PMB PROJECT GENERAL COMMISSIONING PLAN

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

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PMB Project General Commissioning Plan

PMB 项目总体试车方案

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1 General Project Overview 工程总体概况

1.1 Overview of Project 工程概况

1.1.1 Company Profile 公司简介

1.1.1.1 The Hengyi (Brunei) PMB Petrochemical Project (referred to as this project) is located on Pulau Muara Besar (PMB) in the Muara Area of Brunei Darussalam, with a planned investment of USD 3.445 Billion and covering an area of approximately 260 hectares.
中国浙江恒逸（文莱）PMB 石油化工项目(简称本项目)建设在摩拉区的大摩拉（简称 PMB）岛，项目计划投资 34.45 亿美元，占地面积约 260 公顷。
1.1.1.2 In 2011, His Majesty the Sultan of Brunei Darussalam approved the development of the petrochemical project on Pulau Muara Besar (PMB). In April 2012, Hengyi Industries Sdn. Bhd. was established, with Hengyi Petrochemical Company holding 70% of the shares, and Brunei Damai holding 30% of the shares.
2011 年文莱苏丹陛下批准恒逸石化在大摩拉岛建设石化项目。2012 年 4 月，恒逸实业（文莱）有限公司（Hengyi Industries SDN BHD）成立，恒逸石化占 70%股份，文莱 Damai 占 30%股份。
1.1.1.3 The designed crude oil processing capacity of this petrochemical project is 8.0 MMTA, and it is capable of producing 1.5 MMTA of para-xylene upon completion of its construction. The construction of the project includes the construction of 14 new sets of production units, corresponding jetties, storage and transportation, power plant, utilities, central control room, office, and other auxiliary systems.
本项目设计一次原油加工能力为 800 万吨/年，建成后可产 150 万吨/年对二甲苯。项目建设工程内容包括新建 14 套工艺生产装置以及相应的码头、储运、热电、公用工程、中心控制、办公等配套系统工程。

1.1.2 Introduction of Production Units 生产装置简介

1.1.2.1 The processing capacities, technical routes and technology sources of the main production units are shown in Table 1 – 1. 主要生产装置规模、技术路线和技术来源见表 1-1。

Table 1 – 1 Processing Capacities, Technical Routes and Technology Sources of Main Production Units

表 1-1 主要生产装置规模、技术路线和技术来源

No. 序号	Name of Production Unit 装置名称	Processing capacity (10^4 tonnes/year) 规模（万吨/年）	Technical route 技术路线	Source of technology 技术来源
1	Atmospheric and Vacuum Distillation 常减压	800	Electric Desalting → Pre-Distillation Column → Atmospheric Column → Vacuum Column 电脱盐→初塔→常压塔→减压塔	SEI (Sinopec Engineering Incorporation)
2	Light Ends Recovery 轻烃回收	235	Adopts three-column process flow: Gas Compression – Absorber – Desorber – Stabilizer 采用气体压缩-吸收塔-脱吸塔-稳定塔三塔流程	SEI (Sinopec Engineering Incorporation)
3	Acid Gas and LPG Ends Recovery 产品精制	31	Conventional MDEA Amine Desulfurization / Fiber Membrane Contacting 常规 MDEA 胺法脱硫/纤维膜接触	Zhongyi Petrochemical Technology 中一石科
4	Kerosene Hydrotreating 煤油加氢精制	130	Conventional technical process 常规	UOP (Universal Oil Products)
5	Diesel Hydrotreating 柴油加氢精制	220	Liquid Phase Diesel Hydrotreating Technology 液相加氢	RIPP and SEI RIPP 和 SEI （Research Institure of Petroleum Processing）
6	Hydrocracking 加氢裂化	220	Conventional technical process 常规	UOP (Universal Oil Products)
7	LPG Fractionation 气体分馏	60	Three-column process flow 三塔流程	LPEC (Luoyang Petrochemical

No. 序号	Name of Production Unit 装置名称	Processing capacity (10^4 tonnes/year) 规模（万吨/年）	Technical route 技术路线	Source of technology 技术来源
				Engineering Corporation)
8	Aromatics Complex 芳烃联合	150	Patented Technology 专利技术	UOP (Universal Oil Products)
9	Light Naphtha Isomerization 轻石异构化	110	Patented Technology 专利技术	UOP (Universal Oil Products)
10	PSA PSA 氢气提纯	180000Nm^3/h	Pressure Swing Adsorption Technology 变压吸附	Sichuan Tianyi Science & Technology 四川天一
11	Flexicoking 灵活焦化	100	Patented Technology 专利技术	EMRE (Exxonmobil Research and engineering Com pany)
12	Sulfur Recovery and Tail Gas Treatment 硫磺回收	6+6	Sulfur Production + Tail Gas Treatment 制硫＋尾气处理	ZPEC (ZHENHAI Petrochemical Engineering Corporation)
13	Sour Water Stripping 酸性水汽提	180t/h	Single Column Low Pressure Stripping Technology 单塔低压汽提工艺	ZPEC
14	Solvent Regeneration Unit 溶剂再生	500t/h	Conventional Stripping Technology 常规汽提	ZPEC

1.1.2.2 Atmospheric and Vacuum Distillation 常减压装置

（1）The production capacity of Atmospheric and Vacuum Distillation Unit is 8.0 MMTA. It is designed for processing Brunei Light Oil, Qatar Crude Oil, Iran Condensate and Qatar Condensate at the ratio of 3:3.3:1:0.7, with 8400 annual operating hours (similarly hereinafter). 生产规模 800 万吨/年，设计加工原油为文莱轻油：卡塔尔原油：伊朗凝析油：卡塔尔凝析油＝

3:3.3:1:0.7 设计，年开工时数 8400 小时（下同）。

（2）This production unit adopts the following processing route: crude oil pretreatment via two-stage electric desalting, pre-distillation, atmospheric distillation, and vacuum distillation. The atmospheric distillation section adopts SEI's crude oil atmospheric distillation technique; the vacuum distillation section adopts SEI's second generation deep-cut vacuum distillation technique; the energy recovery system adopts comprehensive analysis technology of SEI's energy utilization system; the technical and product support of electric desalting technology for crude oil pretreatment is provided by the patent holding company to ensure that the crude oil contains ≯3mg NaCl/l of salt, ≯0.2% of water while its wastewater contains ≯150ppm of oil after electric desalting.

该装置采用二级电脱盐的原油预处理设施并经过初馏-常压蒸馏-减压蒸馏的工艺加工路线。常压蒸馏部分采用 SEI 原油常压蒸馏流程技术；减压蒸馏部分采用 SEI 第二代减压深拔技术；能量回收采用了 SEI 全装置能量利用系统综合分析技术；原油预处理设施的电脱盐技术由专利商提供技术和产品支持，保证原油脱后含盐≯3mgNaCl/l，含水≯0.2%，电脱盐排水含油≯150ppm 的要求。

1.1.2.3 Light Ends Recovery Unit 轻烃回收装置

The processing capacity of Light Ends Recovery Unit is 2.35 MMTA. Its feedstocks are light hydrocarbons and naphtha from Atmoshpheric and Vacuum Distillation Unit, Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit and Naphtha Hydrotreating Unit. This unit adopts three-column process flow, gas compression – absorber – desorber – stabilizer, to mainl produce dry gas, LPG and naphtha.

轻烃回收装置生产规模 235 万吨/年，以常减压、煤油加氢、柴油加氢、石脑油预加氢的轻烃和石脑油为原料，采用气体压缩-吸收塔-脱吸塔-稳定塔三塔流程，主要产品有干气、液化气、石脑油。

1.1.2.4 Acid Gas and LPG Ends Recovery Unit 产品精制装置

（1）The feedstocks of Acid Gas and LPG Ends Recovery Unit are dry gas and LPG from Light Ends Recovery Unit, dry gas and LPG from Flexicoking Unit, and dry gas recovered in the flare gas holder. The production unit includes Dry Gas and LPG Desulfurization Section, LPG Sweetening Section and Utilities Section.

产品精制原料为轻烃回收的干气、液化气，灵活焦化装置的干气、液化气及火炬气柜回收的干气，装置包括气体及液化气脱硫部分、液化气脱硫醇部分及公用工程部分。

（2）The Dry Gas and LPG Desulfurization Section adopts the MDEA amine desulfurization technique while the LPG Sweetening Section adopts the fiber membrane contacting technique of Ningbo Zhongyi Petrochemical Technology Co., Ltd.

装置的气体、液化气脱硫部分采用 MDEA 醇胺法脱硫工艺。液化气脱硫醇采用宁波中一石化科技有限公司的纤维膜接触技术。

1.1.2.5 The Atmospheric and Vacuum Unit, Light Ends Recovery Unit, and Acid Gas and LPG Ends Recovery Unit form a complex collectively. Sinopec Engineering Incorporation (SEI) is

responsible for the basic design, Luoyang Petrochemical Engineering Corporation (LPEC) is responsible for the detailed design, while China Construction Installation Engineering Co., Ltd. is responsible for the installation of the complex.

常减压、轻烃回收、产品精制为联合装置，由中国石化工程建设有限公司（简称 SEI）负责基础设计，中石化洛阳工程公司（LPEC）负责详细设计，中建安装负责工程安装。

1.1.2.6 1.3 MMTA Kerosene Hydrotreating Unit 130 万吨/年煤油加氢精制装置

The Kerosene Hydrotreaing Unit utilizes ART hydroprocessing catalyst and SEI's hydrodesulfurization technology. Its feedstock is straight-run kerosene from the Atmospheric and Vacuum Distillation Unit. In the presence of hydrogen and catalyst, impurities are removed from its feedstock and thus, reducing the acid value and improving the colour of kerosene in order to produce jet fuels that meet the European standard. The production unit consists of the reaction section and fractionation section, with a common utility system shared with the Diesel Hydrotreating Unit.

本装置采用 ART 公司加氢催化剂和 SEI 加氢脱硫工艺技术，以常减压装置的直馏煤油为原料，在氢气以及催化剂的作用下，脱除原料中的杂质，降低煤油酸值，改善颜色，生产符合欧五标准的喷气燃料产品；装置由反应和分馏两部分组成，与柴油加氢共用一套公用工程系统。

1.1.2.7 2.2 MMTA Diesel Hydrotreating Unit 220 万吨/年柴油加氢精制装置

The Diesel Hydrotreating Unit adopts the liquid phase diesel hydrotreating technology, which is jointly developed by Sinopec Engineering Incorporation and Sinopec Research Institute of Petroleum Processing. Its feedstocks are straight-run diesel, coker naptha and coker diesel while its main product is low-sulfur diesel with sulfur content less than 10ppm and a small amount of naphtha as by-product. This unit consists of reaction section, fractionation section, cold low-pressure separator (CLPS) vapour desulfurization section, and utilities.

本装置采用中国石化工程建设有限公司与中国石化石油化工科学研究院联合开发的液相柴油加氢技术，以直馏柴油和焦化石脑油、焦化柴油为原料，主要生产硫含量不大于 10ppm 的超低硫精制柴油，副产少量石脑油；装置主要由反应、分馏、低分气脱硫及公用工程等部分组成。

1.1.2.8 2.2 MMTA Hydrocracking Unit 220 万吨/年加氢裂化装置

This unit adopts single stage recycle hydrocracking technology of UOP. The feedstocks are straight-run diesel, straight-run vacuum gas oil (VGO) and coker VGO while its main product is heavy naphtha and by-products being LPG and light naphtha. This unit consists mainly of reaction section and fractionation section.

本装置采用 UOP 公司单段全循环加氢裂化技术，以直馏柴油、直馏蜡油、焦化蜡油为原料，主产品为重石脑油，副产品为液化气、轻石脑油；装置主要由反应、分馏等部分组成。

1.1.2.9 The Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit and Hydrocracking Unit form a complex collectively. SEI is responsible for the basic design, LPEC is responsible for the detailed design, while China Chemical Engineering Second Construction Corporation is responsible for the installation of the complex.

煤油加氢、柴油加氢、加氢裂化为联合装置，由 SEI 负责基础设计，LPEC 负责详细设计，中化

二建公司负责工程安装。

1.1.2.10 LPG Fractionation Unit 气体分馏装置

（1） The feedstocks of LPG Fractionation Unit are desulfurized and sweetened coker LPG and LPG from Light Ends Recovery Unit, as well as LPG from Hydrocracking Unit and Continuous Catalytic Reforming Unit. This unit separates propylene from coker LPG and iso-butane from LPG to produce polymer grade propylene and iso-butane that meets the requirements to be used as alkylation feedstock. This unit consists mainly of saturated LPG fractionation section, coker LPG fractionation section, debutanizer section, and propylene fractionation section.

本装置以脱硫脱硫醇后的焦化液化气、轻烃回收液化气、加氢裂化液化气、重整液化气为原料，主要分离焦化液化气中丙烯和液化气中异丁烷组分，生产聚合级丙烯产品和满足烷基化原料指标的异丁烷产品；装置主要由饱和液化气分离、焦化液化气分离、脱异丁烷塔、丙烯精馏塔等部分组成。

（2）LPEC is responsible for the design while China Construction Installation Engineering Co., Ltd. is responsible for the installation of the production unit.

装置由 LPEC 负责设计，中建安装负责工程安装。

1.1.2.11 Aromatics Complex 芳烃联合装置

The Aromatics Complex adopts UOP’s patented technology. Its feedstocks are straight-run naphtha from Light Ends Recovery Unit and heavy naphtha from Hydrocracking Unit, which are to be processed into 1.5 MMTA of para-xylene and other by-products including hydrogen, LPG, raffinate, benzene, toluene and heavy aromatics. The Aromatics Complex consists of 7 processing units, namely Naphtha Hydrotrating Unit, Continuous Catalytic Reforming Unit (including Continuous Catalyst Regeneration), Sulfolane Unit, Tatoray Unit, Parex Unit, Isomar Unit and Xylene Fractionation Unit, as well as intermediate tank farm and utilities.

本装置采用美国 UOP 公司专利技术，以轻烃回收装置来的直馏石脑油和加氢裂化装置来的重石脑油为原料，生产 150 万吨/年对二甲苯，同时副产氢气、液化气、抽余油、苯、甲苯、重芳烃等产品；芳烃联合装置由预加氢、连续重整（含重整催化剂连续再生）、芳烃抽提、歧化、吸附分离、异构化、二甲苯分馏七套加工装置及中间罐区和公用工程部分组成。

1.1.2.12 Pressure Swing Adsorption (PSA) Unit 变压吸附氢气提纯装置（PSA）

This unit adopts the pressure swing adsorption technology developed by Sichuan Tianyi Science & Technology Co., Ltd. and utilizes hydrogen from Continuous Catalytic Reforming Unit, separator offgas from Tatoray Unit, and CLPS vapour from Hydrocracking unit and Diesel Hydrotreating Unit as its feedstocks. The PSA is designed to produce 180,000 Nm^3/h of pure hydrogen.

本装置采用四川天一科技股份有限公司开发的变压吸附气体分离技术，以重整氢、歧化外排氢、加氢裂化与柴油加氢低分气为原料，设计产纯氢 18 万 Nm^3/h。

1.1.2.13 Light Naphtha Isomerization Unit 轻石脑油异构化装置

This unit adopts UOP’s Par-Isom technology and utilizes light naphtha from Hydrocracking Unit

and Naphtha Hydrotreating Unit, pentane from Continuous Catalytic Reforming Unit, and non-aromatics raffinate from Sulfolane Unit as its feedstocks. The C5 and C6 fractions with low octane number are converted to gasoline fractions with high octane number through the isomerization reactions.

本装置采用美国 UOP Par-Isom 工艺技术，以加氢裂化轻石脑油、预加氢轻石脑油、重整装置的戊烷和芳烃抽提非芳抽余油为原料，通过异构化反应，将 C5、C6 馏分中低辛烷值部分转化为高辛烷值的汽油组分。

1.1.2.14 SEI is responsible for the basic design, LPEC is responsible for the detailed design while China Chemical Engineering Third Construction Corporation is responsible for the installation of the Aromatics Complex, PSA, and Light Naphtha Isomerization Unit.

芳烃联合、PSA、轻石异构装置由 SEI 负责基础设计，LPEC 负责详细设计，中化三建公司负责工程安装。

1.1.2.15 Flexicoking Unit 灵活焦化装置

（1）The Flexicoking Unit adopts Exxon Mobil's Flexicoking process design package. Its feedstock is vacuum residue from the Atmospheric and Vacuum Distillation Unit while its products are coker dry gas, coker LPG, coker gasoline, coker diesel, coker light vacuum gas oil, coker heavy vacuum gas oil, purified flexigas, and coke. Coker dry gas and coker LPG are sent to the Acid Gas and LPG Ends Recovery Unit; coker gasoline and coker diesel are sent to the Diesel Hydrotreating Unit; coker light and heavy vacuum gas oil are sent to the Hydrocacking Unit; purified flexigas is sent to the reboilers of xylene column to be used as fuel gas; and coke is sent to the CFB for combustion.

本装置全套引进 ExxonMobil 专利 Flexicoking 工艺包；装置原料来自常减压装置的减渣。焦化干气、液化气至产品精制，焦化汽、柴油进柴油加氢装置，焦化轻、重蜡油至加氢裂化装置；净化灵活气至芳烃联合装置的二甲苯炉做燃料；焦炭去 CFB 锅炉掺烧。

（2）SEI is responsible for the basic design, LPEC is responsible for the detailed design, while China Chemical Engineering Second Construction Corporation is responsible for the installation of the unit.

装置由 SEI 负责基础设计，LPEC 负责详细设计，中化二建公司负责工程安装。

1.1.2.16 Sulfur Recovery and Tail Gas Treatment Unit 硫磺回收及尾气处理装置

This unit adopts the patented sulfur recovery process design of Zhenhai Petrochemical Engineering Co., Ltd. (ZPEC), which utilizes the setup: two series of sulfur recovery section, two series of tail gas treatment section with a shared regeneration system and chimney. The sulfur recovery section adopts the conventional Claus technology to produce liquid or solid sulfur. The concentration of SO2 in tail gas emissions is less than 150mg/Nm^3 to satisfy the requirement in the "*Pollution Control Guidelines for Economic Development in Brunei Darussalam*".

本装置采用镇海石化工程股份有限公司的硫磺回收专有工艺技术设计，采用"两头两尾共用再生和烟囱"设置，制硫部分采用常规 Claus 工艺，生产液态或固态工业硫磺，尾气排放 SO2 浓度

小于 150mg/Nm³，满足《文莱经济发展污染控制指导目录》要求。

1.1.2.17 Solvent Regeneration Unit 溶剂再生装置

The Solvent Regeneration Unit is designed to process 500 t/h of rich amine solution collected throughout the plant. It adopts conventional steam stripping for solvent regeneration.

设计规模处理 500 吨/小时富胺液，装置为全厂脱硫溶剂集中再生，采用常规蒸汽汽提再生工艺。

1.1.2.18 Sour Water Stripping Unit 酸性水汽提装置

（1）The Sour Water Stripping Unit is designed to process 180 t/h of sour water and operates 8400 hours annually.

设计处理 180 吨/小时酸性水，开工时数为 8400 小时。

（2）This unit regenerates sour water collected from the whole plant via single column low pressure stripping process.

装置为全厂酸性水集中再生，采用单塔低压汽提工艺处理酸性水。

1.1.2.19 Sulfur Regeneration Unit, Solvent Regeneration Unit and Sour Water Stripping Unit form a complex collectively. SEI is reposible for the basic design while ZPEC is responsible for the procurement and installation of the complex.

