

**LER TECHNICAL & OPERATION PROCESS SPECIFICATION**

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**Hengyi Industries Sdn Bhd**

**恒逸实业（文莱）有限公司**

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**LER Technical & Operation Process Specification**

**轻烃回收装置工艺技术操作规程**

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Contents　目 录

[Contents　目 录 V](#_Toc527093407)

[1　Technical & Process Specification　工艺技术规程 1](#_Toc527093408)

[1.1　Overview　装置概况 1](#_Toc527093409)

[1.2　Process specifications　工艺指标 10](#_Toc527093410)

[1.3　Three wastes treatment　三废处理 19](#_Toc527093411)

[1.4　Unit equipment　装置设备 22](#_Toc527093412)

[2　Job Operation Method　岗位操作法 32](#_Toc527093413)

[2.1　Job scope　岗位管辖范围 32](#_Toc527093414)

[2.2　Job task　岗位任务 33](#_Toc527093415)

[2.3　Start-up plan　开工方案 36](#_Toc527093416)

[2.4　Normal operation, instrument control scheme and main instrument performance　正常操作、仪表控制方案及主要仪表性能 64](#_Toc527093417)

[2.5　Shutdown scheme　停工方案 151](#_Toc527093418)

[2.6　Judgment, cause analysis and treatment of abnormal phenomena and accidents　异常现象及事故的判断、原因分析和处理方法 169](#_Toc527093419)

[3　Technical Regulations for Safety, Environmental Protection & Health　安全、环保、健康技术规定 188](#_Toc527093420)

[3.1　Safety requirements for plant entry　进装置的安全要求 188](#_Toc527093421)

[3.2　Regulations on equipment safety　设备安全技术规定 193](#_Toc527093422)

[3.3　Fire protection and harmful gas protection　消防及有害气体的防护 194](#_Toc527093423)

[3.4　Technical regulations of environmental protection　环保技术规定 223](#_Toc527093424)

[3.5　Safety, environmental considerations　安全、环保注意事项 226](#_Toc527093425)

[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 228](#_Toc527093426)

[4　Attachment　附件 234](#_Toc527093427)

# 1　Technical & Process Specification　工艺技术规程

1.1　Overview　装置概况

1.1.1　Introduction　装置简介

The unit is based on the total processing flow of the whole plant for the PMB petrochemical project in Zhejiang Hengyi (Brunei), China. A new light ends recovery unit is built in the 8 million tons/year atmospheric and vacuum distillation unit, focusing on processing the overhead oil gas，kerosene hydrogenated naphtha and overhead gas of pre-distillation and atmospheric tower, overhead light hydrocarbon and overhead gas of diesel hydrogenation stripper, overhead naphtha of diesel hydrogenation fractionators and overhead gas of reforming pre-hydrogenation etc., and recovering the light hydrocarbon included. The main products are dry gas, LPG and naphtha.

本装置是根据中国浙江恒逸（文莱）PMB石油化工项目全厂总加工流程安排，在800万吨/年常减压蒸馏联合装置内新建一个轻烃回收单元，集中对PMB项目常减压蒸馏装置初常顶油气、煤油加氢石脑油及塔顶气、柴油加氢汽提塔顶轻烃及塔顶气、柴油加氢分馏塔顶石脑油、重整预加氢塔顶气等进行处理，并回收其中的轻烃。产品主要有干气、液化气、石脑油。

1.1.1.1　Capacity　装置规模

The light ends recovery unit has the design capacity of 235×104 t/a, and operating time of 8,400 hours.

轻烃回收装置的设计规模为235×104t/a，开工时间为8400小时。

1.1.1.2　Feedstocks　装置原料

The feedstocks of the 235×104t/a light ends recovery unit are mainly overhead naphtha of pre-distillation tower and of atmospheric tower, and overhead gas of pre-distillation tower and of atmospheric tower in 800t/a atmospheric and vacuum distillation unit. In addition, kerosene hydrogenated naphtha and overhead gas, overhead light hydrocarbon and overhead gas of diesel hydrogenation stripper, overhead naphtha of diesel hydrogenation fractionator, and light hydrocarbon of reforming pre-hydrogenation are also included as feedstocks.

235×104t/a轻烃回收装置原料主要为800t/a常减压蒸馏装置初顶石脑油和常顶石脑油、初顶气和常顶气。此外，还包括：煤油加氢石脑油及塔顶气，柴油加氢汽提塔顶轻烃及塔顶气、柴油加氢分馏塔顶石脑油，重整预加氢轻烃。

1.1.1.3　Unit sections　装置组成

The 235×104t/a light ends recovery unit mainly consists of the following sections: gas compression, gas absorption and desorption and stabilization of naphtha etc.

235×104t/a轻烃回收装置主要由气体压缩—气体吸收和脱吸—石脑油稳定等部分组成。

1.1.1.4　Technical solutions　技术方案

The 235×104t/a light ends recovery unit was undertaken by Sinopec Engineering Incorporation (SEI) for the overall design and basic design of the unit, and was designed by Sinopec Luoyang Engineering Company. The unit adopts the following technical solutions:

235×104t/a轻烃回收装置由中国石化工程建设有限公司（SEI）承担装置的总体设计和基础设计，由中石化洛阳工程公司承担详细设计。本装置采用以下工艺技术方案：

（1）The three-tower fractionation process flow of ‘gas compression-absorber-desorption tower-naphtha stabilization tower’ is adopted.

采用“气体压缩-吸收塔-脱吸塔-石脑油稳定塔”三塔分馏工艺流程。

（2）The domestic mature light ends recovery processing technology is adopted in this unit.

本装置采用的技术为国内成熟的轻烃回收加工工艺。

（3）The unit uses the chilled water from 7℃ to 12℃ provided by the system as the deep cooling source for absorbent of the absorber, in order to ensure the absorption effect, increase the recovery rate of LPG, and reduce the amount of overhead oil from atmospheric tower as the absorbent.

为保证吸收效果，提高液化气回收率，减少常顶油作为吸收剂的量，本装置利用系统提供的7℃至12℃的冷冻水，作为吸收塔的吸收剂深度冷却冷源。

（4）New enhanced heat exchange equipment is adopted.

采用强化、新型的换热设备。

（5）Considering the limitation of the layout and the convenience of operation, the number of heat exchangers is minimized when selecting the cold exchange equipment, as the heat exchange load and the cooling load become very large, due to the large size of the unit. At the same time, some new and efficient plate air coolers and composite air coolers are used in places with high cooling load such as tower overhead to reduce heat exchange area and save space.

由于装置的大型化，换热负荷和冷却负荷变得非常大，考虑到平面布置的限制和操作方便，在冷换设备选型时尽量减少换热器的设备台位数。同时，在塔顶等冷却负荷很大的地方采用了一些新型，高效的板式空冷器、复合空冷器，以降低换热面积，节省占地。

（6）The magnetic pump is selected for light ends recovery system due to the high risk after leakage.

针对轻烃回收系统泄漏后风险高的特点，轻烃回收的机泵选用了磁力泵。

（7）The integration and optimization of heat is considered between the combined units. Heat integration is applied between light ends recovery unit and the atmospheric and vacuum distillation unit, and partial heat of the atmospheric and vacuum distillation unit (atm. 2nd PA) is used as the heat source for stabilizing the bottom re-boiler. The hot discharge of the downstream unit is realized in the process setting, thereby reducing the cooling load and also energy consumption.

联合装置间考虑了热量的整合和优化。轻烃回收装置和常减压蒸馏单元间热联合，利用常减压的部分热量（常二中）作为稳定塔底重沸器热源。在流程设置上实现下游装置的热出料，从而减少了冷却负荷，降低了能耗。

（8）1.0 MPa steam is used as the heat source of the re-boiler at the bottom of the desorption tower.

脱吸塔底采用1.0MPa蒸汽作为重沸器热源。

（9）Advanced control methods and HSE settings are adopted.

采用先进的控制手段和HSE设置。

（10）More advanced control methods are adopted in the design, and interlocking protection system, accident alarm and emergency shutdown interlocking system are set for important process parameters, which improves the unit reliability of safe operation greatly.

设计中采用了较多先进的控制手段，并对重要的工艺参数均设置联锁保护系统、事故报警及紧急停车联锁系统，大大提高了装置安全运转的可靠性。

1.1.2　Process principle　工艺原理

1.1.2.1　Main process principle of light ends recovery　轻烃回收的主要工艺原理

The 235×104t/a light ends recovery unit adopts the light ends recovery process without compressor. The compressor of the unit is mainly used for pressurization of low pressure gas. The process is mainly as follows:

235×104t/a轻烃回收装置采用无压缩机回收轻烃工艺，本装置压缩机主要用作低压瓦斯气增压。其工艺过程主要为：

（1）The majority of light hydrocarbon in the crude oil are dissolved in naphtha by pressurizing the pre-distillation tower of the atmospheric and vacuum distillation unit, and dissolving straight-run naphtha with light hydrocarbon and some non-condensable to enters the light ends recovery system for recovery of light hydrocarbon.

通过常减压装置初馏塔加压，将原油中的绝大部分轻烃溶解在石脑油中，溶解了轻烃和部分不凝气的直馏石脑油进入轻烃回收系统回收轻烃。

（2）The overhead gas of pre-distillation tower and of atmospheric tower and overhead gas of the coal hydrogenation and of diesel hydrogenation that contains part of light hydrocarbon, are compressed by the compressor and then enter the absorber. The absorber uses overhead naphtha of atmospheric tower with chilled water to cool to 20℃ as the absorbent to absorb the C3 and C4 components in the gas.

含有部分轻烃的初顶气、常顶气、煤加氢塔顶气和柴油加氢塔顶气经压缩机压缩后进入吸收塔。吸收塔使用冷冻水冷却至20℃的常顶石脑油作为吸收剂，吸收气体中的C3、C4组分。

（3）The rich absorption oil after absorption of light hydrocarbon in the absorber enters the desorption tower with the overhead naphtha of pre-distillation tower and part of the overhead naphtha in atmospheric tower to separate the dissolved C2 and below, and the desorption gas is circulated back to the absorber. The desorption tower uses 1.0 MPa steam as the heat source.

吸收塔吸收轻烃后的富吸收油与初顶石脑油和部分常顶石脑油进入脱吸塔，分离其中溶解的C2及以下组分，脱吸气循环回吸收塔。脱吸塔采用1.0MPa蒸汽作为热源。

（4）The straight-run naphtha desorbed by the desorption tower with the mixture of kerosene hydrogenated naphtha, diesel hydrogenated naphtha and light hydrocarbon, reformed light hydrocarbon, etc. enters the stabilizer. The stabilizer adopts the atm. PA#2 as the heat source, and the LPG (C3 and C4 components) separated at the top of the tower is sent to the desulfurization system. The overhead gas of stabilizer is circulated back to the absorber. The stabilized naphtha enters the reforming unit as raw material. The C5 component in the naphtha is separated in the de-pentanizer column of the reforming unit.

经脱吸塔脱吸后的直馏石脑油与煤油加氢石脑油、柴油加氢石脑油和轻烃、重整轻烃等混合后进入稳定塔。稳定塔采用常二中作为热源，塔顶分离的液化气（C3、C4组分）送至脱硫系统，稳定塔顶气循环回吸收塔。稳定后的石脑油则进入重整单元做原料。石脑油中的C5组分在重整单元的脱戊烷塔进行分离。

1.1.2.2　Basic principle of the absorption process　吸收过程的基本原理

The process of absorption and desorption is an important method for separating gas mixtures in refinery. The absorption process is the dissolution of certain gas components (such as C3, C4, or H2S) in the gas mixture in absorbent such as gasoline or ethanolamine. On the other hand, the process of separating the gas component dissolved in the absorption liquid through heating or decompressing is the desorption process.

吸收与解吸过程，是炼油中分离气体混合物的一种重要方法。吸收过程是气体混合物中某些气体组分（如C3、C4等或H2S），在吸收剂中（如汽油或乙醇胺）的溶解过程。反之，把吸收液中溶解的气体组分，通过升温或减压分离出来的过程，则是解吸（脱吸）过程。

There are two types of absorption: one is physical absorption (such as using naphtha as the absorbent to absorb C3 and C4 components in rich gas); the other is chemical absorption (such as using ethanolamine as solvent to absorb hydrogen sulfide in the gas). Chemical absorption is an absorption process accompanied by chemical reaction.

吸收过程有两种类型：一种是物理吸收（如用石脑油作吸收剂吸收富气中的C3、C4组分）；另一种是化学吸收（如用乙醇胺类作溶剂吸收气体中的硫化氢），化学吸收是伴随有化学反应的吸收过程。

The separation of the components in the absorption process is mainly carried out by the different phase equilibrium constants K and the liquid-gas ratio L/V of each respective component.

吸收过程中各组分的分离，主要靠各组分不同的相平衡常数K和液气比L/V来进行。



Where Ai is the absorption factor of a component;

       L——the amount of absorbent, Kmol/h;

       V——the amount of raw material gas, Kmol/h;

       Ki——the phase equilibrium constant of this component.

式中 Ai——某一组分的吸收因数；

L——吸收剂量，Kmol/h；

V——原料气体量，Kmol/h；

Ki——该组分的相平衡常数。

When the number of theoretical plates is constant, the larger the absorption factor, the higher the absorption rate. The phase equilibrium constant is related to the temperature and pressure of absorption: when the temperature is high and the pressure is low, the equilibrium constant is large.

当理论塔板数一定时，吸收因数愈大，吸收率愈高。相平衡常数则与吸收的温度和压力有关：温度高，压力低，则平衡常数大。

1.1.2.3　Selection and influence of absorption and desorption conditions　吸收与解吸条件选择及影响

（1）Absorption pressure　吸收压力

When the liquid-gas ratio and the absorption temperature are constant, raising the absorption pressure increases the gas absorption rate. This is because the solubility increases as the pressure increases, showing the decrease of phase equilibrium constant. When the absorption pressure reaches a certain value, the increase margin of the absorption rate is also small due to the small decrease margin of K value. Moreover, the absorption rate of ethane increases more than that of propane under too high pressure, causing excessive C2 component to be absorbed, while raising the pressure increases the power consumption correspondingly.

当液气比和吸收温度一定时，提高吸收压力，可增加气体的吸收率。这是因为压力增加时溶解度增加，表现为相平衡常数减小。当吸收压力达到某数值后，因K值降低的幅度也很小，吸收率增加的幅度也很小。而且在过高的压力下，乙烷吸收率增加的幅度比丙烷大，会引起过多的C2组分被吸收，同时提高压力，动力消耗也相应增加。

（2）Absorption temperature　吸收温度

The lower the absorption temperature is, the higher the absorption rate will be. As the temperature is lowered, the phase equilibrium constant K is decreased, and thus both the absorption factor and the absorption rate are increased. According to the literature, the absorption factor can be increased by 2% to 4% when the temperature is lowered by 1℃. Since the absorption process is an exothermic process, an intermediate cooling circulation circuit is generally provided in the middle of the absorber, in order to remove the absorption heat and lower the absorption temperature.

吸收温度越低，吸收效率越高。因温度降低，相平衡常数K减小，因而吸收因数和吸收率都增高。有关文献指出，温度降低1℃时，吸收因数可提高2%～4%。因吸收过程是放热过程，为了取走吸收热，降低吸收温度，通常吸收塔中部设有中间冷却循环回路。

（3）Liquid to gas ratio　液气比

The ratio of liquid to gas is the ratio of the absorbent amount to the amount of feed gas entering the absorber. The ratio of liquid to gas increases, the absorption factor increases, and the absorption rate increases too. When the absorption factor reaches a certain value, the increase in the absorption rate is not significant as the liquid-gas ratio is continuously increased. Therefore, an excessive liquid-gas ratio is neither economical nor reasonable.

液气比就是吸收剂量与进入吸收塔的原料气量之比，液气比增大，吸收因数增大，吸收率也增加。当吸收因数达到一定值时，继续增加液气比，吸收率的提高并不明显。因此，过大的液气比既不经济又不合理。

（4）Absorbent quality　吸收剂的质量

If too much C3 and C4 components are dissolved in the stabilized gasoline during absorption, the absorption rates of C3 and C4 will be lowered. Generally, its quality can be adjusted by the stabilizer, when the stabilized gasoline is used as the absorbent.

在吸收过程中若稳定汽油中溶有过多的C3、C4组分，则C3、C4的吸收率要降低。用稳定汽油作吸收剂，其质量的好坏一般可通过稳定塔进行调节。

（5）Superficial gas velocity　空塔气速

If the superficial linear velocity of absorber is too high, a large amount of absorbent will be taken away from the top of the absorber; if the gas velocity is too low, the two phases of gas and liquid will not contact well on the tray, and then the absorption effect will be affected. For the existing tower, the amount of gas determines the superficial linear velocity.

吸收塔的空塔线速度过高，将有大量吸收剂从塔顶带走；气速过低，气液两相在塔板上不能很好地接触，又会影响吸收效果。对于已有塔来说，气量的多少决定了空塔线速度的大小。

Desorption is the opposite process of absorption, so the conditions and influencing factors of desorption are just opposite to the absorption conditions.

解吸是吸收的相反过程，因此，解吸条件和影响因素恰与吸收条件相反。

 **Figure 1**　**Flow diagram with control points**

**图1**　**带控制点流程图**

1.1.4　Brief description of the process　工艺流程简要说明

1.1.4.1　Overhead gas compressor section　塔顶气压缩机部分

The overhead gas from pre-distillation tower and atmospheric tower of the atmospheric and vacuum distillation unit, and the overhead gas of the kerosene hydrogenation unit and of the diesel hydrogenation unit enter the compressor inlet knockout drum (1012-D-601), and the mixture of gas is compressed by the overhead gas compressor (1012-K-601A~C), and is combined with the overhead gas from desorption tower (1012-C-630) into the compressor discharge cooler (1012-E-602W) for cooling, and then is mixed with the overhead gas of reforming pre-hydrogenation, the overhead non-condensable gas of stabilizer from the stabilizer (1012-C-640) enters into the compressor discharge K.O. drum (1012-D-602). The mixture of gas enters the bottom of the absorber (1012-C-610). The condensate at the bottom of the knockout drum is pumped out through the pump of compressor outlet knockout drum (1012-P-602A/B), and is combined with partial absorber bottom oil as the desorption tower feed to the desorption tower (1012-C-630) overhead.

来自常减压蒸馏装置的初顶气、常顶气、煤油加氢装置塔顶气、柴油加氢装置塔顶气进入压缩机入口分液罐（1012-D-601），混合后的气体经塔顶气压缩机（1012-K-601A~C）压缩，与脱吸塔（1012-C-630）塔顶气合并进入压缩机出口水冷器（1012-E-602W）冷却，再与重整预加氢塔顶气、自稳定塔（1012-C-640）来的稳定塔顶不凝气混合进入压缩机出口分液罐（1012-D-602）。混合气体进入吸收塔（1012-C-610）底部。分液罐底部的凝液经压缩机出口分液罐泵（1012-P-602A/B）抽出，与部分吸收塔底油合并作为脱吸塔进料送至脱吸塔（1012-C-630）顶部。

1.1.4.2　Absorber section　吸收塔部分

In the absorber, part of the overhead oil from the atmospheric tower that is cooled to 20℃ with the atm. OVHD oil water coolant cooler (1012-E-615) enters the 50th tray on top of absorber and have reverse contact with the mixed compressed gas entering the bottom of absorber (1012-C-610) to absorb C3 and C4 components contained in the gas. The overhead dry gas is directed out of unit to dry gas desulfurization and the bottom oil of absorber is pumped out by the absorber bottom oil pump (1012-P-610A/B), and is divided into two paths to the desorption tower.

在吸收塔内，经常顶油-冷冻水换热器（1012-E-615）冷至20℃的部分常顶油进入吸收塔顶第50层塔盘，与进入吸收塔（1012-C-610）底部的混合压缩气逆向接触吸收气体中含有的C3、C4组分。塔顶干气出装置去干气脱硫，吸收塔底油经吸收塔底泵（1012-P-610A/B）抽出，分成两路去脱吸塔。

1.1.4.3　Desorption tower section　脱吸塔部分

The absorber bottom oil is divided into two ways: one way is mixed with the condensate from the condensate pump of compressor outlet knockout drum and enters the 40th tray of the top of the desorption tower directly; the other way is mixed with the remaining part of the overhead oil of atmospheric tower and the overhead oil of pre-distillation tower after heat transfer with overhead oil of pre-dist. OVHD oil water coolant cooler exchanger (1012-E-636) , and enters the upper 22nd tray of desorption tower after heat transfer with desorption tower bottom feed exchanger (1012-E-635A/B) . The desorbed gas from the desorption tower is taken from the top of the desorption tower and combined with the compressor outlet gas into the compressor discharge cooler (1012-E-602W). The bottom oil of desorption tower is pumped out to the stabilizer (1012-C-640) by the desorption tower bottom oil pump (1012-P-630A/B). The desorption tower bottom re-boiler (1012-E-630R) uses 1.0MPa steam. as the heat source.

吸收塔底油分成两路：一路与来自压缩机出口分液罐凝液泵的凝液混合直接进入脱吸塔顶第40层塔盘；另一路与剩余部分常顶油以及经初顶油-凝结水换热器（1012-E-636）换热的初顶油混合，经脱吸塔进料换热器（1012-E-635A/B）换热后进入脱吸塔上部第22层塔盘。脱吸塔解吸后的气体自脱吸塔顶引出，与压缩机出口气合并进入压缩机出口水冷器（1012-E-602W）。脱吸塔底油经脱吸塔底泵（1012-P-630A/B）抽出送至稳定塔（1012-C-640）脱吸塔底重沸器（1012-E-630R）采用1.0MPa蒸汽作为热源。

1.1.4.4　Stabilizer section　稳定塔部分

Naphtha from the kerosene hydrogenation unit, naphtha and liquid hydrocarbon of the diesel hydrogenation unit, intermittent liquid hydrocarbon from the reforming unit and unqualified LPG in the tank farm are mixed into the naphtha feed buffer drum (1012- D-645), the mixed naphtha is pumped out by the mixed naphtha pump (1012-P-645A/B) and mixed with the bottom oil of desorption tower from the desorption tower bottom oil pump (1012-P-630A/B). After the heat transfer of the stabilizer feed exchanger (1012-E-645), it enters the upper 26th tray of the stabilizer. The overhead oil gas of stabilizer (1012-C-640) is cooled by the overhead composite air cooler (1012-E-641A-C) of stabilizer and then enters the stabilizer OVHD reflux and product drum (1012-D-641). The liquid in the tank is withdrawn through the stabilizer OVHD reflux and product pump (1012-P-641A/B), some is returned as reflux to the overhead 50th tray of the stabilizer, and the other is sent to the LPG desulfurization unit for desulfurization. The stabilizer bottom oil is sent out from the bottom of the tower through the stabilizer feed exchanger (1012-E-645) and the desorption tower bottom feed exchanger (1012-E-635A/B) for heat transfer to the reforming pre-hydrogenation unit as hot discharge, or is cooled once more to 40°C by the stabilized naphtha air cooler (1012-A-640A/B) and the naphtha startup-shutdown water cooler (1012-E-640W/X) and sent to tank farm. The stabilizer bottom re-boiler (1012-E-640R/S) uses the atm. PA #2 of the atmospheric and vacuum distillation unit as the heat source.

来自煤油加氢装置的石脑油、柴油加氢装置的石脑油、液态烃、自重整装置间断来的液态烃及罐区不合格液化气混合进入石脑油进料缓冲罐（1012-D-645），混合石脑油经石脑油进料泵（1012-P-645A/B）抽出，与来自脱吸塔底泵（1012-P-630A/B）的脱吸塔底油混合，经稳定塔进料换热器（1012-E-645）换热后进入稳定塔上部第26层塔盘。稳定塔（1012-C-640）顶油气经稳定塔顶复合空冷器（1012-E-641A～C）冷却后，进入稳定塔顶回流及产品罐（1012-D-641）。罐内液体经稳定塔顶回流及产品泵（1012-P-641A/B）抽出，一部分作为回流返回稳定塔顶第50层塔盘，另一部分送至液化气脱硫单元进行脱硫。稳定塔底油自塔底压出经稳定塔进料换热器（1012-E-645）、脱吸塔进料换热器（1012-E-635A/B）换热后作为热出料送至重整预加氢装置，或再经石脑油开停工空冷器（1012-A-640A/B）、石脑油开停工水冷器（1012-E-640W/X）冷却至40℃送至罐区。稳定塔底重沸器（1012-E-640R/S）采用常减压蒸馏装置的常二中物料作为热源。

1.2　Process specifications　工艺指标

1.2.1　Quality specifications of main feedstocks and raw materials　主要原料及原辅料质量指标

The feedstocks of the unit are mainly the overhead naphtha of pre-distillation and of atmospheric tower from the atmospheric and vacuum distillation unit. In addition, there are kerosene hydrogenated naphtha and overhead gas, overhead light hydrocarbon and overhead gas of diesel hydrogenation stripper, overhead naphtha of diesel hydrogenation fractionator, and reforming pre-hydrogenated light hydrocarbon.

本装置原料主要为常减压蒸馏装置初常顶石脑油。此外，还有煤油加氢石脑油及塔顶气、柴油加氢汽提塔顶轻烃及塔顶气、柴油加氢分馏塔顶石脑油、重整预加氢轻烃。

The main feedstocks properties are shown in the table below.

主要原料性质见下表。

**Table 1**　**Naphtha properties table  
表1石脑油性质表**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Feed properties (composition)  进料性质（组成） | | Unit  单位 | Overhead oil of pre-distillation tower  初顶油 | Overhead oil of atmospheric tower常顶油 | Kerosene hydrogenated naphtha煤油加氢石脑油 | Diesel hydrogenated naphtha  柴油加氢  石脑油 |
| Flow rate流率 | | t/h | 80.97 | 170.96 | 0.36 | 19.94 |
| Composition组成 | H2O | % mol | 0.1 | 1.05 | 0.0 | 0.60 |
| H2 | % mol | 3.0 | 0.00 | 0.3 | 70.96 |
| H2S | % mol | 0.5 | 0.00 | 0.0 | 5.37 |
| NH3 | % mol | 0.03 | 0.00 | 0.0 | 0.16 |
| C1 | % mol | 0.1 | 0.00 | 0.4 | 4.54 |
| C2 | % mol | 0.6 | 0.00 | 5.7 | 2.73 |
| C3 | % mol | 3.1 | 0.00 | 32.6 | 5.40 |
| IC4 | % mol | 3.0 | 0.01 | 21.8 | 4.48 |
| nC4 | % mol | 6.7 | 0.01 | 36.2 | 2.17 |
| IC5 | % mol | 5.3 | 0.17 | 1.9 | 1.63 |
| nC5 | % mol | 6.9 | 0.13 | 0.9 | 0.60 |
| C5+ | % mol | 70.6 | - | 0.2 | - |
| C6+ | % mol |  | 98.63 | - | 1.37 |
| Specific gravity比重(15.6℃) | |  | 0.6568 | 0.726 | 0.723 | 0.742 |
| Molecular weight分子量 | | g/mol | - | - | - | 14.07 |

**Table 1(continued)**　**Naphtha properties table  
表1（续）石脑油性质表**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Feed properties (composition)  进料性质（组成） | Unit  单位 | Overhead oil of pre-distillation tower  初顶油 | Overhead oil of atmospheric tower常顶油 | Kerosene hydrogenated naphtha煤油加氢石脑油 | Diesel hydrogenated naphtha  柴油加氢  石脑油 |
| ASTM D86 at 760 mmHg (LV) | °C |  |  |  |  |
| 1% |  | - | - | - | 51 |
| 5% |  | 4.5 | 45.8 | 57 | - |
| 10% |  | 17.4 | 59.0 | 88 | 67 |
| 30% |  | 39.9 | 95.6 | 101 | 92 |
| 50% |  | 48.7 | 111.6 | 109 | 112 |
| 70% |  | 70.9 | 128.8 | 149 | 133 |
| 90% |  | 94.7 | 149.1 | 161 | 155 |
| 95% |  | 105.5 | 159.3 | - | 162 |
| 98% |  | 120.6 | 174.5 | 174 | - |

**Table 2 Properties table of liquid light hydrocarbon**

**表2**　**液态轻烃性质表**

|  |  |  |
| --- | --- | --- |
| Feed properties (composition)进料性质（组成） | | Overhead light hydrocarbon of diesel hydrogenated stripper  柴油加氢汽提塔顶轻烃 |
| Flow rate流率kg/h | |  |
| Composition  组成 | H2O | 1.192 |
| H2 | 0.172 |
| H2S | 50.717 |
| NH3 | 0.001 |
| C1 | 0.577 |
| C2 | 3.684 |
| C3 | 45.193 |
| IC4 | 81.941 |
| nC4 | 71.508 |
| IC5 | - |
| nC5 | - |
| C5+ | 1745.015 |
| C6+ | - |
| Specific gravity比重d15.6 15.6 | | 0.6975 |
| ASTM D86 | |  |
| 1% | | 21 |
| 5% | | 30 |
| 10% | | 33 |
| 30% | | 39 |
| 50% | | 47 |
| 70% | | 61 |
| 90% | | 101 |
| 95% | | 118 |
| 98% | | 126 |

**Table 3 Property table of overhead gas**

**表3**　**塔顶气性质表**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Feed properties (composition)  进料性质（组成） | | Overhead gas of pre-distillation tower  初顶气 | | Overhead gas of atmospheric tower  常顶气 | | Kerosene hydrogenated overhead gas  煤油加氢塔顶气 | | Diesel hydrogenated overhead gas  柴油加氢塔顶气 | | Reforming pre-hydrogenated overhead gas  重整预加氢塔顶气 | |
| Mass flow rate质量流率kg/h | | 460.3 | | 368.2 | | 1009.6 | | 2180.49 | | 1814 | |
| Composition  组成 | H2O | | 4.35 | | 9.60 | | - | | 14.74 | | 9.72 |
| H2 | | 0.00 | | 0.00 | | 73.6 | | 99.01 | | 117.6 |
| H2S | | 1.05 | | 8.45 | | 358.9 | | 665.57 | | 395.52 |
| NH3 | | - | | - | | 0.30 | | 0.01 | | - |
| C1 | | 104.88 | | 98.92 | | 51.36 | | 50.45 | | 79.68 |
| C2 | | 35.69 | | 20.44 | | 35.29 | | 61.66 | | 174.3 |
| C3 | | 64.42 | | 23.62 | | 42.72 | | 232.75 | | 127.16 |
| IC4 | | 32.92 | | 14.39 | | 39.09 | | 185.05 | | 70.76 |
| nC4 | | 80.50 | | 41.45 | | - | | 115.08 | | 60.32 |
| IC5 | | 52.98 | | 37.64 | | - | | 1.63 | | 585.36 |
| nC5 | | 33.51 | | 27.91 | | - | | 0.60 | | 147.6 |
| C5+ | | 47.80 | | 83.53 | | 408.34 | | 756.17 | | 42.62 |
| Molecular weight  分子量g/mol | | | 35.1 | | 34.3 | | 17.5 | | 22.6 | | 18.5 |

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

The products of this unit are all intermediate products, mainly dry gas, crude LPG and stabilized naphtha. The main specifications of the products are as follows:

本装置的产品均为中间产品，主要有干气、粗液化气、稳定石脑油。产品主要规格见下表：

**Table 4**　**Main control specifications of product**

**表4**　**产品主要控制指标**

|  |  |  |  |
| --- | --- | --- | --- |
| Product description  产品名称 | Unit  单位 | Control specification  控制指标 | Remarks  备注 |
| Dry gas 干气： |  |  |  |
| C3 and above  C3及C3+组分 | vol | ≯5% |  |
| LPG液化气： |  |  |  |
| C5 and above  C5及C5+组分 | vol | ≯3% |  |
| Steam pressure  蒸气压（37.8℃） | kPa | ≯1380 |  |

**Table 5**　**Main product properties of the unit**

**表5　装置主要产品性质**

|  |  |  |  |
| --- | --- | --- | --- |
| Material description  物料名称 | Dry gas  干气 | LPG  液化气 | Naphtha of stabilizer  稳定石脑油 |
| Molecular weight分子量 | 10.58 | 51.68 | 96.01 |
| Property factor特性因数 | 19.33 | 13.56 | 12.18 |

**Table 5(continued)**　**Main product properties of the unit**

**表5（续）　装置主要产品性质**

|  |  |  |  |
| --- | --- | --- | --- |
| Material description  物料名称 | Dry gas  干气 | LPG  液化气 | Naphtha of stabilizer  稳定石脑油 |
| Density密度D20 4 | 0.468 | 569.1 | 713.2 |
| Specific weight  比重D15.6 | - | 0.5696 | 0.7139 |
| ASTM D86 at 760mmHG(lv) | | | |
| IBP |  |  | 19 |
| 5% |  |  | 48 |
| 10% |  |  | 54 |
| 30% |  |  | 73 |
| 50% |  |  | 97 |
| 70% |  |  | 116 |
| 90% |  |  | 145 |
| 95% |  |  | 157 |
| EBP |  |  | 172 |

Note: The dry point of stabilizer naphtha is controlled by the upstream plant (unit) entering the light ends recovery unit.

注：稳定石脑油的干点由进轻烃回收的上游装置（单元）控制

**Table 6　Composition of dry gas and LPG**

**表6　干气、液化气组成**

|  |  |  |
| --- | --- | --- |
| Material description  物料名称 | Dry gas  干气 | LPG  液化气 |
| Molecular weight分子量 | 10.58 | 51.68 |
| Composition组成mol% | | |
| H2O | 0.30 | 0.08 |
| H2 | 65.40 | 0.00 |
| H2S | 7.05 | 11.31 |
| NH3 | 0.00 | 0.01 |
| C1 | 17.97 | 0.25 |
| C2 | 6.14 | 3.53 |
| C3 | 0.60 | 20.48 |
| IC4 | 0.25 | 16.93 |
| nC4 | 0.70 | 45.44 |
| C5+ | 1.58 | 1.97 |
| 合计 | 100 | 100 |

1.2. 3　Utilities specification公用工程指标

See Table 7 for the utilities specifications of the light ends recovery unit.

轻烃回收装置各公用工程指标见表7

**Table 7　Utilities specifications**

**表7　公用工程指标**

|  |  |  |
| --- | --- | --- |
| Item项目 | Temp. Specification  温度指标  ℃ | Pressure specification  压力指标  MPa |
| 1.0MPaSteam  1.0MPa蒸汽 | / | ≥1.0 |
| Recycled water  循环水 | ≤33 | ≥0.4 |
| Plant air工厂风 |  | ≥0.6 |
| Demineralized water除盐水 |  | ≥0.7 |
| Instrument air  仪表风 |  | ≥0.6 |
| Nitrogen氮气 |  | ≥0.6 |

1.2. 4　Main operating conditions主要操作条件

The main operating conditions of each tower of the light ends recovery unit are shown in Table 8.

轻烃回收装置各塔的主要操作条件见表8

**Table 8　Main operating conditions**

**表8　主要操作条件**

|  |  |  |
| --- | --- | --- |
| Item项目 | Unit单位 | Values数值 |
| Absorber吸收塔 |  |  |
| Overhead pressure  塔顶压力 | MPa(g) | 0.87 |
| Overhead temperature  塔顶温度 | °C | 24 |
| Bottom temperature  塔底温度 | °C | 40 |
| Desorption tower脱吸塔 |  |  |
| Overhead pressure  塔顶压力 | MPa(g) | 1.0 |
| Overhead temperature  塔顶温度 | °C | 55 |
| Bottom temperature  塔底温度 | °C | 143 |
| Re-boiler outlet temperature  重沸器出口温度 | °C | 163 |
| Stabilizer 稳定塔 |  |  |
| Overhead pressure  塔顶压力 | MPa(g) | 1.1 |
| Overhead temperature  塔顶温度 | °C | 69 |
| Bottom temperature  塔底温度 | °C | 186 |
| Re-boiler outlet temperature  重沸器出口温度 | °C | 194 |

**Table 8(continued)　Main operating conditions**

**表8（续）　主要操作条件**

|  |  |  |
| --- | --- | --- |
| Item项目 | Unit单位 | Values数值 |
| Compressor 压缩机 |  |  |
| Outlet pressure出口压力 | MPa(g) | 0.95 |

1.2.5　Main design specifications主要设计指标

The main design specifications of light ends recovery unit are shown in Table 9.

轻烃回收装置主要设计指标见表9

**Table 9　Main design specifications**

**表9　主要设计指标**

|  |  |  |
| --- | --- | --- |
| Item项目 | Specification指标 | Unit单位 |
| Content of dry gas C3 and above  干气C3及以上组分含量 | ≤5 | %（v） |
| Content of LPG C5 and above  液化气C5及以上组分含量 | ≤3 | %（v） |
| Saturated steam pressure of LPG  液化气饱和蒸汽压（37.8℃） | ≤1380 | kPa |

1.2.6　Main process specifications (process cards)主要工艺指标（工艺卡片）

The main process specifications of light ends recovery unit are shown in Table 10.

轻烃回收装置主要工艺指标见表10

**Table 10　Main process specifications**

**表10　主要工艺指标**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No.序号 | Item项目 | Item No.位号 | Unit单位 | Control specification  控制指标 | Remarks备注 |
| 1 | T-610 Overhead temperature 塔顶温度 | TI-61001 | ℃ | 15~25 |  |
| 2 | T-630 Overhead temperature塔顶温度 | TI-63201 | ℃ | 45~65 |  |
| 3 | T-640 Overhead temperature塔顶温度 | TI-64101 | ℃ | 60~80 |  |
| 4 | T-610 Overhead pressure  塔顶压力 | PIC-61001 | MPa | 0.65~0.85 |  |
| 5 | T-630 Overhead pressure  塔顶压力 | PIC-63201 | MPa | 0.8~1.0 |  |
| 6 | T-640 Overhead pressure  塔顶压力 | PI-64101 | MPa | 0.95~1.15 |  |
| 7 | D-641Drum overhead pressure  罐顶压力 | PIC-64401 | MPa | 0.8～1.1 |  |
| 8 | T-630E Re-boiler outlet temperature  再沸器出口温度 | TIC-63207 | ℃ | 140~170 |  |

**Table 10(continued)　Main process specifications**

**表10（续）　主要工艺指标**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item项目 | Item No.位号 | Unit单位 | | Control specification  控制指标 | | Remarks备注 | |
| 9 | T-640 Re-boiler outlet temperature  再沸器出口温度 | TIC-64201 TIC-64202 | | ℃ | | 170~200 | |  |
| 10 | Temperature of stabilizer naphtha to tank farm  稳定石脑油至罐区温度 | TI-64702 | | ℃ | | 25~45 | |  |
| 11 | Temperature of LPG from stabilizer to de-sulfuration  稳定塔液化气至脱硫温度 | TIC-64301 | | ℃ | | 25~45 | |  |
| 12 | T-610 Level液位 | LIC61001 | | % | | 40~60 | |  |
| 13 | T-630 Level液位 | LIC63201 | | % | | 40~60 | |  |
| 14 | T-640 Level液位 | LIC64101 | | % | | 40~60 | |  |
| 15 | D-641Drum level罐液位 | LIC64401 | | % | | 30~70 | |  |

1.2.7　Main material balance　主要物料平衡

**Table 11**　**Material Balance Sheet**

**表11　物料平衡表**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | Feed description  物料名称 | Yield收率 | Flow rate流率 | | | Remarks备注 |
| m% | 104t/a | t/a | kg/h |  |
| First一 | Import入方 | | | | | |
| 1 | Overhead gas of pre-distillation tower初顶气 |  | 0.39 | 11.0 | 460 | From atmospheric and vacuum distillation unit  来自常减压装置 |
| 2 | Overhead gas of atmospheric tower常顶气 |  | 0.31 | 8.8 | 368 | From atmospheric and vacuum distillation unit  来自常减压装置 |
| 3 | Kerosene hydrogenated overhead gas  煤油加氢塔顶气 |  | 0.85 | 24.2 | 1010 | From kerosene hydrogenated unit  来自煤油加氢装置 |
| 4 | Diesel hydrogenated overhead gas  柴油加氢塔顶气 |  | 1.82 | 52.0 | 2166 | From diesel hydrogenated unit 来自柴油加氢装置 |
| 5 | Reforming pre-hydrogenated overhead gas  重整预加氢塔顶气 |  | 1.52 | 43.3 | 1804 | From reforming pre-hydrogenated unit  来自重整预加氢装置 |

**Table 11 (continued) Material Balance Sheet**

**表11（续）物料平衡表**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | Feed description  物料名称 | Yield收率 | Flow rate流率 | | | Remarks备注 |
| m% | 104t/a | t/a | kg/h |  |
| 6 | Diesel hydrogenated light hydrocarbon柴油加氢轻烃 |  | 1.68 | 48.0 | 1999 | From diesel hydrogenated unit 来自柴油加氢装置 |
| 7 | Overhead oil of pre-distillation tower初顶油 |  | 68.02 | 1943.5 | 80979 | From atmospheric and vacuum distillation unit  来自常减压装置 |
| 8 | Overhead oil of atmospheric tower常顶油 |  | 143.61 | 4103.0 | 170959 | From atmospheric and vacuum distillation unit  来自常减压装置 |
| 9 | Kerosene hydrogenated naphtha煤油加氢石脑油 |  | 0.30 | 8.5 | 354 | From kerosene hydrogenated unit  来自煤油加氢装置 |
| 10 | Diesel hydrogenated naphtha柴油加氢石脑油 |  | 16.75 | 478.5 | 19936 | From diesel hydrogenated unit 来自柴油加氢装置 |
|  | Total 小计 | 100 | 235.23 | 6720.8 | 280035 |  |
| Second 二 | Export出方 | | | | | |
| 1 | Dry gas干气 | 0.82 | 1.94 | 55.3 | 2306 | To dry gas de-sulfuration  去干气脱硫 |
| 2 | LPG液化气 | 5.51 | 12.96 | 370.3 | 15430 | To LPG de-sulfuration  去液化气脱硫 |
| 3 | Naphtha石脑油 | 93.67 | 220.33 | 6295.2 | 262299 | To reforming pre-hydrogenation  去重整预加氢 |
|  |  | 100 | 235.23 | 6720.8 | 280035 |  |

1.2.8　Consumption of raw material and utilities and energy consumption specifications　原材料消耗、公用工程消耗及能耗指标

The auxiliary materials consumed by the light ends recovery unit are shown in Table 12.

轻烃回收装置消耗的辅助材料见表12

**Table 12**　**Specification table of auxiliary material**

**表12　辅助材料规格表**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No.  序号 | Description  名称 | Model or specification  型号或规格 | Annual consumption  年用量(t) | Remarks  备注 |
| 1 | Neutralization inhibitor  中和缓蚀剂 | Oil soluble  油溶性 | 17 | Barreled  桶装 |

Utility consumption of light ends recovery unit is shown in Table 13.

轻烃回收装置公用工程消耗见表13

**Table 13**　**Utility Consumption**

**表13　公用工程消耗**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No.序号 | Item项目 | Unit单位 | Consumption  耗量 | Remarks  备注 |
| 1 | Electricity电 | kWh/a | 951.846 |  |
| 2 | 1.0MPa Steam蒸汽 | t/h | 5.93 |  |
| 3 | Fresh water  新鲜水 | t/h | 0.2 |  |
| 4 | Circulating water  循环水 | t/h | 589.15 |  |
| 5 | Instrument Air  仪表风 | m3/h | 60 |  |
| 6 | Plant Air  工业风 | m3/h | 180 | Intermittent间断 |
| 7 | 0.6MPa Nitrogen  氮气 | m3/h | 86 |  |
| 8 | Chilled water  冷冻水 | t/h | 155.46 |  |

The energy consumption of light ends recovery unit is shown in Table 14.

轻烃回收装置能耗见表14

**Table 14**　**Energy consumption of light ends recovery un**

**表14　轻烃回收装置能耗**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item项目 | Consumption消耗量 | | | Energy conversion value能量折算值 | | Unit energy consumption  单位能耗 | |
| Unit consumption  单位耗量 | | Unit consumption  单耗 | MJ/t  raw material原料 | Kilogram oil / t raw material千克标油/ t原料 |
| Unit  单位 | Quantity  数量 | Unit  单位 | Quantity  数量 |
| 1 | Electricity电 | kW.h/h | 951.85 | 4.0504 | MJ/kW.h | 9.546 | 38.627 | 0.923 |
| 3 | 1.0MP  Steam蒸汽 | t/h | 5.93 | 0.0212 | MJ/t | 3182 | 67.382 | 1.609 |
| 5 | Circulating water  循环水 | t/h | 589.15 | 2.1059 | MJ/t | 4.19 | 8.815 | 0.211 |
| 6 | Chilled water冷冻水 | t/h | 155.46 | 0.5557 | MJ/t | 8.79 | 4.880 | 0.117 |
| 7 | Nitrogen  氮气 | m3/h | 86 | 0.3074 | MJ/ m3 | 6.28 | 1.929 | 0.046 |
| 8 | Instrument air仪表风 | m3/h | 60 | 0.2154 | MJ/ m3 | 1.59 | 0.341 | 0.008 |
| 8 | Condensed water凝结水 | t/h | 5.83 | 0.0208 | MJ/t | 320.29 | -6.668 | -0.159 |

**Table 14(continued)**　**Energy consumption of light ends recovery un**

**表14（续）　轻烃回收装置能耗**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item项目 | Consumption消耗量 | | | Energy conversion value能量折算值 | | Unit energy consumption  单位能耗 | |
| Unit consumption  单位耗量 | | Unit consumption  单耗 | MJ/t  raw material原料 | Kilogram oil / t raw material千克标油/ t原料 |
| Unit  单位 | Quantity  数量 | Unit  单位 | Quantity  数量 |
| 9 | Heat input  热输入 | kW | 11803 |  |  |  | 151.73 | 3.62 |
|  |  |  |  |  |  |  |  |  |
|  | Total合计 |  |  |  |  |  | 267.037 | 6.375 |

Note: Raw materials are calculated at 280.036 t / h (ie 235.23 × 104 t/a).

注：原料按280.036t/h（即235.23×104t/a）计算。

1.3　Three wastes treatment　三废处理

1.3.1　Waste water　废水

The waste water discharged from the unit during the production includes sulfur-containing wastewater, alkali-containing wastewater, and oily wastewater. The drainage of the unit is classified according to the principle of diverting wastewater from clean water and splitting flow of various wastewaters.

本装置在生产过程中排出的废水有含硫污水、含碱污水、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。

1）Oily wastewater

含油污水

It includes the sampling cooler, pump cooling, initial rainwater and ground flushing water, etc. the main pollution components are: COD of 250mg/l and petroleum of 150 ~ 200mg/l. The oily wastewater generated from the ground and the pumping side ditch has the design flow rate of 0~9t/h. The oily wastewater is sent to the sewage treatment plant through the pipe network for centralized treatment.

包括取样冷却器、机泵冷却、初期雨水、地面冲洗水等，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0~9t/h。含油污水经管网送至污水处理场进行集中处理。

2）Sulfur-containing wastewater

含硫污水

The sulfur-containing wastewater from the plant mainly comes from the Compressor Discharge K.O. Drum D-602, Stabilizer OVHD Reflux and Product Drum D-641 and the naphtha feed buffer Drum D-645, all of which are discharged intermittently with the discharge rate of 0~ 0.4t/h. The main pollutant components are: sulfide of 620mg/l, COD of 2500mg/l, petroleum of 150mg/l and ammonia nitrogen of 620mg/l. The sulfur-containing wastewater is combined with the sulfur-containing wastewater of the 8 million tons/year atmospheric and vacuum distillation unit and sent to the sour water stripping unit for treatment.

装置含硫污水主要来自于压缩机出口分液罐D-602、稳定塔塔顶分液罐D-641、石脑油进料缓冲罐D-645，均为间断性排放，排放量为0~0.4t/h。主要污染组份为：硫化物620mg/l、COD2500mg/l、石油类150mg/l、氨氮620mg/l。含硫污水与800万吨/年常减压蒸馏装置含硫污水合并后送至酸性水汽提装置进行处理。

**Table 15**　**Property and hazard of main pollutants**

**表15　主要污染物性质危害**

|  |  |  |
| --- | --- | --- |
| Main pollutants  主要污染物 | Property性质 | Hazard危害 |
| Petroleum hydrocarbon  石油烃 | It is a low-toxic substance, stable in water, with a content of 0.2-0.4mg/l, which can form an oil film of 3mg/l on the water surface, and has a slight inhibition on the biochemical oxygen consumption process of water.  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3mg／l，对水的生化耗氧过程有轻度抑制 | After the oil is discharged into the water, a thin film is formed on the water surface to prevent the oxygen in the atmosphere from dissolving in the water, affecting the cleanliness of water and harming the survival of the aquatic organism.  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 |
| Sulfide  硫化物 | Hydrogen sulfide is a toxic substance that is colorless and smelly. It’s acidic and soluble in water.  硫化氢是无色、有臭鸡蛋味的有毒物质。溶于水中呈酸性 | It can enter the human body through breathing and cause tissue hypoxia, central nervous system poisoning, and even death in severe cases.  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 |
| Ammonia nitrogen  氨氮 | It’s a colorless and pungent smell of gas, soluble in water to form ammonia water.  无色、有辛辣味气体，易溶于水形成氨水 | Ammonia enters the respiratory tract and can damage the mucous membranes. It can also cause pulmonary hemorrhage, pulmonary edema and is even life-threatening.  氨从呼吸道进入，可损害粘膜，也可致肺出血、肺水肿甚至危及生命 |

1.3.2　Waste gas　废气

According to different emission modes, waste gas pollution sources can be divided into two categories: organized emission sources and unorganized emission sources. The organized source of emission is mainly the combustion fumes of the heater, while there is no heater in this unit. The unorganized emission sources are various leakages during processing, and the main pollutants are hydrocarbons. When the unit is started up and the operation is abnormal, the hydrocarbon-containing gas discharged from the safety valve is sealed and discharged to the flare system, and is processed by the flare gas recovery for comprehensive utilization.

按照排放方式的不同，废气污染源可分为有组织排放源和无组织排放源两大类。有组织排放源主要为加热炉的燃烧烟气，本装置没有加热炉。无组织排放源为在加工过程中的跑、冒、滴、漏等，其主要污染物为烃类。装置在开工及操作不正常时，安全阀排放的含烃气体均密闭排入火炬系统，通过火炬气回收进行工艺处理后综合利用。

1.3.3　Solid waste　固体废弃物

The solid waste of this unit is mainly mineral oil such as sludge generated during maintenance to clean the equipment and containers, and is stored in accordance with the system requirements and recycled by special vehicles to reduce pollution to the surrounding environment. No solid waste is produced during normal production.

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　Noise　噪音

The main noise sources of the unit include high-power pump, compressor, air cooler, and short-term steam venting during startup and shutdown. The sound pressure level is 80-91dBA. The noise sources of the unit are shown in the table below.

装置主要噪声源有大功率机泵、压缩机、空冷器，及开停工期间短期蒸汽放空等，其声压级为80～91dBA。装置的噪声源见下表

**Table 16**　**Noise sources**

**表16　噪声源**

| Noise sources  噪声源 | Indoor/outdoor室内/室外 | Noise reduction (anti-noise) measures减（防）噪措施 | Noise value after noise reduction降噪后噪声值  dB(A) |
| --- | --- | --- | --- |
| Pump机泵 | Outdoor室外 | Low noise motor  低噪声电机 | ＜85 |
| Compressor压缩机 | Outdoor室外 | Low noise motor  低噪声电机 | ＜85 |
| Air Cooler  空冷器 | Outdoor室外 | Motor and fan of low noise  低噪声电机、风机 | ＜85 |

Hazard of noise**0**：

Hearing impairment, which increases with the intensity of noise exposure, can cause a variety of diseases that affect the human central nervous system. This can affect the function of various parts of the human body, such as the digestive tract and endocrine, etc., and can also cause sympathetic nervous, leading to cardiovascular diseases; which will affect people's normal life and reduce labor productivity. People working in a noisy environment will be upset, prone to fatigue, with inattention and error-prone.

