.

蒸汽管线破裂或阀门故障。

(3) Main response procedures

事故处理的主要步骤

1) Report to the on-duty persons and leaders of the Production Scheduling Department and the Operation Department to organize the operators to respond to the accident.

向计划调度部、运行部值班和领导汇报，组织岗位力量进行事故处理。

2) Close the steam valves to the Atm. and Vac. column to prevent the high temperature oil from reversing.

关闭常底吹汽阀门，减压塔底注气阀门，防止高温油倒串。

3) Reduce the heater temperature to avoid burnt down of the superheated steam tubes.

加热炉降温，避免过热蒸汽炉管烧穿。

4) Properly reduce the crude flowrate based on the residue flowrate and the Vac. residue level.
根据渣油外放和减压塔底液位控制情况，降低原油处理量。

5) After the 0.5 MPa steam supply is available, gradually restore the steam injection and crude flowrate to normal operation.

0.5MPa 蒸汽恢复后，逐步恢复吹汽和装置处理量。

2.6.8 CCW supply interruption 装置停循环水

2.6.8.1 Accident phenomenons (main phenomenons) 事故现象（主要现象）

(1) The pressure of CCW to the process unit drops.

循环水进装置压力指示下降。

(2) The flowrate of CCW to the process unit drops rapidly.

循环水进装置流量迅速下降。

(3) C-400 vacuum is reduced.

C-400 真空度下降。

(4) The temperature of crude from the cooler rises.

油品冷后温度升高。

2.6.8.2 Accident causes and cause confirmation 事故原因及原因确认

(1) CCW pump fails.

循环水泵原因。

(2) CCW piping fails.

循环水管线故障。

(3) Pump house of CCW plant is out of power supply.

循环水厂泵房停电。

2.6.8.3 Main response procedures 事故处理的主要步骤

(1) Report to the on-duty persons and leaders of the Production Scheduling Department and the Operation Department to organize the operators to respond to the accident.

向计划调度部、运行部值班和领导汇报，组织岗位力量进行事故处理。

(2) If CCW interruption lasts for short time, turn down the load and maintain operation. When CCW is available, restore normal operation immediately.

如短时停循环水降量维持生产。循环水恢复后，立即恢复操作

(3) If CCW is interrupted for a long time, follow the steps specified in 2.6.3: Emergency shutdown procedures.

如长时间停循环水，则按照紧急停工处理，参见 2.6.3。

2.6.9 Feed supply interruption 进料中断

2.6.9.1 Causes for feed supply interruption 进料中断的原因

(1) The crude storage level is too low.

原油罐液位过低。

(2) The crude pump (including the motor) fails.

原油泵（包括电机）出现故障。

(3) The opening of the return valve to the crude storage from the crude pump in the storage is too large.

罐区原油泵返回原油罐阀门开得过大。

2.6.9.2 Phenomenon of feed supply interruption 进料中断的现象

(1) The flowrate of crude to the process unit drops.

原油进装置流量下降。

(2) The pressure of crude to the process unit drops.

原油进装置压力下降。

2.6.9.3 Response for crude supply interruption 进料中断的处理

(1) If the level of the crude storage is too low, contact the Operation Scheduling Department and the crude storage farm to switch over crude storages.

如因原油罐液位过低，联系计划调度部和原油罐区换罐。

(2) If opening of the return valve to the crude storage from the crude pump in the storage is too large, contact the storage to further close the valve and restore the normal feed flowrate to the process unit.

如因原油泵返回原油罐阀门开得过大，则联系罐区关小阀门，恢复装置进料。

(3) If the crude interruption to the process unit is caused by the pump failure and the standby pump cannot be started, shut down the process unit per the steps specified in 2.6.3: Emergency shutdown procedures.

如因原油泵故障，而备用泵无法启运，造成装置原料中断时，装置需要紧急停工，按照 2.6.3 组织装置紧急停车。

2.6.10 DCS power supply interruption DCS 黑屏

2.6.10.1 Causes 原因

Any unpredictable factor can cause DCS to crash and not function properly.

任何不可估测的因素均可导致 DCS 死机，无法正常运行。

2.6.10.2 Phenomenons 现象

Most of the parameters on DCS screen are abnormal, or the parameters cannot move, or DCS

cannot correctly execute various operation instructions, or does not respond to any operation, or there is no parameter display for a long time due to data transmission failure. In these cases, DCS may be considered to be down.

DCS 画面显示装置的大多数参数不正常, 或参数不能动, 或 DCS 不能正确执行各项操作指令, 或不响应任何操作, 或因传输故障长时间无参数显示, 可认为 DCS 死机。

2.6.10.3 Actions 处理

(1) Inform the on-duty personnel and the Operation Scheduling Department, and contact the instrument staff to deal with DCS crash.

及时告知当日车间值班和计划调度部, 并联系仪表来人处理 DCS 死机故障。

(2) Understand the cause of the fault, the time required to deal with the fault, the repair progress and repair results.

了解故障原因和处理故障所需时间和处理进度, 及时了解抢修进度和抢修结果。

(3) The DCS crash time is short (≥ 15 minutes), maintain the operation and change to manual control. The field operators use Pre-Dist. instrument parameters for manual control.

DCS 死机时间短, 为 ≥ 15 min, 则维持生产, 各岗位转入人工控制。现场利用仪表一次表参数进行人工控制。

(4) Check and properly control each column bottom, sidedraw, column OVHD return drum and product drum levels to prevent pump evacuation.

检查并控制好各塔底、侧线、塔顶回流罐和产品罐液位, 防止泵抽空。

(5) Properly control C-200 and C-300 levels to prevent coking or burnt down of the heater tubes due to pump evacuation.

控制好 C-200 和 C-300 的液位, 防止因泵抽空引起炉管结焦及炉管烧坏。

(6) Properly control D-101, D-102, D-201, D-202, D-301, D-302 and D-401 interface level.

控制 D-101、D-102、D-201、D-202、D-301、D-302、D-401 界位。

(7) Avoid oil entrained in LP oil vapor.

防止低压瓦斯带油。

(8) Prevent the pump from tripping due to excessive flowrate and excessive current.

防止机泵因流量过大, 电流过大而跳闸。

(9) If DCS is down for more than 15 minutes, or if the panel operators cannot perform control within 15 minutes, follow the shutdown procedures. See 2.6.3.

DCS 死机时间超过 15min, 或在 15min 以内操作无法控制时, 则按停工处理。见 2.6.3。

2.6.11 Actions for desalter abnormalities 电脱盐异常处理

2.6.11.1 Water is entrained in the crude 原油带水

(1) Causes of water entrained in the crude

原油带水的原因

1) water content in the crude into the process unit is high.

原油进装置含水量高。

2) Crude emulsification is severe, and water is properly cut from the desalter drum.

原油乳化严重、脱盐罐切水效果差。

3) The interface in the desalter drum is too high, and water content exceeds the standard.

脱盐罐界位控制过高，含水超标。

(2) Phenomenons of water entrained in the crude

原油带水的现象

1) The interface in the desalter drum rises, the current increases, the voltage drops, and the transformer will trip for severe case.

电脱盐罐界位上升，电流增大，电压下降，严重时变压器跳停。

2) The Pre-Dist. OVHD pressure and temperature rise rapidly, and the column bottom level drops rapidly.

初馏塔塔顶压力、塔顶温度迅速上升，塔底液面迅速下降。

3) The final outlet temperature of the secondary heat exchanger (the inlet temperature of the Pre-Dist.) and the final outlet temperature of the third heat exchanges (the inlet temperature of the Atm. heater) drop.

二次换热终温（初馏塔进塔温度）、三次换热终温（常压炉进炉温度）降低。

4) The interface level in D-101 and D-102 increased rapidly, and much water is cut from the column OVHD reflux drum.

D-101、D-102 界位迅速上升，塔顶回流罐切水增多。

5) The flowrate of crude into the process unit is reduced even the opening of crude feed valve is increased.

原油进装置量降低，阀位开大，提量困难。

(3) Actions taken for water entrained in the crude

原油带水的处理

1) Contact the Operation Scheduling Department in time to switch over the crude or adjust the blending ratio of crudes.

及时联系计划调度部切换原油或调整掺炼比。

2) When the current and voltage of the desalter drum change significantly, first reduce desalter water injection flowrate to reduce the interface and mixer pressure drop in the desalter drum. If the current still rises rapidly and the voltage drops after the above measure is taken, stop desalter water injection immediately. If the transformer is tripped, the desalter water injection shall be stopped immediately.

电脱盐罐电流电压明显变化时，应先降低电脱盐注水量，降低电脱盐罐界位，降低混合压降。如在采取以上措施后，电流仍然快速攀升，电压下降，立即停止电脱盐注水。如变压器跳停，应立即停止电脱盐注水。

3) After the desalter water injection is stopped, the field operators shall check the interface in the desalter drum and water cut from the desalter drum. If oil is entrained in the cut water, stop water cut from the desalter drum.

电脱盐停注水后，外操注意检查现场界位和电脱盐排水情况，如电脱盐排水带油，应停止电脱盐切水。

4) If water has been brought to the Pre-Dist., i.e., the phenomenons in 2), 3), 4), proper countermeasures shall be taken decisively.

如水已经带至初馏塔，即出现现象中的 2)、3)、4) 情况时，应果断采取应对措施。

5) Properly control the column OVHD pressure by means of increasing the column OVHD variable frequency air fan speed, putting more air coolers into operation or even sending the column OVHD gas into the flare system.

控制好塔顶压力，应通过增加塔顶变频调速、增开风机、甚至塔顶瓦斯放火炬等措施降低压力。

6) Stabilize the column OVHD temperature. If water is entrained in the crude, the water latent heat and specific heat are much larger than the crude due to the large amount of water vaporization, which causes the column OVHD temperature to rise rapidly. The column OVHD temperature shall be lowered by increasing the column OVHD reflux, but the column OVHD temperature shall be increased than the normal temperature, and water shall be drained from the Pre-Dist. OVHD as much as possible.

稳定塔顶温度，原油带水后，因大量水汽化，水潜热和比热均比油大得多，造成塔顶温度快速上升，应通过增加塔顶回流的形式降低塔顶温度，但是塔顶温度应较正常时提高，尽量将水从初馏塔塔顶排出。

7) Change the Pre-Dist. OVHD naphtha to LSO system to prevent contamination to the feedstock to CCR Unit.

初顶石脑油改轻污油，防止污染重整料。

8) The flowrate of crude into the process unit shall be increased by reducing the desalter pressure (further open the desalted crude control valves), and further opening the control valve of the crude into the process unit.

应通过降低电脱盐压力（开大脱后原油三路控制阀）、开大原油进装置调节阀等手段，增加原油进装置流量。

9) Properly reduce the feed flowrate to the Atm. heater and the Vac. heater to prevent the too low level in the Pre-Dist.. Control the outlet temperature of the heater to prevent the outlet temperature of the heater from exceeding the specified value.

根据初馏塔的液位，降低常压炉和减压炉的进料，防止塔液位抽空。控制加热炉出口温度，防止加热炉出口温度超温。

10) Increase water cut from the column OVHD KO drum. If the interface is too high, open the bypass of the control valve to increase water cut, and startup the Pre-Dist. OVHD sour water pump to increase sour water sendout flowrate.

塔顶分水罐加强切水，如界位过高，可开调节阀付线增加切水，增开初顶含硫污水泵增加含硫污水外放。

11) When the load fluctuates greatly, it is easy to cause the side oil color to be abnormal. In severe cases, the heat exchanger may leak. The field operators shall strengthen the oil color inspection of the naphtha and sidestreams, and strengthen the inspection of the field equipment.

负荷大幅度波动时，容易引起侧线油色异常，严重时可能造成换热器泄漏等，外操应加强石脑油、侧线等油色检查，加强现场设备的检查。

2.6.11.2 The salt content in desalted crude is too high 脱后原油含盐量过高

(1) Causes

原因

1) Crude flowrate is large, exceeding the operation load.

原油处理量大，超负荷

2) The properties of crude change, such as density and viscosity, crude itself is emulsified seriously, contents of mechanical impurities are high, and the quality of rerun oil is poor or the flowrate of the rerun oil is too large.

原油性质发生变化，如密度、粘度发生较大变化，原油本身乳化严重，机械杂质高，回炼污油性质差或者量过大。

3) Poor injection water quality, such as significant rise of NH₃-N, impurities, pH.

注水水质差，如氨氮、杂质、pH 值等大幅度上升。

4) Mixing valve differential pressure is not properly adjusted.

混合阀差压调节不合适。

5) The operating temperature of the desalter drum is too low.

脱盐罐温度太低。

6) The injection amount of demulsifier is insufficient, and the demulsification effect is poor.

破乳剂注入量不足，破乳效果差。

7) The amount of water injected is too low.

注水量太低。

8) The interface is not properly controlled.

界位控制不正常。

9) The electric field strength is not suitable.

电场强度不合适。

10) Analysis issues, for example, analysis for crude containing H₂S is made without adding sufficient H₂O₂.

分析问题，如含 H₂S 原油，在分析过程中没有添加足够的 H₂O₂ 等。

(2) Actions

处理：

1) Crude flowrate is too high, it shall be appropriately reduced.

若原油处理量超负荷，应适当降处理量。

2) If the properties of the crude deteriorate, for example, the properties of the crude deviates too much from the designed properties, crude blending shall be considered to improve the properties of the crude.

若原油本身性质变坏，如原油性质与设计原油偏差过大，应考虑掺炼、混炼等形式改善原油性质。

3) Control the slop to blended into the crude, especially the slop with high water content and

high mechanical impurity content.

控制污油，尤其是高含水、高机杂的污油应严格控制掺炼量。

4) Check the water quality of the injection water. If the pH value is too high, the NH₃-N and the mechanical impurity content are too high, the water quality shall be improved.

检查注水水质，如 pH 值过高，氨氮和机杂过高，应改善水质。

5) Too low operation temperature of the desalter (such as <110 °C) generally affects the dehydration effect. The water content in the desalted crude also obviously rises. The operation temperature of the desalter may be increased by adjusting the heat exchange network.

电脱盐温度过低（如<110℃）一般影响的是脱水效果，脱后含水也明显上升，可通过调整换热网络，提高脱盐温度。

6) If the salt content is high and water content is low for the desalted crude, it may be considered to increase the mixer pressure drop and water injection amount.

如原油脱后含盐高、脱后含水低，可以考虑增加混合压降、注水量等。

7) If the salt content is high and water content is high for the desalted crude, it may be considered to increase the dosage of demulsifier.

如原油脱后含盐高、脱后含水高，则应考虑增加破乳剂加注量。

8) The role of the electric field is mainly to enhance the dehydration speed. If the salt content is high and water content is high for the desalted crude, adjustment of the electric field is of little significance. If the salt content is high and water content is high for the desalted crude, the voltage shall be adjusted based on the actual situation. If the voltage itself is at high level, the voltage shall be reduced. If the voltage itself is at low level, the electric field strength may be increased.

电场的作用主要是加强脱水速度，如原油脱后含盐高、脱后含水低，则调整电场意义不大。如原油脱后含盐高、脱后含水高，则要根据实际情况调整电压，如电压本身处于高档位，则应降低电压，如电压本身处于低档位，则可提高电场强度。

9) If the salt content is too high for a long time, check the laboratory analysis process for any problems.

如长时间脱后含盐偏高，也应检查化验分析过程是否有问题。

10) The interface control mainly affects the electric field, which further affects the dehydration effect. If the interface is too high, the emulsion layer easily enters a strong electric field, affecting dehydration, and if the interface is too low, it will reduce the electric field strength of the weak electric field and affect the dehydration of the weak electric field, resulting in oil is entrained in the cut water. For high-speed desalter, the crude-water interface shall be reduced as much as possible, provided that on oil is entrained in the cut water.

界位控制主要影响电场，进一步影响到脱水效果，界位过高，乳化层容易进入强电场，影响脱水，界位过低，则会降低弱电场的电场强度，影响弱电场的脱水，以及造成排水含油。对于高速电脱盐，应在确保排水不带油的情况下，尽量降低油水界位。

2.6.11.3 The water content in desalted crude is too high 脱后原油含水量太高

(1) Causes

原因

1) Deterioration of crude properties (density, viscosity), severe emulsification (short settling time in the storage), excessive impurity content in crude (much more slop is blended or slop from the drum drum cleaning is blended).

原油性质恶化（密度、粘度变化），乳化严重（罐区沉降时间短），原油杂质含量过高（如污油回炼大），或者清罐油回炼。

2) Change of injection water quality, pH change (high pH will cause oil emulsification), or high impurity content.

注水水质变化，pH 值变化（高 pH 值会引起原油乳化），或者杂质含量高。

3) Water content in crude itself is too high.

原油本身含水过高。

4) The crude-water interface level in the Pre-Dist. or secondary desalter drum is too high.

一级或二级电脱盐罐油水界面太高。

5) The differential pressure of the mixing valve is too large, resulting in crude emulsification.

混合阀差压太大，引起原油乳化。

6) The electric field voltage is too high or too low.

电场给电压过高或者过低。

7) The crude properties change, the demulsifier is not suitable.

原油性质变化后，破乳剂不适应。

(2) Actions

处理

1) Corresponding measures shall be taken for the changes of crude properties. For example, heavy high-viscosity crude shall be process in the form of blending, the settlement time in storage shall be increased for the crude with high water content and the emulsified crude, and the blending ratio of slop shall be properly controlled.

针对原油性质变化的原因，采取相应措施，如重质高粘原油采取掺炼的形式加工，增加高含水原油和乳化原油的罐区沉降时间，控制污油掺炼比例等。

2) Control the injection water quality. If the pH is too high, inform the Operation Scheduling Department to require the operators in the Sour Water Stripping Unit to properly control the purified water quality and improve the stripping effect.

控制注水水质，如 pH 过高，应通知调度，联系酸水汽提装置控制净化水水质，改善汽提效果。

3) Properly control the crude-water interface level.

合理控制界位。

4) Properly reduce the mixer pressure drop.

适当降低混合压降。

5) Reduce the amount of water injected into the crude.

降低原油注水量。

6) Adjust the electric field voltage.

调整电场电压

7) If the crude properties are too different from the design properties or the original demulsifier selected is not suitable for the crude type, re-select demulsifier.

如长时间原油性质与原设计原油，或者原破乳剂筛选油种差异太大，应考虑重新筛选破乳剂。

2.6.11.4 Oil content in the water cut from the desalter is high 脱盐罐排水带油量大

(1) Causes

原因

1) The properties of the crude change, the emulsification is severe, and the density and viscosity are high.

原油性质变化，乳化严重，密度、粘度大。

2) Slop is rerun, resulting in the current to rise and the crude-water separation effect poor.

回炼污油等，造成电流上升，油水分离效果差。

3) The interface is too low or too high.

界位控制过低，或者过高。

4) The mixer pressure drop is too large.

混合器压降太大。

(2) Actions

处理

1) Corresponding measures shall be taken for the changes of crude properties. For example, heavy high-viscosity crude shall be process in the form of blending, the settlement time in storage shall be increased for the crude with high water content and the emulsified crude.

针对原油性质变化的原因，采取相应措施，如重质高粘原油采取掺炼的形式加工，增加高含水原油和乳化原油的罐区沉降时间。

2) The blending ratio of slop shall be properly controlled.

控制污油掺炼比例等

3) Properly control the crude-water interface level.

合理控制界位。

4) Properly reduce the mixer pressure drop.

降低混合阀压降。

2.6.11.5 The desalter voltage is low and the current is high 电脱盐电压低电流高

(1) Causes

原因

1) Emulsification of crude, or large water content.

原油乳化，或者含水量大

2) The amount of water injection changes, or the water quality changes.

注水量变化，或者水质变化。

3) Slop is rerun.

回炼污油影响。

4) The interface level controller fails, resulting in too high interface level.

界位失灵，界位过高。

5) The crude-water mixture is too strong, resulting in crude emulsification.

油水混合太强烈导致原油乳化。

6) Electrical system fails.

电气故障。

(2) Actions

处理

1) Stop water injection or adjust the amount of water injection appropriately.

停止注水或适当调整注水量。

2) Check the cause of crude emulsification and increase the sedimentation and dehydration time of crude in the storage.

排查原油乳化原因，增加原油在罐区的沉降脱水时间。

3) Properly control the slop blending ratio.

严格控制污油掺炼量。

4) Decrease the interface level and contact the instrument staffs to calibrate the interface level.

降低界位，联系仪表校正界位。

5) Properly reduce the mixer pressure drop.

适当降低混合压降。

6) Contact electrical staff for repair.

联系电气检修。

2.6.11.6 Desalter drum transformer trip 电脱盐罐变压器跳闸

(1) Causes

原因

1) The interface is too high.

界位控制太高。

2) The mixer pressure drop is too large and the crude is emulsified seriously.

混合器压降太大，原油乳化严重。

3) Crude is heavy, viscosity is high, and crude-water separation is difficult.

原油较重，粘度大，油水分离困难。

4) Water injection flowrate is too large.

原油注水量过大。

5) The pressure of the desalting drum is too low, resulting in vaporization in the drum.

脱盐罐压力控制过低，造成罐内汽化。

6) Electrical system fails.

电气设备故障。

7) The operating temperature of the desalter is too high.

脱盐温度过高。

(2) Actions

处理

1) In case of the transformer trip, immediately stop water injection, lower the interface level, and try to energize the transformer as soon as possible to resume water injection.

跳闸后，立即停注水，降低界位，争取尽快送电，恢复注水。

2) Control the mixing intensity based on the process indicators and reduce the mixing intensity. 按工艺指标要求控制混合强度，降低混合强度。

3) If the crude is heavy and the viscosity is large, and cause the transformer trip, restart the water injection after power supply is available and the current and voltage are normal, properly control water injection flowrate to reduce the mixing intensity. If possible, measures shall be taken to improve the properties of crude, for example, LSO shall be blended.

原油较重，粘度较大，造成变压器跳闸的，应在停注水后，恢复送电，电流电压正常后，重新注水，适当控制注水量，降低混合强度。如有可能应采取措施改善原油性质，如与轻质油混炼。

4) Reduce the water injection flowrate to normal level.

降低注水量至正常水平。

5) Increase the pressure of the desalter drum to normal level.

提高电脱盐罐压力至正常。

6) Contact the electrical staff for troubleshooting.

联系电气查找原因，进行处理。

7) Properly reduce the operating temperature of the desalter.

适当降低电脱盐温度。

2.6.12 Column flooding 冲塔

2.6.12.1 Phenomenons 冲塔的现象

(1) The column OVHD temperature and pressure rise rapidly.

塔顶温度、压力迅速上升。

(2) The oil color becomes darker and the specific gravity increases.

油品颜色变深，比重增大。

(3) The crude fractions are on-spec.

油品馏分不正常。

2.6.12.2 Causes 冲塔的原因

(1) Excessive gas phase load due to change of crude properties, high water content in crude, increased light component contents.

原油性质变化，原油含水高，轻组分含量增多等原因，引起气相负荷过大。

(2) The crude in the desalter drum is emulsified, or the interface is too high, and the water is carried into the column.

电脱盐罐内原油乳化，或界位太高，水带入塔内。

(3) Water is carried in the column OVHD reflux, and the reflux flow is too small.

塔顶回流带水，回流量太小。

(4) The pumparound reflux is suddenly interrupted.

中段回流突然中断。

(5) Column bottom level is too high.

塔底液位过高。

(6) The flowrate of steam injected into the column is too large, or water is carried in the steam.

塔底吹汽量过大，或者带水。

(7) The feedstock temperature suddenly changes.

进料温度突变。

(8) The feed flowrate is too large, resulting in too high steam speed.

处理量太大，引起汽速过高。

(8) The instrument fails.

仪表失灵。

2.6.12.3 Actions 冲塔的冲塔的处理

(1) Contact the Operation Scheduling Department to change the product to off-spec product drums.

联系计划调度部将产品改走不合格线。

(2) Contact the crude storage farm to strengthen the water cut from the crude storage, strengthen water cut from the desalter drum, and stop the water injection if necessary.

联系原油罐区加强原油罐切水，电脱盐罐加强切水，必要时停止注水。

(3) If water is carried into the column, stop water injection into the desalter immediately, and then follow the actions steps for water entrained in crude.

带水入塔，应立即停止电脱盐注水，按照原油带水事故处理。

(4) If the column pumparound is interrupted, start the standby pump immediately to resume the column pumparound.

若中段回流中断，应立即启运备用泵，恢复中段回流。

(5) Lower the column bottom level to maintain at normal level.

降低塔底液面，保持正常位置。

(6) Reduce the flowrate of steam injected into the column and strengthen water drainage from 0.5 MPa steam trap.

降低塔底吹汽量，加强 0.5MPa 蒸汽分水罐排水。

(7) Properly reduce the outlet temperature of the heater, stabilize the feed temperature, and control them within the specified range.

适当降低加热炉出口温度，稳定进料温度，控制在指标范围内。

(8) Properly reduce feedstock flowrate into the column.

适当降低处理量。

(9) Contact the instrument staff for repair.

联系仪表修理。

2.6.13 Water is entrained in the column OVHD reflux 塔顶回流带水

2.6.13.1 Causes 塔顶回流带水的原因

(1) The interface in the reflux drum is too high.

回流罐界位过高。

(2) The water cut control valve of the reflux drum fails.

回流罐切水控制阀故障。

(3) The water cut piping or the control valve is blocked.

切水管线或者调节阀堵塞。

(4) False indication of interface meter results in high interface level.

界位计仪表假指示，致使界位装高。

(5) Water is entrained in the crude or flowrate of steam injected into the column is too large, or water is carried in the superheated steam, resulting in too large flowrate of the reflux drum.
原油带水，或者塔底吹汽量过大，过热蒸汽带水等，造成回流罐水量过大。

2.6.13.2 Phenomenons 塔顶回流带水的现象

(1) The column OVHD temperature drops sharply and the temperature is unstable.

塔顶温度骤降，而且温度不稳。

(2) The column OVHD reflux flowrate decreases, while the column OVHD pressure rises.

塔顶回流量减少，而塔顶压力上升。

(3) Water is carried in the crude for a long time, the column OVHD temperature continues falling, and the pressure fluctuates. If this situation is severe, the column OVHD relief valve will be lifted or the column will be flooded.

带水时间长，塔顶温度一直下降，压力波动，严重时全使塔顶安全阀启跳或引起冲塔事故。

(4) Water is carried in the reflux for a long time, the Atm. OVHD reflux pump may experience evacuation.

回流带水时间长，可能引起常顶循泵抽空。

2.6.13.3 Actions 塔顶回流带水的处理

(1) If water is carried in the reflux, stop column OVHD water injection immediately, and resume water injection after this issue is eliminated.

回流带水时，应立即停止塔顶注水，待处理正常后再恢复注水。

(2) Strengthen water cut from the reflux drum to enable the interface level within the normal range.

加强回流罐切水，使界位达到正常控制范围。

(3) The interface level control valve fails, cut control valve out of service, use the bypass for

control, and contact the instrument staff to repair the control valve.

界位控制阀故障，切出控制阀，现场采用副线控制，应联系仪表人员检修调节阀。

(4) Eliminate the blockage of the piping and control valve.

疏通管线及调节阀。

(5) Contact the instrument staff to troubleshoot the interface meter.

联系仪表处理处理界位计。

(6) Eliminate the causes of increased column OVHD reflux.

排除塔顶水量增加的原因。

(7) Change the column OVHD temperature control to manual mode, and adjust the Atm. PA1# and PA2# reflux flowrates to stabilize the operation of the Atm.. Put more air cooler fans into operation reduce the after-cooler oil temperature.

塔顶温度改手动控制，调节常一、二中回流量以稳定常压塔操作。适当增开空冷风机，降低油品冷后温度。

2.6.14 Distillate color is dark 侧线出黑油

2.6.14.1 Causes 原因

(1) The column bottom level gauge fails, resulting in too high bottom level.

塔底液位计故障，造成塔底液面过高。

(2) The flowrate of steam injected into the column is too large.

塔底吹汽量过大。

(3) The heater outlet temperature is too high.

炉出口温度过高。

(4) The distillate temperature is too high, and the distillate flowrate is too large (Atm.heavy diesel and overflash oil, and HVGO).

侧线温度过高，侧线抽出量过大（常三线、常四线、减三线）。

(5) The vacuum degree of the Vac. column suddenly changes and affect the column bottom level, resulting in dark oil.

减压塔真空度突然变化，影响塔底液位装高而侧线出黑油。

(6) Heat exchanger internally leaks.

换热器内漏。

(7) Water is carried in the crude, the Pre-Dist. is flooded. As a result, the Atm. sidedraw becomes dark (during startup of Pre-Dist.1st sidedraw).

原油带水，造成初馏塔冲塔，引起常压侧线出黑油（初一线开时）。

(8) The operation load of the process unit is too large and light crude is processed. As a result, gas phase load is increased and mist is entrained.

装置负荷过大，原油性质轻等引起气相负荷增加，雾沫夹带增加。

(9) The residue sendout piping is blocked or the residue flowrate is too large, exceeding the residue pump capacity. As a result, the level in the Vac. column in increased, and the distillate

becomes dark.

渣油外放不畅，或者渣油量增加大，超出渣油泵外送能力，造成减压塔装高，侧线出黑油。

2.6.14.2 Actions 处理

(1) Contact the Operation Scheduling Department to change the black distillate to the slop piping.

联系计划调度部将出黑油侧线改走污油线。

(2) Check and repair the level gauge to reduce the column bottom level.

检查、维修液位计，降低塔底液面至正常位置。

(3) Properly reduce the flowrate of steam injected into the column.

适当关小塔底吹汽量。

(4) Change the heater outlet temperature control to manual mode to reduce the column feed temperature.

炉出口温度手动控制，降低塔进料温度。

(5) Reduce the distillate draw temperature and flowrate.

降低侧线抽出温度，降低侧线抽出量。

(6) Adjust the vacuum to a stable level and restore it to normal level.

调节真空度平稳，恢复正常水平。

(7) Check the heat exchanger and cut the leaked heat exchanger out of service for repair.

检查换热器，并将内漏换热器切除，进行处理。

(8) Check the Pre-Dist. sidedraw. If the Pre-Dist. sidedraw becomes dark, stop the Pre-Dist. sidedraw and change it to full reflux or stop the Pre-Dist. sidedraw pump.

检查初一线，初一线油色黑时，应停止初一线抽出，初一线改全回流，或者停初一线泵。

(9) Reduce the operation load of the process unit to lower the gas phase load.

降低装置处理量，降低气相负荷。

(10) Notify the Operation Scheduling Department to check the sendout process flow, reduce the quench oil flowrate, start the residue pump in a short time so as to reduce the vacuum bottom level.

通知调度检查外放流程，降低急冷油流量，短时间增开渣油泵，降低减压塔液位。

2.6.15 Column bottom pump evacuation 塔底泵抽空

2.6.15.1 Causes 原因

(1) The column bottom level is too low.

塔底液面过低。

(2) The LSO content in the column bottom oil is too high.

塔底油轻油过多。

(3) The temperature of the superheated steam is low, and water is entrained in the superheated steam.

过热蒸汽温度低，带水。

(4) The pump inlet valve is clogged, the opening of the pump inlet valve is too small, or steam intrudes into the pump inlet valve.

泵入口堵塞、开度过小或串蒸汽。

(5) The sealing oil injection flowrate to the pump is too large, or water is entrained in the sealing oil.

泵封油注入量过大，带水等。

(6) The pump itself fails.

泵体本身故障。

(7) The standby pump is not properly preheated to cause evacuation of the running pump.

备用泵预热不当，引起运行泵抽空。

2.6.15.2 Phenomenons 现象

(1) The column bottom level rises.