硫磺回收、溶剂再生、污水汽提为联合装置，由 SEI 负责基础设计，镇海院整体采购安装。

1.1.3 Port and Storage System 港务储运系统

1.1.3.1 Jetties 码头工程

（1）The jetties are divided into western jetty, eastern jetty, and Single Point Mooring.

码头工程分为西区码头、东区码头及单点系泊。

（2）Western jetties comprise of three 50,000 DWT petrochemical jetties (jetty #1, #2, #3), of which jetty #3 is being reserved. The jetties have a designed throughput capacity of 6.8 MMTA.

西区码头建设 3 座 5 万吨级石化码头（编号：1#、2#、3#码头），其中 3#码头缓建，设计吞吐能力 680 万吨/年。

（3）Eastern jetties comprise of two 30,000 DWT chemical jetties (jetty #4, #5), a 10,000 DWT general cargo jetty (jetty #6), a 2,000 DWT heavy cargo jetty (jetty #7), and a 35,000 DWT coal jetty (jetty #8). The designed throughput capacities of these petroleum products jetties and coal jetty are 4.5 MMTA and 2.0 MMTA respectively.

东区码头建设 2 座 3 万吨级化工码头（4#、5#码头）、1 座 1 万吨级杂货码头（6#码头）、1 座 2000 吨级大件码头（7#码头）、1 座 3.5 万吨级煤码头（8#码头），油品码头设计吞吐能力 450 万吨/年，煤炭码头吞吐能力 200 万吨/年。

（4）A 300,000 DWT Single Point Mooring (SPM) is constructed at the north of PMB to unload imported crude oil and condensate. The SPM is connected to the onshore crude oil pipelines through an 8.7 km subsea pipeline. The designed unloading capacity of SPM is approximately 15 MMTA.

在 PMB 岛北部外海区域，建设一个 30 万吨级单点系泊，用于进口原油和凝析油的接卸，单点系

泊通过 8.7 公里长海底管道与陆上原油管道相连，设计接卸能力约 1500 万吨/年。

1.1.3.2 Storage and Transportation Sytem 储运系统

（1）The petrochemical storage and transportation system of this project comprise of several units which include the tank farm at the main plant area, western tank farm and vehicle loading station, flare and flare gas recovery, oil vapor recovery, and condensate deodorization unit.

本项目油品储运系统由主厂区罐区、西部罐区及汽车装车站、火炬气回收及火炬、油气回收、油气脱臭等单元组成。

（2）There are 145 storage tanks throughout the plant, with a total storage capacity of 2,450,000 m^3, of which are: 97 storage tanks in the main plant area, with a total storage capacity of 1.771 million m^3; 14 storage tanks in the aromatics intermediate tank farm, with a total storage capacity of 82,000 m^3; and 34 storage tanks in the western tank farm, with a total storage capacity of 598,000 million m^3.

全厂共设置储罐 145 座，总罐容约 245 万立方，其中：主厂区罐区 97 台储罐，容积 177.1 万立方；芳烃中间罐区 14 台储罐，容积 8.2 万立方；西部库区 34 台，罐容 59.8 万立方。

（3）There is a set of petroleum product loading system at the western tank farm, which has 5 unloading stations for loading of RON 92 gasoline, RON 97 gasoline, aviation kerosene, and diesel. The designed loading capacity is 1.0 MMTA.

在西部库区设置一套油品装车系统，共设五个装车岛，可实现 92#汽油、97#汽油、航煤、柴油装车需要，设计装车能力 100 万吨/年。

（4）The flare gas recovery unit is equipped with a 20,000 m^3 dry-type gas holder and three 3,600Nm^3/h flare gas recovery compressors. Flare gas is compressed to 1.1 MPa before sending to the Acid Gas and LPG Ends Recovery Unit to be purified and used as fuel gas. There are high pressure (0.35 MPa), low pressure (0.2 MPa), low low pressure (0.05 MPa) flare systems, and a dedicated sour gas pipeline network and flare.

为实现火炬回收利用，设置一台 2 万立干式气柜及三台 3600Nm^3/h 火炬气压缩机，经回收压缩机升压至 1.1MPa 后，送到产品精制装置，净化后作为燃料气。设置高压（0.35MPa）、低压（0.2MPa）、低低压（0.05MPa）火炬系统，另外设有专用的酸性气放空管网及火炬。

（5） In order to meet the discharge standards, the vehicle loading stations and western tank farm are equipped with an oil vapor recovery system respectively; the tank farm in the main plant area is equipped with a condesate deodorization system; the eastern jetty is equipped with a Clean Enclosed Burner (CEB).

为满足达标排放，在汽车装车站和西部库区分别设置一套油气回收系统，在主厂区罐区设置一套扫线油脱臭系统，在东码头设置有 CEB 燃烧器。

1.1.4 Utilities 公用工程

1.1.4.1 Water Supply and Drainage System 给排水系统

（1）Water source: the source of desalinated water relies mainly on the seawater desalination

unit, which has three sets of 12500 m^3/d seawater desalination facilities. The seawater desalination unit produces desalinated water, which is distributed via two routes: the first route enters the power plant to be treated in the boiler make-up water treatment system; the other route is used as production water, fire-fighting water, and domestic water throughout the plant. There are two 10,000 m^3 fire-fighting water and production water tanks, two 500 m^3 domestic water tank, and twenty-one pumps.

水源：淡水来源主要依托海水淡化装置，设置产水能力 12500m^3/d 海水淡化设施三台。海淡产出水为一级除盐水，一路进电站经化水单元处理后作为锅炉水；另一路用于全厂生产水、消防水及生活水，共设有两座 10000m^3 消防水及生产水储罐和两座 500m^3 生活水罐，并配有机泵 21 台。

（2） In order to supply desalinated water during the start-up of the power plant, a lake water treatment facility with 225 t/h water production capacity is set up near the cooling water unit Ⅰ.

为解决电站开工淡水供应问题，公司在Ⅰ循环水场附近建设一套岛上湖水利用的水处理设施，产水能力 225t/h。

（3）Cooling water unit: There are two cooling water units – cooling water unit Ⅰ and cooling water unit Ⅱ. Cooling water unit Ⅰ which is located at the northern section of the main plant area, supplies to every production unit within the plant area. Cooling water unit Ⅱ which is located near the air compression and separation unit, supplies to the air compression and separation unit as well as the administration zone refrigeration station. The processing capacity of cooling water unit Ⅰ and cooling water unit Ⅱ are 27000m^3/h and 5000m^3/h respectively.

循环水场：全厂设 2 座循环水场，Ⅰ循环水场设置在装置区北侧，供厂区各装置。Ⅱ循环水场设置在空分空压站附近，用于空分空压及厂前区制冷站。Ⅰ循环水场设计能力为 27000m^3/h，Ⅱ循环水场的设计能力为 5000m^3/h。

（4）Wastewater treatment: this project is equipped with a wastewater treatment facility; it is responsible for the treatment, recycle and discharge of wastewater involved in the first phase of the project, which includes the oily wastewater, polluted rainwater, saline wastewater, and domestic wastewater. The processing capacities of oily wastewater treatment system and saline wastewater treatment system are 200m^3/h respectively. Upon the treatment of oily wastewater, the water is reused as supplementary water supply in the cooling water unit while treated saline wastewater is discharged after reaching the discharge standards. Waste oil collected at the wastewater treatment plant is directed to the waste oil storage tanks after removal of water. On the other hand, residual activated sludge and scum collected are concentrated and dewatered before they are sent to the CFB boilers in the power plant for treatment. Flue gas from the power plant is discharged after being desulfurized by seawater; treated saline wastewater is discharged into the flue gas desulfurization pool and discharged into the sea together with seawater.

污水处理：本项目设污水处理场一座，承担一期项目排放的含油污水、污染雨水、含盐污水、生活污水等的处理、回用及排放。其中含油污水处理系列处理规模为 200m^3/h，含盐污水处理系列处理规模为 200m^3/h。含油污水处理后，作为循环水场的补充水回用。含盐污水处理合格后达标

排放。污水处理场收集的污油经脱水后送回全厂污油罐区。污水处理场产生的剩余活性污泥、油泥和浮渣经浓缩脱水后，送电站装置 CFB 锅炉处理。动力中心的烟气是经海水脱硫后排放的；污水场的含盐污水经处理合格后排入烟气脱硫池后与海水一起排放去大海。

（5）Offsite flood discharge: in order to prevent the influence of high tide on the plant area, 5 flood discharge points are set up: Q1 having a designed discharge capacity of 11.25 m^3/s and 5 drainage pumps, is located at the western tank farm; Q2 is located at the administration zone; Q3 is located at the crude oil tank farm; Qplot is located on the ground outside the plant area; Qroad is road drainage. The total discharge capacity of Q2+Q3+Qplot+Qroad is 9.11 m^3/s; no pump is used and water flows under the influence of gravity; Q4 having discharge capacity of 41.528 m^3/s and 10 pumps, is located near the rainwater monitoring and accident reservoir; Q5 having discharge capacity of 6.72 m^3/s and 3 pumps, is located near the seawater desalination plant.

厂外排洪：为了防止高潮位海水对于厂区的影响，共设置 5 个排洪点， Q1 位于西部罐区，配置 5 台排水泵，设计排水量 11.25 m^3/s；Q2 位于厂前区，Q3 位于原油罐区，Qplot 位于厂外地面，Qroad 为马路排水，Q2+Q3+Qplot+Qroad 总排水量为 9.11 m^3/s，采用无泵自流方式；Q4 位于雨水事故监控池附近，总排水量为 41.528 m^3/s，配置 10 台泵；Q5 位于海淡装置附近，总排水量为 6.72 m^3/s，配置 3 台泵。

1.1.4.2 Heat and Power Supply Systems 供热供电系统

（1）Power Plant 热电站

1）In the first phase of the project, five 380 t/h circulating fluidized bed boilers and four 55MW extraction-condensing steam tubines (60MW electric generator) will be installed. The boilers are high temperature, high pressure, single drum, natural circulating, dry bottom, single furnace circulating fluidized bed boilers manufactured by the Shanghai Electric Shanghai Boiler Works Co., Ltd. The steam turbines are high temperature, high pressure, single shalft, single cyclinder, single flow, extraction-condensing type, wet impulse steam turbines manufactured by the Dong Fang Turbine Co., Ltd.

一期项目建设 5 台 380t/h 循环流化床锅炉+4 台 55MW 抽凝汽轮机组(60MW 发电机)，其中锅炉为上海锅炉厂有限公司生产的高温、高压、单汽包、自然循环、炉底固态排渣、单炉膛循环流化床锅炉。汽轮机为东方汽轮机有限公司生产的高温、高压、单轴、单缸单排汽、抽汽凝汽式、湿冷冲动式汽轮机组。

2）The power station has a 66kV general electrical substation, which is responsible for the power supply of this project. The 66kV system of the 66kV general electrical substation follows the double bus configuration. Four extraction-condensing type turbine generators are connected to the busbar of the 66kV electrical substation. The general electrical substation supplies power to four 66/10.5kV (complex unit) substations of this project; the 66kV busbar of the electrical substation is connected to the local power grid in Brunei through two 66kV backup transmission lines with a total capacity of 20 MVA. The local power grid in Brunei is only used as start-up power supply, load testing and commissioning of the power plant. When the

generator of the power station runs normally, the 66kV transmission line is disconnected; the generator supplies power to all production units throughout the plant via isolated network operation.

电站设有一座 66kV 总变电站，负责本项目的电力供应。66kV 总变电站的 66kV 系统为双母线接线，4 台抽凝式汽轮机发电机组的发电机并入总变 66kV 母线，总变为本项目的 4 座 66/10.5kV 区域(联合装置)变电站提供电源。总变 66kV 双母线通过两条 66kV 总容量 20MVA 的备用联络线连接到文莱当地电网，仅将文莱当地电网作为启动电源和机组负荷调试用，在动力站发电机组正常运行时，断开 66kV 联络线开关，动力站发电机组带全厂装置孤网运行。

3）The power station may adopt the black start process during the start-up phase. One 50 t/h fuel-fired package boiler, two 7MW waste heat (condensing) generators, and three black-start diesel generators (rated power is 2000kW (2050kVA)/generator; rated voltage is 10.5kV; rated power factor is 0.8). During the initial start-up or occurrence of accident at the power station, the black-start diesel generator is first started to supply power to start-up auxiliary power generator of the boiler and a 7MW (8750kVA) auxiliary power generator of the waste heat generator. After the start-up of the waste heat generator, the 7 MW waste heat generators and diesel generators (full input) operate in parallel to jointly bear the load of a single steam turbine and boiler to supply for consumption throughout the plant so as to complete the black start process of the power station.

电站在启动阶段可以采取黑启动方式，站内设置 1 台 50t/h 燃油快装式启动锅炉+2 台 7MW 余热发电（纯凝）机组，以及 3 台黑启动柴油发电机组（额定功率 2000kW(2050kVA)/台，额定电压 10.5kV，额定功率因素 0.8）。电站初次启动或事故状况下，先启动黑启动柴油发电机组，为启动锅炉的辅机和一台 7MW(8750kVA)余热发电机组辅机供电。待余热发电机组启动完成后，7MW 余热发电机组与柴油发电机组（全部投入）并联运行，共同承担一台机、炉的全部厂用负荷，完成电站黑启动的任务。

4）In order to ensure the stability of isolated network system, an isolated network coordination control system is installed. The system has functions such as real time secondary frequency regulation, real time secondary voltage regulation, power angle measurement, automatic power flow control, specialized control, underfrequency load shedding control, power angle leveling, disconnection protection, synchronization with load, and load management system. The isolated network control system can collaboratively control each of the power source and load of the entire isolated network; the control commands are issued according to their mutual relationship to maintain the stable operation of the isolated network under various modes of operation.

为了实现孤网系统的稳定，配备了孤网协调控制系统，该系统具备实时二次调频、实时二次调压、功角测量、自动潮流控制、特殊控制、低频减载控制、功角调平、解列保护、带负荷同期、负荷管理系统等功能。孤网控制系统能够完整地协同控制整个孤网的各个电源和负荷，根据相互关系发出控制指令，在各种运行方式下，维持孤网的稳定运行。

（2）Steam Supply Systems 供汽系统

1）There are three types of steam pipeline network: 3.5 MPa, 1.0 MPa and 0.5 MPa. According to the steam balance throughout the plant, a total amount of 562.6 t/h steam is required to be supplied by the power plant under normal condtions: 491.8 t/h of 3.5MPa steam and 70.8 t/h of 1.0 MPa steam. 0.5MPa steam from the refinery is supplied for use in the production units, seawater desalination unit and waste heat generators. When one of the seawater desalination units operates, the amount of excess steam is approximately 115.4 t/h and when two of the units operate, the amount of excess steam is approximately 61.3 t/h. During normal operation, the waste heat generator consumes excess steam from the 0.5 MPa steam pipeline network to improve thermal efficiency and reduce steam emissions, while regulating the pressure of the 0.5MPa steam pipeline network at the same time.

全厂设有 3.5MPa、1.0MPa、0.5MPa 三个压力等级的蒸汽管网。根据全厂蒸汽平衡，在正常情况下，需要电站外供 3.5MPa 蒸汽 491.8t/h，1.0MPa 蒸汽 70.8t/h，总供汽量约 562.6t/h。0.5MPa 等级的蒸汽来自炼化厂，供化工装置、海淡装置和余热发电机组利用。当海淡装置 1 台运行时，蒸汽富余量约 115.4t/h；海淡装置 2 台运行时，蒸汽富余量约 61.3t/h。正常运行时，余热发电机组消耗 0.5Mpa 等级蒸汽管网多余的蒸汽，以提高热经济性，减少蒸汽排放，同时作为调节 0.5MPa 蒸汽管网压力的设施。

2）Under normal conditions, the power plant operates with 4 boilers and 4 turbines at 75% load to fulfill the power and steam consumptions of the refinery. When any boiler or steam turbine malfunctions or undergoes overhaul, the output of the other 3 units is increased to meet the power supply and steam requirements. Backup desuperheater with sufficient capacity is also installed so that boiler steam can be supplied throughout the plant when only two of the steam turbines operate.

正常情况下，电站运行方式为 4 炉 4 机，在 75%负荷状态下运行即可满足炼化厂用电、用汽要求。任何一台锅炉或汽机故障或者检修时，增大其余 3 台运行机组的出力，也能满足炼化厂用电、用汽要求，另外设置足够容量的备用减压减温器，当只有 2 台汽机运行时，锅炉蒸汽可通过备用减压减温器给炼化厂供汽。

1.1.4.3 Air and Nitrogen Supply Systems 供风供氮系统

（1）The air separation and air compression unit of this project has a designed processing capacity of 75000Nm^3/h. Six compressors, each with capacity of 15000Nm^3/h, are installed: five for operation and one as backup. The air compressors employed are imported high-speed centrifugal compressors with three-stage compression and two inter-stage cooling. Compressed air at 0.95 MPa and 120℃ is divided into two routes: one route enters the instrument air surge drum after removal of moisture and oil through a filter; the other route is directed to the air separation unit for cryogenic separation to produce gaseous and liquid nitrogen products with 99.99% purity.

本项目自建空分空压装置，设计处理量 75000Nm^3/h，设置六台压缩机，五用一备，单台气量 15000Nm^3/h。空压机采用进口高速离心式压缩机，三级压缩二级级间冷却，压缩后空气压力 0.95 MPa，温度 120℃分两路，一路经过滤去除空气中的水和油，再进入仪表空气缓冲罐。另一路送

至空分装置进行深冷分离，制备纯度 99.99%的氮气和液氮产品。

（2）There are three types of nitrogen pipeline network: 0.6MPa, 0.85MPa (supplied to the Continuous Catalytic Reforming Unit only), and 2.5MPa. The air separation unit has three liquid nitrogen storage tanks: one 2000m^3 0.8MPa low pressure storage tank and two 200m^3 2.5MPa high pressure storage tanks.

全厂氮气管网按压力分为三个等级：0.6MPa 氮气、0.85MPa 氮气（连续重整装置专用）、2.5MPa 氮气，空分装置内设液氮储存 3 台，其中 2000m^3 压力 0.8MPa 低压罐 1 台、200m^3 压力 2.5MPa 高压罐 2 台。

1.1.5 List of Principal Units in the Plant 全厂主要单元一览表

See Appendix 1 for the list of principal units for Hengyi PMB project

恒逸 PMB 项目工程一览表见附件 1

1.2 Entry of Raw Materials and Exit of Products 原料进厂和产品出厂

The crude oil required for this project is wholly transported via sea transportation. The major products include para-xylene, benzene, toluene, chemical light oil, light gasoline blending components, non-standard gasoline, gasoline (RON 92 and 97), aviation kerosene, diesel, LPG, propylene, iso-butane, heavy aromatics, and sulfur (solid and liquid). Gasoline, aviation kerosene and diesel are transported out of the refinery via automotives (cumulatively 1 million tons) to meet the local market demand in Brunei while other products are shipped by the sea. See Table 1-2 and Table 1-3 for the quantity and modes of transportation of various raw materials and products.