听力损伤，它随接触噪声的强度而增加；引起多种疾病，作用于人的中枢神经系统。由此可以影响到人体的各个部位功能，如消化道、内分泌等，也会使人交感神经紧张，导致心血管的疾病；影响人的正常生活，降低劳动生产率。在嘈杂的环境中工作，心烦意乱，容易疲乏，注意力不集中，还容易出错。

1.3.5　Environmental specifications　环保指标

**Table 17**　**Environmental control specifications of light ends recovery unit**

**表17　轻烃回收装置环保控制指标**

| Item项目 | Oiliness含油  mg/l | COD  mg/l | pH value值 | Sulfide  硫化物  mg/l |
| --- | --- | --- | --- | --- |
| Oily wastewater  含油污水 | 300 | 800 | 6~9 | 5 |

1.4　Unit equipment　装置设备

1.4.1　Equipment list and main design parameters　设备一览表及主要设计参数

**Table 18**　**List of Tower and main design parameters**

**表18　塔器一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | Item No.设备  位号 | Equipment description  设备名称 | Medium介质 | Dimensions规格尺寸 | Pressure压力(MPaG) | | Temp.温度(℃) | | Internal structure  内部结构 | | Tower material  塔体材质 | Volume  容积  （m3） |
| Diameter × height (tangent line) × wall thickness (mm)  直径×高度（切线）×壁厚(mm) | Design设计 | Operating操作 | Design设计 | Operating  top/bottom操作  上/下 | Number of plates or layers of packing  塔板数或填料层数 | Material材质 |
| 1 | C-610 | 吸收塔  Absorber | Naphtha, LPG, oil gas  石脑油、液化气、油气 | Ф2200×43714×17×/（3+14） | 1.5/-0.1 | 0.87 | 80/80 | 24/40 | 50-layer ATV float valve  50层ATV浮阀 | Tray塔盘：S11306  Float valve浮阀：S30408 | S11306+Q345R | 165 |
| 2 | C-630 | 脱吸塔 Desorption Tower | Naphtha, LPG, oil gas, H2S  石脑油、液化气、油气、H2S | Upper上Ф2000×13638×（3+10）  Middle中Ф2000/3200×1330×（3+22）  Lower下Ф3200×29659×（3+16） | 1.6/-0.1 | 1.0 | 80/183 | 55/143 | 50-layer ATV float valve  50层ATV浮阀 | Tray塔盘：S11306  Float valve浮阀：S30408 | S11306+Q345R | 283 |
| 3 | C-640 | 稳定塔 Stabilizer | Naphtha, LPG, oil gas  石脑油、液化气、油气 | Upper上Ф3000×5015×（3+22）  Middle-upper中上Ф3000×12200×26  Middle-lower中下Ф3000×2240×46  Lower下Ф4600×25930×40 | 1.61/-0.1 | 1.1 | 80/214 | 69/186 | 50-layer ATV float valve  50层ATV浮阀 | Tray塔盘：S11306  Float valve浮阀：S30408 | The material of top 5015mm is S11306+Q345R  the rest is Q245R顶部5015mm材质为S11306+Q345R  其余为Q245R | 566 |

**Table 19**　**Container list and main design parameters**

**表19　容器一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.位号 | Description名称 | Medium  介质 | Dimensions规格形式 | Material材质 | Temp.温度（℃） | | Pressure压力（MPa·G） | | Volumn容积  （m3） |
| Diameter D × length (tangential line) × wall thickness δmm  直径D×长度（切线）×壁厚δmm | Design设计 | Operating操作 | Design设计 | Operating操作 |
| 1 | D-601 | Compressor Suction K.O. Drum压缩机出口分液罐 | Oil gas, condensate油气、凝液 | Ф2000×7078 ×14  Water drum水包：Ф600×789 ×14 | Q245R | 80 | 40 | 0.36/  -0.1 | 0.03 | 21 |
| 2 | D-602 | 压缩机出口分液罐  Compressor Discharge K.O. Drum | Oil gas, condensate油气、凝液 | Ф2000×7080×（3+12）  Water drum水包：Ф600×790×（3+12） | Q245R | 80 | 40 | 1.5/  -0.1 | 0.93 | 21 |
| 3 | D-630 | Condensate Drum for Desorption Tower Bottom Reboiler脱吸塔底重沸器凝结水罐 | Steam and water蒸汽、水 | Ф 1200×3682×16 | Q245R | 320 | 183 | 1.5 | 1.0 | 3.9 |
| 4 | D-641 | 稳定塔顶回流及产品罐  Stabilizer OVHD Reflux and Product Drum | LPG, oil gas, water液化气、油气、水 | Ф3800×11036×28  Water drum水包：Ф800×837×28 | Q245R | 80 | 40 | 1.61\  -0.1 | 1.05 | 118 |

**Table 19(continued)**　**Container list and main design parameters**

**表19（续）　容器一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.位号 | Description名称 | Medium  介质 | Dimensions规格形式 | Material材质 | Temp.温度（℃） | | Pressure压力（MPa·G） | | Volumn容积  （m3） |
| Diameter D × length (tangential line) × wall thickness δmm  直径D×长度（切线）×壁厚δmm | Design设计 | Operating操作 | Design设计 | Operating操作 |
| 5 | D-645 | 石脑油进料缓冲罐  Naphtha Feed Buffer Drum | Naphtha and water石脑油、水 | Ф 2200×9220×22  Water drum水包：Ф600×787×12 | Q245R | 80 | 40 | 1.38\  -0.1 | 0.55 | 34 |

**Table 20　List of cold-exchange equipment and main design parameters**

**表20　冷换设备一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.位号 | Description名称 | Model型号 | Type型式 | Medium介质 | | Material材质 | | Temp.温度（℃） | | | | Pressure压力（MPa·G） | | | |
| Tube side  管程 | | Shell side  壳程 | | Tube side  管程 | | Shell side  壳程 | |
| Tube side  管程 | Shell side  壳程 | Tube side  管程 | Shell side  壳程 | Design设计 | Operating操作 | Design设计 | Operating操作 | Design设计 | Operating操作 | Design设计 | Operating操作 |
| 1 | E-602W | Compressor Discharge Cooler 压缩机出口水冷器 | CP40 | Plate type板式 | Circulating water循环水 | Dry gas干气 | Sheets板片SMO254  End plate端板Q345R＋SMO254 Lining衬里 | | 250 | 33/43 | 250 | 70/40 | 12bar |  | 15 bar | 10.5 bar |
| 2 | E-615 | 常顶油-冷冻水换热器  Atm. OVHD Oil Water Coolant Cooler | CP40 | Plate type板式 | Chilled water冷冻水 | Overhead oil of atmospheric tower常顶油 | Sheets板片SMO254  End plate端板Q345R＋SMO254Lining衬里 | | 80 | 7/12 | 80 | 40/20 | 23.8 bar |  | 19 bar |  |

**Table 20 (continued)　List of cold-exchange equipment and main design parameters**

**表20（续）　冷换设备一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.位号 | Description名称 | Model型号 | Type型式 | Medium介质 | | Material材质 | | Temp.温度（℃） | | | | Pressure压力（MPa·G） | | | |
| Tube side  管程 | | Shell side  壳程 | | Tube side  管程 | | Shell side  壳程 | |
| Tube side  管程 | Shell side  壳程 | Tube side  管程 | Shell side  壳程 | Design设计 | Operating操作 | Design设计 | Operating操作 | Design设计 | Operating操作 | Design设计 | Operating操作 |
| 3 | E-630R | Desorption Tower Bottom Reboiler脱吸塔底重沸器 | TBJU1000-1.5/1.8-282-6/25-2I | U-tube U型管式 | 1.0MPa Steam蒸汽 | Desorption tower bottom oil脱吸塔底油 | 10# | Q245R | 320 | 250/181 | 183 | 144/164 | 1.5 | 1 | 1.8 | 1.03 |
| 4 | E-635AB | Desorption Tower Bottom Feed Exchanger脱吸塔进料换热器 | CP75 | Plate type板式 | Absorber bottom oil吸收塔底油 | Desorption tower bottom oil脱吸塔底油 | Sheets板片SS316L End plate端板Q345R＋SS316L Lining衬里 | | 156 | 99.1/136.2 | 187 | 157/125 | 25.1 bar |  | 20 bar |  |
| 5 | E-636 | Pre-dist. OVHD Oil Water Coolant Cooler初顶油-凝结水换热器 | BEU500-2.39/1.9-50-6/25-4I | U-tube U型管式 | Condensed water凝结水 | Overhead naphtha of pre-distillation tower初顶石脑油 | 10# | Q245R | 207 | 159/60 | 80 | 40/53 | 1.3 | 0.8 | 2.39 | 1.9 |
| 6 | E-640R | Stabilizer Bottom Reboiler  稳定塔重沸器 | BJS1200-1.44/1.8-500-6/19-4I | Floating head type浮头式 | Atm. PA #2常二中 | Naphtha  石脑油 | 10# | Q345R | 283 | 250/210 | 214 | 187/194 | 1.44 | 0．7 | 1.8 | 1.13 |

**Table 20 (continued)　List of cold-exchange equipment and main design parameters**

**表20（续）　冷换设备一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.l位号 | Description名称 | Model型号 | Type型式 | Medium介质 | | Material材质 | | Temp.温度（℃） | | | | Pressure压力（MPa·G） | | | |
| Tube side  管程 | | Shell side  壳程 | | Tube side  管程 | | Shell side  壳程 | |
| Tube side  管程 | Shell side  壳程 | Tube side  管程 | Shell side  壳程 | Design设计 | Operating操作 | Design设计 | Operating操作 | Design设计 | Operating操作 | Design设计 | Operating操作 |
| 7 | E-640S | Stabilizer Bottom Reboiler  稳定塔重沸器 | BJS1200-1.44/1.8-500-6/19-4I | Floating head type浮头式 | Atm. PA #2常二中 | Naphtha  石脑油 | 10# | Q345R | 283 | 250/210 | 214 | 187/194 | 1.44 | 0．7 | 1.8 | 1.13 |
| 8 | E-640WX | Stabilized Naphtha Cooler 石脑油开停工水冷器 | BEU1200-2.5-395-6/25-4I | U-tube U型管式 | Circulating water循环水 | Naphtha石脑油 | 10# | Q345R | 80 | 33/43 | 80 | 60/40 | 1.44 | 0.45 | 1.8 | 0.6 |
| 9 | E-645 | Stabilizer Feed Exchanger稳定塔进料换热器 | CP75 | Plate type板式 | Mixed naphtha混合石脑油 | Naphtha of stabilizer稳定石脑油 | Sheets板片SS316L  End plate端板Q345R＋SS316L Lining衬里 | | 156 | 45/99.1 | 187 | 125/79 | 25.1 bar |  | 20 bar |  |

**Table 21　Air-cooled equipment list and main design parameters**

**表21　空冷设备一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | Item No.位号 | Description名称 | QTY(set) 数量（台） | Medium介质 | Design conditions设计条件 | | Operating conditions操作条件 | | | Tube bundle管束 | | Fan风机 | |
| Temp.温度（℃） | Pressure压力  MPa | Temp.温度（℃） | | Tube side pressure管程  压力  MPa | Model型号 | QTY数量 | QTY(set)数量（台） | Power功率  kw |
| Tube side inlet管程  进口 | Tube side outlet管程  出口 |
| 1 | A-640AB | Stabilized Naphtha Air Cooler石脑油开停工空冷器 | 2 | Naphtha石脑油 | 200 | 2.5 | 79 | 60 | 0.8 | GPX3-6-193-2.5S-23.4/DR-Ma | 2 | 2 | 30 |
| 2 | A-641/A～C | Stabilizer OVHD Air Cooler稳定塔顶空冷器 | 3 | Overhead oil gas of stabilizer 稳定塔顶油气 | 200 | 2.5 | 69 | 40 | 1.1 | ZP9 | 3 | 12 | 11 |

**Table 22　List of pumps and main design parameters**

**表22　机泵一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.位号 | Description名称 | Model泵型号 | Medium介质 | Rated flow额定流量（m3/h） | Density密度  kg/m3 | Minimum continuous flow最小连续流量（m3/h） | Lift扬程 (mH2O) | Design pressure设计压力(MPa·G) | | Operating temperature操作温度（℃） | Motor电机 | |
| 进口 | 出口 | Power功率  KW | Voltage电压 V |
| 1 | P-601 | Compressor Suction K.O. Drum Pump压缩机入口分液罐凝液泵 | MDCQ6.3-150 | Condensate凝液 | 5.25 | 617 | 1.8 | 136 | 0.02 | 0.9 | 40 | 18.5 | 380 |
| 2 | P-602AB | Compressor Discharge K.O. Drum Pump压缩机出口分液罐凝缩油泵 | HDPMSZAB1200/1.5-Ⅱ | Condensed oil凝缩油 | 1.2 | 617 |  |  | 0.95 | 1.5 | 40 | 4.4 | 380 |
| 3 | P-610AB | Absorber Bottom Oil Pump吸收塔底泵 | MDCE150-100-315 | Naphtha石脑油 | 192.45 | 690 | 60 | 98 | 0.92 | 1.61 | 40 | 75 | 380 |
| 4 | P-630ABC | Desorption Tower Bottom Oil Pump脱吸塔底泵 | MDCE200-150-350 | Naphtha石脑油 | 272.8 | 566 | 80 | 104 | 1.05 | 1.67 | 144 | 110 | 380 |
| 5 | P-641AB | Stabilizer OVHD Reflux and Product Pump稳定塔顶回流及产品泵 | MDCE150-100-400 | LPG液化气 | 241.27 | 535.2 | 80 | 171 | 1.07 | 2.02 | 40 | 160 | 380 |

**Table 22(continued)　List of pumps and main design parameters**

**表22（续）　机泵一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.序号 | Item No.位号 | Description名称 | Model泵型号 | Medium介质 | Rated flow额定流量（m3/h） | Density密度  kg/m3 | Minimum continuous flow最小连续流量（m3/h） | Lift扬程 (mH2O) | Design pressure设计压力(MPa·G) | | Operating temperature操作温度（℃） | Motor电机 | |
| 进口 | 出口 | Power功率  KW | Voltage电压 V |
| 6 | P-645AB | Mixed Naphtha Pump石脑油进料泵 | MDCE80-40-400 | Naphtha石脑油 | 41.14 | 704.4 | 10 | 158 | 0.55 | 1.69 | 40 | 45 | 380 |
| 7 | P-681 | Sour Water Pump含硫污水泵 | DPMSXAAB820/1.0-Ⅱ | Sour Water含硫污水 | 0.79 | 992 |  |  | 0.55 | 0.93 | 40 | 1.5 | 380 |

**Table 23　List of safety valves and main design parameters**

**表23　安全阀一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | Item No.  位号 | Installation location安装位置 | Quantity (set)数量(台) | Process medium工艺介质 | Temp.温度（℃） | Pressure压力（MPa·G） | | | Model specification型号规格 | Inlet / outlet diameter进/出口径 | Valve body material阀体材质 |
| Operating操作 | Constant pressure定压 | Back pressure背压 |
| 1 | PSV-601A/B | D-601 Overhead D-601顶 | 2 | Vent gas  放空气 | 114 | 0.03 | 0.35 | 0.2 | WFXD-15PC2A | 4＂/6＂ | WCB |
| 2 | PSV-602A/B | D-602 Overhead D-602顶 | 2 | Vent gas  放空气 | 84 | 0.93 | 1.5 | 0.2 | WFB-30LCB | 3＂/4＂ | WCB |
| 3 | PSV-610A/B | C-610 Overhead C-610顶 | 2 | Oil gas油气 | 24 | 0.87 | 1.5 | 0.2 | WFB-15LCB | 3＂/4＂ | WCB |
| 4 | PSV-630A/B | C-630 Overhead C-630顶 | 2 | Vent gas  放空气 | 136 | 1.0 | 1.6 | 0.2 | WFB-30KCB | 3＂/4＂ | WCB |

**Table 23(continued)　List of safety valves and main design parameters**

**表23（续）　安全阀一览表及主要设计参数**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | Item No.  位号 | Installation location安装位置 | Quantity (set)数量(台) | Process medium工艺介质 | Temp.温度（℃） | Pressure压力（MPa·G） | | | Model specification型号规格 | Inlet / outlet diameter进/出口径 | Valve body material阀体材质 |
| Operating操作 | Constant pressure定压 | Back pressure背压 |
| 5 | PSV-631A/B | D-630 Overhead D-630顶 | 2 | Vent gas  放空气 | 200 | 1.0 | 1.5 | 0.2 | WFO-30ECB | 1＂/2＂ | WCB |
| 6 | PSV-640A/B | C-640 Overhead C-640顶 | 2 | Vent gas  放空气 | 85 | 1.1 | 1.61 | 0.2 | WFB-30RCB | 6＂/10＂ | WCB |
| 7 | PSV-641A/B | D-641 Overhead D-641顶 | 2 | Overhead oil gas of stabilizer 稳定塔顶油气 | 61 | 1.05 | 1.61 | 0.2 | WFB-30PCB | 4＂/6＂ | WCB |
| 8 | PSV-612A/B | D-645 Overhead D-645顶 | 2 | Mixed naphtha混合石脑油 | 205 | 0.55 | 1.0 | 0.2 | WFB-30MCB | 4＂/6＂ | WCB |

**Table 24　Main design parameters of screw compressor**

**表24　螺杆压缩机主要设计参数**

|  |  |  |  |
| --- | --- | --- | --- |
| Item项目 | | 1st Stage Compressor  一级压缩机 | 2nd Stage Compressor  二级压缩机 |
| Model型号 | | LG49/0.25 | LG17/0.25-0.95 |
| Suction volume吸气量（0.1013MPa，0℃） | | 3000m3/h | 3000m3/h |
| Suction volume (inlet state)吸气量（入口状态） | | 49m3/min | 17m3/min |
| Suction pressure / suction temperature  吸入压力/吸入温度 | | 0.12~0.13 MPa（A）/ 40 ℃ | 0.35 MPa（A）/ 40 ℃ |
| Exhaust pressure / exhaust temperature排气压力/排气温度 | Compressor outlet压缩机出口 | 1.08 MPa（A）/ ≤85 ℃ | 0.38 MPa（A）/ ≤85 ℃ |
| Buffer tank outlet缓冲罐出口 | 1.05 MPa（A）/ 40 ℃ | 0.35 MPa（A）/ 40 ℃ |
| Rotor diameter转子直径 | | 321 mm | 255mm |
| Rotor length to diameter ratio转子长径比 | | 1.65 | 1.1 |
| Rotor profile转子型线 | | SRM-A | SRM-A |
| Direction of rotation旋转方向 | | From the motor end: the male rotor rotates counterclockwise从电动机端看：阳转子逆时针旋转 | From the motor end: the male rotor rotates counterclockwise从电动机端看：阳转子逆时针旋转 |
| Shaft power轴功率 | | 196kW | 200kW |
| Compressor speed机组转速 | | 2580rpm | 2875rpm |
| Radial and thrust bearing type径向与止推轴承型式 | | Sliding bearing滑动轴承 | Sliding bearing滑动轴承 |
| Shaft seal type轴封形式 | | Labyrinth seal + double dry gas seal迷宫密封+双端面干气密封 | Labyrinth seal + double dry gas seal迷宫密封+双端面干气密封 |
| Material材料 | Housing壳体 | ZG1Cr13 | ZG1Cr13 |
| Rotor转子 | 2Cr13 | 2Cr13 |
| Synchronous gear同步齿轮 | 42CrMo（Gear accuracy  齿轮精度：ISO5） | 42CrMo（Gear accuracy  齿轮精度：ISO5） |
| Main motor主电机 | Rated voltage额定电压 | 10kV | |
| rated power  额定功率 | 450kW | |
| Speed转速 | 1488rpm | |
| Flow adjustment method流量调节方式 | | Adjusting the bypass circuit reflux旁路循环回流调节 | Adjusting the bypass circuit reflux旁路循环回流调节 |

1.4.2　Equipment floor plan设备平面布置图

See Appendix 2

见附件1

# 2　Job Operation Method　岗位操作法

2.1　Job scope岗位管辖范围

No.1 unit of refinery complex covers the 8 million tons/year atmospheric and vacuum distillation unit, light ends recovery unit, acid gas & LPG treating unit, initial rainwater lifting unit, oily wastewater lifting unit and the area of 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　Job scope of shift leader班长岗位管辖范围

The shift leaders are responsible for the adjustment control of equipment operation, process specifications and production rate, equipment use and maintenance, and internal and external communication and team management within the job scope of the shift.

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　Job scope of panel operator内操岗位管辖范围

2.1.2.1　The panel operators are responsible for the operation and management of vessels, towers, pipelines, pumps, heaters, compressors and instrument systems, strictly abide by the process, equipment operating procedures, process cards and product quality specifications, and fully complete the production tasks of the shift.

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、工艺卡片及产品质量指标，全面完成当班的生产任务。

2.1.2.2　The panel operators should follow the arrangement and instruction of operation department and shift leader, strengthen the communication with the production scheduler, the shift leader, the field operator and related departments, adjust the DCS operation in time, have good control of the process specifications and product quality and keep smooth production.

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　When there is process upset or other abnormality, the panel operators should have DCS operation adjustment immediately, and organize the field operators to make adjustments, and if necessary, report to the production schedulers and operation department in time.

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　The panel operators should fill in the operation record carefully and timely, report the MES content, and have a good daily log of shift change.

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　Job scope of field operator外操岗位管辖范围

2.1.3.1　The field operators are responsible for the daily operation and maintenance management of all equipments such as vessels, towers, pipelines, pumps, heaters and compressors within the job scope, strictly abide by the process, equipment technical operation procedures, process cards and product quality specifications, and fully complete production tasks of the shift.

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　The field operators should strengthen the communication with the shift leader and panel operators, and have better control of the liquid level, pressure and temperature of the vessel. The field operators should also cooperate with panel operators to make the process specifications of the unit under proper control and to ensure the acceptable quality of the products, and cooperate with the quality inspection department to take samples.

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　The field operators are responsible for the management, use, repair and maintenance of equipment, pipelines, pumps, and lubricant stations within their job scope.

负责所管辖范围内的的设备、管线、机泵、润滑油站的管理、使用、维护和保养工作。

The field operators should fill in the operation record of the pump carefully and have a good daily log of shift change.

认真及时填好机泵运行记录，做好交接班日志。

2.1.3.4　The field operators should do a good job in the sanitation and site standardization of the job-related responsible scope.

做好岗位负责区域的卫生和现场规格化工作。

2.2　Job task岗位任务

2.2.1　Job task of shift leader　班长岗位任务

2.2.1.1　The shift leader should implement strictly the rules and regulations, such as operating procedures, process specifications, shift change system, walk-around inspection system and various safety regulations, and the instructions from higher authority, be responsible for organizing and directing the shift for normal production and troubleshooting the accidents during startup and shutdown, leading the shift members to complete the production work of each job scope, to ensure the personal and equipment safety. The shift leader should look for abnormal conditions and find out the reasons in time and take countermeasures to ensure the completion of production maintenance tasks and various economic and technical specifications.

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　The shift leader should strengthen professional study, familiarize with equipment process and operation, adjust process parameters according to product quality specifications issued by high authority, ensure safe, stable and economic operation of the unit, and produce qualified products. The shift leader should develop rationalization proposals and technological innovation activities.

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　The shift leader should be responsible for keeping detailed records of production orders and instructions (including time and content of receiving the order, and instructor) received during the shift, and make effective organization and implementation.

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　The shift leader have the right to stop and handle, record and report the actions of those who violate the order (instructions) from higher authority and rules and regulations of the shift.

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　The shift leader should be responsible for the job safety technical training of the shift, the new employee's safety education within the shift and the daily safety thoughts education of the whole shift, organize the shift members to participate in the emergency plan drill according to the plan, so that everyone can handle the on-site emergency. The shift leader should also be responsible for the internal assessment of the new employees before going on duty, and only those who have passed the examination can go on duty.

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　The shift leader should be responsible for environmental and equipment sanitation in the responsible area of the shift, and ensure that the tools, instruments and chemicals are complete.

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　The shift leader should complete other tasks assigned by department heads.

完成部门领导交办的其它工作。

2.2.2　Job task of panel operators内操岗位任务

2.2.2.1　The panel operator should implement strictly the rules and regulations, such as operating procedures, process specifications, shift change system, walk-around inspection system and various safety regulations, and the instructions from shift leader, confirm timely the important parameters and interlocking status, view timely the implementation of operational instructions, and do a good job in process control conscientiously and record materials and energy consumption, report regularly and submit MES content, and fill in the daily log of shift change carefully.

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　The panel operator should have the skill in the use and application of DCS system, familiarize with the production process and related operating procedures of his post. The panel operators should implement strictly all safety operation procedures, prohibit operation against rules, 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　The panel operators should monitor the operation of the equipment in his post, maintain communication with the on-site field operators, and adjust timely the operation and troubleshoot the abnormal conditions.

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　When there is process upset or other abnormality, the panel operators should adjust the process immediately and organize the field operators to carry out the corresponding operation on site, and if necessary, report to the production scheduler of the company.

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　The panel operator should pay attention to the property changes of raw material, adjust the control parameters according to the production quality, do a good job in product quality, ensure stable production, 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 panel operator must clean the working area of his post before the shift change, and keep the control room clean and tidy.

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　Job task of field operators外操岗位任务

2.2.2.1　The field operators should follow the directions of shift leader and the panel operators, be responsible for the production operation of the unit on site, monitor the equipment operation status, perform job duties, implement strictly various production management systems and ensure the overall completion of the production tasks of the shift, according to the unit process specifications, operating procedures and process cards, as well as the production tasks and production scheduling instructions issued by the department.

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　The field operators should have walk-around inspection and high-point inspection of the unit timely, find hidden dangers of the unit, report the production conditions of the unit at site to the shift leader and panel operators accurately, and record the real operation conditions 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　The field operators should implement sample collection during the shift.

落实当班期间的样品采集工作。

2.2.2.4　The field operators should do a good job in equipment lubrication and maintenance to ensure stable production.

做好设备润滑保养工作，保证装置平稳生产。

2.2.2.5　The field operators should complete the receipt and delivery of the three chemicals on site, and adjust the usage amount of the three chemicals according to the lab results and on-site inspection.

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　The field operators should comply with labor disciplines, complete fixed-location management and sanitation in the workplace and do a good job in the cleanness of the equipment that they are responsible for.

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　The field operators should master the use of fire-fighting equipment correctly and be responsible for monitoring at site during maintenance.

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　Start-up plan开工方案

2.3.1　Preparation before start-up开工前的准备

2.3.1.1　The start-up plan are prepared by related personnel, reviewed and approved by relevant departments of the company. The operators are familiar with the start-up plan that is put up on the wall.

编制好开工方案并经公司有关部门审核、批准。操作人员熟练掌握开工方案。开工方案上墙。

2.3.1.2　A temporary organization system for the start-up phase is prepared and the division of work is clarified.

编制好开工阶段临时组织体系，明确分工。

2.3.1.3　The operation record, daily log of shift change, confirmation table of operation conditions, and walk-around inspection cards are ready.

准备好操作记录，交接班日志，操作条件确认表、巡检牌。

2.3.1.4　The manholes of each tower and vessels are sealed, and there should have dedicated person responsible for the blind installation of inlet and outlet pipeline for each material. The construction items in the unit have been checked and accepted by the competent departments at all levels to ensure that none of them are missing with complete information and no quality problem. The maintenance site must be kept clean with the materials used up when the maintenance is completed.

各塔、容器的人孔封好，各物料进出管线的盲板安装应由专人负责。装置内施工项目经各级主管部门验收完毕，确保项目无遗漏，质量无问题，资料齐全。检修现场必须做到工完、料尽、场地清。

2.3.1.5　The commissioning of DCS operating system and each regulating valve should be done carefully before the start-up. The combined tests for the reliability of the interlock system must be carried out before the start-up. The operations of the interlock system are accurate and correct, and records are kept.

开工前对DCS操作系统、各调节阀认真调试，联锁系统可靠性在开工前必须经过联合试验，动作准确无误，并做好记录。

2.3.1.6　The power systems, such as water, electricity, steam and air, are introduced into the unit. The lighting of the unit is easy to use, the temporary power supply is removed, the trench is unblocked, and the ground is kept clean and free of debris. The protection work before introducing nitrogen is done to prevent suffocation accident due to leakage.

水、电、汽、风等动力系统引进装置，装置的照明好用，临时电源拆除，地沟畅通，地面保持清洁无杂物。引入氮气前做好防护工作，防止泄漏发生窒息事故。

2.3.1.7　The oils and auxiliary materials for start-up should be prepared.

准备好开工用油和辅助材料

The directions of each product for start-up are confirmed by contacting the production scheduler.

联系好调度确认开工各产品的走向。

2.3.1.8　The firefighting access of the unit is unblocked, and the sewage drain well is unblocked and the cover is acceptable.

装置消防通道畅通，排污水井畅通并封盖合格。

2.3.1.9　The tools and tags for start-up are ready.

准备好开工用的工具和标识牌。

2.3.1.10　The safety and environmental protection facilities, fire-fighting and gas protection equipment, flammable gas and toxic gas alarm devices must be fully equipped and are functional, neatly arranged, and are ready for fire and explosion protection with complete record.

安全环保设施、消防气防器材、可燃气体及有毒气体报警仪必须齐全好用，摆设整齐，并做好防火防爆准备并做好记录。

2.3.2　Start-up steps开工步骤

2.3.2.1　Run-through, purge and pressure test贯通、吹扫、试压

（1）Compressor Suction K.O. Drum D-601进料缓冲罐D-601



**Figure 2　Purge flow diagram of Compressor Suction K.O. DrumD-601**

**图2　进料缓冲罐D-601吹扫流程图**

Note: The direction of the arrow represents the direction of the steam supply

说明：箭头方向代表给汽方向

1）Close the valve of overhead gas for the aviation kerosene hydrofining and diesel hydrofining going into battery limit of the unit, close the valve on top of the drum for overhead gas of pre-distillation tower from D-201 and that of atmospheric tower from the D-301, and close the valve of D-601 to P-601. Close the rear hand valve of PV60101A and PV60101B and the valve on bypass line, and close the valves of D-601 gas into the compressors K-601ABC respectively.

关闭航煤加氢、柴油加氢塔顶气进装置界区阀，关闭初顶瓦斯自D-201、常顶瓦斯自D-301罐顶阀门，关闭D-601至P-601阀门，关闭PV60101A、PV60101B后手阀和付线阀，关闭D-601瓦斯分别进压缩机K-601ABC阀门。

2）The valves of PV60101A, PV60101 and XMV60201 are fully open.

PV60101A、PV60101、XMV60201阀全开。

3）Steam is supplied from the bottom of D-601 drum and is discharged from the drains of overhead gas of pre-distillation tower and atmospheric tower, and the overhead gas of aviation kerosene hydrofining and diesel hydrofining into the battery limit of the unit, where nitrogen is supplied.

从D-601罐底给蒸汽，分别在初顶瓦斯、常顶瓦斯、航煤加氢塔顶气、柴油加氢塔顶气进装置界区给氮气处导淋排汽。

4）Gas is vented from PV60101A, PV60101and XMV60201, and also drain gas at bottom of D-601 tank.

PV60101A、PV60101、XMV60201等处导淋、D-601罐底导淋排气。

5）Pay attention to controlling the steam supply pressure of D-601 tank bottom during routing steam through, to prevent overpressure of D-601.

蒸汽贯通时，注意控制D-601罐底给汽压力，防止D-601超压。

6） The process pipeline is combined with D-601 for pressure test, and the pressure is shown in the gauge of test pressure.

试压时，工艺管线与D-601联合试压，试压压力见试压表。

（2）Compressor Discharge K.O. Drum D-602压缩机出口分液罐D-602



**Figure 3　Purge flow diagram of Compressor Discharge K.O. Drum D-602**

**图3　压缩机出口分液罐D-602吹扫流程图**

Note: The direction of the arrow represents the direction of the steam supply.

说明：箭头方向代表给汽方向

1）Close the valve of D-602 tank bottom to P-602, the outlet valve of compressor K-601ABC, the valve for overhead gas of reforming pre-hydrogenation into battery limit of the unit , the valve on top of D-641 tank and the valve into C-610.

关闭D-602罐底至P-602阀、压缩机K-601ABC出口阀、重整预加氢塔顶气进装置界区阀、D-641罐顶阀、进C-610阀门。

2）Close the front hand valve of PV63201 and the valve on delivery line, the rear hand valve of PV60101A and HV60401 and the valve on delivery line.

关闭PV63201前手阀和付线阀，PV60101A和HV60401后手阀和付线阀。

E-602W is changed to the delivery line.

E-602W改走付线。

3）Fully open PV63201, PV60101A, HV60401, PV64401A and LV60402.

打开PV63201、PV60101A、HV60401、PV64401A、LV60402全开。

4）Firstly, the steam is supplied from the compressor outlet, and is discharged from the drain of PV63201 and the drain into D-602. Close the valve of compressed gas into the D-602 after routing steam through is completed, and carry out the pressure test for the compressed gas pipeline until the maximum steam pressure is reached.

先从压缩机出口给汽，分别在PV63201导淋、进D-602导淋排汽，贯通完成后，关闭压缩气进D-602阀门，压缩气管线试压，试压至蒸汽最高压力。

5）The steam is supplied from the bottom of D-602 tank, and is discharged from the drains of PV60101A, HV60401, PV64401A and LV60402 etc., drains at overhead gas of reforming pre-hydrogenation into battery limit of the unit and of condensed oil to P-602 etc. The steam is discharged when gas is directed into the C-610 (routing steam through C-610 for other processes is done before the intake).

从D-602罐底给汽，分别在PV60101A、HV60401、PV64401A、LV60402等处导淋排汽，重整预加氢塔顶气进装置界区、凝缩油至P-602等处导淋排汽，瓦斯进C-610排汽（C-610其它流程进气前贯通）。

6）D-602 is combined with the process pipeline for pressure test, the test pressure is subject to that of D-602.

D-602与工艺管线联合试压，试压压力以D-602试压压力为准。

7）Pay attention to opening the drain of the E-602W on other side during routing steam through and pressure test to prevent leakage due to pressure buildup.

贯通试压时注意E-602W另一侧导淋打开，防止憋漏。

（3）Absorber system吸收塔系统



**Figure 4　Purge flow diagram of absorber system**

**图4　吸收塔系统吹扫流程图**

Description: The direction of the arrow represents the direction of steam supply.

说明：箭头方向代表给汽方向

1）Close the valve of saturated dry gas into the dry gas desulfurization unit, and the valve of rich absorption oil to P-610, the front hand valve of FV6110 and the valve on delivery line.

关闭饱和干气进干气脱硫装置阀门，富吸收油至P-610阀门，FV61101前手阀和付线阀。

2）Open PV61001 and FV61101.

打开PV61001、FV61101。

3）The steam is supplied from the bottom of C-610 tower, and is discharged from the drains at the bottom of C-610 tower, of PV61001 and FV61101 etc.

从C-610塔底给汽，在C-610塔底、PV61001和FV61101等处导淋排汽。

4）The process pipeline is combined with C-610 for pressure test. The test pressure is subject to that of C-610.

工艺管线与C-610联合试压，试压压力以C-610试压压力为准。

（4）Overhead naphtha of pre-distillation and atmospheric tower into light ends recovery

初、常顶石脑油进轻烃回收



**Figure 5　Purge flow diagram for overhead naphtha of pre-distillation and atmospheric tower into the light ends recovery**

**图5　初、常顶石脑油进轻烃回收吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply.

说明：箭头方向代表给汽方向

1）Close the valve of overhead naphtha of pre-distillation and atmospheric tower into the unit, the front hand valve of FV61301 and the valve on delivery line, and close the valves of naphtha into the K-601ABC.

关闭初顶石脑油、常顶石脑油进装置阀门，FV61301前手阀和付线阀，关闭石脑油进K-601ABC阀门。

2）Open the FV61301 and FV61101 and change E-635 and E615 to delivery line.

打开FV61301、FV61101，E-635、E615走付线。

3）The steam is supplied at the battery limit for overhead naphtha of atmospheric tower and is steam is routed through in the direction of C-610 and K-601ABC respectively.

常顶石脑油从界区给汽，分别往C-610、K-601ABC方向贯通。

4）The steam is supplied from the battery limit for overhead naphtha of pre-distillation tower, and steam is routed through in the direction of C-630 and FV61301 respectively.

初顶石脑油从界区给汽，分别往C-630、FV61301方向贯通。

5） Close the valves into C-610 and C-630 during pressure test and test until the maximum steam pressure is reached.

试压时关闭进C-610、C-630阀门，试至蒸汽最高压力。

6）Pay attention to opening the drain of E-615 and E-635 on other side during routing steam through and pressure test to prevent leakage due to pressure buildup.

贯通试压时注意E-615、E-635另一侧导淋打开，防止憋漏。

（5）Absorber bottom oil and compressor condensed oil吸收塔底油及压缩机凝缩油



**Figure 6　Purge flow diagram of absorber bottom oil and compressor condensed oil**

**图6　吸收塔底油及压缩机凝缩油吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply.

说明：箭头方向代表给汽方向

1）Close the valve at bottom of C-610 and at bottom of D-602 drum, and close the rear hand valve of FV61301 and FV61302 and the valve on delivery line .

关闭C-610塔底、D-602罐底阀门，关闭FV61301、FV61302后手阀和付线阀。

2）Open FV61301, FV61302 and FV60501.

打开FV61301、FV61302、FV60501。

3）The steam is supplied after the withdrawal valve at the bottom of D-602, is routed through in the direction of C-630, and steam is observed at the drain of FV60501.

从D-602罐底抽出阀后给汽，往C-630方向贯通，FV60501导淋见汽。

4）The steam is supplied after the withdrawal valve at the bottom of C-610, is routed through in the direction of C-630, and steam is observed at the drains of FV61301 and FV61302.

从C-610塔底抽出阀后给汽，往C-630方向贯通，FV61301、FV61302导淋见汽。

5）Close the rear hand valve of FV61301, FV61302 and FV60501 and the valve on delivery line during pressure test, and test until the maximum steam pressure is reached.

试压时关闭FV61301、FV61302、FV60501后手阀和付线阀，试至蒸汽最高压力。

6）Pay attention to opening the drain of E-635 on other side during run-through and pressure test to prevent E-635 from leaking due to pressure buildup.

贯通试压时注意E-635另一侧导淋打开，防止E-635憋漏

（6）Desorption tower脱吸塔



**Figure 7　Purge flow diagram of desorption tower**

**图7　脱吸塔吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply.

说明：箭头方向代表给汽方向

1）Close the valve at bottom of C-630 to P-630, and close the rear hand valve of FV63201 and PV64801A and the valve on delivery line .

关闭C-630塔底至P-630阀门，关闭FV63201、PV64801A后手阀和付线阀。

2）Open the FV63201 and PV64801A.

打开FV63201、PV64801A。

3）The steam is supplied from the bottom of C-630, and is discharged from drains at bottom of C-630, and of FV63201, PV64801A, and E-630R etc. respectively.

C-630塔底给汽，分别在C-630塔底、FV63201、PV64801A、E-630R等处导淋排汽。

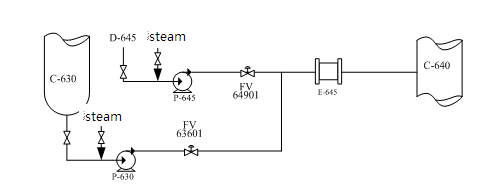
4）Open the drain of E-630R on other side to discharge steam during routing steam through and pressure test to prevent the pressure buildup of E-630R.

贯通试压时E-630R另一侧导淋打开排汽，防止E-630R憋压。

5）The C-630 is combined with pipeline for pressure test, and the test pressure is subject to that of C-630.

试压时C-630和管线联合试压，以C-630试压压力为准。

（7）Stabilizer feed稳定塔进料



**Figure 8　Purge flow diagram of stabilizer feed**

**图8　稳定塔进料吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply.

说明：箭头方向代表给汽方向

1）Close the valve at bottom of C-630 bottom and withdrawal valve at bottom of D-645, and close the rear hand valve of E-645 and valve of delivery line.

关闭C-630塔底、D-645罐底抽出阀，关闭E-645后手阀和付线阀。

2）Open FV64901 and FV63601 fully.

打开FV64901、FV63601全开。

3）The steam is supplied from the bottom of D-645 drum, is routed through the direction of C-640, and is discharged from the outlet drain of E-645. Close the steam supply to bottom of D-645 after run-through is completed, and then the pressure relief at E-645 is completed.

从D-645罐底给汽，往C-640方向贯通，在E-645出口导淋排汽，贯通结束后关闭D-645罐底给汽，E-645处泄压完毕。

4）The steam is supplied from the withdrawal at bottom of C-630, is routed through in the direction of C-640, and is discharged at the outlet drain of E-645.

从C-630塔底抽出给汽，往C-640方向贯通，在E-645出口导淋排汽。

5）The E-645 is changed to delivery line after the completion of routing steam through, and the steam is supplied from the D-645 and C-630 to the C-640 for purge.

贯通结束后，E-645改为付线，分别从D-645、C-630给汽往C-640吹扫。

6）Close the rear hand valve of E-645 once the purge is completed to have pressure test until the maximum steam pressure is reached.

吹扫结束后，关闭E-645后手阀，进行试压，试压至蒸汽最高压力。

（8）Stabilizer and stabilizer overhead稳定塔及稳定塔顶



**Figure 9　Purge flow diagram of stabilizer and stabilizer overhead**

**图9　稳定塔及稳定塔顶吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply

说明：箭头方向代表给汽方向

1）Close the withdrawal valve of stabilized naphtha at bottom of C-640 bottom, the rear hand valve of PV64401A and valve of delivery line, the front and rear hand valves of PV64401B and valve of delivery line, the withdrawal valve of LPG at bottom of D-641 drum, the sour water withdrawal valve of water drum D-641, the valve of LPG to the desulfurization battery limit, the rear hand valve of FV64101 and valve of delivery line, and close all the valves of the system to the light slop oil.

关闭C-640塔底稳定石脑油抽出阀，关闭PV64401A后手阀和付线阀，关闭PV64401B前后手阀和付线阀，关闭D-641罐底液化气抽出阀，关闭D-641水包酸性水抽出阀，关闭液化气至脱硫界区阀，关闭FV64101后手阀和付线阀，关闭系统至轻污油的所有阀门。

2）Open FV64101, FV64601, PV64401A and PV64401B.

打开FV64101、FV64601、PV64401A、PV64401B。

3）Open the drain on other side of the E-640RS (atm. PA #2) to prevent leakage of the E-640RS during routing steam through and pressure test.

E-640RS另一侧（常二中）导淋打开，防止贯通试压时E-640RS憋漏。

4）The steam is supplied from the bottom of C-640 tower, and is closed when the steam is observed from the drain at bottom of the tower, the drain of E-640RS and the P-630B inlet.

从C-640塔底给汽，塔底导淋、E-640RS导淋、P-630B入口见汽后关闭。

5）The steam is observed from the drain of LPG withdrawal at bottom of D-641 and water drum, and also from the drain of PV64401.

D-641底部液化气抽出和水包导淋见汽，PV64401导淋见汽。

1. When steam is routed through the stabilizer overhead system, three sets in parallel with A-641 are routed through one by one, as it is not easy to do for three sets at the same time, to avoid that steam cannot observe from the following paths once it is condensed.

稳定塔顶系统贯通时，A-641并联的三台逐台贯通，不易三台同时贯通，防止蒸汽冷凝后后路不见汽。

7）Open the front hand valve of PV64401B and close it after the steam is seen. The steam should be seen when the rear hand valve is opened.

PV64401B打开前手阀，导淋见汽后关闭前手阀，打开后手阀，导淋也要见汽。

8）When steam is routed through the overhead system, the delivery line of air cooler A-641 ( ie. PV64401B) cannot be opened.

塔顶系统贯通时，空冷A-641的付线（即PV64401B）不能打开。

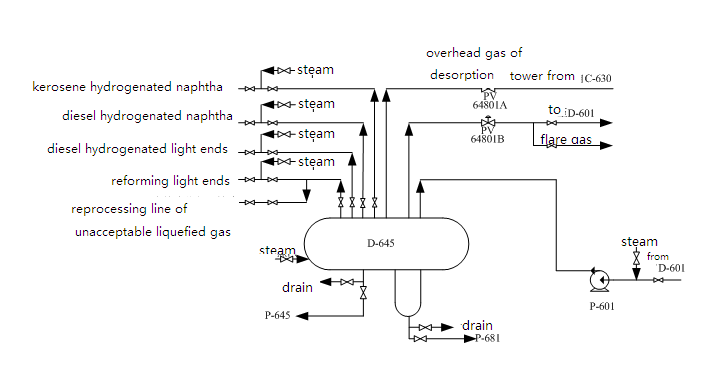
9）The steam is supplied after the withdrawal valve of LPG from D-641, and is routed through in the direction of FV64101 and FV64601.

从D-641液化气抽出阀后给汽，往FV64101、FV64601方向贯通。

10）The stabilizer, the overhead system and the LPG system are combined for pressure test. The test pressure is subject to that of C-640. If the pressure can’t rise to the test pressure, except for steam supply to the bottom of C-640, the locations of steam supply can be increased at P-641 and D-641 etc., and also A-641 can be pressure tested one by one.

试压时，稳定塔和塔顶系统、液化气系统联合试压，压力以C-640试压压力为准，如压力上升不到试压压力，除C-640塔底给汽外，可在P-641、D-641等处增加给汽点，以及A-641逐台试压。

（9）Naphtha Feed Buffer Drum D-645石脑油缓冲罐D-645



**Figure 10　Purge flow diagram of Naphtha Feed Buffer Drum D-645**

**图10　石脑油缓冲罐D-645吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply

说明：箭头方向代表给汽方向

1）Close the valves of unqualified LPG reprocessing line, reforming light hydrocarbon entering into the unit battery limit, and the valve to D-645 overhead. The steam is supplied from where the reforming light hydrocarbon go into the battery limit of unit, and is discharged at the drain on top of D-645 and unqualified LPG into the battery limit of unit. Close the drains once routing steam through and purge is completed. Perform pressure test to the process until up to the maximum steam pressure.

关闭不合格液化气回炼线、重整轻轻进装置界区、进D-645罐顶阀门，从重整轻烃进装置界区给汽，在D-645罐顶和不合格液化气紧装置界区导淋排汽，贯通吹扫结束后，关闭导淋，该流程试压，试至蒸汽最高压力。

2）Close the valve of diesel hydrogenated light hydrocarbon into the unit battery limit and the valve of D-645 overhead. The steam is supplied from where the diesel hydrogenated light hydrocarbon enter the unit battery limit, and is discharged from the drain on top of the D-645 drum. Close the drains once routing steam through and purge is completed. Perform pressure test to the process until up to the maximum steam pressure.

关闭柴油加氢轻轻进装置界区、进D-645罐顶阀门，从柴油加氢轻烃进装置界区给汽，在D-645罐顶导淋排汽，贯通吹扫结束后，关闭导淋，该流程试压，试至蒸汽最高压。

3）Close the valve of diesel hydrogenated naphtha into the unit battery limit and the valve into D-645 overhead. The steam is supplied from where the diesel naphtha and light hydrocarbon enter the unit battery limit, and is discharged from the drain on top of the D-645 drum. Close the drain once routing steam through and purge is completed. Perform pressure test to the process until up to the maximum steam pressure.

关闭柴油加氢石脑油进装置界区、进D-645罐顶阀门，从柴油石脑油轻烃进装置界区给汽，在D-645罐顶导淋排汽，贯通吹扫结束后，关闭导淋，该流程试压，试至蒸汽最高压。

4）Close the valve of kerosene hydrogenated naphtha into the unit battery limit and the valve into D-645 overhead. The steam is supplied from where the kerosene naphtha and light hydrocarbon enter the unit battery limit, and is discharged from the drain on top of the D-645 drum. Close the drain once routing steam through and purge is completed. Perform pressure test to the process until up to the maximum steam pressure.

关闭煤油加氢石脑油进装置界区、进D-645罐顶阀门，从煤油石脑油轻烃进装置界区给汽，在D-645罐顶导淋排汽，贯通吹扫结束后，关闭导淋，该流程试压，试至蒸汽最高压。

5）After the steps of 1), 2), 3) and 4), close the front hand valve of PV64801A and the valve on delivery line, and also the valves to D-601 and to the flare gas, the valve of naphtha to P-645 and of sour water to P-681.

第1）、2）、3）、4）步结束后，关闭PV64801A前手阀和付线阀，关闭至D-601、至火炬气阀门，石脑油至P-645、酸性水至P-681阀门。

6）The steam is supplied from the bottom withdrawal of D-601 drum, and is discharged from the drains of P-601, D-645 water drum, D-645 naphtha withdrawal, PV64801A and PV64801B, etc.

从D-601罐底抽出给汽，依次在P-601、D-645水包、D-645石脑油抽出、PV64801A、PV64801B等处导淋排汽。

7）Open the valves of reforming light hydrocarbon, diesel hydrogenated light hydrocarbon, diesel hydrogenated naphtha, kerosene hydrogenated naphtha, etc. into the D-645, and is discharged from the top of D-645. Close the valves of the above four lines into the D-645 once the steam is observed.

打开重整轻轻、柴油加氢轻烃、柴油加氢石脑油、煤油加氢石脑油等进D-645阀门，分别在D-645罐顶排汽，见汽后关闭以上四条线进D-645阀门。

8）The D-645 is combined with D-601 condensate line and two gas phase balance lines on top of D-645 for pressure test. The test pressure is subject to that of D-645.

试压时，D-645与D-601凝液线、D-645罐顶两条气相平衡线联合试压试压压力以D-645试压压力为准。

（10）Stabilized naphtha稳定石脑油

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**Figure 11　Purge flow diagram of stabilizer naphtha**

**图11　稳定石脑油吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply

说明：箭头方向代表给汽方向

1）The steam is supplied at the line from stabilized naphtha to unqualified naphtha for the pressure test of light slop oil line, and is discharged at each discharge point of light slop oil and from the valve at battery limit from light slop oil to the light slop oil of atmospheric and vacuum distillation unit respectively.

轻污油线试压自稳定石脑油至不合格石脑油线处给汽，分别在各轻污油排放点和轻污油至常减压轻污油的界区阀处排汽。

2）Close the withdrawal valve at bottom of C-640, the valve of stabilized naphtha to the reforming battery limit and to the battery limit of tank farm, and the valve to the unqualified naphtha when steam is routed through, and the PV64702 is fully open.

贯通时关闭C-640塔底抽出阀，稳定石脑油至重整界区阀、至罐区界区阀和至不合格石脑油阀门，PV64702全开。

3）Supply steam from the bottom of C-640 until steam is seen at P-630B.

从C-640塔底给汽，至P-630B处见汽。

4）Close the valve on delivery line of TV64001 and the three-way valve takes the main line.

关闭TV64001付线阀，三通阀走正线。

5）When steam is routed through E-645 and E-635AB, close the valve on delivery line and the outlet valve first. Close the outlet valve, after the steam is seen at the drain of inlet valve. Open the valve on delivery line and the outlet valve, and the steam is seen at the drain outlet. It is not suitable to pass through the plate heat exchanger.

E-645、E-635AB贯通时，先关闭付线阀和出口阀，入口阀导淋见汽后，关闭出口阀，打开付线阀和出口阀，出口导淋见汽，吹扫时不宜走板换。

6）The steam is routed through A-640 one by one, and steam should be seen at all the drains of stabilized naphtha to reforming battery limit and to the battery limit of tank farm and also the drain of PV64702.

A-640逐台贯通，稳定石脑油至重整界区、至罐区界区导淋和PV64702导淋均要见汽。

7）After routing the steam through the main process line is completed, close the E-645 outlet valve and the valve on delivery line, open the valve on delivery line of TV64001, and check whether the delivery line of three-way valve pays is smooth.

主线流程贯通结束后，关闭E-645出口阀和付线阀，打开TV64001付线阀，检查三通阀付线是否畅通。

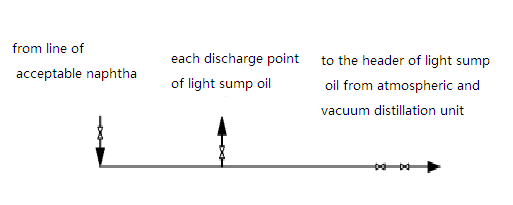
8）Open the drains of E-645, E-635AB and E-640WX on the other side to prevent pressure buildup during routing steam through and purging.

贯通吹扫时E-645、E-635AB、E-640WX另一侧导淋打开，防止憋压。

9）Perform the pressure test for the system until the maximum steam pressure.