塔底液面上升。

(2) The pump outlet pressure drops, the motor current drops, and the pump vibrates violently.

泵出口压力下降，电流下降，机泵振动大。

(3) The pump outlet flowrate reduces and experiences large fluctuation.

泵出口流量下降且波动大。

2.6.15.3 Actions 处理

(1) Increase the column bottom level.

提高塔底液面。

(2) Switch to the standby pump, and reduce the column bottom draw flowrate accordingly. When the pump outlet pressure is normal, gradually increase the column bottom draw flowrate. Adjust the heater outlet temperature, increase the column sidedraw flowrate, and improve the properties of the column bottom oil products.

切换备用泵，适当降低塔底抽出量，泵出口压力正常后，逐步开大抽出量。调整炉出口温度，增加侧线抽出量等，改善塔底油品性质。

(3) Control the temperature and pressure of the superheated steam within the normal range. 控制过热蒸汽温度、压力至正常范围内。

(4) Check if the pump inlet piping is blocked. If the opening of the pump inlet valve is small, further open the pump inlet valve; if steam intrudes into the pump inlet purge valve, install blind at the pump inlet purge valve. Switch to the standby pump, and then check and clean the pump inlet filter.

检查入口线是否堵塞，如开度小开大入口阀，如入口扫线阀串汽，可加盲板。切换备用泵，检查并清理入口过滤器。

(5) Reduce the sealing oil injection flowrate to the pump, and further close the preheat valve. 调小封油注入量，关小预热线。

(6) If the pump itself fails, switch to the standby pump.

泵本身故障则切换备用泵。

(7) Drain all residual oil and water from the standby pump while it is being preheated, and lower the preheating speed accordingly.

备用泵预热时，排尽存气和存水，减缓预热速度。

2.6.16 Atm. Top PA pump evacuation 常顶循泵抽空

2.6.16.1 Causes 原因

(1) The pump inlet piping is blocked.

泵入口来料不畅。

(2) The steam purge valve cannot be fully closed.

蒸汽吹扫阀关不严。

(3) The pump itself fails.

机泵本身故障。

(4) A large amount of water is entrained in the Atm. OVHD reflux.

常顶回流带水严重。

2.6.16.2 Phenomenons 现象

(1) The pump outlet pressure drops, and the motor current drops.

机泵出口压力下降，电机电流下降。

(2) The Atm. Top PA flowrate reduces.

常顶循流量下降。

(3) The Atm. OVHD temperature and pressure rise.

常顶温度上升、压力上升。

(4) Abnormal sound is generated from the pump.

机泵有异常声音。

2.6.16.3 Actions 处理

(1) Control the Atm. OVHD temperature by increasing the Atm. OVHD reflux flowrate. After the Atm. OVHD pressure rises, adjust the Atm. OVHD water coolers or air coolers.

加大常顶回流量来控制常顶温度，常顶压力上升后，调节常顶水冷器或空冷。

(2) If the Atm. OVHD temperature cannot be controlled by increasing the Atm. OVHD reflux flowrate, increase the Atm. PA1# and 2# flowrates or decrease the Atm. PA1# and 2# recycle temperature. If necessary, submit a request to the Production Scheduling Department to turn down the capacity of the process unit.

若常顶回流无法控制常顶温度时，则可加大常一中和常二中回流量或降低常一中、二中返塔温度，必要时请示计划调度部降量处理。

(3) If troubleshooting lasts for a longer time, cut the column OVHD naphtha into the off-spec

product drum drum. Reduce the Kerosene draw flowrate accordingly to avoid off-spec freezing point of the jet kerosene, or cut Kerosene into the off-spec product drum drum for a short period of time.

长时间处理不正常，塔顶石脑油应改成不合格产品。适当降低常一线抽出量，避免航煤冰点不合格，或者常一线短时间改不合格产品。

(4) If the pump inlet piping is blocked, clear the pump inlet piping; if the pump inlet filter is clogged, switch to the standby pump, and then clean the clogged filter.

若泵入口管线不畅疏通管线，若泵入口过滤器堵塞，切换备用泵后清洗过滤器。

(5) If the steam purge valve cannot be fully closed, switch to the standby pump, and then isolate the steam piping and install blind or replace the steam purge valve.

若蒸汽吹扫阀关不严，泵切换后蒸汽隔断加盲板或更换蒸汽阀。

(6) If the pump itself fails, switch to the standby pump, and then contact the bench-workers for troubleshooting.

若机泵本身故障，切换至备用泵运行，联系钳工处理。

(7) If water is entrained in the Atm. OVHD reflux, frequently cut water from the Atm. OVHD reflux.

如常顶回流带水，加大常顶切水。

2.6.17 Atm. PA1# pump evacuation 常一中泵抽空

2.6.17.1 Causes 原因

(1) The pump inlet piping is blocked.

泵入口来料不畅。

(2) The steam purge valve cannot be fully closed.

蒸汽吹扫阀关不严。

(3) The standby pump is not preheated properly.

备用泵预热不当。

(4) The pump itself fails.

机泵本身故障。

2.6.17.2 Phenomenons 现象

(1) The pump outlet pressure drops, and the motor current drops.

机泵出口压力下降，电机电流下降。

(2) The Atm. PA1# flowrate reduces.

常一中流量下降。

(3) The Atm. OVHD reflux temperature and the Kerosene temperature rise, and the Atm. pressure rises.

常顶、常一线温度上升、塔压上升。

(4) Abnormal sound is generated from the pump.

机泵有异常声音。

2.6.17.3 Actions 处理

(1) Control the Atm. OVHD temperature, the Atm. OVHD pressure and the Atm. Top PA flowrate by increasing the Atm. OVHD reflux or Light diesel flowrate or decreasing the Atm. Top PA recycle temperature and the Light diesel recycle temperature. If necessary, submit a request to the Production Scheduling Department to turn down the capacity of the process unit. After the Atm. OVHD pressure rises, adjust the Atm. OVHD water coolers or air coolers.

提高常顶循或常二中流量或降低常顶循和常二中返塔温度来控制顶温、顶压，常顶回流辅助调节，必要时请示计划调度部降量处理。常顶压力上升后，调节常顶水冷器或空冷。

(2) If the pump inlet piping is blocked, clear the pump inlet piping; if the pump inlet filter is clogged, switch to the standby pump, and then clean the clogged filter.

若泵入口管线不畅疏通管线，若泵入口过滤器堵塞，切换备用泵后清洗过滤器。

(3) Drain all residual water and oil from the standby pump while it is being preheated, and properly control the preheating speed.

备用泵预热时，排尽存水和存油，控制预热速度。

(4) If the steam purge valve cannot be fully closed, switch to the standby pump, and then isolate the steam piping and install blind or replace the steam purge valve.

若蒸汽吹扫阀关不严，泵切换后蒸汽隔断加盲板或更换蒸汽阀。

(5) If the pump itself fails, switch to the standby pump, and then contact the bench-workers for troubleshooting.

若机泵本身故障，切换至备用泵运行，联系钳工处理。

(6) If troubleshooting lasts for a longer time, cut the column OVHD naphtha into the off-spec product drum drum. Reduce the Kerosene draw flowrate accordingly to avoid off-spec freezing point of the jet kerosene, or cut Kerosene into the off-spec product drum drum for a short period of time.

长时间处理不正常，塔顶石脑油应改成不合格产品。适当降低常一线抽出量，避免航煤冰点不合格，或者常一线短时间改不合格产品。

2.6.18 Light diesel pump evacuation 常二中泵抽空

2.6.18.1 Causes 原因

(1) The pump inlet piping is blocked.

泵入口来料不畅。

(2) The steam purge valve cannot be fully closed.

蒸汽吹扫阀关不严。

(3) The Light diesel internal reflux flowrate is too large.

常二中内回流过大。

(4) The Heavy diesel draw flowrate is too large.

常三线抽出量过大。

(5) The standby pump is not preheated properly.

备用泵预热不当。

(6) The pump itself fails.

机泵本身故障。

2.6.18.2 Phenomenons 现象

(1) The pump outlet pressure drops, and the motor current drops.

机泵出口压力下降，电机电流下降。

(2) The Light diesel flowrate reduces.

常二中流量下降。

(3) The temperature of the Atm. distillates rises rapidly, and the Atm. OVHD temperature and pressure rise.

常压侧线温度快速上升。塔顶温度和压力上升。

(4) Abnormal sound is generated from the pump.

机泵有异常声音。

2.6.18.3 Actions 处理

(1) Control the Atm. OVHD temperature, the Atm. OVHD pressure and the Atm. OVHD reflux flowrate by increasing the Atm. OVHD reflux or Atm. PA1# flowrate or decreasing the Atm. OVHD reflux recycle temperature and the Atm. PA1# recycle temperature. If necessary, submit a request to the Production Scheduling Department to turn down the capacity of the process unit. After the Atm. OVHD pressure rises, adjust the Atm. OVHD water coolers or air coolers.

提高常顶循、常一中流量或降低常顶循和常一中返塔温度来控制顶温、顶压，常顶回流辅助调节，必要时请示计划调度部降量处理。常顶压力上升后，调节常顶水冷器或空冷。

(2) If troubleshooting lasts for a longer time, cut the Atm. OVHD oil and Kerosene into their respective off-spec product drum drums.

长时间处理不正常，应考虑常顶油和常一线改出不合格产品。

(3) If the pump inlet piping is blocked, clear the pump inlet piping; if the pump inlet filter is clogged, switch to the standby pump, and then clean the clogged filter.

若泵入口管线不畅疏通管线，若泵入口过滤器堵塞，切换备用泵后清洗过滤器。

(4) If the steam purge valve cannot be fully closed, switch to the standby pump, and then isolate the steam piping and install blind or replace the steam purge valve.

若蒸汽吹扫阀关不严则切换泵，将蒸汽隔断加盲板或更换蒸汽阀。

(5) Close the Light diesel internal reflux flowrate for a short time, and when the Light diesel pump is in normal operation, gradually increase the Light diesel internal reflux flowrate to a value lower than that before the Light diesel pump experiences evacuation.

短时间关闭常二中内回流，待常二中泵运行正常后，逐步提高常二中内回流，但应低于抽空前的内回流。

(6) Reduce the Heavy diesel draw flowrate and temperature.

降低常三线的抽出量及抽出温度。

(7) Drain all residual water and oil from the standby pump while it is being preheated, and properly control the preheating speed.

备用泵预热时，排尽存水和存油，控制预热速度。

(8) If the pump itself fails, switch to the standby pump, and then contact the bench-workers for troubleshooting.

若机泵本身故障，切换至备用泵运行，联系钳工处理。

2.6.19 LVGO pump and LVGO PA pump evacuation 减一线及一中泵抽空

2.6.19.1 Causes 原因

(1) The level in the LVGO accumulator tray is too low, which is caused by large LVGO draw flowrate, large sealing oil injection flowrate and false level indication.

减一线抽出量大、封油用量大、液位假指示等引起的减一线集油箱液位过低。

(2) The standby pump is not preheated properly.

备用泵预热不当。

(3) The pump inlet piping is blocked.

泵入口来料不畅。

(4) The steam purge valve cannot be fully closed.

蒸汽吹扫阀关不严。

(5) The pump itself fails.

机泵本身故障。

(6) The Vac. column OVHD vacuum degree drops.

减顶真空度下降。

(7) The pump inlet leaks.

机泵入口有漏点。

2.6.19.2 Phenomenons 现象

(1) The pump outlet pressure drops, and the motor current drops.

机泵出口压力下降，电机电流下降。

(2) The LVGO PA flowrate reduces.

减一中流量下降。

(3) The Vac. column OVHD temperature rises, and the Vac. column OVHD vacuum degree drops.

减顶温度上升，真空度下降。

(4) The LVGO flowrate to OSBL reduces.

减一线出装置流量下降。

(5) Abnormal sound is generated from the pump.

机泵有异常声音。

(6) The level gauge of the LVGO accumulator tray indicates low level (except for false reading).
减一线集油箱液面指示低（假指示除外）。

(7) Abnormal sound is generated from the pump.
机泵有异常声音。

2.6.19.3 Actions 处理

(1) Close the LVGO draw flowrate, and make up Heavy diesel to LVGO. When the level in the LVGO accumulator tray is normal, gradually restore the LVGO PA discharge flowrate, and cut off Heavy diesel to LVGO.

关闭减一线外放，常三线补油至减一线。液位正常后，逐步恢复减一线外放，停补油。

(2) If the level gauge of the LVGO accumulator tray gives false reading, immediately contact the instrument maintenance staff for troubleshooting.

减一线液位假指示时，应立即联系仪表处理。

(3) Drain all residual water and oil from the standby pump while it is being preheated, and properly control the preheating speed.

备用泵预热时，排尽存水和存油，控制预热速度。

(4) If the sealing oil injection flowrate to the pump is too large, reduce the sealing oil injection flowrate to the pump provided that normal operation of the pump can be secured.

封油量过大，应在保障机泵运行要求的情况下，关小机泵封油使用量。

(5) Control the Vac. column OVHD temperature and vacuum degree by increasing the MVGO PA and HVGO PA flowrates or decreasing the MVGO PA and HVGO PA recycle temperatures.

提高减二中和减三中回流量、或降低减二、三中返塔温度来控制减顶温度、减顶真空度。

(6) Increase the vacuum residue draw flowrate or start additional vacuum residue pumps to properly control the Vac. column bottom level. If necessary, submit a request to the Production Scheduling Department to turn down the capacity of the process unit.

加大渣油外放量，或者增开渣油泵，控制好减底液面，防止液面装高，必要时请示计划调度部降量处理。

(7) If the pump inlet piping is blocked, clear the pump inlet piping; if the pump inlet filter is clogged, switch to the standby pump, and then clean the clogged filter.

若泵入口管线不畅疏通管线，若泵入口过滤器堵塞，切换备用泵后清洗过滤器。

(8) If the steam purge valve cannot be fully closed, switch to the standby pump, and then isolate the steam piping and install blind or replace the steam purge valve.

若蒸汽吹扫阀关不严则切换泵，将蒸汽隔断加盲板或更换蒸汽阀。

(9) If the pump itself fails, immediately switch to the standby pump, then organize to maintain the failed pump.

若机泵本身故障，应立即切换备用泵，组织故障机泵的检修。

(10) If pump evacuation is caused by the fluctuation of the Vac. column OVHD degree, adjust the operating conditions to stabilize the Vac. column OVHD vacuum degree.

若因减顶真空度波动则查找原因，调整操作，稳定真空度。

(11) Identify and eliminate the leakage point at the site.

现场查找处理漏点。

2.6.20 MVGO pump and MVGO PA pump evacuation 减二线及二中泵抽空

2.6.20.1 Causes 原因

(1) The level in the MVGO accumulator tray is too low (the MVGO draw flowrate is large, or the level gauge gives false reading).

减二线集油箱液位过低（抽出量大、液位假指示等）。

(2) The standby pump is not preheated properly.

备用泵预热不当。

(3) The sealing oil injection flowrate is too large, or water is entrained in the sealing oil.

封油注入量过大或带水。

(4) The pump inlet piping is blocked.

泵入口来料不畅。

(5) The steam purge valve cannot be fully closed.

蒸汽吹扫阀关不严。

(6) The pump itself fails.

机泵本身故障。

(7) The pump inlet leaks.

机泵入口有漏点。

2.6.20.2 Phenomenons 现象

(1) The pump outlet pressure drops, and the motor current drops.

机泵出口压力下降，电机电流下降。

(2) The MVGO PA flowrate reduces.

减二中回流流量下降。

(3) The MVGO flowrate to OSBL reduces.

减二线出装置流量下降。

(4) The Vac. column OVHD vacuum degree decreases, and the Vac. column OVHD temperature rises.

真空度下降，减顶温度上升。

(5) The MVGO level is low (except for false reading).

减二线液位低（假指示除外）。

(6) Abnormal sound is generated from the pump.

机泵有异常声音。

2.6.20.3 Actions 处理

(1) If the MVGO level is low, the panel operators shall close the MVGO draw flowrate, and reduce the MVGO PA flowrate, while the field operators shall further close the pump outlet valve for pressure buildup, and gradually restore the Vac. column pumaround stream flowrate. When the MVGO level is normal, gradually restore the MVGO discharge flowrate.

如减二线液位低，内操关闭减二线外放量，关小减二中，外操关小泵出口阀憋压，逐步恢复中段回流。减二线液位正常后，逐步恢复减二线外放量。

(2) If the level gauge gives false reading, immediately contact the instrument maintenance staff for troubleshooting.

液位假指示时，应立即联系仪表处理。

(3) Control the Vac. column OVHD temperature and vacuum degree by increasing the LVGO PA and HVGO PA flowrates or decreasing the LVGO PA and HVGO PA recycle temperatures. 加大减一中和减三中回流量、或降低减一中、减三中返塔温度来控制减顶温度、减顶真空度。

(4) Increase the vacuum residue draw flowrate or start additional vacuum residue pumps to properly control the Vac. column bottom level. If necessary, submit a request to the Production Scheduling Department to turn down the capacity of the process unit.

加大渣油外放量，或者增开渣油泵，控制好减底液面，防止液面装高，必要时请示计划调度部降量处理。

(5) Drain all residual water and oil from the standby pump while it is being preheated, and properly control the preheating speed.

备用泵预热时，排尽存水和存油，控制预热速度。

(6) Properly control the sealing oil injection flowrate. If water is entrained in the sealing oil, other high-temperature pumps that use the same sealing oil will also experience cavitation. At this point, suspend sealing oil injection, investigate the causes that water is entrained in the sealing oil, switch to the on-spec sealing oil pot, send the off-spec sealing oil into the heavy slop drum, and put the previous sealing oil pot into service again after it is filled with on-spec sealing oil.

严格控制封油量。如封油带水，其它使用相同封油的高温机泵也会出现抽空现象，应暂停注封油，排查封油带水原因，切换封油，封油罐内的封油往重污油外甩，置换合格后重新投用封油。

(7) If the pump inlet piping is blocked, clear the pump inlet piping; if the pump inlet filter is clogged, switch to the standby pump, and then clean the clogged filter.

若泵入口管线不畅疏通管线，若泵入口过滤器堵塞，切换备用泵后清洗过滤器。

(8) If the steam purge valve cannot be fully closed, switch to the standby pump, and then isolate the steam piping and install blind or replace the steam purge valve.

若蒸汽吹扫阀关不严则切换泵，将蒸汽隔断加盲板或更换蒸汽阀。

(9) If the pump itself fails, switch to the standby pump, and then contact the maintenance staff for troubleshooting.

若机泵本身故障切换备用泵，联系维修人员处理。

(10) Identify and eliminate the leakage point at the site.

现场查找处理漏点。

2.6.21 HVGO pump and HVGO PA pump evacuation 减三线及三中泵抽空

2.6.21.1 Causes 原因

(1) The level in the HVGO accumulator tray is too low (because the HVGO draw flowrate is large, the HVGO flushing oil flowrate is too large, or the level gauge gives false reading).

减三线集油箱液位过低（抽出量大、内回流过大、液位假指示等）。

(2) The sealing oil injection flowrate is too large, or water is entrained in the sealing oil.

封油注入量过大或带水。

(3) The pump inlet piping is blocked.

泵入口来料不畅。

(4) The steam purge valve cannot be fully closed.

蒸汽吹扫阀关不严。

(5) The pump itself fails.

机泵本身故障。

(6) The standby pump is not preheated properly.

机泵预热不当。

(7) The pump inlet leaks.

机泵入口有漏点。

2.6.21.2 Phenomenons 现象

(1) The pump outlet pressure drops, and the motor current drops.

机泵出口压力下降，电机电流下降。

(2) The HVGO PA flowrate reduces.

减三中流量下降。

(3) The HVGO flowrate to OSBL reduces.

减三线出装置流量下降。

(4) The Vac. column OVHD vacuum degree decreases.

真空度下降。

(5) The HVGO flushing oil flowrate reduces.

减三线内回流量下降。

(6) The HVGO level is low.

减三线液位低。

(7) Abnormal sound is generated from the pump.

机泵有异常声音。

2.6.21.3 Actions 处理

(1) If the HVGO level is low, the panel operators shall close the HVGO draw flowrate and the HVGO flushing oil flowrate, and reduce the HVGO PA flowrate, while the field operators shall

further close the pump outlet valve for pressure buildup, and gradually restore the Vac. column pumaround stream flowrate. When the HVGO level is normal, gradually restore the HVGO flushing oil flowrate and the HVGO discharge flowrate.

如减三线液位低,内操关闭减三线外放量和减三线内回流,关小减三中,外操关小泵出口阀憋压,逐步恢复中段回流。减三线液位正常后,逐步恢复减三线内回流和外放量。

(2) If the level gauge gives false reading, immediately contact the instrument maintenance staff for troubleshooting.

液位假指示时,应立即联系仪表处理。

(3) If evacuation of the running pump is caused by preheating the standby pump, immediately stop preheating the standby pump and further close the outlet valve of the running pump until normal operating conditions are re-established for the running pump.

若预热备用泵造成运行泵抽空,应立即停止预热,关小运行泵出口阀,处理正常为止。

(4) Control the Vac. column OVHD temperature and vacuum degree by increasing the LVGO PA and MVGO PA flowrates or decreasing the LVGO PA and MVGO PA recycle temperatures.

加大减一中和减二中回流量,或降低减一中、减二中返塔温度来控制减顶温度、减顶真空度。

(5) Increase the vacuum residue discharge flowrate or start additional vacuum residue pumps to properly control the Vac. column bottom level. If necessary, submit a request to the Production Scheduling Department to turn down the capacity of the process unit.

加大减底渣油外放量,或者增开渣油泵,控制好减底液面,防止液面装高,必要时请示计划调度部降量处理。

(6) Properly control the sealing oil injection flowrate. If water is entrained in the sealing oil, other high-temperature pumps that use the same sealing oil will also experience capitation. At this point, suspend sealing oil injection, investigate the causes that water is entrained in the sealing oil, switch to the on-spec sealing oil pot, send the off-spec sealing oil into the heavy slop drum, and put the previous sealing oil pot into service again after it is filled with on-spec sealing oil.

严格控制封油量。如封油带水,其它使用相同封油的高温机泵也会出现抽空现象,应暂停注封油,排查封油带水原因,切换封油,封油罐内的封油往重污油外甩,置换合格后重新投用封油。

(7) If the pump inlet piping is blocked, clear the pump inlet piping; if the pump inlet filter is clogged, switch to the standby pump, and then clean the clogged filter.

若泵入口管线不畅疏通管线,若泵入口过滤器堵塞,切换备用泵后清洗过滤器。

(8) If the steam purge valve cannot be fully closed, switch to the standby pump, and then isolate the steam piping and install blind or replace the steam purge valve.

若蒸汽吹扫阀关不严将蒸汽隔断或更换蒸汽阀。

(9) If the pump itself fails, switch to the standby pump, and then contact the maintenance staff for troubleshooting.

若机泵本身故障切换备用泵,联系维修人员处理。

(10) Identify and eliminate the leakage point at the site.

现场查找处理漏点。

2.6.22 Vacuum degree in Vac. column drops suddenly 减压塔真空度突然下降

2.6.22.1 Phenomenons 现象

(1) The vacuum pressure gauge gives declined reading (or the residual pressure rises), and the column OVHD temperature rises or drops.

真空度指示下降（或残压上升），塔顶温度上升或者下降。

(2) The level in the Vac. column distillate accumulator tray drops, even causing evacuation of the Vac. column distillate pump.

减压侧线集油箱液面下降，甚至造成侧线泵抽空。

(3) The column bottom level rises, the vacuum residue is in large quantity, and the heat exchange temperature rises.

塔底液面上升，渣油量大，换热温度上升。

2.6.22.2 Causes 原因

(1) The steam flowrate to the steam ejector is interrupted, the steam pressure drops or is too high.

抽真空蒸汽中断、压力下降或者过高。

(2) CCW pressure drops or CCW temperature rises.

循环水压力下降或温度上升。

(3) Fouling occurs in the condenser to affect the cooling performance of the condenser.

冷凝器积垢，影响冷却效果。

(4) The feed flowrate to the Vac. column increases to cause increased light component content.

进料量增加，轻组份增多。

(5) The steam ejector itself fails.

蒸汽喷射器本身故障。

(6) The water ring vacuum pump is tripped.

水环泵起跳。

(7) U-tube is installed on the piping downstream the Vac. column OVHD gas process flow, where a liquid seal is formed.

减顶气后路管线有 U 型管，并形成了液封。

(8) The steam flowrate injected into the heater tubes or purged to the bottom of the Vac. column increases or is carried with water.

炉管注汽或者塔底吹汽量增加或带水。

(9) D-401 water seal is damaged, or equipment/piping of the negative pressure system leaks.

D-401 水封破坏或负压系统设备、管线泄漏。

(10) The column bottom level increases suddenly.

塔底液位突然装高。

(11) The atmospheric leg is clogged, the Vac. OVHD drum (D-401) is filled with oil, and the

piping downstream the Vac. column OVHD gas process flow is blocked.

大气腿堵塞。D-401 油水分离罐油装满，减顶瓦斯后路不畅。

(12) The LP fuel gas (Vac. column OVHD gas) burner is clogged.

低压瓦斯（减顶气）火嘴堵。

2.6.22.3 Actions 处理

(1) If the steam flowrate to the steam ejector is interrupted, take actions per the treatment methods for 1.0 MPa steam interruption. If the steam pressure is too low or too high, increase or decrease the steam pressure.

抽真空蒸汽中断，按照 1.0MPa 蒸汽中断事故处理。蒸汽压力过低或者过高，则提高或者降低蒸汽压力。

(2) Contact the Production Scheduling Department to increase CCW pressure or decrease CCW temperature.

联系计划调度部，提循环水压力或降低循环水温度。

(3) Check the temperature of the stream from the water cooler. If it is confirmed that fouling indeed occurs in the condenser, switch to the standby condenser, then organize to maintain the fault condenser.

检查水冷器冷后温度，确认结垢，则切换备用抽空器和冷凝器后，组织检修。

(4) Adjust the feed flowrate to the Vac. column to normal range, and increase the lift of the Atm. accordingly.

调节进料量至正常，适当提高常压拔出率。

(5) Switch the failed steam ejector to the standby steam ejector, then contact the maintenance staff to maintain the failed steam ejector.

将故障喷射器切换至备用抽真空器，联系检修人员检修故障蒸汽喷射器。

(6) Switch the 3rd stage water ring vacuum pump to the steam ejector, then investigate the causes of automatic trip of the water ring vacuum pump. Upon completion of troubleshooting, resume the normal operation of the water ring vacuum pump.

三级抽真空切换蒸汽抽真空器，查明水环泵起跳原因，排除后，恢复水环泵运行。

(7) After the Vac. column OVHD gas is switched to the flare gas, purge the piping downstream the Vac. column OVHD gas process flow with nitrogen.

减顶气改火炬气后，减顶气后路管线用氮气吹扫。

(8) Adjust the steam flowrate injected into the heater tubes, stabilize the pressure of the steam purged to the bottom of the Vac. column, adjust the steam flowrate purged to the bottom of the Vac. column, and frequently cut water from the steam trap.

调整炉管注气，稳定塔底吹汽压力，调节吹汽量，加强蒸汽分水罐切水。

(9) If D-401 water seal is damaged, establish the water seal in a timely manner, identify and eliminate any leakage point on the equipment in a timely manner. Check the Vac. column OVHD oil level to increase the Vac. column OVHD oil draw flowrate.

如 D-401 水封破坏及时建立水封，查找出泄漏设备及时处理泄漏点。检查减顶油液位，增加减顶

油外放。

(10) Increase the vacuum residue discharge flowrate to control the Vac. column level.

加大渣油外放量，控制减压塔液位。

(11) Suspend operation of the steam ejector associated with the clogged atmospheric leg. After any clog in the atmospheric leg is eliminated, resume the normal operation of the steam ejector.

暂停不畅的大气腿的抽真空器，疏通大气腿后，恢复运行。

(12) If the LP fuel gas (Vac. column OVHD gas) burner is clogged, switch the Vac. column OVHD gas to the flare gas, then troubleshoot the clogged burner.

如火嘴堵，减顶气改至火炬，处理结焦的火嘴。

2.6.23 Feed flowrate to heater is interrupted 加热炉进料中断

2.6.23.1 Phenomenons 现象

(1) The feed flowrate to the heater reduces rapidly, and the heater outlet temperature rises.

进料量直线下降，加热炉出口温度上升。

(2) The heater interlock is actuated, and the heater burners are stopped.

加热炉联锁，炉熄火。

2.6.23.2 Causes 原因

(1) The heater feed pump experiences evacuation.

加热炉进料泵抽空

(2) The control valve fails.

调节阀故障。

2.6.23.3 Actions 处理

(1) Investigate the causes of pump evacuation, and take corresponding measures to restore the normal operation of the pump on a specific case basis (see treatment methods as described in "2.6.15: Column bottom pump evacuation").

排查机泵抽空的原因，根据不同原因采取不同措施恢复机泵正常运行（见 2.6.15 塔底泵抽空处理）。

(2) If the control valve fails, switch to the bypass valve to restore feed flowrate to the heater as soon as possible, and maintain the failed control valve.

故障调节阀改付线控制，尽快使进料恢复正常，调节阀检修。

(3) After the feed flowrate to the heater is restored, check the operating conditions of the heater. If the pilot is not stopped, immediately fire the heater; if the pilot is stopped, fire the heater per the firing procedures for new heater.

加热炉进料恢复后，检查加热炉情况，如长明灯未熄灭，应立即组织加热炉点火，长明灯熄灭则按照新炉点火步骤点火。

2.6.24 Fuel gas interruption 燃料气中断

2.6.24.1 Phenomenons 现象

- (1) The fuel gas pressure and flowrate decrease.

燃料气压力、流量下降。

- (2) The fuel gas burners stop.

燃料气火嘴熄火。

- (3) The heater outlet temperature decreases, and the fire box temperature decreases sharply.

炉出口温度下降，炉膛温度急剧下降。

- (4) The superheated steam temperature decreases.

过热蒸汽温度下降。

2.6.24.2 Causes 原因

- (1) The fuel gas piping system fails.

燃料气管网故障。

- (2) The fuel gas pressure control valve fails.

燃料气压控阀故障。

2.6.24.3 Actions 处理

- (1) The panel operators close the fuel gas quick shut-off valve and the fuel gas control valve, and the field operators close the hand valve of each burner.

内操关闭燃料气快速切断阀和燃料气调节阀，外操关闭各火嘴的手阀。

- (2) Contact the Production Scheduling Department to investigate the causes of fuel gas interruption and clarify the time when the fuel gas could be restored.

联系调度查明燃料气中断的原因，及恢复时间。

- (3) Fire additional fuel oil burners in the Atm. heater. After the fuel gas is restored, fire the Vac. heater per the firing procedures for new heater.

常压炉增点燃料油火嘴，减压炉在燃料气恢复后，按照新炉点火程序点火。

- (4) If the fuel gas pressure control valve fails, switch to the bypass valve for control.

燃料气压控阀故障，则改付线控制。

- (5) If the fuel gas is interrupted for a prolonged time, shut down the process unit per “2.6.3: Emergency shutdown methods”.

如长时间燃料气中断，装置紧急停车，见 2.6.3。

2.6.25 Oil is contained in fuel gas 燃料气带油

2.6.25.1 Phenomenons 现象

- (1) The fire box temperature and the heater outlet temperature rise quickly.