本项目所需的原油 100%海运进厂，产品主要为对二甲苯、苯、甲苯、化工轻油、轻质汽油调合组分、非标汽油、汽油（92#、97#）、航煤、柴油、LPG、丙烯、异丁烷、重芳烃、硫磺（固体、液体）等。为了满足文莱当地市场需求，汽油、航煤和柴油采用汽运出厂 100 万吨（合计），其它产品采用海运方式出厂。各种原料和产品对外运量及运输方式见表 1-2、表 1-3

Table 1-2: Quantities and modes of transportation of various materials

表 1-2 对外主要运输量及运输方式一览表

Name 名称	No. 序号	Name of material 物料名称	Annual transportation quantity (10^4 tonnes) 年运量(万吨）		Into/Out of the plant 进出厂	
			Chemical light oil scheme 轻油方案	Gasoline scheme 汽油方案	Sea transportation ratio 海运比例	Automotive transportation ratio 汽运比例

Name 名称	No. 序号	Name of material 物料名称	Annual transportation quantity (10^4 tonnes) 年运量(万吨）		Into/Out of the plant 进出厂	
			Chemical light oil scheme 轻油方案	Gasoline scheme 汽油方案	Sea transportation ratio 海运比例	Automotive transportation ratio 汽运比例
Raw materials 原料	1	Crude oil 原油	800	800	100%	/
	2	Feedstock of naphtha hydrotreating 预加氢原料	20	20	100%	/
	3	MTBE	3.73	2.6	100%	/
	4	FCC (fluidized catalytic cracking) gasoline 催化汽油	0	73.58	100%	/
Products 产品	1	Para-xylene 对二甲苯	150	150	100%	/
	2	Benzene 苯	47.9	52.3	100%	/
	3	Toluene 甲苯	29.4	0	100%	/
	4	Chemical light oil 化工轻油	69.96	0	100%	/
	5	Light gasoline blending componens 轻质汽油调合组分	29	0	100%	/
	6	Non-standard gasoline 非标汽油	46.73	0	100%	/
	7	Gasoline 汽油	0	232	90%	10%
	8	Aviation kerosene 航煤	117.13	117.13	80%	20%
	9	Diesel	174.11	174.11	70%	30%

Name 名称	No. 序号	Name of material 物料名称	Annual transportation quantity (10^4 tonnes) 年运量(万吨）		Into/Out of the plant 进出厂	
			Chemical light oil scheme 轻油方案	Gasoline scheme 汽油方案	Sea transportation ratio 海运比例	Automotive transportation ratio 汽运比例
		柴油				
	10	LPG 液化石油气	31.93	31.93	100%	/
	11	Propylene and iso-butane 丙烯、异丁烷	20.48	20.48	100%	/
	12	Heavy aromatics 重芳烃	3.93	3.93	100%	/
	13	Sulfur (solid and liquid) 硫磺（固体、液体）	8.24	8.24	100%	/

Table 1-3: Entry and exit of meterials via sea transportation

表 1-3 水运进出物料通道一览表

No. 序号	Name of medium 介质名称	Transportation quality (10^4 tonnes/ year) 运输量（万吨/年）		Jetty 码头	Remarks 备注
		Chemical Light Oil Scheme 化工轻油方案	Gasoline scheme 汽油方案	Berth 泊位	
1	Crude oil and condensate 原油凝析油	120	120	1#、2#	
2	Para-xylene 对二甲苯	150	150	1#、2#、5#、6#	
3	Benzene 苯	47.9	52.3	4#、5#	Shares loading arm with gasoline 与汽油共用输油臂
4	Toluene	/	/	/	Shares loading

No. 序号	Name of medium 介质名称	Transportation quality (10^4 tonnes/ year) 运输量（万吨/年）		Jetty 码头	Remarks 备注
		Chemical Light Oil Scheme 化工轻油方案	Gasoline scheme 汽油方案	Berth 泊位	
	甲苯				arm with gasoline 调合汽油
5	Chemical Light Oil 化工轻油	69.96	0	1#、2#	Shares loading arm with gasoline 与汽油共用输油臂
6	Non-standard gasoline 非标汽油	46.73	0	1#、2#	
7	RON 92 gasoline 92#汽油	0	232	1#、2#	
8	Aviation kerosene 航煤	100.13	100.13	1#、2#	
9	Diesel 柴油	134.11	134.11	1# 2#	
10	Feedstock of naphtha hydrotreating 预加氢原料	20	20	4#	
11	MTBE	3.73	2.6	6#	Shares loading arm with FCC gasoline 与催汽共用
12	FCC gasoline 催化汽油	0	73.58	4#、6#	
13	LPG	31.93	31.93	4# 6#	
14	Propylene and iso-butane	20.48	20.48	6#	Shares loading arm with iso-butane and

No. 序号	Name of medium 介质名称	Transportation quality (10^4 tonnes/ year) 运输量（万吨/年）		Jetty 码头	Remarks 备注
		Chemical Light Oil Scheme 化工轻油方案	Gasoline scheme 汽油方案	Berth 泊位	
	丙烯、异丁烷				LPG 异丁烷和 LPG 共用输油臂
15	Iso-pentane 异戊烷	29	0	5#	
16	Heavy aromatics 重芳烃	3.93	3.93	4#	
17	Liquid sulfur 液体硫磺	8.24	8.24	6#	
18	Heavy VGO 减压重油	Nil 无	Nil 无	5#	
Subtotal 小计	Total 合计	815.54	949.3		

2 Basis and principles for formulation of the overall commissioning plan 总体试车方案的编制依据与编制原则

2.1 Basis of Formulation 编制依据

2.1.1 Hengyi (Brunei) PMB Petrochemical Project Feasibility Study Report (Document No. B6731-02FS);
恒逸实业(文莱)PMB 石油化工项目可行性研究报告（档案号 B6731-02FS）;
2.1.2 Hengyi (Brunei) PMB Petrochemical Project Overall Design Document B6731−01GD;
恒逸实业(文莱)PMB 石油化工项目总体设计文件- B6731－01GD；
2.1.3 Meeting minutes for coordination meetings and conferences of overall design between Hengyi (Brunei) and the design institutes.
恒逸实业(文莱)和总体设计院组织的各次总体设计协调会、对接会会议纪要；
2.1.4 “Project Management Manual” approved by the decision-making committee of the

project.

项目决策委员会批准的《项目管理手册》；

2.1.5 Reports which include the Quantitative Risk Assessment (QRA) report, Hazard and Operability Study (HAZOP), Safety Integrity Level (SIL) evaluation of instrumentations.

定量风险评价报告(QRA)、危险和可操作性（HAZOP）分析、仪表完整性 SIL 评估等报告；

2.1.6 “Implementation Agreement for PMB Development Project” signed between Hengyi Industries (Brunei) Sdn. Bhd. and the Brunei Government.

恒逸实业（文莱）有限公司与文莱政府签订的《PMB 开发项目实施协议》；

2.1.7 Process packages or technical data, external contract, and other relevant documents provided by the patent holding companies.

专利商提供的工艺包或技术数据、外部协议等有关文件等。

2.1.8 “Code for Project Commissioning in Chemical Industry (HG-20231-2014)”;

《化学工业建设项目试车规范（HG-20231-2014）》；

2.1.9 “Management Regulations for Production Preparation and Commissioning of Sinopec Petrochemical Projects” No. 897 by Sinopec Engineering Incorporation.

《中国石化建设项目生产准备与试车管理规定》中国石化建〔2011〕897 号。

2.2 Principles of Formulation 编制原则

2.2.1 Utilities and auxiliary facilities shall first be put into operation; the guiding ideology of “inverse start-up” for production units to coordinate the critical control points of the commissioning operation in an effort to shorten the commissioning time.

按照“先外围、后主体”即公用工程和辅助设施先行，工艺装置“倒开车”的指导思想统筹试车关键控制点，努力缩短试车时间；

2.2.2 Adhere to the high standards, strict requirements, and meticulous organization of the start-up operation; each critical step shall undergo three stages of confirmation; Promote the three spirits: scientific spirit, all-inclusive spirit, and hardworking spirit; Abide by "Four Do Not Start-up Conditions": do not start-up if the start-up conditions are not satisfied, the procedures are ambiguous, the commander is not at the scene, or when there are presence of unresolved problems. Strictly examine the project quality, personnel training, equipment purging, gas leak test and drying standards to achieve safe, stable, and successful start-up in a single attempt.

坚持投料试车工作高标准、严要求、精心组织，每个关键步骤要经过三级确认，发扬“三种精神（科学精神、全局精神、拼搏精神）”，严格遵守四不开车（条件不具备不开车、程序不清楚不开车、指挥不在现场不开车、出现问题不解决不开车），严把“工程质量关、人员培训关和设备吹扫、气密、干燥关”，做到安全、平稳，确保一次投料试车成功；

2.2.3 The pre-commissioning shall be carried out early; the purging and gas leak test shall be performed strictly; the commissioning shall be conducted comprehensively; the start-up shall be implemented in a stable manner; the commissioning plan shall be excellent; and the commissioning cost shall be low.

做到单机试车要早，吹扫气密要严，联动试车要全，投料试车要稳，试车方案要优，试车成本要低；

2.2.4 Fully understand, learn and draw on advanced technologies and methods used in the same industry, and adopt them appropriately in the commissioning plan.

充分了解、学习和借鉴国内外、同行业先进的技术和方法，在试车方案中适当采用。

3 Guiding Ideology and Criteria for Commissioning 试车的指导思想和应达到的标准

3.1 Purpose of Commissioning 试车目的

3.1.1 In order to build a solid foundation for the smooth operation of the plant while providing a basis for its future technological transformation, the qualities of design, construction and installations of the project is carefully assessed during its commissioning, of which existing problems are detected and immediately resolved.

通过试车考核设计、施工、安装质量，及时发现并处理问题，为顺利投产奠定基础，为今后的技改提供依据。

3.1.2 To train the employees through start-up of the plant: improve the operating skills of production operators and enhance the professional skills of management personnel.

通过投料试车锻炼职工队伍，提高生产一线员工的操作水平及生产管理人员的业务水平。

3.1.3 Examine whether the set up of the production system and staffing of operating personnel meet the production needs.

检验生产系统机构设置及生产人员配置是否适应生产需要。

3.1.4 Link up the process flow of the whole plan through commissioning.

通过试车达到贯通全厂工艺流程的目的。

3.1.5 Gradually optimize the technological parameters of the whole process flow.

逐步优化全流程工艺技术指标。

3.1.6 Assess whether the performances of various equipment meet the production needs.

考核各种设备的性能能否满足生产需要。

3.1.7 Assess whether the main technical conditons and economic indicators meet the design requirements.

主要工艺技术条件及技术经济指标是否能达到设计要求。

3.1.8 Adjust the relations of production between the production departments and functional departments.

磨合各生产部门和各职能部门的生产关系。

3.1.9 Provide a basis for the selection of process and equipment during construction follow-up of the project.

通过投料试车为后续工程建设提供工艺及设备选型依据。

3.2 Guiding Ideology of the Commissioning 试车指导思想

3.2.1 Adhere to the principle of “safety first, prioritize environmental protection, overall planning, and meticulous organization”. Start-up the safety and environmental protection facilities simultaneously with the production units; promote the scientific spirit, all-inclusive spirit, and hardworking spirit; ensure that no international disputes and accidents such as those of personal, production, equipment, fire, explosion, radioactive, and environmental protection occur during the commissioning process.

坚持“安全第一，环保优先，统筹安排，精心组织”的原则，安全环保设施与工艺装置同步开工，发扬科学精神、全局精神、拼搏精神，确保试车过程不发生人身、生产、设备、着火、爆炸、放射、环保等事故和国际争端。

3.2.2 Adhere to high standards and strict requirements. Abide by "Four Do Not Start-up Conditions": do not start-up if the start-up conditions are not satisfied, the procedures are ambiguous, the commander is not at the scene, or when there are presence of unresolved problems, to ensure successful start-up in a single attempt.

高标准，严要求，做到“四不开车”（条件不具备不开车，程序不清楚不开车，指挥不在场不开车，出现问题不解决不开车），确保投料试车一次成功。

3.2.3 Strictly follow the commissioning procedures in sequence; accomplish “early pre-commissioning, comprehensive commissioning, and stable start-up”. The pre-commissioning, commissioning and start-up shall be carried out steadily and cautiously in their sequence.

严格按照试车程序依次进行，做到“单机试车要早、联动试车要全、投料试车要稳”，先单机试车，后联动试车，再投料试车，不得逾越，稳扎稳打，步步为营。

3.2.4 Optimize the linkage between production, supply, sales, storage and other aspects. Reduce materials outsourcing, discharge of unqualified products and wastes, as well as the consumption of energy and materials while taking economic benefits into account.

优化产、供、销、存等环节衔接，减少外购物料、不合格产品和废物废料的排放等，降低能耗物耗，兼顾经济效益。

3.2.5 The whole process of commissioning shall be in compliance with the documented requirements or clauses in the Implementation Agreement and of relevant laws of Brunei Darussalam.

试车全过程遵守文莱达鲁萨兰国相关法律和实施协议等文件条款要求。

3.3 Criteria for Start-up 投料试车应达到的标准

3.3.1 Safety, environmental protection, firefighting, and industrial health facilities adhere to the “three simultaneity” system. Discharge or treatment measures of the “three wastes” meet the requirements of environmental protection, and the indicators monitored meet relevant standards.

安全、环保、消防和工业卫生做到“三同时”，“三废”的排放或处理措施符合环保要求，监测指

标符合标准。

3.3.2 The commissioning system is operating normally; the interlocking and automatic control systems specified in the commissioning plan have been put into operation and meet the design requirements.

试车系统运行正常，试车方案中规定的联锁和自动控制系统皆已投入，并达到设计要求。

3.3.3 The start-up operation is carried out according to the plan, the main control points are achieved, qualified products are produced through continuous operation, and the continuous operation lasts for more than 72 hours.

投料试车按计划进行，达到主要控制点，连续运行产出合格产品，并且连续运行 72 小时以上。

3.3.4 Perform material balance and reduce the consumption of feedstocks, fuel, and power.

做好物料平衡，降低原料、燃料、动力消耗。

3.3.5 The production units reach 70% of their designed load during the commissioning. The quality and yield of all products, as well as the consumption of chemical agents, energy, and utilities such as water, electricity, steam and air meet the design requirements.

试生产装置达到设计的 70%负荷，各产品的质量和收率达到设计要求，水、电、汽、风等公用工程消耗、化剂消耗和能耗达到设计要求。

4 Startup Requirements 投料试车应具备的条件

4.1 Handover 中间交接

All EPC general contractors must carry out handover in strict accordance with the “Handover Requirements” as required in Sinopec Group’s Sinopec Construction Project Production Preparation and Commissioning Regulations, as well as the provisions in EPC general contractor’s contract.

各EPC总承包商必须严格按照中国石化总公司《石油化工建设项目生产准备与试车规定》要求的“工程中间交接应具备的条件”、EPC总承包合同的规定进行中间交接。项目中交应具备的条件为：

4.1.1 The contractor has completed all the construction contents on the process operation line, and the process operation line are linked and meet the requirements for tests including pressure test, and commissioning.

承包商完成了工艺运行路线上的所有建设内容，工艺路线全部贯通，具备系统试压、水电联运等条件。

4.1.2 The problems discovered during “Punch Listing” have been solved and meet the contract & design requirements.

“三查四定”所发现的问题已基本处理完毕，并满足合同、设计要求。

4.1.3 Submitted the punch list.

提交施工尾项表。

4.1.4 Has obtained a permanent facility occupation permit issued by ABCi.

获得了 ABCi 签发的永久设施投用许可。

4.1.5 Pipeline purging, pressure test and precommissioning have been completed.

管道系统吹扫、试压及设备单机试运行已完成。

4.1.6 All subsystem of project can operate normally.

工程所属各个子系统能正常运行。

4.1.7 Startup preparation check are completed (All documents are qualified and have obtained all government approvals).

开车就绪检查完成（全部文件合格，具备全部政府批件）。

4.1.8 The third party quality inspection unit shall issue the “comprehensive quality inspection report”.

第三方质量检验单位应出具《检测质量综合报告》。

4.1.9 Engineering data compilation is complete.

工程资料收集齐全。

4.2 Commissioning Licence of the Project 项目试车许可

According to the requirement of the “Pulau Muara Besar Island Development Project Implementation Agreement”, the commissioning of the project must go through two stages, which are the interim licence to operate (before pre-commissioning), and licence to operate (before commissioning). In accordance to the production units under each production operation department, the packages during construction period (see 4.2.1) are grouped and categorized for submission in obtaining approval.

根据《PMB开发项目实施协议》要求，本项目试车必须经过临时运行许可（单机试车之前）、运行许可（投料试车前）二个阶段，根据各运行部管辖的装置将建设期各包（详见4.2.1）分组分类进行报审。

4.2.1 Packages during Construction Period 建设期分包

The packages during construction period is used for the government approval content in PCAP, except for the production preparation content of the operation permit. The conditions for obtaining the operation permit is the completion of various compliance work approvals in the design, procurement, and construction processes during the construction period.

建设期分包用于 PCAP 中除运行许可生产准备内容外的政府报批内容，运行许可的获取的前提是建设期的设计、采购、施工过程中各种合规性工作批准的完成。

Table 4-1 Packages during Construction Period

表 4-1 建设期分包

Main Content 主项目	Estimated Submission Date 预计提交时间

Main Content 主项目	Estimated Submission Date 预计提交时间
1. All EIA approvals for the project; 项目所有的环评批准书；	Submitted on March 2013 2013.3 已提交
2. All Environmental Management & Monitoring Plan Approval for the project 项目所有的环境管理与监测计划批准书；	Approved
3. Land Lease Registration for the Petrochemical Plant 石化装置的土地租赁注册；	Partial Completion 部分完成
4. All Sewage / Drainage / Coastal exit Approvals for the project 项目所有的污水、排水及海岸排水批准书；	N/A 不适用
5. All Jetty and Navigation Area, Construction, Operation, and Transportation Approval for the project 项目所有的码头和航道区域、施工、运行和运输批准书；	2018.11.30
6. All Power Transmission Line Integration to Existing System Approval for the project 项目所有并入现有电网的输电线批准书；	N/A 不适用
7. All Radio Communications Approval for the project 项目所有的无线电通讯批准书；	2018.9.30
8. All Waste Disposal Approvals for the project 项目所有的废物处理批准书；	2018.11.30
9. All Import and Export Approvals for the project 项目所有的进出口批准书；	2018.11.30
10. All Wading Work Construction Approvalsfor the project 项目所有的涉水施工批准书；	Submitted 已提交
11. All Import, collector licence, storage, transportation & usage of petroleum, radioactive, toxic, corrosive, explosive and flammable substances Approvals for the Project 项目所有石油、放射性物质、有毒物质、腐蚀性物质、易燃、易爆物质的进口、收集、存储、运	2018.11.30

Main Content 主项目	Estimated Submission Date 预计提交时间
输和使用批准书；	
12. All Planning permits for Project 项目所有的规划许可；	Submitted 已提交
13. All Development Approvals for the Project 项目所有的开发许可；	Submitted 已提交
14. All Construction permits for the Project 项目所有的施工许可；	Underway 进行中
15. All Design notifications submitted in accordance with the applicable Laws in respect of the Project 项目所有的设计通知按照适用法律提交；	Submitted 已提交
16. All Safety case certificates arising from the applicable Laws for the Project 项目所有根据适用法律应获取的“Safety Case”证书；	Underway 进行中
17. All Occupation permits in respect of the Project 项目所有的入伙准证	2018.7.30~11.30
18. All Statement of Review has been issued in accordance with the Agreement for each of the relevant Critical Design Documents and remains in effect with no outstanding Statement of Review on the account of suspension, cancellation or failure by Hengyi to submit Critical Design Documents as required under the Agreement. Refer to the following 44 items for detailed content (PCT review) 每一份相关关键设计文件已经按照实施协议获取了《审查声明》，且这些《审查声明》处于有效状态，不存在因恒逸中止、取消或未提交关键设计文件而未获取《审查声明》的情形。--详见下述 44 项具体内容（PCT 审查）	
1. Project execution plan. 项目执行计划	Submitted 已提交
2. Critical Contractor capability & qualification (prior to contract awarded per BCO	Submitted 已提交