系统试压时试至蒸汽最高压力。

（11）Lines of light sump oil轻污油线



**Figure 12　Purge flow diagram for lines of light sump oil**

**图12　轻污油线吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply

说明：箭头方向代表给汽方向

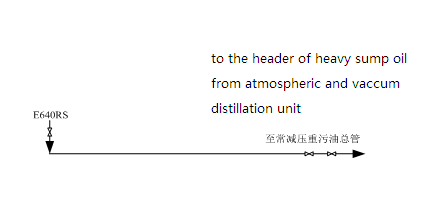
1）The steam is supplied at the line from stabilized naphtha to unqualified naphtha for the pressure test of light slop oil line, and is discharged at each discharge point of light slop oil and from the valve at battery limit from light slop oil to the light slop oil of atmospheric and vacuum distillation unit respectively.

轻污油线试压自稳定石脑油至不合格石脑油线处给汽，分别在各轻污油排放点和轻污油至常减压轻污油的界区阀处排汽。

2）Perform the pressure test until the maximum steam pressure.

试压时试至蒸汽最高压力。

（12）Lines of heavy sump oil重污油线



**Figure 13　Heavy oil line purge flow chart**

**图13　重污油线吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply

说明：箭头方向代表给汽方向

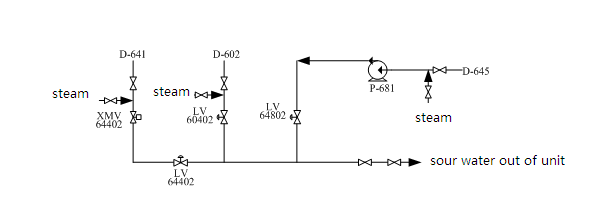
1）For routing steam through the lines of heavy sump oil, refer to the procedure of routing steam through and pressure test of atm. PA #2.

重污油线贯通时结合常二中贯通试压时进行。

2）The test pressure is the same as that of the atm. PA #2.

试压压力与常二中同。

（13）Sour Water Line酸性水线



**Figure 14　Purge flow diagram of sour water line**

**图14　酸性水线吹扫流程图**

Note: The direction of the arrow represents the direction of steam supply

说明：箭头方向代表给汽方向

1）Close the sour water valve of water drum D-641, D-602 and D-645 and also the valve of sour water out of unit battery limit, the XMV64402, LV60402 and LV64802 are fully open.

关闭D-641、D-602、D-645水包的酸性水阀门和酸性水出装置界区阀，XMV64402、LV60402、LV64802全开。

2）The steam is supplied from the water drum D-641, and is discharged at the drains of LV64402 and of sour water battery limit etc.

从D-641水包给汽，在LV64402、酸性水界区等处导淋排汽。

3）The steam is supplied from the water drum D-602, and is discharged at the drains of LV60402 and of sour water battery limit etc.

从D-602水包给汽，在LV60402、酸性水界区等处导淋排汽。

4）The steam is supplied from the water drum D-645, and is discharged at the drains of LV64802 and of sour water battery limit etc.

从D-645水包给汽，在LV64802、酸性水界区等处导淋排汽。

5）The sour water processes are combined for pressure test until the maximum steam pressure.

酸性水流程联合试压，试至蒸汽最高压力。

2.3.2.2　Nitrogen purge of system系统氮气置换

（1）Nitrogen purge of compressor, absorber feed and absorber system

压缩机、吸收塔进料及吸收塔系统氮气置换

1）For the overhead gas of pre-distillation tower, nitrogen is supplied to the top of pre-dist. OVHD product drum D-201 of the pre-distillation tower, and is discharged at the drain of overhead gas of pre-distillation tower to the top of D-601. Discharge it into D-601, if the oil gas is discharged from the drain.

初顶气在初馏塔塔顶分液罐D-201罐顶给氮气，在初顶气至D-601罐顶的倒淋排气，如导淋排放有油气，则往D-601罐内排放。

2）For the overhead gas of atmospheric tower, nitrogen is supplied to the top of the atm. OVHD product drum D-301 of the atmospheric tower, and is discharged at the drain of overhead gas of atmospheric tower to the top of D-601. Discharge it into D-601, if oil gas is seen from the drain.

常顶气在常压塔塔顶分液罐D-301罐顶给氮气，在常顶气至D-601罐顶的倒淋排气，如导淋排放有油气，则往D-601罐内排放。

3）For the overhead gas of diesel hydrogenation, aviation kerosene hydrogenation and reforming pre-hydrogenation, nitrogen is supplied to the battery limit going into the unit, and is discharged at the drain on top of D-601. Discharge it into D-601, if oil gas is seen from the drain.

柴油加氢塔顶气、航煤加氢塔顶气、重整预加氢塔顶气在进装置界区给汽，在D-601罐顶的倒淋排气，如导淋排放有油气，则往D-601罐内排放。

4）Nitrogen is supplied to the drum D-601, and is discharged through the PV60101B to the flare gas. It is discharged from the liquid drum drain of condensed oil at bottom of the drum D-601 and is discharged through the balance line of D-645 to D-601 to the flare gas.

D-601罐体给汽，通过PV60101B往火炬气排气，D-601罐底部凝缩油液包导淋排气，通过D-645至D-601平衡线往火炬气排气。

5）Close the valve from top of D-601 to the compressor, shed the rapid shut-off valve XMV60201 at the inlet of compressor and open it. Gas is supplied to the top of the D-601 and is discharged to the compressor K-601ABC.

关闭D-601罐顶至压缩机阀门，摘除压缩机入口快速切断阀XMV60201，并打开，在D-601罐顶给气，往压缩机K-601ABC排气。

6）Close the valve at the outlet of compressor, supply gas to the outlet of compressor, and discharge it at the drain on top of the drum D-602.

关闭压缩机出口阀门，从压缩机出口给气，往D-602罐顶导淋排气。

7）For the line of overhead gas of stabilizer to D-602, gas is supplied to the top of the drum D-641, and is discharged at the drain of this line to the top of the drum D-602.

稳定塔顶气至D-602线，在D-641罐顶给气，在该线至D-602罐顶的导淋排气。

8）nitrogen is supplied to the drum D-602, and is discharged to the flare gas through HV60401, and is discharged at the drains for the sour water line at the bottom of the drum D-602 and the line of condensed oil.

D-602罐体给氮气，通过HV60401往火炬气排气，D-602罐底部酸性水线和凝缩油线导淋排气。

9）Close the valve from top of D-602 to the C-610, then supply gas after the valve, and send it to the C-610. Supply gas at the battery limit of dry gas to the desulfurization, and send it to the C-610. Supply gas from the bottom of the C-610 tower, and discharge it by opening the overhead vent line of the C-610 (or flare gas), and by opening the drain at the bottom of the tank C-610.

关闭D-602罐顶至C-610阀门，从阀后给气，往C-610赶气。从干气至脱硫界区给气，往C-610赶气。从C-610塔底给气，把C-610塔顶放空（或者火炬气）线打开排气，C-610罐底导淋打开排气。

10）After the purge of the line from compressed gas to the D-602 with nitrogen is completed, close the drain on top of the drum D-602, and discharge nitrogen to the top of the desorption tower to purge the process of desorption gas to the E-602W.

压缩气至D-602线氮气置换结束后，关闭D-602罐顶的导淋，往脱吸塔顶排气，置换脱吸气至E-602W流程。

11）When the return line of D-602 to D-601 is purged, nitrogen is discharged from top of the drums D-601 and D-602 to the drain valve PV60101B in turns.

D-602至D-601的返回线置换时，分别从D-601、D-602罐顶往PV60101B导淋轮流排气。

Make full use of the dry gas seal of the compressor etc. to purge the compressor.

压缩机的置换，充分利用压缩机的干气密封等，进行置换。

12）When purging using nitrogen, water should be discharged from the drain in the process (if any) since the nitrogen pressure is low when large amount of nitrogen is consumed, leading to the nitrogen sealing in the water storage location. If the nitrogen is used for purging before the startup following shutdown of the unit for maintenance, it should be checked that whether the water contains oil during the drainage. Oil should not be discharged, while it should be sent into towers and tanks, if any oil is seen.

氮气置换时，用氮量大时氮气压力低，存水部位形成氮封，流程上有导淋应排水，如是装置停车检修后开车前氮气置换，排水过程中应检查是否含油，如见油则不得排放，应往塔、罐内排放。

13）Collect gas samples on the top of D-601, D-602, and C-610, and analyze the O2 content. The O2 content is acceptable if it’s ≤0.5% (V).

在D-601、D-602、C-610顶部采集气体样，分析O2含量≤0.5%（V）则分析合格。



**Figure 15　Nitrogen purge flow diagram of compressor, absorber feed and absorber system**

**图15　压缩机、吸收塔进料及吸收塔系统氮气置换流程图**

（2）Nitrogen purge of desorption tower feed, overhead naphtha of pre-distillation and atmospheric tower to light ends and desorption tower system

脱吸塔进料、初常顶石脑油至轻烃、脱吸塔系统氮气置换

1）Nitrogen is supplied after the condensed oil valve at bottom of the drum D-602 purging to C-630, and P-602 is routed to the delivery line.

D-602罐底凝缩油阀后给氮气，往C-630置换，P-602走付线。

2）Nitrogen is supplied after the valve of rich absorption oil at the bottom of the tower C-610 purging to C-630, and P-610 is routed to the delivery line.

C-610塔底富吸收油阀后给氮气，往C-630置换，P-610走付线。

3）Nitrogen is supplied at the battery limit of overhead naphtha of pre-distillation tower into the light ends recovery unit through E-636, purging to C-630.

初顶石脑油进轻烃回收装置界区给氮气，经E-636后，往C-630置换。

4）Nitrogen is supplied at the battery limit of overhead naphtha of atmospheric tower into the light ends recovery unit, purging in three directions of E-615→C-610, compressor and E-635 by turns.

常顶石脑油进轻烃回收装置界区给氮气，往E-615→C-610、压缩机和E-635三个方向轮流置换。

5）Open the delivery line of safety valve on top of the tower C-630, and discharge gas to the flare gas system, or discharge it by opening the overhead vent.

C-630塔顶安全阀付线打开，往火炬气系统排气，或者塔顶放空打开排气。

6）Gas is discharged from the bottom of C-630 and at the low point vent of re-boiler E-630R. If there is oil, it needs to be discharged into the underground light slop oil tank.

C-630塔底和再沸器E-630R低点放空排气，如有油则需往地下轻污油罐排放。

7）Gas is supplied at the outlet of compressor for the process of desorption gas to E-602W, purging to the top of tower C-630.

脱吸气至E-602W流程在压缩机出口给汽，往C-630塔顶置换。

8）When the balance line of desorption gas to the E-645 is purged, it can be done by discharging the nitrogen from D-645 to the direction of C-630 to purge after the nitrogen purge of D-645 is completed.

脱吸气至E-645平衡线置换时，可在D-645置换结束后，利用D-645的氮气往C-630排气置换。

9）When nitrogen is used to purge, water should be discharged from the drain in the process (if any) since the nitrogen pressure is low when large amount of nitrogen is consumed, leading to the nitrogen sealing in the water storage location. If the nitrogen is used for purging before the startup following shutdown of the unit for maintenance, it should be checked that whether the water contains oil during the drainage. Oil should not be discharged, while it should be sent into towers and tanks, if any oil is seen.

氮气置换时，用氮量大时氮气压力低，存水部位形成氮封，流程上有导淋应排水，如是装置停车检修后开车前氮气置换，排水过程中应检查是否含油，如见油则不得排放，应往塔、罐内排放。

10）Collect the gas sample on the top of C-630 and analyze the O2 content. The O2 content is acceptable if it’s ≤0.5% (V).

在C-630顶部采集气体样，分析O2含量≤0.5%（V）则分析合格。



**Figure 16　Flow diagram for nitrogen purge of desorption tower feed, overhead naphtha of pre-distillation and atmospheric tower to light ends and desorption tower system**

**图16　脱吸塔进料、初常顶石脑油至轻烃、脱吸塔系统氮气置换流程图**

（3）Nitrogen purge of stabilizer feed, stabilizer and stabilizer overhead system, and system of stabilizer naphtha

稳定塔进料、稳定塔及稳定塔顶系统、稳定石脑油系统氮气置换

1）Nitrogen is supplied at the battery limit of unit for the lines of aviation kerosene hydrogenated naphtha, diesel hydrogenated naphtha, diesel hydrogenated light hydrocarbon and reforming light hydrocarbon, and is discharged at the drain on top of the drum D-645. If there is oil gas discharged from the drain, it will be discharged into the drum D-645.

航煤加氢石脑油线、柴油加氢石脑油线、柴油加氢轻烃线、重整轻烃线在装置界区给氮气，在D-645罐顶导淋排气，如导淋排放有油气，则往D-645罐内排放。

2）Nitrogen is supplied after the withdrawal valve at the bottom of the drum for the condensate line of D-601, P-601 is routed to the delivery line, venting to D-645.

D-601凝液线在罐底抽出阀后给氮气，P-601走付线，往D-645排气。

3）Gas is discharged by opening the overhead vent of D-645. Take gas samples for analysis. Purge to the top of the tower C-630 after the O2 content in overhead gas is analyzed to be ≤ 0.5% (V).

D-645罐顶放空打开排气，采样分析合格分析罐顶气O2含量≤0.5%（V）后，往C-630塔顶置换。

4）Supply nitrogen after the withdrawal valve of mixed naphtha at bottom of the drum D-645, purging to the C-640 through the E-645 and P-645 is directed to the delivery line.

D-645罐底混合石脑油抽出阀后给氮气，经E-645往C-640置换，P-645走付线。

5）Supply nitrogen after the withdrawal valve of desorption oil at bottom of the tower C-630, purging to the C-640, and P-630 is directed to the delivery line.

C-630塔底脱吸油抽出阀后给氮气，往C-640置换，P-630走付线。

6）Close the LPG valve at bottom of the drum D-641, and supply nitrogen after the valve and purge to C-640 and P-641 is directed to the delivery line.

关闭D-641罐底液化气阀门，阀后给氮气往C-640置换，P-641走付线。

7）Supply nitrogen at the battery limit of LPG out of the unit and purge to C-640.

液化气出装置界区给氮气，往C-640置换。

8）Supply nitrogen at the battery limit of light ends recovery unit for stabilized naphtha to the tank farm and to the reforming line, and purge with nitrogen to C-640.

稳定石脑油至罐区和至重整线，在轻烃回收装置界区给氮气，往C-640给氮气置换。

9）Gas is vented by opening the top of the drum D-641 to flare gas and the vent valve.

D-641罐顶至火炬气和放空阀打开排气。

10）Gas is discharged from the bottom of C-640 and the low point vent of re-boiler E-640RS. If there is oil, it needs to be discharged into the underground light slop oil tank.

C-640塔底和再沸器E-640RS低点导淋处排气，如有油，则往地下轻污油罐排放。

11）When nitrogen is used to purge, water should be discharged from the drain in the process (if any) since the nitrogen pressure is low when large amount of nitrogen is consumed, leading to the nitrogen sealing in the water storage location. If the nitrogen is used for purging before the startup following shutdown of the unit for maintenance, it should be checked that whether the water contains oil during the drainage. Oil should not be discharged, while it should be sent into towers and tanks, if any oil is seen.

氮气置换时，用氮量大时氮气压力低，存水部位形成氮封，流程上有导淋应排水，如是装置停车检修后开车前氮气置换，排水过程中应检查是否含油，如见油则不得排放，应往塔、罐内排放。

12）Collect the gas sample on the top of D-641 and analyze the O2 content. The O2 content is acceptable if it’s ≤0.5% (V).

在D-641顶部采集气体样，分析O2含量≤0.5%（V）则分析合格。



**Figure 17　Flow diagram of nitrogen purge for stabilizer feeds, stabilizer and stabilizer overhead system, and stabilizer naphtha system**

**图17　稳定塔进料、稳定塔及稳定塔顶系统、稳定石脑油系统氮气置换流程图**

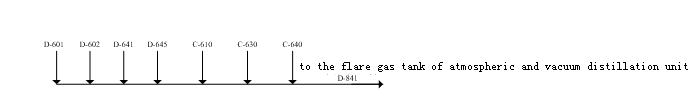
（4）Flare gas system火炬气系统

1）The nitrogen purge of the flare gas system should be carried out in combination with that of the equipment of each flare gas discharge point. Supply nitrogen from the top of D-601, D-602, D-641, D-645, C-610, C-630 and C-640 respectively and discharge to the Flare K.O. Drum D-841 of the atmospheric and vacuum distillation unit. Open the overhead vent of the drum D-841.

火炬气系统氮气置换时应结合各火炬气排放点设备的氮气置换进行，分别从D-601、D-602、D-641、D-645、C-610、C-630、C-640顶部给气，往常减压装置火炬气分液罐D-841排放。D-841罐顶放空打开。

2）The flow rate of nitrogen purge at each point should be strictly controlled, due to the small diameter of the vent line on top of drum D-841. The vent valves on top of the towers and the drums should be opened when a large amount of nitrogen is consumed at the beginning of purge to discharge gas in order to prevent the pressure buildup in the system.

因D-841罐顶放空线管径较小，应严格控制各点的氮气置换流量，各塔顶、罐顶在初期大量氮气置换时应打开各塔顶、罐顶的放空阀排气，防止系统憋压。



**Figure 18　Flow diagram of nitrogen purge for the flare gas system**

**图18　火炬气系统氮气置换流程图**

2.3.2.3　Introduction of refined naphtha for circulation引精制石脑油循环

1. Line up the process of introducing oil改好引油流程

All safety valves of towers and drums are put into service, and the delivery lines are closed. Each vents and drains are all closed. Line up the circulation process of the light ends recovery unit, according to the following figure.

各塔、罐安全阀全部投用，付线关闭。各放空、导淋全部关闭。按照下图改通轻烃回收装置循环流程。



**Figure 19　Flow diagram of introducing refined naphtha for circulation**

**图19　引精制石脑油循环流程图**

（2）Introduction of naphtha to establish the circulation among three towers引石脑油建立三塔循环

1）Contact the production scheduler to inform the tank farm to send naphtha to the light ends recovery system, and inject naphtha to the C-610 through the line of stabilized naphtha to tank farm.

联系调度，通知罐区向轻烃回收系统送石脑油，通过稳定石脑油至罐区线往C-610进油。

When the C-610 level is above 80%, open the P-610A/B to deliver oil to the C-630.

当C-610液面至80%以上时，开P-610A/B向C-630送油。

2）Adjust FIC61301, FIC61302, and control the amount of naphtha to C-630.

调节FIC61301，FIC61302,控制去C-630石脑油量。

3）When the C-630 level is 80%, open the P-630A/C to deliver oil to the C-640.

当C-630液面至80%时，开P-630A/C向C-640送油。

4）Adjust FIC63601 to control the amount of naphtha to C-640.

调节FIC63601，控制去C-640石脑油量。

5）Confirm that the process of C-640 bottom oil to the P-630B is smooth and the bottom valve is closed.

确认C-640塔底油去P-630B流程畅通，塔底阀关闭。

6）When the C-640 level reaches 100%, continue to collect oil of more than 50m3, contact the production scheduler to inform the tank farm to stop the oil supply, and close the valve of stabilized naphtha to the tank farm.

当C-640液面至100%时，继续收油50m3以上，联系调度通知罐区停止送油，关闭稳定石脑油至罐区阀门。

7）Start the P-630B to send oil to the C-610.

启运P-630B向C-610送油。

8）Adjust FIC64702 to control the amount of naphtha to C-610.

调节FIC64702，控制去C-610石脑油量。

9）Strengthen to discharge the water at the drains of the towers during the early stage of oil introduction, and close the valve when oil is seen.

加强各塔在前期引油时应加强导淋处切水，见油后关闭。

10）Contact the instrument staff to calibrate and check whether the liquid level, flow rate and temperature are accurate.

联系仪表校对各液面、流量、温度是否准确

11）Check the equipment for leaks regularly.

经常检查设备有无泄漏

12）Confirm that the circulation among three towers is normal with stable liquid level, and functional instruments.

确认三塔循环正常、液位平稳、仪表好用

13）Put air coolers and water coolers into service.

投用各空冷器、水冷器。

14）Introduce chilled water and establish an open cycle of chilled water (the naphtha from E-615 is routed to the delivery line).

引冷冻水，建立冷冻水开路循环（E-615石脑油走付线）。

2.3.2.4　Introduction of feedstock for startup引进料开工

（1）Introduction of straight-run naphtha引直馏石脑油

1）When the atmospheric and vacuum distillation unit is started up normally, the overhead naphtha of pre-distillation and atmospheric tower is introduced to the light ends recovery unit after it’s acceptable.

常减压开车正常，初顶石脑油和常顶石脑油合格后引至轻烃回收装置。

2）The stabilized naphtha is routed to the tank farm and close the circulation process to C-610.

稳定石脑油改至罐区，关闭至C-610的循环流程。

3）Improve straight-run naphtha C-610 and C-630.

将直馏石脑油改进C-610和C-630。

4）Put E-615 into service to control the absorber overhead temperature.

投用E-615，控制吸收塔顶温度。

5）Line up the process for the overhead gas of desorption tower to D-602, close the process of tank D-602 to the absorber, and line up the process to the flare gas, and put E-602W into service.

改通脱吸塔顶气至D-602流程，D-602罐至吸收塔关闭，改通至火炬气流程，并投用E-602W。

（2）Start the desorption tower开脱吸塔

1）Before introducing 1.0MPa steam to the E-630R, the water is drained and the steam is seen.

引1.0MPa蒸汽至E-630R前，排尽存水并见汽。

2）Put TIC63207 into service and slowly increase the opening of TIC63207 to control the heating rate.

投用TIC63207，并缓慢打开TIC63207开度，控制升温速度。

3）Put D-630 in the level control LIC63301 and line up the process of condensed water out of the unit through E-636. When the liquid level of LIC63301 is shown, open the valve to send condensed water out of the unit.

投用D-630液位控制LIC63301，改通凝结水经E-636出装置的流程，LIC63301有液位后，开阀往装置外送凝结水。

4）Control the overhead temperature, the overhead pressure and the bottom temperature of C-630, according to the process card.

按照工艺卡片控制C-630塔顶温度、塔顶压力和塔底温度。

（3）Start stabilizer开稳定塔

1）Switch the overhead gas of tank D-641 to D-602 and vent it to flare from the top of the tank D-602.

D-641罐顶气改至D-602，从D-602罐顶放火炬。

2）Put all the overhead air cooler of stabilizer and pressure control valves into service.

稳定塔顶空冷，压力控制阀等全部投用。

3）At this point, the atmospheric and vacuum distillation unit is in normal operation after startup, and the atm. PA #2 has been introduced to the delivery line of E-640RS in circulation. Open the inlet and outlet valves of the E-640RS gradually until it is fully open.

此时常减压已经开正常，常二中已经引至E-640RS付线循环。逐步打开E-640RS的进出口阀，直至全开。

4）After the inlet and outlet of E-640RS is fully opened, the re-boiler outlet temperature will not increase any more, gradually decrease the TIC64201 and TIC64202, to heat up the re-boiler.

E-640RS进出口全开后，再沸器出口温度不再上升时，逐步关小TIC64201、TIC64202，再沸器升温。

5）Control the overhead pressure of the tower C-640 and the tank D-641. The pressure of D-641 can be controlled according to the upper limit of the specification.

控制C-640塔顶和D-641罐顶压力，D-641压力可按照指标上限控制。

6）After the liquid level of D-641 is above 60%, start D-641 and apply the reflux to control the overhead temperature of the C-640.

D-641液位达到60%以上后启运D-641打回流，控制C-640塔顶温度。

7） If the liquid level of C-640 increases, the overhead level of the tank can be controlled by discharging from the top of tank to the flare gas.

如C-640液位上升，可通过罐顶至火炬气排放，控制罐顶液位。

8）Adjust the parameters, such as the overhead temperature, pressure, tower bottom temperature of the tower C-640, and analyze the LPG and direct it to the LPG desulfurization unit after the specification of LPG is acceptable.

调整C-640塔顶温度、压力、塔底温度等参数，分析液化气指标合格后改至液化气脱硫醇单元。

（4）Introduction of dry gas into light ends recovery unit引干气进轻烃回收

1）Put the pressure control valve on top of the tank D-601 and the overhead gas to flare gas into service.

投用D-601罐顶压控阀，罐顶气至火炬气。

2）Introduce the overhead gas of pre-distillation and atmospheric tower to D-601.

引初顶气和常顶气至D-601。

（5）Start the compressor开压缩机

1）Introduce the overhead naphtha of atmospheric tower to the compressor to establish the liquid injection of the compressor.

引常顶石脑油至压缩机，建立压缩机喷液。

2）Put the compressor system cooler, lubricating oil, etc. into service, and the compressor is ready for the startup.

投用压缩机系统冷却器、润滑油等系统，压缩机具备开车条件。

3）Put the compressor interlock into service.

投用压缩机联锁。

4）Start the compressor. Only one compressor of K-601ABC is started, before the overhead gas of aviation kerosene hydrogenation tower and diesel hydrogenation tower is not routed into the unit. If the compressor load is still too small, it can be partially circulated through PV60101A.

启运压缩机。航煤加氢和柴油加氢塔顶气未改进装置前，K-601ABC只开一台。如压缩机负荷仍然偏小，可通过PV60101A部分循环。

（6）Start absorber开吸收塔

1）Line up the process of purified dry gas to dry gas desulfurization.

改通净化干气至干气脱硫的流程。

2）D-602 dry gas was changed to C-610, and the D-602 tank overhead was closed to the flare gas valve.

D-602干气改至C-610，关闭D-602罐顶至火炬气阀门。

3）Adjust the pressure of absorber and adjust the amount of absorbent.

调整吸收塔的压力，调整吸收剂量。

（7）Introduction of hydrogenated overhead gas into the unit引加氢塔顶气进装置

1）Introduce the overhead gas of aviation kerosene hydrogenation tower into D-601.

引航煤加氢塔顶气进D-601。

2）Introduce the overhead gas of diesel hydrogenation tower.

引柴油加氢塔顶气。

3）Put the pressure control PIC60101 on top of the tank D-601 into service, and control the pressure according to the process card.

投用D-601罐顶压控PIC60101，按照工艺卡片控制压力。

4）Observe the opening of PV60101A and PV60101B. If the opening of PV60101B is small, while that of PV60101A is large, and the inlet flow rate FI60101 of compressor is lower than the capacity of a single compressor, it is not necessary to start an additional compressor. If the PV60101B has a large opening, and the flow rate FI60101 reaches the delivery flow of a single compressor, then start an additional compressor.

观察PV60101A和PV60101B开度，如果PV60101B很小，而PV60101A开度较大，压缩机入口流量FI60101低于单台压缩机的能力，则不需要增开压缩机。如PV60101B开度较大，而FI60101流量达到了单台压缩机的输送流量，则增开一台压缩机。

5）Introduce the overhead gas of reforming pre-hydrogenation into D-602.

引重整预加氢塔顶气进D-602。

6）When there is liquid level indication of D-601 and D-602, start the P-601 and P-602 to deliver oil to D-645 and C-630 respectively.

D-601、D-602有液位则分别启运P-601和P-602分别往D-645和C-630送油。

（8）Put the mixed naphtha tank D-645 into service投混合石脑油罐D-645

1）Put the process for the overhead gas of desorption tower to the balance gas on top of the tank D-645 into service to control the pressure of D-645.

投用脱吸塔顶气至D-645罐顶平衡气流程，控制D-645压力。

2）Introduce the aviation kerosene hydrogenated naphtha, diesel hydrogenated naphtha, diesel hydrogenated light hydrocarbon, and reforming light hydrocarbon into D-645. Put the process into service slowly and gradually, since there may have much water in the external pipelines when they are put into service for the first time.

分别引航煤加氢石脑油、柴油加氢石脑油、柴油加氢轻烃、重整轻烃进D-645。由于外管初次投用，外管可能存水较多，应缓慢、逐步投用流程。

3）Start the P-681 to discharge water to the sour water tank after there is level indication of D-645.

D-645有界位后，启运P-681往酸性水罐切水。

4）Start the P-645 to feed the mixed naphtha into the stabilizer, after the D-645 liquid level reaches 60%.

D-645液位达到60%后，启运P-645，混合石脑油进稳定塔。

5）According to the needs of the reforming pre-hydrogenation unit, put the direct supply process of stabilized naphtha into service.

根据重整预加氢装置需要，投用稳定石脑油直供流程。

2.3.3　Operation adjustment操作调整

2.3.3.1　Adjustment of absorber吸收塔的调整

The operation of the absorber has a great impact on the recovery of C3 and C4. It is necessary to adjust the operation to reduce the content of C3 and C3 above components in the dry gas in order to solve the problem of “the components of C3 and C3+ entrained in dry gas”. In addition, the oil in the absorption will cause the amine solution of the desulfurization system to foam.

吸收塔的运行好坏对C3、C4的回收影响较大，需要做好操作的调整，降低干气中的C3及C3以上组分的含量，解决“干气不干”的问题。另外吸收中带油会造成脱硫系统的胺液发泡。

（1）To control the temperature of the absorbent after cooling, the temperature of the absorbent should be minimized to ensure the overhead temperature of the absorber.

控制好吸收剂的冷后温度，应尽量降低吸收剂的温度，保证吸收塔顶温度。

（2）When the content of C3 and C4 components in dry gas exceeds the standard, the amount of absorbent should be appropriately increased.

当干气中C3、C4组分含量超标时，应适当增加吸收剂的量。

（3）The desorption tower is adjusted in combination with the content of the C2 component in the LPG at the top of the stabilizer. If the C2 component in the stabilized LPG is within the specification, the degree of desorption of the desorption tower can be appropriately reduced.

结合稳定塔顶液化气中C2组分含量，调整脱吸塔。如稳定液化气中C2组分在指标范围内，可以适当降低脱吸塔的脱吸程度。

（4）If the condensed oil of the dry gas desulfurization system increases and the amine solution is foaming, it should be checked whether the absorber is overloaded, and whether the flow rate of dry gas is too high, resulting in purified dry gas with liquid.

如干气脱硫系统凝缩油增加，胺液出现发泡，应检查吸收塔是否超负荷，干气流量是否过大，造成净化干气带液。

（5）In the higher temperature of the absorbent, in addition to adjusting the amount of chilled water, check the temperature of the overhead secondary naphtha of atmospheric tower after cooling, adjust the second-stage cooler of the atmospheric and vacuum distillation unit, and lower the temperature of the overhead secondary naphtha of atmospheric tower.

在吸收剂温度较高，除调整冷冻水用量以外，检查常顶二级石脑油的冷后温度，调整常减压装置常顶二级的冷却器，降低常顶二级石脑油的温度。

（6）The higher the absorption pressure, the better the absorption will be. When the C3 and C4 components increases in the dry gas, the overhead pressure of the tank D-602 can be combined (affecting the overhead pressure of the tank D-641) to increase the operation pressure of the absorber appropriately within the range of the process specifications.

吸收压力越高越有利于吸收，在干气中C3、C4组分上升时，可结合D-602罐顶压力（影响D-641罐顶压力），在工艺指标范围内适当提高吸收塔的操作压力。

2.3.3.2　Adjustment of desorption tower脱吸塔的调整

The operation of the desorption tower has an effect on both the absorber and the stabilizer.

脱吸塔的运行对吸收塔和稳定塔均有影响。

（1）When the content of C3 and C4 in the dry gas is higher, the bottom temperature and the overhead temperature of the desorption tower can be lowered appropriately, and the overhead pressure of the desorption tower is increased , that is, the degree of desorption is lowered.

干气中C3、C4含量组分高时，可适当降低脱吸塔塔底温度和脱吸塔顶温度，提高脱吸塔顶压力，即降低脱吸度。

（2）When the content of C2 and C2 below in the LPG exceeds the standard, if the adjustment to the overhead pressure of the tank D-641 is limited, the bottom temperature and the overhead temperature of the desorption tower should be increased appropriately to reduce the overhead pressure of the desorption tower, that is, to improve the desorption degree.

当液化气中C2及C2以下组分含量超标，调整D-641罐顶压力受限时，应适当提高脱吸塔底温度和脱吸塔顶温度，降低脱吸塔顶压力，即提高脱吸度。

2.3.3.3　Adjustment of stabilizer稳定塔的调整

The adjustment of the stabilizer mainly focuses on the quality of the LPG product, the initial boiling point of the stabilizer naphtha and the evacuation of the LPG pump.

稳定塔的调整主要围绕液化气产品质量、稳定石脑油的初馏点和液化气泵抽空进行调整。

（1）When the content of C5+ (C5 and above) in the LPG exceeds the standard, the bottom temperature and the overhead temperature of the stabilizer should be lowered appropriately to increase its overhead pressure.

液化气中C5+（C5及以上组分）含量超标时，应适当降低稳定塔底温度和稳定塔顶温度，提高塔顶压力。

（2）If the initial boiling point of the stabilizer naphtha is lower, while the C5+ content of the LPG is higher, the stabilizer bottom temperature should be increased appropriately, and the stabilizer overhead temperature should be lowered.

如稳定石脑油初馏点较低，而液化气的C5+组分含量高，则应适当提高稳定塔底温度，同时降低稳定塔顶温度。

（3）If the initial boiling point of the stabilizer naphtha is lower, the stabilizer bottom temperature should be increased appropriately.

如稳定石脑油初馏点较低，则应适当提高稳定塔底温度。

（4）When the content of C2- (C2 and below) in the stabilized LPG is higher, it can be adjusted by increasing the temperature after cooling on top of the stabilizerand lowering the pressure of the knockout drum D-641 on top of the stabilizer. If there is no room to adjust the temperature after cooling, it should rely mainly on the adjustment to the pressure of D-641.

当稳定液化气中C2-（C2及以下组分）组分含量高时，影响，可以通过提高稳定塔顶冷后温度，降低稳定塔顶分液罐D-641压力进行调整。如冷后温度无调节余地，则应以调整D-641压力为主。

（5）When adjusting the pressure of D-641, prevent the P-641 from being evacuated after the pressure is reduced. If the P-641 is exhausted, it should be stopped immediately, and the pressure of D-641 should be increased, and the standby pump of P-641 should be started. Close the inlet and outlet valves of the evacuated pump P-641 with the gas discharging to the flare gas, and re-fills the pump before running.

调整D-641压力时应防止压力降低后引起P-641抽空。出现P-641抽空后，应立即停运P-641，提高D-641压力，启运P-641备用泵。P-641抽空的泵关闭进出口阀，往火炬气排气，重新灌泵后再运行。

（6）If the C2- component in the LPG exceeds the standard, and the stabilizer has no room for adjustment, the degree of desorption of the desorption tower should be increased appropriately.

如液化气中C2-组分超标，而稳定塔无调节余地时，应适当增加脱吸塔的脱吸度。

2.3.3.4　Adjustment of compressor　压缩机的调整

（1）The compressor K-601ABC is ‘two open and one standby’ in normal production, and it is strictly prohibited from overload and low load operation.

正常生产时压缩机K-601ABC为“二开一备”，压缩机严禁超负荷和低负荷运行。

（2）When the compressor load is reduced, that is, the opening of the valve PV60101A for D-602 back to D-601 is large, stopping a compressor should be considered.

当压缩机负荷降低，即D-602返D-601阀PV60101A开度大时，应考虑停运一台压缩机。

（3）When the opening of PV60101A for the compressor is small or even fully closed, and the opening of the pressure control valve PV60101B on top of the tank D-601 to the flare gas is increased, starting an additional compressor should be considered.

当压缩机PV60101A开度小，甚至全关，而D-601罐顶至火炬气的压控阀PV60101B开度增加时，应考虑增开一台压缩机。

（4）Have a better control of the cooling between the compressor stages.

控制好压缩机各级间冷却。

2.4　Normal operation, instrument control scheme and main instrument performance　正常操作、仪表控制方案及主要仪表性能

2.4.1　Operation methods of process　工艺操作法

2.4.1.1　Control of C3+ component in the absorption dry gas　吸收干气C3+组分控制

The main components of the absorption dry gas are methane and ethane. When the C3+ component in the LPG is high, this causes some light hydrocarbon to enter the dry gas, affecting the yield of light hydrocarbon and also the effect of dry gas desulfurization. The component in the absorption dry gas is mainly related to the operation of the absorber.

吸收干气的主要成分为甲烷和乙烷，当液化气中组分高C3+时，造成部分轻烃进入干气，影响轻烃的收率，同时也影响到干气脱硫的效果。吸收干气中的组分主要与吸收塔的运行情况有关。

Control range: ≤5% (V%).

控制范围：≤5%（V%）。

Relevant parameters: absorber overhead temperature TI61001, absorber overhead pressure PIC61001, absorbent flow rate FIC61101 and absorbent temperature TI61002.

相关参数：吸收塔顶温度TI61001、吸收塔顶压力PIC61001、吸收剂流量FIC61101、吸收剂温度TI61002。

Control mode: PIC61001 automatic control and FIC61101 automatic control.

控制方式：PIC61001自控、FIC61101自控。



**Figure 20**　**Control flow diagram of** C3**+ components in absorption dry gas**

**图20　吸收干气**C3**+组分控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The content of C3+ component in the absorption dry gas is high.吸收干气C3+组分含量高 | The overhead pressure of absorber is low.  吸收塔顶压力低 | Increase the overhead pressure of absorber  提高吸收塔顶压力 |
| The overhead temperature of absorber  吸收塔顶温度 | a）Adjust the flow rate of chilled water  调整冷冻水流量  b）Contact the production scheduler to inform the utility unit for adjustment of the absorbent temperature.  联系调度通知公用工程调整吸收剂温度  c）Adjust the overhead naphtha temperature of atmospheric tower.  调整常顶石脑油温度 |
| The amount of absorbent is insufficient.  吸收剂量不足 | Increase the flow of absorbent.  增加吸收剂流量 |
| The absorber is overloaded.  吸收塔超负荷 | Reduce the desorption degree of the desorption tower properly.  适当降低脱吸塔脱吸度 |

2.4.1.2　Control of C2- component in stabilized LPG　稳定液化气C2-组分控制

The content of the C2-component in stabilized LPG affects the vapor pressure of the LPG, and has a great influence on the storage and transportation safety of the LPG.

稳定液化气C2-组分的含量影响到液化气的蒸汽压，对液化气的储运安全影响较大。

Control range:

控制范围：

Related parameters: the overhead temperature TI63201 and pressure PIC63201 of desorption tower, the bottom temperature TI63206 of desorption tower, the pressure PIC64401 of knockout drum on top of stabilizer and the overhead temperature TIC64301of stabilizer after cooling.

相关参数：脱吸塔塔顶温度TI63201和压力PIC63201、脱吸塔塔底温度TI63206，稳定塔塔顶分液罐压力PIC64401、稳定塔顶冷后温度TIC64301。

Control mode: The PIC63201 is in single loop control and the overhead temperature TI63201 is controlled by FIC61302 in single loop, TI63206 is controlled by TIC63207 in single loop, PIC64401 is controlled by PV64401A and PV64401B in two-way and TIC64301 is in frequency converting control by A-641.

控制方式：PIC63201单回路控制，塔顶温度TI63201由FIC61302单回路控制，TI63206由TIC63207单回路控制，PIC64401由PV64401A和PV64401B双程控制，TIC64301由A-641变频控制。



**Figure 21**　**Flow diagram of stabilized LPG** C2**-component control**

**图21　稳定液化气**C2**-组分控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The content of C2- component in the stabilized LPG is high.  稳定液化气C2-组分含量高 | The temperature of TIC64301 is low.  TIC64301温度低 | a）Reduce the reflux flow appropriately.  适当降低回流量。  b）Some overhead fans of air cooler should be stopped in time, in case of the heavy rain leads to the low temperature of the reflux.  如遇下暴雨，造成回流温度低，应及时停运  部分塔顶空冷风机。 |
| The pressure of PIC64401 is high.  PIC64401压力高 | a）Reduce the pressure of PIC64401 appropriately.  适当降低PIC64401压力。  b）Start more overhead fans of the stabilizer, or adjust the variable frequency of the fan.  增开稳定塔顶风机，或调解风机变频。 |
| The desorption tower has low desorption degree.脱吸塔脱吸度低 | a）Increase the bottom temperature of the desorption tower.  提高脱吸塔底温度  b）Increase the overhead temperature of the desorption tower.  提高脱吸塔顶温度  c）Decrease the overhead pressure of the desorption tower.  降低脱吸塔顶压力 |

2.4.1.3　Stabilized LPG C5+ component control　稳定液化气C5+组分控制

The C5+ content in the overhead LPG of the de-butanizer tower is the main quality control specification of the LPG. It is a direct reflection of the splitting effect between the LPG and the bottom reforming stock of the stabilizer. The key to controlling the C5+ content is to have a better control of the overhead temperature and the overhead pressure of the stabilizer, as well as the bottom heat source of the stabilizer, to stabilize the bottom temperature, and maintain a suitable reflux flow at the top of the stabilizer to obtain the desired fractionation effect. It is mainly affected by the overhead temperature, the overhead pressure and the overhead reflux. Generally, the overhead temperature is high and the pressure is low, this tends to cause high C5+ content in the LPG at the top of the stabilizer. Conversely, this content is low.

脱丁烷塔塔顶液化气中C5+含量是液化气的主要质量控制指标，是稳定塔液化气和塔底重整料之间分割效果的直接体现，控制C5+含量关键是控制好稳定塔塔顶温度和塔顶压力，控制好稳定塔塔底热源，稳定好塔底温度，保持稳定塔顶合适的回流量，以获得理想的分馏效果。主要受塔顶温度、塔顶压力和塔顶回流的影响大，一般塔顶温度高、压力低，易造成稳定塔顶液化气中C5+含量高；反之，稳定塔塔顶液化气中C5+含量低。

Control range: ≤ 3% (V%).

控制范围：≤3%（V%）。

Relevant parameters: stabilizer overhead temperature TI64101, stabilizer overhead pressure PI64101, stabilizer feed temperature TIC64001 and stabilizer bottom temperature TI64106.

相关参数：稳定塔顶温度TI64101、稳定塔顶压力PI64101、稳定塔进料温度TIC64001、稳定塔底温度TI64106。

Control mode: The stabilizer overhead pressure of PI64101 is controlled by PIC64401 in single loop, the stabilizer overhead temperature of TI64101 is controlled by TIC64301 and FIC64101, the stabilizer feed temperature of TIC64001 is controlled by adjusting the delivery line of bottom oil from the stabilizer E-645, and the stabilizer bottom temperature of TI64106 is controlled by TIC64201 and TIC64202.

控制方式：稳定塔顶压力PI64101通过PIC64401单回路控制，稳定塔顶温度TI64101通过TIC64301和FIC64101控制，稳定塔进料温度TIC64001通过调节E-645稳定塔底油付线控制，稳定塔塔底温度TI64106通过TIC64201和TIC64202控制。

Atm. PA#2

Atm. PA#2

To LPG Sweetening Unit

Bottom oil of desorption tower

Bottom oil of absorber



**Figure 22**　**Control flow diagram of** C5**+ component in stabilized** **LPG**

**图22　稳定液化气**C5**+组分控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The C5+ component content in stabilized LPG is high.  稳定液化气C5+组分含量高 | The overhead temperature of stabilizer rises.  稳定塔顶温度上升 | a）If the reflux regulating valve FIC64101 fails, the FIC64101 is routed temporarily to the delivery line for control and repair the valve.  如是回流调节阀FIC64101故障，则FIC64101临时改付线控制，检修调节阀。  b）The pump of LPG is evacuated. Start the spare pump, take the evacuated pump of LPG out of service and exhaust it, and then refill the pump.  液化气泵抽空。开备用泵，抽空液化气泵切出排气后重新灌泵。  c）The fan fails, causing the reflux temperature to increase. Stop the faulty fan and increase the speed of the running fan.  风机故障，导致回流温度上升。停运故障风机，提高运行风机的转速。 |
| The temperature of feeds rises.  进料温度上升 | Check the three-way valve TV64001 to stabilize the temperature of the TIC64001.  检查三通阀TV64001，稳定控制TIC64001温度。 |
| The bottom temperature of stabilizer rises.  稳定塔塔底温度上升 | a）The flow and also the temperature of the atm. PA #2 from the atmospheric and vacuum distillation unit increases, and the feed rate of light hydrocarbon decreases, all of which may cause the bottom temperature of stabilizer to rise. By adjusting the opening of TIC64202 and TIC64201, the temperature of the stabilizer can be lowered.  常减压装置的常二中流量增加、常二中温度上升，轻烃进料量减少等可能造成稳定塔塔底温度上升，通过调节TIC64202、TIC64201开度，降低稳定塔温度。  b）The three-way valves of TV64201 and TV64202 fail. These valves are controlled by the local handwheel. Perform maintenance, when there is an opportunity.  三通阀故障TV64201、TV64202故障。采用三通阀现场手轮控制。择机检修。 |

2.4.1.4　Initial boiling point control of stabilizer naphtha　稳定石脑油初馏点控制

The initial boiling point of stabilizer naphtha reflects the separation effect of the light hydrocarbon (LPG) component in the stabilizer. The low initial boiling point indicates that more LPG components contained in the stabilizer naphtha are not separated, affecting the storage and transportation safety of the stabilized naphtha, and also increasing the burden of reforming pre-hydrogenation.

稳定石脑油的初馏点反映了稳定塔轻烃（液化气）组分的分离效果，初馏点低，表明稳定石脑油中含有较多的液化气组分未分离，影响到稳定石脑油储运的安全，增加重整预加氢的负担。

Control range: ≥35℃

控制范围：≥35℃

Relevant parameters: stabilizer overhead pressure PI64101 and stabilizer bottom temperature TI64104.

相关参数：稳定塔顶压力PI64101和稳定塔底温度TI64104。

Control mode: PI64101 is controlled by the control of PIC64401 and TIC64301. The TI64104 is controlled by adjusting the TIC64201 and TIC64202.

控制方式：PI64101通过控制PIC64401和TIC64301进行控制。TI64104通过调整TIC64201和TIC64202进行控制。



**Figure 23**　**Flow diagram for initial boiling point control of stabilizer naphtha**

**图23　稳定石脑油初馏点控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The initial boiling point of the stabilizer naphtha is low.  稳定石脑油初馏点低 | The overhead pressure of stabilizer rises.  稳定塔顶压力上升 | a）Adjust PIC64401 to reduce overhead pressure.  调节PIC64401，降低塔顶压力  b）Adjust A-641 to lower the temperature after cooling.  调整A-641，降低冷后温度。 |
| The bottom temperature of stabilizer decreases.  稳定塔塔底温度降低 | a）The flow and also the temperature of the atm. PA #2 from the atmospheric and vacuum distillation unit decreases, and the feed rate of light hydrocarbon decreases, all of which may cause the bottom temperature of stabilizer to decrease. By adjusting the opening of TIC64202 and TIC64201, the temperature of the stabilizer can be lowered.  常减压装置的常二中流量降低、常二中温度降低，轻烃进料量减少等可能造成稳定塔塔底温度降低，通过调节TIC64202、TIC64201开度，降低稳定塔温度。  b）The three-way valve fails, causing the delivery line of three-way to open wider. The three-way valve is controlled by the local handwheel. Perform maintenance, when there is an opportunity.  三通阀故障，造成三通付线开大。采用三通阀现场手轮控制。择机检修。 |

2.4.1.5　Dry point control of stabilized naphtha　稳定石脑油干点控制

The dry point is the maximum vapor phase temperature finally reached when the oil is distilled by heating in an Engler distillation equipment. The dry point is mainly related to the tail composition of the oil distillation range. The dry point is the main quality control indicator for naphtha of the stabilizer. It is directly related to whether the reforming raw materials can meet the requirements of the product quality.

干点是油品在恩氏蒸馏设备中进行加热蒸馏时蒸馏到最后达到的最高汽相温度。干点主要与油品馏程的尾部组成相关。干点是稳定石脑油的主要质量控制指标，它直接关系到能否满足重整原料对产品质量的要求。

Control range: ≤175 °C.

控制范围：≤175℃。

Relevant factors: The naphtha of light ends system is mainly the straight run naphtha of the atmospheric and vacuum distillation unit, naphtha of the aviation kerosene hydrogenation unit, naphtha of the diesel hydrogenation unit, light hydrocarbon of the diesel hydrogenation unit and light hydrocarbon of the reforming unit. The light ends recovery unit only separates C3～C4 in naphtha, and the dry point of stabilized naphtha exceeding the standard is mainly checked from the following aspects:

相关因素：轻烃系统的石脑油主要来源于常减压蒸馏装置直馏石脑油、航煤加氢石脑油、柴油加氢石脑油、柴油加氢的轻烃、重整轻烃等。轻烃回收装置仅对石脑油中的C3～C4进行分离，稳定石脑油干点超标主要从以下几个方面进行排查：

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The dry point of stabilized naphtha is high.  稳定石脑油干点高 | The naphtha dry point of pre-distillation tower is high.  初顶石脑油干点高 | The overhead temperature of the pre-distillation tower is adjusted. The naphtha is changed to the light slop oil. After re-analysis, the qualified product is taken out.  调整初馏塔顶温度，石脑油改至轻污油，重新分析合格后改出合格产品。 |
| The naphtha dry point of atmospheric tower is high.  常顶石脑油干点高 | Adjust the overhead temperature of the atmospheric tower, change the naphtha to the light slop oil, and after re-analysis, the on-specification product is taken out.  调整常压塔顶温度，石脑油改至轻污油，重新分析合格后改出合格产品。 |
| The mixed naphtha dry point of D-645 is high.  D-645混合石脑油干点高 | Check and analyze naphtha排查分析石脑油 |
| Internal leakage of  stabilizer re-boiler E-640RS is found.  稳定塔再沸器E-640RS内漏 | The stabilizer naphtha is changed to the light slop oil, check and identify the leaked re-boiler, and stop the atm. PA #2. The light ends system is purged with naphtha, and the qualified product is taken out after re-analysis.  稳定石脑油改至轻污油，排查确定泄漏的再沸器，停运常二中。轻烃系统石脑油置换，重新分析合格后改出合格产品。 |
| The stabilized naphtha is dark in color.  稳定石脑油颜色发黑 | The overhead heat exchanger of atmospheric tower leaks and crude oil contaminates overhead naphtha of atmospheric tower.  常压塔顶换热器泄漏，原油污染常顶石脑油 | The naphtha of stabilizer is changed to the light slop oil, check and identify the leaked heat exchanger, and stop the leaked heat exchanger, purge the naphtha system, and after the stabilized naphtha color becomes normal, the qualified product is taken out.  稳定石脑油改出轻污油，排查确定泄漏的换热器，并停用泄漏换热器，置换石脑油系统，稳定石脑油油色正常后改出合格产品。 |
| The flush of sediment from overhead heat exchanger and others contaminates naphtha.  塔顶换热器等沉积物冲刷污染石脑油 | 1. The stabilizer naphtha is changed to the light slop oil. Collect the contaminated naphtha and put it in a static state, and the naphtha color is clear and transparent after sedimenting. It can be determined that the naphtha contamination is caused by the sediment scrubbing of equipment such as heat exchangers.   稳定石脑油改出轻污油。采集受污染的石脑油静止，无静止后石脑油颜色澄清并透明，可以确定为换热器等设备沉积物冲刷引起的石脑油污染。   1. Check each stream of naphtha, determine the source of the pollutants, and take out the contaminated naphtha to the light slop oil. After the color of the stabilizer naphtha becomes normal, take out the qualified product.   排查各股石脑油，确定污染物的来源，切出受污染的石脑油至轻污油。稳定石脑油颜色正产后该出合格产品。   1. Analyze the cause of the naphtha contamination and take corresponding measures until the color of the stream becomes normal and then put it back to the light ends recovery.   分析石脑油污染的原因，采取相应的措施，直至该股物料颜色正常后再并入轻烃回收。 |

2.4.2　Operation methods of equipment (pumps, compressors, heat exchangers, etc.)　设备操作法（机泵、压缩机、换热器等）

2.4.2.1　Operation of centrifugal pump　离心泵的操作

（1）Key inspection points of pumps　机泵检查重点

1）Frequently check the inlet and outlet pressure, current, sealing oil pressure, oil level of bearing housing or oil mist lubrication, oil ring, cooling water flow, bearing temperature, sound and vibration of each part.