炉膛温度和炉出口温度急剧上升。

(2) The flame color turns from blue to red, and black smoke is emitted from the chimney.
火焰由蓝色转红色，烟囱冒黑烟。

(3) The fire box is dim, and the oxygen content in the fire box is low.
炉膛昏暗，炉膛氧含量低。

(4) In severe cases, flame is spurted from the burners even the ventilation damper, and oil flows out from each burner at the bottom of the heater and catches a fire.
严重时火焰从火嘴甚至通风门喷出，炉底各火嘴滴油并着火。

2.6.25.2 Causes 原因

(1) The makeup liquefied gas is not fully vaporized.
补充液化气汽化不充分。

(2) Each fuel gas source is not controlled properly, resulted that oil is entrained in the fuel gas.
各燃料气来源控制不当，带油。

(3) The condensate in the HP fuel gas KO drum is not drained in a timely manner, resulted that the level gauge of the HP fuel gas KO drum gives false reading.
高压瓦斯罐排凝不及时，液位假像。

2.6.25.3 Actions 处理

(1) Frequently cut the condensate from the HP fuel gas KO drum.
加强燃料气分液罐切液。

(2) Contact the Production Scheduling Department to investigate the causes of oil entrainment in fuel gas.
联系计划调度部问明原因。

(3) If only trace of oil is entrained in the fuel gas, further close or stop some burners, and increase air flowrate to the heater.
如果瓦斯带油不严重，关小或者熄灭部分火嘴，增加加热炉供风。

(4) If oil begins to drip at the bottom of the heater and catches a fire, take actions per the emergency shutdown procedures for heater, i.e., stop the heater, extinguish the fire with smothering steam and fire extinguishers. And in case of large fire, inform the fire brigade for fire extinguishing.

如果已在炉底发现滴油并着火，加热炉按照紧急停炉处理，熄火，并用蒸汽、灭火器灭火，火大时通知消防队灭火。

(5) If the level gauge of the HP fuel gas KO drum gives false reading, contact the instrument maintenance staff for troubleshooting.
燃料气分液罐液位假指示，则联系仪表人员处理。

2.6.26 Coking in heater tubes 炉管结焦

2.6.26.1 Phenomenons 现象

(1) The heater outlet temperature is low, and the fire box temperature is high.

炉出口温度提上不去，炉膛温度高，炉出口温度低。

(2) Some heater tubes become red due to locally overheating, and even experience deformation in severe cases.

炉管局部过热部分开始发红，严重时炉管变形。

(3) The heater tubes experience large resistance force, and the pump outlet pressure and the pressure of the feed to each pass of the heater increase.

炉管阻力大，泵出口压力及各路进料压力升高。

(4) There are black spots on the heater tubes.

炉管上有黑色斑点。

2.6.26.2 Causes 原因

(1) The flame directly impinges on the heater tubes, resulted that the heater tubes are locally overheated.

火焰直扑炉管，局部过热。

(2) The operating conditions are unstable, the heater outlet temperature is too high, or the thermocouple gives low temperature reading while the actual temperature is high.

操作波动，炉出口温度过高或热电偶指示不准而实际温度高。

(3) The crude flowrate to each pass of the heater is too small, resulted that the flow velocity of the crude is too slow, or each pass of the heater experiences serious bias.

处理量太小引起流速过慢或各支路偏流较为严重。

(4) Fail to take actions for feed interruption in a timely manner.

进料中断处理不及时。

2.6.26.3 Actions 处理

(1) If coking in the heater tubes is not serious, adjust the flame of burners in the heater for evenness, decrease the heater outlet temperature accordingly, further open the inlet of the tube where coking is formed, increase the crude flowrate to the heater to accelerate the flow velocity of the crude so as to prevent further coking, and if necessary, inject steam into the heater tubes accordingly.

如果结焦不严重时，可把炉子火焰调节均匀些，适当降低出口温度，并把结焦的分支炉管入口开大，提处理量，使油品流速加快，防止继续结焦，必要时可适当开炉管注汽。

(2) If coking in the heater tubes is serious, shut down the process unit, and stop the heater for cleaning or burning the cokes.

结焦严重时，装置停车，安排停炉清焦或者烧焦。

2.6.27 Black smoke is emitted from chimney 烟囱冒黑烟

2.6.27.1 Causes 原因

(1) The heater tubes are burnt out.

炉管烧穿。

(2) The instrument malfunctions.

仪表失灵。

(3) Oil is entrained in the fuel gas.

燃料气带油。

(4) The opening of the flue gas duct damper, the air duct damper and the butterfly valve in air supply piping are not proper, resulting in incomplete combustion due to insufficient oxygen content in the fire box.

烟道挡板、风门及蝶阀开度不合适，造成缺氧使燃烧不完全。

(5) The feed flowrate to the heater increases suddenly.

炉进料量忽然增加。

(6) The pressure of fuel oil/fuel gas fluctuates greatly.

燃料压力波动大。

(7) The fuel oil is not atomized properly.

燃料油雾化不好。

(8) The heat value of the fuel gas changes.

燃料气热值变化。

2.6.27.2 Actions 处理

(1) In case that the heater tubes are burnt out, shut down the process unit per 2.6.4.3.

炉管烧穿，装置紧急停工，见 2.6.4.3。

(2) If the instrument malfunctions, immediately switch to the "Manual" mode.

仪表控制失灵，应立即改手动控制。

(3) If oil is entrained in the fuel gas, take actions per "2.6.25: Oil entrainment in fuel gas".

如果燃料气带油，则按燃料气带油进行处理，见 2.6.25。

(4) Depending on the burning conditions of the burners, adjust the opening of the flue gas duct damper, the air duct damper and the butterfly valve in air supply piping.

根据火嘴燃烧情况，调节烟道挡板，风门及供风蝶阀的开度。

(5) Slowly increase/decrease the feed flowrate to the heater.

提降量要缓慢。

(6) Contact the Production Scheduling Department to investigate the involved causes in a timely manner to keep the pressure of the fuel oil/fuel gas stable.

联系计划调度部，及时查找原因并平稳燃料压力。

(7) If fuel oil is used, properly adjust the opening of the dampers and baffle and control the oil/steam ratio and air supply flowrate, to ensure good performance of the fuel oil burners.

如烧油火时，则调整好“三门一板”操作，控制好油气比例及送风量，确保油火燃烧良好。

(8) Control the fuel gas flowrate to the heater, further open the air damper, and stop some

burners.

控制燃料气入炉流量，开大风门，部分熄火。

2.6.28 Heater burner could not be fired 加热炉火嘴点不着

2.6.28.1 Causes 原因

(1) The draught force of the fire box is too large or the air pressure is too large.

炉膛抽力太大或风压过大。

(2) A large amount of non-flammable gas is contained in the fuel gas.

瓦斯气中含不可燃气体量大。

(3) The pressure of the fuel oil/fuel gas to the heater is too low.

炉前燃料压力太低。

(4) The steam flowrate to the burners is too large, resulting in improper oil/steam ratio.

火嘴蒸汽开得太大，油、汽比不当。

(5) Deficiency is identified in burner itself.

火嘴本身原因。

(6) The air duct damper is not opened.

风门未开。

2.6.28.2 Actions 处理

(1) Further close the air duct damper or the flue gas duct damper.

关小风门或烟道挡板。

(2) Remove the non-flammable gas in the flue gas system.

置换瓦斯系统中的不可燃气体。

(3) Increase the pressure of the fuel oil/fuel gas to the heater.

提高炉前燃料压力。

(4) Adjust the oil and steam pressure or the oil/steam ratio in a timely manner.

及时调整油、汽压力或流量比例。

(5) Clean or disassemble the defective burners, or replace new burners.

清理、拆装或更换新火嘴。

(6) Open the air duct damper.

打开风门。

2.6.29 Backfire 回火

2.6.29.1 Causes 原因

(1) Backfire encountered while firing the heater is often caused by the following three aspects, i.e., flammable gas exists in the fire box, the flue gas duct damper is not opened, or the fuel valve is opened too vigorously.

点火时回火，往往因炉膛有易燃气体，或烟道挡板未开，或因燃料开阀过猛。

(2) A large amount of fuel oil is injected into the heater or a large amount of oil is entrained in the fuel gas.

燃料油大量喷入炉内或瓦斯大量带油。

(3) The opening of the flue gas duct damper is too small, reducing the draught force of the fire box, or the heater is operated under overload conditions, resulted that the flue gas could not be discharged from the heater.

烟道挡板开度过小，降低了炉子抽力，或炉子超负荷运行，使烟气排不出去。

(4) When firing/stopping the fuel gas burners, large opening of the Pre-Dist. damper could easily cause backfire, and too low fuel gas pressure could also easily cause backfire.

在点燃料气火及灭燃料气火时，一次风门大易造成回火，燃料气压力过低时瓦斯易回火。

(5) The heater is operated under overload conditions, resulted that the flue gas could not be discharged from the heater in a timely manner.

炉子超负荷运行，烟气未及时排放。

2.6.29.2 Actions 处理

(1) Before firing the heater, always check the opening of the flue gas duct damper, fully close the Pre-Dist. valves of all burners, and purge the fire box with steam for at least 15min.

点火前必须检查烟道挡板开度，及关严火嘴一次阀并用蒸汽吹扫炉膛，吹扫时间不得少于 15min。

(2) It is strictly forbidden to inject a large amount of fuel oil or fuel gas into the heater before it is fired, and it is also strictly forbidden to have oil to be entrained in the fuel gas.

严禁燃料油或瓦斯在点燃前大量进入炉内，瓦斯严禁带油。

(3) Do not operate the heater under overload conditions, and ensure that the negative pressure is always maintained in the heater.

不能超负荷运行，要使炉内始终保持负压操作。

(4) Further close the butterfly valve in air supply piping before firing/stopping the fuel gas burners, and always quickly fire/strop the fuel gas burners.

点瓦斯火，灭瓦斯火前把供风蝶阀关小，点火和灭火时必须迅速。

(5) It is strictly forbidden to lock the flue gas duct damper or excessively close the flue gas duct damper when adjusting the flue gas duct damper.

严禁在调节烟道挡板时，将挡板关死或关的过小。

2.6.30 Oil is leaked from packing or end face seal 盘根或端面密封漏油

2.6.30.1 Causes 原因

(1) The packing is deflected by compression or is not compressed tightly.

盘根压偏或压得不紧。

(2) CCW piping is blocked or CCW is interrupted.

冷却水不畅通或中断。

- (3) The bushing or packing is worn out.

轴套或填料磨损。

2.6.30.2 Actions 处理

- (1) Tighten the packing gland with even force.

均匀紧盘根压盖。

- (2) Eliminate any clog in CCW piping. If CCW to the pump is interrupted, take actions per the treatment procedures for CCW interruption.

消除冷却水堵塞，保证畅通，若机泵冷却水中断，则按冷却水中断事故进行处理。

- (3) Switch to the standby pump, and maintain the faulty pump in a timely manner.

切换至备用泵，及时检修有故障的泵。

2.6.30 Bearing housing of pump is hot 泵轴承箱发热

2.6.31.1 Causes 原因

- (1) The pump shaft is not concentric with the motor shaft.

泵轴和电机轴不同心。

- (2) Lube oil is insufficient or does not meet requirements.

润滑油不足或故障。

- (3) The oil slinger runs out of the fixed position.

甩油环跳出固定位置。

- (4) CCW is insufficient or interrupted.

冷却水不足或中断。

- (5) The clearance between bearing retainers is large or the bearing retainers are loosened.

轴承弹保持架间隙大或松散。

- (6) The axial thrust force becomes larger.

轴向推力变大。

- (7) Water intrudes into the bearing housing.

轴承箱进水。

2.6.31.2 Actions 处理

- (1) Stop the pump for re-alignment.

停泵找正。

- (2) Add lube oil or check and condition the lube oil to ensure that it meets requirements.

添加润滑油或检查调整至正常。

- (3) Put the oil slinger in the right place.

放正甩油环。

- (4) Supply sufficient CCW.

给足冷却水。

(5) Stop the pump for adjustment.

停泵调整。

(6) Replace the bearing.

更换轴承。

(7) Investigate the causes that water intrudes into the bearing house for troubleshooting, and replace the lube oil.

查出进水原因，消除进水，更换润滑油。

2.6.32 Abnormal sound is generated from the motor 电机有杂音

2.6.32.1 Causes 原因

(1) The cooling fan is not installed in a balanced manner.

风翅安装不平衡。

(2) The anchor bolts are not tightened, or the screws on the coupling are loosened and the rubber washers are worn out.

地脚螺丝没上紧或靠背轮螺丝松动及橡胶垫圈磨损。

(3) The flat pads for the anchor bolts are not sealed completely.

地脚平垫不严。

(4) Alignment (coaxiality) does not meet requirements, or the shaft is bent.

找正（同轴度）有问题或轴弯曲。

2.6.32.2 Actions 处理

For abnormal conditions of the motor, generally contact the electricians for troubleshooting, and in case of an emergency, immediately switch to the standby pump.

电机不正常现象，一般情况下联系电工检查修理，紧急时立即切换泵。

2.6.33 Vibration of centrifugal pump 离心泵振动

2.6.33.1 Causes 原因

(1) The rotor is unstable.

转子不平稳。

(2) The pump shaft is not concentric with the motor shaft.

泵轴和电机轴不同心。

(3) The bearing experiences excessive friction, and the clearance between bearing holes exceeds the allowable value.

轴承过度摩擦和轴承孔超过允许间隙。

(4) The coupling is not aligned as required, or the rubber ring of the pin coupling is aged and peered off.

对轮找正不符合要求或柱销联轴器的胶皮圈老化、脱落。

(5) The impeller is locally clogged, or the auxiliary piping of the external components experience vibration.

叶轮局部堵塞或外部件附属管线振动。

(6) The anchor bolts for the motor or pump are loosened.

电机或泵的地脚螺丝松动。

(7) Caused by evacuation.

汽蚀和抽空引起。

(8) The thrust force of the shaft becomes larger to cause axial displacement.

轴的推力变大，引起串轴。

2.6.33.2 Actions 处理

(1) Check and adjust the rotor for balance.

检查、调整找平衡。

(2) Stop the pump for re-alignment.

停泵重新找正。

(3) Replace the bearing or adjust the clearance between bearing holes.

更换轴承或调整间隙。

(4) Re-align the coupling, and replace the rubber ring.

重新找正，更换胶皮圈。

(5) Take actions to eliminate any clog in the impeller.

疏通堵塞之处。

(6) Tighten the anchor bolts.

把紧地脚螺丝。

(7) Take actions to troubleshoot pump evacuation.

处理抽空事故。

(8) Balance the axial thrust force to eliminate axial displacement.

平衡轴向推力，克服串轴。

2.6.34 Temperature of CCW for pump is high or CCW to pump is interrupted 机泵冷却水温度高或冷却水中断

2.6.34.1 Causes 原因

(1) The water piping is clogged.

水管堵塞。

(2) CCW pressure is low or CCW to the pump is interrupted.

冷却水压力低或停水。

(3) CCW valve is further closed automatically or damaged due to vibration.

因震动水阀自动关小或水阀坏。

2.6.34.2 Actions 处理

(1) If the water piping is clogged, switch to the standby pump, and take actions to eliminate any clog in the water piping in a timely manner.

若水管堵塞，则应切换泵，及时处理水管堵塞。

(2) If CCW pressure is low, contact the Production Scheduling Department to increase CCW pressure; if CCW to the pump is interrupted, take actions per the treatment methods for CCW (or softened water) interruption.

若冷却水压力低，联系计划调度部提冷却水压力；若冷却水中断，则按循环水（或软化水）中断进行事故处理

(3) Further open CCW valve or replace CCW valve in a timely manner

及时开大水阀或换水阀

2.6.35 Motor trip 电机跳闸

2.6.35.1 Causes 原因

(1) The rotor winding of the motor is short-circuited.

电机转子绕组短路。

(2) The voltage of the power grid is too low, resulting in overlarge current.

电网电压过低，造成电流过大。

(3) The rotor of the pump is stuck.

泵的转子卡住。

(4) The motor is overloaded.

电机过负荷。

2.6.35.2 Actions 处理

In case of motor trip, immediately switch to the standby pump, then investigate the involved causes in a timely manner, and contact the electricians for troubleshooting.

发现电机停后应及时查找原因，及时启动，切换备用泵，并联系电工检查维修。

2.6.36 Automatic trip of water ring vacuum pump 水环真空泵自跳

2.6.36.1 Phenomenons 现象

(1) Both vacuum degree in Vac. column and vacuum degree at the inlet of the water ring vacuum pump drop (the residual pressure rises).

减压塔和水环泵入口真空度均下降（残压上升）。

(2) The level in the Vac. column is higher than the specified range.

减压塔液位装高。

(3) The working fluid flowrate in the water ring vacuum pump is lower than the interlock SP.

水环泵工作液流量低于联锁值。

(4) DCS system alarms.

DCS 报警。

2.6.36.2 Causes 原因

(1) The interlocking conditions, which may cause shutdown of the water ring vacuum pump, occur, e.g., the Vac. column OVHDs level is high, and the working fluid level gauge gives false reading.

出现水环泵联锁的条件，引起水环泵联锁停车，如减顶油液位高、工作液液位假指示等。

(2) The water ring vacuum pump fails.

液环真空泵故障。

(3) The motor of the water ring vacuum pump fails.

电机故障。

(4) The motor of the water ring vacuum pump is de-energized.

水环真空泵电机断电。

(5) The water ring vacuum pump is operated under overload conditions.

超负荷运行。

(6) The water ring vacuum pump experience serious evacuation.

真空泵汽蚀严重。

2.6.36.3 Actions 处理

(1) Put the 3rd ejector into service, and close the inlet valve of the water ring vacuum pump. (2) Investigate the causes that the water ring vacuum pump is tripped automatically. When troubleshooting has been completed and confirmed, contact the electricians to energize the water ring vacuum pump, and then switch the 3rd sage steam ejector to the water ring vacuum pump.

(1) 投用三级蒸汽抽真空器，关闭水环泵入口阀。排查水环泵联锁的原因，排除确认后，联系

(2) 电工送电后，将三级蒸汽抽真空切换为水环泵。

(3) Contact the mechanical maintenance staff to check and maintain the failed water ring vacuum pump.

联系维修人员检查水环真空泵，组织检修。

(4) Contact the electrical maintenance staff to check for electrical failure.

联系电气维修人员检查故障。

(5) Contact the electricians to troubleshoot the motor and energize the water ring vacuum pump.

联系电工处理电机、送电。

(6) Investigate the causes that the operation load of the water ring vacuum pump increases, to reduce the operation load.

排查真空泵负荷上升的原因，降低负荷。

(7) Take actions to eliminate evacuation in the water ring vacuum pump.

处理真空泵汽蚀。

(8) After the water ring vacuum pump is tripped automatically, the vacuum degree in the Vac. column could be impaired, therefore, the panel operators shall properly control each Vac. column liquid level of sidedraw and the Vac. column level per 2.6.22.

水环泵自跳后，减压真空度破坏，内操要按照 2.6.22 做好减压塔的侧线液位和减压塔液位的控制。

2.6.37 Automatic trip of air blower 鼓风机自跳

2.6.37.1 Causes 原因

(1) The air blower fails.

鼓风机故障。

(2) The motor of the air blower is de-energized or fails.

鼓风机电机断电或故障。

(3) The operation load is too large.

运转负荷过大。

(4) The heater interlock actions improperly.

加热炉联锁动作不正常。

2.6.37.2 Actions 处理

(1) Take actions per the treatment procedures for automatic trip of the air blower.

按鼓风机自跳后步骤执行。

(2) Contact the maintenance staff to troubleshoot the air blower.

联系维修人员处理鼓风机。

(3) Contact the electricians to troubleshoot the motor of the air blower.

联系电工处理鼓风机电机。

(4) Properly adjust the air duct damper and the flue gas duct damper to regulate the negative pressure and the oxygen content in the fire box.

调节好风门和烟道挡板，调节炉膛负压和氧含量。

(5) Investigate the causes of improper action of the heater interlock. Upon completion of troubleshooting, re-start the air blower.

检查加热炉联锁原因，排除后，重新启运鼓风机。

2.6.38 Automatic trip of induced draft fan 引风机自跳

2.6.38.1 Causes 原因

(1) The induced draft fan fails.

引风机故障。

(2) The motor of the induced draft fan is de-energized or fails.

引风机电机断电或故障。

(3) The operation load is too large.

运转负荷过大。

(4) The heater interlock actions improperly.

加热炉联锁动作不正常。

(5) The air preheater leaks seriously.

空气预热器漏风过大。

2.6.38.2 Actions 处理

(1) Take actions per the treatment procedures for automatic trip of the induced draft fan.

按引风机自跳后操作步骤执行。

(2) Contact the maintenance staff to troubleshoot the induced draft fan.

联系维修处理引风机。

(3) Contact the electricians to troubleshoot the motor of the induced draft fan.

联系电工处理引风机电机。

(4) Properly adjust the air duct damper and the flue gas duct damper to regulate the negative pressure and the oxygen content in the fire box.

调节好风门和烟道挡板，调节炉膛负压和氧含量。

(5) Investigate the causes of improper action of the heater interlock. Upon completion of troubleshooting, re-start the induced draft fan.

检查加热炉联锁原因，排除后，重新启运引风机。。

(6) Check and troubleshoot the air preheater.

检查、处理空气预热器。

3 Technical Regulations for Safety, Environmental Protection & Health 安全、环保、健康技术规定

3.1 Safety requirements for plant entry 进装置的安全要求

3.1.1 Safety requirements 安全要求

3.1.1.1 The personnel entering production plant shall wear proper PPEs, and working after drinking shall be prohibited. All workers must frequently inspect, analyze and communicate the work, and must not sleep, read books and papers not related to the work and shout aloud during work.

进入生产装置人员须穿戴好合格的 PPE，不得酒后上岗。在岗期间做到三勤(勤检查、勤分析、勤联系)和三不(不打瞌睡、不看与生产无关的书报、不随便大声叫喊)。

3.1.1.2 The persons not related to the production shall not be allowed to enter the production

plant. Relevant permit shall be obtained for all vehicles (except the vehicles for fire control, gas defense and ambulance) before entering the plant, and no vehicle is allowed to enter the plant without permit.

与生产装置无关人员一律不准进入。一切机动车辆(消防、气防及急救护车辆除外)需办理相关许可证进入,机动车辆必须加装阻火器,未经许可不得进入装置。

3.1.1.3 The visiting apprentices and new employees must pass Level III safety education. The equipment and facilities shall not be operated without permission. New employees shall not begin their work before obtaining the relevant certificates.

外来实习人员和新入职员工,须通过三级安全教育。未经允许不得动用所属设备设施。新员工未取得上岗操作证,不得上岗操作,参观人员包括访客不得在没有批准并在恒逸员工陪同下自在装置区域内行动。

3.1.1.4 Placing clothes, wiping cloth and other flammable material on high temperature equipment and pipeline shall be strictly prohibited.

高温设备和管线上严禁放衣服、抹布及其它易燃物。

3.1.1.5 The workers on duty shall properly maintain and manage the safety and fire control facilities; the fire control facilities (boxes) shall not be used for other purpose.

当班员工应做好安全消防设施、器材的维护管理工作,消防器材(箱)不得挪作它用。

3.1.1.6 The operators shall stick to their posts in case of any accident, and perform the work according to instructions of foreman.

装置发生事故时,操作人员应按照应急预案程序处理事故。

3.1.1.7 Protection measures and remarkable safety label shall be provided for H₂S sampling points; the sampler shall be inspected and suitable PPEs shall be used before sampling.

硫化氢的采样点要注意防止 H₂S 中毒,采样点应挂有明显的安全标志牌,采样前要认真检查采样器具是否完好,并佩戴适宜的防毒器具。

3.1.1.8 The workers shall participate in the team safety activities of at least twice each month, and the 1 hour per time; the management personnel shall participate in the team safety activities at least once per month.

岗位人员每月至少参加 2 次班组安全活动,每次至少 1 小时,管理人员每月参加 1 次班组安全活动。

3.1.1.9 恒逸的安全生产及企业行为必须满足文莱法律法规及 SHENA(文莱国家安全、健康及环境管理局)HSE 指南的相关要求。

3.1.1.10 严禁进入装置人员携带火种。

3.1.1.11 严禁在装置内拨打手机。

3.1.2 Regulations on toxicosis and asphyxiation prevention 防止中毒窒息规定

3.1.2.1 When entering the confined space with toxic and harmful gas or anoxxygenous atmosphere, the manhole shall be opened for natural ventilation, purged and isolated with blind, the sample data shall be analyzed and accepted, the work permit for confined space entry shall

be obtained, and qualified supervisor shall be designated.

进入含有有毒有害气体或缺氧环境的受限空间作业时，应打开人孔自然通风，并吹扫置换加盲板隔离，采样分析合格，办理进入受限空间作业许可证，采取适合的防范措施，方可进入作业。

3.1.2.2 Reliable PPEs must be used when working in toxic and asphyxiant atmosphere.

在有毒和窒息环境中作业时，必须佩戴适合的劳动防护用品。

3.1.2.3 Risks assessment shall be performed, and emergency response plan and necessary PPEs shall be prepared for positions with toxic and asphyxiant atmosphere.

对有毒或有窒息危险的岗位，要进行风险评价，制订应急计划和配备必要的劳动防护用品。

3.1.2.4 The places with toxic and harmful material shall be periodically inspected and relevant measures shall be adopted to assure that such places conform to the standard of Brunei.

要定期对有毒有害场所进行检测，采取措施，使之符合文莱国家标准。

3.1.2.5 The toxic material and relevant PPEs must be managed by dedicated persons and periodically inspected.

对各类有毒物品和防毒器具必须有专人管理，并定期检查。

3.1.2.6 The gas detection equipment and instrument shall be periodically inspected and calibrated to assure they are in good conditions.

气体检测设备、仪器要定期检查、校验，保持完好。

3.1.2.7 The persons suffering from toxicosis and asphyxia shall be timely treated with correct method.

发生人员中毒、窒息时，处理及救护及时、方法正确。

3.1.3 Regulations on H₂S toxicosis prevention 防止硫化氢中毒规定

3.1.3.1 The persons handling H₂S must participate in the education training for H₂S toxicosis and emergency rescue and pass the test before begin the work.

从事接触硫化氢人员上岗前须接受有关硫化氢中毒及救护知识的教育培训，经考试合格后，方准上岗作业。

3.1.3.2 Each department shall establish the layout plan for area with H₂S, and place warning board at hazardous place.

本部门要建立硫化氢存在区域平面分布图，并在危险作业点设置警示牌。

3.1.3.3 Proper PPE shall be provided and managed according to the H₂S exposure hazards to working post and environment.

按照岗位和工作环境接触硫化氢的危害，配备符合标准要求的劳动防护用品，加强管理。

3.1.3.4 The production shall be performed in enclosed system, and the sealing leakage points shall be periodically inspected. If the H₂S concentration exceeds the values specified in national standards of country where the project locates due to material change, plant revamp or operation conditions change, the supervision authorities shall adopt effective protection measures, so as to assure the H₂S concentration in plant area conforming to the standards of Brunei.

密闭化生产，定期检测生产区域有毒有害气体，确保工作环境中的有毒有害气体浓度符合文莱国家标准。

3.1.3.5 The plant or area with risks of H₂S leakage shall be provided with harmful and toxic gas detector and alarm, and such detectors and alarms shall be 100% in good conditions. 在有硫化氢泄漏危险的装置或区域，安装有毒有害检测报警器，确保 100%完好投用。

3.1.3.6 If the workers are required to enter the equipment and vessel for maintenance, the work can be performed after purging, blind installation, sampling and analysis, obtaining work permit for confined space. Feasible construction procedure and safety measures must be prepared before work under special cases.

需要进入设备、容器检修，一般要经过吹扫、置换、加盲板、采样分析合格后、办理受限空间作业许可证才能作业。但特殊情况，必须要制订切实可行的施工方案和安全措施，方可作业。

3.1.3.7 H₂S protection mask shall be used for activities of sampling, inspection, dewatering, leakage repair, maintenance and etc., and at least two persons shall be present at site, one works in confined space and one supervise the work.

从事对存有硫化氢介质的采样、检尺、脱水、堵漏、检修等作业时，要佩戴防硫化氢防护面具，应有两人同时到现场，站在上风口，一人作业，一人监护。

3.1.3.8 When working in H₂S contaminated area with special PPE, the PPE shall not be removed before leaving the hazardous area to avoid toxicosis.

在硫化氢污染区佩戴特种防护用品作业时，在未脱离危险区域前严禁摘下防护用具，以防中毒。

3.1.4 Regulations on electrostatic hazards prevention 防止静电危害规定

3.1.4.1 The flammable and explosive material flow shall be strictly controlled according to process requirements, and blending and agitating with compressed air shall be prohibited.

严格按照工艺要求控制输送易燃易爆介质流速，禁止使用压缩空气调合、搅拌。

3.1.4.2 The flammable and explosive fluid shall be hold for a period of time after transfer, and then it shall be inspected, tested and sampled.

易燃易爆流体停止输送后，须静止一定时间，方可进行检尺、测温、采样等作业。

3.1.4.3 Explosion proof tools shall be used when filling the flammable and explosive fluid into drums.

对易燃易爆流体贮罐进油操作，应使用防爆工具。

3.1.4.4 Fill oil from top of road drumer shall be prohibited, and the drumer shall be filled under level with loading arm. Oil products shall not be loaded in plant or storage.

禁止从油槽车罐上部输油，应采用鹤管液下装车。严禁在装置或罐区灌装油品。

3.1.4.5 Entering flammable and explosive area with clothes may generate electrostatics, and putting on/taking off clothes or wiping equipment with chemical fiber fabrics shall be prohibited.

严禁穿非防静电的服装进入易燃易爆区，不得在该区域穿、脱衣或用化纤织物擦拭设备。

3.1.4.6 The humidity of the area that may generate chemical fiber and powder statics shall be controlled within the specified range.

容易产生化纤和粉体静电的环境，其湿度必须控制在规定范围以内。

3.1.4.7 The equipment within flammable and explosive area that may generate chemical fiber and powder electrostatics must be properly grounded.

易燃易爆区易产生化纤和粉体静电的装置，必须做好设备防静电接地

3.1.4.8 The measures for electrostatics removal shall be adopted for material and packages that may generate electrostatics; the plant and storage shall be provided with human body electrostatic eliminator.

易产生静电的介质输送和包装，须采取消除静电或泄出静电措施，装置、储罐区设置人体静电消除器。

3.1.4.9 The measures and devices against electrostatics shall be inspected and filed periodically by dedicated person.

防静电措施和设备要指定专人定期进行检查并建卡登记存档。

3.1.5 Regulations on LPG safety 液化石油气安全规定

3.1.5.1 Operating LPG equipment and pipeline above the specified temperature, pressure, speed and load shall be strictly prohibited.

对液化石油气的设备及管线严禁超温、超压、超速、超负荷运行。

3.1.5.2 The LPG equipment and pipeline shall be inspected at random intervals for leakage; proper measures shall be immediately adopted in case of any leakage. The relevant detection and alarm facilities shall be periodically inspected to assure the flexibility and reliability.

不定期检测液化气设备与管线，及时检测泄漏点，一旦发现泄漏，立即采取措施，以防事态扩大。有关检测报警设施必须定期检查试验，确保灵敏可靠。

3.1.5.3 LPG shall not be vented without permission; LPG shall be vented via HP/LP flare pipeline network for combustion.

液化石油气严禁随意排放，若需要排放，必须通过高低压火炬管网排

3.1.5.4 Safety education shall be performed for personnel handling LPG; emergency response procedure rehearsal shall be properly organized, recorded and filed.