Main Content 主项目	Estimated Submission Date 预计提交时间
requirement) 关键承包商的能力和资质（根据 BCO 要求，在授予合同前提供）	
3. Hengyi & contractor organization chart, responsibility and contact List 恒逸和承包商的组织结构图、职责和联系人列表	Submitted 已提交
4. Evidence of relevant Approvals 相关批准的证明	2018.11.30
5. Scope of Work ("SOW") change application 工作范围 ("SOW") 变更申请	项目开车前
6. Approved SOW change, register with supporting documents 批准后的 SOW 变更单及证明文件台账	项目开车前
7. HSE Management System HSE 管理系统	2018.10. 10
8. Emergency & accident monitoring system. 应急和事故监测系统	2018. 10. 10
9. HSE non-conformance monitoring system. HSE 不合规监测系统	2018. 10. 10
10. Environmental Monitoring System. 环境监测系统	2018. 10. 10
11. Quality assurance/quality control management system QA/QC 管理系统	Submitted 已提交
12. Quality assurance/quality control non-conformance control procedure. QA/QC 不合规控制程序	Submitted 已提交
13. Project Program (Level 1 / 2 / 3 Schedule) with 3 months look ahead 未来 3 个月的项目计划（第 1/2/3 级计划）	Every 3 Months 每季度
14. Monthly Progress Report 月进度报告	Monthly 每月
15. Weekly Progress Report 周进度报告	------
16. Document submission schedule 文件提交计划	Submitted 已提交

Main Content 主项目	Estimated Submission Date 预计提交时间
17. Document numbering procedure 文件编码程序	Submitted 已提交
18. Management document register 管理文件台账	2018.9.30
19. Design technical document register ("TDR") 设计技术文件台账 ("TDR")	2018.9.30
20. Feasibility study report 可行性研究报告	Submitted 已提交
21. QRA assessment & report QRA 评价和报告	Submitted 已提交
22. HAZID assessment & report HAZID 评价和报告	Submitted 已提交
23. HAZOP 评价和报告 HAZOP assessment & report	Submitted 已提交
24. SIL assessment & report SIL 评价和报告	Submitted 已提交
25. Front end engineering package 前期工程设计包	Submitted 已提交
26. Detail Design package 详细设计包	2018.9.30
27. Red-line markup drawings 红线标记图纸	After Handover 中交后
28. As-Built Drawings 竣工图	装置试车后提交
29. Critical Equipment & special material manufacturing inspection & test schedule. 关键设备和特殊材料制造检试验计划	Monthly 每月
30. Manufacturing data book 制造数据手册	One month after equipment manufacturing is completed 设备制造完成后一个月
31. Manufacturing inspection & test report 制造检试验报告	One month after equipment manufacturing is completed 设备制造完成后一个月
32. ITO verification, inspection & test report and/or ceritificate 检试验机构确认，检试验报告和/或证书	One month after equipment manufacturing is completed 设备制造完成后一个月

Main Content 主项目	Estimated Submission Date 预计提交时间
33. Construction inspection and supervison report 施工检验监督报告	Two month after Handover 中交后二个月
34. Construction Punch List 施工尾项表	2018.12.30
35. Pre-commissioning and commissiong plan 预投料试车和投料试车计划	Included in General Commissioning Plan 包含在总体试车方案里，2018.9.10
36. Operationing and Maintenance Manuals 操作手册和维护手册	2018.5.30~10.30
37. Training framework plan 培训框架计划	Submitted 已提交
38. Pre-commissionning check list 预投料试车检查表	2018.9.30
39. Production preparation procedure and schedule plan 生产准备时间计划	Included in General Commissioning Plan 包含在总体试车方案里，2018.9.10
40. Pre-commissioning test report 预投料试车试验报告	2019.3.30
41. Completion & handover report 完工和中交报告	2019.3.30
42. Facility modification plan 设施修改计划	2019.3.30
43. Decommissioning, abandonment & restoration 退役、废弃和恢复	N/A 不适用
44. Ready for start-up audits have been performed and satisfied by the relevant Government Entities and corresponding Approvals have been provided to Hengyi for the Project (MEI leads all approval authorities for site audits) 相关政府部门已圆满地进行了开车就绪审查，且已针对本项目向恒逸授予了相应的批准书（能源局牵头审批机构进行现场审查）。	2018.12.30

4.2.2 Licence to Operate Package Grouping 运行许可包组划分

In accordance to the construction progress of the project and generall commissioning network, the packages are grouped and classified, so that the process in obtaining the licence to operate is synchronized with the construction progress of the project.

根据项目施工进度和总体试车网络，对各包进行分组分类，便于运行许可报批与工程施工进度同步。

Table 4-2 Licence to Operate Package Group

表 4-2 运行许可包组划分

Package No 包序号	Package Name 包名称	Package Sub No. 副包序号	Content 内容
Package Group 0 Project general documents 包组 0 总体			
Package 0 包 0	General 总体		Project general documents 总体文件
Package Group A Power Plant 包组 A 电厂			
Package 2 包 2	Coal Jetty 煤码头		35 KDWT Coal jetty 煤码头
Package 10 包 10	Desalination Unit 海水淡化装置		Seawater desalination plant 海水淡化装置
Package 13 包 13	Power Department 热电部		Steam power plant and general electric substation 热电站和总变站
Package Group B Infrastructure 包组 B 基础设施			
Package 8 包 8	General Plan and Transportation 总图运输		General plot plan, Plant vertical planning, Road and Drainage/Sewage, Common pipeline, Fence/Gate and the Security room, Landscaping 总平面布置图、厂房竖向规划、道路排水/污水、公用管道、围栏/大门及保安室、美化景观
Package 11 包 11	Utilities 公用工程装置		Water supply and fire water pressurization pump station, Cooling water unit, foam station, fire station and gas protection station, The rainwater monitoring and accident reservoir, Piping network for water supply/drainage and

Package No 包序号	Package Name 包名称	Package Sub No. 副包序号	Content 内容
			fire fighting , The drainage pumping station, Sewage and wastewater recycling facilities, Solid waste transit storage, 66KV power substation(1), 66KV power substation(2), Plant-wide road lighting, Plant-wide power supply and distribution system, Telecommunication systems , Plant-wide information system, Hot water station, Administration zone refrigeration station, Refrigeration station for process area. 供水消防加压泵站、循环水场、泡沫站、消防站及气防站、雨水监测和事故水池、给排水及消防水管网、污水加压泵站、污水和污水回收设施、固体废物转运库、66KV 变电站(1)、66KV 变电站(2)、全厂道路照明、全厂供电配电系统、电信系统、全厂信息系统、热水站、行政区制冷站，工艺区制冷站。
Package 12 包 12	Air Separation Unit 空分空压装置		Air separation and air compression 空分空压装置
Package 14 包 14	Administration Zone 行政区		Central laboratory and environment monitoring centre, Office building, Maintenance station, Warehouse, Chemicals warehouse, Central control room（CCR） 中心化验室及环境监测中心、办公大楼、维修站、仓库、化学品仓库、中控室(CCR)
Package 18 包 18	Offsite Stormwater Drainage System 厂外雨水排放系统		Outside premises stormwater discharge system 厂外雨水排放系统
Package Group C Storage Area & Jetties 包组 C 罐区及码头			
Package 1	No. 1-7 Jetties		50 KDWT No. 1-3 jetties,

Package No 包序号	Package Name 包名称	Package Sub No. 副包序号	Content 内容
包 1	1-7 号码头		30 KDWT No. 4-5 jetties, 10KDWT No. 6 jetty, 2KDWT No.7 jetty 1-7 号码头
Package 2 包 2	Coal Jetty 煤码头		35 KDWT Coal jetty 煤码头
Package 9 包 9	Eastern Tank Area and Torch 东部罐区和火炬	Package 9A 包 9A	Eastern Tank Farm 东部罐区
		Package 9B 包 9B	Flare Facility & Flare Gas Recovery Facility 火炬及火炬气的回收
		Package 9C 包 9C	Interconnection Pipe network 厂际管廊
Package 15 包 15	Pipe Rack and Western Tank Farm 管架和西部罐区		Pipe rack and access road (Between Eastern site and western jetty), Pipe rack and access road (Between eastern site and eastern jetty), Pipe rack and access road (Between eastern site and flare), western tank farm. 管廊及道路(东部厂区和西码头间)、管廊及道路(东部厂区和东码头间)，管廊及道路(东部厂区和火炬间)，西部库区。
Package 17 包 17	Single Point Mooring 单点系泊		Single point mooring, Subsea crude oil pipeline 单点系泊，海底原油管道
Package Group D Production Unit 包组 D 生产装置			
Package 3 包 3	CDU/VDU 常减压蒸馏装置	Package 3A 包 3A	8 MMTA Atmospheric and Vacuum Distillation Unit 常减压蒸馏装置
		Package	2.35 MMTA Light Ends Recovery Unit,

Package No 包序号	Package Name 包名称	Package Sub No. 副包序号	Content 内容
		3B 包 3B	轻烃回收装置
		Package 3C 包 3C	Acid Gas & LPG Ends Recovery Unit 产品精制装置
Package 4 包 4	Hydrogenation Unit 加氢装置	Package 4A 包 4A	1.3 MMTA Kerosene Hydrotreating unit 航煤加氢装置
		Package 4B 包 4B	2.2 MMTA Diesel Hydrotreating unit 柴油加氢装置
		Package 4C 包 4C	2.2 MMTA Hydrocracking Unit 加氢裂化装置
		Package 4D 包 4D	600 KMTA LPG Fractionation Unit 气分装置
Package 5 包 5	Aromatics Unit 芳烃装置	Package 5A 包 5A	1.5 MMTA Aromatics unit 芳烃联合装置
		Package 5B 包 5B	180kN m^3/h PSA unit PSA 氢提纯装置
		Package 5C 包 5C	Light Naphtha Isomerization unit 轻石脑油异构化装置
Package 6 包 6	Flexicoking Unit 灵活焦化装置		1.0 MMTA Flexicoking unit 灵活焦化装置
Package 7 包 7	Sulfur Unit 硫磺回收装置	Package 7A 包 7A	180 t/h Sour water stripping unit 酸性水汽提装置
		Package 7B 包 7B	500 t/h Solvent Regeneration unit 溶剂再生装置

Package No 包序号	Package Name 包名称	Package Sub No. 副包序号	Content 内容
		Package 7C 包 7C	60+60 kta Sulfur recovery & tail gas treatment unit 硫磺回收装置
Package Group E Environment 包组 E 环境			
Package 16 包 16	Environmental Monitoring 环境监测		Air emissions monitoring station, Noise monitoring station, Groundwater monitoring wells and sampling/monitoring, Sea water quality sampling and monitoring 空气监测站、噪音监测站、地下水监测井和采样及监测、海水水质采样和监控
Package Group X Marine Works 包组 X 海洋工程			
Package 1 包 1	No. 1-7 Jetties 1-7 号码头		50 KDWT No. 1-3 jetties, 30 KDWT No. 4-5 jetties, 10KDWT No. 6 jetty, 2KDWT No.7 jetty 1-7 号码头
Package 2 包 2	Coal Jetty 煤码头		35 KDWT Coal jetty 煤码头
Package 17 包 17	Single Point Mooring 单点系泊		Single point mooring, Subsea crude oil pipeline 单点系泊，海底原油管道

4.2.3 Contents Required for Licence to Operate and Submission Progress 运行许可所需内容及提交进度

Refer to Table 4-3 for the required contents for licence to operate and submission progress 运行许可所需内容及提交进度见表 4-3

Table 4-3 Required Contents for Licence to Operate and Submission Progress

表 4-3 运行许可所需内容及提交进度

Main Content 主项目	Estimated Submission Date 预计提交时间
1. All EIA approvals for the project; 项目所有的环评批准书；	Submitted on March 2013 2013.3 已提交

Main Content 主项目	Estimated Submission Date 预计提交时间
2. All Environmental Management & Monitoring Plan Approval for the project 项目所有的环境管理与监测计划批准书；	Approved
3. Land Lease Registration for the Petrochemical Plant 石化装置的土地租赁注册；	Partial Completion 部分完成
4. All Sewage / Drainage / Coastal exit Approvals for the project 项目所有的污水、排水及海岸排水批准书；	此项不适用
5. All Jetty and Navigation Area, Construction, Operation, and Transportation Approval for the project 项目所有的码头和航道区域、施工、运行和运输批准书；	2018.11.30
6. All Power Transmission Line Integration to Existing System Approval for the project 项目所有并入现有电网的输电线批准书；	This does not apply 此项不适用
7. All Radio Communications Approval for the project 项目所有的无线电通讯批准书；	2018.9.30
8. All Waste Disposal Approvals for the project 项目所有的废物处理批准书；	2018.11.30
9. All Import and Export Approvals for the project 项目所有的进出口批准书；	2018.11.30
10. All Wading Work Construction Approvalsfor the project 项目所有的涉水施工批准书；	Submitted 已提交
11. All Import, collector licence, storage, transportation & usage of petroleum, radioactive, toxic, corrosive, explosive and flammable substances Approvals for the Project 项目所有石油、放射性物质、有毒物质、腐蚀性物质、易燃、易爆物质的进口、收集、存储、运输和使用批准书；	2018.11.30
12. All Planning permits for Project	Submitted

Main Content 主项目	Estimated Submission Date 预计提交时间
项目所有的规划许可；	已提交
13. All Development Approvals for the Project 项目所有的开发许可；	Submitted 已提交
14. All Construction permits for the Project 项目所有的施工许可；	In Progress 进行中
15. All Design notifications submitted in accordance with the applicable Laws in respect of the Project 项目所有的设计通知按照适用法律提交；	Submitted 已提交
16. All Safety case certificates arising from the applicable Laws for the Project 项目所有根据适用法律应获取的“Safety Case”证书；	In Progress 进行中
17. All Occupation permits in respect of the Project 项目所有的入伙准证	2018.7.30~11.30
18. All Statement of Review has been issued in accordance with the Agreement for each of the relevant Critical Design Documents and remains in effect with no outstanding Statement of Review on the account of suspension, cancellation or failure by Hengyi to submit Critical Design Documents as required under the Agreement. Refer to the following 44 items for detailed content (PCT review) 每一份相关关键设计文件已经按照实施协议获取了《审查声明》，且这些《审查声明》处于有效状态，不存在因恒逸中止、取消或未提交关键设计文件而未获取《审查声明》的情形。--详见下述 44 项具体内容（PCT 审查）	
1. Project execution plan. 项目执行计划	Submitted 已提交
2. Critical Contractor capability & qualification (prior to contract awarded per BCO requirement) 关键承包商的能力和资质（根据 BCO 要求，在授	Submitted 已提交

Main Content 主项目	Estimated Submission Date 预计提交时间
予合同前提供）	
3. Hengyi & contractor organization chart, responsibility and contact List 恒逸和承包商的组织结构图、职责和联系人列表	Submitted 已提交
4. Evidence of relevant Approvals 相关批准的证明	2018.11.30
5. Scope of Work ("SOW") change application 工作范围 ("SOW") 变更申请	项目开车前
6. Approved SOW change, register with supporting documents 批准后的 SOW 变更单及证明文件台账	项目开车前
7. HSE Management System HSE 管理系统	2018.10.10
8. Emergency & accident monitoring system. 应急和事故监测系统	2018.10.10
9. HSE non-conformance monitoring system. HSE 不合规监测系统	2018.10.10
10. Environmental Monitoring System. 环境监测系统	2018.10.10
11. Quality assurance/quality control management system QA/QC 管理系统	Submitted 已提交
12. Quality assurance/quality control non-conformance control procedure. QA/QC 不合规控制程序	Submitted 已提交
13. Project Program (Level 1 / 2 / 3 Schedule) with 3 months look ahead 未来 3 个月的项目计划（第 1/2/3 级计划）	Every 3 Months 每季度
14. Monthly Progress Report 月进度报告	Monthly 每月
15. Weekly Progress Report 周进度报告	------
16. Document submission schedule 文件提交计划	Submitted 已提交
17. Document numbering procedure 文件编码程序	Submitted 已提交

Main Content 主项目	Estimated Submission Date 预计提交时间
18. Management document register 管理文件台账	2018.9.30
19. Design technical document register ("TDR") 设计技术文件台账 ("TDR")	2018.9.30
20. Feasibility study report 可行性研究报告	Submitted 已提交
21. QRA assessment & report QRA 评价和报告	Submitted 已提交
22. HAZID assessment & report HAZID 评价和报告	Submitted 已提交
23. HAZOP 评价和报告 HAZOP assessment & report	Submitted 已提交
24. SIL assessment & report SIL 评价和报告	Submitted 已提交
25. Front end engineering package 前期工程设计包	Submitted 已提交
26. Detail Design package 详细设计包	2018.9.30
27. Red-line markup drawings 红线标记图纸	After Handover 中交后
28. As-Built Drawings 竣工图	2019.11.30
29. Critical Equipment & special material manufacturing inspection & test schedule. 关键设备和特殊材料制造检试验计划	Monthly 每月
30. Manufacturing data book 制造数据手册	One month after equipment manufacturing is completed 设备制造完成后一个月
31. Manufacturing inspection & test report 制造检试验报告	One month after equipment manufacturing is completed 设备制造完成后一个月
32. ITO verification, inspection & test report and/or ceritificate 检试验机构确认，检试验报告和/或证书	One month after equipment manufacturing is completed 设备制造完成后一个月

Main Content 主项目	Estimated Submission Date 预计提交时间
33. Construction inspection and supervison report 施工检验监督报告	Two month after Handover 中交后二个月
34. Construction Punch List 施工尾项表	2018.12.30
35. Pre-commissioning and commissiong plan 预投料试车和投料试车计划	Included in General Commissioning Plan 包含在总体试车方案
36. Operationing and Maintenance Manuals 操作手册和维护手册	2018.5.30~10.30
37. Training framework plan 培训框架计划	Submitted 已提交
38. Pre-commissionning check list 预投料试车检查表	2018.9.30
39. Production preparation procedure and schedule plan 生产准备时间计划	Included in General Commissioning Plan 包含在总体试车方案
40. Pre-commissioning test report 预投料试车试验报告	2019.3.30
41. Completion & handover report 完工和中交报告	2019.3.30
42. Facility modification plan 设施修改计划	2019.3.30
43. Decommissioning, abandonment & restoration 退役、废弃和恢复	
44. Ready for start-up audits have been performed and satisfied by the relevant Government Entities and corresponding Approvals have been provided to Hengyi for the Project (MEI leads all approval authorities for site audits) 相关政府部门已圆满地进行了开车就绪审查，且已针对本项目向恒逸授予了相应的批准书（能源局牵头审批机构进行现场审查）。	2018.12.30

4.3 Personnel Training 人员培训

The targeted total number of personnel for this project is 1688. Among them, the targeted number of management personnel and functional personnel is 370, and target number of operators is 1318. Among the operators, 810 out of 1318 were experienced operators, and 508 out of 1318 were trainee operator, in which the experienced operators account for 61.46% of the total operators. The recruitment is performed mainly via internet, school/universities, and recommendations. The experienced management personnel and operators are mainly recruited from China's large-scale oil refinery & chemical production industries. Meanwhile, the trainee operators are mainly recruited from China petroleum and petrochemicals schools/universities, and some job position needs to be recruited locally in Brunei. A small number of auxiliary systems are managed by outsourcing services.