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。

① Rolling bearing temperature is ≯70°C

滚动轴承温度≯70℃。

②The motor casing temperature is ≯°85°C, and the motor current does not exceed 95% of the rated current.

电机外壳温度≯85℃，电机电流不超过额定电流的95%。

③For bearings with the rotation speed of 1500 rpm, the vibration is ≯0.09mm, for bearings with the rotation speed of 3000 rpm, the vibration is ≯0.06mm.

转速为1500转/分的轴承，振动≯0.09mm，转速为3000转/分的轴承，振动≯0.06mm。

④Leakage and loss requirements of mechanical seals: For the light oil, it does not exceed 10 drops / min; for the heavy oil, it does not exceed 5 drops / min. Leakage and loss requirements of soft packing seals: for the light oil, it does not exceed 20 drops / min; for the heavy oil, it does not exceed 10 drops / min.

机械密封漏损要求：轻质油不超过10滴/分；重质油不超过5滴/分。软填料密封漏损要求：轻质油不超过20滴/分；重质油不超过10滴/分。

2）Always check the pump (including the pump body, the wheel cover, the motor casing, the pump base, the valve line, the inlet and outlet pressure gauge, etc.) and the surrounding sanitation.

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 “three-step filtration” and “five-fixation” systems of the lube oil, and regularly change the lube oil and grease according to regulations, and make a record.

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, record, and hand over the relevant parameters in a serious, accurate, detailed, and timely manner.

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）When the centrifugal pump is found evacuated, turn down the outlet valve in time, find the cause, adjust the flow in time, and prohibit the centrifugal pump from pumping out 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 over system of the standby pump and bar it over at the specified time.

严格执行备用机泵盘车制度，按规定时间盘车。

7）The hot oil pump body should be warmed up and supplied the cooling water to meet the requirements of switching at any time.

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）Preparation before start-up　启动前的准备工作

1）Do well with the contact work before starting the pump and confirm that the process is smooth.

开泵前要做好联系工作，并确认流程畅通。

2）Check whether the pump cover and inlet and outlet pipelines, auxiliary pipelines, valves, flanges, pressure gauges, etc. are intact, and whether the outlet and inlet vent valves are closed, and the steam valves are 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 whether the pump, motor and coupling guard cover and anchor bolts are complete and not loose.

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 that the pump outlet and inlet valve components are complete.

检查泵出、入口阀门各部件是否齐全。

5）Check that each pressure gauge is intact and the pressure valve is open.

检查各压力表是否完好，引压阀打开。

6）According to the requirements of the three-step filtration, add the qualified lube oil of the specified grade to the bearing housing, and the oil level should be 1/2~2/3 of the oil mark. Check whether the oil retaining ring or the oil seal leaks after oil addition. Note: The oil mist lubrication pump should be checked whether the oil mist lubrication system of the pump is normal.

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。

7）Put the cooling water into use to check if the water line is clear and adjust the water flow rate.

投用冷却水，检查水路是否畅通，同时调节好水量。

8）Open the inlet valve slightly, prime the pump body, slowly open the pump outlet drain valve to exhaust the gas of the pump, close the drain valve, and check the seal for leaks. Check and find all is normal and then open the inlet valve.

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。

9）Check by barring over the pump whether the rotor is evenly light and heavy, and whether there is abnormal sound in the pump body. If the barring over is tight or has abnormal sound, the pump cannot be started. Contact the maintenance personnel 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。

10）Check that the self-flushing system is normal.

检查自冲洗系统正常。

11）Confirm that the hot oil pump is fully warmed up.

确认热油泵预热充分。

12）The motor is powered for service.

电机送电待用。

（3）Preheating of hot oil pump　热油泵预热

1）Supply the cooling water to all parts before warming up.

预热前要给好各部位冷却水。

2）Line up the slop oil line process of the pump, slightly open the valve on the preheating cross-over line at the outlet of the pump, and close the cross-over valve after filling the line.

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 inlet valve of the pump slightly, drain the water and gas to the slop oil line. After the drain valve temperature approaches the oil temperature, close the drain valve of the pump.

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 the standby pump is warmed up, contact the panel operator and observe whether the running pump has no flow fluctuation or 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 inlet valve of the pump and slowly open the valve on the preheating cross-over line at the outlet of the pump.

打开泵进口阀，慢慢开泵出口预热跨线阀。

6）Gradually increase the oil circulation in the pump, and the preheating temperature rise rate is controlled at about 50 °C / h.

逐步增加泵内油品循环量，预热升温速度控在50℃/h左右。

7）After reaching the normal preheating temperature, bar over as required. (During warming up, it is strictly prohibited to bar over before reaching 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）Do not over-circulate the oil in the pump during preheating, so as to avoid causing the pump to be evacuated or leaking or reversing because the temperature rises too fast.

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 that the difference between the continuously preheated temperature at the flange of pump body and the temperature of the conveying medium is not more than 40 °C. Preheating should be uniform, not hot in the upper and cold in the lower or hot in the front and cold in the rear or partial hot.

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℃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 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 preheating, it can be started or put into normal standby. 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 and inform the panel operator to prepare to start the pump.

联系内操，告知准备启动机泵。

2）Close the preheating valve first for the hot oil pump.

热油泵先关预热阀。

3）Press the start button to start the pump, pay attention to the current indication and the change of the pump outlet pressure indication, check the leak of the seal and whether the operation sound of the pump is normal. Check the vibration of the pump and the temperature rise of each operating point. If the current is overloaded, the pump has noise or other abnormalities, stop the pump immediately to find the cause.

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 started and normal, and observe the changes of the current and pump outlet pressure.

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 injection of the sealing oil.

调整封油的注入量。

6）After the pump is put into operation normally, observe it for 3 to 5 minutes on the site, and confirm that the pump operation (the 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 operator and make a record.

泵开启后，通知内操，并作好记录。

（5）stop of the centrifugal pump　离心泵的停泵

1）Contact the panel operator to prepare to stop the pump.

联系内操，做好停泵准备。

2）Slowly close the pump outlet valve and press the power off button.

缓慢关闭泵出口阀，按停电按钮。

3）If the pump is used as a backup after shutdown, turn down the cooling water and sealing oil.

若停运后作为备用泵，关小冷却水及封油。

4）After the hot oil pump is stopped, it is necessary to resume the preheating for standby.

热油泵停运后要恢复预热备用。

（6）Switching of centrifugal pump　离心泵的切换

1）Check the condition of the standby pump according to the normal preparation procedure and confirm that the backup pump has reached the start-up condition.

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 operator to switch the pump.

联系内操准备切换泵。

3）Press the start button to start the pump (stop preheating first for the hot oil pump), pay attention to the current indication and the change of the pump outlet pressure indication, check the leak of the seal.

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 confirming there is flow of the pump, slowly open the outlet valve of the standby pump, and gradually turn down the outlet valve of the operating running pump until the opening of the outlet valve of the backup pump meets the process requirement and the outlet valve of the operating running pump is fully closed, and check the operation of the standby pump. The operating running pump is stopped after 10 minutes of 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）After the operating pump is stopped, follow the normal stop procedure of the pump.

原运泵停泵后，按正常停泵步骤处理。

Note: When switching, pay attention to control the flow 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）Conditions and steps for emergency shutdown of the pump　紧急停泵的条件及步骤

1）Conditions for emergency shutdown of the pump紧急停泵的条件

①There is severe noise, severe vibration, and serious leakage of mechanical seal.

有严重噪音、振动剧烈、机械密封严重泄漏。

②The pump evacuation can not be solved.

泵抽空无法消除。

③The bearing temperature is too high and continues to increase rapidly.

轴承温度过高继续快速上升。

④There are power outages, motor overheating, smoke, fire and other unexpected situations.

出现停电、电机过热、冒烟、着火等意外情况。

2）Emergency shut-down procedures紧急停泵步骤

①Press the stop button to quickly close the outlet valve. If it is not possible to access to the pump, 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 possible, the standby pump should be started quickly.

如条件允许，应迅速启动备用泵。

③Operate the remaining according to the normal start and stop procedures.

其余步骤按正常开停泵步骤操作。

（8）Common troubleshooting of pumps　泵的常见故障处理

1）Bearing temperature is too high

轴承温度过高

|  |  |
| --- | --- |
| Causes原因 | Treatment处理 |
| ①Failure of lube oil mist system.  润滑油雾系统故障。  ②The cooling water or sealing oil is insufficient or interrupted.  冷却水或封油不足或中断。  ③Water enters the bearing box.  轴承箱进水。  ④Bearing damage.  轴承损坏。  ⑤Pump concentricity is not in alignment.  机泵同心度不正。  ⑥Axial force is too large.  轴向力过大。  ⑦The ambient temperature is too high.  环境温度过高。  ⑧Overload operation.  超负荷运转。 | ①Handle the lube oil mist system.  处理润滑油雾系统。  ②Increase the cooling water or sealing oil.  加大冷却水或封油。  ③Contact the mechanic to deal with.  联系机修处理。  ④Contact the mechanic to replace the bearing.  联系机修更换轴承。  ⑤Contact the mechanic to make alignment.  联系机修找正。  ⑥Contact the mechanic to deal with.  联系机修处理。  ⑦Open wide the cooling water or take external cooling measures.  开大冷却水或采取外部冷却措施。  ⑧Adjust the discharge amount.  调整排出量。 |

2）Leakage of mechanical seal　机械密封泄漏

| Cause原因 | Treatment处理 |
| --- | --- |
| ①Improper selection or installation of mechanical seal.  机封选型或安装不当。  ②The flushing medium pressure of mechanical seal is low  机封冲洗介质压力低  ③The flushing medium of mechanical seal contains impurities  机封冲洗介质含杂质  ④Pump concentricity is not in alignment.机泵不同心。  ⑤The bearing wear causes the rotor to be eccentric.  轴承磨损，造成转子偏心。  ⑥The mechanical seal is damaged.  机封损坏。  ⑦pump is severely evacuated.  泵严重抽空。  ⑧Pump preheating is too fast.  泵预热速度过快。 | ①Select or install the specified mechanical seal as required.  按规定选用或安装机封。  ②Adjust the flushing medium pressure of the mechanical seal according to the regulations  按规定调节机封冲洗介质压力  ③Ensure the flushing medium quality of the mechanical seal  确保机封冲洗介质质量  ④Contact the mechanic to make alignment.  联系机修找正。  ⑤Contact the mechanic to replace the bearing.  联系机修更换轴承。  ⑥Contact the mechanic to deal with.  联系机修处理。  ⑦Switch the spare pump and contact the mechanic to replace the seal.  切换备用泵，联系机修更换密封。  ⑧Strictly control the preheating speed.  严格控制预热速度。 |

3）Excessive vibration　振动超标

| Cause原因 | Treatment处理 |
| --- | --- |
| ①The anchor bolts are loose.  地脚螺栓松动。  ②The impeller is loose or there is debris in the impeller.  叶轮松动或叶轮内有杂物。  ③the pump is not concentric.  机泵不同心。  ④The bearing clearance is too large or damaged.  轴承间隙过大或损坏。  ⑤Pump is evacuated or has cavitations.  抽空或汽蚀。  ⑥The flow fluctuates a lot.  流量波动大。  ⑦The inlet and outlet lines generate excessive stress.  出入口管线产生过大应力。 | 1. Contact the mechanic or electrician to fasten anchor bolts.   联系机修或电工紧固地脚螺栓。   1. Contact the mechanic to deal with.   联系机修处理。   1. Contact the mechanic to make alignment.   联系机修找正。   1. Contact the mechanic to repair.   联系机修检修。   1. Find the cause and eliminate it in time.   查找原因，及时消除。   1. Stabilize the working conditions.   稳定工况。   1. Try to eliminate stress.   设法消除应力。 |

1. Pump evacuation　泵抽空

| Cause 原因 | Treatment处理 |
| --- | --- |
| 1. The level of the inlet vessel is too low or the inlet pressure is not enough.   入口容器液位过低或入口压力不够。   1. The inlet line has steam.   入口管线窜汽。  ③The opening of the outlet line valve is too small to generate vortex vaporization.  出口管路阀门开度过小产生涡流汽化。  ④The preheating operation of the hot oil pump is not proper or the speed is too fast.  热油泵预热操作不当或速度过快。  ⑤The impeller falls off or there is debris in the impeller.  叶轮脱落或叶轮内有杂物。  ⑥the gap at fit part of the impeller is too large.  叶轮配合部分间隙过大。  ⑦The sealing oil is too large or the sealing oil has water.  封油过大或封油带水。  ⑧The cooling water jacket perforates.  冷却水套穿孔。 | ①Adjust the level of the inlet vessel in time.  及时调整入口容器液位。  ②Check and replace the valve or add the blind.  检查更换阀门或加盲板。  ③Properly open wide the outlet line valve.  适当开大出口管路阀门。  ④Check the preheating condition, suspend it and then slowly recover.  检查预热情况，暂停预热，然后缓慢恢复。  ⑤Contact the mechanic to deal with.  联系机修处理。  ⑥Contact the mechanic to repair.  联系机修检修。  ⑦Turn down the sealing oil and the sealing oil tank is dehydrated.  封油调小，封油罐脱水。   1. Contact the mechanic to deal with.   联系机修处理。 |

1. Increase of current in motor 　电机电流升高

|  |  |
| --- | --- |
| Cause原因 | Treatment处理 |
| ①The motor or pump bearing is damaged.电机或泵的轴承损坏。  ②The rotating parts have friction.  转动部件有摩擦。  ③The specific gravity flow rate of the delivery medium becomes large.  输送介质比重流量变大。  ④Ammeter fails.电流表坏。 | ①Replace the pump and replace the bearing.换泵更换轴承。  ②Check the repair.检查修理。  ③Find the cause and deal with.查找原因处理。  ④Contact the electrician for treatment.联系电工处理。 |

2.4.2.2　Operation of metering pump　计量泵的操作

（1）Inspection before start of pump　开泵前的检查

1）Check if the anchor bolts are loose and the grounding lead 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 line, pressure gauge and other accessories are intact.

检查泵出口管线，压力表等附件完好。

3）Check the lube oil and the oil level should 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 if the level of the material drum is normal (the liquid level is too low to start).

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 whether the pump inlet and outlet lines are unblocked and open the pump inlet and outlet valves.

检查泵进、出口管线是否畅通，打开泵进、出口阀门。

（2）Start pump　开泵

1）Pump motor, the stroke is running at the “0” position.

泵电机，冲程在“0”位处运转。

2）According to the production requirements, slowly adjust the pump stroke to the desired range.

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 flow rate is stable.

检查泵出口压力是否正常，流量是否稳定。

Note: When starting the metering pump, pay close attention to the change of pump outlet pressure to prevent pressure building-up.

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 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）Pump switching　泵切换

1）Prepare the inspection before starting the pump.

做好开泵前的检查准备工作。

2）Start the pump according to the start procedures.

按开泵步骤启动备泵。

3）While increasing the stroke of the back-up pump, reduce the stroke of the operating pump to minimize the flow fluctuation caused by the switching.

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 original running pump is adjusted to “0” position, stop the operating pump for standby.

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 the magnetic pump　磁力泵的操作

（1）Preparation before starting　启动前准备工作

1）Check the components of the pump outlet and inlet lines, such as valves, flanges, anchor screws, pressure gauges, etc., to see if it is complete and easy to use, and whether the bolts are fastened in place, to ensure that the equipment body 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。

1. Contact the electrical, instrument, and maintenance staff to conduct a comprehensive inspection to confirm whether the starting condition is available (including whether the power line, instrument signal, etc. are normal).

联系电气、仪表、维修进行全面检查，确认是否具启动条件（包括电源线路、仪表信号等是否正常）。

3）Before priming the pump, disconnect the pump inlet from the inlet pipe, flush the inlet pipe with clean water or other clean liquid, check whether the inlet filter is plugged, and ensure that there are no solid particles and residual rust in the inlet pipe. The carbon steel pipe should be taken anti-rust measures, otherwise it will seriously affect the operation of the magnetic pump and even damage the parts 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) with the panel operators. If the feedback is correct, contact the field operator to change the process and introduce the medium before the 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）Slowly open the pump inlet valve, open the pump outlet vent valve, take care to bar over, drain the pump water and gas, close the vent valve after seeing the medium, and the pump inlet valve is fully opened;

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 energize and confirm by signing on the delivery permit.

联系电工送电，并在送电票上签字确认。

Note: Incomplete exhaust may cause damage to the internal sliding bearing due to the dry running at start-up; if the temperature of the conveying medium exceeds 93°C, it should be preheated before running the pump.

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℃时，应在运转泵前先预热。

（2）Startup steps　启动步骤

1）The no-load running of the magnetic pump will cause the bearing to be damaged and the magnetic body to lose magnetism. Therefore, this type of pump is strictly prohibited to run without load.

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 opened and the outlet valve is fully closed (open the outlet valve as soon as possible after the start of pump with easily vaporizing medium to prevent evacuation due to overheating).

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 flow meets the process operation requirement. Special attention should be paid to the outlet pressure immediately after the pump is started. If the discharge pressure cannot be reached within a short period of time (generally within 10s), immediately turn off the motor. Re-discharge and prime the pump and start the pump (the pump discharge pressure = pump inlet pressure + pump head × media specific gravity). If it continues to operate, it will cause damage to the internal sliding bearing, and the magnetic rotor temperature rises too high and fails, so the pump is always monitored the operating conditions during initial 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×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。

①The panel operator pays attention to the evacuation alarm display of the pump, if abnormality is found, stop the pump 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。

②Test with a portable vibrometer and record the vibration value, compare it with the previous data, and 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。

③Check that the temperature of the cylinder lining is not more than 100 °C. If the pump is equipped with a temperature detector of the distance sleeve, check whether the temperature of the distance sleeve is consistent with the previous one, and 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℃，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。

④During the operation, check whether the pressure difference between the inlet and outlet of the pump is normal, and 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。

⑤During the process operation, attention should be paid to the change of the medium composition of the pump inlet process and the change of the level of 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。

（3）Switch between pumps　机泵之间的切换

1）Centrifugal pumps are generally switched once a month.

离心泵一般为一个月切换一次。

1. Prepare to start the spare pump according to the preparation steps.

按开泵前的准备步骤做好开备用泵的一切准备工作。

3）Start the standby pump, slowly open the outlet valve, close the outlet valve of the pump, and confirm that the pump is running normally. After the outlet valve of the pump is closed, press the “Stop” button of the pump to be stopped.

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。

（4）Out of service　停运

1）Close the outlet valve of the pump (in case that the outlet valve is closed, the pump should not run continuously for more than 2 minutes to prevent the magnetic actuator from overheating and fail).

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）。

2）When the machine is shut down for a long time, the pump cavity should be drained.

长期停机时，泵腔内应排放干净。

3）For the delivery of easily crystallized liquid such as salt, alkali and others, when the downtime is long, the pump should be drained completely and rinsed with clean water. Shortly wash the gap between the internal sliding bearing and the distance sleeve by injecting clean water.

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。

4）When the temperature in winter is low, the liquid in the pump chamber will be solidified. When the machine is stopped, the liquid in the pump should be drained directly, or the non-freezing temperature should be maintained with proper reflux through the pump chamber.

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。

（5）Maintenance and troubleshooting　维护及故障处理

1）Check every day during operation for abnormal noise, vibration and bearing temperature; check for leaks in the pump and piping; check for leaks in the sealed chamber; check if the temperature is abnormal compared with the normal value.

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。

2）When the pump inlet pipe and storage tank are made of carbon steel, the distance 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。

3）For pumps with graphite bearings, the wear and tear should be checked once a year. The maximum allowable clearance is as follows. If it exceeds or is about to exceed the specified, and there is obvious wear scar and partial damage, it should be replaced.

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。最大允许间隙如下表，超过或即将超过规定、有明显磨痕、局部损坏时应更换。

|  |  |
| --- | --- |
| Bore diameter of bearing  轴承内孔直径 | Radial diameter clearance  径向直径间隙 |
| 30 | 0.15 |
| 40 | 0.18 |
| 50 | 0.20 |
| 60 | 0.23 |

5）Fault analysis and repair of magnetic pump　磁力泵的故障分析和维修

|  |  |  |
| --- | --- | --- |
| Failure phenomenon  故障现象 | Failure cause  故障原因 | Maintenance method  维修方法 |
| No delivery  没有排量 | Liquid does not prime the pump chamber, there is gas in the pump  液体没有灌满泵腔，泵内有气体 | Check whether the pump and inlet pipe are full of liquid, re-discharge and prime the pump  检查泵和进口管道是否充满液体，重新排气灌泵 |
| The magnetic rotor is de-energized due to excessive idling temperature rise.  磁转子因空转温升过高而退磁失效 | Replace the magnetic rotor and increase monitoring to prevent idling.  更换磁转子，增加监控防止空转 |
| Blockage of inlet pipe  进口管道堵塞 | Clear obstacles清理障碍 |
| The inner rotor is stuck and the magnetic rotor is slipped.  内部转子卡住而使磁转子打滑 | The pump is opened and the stuck portion is removed. 拆开泵检查，消除卡住部位 |
| Foreign debris blocks the impeller.  外来杂物堵住叶轮 | The impeller is cleaned by back-flush.  用反冲洗法清理叶轮 |
| The bottom valve or inlet pipe is not sufficiently submerged under the liquid.  底阀或进口管没有足够没入液下 | It is recommended to process enough depth and use the baffle to remove the vortex  建议工厂足够深度，使用挡板消除旋涡 |
| Excessive wear of the thrust disc causes the impeller to be stuck with the housing  推力盘磨损过大使叶轮与壳体卡住 | Disassemble the pump, adjust the movement of the inner rotor, and the clearance between the impeller and the housing  拆开泵，调整内转子窜量，叶轮与壳体间歇 |
| Suction height is too high  吸上高度太高 | Reduce the installation height降低安装高度 |
| Flow or head does not reach the rated value  流量或扬程达不到额定值 | The air in the pump chamber is not exhausted completely.  泵腔内空气未排尽 | Continue to exhaust继续排气 |
| The gasket leaks垫片漏气 | Replace the gasket更换垫片 |
| The sealing chamber leaks  密封腔漏气 | Replace or re-adjust the sealed chamber  更换或重新调整密封腔 |
| Partial blockage of the impeller or pump throat  叶轮或泵体喉部部分堵塞 | Use the backwash to clean the impeller or remove the pump body by poking with wire.  用反冲洗法清理叶轮、或拆卸泵体用铁丝捅 |
| The seal ring gap of the impeller or pump body is too large  叶轮或泵体密封环间隙过大 | Replace the seal ring or replace the impeller  更换密封环或更换叶轮 |
| Suction head is not enough  吸入水头不够 | Ensure that the shut-off valve of the suction pipe is fully opened, the pipe is not blocked, and the suction head is increased.  保证吸入管道切断阀全开，管道不堵塞，增大吸入水头 |
| Impeller wear or damage  叶轮磨损或损坏 | Check, if necessary, please replace  检查，如需更换请更换 |
| Wrong direction of rotation  转动方向错误 | Change the direction of rotation  by the arrow on the bearing housing  按轴承箱上的箭头改变转向 |
| No outlet flow出口断流 | Turn down the outlet throttle valve  关小出口节流阀 |
| Failure phenomenon  故障现象 | Failure cause  故障原因 | Maintenance method  维修方法 |
| Hot bearing  轴承变热 | Poor co-axiality 同轴度差 | Recalibrate the concentricity  of the pump and motor  重新校正泵和电机同轴度 |
| Incorrect lubrication  不正确的润滑 | Check lubricant specifications and dosage  检查润滑油规格和用量 |
| Insufficient coolant  冷却液不足 | Check the cooling system  检查冷却系统 |
| Bearing wear轴承磨损 | Replace the bearing更换轴承 |
| Excessive noise or vibration of Pump泵过大噪音或振动 | Poor co-axiality同轴度差 | Correct the coupling co-axiality  校正联轴器同轴度 |
| Blockage and imbalance of partial impeller  部分叶轮阻塞不平衡 | Clean the impeller with back-flush  用反冲洗法清理叶轮 |
| Damaged or bent  Impeller or shaft  叶轮或轴损坏或弯曲 | Replace as required按要求更换 |
| Impeller imbalance  叶轮不平衡 | Balance the impeller平衡叶轮 |
| The foundation is not firm  地基不牢固 | Connect the pump and / or foundation support firmly, re-grout or reinforce  将泵和/或基础支撑连接牢固、重新灌浆或加固 |
| Inlet and outlet pipe support is incorrect  进出口管支撑不正确 | Separately support the pipeline  将管道独立支撑 |
| Pump has cavitations or is evacuated  泵被气蚀抽空 | Determine process system failures and repair, increase suction head  确定工艺系统故障并维修，提高吸入水头 |
| Failure phenomenon  故障现象 | Failure cause  故障原因 | Maintenance method  维修方法 |
| Sealed cavity leaks  密封腔泄漏 | Distance sleeve wear  隔离套磨损 | Replace the wear parts (distance sleeve)  更换磨损不见（隔离套） |
| Slack gasket密封垫松弛 | Retighten the fastening bolts of the distance sleeve  重新紧固隔离套紧固螺栓 |
| Over rated current of motor电机超额定电流 | The lift is lower than the rated value and the delivery is too large  扬程低于额定值，排量过大 | Consult factory咨询制造厂 |
| Install the throttle valve安装节流阀 |
| Cut the impeller切割叶轮 |
| Liquid density is greater than the specified value of the purchase data sheet  液体密度大于采购数据单规定值 | Check liquid density and viscosity  检查液体密度和粘度 |
| The rotating member is stuck or embedded in impurities  转动件卡死或嵌入杂质 | Check the clearance of internal wear parts / remove surface impurities  检查内部耐磨件的间隙/去除表面杂质 |
| Failure phenomenon  故障现象 | Failure cause  故障原因 | Maintenance method  维修方法 |
| Oil leakage  of bearing end cover  轴承端盖漏油 | The oil level is too high油位太高 | Adjust the oil level of the oil cup  调整油杯油位高度 |
| Misalignment of  oil return hole回油孔未对准 | Remove the end cover and re-attach the end cover to the oil groove to align with the oil return hole of the bearing body.  拆下端盖，重新将端盖盖回油槽对准轴承体回油空 |
| The level of the mounting base is not calibrated  底座安装基准面未校准水平 | Recalibrate the level重新校正水平 |

2.4.2.4　Operation of shell and tube heat exchanger　管壳式换热器操作

Due to the large size of the heat exchanger, higher severity is also imposed on the operation of the heat exchanger. The general operating principle for large heat exchangers is to operate smoothly and to prevent large fluctuations in temperature and pressure. In order to ensure the normal operation of the heat exchanger and no leakage and fire accident, the operation of the heat exchanger is as follows:

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）Inspection and preparation before use　使用前的检查准备工作

1）Check if the electrostatic grounding of the heat exchanger is good;

检查换热器静电接地是否良好；

2）Check if the anchor bolts and the bolts of each connecting flange are loose (the sliding end should have a gap);

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 if the inlet and outlet valves are in good condition and the handwheel is complete and easy to use;

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 defects such as deformation, bumping 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 whether the temperature, pressure gauge and other instruments are in good conditions;

检查温度、压力表等仪表是否好用；

6）Only after the test pressure is acceptable, it can be put into service.

试压合格后，方可投用。

（2）Service of shell-and-tube heat exchanger　管壳式换热器的投用

1）Drain the water in the heat exchanger, carry out the steam run-through, preheating, pressure test, and note that the shell and tube side must be carried out 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）After the test pressure is passed, the temporary air line is connected, and the test pressure steam is purged to prevent the water in the heat exchanger. After the hot oil enters, the water vaporizes and the pressure rises, causing the heat exchanger to leak.

试压合格后，接临时风线，对试压蒸汽进行吹扫，防止换热器内存水，热油进去后水汽化，压力上升，造成换热器泄漏。

3）Before service, first check the closed drain valve whether it is closed so as not to cause oil running.

投用前，应首先检查密闭排污阀，是否关严，以免造成跑油。

4）When the heat exchanger is activated, the cold oil should be introduced first and then the hot oil to avoid leakage caused by 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。

5）Start slowly when oil is introduced, open the closed drain valve of the cold oil, and slowly open the outlet valve of the cold oil to slowly heat up the heat exchanger. The heating rate is roughly controlled at 50°C / hour, when the closed drain valve has the oil to pass through, immediately close the closed drain valve, slightly open the cold oil inlet valve, after the cold oil inlet valve is opened, the cold oil outlet valve will be opened wide appropriately according to the heat exchanger temperature, and then the inlet valve will be opened to adjust the heating rate 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℃/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。

6）The hot oil should be introduced slowly to prevent a sudden increase in pressure caused by a small amount of residual water, which may cause damage to the equipment. Open the closed drain valve of the hot oil, slightly open the outlet valve of the hot oil, the heating rate is roughly controlled at 50 ° C / hour, when the hot oil passes through the closed drain valve, close the drain valve. Then slightly open the inlet valve of the hot oil, appropriately open wide the outlet valve of the hot oil according to the temperature rise of the heat exchanger, and then open the inlet valve to adjust the heating rate until the inlet and outlet valves of the heat exchanger of the hot oil 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℃/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。

7）Slowly close the secondary line of the cold oil end and the secondary line of the hot oil end, and adjust slowly several times until the secondary line of the heat exchanger 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。

8）Pay attention to system pressure changes and leakage during putting it into service. If there is a problem, change to the secondary line. After the equipment is put into use, make a detailed inspection. After no abnormality is found, you can leave and make a record. At the same time, it is necessary to strengthen inspections at the initial stage of service to prevent leakage.

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）Out of service of shell and tube heat exchangers　管壳式换热器的停用

1）First open the auxiliary line valve of the hot oil line, and confirm that the hot oil inlet and outlet valves are closed after the auxiliary line is unblocked;

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）Re-open the secondary line valve of the cold oil line, and confirm that the secondary line is unblocked and then close the inlet and outlet valves of the cold oil;

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）Then purge (when the oil is above 200 °C, it should be properly cooled before purge).

然后进行吹扫（油品在200℃以上时，应适当冷却后再扫线）。

（4）Notes　注意事项

1）During the operation, it is necessary to ensure the smoothness of the rear process and prevent the heat exchanger from being pressure building up.

操作过程中要确保后路的畅通，严防换热器憋压。

2）Always check pressure, temperature changes, and leaks in the heat exchanger.

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）Always check for leaks at flange joints such as large head covers, channels and closed drain valves.

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 should not exceed the standard. When the operation changes, the adjustment of the operation must be slow, especially pay attention to the change of the operating pressure and temperature of the heat exchanger; prevent the large fluctuations of the pressure and temperature from causing the heat exchanger to leak.

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）Find problems and deal with them in a timely manner, report and record.

发现问题及时进行处理、汇报并记录。

2.4.2.5　Operation of the cooler　冷却器的操作

（1）Service of shell and tube cooler　管壳式冷却器的启用

1）Slowly open the cooling water outlet valve, then open the drain venting valve of the cooler cooling water, and then slowly open the inlet valve wider.

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）When introducing the oil, it should be slower to prevent the sudden increase of pressure caused by a small amount of residual water, which will damage the equipment. First open the closed drain valve of the hot oil, slowly open the hot oil outlet valve, and then slowly open the hot oil inlet. When the air is exhausted, immediately close the closed drain valve. When the heat exchanger is full of oil, slowly close the secondary line.

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 the cooler enters the oil, adjust the required oil cooling temperature with the outlet valve opening of the circulating water. Avoid too low temperature of the heavy oil after cooling and the freezing of the equipment and pipelines; at the same time, avoid too little water supply and high temperature, which will cause the cooler to foul and water to vaporize and damage the equipment.

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，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）Out of service of shell and tube cooler　管壳式冷却器的停用

1）Open the secondary line valve of the hot oil and close the hot oil inlet and outlet valves after confirming the secondary line is unblocked.

开热油副线阀，确认副线畅通后关闭热油进、出口阀。

2）Open the vent valve of the circulating water and gradually close the inlet and outlet valves of the circulating water.

打开循环水放空阀，然后逐渐关闭循环水进、出口阀。

3）Drain the water, and after the temperature of the hot oil drops to about 80 °C, purge the shell side of the cooler with steam.

将水放尽，待热油的温度下降到80℃左右，再用蒸汽对冷却器壳程进行吹扫。

（3）Notes　注意事项

1）Always check if the cooling water has oil, and if the drainage temperature is too high, it will cause fouling and vaporization.

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）Whether the oil cooling temperature is within the control specification.

油品冷却温度是否在控制指标之内。

3）Check for leaks at the flange joints such as the large head cover, the channel, and the closed drain valve.

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 should not exceed the standard. When the operation changes, pay special attention to the change of the operating pressure and temperature of the heat exchanger.

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。

5）Find problems and deal with them in a timely manner, report and record.

发现问题及时进行处理、汇报并记录。

2.4.2.6　Operation of the re-boiler　重沸器的操作

（1）Service of re-boiler　重沸器的投用

1）Firstly put cold oil into service: drain the water before entering the oil in the tower. When the oil is introduced into the tower, the cold oil will enter the re-boiler. First open the closed drain valve at shell side, when the closed drain valve has flow, close it.

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）Pay attention to the temperature at the temperature measurement point of the shell side returning tower. When the temperature continues to rise to a stable value, the shell side is full 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）Put the hot oil into service: First open the closed drain valve on the upper and lower sides of the tube, and drain the water; close the closed drain valve after entering the hot oil and there is a flow, pay attention to prevent burns.

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 re-boiler tube side, pay attention to slowly opening wide the primary line control valve of the heat source, and turn down the control valve of the heat bypass. At this time, the temperature of the shell side returning the tower will increase. When it increases to a certain value, it indicates that the shell side has formed a siphon flow.

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）Out of service of the re-boiler　重沸器的停用

1）Gradually turn down the primary line control valve of the heat source and open wide the control valve of the heat bypass.

逐渐关小热源正线控制阀，开大热旁路控制阀。

1. Close the inlet and outlet valves of tube side.

关闭管程进、出口阀。

1. When the hot oil is moderately cooled, drain all the oil.

当热油适度冷却后，放尽所有存油。

2.4.2.7　Operation of air cooler　空冷器的操作

1. Start of air cooling fan　空冷风机的启动

1）Before starting the air-cooling fan, check and clean the stuff and inflammable materials around the air-cooler; check whether the fan and the belt are intact;

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；

(2) Manually bar over the fan freely with no friction, and check whether the grounding lead is off.

用手盘动风机自如、无摩擦碰撞；检查接地线是否脱落。

2）Open the inlet and outlet valves. After confirming that there is no object in the fan, itch the motor to confirm that the direction of rotation is correct, then press the button to start the motor.

打开进、出口阀。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。

3）Pay attention to checking the operation of the fan: such as bearing temperature, vibration, and whether the belt is falling off. If the belt is loose, the air cooling fan should be switched to ensure the temperature at the top of the tower and the temperature after cooling are stable, and contact the machinist 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 channel of the air cooler, tube bundle, plug, inlet and outlet flange for leakage; and whether the bearing vibration is too large.

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）Out of service of the air cooler　空冷器的停用

1）Press the button to stop the motor.

按电钮停运电机。

2）During the stop, attention should be paid to the changes in temperature and pressure of the relevant process equipment, and adjustments should be made 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）Inspection items　巡检内容

1）Check if the motor temperature is too high, the bearing temperature is not more than 65 °C, and the motor is running normally.

检查电机温度是否过高，轴承温度不大于65℃，电机运行是否正常。

2）Check for leaks at sealing points such as flanges, channels and plugs of tube bundles.

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 operation number of air coolers according to the process requirements, and control the outlet temperature within the index range.

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 if the tightness of the belt is proper. If the belt is loose, the fan should be stopped. After the power is cut off, contact the mechanic 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 the bearing temperature, vibration, and whether the belt is falling off.

检查风机运行情况：如轴承温度、震动情况、皮带有无脱落等。

2.4.2.8　Operation of plate and shell heat exchanger　板壳式换热器的操作

The equipment shall be designed according to the pressure difference. During normal operation, putting into service and taking out of service of the equipment, the plate side and shell side shall be balanced with pressure rise & drop and temperature rise and drop; the pressure difference between the plate side and the shell side 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）Put into service　投用

1）Confirm that all vents 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 valve 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 the material, and open the exhaust 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 the material, and open the exhaust 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 open the valve when introducing materials to prevent the fluid from striking the plate bundle.

引入物料时严禁急开阀门，防止流体冲击板束。

6）For the initial service, it should be strengthened to check whether the thermal expansion of the equipment is restricted. Observe the pressure & temperature change of the plate side and shell side, and ensure that the temperature and pressure of the plate side and shell side are slowly and steadily increased, and the temperature rise rate does 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℃/h。

7）Once the pressure difference is reduced and there is a sign of mixing phase, the equipment should be completely isolated 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）Out of service　停用

1）When the equipment is out of service, first close the hot flow inlet valve and then close the cold flow inlet valve; when cutting off the material, it should be carried out slowly. It is strictly forbidden to close the valve sharply to prevent the fluid from impacting the plate bundle.

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 the pressure & temperature change of the plate side and shell side, and ensure that the temperature and pressure of the plate side and shell side 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: When the heat transfer capacity of the equipment is reduced, the equipment should be cleaned.

清洗：设备传热能力下降时，应对设备进行清洗

1）When conditions permit, the nitrogen purge is recommended.

当条件许可时，建议选用氮气吹扫。

2）The pressure for high pressure cleaning water should be controlled below 0.6 MPa, the temperature should be controlled below 80 °C, and the Cl- content should 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℃以下，控制Cl-含量不超过25mg/L。

3）The steam purge should be carried out simultaneously with the plate side and shell side, strictly controlling the positive and negative pressure difference below 0.6 MPa, and the purge temperature 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℃。

4）During the purge and cleaning process, the pressure and temperature should be raised and lowered slowly.

吹扫、清洗过程中，同样应缓慢升降压、升降温。

5）After the flushing is completed, the water should be drained and blown dry with compressed air to completely remove the accumulated water in the plate bundle.

冲洗完成后应排尽积水，并用压缩空气吹干，以便彻底清除板束中的积水。

（4）Notes　注意事项

1）The flow should be adjusted slowly to avoid water hammer.

应缓慢调节流量，避免出现水击。

1. Before starting the pump, the plate heat exchanger should first take the secondary line. After the outlet pressure and flow rate of the pump are normal, slowly 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。

1. Before purging the pipeline, the plate heat exchanger should be taken out and the equipment should 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。

2.4.2.9　Operation of screw compressor　螺杆压缩机的操作

The screw compressor K601A~C is one of the key equipment of the light ends recovery unit. Its main function is to recover and pressurize the overhead gas of the pre-distillation tower, the overhead gas of the atmospheric tower, the overhead gas of the kerosene hydrogenation tower, the overhead gas of the diesel hydrogenation tower and the overhead gas of the naphtha pre-hydrogenation tower of the atmospheric and vacuum distillation unit, and sent to the downstream to stabilize and absorb with naphtha.

螺杆压缩机K601A~C是轻烃回收装置关键设备之一，它的主要任务是将常减压蒸馏装置的初顶气、常顶气和煤油加氢塔顶气、柴油加氢塔顶气、石脑油预加氢塔顶气等回收增压，送到下游与石脑油进行稳定吸收。

The screw compressor is a high-speed rotary machine, which belongs to a positive displacement compressor and has the advantages of both piston type and centrifugal type. The screw compressor K601A~C of the light ends recovery unit has three sets with two in operation and one standby normally. The single unit consists mainly of the primary compressor, secondary compressor, gearbox, main motor, interstage cooler, interstage buffer tank, outlet cooler, knockout drum, oil station, dry gas sealing system and spray skid.

螺杆压缩机是一种高速回转机械，属于容积式压缩机，兼有活塞式和离心式两者之优点。轻烃回收装置螺杆式压缩机K601A~C共有三台正常情况下开二备一。单台机组构成主要有一级压缩机、二级压缩机、变速箱、主电机、级间冷却器、级间缓冲罐、出口冷却器、分液罐、油站、干气密封系统、喷液撬等部分构成。

（1）Service of screw compressor　螺杆压缩机的投用

1）Preparation before use　投用前的准备工作

①After the completion of the construction, confirm that the system purified air and nitrogen purge are acceptable.

在施工完毕后，确认系统净化风或氮气吹扫合格。

②After the unit motor is installed and inspected, confirm that the motor single-run is acceptable and the direction of rotation is correct. Confirm that the unit's inlet and outlet lines and other lines are well installed.

机组电机安装检修后，确认电机单试合格、转向正确。确认机组的出入口管线以及其它管线安装良好。

③Confirm that the fire equipment and necessary tools are fully prepared.

确认消防器材及必要的工器具准备齐全。

④Confirm that the inlet filter of the circulating cooling water has been cleaned, and the cooling water has been applied to the 1st stage and 2nd stage coolers and lube oil coolers.

确认循环冷却水进口过滤器已清洗干净，一级和二级级间冷却器、润滑油冷器已投用冷却水。

⑤Open the upstream and downstream hand valves of each safety valve to confirm that the lead seal is complete and intact.

开各安全阀上下游手阀，确认铅封齐全、完好。

⑥Open all pressure switches, pressure gauges, pressure transmitters, level gauges and all valves leading to the instrument of the system. Thoroughly check whether the thermometers and pressure gauges are complete, the range is correct, and the red line mark of the pressure gauge is clear and correct. Various debugging and verification of the control system of the instrument to the compressor is completed.

打开系统上各压力开关、压力表、压力变送器、液位计及所有通向仪表的阀门。全面检查各处温度计、压力表是否齐全，量程是否正确无误，压力表红线标志是否清晰、正确。仪表对压缩机的控制系统各种调试、校验完毕。

⑦Open the drain valve of the system, and close all the drain valves after the purge of the dry compressed air is acceptable.

打开系统中各排凝放空阀，在干燥压缩空气置换合格后，关闭所有的排凝阀。

⑧Confirm that the compressor machinery, electrical, instrumentation, etc. are in good condition, cooperate with the instrument staff to calibrate the interlock value and put the interlock into service, and contact the electric section to send power to the compressor main motor, lube oil pump and other equipment. The space heater of the main motor is operated normally.

确认压缩机机械、电气、仪表等完好，配合仪表校正各联锁值并投上联锁，联系电气给压缩机主电机、润滑油油泵等设备送上电。主电机空间加热器投用正常。

⑨Confirm that each regulating valve is easy to use and the lube oil filter is clean.

确认各调节阀好用、润滑油过滤器清洗干净。

2）Preparation of electrical facilities　电气设施的准备工作

①When initially starting up or starting-up again after long-term shut-down, the wiring of the electrical component should be re-tightened, and the insulation resistance test should be done on the main circuit of the control cabinet and motor, and comply with relevant standards. This work should be done by the electrical staff.

在初次开机或长时间停用后再次开机时，应将电器元件接线重新紧固，并做控制柜主回路、电机绝缘电阻测试，并符合相关标准。此项工作由电气专业负责完成。

②Confirm that the grounding is good.

确认接地良好。

③Confirm that all electric control doors are closed.

确认所有电控门关闭。

④Confirm that the contact parts of each electrical component are good.

确认各电器元件接触部位良好。

⑤During the use of the control cabinet, confirm that the ventilation is good, and it is strictly forbidden to store foreign objects; when the machine is shut down for a long time, confirm that the control cabinet is locked and the power supply is cut off.

在控制柜使用期间，确认通风良好，严禁存放异物；长期停机时，确认控制柜锁好、电源断电。

3）Air-tight test of the system　系统的气密实验

①The air-tight test should be carried out with the dry clean nitrogen with high purity (99.99%). Test pressure: 0.95Mpa (G) should be used for the high pressure part and 0.35MPa (G) for the low pressure part.

气密性试验应用干燥洁净的高纯度氮气（99.99%）进行。试验压力：高压部分应采用0.95Mpa（G），低压部分应采用0.35MPa（G）。

③Before the system is pressure tested, confirm that the valve of the system pressure sensor is closed and open the solenoid valve in each line.

系统试压前，确认系统压力传感器的阀门已关闭，打开各管路中的电磁阀。

③The test pressure should be gradually increased to 10% of the specified test pressure, and when the pressure is not more than 0.05MPa, hold for 5 minutes, and then all the welded joints and connected parts should be checked for initial leaks. If there is a leak, the system should be connected to the atmosphere and repaired and retested. After passing the initial leak check, continue to slowly increase to 50% of the test pressure and check for leaks. If there is no leakage or abnormality, continue to increase by 10% of the test pressure in steps, and each stage is stabilized for 10 minutes until the test pressure is reached. After holding for 10 minutes, use soapy water or other foaming agent to check the joints of welds, flanges, etc. for leaks.

试验压力应逐级缓升至规定试验压力的10%，且在不超过0.05MPa时，保压5分钟，然后对所有焊接接头和连接部位进行初次泄漏检查。如有泄漏，则应将系统同大气连通后修补并重新试验。经初次泄漏检查合格后再继续缓慢升压至试验压力的50%，进行检查。如无泄漏及异常现象，继续按试验压力的10%逐级升压，每级稳压10分钟，直至达到试验压力。保压10分钟后，用肥皂水或其他发泡剂刷抹在焊缝、法兰等连接处检查有无泄漏。

④The system is inflated to the specified test pressure. After the pressure is kept for 6 hours, the pressure gauge reading is recorded. After 24 hours, the pressure gauge reading is checked. The pressure drop should be calculated according to the following formula and should not be greater than 1% of the test pressure. When the pressure drop exceeds the above requirements, the cause should be identified, the leak should be eliminated, and the test should be repeated until it is acceptable.

系统充气至规定的试验压力, 保压6小时后开始记录压力表读数，经24小时后再检查压力表读数，其压力降应按下式计算，并不应大于试验压力的1%，当压力降超过以上规定时，应查明原因，消除泄漏，并应重新试验，直至合格。

4）Service of lube oil system　润滑油系统的投用

①Add the turbine oil 46# to the oil tank.

向润滑油箱加46#汽轮机油。

②Close the outlet and inlet valves of the compressor, and put the isolation gas and sealing gas into service.

关闭压缩机的出、入口阀门，投用隔离气、密封气。

③Confirm that the pressure switch, pressure gauge, pressure transmitter, level gauge and all valves leading to the instrument of the lube oil system have been put into service.

确认润滑油系统上各压力开关、压力表、压力变送器、液位计及所有通向仪表的阀门已投用。

④Confirm that the lube oil system process has been line up, and confirm that the hand valves upstream and downstream safety valves and the inlet and outlet hand valves of the oil pump have been opened.

确认润滑油系统流程已打通，确认各安全阀上下游手阀和油泵出入口手阀已经打开。

⑤Close the vent hand valve of oil filter 1#, 2#. The level of the lube oil tank is to the upper limit.

关闭1#、2#油过滤器放空手阀。润滑油箱液位至上限值。

⑥Depending on the oil temperature, the electric heater is used to adjust the cooling water flow of the oil cooler, and the oil temperature is controlled at about 25 °C.

视油温情况，投用电加热器调节油冷器的冷却水流量，将油温控制在25℃左右。

⑦Confirm that the oil cooler and a set of oil filters have been put into use. Make sure that the motors of the two lube oil pumps are powered. Start the lube oil auxiliary pump and establish the circulation of the lube oil system.

确认油冷器和一组油过滤器已投用。确认两台润滑油泵电机都已送电。启动润滑油辅泵，建立润滑油系统循环。

A　Bar over the compressor.

盘动压缩机。

B　Switch the lube oil filter.

切换润滑油过滤器。

C　Open and check the differential pressure gauge of the lube oil filter. When the differential pressure exceeds 0.1MPa, the filter should be switched and cleaned.

打开并检查润滑油过滤器差压表，当差压超过0.1MPa时，应切换、清洗过滤器。

D　Adjust the pressure of the oil system.

油路系统调节压力。

⑧After the operation is normal, switch the oil pump to the main lube oil pump, and at the same time, the auxiliary lube oil pump put to the “Automatic” position, and the main pump is put to the “Manual” position.

待运行正常后，将油泵切换至润滑油主泵，同时将润滑油辅泵投至“自动”位置，主泵投至“手动”位置。

⑨Confirm that the alarm and interlocking service of the lube oil system is normal. For the initial start-up or after the overhaul, it is necessary to test the alarm and interlock of the lube oil system to meet the following requirements

确认润滑油系统的报警及联锁投用正常。对于首次或大修后开工，需对润滑油系统的报警及联锁进行试验，使之符合下列要求。

A　An alarm will be given when the lube oil pressure drops to 0.25MPa, and the auxiliary oil pump will automatically start..

润滑油压力下降至0.25MPa报警，辅助油泵自启动。

B　The lube oil pressure is lower than 0.15MPa, the main pump automatically interlocks to stop.

润滑油压力低于0.15MPa，主机自动联锁停机。

C　Switch the oil pump and repeat the above steps.

切换油泵，重复上述步骤。

⑩Confirm that the level of the oil tank is normal, and the lube oil pressure and temperature are normal.

确认润滑油箱的液位正常，润滑油的油压及油温正常。

5）Put the process system into service　工艺系统的投用

①Confirm that the unit's inlet and outlet pipelines and other pipelines are well installed.

确认机组的出入口管线以及其它管线安装良好。

②Confirm that the inlet filters of the process system and compressor are clean.

确认工艺系统及压缩机入口过滤器清洗干净。

③Confirm that the debugging of regulating valves are completed and easy to use.

确认各调节阀调试完成并好用。

④The valves upstream and downstream safety valves are put into service.

安全阀上下游阀门投用。

⑤The knockout drum is filled to the specified level, and the compressor outlet is unblocked.

分液罐收液到规定液位，压缩机出口畅通。

⑥According to the compressor capacity, the composite adjustment of industrial medium flow and spray volume meets the requirements.

根据压缩机复合调节工业介质流量、和喷液量等符合要求。

6）Commissioning　试运转

①Preparations before running运行前准备

The first start-up is a pilot running, you should carefully check the condition of each part is normal and reliable, and do the following preparations.

首次开机是试验性的开机，要认真、仔细地检查各部分的情况是否正常可靠，并做好如下准备工作。

A　Confirm that there are no inflammable or explosive substances near the unit.

确认机组附近无易燃易爆物质。

B　Check that the lube oil system is ready to operate; if not, check and handle it.

检查润滑油系统是否准备完毕处于待命状态；如没有，则检查并处理好。

C　Check that the process system is normal; if not, check and handle it.

检查工艺系统正常；如没有，则检查并处理好。

D　Check that the dry gas sealing system has been put into use; if not, check and handle it.

检查干气密封系统已投用；如没有，则检查并处理好。

E　Check that the circulating water of the oil cooler and the cooler has been used; if not, check and handle it.

检查油冷器和冷却器的循环水已投用；如没有，则检查并处理好。

F　Manually bar over the two screw compressors 2 to 3 turns, it is normal and no abnormalities.

手动盘车2台螺杆压缩机2～3圈，正常，无异常现象。

G Adjusts the oil supply pressure of the secondary balance disc at 0.25MPa.

调节二级平衡盘供油压力为0.25MPa。

②Start启动

A　Confirm that the valve is in the correct state.

确认阀门状态正确。

B　Close the main motor power and control power.

合上主电机电源和控制电源。

C　Turn off the main motor space heater.

关闭主电机空间加热器。

D　Open the exhaust valve on the compressor.

打开压缩机上的排气阀。

E　Start the oil pump and adjust the oil pressure.

启动油泵，调整油压。

F　Slightly open the compressor inlet valve.

压缩机入口阀稍开。

G　After the lube oil system is operating normally, start the compressor.

待润滑油系统运行正常后，启动压缩机。

H　According to the outlet pressure of the compressor, the oil supply pressure of the secondary balance disc is adjusted from 0.25 MPa to 0.6. The control relationship and adjustment point are as follows: outlet pressure: 0 MPa → 0.2 MPa → 0.4 MPa → 0.6 MPa → 0.8 MPa → 0.95 MPa, oil pressure of balance disc: 0.25 MPa → 0.32 MPa → 0.4 MPa → 0.47 MPa → 0.53 MPa → 0.6 MPa.

根据压缩机出口压力，调节二级平衡盘供油压力从0.25MPa升高到0.6，对照关系和调节点如下：出口压力：0MPa→0.2MPa→0.4MPa→0.6MPa→0.8MPa→0.95MPa，平衡盘油压：0.25MPa→0.32MPa→0.4MPa→0.47MPa→0.53MPa→0.6MPa。

I　Slowly open the compressor inlet valve.