从事液化石油气作业人员要定期参加安全培训，参与事故预案演练，提高事故处理能力。

3.1.5.5 The plant and area handling LQP must be provided with flammable gas detector, alarm, and necessary protection devices.

有液化石油气的装置和区域，必须配备可燃气体监测报警器和必要的保护装置。

3.1.5.6 The LPG equipment and pipeline shall be periodically inspected, tested and recorded according to the post responsibility system.

认真执行岗位责任制，对在用的液化石油气设备与管线要认真进行巡回和定期专业检查、检测，作好记录。

3.1.5.7 The equipment for LPG drum and transfer shall be provided with complete safety attachments, periodically inspected to assure the flexibility and reliability.

储存、输送液化石油气的设备要配齐各种安全附件，定期检修检验，保证灵敏可靠。

3.1.5.8 The problems and potential hazards shall be timely treated to avoid accident.

发现问题及隐患要及时处理，采取可靠措施，防止事故发生。

3.1.6 Regulations on work safety 操作安全技术规定

3.1.6.1 Workers of relevant positions must be strictly performed according to the process card, operation regulations and technical specification.

岗位人员要严格执行工艺卡片和岗位操作法、技术规程的规定，禁止违章操作。

3.1.6.2 The startup and shutdown procedure shall be strictly observed, and the equipment temperature and pressure shall be increased and decreased according to the specified speed.

严格执行开停工方案，按照操作步骤控制设备升温升压、降温降压速度。

3.1.6.3 The plant interlock operation management regulations must be observed, the interlocks shall not be overridden without permission, and the control methods or control parameters shall not be changed without permission. When instrument operator operates the automation instrument, confirmation of technical personnel of operation department shall be required and the relevant formalities shall be handled.

严格执行装置联锁操作管理规定，不得任意切除联锁，不得任意更改控制方案或修改控制参数；仪表操作工处理自保系统仪表时，须经运行部门技术人员确认，并办理相关手续。

3.1.6.4 The technical regulations for large machinery unit startup, heater startup, gas tightness test, purging, steam introduction, gas introduction, heat exchanger switch, blowdown and etc. shall be strictly observed.

严格执行开启大机组、点炉、气密、置换、引蒸汽、引瓦斯、换热器投用、排污等有关技术规定。

3.1.6.5 The audio-visual alarm, flammable gas detector, portable flammable gas detector and alarm, portable H₂S gas detection and alarm shall be periodically inspected according to the regulations of Company.

固定式可燃气体报警器、固定式硫化氢报警器、便携式气体报警器以及其它气体报警器，按公司规定进行定期校验。

3.1.6.6 Work permit must be obtained for confined space entry; the work can be begun only after the toxic gas, oxygen and flammable gas analysis is performed, and dedicated supervision person is designated.

装置内高风险作业必须办理作业许可证，开展风险辨识，落实安全措施。

3.1.6.7 The H₂S sampling point shall be marked with eye-catching warning board, and the sampler shall be checked for completeness before work; the samples shall be taken by two persons, one takes samples and the other provides protection; the work must be performed at upwind direction; and the positive pressure breather shall be used during working. The manual valve shall be opened slowly during sampling; if the valve is difficult to open, knocking the valve with spanner shall be prohibited.

含 H₂S 的采样点应挂有明显的警示牌，采样前要认真检查采样器是否完好，采样时须两人进行操作，一人采样，一人监护，且须站在上风向，佩带好正压式空气呼吸器。采样过程中，手阀应慢

慢打开，如阀难以打开，切忌用扳手敲打阀门。

3.2 Regulations on Equipment safety 设备安全技术规定

3.2.1 The HSE equipment shall be inspected strictly according to the requirements, and confirmed via signature item by item, managed by a closed-loop manner;

严格执行 HSE 设备设施检查要求，逐项确认签字跟踪整改，闭环管理。

3.2.2 Before closing the column and vessel manholes, make thorough check to assure no impurities in the equipment. For equipment not inspected against the checklist, open the manhole already closed for inspection

设备安全阀必须定压正确，铅封完好，定期检验，保证好用。一旦安全阀启跳，待压力恢复后，应尽快切出维修，重新定压后才能恢复使用；

3.2.3 The startup purging and pressure test of column and pipeline shall be performed strictly according to the commissioning, purging and pressure test procedure;

塔、管线开工吹扫、试压要严格执行贯通、吹扫、试压方案。

3.2.4 The relief valve, pressure gauge, level gauge and other Pre-Dist. detection and measurement instrument must be timely commissioned before startup purging.

开工吹扫前要及时、正确投用安全阀、压力表、液面计等一次检测、测量仪表。

3.2.5 Pipeline shall be inspected before the steam and water is introduced; the steam shall be introduced slowly to avoid water hammer.

引汽、引水要先检查管路，引汽要缓慢进行，防止水击。

3.2.6 The equipment temperature and pressure shall be increased strictly according to the operation specification to avoid damaging the equipment;

设备升温、升压要严格按操作规程进行，防止损坏设备。

3.2.7 The rotary equipment shall operate the equipment according to the operation specification; so that the problem can be timely identified and solved during startup;

转动设备运行要按照设备操作规程进行，在启动过程中做到及时检查、发现问题及时解决。

3.2.8 The heat exchanger must be put into service according to the specification; the shell side shall not be closed when the media passes through the tube side to avoid overpressure;

冷换设备投用必须按规程操作，当换热器管程走介质时，则壳程不得封闭，防止憋压。

3.2.9 The equipment shall be protected to avoid vacuum conditions during startup; over temperature and overpressure shall be avoided to prevent equipment and pipeline from being damaged;

在开工过程中，严防各设备抽负压，严禁设备超温、超压，防止损坏设备管线。

3.2.10 The flow meter and control valve shall be changed to sub-line during introducing the steam to system.

在蒸汽贯通时应将流量计、调节阀改付线。

3.3 Fire protection and harmful gas protection 消防及有害气体的防护

3.3.1 Fire prevention and fire protection 防火及消防

3.3.1.1 Some basic concepts of fire protection knowledge 消防知识的一些基本概念

(1) Combustion and its conditions and necessary conditions

燃烧及其条件和必要条件

Combustion is exothermic reaction between material and oxidizer, flame and visible light will be released at same time. Flammability: the flammability of oil products shall be determined according to their flash point, ignition point, and self-ignition points; when the oil products and oxidizer (oxygen or air) are exposed to fire source or certain temperature conditions, the products may be ignited. The three conditions for combustion include flammable material, oxidizer, and ignition source.

燃烧是物质与氧化剂之间的放热反应，它通常会同时释放出火焰或可见光。燃烧性：石油产品的燃烧性是根据其闪点、燃点和自燃点的高低而决定的，当它们与助燃物（氧或空气）遇到火源或在一定的温度条件下即发生燃烧。燃烧的三个必要条件：可燃物、助燃物、火源。

(2) Spontaneous ignition and spontaneous ignition point

自燃与自燃点

Spontaneous ignition means a self-combustion phenomenon of combustible matter which takes place without direct effect by external fire source when reaching a certain temperature resulting from gradual temperature increase because heat accumulation or self-heating occurs and the heat cannot be dissipated.

自燃是指可燃物在没有外界火源的直接作用，因受热或自身发热，并由于散热受到阻碍，使热量蓄积，温度逐渐上升，当达到一定温度时发生的自行燃烧的现象。

Minimum temperature at which combustible matter reaches spontaneous ignition is called spontaneous ignition point.

可燃物质达到自行燃烧的最低温度称自燃点。

(3) Flash burning and flash point

闪燃与闪点

Flash burning: the combustion phenomenon that sufficient flammable vapor will be generated on the surface of liquid (solid), and flame is caused and then extinguished when exposed to fire.

闪燃：在液体（固体）表面上能产生足够的可燃蒸气，遇火能产生一闪即灭的火焰的燃烧现象称为闪燃。

Flash point: The minimum temperature required for flash burning at surface of liquid (solid) under specified test conditions.

闪点：在规定的试验条件下，液体（固体）表面能产生闪燃的最低温度称为闪点。

(4) Explosion and explosion limit

爆炸与爆炸极限

Explosion means a phenomenon in which temperature or pressure or both increase rapidly resulting from rapid oxidation or decomposition reaction of substance. Explosion may be divided into physical, chemical and nuclear explosions.

爆炸是指由于物质急剧氧化或分解反应，使温度、压力急剧增加或使两者同时急剧增加的现象。爆炸可分为：物理爆炸、化学爆炸和核爆炸。

Explosion limit means the highest or the lowest concentration of combustible gas, vapor or dust after it is mixed with air, at which explosion may takes place when it exposes to fire. It is typically expressed in volume percentage.

爆炸极限是指可燃气体、蒸汽或粉尘与空气混合后，遇火产生爆炸的最高或最低浓度。通常以体积百分数表示。

(5) Types of conventional fire extinguisher

常用灭火器的种类

Foam fire extinguishers, dry powder fire extinguishers, CO₂ fire extinguisher, 1211 fire extinguisher, etc.

泡沫灭火器、干粉灭火器、CO₂ 灭火器、1211 灭火器等。

(6) Classification of fire accident

火灾的分类

Fire accident: the disasters that is caused by combustion out of control during specified time and space. The fire accident may be classified into four categories according to the combustion characteristics of material.

火灾的定义是：在时间和空间上失去控制的燃烧所造成的灾害。按物质的燃烧特性将火灾分为如下 5 类：

1) Class A fire: referring to the fire of solid material containing organics, and may generating hot ash during combustion, such as wood, cotton, wool, hemp, paper and etc.;

A 类火灾，是指固体物质火灾，这种物质往往具有有机物质，一般在燃烧时能产生灼热的灰烬，如木材、棉、毛、麻、纸张等。

2) Class B fire: referring to fire of liquid of meltable solid, such as gasoline, kerosene, diesel oil, crude oil, methanol, ethanol, asphalt, paraffin;

B 类火灾，是指液体火灾和可熔化的固体物质火灾，如汽油、煤油、柴油、原油、甲醇、乙醇、沥青、石蜡火灾。

3) Class C fire: referring to fire of gases, such as coal gas, natural gas, methane, ethane, propane, hydrogen and etc.;

C 类火灾，是指气体火灾，如煤气、天然气、甲烷、乙烷、丙烷、氢气火灾等。

4) Class D fire: refering to fire of metal, such a potassium, sodium, magnesium, titanium, lithium, aluminum magnesium alloy and etc.

D 类火灾，是指金属火灾，如钾、钠、镁、钛、锂、铝镁合金火灾等。

5) 电气火灾

(7) Fire extinguishing principles

安全灭火的原则

1) The system shall be alarmed immediately after fire accident, and the rescue work shall be timely organized.

发生火灾应迅速报警，并组织人员抢救。

2) The power supply, gas supply, oil supply and various flammable, combustible and toxic materials shall be stopped first.

灭火首先应切断电源、气源、油源及各种可燃、易燃和有毒物质。

3) The fire of electrical equipment shall be extinguished via CO₂ fire extinguisher or 1211 fire extinguisher instead of foam fire extinguisher to avoid hurting personnel.

电气设备着火要用 CO₂ 灭火器、干粉灭火器或 1211 灭火器，不准浇水和使用泡沫灭火器，防止导电伤人。

4) In case that a large area fire takes place at gas drum drums for oil, liquefied, etc., do not directly water the fire. Because oil is lighter than water, this easily cause flame splash, expanding the area in which fire takes place. Fire may be put out by foam ejected from a lot of foam extinguishers, or by spraying water to edge of the drum for decreasing the temperature.

油、液化气等储罐发生大面积火灾时，不能直接往火面上浇水，因为油类比水轻，容易把火苗溅出，扩大火灾面积，可使用大量泡沫灭火机喷射泡沫灭火，或在罐边喷水降温灭火。

5) Where a fire takes place at precision instruments or documents, use dry powder and 1211 fire extinguishers, or fully cover it with wetted woollen blankets, and do not use yellow sand or acid fire extinguishers.

精密仪表器或文档资料着火，要采用干粉、CO₂ 灭火器和 1211 灭火器，或用毛毯浸湿捂住，不得用黄砂或酸性灭火器。

3.3.1.2 Operation method of various fire extinguishers 各类灭火器的使用方法

(1) Operation method of portable dry powder fire extinguisher

手提式干粉灭火器的使用方法

Take dry powder fire extinguishers to combustion area, hold its nozzle with left hand, remove car seal with right hand, pull the pull ring of external steel cylinder (CO₂), align and eject dry powder to the root of flame.

将干粉灭火器提到燃烧区域，左手握住喷嘴，右手拆掉铅封，拉起外钢瓶（二氧化碳）的拉环，干粉对准火焰的根部喷出。

(2) Operation method of CO₂ fire extinguisher

二氧化碳灭火器的使用方法

Take CO₂ fire extinguisher to fire site, align trumpet nozzle to source of ignition with left hand, remove car seal with right hand, turn on valve switch, align and eject to the root of flame.

将二氧化碳灭火器提到着火现场，左手将喇叭嘴对准火源，右手拆掉铅封，拧开阀门的开关，对准火焰的根部喷出即可灭火。

(3) Operation method of wheeled dry powder fire extinguisher

手推车干粉灭火器使用方法

Move the fire extinguisher to fire site, hold powder spray rubber hose with one hand and align it

to source of ignition, and turn the power cylinder handwheel with another hand in CCW direction. When pressure gauge indicates 8.38Mpa, open fire extinguisher switch to eject dry powder. Wag spray pipe, rapidly advance, and prevent from after-combustion.

将灭火器推到起火地点，一手握喷粉胶管，对准火源，另一手逆时针方向旋转动力瓶手轮，待压力表指针达到 8.38MPa 时，打开灭火器开关，干粉即可喷出，左右摆动喷管，快速推进，防止复燃。

3.3.1.3 Basic method of extinguishing fire 灭火的基本方法

(1) Cooling

冷却灭火

One of the conditions to maintain continuous combustion for common flammable material is that the flammable material reaches the initiation temperature at flame or hot conditions. Therefore, when the temperature of common flammable material is cooled to a temperature lower than ignition temperature or flash point, the combustion reaction will be stopped. The fire extinguishing mechanism of water is cooling.

对一般可燃物来说，能够持续燃烧的条件之一就是它们在火焰或热的作用下达到了各自的着火温度。因此，对一般可燃物火灾，将可燃物冷却到其燃点或闪点以下，燃烧反应就会中止。水的灭火机理主要是冷却作用。

(2) Smothering

窒息灭火

The flammable material must be burned above the required minimum oxygen concentration, or the burning cannot be continued. Therefore, the fire can be extinguished via reducing the oxygen concentration around the flammable material. The fire extinguishing mechanism of CO₂, N₂, steam and etc. is smothering.

各种可燃物的燃烧都必须在其最低氧气浓度以上进行，否则燃烧不能持续进行。因此，通过降低燃烧物周围的氧气浓度可以起到灭火的作用。通常使用的二氧化碳、氮气、水蒸气等的灭火机理主要是窒息作用。

(3) Isolation

隔离灭火

The combustion will be automatically stopped if the flammable material is isolated from ignition source or oxygen. The relevant valves shall be closed during fire accident to block the flammable gas and liquid to fire accident area; open the relevant valves to transfer the flammable liquid in vessels affected by fire accident to safe area via pipeline.

把可燃物与引火源或氧气隔离开来，燃烧反应就会自动中止。火灾中，关闭有关阀门，切断流向着火区的可燃气体和液体的通道；打开有关阀门，使已经发生燃烧的容器或受到火势威胁的容器中的液体可燃物通过管道导至安全区域，都是隔离灭火的措施。

(4) Chemical inhibition

化学抑制灭火

Breaking the combustion chain reaction via reaction between fire extinguishing agent and the

intermediate free radical of chain reaction. The main fire extinguishing mechanism of conventional dry powder fire extinguishing agent, halon extinguishing agent is chemical inhibition.

就是使用灭火剂与链式反应的中间体自由基反应，从而使燃烧的链式反应中断使燃烧不能持续进行。常用的干粉灭火剂、卤代烷灭火剂的主要灭火机理就是化学抑制作用。

3.3.1.4 Fire report and fire extinguishing principles 火灾的报告和扑救原则

(1) Fire report and alarm

火灾的报告、报警

1) After finding the fire, immediately report it to both shift leader and main dispatching room, and clearly tell fire location, combustible matter and fire behavior.

发现着火后，立即报告班长和总调度室，说清着火的部位，燃烧物和火势。

2) After finding the fire, timely report it to fire brigade by telephone. After dialing 9119 and putting it through, tell department, location and position at which the fire occurs, and name of combustible matter, carefully answer the other side's questions, and tell the other side this telephone number and caller's name. After reporting it, send the personnel to go to crossing for waiting for fire engine.

发现着火后应及时用电话向消防队报警，拨 9119 接通后，说明着火的部门、地点、部位、燃烧物名，认真回答对方的提问，告诉对方本机的号码和报警人的姓名。报警后派人去路口迎候消防车。

(2) Fire extinguishing principles

扑救原则

1) First control fire, and then put out it. After the fire occurs, immediately check and determine the position at which the fire occurs, take the process actions to shut off material supply to fire position. In case of gas fire, fill N₂ or steam into piping or vessel. When it is difficult to control fire behavior, properly take the temperature decrease and flow decrease actions until emergency shutdown.

先控制后扑救。起火后立即查清着火的部位，采取工艺措施切断着火部位的供料，气体着火向管道或容器内充加 N₂ 或蒸汽，火势难以控制时，应相应采取降温降量直至紧急停车。

2) Separate, surround and put out the fire. After the fire occurs, uniformly organize and coordinate the actions, and separate and control the fire if fire area is large. When it is difficult to suppress and put out fire due to large fire area, extinguish the fire points at peripheral area one by one, and then concentrate the force to extinguish final fire point. When the fire occurs, the personnel at post shall stick to their post, and actively cooperate with fireman to put out fire. 分割围歼扑救。火灾发生后要统一组织协调行动，对火灾面积较大的实际隔离控制。火场面积大抑制扑救困难时，应采取逐个消灭周围火点。而后集中力量扑灭最终火点的方法。发生火灾时岗位人员要坚守岗位，积极配合消防队员灭火。

3) Protect surrounding facilities. Use water curtain, steam curtain to cool the surrounding equipment by spraying water on it, or take trenching and cofferdam actions to protect adjacent

equipment. Prevent fire from spreading. Timely evacuate valuables and flammables & explosives. When extinguishing fire, it is necessary to have the spirit of courage and persistence, and special attention shall be paid to scientific methods and safety to reduce unnecessary death and injury.

保护周围设施。采取水幕、汽幕对周围设备洒水冷却或挖沟围堰等措施保护相邻的设备。防止火灾蔓延，对贵重物品和易燃易爆物品要及时疏散。扑救火灾时即要有勇敢顽强的精神，又要注意科学的方法和安全，减少不必要的伤亡。

4) After the fire is put out, carefully check for residual fire source in the fire site and put out it, and prevent from after-combustion.

火灾扑灭后要仔细检查，消灭火场的残存火源，防止复燃。

3.3.1.5 Extinguishing initial fire 初起火灾的扑救

Methods and principles to extinguish initial fire: the fire shall be extinguished with adjacent firefighting facilities, equipment in case of fire accident. The manual firefighting system, if any, shall be started immediately.

初起火灾扑救的方法和原则：发生火灾后，要及时使用就近的灭火器材、设备进行扑救。有手动灭火系统的应立即启动。

(1) Isolating the flammable material.

断绝可燃物

1) Removing the flammable material near the fire accident spot that may cause fire spreading; 将燃烧点附近可能成为火势蔓延的可燃物移走。

2) Closing the relevant valves to cut off the flammable gas and liquid flowing to fire accident spot;

关闭有关阀门，切断流向燃烧点的可燃气体和液体。

3) Open the relevant valve to send the flammable material in vessels on fire or affected by the fire accident to safe area via pipeline.

打开有关阀门，将已经燃烧的容器或受到火势威胁的容器中的可燃物料通过管道导至安全地带。

4) Mud, sand dikes shall be used to block the flammable liquid flowing to fire accident spot.

采用泥土、黄沙筑堤等方法，阻止流淌的可燃液体流向燃烧点。

(2) Cooling

降温

1) If fire water system, fire engine or pump are available in this department (area), use these facilities to extinguish the fire.

本部门（地区）如有消防给水系统、消防车或泵，应使用这些设施灭火。

2) If this department is provided with the appropriate fire extinguishers, use the fire extinguisher to extinguish the fire.

本部门如配有相应的灭火器，则使用灭火器灭火。

3) In case of lack of fire-fighting apparatus, materials and facilities, use simple tools such as buckets, wash basin to extinguish the fire.

如缺乏消防器材设施，则应使用简单工具灭火，如水桶、面盆等。

(3) Smothering

窒息

1) Covering the surface of burning material with foam fire extinguisher;

使用泡沫灭火器喷射泡沫覆盖燃烧物表面。

2) Covering the burning area with cover of vessels and equipment;

利用容器、设备的顶盖盖没燃烧区。

3) Covering the pot immediately in case of oil pot fire;

油锅着火时，立即盖上锅盖。

4) Cover the surface of burning material with wet blanket, quilt, burlap and etc.;

将毯子、棉被、麻袋等浸湿后覆盖在燃烧物表面。

5) Covering the burning material with sand, soil; the fire on material not compatible with water shall be extinguished with gas fire extinguisher, dry sand, soil.

用沙、土覆盖燃烧物。对忌水物质，必须采用干燥沙、土扑救。

(4) Beating at the flames

扑打

For fire of small area grassland, shrub and other solid combustible matter, and fire behavior is small, beat at the flames with brooms, tree branches, clothes.

对小面积草地、灌木及其他固体可燃物燃烧，火势较小时，可用扫帚、树枝条、衣物扑打。

(5) Cutting-off power supply

断电

1) The power supply must be cut off in case of fire on electrical equipment, or the fire may affect the safety of electrical circuits, electrical equipment, or the firefighting personnel.

如发生电气火灾，或者火势威胁到电气线路、电气设备，或电气影响灭火人员安全时，首先要切断电源。

2) If using extinguishing agents such as water, foam to extinguish the fire, perform it after cutting-off power supply.

如使用水、泡沫等灭火剂灭火，必须在切断电源以后进行。

(6) Preventing fire from spreading

阻止火势蔓延

1) For small area indoor fire in good closed conditions, first close windows and doors to prevent fresh air from entering before not ready for extinguishment.

对封闭条件较好的小面积室内着火，在未做好灭火准备前，先关闭门窗，以阻止新鲜空气进入。

2) For the room adjacent to the building in which the fire occurs, first close door of adjacent room, and then spray water on the door if possible.

与着火建筑相毗邻的房间，先关上相邻房门，可能条件下还应再向门上浇水。

(7) Explosion prevention

防爆

1) Transfer flammables & explosives, pressure vessel that are threatened by the fire to a safe

location.

将受到火势威胁的易燃易爆物质、压力容器等转移到安全地区。

2) Immediately stop material feed to pressure vessel and equipment that are threatened by the fire, and direct the material in the vessel to a safe location.

对受到火势威胁的压力容器、设备应立即停止向内传输物料，并将容器内物料设法导走。

3) Stop heating the pressure vessel, and open cooling system valve to cool the pressure vessel equipment.

停止对压力容器加温，打开冷却系统阀门，对压力容器设备进行冷却。

4) Where manual relief device is provided, immediately open the related valve to perform venting and pressure relief.

有手动放空泄压装置的，应立即打开有关阀门放空泄压。

3.3.1.6 Safety knowledge of explosion prevention 防爆安全知识

Explosion means a phenomenon in which a great deal of energy is released instantly in the mechanical work way with the rapid substance transition from one state to another state. Explosion is generally classified as two types, i.e. chemical and physical explosions. The former mainly means explosion of combustible gas, steam or dust, and the latter mainly includes explosion of boiler, pressure vessel and piping.

爆炸是指物质由一种状态迅速地转变成另一种状态，并在瞬间以机械功的形式放出大量能量的现象。爆炸一般分为化学性爆炸和物理性爆炸两种类型。前者主要指可燃气体、蒸汽或粉尘的爆炸，后者主要包括锅炉、压力容器及管道的爆炸。

Chemical explosion accidents are more. In many cases, the duration for which explosion accidents have taken place is very short, and there is almost no opportunity to initial control and personnel evacuation, thus death and injuries are more. Moreover, explosion accident tends to not only result in damage of facilities and equipment or injury and death, but also to cause other accidents such as fire.

化学性爆炸事故较多。在很多情况下，爆炸事故发生的时间都很短，几乎没有初期控制和疏散人员的机会，因而伤亡较多。而且爆炸事故往往不仅仅只是单纯地破坏工厂设施、设备或造成人员伤亡，还会进一步引发火灾等其它事故。

Precautions for explosion accident are as follows:

预防爆炸事故主要有以下措施

1) Monitoring measures shall be adopted for flammable gas, steam, dust concentration in air; safety and protection measures shall be adopted immediately when the concentration reaches the hazardous level.

采取监测措施，当发现空气中的可燃气体、蒸汽或粉尘浓度达到危险值时，应立即采取适当的安全防护措施。

2) Welding work must be avoided in fire and explosive workshop, and safe distance must be kept between the welding work site and flammable and explosive equipment.

在有火灾、爆炸危险的车间内，应尽量避免焊接作业，进行焊接作业的地点必须要和易燃易爆的

生产设备保持安全距离。

3) Hot work on equipment and pipeline for flammable and explosive material shall be performed strictly according to the management regulations for hazardous activities; work permit must be obtained and the equipment and pipeline must be isolated, purged, cleaned and analyzed to assure the safety of hot work.

对生产、盛装易燃易爆物料的设备和管道进行动火作业时，应严格执行隔绝、置换、清洗、动火分析等有关规定，确保动火作业的安全。

4) Spark arrester shall be installed on the exhaust pipe of truck and tractor in area with fire and explosion hazards.

在有火灾、爆炸危险的场合，汽车、拖拉机的排气管上应安装火星熄灭器。

5) The vessels and cylinders for flammable gas and liquid shall be handled with care; throwing and bumping shall be strictly avoided.

搬运盛有可燃气体或易燃液体的容器、气瓶时要轻拿轻放，严禁抛掷、防止相互撞击。

6) The workers entering workshop with flammable and explosive material shall wear antistatic working clothes and shoes without nails.

进入易燃易爆车间的人员应穿防静电的工作服，不穿带钉子的鞋。

7) For grease with spontaneous ignition capacity itself, substances that may cause spontaneous ignition when exposing to air, and the substances that may cause combustion and explosion when exposing to water, take separation from air, waterproof, moistureproof actions, or take ventilation, heat dissipation and cooling actions to prevent from spontaneous ignition and explosion of substance.

对于物体本身具有自燃能力的油脂、遇空气能自燃的物质以及遇水能燃烧爆炸的物质，应采取隔绝空气、防水、防潮或采取通风、散热、降温等措施，以防止物质自燃和爆炸。

8) Different material that may cause explosion when exposed to each other shall not be placed together; the material that may decomposed and exploded with exposed to acid or alkali shall not be placed away from the acid or alkali; the material is sensitive to mechanical effect shall be handled with care.

互相接触会引起爆炸的两类物质不能混合存放；遇酸、碱有可能发生分解爆炸的物质应避免与酸碱接触；对机械作用较为敏感的物质要轻拿轻放。

9) Stabilizer shall be added to the unstable material during drum.

对于不稳定物质，在贮存中应添加稳定剂。

10) Prevent from release, overflow, dropping and leakage of flammables & explosives during production process to avoid diffusion to air, resulting in explosion accident.

防止生产过程中易燃易爆物的跑、冒、滴、漏，以防扩散到空气中而引起爆炸事故。

11) Operators for boilers must be trained and pass the test, obtain the work permit before operation.

锅炉操作人员必须经过培训并考试合格，取得操作证以后方可进行操作。

12) The boiler, pressure vessel can be used only when the relief valve, pressure vessel, level gauge and other safety devices are in good conditions; over-temperature and overpressure shall

be avoided.

锅炉、压力容器须在安全阀、压力表、液体计等安全装置保持完好的情况下才能使用；严禁超温超压运行。

3.3.2 Hazardous chemicals 危险化学品

3.3.2.1 Basic knowledge of hazardous chemicals 危险化学品基本知识

Hazardous chemicals mean the chemicals with explosion, flammability, toxicity and harm, corrosion, radioactivity natures, which require special care during production, operation, drum, transportation, use and disposal because they are apt to cause personal casualties and property losses. They include explosives, compressed air and liquidated gas, flammable liquids, flammable solids, spontaneous combustion materials, moisture-ignite flammables, oxidant, organic peroxide, noxious materials, radioactive substance and corrosive materials. They have hazardous natures such as flammability, explosion, toxicity and harm, corrosion and radioactivity. 危险化学品指具有爆炸、易燃、毒害、腐蚀、放射性等性质，在生产、经营、储存、运输、使用和废弃物处置中，容易造成人身伤亡和财产损毁而需要特别防护的化学品；包括爆炸品、压缩气体和液化气体、易燃液体、易燃固体、自燃物品和遇湿易燃物品、氧化剂和有机过氧化物、毒害品、放射性物品和腐蚀品；其具有燃烧性、爆炸性、毒害性、腐蚀性、放射性的危险特性。

3.3.2.2 Accident control and protection actions of hazardous chemicals 危险化学品事故控制和防护措施

Current main preventive actions of hazardous chemicals poisoning and contamination accidents are substitution, change of process, separation, ventilation, personal protection and keeping clean.

危险化学品中毒、污染事故预防目前采取的主要措施是替代、变更工艺、隔离、通风、个体防护和保持卫生。

Prevention of hazardous chemicals fire, explosion accidents includes the following three points: 危险化学品火灾、爆炸事故的预防有以下三点：

(1) Prevent from forming of combustion, explosion systems, mainly including substitution, closing, inert gas protection, displacement ventilation, safety monitoring and interlocking.

防止燃烧、爆炸系统的形成，主要包括替代、密闭、惰性气体保护、通风置换、安全监测及连锁。

(2) Eliminate ignition source, mainly including control of open fire and high temperature surface, prevention of spark resulting from friction and impact, prevention of electric spark by explosionproof equipment used in fire, explosion hazardous area.

消除点火源，主要包括控制明火和高温表面、防止摩擦和撞击产生火花、火灾爆炸危险场所采用防爆电气设备避免电气火花。

(3) Measures to restrict the fire, explosion spreading, mainly including flame arrester, explosionproof and pressure relief devices, and fire and exposition prevention partition, etc.

限制火灾、爆炸蔓延扩散的措施，主要包括阻火装置防爆卸压装置及防火防爆分隔等。

3.3.2.3 Routes of entry into body, hazards and first aid of hazardous chemicals 危险化学品侵入人体的途径、危害和抢救

Chronic poisoning symptom will be shown after hazardous chemicals enter body through a certain route and accumulates to certain dosage in the body. Chronic poisoning means the poisoning resulting from long-term entry into body of noxious hazardous chemicals in small dose. Subacute poisoning means the poisoning resulting from short-term entry into body of noxious hazardous chemicals in big dose. Acute poisoning means the poisoning resulting from entry into body of plenty of hazardous chemicals one time or in short time.