本项目总定员为1688人；其中管理人员及各职能人员定员为370人，技能操作人员定员为1318人，技能操作人员中熟练工定编为810人，学生定编为508人，熟练工占生产操作人员总比例的61.46%。招聘渠道主要为网络、校园及熟人推荐等，管理人员和操作人员中的熟练工主要来自国内大型炼化生产企业，学生主要从国内石油石化类学校招聘，个别岗位需要在文莱当地人进行招聘。少量辅助系统采用外包服务管理。

4.3.1 Operator Training 操作人员培训

In order to scientifically co-ordinate the employees' training, the company has formulated training-related systems such as the "General Training Plan" and "Shanghai Training Base Management System". The training of new units is divided into several modules such as induction education, theoretical knowledge foundation training, professional skills training, DCS training, similar training production practice training, certificate acquirement for special operation personnel training, simulation training, and units' on-site training. Simultaneously, personnel are selected to go abroad for training, that are in accordance to the requirements of the imported technology contracts. These major categories include the relevant training on safety, fire-fighting, gas protection, environmental protection, and basic skills knowledge. The training details is divided into seven stages as shown below:

为科学统筹员工培训工作，公司制订了《员工总体培训方案》及《上海基地培训管理制度》等培训相关制度。新装置培训分为入职教育、基础理论知识培训、专业技能培训、DCS 培训、同类装置生产实习培训、特殊作业人员取证培训、仿真培训、装置现场培训等几个模块，同时根据引进技术合同的要求选派人员出国培训。这几大类中包括相关的安全、消防、气防、环保知识和基本技能的培训。具体培训工作分为七个阶段，如下：

4.3.1.1 Phase 1 Induction Education and Basic Theoretical Knowledge Training 第一阶段 入职教育及基础理论知识培训

（1）Induction Education Training. It includes introduction on Hengyi Company, introduction on PMB Petrochemical Project, code of conduct, basic theoretical knowledge, and HSE training.

This allows the employees to have a detailed understanding on the company's organizational structure, Hengyi PMB project, and the management system.

入职教育培训。包含恒逸企业简介、PMB 炼化项目简介、行为规范、基础理论知识、HSE 培训等，使员工对公司组织结构、恒逸 PMB 项目及管理制度有了较为详细的了解。

（2）Basic Theoretical Knowledge Training. It includes the basic knowledge of petroleum processing, process technologies, machineries & equipment, automation control, power generation & consumption, storage & transportation of petroleum products, petroleum product analysis, and other professional knowledge. This allows the operators to have the basic knowledge of petroleum refining and perceptual knowledge of petrochemical plants.

基础理论知识培训。包含石油加工基础知识、工艺技术、机械设备、自动化控制、发电和用电、油品储运、油品分析等专业知识。使操作人员获得了石油炼制的基本知识和对石化装置的感性认识。

4.3.1.2 Phase 2 Professional Skills Training 第二阶段 专业技能培训

Professional skills training's content includes: process technical procedures, process equipment interlock & single equipment operation, and level 2 safety education for production units. This allows the operators to master the production unit's process principles and process operation & control.

专业技能培训的具体内容有：工艺技术规程、工艺设备联锁和单机操作、装置二级安全教育等内容，使操作人员掌握本装置的工艺原理、过程操作与控制等。

4.3.1.3 Phase 3 DCS Training 第三阶段 DCS 培训

Specific contents of DCS Training: DCS system hardware and system overview, system conventional operation and control; DCS system tools, control chart configuration and flow chart, etc. making trainees familiar with the operating environment and methods, so as to improve their theoretical level and practical operation skills.

DCS 培训的具体内容：DCS 系统硬件及系统概述、系统常规操作及控制；DCS 系统工具、控制图组态及流程图等，使参训人员熟悉操作环境、操作方法，以提高他们的理论水平和实际操作技能。

4.3.1.4 Phase 4 Similar Unit Production Practice Training 第四阶段 同类装置生产实习培训

Operators are respectively sent to Hangzhou Caprolactam, Sinopec Shanghai Petrochemical Co. Ltd., Shanghai Biouxi Gas Co. Ltd., Sinopec Maoming Petrochemical Co., and Quanzhou Petrochemical Co. Ltd. for on-site internship training. In accordance to operators' department, production units, and their shift groups, they will be respectively sent to the production plant's related counterpart production units to undergo internship training. The training will be carried out by inviting experts from the counterpart production units to give lectures and the operators will follow their working shift pattern throughout the training to combine both theory and practical. The training content includes the related production unit technologies, technical equipment & safety, instrumentation operation, familiarization with on-site process flow, normal on-site operation of production unit, startup and shutdown operation of production unit, and

accident assessment & handling. This allows the operator to master the operating skills of operating the oil refining unit.

操作人员分别赴杭州己内酰胺、上海石化、上海比欧西、茂名石化、泉州石化等进行生产工厂实地培训。分部门、分装置、分班组到对口工厂同类装置进行实地培训，以请对口工厂专家讲课和跟班倒的方式，理论与实践操作相结合的方式、岗位练兵的方式培训。培训内容为相关装置工艺、设备和安全技术，仪表操作，熟悉现场流程、装置现场正常操作、装置开停工操作、事故判断和处理等培训，使操作人员掌握所在炼油装置操作技能。

4.3.1.5 Phase 5 Certificate Acquirement for Special Operation Personnel Training 第五阶段 特殊作业人员取证培训

Carry out safety and operation skills training for personnel working in pressure vessels, electricians undergoing power grid operation, crane and forklift driving, hazardous chemicals operation and other special operations, so as to enable personnel to master corresponding safety skills and practical operation capabilities.

对压力容器、电工进网作业、起重及叉车驾驶、危化品操作及其它各类特种作业岗位人员进行安全及操作技能培训，使员工掌握相应的安全技能和实际操作能力。

4.3.1.6 Phase 6 Simulation Training 第六阶段 仿真培训

The company has developed simulation systems for major processing units to train the operators by simulation of the startup and shutdown processes, accident handling, and other scenario. This allow the operators to master the accident handling and startup & shutdown operation their respective production unit assigned to.

公司开发了主要装置的仿真系统，操作人员通过模拟开停工过程、事故处理等培训，掌握了所在炼油装置的事故处理和装置开车操作。

4.3.1.7 Phase 7 Production Unit On-site Training 第七阶段 装置现场培训

Operators will enter into the production unit site to familiarize the process flow and identify the equipment. Some of the operators will participate in the pre-commissioning, study the startup plan, rehearse accident handling, engage in on-site inspections of the processing units, witness operations such as cleaning, installation, pressure test, acceptance and single test run of the related equipment including the pipelines, pressure vessels, and mechanical equipment. So as to achieve “Three Understandings and Six Knows” (Three Understandings: understand the principles, understand the structures, and understand the plans and procedures; Six knows: know how to read diagrams, know how to operate, know how to undergo maintenance, know how to calculate, know how to communicate, and know how to troubleshoot problems); This allow the operators to master the operation skills of the production unit that they are assigned to, and able to meet their job post requirements.

操作人员进入装置建设现场，摸流程、认设备，部分人员参与单机试运，学习开工方案，演练事故处理，装置现场检查，见证相关管线、压力容器、机械设备等的清洁、安装、试压、验收和单机试运等，达到“三懂六会”（三懂：懂原理、懂结构、懂方案规程）；六会：（会识图、会操作、会维护、会计算、会联系、会排除故障）；使其熟练掌握所在炼油装置或单元操作技能，达到任

职上岗条件。

4.3.2 Work Qualification Certificate Acquirement 上岗取证

After all the trainings are completed, the company will organize the employees to take the work qualification examination and to acquire the work qualification certificate. The examination content includes the job post's related special work, job post's tasks, and the HSE knowledge within the job post. After passing the examination, the human resources department will issue the certificate.

所有培训结束后，公司组织员工上岗取证考试，考试内容包括岗位范围内的特殊作业、岗位业务和 HSE 知识三方面考核内容，考核合格后由人力资源部发放上岗证。

4.3.2.1 Job post's related special work shall be trained, and the examination must be qualified.

岗位范围内的特殊作业项目均需培训考核合格。

4.3.2.2 Job post's works includes job post technical knowledge and practical operation, and therefore it is divided into two content, namely the requirement to understand and requirement to master, and the scores must reach 60 points and above for qualification.

岗位业务分为岗位技术理论和实际操作，即应知和应会两部分内容，成绩均须达到 60 分及以上为合格。

4.3.2.3 HSE knowledge includes level 3 safety education, job post safety operation regulation, labor protection, and occupational health & environmental protection. The passing score is 80 points or above.

HSE 知识包括三级安全教育、岗位安全操作规程、劳动保护、职业卫生及环境保护等， 成绩必须达 80 分及以上为合格。

4.4 Technical Preparation 技术准备

The following training materials, technical data, management systems and various commissioning schemes are respectively prepared in accordance to the design document and imported technology package of the PMB reinfery project, as well as referring to the relevant data and the practical experience of commissioning & trial operation of similar production units found in China or other countries.

根据 PMB 炼油项目工程的设计文件、引进技术工艺包，并参照国内外同类装置的有关资料和试车生产的实践经验，分别编制以下培训教材、技术资料、管理制度和各种试车方案。

4.4.1 Training Materials 培训教材

In order to strengthen the training of employees, 63 set of oil refining industry technical

knowledge series were purchased in 2017 as training materials for basic knowledge of various specialties, which can be seen in table 4 – 1 for more details. In addition, the production preparation department has also compiled and prepared training materials such as “Young Employee Training” and “Practical English for Oil Refining”.

为加强职工的培训工作， 2017 年购买了 63 套炼油工业技术知识丛书作为各专业基础知识培训教材，详见表 4-1。另外，生产准备部还组织编写了《青工培训基础知识》、《Young Employee Training》、《炼油实用英语》等培训教材。

Table 4-1 Training Materials List

表 4-1 培训教材清单

No. 序号	Training Materials 教材名称	No. 序号	Training Materials 教材名称
1	Atmospheric & Vacuum Distillation Unit Technical Questions & Answers 《常减压装置技术问答》	33	Cooling Water Operation Handbook 《循环水操作工》
2	Atmospheric & Vacuum Distillation Unit Operating Guidelines 《常减压蒸馏装置操作指南》	34	Wastewater Treatment Handbook 《污水处理工》
3	Sulfur Recovery Complex Unit Technical Questions & Answers 《硫磺回收联合装置技术问答》	35	Maintenance Electrician Handbook 《维修电工》
4	Atmospheric & Vacuum Distillation Unit Emergency Response Knowledge Questions & Answers 《常减压蒸馏装置应急知识问答》	36	Operation Electrician Handbook 《运行电工》
5	Natural Gas Purification Process 《天然气净化工艺》	37	Electrical Shift Worker Handbook 《电气值班员》
6	Sulfur Recovery Technology & Engineering 《硫磺回收技术与工程》	38	Production Dispatcher Management Knowledge and Practice 《生产调度管理知识与务实》
7	Hydrocracking Unit Technical Questions & Answers 《加氢裂化装置技术问答》	39	Aromatic Technology 《芳烃技术》

No. 序号	Training Materials 教材名称	No. 序号	Training Materials 教材名称
8	Gasoline, Kerosene & Diesel Hydrotreating Unit Emergency Response Knowledge Questions & Answers 《汽（煤、柴）油加氢装置应急知识问答》	40	Oil Refinery Engineers Handbook – Design Standards & Specifications 《石油炼制工程师手册——设计标准与规范》
9	Aromatic Unit Technical Questions & Answers 《重整装置技术问答（第三版）》	41	China Oil Refining Technology (3rd Edition) 《中国炼油技术（第三版）》
10	Hydrotreating Unit Technical Questions & Answers 《加氢精制装置技术问答》	42	Oil Blending Technology 《油品调和技术》
11	Regulating Valve & Valve Positioner 《调节阀与阀门定位器》	43	Oil Refinery Storage & Transportation Technology and Management 《炼油厂炼油储运技术及管理》
12	Petrochemical Instruments & Automation 《石油化工仪表及自动化》	44	Oil Metering Personnel Handbook (3rd Edition) 《油品计量员读本（第三版）》
13	Analysis of Typical Instrument Fault Case 《仪表典型故障案例分析》	45	Oil Refining & Petrochemical Industry Three Chemical Agent Manual 《炼油及石油化工三剂手册》
14	Oil Refinery Static Equipment 《炼油厂静设备》	46	Oil Refining Industries General Safety Knowledge Handbook 《炼油企业通用安全知识读本》
15	Oil Refinery Rotary Equipment 《炼油厂动设备》	47	Catalytic Cracking Unit Operation Handbook 《催化裂化装置操作工》
16	Safety & Health Training Course for Safety Management Personnel 《安全管理人员安全健康培训教程》	48	Catalytic Cracking Unit Technical Questions & Answers 《催化裂化装置技术问答》
17	Firefighting, Rescue & Handling for Hazardous Chemicals 《危险化学品消防救援与处置》	49	Oil Storage Safety and Accident Case Studies 《油库安全事故案例剖析》
18	Atmospheric & Vacuum Distillation Unit	50	Oil Loading & Unloading HSE

No. 序号	Training Materials 教材名称	No. 序号	Training Materials 教材名称
	Operator Handbook 《常减压蒸馏装置操作工》		Training Handbook 《油品装卸工 HSE 培训读本》
19	Sulfur Recovery Unit Operator Handbook 《硫磺回收装置操作工》	51	Oil Storage & Transportation 《油品储运》
20	Hydrocracking Unit Operator Handbook 《加氢裂化装置操作工》	52	Oil Storage Safety Technical Manual (2nd Edition) 《油库安全技术手册（第 2 版）》
21	Gasoline, Aviation Kerosene, and Diesel Hydrotreating Unit Operator Handbook 《汽（煤、柴）油加氢装置操作工》	53	Spherical Storage Tank Technical Questions & Answers 《球形储罐技术问答》
22	Catalytic Reforming Unit Operator Handbook 《催化重整装置操作工》	54	Oil Storage Tank Safety Operation & Management 《油罐安全运行与管理》
23	Xylene Unit Operator Handbook 《二甲苯装置操作工》	55	Hazard and Operability Study (HAZOP) Application Guideline 《危险与可操作性分析（HAZOP）应用指南》
24	Benzene Production Unit Operator Handbook 《制苯装置操作工》	56	Job Safety Analysis (JSA) Guideline 《作业安全分析（JSA）指南》
25	Hydrogen Production Unit Operator Handbook 《制氢装置操作工》	57	Oil Storage, Transportation, and Oil Blending Operation Handbook 《油品储运调和操作工》
26	Oil Storage, Transportation & Blending Operator Handbook (Sinopec) 《油品储运调和操作工》（中石化）	58	GB 26860-2011 Power Safety Work Regulations – Electrical Section of Power Plant & Substation 《GB 26860-2011 电力安全工作规程 发电厂和变电站电气部分》
27	Oil Storage, Transportation & Blending Operator Handbook (CNPC	59	Petrochemical Equipment Maintenance & Repair

No. 序号	Training Materials 教材名称	No. 序号	Training Materials 教材名称
	《油品储运调和操作工》（中石油）		Regulations – Volume 6 Electrical Equipment 《石油化工设备维护检修规程--第六册 电气设备》
28	Oil Loading & Unloading Operator Handbook 《油品装卸工》	60	GB50150-2016 Standard for Electrical Equipment Installation and Handover Test 《GB50150-2016 电气装置安装工程电气设备交接试验标准》
29	English Course for Oil & Gas Storage and Transportation (2nd Edition) 《油气储运英语教程（第 2 版）》	61	Digital Electro-hydraulic Control System for Steam Turbine of Power Station - DEH 《电站汽轮机数字式电液控制系统-DEH》
30	Cryogenic Gas Separator Operator Handbook 《气体深冷分离工》	62	Operation and Management of Large-scale power plant (Technical Series of Large-scale power plant) 《大型热电机组运行与管理(大型热电联产机组技术丛书)》
31	Desalinated Water Treatment Handbook 《化学水处理工》	63	GB261164.1-2010 Electrical Safety Work Regulations – Part 1: Thermal and Mechanical Parts 《GB26164.1-2010 电业安全工作规程第 1 部分:热力和机械部分》
32	Steam Turbine Operation Shift Handbook 《汽轮机运行值班员》		

4.4.2 Technical Information 技术资料

The process flow diagram was finished prepared and printed on July 2017 and was distributed for study. The process technical regulations, safety technical regulations, preliminary edition of process index, accident response plan, and the accident compilation of similar devices shall be prepared and printed by 30th August 2018.

工艺流程图册于 2017 年 7 月份编制印刷完成，下发学习；工艺技术操作规程、工艺指标初版、

事故处理预案、同类装置事故汇编等 2018 年 9 月 30 日前完成编制印刷。

4.4.3 Commissioning Plan 试车方案

The printing of initial commissioning plan for utilities including boiler makeup water treatment system, cooling water unit, air separation unit, and steam power plant is to be completed on Sepl 2018. The printing of initial commissioning plan for production unit is estimated to be completed in Dec 2018.

化学水处理、循环水场、空压站及动力中心等公用工程系统的首次试车方案 2018 年 9 月印刷完毕。生产装置的首次试车方案预计 2018 年 12 月印刷完毕。

4.4.4 Production Management Rules and Regulations 生产管理规章制度

In June 2018, the preparation and review of the three production management systems of “production dispatcher management system”, “production operation management system”, and “process technical management system” were completed, which include 38 management procedures to ensure the orderly progress of all production work. The management system and procedures are shown in table 4 –2.

2018 年 6 月完成了《生产调度管理制度》、《生产运行管理制度》、《工艺技术管理制度》3 个生产管理制度的编制审核，包括 38 项管理程序，确保各项生产工作有序进行。管理制度和管理程序见表 4-2。

Table 4-2 Production Management System Details

表 4-2 生产管理制度明细

System Name 制度名称	No. 序号	Content 内容
Production Dispatcher Management System 生产调度管理制度	1	Production Dispatcher Command Management Procedure 生产调度指挥管理程序
	2	Production Dispatcher Order Management Procedure 生产调度指令管理程序
	3	Production Dispatcher Meeting Management Procedure 生产调度会议管理程序
	4	Production Dispatcher Report Management Procedure

System Name 制度名称	No. 序号	Content 内容
		生产调度报表管理程序
	5	Dispatcher Daily Report Preparation Procedure 调度日报编制程序
	6	Production Shift Management Procedure 生产值班管理程序
	7	Emergency Response Management Procedure 应急响应处理管理程序
Production Operation Management System 生产运行管理制度	8	Startup and Shutdown Plan, and Network Management Procedures 开停工方案和网络管理程序
	9	Production Unit Startup and Shutdown Management Procedure 装置开停工管理程序
	10	Production Unit Startup and Shutdown Confirmation Procedure 装置开停工确认程序
	11	Production Abnormity Management Procedure 生产异常管理程序
	12	Steam and Electricity System Operation Management Procedure 汽电系统运行管理程序
	13	Fuel Gas System Operation Management Procedure 瓦斯系统运行管理程序
	14	Crude Oil Receiving & Unloading Management Procedure 原油接卸管理程序
	15	Crude Oil Management Procedure 原料油管理程序
	16	Unqualified Raw Material Oil Review Procedure 不合格原料油评审程序

System Name 制度名称	No. 序号	Content 内容
	17	Slop Oil Recovery Management Procedure 污油回收管理程序
	18	Slop Oil Reprocessing Management Procedure 污油回炼管理程序
	19	Tank Cleaning Management Procedure 清罐管理程序
	20	System Pipeline Pressure Relief Management Procedure 系统管线放压管理程序
工艺技术管理制度	21	Process Technical Operation Regulations Preparation Procedure 工艺技术操作规程制订程序
	22	Process Technical Operation Regulations Revising Procedure 工艺技术操作规程修订程序
	23	Technical Drawing Preparation Procedure 技术图纸编制程序
	24	PI System Uploads Content Changes Procedure PI 系统上传内容变更程序
	25	Commissioning Plan Preparation Procedure 试车方案编制程序
	26	Startup and Shutdown Plan Preparation Procedure 开停工方案编制程序
	27	New Crude Oil Type Processing Plan Preparation Procedure 新油种加工方案编制程序
	28	Technical Summary Preparation Procedure 技术总结编制程序
	29	Production Unit Rating Plan Preparation Procedure 装置标定方案编制程序
	30	Production Unit Rating Plan Preparation Procedure 装置标定总结编制程序

System Name 制度名称	No. 序号	Content 内容
	31	Process Index Preparation Procedure 工艺指标制订程序
	32	Process Index Revising Procedure 工艺指标修订程序
	33	Routine Inspection Plan Preparation Procedure 巡检方案编制程序
	34	Routine Inspection Plan Revising Procedure 巡检方案修订程序
	35	Process Interlock Record Preparation Procedure 工艺联锁台账编制程序
	36	Process Interlock Changes Procedure 工艺联锁变更程序
	37	Firefighting Water Intake Usage Procedure 消防水取水使用程序
	38	Production Water Usage Procedure 生产水用水程序

4.4.5 Imported Technology Package Translation 引进工艺包翻译

The translation for the 13 imported technology packages, including Acid Gas & LPG Ends Recovery Unit, Hydrocracking Unit, Aromatic Unit, Light Naphtha Isomerization Unit, and Flexicoking Unit, has been completed in March 2017, and has been printed.