缓慢打开压缩机入口阀。

J　Adjust the amount of liquid spray to ensure that the compressor outlet does not overheat.

调节喷液量，保证压缩机出口不超温。

K　Observe the operation when the load is 20%, and the load is increased after the operation is stable.

20%负荷时进行运转观察，等运行平稳后，再增加负荷。

L　When the compressor is running normally, open the inlet valve and load it step by step to 100% with a difference of 20% at intervals of 10 minutes. At the same time, pay attention to adjusting the return valve and spray valve at each stage of the compressor to ensure that the system is within the normal working range, and the motor is not overloaded.

当压缩机运转正常后，开入口阀，按20%的级差间隔10分钟逐级加载至100%。同时注意调整压缩机各级返回阀和喷液阀，保证系统在设备正常工作范围内，且所配电机不超载运行。

M　Comprehensively check for other abnormal conditions

全面检查有无其它异常情况。

③Debugging of operation parameters运行参数调试

A　Adjust the oil supply pressure to normal.

调整供油压力正常。

B　Adjust the cooling water amount of the oil cooler, and control the lube oil temperature to be 40°C ~ 60°C.

调整油冷器的冷却水量，控制润滑油油温在40℃～60℃为宜。

C　Adjust the amount of cooling water in the condenser and control the condensing pressure within the range of normal operating parameters.

调整冷凝器的冷却水量，控制冷凝压力在正常运转参数的范围内。

D　As the process gas changes, adjust the return valve and the spray valve at each stage of the compressor until the compressor inlet valve is fully open.

随着工艺气变化，调整压缩机各级返回阀和喷液阀，直至压缩机入口阀全开。

E　Adjust the spray valve appropriately when the outlet temperature of the compressor increases.

压缩机出口温度升高时适时调整喷液阀。

F　The unit runs stably for 4 hours, and if there is no abnormality, it can be stopped.

设备稳定运行4小时，如无异常，即可停机。

④Shutdown停机

A　As the process gas volume decreases, the return valves of each stage are gradually opened, and the suction shut-off valve of the compressor is gradually turned down.

随着工艺气量的减小，逐步打开各级返回阀，逐渐关小压缩机的吸气截止阀。

B　According to the outlet pressure of the compressor, the oil supply pressure of the secondary balance disc is adjusted from 0.25 MPa to 0.6 MPa, and the control relationship and adjustment point are as follows. The outlet pressure is 0 MPa → 0.2 MPa → 0.4 MPa → 0.6 MPa → 0.8 MPa → 0.95 MPa, and the oil pressure of the balance disc is 0.25 MPa → 0.32 MPa → 0.4 MPa → 0.47 MPa → 0.53 MPa → 0.6 MPa.

根据压缩机出口压力，调节二级平衡盘供油压力从0.25MPa升高到0.6MPa，对照关系和调节点如下。出口压力0MPa→0.2MPa→0.4MPa→0.6MPa→0.8MPa→0.95MPa，平衡盘油压0.25MPa→0.32MPa→0.4MPa→0.47MPa→0.53MPa→0.6MPa。

C　The suction pressure of the compressor is within the minimum normal operating range and the compressor is stopped. After the bearing temperature is normal, stop the oil pump. Bar over to discharges the liquid from the compressor body.

压缩机吸气压力在最低正常运行值范围内，停压缩机。待轴承温度正常后，停油泵。盘车排出压缩机体内液体。

D　Close the inlet valve of the compressor.

关闭压缩机的入口阀。

E　Close the exhaust cut-off valve and shut-off valve on spray side of the compressor.

关闭压缩机的排气截止阀和喷液侧截止阀。

F　Delay 10 minutes, stop supplying water to the oil cooler and condenser.

延时10分钟，停止向油冷却器、冷凝器供水。

G　Drain the liquid inside the unit body.

排净机体内部液体。

H　Cut off the main power of the compressor.

切断压缩机主电源。

I　Put the space heater of the main motor into use.

投用主电机空间加热器。

J　After the temperature of the system is lowered, stop the lube oil pump and stop the dry gas sealing system.

系统温度降低以后，停润滑油泵，停干气密封系统。

K　Do well with the shut-down or maintenance preparation.

做好相应停车工作或检修准备工作。

（2）Normal start-up and shut-down of screw compressor　螺杆压缩机的正常开停机

1）Preparation before start-up of the screw compressor　螺杆压缩机开机前的准备

After the commissioning is completed, it is necessary to carefully check whether the conditions of each part are normal and reliable, and make the following preparations:

调试阶段完成后，首先要认真、仔细地检查各部分的情况是否正常可靠，并做好如下准备工作：

①Confirm that there are no inflammable or explosive substances near the equipment.

确认设备附近无易燃易爆物质。

②Confirm that sufficient turbine oil has been charged.

确认已充注足量的汽轮机油。

③Confirm that the naphtha has been collected.

确认石脑油已经收集到位。

④Adjust the oil supply pressure of the secondary balance disc to 0.25MPa.

调节二级平衡盘供油压力为0.25MPa。

⑤Preparations before start-up have been completed.

运行前的准备工作已完成。

2）Start　启动

①Confirm that the valve is in the correct state.

确认阀门状态正确。

②Close the main motor power and control power.

合上主电机电源和控制电源。

③Stop the space heater of the main motor.

停主电机空间加热器。

④Check that the starting conditions are met.

检查启机条件满足。

⑤Lube oil pump is placed in an automatic state.

润滑油泵置于自动状态。

⑥Start the oil pump and adjust the oil pressure.

启动油泵，调整油压。

⑦Close the compressor inlet valve.

将压缩机入口阀关闭。

⑧After the lube oil system is operating normally, start the compressor.

待润滑油系统运行正常后，启动压缩机。

⑨After the oil pump and the main machine are started, the inlet valve is slowly opened according to the suction pressure.

油泵、主机启动后，根据吸气压力缓慢开启入口阀。

⑩Observe whether each operating parameter is within the set operating parameters. If it is out of range, you need to find out the cause and re-adjust.

观察各运行参数是否在设定的运行参数范围内。如超出运行范围，需查明原因，重新调整。

3）Adjustment after start-up　启动后的调整

①When the load changes or the parameter shows a small deviation, the opening of the relevant valve should be adjusted slightly.

当负荷改变或参数出现较小偏离时，应微量调整相关阀门开启度。

②According to the outlet pressure of the compressor, the oil supply pressure of the secondary balance disc is adjusted from 0.25 MPa to 0.65 MPa. The control relationship and adjustment points are as follows: outlet pressure: 0 MPa → 0.2 MPa → 0.4 MPa → 0.6 MPa → 0.8 MPa → 0.95 MPa; the oil pressure of the balance disc is 0.25 MPa → 0.32 MPa → 0.4 MPa → 0.47 MPa → 0.53 MPa → 0.6 MPa.

根据压缩机出口压力，调节二级平衡盘供油压力从0.25MPa升高到0.65MPa，对照关系和调节点如下：出口压力：0MPa→0.2MPa→0.4MPa→0.6MPa→0.8MPa→0.95MPa；平衡盘油压0.25MPa→0.32MPa→0.4MPa→0.47MPa→0.53MPa→0.6MPa。

3）Normal operation and maintenance　正常操作和维护

①Keep the whole unit clean and standard.

保持整个机组的清洁卫生，规格化。

②Regularly check the suction and discharge pressure, temperature, spray pressure, spray temperature, level of knockout drum, bearing temperature and other parameters of the compressor, and make a record.

定期检查压缩机的吸排气压力、温度、喷液压力、喷液温度、分液罐油位、轴承温度等参数，并做好记录。

③Regularly inspect and discharge the condensate and lube oil of each part of the unit.

定期检查并排放机组各部凝液和润滑油。

④Check the running status of the unit regularly by whether the vent gas is discharged smoothly and the venting amount.

定期通过各路放空气体是否畅通，及放空量的大小检查机组运行状态。

⑤Check whether there is abnormal heating in the compressor body, whether the shaft seal and the connection of the unit are leaking, and check whether the vibration and sound of each part of the compressor are normal.

检查压缩机机体各处是否有不正常发热现象，轴封及机组各连接处是否泄漏，检查压缩机各部振动、声音是否正常。

⑥Regularly contact the laboratory to check the quality of the lubricant.

定期联系化验检查润滑油质量。

4）Normal shutdown operation　正常停机的操作

①Stop the main motor.

停下主电机。

②Close the suction and exhaust valves, the naphtha circulation valve, and the naphtha make-up valve.

关闭进气阀和排气阀、石脑油循环阀、石脑油补液阀。

③Adjust the oil supply pressure of the secondary balance disc to 0.25MPa.

调节二级平衡盘供油压力为0.25MPa。

④Manually bar over a few turns after the compressor stops. Stop the compressor for more than 20 minutes and then stop the oil pump.

压缩机停止后手动盘车数圈。压缩机停车20分钟以上，停转油泵。

⑤Turn off the dry gas sealing system.

关闭干气密封系统。

⑥Open the inlet valve to relieve pressure.

打开入口阀门泄压。

⑦ Put the space heater of the main motor into use.

投用主电机空间加热器。

⑧The spare machine is barred over according to the regulations, once per shift.

备用机按规定盘车，每班一次。

5）Abnormal shut-down　非正常停机

①failure shut-down故障停机

The unit is equipped with the safety protection device. When the interlocking activates, the unit will automatically stop running, and at the same time, an audible and visual alarm will be given off, and the display will indicate the faulty component:

机组设有安全保护装置。当联锁动作时，均会使机组自动停止运行，同时发出声光报警、显示器显示故障部件。此时：

A　Press the disarm button to stop the alarm.

按下解除报警按钮，停止报警。

B　Close in turns the spray valve, compressor inlet valve, and exhaust block valve.

依次关闭喷液阀、压缩机入口阀和排气截止阀。

C　Adjust the oil supply pressure of the secondary balance disc to 0.25MPa.

调节二级平衡盘供油压力为0.25MPa。

D　Identify the cause of the fault and press the reset button after troubleshooting. Start the unit according to the start-up procedure.

查明故障原因并排除故障后按复位按钮，按照启动步骤启动机组。

②emergency shut-down紧急停机

When there is a serious safety hazard at the operation site, an emergency shut-down is required. The steps are as follows:

当操作现场出现严重安全隐患时，必须紧急停机。操作步骤如下：

A　Press the emergency stop button.

按急停按钮。

B　Cut off the total power supply.

切断总电源。

C　Closes the spray valve, compressor inlet valve and exhaust shutoff valve.

依次关闭喷液阀、压缩机入口阀和排气截止阀。

D　find out the causes and eliminate hidden dangers.查明原因，排除隐患。

③power outage断电停机

In the event of a sudden power outage, follow these steps:

突然停电时，按照以下操作步骤进行：

A　Close in turns the spray valve, compressor inlet valve and exhaust block valve.

依次关闭喷液阀、压缩机入口阀和排气截止阀。

B　Cut off the total power supply.

切断总电源。

④Long-term shut-down长期停车

After shut-down according to normal steps

按照正常步骤停车后

A　Close the valve on the process gas and spray lines, or install the blind for isolation.

关闭工艺气体和喷液管线上的阀门，或加盲板隔离。

B　The unit body is drained the process gas and filled with nitrogen.

机体工艺气体排净，充氮气保护。

C　Close the circulating cooling water valve and drain the water.

关闭循环冷却水阀，导淋将水放净。

D　Put the space heater of the main motor into service.

投用主电机空间加热器。

E　Lock the control cabinet and shut off the power.

将控制柜锁好，并将电源断电。

（3）Analysis and treatment of abnormalities 　异常现象的原因分析及处理方法

|  |  |  |
| --- | --- | --- |
| Failure  故障 | Cause  故障原因 | Troubleshooting  故障排除 |
| Compressor cannot be started  压缩机不能启动 | 1.Failure of main motor  主电机故障  2. Failure of instrument control syst-em  仪表控制系统故障  3. Seizure of screw rotor  螺杆转子咬死 | 1.Check the main motor condition  检查主电机状态  2.Check instrument wiring and control system  检查仪表接线及控制程序  3.Bar over several turns and c-heck the rotor condition  盘车数转，检查转子情况 |
| Compressor cannot reach rated gas ca-pacity  压缩机达不到额定气量 | 1.Blockage of suction filter  吸气过滤器阻塞  2. By-pass valve is in open state  旁通阀处于打开状态  3.Suction valves are not opened entirely during normal operation  正常运行时进气阀门没有完全打开 | 1. Replace or clean filter cartridges  更换或清洗滤芯  2. Close by-pass valve entirely.  完全关闭旁通阀  3. Open the suction valve entir-ely.  完全打开进气阀  4.Check main motor speed  检查主电机转速 |
| Compressor Cannot reach the rated pr-essure  压缩机达不到额定压力 | 1.Idle valves of gas piping network are not closed or pipes leak  气路系统管网中不工作阀未关，管道漏气  2. The suction pressure is too low or the suction valve is not opened entirely.  进气压力过低或进气阀门没有完全打开 | 1.Check compressor gas pipeline, and close idle valves and fix the leakage  检查压缩机气路管线，关闭不工作阀门堵漏  2.Check the opening of valves on the inlet pipeline.  检查进气管道上阀门开启状况 |
| Failure  故障 | Cause  故障原因 | Troubleshooting  故障排除 |
| Overload  负荷过载 | 1.Low voltage of power grid or grid capacity is not enough  电网电压过低或电网容量不够  2.Suction or exhaust pressure exceed the rated  进气压力或排气压力超过额定压力 | 1.Check the state of the power grid and troubleshoot the abnormal fault  检查电网状态并排除异常故障  2. Adjust suction or exhaust network pressure to a normal range.  调整进气或排气管网压力，使其在正常范围内 |
| High discharge pressure of compressor  压缩机排压过高 | 1.Pipe network pressure exceeds th-e rated.  管网压力超过额定压力  2.Improper operation of valve  阀门操作不恰当  3.Excessive flow of compressor  压缩机流量过大 | 1. Adjust the discharge pipe n-etwork pressure  调整排气管网压力  2.Adjust position of valve  调节阀门位置  3.Adjust circulation return valve  调节循环回流阀 |
| Too high discharge temperature of com-pressor  压缩机排温过高 | 1.Discharge pressure exceeds the rated pressure  排气压力超过额定压力  2.Suction temperature rise causes t-he discharge temperature to increase.  吸气温度升高引起排气温度升高  3.Suction temperature is too low an-d the blockage due to the ice at i-nlet causes the vacuum, making the discharge temperature to increase  吸气温度过低，进口结冰阻塞造成真空，使排温升高  4.Suction pressure is too low, the e-xternal pressure ratio increase causes the discharge temperature to increase  吸气压力过低，外压比升高引起排温升高  5.There is no water supply at water interlayer of the cylinder.  气缸体水夹层无供水 | 2.Adjust the pressure of the ex-haust pipe network  调整排气管网压力  3.Adjust the process system a-nd reduce the temperature of the inlet pipe network  调整工艺系统，降低进气管网的温度  4. Adjust the process system, check whether there is a plug at inlet line  调整工艺系统，检查进气管道是否有阻塞  5. Check piping and valve ope-ning to ensure the inlet pressure is in normal range.  检查管线及阀门开度，确保进气压力在正常范围内  6. Check the circulating water of water interlayer.  检查水夹层循环水情况 |
| Abnormal noise or vibration of compressor or main motor.  压缩机或主电机的噪声或振动异常 | 1. Screw rotor or main motor rotor is in collision or contact with the cy-linder.  螺杆转子或主电机转子与缸体碰撞或接触  2. The dynamic balance of compres-sor or main motor exceeds the allo-wed value.  压缩机或主电机动平衡超过允许值  3.Bearing minor damage, or axial m-ovement of thrust bearing exceeds the specified value  轴承轻微损坏，或止推轴承轴向窜动值超过规定值  4. Alignment is not good and coupli-ng movement is too much  对中不好，联轴器窜动太大  5. There are some foreign materials inside the machine, or in the inlet or discharge pipe  机内有异物进入，或者进、排气管内有异物  6.Connections or bolts loose  连接件或地脚螺栓松动 | Check and repair after shut do-wn of the compressor  压缩机停车后检查修理 |
| Failure  故障 | Cause  故障原因 | Troubleshooting  故障排除 |
| Seizure of Rotors  螺杆咬死 | 1.Cylinder sucks hard foreign materi-al and causes the rotor to stuck.  气缸内吸入硬质异物使转子卡死  2.The temperature rises too much d-uring compression to cause exces-sive expansion of the rotor.  压缩过程中温度升高太多使转子膨胀过大  3.The external force of the pipe afte-r operation deforms the unit becau-se of the improper installation.  安装不当，运行后管道外力使机身变形 | 1.Clean the foreign material in-side the cylinder and check the inlet and disch-arge pipe, purge to clean  清除缸内杂物，检查进、排气管道，并吹扫至清洁  2.Check the pipe system is un-blocked, and the cooling water in water interlayer is unblocked.  检查各管路系统是否通畅，水夹层冷却水是否通畅  3.Check the quality of the inst-allation, readjust the installation of the inlet and discharge pipe, eliminating external force  检查安装质量，重新调整进、排气管道安装，消除外力 |
| Mixture of oil and water  油水混合 | 1. Leakage of oil cooler.   油冷却器渗漏  2. Failure of shaft sealing.  轴封失效  3.Insufficient filling or low pressure of shaft sealing device.轴封装置充气量不足或者压力过低 | 1.Check oil cooler.  检查油冷却器  2. Adjust or change shaft seal.  调整或更换轴封  3.Adjust the buffer gas system of the seal device, adjust the nitrogen pressure调整密封装置中的缓冲气系统，调整氮气压力 |
| Oil return temperatu-re of compressor i-s too high  压缩机回油  温度过高 | 1. Oil supply temperature is too high.  供油温度过高  2. The oil in the oil distributor is inappropriate distributed or the oil is inadequate  油分配器中对油量分配不合理或油量不足  3. Oil deterioration, foreign material and others cause the fa-ilure of the bearing or seal.  油变质、进入异物等引起轴承或密封失效 | 1.Check the oil supply system and the oil cooler  检查供油系统和油冷却器  2.Adjust the valves of the oil d-istributor, so that the oil at all injection points is enough.  调整油分配器各阀门，使各注油点油量充足  3．Remove and inspect the co-mpressor, change the lube oil i-f necessary.  拆卸并检查压缩机，必要时更换润滑油 |
| Failure  故障 | Cause  故障原因 | Troubleshooting  故障排除 |
| Abnormal temperatu-re of main motor, oil pump motor主电机、油泵电机温度异常 | 1.Imbalance of three phase current of the motor.  电机三相电流不平衡  2.The air of the motor air cooler is inadequate.  电机风冷器风量不足  3.Lack of lubrication or damage of t-he bearing  轴承润滑不足或损坏 | 1. Notify the motor manufacturer, adjustment phase current b-alance  通知电机厂，调整相电流平衡  2. Overhaul the motor air cool-er  检修电机风冷器  3. Supplement lubricant or repl-ace the bearing  补充轴承润滑油或更换轴承 |
| 除上述故障需处理外，一旦机组发现异常情况，亦需紧急停车，以避免事故进一步扩大。在未查清故障原因和排除故障之前不得重新启动压缩机。  In addition to the above faults, emergency shut-down is required in case of any abnorm-al situation found in the unit to avoid further expansion of the accident. The compressor should not be started until the cause of failure is found and cleared. | | |

2.4.3　Daily maintenance of equipment (centrifugal pump)　设备日常维护（离心泵）

2.4.3.1　Routine maintenance of operating positions　操作岗位的日常维护

（1）Routine maintenance by field operators　外操日常维护

1）Check the inlet and outlet pressures of the pump and whether the current is normal.

检查泵进、出口压力，电流是否正常。

2）Whether there are noises in other rotating parts such as the pump, the motor bearing and the coupling.

机泵、电机的轴承及联轴器等其他转动部件是否有杂音。

3）Check that the bearing temperature is within the index range, and the bearing temperature rise does not exceed the ambient temperature of 40℃, and the maximum does not exceed 80℃.

检查轴承温度在指标范围内，轴承温升不超过环境温度40℃，最高不超过80℃。

4）Check the vibration of the pump and confirm that it is running in Zone A or Zone B. The monitoring operation record should be done for the short-term operation in Zone C. Each shift should measure and record the operations in the “Pump Operation Log in Zone C”.

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。

5）Check the bolts of the pump body are loose, as well as the system pipes and base supports.

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 grounding wire of the motor and the operating column is intact

检查电机及操作柱接地线是否完好。

7）Do well with the priming of the pump, lubricating, preheating, and regular barring over of the spare pump so that it can be started at any time.

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, filters, 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）Do well with equipment sanitation and standardization, and check whether there are running, emitting, dripping and leaking in the conveying medium, lube oil, sealing liquid, and tracing steam.

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）Inspection of oil level and oil quality of bearing housing, oil mark and oil cup red line are complete, clean and clear inside and outside.

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 open.

检查出入口阀门是否全开。

12）If the following auxiliary equipment is available, it should be checked during use:

如果有下列辅助设备，在使用期间应进行检查：

①Lubrication: The oil level is between the double red lines of the window (1/2~2/3), and the oil quality is clean.

润滑：油位在视窗的双红线之间（1/2～2/3），油质干净。

②Cooling: Check that the cooling medium is circulating normally, and the flow rate and temperature 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: Check the circulation of the flushing medium is normal, the pressure, level, temperature and flow rate 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 mechanical seal. Allowable values are: 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。

5）Check that the breathing valve on the bearing housing is clear and the window 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 flow and pressure are normal.

检查泵出口流量、压力是否正常。

2）The bearing temperature and vibration have online monitoring system, whether the data is normal, and the panel and field operators should check and record.

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）Whether the pressure and level of the sealing fluid tank of the auxiliary sealing system are normal.

辅助密封系统封液罐的压力、液位是否正常。

2.4.3.2　Regular maintenance　定期维护保养

（1）Regular oil change: once every 6 months, replace the lubricant of the pump to be switched in before the regular switch, the oil change interval is not more 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 grease filling of the motor: Add grease according to the on-site operating conditions, and perform the grease filling cycle of the electric 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）Regularly switch, periodically switch the standby pump according to the following principles, and implement it according to the“Management System of standby pump barring over and periodic switching”.

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 switching: refers to equipment that has a backup one, and the process and equipment conditions allow switching operations. The standby equipment is switched once 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 equipment with a spare one, but the process and equipment conditions are not allowed to perform conventional switching operations. Equipment that requires special and necessary precautions to be switched by equipment technicians can be switched once 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）The pump, air-cooling fan and pneumatic diaphragm pump that are intermittently operated due to process causes do not perform regular switching. For a few pumps that are prone to system fluctuations during switching, periodic switching may not be performed. When the unit or section is shut-down, the switching or trial operation of the standby pump should be arranged during the start-up and shut-down, and the cause should be indicated in the “List of Barring over Frequency and Switching Cycles of the Backup Pump”.

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。

2.4.3.3　Regular maintenance　定期维修

（1）Regular maintenance cycle. The maintenance cycle is managed according to the mechanical seal and bearing life. The service life of the mechanical seal is 25000h, and the service life of the bearing is generally 50000h.

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 maintenance items

定期检修项目

1）Check and replace mechanical seals and bearings (the rolling bearings must be replaced when the double-supported pumps are replaced, the seals and the rolling bearings are not required to be replaced for the cantilever pumps.)

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）。

2）Disassemble to check the wear, corrosion and erosion of each component. The pump shaft and impeller are subjected to non-destructive testing when 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。

3）Check and clean bearings, oil seals, etc., measure and adjust the bearing oil seal gap.

检查清理轴承、油封等，测量、调整轴承油封间隙。

4）Check and measure the circle run out and clearance of each part of the rotor, and calibrate the dynamic balance 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。

5）Check and correct the straightness of the shaft

检查并校正轴的直线度。

6）Measure and adjust the axial movement of the rotor.

测量并调整转子的轴向窜动量。

7）Check the misalignment of the pump body, foundation, anchor bolts and inlet and outlet flanges to prevent additional stress from being applied to the pump body and re-pipe if necessary.

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。

8）Check, repair, replace the coupling and check the alignment of the drive and the pump.

检查、修理、更换联轴器及驱动机与泵的对中情况。

9）Handle general defects that occur during operation.

处理在运行中出现的一般缺陷。

10）Check and clean the cooling water, sealing oil and lubrication of the system.

检查清理冷却水、封油和润滑等系统。

2.4.4　Shutdown and maintenance requirements for special equipment　特殊设备的停工处理及维护要求

The special equipment for light ends recovery unit is screw compressor K601A~C

轻烃回收装置的特殊设备为螺杆压缩机K601A~C

2.4.4.1　Daily maintenance　日常维护保养

（1）Check the inlet pressure of the 1st stage compressor is 0.12～0.13MPa and the temperature is 0～45℃.

检查一级压缩机进气压力0.12～0.13MPa，温度0～45℃。

（2）Check the discharge pressure of the primary compressor is 0.38 MPa and the temperature is ≤ 85℃.

检查一级压缩机排气压力0.38MPa，温度≤85℃。

（3）Check the inlet pressure of the 2nd stage compressor is 0.35 MPa and the temperature is 40℃.

检查二级压缩机进气压力0.35MPa，温度40℃。

（4）Check the discharge pressure of the 2nd stage compressor is 1.08MPa and temperature is ≤ 85℃

检查二级压缩机排气压力1.08MPa，温度≤85℃。

（5）Check the differential pressure of the inlet filter of 1st stage compressor is <3KPa.

检查一级压缩机入口过滤器差压＜3KPa。

（6）Check that the high pressure oil is supplied normally, and the manifold pressure is 0.4～0.8MPa.

检查高压油供油正常，总管压力0.4～0.8MPa。

（7）Check the differential pressure of the lube oil filter is 0～0.15MPa.

检查润滑油过滤器差压0～0.15MPa。

（8）Check that the manifold pressure of the lube oil supply is 0.6 MPa, the temperature is 10～55℃, and the accumulator is working normally.

检查润滑油供油总管压力为0.6MPa，温度10～55℃，检查蓄能器工作正常。

（9）Check the temperature of the lube oil tank is 10～65℃. The level is 640 ~ 740mm.

检查润滑油箱温度10～65℃。液位640～740mm。

（10）Check the inlet pressure of isolation gas for the 1st stage and 2nd stage compressor is 0.3MPa.

检查一级、二级压缩机隔离气进气压力0.3MPa。

（11）Check the differential pressure of the lead gas and balance chamber of the 1st stage and 2nd stage compressors is 0.02 MPa

检查一级、二级压缩机前置气与平衡腔差压0.02MPa。

（12）Check that the pressure difference between the lead gas and the main seal gas of the 1st stage compressor is 0.3 MPa.

检查一级压缩机前置气与主密封气压差0.3MPa。

（13）Check the pressure difference between the lead gas and main seal gas of the 2nd stage compressor is 0.1 MPa.

检查二级压缩机前置气与主密封气压差0.1MPa。

（14）Check the differential pressure of the compressor spray filter is 0~0.15MPa

检查压缩机组喷液过滤器差压0～0.15MPa

（15）Check the bearing radial bearing and thrust bearing temperature of the 1st stage compressor is <85℃.

检查一级压缩机径向轴承、止推轴承温度＜85℃。

（16）Check the bearing radial bearing temperature is <85℃ and thrust bearing temperature is <90℃ of the 2nd stage compressor.

检查二级压缩机径向轴承温度＜85℃，止推轴承温度＜90℃。

（17）Check the gearbox bearing temperature is <85℃.

检查齿轮箱轴承温度＜85℃。

（18）Check the bearing temperature of the main motor is <90℃, the stator temperature of the main motor is <150℃.

检查主电机轴承温度＜90℃，主电机定子温度＜150℃。

（19）Check the level of the knockout drum of the compressor is 3.5～6.5kPa.

检查压缩机气液分离器液位3.5～6.5kPa。

（20）Check that the lube oil pump is running normally, the standby pump button is in the “automatic” state, check that the lube oil return is normal, and observe whether the lube oil is emulsified through the oil sight glass.

检查润滑油泵运行正常，备用泵按钮处于“自动”状态，检查润滑油回油正常，通过油视镜观察润滑油是否存在乳化现象。

（21）Check the operation of the unit for abnormal noise, abnormal vibration of the pipeline, cleanliness around the unit, and whether there are running, emitting, dripping or leaking.

检查机组运行有无异响、管线有无异常振动、机组周边保持清洁，是否存在跑、冒、滴、漏。

（22）Check whether the operation of the auxiliary equipment such as lube oil pump, oil cooler and separator is normal. Check the DCS instrument and control valve for normal operation.

检查润滑油泵、油冷器、分离器等附属设备运行是否正常，内操注意检查DCS仪表、控制阀运行是否正常。

Note: According to the relevant requirements of the unit management, the daily inspection and maintenance of the unit needs to be recorded on the special inspection log. Each specialty (field operator, panel operator, machinery, electrical and instrument operators, and chief engineer) should carefully record and sign the daily situation in details and keep the log as the equipment file.

注意：根据机组管理的相关要求，机组日常巡检和维护需要在专用的巡检本上记录，各专业（外操、内操、机电仪、主管工程师）要详细记录并签字作为设备档案留存。

2.4.4.2　Regular maintenance　定期维护保养

（1）Regular analysis of oil quality: take samples and make analysis of tank lubricants every month.

油质定期分析：每月对油箱润滑油采样分析。

（2）The lube oil pumps are regularly barred over every day.

润滑油泵每天定期盘车。

（3）Accumulators are regularly tested: the normally operating accumulators are tested every six months.

蓄能器定期检测：正常运行的蓄能器每六个月检测一次。

（4）Check whether the standby unit has the standby condition and regularly bar over, and bar it over once a day. If necessary, it can be shut down for standby after trial operation.

检查备用机组是否具备备用条件并定期盘车，每天盘车一次，必要时可以进行试运行后停机作备用。

（5）Two units are on operation and one on standby, switch once every quarter. The standby unit runs with oil once a month and runs for 2 hours each time

机组为两开一备，每季度切换一次，备用机组每月跑油一次，每次跑油2小时。

（6）Regularly calibrate the safety valve, usually once a year.

定期对安全阀进行校验，一般为一年一次。

（7）Switch the lube oil filter regularly and replace the filter element according to the differential pressure.

定期切换润滑油过滤器，根据差压情况更换过滤器滤芯。

（8）The mechanic should check the operation of the unit regularly; the electrical department should regularly check the operation, vibration and temperature of the motor, periodically refills the grease, and check the grounding regularly; the instrument department should regularly check the operation of the field instrument.

机修专业应定期检查机组运行情况；电气专业定期检查电机运行振动温度情况、定期加脂，定期检查接地是否正常等；仪表专业定期检查现场仪表运行情况。

2.4.4.3　Regular maintenance　定期维修

（1）Maintenance cycle　检修周期

|  |  |  |  |
| --- | --- | --- | --- |
| Maintenance category  检修类别 | Minor repair  小修 | Medium repair  中修 | Overhaul  大修 |
| Maintenance cycle (month)  检修周期（月） | 3~6 | 12 | 36~48 |

（2）Minor repair　小修

1）Check and tighten the bolts at each part.

检查、紧固各部位螺栓。

2）Check the tank level, oil quality, filter, oil cooler and lube oil pump.

检查油箱液位、油质、过滤器、油冷器、润滑油泵。

3）Eliminate other defects.

消除其他缺陷。

（3）Medium repair　中修

1）Includes minor repairs.

包括小修项目。

2）Check the tooth surface wear of the gearbox.

检查齿轮箱齿面磨损情况。

3）Check if the joints are loose or leaking.

检查各接头是否松动或泄漏。

4）Check whether the instrument and interlock device are sensitive and reliable.

检查仪表、联锁装置是否灵敏可靠。

（4）Overhaul　大修

1）Includes medium repair items.

包括中修项目。

2）Disassemble and clean the parts, and place the removed parts neatly and mark them.

解体、清洗各部件，拆下零件要求摆放整齐并做好标记。

3）Check the wear of each component and determine whether to replace it according to the wear.

检查各部件的磨损情况，根据磨损的程度确定是否更换。

4）Check and clean the oil tank, filter and cooler.

检查并清洗油箱、过滤器、冷却器。

5）Check or replace the dry gas sealing system.

干气密封系统检查或更换。

6）Inspection, cleaning and debugging of all valves (including safety valves) of the system.

系统所有阀门（包括安全阀）检查、清洗、调试。

7）Calibration and tuning of various measurement and control instrument.

各种测量、控制仪表校正、整定。

8）Check the condition of the unit body and foundation, adjust and tighten the bolts.

检查机身与基础的状况，调整并紧固螺栓。

9）Disassemble the lube oil pump for inspection.

润滑油泵解体检查。

10）Disassemble the oil cooler for structure or corrosion inspection.

油冷器结构或腐蚀解体检查。

11）Eliminate the leaking points of the unit's instrument.

机组仪表、漏点消缺。

12）Debugging of unit alarm and instrument interlocking.

机组报警、仪表联锁调试。

2.4.5　Description of the general part of the instrument system　仪表系统通用部分说明

The process of the unit is continuous production, the process medium is mostly flammable and explosive, some media are corrosive, and the selection of self-control equipment strictly meets the explosion-proof, anti-corrosion and control requirements. The design of the instrument and control system must be characterized by safety, reliability, advanced technology, excellent performance and reasonable economics. It fully meets the operational requirements of the process, achieves the requirements for centralized control, stable operation, safe production, flexible and efficient, long-term reliability, convenient maintenance and unified management, gives full play to the production and processing capabilities of the process equipment, improves 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 of the unit is designed according to the process of 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 combustible and toxic gas detection system (FGS) and so on.

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），火灾和可燃气及有毒气体检测系统（FGS）等。

The main process detection and control variables of the unit are displayed, adjusted, recorded, alarmed, etc. in the DCS. The operating status of electrical equipment such as main pumps in each unit and section are displayed in DCS. The automatic control scheme mainly adopts the conventional automatic control, and adopts mature and stable complex control according to the characteristics and requirements of different processes to achieve the safe, stable, accurate and flexible automatic process 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 cabinet of the unit is placed in the field cabinet room (FAR-1), and the operation station of the control system is in the central control room, which are connected by armored redundant optical cables. The unit shares an on-site cabinet room (FAR-1) with the atmospheric and vacuum distillation unit and the light ends recovery unit. For the particularly important emergency stop button, etc., it will be placed on the auxiliary console of the central control room, and the signal will be connected by hard wires to the remote I/O unit installed in the cabinet room 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。本装置与常减压装置、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　Automatic Control Scheme　自动控制方案

Most of the control loops of this unit adopt single-loop fixed-value control, and some adopt complex control such as cascade, which is completed by the DCS control system. The main control schemes 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）The bottom level of the desorption tower and the outlet flow of the bottom oil constitute a cascade control loop.

脱吸塔底液位与塔底油出口流量组成串级控制回路。

（2）The bottom level of the absorber and the outlet flow of the bottom oil constitute a cascade control loop.

吸收塔底液位与塔底油出口流量组成串级控制回路。

（3）The overhead temperature of the stabilizer and the overhead reflux flow constitute a cascade control loop.

稳定塔顶温度与塔顶回流量组成串级控制回路。

（4）The bottom level of the stabilizer and the naphtha flow of the stabilizer to export the unit constitute a cascade control loop.

稳定塔底液位与稳定石脑油出装置流量组成串级控制回路。

2.4.6　Logic control description of main process operation instrument　主要工艺操作仪表逻辑控制说明

2.4.6.1　Pressure control of inlet knockout drum of compressor　压缩机入口分液罐压力控制

The pressure control of the Compressor Suction K.O. Drum D-601 at the inlet of compressor is an important indicator to control the compression ratio. The low pressure control and the rise of the compression ratio are not conducive to the stable operation of the compressor. The pressure control is high, resulting in the back pressure rise of various overhead gases entering the light ends recovery unit.

压缩机入口分液罐D-601压力是控制压缩机压缩比的重要指标，压力控制低了压缩机的压缩比上升，不利于压缩机的稳定运行，压力控制高了，造成各塔顶气进轻烃回收背压上升。

Control range: 20 ~ 30kPa

控制范围：20～30kPa

Control specification: operation instruction

控制指标：操作指令

Related parameters: the compressor flow, flow of return to inlet of the compressor, D-601 discharge flow to the flare.

相关参数：压缩机流量、压缩机出库返回入口流量、D-601排放火炬流量。

Control mode: the pressure PIC60101 of D-601 adopts the two-way control PV60101A and PV60101B. When PIC60101 is high, first close PV60101A. After PV60101A is turned down to minimum and PIC60101 is still high, open PV60101B. When PIC60101 is low, first close PV60101B. After PV60101B is turned down to minimum and the PIC60101 is still low, open PV60101A.

控制方式：D-601压力PIC60101采用PV60101A和PV60101B双程控制，PIC60101高时，先关PV60101A，PV60101A关至最小后PIC60101仍然偏高，则开PV60101B；PIC60101低时，先关PV60101B，PV60101B关至最小后PIC60101仍然偏低时，再开PV60101A。



**Figure 24**　**Pressure control flow diagram of Compressor Suction K.O. Drum**

**图24　压缩机入口分液罐压力控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The inlet pressure of the compressor suddenly rises.压缩机入口压力突然上升 | The overhead gas of each tower increases greatly.各塔顶气大幅度增加 | Turn down PV60101A and open PV60101B.  关小PV60101A，打开PV60101B |
| If only one compressor is started, additionally start others.  如压缩机只开了一台则增开压缩机 |
| Compressor fails and switch the compressor  压缩机故障，切换压缩机 |
| Regulating valve failure调节阀故障 | Regulating valve PV60101A and PV60101B fail, using the delivery line to control, regulating valve is arranged for maintenance  调节阀PV60101A和PV60101B故障，采用付线控制，调节阀安排检修 |
| Compressor failure压缩机故障 | switch the compressor切换压缩机 |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| Compressor inlet pressure suddenly drops.压缩机入口压力突然下降 | Overhead gas of each tower entering the unit suddenly decreases.  各塔顶气进装置突然减少 | Open wide PV60101A, increase compressor circulation开大PV60101A，增加压缩机循环量 |
| When the two compressors are running at the same time, when the PV60101A is turned down to the minimum, one compressor can be stopped.  两台压缩机同时运行时，PV60101A关至最小时，可停运一台压缩机 |
| Regulating valve failure调节阀故障 | The regulating valve adopts the delivery line to control, take it out and arrange for maintenance.  调节阀采用付线控制，切出，并安排调节阀检修 |

2.4.6.2　Levelcontrol of Compressor Discharge K.O. Drum压缩机出口分液罐液位控制

The Compressor Discharge K.O. Drum D-602 of compressor has a high level, which easily causes the D-602 to be full of liquid, resulting in the high back pressure interlock of the compressor; the low level is likely to cause the pump to be evacuated.

压缩机出口分液罐D-602液位高，易造成D-602满液位，引起压缩机背压高联锁；液位低易造成泵抽空。

Control range: 30 to 60%

控制范围：30～60%

Control specification: operation instruction

控制指标：操作指令

Relevant parameters: condensate flow rate, heavy component carrying flow of dry gas entering the unit, inlet and outlet temperature change of compressor.

相关参数：凝液流量、干气进装置重组分携带量、压缩机进出口温度变化。

Control mode: D-602 level LIC60401 uses the interlock control of the compressed condensate flow FIC60501.

控制方式：D-602液位LIC60401采用压缩凝液流量FIC60501联锁控制。





**Figure 25**　**Level control flow diagram of Compressor Discharge K.O. Drum**

**图25　压缩机出口分液罐液位控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The level suddenly rises  液位突然上升 | P-602 failure  P-602故障 | P-602 trips. Start the backup pump and check the trip cause of the pump.  P-602跳停。启运备用泵，排查机泵跳停原因。 |
| The diaphragm is faulty and the check valve is not closed. Switch the backup pump and repair the pump.隔膜故障，单向阀不密闭。切换备用泵，机泵检修。 |
| Regulating valve failure  调节阀故障 | With the delivery line for control, the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| The dry gas entering the unit has the serious entrainment of heavy components.  干气进装置重组分携带严重 | The dry gas entering the unit has a high temperature, which causes a large amount of heavy components entrainment. The upstream should adjust the temperature after the cooler, and take out the stream when the situation is severe. Increase the P-602 export flow, and in extreme cases start the double pump.  干气进装置温度高，造成重组分携带量大。上游调整冷后温度，严重时切出该股物料。增加P-602外送流量，极端情况可开双泵。 |
| Reform and pre-hydrogenate the dry gas with liquid. Inform the upstream hydrogenation unit to inspect and drain the liquid, and in extreme cases take out the stream.  重整预加氢干气带液。通知上游加氢检查和排液，极端情况下切出该股物流 |
| The overhead knockout drum of the stabilizer is full and with liquid. Increase the export of LPG.  稳定塔顶分液罐液位装满，带液。增加液化气外送。 |
| The dry gas of the desorption tower has liquid. Check the desorption tower, control the overhead temperature and check the level.  脱吸塔干气带液。检查脱吸塔检查，控制脱吸塔塔顶温度，检查脱吸塔液位。 |
| The desorption tower has a high load and the mist is entrained. Appropriately reduce the feed to the desorption tower, and part of the dry gas is sent to the flare.  脱吸塔负荷高，雾沫夹带。适当降低脱吸塔进料，部分干气改放火炬。 |

2.4.6.3　Overhead pressure control of absorber　吸收塔塔顶压力控制

The overhead pressure control of the desorption tower is related to the effect of dry gas absorption. The pressure is too low, the absorption effect is poor, the C3+ component in the dry gas rises, the pressure is high, the D-602 back pressure rises, the compression ratio rises, the back pressure of the desorption gas, overhead gas of the stabilizer, overhead gas of the reforming pre-hydrogenation tower is rising.

脱吸塔塔顶压力控制关系到干气吸收的效果。压力过低，吸收效果差，干气中C3+组分上升，压力高，造成D-602背压上升，压缩机压缩比上升，脱吸气、稳定塔顶气、重整预加氢塔顶气等背压均上升。

Control range: 0.65 ~ 0.90MPa.

控制范围：0.65～0.90MPa。

Control specification: operating instructions.

控制指标：操作指令。

Related parameters: flow of the dry gas of the absorber to the dry gas desulfurization unit

相关参数：吸收干气至干气脱硫流量

Control mode: The overhead pressure of the absorber is controlled by a single loop of the overhead pressure control valve PV61001.

控制方式：吸收塔塔顶压力采用塔顶压控阀PV61001单回路控制。



To dry gas desulfurization

**Figure 26**　**Flow diagram of overhead pressure control of the absorber**

**图26　吸收塔塔顶压力控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The pressure at the top of the absorber rises.  吸收塔塔顶压力上升 | The back pressure of the dry gas desulfurization unit rises.  干气脱硫装置背压上升 | Check the cause of the high back pressure of the dry gas desulfurization unit and adjust the operation.  排查干气脱硫装置背压高的原因，调整操作。 |
| Regulating valve failure调节阀故障 | With delivery line control, the regulating valve is overhauled.采用付线控制，调节阀检修。 |

2.4.6.4　Absorbent flow control of absorber　吸收塔吸收剂流量控制

The absorbent flow rate of the absorber is an important parameter for controlling the overhead temperature of the absorber and controlling the absorption effect. The flow rate of the absorbent is low, the overhead temperature of the absorber rises, and the absorption effect is lowered.

吸收塔吸收剂流量是控制吸收塔塔顶温度，控制吸收效果的重要参数。吸收剂流量低，吸收塔顶温度上升，吸收效果降低。

Control range: 50-100t/h.

控制范围：50-100t/h。

Control specification: operation instruction

控制指标：操作指令

Related parameters: absorbent temperature

相关参数：吸收剂温度

Control mode: single loop control for FIC61101.

控制方式：FIC61101单回路控制。



**Figure 27**　**Flow diagram of absorbent flow control of absorber**

**图27　吸收塔吸收剂流量控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The flow rate suddenly rises. 流量突然上升 | The control valve is faulty.  调节阀故障 | The delivery line is used for control and the regulating valve is overhauled.  采用付线控制，调节阀检修。 |
| The flow rate suddenly drops.流量突然下降 | The control valve is faulty  调节阀故障 | The delivery line is used for control and the control valve is repaired. 采用付线控制，调节阀检修。 |
| The overhead naphtha pump of the atmospheric tower is faulty.  常顶石脑油泵故障 | Switch the overhead naphtha pump of the atmospheric tower.  切换常顶石脑油泵。 |
| The overhead naphtha of the atmospheric tower turns to be unacceptable.  常顶石脑油改出不合格产品 | Close the valve from the overhead naphtha of the atmospheric tower to the absorber, open the connection valve of the overhead naphtha of pre-distillation tower to the absorbent and the absorbent is changed to the overhead naphtha of pre-distillation tower.  关闭常顶石脑油至吸收的阀门，打开初顶石脑油至吸收剂的连通阀，吸收剂改为初顶石脑油。 |
| The yield of the overhead naphtha of the atmospheric tower is low.  常顶石脑油收率低 | Open the connection valve of the overhead naphtha of pre-distillation tower to the absorbent, and the absorbent part is changed to the overhead naphtha of pre-distillation tower.  打开初顶石脑油至吸收剂的连通阀，吸收剂部分改为初顶石脑油。 |

2.4.6.5　Bottom level control of absorber　吸收塔塔底液位控制

The bottom level of the absorber is an important parameter for controlling the material balance. The fluctuation of the level causes fluctuations in the material balance of the light hydrocarbon system, causing fluctuations in the level and feed of the desorption tower and the stabilizer.

吸收塔塔底液位是控制物料平衡的重要参数，液位大幅度波动造成轻烃系统物料平衡波动，引起脱吸塔、稳定塔的液位和进料波动。

Control range: 30-70t/h.

控制范围：30-70t/h。

Control specification: operation instruction

控制指标：操作指令

Relevant parameters: bottom oil flow of absorber to the bottom of the desorption tower, bottom oil flow of absorber to the top of the desorption tower.

相关参数：吸收塔底油至脱吸塔塔底流量、吸收塔底油至脱吸塔塔顶流量。

Control mode: LIC61001 and FIC61301 are in cascade control.

控制方式：LIC61001与FIC61301串级控制。

absorber bottom oil to OVHD of desorption tower

absorber bottom oil to middle section of desorption tower



**Figure 28**　**Flow diagram of bottom level control of absorber**

**图28　吸收塔塔底液位控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The level of absorber rises abruptly.  吸收塔液位突然上升 | Failure of regulating valve  调节阀故障 | Use the delivery line for control, and the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| Increase of absorbent  吸收剂增加 | Stabilize the absorbent flow.  稳定吸收剂流量。 |
| Failure of P-610  P-610故障 | Switch the backup pump. Check the cause and do maintenance.  切换备用泵。排查原因，组织检修。 |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The level of absorber suddenly drops.吸收塔液位突然下降 | Failure of regulating valve  调节阀故障 | Use delivery line for control, and the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| Reduction of the absorbent.  吸收剂减少 | Stabilize the absorbent flow.稳定吸收剂流量。 |

2.4.6.6　Bottom level control of desorption tower　脱吸塔塔底液位控制

The bottom level control of desorption tower is an important parameter for controlling the balance of the material. The fluctuation of the level causes fluctuations in the material balance of the light hydrocarbon system, causing fluctuations in the level and feed of the stabilizer.

脱吸塔塔底液位是控制物料平衡的重要参数，液位大幅度波动造成轻烃系统物料平衡波动，引起稳定塔的液位和进料波动。

Control range: 30 ~ 70t / h.

控制范围：30～70t/h。

Control specification: operation instruction

控制指标：操作指令

Related parameters: Stabilize the flow of the bottom oil to the desorption tower.

相关参数：稳定底油至脱吸塔塔流量。

Control mode: LIC63201 and FIC63601 are in cascade control.

控制方式：LIC63201与FIC63601串级控制。



**Figure 29**　**Flow diagram of bottom level control of the desorption tower**

**图29　脱吸塔塔底液位控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The level of the desorption tower suddenly rises.脱吸塔液位突然上升 | The regulating valve is faulty.  调节阀故障 | The delivery line is used for control and the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| The feed of desorption tower increases  脱吸塔进料增加 | Stabilize the absorber operation and feed of desorption tower.  稳定吸收塔操作，平稳脱吸塔进料料 |
| Failure P-630  P-630故障 | Switch the backup pump. Check the cause and repair.  切换备用泵。排查原因，组织检修。 |
| The level of the desorption tower suddenly drops.脱吸塔液位突然下降 | Failure of the regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| Desorption tower feed reduction  脱吸塔进料减少 | Stabilize the absorber operation and feed of the desorption tower.  稳定吸收塔操作，平稳脱吸塔进料料 |

2.4.6.7　Overhead pressure control of desorption tower　脱吸塔塔顶压力控制

The overhead pressure of the desorption tower is an important parameter for controlling the desorption effect. The pressure control is low, the desorption is excessive, some light hydrocarbons are precipitated, and the absorber load is increased; the pressure is high, the desorption is insufficient, and some C2 remains in the naphtha, increasing the load of the stabilizer, causing a rise in the C2 component of the stabilized LPG when it is severe.

脱吸塔塔顶压力是控制脱吸效果的重要参数，压力控制低，过脱吸，部分轻烃析出，增加吸收塔负荷；压力高，脱吸不足，部分C2残留在石脑油中，增加稳定塔负荷，严重时引起稳定液化气C2组分上升。

Control range: 0.9 ~ 1.1MPa.

控制范围：0.9～1.1MPa。

Control specification: operation instruction

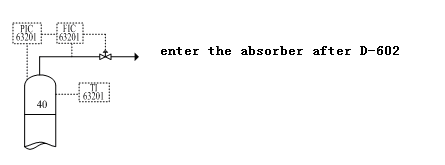
控制指标：操作指令

Related parameters: desorption gas flow and D-602 pressure.

相关参数：脱吸气流量、D-602压力。

Control mode: PIC63201 and FIC63201 are in cascade control.

控制方式：PIC63201与FIC63201串级控制。



**Figure 30**　**Flow diagram of overhead pressure control of the desorption tower**

**图30　脱吸塔塔顶压力控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The overhead pressure of the desorption tower rises.  脱吸塔塔顶压力上升 | Failure of the regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed of the desorption tower increases脱吸塔进料增加 | Stabilize the absorber operation and feed of the desorption tower.  稳定吸收塔操作，平稳脱吸塔进料料 |
| The bottom temperature of the tower rises sharply.  塔底温度大幅度上升 | Stabilize the bottom temperature  稳定塔底温度 |
| High back pressure of D-602  D-602背压高 | Adjust pressure of D-602  调整D-602压力 |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The overhead pressure of the desorption tower is lowered.脱吸塔塔顶压力下降 | The valve is faulty.  调节阀故障 | The delivery line is used for control and the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| Feed of the desorption tower is reduced.  脱吸塔进料减少 | Stabilize the absorber operation and feed of the desorption tower.  稳定吸收塔操作，平稳脱吸塔进料料 |
| The bottom temperature of the tower drops drastically.  塔底温度大幅度下降 | Stabilize the bottom temperature  稳定塔底温度 |

2.4.6.8　Overhead reflux control of desorption tower　脱吸塔塔顶回流控制

The overhead reflux of the desorption tower is an important parameter to control the desorption effect. The reflux flow control is low, the washing effect is poor, the temperature at the top of the tower rises, some light hydrocarbons are precipitated, and the absorber load is increased. The reflux flow rate is controlled high, the temperature at the top of the tower is low, the desorption is insufficient, and part of C2 remains in the naphtha, increasing the load of stabilizer, and in severe cases, causing the C2 component of the stabilized LPG to rise.

脱吸塔塔顶回流是控制脱吸效果的重要参数，回流流量控制低，洗涤效果差，塔顶温度上升，部分轻烃析出，增加吸收塔负荷；回流流量控制高，塔顶温度低，脱吸不足，部分C2残留在石脑油中，增加稳定塔负荷，严重时引起稳定液化气C2组分上升。

Control range: 15 ~ 35t / h.

控制范围：15～35t/h。

Control specification: operation instruction

控制指标：操作指令

Relevant parameters: overhead naphtha flow of pre-distillation tower and atmospheric tower, bottom oil flow to the middle of the desorption tower, overhead temperature of desorption tower, feed temperature desorption tower, feed flow rate of desorption tower, bottom temperature of desorption tower.