危险化学品通过一定途径进入人体，在体内积蓄到一定剂量后，就表现出慢性中毒症状。所谓慢性中毒就是毒性危险化学品长时期、小剂量进入人体所引起的中毒；若在较短时间有较大剂量的毒性危险化学品进入人体内所引起的中毒称为亚急性中毒；若毒性危险化学品一次或短时间内大量进入人体内所引起的中毒称为急性中毒。

Routes of entry into body of hazardous chemicals include respiratory tract, skin, digestive tract. 危险化学品侵入人体的途径包括呼吸道、皮肤、消化道。

Hazards of hazardous chemicals on body mainly include irritation, allergy, smothering, anesthesia and coma, poisoning, carcinogenic teratogenic, mutagenesis and pneumoconiosis. 危险化学品对人体的危害主要有刺激、过敏、窒息、麻醉和昏迷、中毒、致癌致畸、致突变和尘肺。

First aid of hazardous chemical poisoning includes the following:

危险化学品中毒的抢救包括以下几方面：

(1) Site preparation of the emergency care personnel. When acute poisoning takes place, noxious hazardous chemicals typically enter into body through respiratory system or skin. Therefore, the emergency care personnel shall properly perform self-protection of respiratory system or skin prior to first aid. For example, wear protective clothes and oxygen mask or oxygen breathing apparatus. Otherwise, the victim can not only be rescued, but also the emergency care personnel is poisoned so that the poisoning accident is expanded.

救护者现场准备。急性中毒发生时，毒性危险化学品大多是由呼吸系统或皮肤进入体内。因此，救护人员在救护之前应做好自身呼吸系统皮肤的防护。如穿好防护衣，佩戴供氧式防毒面具或氧气呼吸器。否则，不但中毒者不能获救，救护者也会中毒，使中毒事故扩大。

(2) Shut off source of noxious hazardous chemicals. The emergency care personnel shall rapidly move the victim to a place with fresh air and good ventilation. During the first aid and victim moving processes, do not force to pull the victim to prevent from external injury, resulting in aggravation. Unfasten the victim's clothes and belt, and place his/her in supine position to ensure that the victim's respiratory tract shall be unobstructed. Special attention shall be paid to keep the victim warm. After the emergency care personnel enters the site, besides first aid of the victim, carefully check and take strong measures, such as closing valves in the leaked piping, stopping equipment leak, stopping material supply to shut off source of noxious hazardous chemicals. For toxic gas or vapor leaked, rapidly start ventilation and exhausting facilities, or

open windows and doors, or perform neutralizing treatment, reduce concentration of noxious hazardous chemicals in air, and create favorable conditions for first aid.

切断毒性危险化学品来源。救护人员应迅速将中毒者移至空气新鲜、通风良好的地方。在抢救搬运过程中,不能强拖硬拉以防造成外伤,使病情加重,应松开患者衣服、腰带并使其仰卧,以保持呼吸道通畅。同时要注意保暖。救护人员进入现场后,除对中毒者进行抢救外,还应认真查看,并采取有力措施,如关闭泄漏管道阀门、堵塞设备泄漏处、停止输送物料等以切断毒性危险化学品来源。对于已经泄漏出来的有毒气体或蒸气,应迅速启动通风排毒设施或打开门窗,或者进行中和处理,降低毒性危险化学品在空气中的浓度,为抢救工作创造有利条件。

(3) Rapidly take off the clothes, shoes, stocks and gloves contaminated by noxious hazardous chemicals, fully flush the skin contaminated by noxious hazardous chemicals with plenty of clean water or detoxification solution. Pay attention to prevent cleaning agent from promoting absorption of noxious hazardous chemicals, and from breathing poisoning resulting from cleaning agent itself. For viscous noxious hazardous chemicals, flush it with plenty of soapy water (for trichlorfon, do not flush it with alkaline solution). Special attention shall be paid to contamination in the folded skin, hair and fingernail. For water soluble noxious hazardous chemicals, first wipe off noxious hazardous chemicals with cotton, dry cloth, and then flush it with clean water.

迅速脱去被毒性危险化学品污染的衣服、鞋袜、手套等,并用大量清水或解毒液彻底清洗被毒性危险化学品污染的皮肤。要注意防止清洗剂促进毒性危险化学品的吸收,以及清洗剂本身所致的呼吸中毒。对于教稠性毒性危险化学品,可以用大量肥皂水冲洗(敌白虫不能用碱性液冲洗),尤其要注意皮肤褶皱、毛发和指甲内的污染,对于水溶性毒性危险化学品,应先用棉絮、干布擦掉毒性危险化学品,再用清水冲洗。

(4) If acute poisoning is resulted from entry of noxious hazardous chemicals through mouth, for noncorrosive noxious hazardous chemicals, rapidly perform gastric lavage with 1/5000 potassium permanganate solution or 1% to 2% sodium bicarbonate solution, and then perform catharsis with magnesium sulfate solution. For corrosive noxious hazardous chemicals, gastric lavage should generally be performed, egg white, milk or aluminium hydroxide gel may be fed to protect gastric mucosa.

若毒性危险化学品经口引起急性中,对于非腐蚀性毒性危险化学品,应迅速用 1/5000 的高锰酸钾溶液或 1%~2%的碳酸氢钠溶液洗胃,然后用硫酸镁溶液导泻。对于腐蚀性毒性危险化学品,一般不宜洗胃,可用蛋清、牛奶或氢氧化铝凝胶灌服,以保护胃黏膜。

(5) Let the victim breath the oxygen. If the victim's breathing stops or cardiac arrest takes place, immediately perform resuscitation.

令中毒患者呼吸氧气。若患者呼吸停止或心跳骤停,应立即施行复苏术。

(6) While taking first aid measures at site, prepare vehicles or stretcher so that the victim may timely be sent to hospital for medical treatment.

在采取现场抢救措施的同时,应准备车辆或担架,以便将中毒者及时送往医院救治。

3.3.3 Hazardous chemicals leakage treatment and fire control 危险化学品泄漏处理及火灾控

制

3.3.3.1 Leakage treatment 泄漏处理

(1) Leakage source control. Use shut-off valve to shut off leakage source, perform online leakage stop to reduce leakage amount, or use standby relief device to safely release it.

泄漏源控制。利用截止阀切断泄漏源，在线堵漏减少泄漏量或利用备用泄料装置使其安全释放。

(2) Leakage disposal. Leakage at site shall be covered, contained, diluted, disposed timely. When disposal, the proper method shall also be used based on the properties of hazardous chemicals.

泄漏物处理。现场泄漏物要及时地进行覆盖、收容、稀释、处理。在处理时，还应按照危险化学品特性，采用合适的方法处理。

3.3.3.2 General considerations of fire control 火灾控制一般注意事项

(1) Properly select the fire extinguishing agent, and give full play to its effectiveness. Common extinguishing agents include water, steam, carbon dioxide, dry powder and foam, etc. There are many types of extinguishing agents, and their efficiency and performance are different. Thus, when putting out the fire, select the extinguishing agent with very high cooling and extinguishing performance based on properties of combustion material, features of equipment and facilities, position of fire source point (high, low) and fire behavior, and give full play to maximum efficiency and performance of cooling and extinguishing of the respective extinguishing agents.

正确选择灭火剂并充分发挥其效能。常用的灭火剂有水、蒸汽、二氧化碳、干粉和泡沫等。由于灭火剂的种类较多，效能各不相同，所以在扑救火灾时，一定要根据燃烧物料的性质、设备设施的特点、火源点部位（高、低）及其火势等情况，要选择冷却、灭火效能特别高的灭火剂扑救火灾，充分发挥灭火剂各自的冷却与灭火的最大效能。

(2) Special attention shall be paid to protection of key positions. For example, when there are a great deal of flammables & explosives or toxic chemicals in a area, this position should be taken as the key protection object. While implementing the cooling protection, organize the force as soon as possible to eliminate the fire source points around it to prevent fire from expansion. 注意保护重点部位。例如，当某个区域内有大量易燃易爆或毒性化学物质时，就应该把这个部位作为重点保护对象，在实施冷却保护的同时，要尽快地组织力量消灭其周围的火源点，以防灾情扩大。

(3) Prevent after-combustion and after-explosion. After the fire is extinguished, the necessary number of fire fighting force should be remained to continue to cool the equipment, facilities, buildings (structures) in the combustion area, to eliminate the source of fire, and timely to dispose the leaked hazardous chemicals. For places where fire may be extinguished with water, use steam or spray water to perform dilution as possible, and eliminate residual flammable gases or vapors in the space to prevent after-combustion and after-explosion.

防止复燃复爆。将火灾消灭以后，要留有必要数量的灭火力量继续冷却燃烧区内的设备、设施、建（构）筑物等，消除着火源，同时将泄漏出的危险化学品及时处理。对可以用水灭火的场所要

尽量使用蒸汽或喷雾水流稀释，排除空间内残存的可燃气体或蒸气，以防止复燃复爆。

(4) Prevent high temperature hazards. The presence of high temperatures on the fire not only causes the spread of the fire, but also threatens the safety of fire fighters. Water spray may be used for cooling. Use shelter protection. Wear insulated clothing for protection. Regularly organize change of shifts to avoid high temperature hazards.

防止高温危害。火场上高温的存在不仅造成火势蔓延扩大，也会威胁灭火人员安全。可以使用喷水降温、利用掩体保护、穿隔热服装保护、定时组织换班等方法避免高温危害。

(5) Prevent poison hazards. In the event of a fire, toxic substances such as carbon monoxide, carbon dioxide, sulfur dioxide, and phosgene may be produced. When putting out the fire, the guard zone should be set up. The emergency personnel entering the guard zone should wear personal protective equipment and take appropriate measures to eliminate the poison.

防止毒害危害。发生火灾时，可能出现一氧化碳、二氧化碳、二氧化硫、光气等有毒物质。在扑救时，应当设置警戒区，进入警戒区的抢险人员应当佩戴个体防护装备，并采取适当的手段消除毒物。

3.3.3.3 Fire extinguishment considerations of several special chemicals 几种特殊化学品火灾扑救注意事项

(1) When extinguishing a gas fire, blindly putting out the flame shall be avoided. Stable combustion shall be kept without taking measures to stop the leakage. Otherwise, a large amount of flammable gas leaks out and mixes with the air, and an explosion will occur when exposing to an ignition source, causing serious consequences.

扑救气体类火灾时，切忌盲目扑灭火焰，在没有采取堵漏措施的情况下，必须保持稳定燃烧。否则，大量可燃气体泄漏出来与空气混合，遇点火源就会发生爆炸，造成严重后果。

(2) When extinguishing an explosives fire, using sand to cover the fire shall be avoided to prevent explosive power of explosives from increasing. In addition, when extinguishing an explosives stack fire, the water flow should be sprayed in hoisting way to prevent the strong water flow from directly impacting the stack so as to avoid the collapse of the stack, causing another explosion.

扑救爆炸物品火灾时，切忌用沙土盖压，以免增强爆炸物品的爆炸威力；另外扑救爆炸物品堆垛火灾时，水流应采用吊射，避免强力水流直接冲击堆垛，以免堆垛倒塌引起再次爆炸。

(3) When extinguishing a moisture-ignite flammables fire, it is absolutely forbidden to use wet fire extinguishing agents such as water, foam, acid and alkali to put out the fire. Generally, dry powder, carbon dioxide, or halon may be used to put out the fire. But carbon dioxide and halon is invalid for potassium, sodium, aluminum, magnesium, etc.

扑救遇湿易燃物品火灾时，绝对禁止用水、泡沫、酸碱等湿性灭火剂扑救。一般可使用干粉、二氧化碳、卤代烷扑救，但钾、钠、铝、镁等物品用二氧化碳、卤代烷无效。

(4) Solid moisture-ignite flammables should be covered with cement, dry sand, dry powder, diatomaceous earth, etc. For dust such as magnesium and aluminum powders, do not spray a pressurized extinguishing agent to prevent dust from blowing up, causing dust explosion.

固体遇湿易燃物品应使用水泥、干砂、干粉、硅藻土等覆盖。对镁粉、铝粉等粉尘，切忌喷射有压力的灭火剂，以防止将粉尘吹扬起来，引起粉尘爆炸。

(5) When extinguishing a flammable liquid flammables fire, straight stream water shall be used for a liquid that is lighter than water and insoluble in water, and spray water is often ineffective. Ordinary protein foam or light foam may be used to put out the fire. It is preferred that alcohol resistant foam shall be used to put out the water-soluble liquid fire.

扑救易燃液体火灾时，比水轻又不溶于水的液体用直流水、雾状水灭火往往无效，可用普通蛋白泡沫或轻泡沫扑救；水溶性液体最好用抗溶性泡沫扑救。

(6) When extinguishing noxious hazardous chemical and corrosive material fire, low-pressure water or spray water shall be used as possible to prevent noxious hazardous chemical and corrosive material from splashing. In case of acid or alkali corrosive material, it is preferred to prepare the appropriate neutralizing inhibitor to dilute and neutralize them.

扑救毒害和腐蚀品的火灾时，应尽量使用低压水流或雾状水，避免腐蚀品、毒害品溅出；遇酸类或碱类腐蚀品最好调制相应的中和剂稀释中和。

(7) Flammable solids, spontaneous combustion material fire may generally be extinguished with water and foam. As long as the combustion range is controlled, the fire may be extinguished gradually. However, fire extinguishment methods of a few of flammable solids and spontaneous combustion material are special. For example, 2,4-dinitroanisole, dinitronaphthalene and naphthalene are flammable solids that are apt to sublime. After they are heated, they may produce flammable vapors which may mixed with air and form explosive mixture, which are prone to explosion, especially indoors. During the fire extinguishment, the misty water shall be sprayed from above and around the burning area, and all ignition sources around the area shall be extinguished.

易燃固体、自燃物品火灾一般可用水和泡沫扑救，只要控制住燃烧范围，逐步扑灭即可。但有少数易燃固体、自燃物品的扑救方法比较特殊。如 2,4-一二硝基苯甲醚、二硝基萘、萘等是易升华的易燃固体，受热放出易燃蒸气，能与空气形成爆炸性混合物，尤其是在室内，易发生爆炸。在扑救过程中应不时向燃烧区域上空及周围喷射雾状水，并消除周围一切点火源。

3.3.4 Application method of conventional gas mask 常用防毒面具的使用方法

3.3.4.1 Application method of breathing apparatus 空气呼吸器使用方法

Air breathing apparatus is a positive pressure supply type breathing apparatus, and the air required for the human body to breathe is supplied by the air in the gas cylinder.

空气呼吸器为正压供给式呼吸器，人体呼吸所需空气靠贮气瓶中空气供给。

(1) Preparation before application

使用前准备工作

1) Open the cylinder switch, short alarm sound can be heard with the increasing pressure in pressure regulator, piping system. After the gas cylinder switch is fully opened, check the drum pressure of the gas cylinder, which should be more than 3/4 (28 to 30MPa). Or observe the

position of the bottle head, the position pointed by the pointer shall generally be more than 20MPa. The cylinder shall be replaced if the pressure is less than 20MPa.

打开气瓶开关，随着减压器、管路系统中压力的上升，会听到警报器发出短暂的音响。储气瓶开关完全打开后，检查气瓶的贮存压力，一般应在 3/4 以上（28~30MPa）。或观察储气瓶瓶头处，指针所指位置，一般应在 20 MPa 以上，低于 20 MPa 应更换气瓶。

2) Close the cylinder switch, and observe the reading of pressure gauge; if the pressure drop in 5 minutes is not greater than one scale division (2Mpa), this means HP sealing of air supply piping system is under good conditions.

关闭气瓶开关，观察压力表的读数，在 5 分钟时间内压力下降不大于一格（2MPa），表明供气管系统高压气密完好。

3) After airtightness of the high-pressure system is under good conditions, open the supply valve switch, and observe the change of indicating value of pressure gauge. When the cylinder pressure drops below 1/4 (4 to 6MPa), the alarm horn sounds, and purge vent line of the alarm one time.

高压系统气密性完好后，打开供给阀开关，观察压力表示值变化，当气瓶压力降至 1/4 以下（4~6MPa），警报器气笛发出音响，同时也是吹洗一次警报器通气管路。

Note: When air breathing apparatus isn't used, monthly check it according to this method.

注：空气呼吸器不使用时，每月按此方法检查一次。

（2）Application method

佩戴方法

1) Prior to use, first close the supply valve transfer and bypass switches, and open the gas cylinder switch.

使用前首先关闭供给阀转换开关、旁路开关，打开储气瓶开关。

2) Place the breathing apparatus on back (Cylinder switch part is downward), and adjust shoulder straps, belts according to the body situation in such a way that it should fit the body fit, and secure and comfortable.

将呼吸器背在人体身后（气瓶开关部份向下），根据身材调节肩带、腰带、以合身牢靠、舒适为宜。

3) Wear a full face mask, and tighten the full face tie so that the full face well fits the face. The tie shall not be over-tightened. The face shall feel comfortable, and be free from obvious pressure and headache. Then insert the quick plug, and insert it firmly. At this time, take a deep breath, and the switch will automatically be started. Take 2 or 3 deep breaths, and feel comfortable. When holding the breath, the supply valve shall stop supplying air. Check that the full face mask shall proper fit the face based on the following method: block the quick air port under the mask with your palm, and take deep breath several times so that the air in the mask is used up. The mask body shall move to the human face, and the mask shall be kept under negative pressure. The human body feels that breathing is difficult, this means that the mask and the face have good air tightness. The time should not be too long. It is enough to take a few breaths.

佩戴上全面罩，将全面罩系带收紧，使全面罩与面部贴合良好。系带不必收得过紧，面部应感觉

舒适，无明显的压迫感及头痛，然后将快速插头插好、插牢，此时深吸一口气，转换开关自动开启。进行 2~3 次的深呼吸，感觉舒畅，屏气时，供给阀门应停止供气。检查全面罩与面部是否贴好的方法是：用手掌堵住面罩下方的快速接口、深呼吸数次，将面罩内气体吸完。面罩体应向人体面部移动，面罩内保持负压，人体感觉呼吸困难，证明面罩和面部有良好气密性，时间不宜过长，深吸几次气就可以了。

4) When wearing different series of air breathing apparatus, the wearer should observe the indicating value of the pressure gauge at any time during the use. When pressure in cylinder is decreased to less than 1/4 (4 to 6MPa), the alarm will give alarming sound, the user shall immediately evacuate from site.

在佩戴不同系列的空气呼吸器时，佩戴者在使用过程中应随时观察压力表的指示数值。当压力下降到 1/4 以下（4~6MPa）或警报器发出警报音响时，应撤离现场。

5) Loosen the belt clip of full mask and remove the full mask after use, close the supply valve switch. Remove the breathing apparatus from body and close the cylinder switch. Place the supply valve transfer switch in the open position to release residual air from the breathing apparatus.

使用后将全面罩系带卡子松开，从面部摘下全面罩，同时将供给阀转换开关置于关闭状态。从身体上拆下呼吸器，关闭气瓶开关。将供给阀转换开关置于开启位置，将呼吸器内残留气体释放出来。

(2) Important notes

注意事项

1) The used air breathing apparatus shall fully be inspected monthly.

使用过的空气呼吸器每月应进行一次全面检查。

2) The pressure gauge for air breathing apparatus shall be calibrated annually.

空气呼吸器用的压力表每年应校对检查一次。

3) After air pressure of air breathing apparatus drops below 1/4 (6 MPa) or the alarm is activated during the use, the operator in the noxious area must be evacuated as soon as possible.

空气呼吸器在使用过程中气压降到 1/4 以下（6MPa）或报警器报警后，在毒区的作业人员必须尽快撤离。

4) For operations in noxious area, it is strictly forbidden to remove the air breathing apparatus mask when not leaving the noxious area.

在有毒区域内作业，严禁在没离开染毒区域时摘下空气呼吸器面罩。

5) Prior to use of the air breathing apparatus, the cylinder valve must be opened first. Do not wear the mask until the reading of pressure gauge shall be more than 1/2 (i.e. 20 minutes), 15 MPa. It is forbidden to open the cylinder valve after wearing the mask.

在使用空气呼吸器前，必须先打开气瓶阀门，气压表读数在 1/2（即 20 分钟）、15MPa 以上方可戴上面罩进行作业，严禁先戴面罩后开气瓶阀门。

6) Only trained, qualified personnel may wear air breathing apparatus and enter the noxious zone to perform operations.

未经佩戴训练的人员，不能佩戴空气呼吸器进入毒区内作业。

7) Only air protection specialist is allowed to perform troubleshooting, adjustment and calibration of the air breathing apparatus.

非气防专业人员不得私自处理空气呼吸器发生的故障或调校空气呼吸器。

8) Lenses in full face mask shall often be kept clean and clear.

全面罩的镜片应经常保持清洁、明亮。

3.3.4.2 Safe operation method of filter type gas mask 过滤式防毒面具安全使用方法

(1) Range of safety use

安全实用范围

The filter type gas mask with tube is used for the atmosphere with oxygen concentration not less than 18%, toxic material concentration not greater than 1% (ammonia 2%).

带导管过滤式防毒面具是用于空气中氧含量不低于 18%，有毒有害介质不高于 1%（氨 2%）的环境。

1) No. 3 canister (brown) is used to prevent steam and toxic gases such as chlorine, benzene, carbon disulfide and steam.

3 号滤毒罐（褐色）用于防范氯、苯、二硫化碳等有毒气体与蒸汽。

2) No. 4 canister (gray) is used to prevent toxic gases such as ammonia and hydrogen sulfide.

4 号滤毒罐（灰色）用于防范氨、硫化氢等有毒气体。

3) No. 5 canister (white) is used to prevent toxic gases such as carbon monoxide.

5 号滤毒罐（白色）用于防范一氧化碳等有毒气体。

(2) Maintenance

维护保养

1) The spare filter type gas mask at site shall be placed in dedicated cabinet; the cabinet shall be sealed; the gas mask shall be placed in dry and cool place to avoid exposure to acid, alkaline, or toxic material and etc.

现场备用的过滤式防毒面具应放在专用的柜内，柜上应贴封条，应防潮、防高温，禁止与酸、碱、油类或有毒等物品接触。

2) The talcum powder shall be placed on the rubber parts of bow cap in case of long term drum to assure the completeness.

长期存放的头罩应在橡胶部位均匀撒上滑石粉，以保持完好。

3) The top cover and bottom plug of used canister shall be covered and plugged respectively to avoid humidity and toxic gas entering canister and affect the performance.

使用后的滤毒罐应将顶盖、底塞分别盖上、堵紧，防止罐内滤毒药剂受潮或吸附有毒气体，以致影响防毒效能。

4) The canister for normal use shall be inspected once per quarter, and once per year for stored canister; the canister that cannot be reused shall be timely scrapped with new filtration agent.

常用的滤毒罐每季度检查一次；长期存放的滤毒罐每年检查一次；对于失效的滤毒罐，则应及时报废，更换新的滤毒药剂。

(3) Application method

使用方法

1) The bow cap, air tube shall be checked for damage, blockage, connection tightness, breath valve fitness; and the canister shall be checked for top cover and bottom plug availability, proper packaging; the canister shall not be used if any defect is found.

检查头罩、导气管有无缺件、损坏、漏气、堵塞，连接是否紧密牢固，呼吸阀是否好用；滤毒罐有无顶盖、底塞，有无装填不实现象，如不合格严禁佩戴。

2) Removing the rubber plug at bottom of canister.

拔去滤毒罐底部胶塞。

3) Putting on the bow cap on head from bottom to top; the eye window shall be placed at 1cm below the eye location.

把头罩从下至上套在头上，眼窗中心位置在眼睛正前方下一厘米左右。

4) Taking deep breath several times, and entering site after confirming the canister is at normal conditions.

深呼吸数次，确认正常后方可进入现场。

5) Working within the specified protection and shall not work overtime.

要在药品规定的标准防毒时间范围内作业，不得超时间作业。

3.3.5 Emergency rescue and evacuation knowledge 应急救护与逃生知识

3.3.5.1 Emergency response principles 应急原则

all personnel participating in the emergency response plan must perform the work according to instruction and following principles to prevent accident from occurring and dispersing, minimize the personal injury and assets loss.

应急指挥人员为了尽快扼制事故发生和蔓延，尽可能减少人员伤亡和财产损失，所有参与应急计划实施的人员必须做到一切行动听指挥，必须遵守以下应急原则：

(1) The person shall be rescued first then the goods in case of emergency situation; alarm must be first given before fire extinguishing in case of serious fire accident.

一般要先救人后救物。

(2) Alarm must be first given before fire extinguishing in case of serious fire accident.

重大火灾先报警后灭火。

(3) The feedstock shall be first isolated to avoid explosion in case of fire on flammable gas.

可燃气体泄漏着火，不应立即扑灭火灾，应先进行隔离以防爆炸。

(4) The site fire sources shall be controlled first in case of leakage of large quantity of liquid hydrocarbon, gas.

大量液态烃、瓦斯泄漏应先控制现场各种火源。

(5) Vessel shall be vented firstly to prevent from explosion.

容器先泄压以防爆炸。

(6) The emergency response personnel shall first protect themselves before rescue the site poisoned persons; the victims shall be sent to first aid center. First aid shall be provided first to

poisoned victims and those suffered from cardiac arrest (artificial respiration and external chest compression).

现场中毒窒息人员抢救，首先应做好自身防护，抢救出来的伤员送急救中心。中毒和心跳停止的伤员立即现场急救（做人工呼吸和胸外心脏挤压法）。

（7）Large quantity of clean water shall be used to flush the affected position for at least 15min in case of chemical burn and corrosion (such as ammonia water); the wounded area of fracture or electric arc burn shall be protected to avoid water or impurities.

化学品的灼伤腐蚀（如氨水）首先要对患处用大量清洁水冲洗至少 15 分钟，骨折或电弧烧伤者应先保护创面，禁止沾水或杂物。

3.3.5.2 Protection regulations and first aid principles for toxicosis and asphyxia 中毒窒息的防护规定和急救原则

（1） Basic requirements

基本要求

1) The operation, maintenance and other personnel must receive the safety education before work, including basic property of hazardous material of each production plant and position. Proficiency in safety procedures; proficiency in the operation, maintenance and drum of personal protective equipment at all levels; proficient in the basics of self-rescue and mutual rescue.

熟练掌握安全规程；熟练掌握各级防护用品的使用、维护保养；熟练掌握自救、互救的基本要领。操作、检修及其他有关人员上岗前接受安全教育，内容包括：了解生产装置、岗位有毒有害物质的基本性质；熟练掌握安全规程；熟练掌握各级防护用品的使用、维护保养；熟练掌握自救、互救的基本要领。

2) The internal personnel of the operation department, and the machine maintenance, electrical, instrumentation and laboratory personnel who directly serve the production must periodically participate in physical examination before work and after working for certain years; the personnel with occupational contraindication shall not perform the relevant work.

运行部内部职工及直接为生产服务的机修、电气、仪表、化验等人员，上岗前须经过身体检查，在岗位工作一定年限后应定期接受身体检查，有职业忌症者不得从事岗位操作。

3) The operation department shall irregularly require the relevant departments of the plant to perform inspection based the change of the materials and products produced, timely grasp the types and distribution of toxic and hazardous substances, and demarcate the key management scope together with the safety supervision department, and formulate the operation protection and monitoring measures, file them in the production dispatching department.

运行部应根据生产的物料及产品变化情况，不定期地报厂有关部门对其进行检测，及时掌握有毒有害物质的种类和分布，会同安监部门划定重点管理范围，拟定作业防护以及监护措施，并在生产调度部门备案。

（2） PPE provision and application regulations

防护装备的配置与使用规定

1) The operation department shall be provided with first aid apparatus box, the following first aid apparatus in box (respirator, filter type gas mask, stretcher, fire clothes, organic glass mask, protective gloves, oil-resistant boots, safety rope, safety belt) shall be periodically inspected to ensure that they shall be under good conditions.

运行部应配急救器材箱，箱内必备下列急救用品。空气呼吸器、过滤式防毒面具、担架、防火服、有机玻璃面罩、耐酸碱手套、耐油靴、安全绳、安全带。要定期检查保证齐全完好。

2) Filter type gas mask and respiratory apparatus shall be provided for positions exposure to H₂S for normal operation and accident treatment.

有硫化氢岗位配备过滤或防毒面具和空气呼吸器，供正常操作和处理故障时使用。

3) Automatic detector and alarm shall be installed at the places with presence of H₂S, to monitor the concentration of H₂S.

在硫化氢存在的场所，安装自动监测报警器，随时监测硫化氢的浓度状况。

(3) Site first aid principles

现场急救原则

1) If anyone is found poisoned or injured, first of all ensure own security, then immediately remove the victim to safe place for rescue, and dial 9120 for help, and report to HSE department and dispatching department provided that the safety of rescue personnel can be assured.

发现有人中毒或其他伤害，在确保自身安全的情况下，应立即将受害者移出毒区进行抢救，并拨打 9120 电话，向 HSE 部和调度部汇报。

2) When more than one person are found poisoned, the foreman on duty shall immediately organize the duty personnel to perform rescue work, cut off the poison source and take the victims out of the dangerous area.

在发生多人中毒的情况下，当班班长应迅速组织班员进行救护工作，在确保自身安全的情况下，迅速切断毒源，把患者抢救出毒区。

3) Under accident conditions, the emergency care personnel must wear anti-virus equipment to enter the noxious area to perform first aid of the victim. In the process of first aid, the emergency care personnel must pay attention to the operating conditions of their anti-virus equipment. If they feel difficulty breathing or uncomfortable, they shall immediately withdraw from the noxious area.

在事故状态下，救护人员必须戴好防毒器材进入毒区抢救患者，在抢救的过程中，救护人员必须注意自己防毒器材的使用情况，若感到呼吸困难或身体不舒服时，应立即退出毒区。

4) Two workers must form one group when entering the area with hazardous poison area. Rubber clothes, rubber boots and rubber gloves must be used with entering the poisonous area of ammonia, chlorine, H₂F, NO_x or acid, alkali, liquid ammonia, methanol spraying.

进入危险性较大的毒区时，必须两人一组，进入高浓度的氨气、氯气、氟化氢、氮氧化物或有酸碱、液氨、甲醇喷溅的毒区，必须穿戴胶皮防护服、胶皮靴、胶皮手套。

5) If the accident involves fracture and burn, special attention shall be paid to avoid harmful consequences. If the victims cannot be removed from the area, relevant gas masks must be used.

事故区伴有骨折、烫伤的患者。应仔细加以防护，以免造成不良后果。若不能将患者迅速移出毒区，须给其戴上相应的防毒面具。

6) The victims shall be placed at locations with proper ventilation and temperature conditions after removing from hazardous area; the clothes and belt shall be immediately loosened to assure the smooth breath. The contaminated clothes must be removed and proper measures shall be adopted to keep warm.

患者移出毒区后，应放在空气流通和温度适宜的地方，立即解开衣领、腰带等，以保持患者的呼吸畅通。如患者的衣服被毒物污染，须脱去衣服，在冬天应注意给患者保暖。

7) If the victims suffer from breathing cease or dyspnea, artificial respiration shall be given. The victims suffering from H₂S, CO toxicosis, nitrogen, CO₂ asphyxia shall be treated via resuscitator or artificial respiration; cardio-pulmonary resuscitation shall be used in case of cardiac arrest.

如患者呼吸已停止或呼吸困难时，应立即进行人工呼吸，硫化氢、一氧化碳中毒，氮气、二氧化碳窒息的患者，可使用苏生器或人工呼吸的方法来急救；如患者心跳停止时，应立即施行心肺复苏急救。

8) Cardiac massage type artificial respiration shall be prohibited for victims suffered from chlorine, ammonia, NO_x toxicosis, and only mouth-to-mouth resuscitation or oxygen therapy is allowed. Common artificial respiration is only used for breath cease due to electric shock.

对于氯气、氨气、氧化氮中毒的患者，禁止使用压迫式人工呼吸的方法，只允许施行口对口人工呼吸或给予输氧抢救。只有在“电击式”呼吸停止时才允许使用一般的人工呼吸方法。

9) Resuscitator or artificial respiration method shall be prohibited for secondary dyspnea, and only oxygen therapy is allowed. The victims shall be timely sent to hospital for treatment.