产品精制、加氢裂化、芳烃联合、轻石异构化和灵活焦化 13 项引进技术工艺包已于 2017 年 3 月翻译完成，并编印成册下发。

Table 4 – 3 Imported Technology Package Translation Table

表 4-3 引进工艺包翻译一览表

No. 序号	Production Unit 装置	Technology Package 工艺包
1	Kerosene Hydrotreating Unit 煤油加氢	ART
2	Hydrocracking Unit 加氢裂化	UOP
3	Aromatic Unit 芳烃联合	UOP

4	Light Naphtha Isomerization Unit 轻石异构	UOP
5	Flexicoking Unit 灵活焦化	EMRE

4.5 Material Preparation 物资准备

4.5.1 Raw Material 原料

4.5.1.1 Atmospheric & Vacuum Distillation Unit will undergo 2 startup. The first startup is to process 60,000 tons of low-sulfur crude oil, to produce preparatory materials for the startup of other production unit. The beginning of the second startup will be 5 days that uses the low-sulfur crude oil as the feedstock, with a total of 220,000 tons.

常减压装置两次投料。首次开工使用低硫原油备料试车，原油加工量 6 万吨，给其他装置储备开工原料，二次开车初期加工 5 天低硫原油，总量 22 万吨。

4.5.1.2 35,000 Tons of refined naphtha. The PMB Project does not have a hydrogen production unit. The hydrogen for hydrogenation unit of this project depends entirely on the by-product hydrogen produced from continuous reforming unit. Before the reforming unit startup and operate normally, there is no hydrogen supply in the whole plant. Therefore, in order to solve the problem of hydrogen supply required for reforming unit startup and gas leak test of hydrogenation unit, the naphtha hydrotreating unit process flow and equipments are designed in such as way that there will be a high platinum catalyst reactor added to process the refined naphtha in producing hydrogen gas for the reforming startup and gas leak test of hydrogenation unit. Hydrogen gas leak test will be carried out twice, with the first and second hydrogen gas leak test duration is estimated to be 7 days and 4 days respectively. Hydrogen production from high platinum catalyst is carried out by loading 6.5 tons of high platinum pellet catalyst, with a space velocity of $15h^{-1}$ ~ $20h^{-1}$, a feed of 100t/h, a pressure of 1.7 ~ 2.0 MPa, and a temperature of 400 ~ 450°C, that can produce >6,000Nm^3/h of hydrogen gas to be supplied for hydrogen gas leak test. The high platinum catalyst hydrogen production will be carried out for 11 days with total of refined naphtha required to be 24,400 tons. The refined naphtha are planned to be imported in 2 batches, using 2 storage tank (tank bottom volume of 2400 tons/tank). By considering the volume of storage tank bottom, pipelines, and to have extra 2 days for hydrogen production, 35,000 tons of refined naphtha will be purchased.

精制石脑油 3.5 万吨。PMB 项目没有制氢装置，加氢装置生产用氢气全部依靠连续重整装置的副产氢气，在重整装置开正常前，全厂没有氢气源供给，为解决重整开工用氢和加氢装置气密用氢，设计利用预加氢工艺流程和设备，在预加氢反应器前增加一台小型高铂小球反应器，用精制油产氢气供重整开工和加氢装置气密用氢。氢气气密按两次进行，第一次氢气气密 8 天、第二次氢气气密 4 天。高铂制氢安装 6.5 吨高铂小球催化剂，空速 $15h^{-1}$--$20h^{-1}$，进料 100t/h，压力 1.7-2.0MPa，

温度 400-450℃，可产氢气>6000Nm³/h，供加氢气密，高铂制氢运行 11 天共需精制油 2.64 万吨。计划按照两批进厂，使用两个储罐（罐底量 2400 吨/罐），考虑罐底、管线储量以及预留 2 天氢气气密时间，采购量 3.5 万吨。

4.5.1.3 15,000 tons of Mixed Xylene. Mixed Xylene is used for material inventory purposes during startup in Tatoray Unit, Benzene & Toluene Fractionation Unit, Parex Unit, Isomar Unit and Xylene Fractonation Unit. The material inventory amount required during startup is 10,969 tons that are to be stored in 1050-T801A/B (Storage tank bottom volume is 2300 tons/tank and safety allowance volume of tank bottom is 3 meters).

混合二甲苯 1.5 万吨。用于歧化单元、苯、甲苯分馏单元、吸附分离单元、异构化单元、二甲苯单元开工垫料。开工垫料量 10969 吨，储罐 1050-T801A/B（罐底量 2300 吨/罐，安全余量罐底 3 米）。

4.5.1.4 10,000 tons of reformate oil (Reformate Oil produced under normal operating conditions). Reformate oil will be processed by the reformate splitter column of xylene fractionation unit to produce C6C7 fraction that will be used for material inventory purpose in Sulfulane Extractive Distillation Unit; C9A+ fraction that will be used for material inventory purpose in Xylene Fractionation Unit's xylene column and heavy aromatic column bottom; C8A fraction that will be used for material inventory circulation during startup of the above production units. The material inventory amount is 8,000 tons that are to be stored in 1050-T404A/B (Storage tank bottom volume is 1,300 tons/tank).

重整生成油 1 万吨(按正常工况重整生成油组成)。重整生成油经二甲苯单元重整油分离塔处理后，分离出 C6C7 为抽提单元垫料，C9A+为二甲苯单元二甲苯塔及重芳烃塔底料，C8A 用于上述装置开工循环垫料。垫料量 0.8 万吨，储罐 1050-T404A/B（罐底量 1300 吨/罐）。

4.5.1.5 5,000 tons of Atmospheric & Vacuum Distillation Unit startup diesel oil. Atmospheric & Vacuum Distillation Unit startup diesel oil for commissioning, oil sealing, flushing and require 3,000 tons circulation purposes. The pipeline volume is 540 tons and stored in 4202-T001 with tank bottom volume of 1,460 tons.

常减压油运柴油 0.50 万吨。常减压装置油运、封油、冲洗、循环需 3000 吨，管线存量 540 吨，储罐 4202-T001，罐底 1460 吨。

4.5.2 Fuel 燃料

4.5.2.1 22,000 tons of liquefied Petroleum Gas(LPG) that will be used for furnace heating and commissioning of individual production unit.

液化气 2.2 万吨，用于各装置烘炉热油运。

4.5.2.2 The total amount of diesel used for power station in 2018 is 8,400 tons. Among them, the diesel generator will use 200 tons, startup boiler will use 7,800 tons, and CFB boiler will use 400 tons.

2018 年电站用柴油合计 0.84 万吨。其中柴油发电机用柴油 0.02 万吨、启动锅炉用柴油 0.78 万

吨、CFB 锅炉用柴油 0.04 万吨。

4.5.2.3 Coal. The bed material is scheduled to arrive at the coal jetty. For the temporary navigation through the channel, the channel will be dredged to -9 meters and the vessel will enter according to tide level (2 meters tide). A 15,000 DWT ships can be selected and the draught is limited to 10 meters. The establishment of 30,000 tons coal storage can be considered, that can provide a flexibility in adjusting the coal stock in accordance to the production needs and the trend of coal price during the operation of power plant.

煤。航道临时通航期间，航道疏浚到-9 米，乘潮（2 米潮水）进港，可选用 1.5 万载重吨船只，吃水限制 10 米。考虑逐步建立 3 万吨煤炭库存，电站投产后根据生产需要和煤炭价格走势再调整煤炭库存。

4.5.3 Chemical Raw Materials For Commissioning 试车用化工原材料

All the chemical raw materials required for commissioning have been submitted to the procurement planning section, and the arrival time for the material can meet the date requirement for commissioning. For more details, please refer to “Chemical Raw Materials Procurement Planning List”.

试车用化工原材料已经全部提交采购计划，到货时间均能满足试车需要，详见《化工原材料采购计划表》附表。

4.6 On-site Normal Operation Ensuring for Production 现场保运

4.6.1 The Equipment Maintenance Department is mainly responsible for daily production maintenance and repair work, including sporadic emergency repair work. For the cases of large-scale planned overhaul or large-scale production unit shutdown for emergency repair, it is required to seek external assistance to solve the shortage of personnel and the lack of technical skills.

设备检修部主要负责日常的生产维护及检修工作，包括零星突发事件的抢修工作。大型的计划大修或大面积装置停工抢修还需要寻求外部力量解决人员与技术力量的不足。

The targeted number of personnel in Equipment Maintenance Department is 373, including 70 local recruits in Brunei and 8 fresh graduates.

设备检修部定员 373 人，包含文莱当地招聘 70 人，学校招聘应届毕业生 8 人。

4.6.1.1 The plant-wide maintenance group consist of 4 rotary equipment maintenance group, 1 valve sealing group, 1 lifting group, 4 static equipment maintenance group, and 1 general group. The rotary equipment maintenance group and static equipment maintenance group are responsible for the maintenance and repairation of plant-wide rotary and static equipment. The valve sealing group is responsible for plant-wide valve maintenance & reparation, as well as pressure setting for safety valve, and seal replacement. The general group is responsible for

small amount of sporadic work including scaffold work, paint work, heat preservation work and cleaning work.

全厂设备维护班组设置机修 4 个班、密封阀门班 1 个、起重班 1 个、检修 4 个班、综合班组 1 个。机修班和检修班负责全厂动静设备维修，密封、阀门班负责全厂安全阀维修及定压工作，密封的更换。综合班负责架子、油漆、保温、清洗等少量零星工作。

4.6.1.2 In the project, there are two 18 meter x 67 meter maintenance station building. The instrument maintenance station building is equipped with a 10 tons double beam crane and the equipment maintenance station building is equipped with a 16 tons double beam crane. There is a three-storey general building within the maintenance station section that are used for work group rest place and for the offices of equipment management department, electrical operation department, and instrument control department. There is maintenance point installed at the powerstation and the western tank farm area to facilitate the storage of commonly used machines & tools, as well as the resting place for maintenance personnel.

项目现场检修房有两幢 18 米*67 米，仪修厂房配有 10 吨双梁起重机，机修厂房配有 16 吨双梁起重机。维修站建有一栋 3 层综合楼，供班组休息及机械、电气（部分）、仪表办公共用房。电站及西部罐区设有维修点，便于日常机具存放及维护人员休息。

4.6.1.3 The construction unit (hereinafter referred to as Production Normal Operation Ensuring Unit) is responsible for ensuring the constructed production unit operate normally during production preparation and commissioning stage. The production preparation department is responsible for inspection, supervision and assessment.

施工单位（以下称保运单位）负责所建装置生产准备及试车阶段的保运工作，生产准备部负责检查、监督与考核。

4.6.1.4 Production Normal Operation Ensuring Unit is to equipped with reasonable equipment to carry out 24 hour normal operation ensuring work in accordance to the requirements of operation departments.

保运单位根据运行部的要求，配备合理的施工器具和人员实行全天候的保运工作。

4.6.1.5 During the daytime, the production normal operation ensuring unit shall perform their work based on the maintenance safety permit issued by the equipment management personnel from the operation department; During the night work, they shall perform their work based on the maintenance work safety permit issued by the personnel on duty from operation department.

白天施工保运单位凭运行部设备管理人员开署的检修施工安全许可票施工；夜间施工凭运行部值班人员签发的检修施工安全许可票施工。

4.6.1.6 After the completion of work, the production normal operation ensuring unit shall notify relevant technical personnel to carry out the acceptance after they have performed inspection by themselves and it is qualified. If the acceptance is not qualified, re-work is required. If the acceptance is qualified, the inspection and maintenance record shall be completed within 2 working days, while the operation department shall complete the archiving of the equipment

inspection and maintenance record within 3 working days.

施工完成以后，保运单位在自检合格的情况下通知相关技术人员进行验收。验收不合格返工，验收合格在两个工作日内完成检维修记录，运行部在三个工作日内完成设备检维修记录归档工作。

4.6.1.7 The materials required throughout the work period will be provided by the operation department. The production normal operation ensuring unit shall collect the materials from the procurement management department in accordance to the material list issued by the operation department.

施工期间发生的材料由运行部提供，保运单位凭运行部出具的料单去采购管理部领料。

4.6.1.8 The production normal operation ensuring unit shall clarify their duty shift location and to perform 24 hour shift duty, so as to ensure their personnel are available at any time when required as well as to undergo routine inspection.

保运单位应明确保运值班地点，实行二十四小时值班，确保随叫随到，并定期进行巡回检查。

4.6.1.9 The personnel from equipment maintenance department, electrical operation department, instrument control department and materials supplies department shall be on-site and fully co-operate for production normal operation ensuring work.

设备检修部、电气运行部、仪表控制部和物资管理部人员应服务到现场，全力配合好保运工作。

4.6.2 Special Tools. Special tools purchased for specific equipments shall be unpacked, registered and put into storage, as well as to establish a record. The construction unit is only allowed to borrow special tools that are needed for installation purposes, while the rest of the tools are not allowed to be borrowed without the approval of the equipment management department; Other kind of special tools shall be declared and managed by respective equipment maintenance department, electrical operation department, and instrument control department.

专用工具。随设备采购的专用工具，均开箱登记并入库、建立台账，施工单位只允许借用安装所需的专用工具，其余入库，未经机械动力部批准不允许外借；其它专用工具，由设备检修部、电气运行部、仪表控制部各自申报，并负责进行保管。

4.6.3 Spare parts. Spare parts include random spare parts, and spare parts for startup (2-year spare parts). Random spare parts have been purchased during the ordering stage and will arrive at the same time with the equipment, which will be unpacked and be stored upon its arrival. Spare parts for startup (2-year spare parts) will be purcharsed and put into storage as required before commissioning. The Materials Supplies Department shall establish a reasonable process for getting the spare parts. The spare parts for rotors (accident parts) include a total of 18 rotors, 1 set of axial flow machine static blades, and 1 set of axial flow machine rotary blade.

备品配件。备品配件包括随机备件、开工备件（两年备件）， 随机备件在订货时已采购，随设备同时到达现场，开箱后入库存放；开工备件（两年备件）在试车前已按要求采购到货并入库；所有备件的领取，物资装备部建立合理的流程。转子（事故件）备件共计 18 根转子及一套轴流机静叶和一套轴流机动叶。

4.7 Communication System 通讯联络系统

4.7.1 The telecommunication system of this project includes: automated phone system, production dispatch telephone system, local area network system, wireless intercom, amplified intercom system, television monitoring system, automatic fire alarm system, Video conference system, cable television system, and smart card management system.

本项目电信系统设有：自动电话系统、生产调度电话系统、局域网络系统、无线对讲电话、扩音对讲电话系统、电视监控系统、火灾自动报警系统、会议电视系统、有线电视系统、智能卡管理系统等。

4.7.2 Currently, the core parts of the local area network system, wirelress intercom, amplified intercom system, video conference system, cable television system and IP phone system have been completed. With the expansion of the construction completion scope, the subsequent coverage scope will continue to be increased. The TV monitoring system has been partially completed, and new demand nodes will be deployed according to the construction progress of the plant area.

目前，已完成了局域网络系统、无线对讲电话、扩音对讲电话、会议电视系统、有线电视系统以及 IP 电话系统的核心部分构建，随施工完成范围的扩大继续增加后续的覆盖范围；电视监控系统已部分完成，后续将根据厂区建设的进度部署新的需求节点。

4.7.3 There are 76 wireless network access nodes, 211 IP phones, and 52 video surveillance. The coverage includes dormitories area, temporary offices, PPK dormitories, and coastal warehouses. In the future, wired and wireless methods will be used to cover the entire plant. The wired methods refers to the traditional optical cable transmissioning, and the convergence equipment in each region carries out diffusion access layer.

现有无线网络接入节点 76 个，IP 电话 211 部，视频监控 52 个。覆盖范围包括营地、临建办公室、PPK 宿舍以及海边仓库。未来使用有线加无线的方式使得信号覆盖全厂。有线方式即传统的光缆传输，各区域汇聚设备进行扩散接入层。

4.7.4 Material purchase plan, the embeding of plant-wide weak current system is in progress. Wireless transmission is currently using the Huawei ELTE 4G network. By using this network to achieve the dispatch information and monitoring at area where wired transmission is inconvenient. At present, the progress is still at the stage of frequency band application and continues to discuss with AITI on the nature of frequency band usage to determine the frequency band rental price.

材料申购计划，全厂弱电预埋正在进行。无线传输目前计划使用华为 ELTE 4G 网络，通过该网络来实现后期信息调度、不方便有线传输区域的监控等，目前进度停留在频段申请阶段，继续和 AITI 商谈频段使用性质来确定协商频段租用价格。

4.7.5 Single point mooring signal transmission is achieved by using a single point mooring tower. Wireless signal transmission equipment is used to contact offshore vessels and transmit

the ELTE and single point mooring signals to the main office via optical cable. It is planned to set up an operator signal transmission equipment in the single point mooring, thus duration and cost.

单点系泊信号传输使用单点系泊塔实现，使用无线信号传输设备联系海上船只，并通过光缆将 ELTE 和单点系泊信号一起传入主办公室。计划将运营商信号传输设备架设于单点系泊，节省工期成本。

4.7.6 In accordance to the optical cable installation plan, DARe is still required to authorize DST, PCSB and Telbru for them to island. Since the initiative is not in Hengyi's side, there are currently planned two schemes, A and B to proceed: Scheme A is to borrow the 66kV redundant optical cable, and scheme B is to urge the communication company to communicate with DARe in obtaining the authorization.

光缆上岛计划目前仍需 DARe 给 DST、PCSB 和 Telbru 上岛授权，鉴于主动权不在我方手中，目前有 A 和 B 两种方案：A 计划借用 66KV 多余的光缆，B 计划催促各通信商沟通 DARe 获取授权。为防止 A 计划中，通信商无法进入变电站施工及维护，A 和 B 计划同时进行。

4.8 Firefighting and Gas Protection Emergency Rescue System 消气防急救系统

4.8.1 In this project, a firefighting brigade will be set up, that will be managed by HSE department. The brigade will have 4 management position which shall be managed by the senior fire engineer and assisted by the fire engineer. The fire brigade will have commander, fire prevention, comprehensive and training/equipment position. There will be 2 fire detachment under the firefighting brigade, that are the main plant area fire detachment and western tank farm fire detachment. The fire detachment will have a captain, communication dispatcher, firefighter and driver. The number of personnel in fire detachments is 76 and there will be 13 vehicles on duty. The 13 vehicles are 5 large flow tank foam firefighting truck, 2 firefighting engine with high pressure cannon, 1 emergency rescue vehicle, 1 oil spill quick disposal vehicle, 1 communication commanding vehicle, 1 dry powder foam vehicle, 1 foam supply vehicle and 1 ambulance.