相关参数：初常顶石脑油流量、吸收塔底油至脱吸塔中部流量、脱吸塔顶温度、脱吸塔进料温度、脱吸塔进料流量、脱吸塔底温度。

Control mode: single loop control for FIC61302

控制方式：FIC61302单回路控制。



**Figure 31**　**Flow diagram overhead reflux control of the desorption tower**

**图31　脱吸塔塔顶回流控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The overhead reflux of the desorption tower rises.  脱吸塔塔顶回流上升 | Failure of regulating valve.  调节阀故障 | The delivery line is used for control and the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| Level fluctuation of absorber.  吸收塔液位波动 | Stabilize the level of the absorber.  稳定吸收塔液位 |
| The overhead reflux of the desorption tower is lowered  脱吸塔塔顶回流下降 | Failure of regulating valve.  调节阀故障 | The delivery line is used for control and the regulating valve is repaired.  采用付线控制，调节阀检修。 |
| Failure of FIC61301 FIC61301故障 | Stabilize the FIC61301 control, if unable to control, take out and use the delivery line for control.  稳定FIC61301控制，无法控制切出改付线控制 |
| Level fluctuation of absorber  吸收塔液位波动 | Stabilize the level of the absorber.  稳定吸收塔液位 |
| Failure of absorber bottom pump  吸收塔底泵故障 | Switch the absorber bottom pump.  切换吸收塔底泵 |

2.4.6.9　Re-boiler outlet temperature control of desorption tower　脱吸塔再沸器出口温度控制

The re-boiler outlet of the desorption tower is an important parameter to control the desorption effect. The re-boiler outlet temperature is controlled high, the overhead reflux can not be maintained, the temperature at the top of the tower rises, some light hydrocarbons are precipitated, the absorber load is increased, and the energy consumption is increased. The re-boiler outlet temperature is low, the desorption is insufficient, and some of the C2 remains in the naphtha, which increases the load of the stabilizer, and in severe cases, causes the C2 component of the stabilized LPG to rise.

脱吸塔再沸器出口是控制脱吸效果的重要参数，再沸器出口温度控制高，塔顶回流压不住，塔顶温度上升，部分轻烃析出，增加吸收塔负荷，同时增加能耗；再沸器出口温度低，脱吸不足，部分C2残留在石脑油中，增加稳定塔负荷，严重时引起稳定液化气C2组分上升。

Control range: 150 ~ 170 ° C.

控制范围：150～170℃。

Control specification: operation instruction

控制指标：操作指令

Related parameters: bottom temperature of desorption tower, 1.0 MPa steam flow, level of condensate tank D-630.

相关参数：脱吸塔塔底温度、1.0MPa蒸汽流量、凝结水罐D-630液位。

Control mode: single loop control for TIC63207.

控制方式：TIC63207单回路控制。



**Figure 32**　**Flow diagram of re-boiler outlet temperature control of desorption tower**

**图32　脱吸塔再沸器出口温度控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The re-boiler outlet temperature rises  再沸器出口温度上升 | Failure of regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed the desorption tower suddenly decreases脱吸塔进料突然减少 | Stabilize the feed of the desorption tower and reduce the amount of steam.  稳定脱吸塔进料，减少蒸汽用量。 |
| The feed temperature of the desorption tower rises  脱吸塔进料温度上升 | Stabilize the feed temperature of the desorption tower and reduce the amount of steam.  稳定脱吸塔进料温度，减少蒸汽用量。 |
| Re-boiler outlet temperature drops  再沸器出口温度下降 | Failure of the regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed of the desorption tower suddenly increases  脱吸塔进料突然增加 | Stabilize the feed of the desorption tower and increase the amount of steam.  稳定脱吸塔进料，增加蒸汽用量。 |
| 1.0MPa steam temperature drops.  1.0MPa蒸汽温度降低 | Stabilizing the absorber level  稳定吸收塔液位 |
| 1.0MPa steam with water  1.0MPa蒸汽带水 | Notify the production scheduler to contact the utility department to check and strengthen the drainage of the steam knockout drum.  通知调度联系公用工程检查，加强蒸汽分水罐排水。 |
| D-630 has high level and poor drainage  D-630液位高，排水不畅 | Check D-630 for poor drainage and lower the D-630 level to avoid the full level.  检查D-630排水不畅原因，拉低D-630液位，避免液位装满。 |

2.4.6.10　Control of feed temperature TIC-64001 of stabilizer　稳定塔进料温度TIC-64001控制

The stable control of the feed temperature of the stabilizer is of great significance for the product quality of the stabilizer. The feed temperature is unstable, causing the large fluctuation of overhead temperature, and affecting the C5 indicator of the LPG and others.

稳定进料温度的平稳控制对于稳定塔产品质量控制具有重要意义，进料温度不稳，造成塔顶温度波动较大，影响液化气的C5等指标。

Control range: 150～165℃

控制范围：150～165℃

Control target: operation instructions.

控制目标：操作指令。

Relevant parameters: bottom temperature of desorption tower, bottom oil flow of desorption tower, mixed naphtha temperature, mixed naphtha flow rate, bottom temperature of stabilizer, naphtha flow rate of stabilizer, etc.

相关参数：脱吸塔塔底温度、脱吸塔底油流量、混合石脑油温度、混合石脑油的流量、稳定塔底温度、稳定石脑油流量等。

Control mode: The feed temperature TIC-64001 of the stabilizer is controlled by the three-way valve TV-64001 by adjusting the flow rate of the delivery line on the stabilizer naphtha side of the heat exchanger E-645. TIC-64001 is single reflux control.

控制方式：稳定塔进料温度TIC-64001由三通阀TV-64001通过调节换热器E-645稳定石脑油侧付线流量对进塔温度进行控制。TIC-64001单回流控制。



**Figure 33**　**Flow diagram of feed temperature control of stabilizer**

**图33　稳定塔进料温度控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The feed temperature of stabilizer rises.  稳定塔进塔温度上升 | Failure of regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed of stabilizer suddenly decreases  稳定塔进料突然减少 | Stabilize the feed of stabilizer, adjust TV64001, and stabilize the feed temperature.  稳定脱稳定塔进料，调整TV64001，稳定进料温度。 |
| The bottom temperature of desorption tower rises.  脱吸塔底温度上升 | The feed temperature of the desorption tower rises due to the abnormal operation, and the feed temperature of the desorption tower is stabilized as much as possible. The bottom temperature of the desorption tower rises due to the normal operation, adjust TV64001 in time and stabilize the feed temperature.  非常操作引起的脱吸塔进料温度上升，尽量平稳脱吸塔进料温度，正常操作引起的脱吸塔塔底温度上升，及时调整TV64001，稳定进料温度 |
| The bottom temperature of stabilizer changes significantly.  稳定塔底温度大幅度变化 | Smoothly control the bottom temperature of stabilizer.  平稳控制稳定塔底温度 |
| The bottom level of stabilizer fluctuates a lot.  稳定塔底液位波动大 | Smoothly control the level at the bottom of the stabilizer to prevent large fluctuations in naphtha flow of stabilizer.  平稳控制稳定塔底液位，防止稳定石脑油流量大幅度波动。 |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The feed temperature of the stabilizer drops.  稳定塔进塔温度下降 | Failure of regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed of the stabilizer suddenly increases.  稳定塔进料突然增加 | Stabilize the feed of the stabilizer, adjust TV64001 and stabilize the feed temperature.  稳定稳定塔进料，调整TV64001，稳定进料温度。 |
| The bottom temperature of the desorption tower drops  脱吸塔底温度下降 | The feed temperature of the desorption tower is lowered due to the abnormal operation, and the feed temperature of the desorption tower is stabilized as much as possible. The bottom temperature of the desorption tower is increased due to normal operation, adjust the TV64001 in time and stabilize the feed temperature.  非常操作引起的脱吸塔进料温度下降，尽量平稳脱吸塔进料温度，正常操作引起的脱吸塔塔底温度上升，及时调整TV64001，稳定进料温度 |
| The bottom temperature of stabilizer changes significantly.  稳定塔底温度大幅度变化 | Smoothly control the bottom temperature of the stabilizer  平稳控制稳定塔底温度 |
| The bottom level of stabilizer has great fluctuations  稳定塔底液位波动大 | Smoothly control the bottom level of the stabilizer to prevent large fluctuations in naphtha flow of the stabilizer.  平稳控制稳定塔底液位，防止稳定石脑油流量大幅度波动。 |

2.4.6.11　Pressure control of Stabilizer OVHD Reflux and Product Drum D-641　稳定塔塔顶分液罐D-641压力控制

The pressure PIC64401 of Stabilizer OVHD Reflux and Product Drum D-641 is one of the most important parameters of the stabilizer. The unstable control of PIC64401 affects the C2 component content of the stabilized LPG, and also causes the overhead pressure change of the stabilizer, which in turn affects the C5 index of stabilized LPG, and improper pressure control can easily cause the LPG pump to be evacuated.

稳定塔塔顶分液罐D-641的压力PIC64401是稳定塔最重要的参数之一，PIC64401控制不稳定既影响到稳定液化气的C2组分含量，也会造成稳定塔顶压力变化，进而影响到稳定液化气的C5指标，同时压力控制不当还容易造成液化气泵抽空。

Control range: 0.85 ~ 1.1MPa.

控制范围：0.85～1.1MPa。

Control target: operation instructions.

控制目标：操作指令。

Related parameters: Stabilize the overhead temperature after cooler and the pressure of D-602.

相关参数：稳定塔顶冷后温度、D-602压力。

Control mode: PIC64401 is two-way controlled by PV64401A and PV64401B.

控制方式：PIC64401由PV64401A和PV64401B双程控制。



**Figure 34**　**Flow diagram of pressure control of overhead knockout drum of the stabilizer**

**图34　稳定塔塔顶分液罐压力控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The pressure at the top the tank D-641 rises.  D-641罐顶压力上升 | The regulating valve PV64401A failed and is fully closed.  调节阀PV64401A故障全关 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修 |
| The regulating valve PV64401B failed and is fully opened.  调节阀PV64401B故障全开 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修 |
| Back pressure rise of D-602  D-602背压上升 | Adjust the pressure of D-602 and absorber  调整D-602和吸收塔的压力 |
| High temperature of TIC64301  TIC64301温度高 | Adjust A-641A~C and lower TIC64301  调整A-641A～C，降低 TIC64301 |
| After the rain, the air cooling A-641A~C is not adjusted in time.  雨后空冷A-641A～C调整不及时 | Timely adjust A-641A～C, increase frequency control or turn on additional fans.  及时调整A-641A～C，增加变频调速或者增开风机 |
| Low desorption of desorption tower  脱吸塔脱吸度低 | Adjust the operation of the desorption tower to reduce the C2 component content of the bottom oil.  调整脱吸塔操作，降低脱吸塔底油C2组分含量。 |
| Light hydrocarbons in mixed naphtha increases.  混合石脑油含轻烃增加 | Timely adjust the operation and stabilize the overhead pressure, if overpressure occurs, discharge to the flare.  及时调整操作，稳定塔顶压力，超压可适当放火炬 |
| LPG pump is evacuated.  液化气泵抽空 | Switch the LPG pump and stabilize the overhead reflux control.  切换液化气泵，稳定塔顶回流控制。 |
| Excessive amount of refining LPG  回炼液化气量过大 | Reduce the refining amount of LPG  降低液化气回炼量 |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| The pressure at the top the tank D-641 drops.  D-641罐顶压力下降 | Failure of regulating valve PV64401A  调节阀PV64401A故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| Excessive desorption of desorption tower  脱吸塔过脱吸 | Adjust the operation of desorption tower.  调整脱吸塔操作。 |
| The feed of stabilizer is greatly reduced  稳定塔进料大幅度降低 | Stabilize the feed of the stabilizer.  稳定稳定塔进料 |
| Sudden heavy rain  突然下暴雨 | Adjust the fan frequency control or stop part of fans.  调整风机变频调速或者停运部分风机 |
| Internal leakage of safety valve at the top of the tower or tank.  塔顶或者罐顶安全阀内漏 | Check the overhead safety valve and take out the faulty safety valve for overhaul.  检查塔顶安全阀，切出故障的安全阀检修 |
| Abnormal control of reflux control, low temperature at the top of the tower  回流控制异常，塔顶温度过低 | Adjust the operation, stabilize the reflux flow and overhead temperature.  调整操作，稳定回流量和塔顶温度 |
| Large fluctuations of bottom level of stabilizer.  稳定塔底液位波动大 | Smoothly control the bottom level of the stabilizer to prevent large fluctuations in naphtha flow of stabilizer.  平稳控制稳定塔底液位，防止稳定石脑油流量大幅度波动。 |

2.4.6.12　Control of re-boiler oil outlet temperature TIC64201, TIC64202 of stabilizer　稳定塔重沸器油出口温度TIC64201、TIC64202控制

The re-boiler oil outlet temperature TIC64201, TIC64202 of the stabilizer is an important parameter to control the separation efficiency of naphtha light hydrocarbons. The high temperature causes some heavy components to vaporize, increase the top load, and affect the C5 component content in naphtha of the stabilizer; The temperature is low, a lot of residual LPG component in naphtha of the stabilizer, and the yield of the LPG is lowered.

稳定塔重沸器油出口温度TIC64201、TIC64202是控制石脑油轻烃分离效率的重要参数，温度高，造成部分重组分汽化，增加塔顶负荷，影响稳定石脑油C5组分含量；温度低，稳定石脑油中液化气组分残留多，液化气收率降低。

Control range: 170～200℃

控制范围：170～200℃

Control target: operation instructions.

控制目标：操作指令。

Relevant parameters: atm. PA #2, atm. PA #2 temperature, feed flow of stabilizer, feed temperature of stabilizer.

相关参数：常二中流量、常二中温度、稳定塔进料量、稳定塔进料温度。

Control mode: TIC64201, TIC64202 is single loop control, control the side delivery line of the atm. PA #2 of E-640RS to adjust the heat removal of the re-boiler.

控制方式：TIC64201、TIC64202单回路控制，控制E-640RS常二中侧付线来调整重沸器的取热。



Atm. PA #2

Atm. PA #2

**Figure 34**　**Flow diagram of re-boiler oil outlet temperature control of stabilizer**

**图34　稳定塔重沸器油出口温度控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| TIC64201, TIC64202 rise  TIC64201、TIC64202上升 | The regulating valve failed and is fully closed.  调节阀故障全关 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修 |
| The atm. PA #2 flow has increased significantly.  常二中流量大幅度增加 | Adjust the opening of TV64201 and TV64202.  调整TV64201、TV64202开度 |
| The atm. PA #2 temperature has increased significantly.  常二中温度大幅度上升 | Adjust the opening of TV64201 and TV64202.  调整TV64201、TV64202开度 |
| The empty level of the stabilizer has caused TIC64201, TIC64202 to rise rapidly  稳定塔液位空引起 TIC64201、TIC64202快速上升 | Reduce the naphtha discharge of the stabilizer, improve the level of the stabilizer, and the panel and field operators check the level instrument  减少稳定石脑外放，提高稳定液位，内外操检查核对液位仪表 |
| The level of the stabilizer has fluctuations.  稳定塔液位波动 | Smoothly control the level of the stabilizer.  平稳控制稳定塔液位 |
| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| TIC64201, TIC64202 drop  TIC64201、TIC64202下降 | Failure of regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The atm. PA #2 flow has dropped significantly.  常二中流量大幅度下降 | Adjust the opening of TV64201and TV64202.  调整TV64201、TV64202开度 |
| The atm. PA #2 temperature is greatly down.  常二中温度大幅度下井 | Adjust the opening of TV64201and TV64202.  调整TV64201、TV64202开度 |
| The atm. PA #2 pump is evacuated.  常二中泵抽空 | Switch the atm. PA #2 pump.  切换常二中泵 |
| There is a level fluctuation of stabilizer.  稳定塔液位波动 | Smoothly control the level of the stabilizer.  平稳控制稳定塔液位 |
| The fouling blocks the inlet line and reduces the heat transfer effect of the re-boiler.  积垢堵塞入口管线、降低重沸器换热效果 | Take out the re-boiler for maintenance  切出重沸器进行检修 |

2.4.6.13　Control of bottom level LIC-64101 of stabilizer　稳定塔塔底液位LIC-64101控制

The stable level control of the stabilizer is beneficial to stabilize the re-boiler outlet temperature, stabilize the feed temperature, and is also conducive to the stable feed of the downstream unit (reforming pre-hydrogenation).

稳定塔液位稳定控制有利于稳定塔重沸器出口温度、稳定进料温度，也有利于下游装置（重整预加氢）的进料稳定。

Control range: 30~70%;

控制范围： 30~70%；

Control target: operation instructions.

控制目标：操作指令。

Relevant parameters: feed flow of stabilizer, naphtha export flow of stabilizer.

相关参数：稳定塔进料流量、稳定石脑油外送流量。

Control mode: the bottom level control LIC-64101 of the stabilizer and the export naphtha flow control FIC-64702 of the stabilizer constitute the cascade control.

控制方式：稳定塔底液位控制LIC-64101与外送稳定石脑油流量控制FIC-64702组成串级控制。



**Figure 36**　**Flow diagram of bottom level control of stabilizer**

**图36　稳定塔塔底液位控制流程图**

| Abnormalities  异常现象 | Causes  原因 | Remedies  处理方法 |
| --- | --- | --- |
| The level of the stabilizer rises  稳定塔液位上升 | The regulating valve FV64702 failed and is fully closed.  调节阀FV64702故障全关 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修 |
| The stabilizer naphtha discharge process is not smooth.  稳定石脑油外放流程不畅 | Contact the production scheduler to inform the downstream unit to check and make adjustments.  联系调度联系下游装置检查与调整 |
| The feed of stabilizer has increased significantly.  稳定塔进料大幅度增加 | Stabilize the feed and adjust the naphtha discharge of the stabilizer  稳定进料，调整稳定石脑油外放 |
| The level of thestabilizer drops.  稳定塔液位下降 | Failure of regulating valve  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed of stabilizer is greatly reduced.  稳定塔进料大幅度减少 | Stabilize the feed and adjust the naphtha discharge of the stabilizer  稳定进料，调整稳定石脑油外放 |

2.4.6.14　Control of overhead knockout drum level LIC-64601 of stabilizer　稳定塔塔顶分液罐液位LIC-64601控制

The level of the overhead knockout drum of the stabilizer is controlled too low, which easily causes the LPG pump to be evacuated, causing damage to the pump and interruption of the overhead reflux, and resulting in fluctuation of the stabilizer.

稳定塔顶分液罐液位控制过低，容易造成液化气泵抽空，引起机泵损坏和塔顶回流中断，造成稳定塔波动。

Control range: 40 to 80%

控制范围：40～80%

Control specification: operation instruction

控制指标：操作指令

Related parameters: reflux flow, export flow of LPG

相关参数：回流流量、液化气外送流量

Control mode: LIC64401 and FIC64601 are in cascade control.

控制方式：LIC64401与FIC64601串级控制



To Acid Gas & LPG Treating Unit

To D-602

**Figure 37**　**Flow diagram of level control of overhead knockout drum of stabilizer**

**图37　稳定塔塔顶分液罐液位控制流程图**

|  |  |  |
| --- | --- | --- |
| Abnormality  异常现象 | Cause  原因 | Remedy  处理方法 |
| D-641 level rises.  D-641液位上升 | The regulating valve FV64601 failed completely closed.  调节阀FV64601故障全关 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修 |
| The discharge of LPG is blocked.  液化气外放受阻 | Contact the downstream unit to inspect and adjust.  联系下游装置检查与调整 |
| The LPG pump is evacuated  液化气泵抽空 | Switch the evacuated LPG pump and fix the LPG pump.  切换抽空的液化气泵，处理好液化气泵 |
| After heavy rain, the overhead temperature after cooling is lowered.  下暴雨，塔顶冷后温度降低 | Adjust the fan frequency control or stop part of fans.  调整风机变频调速或者停运部分风机 |
| D-641 level drops.  D-641液位下降 | Failure of regulating valve.  调节阀故障 | Use the delivery line for control and repair the regulating valve.  采用付线控制，调节阀检修。 |
| The feed of stabilizer is greatly reduced.  稳定塔进料大幅度减少 | Stabilize the feed and adjust the naphtha discharge of stabilizer.  稳定进料，调整稳定石脑油外放 |

2.4.7　Description of complex control loop　复杂控制回路说明

The single-loop fixed-value control refers to a closed-loop control system consisting of a measuring component, a transmitter, a regulator, a regulating valve and an object, also known as a single-loop feedback control system. The single loop regulation consists of a PID module. For example, when the control mode of the regulator PIC20201 is set to “MAN” (manual), the operator directly changes the “OUT” (output) value of the PIC20201, which changes the opening of the corresponding regulator valve PV20201 and achieves the control for the tower pressure; when the control mode is set to "AUTO" (automatic), the operator sets the "SP" value of the loop, and the regulator controls the output. It should be the bumpless switching when the control mode is switched from "MAN" to "AUTO" (i.e. the set value automatically tracks the measured value).

单回路定值控制是指由一个测量元件、变送器，一个调节器，一个调节阀和一个对象所构成的闭环控制系统，又称单回路反馈控制系统。单回路调节由一个PID模块组成，例如调节器PIC20201控制方式设定为“MAN”（手动）时，操作人员直接改变PIC20201的“OUT”(输出)值，就改变了相应调节阀PV20201的开度，实现对塔压的控制；控制方式设定“AUTO”（自动）时，操作人员设定该回路的“SP”值，由调节器控制输出。控制方式在由“MAN”切换至“AUTO”时应为无扰动切换（即设定值自动跟踪测量值）。

The cascade control loop is a complex control system with many applications. It is a system that uses a pair of primary and secondary regulators in series to stabilize a main variable. In the cascade control system, the main variable is the process index, and the auxiliary variable is the auxiliary controlled variable introduced to stabilize the main variable. Therefore, the system uses two sets of primary and secondary measuring transducers. The output of the main regulator in the system, as the set value of the secondary regulator, the output of the secondary regulator directly controls the opening of the regulating valve. The whole system consists of two control loops: the primary regulator, which stabilizes the process index, aims at constant values and forms a fixed value control loop, is called the main loop; the loop consisting of the internal secondary regulator, its set value changes with the output of the primary regulator, is a follow-up control loop and called the secondary loop.

串级控制回路是应用较多的一种复杂控制系统，是利用主、副两个调节器串在一起来稳定一个主变量的系统。在串级控制系统中，主变量就是工艺指标，副变量则是为了稳定主变量而引入的辅助被控变量。因此，系统中采用主、副两套测量变送器。系统中主调节器的输出，作为副调节器的设定值，副调节器的输出直接去控制调节阀的开度。整个系统包括两个控制回路：稳定工艺指标的主调节器，它以恒值为目的，构成一个定值控制回路，称为主回路；内部包含的副调节器构成的回路，它的设定值随着主调节器输出而变化，是一个随动控制回路，称为副回路。

The cascade control system is still a fixed value control system as a whole, but the cascade control system adds a follow-up secondary loop to the structure, so it has the following characteristics: (1) due to the rapid action of the secondary loop, the system has strong anti-interference ability; (2) the characteristics of the object are improved due to the existence of the secondary loop; (3) due to the existence of the secondary loop, the adaptability to the load change is strong. In short, the cascade control system is suitable for occasions where the process requirements are high, there is lag in object's capacity and time constant is large, the interference effect is strong and frequent, the load changes greatly and the simple control system can not meet the requirements. Especially when the main interference comes from the regulating valve, the application of cascade control is very suitable. The commonly used cascade control types are: level-flow, temperature-flow.

串级控制系统从总体来看，仍然是一个定值控制系统，但是串级控制系统在结构上增加了一个随动的副回路，因此具有以下特点：（1）由于副回路的快速作用，使系统具有较强的抗干扰能力；（2）由于副回路的存在，改善了对象的特性；（3）由于副回路的存在，对负荷变化的适应性较强。总之，串级控制系统适用于工艺要求高、对象的容量滞后和时间常数大、干扰作用强而频繁、负荷变化大，简单控制系统满足不了要求的场合。尤其当主要干扰来自调节阀方面时，应用串级控制是很适宜的。常用的串级控制型式有：液位－流量、温度－流量。

For the service of the cascade control loop, the method of first put the secondary loop into service and then the primary loop is generally adopted. Be careful to ensure that there is no disturbance when switching.

串级控制回路的投用，普遍采用的是先投副回路再投主回路的方法。注意切换时尽量要保证无扰动切换。

The complex loop involved in this unit is mainly when the tank boundary is low-low, the valve is closed and the pump is stopped. The specific instructions are as follows:

本装置涉及到的复杂回路主要为罐内界位低低时，阀关、停泵，具体说明如下：

**Table 25**　**Description of complex loop control**

**表25　复杂回路控制说明表**

|  |  |  |  |
| --- | --- | --- | --- |
| No.  序号 | Instrument item No.  仪表位号 | Phenomenon Description  现象描述 | Actions  执行动作 |
| 1 | LIC60401 | The condensate level at outlet of the compressor and the condensate flow are in cascade control, LIC60401 is put to automatic control, and FIC60501 is put to cascade control.  压缩机出口凝液液位与凝液流量串级控制，LIC60401投用自动控制，FIC60501投用串级控制。 | When the LIC60401 is high, increase flow of FIC60501 and open the flow control valve FV60501. When the LIC60401 is low, reduce the flow of FIC60501 and close the valve FV60501.  LIC60401高，增FIC60501流量，流量控制阀FV60501阀开。LIC60401低，降低FIC60501流量，FV60501阀关。 |
| FIC60501 |
| 2 | LIC61001 | The level of the absorber and bottom oil flow rate of the absorber are in cascade control, the LIC61001 is put to automatic control, and the FIC61301 put to cascade control.  吸收塔液位与吸收塔底油流量串级控制，LIC61001投用自动控制，FIC61301投用串级控制。 | When the LIC61001 is high, increase the flow of FIC61301, and open the flow control valve FV61301. When the LIC61001 is low, reduce the flow of FIC61301, and close the valve FV61301.  LIC61001高，增FIC61301流量，流量控制阀FV61301阀开。LIC61001低，降低FIC61301流量，FV61301阀关。 |
| FIC61301 |
| 3 | LIC63201 | The bottom level of the desorption tower and the bottom oil flow rate of the desorption tower are controlled in cascade, the LIC63201 is put to automatic control, and the FIC63601 is put to cascade control.  脱吸塔底液位与脱吸塔底油流量串级控制，LIC63201投用自动控制，FIC63601投用串级控制。 | When the LIC63201 is high, increase the flow of FIC63601, and open the flow control valve FV63601. When the LIC63201 is low, reduce the flow of FIC63601, and close the valve FV63601.  LIC63201高，增FIC63601流量，流量控制阀FV63601阀开。LIC63201低，降低FIC63601流量，FV63601阀关。 |
| FIC63601 |

**Table 25(continued)**　**Description of complex loop control**

**表25（续）　复杂回路控制说明表**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No.  序号 | | Instrument item No.  仪表位号 | Phenomenon Description  现象描述 | | Actions  执行动作 | |
| 4 | | LIC64101 | The level of stabilizer and naphtha flow rate of stabilizer are in cascade control, LIC64101 is put to automatic control, and FIC64702 is put to cascade control.  稳定塔液位与稳定石脑油流量串级控制，LIC64101投用自动控制，FIC64702投用串级控制。 | | When the LIC64101 is high, increase the flow of FIC64702, and open the flow control valve FV64702. When the LIC64101 is low, reduce the flow of FIC64702 flow, and close the valve FV64702.  LIC64101高，增FIC64702流量，流量控制阀FV64702阀开。LIC64101低，降低FIC64702流量，FV64702阀关。 | |
| FIC64702 |
| 5 | LIC64401 | | | The level of overhead reflux tank of the stabilizer and the LPG flow of stabilizer are in cascade control, LIC64401 is put to automatic control, and FIC64601 is put to cascade control.  稳定塔顶回流罐液位与稳定液化气流量串级控制，LIC64401投用自动控制，FIC64601投用串级控制。 | | When the LIC64401 is high, increase the flow of FIC64601, open the flow control valve FV64601. When the LIC64401 is low, reduce the flow of FIC64601, and close the valve FV64601.  LIC64401高，增FIC64601流量，流量控制阀FV64601阀开。LIC64401低，降低FIC64601流量，FV64601阀关。 |
| FIC64601 | | |
| 6 | LIC64801 | | | The level of mixed naphtha feed buffer tank D-645 and naphtha flow of stabilizer are in cascade control, LIC64801 is put to automatic control and FIC64901 is put to cascade control.  混合石脑油缓冲罐D-645液位与稳定石脑油流量串级控制，LIC64801投用自动控制，FIC64901投用串级控制。 | | When the LIC64801 is high, increase the flow of FIC64901, open the flow control valve FV64901. When the LIC64801 is low, reduce the flow of FIC64901, and close the valve FV64901.  LIC64801高，增FIC64901流量，流量控制阀FV64901阀开。LIC64801低，降低FIC64901流量，FV64901阀关。 |
| FIC64901 | | |

2.4.8　Logic control procedure for unit with self-protection　装置自保的逻辑控制规程

The self-protection logic of the unit is mainly set, under the condition of equipment failure or accident, to prevent the materials from channeling with each other and causing accidents or to prevent accidents from expanding further and secondary accidents.

本装置自保逻辑主要是设备故障或事故状态下，防止物料互窜而引发事故或者防止事故进一步扩大以及发生次生事故而设置的。

2.4.8.1　Emergency cut-off interlock for bottom material of absorber C-610　吸收塔C-610塔底物料紧急切断联锁

When the unit of desorption tower leaks, or an accident leads to an emergency stop etc., and it is necessary to cut off the feed of desorption tower C-630, then it is required to close the process of the absorber bottom oil into the desorption tower. An emergency shut-off valve UV-61001 is provided between the bottom of the C-610 and the bottom pump P-610 of absorber. The UV-61001 can be operated from the field operating column and the control console in central control room.

当脱吸塔单元泄漏，或者突发事故而引发紧急停车等情况，需要切断脱吸塔C-630的进料，则需要关闭吸收塔塔底油进脱吸塔的流程。C-610塔底与吸收塔底泵P-610之间设有紧急切断阀UV-61001。UV-61001可通过现场操作柱和中心控制室辅操台进行操作。

When UV-61001 is closed, P-610AB is shut down at the same time, and C-630 is stopped to feed.

当UV-61001关闭后，P-610AB同时停运，C-630进料中止。

2.4.8.2　Emergency cut-off interlock for bottom material of desorption tower C-630　脱吸塔C-630塔底物料紧急切断联锁

When the stabilizer unit leaks or an accident leads to an emergency stop, etc., it is necessary to cut off the feed of the stabilizer C-640, then it is required to close the process of the bottom oil of the desorption tower into the stabilizer. An emergency shut-off valve UV-63201 is provided between the bottom of the C-630 and the bottom pump P-630 of absorber. The UV-63201 can be operated through the field operating column and the control console in central control room.

当稳定塔单元泄漏，或者突发事故而引发紧急停车等情况，需要切断稳定塔C-640的进料，则需要关闭脱吸塔塔底油进稳定塔的流程。C-630塔底与吸收塔底泵P-630之间设有紧急切断阀UV-63201。UV-63201可通过现场操作柱和中心控制室辅操台进行操作。

When the UV-63201 is closed, the P-630ABC is shut down at the same time, and the C-640 is stopped to feed.

当UV-63201关闭后，P-630ABC同时停运，C-640进料中止。

2.4.8.3　Emergency cut-off interlock logic for bottom material of naphtha feed buffer tank D-645

石脑油缓冲罐D-645罐底物料紧急切断联锁逻辑

When the unit or the stabilizer leaks or other accidents lead to an emergency stop, etc., it is necessary to cut off the feed of the stabilizer C-640, and then it is required to close the process of mixed naphtha into the C-640. An emergency shut-off valve UV-64801 is provided between the bottom of the mixed naphtha feed buffer tank D-645 and the P-645. The UV-64801 can be operated from the field operating column and the control console in central control room.

当装置或稳定塔发生泄漏或其他突发事故而引发紧急停车等情况，需要切断稳定塔C-640的进料，需要关闭混合石脑油进C-640的流程。混合石脑油进料缓冲罐D-645罐底与P-645之间设有紧急切断阀UV-64801。UV-64801可通过现场操作柱和中心控制室辅操台进行操作。

When UV-64801 is closed, P-645AB is shut down at the same time, and the C-640 is stopped to feed.

当UV-64801关闭后，P-645AB同时停运，C-640进料中止。

2.4.8.4　Emergency cut-off interlock logic for bottom material of stabilizer overhead reflux tank D-641　tank稳定塔顶回流罐D-641罐底物料紧急切断联锁逻辑

When there is a major leakage in the LPG pump P-641 and the stabilized LPG pipeline, in order to avoid a major accident, or other circumstances requiring emergency shutdown of the bottom LPG from D-641 tank, it is necessary to cut off the bottom LPG of D-641 quickly. A quick shut-off valve XMV-64401 is provided between D-641 and P-641. The XMV-64401 can be operated from the field operating column and the control console in central control room.

当液化气泵P-641及稳定液化气管线发生重大泄漏，为避免引发重大事故，或者出现其它需要紧急关闭D-641罐底液化气的情况时，需要快速关闭D-641罐底液化气。D-641与P-641之间设有快速切断阀XMV-64401。XMV-64401可通过现场操作柱和中心控制室辅操台进行操作。

When the XMV-64401 is closed, the P-641AB is shut down at the same time, thereby cutting off the material of the LPG pump and related piping.

当XMV-64401关闭后，P-641AB同时停运，从而切断液化气泵及相关管路的物料。

2.4.8.5　Emergency cut-off interlock for material from water drum of stabilizer overhead reflux tank D-641　稳定塔顶回流罐D-641水包物料紧急切断联锁

The sour water drum of D-641 is discharged intermittently through self-pressure to the sour water stripping unit. In order to avoid the LPG is sucked to the sour water stripping unit due to the low level of water drum D-641, causing an accident, an emergency shut-off valve UV-64402 is provided on the drainage line of the water drum D-641. When the level LI-64402 of water drum D-641 is less than or equal to 10%, the UV-64402 is automatically closed by the SIS system to prevent the LPG from going to the sour water stripping unit. The UV-64402 is also closed by the field operating column of the valve.

D-641水包的酸性水通过自压间断排放至酸性水汽提装置，为避免D-641水包低界位时，液化气窜至酸性水汽提装置，引发事故，在D-641水包排水线上设有紧急切断阀UV-64402。当D-641水包界位LI-64402小于等于10%时，则通过SIS系统自动关闭UV-64402关闭，防止液化气窜至酸性水汽提装置。也通过现场阀门操作柱关闭UV-64402。

2.4.8.6　State description of logic actions for emergency shut-off valve of screw compressor main inlet and outlet　螺杆压缩机总出入口紧急切断阀逻辑动作状态说明

In order to prevent accidents caused by backward flow of process gas, the screw compressor K-601ABC inlet and outlet lines are equipped with emergency shut-off valves UV-60201 and UV-60202. The UV-60201 and UV-60202 are interlocked with the running states of K-601ABC motor. When the K-601ABC is shut down, the XMV-60201 and XMV-60202 are closed automatically by interlocking. The XMV-60201 and XMV-60202 can also be closed by pressing the button for closing the emergency shut-off valve with the field operating column.

为防止工艺气倒窜引起事故，螺杆压缩机K-601ABC进出管线上设有紧急切断阀UV-60201和UV-60202。UV-60201和UV-60202与K-601ABC电机运行状态进行联锁，当K-601ABC停车后，XMV-60201和XMV-60202通过联锁自动关闭。也通过现场操作柱，按下关闭紧急切断阀按钮，关闭XMV-60201，XMV-60202。

2.4.9　Interlocking logic control diagram for plant self-protection　装置自保的联锁逻辑控制图

2.4.9.1　Interlocking logic for emergency isolation valve of absorber C-610 bottom

吸收塔C-610塔底紧急隔离阀联锁逻辑

Close C-610 bottom emergency isolation valve UV-61001 through on-site operating switch

stop

close

stop

Close C-610 bottom emergency isolation valve through operating switch on the control console



2.4.9.2　Interlocking logic for emergency isolation valve of desorption tower C-630 bottom

脱吸塔C-630塔底紧急隔离阀联锁逻辑

Close C-630 bottom emergency isolation valve UV-63201 through on-site operating switch



close

stop

stop

stop

Close C-630 bottom emergency isolation valve through operating switch on the control console

2.4.9.3　Interlocking logic for emergency isolation valve of mixed naphtha tank D-645 bottom 混合石脑油罐D-645罐底紧急隔离阀联锁逻辑

Close D-645 bottom emergency isolation valve UV-648001 through on-site operating switch



Close D-645 bottom emergency isolation valve UV-648001 through on-site operating switch

stop

close

stop

2.4.9.4　Interlocking logic for emergency isolation valve of stabilizer reflux tank D-641 bottom 稳定塔回流罐D-641罐底紧急隔离阀联锁逻辑

Close D-641 bottom emergency isolation valve XMV-64401 through on-site operating switch



Close D-641 bottom emergency isolation valve XMV-64401 through operating switch on the control console

stop

stop

close

2.4.9.5　Interlocking logic for emergency isolation valve of water drum drainage line for stabilizer reflux tank D-641

稳定塔回流罐D-641水包切水线紧急隔离阀联锁逻辑



D-641water drum level

close

2.4.9.6　Interlocking logic for emergency isolation valve of compressor main outlet and inlet

压缩机总出口、入口紧急隔离阀联锁逻辑

Motor stop of compressor K-601A~C



close

close

2.4.10　DCS control system　DCS控制系统

The process of the plant is continuous production, and the process media are mostly flammable and explosive, some of which are corrosive, and the selection of the self-control equipments strictly meets the requirements of explosion-proof, anti-corrosion and control. The automatic control equipment selected by the plant is not only advanced in technology, reliable in quality, economical and reasonable, with mature experience and good technical support, but also meets the needs of large-scale petrochemical plants for automated instruments. The automatic control level of the plant is designed according to the process technology of the plant and the overall design level of the whole factory control system. The control system setting principle is decentralized control, centralized operation, centralized management, and establishes the foundation for information management of the whole factory.

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。

The plant is provided with a separate on-site cabinet room shared with an 8 million tons/year atmospheric and vacuum distillation unit and acid gas & LPG treating unit. The operating stations, printers, data storage devices, and other operating terminals of the DCS/SIS system are all concentrated in the Management Control Center (CCR). The DCS/SIS system cabinet, safety grid cabinet, power distribution cabinet and auxiliary instrument cabinets are installed in the field cabinet.

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产品装置共用。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。

The process control system of the unit adopts the distributed control system (DCS for short), and all the detection and control signals of the plant (excluding the unit) are sent to the DCS, and the signal detection, process control, process alarm, data recording, information processing and other systems are performed through the DCS and production operations are performed in the central control room. The operating status of the main pump equipments in the plant is displayed on the DCS. Other related systems have communication links with DCS. The DCS has a network interface to the factory 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。

The plant shares a central control room with other production plants to facilitate operation, management, resource sharing, and investment saving. Therefore, the plant and the others use the same DCS system, which facilitates centralized processing of the entire factory computer data and centralized management of production. The cabinets of the plant are placed in the cabinet chamber of the on-site cabinet room. The cabinet room is shared with the atmospheric and vacuum plant and the product purification plant, and the operation station is placed in the central control room.

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，产品精制装置共用，操作站集中放置在中心控制室。

2.4.10.1　Startup of HIS (operator station)　HIS（操作员站）启动

It is very important to start the operation and monitoring functions of the HIS before the plant starts operating and monitoring. The specific startup instructions for 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 enter CENTUM.

打开电脑输入CENTUM 。

1. Click [Start] → [YOKOGAWA CENTUM] → [HIS UTILITY].

点击[开始]→[YOKOGAWA CENTUM]→[HIS UTILITY]。

1. Enter your username and password.

输入用户名和密码。

2.4.10.2　HIS monitor and operating keyboard instructions　HIS监视器及操作键盘说明

（1）Monitor　监视器

The multi-monitor monitoring feature connects two monitors to one operator station (HIS) and displays an operation and monitoring window on each monitor. In this way, two monitors can be processed as a large virtual desktop area. Multi-monitor capabilities of Windows XP are required for multi-monitor monitoring.

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 Windows XP 的多监视器功能。

There are two types of monitors in a multi-monitor monitoring environment: one is the primary monitor and the other is the secondary monitor. The main monitor and the secondary monitor can perform the following display operations: ① the cursor can move freely between the main monitor and the secondary monitor; ② the window between the main monitor and the secondary monitor can be switched (switched and exchanged); ③ the window can be called by specifying the monitor of the display window; ④the window can be deleted by specifying the corresponding monitor; Each monitor can perform the 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。

Operating keyboard

操作键盘

1. Each HIS will be equipped with a Yokogawa operating keyboard instead of a standard PC keyboard. The dust-proof and anti-drip keyboards are set to the flat keys as required for their function, so that one contact operation can be performed. This keyboard will become the standard keyboard for factory 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用的标准键盘。

2.4.10.3　Toolbar　工具栏

Data entry keys

A toolbar is a window that contains buttons that can activate other types of windows, which 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　Description of the process window　过程窗口的说明

1. Flowchart window, showing the flowchart of the plant or control status that the user has made. This window displays the real-time process status and the process data field and an indicator with a dynamic curve. The original data of the flowchart is determined as the regulator changes the color of the target object 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。

1. Logic diagram window, showing 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。

1. Sequence table window, showing the detailed sequence or 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。

1. Control the graphics window, showing the function blocks defined in 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 operating mode of the module　改变模块的操作模式

The module mode can be displayed by clicking on the module mode display area and also can be changed by changing the mode of 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手动。2）AUT : Automatic自动。3）CAS : Cascade串级。

The functions of these three buttons are the same as those of the keys with the same mark on the HIS operating 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　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 output value (MV). The right indicator on 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 will be changed depending on the operating state of the instrument panel (MAN, AUT, CAS) and the state of the operating keyboard TARGET KEY. The indicator color will be red when the indicator is controllable by the operator and 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TARGET KEY 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）Slight increase or decrease in SV, MV

少量的增减SV,MV

Click on the SV or MV indicator on the instrument panel and the following dialog will be appeared. Press and hold the 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）Tag number attribute　位号的属性

The tag number 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 importance level of the tag number is defined by TAG MARK during engineering configuration. One TAG MARK has a corresponding function block, reflecting its importance level (IMPORTANT LEVEL). 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）Security Level安全等级

In the Definition Builder of function blocks, each tag number is assigned with the security level of the function block. Depending on the security category of the username and the security level of the corresponding function block, there is a limit to 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。

The detail window and control panel's tag number can be observed through monitoring.

监控即可以观察到细目窗口和控制面板的位号。

The operation is to change the MV, SV, control mode, alarm set value, etc. at that point.

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 level报警处理等级

In the defined configuration of the function module, the alarm handling level of the tag number is defined. When the bit number 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 object of the alarm 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 flash of the alarm will continue 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-locking type非锁定类型

When the alarm is restored, the flash of the alarm is stopped regardless of whether the alarm is acknowledged.

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 considered 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 circuit, when the downstream open circuit returns to closed, the output value will change drastically.

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 from happening, the forced output value is equal to (tracking) the set value of the downstream controller, so that when the mode is switched, the output value will not upset, and the 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 occurs, 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, and 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 with up to 200 alarm messages 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 confirmed alarm message. When there is an unacknowledged alarm message, it is deleted from the first unacknowledged alarm message stored.

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）Function　功能

The HIS trend recording function obtains process data from the FCS and displays a trend recording function that obtains changes in the data in the form of a graph. The trend recording function has 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的趋势记录功能。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). The 20 trend modules can be defined as a pattern of rotary trend or batch trend. The remaining 30 modules are defined as trend blocks for other stations. The trend format and sampling period 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 period, 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）The sampling period and recording range of the trend data. The sampling period of the process data is defined in each trend block. The sampling period is divided into: 1 second, 10 seconds, 1 minute, 2 minutes, 5 minutes, and 10 points. Only the sampling period of two trend blocks is defined as 1 second or 10 seconds.

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）Composition of the trend window　趋势窗口的组成



The functions of 1~19 buttons 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 the 8 trend pens of 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. Selecting the trend pen in the trend window 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 point, double-click the point name of any one of the eight strokes 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 history report information window displays the general view of the history information, and the history report includes the type of the alarm information and the operator operation history information. Use the toolbar to activate the history 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 status overview window displays the status of the communication bus and the status of the various stations. In the drop-down menu, click [System Status Display] to display the 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　Fire and gas system overview of the plant　装置火气系统总貌图

The general picture of the fire and gas system shows the geographical overview of the main process unit, divided into different FGS areas, each with an indicator light representing the public fire alarm in the area. When you click on an area, the FGS detector arrangement for that area will be called. In the event of fire, flammable or toxic gases appear in the plant, and the representative symbol of the plant will change to the color of the alarm 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 picture can be used to: call the factory 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 control system　SIS控制系统

The PMB petrochemical project uses TRICONEX's Tricon system as the safety instrumented system of the project, which is integrated by Beijing Conson 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 the SIS system hardware, software, technical services, engineering services, software configuration, system integration, factory acceptance (FAT), packaging and transportation, unpacking inspection, installation guidance, field testing, site acceptance (SAT) and the SIS system to be put into operation for the start-up of the plant.

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　System structure description　系统结构说明

（1）The overall structure of the system. The SIS consists of controllers, an IO racks, operator stations, engineering stations/SOE stations, and network devices. The remote IO rack, operator station, engineer station/SOE station are set in the central control room, and the controller, engineer and SOE station are set in the 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）Communicate with DCS. The SIS uses redundant RS485 to communicate with the DCS to send the required SIS parameters to the 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 engineering stations/SOE stations, one A4 black and white laser printer, and one A4 color laser printer are used in the central control room for debugging and high-speed data acquisition and analysis. In the on-site cabinet room, each SIS system is equipped with an engineer and SOE station, and an 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, each SIS system is equipped with one operator station. The operator station configures 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 the GPS clock server provided by the DCS system vendor integration) is provided in the central control room in accordance with the SNTP protocol RJ45 interface. The clock synchronization signal of the clock server RJ45 interface is connected to the core switch of the SIS system located in the central control room. All SIS controllers and host computers in the central control room SIS network will realize clock synchronization through the 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

The SIS hardware is based on the TMR redundant fault-tolerant TRICON controller, which meets the requirements of IEC61508 SIL1-3 and is certified by TUV AK5-6. The main functions include: factory interlock protection; related alarms and records; instrument status monitoring; screen monitoring, operation and trend recording can be realized through the operator station; online diagnostic maintenance and high-speed process history analysis of the system can be realized through the engineer/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 scheme　停工方案

2.5.1　Preparation and inspection before shutdown　停工前的准备与检查

2.5.1.1　Shutdown requirements　停工要求

（1）Organizational measures, shutdown schemes, and safety work must be put in place before shutdown. Participants should be familiar with the shutdown schemes of the plant.

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）Strictly organize the work according to the steps of shutdown schemes and the shutdown schedule time to ensure that the shutdown is safe, punctual and orderly.

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）Ensure that no degraded products during production rate reduction, no over-temperature, no over-pressure, no water hammer, no oil leakage, no oil backflow, no fire, no explosion.

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。

（4）There is no oil, water and gas in the pipeline, and no delay.

管线内不存油、水和瓦斯气、不拖时间。

（5）After the shutdown, the blind plate is added to the specified part and managed by the specific person.

停工后在规定部位加好盲板，盲板实行专人管理。

（6）After the shutdown, remove all pressure gauges and casing thermometers, and verify the removed pressure gauges.

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）Open the manholes of the towers, tanks and containers in accordance with regulations to ventilate and cool, and the entering into the towers, tanks and containers can be allowed only after the explosive gas analysis are qualified.

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）Because the sulfur content of the raw materials of the plant is high, during the shutdown process, corresponding countermeasures should be prepared for each tower and vessels to prevent spontaneous combustion of ferrous sulfide.

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）Strengthen safety and environmental management, and disorderly discharge and emissions of residual oil and sewage are strictly prohibited.

加强安全和环保管理，严禁残油和污水乱排乱放。

2.5.1.2　Preparation and inspection before shutdown　停工前的准备与检查

（1）Prepare the shutdown scheme, organize operators to learn and take the exam, and make a record.

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 the back water, the line purging list, the blind plate layout, the blind plate list, shutdown network diagram. The designated purging personnel shall be designated and announced on the wall of the central control room. After the completion of the purging, the responsible person shall sign and confirm.

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）Confirm that the utility system of the plant is operating normally.

确认装置公用工程系统运行正常。

（4）Verify that all valve stems in the plant have been lubricated.

确认装置内所有阀门丝杆已浇润滑油。

（5）Confirm that the liquid level of each tower and container is normal and the pump is running normally.

确认各塔、容器液位正常，机泵运转正常。

（6）The safety valve is put into use and sealed.

安全阀投用、打铅封。

（7）Departments such as the planning and dispatching, oil tank farm, electrical, instrumentation, and laboratory should coordinate with each other to ensure that product in and out lines, unqualified lines, and return lines are lineup.

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）Fire-fighting steam and fire-fighting equipments, gas masks, explosion-proof wrenches and other shutdown tools are ready for use. Do good jobs in the protection of amine base work; prepare labor protection products (masks, plastic gloves, etc.).

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）Make sure to prepare enough loess, asbestos cloth, iron ring, wood chips, purging tape, wire, empty vats.

确认准备足黄土、石棉布、铁圈、木屑、吹扫胶带、铁丝、空大桶。

（10）Make sure the plant is well lit.

确认装置照明完好。

（11）The walkie-talkie and charger are fully equipped.

对讲机及充电器齐全好用。

（12）Prepare the FeS passivator.

准备好FeS钝化剂。

2.5.2　Shutdown procedures　停工步骤

2.5.2.1　Stop the compressor, cut off the gas into the light ends recovery unit　停运压缩机，各瓦斯切断进轻烃回收装置

（1）Before the light ends recovery unit shutdown, contact the production scheduler to feed stabilized naphtha to the tank farm, and stop the stabilized naphtha direct supply to the reformer.

轻烃停车前，联系调度将稳定石脑油全部改至罐区，停稳定石脑油直供重整装置。

（2）Close the D-601 drainage process flow.

关闭D-601切水流程。

（3）Contact the production scheduler to stop the overhead gas of aviation kerosene hydrogenation tower, diesel hydrogenation tower and reforming hydrogenation tower to the plant.

联系调度，依次将航煤加氢塔顶气、柴油加氢塔顶气、重整加氢塔顶气停进装置。

（4）Contact the atmospheric and vacuum unit to switch the pre-distillation tower overhead gas and the atmospheric tower overhead gas to the flare gas, and close the valves of the pre-distillation tower overhead gas and the atmospheric tower overhead gas into the light ends recovery unit.

联系常减压装置，将初顶气和常顶气改至火炬气，关闭初顶气和常顶气进轻烃回收阀门。

（5）Stop the compressor, and the D-601 and D-602 tank overhead gas is sent to the flare gas.

停运压缩机，D-601、D-602罐顶气改至火炬气。

（6）Close the dry gas to the C-610 tower process flow.

关闭干气至C-610塔流程。

（7）Close the process flow from C-610 tower overhead to the dry gas desulfurizer, and switch the overhead gas to the flare gas (delivery line of safety valve)

关闭C-610塔顶至干气脱硫装置流程，塔顶改至火炬气（安全阀付线）

（8）Continue to pump the condensate of D-601 and D-602 to D-645 and C-630. After stopping the P-601 and P-602, the pump outlet valve and the delivery line valve must be immediately closed to prevent pressure breakthrough.

D-601、D-602有凝液继续用泵送至D-645和C-630。停运P-601、P-602后必须立即关闭泵出口阀、付线阀等，防止窜压。

2.5.2.2　Stop mixed naphtha into the unit　停混合石脑油进装置

（1）Contact the production scheduler , the materials such as aviation kerosene hydrogenated naphtha, diesel hydrogenated naphtha, diesel hydrogenated light hydrocarbons, and reformed light hydrocarbons are routed out of the light ends recovery unit to close the battery limit valve of the light ends recovery unit.