对于继发性呼吸困难者，严禁使用苏生器或人工呼吸的方法来急救，只能给予输氧，并应尽快将患者转交医院处理。

10) Oxygen therapy treatment must be used immediately for victims suffered from dyspnea and cyanosed face; victims suffered from H₂S and CO toxicosis shall be treated via hyperbaric oxygen chamber.

对于呼吸困难者面色青紫的患者，应迅速给予输氧，硫化氢和一氧化碳中毒的患者，最好给予高压氧仓治疗。

11) Artificial respiration or cardio-pulmonary resuscitation must be performed until the victim shall be capable of steady spontaneous breathing or has died based on verification by a doctor. After the first aid is completed, the person in charge of first aid may leave the first aid site only when he/she has explained the first aid operations to the doctor.

人工呼吸或心肺复苏术必须进行到患者能进行稳定自主呼吸或经医生鉴定确已死亡为止。急救完毕，救护负责人应将救护情况向医生交代清楚后，方可离开救护现场。

12) Personnel who enters the noxious area to participate in the first aid must ensure clear division of labor, responsibility to the people, unified command, and orderly operations.

凡进入毒区参加抢救的人员，必须做到分工明确，责任到人，统一指挥，有条不紊。

3.3.5.3 Artificial respiration (cardio-pulmonary resuscitation) 人工呼吸（心肺复苏）

The artificial respiration method is suitable for victim whose breathing has stopped, but whose heart is still beating or just stopped, and whose body temperature is kept.

人工呼吸法适用于呼吸已停止，但心脏仍跳动或刚刚停止，还有体温的患者。

(1) Preparation for implementation of compression artificial respiration

施行压迫式人工呼吸法的准备

Remove the victim from the site, and place him/her in a suitable place with good ventilation and suitable temperature, immediately unfasten his/her collar and belt, etc. to ensure that the victim's respiratory tract shall be unobstructed. Take off the clothes affecting breathing. In winter, special attention shall be paid to keep the victim warm to prevent him/her from catching a cold.

把患者抬出现场放置在空气流通和温度适宜的地方，立即解开其衣领、腰带等，以保持患者的呼吸道畅通。脱去妨碍呼吸的衣服，在冬天应注意给患者保暖，防止受冷。

Carefully check the victim's chest, back, upper arm for fractures, dislocations and severe burns.

If the above wound is found, compressional artificial respiration shall not be performed;

仔细检查患者的胸部、背部、上臂有无骨折、脱臼、严重灼伤，否则不能进行压迫式人工呼吸法；

Open the victim's mouth, remove the blockage such as dentures, food, blood clots, etc. in his/her mouth, and pull out the tongue to ensure the airway is unobstructed.

使患者嘴张开，清除患者口腔内的假牙、食物、血块等堵塞物，拉出舌头保证呼吸道畅通。

(2) Compression artificial respiration shall be carried out according to the following requirements:

压迫式人工呼吸法应按下列要求进行

1) Place the victim on a hard flat surface and in a supine position with a slightly padded back.

把患者放在硬质平地，并处于仰卧位状，背部稍加垫。

2) The first aid personnel shall straddle and kneel on both sides of the victim's waist, extend all of fingers of both hands, place the thumb inward on the lower part of the thorax, and place the remaining four fingers on the thoracic ribs.

救护人员分腿跪在患者的腰部两侧，双手五指伸开，拇指向内放在胸廓下部，其余四指向外放在胸廓肋骨上。

3) The emergency care personnel's forearm shall be straight downwards, slightly compress forwards so that exhalation may be formed, and then release both hands so that the inspiration may formed by restoring to the original shape under action of the victim's thoracic elasticity. Repeatedly perform above steps.

施救人员前臂伸直向下，稍向前压迫，形成呼气，然后放开双手，利用患者胸廓弹性恢复原状形成吸气，如此循环进行。

Important notes:

注意事项:

1) The compression on the chest shall not too strong, and the movement shall be moderate and uniform to prevent fracture. The frequency is 14 to 16 times per minute.

压迫胸部不可用力过猛，动作要缓和、均匀，以防骨折。每分钟频率为 14~16 次。

2) Do not compress the stomach of the victim to prevent the food from being squeezed out and

inhaled into the lungs.

不得压迫患者胃部，以防压出食物，吸入肺部。

3) Interruption isn't allowed, and there must be replacement personnel. The frequency after replacement shall be the same as the original that.

不得间断，必须有人替换，替换后频率应与原动作频率相同。

4) When artificial respiration is performed, have patience to perform this operation until the victim has established stable spontaneous breathing or the doctor confirms death. Do not stop or interrupt the operation in the midway.

施行人工呼吸时，应耐心施行到患者出现稳定自主呼吸或医生确定死亡为止，中途不得停止或间断。

(3) Mouth-to-mouth respiratory method

口对口人工呼吸法

1) The mouth-to-mouth artificial respiration method shall be carried out in accordance with the following requirements. The preparation work is the same as that of compression artificial respiration method.

施行口对口人工呼吸方法应按照以下各项要求进行，其准备工作同压迫式人工呼吸方法。

Keep the victim's head backwards as possible with the nostrils facing up, and the head shall not raised by padding it.

使患者的头部尽量后仰，让鼻孔朝上，头部不要垫高。

2) The emergency care personnel shall kneel on the left or right side of the victim's head, use one hand to pinch the victim's nostrils, and use the other hand's thumb and forefinger to open their mouths. If the mouth isn't opened, expire air to naris.

救护人员跪在患者头部的左边或右边，用一只手捏紧患者的鼻孔，另一只手的拇指和食指掰开嘴巴，如不掰开嘴巴，可向鼻孔吹气。

3) After deep breathing, close the victim's mouth, and expire the air into it (or through a layer of gauze). When expiring the air, make sure that the victim's chest shall be swelled. Expire the air for two seconds, and stop for three seconds. 14 to 16 times per minute is preferred.

深呼吸后，紧帖掰开患者的嘴吹气（也可隔一层纱布），吹气时，要使患者的胸部膨起，吹气二秒，停三秒，每分钟 14~16 次为宜。

4) When the emergency care personnel inspires air after expiring the air, relax the victim's mouth or nose, and let him/her inspire air automatically. Insist on these operations without interruption until the doctor participates in the first aid.

救护人员吹气后换气时，放松患者的嘴或鼻，让其自动换气。应坚持进行，不可中断，直至医生参加抢救为止。

(4) For the example of heartbeat stopping, the first-aid measures to restore the heartbeat should be used, i.e. put the left palm on the victim's left chest, and lightly tap on it several times with the right hand. If the heartbeat has not recovered, perform first aid with the chest compression method while performing mouth-to-mouth resuscitation.

对停止心跳的例子，适宜采用恢复心跳的急救措施，即用左手掌放在患者的左胸口上，用右手在

掌上轻击数下，若心跳仍未恢复，应采用胸外心脏挤压法进行抢救，并同时进行口对口人工呼吸。

(5) When performing cardiopulmonary resuscitation, comply with the following requirements: 作心肺复苏术时，须按以下要求进行：

1) Release the victim's clothes, place the victim on the ground in a supine position, and do not place him/her in a soft place.

将患者衣服解开，仰卧在地上，不可躺在松软的地方。

2) The emergency care personnel shall straddle and kneel on both sides of the victim's waist, fold their hands, and place the roots of the palms at the position slightly higher than heart home so that the roots of the palms is located at 1/3 of lower part of the sternum.

救护人员分腿跪在患者的腰部两侧，双手相叠，手掌根部放在心口窝稍高一点的地方掌根部放在胸骨下部 1/3 处。

3) With the gravity of the upper body of the emergency care personnel, the roots of the palm is rhythmically pressed in the impact vertically downwards (in the direction of the spine), causing the sternum to sink 3 to 5 cm; press it once per second.

以救护人员上身的重力，用手掌根有节奏地冲击地垂直向下（脊椎的方向）挤压，使胸骨下陷至少 5~6cm，每秒种挤压一次。

4) After pressing, the rear of the palm root shall be quickly relaxed, allowing the victim's chest to recover automatically, and heart is filled with the blood again. Each time relax the palm, the palm shall not leave the chest wall. Insist on these operations without interruption until the doctor participates in the first aid.

挤压后，掌根很快后部放松，让患者胸部自动复原，血又充满心脏，每次每次放松使手掌不必离开胸壁。应坚持进行，不可中断，直至医生参加抢救为止。

3.3.5.4 On-site first aid of skin and eye chemical burns 皮肤及眼化学性灼伤现场急救

(1) Strong acid burns

强酸灼伤

Rinse immediately with plenty of running clean water. The rinsing time shall generally be not less than 15 minutes. Avoid using hot water. After thorough rinsing, it can be neutralized with 2 to 5% sodium hydrogencarbonate solution, light lime water, soapy water, etc. Before thoroughly rinsing the skin with plenty of running water, avoid direct neutralization on the skin with basic drugs, which will aggravate skin damage. Do not neglect special parts such as the scalp, hands, perineum and wrinkles when flushing.

立即用大量流动清水冲洗，冲洗时间一般不少于 15 分钟，忌用热水。彻底冲洗后可用 2~5% 碳酸氢钠溶液、淡石灰水、肥皂水等进行中和。切忌未经大量流水彻底冲洗，就用碱性药物在皮肤上直接中和，这会加重皮肤的损伤。冲洗时切勿疏忽头皮、手、会阴及皱褶部位等特殊部位。

When strong acid splashes into the eye, immediately flush it with plenty of water or saline. Rinse the head under the faucet so that the rinsed water flows down from the sacral side of the injured eye to prevent the acid flushing solution from entering the uninjured eye. The rinsing time shall be no less than 15 minutes. When rinsing, the upper and lower eyelids shall be opened, so that

the acid does not remain in the eye and the lower humerus, forming a dead space resulting from remained acid. If there is no flushing equipment, immerse the eye in the basin filled with clear water, pull the lower eyelid, swing the head, and wash off the acid. After the above treatment, immediately sent the vicmit to the ophthalmology department for treatment.

强酸溅入眼内时，现场立即用大量清水或生理盐水冲洗，冲洗应将头置于水龙头下，使冲洗后的水自伤眼的颞侧流下，避免带酸的冲洗液进入好眼。冲洗时间应不少于 15 分钟。冲洗时应拉开上下眼睑，使酸不至于留存眼内和下穹隆形成留酸死腔。如无冲洗设备，可将眼浸入盛清水的盆内，拉开下眼睑，摆动头部，洗掉酸液。经上述处理后，立即送眼科进行治疗。

(2) Alkali burns

碱灼伤

Immediately rinse with plenty of running water until the soapy material disappears, then rinse further with 1-2% acetic acid or 3% boric acid solution. Eye washing of alkali burns are the same as that of acid burns. After thorough rinsing, 2 to 3% boric acid solution may be used for further rinsing.

立即用大量流动清水冲洗至皂样物质消失为止，然后再用 1~2%醋酸或 3%硼酸溶液进一步冲洗。眼部碱灼伤清洗同酸灼伤。彻底冲洗后，可用 2~3%硼酸溶液作进一步冲洗。

3.3.5.5 Safe escape 安全逃生

(1) When there is a small area of fire, the towel may help save the escape. If there is way for escape in the event of a fire, put a wet towel on your nose and mouth to avoid burning of respiratory system by hot air flow. Generally, the smoke removal rate may reach 60% if the towel is folded in 8 layers. If trapped in a fire, quickly close all exits leading to the fire, then open the door and window to the outside, take out the towel and constantly wave it, and send a distress signal to the passing people.

当出现小面积失火时，毛巾可以帮助自救逃生。假如在火灾发生时还能夺路逃生的话，可以把湿毛巾叠起来捂住口鼻，这样可以避免热气流对呼吸系统的灼伤。一般说来，毛巾叠 8 层，除烟率可达到 60%。发生火灾时若被困住，要迅速关闭所有能通向火场的出口，然后打开通向外边的门窗，取出毛巾不停地挥动，向过往群众发出呼救信号。

Towels may also help with the rescue. When rescuing the trapped comrades in the fire, cover the face and head of the rescued person with a wet towel to prevent the rescued person from burning when passing through the fire zone.

毛巾还可以帮助抢救。在火场抢救被困同志时，要用湿毛巾把被救者的脸和头部盖住，以免穿过火区时被救人员烧伤。

(2) The rescued person burned in the fire zone. If the rescued person has been burned, you may also cover the injured portion with a towel to avoid wound infection. To avoid burns on your hands, pad a wet towel on your hands will solve the problem when you are rushing to transport your belongings in a fire.

火区时被救人员烧伤。如被救人员已烧伤，也可以用毛巾将伤部盖住，以免伤口感染。在火灾中抢运被烧的财物时，为避免手部烫伤，垫上一条湿毛巾就会解决问题。

(3) Escape rehearsal to ensure be calm in danger. Everyone shall be aware of the construction of the equipment and the escape route, actively participate in emergency escape rehearsals, familiar with fire facilities and self-rescue escape methods. In this way, when a fire occurs, you will not feel that there is no way to escape.

逃生预演，临危不乱。每个人对装置结构及逃生路径要做到了然于胸，积极参加应急逃生预演，熟悉消防设施及自救逃生的方法。这样，火灾发生时，就不会觉得走投无路了。

(4) Familiar with the environment, and keep in mind the exits. For your own safety, be sure to pay attention to evacuation passages, safety exits, and stairway orientations so that you may escape from the site as soon as possible.

熟悉环境，牢记出口。为了自身安全，务必留心疏散通道、安全出口及楼梯方位等，以便关键时刻能尽快逃离现场。

(5) The exit of the passage shall be unobstructed. Stairs, passages, safety exits are the most important escape routes in the event of a fire. They shall be unobstructed, free from stacked matters or locked so that they may be pass through safely and quickly in an emergency.

通道出口，畅通无阻。楼梯、通道、安全出口等是火灾发生时最重要的逃生之路，应保证畅通无阻，切不可堆放杂物或设闸上锁，以便紧急时能安全迅速地通过。

(6) Fight small fires, and benefit others. When a fire takes place, if the fire behavior is not large, and has not caused a great threat to people, you shall try to control and extinguish the small fire when there are enough fire-fighting equipment around such as fire extinguishers and fire hydrants. Do not panic, scream and run helter-skelter. Seting aside small fire will cause disaster. 扑灭小火，惠及他人。当发生火灾时，如果发现火势并不大，且尚未对人造成很大威胁时，当周围有足够的消防器材，如灭火器、消防栓等，应奋力将小火控制、扑灭；千万不要惊慌失措地乱叫乱窜，置小火于不顾而酿成大灾。

(7) Keep calm, clearly identify direction, and quickly evacuate. In the event of a fire, in the face of heavy smoke and fire, you must first force yourself to remain calm, quickly determine dangerous and safe locations, decide on ways to escape, and evacuate the dangerous site as soon as possible. Do not blindly follow others, get crowded and chaotic, and run helter-skelter. When evacuating, be careful to run in a bright place or outside open site, and try to run below the floor. If the passage has been blocked by fire and smoke, you shall leave opposite to fire, and escape to outside through the balcony, air window, roof, etc.

保持镇静，明辨方向，迅速撤离。突遇火灾，面对浓烟和烈火，首先要强令自己保持镇静，迅速判断危险地点和安全地点，决定逃生的办法，尽快撤离险地。千万不要盲目地跟从他人和相互拥挤、乱冲乱窜。撤离时要注意，朝明亮处或外面空旷地方跑，要尽量往楼层下面跑，若通道已被烟火封阻，则应背向烟火方向离开，通过阳台、气窗、天台等往室外逃生。

(8) Not in danger, not greed. In the fire site, human life is the most important. When you are in danger, you shall evacuate as soon as possible. Don't waste your precious time on dressing or looking for and moving away from valuables because you are shy or take care of valuables. Personnel who have fled the danger do not return to the dangerous site, and hurl themself willingly into the net.

不入险地，不贪财物。在火场中，人的生命是最重要的。身处险境，应尽快撤离，不要因害羞或顾及贵重物品，而把宝贵的逃生时间浪费在穿衣或寻找、搬离贵重物品上。已经逃离险境的人员，切莫重返险地，自投罗网。

(9) Simple protection, covering nose and creeping. When escape, prevent smoke poisoning and suffocation since you will pass through a smoke-filled route. To prevent from inhaling dense smoke in fire site, you may cover your nose with a towel, and creep and evacuate. The smoke is lighter than the air, and floats on the upper part. It is the best way to avoid the inhalation of smoke and filter out the toxic gas that evacuate in the way closing to ground. When passing through the fire-blocking area, wear protective masks, helmets, fire-retardant insulation suits, etc. If these protective gears aren't available, you may put cold water on your head or body, or wrap your head and body with wet towels, wet quilts, wet blankets, and then rush out.

简易防护，蒙鼻匍匐。逃生时经过充满烟雾的路线，要防止烟雾中毒、预防窒息。为了防止火场浓烟呛入，可采用毛巾、口罩蒙鼻，匍匐撤离的办法。烟气较空气轻而飘于上部，贴近地面撤离是避免烟气吸入、滤去毒气的最佳方法。穿过烟火封锁区，应配戴防毒面具、头盔、阻燃隔热服等护具，如果没有这些护具，那么可向头部、身上浇冷水或用湿毛巾、湿棉被、湿毯子等将头、身裹好，再冲出去。

(10) Make good use of the passage, and do not get into the elevator. Buildings designed and built according to codes and standards will be provided with more than two escape stairs, passages or safety exits. In the event of a fire, you shall choose to enter a relatively safe stairway based on the situation. In addition to the use of stairs, you may also escape danger by climbing to the surrounding safe place by means of balcony, window sill, sky roof of the building and by sliding down the building along the downpipe, lightning protection line and other projections of building structures. In high-rise buildings, the power supply system to the elevator will be cut off at any time during the fire or the elevator will be deformed due to the heat, causing that people are trapped in the elevator. Meanwhile, the elevator shaft is like a through-hole chimney, the toxic smoke directly threatens the life of the trapped people, therefore, do not escape by ordinary elevators.

善用通道，莫入电梯。按规范标准设计建造的建筑物，都会有两条以上逃生楼梯、通道或安全出口。发生火灾时，要根据情况选择进入相对较为安全的楼梯通道。除可以利用楼梯外，还可以利用建筑物的阳台、窗台、天面屋顶等攀到周围的安全地点沿着落水管、避雷线等建筑结构中凸出物滑下楼也可脱险。在高层建筑中，电梯的供电系统在火灾时随时会断电或因热的作用电梯变形而使人被困在电梯内同时由于电梯井犹如贯通的烟囱般直通各楼层，有毒的烟雾直接威胁被困人员的生命，因此，千万不要乘普通的电梯逃生。

(11) Escape in slow falling, and save yourself by sliding down by the rope. If the safety passage has been blocked, and the rescuers cannot arrive at timely, you may quickly use the ropes or clothes around you to make a simple lifeline, and wet the lifeline with water, and then you may slide down from the window sill or balcony to the lower floor or the ground by means of the lifeline; safely escape.

缓降逃生，滑绳自救。安全通道已被堵，救援人员不能及时赶到的情况下，你可以迅速利用身边

的绳索或衣服等自制简易救生绳，并用水打湿从窗台或阳台沿绳缓滑到下面楼层或地面；安全逃生。

(12) Staying in refuge places, and waiting for rescue. If you feel hot by touching the door by hand, the flame and the smoke will come to the face at this time as soon as you open the door. The escape route was cut off, and there is no rescuer in a short time. At this time, it is possible to create a shelter in which sticking and waiting for rescue. Firstly, tightly close the doors and windows facing to the fire, and open the doors and windows opposite to the fire. Plug the door seams with wet towels, wet cloth, or cover the doors and windows with wetted quilt with water, and then continuously water the room to prevent the fire and smoke from entering, and stick to in the room until the rescuers arrive at.

避难场所，固守待援。假如用手摸房门已感到烫手，此时一旦开门，火焰与浓烟势必迎面扑来。逃生通道被切断且短时间内无人救援。这时候，可采取创造避难场所、固守待援的办法。首先应关紧迎火的门窗，打开背火的门窗，用湿毛巾、湿布塞堵门缝或用水浸湿棉被蒙上门窗然后不停用水淋透房间，防止烟火渗入，固守在房内，直到救援人员到达。

(13) Slowly shaking bright-colored clothes out of the window, throwing light and dazzling thing outside, and asking for help. Personnel who temporarily failed to escape since trapped by the fire shall stay in places such as balconies and windows that are easy to be found and may avoid fire and smoke as possible. During the day, you may shaking bright-colored clothes out of the window, or throw light and dazzling things outside. In the evening, you may continuously flash with the flashlight from window or knock on the things, and send out an effective distress signal timely to attract the attention of the rescuer. Because firefighters will explore along the wall when they enter the room, personnel fail to self-rescue capacity due to suffocation by the smoke shall try to roll to the wall or the door to facilitate the firefighters to find and rescue them. In addition, rolling to the wall may prevent from injury resulting from collapsed building structure.

缓晃轻抛，寻求援助。被烟火围困暂时无法逃离的人员，应尽量呆在阳台、窗口等易于被人发现和能避免烟火近身的地方。在白天，可以向窗外晃动鲜艳衣物，或外抛轻型晃眼的东西；在晚上即可以用手电筒不停地在窗口闪动或者敲击东西，及时发出有效的求救信号，引起救援者的注意。因为消防人员进入室内都是沿墙壁摸索行进所以在被烟气窒息失去自救能力时，应努力滚到墙边或门边，便于消防人员寻找、营救；此外，滚到墙边也可防止房屋结构塌落砸伤自己。

(14) Do not panic and run helter-skelter if the fire is already in the body. If someone on the fire site finds that there is a fire in his/her body, do not panic and run helter-skelter, or beat it with hands. This is because wind is formed when you run or beat fire, resulting in acceleratation of oxygen replenishment, and promotion of the fire. When the clothes on the body is ignited, quickly try to take off the clothes or roll on the ground to suppress the fire; jump into the water timely or to water the body; it is more effective to spray the fire extinguishing agent.

火已及身，切勿惊跑。火场上的人如果发现身上着了火，千万不可惊跑或用手拍打，因为奔跑或拍打时会形成风势，加速氧气的补充，促旺火势。当身上衣服着火时，应赶紧设法脱掉衣服或就地打滚，压灭火苗；能及时跳进水中或让人向身上浇水、喷灭火剂就更有效了。

(15) There is a skill in jumping off the building, survival is achieved although injury. People

who are in the fire smoke are often trapped in extreme horror, their spirit seems broken. The panic may easily lead to desperate behaviors such as escape by jumping off the building. It is noted that jumping off the building may be adopted only when the rescue air cushion has been prepared by the firefighters and jumping off the building shall be performed under the direction, or when the build floor isn't high (generally 4 floors or less), or when he/she will be died by burning if the non-jumping building is performed. Calmly wait for the rescue of firefighters if life has not been seriously threatened, even if there is no route of retreat. Jumping off the building also requires skills. When jumping off the building, try to jump to the middle of the rescue cushion, or choose to the direction where there is a pool, soft awning, grass. If possible, try to hold some soft items such as quilts, sofa cushions, or open a large umbrella to slow down the impact. If you jump off the building by hand, you must catch hold of the window sill or balcony to make the body sag naturally so as to reduce the vertical distance as much as possible. Before landing, you shall hold your head by both hands, and bend body into a ball to reduce the damage. Although jumping off the building may survive, it will cause certain damage to the body, so be careful and cautious.

跳楼有术，虽损求生。身处火灾烟气中的人，精神上往往陷于极端恐怖和接近崩溃，惊慌的心理极易导致不顾一切的伤害性行为如跳楼逃生。应该注意的是：只有消防队员准备好救生气垫并指挥跳楼时或楼层不高（一般 4 层以下），非跳楼即烧死的情况下，才采取跳楼的方法。即使已没有任何退路，若生命还未受到严重威胁，也要冷静地等待消防人员的救援。跳楼也要讲技巧，跳楼时应尽量往救生气垫中部跳或选择有水池、软雨篷、草地等方向跳；如有可能，要尽量抱些棉被、沙发垫等松软物品或打开大雨伞跳下，以减缓冲冲击力。如果徒手跳楼一定要扒窗台或阳台使身体自然下垂跳下，以尽量降低垂直距离，落地前要双手抱紧头部身体弯曲卷成一团，以减少伤害。跳楼虽可求生，但会对身体造成一定的伤害，所以要慎之又慎。

3.3.5.6 消防专业附件

- (1) 炼油一部灭火器明细统计表（查阅对应文件）
- (2) 炼油一部消防地管、消防干管及消防器材分布图（查阅对应文件）
- (3) 关键装置危险点风险评价识别表（查阅对应文件）(4) 常减压装置、轻烃回收装置、产品精制装置可燃有毒气体检测器布置图（查阅对应文件）

3.4 Technical regulations of environmental protection 环保技术规定

3.4.1 Wastewater discharge 废水排放

3.4.1.1 Various waste water produced under normal production, which contains solvent and oil such as sulfuric acid water in KO drums, shall be sent to the acidic water stripping unit where it is treated. Cooling water of rotating machinery seals shall be discharged into the oily water system. It is strictly forbidden to discharge oily water into the rainwater system.

正常生产下产生的各种可能携带溶剂、油污的废水，如各分液罐的含硫酸性水一律送至酸性水汽提装置进行处理，机泵密封冷却水等一律排入含油污水系统，严禁将含油的污水排入雨水系统。

3.4.1.2 When it is raining, check the oil content of the initial rainwater. The initial oily water shall not be discharged into the rainwater system, and shall be discharged to the sewage system.

下雨时检查初期雨水的含油情况，含油的初期污水不得排入雨水系统，需改排放至污水系统。

3.4.1.3 Oily wastewater produced by routine maintenance and repair of various equipment such as heat exchanger and rotating machinery shall be discharged into the oily water system. It is strictly prohibited to discharge it into the rainwater system or discharge it locally and arbitrarily.

日常抢维修各种设备，如换热器、机泵等产生的含油废水，应排入的含油污水系统，严禁排入雨水系统或就地乱排。

3.4.1.4 For oily wastewater produced during equipment start-up/shutdown or other abnormal production conditions such as cleaning the heat exchanger tube bundle, the contamination discharge application form shall be completed 48 hours in advance. The discharge may be performed after the relevant competent department shall designate the drainage point, which has been approved by the safety and environmental protection departments.

在装置开停工或因其它非正常生产状态所产生的含油废水，如清洗换热器管束等要提前 48 小时填写高浓度污水经异常排污申请审批后按照制定的方式外排，并由有关主管部门指定排水点、安全环保部现场确认审批后，方可按批复意见执行。

3.4.1.5 After a pollution accident occurs due to various reasons, the department management personnel shall report it to the environmental protection authority (including time, location, contaminated medium, hazards and possible causes, etc.) after receiving the report and confirming the pollution situation, and timely inform the downstream equipment (water supply and drainage) so that emergency treatment may be performed.

当因各种原因发生污染事故后，部门管理人员在接到报告，确认污染情况后，及时向环保主管部门报告（包括时间、地点、污染的介质、造成的危害以及可能的原因等），并将有关情况及时向下游装置（供排水）通报，以便进行紧急处理。

3.4.2 Exhaust gas emission 废气排放

3.4.2.1 The sources of exhaust gas of this plant are mainly the flare gas discharge during abnormal production and the cooking of equipment towers, drums and other equipment during shutdown.

本装置的废气来源主要为生产异常时的火炬气排放和停工时装置塔、罐等设备的蒸煮，还有加热炉烟气。

3.4.2.2 Various harmful gases may be generated during normal production. Special attention shall be paid to smooth operation. Properly maintain liquid level, improve quality of equipment maintenance, and minimize the discharge of various toxic and harmful gases.

正常生产时可能产生各种有害气体，要注意搞好平稳操作，保持好液位，强化设备维修质量，尽量减少各种有毒有害气体的排放。

3.4.2.3 A large amount of flare gas emissions must be reported to the company's dispatching

department so that to recovery and control of the flare gas shall be performed properly.

大量火炬气的排放必须向公司调度部门汇报，做好火炬气的回收与控制。

3.4.2.4 When the equipment such as towers, heat exchangers and rotating machinery is repaired, various toxic and harmful gases may be generated. Full treatment shall be performed in advance. Fluid in equipment shall be fully drained to reduce the generation of toxic and harmful gases.

当设备维修时，也可能产生各种有毒有害气体，如塔、换热器、机泵等，事前应进行充分处理，排净介质，减少有毒有害气体的产生。

3.4.2.5 In the event of exhaust gas emission resulting from startup/shutdown of the equipment or other abnormal production conditions, the contamination discharge application form shall be filled out and submitted to the environmental protection department one week in advance. The emission shall be in accordance with the requirements of the approval.

在装置开停工或其它出现非正常生产状态下出现的废气排放，按照环保信息管理的要求，及时通报相关环保信息。

3.4.2.6 In case emergency emission of a large amount of exhaust gas must be performed, the report, in which accident description, the composition and nature of emissions, and measures taken shall be indicated, shall be submitted to the environmental protection department within the specified time.

当因紧急情况必须排放大量废气时，应在规定时间内向环保主管部门补交报告，说明事故经过、所排废气的组分、性质、排放量及采取措施。

3.4.3 Solid waste discharge 固废排放

3.4.3.1 The solid waste of the plant is mainly generated during the overhauling. The overhauling of tower, drum and heat exchange maintenance will produce certain wastes such as oil residue and sludge waste.

装置固体废弃物主要产生于检修时，塔、罐、换热检修等会产生一定的油渣、油泥类废弃物，废弃的硒鼓目前由总经办统一回收。

3.4.3.2 During the overhauling, solid waste must be collected separately, and disposed of by a qualified environmental treatment company.

检修时，固体废弃物必须分类收集，由有资质的环保处理公司进行处理。

3.4.3.3 Waste gloves, rags and tapes produced during normal production shall be collectively collected, and disposed according to the requirements of company and local environmental protection. Oil-free domestic wastes such as paper scraps and lunch boxes may be sent to the domestic garbage bins. Minimize paper use, and implement paperless office. Discarded rechargeable batteries and toner cartridges shall be uniformly recycled and handed over to the safety and environment department for disposal.

在正常生产时所产生的废手套、抹布、胶带等集中收集，根据公司和当地环保规定进行处理；若为不含油的生活垃圾，如纸屑、餐盒等可送入生活垃圾箱内；尽量减少用纸，实行无纸化办公，

废弃的充电电池、硒鼓等具要统一回收、上交安环部处置。

3.4.3.4 For various chemical raw materials and their packaging materials required for normal production such as catalysts, barrels and bags, the solid waste disposal application form shall be filled out. After obtaining confirmation by the relevant competent department, submit it to the safety and environment department for approval, and then unified recycling of these wastes may be performed by a qualified company.

正常生产所需的各种化工原材料及其包装物，如催化剂、桶、袋等应填写固体废物处理申请单，经有关主管部门确认后，报安环部批准，由具有资质的单位进行统一回收。

3.4.4 Noise emission 噪声排放

3.4.4.1 Noise in the plant during normal production mainly comes from the operation of the rotating machinery and the blowers. Wear earplugs in areas with high noise, such as the pump area of the plant.

装置内正常生产期间的噪声主要来自于机泵和风机的运转，在噪声较大的区域，如装置的泵区等处应佩带耳塞。

3.4.4.2 A large amount of noise will also generated when the steam piping and equipment are emptied. A silencer shall be installed to eliminate noise.