本项目消防队设大队编制，归属 HSE 管理，大队设置 4 个管理岗位，由消防主任工程师统一管理，消防工程师协助管理。消防大队设大队长、综合、防火、战训/设备等岗位；大队下建制两个中队，分别为主厂区中队和西库区中队，队长助理（执勤队长）负责消防队日常运营和管理及第一应急反应，中队设班长、通讯调度员、消防员、驾驶员 4 种岗位；中队人员编制 76 人，执勤战备车辆配置 13 台，主要车型有大流量水罐泡沫消防车 5 台、高喷消防车 2 台、抢险救援车 1 台、溢油快速处置 1 台、通讯指挥车 1 台、干粉泡沫车 1 台、泡沫供给车 1 台、救护车 1 台。

4.8.2 In this project, there is 1 gas protection station located on the ground floor of the maintenance building. In using service outsourcing, 1 ~ 2 doctor, 3 nurses, 1 ambulance and 2 drivers will be set up. Emergency rescue hotline will be set up and 24-hour duty operation system will be implemented. All the gas prevention station personnel shall participate in the first

aid skills training conducted by first aid center to meet the requirements of the first aid initial treatment skills. In particular, special training will be conducted for accidents that could happen during the startup process such as poisoning, suffocation, trauma, chemical burns high temperature burns, falling from high altitude and others. A comprehensive inspection will be conducted for the first aid equipment that are found in gas protection station and gas protection vehicle, so as to ensure the normal operation of equipments. Medicines, and consumables shall be purchased to replenish the inventory in order to meet the emergency needs during startup.

本项目气防站设置 1 个，位于维保楼一层，采取业务外包的方式，设置医生 1-2 人、护士 3 人，救护车 1 台，司机 2 人，建立应急救护报警专线，实行 24 小时值班运营制度。气防站人员均参加 120 急救中心开展的急救技能培训，满足急救初期处理技能要求，尤其对开工过程中可能发生的化学危害因素中毒、窒息，以及开放性外伤、化学灼伤、高温烫伤、高空坠落等进行专项培训与训练。对气防站及气防急救车上的急救设备与器材进行全面检查，确保设备器材正常运行。采购药品、耗材补充库存，满足开工应急需求。

4.9 Production Dispatch System 生产调度系统

4.9.1 In this project, there is a production dispatch system with a total staff of 19, that includes 1 dispatcher manager, 2 day shift dispatcher, and 16 duty shift dispatcher. Duty shift dispatcher will operate according to 4-team shift pattern, with each shift team having 1 chief dispatcher, 2 dispatcher and 1 dual lingual dispatcher. 本项目设生产调度系统，总定员 19 人，包括调度经理 1 人，白班调度 2 人，值班调度 16 人。值班调度按 4 班 2 倒模式运行，每班设值班长 1 人，生产调度 2 人，双语调度 1 人。

4.9.2 The first draft of the “Dispatcher Manual” was completed on 30th April 2018 for dispatching personnel to learn and simulate. In addition, dispatcher personnel were organized to undergo training and learning in batches at Sinopec Shanghai Petrochemical Co. Ltd., and Sinopec Maoming Petrochemical Co.. By combining the situation of this project with the training, they are arranged to participate in theoretical and on-site training of the typical oil refining unit such as single point mooring, jetties operation, oil storage & transportation, oil blending, atmoepheric & vacuum distillation, coking, hydrocracking, light ends recovery, acid gas & LPG ends recovery, LPG fractionation, kerosene hydrotreating, diesel hydrotreating, sulfur recovery, and aromatic complex. It is also arranged to focus on organizing shift duty practical dispatch production commanding training, so that the dispatcher have the necessary basic theoretical knowledge and dispatch command coordination skills.

2018 年 4 月 30 日编制完成了《调度手册》初稿供调度人员学习、模拟执行，并分批组织值班调度人员赴上海石化和茂名石化等大型炼油化工企业培训学习。结合本项目情况，安排参加单点系泊、码头作业、油品储运调合以及常减压、焦化、加氢裂化、轻烃回收、产品精制、气分、煤油加氢、柴油加氢、硫磺回收和芳烃联合等典型炼油化工装置的理论基础和现场培训，重点组织值

班调度生产指挥实习培训，使调度人员掌握必要的理论基础知识和调度指挥协调专业技能。

4.9.3 Production dispatch system is equipped with advanced equipment and tools such as wireless intercom, special dispatch telephone switchboard, industrial television monitoring system, emergency information releasing platform, and dispatch commanding vehicle to facilitate dispatcher production command and on-site coordination.

生产调度系统配备无线对讲、专用调度电话总机、工业电视监控系统、应急信息发布平台和调度指挥车等先进设备和工具，方便调度生产指挥和现场协调。

4.10 Quality Analysis Department Preparation Work 质量检验部准备工作

4.10.1 From July 2017 to November 2017, the basic theoretical training for laboratory tests was basically completed, with an average score of 95.3 over the 18-week examination, and has mastered the basic theoretical knowledge of oil refining laboratory tests. In November 2017, 12 personnel have been arranged to go to Linjiang caprolactam plant for internship purpose on water quality, coal quality and lubricating oil analysis and have completed the internship in end of December 2017. At the end of the internship, they have mastered all the analytical item of the caprolactam plantthat involve water quality, coal quality and lubricating oil testing, that have achieved the ability to perform the analysis independently. In December 2017, the quality analysis department personnel that are starting in Shanghai training base participated in the Sinopec Shanghai Petrochemical Co. Ltd. internship, that are arranged by the company. The personnel are able to learn the water quality analysis, environmental monitoring, oil physical properties analysis, oil element analysis, chromatography analysis, coal analysis, raw material analysis, and standard solution preparation. On August 2018, the internship will be completed, and the analyst personnel will have the ability to perform the analysis independently.

2017 年 7 月至 11 月化验基础理论培训基本结束，通过 18 周的考试总平均分 95.3 分，掌握了炼油化验的基本理论知识。11 月份已安排 12 人赴临江己内酰胺进行水质、煤质、润滑油分析的实习到 12 月底结束。实习结束后熟练掌握己内酰胺所有涉及水质煤质润滑油检测的分析项目达到独立顶岗。12 月份上海基地人员按公司总体安排参加上海石化实习。学习水质分析、环保监测、油品物性分析、油品元素分析、色谱分析、煤炭分析、原材分析、标准溶液配制。2018 年 8 月份实习结束后所有分析人员达到独立顶岗水平。

4.10.2 Analytical Item and Methods. To complete the analytical items and analysis frequency of individual operation department on August 2018. In August 2018, the company has completed the connection between the product sales market and the requirements of product quality standard, and have purchased ASTM, ISO, EN and IP product quality standard, as well as organized professionals to complete the translation of production standards.

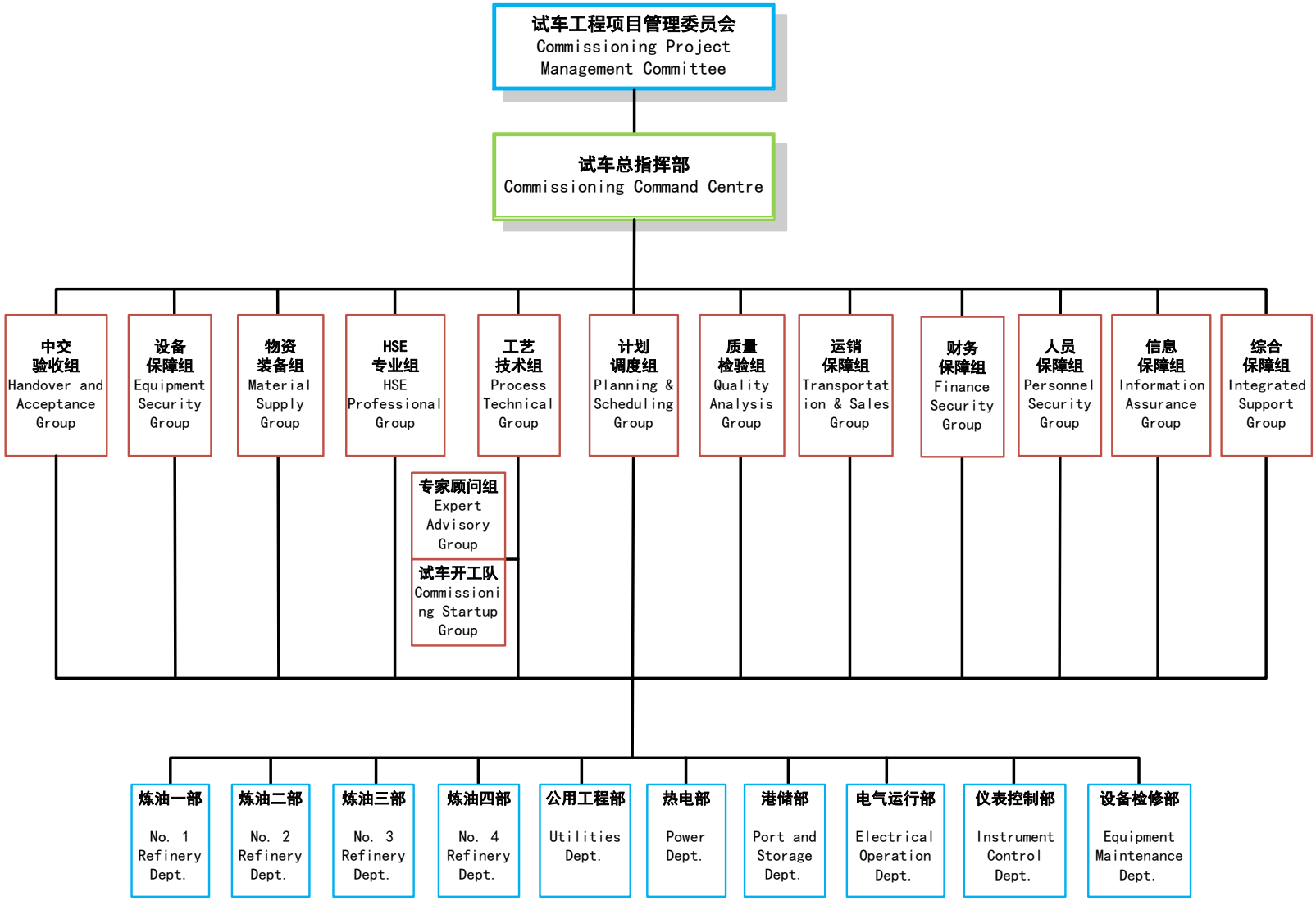
分析项目及方法。2018 年 8 月，完成各运行部分析项目、分析频次的需求对接。2018 年 8 月，完成产品销售市场及产品质量标准的需求对接，购买了 ASTM、ISO、EN、IP 产品质量标准，组织专业人员完成产品标准翻译。

4.10.3 Laboratory and Analytical Instruments. In 2017, the tender and purchase of central laboratory and environment monitoring station ventilation, centralized gas sipply, furniture, reagent materials, instruments and equipments have been completed.
化验室及分析仪器。2017 年完成中心化验室暨环境监测站暖通、集中供气、家具、试剂耗材、国产仪器设备的定标与请购。

5 Organization and Command System of Commissioning 试车的组织与指挥系统

After the construction and handover have been completed, a commissioning team composed of Hengyi Industries as the main, and other participation units including the general contractor unit, design unit, construction unit, startup team, as well as experts from china or other countries. In order to achieve a well organized system, uniform coordination, safety first, good quality, strict & close relationships, it was decided to set up commissioning leading group, commissioning command centre, technical expert advisory group, and a startup team. The specific functional structure and work responsibilities are as follows:
本项目建成中交后，组成以恒逸石化为主，总承包单位、设计单位、施工单位、开工队以及国内外专家等参加的试车队伍，为做到组织有序、协调一致、安全第一、质量至上、组织严密、方案科学，决定成立试车工作领导小组、试车指挥部、技术专家顾问组和开工队，及各专业组，具体人员构成和工作职责如下：

5.1 Commissioning Leading Group 试车工作领导小组



5.2 Project Management Committee of Commissioning Project 试车工程项目管理委员会

5.2.1 Members of Leading Group 领导小组成员

Group Leader: Qiu Jianlin

组　长：邱建林

Members: Shareholder Member

成　员：股东方成员

5.2.2 Job Responsibilities 工作职责

5.2.2.1 Earnestly implement the HSE requirements of Brunei government and company;

认真贯彻文莱政府和公司的 HSE 要求；

5.2.2.2 Strive for Brunei government's support for commissioning work to ensure a good external environment;

争取文莱政府对投料试车工作的支持，确保良好的外部环境；

5.2.2.3 Determine the overall principles, objectives, guidelines and work progress of commissioning;

确定投料试车的总体原则、目标、方针和工作进度；

5.2.2.4 Coordinate and solve major problems in project and commissioning

协调解决工程和投料试车的重大问题；

5.2.2.5 Check and guide the completion of the key points and crucial links in the commissioning process, and check the main nodes and work objectives in the commissioning;

检查指导投料试车过程中重点与关键环节的完成情况，考核投料试车中的主要节点和工作目标；

5.2.2.6 Issue a work order.

发布开工令。

5.3 General Command Centre of Commissioning 试车总指挥部

5.3.1 Members of the Commissioning Command 试车指挥部成员

Commander: Chen Liancai

总 指 挥：陈连财

Deputy Commanders: Production Deputy General Manager, Zhang Jianhua, Du Haipeng, Shen Xiaofei, Ni Xiaoliang, Xu Ye, Zhang Liqun, Mao Ying, Chen Kongju, Alan Goh, Li Peng

副总指挥：张建华、杜海鹏、沈晓飞、倪晓亮、徐　野、张立群、毛　应、陈孔炬、Alan Goh、李　鹏

Members: Yu Lin, Tong Xueyun, Xu Zhongyi, Wang Dongsheng, Jin Danwen, Zhu Zhejun, Qian Zhihai, Wang Jiyuan, Jin Rentong, Zou Hui, Zhao Fuzhen, Sun Jin, Li Qilong, Xiao Chunbao

成　　员：俞　霖、童雪云、许忠仪、王东生、金丹文、朱浙军、钱志海、王纪元、金仁通、邹慧、赵辅珍、孙　进、李启龙、肖春宝

5.3.2 Job Responsibilities 工作职责

5.3.2.1 Under the direct leadership of the commissioning work leading group, be responsible for directing the commissioning work

在试车工作领导小组的直接领导下，负责指挥投料试车工作；

5.3.2.2 Hold regular meetings of the commissioning command centre to coordinate and solve major problems in the commissioning process;

定期召开试车指挥部会议，协调解决投料试车过程的主要问题；

5.3.2.3 In strict accordance with the requirements of the regulations on project production preparation and commissioning, organize the “punch listing, intermediate handover, four do not start-up condition” inspection, and confirmation of starting conditions of all units;

严格按照《项目生产准备与投料试车规定》的要求，组织各装置的“三查四定”、中间交接、“四不开车”检查，及开工条件确认等工作；

5.3.2.4 According to the overall requirements of commissioning coordination, organize and coordinate all departments to make full preparation before start-up to ensure that all units are safe and secure with successful commissioning in one attempt;

按投料试车统筹的总体要求，组织协调各部门做好开车前的准备工作，确保装置安全稳妥一次投料试车成功；

5.3.2.5 Be responsible for implementing HSE measures and plans for the entire commissioning process, organizing and handling emergencies in the commissioning process, and ensuring that the entire commissioning process meets the HSE requirements of the local government and headquarters of the company;

负责落实投料试车全过程的 HSE 措施和方案，组织处理投料试车过程的突发事件，确保投料试车全过程符合地方政府和总公司的 HSE 要求；

5.3.2.6 Complete all tasks assigned by the engineering project committee.

完成工程项目委员会下达的各项工作任务。

5.4 Professional Group Under Command Centre 指挥部下设专业组

5.4.1 Handover and Acceptance Group 中交验收组

5.4.1.1 Handover and Acceptance Group Member 中交验收组成员

Group Leader: Du Haipeng

组　长：杜海鹏

Deputy Group Leaders: Ni Xiaoliang, Xu Ye

副组长：倪晓亮、徐　野

Members: Yu Lin, Tong Xueyun, Xu Zhongyi, Wang Dongsheng, Wang Jiyuan, Zhang Chaohong, Tang Chongfeng, Qian Zhihai, Xiao Chunbao, Li Qilong, Sun Jin, Zhang Chonglin, Xu Zhengrong, Tan Fengyan, Zhao Shuyong, Gao Wei (Head of Department), Qian Hao, She Hongmei, Cao Wei (Head of Department), Tao Jianping

成　员：俞　霖、童雪云、许忠仪、王东生、王纪元、张朝红、唐崇峰、钱志海、肖春宝、李启龙、孙　进、张崇林、徐峥嵘、谭凤岩、赵树勇、高　伟（部长）、钱　浩、佘红梅、曹　伟（部长）、陶健平

5.4.1.2 Job Responsibilities 工作职责

5.4.1.3 To be responsible for organizing the design unit, construction unit, and relevant personnel of PMB project to carry out verification and handover work in accordance to the design and physical quantity; To organize relevant units to participate in the pre-commissioning;

负责组织设计单位、施工单位和 PMB 项目有关人员按设计和实物量进行核实交接；组织有关单位参加单机试运；

5.4.1.4 To be responsible for organizing the handover of spare materials, spare parts, and technical tools;

负责组织备品、备件、专业工具的交接；

5.4.1.5 To be responsible for the acceptance of engineering quality, as well as the prelimary data of engineering quality and the examination & verification of relevant test run;

负责工程质量的验收，以及工程质量的初评资料和有关调试的交审验证；

5.4.1.6 To be responsible for completing the engineering wind up works, and to determine the completion time;

负责工程尾项的清理及完成时间的确定；

5.4.1.7 To be responsible for the acceptance of random technical data.

负责随机技术资料的验收。

5.4.1.8 Functional departments need to participate in the acceptance of all units, and all operation departments need to participate in the acceptance of units within their jurisdiction.