联系调度，将航煤加氢石脑油、柴油加氢石脑油、柴油加氢轻烃、重整轻烃等物料改出轻烃回收装置，关闭轻烃回收装置界区阀。

（2）After the D-645 naphtha is empty, stop the P-645 and close the pump outlet valve and the delivery line valve to prevent backward flow of the material.

D-645石脑油送空后停运P-645，关闭泵出口阀和付线阀，防止窜料。

（3）Stop the P-681 and close the D-645 drainage process flow.

停运P-681，关闭D-645切水流程。

（4）D-645 tank overhead gas is switched to flare gas, close balance line from D-645 to D-601, and balance line from the desorption tower overhead gas to D-645.

D-645罐顶改至火炬气，D-645至D-601平衡线、脱吸塔顶气至D-645平衡线关闭。

2.5.2.3　Stop the desorption tower　停脱吸塔

（1）Slowly remove the heat source of the bottom re-boiler of the desorption tower, and gradually turn off the TV63207 until the 1.0MPa steam is completely closed.

缓慢撤脱吸塔塔底重沸器热源，逐步关小TV63207，直至1.0MPa蒸汽全部关闭。

（2）Close 1.0MPa steam into the E-630R valve to prevent leakage inside the regulating valve.

关闭1.0MPa蒸汽进E-630R阀门，防止调节阀内漏。

（3）The condensate outlet valve is closed and the on-site condensate outlet valve is closed.关闭凝结水出装置调节阀，现场凝结水出装置阀门关闭。

（4）Open the overhead vent of the D-630 drum and the bottom condensate discharge of the drum to drain water completely to prevent the steam from condensing and forming a vacuum inside the tank.

D-630罐顶放空打开，罐底排凝打开，排尽存水，防止蒸汽冷凝后，罐内形成真空。

（5）Maintain the overhead pressure of the C-630 tank.

维持好C-630罐顶压力。

2.5.2.4　Stop the stabilizer　停稳定塔

（1）Slowly remove the heat source of the reformer of the bottom stabilizer, and gradually open the TV64201 and TV64202 until the three-way valve is fully open.

缓慢撤稳定塔塔底重整器热源，逐步打开TV64201、TV64202，直至三通阀全部打开。

（2）Close the valve of atm. PA #2 to E-640RS. When closing the valve, observe the flow rate change of the atm. PA #2 to prevent the flow buildup of the atm. PA #2 due to different delivery lines of three-way valve.

关闭常二中进E-640RS的阀门，关闭阀门时应观察常二中流量变化，防止三通阀付线不同引起常二中憋量。

（3）Overhead temperature of the stabilizer should be controlled during the process of temperature decreasing. It is forbidden to send the LPG remaining in D-641 into the C-640 tower during the shutdown.

稳定塔撤温过程中控制好塔顶温度，禁止将D-641残存的液化气在停工过程中打入C-640塔内。

2.5.2.5　Pressure release of the system　系统撤压

（1）When the temperature of the bottom of the desorption tower and the bottom of the stabilizer are lowered to 40-80 °C, contact the production scheduler to stop the chilled water and close the E-615 chilled water valve.

当脱吸塔塔底和稳定塔塔底温度降至40-80℃时，联系调度停运冷冻水，关闭E-615冷冻水阀门。

（2）The overhead pressure of the desorption tower is released through the D-602 tank overhead to the flare gas.

脱吸塔顶通过D-602罐顶至火炬气泄压。

（3）The overhead pressure of the stabilizer is released to the flare gas.

稳定塔顶通过至火炬气泄压。

（4）The LPG of D-641 should be transported to the LPG desulfurization system as much as possible.

D-641的液化气应尽量输送至液化气脱硫系统。

（5）When the overhead pressure of D-641 tank drops to the pressure of exhaustion of P-645, the P-641 should be stopped immediately, and the D-641 should be opened to the flare valve to relieve pressure. The D-641 residual LPG should be evaporated to the flare gas as much as possible.

如D-641罐顶压力下降至P-645抽空时，应立即停运P-641，并打开D-641至火炬气阀泄压，D-641存留液化气应尽量蒸发至火炬气。

（6）When the pressure of the D-640 drops to the pressure that residual oil can no longer be exported with self-pressure, then the P630B should be used instead.

当D-640的压力降至存油不能再自压出装置时，改为采用P630B输送。

2.5.2.6　Oil return of the system　系统退油

（1）Contact the production scheduler to feed the overhead naphtha of pre-distillation tower and the overhead naphtha of the atmospheric tower from the atmospheric and vacuum distillation unit to the light slop oil tank.

联系调度将常减压装置的初顶石脑油和常顶石脑油改轻污油罐。

（2）Close the valve of the overhead naphtha of pre-distillation tower and the overhead naphtha of the atmospheric tower to the light ends recovery system.

关闭初顶石脑油和常顶石脑油进轻烃回收系统阀门。

（3）The C-610 tower naphtha is sent to the C-630 tower until the level of tower is emptied.

C-610塔石脑油全部送至C-630塔，直至塔液位抽空。

（4）The C-630 tower naphtha is sent to the C-640 tower until the level of tower is emptied.

C-630塔石脑油全部送至C-640塔，直至塔液位抽空。

（5）The C-640 tower naphtha is sent to the tank farm until the level of tower is emptied.

C-640塔石脑油全部送至罐区，直至塔液位抽空。

（6）After the return of the naphtha oil of each tower is completed, close the process flow of the stabilized naphtha to the tank farm.

各塔石脑油退油结束后关闭稳定石脑油至罐区流程。

（7）Contact the production scheduler to line up the process flow of stabilized naphtha to the light slop oil tank, and require the light ends recovery unit to prepare for the water replacement.

联系调度改通稳定石脑油至轻污油流程，轻烃回收装置准备顶水。

2.5.2.7　System nitrogen purge and water replacement　系统氮气置换和水顶油

During the water replacement, it should be started from the upstream process flow to the downstream, that is, after the water replacement of last process is completed, and then the next process is started. After each drum is filled with water, the pump should be started. The pump should be stopped until the water remain of the drum is pumped out completely. After that, fill the water again, and start the water replacement again. This is repeated several times to ensure that the residual oil of the tank is emptied.

装置顶水时应从前往后顶水，前面的流程顶水结束后再顶后面的流程，每个罐装满水后启泵，应将罐内存水抽空后停泵，再装水，再顶水，如此重复多次，确保罐内存油顶干净。

During the water replacement of each tower, it is necessary to drain the water remain in the tower and then refill the water to prevent the oil from floating on the surface of the water. During the water replacement of the desorption tower and the stabilizer, the water level in the tower should be above the re-boiler reflux and overflow the residual oil in the re-boiler to prevent water remain in the outlet pipe of the re-boiler.

各塔顶水时，每次也需要将塔内的存水送完后再装水，防止油飘浮在水面未送出装置。脱吸塔和稳定塔顶水时应将塔内液位装至重沸器返塔口以上，将重沸器内的存油溢出，防止重沸器内出出口管线存水。

（1）D-601 feed line and D-601 nitrogen purge

D-601进料线及D-601氮气置换



**Figure 38**　**D-601 Nitrogen purge flow diagram of feed line and D-601**

**图38　D-601进料线及D-601氮气置换流程图**

Note:

说明：

1）D-601 tank overhead to flare.

D-601罐顶至火炬。

2）The nitrogen is supplied from the overhead of D-201 to the overhead gas of pre-distillation tower.

初顶气从常减压D-201顶给氮气。

3）The nitrogen is supplied from the overhead of D-301 to the overhead gas of atmospheric tower.

常顶气从常减压D-301罐顶给氮气。

4）The nitrogen is supplied from battery limit to the overhead gas of aviation kerosene hydrogenation tower and the diesel hydrogenation tower.

航煤加氢塔顶气和柴油加氢塔顶气从界区给氮气。

5）D-601 residual oil is discharged from the bottom of the tank to the underground light slop oil tank.

D-601存油从罐底至地下轻污油罐排放。

6）The condensate line is supplied with nitrogen after the withdrawal valve at the bottom of the D-601 tank and the nitrogen is fed to the D-645 via the delivery line of P-601.

凝液线从D-601罐底抽出阀后给氮气经P-601付线往D-645置换。

7）P-601 drain is discharged to the underground light slop oil tank.

P-601导淋至地下轻污油罐排放。

（2）D-602 feed line nitrogen purge and D-602 water replacement

D-602进料线氮气置换及D-602顶水



**Figure 39**　**Flow diagram for nitrogen purge of D-602 feed line and D-602 water replacement**

**图39　D-602进料线氮气置换及D-602顶水流程图**

Note:

说明：

1）The overhead D-602 tank to flare gas is open. The compressor outlet is supplied with nitrogen after the electric valve.

D-602罐顶至火炬气打开。压缩机出口在电动阀后给氮气。

2）Nitrogen gas is supplied to the overhead D-601 tank after the gas line valve, and the condensate of low point of the compressor is discharged to the light slop oil tank.

D-601罐顶气线阀后给氮气，压缩机处低点排凝至轻污油罐排气。

3）The reforming pre-hydrogenation unit to the plant is supplied with nitrogen.

重整预加氢进装置给氮气。

4）D-641 stabilized gas line is supplied with nitrogen.

D-641稳定气线给氮气。

5）The nitrogen supplied to the overhead of D-602 tank is purged to C-630.

D-602罐顶气给氮气往C-630置换。

6）The drain of D-602 tank bottom condensate line is connected to the temporary water line. After the D-602 is filled with water, start the P-602 to sent water to the C-630 for water replacement. After the P-602 is pumped off, the pump is stopped and the water is refilled.

D-602罐底凝液线导淋接临时水线。D-602装水满后，启运P-602往C-630顶水，P-602抽空后停泵重新装水，反复顶水多次。

（3）D-645 feed line nitrogen replacement and D-645 water replacement

D-645进料线氮气顶油及D-645顶水



**Figure 40**　**D-645 Flow diagram for oil replacement of D-645 feed line and D-645 water replacement with nitrogen**

**图40　D-645进料线氮气顶油及D-645顶水流程图**

Note:

说明：

1）The D-645 tank overhead is switched to the flare gas.

D-645罐顶改至火炬气。

2）The position where reforming light hydrocarbons, diesel hydrogenated light hydrocarbons, diesel hydrogenated naphtha, and aviation kerosene hydrogenated naphtha fed into the plant is supplied with nitrogen to send oil to D-645.

重整轻烃、柴油加氢轻烃、柴油加氢石脑油、航煤加氢石脑油进装置处给氮气往D-645顶油。

3）After D-645 has oil, start P-645 and send oil to C-640.

D-645有油后启动P-645往C-640送油。

4）After the oil replacement of the feed line is finished, the bottom drain of the D-645 tank is connected to the temporary water line to fill the D-645 with water. Start the P-645 to purge to C-645.

进料线顶油结束后，D-645罐底导淋接临时水线，往D-645装水，启动P-645往C-645置换。

（4）Water replacement and oil return of the overhead naphtha line of pre-distillation tower and atmospheric tower and the absorber初常顶石脑油线及吸收塔顶水退油



**Figure 41**　**Flow diagram of the water replacement and oil return of the overhead naphtha line of pre-distillation tower and atmospheric tower and the absorber**

**图41　初常顶石脑油线及吸收塔顶水退油流程图**

Note:

说明：

1）For the absorbent line, the water is fed from the overhead naphtha line of atmospheric tower to the top of the C-610. For the overhead naphtha line of atmospheric tower, water replacement is started from D-302 to D-301, and then start the P-321 for water replacement of absorber.

吸收剂线从常顶石脑油线给水，往C-610上部顶水。常顶石脑油线从D-302往D-301顶水后，启运P-321往吸收塔顶水。

2）After the C-610 liquid level reaches 80%, start the P-610 for water replacement of C-610.

C-610液位达到80%以后，启运P-610往C-610顶水。

3）After the absorbent line and the absorption tray are rinsed out, switch into P-610 inlet water supply.

吸收剂线和吸收塔盘冲洗干净后，改为P-610入口给水。

4）When starting the P-610 for water replacement of C-630, both the upper and middle sections of the C-630 should be considered.

启运P-610往C-630顶水时，注意往C-630上部和中部两个方向均要顶水。

5）During the water replacement of C-610, the liquid level of the tower is required to be emptied and then refilled, and it is repeated several times to ensure that there is not a large amount of oil in the tower.

C-610顶水时要求塔液位抽空后再装水，反复多次，确保塔内不大量存油。

6）For the overhead naphtha line of pre-distillation tower, water is supplied from D-302 to the D-301, and then start the P-221 for water replacement of C-630.

初顶石脑油线从常减压D-302给水，往D-301顶水，再启运P-221往C-630顶水。

（5）Water replacement and oil return of desorption tower

脱吸塔顶水退油



To C-640

**Figure 42**　**Flow diagram of water replacement and oil return of desorption tower**

**图42　脱吸塔顶水退油流程图**

Note:说明：

1）After the oil replacement of absorber and the absorber bottom oil to the desorption tower is completed, the absorber is filled with water, and the liquid level is established. According to the normal liquid level control, water is supplied to the C-630.

吸收塔及吸收塔底油至脱吸塔进料顶油结束后，吸收塔装水，并建立液位，按照正常液位控制，往C-630装水。

2）After the C-630 is filled with water, start the P-630 for the water replacement of the stabilizer.

C-630装满水后，启运P-630往稳定塔顶水。

3）When the C-630 is filled with water, the liquid level is required to be above the E-630R return port to allow overflow of the E-630R residual oil from the top.

C-630装水时要求液位装至E-630R返塔口以上，将E-630R存油从顶部溢出。

4）During the water replacement of C-630, it is required to empty the liquid, refill the water and then start the pump for downstream water replacement. This should be repeated many times.

C-630顶水时要求液位拉空后，再重新装水，再启泵往后顶水。如此反复多次。

（6）Water replacement and oil return of overhead stabilizer

稳定塔塔顶顶水退油



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**Figure 43**　**Flow diagram of water replacement and oil return of the stabilizer**

**图43　稳定塔塔顶顶水退油流程图**

Note:说明：

1）Water is supplied from P-641 inlet and then sent to D-641. After D-641 is full with water, then start P-641 to send water to the C-640 through reflux line. After the D-641 liquid is empty, stop the pump P-641, and refill the D-641 with water before starting the P-641 to sent water to C-640. Repeat this many times.

P-641入口给水，往D-641装水，D-641装满水后启运P-641经回流线往C-640顶水。D-641液位拉空后，停泵P-641，D-641重新装满水后再启运P-641往C-640顶水。如此重复多次。

2）After water replacement of D-641 and C-640 reflux line is completed, the water is sent to the desulfurization system of LPG .

D-641和C-640回流线顶水结束后，往液化气至脱硫系统顶水。

（7）Stabilizer C-640 and stabilizer naphtha water replacement

稳定塔C-640及稳定石脑油顶水



**Figure 44**　**Flow diagram of water replacement and oil return of stabilizer and stabilizer naphtha**

**图44　稳定塔及稳定石脑油顶水退油流程图**

Note:说明：

1）Water is supplied from the P-641 and P-630AC to the C-640, the C-640 liquid level should be above the E-640R/S return port to overflow the oil in the re-boiler and the inlet and outlet lines.

从P-641和P-630AC往C-640给水，C-640液位装至E-640R/S返塔口以上，将重沸器及进出口管线的存油溢出。

2）Start P-630B for water replacement of the stabilizer naphtha to the tank farm.

启运P-630B往稳定石脑油至罐区流程顶水。

3）Empty the C-640 liquid, filled with water, then empty it again and repeat this process several times.

C-640液位拉空，装水，再拉空，反复重复多次。

4）Contact the production scheduler to coordinate the water replacement of stabilized naphtha line to reforming section.

联系调度，协调稳定石脑油线往重整顶水。

2.5.2.8　Steam purge and replacement　蒸汽吹扫、置换

（1）D-601

1）The D-601 drum body is supplied with steam and exhausted from the overhead, and the bottom condensate containing oil is discharged to the underground light slop oil tank.

D-601罐本体给汽，罐顶排汽，罐底部排凝有油排至地下轻污油罐。

2）Control the amount of steam to prevent overpressure in the tank.

控制用汽量，防止罐超压。

（2）D-602 and its inlet and outlet line　D-602及其进出口线



**Figure 45**　**D-602 and its inlet and outlet line purge flow diagram**

**图45　D-602及其进出口线吹扫置换流程图**

Note:

说明：

1）The compressed gas and the D-602 drum body are supplied with steam.

压缩气和D-602罐本体给汽。

2）The bottom of the tank is regularly drained to the underground light slop oil tank.

罐底部定期排液至地下轻污油罐。

3）Vent from the top of the tank, steam the D-602, and control the steam consumption to prevent the oil from being discharged into the atmosphere.

罐顶部放空排气，D-602蒸罐，控制用汽量，严防油排出大气。

4）After the compressed gas purging of D-602 is completed, close the inlet and delivery line valve of the compressed gas to the E-602, and the compressed gas is blown back to the top of the desorption tower, and is exhausted at the top of the desorption tower.

压缩气进D-602吹扫结束后关闭压缩气至E-602的入口及付线阀，压缩气往脱吸塔顶气返吹，在脱吸塔顶排气。

5）After the D-602 steaming is finished, open the valve of stabilized gas at the top of the D-641 drum, close the D-602 drum overhead vent valve, and purge the stabilized gas line to D-641.

D-602蒸罐结束后，打开稳定气在D-641罐顶的阀门，关闭D-602罐顶放空阀，往D-641吹扫稳定气线。

6）After the stabilized gas line purge is completed, close the stabilized gas valve, D-602 steam is switched to C-610, and purge the C-610 feed line and steam the tower.

稳定气线吹扫结束后，关闭稳定气阀门，D-602蒸汽改至C-610，吹扫C-610进料线和蒸塔。

（3）Overhead naphtha of atmospheric tower and absorber

常顶石脑油及吸收塔



**Figure 46**　**Purge flow diagram of overhead naphtha of atmospheric tower and absorber**

**图46　常顶石脑油及吸收塔吹扫置换流程图**

Note:

说明：

1）C-610 tower bottom and D-602 is supplied with steam to steam the tower.

C-610塔底和D-602给汽，蒸塔。

2）The overhead naphtha of atmospheric tower to the plant battery limit is supplied with steam and purge to the C-610. When purging, the E-615 chilled water side drain should be opened to prevent pressure building up, and the E-615 is purged through delivery line at first and then is switched to E-615 purge for about half an hour.

常顶石脑油进装置界区给汽，往C-610吹扫，吹扫时E-615冷冻水侧导淋打开防止憋压，E-615先走付线吹扫，吹扫末期走E-615吹扫约半小时。

3）The top of the C-610 tower is opened and exhausted.

C-610塔顶放空打开，排汽。

4）Drain the bottom of the C-610 tower, and oil is discharged into underground light sump oil tank.

C-610塔底排凝打开，排水，有油排入地下轻污油罐。

5）The top of the absorber to the desulfurization line is emptied in the dry gas desulfurization liquid separation tank.

吸收塔顶至脱硫线在干气脱硫分液罐排空。

6）After the purge of the overhead naphtha line of atmospheric tower, purge to the compressor, the feeding line of overhead naphtha of pre-distillation tower and the desorption tower separately.

常顶石脑油线吹扫结束后，往压缩机、初顶石脑油和脱吸塔进料线分别吹扫。

（4）Overhead naphtha of pre-distillation tower, absorption bottom oil and desorption tower

初顶石脑油、吸收塔底油及脱吸塔



**Figure 47**　**Purge flow diagram of overhead naphtha of pre-distillation tower, absorber bottom oil and desorption tower**

**图47　初顶石脑油、吸收塔底油及脱吸塔吹扫置换流程图**

Note:

说明：

1）Steam the desorption tower from the bottom, open the overhead vent and drain from the bottom condensate discharging line of the tower, and after seeing the oil, it should be discharged to the underground light slop oil tank.

脱吸塔底给汽蒸塔，塔顶放空打开，塔底排凝线切水，见油后排至地下轻污油罐。

2）Steam the bottom of the absorber to purge to the desorption tower, from the overhead the desorption tower at first, and then to the middle section.

吸收塔底给汽往脱吸塔吹扫，先往脱吸塔顶部吹扫，再往脱吸塔中部吹扫。

3）Steam the bottom of D-602 tank to purge the condensate line to the desorption tower.

D-602罐底给汽，往脱吸塔吹扫凝液线。

4）Steam the overhead naphtha line of pre-distillation tower from the battery limit to purge to the desorption tower.

初顶石脑油线在界区给汽，往脱吸塔吹扫。

5）When the E-636 is purged, open the drain at condensate side to prevent pressure building up. For the E-635 purging, the delivery line of E-635 should be purged at first, and switched to E-635 at the end of desorption tower feeding line purging. When the E-635 is purged, the process flow of the other side (stabilized naphtha) should be kept unblocked (or purged with the other side) to prevent pressure building up.

E-636吹扫时，凝结水侧导淋打开，防止憋压。E-635吹扫时先走付线，脱吸塔进料吹扫末期改进E-635，E-635吹扫时，另一侧（稳定石脑油）要保持流程畅通（或与另一侧同时吹扫），防止憋压。

6）When steaming the tower, drain the re-boiler at a low point, and the oil is discharged to the underground light slop oil tank.

蒸塔时，重沸器低点导淋排水，有油排至地下轻污油罐。

7）The lines from the desorption tower overhead to the E-602W and to the D-645 should be purged when the D-602 and D-645 are purged respectively.

脱吸塔顶至E-602W和至D-645线，分别结合D-602、D-645吹扫时吹扫。

（5）Mixed naphtha, stabilizer feed, stabilizer and overhead system

混合石脑油、稳定塔进料、稳定塔及稳定塔顶系统



**Figure 48**　**Purge flow diagram of mixed naphtha, stabilizer feed, stabilizer and overhead system**

**图48　混合石脑油、稳定塔进料、稳定塔及稳定塔顶系统吹扫置换流程图**

Note:

说明：

1）Steam the reforming light hydrocarbon line, the diesel hydrogenated light hydrocarbon line, the diesel hydrogenated naphtha line, and the aviation kerosene hydrogenated naphtha line in turn from the battery limit. In order to prevent steam flow rate from being too large, and pressure building up of D-645, the four lines should not be steamed at the same time.

重整轻烃线、柴油加氢轻烃线、柴油加氢石脑油线、航煤加氢石脑油线分别在界区轮流给汽，为防止给汽过大，D-645憋压，四条线不同时给汽。

2）The D-645 mixed naphtha extraction valve is opened, and steam the D-645 feeding line to purge to the stabilizer through P-645 delivery line.

D-645混合石脑油抽出阀打开，D-645进料给汽后，经P-645付线往稳定塔吹扫。

3）Steam is supplied after the desorption tower oil extraction valve to steam the bottom of the desorption tower, and is purged through the P-630 delivery line to the stabilizer.

脱吸塔底在脱吸塔底油抽出阀后给汽，经P-630付线往稳定塔吹扫。

4）Start the air cooling of stabilizer overhead to cool the purging steam at the top of the tower, and open the D-641 to the safety valve.

稳定塔顶的空冷启运，冷却塔顶的扫线蒸汽，D-641至安全阀打开。

5）Steam the D-641 after the LPG withdraw valve and purge to the stabilizer through the P-641 delivery line. Steam the LPG to desulfurization from the battery limit and purge to the stabilizer.

D-641液化气抽出阀后给汽，经P-641付线往稳定塔吹扫，液化气至脱硫在界区给汽，往稳定塔吹扫。

6）The condensate of D-641 is discharged on the spot. After the oil is observed, it should be discharged to the underground light slop oil tank.

D-641的冷凝水就地排放，见油后排至地下轻污油罐。

7）After the purging of line, steam from the bottom of the stabilizer to the steam tower, and drain from the bottom vent of the tower. After seeing the oil, it should be discharged to the underground light slop oil tank.

扫线结束后，稳定塔底给汽蒸塔，塔底放空打开排水，见油后排至地下轻污油罐。

8）Drain E-640RS at the low point, after seeing the oil, discharge to underground light slop oil tank.

E-640RS低点导淋排水，有油排至地下轻污油罐。

9）When the E-645 is purged, the E-645 delivery line should be purged at first and switched to E-645 at the end of the purge. At the same time, line up the other side (stabilizer naphtha)(or simultaneously with the other side) to prevent pressure building up.

E-645吹扫时先走付线，吹扫末期改进E-645，E-645吹扫时，另一侧（稳定石脑油）要保持流程畅通（或与另一侧同时吹扫），防止憋压。

（6）Stabilized naphtha line

稳定石脑油线



**Figure 49**　**Purge flow diagram for naphtha line of stabilizer**

**图49　稳定石脑油线吹扫置换流程图**

Note:

说明：

1）Steam the stabilizer from the bottom of the tower. Stabilized naphtha to the reforming and tank farm should be supplied with steam respectively and purge to the absorber.

稳定塔底给汽，稳定石脑油至重整和罐区分别给汽，往吸收塔吹扫。

2）The fan for the air cooler A-640AB must be stopped when purging. If the temperature is too low to the purge, the A-640AB should be purged one by one.

吹扫时空冷A-640AB必须听风机，如遇冷后温度度，吹扫困难，A-640AB应逐台吹扫。

3）When the E-645 and E-635 are purged, start from the delivery line purging, and switch to the main line purging, and open the drain at E-640WX circulating water side to prevent pressure building up of the heat exchanger and the cooler.

E-645和E-635吹扫时先吹扫付线，吹扫末期走正线，E-640WX循环水侧导淋倒开，须防止换热器和冷却器憋压。

2.5.2.9　Tower washing　洗塔

The steam purging of the light ends recovery unit and tower steaming is completed, each tower is required to wash with water. The purpose of the tower washing is, firstly, to wash the residual oil on the tray, and secondly, to low the temperature of the tower to create conditions for the passivation.

轻烃回收装置蒸汽吹扫结束，蒸塔结束后，需要各塔打水洗塔，洗塔的目的一是塔盘上的存油冲洗下来，二是将塔的温度降下来，为钝化创造条件。

When washing,

洗塔时：

（1）Water is supplied to the absorber from the overhead of pre-distillation tower and overhead of atmospheric tower, and drain the tower washing water of C-610 and discharge it to the sewage system.

吸收塔从常减压初常顶给水，打开C-610就地排空排放洗塔水，往污水系统排放。

（2）After the end of the absorber washing, the water is supplied from the bottom of the absorber, and after the absorber is filled with water, start the P-610 to wash the upper section of C-630 and discharge washing water into the sewage system.

吸收塔洗塔结束后，从吸收塔塔底给水，吸收塔装满水后，启运P-610往C-630上部洗塔，打开C-630就地排空排放洗塔水，往污水系统排放。

（3）For C-640 washing, water is supplied from P-641 inlet and sent to D-641, when D-641 is filled with water, start P-641 to wash the top of C-640 tower, and then open the C-640 to discharge in situ washing water to the sewage system.

C-640洗塔，从P-641入口给水，往D-641装水，D-641装满水后，启运P-641往C-640塔顶部洗塔，打开C-640就地排空排放洗塔水，往污水系统排放。

2.5.2.10　Passivation　钝化

The passivation scope for shutdown of light ends recovery system includes: absorber, desorption tower, stabilizer and stabilizer system, and each liquid separation drum.

轻烃回收系统停工需要钝化的范围包括：吸收塔、脱吸塔、稳定塔及稳定塔系统、各分液罐。



Dosing pump

Dosing pump

Dosing pump

**Figure 50**　**Flow diagram of passivation of each tower**

**图50　各塔钝化流程图**

1）Develop the passivation operation scheme and organize personnel to learn.

编制钝化方案，组织人员学习。

2）The tower that needs to be passivated should be purged and be free of oil.

需要钝化的塔罐吹扫干净，不含油。

3）As shown in the figure, the relevant pipeline should be removed, and the temporary pipeline (the dotted line in the figure) is used to connect the bottom pump and the overhead return line to establish a circulation process.

如图，拆除相关管线，采用临时管线（图中虚线部分）将塔底泵和塔顶回流线连接，建立循环流程。

4）The temporary dosing pump is supplied by the passivator manufacturer and connected according to the process flow in the figure.

由钝化剂厂家提供临时加药泵，并按图中流程连接。

5）According to the scheme, the passivation solution is prepared and pumped into the tower through the dosing pump. After the liquid level is established, the relevant pump is started to establish a cycle.

按照方案配置好钝化剂溶液，通过加药泵打入塔中，建立液位后，启运相关机泵，建立循环。

6）In the passivation process, the color change of the passivator is checked, and the passivation effect is determined according to the color change of the passivator.

钝化过程，检查钝化剂的颜色变化，根据钝化剂的颜色变化确定钝化效果。

7）During the passivation process, passivator should be added depending on the passivation situation.

钝化过程根据钝化情况补加钝化剂。

8）After the passivation is completed, the residual passivation solution is sent into D-601, D-602, D-641, D-645 for soaking.

钝化结束后，将钝化残夜打入D-601、D-602、D-641、D-645进行浸泡。

9）The residual passivation liquid is collected and processed according to the relevant requirements of the company's environmental protection.

钝化残液按照公司环保的相关要求进行收集处理。

2.5.2.11　Each fractionation tower water injection during the shutdown　停工检修过程中各分馏塔打水

In case of high temperature during the maintenance and repair, in order to prevent self-ignition of ferrous sulfide, it is necessary to inject water regularly to cool down.

停工检修过程中遇高温天气，为防范硫化亚铁自燃，需要定期打水降温。

1）The absorber is supplied with water from the overhead naphtha pump P-321 of atmospheric tower of atmospheric and vacuum unit, and the water is pumped into the tower through the absorbent line. After the water is seen at the bottom of the tower for 10 minutes, stop the water injection.

吸收塔从常减压常顶石脑油泵P-321给水，经吸收剂线往塔内打水，塔底见水10分钟后停打水。

2）The water is injected from the absorber pump P-610 to desorption tower and pumped to reflux of the upper part of the desorption tower. After the water is seen at the bottom of the tower for 10 minutes, stop the water injection.

脱吸塔从吸收塔泵P-610处给水，往脱吸塔上部回流打水，脱吸塔底见水10分钟后停打水。

3）The water is injected from the LPG pump P-641 to the stabilizer and pumped to overhead reflux of the stabilizer. After the water is seen at the bottom of the tower for 10 minutes, stop the water injection.

稳定塔从液化气泵P-641处给水，往稳定塔顶回流打水，塔底见水10分钟后停打水。

4）During the overhaul process, the temperature of each tower shall be checked regularly. When the temperature rises significantly, water injection should be performed immediately.

检修过程中定期检查各塔温度，温度明显上升后，应立即组织打水。

2.6　Judgment, cause analysis and treatment of abnormal phenomena and accidents　异常现象及事故的判断、原因分析和处理方法

2.6.1　Principle of treatment　处理原则

The measures to be taken in the event of an accident vary from accident to accident, but the general principle should be handled in the following priority order: first to ensure personal safety; secondly to ensure equipment safety; to rescue materials and products; to avoid serious damage to upstream and downstream of the plant, tank farm and utilities; and to 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 should be followed during accident handling:

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。

After the production accident, the operators, especially the foreman, must first calm down, never panic, yell and scream, and quickly organize personnel to find out the cause and location of the accident according to the phenomenon of the accident, so that the judgment is accurate. Then, on the other hand, arrange personnel to report to the superior leadership, the production scheduler, and fire brigade in a timely manner. On the other hand, accurately determine the state of the accident, arrange personnel to take all measures, and arrange the personnel to retreat to the appropriate state for operation according to the state of the accident handling and handle the accident.

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 is to ensure the safety of the person and equipment, to control the development of the situation, and to quickly resume 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 is to act according to the rules. In the process of handling accidents, strictly abide by the operating procedures, rules and regulations, and implement 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 balancing. The three balances of material, heat and pressure are used as the basis for accident treatment to control the temperature and pressure within accepted specification. Otherwise, the following operation should be performed: decrease the feed rate, decrease the temperature of re-boiler, start the air cooler, release to the flare and stop the pump and release the pressure; control the liquid level of the tower and tank not to exceed the specification, especially attention should be paid to the liquid level at the bottom of the tower. If the liquid level is low, the pump is easy to pump off. At this time, the pumping amount should be reduced or the pump should be stopped. If the liquid level is high, the tower washing should be performed, and the pumping amount should be increased in time and feed rate should be decreased until the feed is cut off. If the tank liquid level exceeds the specification, it is easy to carry or spill oil, which leads to the expansion of the situation and should be adjusted 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、抽嗤，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　Major accidents requiring emergency shutdown　需紧急停工的主要事故

2.6.2.1　Each fractionation tower leaks, causing a fire.

各分馏塔泄漏，引发着火。

2.6.2.2　The leakage of LPG pump is severe and inaccessible for personnel to stop the pump and close the valve.

液化气泵严重泄漏，人员无法靠近停泵关阀。

2.6.2.3　A leak in the main process line cause a fire.

主流程管线泄漏引发着火。

2.6.2.4　The unit is powered off and cannot be recovered in a short time.

装置停电，短时间无法恢复。

2.6.2.5　The re-boiler leaks and cannot be repaired for a short time and may cause a major accident.

重沸器泄漏，无法短时间修复，并可能引发重大事故。

2.6.2.6　The instrument air is interrupted and cannot be recovered in a short time.

仪表风中断，短时间无法恢复。

2.6.2.7　The pump at the bottom of the absorber and the pump at the bottom of the desorption tower are faulty, and the standby pump cannot be started.

吸收塔底泵、脱吸塔底泵运行泵故障，备用泵无法启运。

2.6.2.8　Major disasters such as earthquakes.

重大的灾害如地震等。

2.6.2.9　A major accident in other plant has serious influence on the safety of the device.

外装置重大事故严重本装置安全。

2.6.3　Emergency shutdown measures　紧急停工处理方法

In the production of the plant, when encountering a sudden major accident, the plant is difficult to control, in order to quickly control the situation, avoid the expansion and spread of the accident, protect the safety of the person and equipment, minimize losses, and quickly resume production, emergency shutdown measures can be taken decisively. The emergency shutdown procedure of this plant is:

在装置生产过程中，当遇到突发的重大事故时，装置难以控制，为了迅速控制事态，避免事故的扩大和蔓延，保护人身、设备的安全，最大限度地减少损失，迅速恢复生产，即可果断地采取紧急停工手段。本装置紧急停车程序为：

2.6.3.1　Decrease the temperature of each re-boiler, and the heat source is switched to delivery line.

各重沸器撤温，热源改走付线。

2.6.3.2　The overhead of each tower and drum is switched to the flare gas for pressure relief.

各塔顶、罐顶改火炬气泄压。

2.6.3.3　The compressor is out of service.

压缩机停运。

2.6.3.4　Cut off straight run naphtha, aviation kerosene hydrogenation and diesel hydrogenated naphtha, diesel hydrogenation and reforming pre-hydrogenated light hydrocarbon feed to the plant.

切断直馏石脑油、航煤加氢和柴油加氢石脑油、柴油加氢和重整预加氢轻烃进装置。

2.6.3.5　Cut off overhead gas of each tower to the plant.

切断各塔顶气进装置。

2.6.3.6　Cut off the absorption of dry gas to the desulfurization unit.

关闭吸收干气至脱硫装置。

2.6.3.7　Close emergency shut-off valve of each tower to prevent the pressure breakthrough of each fractionation tower.

关闭各塔底紧急切断阀，防止各分馏塔窜压。

2.6.4　Accident handling method　事故处理方法

2.6.4.1　Large amount of leakage of LPG pump　液化气泵大量泄漏

If the LPG pump leaks slightly, wear an air respirator, check the leakage at the site, stop the leaking pump, close the inlet and outlet valves, relieve the pressure to the flare gas, and switch to the standby pump. In case of a large leak of LPG pump

液化气泵轻微泄漏，应佩戴空气呼吸器，到现场检查泄漏部位，并停运泄漏的机泵，关闭出入口阀，往火炬气泄压，并切换备用泵。如遇液化气泵大量泄漏

（1）Close the D-641 tank bottom LPG emergency shut-off valve.

关闭D-641罐底液化气紧急切断阀。

（2）Close overhead reflux of the stabilizer and LPG export (LPG desulfurization).

关闭稳定塔顶回流和液化气出装置（液化气脱硫）。

（3）Dilute the leaked LPG with a mist of water sprayed by fire water cannon on the spot.

现场用消防炮打雾状水稀释泄漏的液化气。

（4）Decrease the temperature of re-boiler of stabilizer and prevent overhead temperature from overheating.

稳定塔重沸器撤温，防止塔顶温度超温。

（5）Control the overhead pressure and level of stabilizer. When the liquid level is high, immediately close the D-641 to D-602 valve and switch to the flare.

控制好稳定塔顶压力和液位，液位高时应立即关闭D-641至D-602阀门，改为放火炬。

（6）If possible, wear an air respirator and open the valve of the pump to release the pressure (note: a copper wrench should be used to prevent spark generation).

如有可能应佩戴空气呼吸器，打开机泵排火炬的阀门泄压（注意：应使用铜扳手，防止火花生成）。

（7）The repair plan is determined based on the location of the leak. Resume the operation after the repair.

根据泄漏的部位确定检修方案。检修好后恢复操作。

2.6.4.2　D-641 leakage　D-641泄漏

The parts of the Stabilizer OVHD Reflux and Product Drum D-641 that are easy to leak are the on-site liquid level gauge, instrument tapping, small tank nozzle, etc. If the on-site level gauge breaks, the air breathing apparatus should be worn to close the valve of the liquid level gauge. In case of a large amount of leakage of D-641, if the leakage medium is LPG, the following measures should be taken:

稳定塔顶回流罐D-641容易泄露的部位为现场液位计、仪表接管、罐体小接管等，如是现场液位计破裂泄漏，应佩戴空气呼吸器到现场关闭液位计的阀门。如遇D-641大量泄漏，泄漏介质为液化气时，应采取以下操作措施：

（1）Start the fire water cannon immediately, spray the misty water to the leaking part of the LPG so as to dilute the leaked LPG.

立即启动消防炮，往液化气泄漏部位打雾状水，稀释泄漏的液化气。

（2）Increase the export amount of LPG and reduce the level of the D-641 to the greatest extent.

增加液化气外送量，尽量降低D-641液位。

（3）Reduce the temperature of re-boiler of stabilizer so as to decrease the temperature of stabilizer.

稳定塔重沸器撤温，降低稳定塔温度。

（4）Close the valve of the D-641 stabilizer overhead gas to the D-602, release the pressure of D-641 to the flare gas to reduce the pressure. When the LPG pump is pumped off, stop the LPG pump, and close the valve of stabilizer overhead reflux and the valve for desulfurization of the LPG.

关闭D-641稳定塔顶气至D-602的阀门，D-641往火炬气泄压，降低压力。液化气泵抽空时，停运液化气泵，关闭稳定塔顶回流和至液化气脱硫的阀门。

（5）When the top pressure of the D-641 drum is reduced to less than 0.4 MPa, the water can be supplied from the inlet of the LPG pump to increase the liquid level of the D-641 until the liquid level rises above the leaking portion.

当D-641罐顶压力降低至0.4MPa以下时，可从液化气泵入口给水，垫高D-641的液位，直至水的液位上升至泄漏部位以上。

（6）When the stabilized pressure is too low to export, P-630B should be started to export stabilized naphtha.

稳定压力低至无法外送时，应启动P-630B，将稳定石脑油外送。

（7）According to the location of the leak, determine the maintenance plan. Resume the operation after the inspection is over.

根据泄漏部位，确定检修方案。检修结束后恢复操作。

2.6.4.3　Re-boiler E-640RS leak　重沸器E-640RS泄漏

There is a large amount of leakage in the re-boiler E-640RS. There are two cases: one is that the leakage medium is the atm. PA #2, and the other is that the leakage medium is naphtha.

重沸器E-640RS大量泄漏，分两种情况：一是泄漏介质为常二中，二是泄漏介质为石脑油。

（1）leakage at atm. PA #2 side

常二中侧泄漏

1）The inlet and outlet valves of the atm. PA #2 of the leaked re-boiler should be closed immediately. If the pressure on the atm. PA #2 side is reduced and in case of sealing surface leakage (common), immediately contact the maintenance unit for fastening. After tightening, the atm. PA #2 should be put into service again.

应立即关闭泄漏重沸器的常二中进出口阀，常二中侧压力降低后，如是密封面泄漏（常见），应立即联系维保单位紧固。紧固后，重新投用常二中。

2）In case of fire caused by a large amount of leakage, fire fighting water should be used immediately to extinguish the fire. According to the fire extinguishing situation, determine whether the light ends recovery is stopped.

如大量泄漏引发着火，应立即打消防水灭火。根据灭火情况，确定轻烃回收是否停车。

（2）Naphtha side leakage

石脑油侧泄漏

1）In case of the naphtha side leakage, if it does not catch fire, immediately remove the heat source of the leaking re-boiler and close the inlet and outlet valves of the atm. PA #2. In the case of another running re-boiler, the three-way delivery line of the atm. PA #2 should not be fully opened. Open the delivery line depending on the situation, so that no flow buildup of the atm. PA #2 can be ensured and the temperature of the re-boiler can be controlled.

石脑油侧泄漏，如未着火，泄漏的重沸器应立即撤热源，关闭常二中进出阀，在另一台重沸器运行的情况下，常二中的三通付线不应全部打开，应视具体情况开付线，既确保常二中不憋量，又保证重沸器温度控制。

2）In the case of valves at the inlet and outlet of the leaking re-boiler, the inlet and outlet valves of the naphtha to the re-boiler should be immediately shut off, and release pressure to the underground light slop oil tank.

在泄漏重沸器进出口有阀的情况，应立即关闭石脑油进出重沸器的阀门，往地下轻污油罐泄压。

3）Contact the maintenance unit for re-boiler fastening.

联系维保紧固泄漏重沸器。

4）In the event of a fire caused by naphtha leakage, fire extinguishers such as fire water cannons and fire hydrants should be activated immediately.

如石脑油泄漏引发着火，应立即启动消防炮、栓等现场灭火。

5）Decrease the temperature on the atm. PA #2 side.

常二中侧撤温。

6）Close the naphtha side inlet and outlet valves. Release the pressure at the low point. Contact the maintenance unit for repairs.

关闭石脑油侧进出口阀。低点排放泄压。联系维保单位进行抢修。

7）If there is no inlet and outlet valve on the naphtha side, but if the leakage is too large and cannot be repaired on site, emergency shutdown of light ends recovery should be started.

如石脑油侧进出口没有阀门，而泄漏过大，现场无法阻止抢修的情况下，应启动轻烃回收紧急停车。

8）For the stabilizer, reduce the temperature and release the pressure. Close the valve of overhead gas to D-602, release the pressure to the flare gas. The atm. PA #2 is sent to re-boiler delivery line, close the inlet and outlet valve of the atm. PA #2 of the re-boiler.

稳定塔撤温、撤压。关闭塔顶气至D-602阀，开至火炬气泄压。常二中全部走重沸器付线，关闭重沸器常二中的进出口阀。

9）Reduce the temperature of desorption tower and cut off heat source of E-630.

脱吸塔撤温，关闭E-630热源。

10）Close the stabilizer feed. Stop the bottom pump of desorption tower.

关闭稳定塔进料。停脱吸塔底泵。

11）Contact the production scheduler to cut off materials of aviation kerosene hydrogenation, diesel hydrogenation, reforming and other units into the light ends recovery, close the battery limit valve, and stop the P-645.

联系调度停航煤加氢、柴油加氢、重整等装置进轻烃回收的物料，关闭界区阀，停运P-645。

12）Stop the compressor, D-601, D-602 tank overhead gas is switched to the flare, close the valve of absorption dry gas to desulfurization unit, and the desulfurization unit should be adjusted according to the interruption of saturated dry gas feed.

停运压缩机，D-601、D-602罐顶气改放火炬，关闭吸收干气至脱硫的阀门，脱硫装置按照饱和干气进料中断进行调整。

13）The overhead naphtha of pre-distillation tower and overhead naphtha of atmospheric tower should be switched to the tank farm, and stop feeding to the light ends recovery.

The absorber bottom pump is stopped.

初顶石脑油、常顶石脑油改至罐区，停进轻烃回收。

停运吸收塔底泵。

14）After the LPG pump is pumped off, stop the pump, close the valve to the acid gas & LPG treating unit, which should be treated according to the procedure of interruption of the saturated LPG feed. Close the reflux valve.

液化气泵抽空后，停泵，关闭至产品精制阀门，产品精制按照饱和液化气进料中断进行处理。关闭回流阀门。

15）After the stabilizer naphtha is exhausted, start the P-630B to transport oil when the pressure is insufficient.

稳定塔石脑油退尽后，压力不足时启动P-630B送油。

16）Organize repairs, and determine whether to wash towers, steam towers, etc. for the stabilizer according to the repair situation.

组织抢修，根据抢修情况确定是否对稳定塔进行洗塔、蒸塔等。

2.6.4.4　Inner leakage of re-boiler E-640RS　重沸器E-640RS内漏

Atm. PA #2 is used as the heat source of E-640RS. If there is an internal leak, the diesel reflux will mix into the stabilized naphtha, causing off-specification of the stabilizer naphtha. Because the oil color of atm. PA #1 is transparent, in case of slight leakage, it cannot be judged from the appearance and can only be confirmed by laboratory analysis.

E-640RS采用常二中作为热源，如出现内漏，常二中柴油进入稳定石脑油，造成稳定石脑油产品不合格。由于常二中油色透明，轻微内漏，从外观上无法判断，只能通过化验分析进行确认。

Method Confirmation:

确认方法：

Perform dry point analysis of mixed naphtha (naphtha from secondary processing unit, light hydrocarbons, etc. into D-645), overhead naphtha of pre-distillation tower, overhead naphtha of atmospheric tower, stabilized naphtha. If there is an abnormal rise in the stabilized naphtha dry point, and dry point of the mixed naphtha, the overhead naphtha of pre-distillation tower and the overhead naphtha of atmospheric tower are normal, it can be determined as inner leakage of E-640RS.

采混合石脑油（二次加工装置石脑油、轻烃等进D-645）、初顶石脑油、常顶石脑油、稳定石脑油分析干点，如出现稳定石脑油干点异常上升，而混合石脑油、初顶石脑油和常顶石脑油干点正常，则可确定为E-640RS内漏。

（1）Treatment method of E-640RS naphtha side with valve

E-640RS石脑油侧有阀的处理方法

1）When the laboratory analysis found that the stabilized naphtha dry point increased abnormally, contact the production scheduler to switch the stabilized naphtha into the light slop oil tank and stop the feed to the reforming and naphtha tank of tank farm.

当化验分析发现稳定石脑油干点异常上升时，联系调度，将稳定石脑油改至轻污油罐，停至重整、罐区石脑油罐。

2）Perform dry point analysis of mixed naphtha, overhead naphtha of pre-distillation tower, overhead naphtha of atmospheric tower, E-640R outlet naphtha, E-640S outlet naphtha to confirm the leaking re-boiler.

采混合石脑油、初顶石脑油、常顶石脑油、E-640R出口石脑油、E-640S出口石脑油，分析干点，确定泄漏的重沸器。

3）Close the inlet and outlet valves of atm. PA #2 to the leaking re-boiler.

关闭泄漏重沸器的常二中进出口阀门。

4）Close the inlet and outlet valves of naphtha to the leaking re-boiler.

关闭泄漏重沸器的石脑油进出口阀门。

5）The stabilizer liquid level is controlled based on the lower limit, and the contaminated naphtha should be sent to the light slop oil tank as soon as possible.

稳定塔液位按照下限控制，尽快将污染的石脑油送至轻污油罐。

6）Take sample to analyze the dry point of the stabilized naphtha. If the test result is qualified, contact the production scheduler to send the stabilized naphtha to the reforming unit or tank farm.

采样分析稳定石脑油干点，合格后，请示调度送至重整或者罐区。

（2）Treatment method of E-640RS naphtha side without valve

E-640RS石脑油侧无阀的处理方法

1）When the laboratory analysis found that the stabilized naphtha dry point increased abnormally, contact the production scheduler to switch the stabilized naphtha into the light slop oil tank and stop the feed to the reforming and naphtha tank of tank farm.

当化验分析发现稳定石脑油干点异常上升时，联系调度，将稳定石脑油改至轻污油罐，停至重整、罐区石脑油罐。

2）Perform dry point analysis of mixed naphtha, overhead naphtha of pre-distillation tower, overhead naphtha of atmospheric tower, E-640R outlet naphtha, E-640S outlet naphtha to confirm the leaking re-boiler.

采混合石脑油、初顶石脑油、常顶石脑油、E-640R出口石脑油、E-640S出口石脑油，分析干点，确定泄漏的重沸器。

3）After confirming that the re-boiler has leaked, ask the competent authority to start shutdown procedure of the light ends recovery unit.

确定是重沸器泄漏后，请示主管部门，启动轻烃回收装置停车程序。

4）Remove the heat source of the re-boiler of desorption tower and the stabilizer, and reduce the temperature and pressure of the system such as desorption and stabilization. The overhead gas of the D-641 tank to D-602 is stopped and switched to the flare.

脱吸塔、稳定塔重沸器逐步撤热源，脱吸、稳定等系统降温、降压。D-641罐顶气停至D-602，改为放火炬。

5）Stop the compressor, switch the low-pressure gas in the D-601 tank to the flare, close the process flow of absorption of dry gas to the acid gas & LPG treating unit, and in case the absorber pressure is high, vent properly to the flare.

停压缩机，将低压瓦斯在D-601罐改至火炬，关闭吸收干气至产品精制流程，吸收塔压力高可适当放火炬。

6）D-602 tank overhead switch to the flare

D-602罐顶改放火炬。

7）Contact the production scheduler, notify the aviation kerosene hydrogenation, diesel hydrogenation, reforming and other units that feeding of the dry gas, naphtha, light hydrocarbons into the light ends recovery unit should be switched to out of the light ends recovery unit, and close the valve of relevant materials to the unit.

联系调度，通知航煤加氢、柴油加氢、重整等装置，将进轻烃回收装置的干气、石脑油、轻烃等改出轻烃回收装置、关闭相关物料进装置阀门。

8）Stop the P-645 pump and cut off the process flow of mixed naphtha into the stabilizer.

停运P-645泵，切断混合石脑油进稳定塔流程。

9）The stabilizer temperature is controlled by the reflux of the top of the tower, and the stabilized LPG should be sent to the saturated LPG desulfurization as much as possible.

通过稳定塔顶回流控制好稳定塔温度，稳定液化气尽量送至饱和液化气脱硫。

10）After the stabilized LPG pump P-641 is pumped off, stop the pump immediately and close the valve to the desulfurization valve and to the reflux of the stabilizer.

稳定液化气气泵P-641抽空后，立即停泵，关闭至脱硫阀、至稳定塔回流的阀门。

11）After the C-640 pressure is reduced to 0.4 MPa, start the P-630B to continue to discharge oil to the light slop oil tank.

C-640压力降低至0.4MPa后，应启运P-630B继续往轻污油罐退油。

12）When the temperature of the desorption tower and the stabilizer is reduced to below 60 °C, the overhead naphtha of pre-distillation tower and the overhead naphtha of atmospheric tower are switched to the tank farm, and stop the feed to the light ends recovery unit.

当脱吸塔、稳定塔塔釜温度降至60℃以下时，将初顶石脑油、常顶石脑油改至罐区，停止进轻烃回收装置。

13）The atm. PA #2 of E-640RS is completely routed to the delivery line and the inlet and outlet valves of re-boiler are closed. Turn off the heated steam of the E-630R.

E-640RS常二中全部改走付线，关闭进出重沸器阀门。关闭E-630R的加热蒸汽。

14）Stop the absorber bottom pump P-610, the desorption tower bottom pump P-630, and close the outlet valves. The residual oil in the stabilizer continues to be sent to the light slop oil tank through the P-630B until it is completely delivered.

停运吸收塔底泵P-610、脱吸塔底泵P-630，并关闭出口阀。稳定塔内的存油继续通过P-630B外送至轻污油罐，直至全部送出装置。

15）Close the stabilizer feed valve.

关闭稳定塔进料阀。

16）When the D-641 pressure is reduced to 0.3 MPa, open the P-641's makeup valve to fill the D-641. After the D-641 liquid level reaches 60-80%, start the P-641 to pump washing water to the stabilizer. All the naphtha inside the tower and the re-boiler should be replaced completely.