在蒸汽管线设备需排空时也会产生很大噪声，应安装消音器以消除噪声。

3.4.4.3 Noise will also be generated during the shutdown, piping purging, startup, pressure test and discharge of the plant. When discharging, special attention shall be paid to control the opening of the valve, and install a silencer to reduce noise.

在装置停工扫线、开工试压排放时也会产生噪声，在排放时要注意控制阀门开度，并安装消音器，减少噪声。

3.4.4.4 Regularly inspect the noise in the site. Actively take measures for the out-of-specification area after inspection. The plant shall actively promote the application of low-noise equipment.

定期对现场噪声进行检测，对于超标的检测区域要积极采取治理措施，装置应积极推进低噪声设备的应用。

3.5 Safety, environmental considerations 安全、环保注意事项

3.5.1 According to the requirements of GB50058-92, *Electrical Installations Design Code for Explosive Atmospheres and Fire Hazard*, hazardous area shall be classified based on the explosive atmosphere and fire hazard environment of the installation. The fire hazard of the plant is classified as Category A, and the explosion and fire hazard is classified as Zone 2.

爆炸危险场所划分根据《爆炸和火灾危险环境电力装置设计规范》GB50058-92 的规定，按装置的爆炸危险环境和火灾危险环境进行区域划分。该装置火灾危险分类为甲类，爆炸和火灾危险场所划分为 2 区。

3.5.2 Equipment shall be arranged and selected according to the requirements of fire protection and explosion-proof safety codes. Same type of equipment shall be arranged in a centralized manner to facilitate safety management and operation.

设备平面布置、设备选型满足防火、防爆安全规范要求，将同类设备分区集中布置，以利于安全管理及安全操作。

3.5.3 The fire separation distance of process equipment shall meet the GB50160-2008, "Fire Prevention Code of Petrochemical Enterprise Design".

工艺设备的防火间距满足《石油化工企业设计防火规范》GB50160-2008。

3.5.4 Equipment such as towers, vessels and piping that may cause overpressure during process operation shall be provided with relief valve or pressure relief devices. flammable and explosive gases shall be vented into a closed flare system, and the operation of toxic and hazardous substances shall be performed in a closed manner.

对在工艺操作中可能产生超压的塔、容器和管道等设备设置安全阀泄压设施；易燃易爆气体排入密闭的火炬系统，有毒有害物质的操作均密闭进行。

3.5.5 Changes in temperature, pressure, and liquid level may cause unsafe factors, and high and low limit alarm systems for these changes shall be provided in the design.

温度、压力、液面等变化可能导致不安全因素，设计中设置了高、低限报警系统。

100% of backup rate of critical rotating equipment is provided to ensure safe and continuous production.

关键转动设备的备用率按照 100%设置，以确保安全连续生产。

3.5.6 Each section shall be provided with fixed fire-fighting steam line and adequate hose station so that the points where leakage may occur shall be within the range of the fire-fighting steam hose.

各部分均设有固定的消防蒸汽管线和足够的软管站，使可能出现泄漏的点均在消防蒸汽软管范围之内。

3.5.7 To control noise, low noise equipment and rotating machinery shall be selected for this plant. For compressor and rotating machinery, these vendors shall take sound attenuation measures to control the noise below 85dB(A). The operator shall wear earplugs to mitigate the noise hazard when in contact with high-noise equipment.

为控制噪声，该装置均选用低噪声设备和机泵。选用的压缩机和机泵均要求供应商对其设备进行消音处理，使其噪声控制在 85dB(A)以下；操作人员在接触高噪声的设备时配戴耳塞，以减轻噪声的危害。

3.5.8 The production equipment shall be arranged in the open air so that diffusion of flammable & explosive and toxic gases may be diffused timely.

生产装置设备均为露天布置，有利于易燃易爆、有毒气体及时扩散。

3.5.9 Shift, changing and outdoor operator rest rooms shall be provided in the complex plant. 联合装置内设交接班室、更衣室及室外操作人员休息室。

3.5.10 Piping and equipment with external surface temperature greater than 60 °C and to which personnel may be exposed shall be provided with anti-scalding insulation.

对外表面温度大于 60℃而且人员有可能接触的管道及设备均实行防烫保温。

3.5.11 The instrument control room shall be located outside the explosive hazardous area. The room shall be equipped with artificial lighting and air conditioning system.

仪表控制室设置在爆炸危险区域外，室内设人工采光，安装空调系统。

3.5.12 Personnel engaging in toxic operations shall wear PPEs such as gas masks. 有毒作业岗位配备防毒面具等劳动保护用品。

3.5.13 To ensure the health of operation personnel, the operation and management personnel of the plant shall be subject to regular physical examinations.

为确保操作人员的身体健康，要求对装置的操作人员及管理人员定期进行体检。

3.5.14 Strictly follow fire protection codes.严格执行防火规范。

3.5.15 To improve reliability and self-rescue capability of fire safety, the plant shall be provided with fire-fighting facilities, and fire hydrants shall be installed at appropriate locations.

为了提高防火安全的可靠性和自救能力，装置设有消防设施，在适当位置设置消防栓。

3.5.16 The complex plant shall be provided with 15 manual fire alarm buttons, and the alarm signal shall be sent to the alarm panel in the control room.

联合装置内设有 15 个火灾手动报警按钮，并将报警信号送至控制室内的报警盘上。

3.5.17 According to the requirements of code for design of fire protection, reducing-stabilized pressure box type fire hydrant and portable dry powder fire extinguishers depending on different places shall provided in the design to meet the requirements of safety fire protection.

根据场所不同，按照设计防火规范要求，设计上配置有减压稳压型箱式消防栓、手提式干粉灭火器，以满足安全消防的要求。

3.5.18 Sufficient hose stations and steam fire-fighting facilities shall be provided in the plant to meet the protection radius as specified so that the location where the fire may occur shall be within the coverage of steam fire protection.

装置内设置足够的软管站和蒸汽消防设施，满足规定要求的保护半径，使可能发生火灾的场所处于蒸汽消防的覆盖范围之内。

3.6 Safety and environmental protection considerations during shutdown and overhauling 停工检修期间安全、环保注意事项

3.6.1 Safety considerations during shutdown 停工期间安全注意事项

3.6.1.1 The shutdown of the plant shall be performed under unified command, and strictly follow the shutdown plan to ensure smooth and safe shutdown of the plant.

装置停工统一指挥，必须严格执行停工方案，确保装置顺利安全停工。

3.6.1.2 After the shutdown of the plant, shut off the materials to and from the plant according to the shutdown plan, operation method and process requirements, and strictly follow the national industrial sanitary and discharge/emission standards. No toxic or hazardous materials shall be allowed to be discharged arbitrarily. If there is no flare facility, the pressurized flammable

and explosive gas shall be vented slowly, and depressurization measures shall be taken gradually. Fire-fighting measures must be taken at the end of the vent line.

按停工方案、操作法和工艺要求切断进出物料，严格执行环保职业卫生相关规定，不允许任意排放有毒、有害物料。

3.6.1.3 Equipment, vessel and piping with toxic, flammable and corrosive materials shall be thoroughly purged according to the requirements (combustible materials shall not be directly purged with compressed air), cooked, neutralized, replaced. Four-setting (i.e. setting standards, setting time, setting personnel and setting responsibility) shall be performed. Assign full-time personnel to perform acceptance, recording and filing. Ensure that the plant shall meet the requirements of safe fire use before the plant is overhauled.

对有毒、可燃、有腐蚀性物料的设备、容器、管道应按规定进行彻底的吹扫（可燃物料严禁用压缩空气直接吹扫）、蒸煮、中和、置换等处理。并做到四定：定标准、定时间、定人员、定职责。要有专人验收，记录备案。保证装置在交付检修前，达到安全用火要求。

3.6.1.4 After the plant has been shut down, replaced, analyzed and accepted, the material piping to and from the units shall be plugged by blind plates and marked obviously according to the flow charts of blind plate installation and removal in the shutdown plan. The blind plates shall be managed by the assigned personnel to prevent blind plate to installed or removed from missing.

装置停工、置换、分析合格后，应按停工方案，统筹协调抽堵盲板作业，避免抽堵盲板作业过程中发生跑料、中毒等安全事故。作业结束后，及时在盲板上张挂标识牌。盲板应指定专人统一管理，防止漏堵、漏抽。

3.6.1.5 During shutdown overhauling, if there is flammable, explosive, toxic or hazardous substances, inlets/outlets to/from and connections with the production system shall be plugged by blind plates, and "Caution! There is hazardous material" warning and prohibition signs shall be tagged out. If necessary, Assign full-time personnel to take charge of it.

在停工检修中，对存留有易燃、易爆、有毒、有害物质的管道、设备，在其出入口或与生产系统相连处应加上盲板，挂上“内有物料、注意安全”的警告牌及禁动牌，必要时指定专人看管。

3.6.1.6 During shutdown purging, the purging personnel of each post shall strengthen the patrol inspection to prevent from accidents such as misdirected flow and drum overflow. If a large amount of oil and oil vapor is scattered during the whole shutdown and purging, immediately and properly treat it, and if necessary, protection by fire truck is required.

停工吹扫期间，各岗位吹扫人员应加强巡回检查，防止串线、冒罐等事故的发生。在整个停工、吹扫过程中若出现大量油品和油气散落出来时，应立即妥善处理，必要时，可要求消防车保护。

3.6.1.7 During shutdown purging, driving motor vehicles in the area and any hot work shall be prohibited strictly.

停工吹扫期间，严禁机动车辆在该区域行驶和任何动火作业。

不适用 3.6.1.9 Before the plant is overhauled, the oily water system in the plant must be thoroughly flushed to fully remove the oil and vapor, and wellhead, funnel opening and open channel connected to oily water system shall be completely sealed and closed to prevent fire

and explosion during the hot work. Conspicuous signs shall be provided for the cable trench in the plant, indicating that the area where load-carrying vehicle and the crane traffic are prohibited, and the vehicle parking area.

装置交付检修前，必须对装置内的含油污水系统进行彻底冲洗，赶尽油气，并对井口和漏斗口以及含油污水系统相通的明沟彻底封严盖牢，防止动火时发生着火爆炸。对装置内的电缆沟做出明显的标志，标出禁止载重车辆及吊车通行区和车辆停放区。

3.6.1.10 Before opening the lowest point of the equipment manhole, decrease the internal temperature to a safe condition, and orderly open the manhole from top to bottom. When opening the bottom manhole, first open the bottom residual material discharge valve, and wait until no residual material in it is verified to prevent blockage.

打开设备人孔最低点前，应使其内部温度降到安全条件下，并从上而下依次打开人孔。在打开底部人孔时，应先打开最底部放料排渣阀门，待确认内部没有残存物料时方可进行，防止有堵塞现象。

3.6.2 Environmental protection considerations during shutdown overhauling 停工检修期间环保注意事项

3.6.2.1 Pollutant pre-reporting system shall be used when discharging pollutants during startup, shutdown and overhauling of the plant. The type, quantity, mode of discharge and measures taken for pollutant discharge will be reported to the relevant competent authorities in the form of reports one week before the shutdown.

装置在开停工检修排放污染物时，开停工检修应编制相应方案，在方案中应识别开停工检修过程中产生的环境因素，并制定相应控制措施。

3.6.2.2 During shutdown and overhauling of the plant, toxic and hazardous substances shall be recycled, and shall not be discharged into the ground or underground piping network when washing all equipment and piping.

装置停工检修时，所有设备管线在清扫时，有毒有害物质均要回收，不得排入地面或地下管网。

3.6.2.3 Acid or alkali wastewaters, which will enter the rainwater system, must be neutralized by acid or alkali respectively to prevent environment from pollution and piping from corrosion before being discharged into the system piping network.

进入雨水系统的酸碱废水，必须酸碱中和合格后，方可排入系统管网，以防止污染环境及腐蚀管道。

3.6.2.4 Sludge in sewage plant or when cleaning drums and vessels shall be piled up at the designated place after dehydration, and recycled by a qualified environmental protection company.

凡污水场或清理池子及容器时的污油泥，要经脱水后在指定地点堆放，由有资质的环保处理公司回收处理。

3.6.2.5 Solid waste during overhauling shall not be discharged arbitrarily. For toxic and hazardous substances, it shall be reported in advance, and shall be recycled by a qualified environmental protection company after being approved by the company's environmental

protection department.

检修期间的固体废物，必不得随意排放，对于有毒有害物质，要提前申报，经公司主管环保的部门审批后由有资质的环保处理公司回收处理。

3.6.2.6 When venting equipment and piping, sound attenuation measures shall be took if noise is severely out-of-specification.

设备、管线放空时，若噪声严重超标，必须加消音设施。杜绝扰民事件发生。

3.6.2.7 After the overhaul is completed, the “three-waste” control facilities of the plant must be put into service simultaneously with the main unit.

检修完毕，装置的“三废”治理设施必须与主体装置同时投用。

3.6.3 Safety and environmental protection considerations of important posts 重要岗位安全环保注意事项

3.6.3.1 Where all works such as production and construction require the use of open flames (including electric welding, fire welding, blowtorch, various stoves, etc.) in the operation area, temporary power supply is used in production facilities and storage, and motor vehicle enters production facilities and storage, take necessary fire prevention measures, and apply for hot work application procedures, which shall be approved by relevant departments. It is strictly forbidden to perform hot work fire at will.

生产区域内，凡高风险作业涉及动火（包括电焊、火焊、喷灯、各种炉灶等），生产装置和罐区使用临时电源，机动车辆进入生产装置和罐区，均须采取必要的防火措施，办理相关作业许可证，并经有关部门批准。严禁随意动火。

3.6.3.2 Hot work shall strictly implement the hot work system so as to ensure “no hot work is allowed in four-condition”, that is, no hot work is allowed if hot work permit isn’t issued, no hot work is allowed if safety measures in hot work permit aren’t taken, position and time of hot work aren’t in accordance with hot work permit, and no hot work is allowed if the guardian is absent.

动火作业应严格执行安全管理制度，做到“四不动火”，即动火作业许可证未经签发不动火，安全措施没有落实不动火，动火部位、时间与动火作业许可证不符不动火，监护人不在场不动火。

3.6.3.3 Assign a hot work supervisor with strong sense of responsibility and familiar with the production process and the conditions in the site. The hot work supervisor must always grasp the hot work site and surrounding conditions, and check the fire prevention measures. If abnormal conditions are found, timely take measures or stop hot work. If necessary, the hot work supervisor has the right to stop hot work.

监护人应选派责任心强、熟悉生产流程和现场情况的人员担任。监护人必须时刻掌握动火现场及周围情况，检查防火措施。如发现异常情况，要及时采取措施或停止动火。必要时，监护人有权要求停止动火。

3.6.3.4 Hot work must be performed at the specified time, location and position.

必须按指定的时间、地点、部位动火。

3.6.3.5 Proper and reliable fire safety measures shall be provided for hot work. When hot work

is performed on the refining equipment and vessel or equipment and vessel containing oil and vapor, strictly comply with the following requirements:

动火必须有妥善可靠的防火安全措施。炼油和盛装油气的设备、容器、管线用火时，必须严格执行下列规定：

(1) When performing normal hot work, the total cooking and washing time of towers and oil drums shall not be less than 48 hours. In addition, sufficient time must be reserved for flushing them with water. Tower cooking and flushing may be performed alternately. Ensure that they shall be purged to full clean.

正常动火时，塔类、油罐总蒸洗时间不得少于 48 小时。此外，还必须安排充足时间用水冲洗。蒸塔、冲洗可交叉进行，确保吹扫干净。

(2) Vessels shall be purged with steam for 24 hours, and flushed with water.

容器类用蒸汽吹扫 24 小时，并用水冲洗干净。

(3) Heat exchange equipment and the heater tube shall be purged with steam for at least 12 hours.

热交换设备及炉管用蒸汽吹扫时间不得少于 12 小时。

(4) When the piping is purged, purge the piping with steam until the piping is through, and then continue to purge the piping for more than 4 hours for LSO and more than 8 hours for heavy oil. The gas and liquid hydrocarbon pipings shall be purged with steam for more than 8 hours so that the condensed oil in the piping may be cooked and purged thoroughly.

管线吹扫时，在用蒸汽扫通后，轻油管线必须继续吹扫 4 小时以上，重油管线必须继续吹扫 8 小时以上。瓦斯、液态烃管线用蒸汽吹通后继续吹扫 8 小时以上，以便将管线内的凝缩油彻底蒸吹干净。

(5) Ferrous sulfide removed from the equipment must be disposed properly, and must not be piled up randomly in the plant. Hot work may be performed only when gas analysis has been performed and accepted:

炼油和盛装油气的设备、容器要清扫干净，并用盲板隔绝。设备内清除的硫化亚铁必须妥善处理，不得在装置内任意堆放。进行气体分析并合格，经检查后才准用火：

Acceptable level of combustible gas (vapor) shall be less than 1% (v) for a lower explosion limit more than 10% (v), <0.5% (v) for lower explosive limit more than 4% (v), or <0.2% (v) for lower explosion limit less than 4% (v). For the lower explosion limit of mixtures with two or more combustible gases, the lower of the lower explosion limit shall apply; Acceptable level of oxygen shall be 19.5 %~23.5%(v).

爆炸下限 $\geq 4\%$ （体积比）的可燃气体（蒸汽），其浓度 $<0.5\%$ （体积比）为合格；爆炸下限 $<4\%$ （体积比）的可燃气体（蒸汽），其浓度 $<0.2\%$ （体积比）为合格；两种以上可燃气体混合物的爆炸下限，应以爆炸下限低者为准；氧气含量 19.5%~23.5%（体积比）为合格。

3.6.3.6 When entering the vessel to perform operations, the permit of confined space work shall be obtained. For vessel containing H_2S media, H_2S gas analysis is required, and the H_2S level shall be ≥ 10 mg/m³.

进入容器作业，要办理受限空间作业许可证。对盛装含有 H_2S 介质的容器，进入容器作业前

氧含量、可燃气、有毒气体分析合格，仍然要采取防中毒措施，以防硫化氢意外释放。

3.6.3.7 Drawings (list) of blind plate shall be required for overhaul of the refinery production units. The blind plates to be installed shall be tagged out one by one according to the item numbers in the blind plate drawings. When the equipment is purged, the original recording of disassembly and assembly of blind plate for equipment and piping shall be available.

炼油生产装置检修要有盲板图（表），所装盲板要按盲板图上的标号逐一挂牌作好标记。设备吹扫时，设备及管线的盲板拆装应有原始记录备查。

3.6.3.8 Power supply of electric welding machine shall be connected to the switch at the designated location. Power cable, hold wire and grounding wire shall be well insulated. The grounding wire must be fixed on the fire-welded part. The power cable must not be crossed from above the well head. The distance between the acetylene and the oxygen cylinders shall not be less than 5 meters. Distance from acetylene or oxygen cylinder to hot work point shall not be less than 10 meters. The oxygen cylinder shall be prevented from direct sunlight, nozzle of the cylinder shall be free from oil, grease, and dirt. Use of acetylene rubber hose for oxygen purging is strictly prohibited.

电焊机电源应接于指定地点开关上，电源线、把线、地线均应绝缘良好。地线必须固定于用火烧焊部位，电源线禁止从下水井口上方跨过。乙炔气瓶与氧气瓶之间距离不得小于 5 米，乙炔气瓶、氧气瓶距动火点不得小于 10 米。氧气瓶应防止曝晒，瓶嘴严禁沾油污，乙炔胶管严禁用氧气吹扫。

3.6.3.9 Flammable materials around the fire site shall be removed fully. The nearby wells, trenches and cable trenches, etc. shall be reliably closed after flammable materials are removed. Steam protection shall be used. Fire-fighting equipment and materials (such as steam hose, fire extinguishers, etc.) shall be available.

应清除用火现场周围易燃物。附近的下水井、地沟、电缆沟等清除易燃物后要可靠封闭，并用蒸汽掩护，并备有消防器材（如蒸汽胶管、灭火器等）。

3.6.3.10 For height hot work, use asbestos cloth to prevent spark from spattering outward. In case of fresh breeze winds and above, hot work shall be stopped.

高空动火，要用防火布等挡好火星，防止向外飞溅。遇有 5 级以上大风，必须停止动火。

3.6.3.11 Hot work on vessel, equipment and piping for high temperature, pressure, flammable and toxic services are generally not allowed. However, it may be treated as a special hot work after taking necessary and reliable safety and technical measures when hot work is necessary in production.

高温、带压、可燃及有毒介质的容器、设备、管线一般不允许动火，但生产上确实必须用火时，在采取必要可靠的安全技术措施后，可作为特殊用火处理。

3.6.3.12 During hot work, immediately stop hot work in the event that there is any threat to hot work safety such as oil overflow, misdirected oil and flammable gas leakage.

用火过程中，遇有跑油、窜油和可燃气体泄漏等威胁用火安全的情况时，应立即停止用火。

3.6.3.13 Before each hot work, carefully checked to see if there is any changes in the surrounding conditions. When leaving work, do not retain residual fire, and switch off the power

supply switch. After the gas welding operation is completed, the welding torch must be taken out of from equipment and vessel.

每次动火之前, 应认真检查, 注意周围条件是否有变化。下班时不得留有余火, 电源开关应拉断。气焊作业完毕, 必须将焊枪拿出设备、容器。

3.6.3.14 It is forbidden to discharge combustible matter such as oil, gas, liquid hydrocarbons and acid sewage to the ground, trench, sewer and atmosphere.

临时照明灯电压不得超过 36 伏, 行灯必须有防护罩和隔离变压器, 电线绝缘良好。在特别潮湿的场所或金属容器内, 行灯电压不得超过 12V。装置内一切电气作业由电工负责。严禁湿手操作电器开关。

3.6.3.15 The temporary lighting voltage shall not exceed 36V. The running lights must be provided with protective cover, and the wires are well insulated. The lamp voltage must not exceed 12V in particularly humid locations or in metal vessel. All electrical works in the plant shall be the responsibility of the electrician. Do not operate the electrical switch with a wet hand. 临时照明灯电压不得超过 36 伏, 行灯必须有防护罩, 电线绝缘良好。在特别潮湿的场所或金属容器内行灯电压不得超过 12V。装置内一切电气作业由电工负责。严禁湿手操作电器开关。

4 工艺变更

4.1 增加初馏塔底退油线

如图所示, 增加初馏塔塔底泵P230A出口至渣油泵P430AB出口总管(至1011-200-P-043301-5B3-HC)跨线, 该流程增加后, 初馏塔可实现直接向渣油线退油, 可在大幅度缩短装置开车(水冲洗、柴油顶水)、停车(分区退油)时间, 实现停工密闭吹扫等方面起到作用。

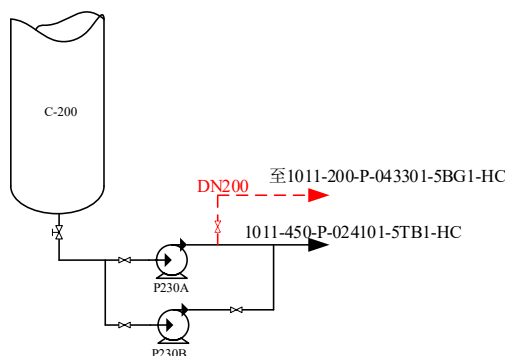


图 122 增加初馏塔底退油线

4.2 增加常压塔退油线及常底泵备用渣油泵流程

渣油泵 P430AB 单台泵的设计流量为 $198.2 \times 0.846 = 167.7 \text{ t/h}$ 。装置在开工循环期间，需要循环量为 400t/h 左右，即使两台渣油泵同时运行（335t/h），也难以满足开工需要。如在开车过程中发生一台机泵故障（泄漏、震动、入口过滤器堵等），则装置根本无法开车。因此需要解决开工过程渣油泵能力不足的问题，解决办法为用常底泵 P330A 作为渣油泵 P430AB 的备用泵。如下图（虚线部分）：

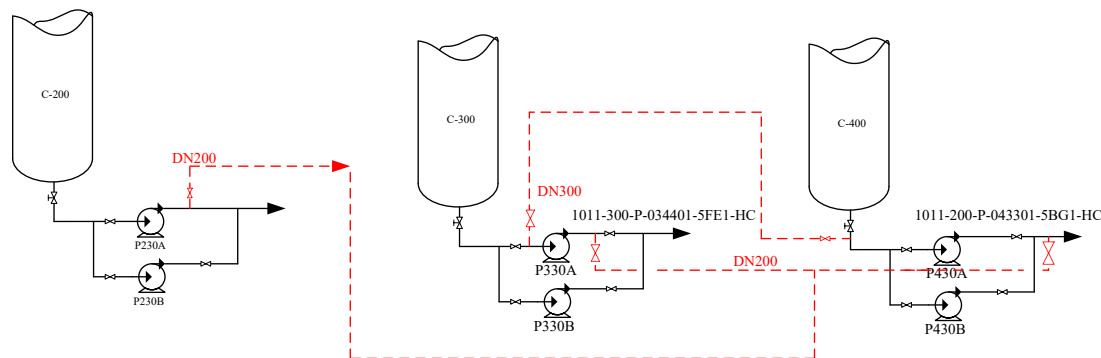


图 123 增加初馏塔底退油线

4.3 取消减一线、二线、三线外放单项阀

鉴于越来越严的环保要求，停工时需要实现密闭吹扫。目前减一线调节阀 FV71103、减二线调节阀 FV71102、减三线调节阀 FV71101 后均增加了单向阀，停工时无法实现减压侧线往减压塔内密闭吹扫，因此需要取消单向阀。大多数新建的常减压装置在该部位都没有加单向阀，由于减一、二、三线均作为 VGO（加氢裂化原料），及时在极端情况下某个侧线泵跳停后，VGO 倒串回塔，对产品质量的控制和生产运行均不会产生影响。

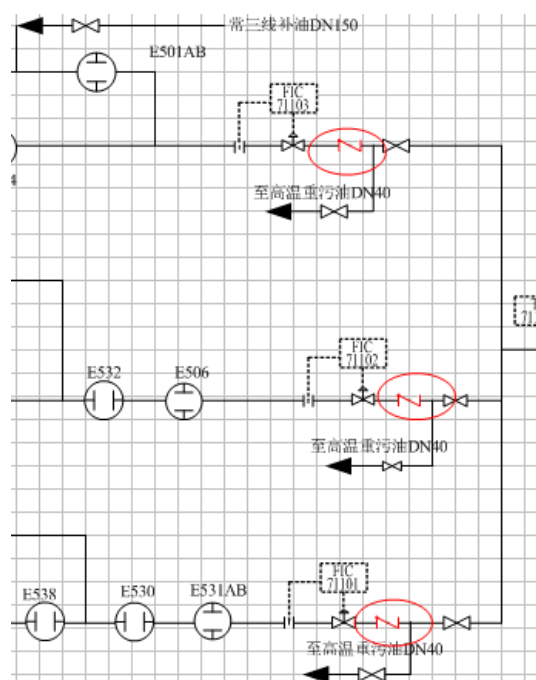


图 124 取消减一线、二线、三线外放单项阀

4.4 水环泵出口分液罐液位控制阀从 P426AB 入口调整至出口

如图所示，减压塔水环真空泵出口分液罐液位控制阀位于凝液泵 P-426AB 入口，改至出口。

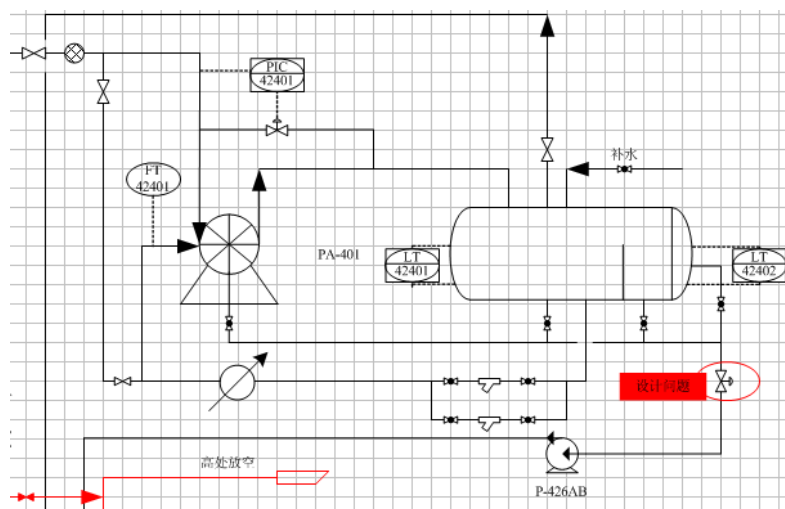


图 125 水环泵出口分液罐液位控制阀从 P426AB 入口调整至出口

4.5 增加常三线至混合蜡油流程

- (1) 根据公司生产经营需要，今后需要增产化工原料时，常三线主要出加氢裂化原料。
- (2) 根据本次总体试车方案，需要为加氢装置备轻质柴油常二线，首次开车时常二线与常三线需要分开，常三线出蜡油。增加常三线至混合蜡油流程。

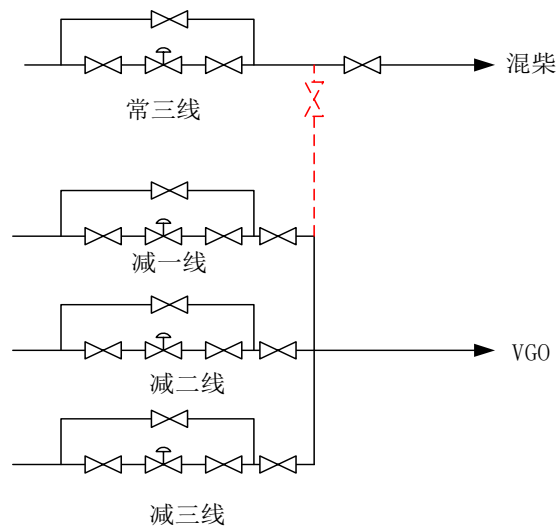


图 126 增加常三线至混合蜡油流程

4.6 常压中段回流增加开工柴油线

根据常减压装置投料试车方案，增加常压中段开工柴油线。

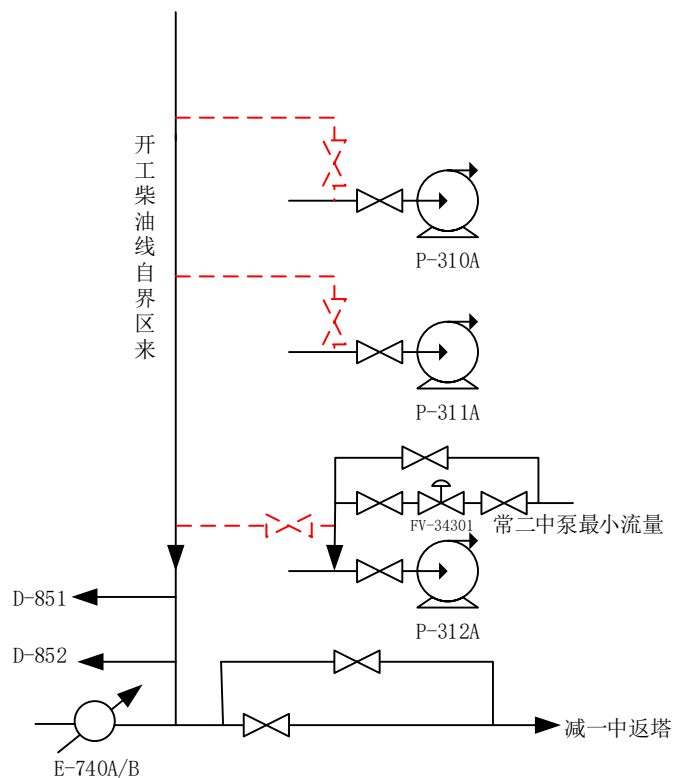


图 127 常压中段回流增加开工柴油线

4.7 低温重污油与高温重污油之间增加跨线

装置停工时，低温重污油线需要进行吹扫，增加低温重污油线的吹扫流程。

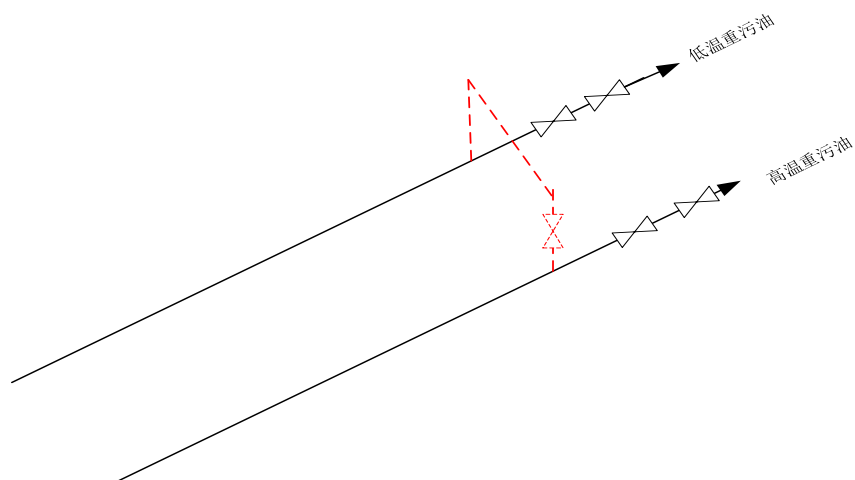


图 128 低温重污油与高温重污油之间增加跨线

4.8 急冷油、渣油返塔流程需增加根部阀（塔壁有根部阀）

（1）、装置在停工，减压塔退扫线污油或者渣油流程扫线时，污油会倒窜至已处理干净的急冷油线和渣油返塔线，致使这两条线无法处理干净。

（2）、急冷油返塔采用的质量流量计无副线，若流量计出现故障无法切除检修。

通过在急冷油、渣油返塔流程增加隔断阀可避免以上问题，同时需在隔断阀后增加蒸汽扫线流程。

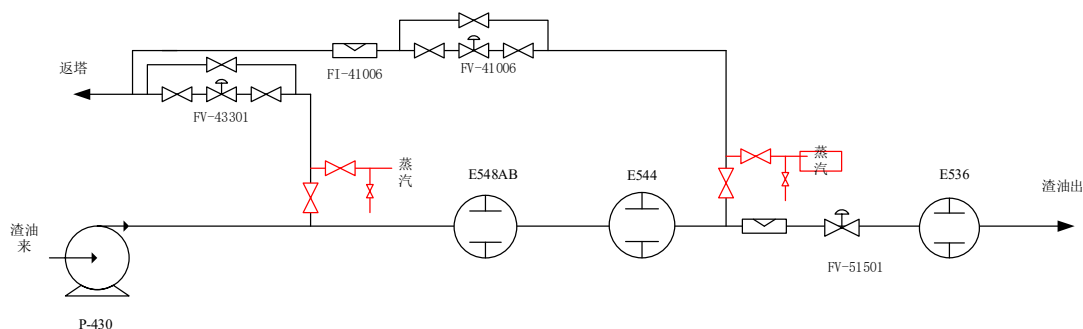


图 129 急冷油、渣油返塔流程需增加根部阀

4.9 减顶油增加至火炬凝液泵出口流程

减顶油进入火炬气分液罐 D-841，D-841 罐底泵 P-841 只有一台，当 P-841 故障需要检修时，减顶油无去向，装置存在停车风险。

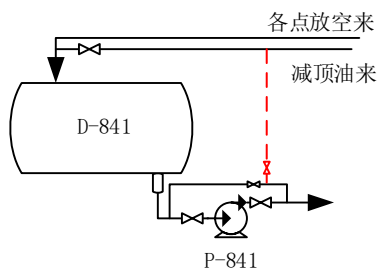


图 130 减顶油增加至火炬凝液泵出口流程

4.10 含烃尾气增加放空线

在生产过程中，由于受下游装置影响或后路流程不畅，造成含烃尾气无法外送，需增加含烃尾气泄压流程，应含烃尾气含氧无法进入火炬系统，目前含烃尾气放空只能进入大气，放空点须在所在框架最高点，朝向框架外侧。

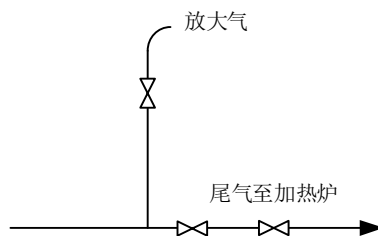


图 131 含烃尾气增加放空线

4.11 加热炉瓦斯末端增加放空至火炬流程

- (1)、装置在停工时，燃料气管线需吹扫置换，若直接吹至炉膛，污染大气；
 (2)、装置在开工时，加热炉点火前，需引燃料气置换管内氮气，易造成燃料气漏至大气，存在一定的安全隐患且对大气造成污染。

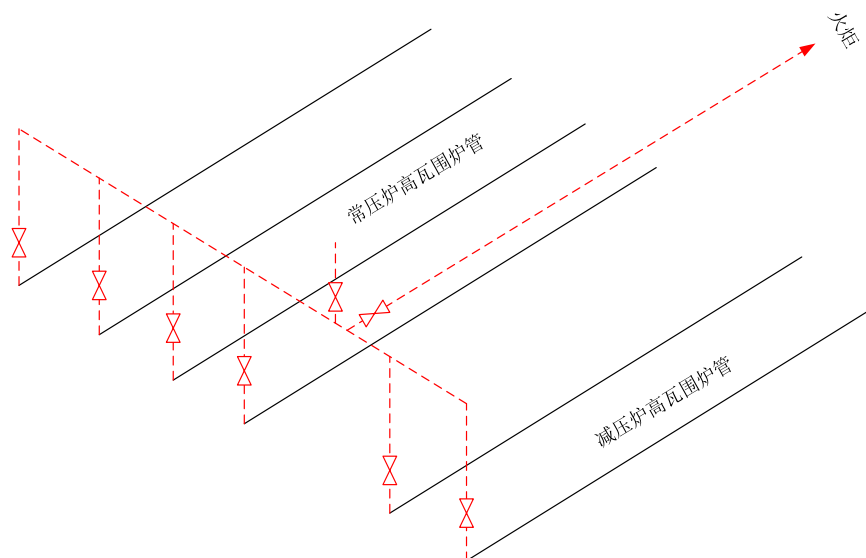


图 132 加热炉瓦斯末端增加放空至火炬流程

4.12 高温缓蚀剂注入点移至减三中返塔控制阀处

现高温缓蚀剂注入点在减三线抽出口后，注入的缓蚀剂直接随减三线送出装置，难以在减压塔内件、填料有效的成膜，建议将注入点改至减三控制阀处，高温缓蚀剂注入减三中后首先在塔内部有效的成膜，后随减三线、减三中有有效的在管线及设备内成膜，达到预期的防腐效果。

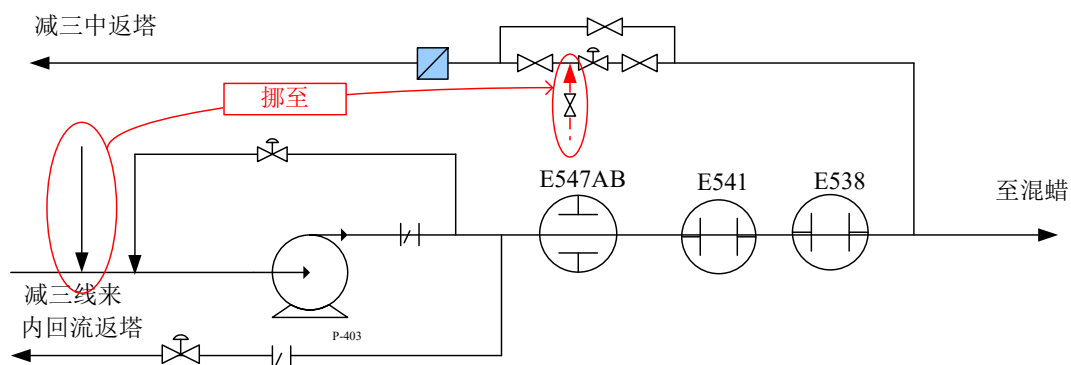


图 133 高温缓蚀剂注入点移至减三中返塔控制阀处

4.13 增加常减压开车氮气置换流程

常减压设计时无氮气置换流程，原开工方案在开工过程中通过油气向大气赶空气，这样做存在一定的安全隐患，且对大气污染较大，现通过增加氮气置换流程，在装置进油前将系统置换干净。

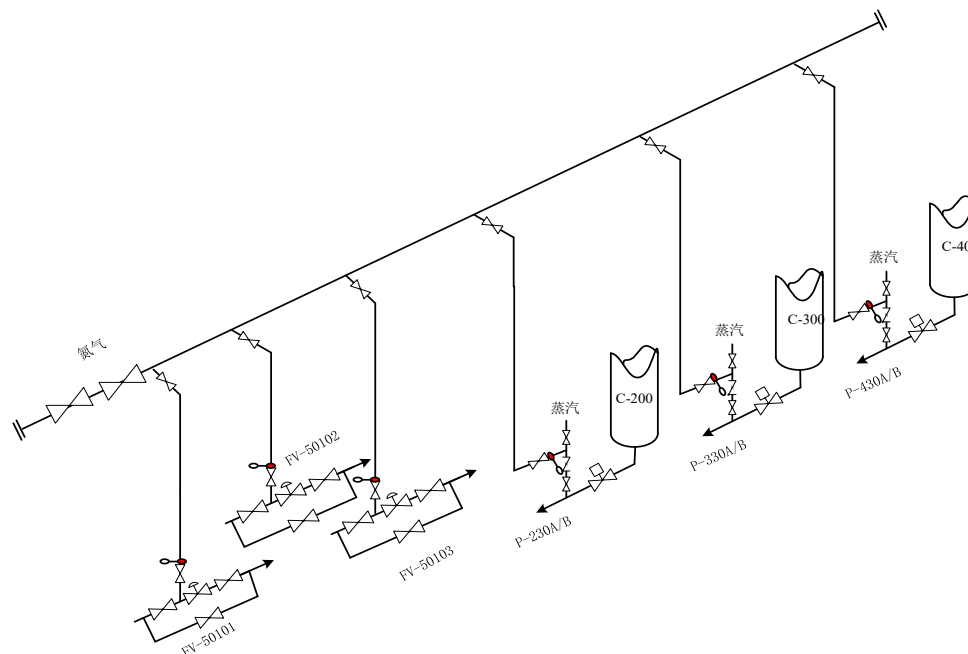


图 134 增加常减压开车氮气置换流程

4.14 初顶回流罐 D-202 切水增加原油带水处理流程

存在问题：1) D-202 切水自流进入 D-201，再经 P-225AB 送至硫磺回收酸水汽提装置。当原油性质变化，发生原油带水至初馏塔时，酸性水增加，无法及时从 D-202 水包排至 D-201，造成水进入油相，引起回流带水，造成初馏塔操作进一步恶化，严重时造成初馏塔超压、安全阀起跳、初一线和初底泵抽空等。2) 新增的大量高温酸（90-98℃）性水进入低温（40℃）的 D-201 造成 D-201 的油汽化，进入压缩机的可凝油气增加，既增加了压缩机的负荷，也增加了压缩机进出口分液罐 D-601、D-602 凝缩油量，引起轻烃回收装置波动。

应对措施：增加 D-202 切水至 P225A→A-202A-D 流程。当原油带水时，用 P-225A 将 D-202 的水通过泵增压送至 A-202 冷却，避免初馏塔回流带水的同时，降低机内 D-202 酸性水的温度。

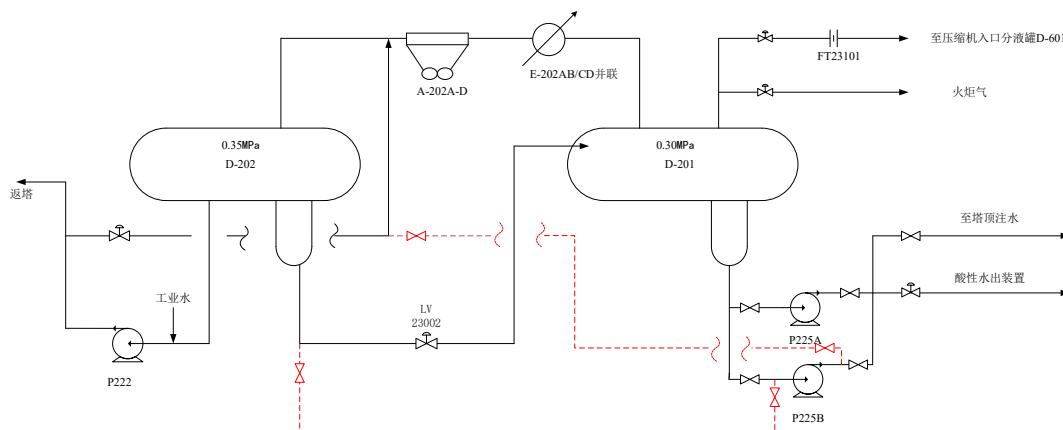


图 135 初顶回流罐 D-202 切水增加原油带水处理流程

4.15 常顶一级油改至稳定石脑油出装置

常顶一级石脑油冷后温度 120℃ 部分做常顶回流回塔另一部分进二级冷却系统冷至 40℃ 至轻烃回收装置加热到 170℃ 脱 C4 后再经冷却后出装置，造成能耗浪费，常顶一级石脑油初馏点在 60~80℃，高于稳定石脑油 40℃ 的指标。在常顶一级油至常顶二级冷却系统控制阀 LIC-33001 阀后新增一条 DN150 的管线至稳定石脑油出装置控制阀 FIC-64702 阀后。

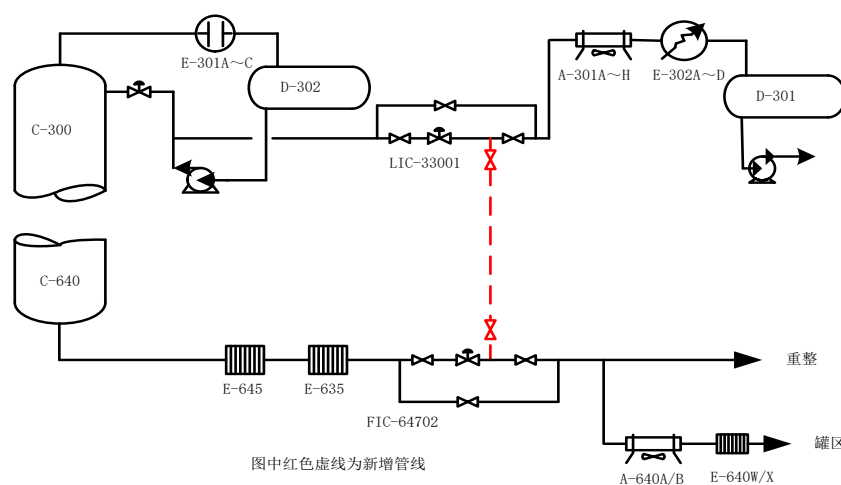


图 136 常顶一级油改至稳定石脑油出装置

4.16 初顶一级油改进常顶二级空冷

初顶油气为两级冷凝，初顶一级石脑油 98℃ 一部分作为回流，另一部分进初顶二级冷却器，石脑油产品平均流量达 107t/h（设计 81.021t/h），造成初顶石脑油产品泵 P-221A/B 外送困难，形成装置大负荷运行瓶颈。在初馏塔塔顶一级冷后石脑油至二级空冷控制阀 LIC-23001 后新加一条 DN100 的管线至常顶二级空冷入口，将初顶一级油改进常顶二级油系统。

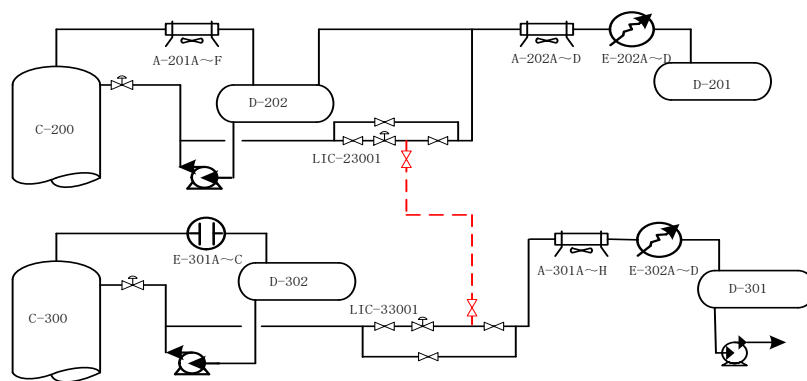


图 137 初顶一级油改进常顶二级空冷

4.17 初常顶产品罐增加撇悬浮物流程

因常减压初顶产品罐 D-201、常顶产品罐 D-301 油水界面间存在大量黑色悬浮物（元素组成主要为 C、H），黑色悬浮物密度介于水和石脑油之间，无法通过酸性水排出。当黑色悬浮物沉积装满水包之后进入石脑油，造成初顶石脑油和常顶石脑油出现黑色杂质，严重时出黑油，对重整预加氢装置影响大，因此需要定期排出 D-201、D-301 油水界面的黑色沉积物。分别在初顶切水控制阀后和常顶切水控制阀后，增加一条跨线至 D-401，将悬浮物撇至 D-401 后，经油水分离后，将悬浮物随着减顶油流程送至轻污油罐。

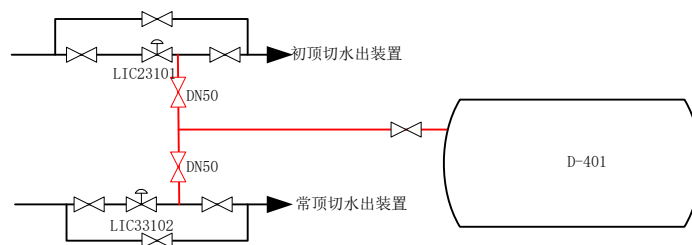


图 138 初常顶产品罐增加撇悬浮物流程

4.18 常减压装置增加含油污水撇油流程

常减压装置含油污水池采用自吸泵抽出，由于抽出口在池底部，油污悬浮在水上方，含油污水池内存油无法排出，从而导致污水池内存油越积越厚，存在一定安全隐患，以及易对下游装置造成冲击；现拟通过闲置高温缓蚀剂的配剂泵，将含油污水池内存油撇至火炬罐中。

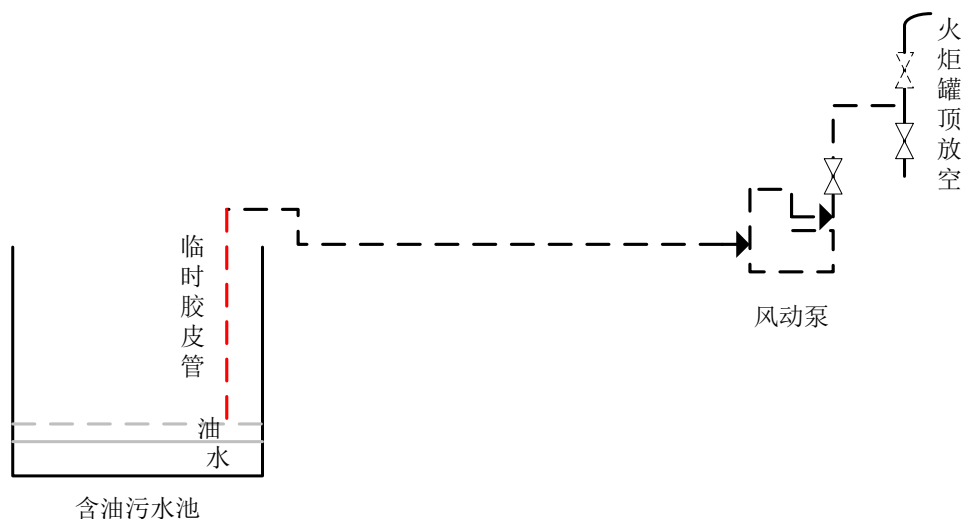


图 139 常减压装置增加含油污水撇油流程

4.19 混合柴油调和减压渣油流程

应公司生产要求，降低航煤加氢负荷，将常一线油部分或者全部并至柴油加氢加工，提高柴油加氢负荷同时降低柴油加氢二次油加工比例。

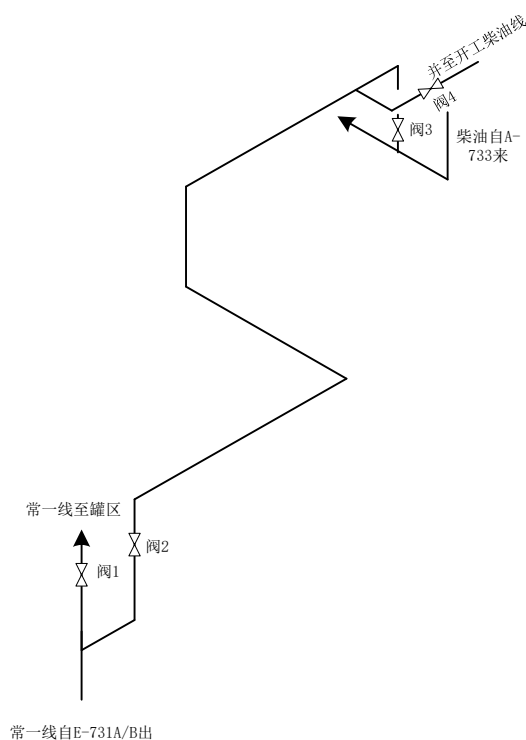


图 140 混合柴油调和减压渣油流程

4.20 增加蜡油水冷器

利用目前闲置换热器 E-510 作为蜡油水冷器，采用循环水作为冷却介质。

4.21 燃料油并至混合柴油

应公司生产要求，增加燃料油至混合柴油流程。

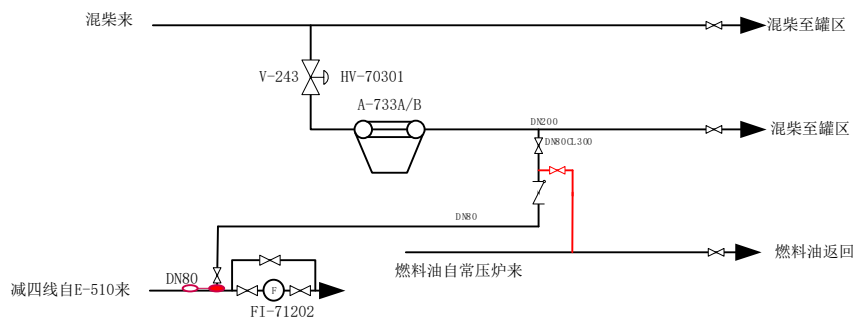


图 141 燃料油并至混合柴油

5 Supplementary Rules 附则

5.1 The Regulations are under the jurisdiction of the Scheduling and Dispatch Office.

本规定由计划调度部归口管理。

5.2 The Regulation is drafted No.1 Refiney Dept.

本办法起草部门：炼油一部。

5.3 The No.1 Refiney Dept. has the right to interpret.

本办法解释权归炼油一部。

5.4 Revision, preparation and approval of the Provisions are shown in table 63:

本规定版本编制和审批情况见表 63：

Table 63 Revision, preparation and approval of document

表 63 文件版本编制和审批情况

2	2021-7-23	Li Houliang 李厚亮	Zhang Chonglin 张崇林	Yu Lin 俞霖
Revision 版本	Issued date 颁布日期	Prepared by 编制人	Reviewed by 审核人	Approved by 批准人

6 Attachments.1 附件一

Attachment 1 List of Blinds for Startup and Shutdown of Atmospheric and Vacuum Distillation Unit

S/N	Description	Specifications, mm	Installed Location	Blind State			Remarks
				Startup	Normal operation	Shutdown	
1	Crude - from crude storage farm	DN450, PN	Piperacks	Remove	None	Install	Spectacle blind
2	Startup large circulation line - to the crude storage farm	DN300, PN	Piperacks	Install	None	Remove	Spectacle blind
3	Startup diesel - from storage	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
4	Atmospheric distillate 1# - to Kerosene Hydrofining Unit	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
5	Kerosene - to storage	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
6	Mixed diesel - to Diesel Hydrofining Unit	DN300, PN	Piperacks	Remove	None	Install	Spectacle blind
7	Mixed diesel - to storage	DN300, PN	Piperacks	Remove	None	Install	Spectacle blind
8	Mixed gas oil - to Hydrocracking Unit	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
9	Mixed gas oil - to storage	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
10	Vacuum residue - to Flexicoking Unit	DN200, PN	Piperacks	Remove	None	Install	Spectacle blind
11	Vacuum residue - to storage	DN200, PN	Piperacks	Remove	None	Install	Spectacle blind
12	Sour water - to OSBL	DN150, PN	Piperacks	Remove	None	Install	Spectacle blind

Attachment 1(continued) List of Blinds for Startup and Shutdown of Atmospheric and Vacuum Distillation Unit

S/N	Description	Specifications, mm	Installed Location	Blind State			Remarks
				Startup	Normal operation	Shutdown	
13	Vented oil vapor - to low pressure flare	DN800, PN	Piperacks	Remove	None	Install	Spectacle blind
14	Light slop - to storage	DN300, PN	Piperacks	Remove	None	Install	Spectacle blind
15	High temperature heavy oil - to storage	DN350, PN	Piperacks	Remove	None	Install	Spectacle blind
16	Low temperature heavy oil - to storage	DN350, PN	Piperacks	Remove	None	Install	Spectacle blind
17	DM water - from system	DN150, PN	Piperacks	Remove	None	Install	Spectacle blind
18	Fresh water - from system	DN300, PN	Piperacks	Remove	None	Install	Spectacle blind
19	CCW supply - from system	DN800, PN	Piperacks	Remove	None	Install	Spectacle blind
20	CCW return - to system	DN800, PN	Piperacks	Remove	None	Install	Spectacle blind
21	Purified water - from system	DN150, PN	Piperacks	Remove	None	Install	Spectacle blind
22	Portable water - from system	DN50, PN	Piperacks	Remove	None	Install	Spectacle blind
23	MDEA solution - from system	DN100, PN	Piperacks	Remove	None	Install	Spectacle blind
24	MDEA solution - to system	DN100, PN	Piperacks	Remove	None	Install	Spectacle blind
25	1.0Mpa steam - from system	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
26	0.5Mpa steam - from system	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
27	Plant air - from system	DN100, PN	Piperacks	Remove	None	Install	Spectacle blind

Attachment 1(continued) List of Blinds for Startup and Shutdown of Atmospheric and Vacuum Distillation Unit

S/N	Description	Specifications, mm	Installed Location	Blind State			Remarks
				Startup	Normal operation	Shutdown	
28	Instrument air- from system	DN80, PN	Piperacks	Remove	None	Install	Spectacle blind
29	Nitrogen - from system	DN50, PN	Piperacks	Remove	None	Install	Spectacle blind
30	Steam condensate - to system	DN80, PN	Piperacks	Remove	None	Install	Spectacle blind
31	HP gas - from system	DN250, PN	Piperacks	Remove	None	Install	Spectacle blind
32	Fuel oil - from system	DN100, PN	Piperacks	Remove	None	Install	Spectacle blind
33	P230A startup water - from system	DN250, PN	Piperacks	Install	None	Remove	Spectacle blind
34	P222A startup water - from system	DN200, PN	Piperacks	Install	None	Remove	Spectacle blind
35	P322A startup water - from system	DN200, PN	Piperacks	Install	None	Remove	Spectacle blind
36	P401A startup water - from system	DN150, PN	Piperacks	Install	None	Remove	Spectacle blind

附录 1 常减压装置开停工盲板表

序号	名称	规格 mm	安装部位	盲板状态			备注
				开工	正常生产	停工	
1	原油-自原油罐区来	DN450, PN	管桥	拆	无	盲	8 字盲板
2	开工大循环线-至原油罐区	DN300, PN	管桥	盲	无	拆	8 字盲板
3	开工柴油-自罐区来	DN250, PN	管桥	拆	无	盲	8 字盲板
4	常一线-航煤加氢	DN250, PN	管桥	拆	无	盲	8 字盲板
5	常一线-至罐区	DN250, PN	管桥	拆	无	盲	8 字盲板
6	混合柴油-至加氢装置	DN300, PN	管桥	拆	无	盲	8 字盲板
7	混合柴油-至罐区	DN300, PN	管桥	拆	无	盲	8 字盲板
8	混合蜡油-至加氢裂化装置	DN250, PN	管桥	拆	无	盲	8 字盲板
9	混合蜡油-至罐区	DN250, PN	管桥	拆	无	盲	8 字盲板
10	减压渣油-至焦化	DN200, PN	管桥	拆	无	盲	8 字盲板
11	减压渣油-至罐区	DN200, PN	管桥	拆	无	盲	8 字盲板
12	含硫污水-出装置	DN150, PN	管桥	拆	无	盲	8 字盲板
13	放空油气-至低压火炬	DN800, PN	管桥	拆	无	盲	8 字盲板
14	轻污油-至罐区	DN300, PN	管桥	拆	无	盲	8 字盲板
15	高温重污油-至罐区	DN350, PN	管桥	拆	无	盲	8 字盲板
16	低温重污油-至罐区	DN350, PN	管桥	拆	无	盲	8 字盲板
17	除盐水-自系统来	DN150, PN	管桥	拆	无	盲	8 字盲板
18	新鲜水-自系统来	DN300, PN	管桥	拆	无	盲	8 字盲板

附录 1（续） 常减压装置开停工盲板表

序号	名称	规格 mm	安装部位	盲板状态			备注
				开工	正常生产	停工	
19	循环冷水-自系统来	DN800, PN	管桥	拆	无	盲	8 字盲板
20	循环热水-至系统	DN800, PN	管桥	拆	无	盲	8 字盲板
21	净化水-自系统来	DN150, PN	管桥	拆	无	盲	8 字盲板
22	生活水-自系统来	DN50, PN	管桥	拆	无	盲	8 字盲板
23	胺液-自系统来	DN100, PN	管桥	拆	无	盲	8 字盲板
24	胺液-至系统	DN100, PN	管桥	拆	无	盲	8 字盲板
25	1.0Mpa 蒸汽-自系统来	DN250, PN	管桥	拆	无	盲	8 字盲板
26	0.5Mpa 蒸汽-自系统来	DN250, PN	管桥	拆	无	盲	8 字盲板
27	非仪表风-自系统来	DN100, PN	管桥	拆	无	盲	8 字盲板
28	仪表风-自系统来	DN80, PN	管桥	拆	无	盲	8 字盲板
29	氮气-自系统来	DN50, PN	管桥	拆	无	盲	8 字盲板
30	蒸汽凝结水-至系统	DN80, PN	管桥	拆	无	盲	8 字盲板
31	高压瓦斯-自系统来	DN250, PN	管桥	拆	无	盲	8 字盲板
32	燃料油-自系统来	DN100, PN	管桥	拆	无	盲	8 字盲板
33	P230A 开工用水-自系统来	DN250, PN	管桥	盲	无	拆	8 字盲板
34	P222A 开工用水-自系统来	DN200, PN	管桥	盲	无	拆	8 字盲板
35	P322A 开工用水-自系统来	DN200, PN	管桥	盲	无	拆	8 字盲板
36	P401A 开工用水-自系统来	DN150, PN	管桥	盲	无	拆	8 字盲板