当D-641压力降低至0.3MPa以后，打开P-641的补水阀往D-641装水。D-641液位到60-80%以后，启动P-641往稳定塔打水洗塔。将塔内和重沸器内的石脑油全部置换干净。

17）After the tower washing is finished, open the bottom vent valve of leaking re-boiler naphtha side to drain, and if there is oil, it is discharged to the underground light slop oil tank.

洗塔结束后，泄漏的重沸器石脑油侧底部放空阀打开排水，有存油则排至地下轻污油罐。

18）Purge the atm. PA #2 of the leaking re-boiler, steam the stabilizer.

泄漏的重沸器常二中侧扫线，稳定塔给蒸汽蒸塔。

19）The re-boiler is delivered for overhaul. After the overhaul, restart the light ends recovery unit according to the start-up plan.

重沸器交付检修。检修结束后，按照开工方案，重新启动轻烃回收装置开车。

2.6.4.5　Re-boiler E-630R leak　重沸器E-630R泄漏

E-630R is the bottom re-boiler of desorption tower with 1.0 MPa steam as the heat source. When the leakage medium is 1.0MPa steam, immediately contact the maintenance unit for treatment. When the leaking medium is naphtha and cannot be repaired in the field, the light ends recovery unit should be stopped.

E-630R为脱吸塔底重沸器，采用1.0MPa蒸汽作为热源。泄漏介质为1.0MPa蒸汽时，应立即联系维保单位进行处理。泄漏介质为石脑油时，现场无法抢修时，轻烃回收装置组织停车。

（1）Reduce the temperature of desorption tower and turn off the re-boiler heat source (1.0 MPa steam) .

脱吸塔撤温，关闭重沸器热源（1.0MPa蒸汽）。

（2）Reduce the temperature of stabilizer. The re-boiler E-640RS heat source atm. PA #2 is switched to delivery line and close the inlet and outlet valves.

稳定塔撤温。重沸器E-640RS热源常二中改走付线，关闭进出口阀。

（3）Stop the compressor, release the pressure of D-601, D-602 to the flare, close the valve of absorber overhead gas to the acid gas & LPG treating unit, and the acid gas & LPG treating unit is processed according to the saturated dry gas feed interruption.

停压缩机，D-601、D-602改至火炬气泄压，关闭吸收塔顶气至产品精制装置阀门，产品精制按照饱和干气进料中断进行处理。

（4）Stop the absorption bottom pump and close the desorption tower feed.

停吸收塔底泵，关闭脱吸塔进料。

（5）Contact the production scheduler to stop aviation kerosene hydrogenation, diesel hydrogenation, reformed naphtha and light hydrocarbon to the plant, close the battery limit valve, and stop the P-645.

联系调度停航煤加氢、柴油加氢、重整的石脑油和轻烃进装置，关闭界区阀，停运P-645。

（6）Overhead naphtha of atmospheric tower and overhead naphtha of pre-distillation tower are switched to tank farm, stop the feed to the light ends recovery unit.

常顶石脑油、初顶石脑油改至罐区，停进轻烃回收装置。

（7）The desorption tower bottom oil is sent to the stabilizer and stop the pump.

脱吸塔底油全部送至至稳定塔后停泵。

（8）Notify the production scheduler to stop the stabilized naphtha export. Stop the stabilizer LPG pump P-641 and close the valve of the LPG to the acid gas & LPG treating unit and reflux valve. The acid gas & LPG treating unit is treated in accordance with the interruption of the saturated LPG feed.

通知调度，停出稳定石脑油。停稳定液化气泵P-641，关闭液化气至产品精制阀门和回流阀门。产品精制装置按照饱和液化气进料中断进行处理。

（9）Release the pressure of the stabilizer. Determine whether the pressure is completely released depending on the repair situation of the E-630R.

稳定塔可撤压，根据E-630R抢修情况，确定是否完全撤压。

（10）Determine if the C-630 is further processed (washing tower, steaming tower, etc.) depending on the repair situation of the E-630R.

试E-630R抢修情况确定C-630是否进一步处理（洗塔、蒸塔等）。

2.6.4.6　Leakage of C-610 tower　C-610塔泄漏

In the event of a leak in the body of the absorber C-610, in order to avoid major safety accidents, the following measures should be taken immediately:

吸收塔C-610塔体出现泄漏时，为避免发生重大安全事故，应立即采取以下措施：

（1）The compressor should be stopped immediately, overhead gas of D-601 and D-602 should be switched to the flare gas, and the process of absorbing dry gas to the acid gas & LPG treating unit should be closed, and the tower overhead gas should be switched to the flare gas to release the pressure. Acid gas & LPG treating unit should be treated in accordance with the interruption of saturated dry gas feed.

应立即停运压缩机，D-601、D-602改至火炬气，关闭吸收干气至产品精制装置流程，塔顶改火炬气泄压。产品精制按照饱和干气进料中断进行处理。

（2）Close the valve of overhead naphtha of atmospheric tower into the C-610.

关闭常顶石脑油进C-610塔阀门。

（3）If the leak is in the lower part of the tower, the absorber naphtha is sent to the C-630 tower through P-610 completely.

如泄漏部位在塔下部，吸收塔石脑油全部通过P-610送至C-630塔。

（4）Reduce the temperature of desorption tower re-boiler to ensure that the temperature at the top of the desorption tower is not over temperature.

脱吸塔重沸器撤温，保证脱吸塔顶温度不超温。

（5）Maintain the operation of stabilizer and control the stabilizer in good condition.

维持稳定塔运行，控制好稳定塔。

（6）Determine whether the C-610 tower is further processed depending on the repair situation. To overhaul the C-610, continue with the following steps. Close the valve of D-602 dry gas to the C-610 tower.

视抢修情况确定是否，对C-610塔进一步处理。如需对C-610进行检修，继续以下步骤。

关闭D-602干气至C-610塔阀门。

（7）After the pressure of the C-610 tower is released to normal, the absorbent feed line is connected to the temporary water pipeline to flush oil stored on the tray, and drain the tower washing oil-water to the underground light slop oil tank. Since the light slop oil tank is small, the washing time and the water consumption should be controlled.

C-610塔压力撤至常压后，吸收剂进料线接临时管线打水，冲洗塔盘上的存油，洗塔油水排至地下轻污油罐。由于轻污油罐较小，应控制洗塔时间和洗塔用水量。

（8）After the tower washing is finished, drain the water in the tower, close the overhead valve to the flare, and open the vent line.

洗塔结束后，排尽塔内的存水，塔顶关闭至火炬的阀门，打开放空线。

（9）The bottom of the C-610 is supplied to steam tower.

C-610底部给蒸汽蒸塔。

（10）After the tower steaming is finished, blind the dry gas to the tower, the absorbent to the tower, absorbing dry gas to the acid gas & LPG treating unit, the safety valve, overhead withdraw, and organize the maintenance.

蒸塔结束后，干气进塔、吸收剂进塔、吸收干气至产品精制、安全阀、塔顶抽出等加装盲板，组织检修。

2.6.4.7　Naphtha containing black oil　石脑油出黑油

Stabilized naphtha containing black oil may be caused by two situations: one is the internal leakage of the heat exchanger of overhead oil/gas of atmospheric tower and crude oil; the other is that the sediment of the pre-distillation tower or atmospheric tower system is agitated to cause naphtha pollution.

稳定石脑油出黑油，可能有两种情况引起：一是常顶油气与原油的换热器内漏；二是初顶或者常顶系统的沉积物被搅动造成石脑油污染。

Take naphtha sample and rest for 10 minutes, if there is no change of the oil color, it is judged to be a leak inside the heat exchanger; if the color of the naphtha becomes light and transparent, with sediment at the bottom of the bottle, it is judged to be the overhead sediment pollution of pre-distillation tower and atmospheric tower.

采集石脑油样品，静置10分钟后，如油色无变化，则判断为换热器内漏，如石脑油颜色变轻、透明，瓶底部有沉积物则判断为初常顶的沉积物污染。

When black oil contained in the naphtha is found, the following measures should be taken immediately:

石脑油出黑油后，应立即采取以下措施：

（1）Contact the production scheduler to feed the stabilized naphtha to the light slop oil tank, and close the valve of stabilized naphtha to the reforming unit and tank farm.

联系调度，将稳定石脑油改至轻污油罐，关闭稳定石脑油至重整、至罐区的阀门。

（2）Identify the source of black oil.

查明黑油来源。

（3）If the black oil is caused by the overhead naphtha of atmospheric tower, then it should be fed to the light slop oil tank, and the light ends recovery process will be shut down. Part of the overhead naphtha of pre-distillation tower should be used as absorbent.

黑油如是常顶石脑油引起，常顶石脑油改至轻污油罐，关闭至轻烃回收流程。初顶石脑油部分该做吸收剂。

（4）If the black oil is caused by the overhead naphtha of pre-distillation tower, then it should be fed to light slop oil tank, and the light ends recovery process will be shut down.

黑油如是初顶石脑油引起，初顶石脑油改至轻污油罐，关闭至轻烃回收流程。

（5）Each fractionation tower is controlled by a low level to replace the black oil of the light hydrocarbon naphtha as soon as possible.

各分馏塔低液位控制，尽快将轻烃石脑油的黑油置换干净。

（6）Check to make sure the color of the stabilized naphtha is qualified, and then ask instructions from the production scheduler to feed the stabilized naphtha to the reformer or naphtha tank of tank farm.

检查稳定石脑油颜色合格后，请示调度，将稳定石脑油改至重整或者罐区石脑油罐。

2.6.4.8　Unqualified dry point of stabilized naphtha (dry point is higher than control specification)　稳定石脑油干点不合格（干点高于控制指标）

If the stabilized naphtha dry point is unqualified, the source of the unqualified naphtha should be immediately identified, generally caused by the following aspects: high overhead naphtha of atmospheric tower dry point, high overhead naphtha of pre-distillation tower dry point, mixed naphtha (aviation kerosene hydrogenation, diesel hydrogenation, reforming), inner leakage of stabilizer re-boiler and so on. In case of unqualified dry point of stabilized naphtha, the following measures should be taken immediately:

稳定石脑油干点不合格，应立即查明不合格石脑油的来源。一般可能由以下几个方面引起：常顶石脑油干点高、初顶石脑油干点高、混合石脑油（航煤加氢、柴油加氢、重整）、稳定塔重沸器内漏等。出现稳定石脑油干点不合格后，应立即采取以下措施：

（1）Report to the production scheduler, feed stabilized naphtha to light slop oil tank, and close the process flow to reforming unit and tank farm.

汇报调度，将稳定石脑油改至轻污油罐，关闭至重整、罐区等流程。

（2）Take samples of the overhead naphtha of pre-distillation tower, the overhead naphtha of atmospheric tower, the mixed naphtha and the re-boiler E-640RS export naphtha for analysis to determine the source of the unqualified naphtha.

采初顶石脑油、常顶石脑油、混合石脑油和重沸器E-640RS出口石脑油进行分析，确定不合格石脑油来源。

（3）For E-640RS internal leakage, see “2.6.4.4 Re-boiler E-640RS Internal Leakage” for subsequent treatment measures.

如是E-640RS内漏，后续处理措施见“2.6.4.4 重沸器E-640RS内漏”。

（4）If the dry points of overhead naphtha of pre-distillation tower and the overhead naphtha of atmospheric tower are unqualified, the follow-up treatment measures are the same as “2.6.4.7 Naphtha Containing Black Oil”.

如是初常顶石脑油干点不合格，后续处理措施同“2.6.4.7 石脑油出黑油”。

（5）If the mixed naphtha is unqualified, continue to sample and analyze to determine which material is causing it. Once determined, stop the material fed to D-645.

如是混合石脑油不合格，则继续采样分析，确定是那一股物料引起。确定后，将该股物料停止进D-645。

（6）The D-645 and C-640 liquid levels are controlled based on the lower limit so as to replace the stabilized naphtha as soon as possible.

D-645、C-640液位按照下限控制，尽快将稳定石脑油置换干净。

（7）Take sample to analyze the dry point of the stabilized naphtha, and then feed to the reforming unit or tank farm after the analysis result is qualified.

采样分析稳定石脑油干点，合格后改至重整或者罐区。

2.6.5　Plant blackout　装置停电

For the shutdown of bottom pumps, overhead fans, overhead reflux pumps and compressors due to plant blackout, if it cannot be recovered in a short time, emergency shutdown procedure should be started and performed according to this procedure.

装置停电，各塔底泵停运、塔顶风机停运、塔顶回流泵停运、压缩机停运等，如短时间无法恢复，装置需要启动紧急停车程序，按照紧急停车方式，组织装置紧急停车。

2.6.5.1　Reduce the temperature of each boiler. Route the atm. PA #2 to delivery line and close the valve of 1.0MPa steam to re-boiler.

各重沸器撤温，常二中改走付线、1.0MPa蒸汽关进重沸器阀。

2.6.5.2　Release the pressure of overhead gas of each tower and tank to the flare. Stop the compressor.

各塔顶、罐顶改火炬气泄压，压缩机停运。

2.6.5.3　Cut off straight run naphtha, aviation kerosene hydrogenation and diesel hydrogenated naphtha, diesel hydrogenation and reforming pre-hydrogenated light hydrocarbon feed to the plant.

切断直馏石脑油、航煤加氢和柴油加氢石脑油、柴油加氢和重整预加氢轻烃进装置。

2.6.5.4　Cut off overhead gas of each tower to the plant.

切断各塔顶气进装置。

2.6.5.5　Shut down the bottom pumps, LPG pumps, mixed naphtha pumps, etc., and close the pump outlet valves.

停运各塔底泵、液化气泵、混和石脑油泵等，关闭泵出口阀。

2.6.5.6　Cut off the absorption dry gas to the desulfurization unit.

关闭吸收干气至脱硫装置。

2.6.5.7　Close each tower emergency shut-off valve to prevent the pressure breakthrough of each fractionation tower.

关闭各塔底紧急切断阀，防止各分馏塔窜压。

2.6.6　Air supply outage of the plant　装置停风

When air supply of the plant is stopped, close all the air-open valves, and open all the air shutoff valves. If it cannot be recovered in a short time, the emergency shutdown procedure should be started immediately.

装置停风，所有分开阀全部关闭，所有的风关阀全部打开。装置停风，短时间无法恢复，应立即启动紧急停车程序。

2.6.6.1　Close the export valve of stabilized naphtha to prevent the high pressure oil gas from escaping to the tank farm and downstream units after the stabilizer liquid level is empty.

关闭稳定石脑油出装置阀门，防止稳定塔液位空后，高压油气窜至罐区及下游装置。

Reduce the temperature of each re-boiler, and route the heat source to delivery line.

各重沸器撤温，热源改走付线。

2.6.6.2　Release the pressure of overhead gas of each tower and tank to the flare.

各塔顶、罐顶改火炬气泄压。

2.6.6.3　The compressor is out of service.

压缩机停运。

2.6.6.4　Cut off straight run naphtha, aviation kerosene hydrogenation and diesel hydrogenated naphtha, diesel hydrogenation and reforming pre-hydrogenated light hydrocarbon feed to the plant.

切断直馏石脑油、航煤加氢和柴油加氢石脑油、柴油加氢和重整预加氢轻烃进装置。

2.6.6.5　Cut off overhead gas of each tower into the plant.

切断各塔顶气进装置。

2.6.6.6　Close the valve of absorption dry gas to the desulfurization unit.

关闭吸收干气至脱硫装置阀门。

2.6.7　Steam supply outage of the plant　装置停汽

The plant mainly uses 1.0MPa steam as the heat source of the desorption tower. When 1.0MPa steam is interrupted, the heat source of desorption tower is interrupted, the temperature of the bottom of desorption tower is rapidly reduced, the temperature and pressure at the top of the tower are correspondingly reduced, and the plant needs to be adjusted accordingly until steam supply is restored.

装置主要使用1.0MPa蒸汽作为脱吸塔热源，1.0MPa蒸汽出现中断，则脱吸塔热源中断，脱吸塔塔底温度迅速降低，塔顶温度和压力相应降低，装置需要作出相应调整，并等待恢复供气。

2.6.7.1　Reduce the overhead reflux of desorption tower depending on the overhead temperature of the desorption tower, and in the extreme case, it can be completely closed, and the bottom oil of the absorber is fed into the tower from the feed line of the desorption tower.

根据脱吸塔塔顶温度，降低脱吸塔顶回流量，极端情况下可全部关闭，吸收塔底油从脱吸塔进料线进塔。

2.6.7.2　By controlling the top pressure of the desorption tower, the pressure of the desorption tower can be appropriately reduced.

控制好脱吸塔塔顶压力，可适当降低脱吸塔压力。

2.6.7.3　To control the feed temperature of the stabilization tower, the E-645 delivery line can be appropriately opened to increase the feed temperature of the desorption tower.

控制稳定塔进料温度，可适当开大E-645付线，提高脱吸塔进料温度。

2.6.7.4　The stable top pressure is controlled. In extreme cases, the D-641 tank top can be changed to the torch to control pressure and the LPG quality.

控制好稳定塔顶压力，极端情况下可将D-641罐顶改放火炬控制压力和液化气质量。

2.6.8　Water supply outage of the plant　装置停水

The water used in the plant includes: chilled water, demineralized water, and circulating water.

装置用水包括：冷冻水、除盐水、循环水。

2.6.8.1　Chilled water outage of the plant　装置停冷冻水

The chilled water is used as cooling source for the absorber. When the chilled water is interrupted, the temperature of the absorbent rises, and the temperature of the absorber rises, resulting in a poor absorption effect, and a phenomenon that the saturated dry gas "dry gas does not dry" appears. Since the purified dry gas used as fuel gas may cause fluctuations in the calorific value of the fuel gas. However, since the saturated purified gas accounts for a small proportion of fuel gas, it has little effect on the whole factory. In the event of chilled water outage, the following adjustments should be made:

装置冷冻水用作吸收塔吸收剂的冷却源。冷冻水中断，吸收剂温度上升，吸收塔温度上升，造成吸收效果变差，出现饱和干气“干气不干”的现象。由于净化干气作为燃料气，可能引起燃料气热值波动，但是由于饱和净化干气占燃料气比例不大，对全公司影响不大。出现冷冻水中断，应进行以下几个方面的调整：

（1）Appropriately reduce the dry gas feed to prevent dry gas from liquid entrainment.

适当降低干气进料，防止干气带液。

（2）Report to the production scheduler, pay close attention to the operation changes of the heater, and adjust in time to prevent the temperature fluctuation of the heater and black smoke.

汇报调度，密切关注加热炉运行变化，及时调整，防止加热炉温度波动和冒黑烟。

（3）Resume operation after the chilled water is interrupted.

待冷冻水中断后恢复操作。

2.6.8.2　DW supply outage of the plant　装置停除盐水

The demineralized water is mainly used to spray water of the combined air cooling at the top of the stabilizer. If the demineralized water is interrupted, the temperature of the LPG will be high after cooling. The occurrence of demineralized water interruption should be adjusted from the following aspects:

装置除盐水主要用于稳定塔顶复合空冷的喷淋用水，除盐水中断，将造成液化气冷后温度高。出现除盐水中断应从以下几个方面进行调整：

（1）Strengthen the air cooling adjustment of the stabilizer, fully open air cooling, and adjust variable frequency to the highest speed.

加强稳定塔空冷调整，全开空冷，变频调速至最高。

（2）Control the overhead pressure of the stabilizer to prevent overpressure, and appropriately reduce the temperature of the re-boiler. If the downstream LPG desulfurization is affected, the export of LPG may be suspended, and vent to the flare properly when the liquid level is high.

控制稳定塔塔顶压力，防止超压，可适当降低再沸器温度，如对下游的液化气脱硫造成影响，可暂停液化气出装置，液位高后适当放火炬。

（3）Immediately connect the fire hose with fire fighting water and replenish the water to the combined air-cooled tank.

立即用消防水带接入消防水，向复合空冷水槽补水。

（4）After the demineralized water is restored, the operation is gradually resumed.

除盐水恢复逐渐恢复操作。

2.6.8.3　Circulating water supply outage of the plant　装置停循环水

The circulating water for the plant is mainly supplied for stabilized naphtha water cooler, compressor and compressor interstage water cooler. If the circulating water is interrupted, it should be adjusted from the following aspects:

装置用循环水设备主要为稳定石脑油水冷器，压缩机及压缩机级间水冷器。如循环水中断，应从以下几个方面进行调整：

（1）Stop the compressor and vent the D-601 gas to the flare.

停运压缩机，D-601瓦斯改放火炬。

（2）If the temperature of the stabilized naphtha exceeds the specification, the process of stabilized naphtha to the tank farm should be closed, and switched to direct supply for reforming unit.

如稳定石脑油温度超标，关闭稳定石脑油至罐区流程，稳定石脑油全部改为直供重整。

（3）If the liquid level of the stabilizer rises, the light hydrocarbon feed should be gradually reduced, and the straight run naphtha is switched to export.

如稳定塔液位上升，应逐渐减少轻烃进料，直馏石脑油部分改出装置。

（4）Control the pressure of the absorber.

控制好吸收塔的压力。

（5）After the circulating water is restored, the operation is gradually resumed.

循环水恢复后，逐渐恢复操作。

2.6.9　Feed interruption　进料中断

2.6.9.1　Naphtha interruption　石脑油中断

（1）If naphtha is interrupted, each naphtha and light hydrocarbon feed valve should be shut down immediately.

石脑油中断，应立即关闭各石脑油和轻烃进装置阀门。

（2）The stabilized naphtha export is turned off and switched to circulation to the absorber.

关闭稳定石脑油出装置，改为循环回吸收塔。

（3）After the naphtha feed is restored, stop the light hydrocarbons circulating and gradually =resume the process.

石脑油进料恢复后，轻烃停循环，逐渐恢复流程。

2.6.9.2　Dry gas interruption　干气中断

The dry gas interruption only affects the compressor and the absorber. When the dry gas feed is interrupted:

干气中断，仅对压缩机和吸收塔造成影响。干气进装置中断时：

（1）Shut down one compressor and the compressor inlet and outlet is switched to circulation.

停运一台压缩机，压缩机进出口改为循环。

（2）Close D-602 to C-610 valve to prevent oil gas from falling back to D-601 and D-602.

关闭D-602至C-610阀门，防止吸收油气倒窜回D-601、D-602。

（3）Close the absorption dry gas to the dry gas desulfurization process.

关闭吸收干气至干气脱硫流程。

（4）Control the pressure of the saturated dry gas desulfurization system.

控制好饱和干气脱硫系统的压力。

2.6.10　Black screen of DCS　DCS黑屏

In the event of black screen of DCS, immediately contact the instrument personnel for inspection. At the same time, the field operators check on site the following items: the liquid level of the in-situ level gauge of each tower and tank, the pressure of the local pressure gauge of each tower and drum, and check overhead bimetal thermometer of each tower is not overheated. If the DCS black screen cannot be recovered in a short time, the emergency shutdown procedure should be started.

装置出现DCS黑屏，立即联系仪表人员检查，同时外操加强现场的检查，主要检查各塔和罐的就地液位计的液位、检查各塔和罐的就地压力表的压力，检查各塔顶的双金属温度计不超温。如DCS黑屏无法在短时间内恢复，装置应启动紧急停车程序。

2.6.10.1　Reduce the temperature of the desorption tower re-boiler, and open the three-way valve delivery line of atm. PA #2 on site, and close the inlet valve of atm. PA #2 to E-640RS.

稳定塔重沸器撤温，现场打开常二中的三通阀付线，关闭常二中进E-640RS入口阀。

2.6.10.2　Reduce the temperature of the desorption tower re-boiler and close the valve of 1.0 MPa steam to the E-630R at site.

脱吸塔重沸器撤温，现场关闭1.0MPa蒸汽进E-630R的阀门。

2.6.10.3　Open the top of each tower on-site and the top of the tank to the flare valve to relieve pressure.现场打开各塔顶、罐顶至火炬气阀门泄压。

2.6.10.4　Cut off straight run naphtha, aviation kerosene hydrogenation and diesel hydrogenated naphtha, diesel hydrogenation and reforming pre-hydrogenated light hydrocarbon feed to the plant.

切断直馏石脑油、航煤加氢和柴油加氢石脑油、柴油加氢和重整预加氢轻烃进装置。

2.6.10.5　Cut off each tower gas inlet device.切断各塔顶气进装置。

2.6.10.6　Stop the compressor.停运压缩机。

2.6.10.7　Shut down the bottom pump, LPG pump, mixed naphtha pump, etc., and close the pump outlet valve.

停运各塔底泵、液化气泵、混和石脑油泵等，关闭泵出口阀。

2.6.10.8　Close the absorption dry gas to the desulfurization unit.关闭吸收干气至脱硫装置。

2.6.10.9　Close each tower emergency shut-off valve to prevent the pressure breakthrough of each fractionation tower.

关闭各塔底紧急切断阀，防止各分馏塔窜压。

**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劳动保护，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，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。

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，操作人员应坚守岗位及时汇报，听从班长统一指挥，不得惊慌失措。

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 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。

3.1.2　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 anoxygenous atmosphere, the manhole shall be opened for natural ventilation, purged and isolated with blind plate, the sample data shall be analyzed and accepted, the work permit for confined space entry shall be obtained, and qualified supervisor shall be designated.

进入含有毒有害气体或缺氧环境的有限空间内作业时，应打开人孔自然通风，并吹扫置换后价盲板隔离，采样分析数据合格，办理进入受限作业许可证，指派经过培训合格的监护人。

3.1.2.2　Reliable PPEs must be used when working in toxic and asphyxiant atmosphere.

在有中毒和窒息环境作业时，必须佩带可靠的劳动防护用品。

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.

各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，定期检测密封泄漏点，因物料改变、装置改造或操作条件发生变化致使硫化氢浓度超过所在地国家标准时，主管部门要采取相应有效的防护措施，确保生产装置区域作业环境硫化氢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。

3.1.3.9　The workers handling H2S shall periodically participate in the physical examination; the persons suffering from occupational diseases shall be requested to change working post.

从事硫化氢作业的人员，要按规定定期进行体检、对患有“职业禁忌症”的岗位人员，要按要求转换工作岗位。

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 held 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 tanks.

对易燃易爆流体贮罐进油操作，应使用防爆工具。

3.1.4.4　Filling oil from top of road tanker shall be prohibited, and the tanker shall be filled under level with loading arm. Oil products shall not be loaded in plant or tank farm.

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. 严禁穿易产生静电的服装进入易燃易爆区，不得在该区穿、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 tank farm 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.

液化石油气不准随意放空，要通过高低压火炬管网排放燃烧。

3.1.5.4　Safety education shall be performed for personnel handling LPG; emergency response procedure rehearsal shall be properly organized, recorded and filed.

对从事液化石油气作业人员定期进行安全教育，组织事故预案演练，建立记录、档案。

3.1.5.5　The plant and area handling LPG 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 storage 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.

装置内声光报警、可燃气体检测仪、便携式可燃气体检测报警仪、便携式H2S气体检测报警仪等按公司规定进行按期提交检验。

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.

进入受限空间要办理作业许可证，事先应进行有毒、氧含量及可燃气体介质分析合格后方可作业，并有专人在现场监护。

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　Sealing towers and vessels shall be carefully checked before closing the manholes to assure that there is no foreign matters left inside; the manholes must be opened for inspected if the tanks and vessels are not inspected;

封闭塔、容器的人孔时，要认真检查，保证设备内不留任何杂物；未经检查表确认的设备，已封人孔必须打开进行检查。

3.2.3　The startup purging and pressure test of towers 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 safety valve, pressure gauge, level gauge and other primary 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 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 be 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4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。

（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 storage tanks for oil, liquefied, etc., do not directly water the fire. Because oil is ligher 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 tank 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8.38兆帕时，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, halogen 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　初期火灾的扑救

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.

初期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 braches, 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、树校条、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 than 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 shows 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 storage.

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 safety 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, storage, 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 explosion proof 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, explosion proof 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。

Fist 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 will be 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。在抢救抬运过程中,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)，尤其要注意皮肤裙皱、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 month, 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%的碳酸氢纳溶液洗胃，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. During 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 an 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 halogen 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 neutralizer 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 sublimate. 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 storage 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以上，低于20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 the 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气口、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 form 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。

（3）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 storage 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

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 storage of personal protective equipment at all levels; proficient in the basics of self-rescue and mutual rescue.

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、维护保管；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.

部门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 positive pressure 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式防毒面具和正压式空气呼吸器，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, NOx 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, NOx, 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 fist 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 preperred.

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/hear 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3～5厘米，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，以便关键时候能尽快逃离现场。

（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 shake 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 on 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。

3.4　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 sewage system. It is strictly forbidden to discharge oily sewage 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 sewage 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 sewage 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小时填写污染物排放申请表，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, tanks 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。

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，应提前一周填写污染物排放申请表给环保主管部门，并按批复意见执行。

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。

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，以利于安全管理和安全操作。

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 field 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，在适当位置设置消火栓。

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.

装置停工后，按停工方案、操作法、和工艺要求切断进出物料，严格执行国家工业卫生排放标准，不允许任意排放有毒、有害物料。无火炬设施的带压易燃、易爆气体排空要缓慢进行，采取逐渐减压措施，放空管线末端必须采取防火措施。

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 assignned personnel to prevent blind plate to installed or removed from missing.

装置停工、置换、分析合格后，应按停工方案抽堵盲板流程图，将进出装置的物料管线堵上盲板，做上明显的标志。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、有害物质时，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 tank 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。

3.6.1.8　During overhauling in winter, timely drain the water in the equipment after purging, and special attention shall be paid to antifreezing.

冬季检修，停工吹扫后应及时排除积水，注意防冻。

3.6.1.9　Before the plant is overhauled, the oily sewage 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 sewage 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与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，采用污染物预报告制度。停工前一周将污染物排放种类、数量、排放方式及采取措施以报告形式上报有关主管部门。

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 tanks 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 tank farm, and motor vehicle enters production facilities and tank farm, 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 at will.

作业区内，凡生产建设等工作需要使用明火（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，办理用火申请手续，并经有关部门批准。严禁随意用火。

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.

用火应严格执行用火制度，做到“四不用火”，即用火票未经签发不用火，用火票的安全措施没有落实不用火，用火部位、时间与用火票不符不用火，监护人不在场不用火。

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.

看火人应选派责任心强、熟悉生产流程和现场情况的人员担任。看火人必须时刻掌握用火现场及周围情况，检查防火措施。如发现异常情况，要及时采取措施或停止用火。必要时，看火人有权要求停止用火。

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、部位用火。

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:

用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 tanks 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 light oil 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 be19.5 %~23.5%(v).

爆炸下限＞10%（v）的可燃气体（蒸汽）,其浓度＜1%（v）为合格；爆炸下限＞4%（v）的可燃气体（蒸汽）,其浓度＜0.5%（v）为合格；爆炸下限＜4%（v）的可燃气体（蒸汽）,其浓度＜0.2%（v）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%（v）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 H2S media, H2S gas analysis is required, and the H2S level shall be ≯ 10 mg/m3.

进入容器作业，要办理进罐、入塔作业票。对盛装含有H2S介质的容器，要做H2S气体分析，H2S含量要求≯10mg/m3。

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.

高空用火，要用石棉布等挡好火星，防止向外飞溅。遇有5级以上大风，必须停止用火。

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 no 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.

禁止向地面、地沟、下水道和空气中排放油品、瓦斯、液态烃、酸性污水等可燃物。

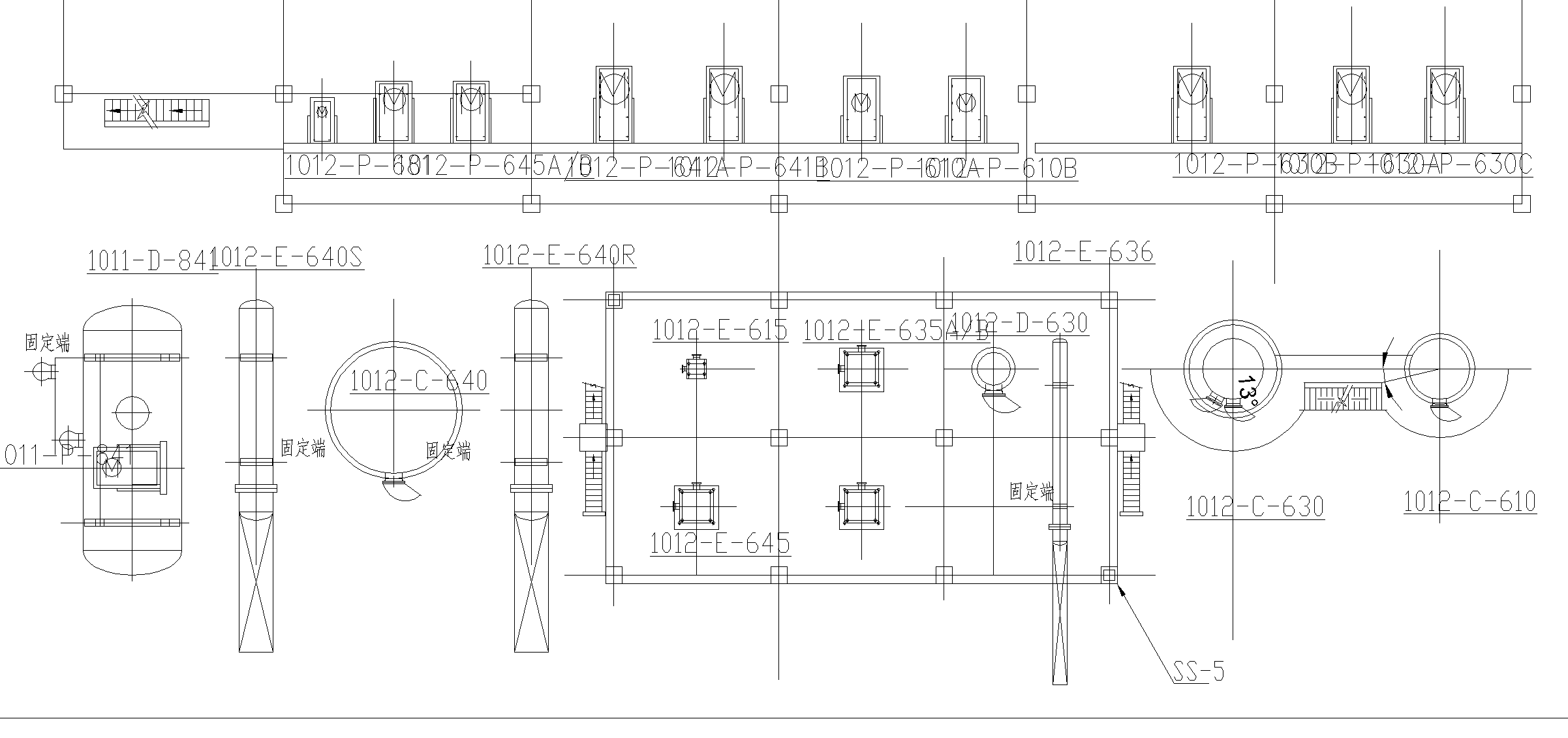
3.6.3.15　The temporary lighting voltage shall not exceed 36V. The running lights must be provided with protective cover, and the wires are well insulated. The lamp voltage must not exceed 12V in particularly humid locations or in metal vessel. All electrical works in the plant shall be the responsibility 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　Attachment　附件**

Attachment 1　Layout plan

附件1　平面布置图

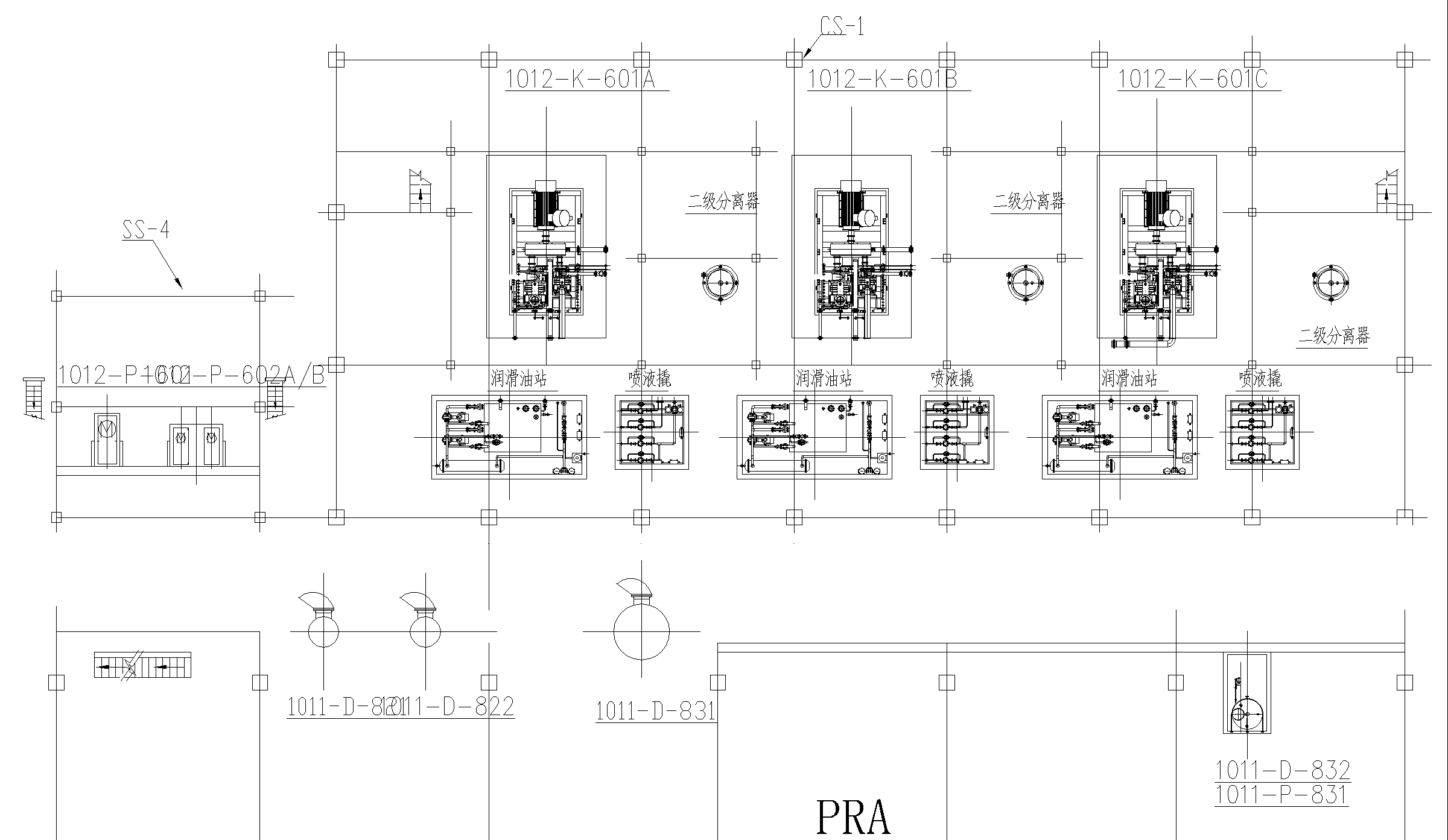


Fixed end

Fixed end

Fixed end

Fixed end



Lubricating station

Liquid injection skid

Lubricating station

Liquid injection skid

Liquid injection skid

Lubricating station

Secondary separator

Secondary separator

Secondary separator

Attachment 2　Start-up and shutdown blind plant list

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Hengyi Industries SdnBhd | | | | | | | | | | | | |
| Blind plate confirmation form of plant start-up and shutdown | | | | | | | | | | | | |
| Record number |  | | | | | Department | | No.1 department of refinery | | | | |
| Plant name | | | Light ends recovery | | | Service time | |  | | | Start-up/shut down | Installed before start-up/removed before shutdown | | |
|  | | |  | | |  | |  | | |  |  | | |
| Serial number | Position | | | No. | Specification  (diameter/pressure) | | Installation time | | Confirmed by  (signature) | | Removal time | | Confirmed by  (signature) | Remarks |
| 1 | Valve downstream of overhead gas of kerosene hydrogenation unit to battery limit | | | P-067003 | Dg150 Pg20 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 2 | Valve downstream of overhead gas of diesel hydrogenation unit to battery limit | | | P-067004 | Dg150 Pg20 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 3 | Valve downstream of overhead gas of reforming pre-hydrogenation tower to battery limit | | | P-067005 | Dg100 Pg50 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 4 | Valve downstream of overhead gas of kerosene hydrogenation naphtha to battery limit | | | P-067103 | Dg40 Pg50 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 5 | Valve downstream of naphtha of diesel hydrogenation unit to battery limit | | | P-067104 | Dg100 Pg50 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 6 | Valve downstream of hydrocarbon of diesel hydrogenation unit to battery limit | | | P-067105 | Dg40 Pg50 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 7 | Valve downstream of hydrocarbon containing sulfur of reforming unit to battery limit | | | P-067106 | Dg50 Pg50 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 8 | Valve downstream of unqualified LPG of tank farm to battery limit | | | P-067111 | Dg50 Pg50 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |
| 9 | Valve downstream of absorber overhead gas to battery limit of dry gas desulfurization unit | | | P-061001 | Dg150 Pg20 | | Lineup before start-up | |  | | Blind before shutdown | |  |  |

Attachment 2(continued)　Start-up and shutdown blind plant list

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Hengyi Industries SdnBhd | | | | | | | | | | | |
| Blind plate confirmation form of plant start-up and shutdown | | | | | | | | | | | |
| Record number |  | | | | | Department | | No.1 department of refinery | | | |
| Plant name | | | Light ends recovery | | | Service time | |  | | | Start-up/shut down | Installed before start-up/removed before shutdown | |
|  | | |  | | |  | |  | | |  |  | |
| Serial number | Position | | | No. | Specification  (diameter/pressure) | | Installation time | | Confirmed by  (signature) | | Removal time | Confirmed by  (signature) | Remarks |
| 10 | Valve downstream of overhead oil of pre-distillation tower to battery limit | | | P-067101 | Dg200 Pg50 | | Lineup before start-up | |  | | Blind before shutdown |  |  |
| 11 | Valve downstream of overhead oil of atmospheric tower to battery limit | | | P-067102 | Dg250 Pg50 | | Lineup before start-up | |  | | Blind before shutdown |  |  |
| 12 | Valve upstream of LPG export to LPG desulfurization unit | | | P-064601 | Dg100 Pg50 | | Lineup before start-up | |  | | Blind before shutdown |  |  |
| 13 | Valve upstream of stabilized naphtha export to reforming pre-hydrogenation unit | | | P-063102 | Dg300 Pg50 | | Lineup before start-up | |  | | Blind before shutdown |  |  |
| 14 | Valve upstream of stabilize naphtha export to tank farm | | | P-064703 | Dg300 Pg50 | | Lineup before start-up | |  | | Blind before shutdown |  |  |
| 15 | Valve upstream of purging steam to D-601 bottom | | | LS-060102 | Dg40 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 16 | Valve upstream of purging nitrogen to D-601 bottom | | | NG-060103 | Dg25 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 17 | Valve upstream of purging steam to D-602 bottom | | | LS-060403 | Dg40 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 18 | Valve upstream of purging nitrogen to D-602 bottom | | | NG-060403 | Dg25 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 19 | Valve upstream of purging steam to C-610 bottom | | | LS-061001 | Dg80 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 20 | Valve upstream of purging nitrogen to C-602 bottom | | | NG-061002 | Dg50 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 21 | Valve upstream of purging steam to C-630 bottom | | | LS-063201 | Dg80 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 22 | Valve upstream of purging nitrogen to C-630 bottom | | | NG-063201 | Dg50 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |

Attachment 2(continued)　Start-up and shutdown blind plant list

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Hengyi Industries SdnBhd | | | | | | | | | | | |
| Blind plate confirmation form of plant start-up and shutdown | | | | | | | | | | | |
| Record number |  | | | | | Department | | No.1 department of refinery | | | |
| Plant name | | | Light ends recovery | | | Service time | |  | | | Start-up/shut down | Installed before start-up/removed before shutdown | |
|  | | |  | | |  | |  | | |  |  | |
| Serial number | Position | | | No. | Specification  (diameter/pressure) | | Installation time | | Confirmed by  (signature) | | Removal time | Confirmed by  (signature) | Remarks |
| 23 | Valve upstream of E-630R shell pass bottom to light slop tank E-630R | | | SB-063301 | Dg50 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 24 | Purging steam to C-640 | | | LS-064101 | Dg80 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 25 | Valve upstream of purging nitrogen to C-640 bottom | | | NG-064101 | Dg80 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 26 | Purging steam of E-640R tube pass E-640R | | | LS-064201 | Dg40 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 27 | Purging steam of E-640S tube pass E-640S | | | LS-064201 | Dg40 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 28 | Valve upstream of E-640RS shell pass bottom to light slop line E-640RS | | | SB-064201 | Dg50 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 29 | Valve upstream of purging steam to D-641 bottom | | | LS-064403 | Dg40 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 30 | Valve upstream of purging steam to D-645 bottom | | | LS-064803 | Dg40 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 31 | Valve upstream of start-up water to P-322A | | | 1011-PW-034001 | Dg200 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 32 | Purging nitrogen of D-301 overhead gas of atmospheric tower outlet line to light ends recovery unit | | | 1011-NG-033101 | Dg40 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 33 | Purging nitrogen of D-201 overhead gas of atmospheric tower outlet line to light ends recovery uni | | | 1011-NG-023101 | Dg40 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 34 | Valve upstream of purging nitrogen of kerosene hydrogenation unit overhead gas to battery limit | | | NG-067001 | Dg150 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |

Attachment 2(continued)　Start-up and shutdown blind plant list

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Hengyi Industries SdnBhd | | | | | | | | | | | |
| Blind plate confirmation form of plant start-up and shutdown | | | | | | | | | | | |
| Record number |  | | | | | Department | | No.1 department of refinery | | | |
| Plant name | | | Light ends recovery | | | Service time | |  | | | Start-up/shut down | Installed before start-up/removed before shutdown | |
|  | | |  | | |  | |  | | |  |  | |
| Serial number | Position | | | No. | Specification  (diameter/pressure) | | Installation time | | Confirmed by  (signature) | | Removal time | Confirmed by  (signature) | Remarks |
| 35 | Valve upstream of purging nitrogen of diesel hydrogenation unit overhead gas to battery limit | | | NG-067002 | Dg150 Pg20 | | Blind before start-up | |  | | Lineup before shutdown |  |  |
| 36 | Valve upstream of purging nitrogen of reforming pre-hydrogenation unit overhead gas to battery limit | | | NG-067003 | Dg100 Pg50 | | Blind before start-up | |  | | Lineup before shutdown |  |  |

附件2　开停工盲板一览表

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | 恒逸实业（文莱）有限公司 | | | | | | | | | | | | |
| 装置开停工盲板确认登记表 | | | | | | | | | | | | |
| 记录编号 |  | | | | | 使用单位 | | 炼油一部 | | | | |
| 装置名称 | | | 轻烃回收 | | | 使用时间 | |  | | | 开工/停工 | 开工前加/停工前拆 | | |
|  | | |  | | |  | |  | | |  |  | | |
| 序号 | 盲板位置 | | | 编号 | 盲板规格  （直径/压力） | | 安装时间 | | 确认人员  （签名） | | 拆除时间 | | 确认人员  （签名） | 备注 |
| 1 | 煤油加氢装置塔顶气进装置界区阀后 | | | P-067003 | Dg150 Pg20 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 2 | 柴油加氢装置塔顶气进装置界区阀后 | | | P-067004 | Dg150 Pg20 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 3 | 重整预加氢塔顶气进装置界区阀后 | | | P-067005 | Dg100 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 4 | 煤油加氢石脑油进装置界区阀后 | | | P-067103 | Dg40 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 5 | 柴油加氢装置石脑油进装置阀后 | | | P-067104 | Dg100 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 6 | 柴油加氢装置轻烃进装置界区阀后 | | | P-067105 | Dg40 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 7 | 重整装置含硫轻烃进装置界区阀后 | | | P-067106 | Dg50 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 8 | 罐区不合格液化气进装置界区阀后 | | | P-067111 | Dg50 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 9 | 吸收塔顶气至干气脱硫装置界区阀后 | | | P-061001 | Dg150 Pg20 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 10 | 初顶油进装置界区阀后 | | | P-067101 | Dg200 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 11 | 常顶油进装置界区阀后 | | | P-067102 | Dg250 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 12 | 液化气出装置界区至液化气脱硫装置阀前 | | | P-064601 | Dg100 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 13 | 稳定石脑油出界区至重整预加氢阀前 | | | P-063102 | Dg300 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |

附件2（续）　开停工盲板一览表

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | 恒逸实业（文莱）有限公司 | | | | | | | | | | | | |
| 装置开停工盲板确认登记表 | | | | | | | | | | | | |
| 记录编号 |  | | | | | 使用单位 | | 炼油一部 | | | | |
| 装置名称 | | | 轻烃回收 | | | 使用时间 | |  | | | 开工/停工 | 开工前加/停工前拆 | | |
|  | | |  | | |  | |  | | |  |  | | |
| 序号 | 盲板位置 | | | 编号 | 盲板规格  （直径/压力） | | 安装时间 | | 确认人员  （签名） | | 拆除时间 | | 确认人员  （签名） | 备注 |
| 14 | 稳定石脑油出界区至罐区阀前 | | | P-064703 | Dg300 Pg50 | | 开工前通位 | |  | | 停工前盲位 | |  |  |
| 15 | 蒸汽扫线进入D-601罐底阀前 | | | LS-060102 | Dg40 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 16 | 氮气扫线进入D-601罐底阀前 | | | NG-060103 | Dg25 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 17 | 蒸汽扫线进入D-602罐底阀前 | | | LS-060403 | Dg40 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 18 | 氮气扫线进入D-602罐底阀前 | | | NG-060403 | Dg25 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 19 | 蒸汽扫线进入C-610塔底阀前 | | | LS-061001 | Dg80 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 20 | 氮气扫线进入C-610塔底阀前 | | | NG-061002 | Dg50 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 21 | 蒸汽扫线进入C-630塔底阀前 | | | LS-063201 | Dg80 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 22 | 氮气扫线进入C-630塔底阀前 | | | NG-063201 | Dg50 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 23 | E-630R壳程底部至清污油罐阀前 | | | SB-063301 | Dg50 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 24 | 蒸汽扫线进入C-640塔 | | | LS-064101 | Dg80 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 25 | 氮气扫线进入C-640塔底阀前 | | | NG-064101 | Dg80 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 26 | E-640R管程蒸汽扫线 | | | LS-064201 | Dg40 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |

附件2（续）　开停工盲板一览表

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | 恒逸实业（文莱）有限公司 | | | | | | | | | | | | |
| 装置开停工盲板确认登记表 | | | | | | | | | | | | |
| 记录编号 |  | | | | | 使用单位 | | 炼油一部 | | | | |
| 装置名称 | | | 轻烃回收 | | | 使用时间 | |  | | | 开工/停工 | 开工前加/停工前拆 | | |
|  | | |  | | |  | |  | | |  |  | | |
| 序号 | 盲板位置 | | | 编号 | 盲板规格  （直径/压力） | | 安装时间 | | 确认人员  （签名） | | 拆除时间 | | 确认人员  （签名） | 备注 |
| 27 | E-640S管程蒸汽扫线 | | | LS-064201 | Dg40 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 28 | E-640RS壳程底部进入清污油线阀前 | | | SB-064201 | Dg50 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 29 | 蒸汽扫线进入D-641罐底阀前 | | | LS-064403 | Dg40 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 30 | 蒸汽扫线进入D-645罐底阀前 | | | LS-064803 | Dg40 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 31 | 开工用水进入P-322A泵阀前 | | | 1011-PW-034001 | Dg200 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 32 | 氮气扫线进入D-301常顶气出口线至轻烃回收装置 | | | 1011-NG-033101 | Dg40 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 33 | 氮气扫线进入D-201常顶气出口线至轻烃回收装置 | | | 1011-NG-023101 | Dg40 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 34 | 煤油加氢塔顶气进装置界区氮气扫线阀前 | | | NG-067001 | Dg150 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 35 | 柴油加氢塔顶气进装置界区氮气扫线阀前 | | | NG-067002 | Dg150 Pg20 | | 开工前盲位 | |  | | 停工前通位 | |  |  |
| 36 | 重整预加氢塔顶气进装置界区氮气扫线阀前 | | | NG-067003 | Dg100 Pg50 | | 开工前盲位 | |  | | 停工前通位 | |  |  |