职能部门需参加所有单元中交验收，各运行部参加管辖范围内的单元装置中交验收工作。

5.4.1.9 Complete all tasks assigned by the commissioning command centre.

完成试车指挥部下达的各项工作任务。

5.4.2 Scheduling & Dispatch Group 计划调度组

5.4.2.1 Scheduling & Dispatch Group Members 计划调度组成员

Group Leader: Jin Rentong

组　长：金仁通

Deputy Group Leaders: Bao Xingqiu, Zhang Lianzhu

副组长：鲍星球、张连柱

Members: Jiang Jin, Tian Liang, Ying Yongan, Sun Zhongtian, Ma Feng, Fan Fuqiang, Zhu Liangliang, Wang Qinglin, Zhang Xiaojun, Li Jun

成　员：江　进、田　亮、应永安、孙中田、马　锋、范夫强、朱亮亮、王庆麟、张晓军、李　军

5.4.2.2 Job Responsibilities 工作职责

（1）Under the direct leadership of the commissioning command centre, to be responsible for

the coordination of the general commissioning and for handling daily affairs;
在试车指挥部的直接领导下，负责总体试车的衔接协调工作以及日常事务的处理；
（2）Be responsible for coordinating the general commissioning progress, preparing the general commissioning network, general commissioning plan, and general commissioning briefing;
负责总体试车进度协调，编制总体试车网络、总体试车方案、总体试车简报；
（3）Comprehensively coordinate the cooperation of storage and transportation systems, utilities and production units in the process of pre-commissioning, commissioning and chemical material feeding;
全面协调单机试车、联动试车、化工投料过程中储运系统、公用工程和装置的协同配合；
（4）Responsible for the preparation of water, electricity, steam, wind, nitrogen and fuel balance plan and is responsible for organizing the implementation;
负责编制水、电、汽、风、氮及燃料的平衡方案并负责组织实施；
（5）Responsible for the division of labor and coordination of system pipeline operation management, and organize the implementation of technical modification content;
负责系统管线运行管理的分工和协调，并组织实施项目甩头内容；
（6）Responsible for the preparation and implementation of material balance plan;
负责编制物料平衡方案的编制，并织实施；
（7）Responsible for coordinating the incoming and outgoing materials and the surrounding relations during general commissioning of the whole plant;
负责协调全厂总体试车过程中进出物料及周边关系；
（8）Responsible for optimizing the production plan and scheme during commissioning;
负责试车期间生产计划及方案优化；
（9）Complete all tasks assigned by the commissioning centre.
完成试车指挥部下达的各项工作任务。

5.4.3 Process Technical Group 工艺技术组

5.4.3.1 Process Technical Group Members 工艺技术组成员

Group Leader: Yu Lin
组　长：俞　霖
Deputy Group Leader: Wang Jiyuan
副组长：王纪元
Members: Gao Wei, Zhang Chuantuan, Hou Xu
成　员：高　伟、张创团、侯　旭

5.4.3.2 Job Responsibilities 工作职责

（1）Responsible for supervising, inspecting, and examining the implementation of the start-up plan, process and technical indexes, technical regulations, and technical measures;
负责监督、检查、考核开工方案、工艺技术指标、技术规程、技术措施的执行情况；

（2）Responsible for drawing up major steps for the start-up of the new unit and proposing technical requirements and technical plans;
负责制定新装置开工重大步骤，提出技术要求和技术方案；
（3）Put forward preliminary opinions on the technical problems to be solved and report them to the start-up command centre in a timely manner;
对解决的工艺问题提出初步意见，并及时向开工指挥部汇报；
（4）Responsible for the examination and implementation of raw materials, chemical raw materials and product quality and laboratory analysis projects;
负责原料、化工原材料和产品质量及化验分析项目的审定与实施；
（5）Responsible for proposing treatment measures and solutions to technical problems and abnormal situations during commissioning;
负责试运中技术疑难问题和非正常情况的处理措施及解决办法的提出；
（6）Responsible for organizing the confirmation work before the process interlock is put into service;
负责组织工艺联锁投用前的确认工作；
（7）Responsible for blind flange management in units' battery limit;
负责装置边界的盲板管理；
（8）Responsible for organizing examination and calibration of the unit;
负责对装置组织考核标定；
（9）Responsible for preparing the start-up briefing;
负责编写开工简报；
（10）Complete all tasks assigned by the commissioning centre.
完成试车指挥部下达的各项工作任务。

5.4.3.3 Professional Group and Start-up Team 专家组和开车队

The personnel structure is divided into 4 parts: ① Experts from the same equipment industry in this department; ② Unit's director or process director with rich production experience; ③ Shift supervisor with rich experience in start-up and shutdown work, with 1 person in each shift, totaling 4 persons; ④ Hire expert start-up team from external foreign patent firms,
人员结构分为 4 部分：①本部门同装置行业内专家；②生产经验丰富的车间主任或工艺主任；③开停工经验丰富的班长，每班配 1 人，共 4 人；④外聘国外专利商开工队。

Table 5 – 1 List of Commissioning Expert Group, Start-up Team and Foreign Patent Firms
表 5-1 试车专家组、开工队、国外专利商名单

Operation Department	Production Unit 装置	Hired Experts from China 国内拟聘用	Patented Company	China (No. of

运行部		Experts 专家	Production Unit Director 生产主任级	Monitor 班长	(No. of Personnel) 专利商专家（人数）	Personnel) 中国（人数）
No. 1 Refinery Dept. 炼油一部	Atmospheric & Vacuum Distillation Unit / Light Ends Recovery Unit / Acid Gas & LPG Ends Recovery Unit 常减压/轻烃回收/产品精制	/	/	/	No. 1 Refinery Dept. 炼油一部	Atmospheric & Vacuum Distillation Unit / Light Ends Recovery Unit / Acid Gas & LPG Ends Recovery Unit 常减压/轻烃回收/产品精制
No. 2 Refinery Dept. 炼油二部	Hydrocracking Unit, LPG Fractionation Unit 加氢裂化、气分	1	1	4	No. 2 Refinery Dept. 炼油二部	Hydrocracking Unit, LPG Fractionation Unit 加氢裂化、气分
	Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit 煤油、柴油加氢	1	1	4	无	Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit 煤油、柴油加氢
No.3 Refinery Dept. 炼油三部	Continuous Reforming Unit 连续重整	1	1	4	No.3 Refinery Dept. 炼油三部	Continuous Reforming Unit 连续重整
	Aromatics Unit 芳烃	1	1	4		Aromatics Unit 芳烃
No. 4 Refinery Dept. 炼油四部	Flexicoking Unit 灵活焦化	1	/	/	No. 4 Refinery Dept. 炼油四部	Flexicoking Unit 灵活焦化
	Sulfur Recovery Units 硫磺回收	/	/	/	/	Sulfur Recovery Units 硫磺回收

Operation Department 运行部	Production Unit 装置	Hired Experts from China 国内拟聘用			Patented Company (No. of Personnel) 专利商专家（人数）	China (No. of Personnel) 中国（人数）
		Experts 专家	Production Unit Director 生产主任级	Monitor 班长		
Quality Analysis Dept. 质量检验部	/	/	/	/	Quality Analysis Dept. 质量检验部	/
Port and Storage Dept. 港口储运部	Storage & Transportation, Jetties 储运、码头	/	/	/	Port and Storage Dept. 港口储运部	Storage & Transportation, Jetties 储运、码头 Single Point Mooring 单点系泊
	Single Point Mooring 单点系泊	1～2	/	/	/	
Utilities Dept. 公用工程部	/	/	/	/	Utilities Dept. 公用工程部	/
Power Dept. 热电部	/	/	/	/	Power Dept. 热电部	/

5.4.4 HSE Professional Group HSE 专业组

5.4.4.1 HSE Group Members HSE 组成员

Group Leader: Xiao Chunbao

组　长：肖春宝

Deputy Group Leaders: Rao Zhongming, Li Chunlin

副组长：饶仲明、李春林

Members: Ding Zaishan, Li Wei, Shun Peng, Tan Quanzhong, Xiao Jian, Cai Liangliang, Xiang Dongxu, Ma Guangteng

成　员：丁再山、李　伟、孙　鹏、谭权中、肖　剑、蔡亮亮、项东旭、马广腾

5.4.4.2 Job Responsibilities 工作职责

（1）Responsible for the inspection of safety work during commissioning and construction;
负责试运及施工中安全工作的检查；

（2）Responsible to organize and formulate the HSE management regulations for the commissioning, as well as to organize the implementation of the HSE management regulations during the commissioning;
负责组织制定试运中的 HSE 管理的规定，组织实施试运中的 HSE 管理措施；

（3）Responsible for organizing the acceptance of safety & environmental protection facilities, firefighting facilities, and sanitation facilities of the unit;
负责组织新装置的安全环保设施、消防设施、卫生设施的验收；

（4）Responsible for organizing the risk assessment during the commissioning, as well as to check and monitor the rectification of hidden dangers;
负责组织试运过程中的风险评估，检查监督隐患的整改；

（5）Handle relevant approvals for commissioning and start-up of safety, firefighting and environmental protection facilities;
办理安全、消防和环保设施的试车投产开工有关批文；

（6）Propose preliminary opinions on the problems that the group might not be able to solve and to report it to the commissioning command centre;
对本组未能解决的问题提出初步意见，报开工指挥部；

（7）Management of blind plates at the battery limits between the monitoring system and production units;
监督系统与装置边界盲板的管理；

（8）Responsible for carrying out level 1 safety induction and training for personnel entering the site;
负责对入场人员进行一级安全教育和培训；

（9）Conduct in-depth on-site monitoring and inspection, as well as to urge and assist in solving relevant safety issues, to correct any operation that are against the regulations, having the rights to stop operations in case of any danger or safety production emergency situations, and immediately report to relevant leaders.
深入现场监督检查，督促并协助解决有关安全问题，纠正违章作业，遇有危及安全生产的紧急情况，有权责令其停止作业，并立即报告有关领导；

（10）Inspect the implementation of various HSE management systems during the commissioning, and carry out key safety monitoring on the direct work operation;
检查试运中各项 HSE 管理制度的执行情况，对直接作业环节进行重点安全监督；

（11）Responsible for drawing up rescue plans for different injuries and poisoning situations;
负责制定不同伤害及中毒情况下的抢救预案；

（12）Responsible for the implementation of medical personnel and emergency rescue supplies;
负责落实医护人员和应急救护用品；

（13）Responsible for setting up temporary medical rescue points in safe areas to treat the

injured.

负责在安全区域内设置临时医疗救护点，对受伤人员进行救治；

（14）Complete all tasks assigned by the commissioning command centre.

完成开工指挥部布置的各项工作任务。

5.4.5 Quality Analysis Group 质量检验组

5.4.5.1 Quality Analysis Group Members 质量检验组成员名单

Group Leader: Luo Jianlin

组　长：罗建林

Deputy Group Leader: Cheng Yehua

副组长：程业华

Members: Zhang Zhong, Li Jikai, Shi Jianpeng

成　员：张　忠、李继开、石建鹏

5.3.5.2 Job Responsibilities 工作职责

（1）Responsible for the management and use of product standards, and complete the update and review of product standards in a timely manner.

负责产品标准的管理和使用，及时完成产品标准的更新及复审等工作；

（2）Responsible for supervising and controlling the quality management process to ensure the accuracy and effectiveness of quality data;

负责对质量管理过程进行监督控制，确保质量数据的准确、有效；

（3）Responsible for the rectification of quality management non-conformities during commissioning, and supervise and inspect the implementation of various rectification measures and preventive measures.

负责试车期间质量管理不符合项的整改，监督检查各项整改措施和预防措施的落实；

（4）Responsible for sampling, inspection, sample retention, and information transmission of analysis results during commissioning;

负责试车期间取样、检验、留样、分析结果的信息传递等工作；

（5）Complete all tasks assigned by the commissioning command centre.

完成试车指挥部下达的各项工作任务。

5.4.6 Equipment Support Group 设备保障组

5.4.6.1 Equipment Support Group Members (include production ensurance) 设备保障组成员（含保运）

Group Leader: Tong Xueyun

组　长：童雪云

Deputy Group Leaders: Tao Jianping, Pan Xiaoming

副组长：陶健平、潘小明

Members: Xie Kejun, Zhang Zhaohui, Li Hui, Zhang Lei, Liu Bo, Bi Youyuan

成　员：谢可君、张召辉、李　辉、张　磊、刘　波、毕有元

5.4.5.2 Job Responsibilities 工作职责

（1）Responsible for pre-commissioning, purging, pressure testing and other works;

负责单机试运、吹扫试压等工作；

（2）Responsible for the rectification of any wind-up work of unit startup;

负责装置开工收尾工作的整改；

（3）Participate in the inspection and acceptance of process equipment, rotary motor equipment, and pipelines;

参加工艺设备、机动设备、管线的检查验收；

（4）Participate in the examination and approval of pre-commissioning plan for critical equipment;

参加审定关键设备的单机试运方案；

（5）Participate in the handover of spare materials, spare parts, and technical tools;

参加备品、备件、专用工具的交接；

（6）Responsible for proposing measures and countermeasures for equipment technical problems that might arise during pre-commissioning, and to organize the implementation;

负责对试运中出现的设备技术问题提出措施和对策，并组织实施；

（7）Responsible for the assessment of pressure vessel certification data, as well as the preparation and issuance of registration certificates for their usage;

负责压力容器取证资料的审核和使用登记证的制作、下发；

（8）Propose preliminary opinions on technical problems that the group cannot solve, and report them to the commissioning command centre;

对本组无法解决的工艺问题提出初步意见，并及时向开工指挥部汇报；

（9）Responsible for the communication between the PMB project and construction unit;

负责 PMB 项目与施工单位的联系；

（10）Complete all tasks assigned by the commissioning command centre.

完成试车指挥部下达的各项工作任务。

5.4.7 Instrument Debug & Control Supporting Group 仪表调试控制保障组

5.4.7.1 Instrument Debug & Control Supporting Group Members 仪表调试控制保障组成员

Group Leader: Xu Zhongyi

组　长：许忠仪

Deputy Group Leader: Cao Wei

副组长：曹　伟

Members: Jia Wei, Li Yanliang, Jin Lichuan, Ding Shichun, Lian Yongqing, Zhao Ming, Xu Mingzhou, Tian Tiejun, Meng Xing, Xiao Zike, Liu Dehua, Xiao Bin, Cao Yongning, Dou Kai, Zhang Jilong

成　员：贾　炜、李彦良、金礼川、丁似春、练永青、赵　明、徐铭洲、田铁军、孟　醒、肖子可、刘德华、肖　滨、曹永宁、豆　凯、张基龙

5.3.6.2 Job Responsibilities 工作职责

（1）Responsible for establishing the PMB project instrument maintenance normal operation ensuring group, and to uniformly command the instrument debugging normal operation ensuring work.

负责建立 PMB 项目仪表维护保运组织，统一指挥工程的仪表试车保运工作。

（2）Organize and coordinate instrument related matters, to master the project progress, check & control the quality, inspect & monitor HSE, and to propose rectification requirements;

组织协调仪表事宜，掌握项目进度、检查控制质量、HSE 检查监督，提出整改要求；

（3）Cooperate on instrumentation works with production units, pre-commissioning of equipments, purging and pressure test;

配合生产装置、设备单机试运、吹扫试压等仪表工作；

（4）Responsible for putting the instrument into service and their maintenance work during unit startup;

负责配合装置开工的仪表投用维护工作；

（5）Participate in all kind of instruments inspection and acceptance for process and rotary motor equipment package;

参加工艺、机动设备配套各类仪表的检查验收；

（6）Responsible for the commissioning of DCS, SIS, CCS, FGS, and PLC System and instrument joint calibration, and to participate in the interlock commissioning of process, large device set and others;

负责 DCS、SIS、CCS、FGS、PLC 系统及仪表联校调试工作，参与工艺、大机组等设备的联锁试车；

（7）Participate in the handover and management of instrument spare materials, spare parts, and technical tools;

参加仪表备品、备件、专用工具的交接和管理；

（8）Responsible for proposing measures and countermeasures for instrument and equipment technical problems that might arise during commissioning, and to organize the implementation of such measures and countermeasures;

负责对试运中出现的仪表设备技术问题提出措施和对策，并组织实施；

（9）Propose preliminary opinions on problems that the group cannot solve, and to report to the commissioning command centre promptly;

对本组无法解决的问题提出初步意见，并及时向开工指挥部汇报；

（10）Responsible for planning and establishing the company’s highest measurement standard and its value traceability system;

负责策划和建立公司最高计量标准及其量值溯源体系；

（11）Responsible for examining and approving the company’s measurement equipment calibration plan, and carrying out measurement equipment quantity transfer and quantity

traceability work;

负责审批公司测量设备校准计划，开展测量设备的量值传递和量值溯源工作；

（12）Responsible for technical review of trade handover measuring equipment involved in the project;

负责工程项目中涉及贸易交接测量设备的技术审查；

（13）Responsible for organizing SOP formulation for the operation of use, maintenance, calibration and period verification of trade handover measuring equipment;

负责组织对贸易交接计量设备的使用、维护、校准和期间核查等操作制定 SOP；

（14）Responsible for the calibration of standard measuring equipment according to the provisions of international standards such as API value traceability;

负责校准用标准计量设备按 API 等国际标准的规定进行量值溯源；

（15）Responsible for the regular calibration and period check of the incoming and outgoing measuring equipment;

负责进出厂计量设备的定期校准和期间核查；

（16）Responsible for reviewing and countersigning the measurement clauses of incoming and outgoing materials business contracts;

负责进出厂物料商务合同计量条款的审核会签；

（17）Responsible for supervising, checking and confirming the measurement process and data of incoming and outgoing materials;

负责进出厂物料计量过程和数据的监督、抽查和确认；

（18）Responsible for retroactive processing of abnormal measurement data of incoming and outgoing materials;

负责进出厂物料异常计量数据的追溯处理；

（19）Responsible for the investigation and analysis of trade measurement disputes and issue measurement error reports.

负责贸易计量纠纷的调查分析，出具计量误差报告。

（20）Complete all tasks assigned by the commissioning command centre.

完成试车指挥部下达的各项工作任务。

5.4.8 Electrical Operation & Maintenance Supporting Group 电气运维保障组

5.4.8.1 Electrical Operation & Maintenance Supporting Group Members 电气运维保障组

Group Leader: Wang Dongsheng

组　长：王东生

Deputy Group Leaders: Guo Chonghuo, Li Ping, Xiao Xicai

副组长：郭崇伙、李平、肖锡才

Members: Pan Yu, Zhou Xuelin, Liu Huaqing, Li Xingwang, Feng Jun, Liu Jingang, Wang Lei, Ma Qiang, Li Bo, Teng Hailu

成　员：潘　玉、周雪林、刘华清、李兴旺、冯　俊、刘金刚、王　磊、马　强、李　博、滕海

鲁

5.4.8.2 Job Responsibilities 工作职责

（1）Responsible for establishing operation and maintenance team, and to fully mobilize them and to provide uniform command on the normal operation ensuring work for the commissioning of the project.

负责建立运维组织，充分调动，统一指挥工程的试车保运工作；

（2）Under a determined working mode of the system, to adopt necessary adjustment means and to carefully operate in maintaining the system to run smoothly and stable.

在确定的系统工作方式下，采用必要的调节手段，精心操作，保持系统运行稳定；

（3）Responsible for the inspection and technical confirmation before sending power to the four regional substations, as well as all their substation and distribution station.

负责四个区域变电所及下辖的所有变、配电室送电前的检查和技术确认；

（4）Participate in the inspection and acceptance of electrical equipment, grounding system and lighting system;

参加电气设备、接地系统、照明系统的检查验收；

（5）Participate in the commissioning of electrical motor soft start control;

参与软启动控制的电动机的调试及试车；

（6）Carry out technical confirmation on the pre-commissioning of all motors, and to confirm the one-to-one correspondence between on-site equipment, power transmission circuit, and control circuit;

对所有电动机的单机试车情况进行技术确认，对现场设备与送电回路、控制回路的一一对应关系进行确认；

（7）Responsible for proposing measures and countermeasures for equipment technical problems that might arise during commissioning and to organize the implementation of such measures and countermeasures.

负责对试运中出现的设备技术问题提出措施和对策，并组织实施；

（8）Responsible for commissioning of electrical equipment and to put them into service;

负责电气设备的调试和投用工作；

（9）Participate in large device unit electrical interlock debugging and commissioning;

参与大机组的电气联锁调试和试车；

（10）Participate in handover of spare materials, spare parts, technical tools, and drawings;

参加备品、备件、专用工具、图纸资料的交接；

（11）Responsible for the communication between PMB project and construction unit, and assist in solving the problems within the electrical related specialty during the startup normal operation ensuring process;

负责 PMB 项目与施工单位的联系，协助解决开工保运过程中的电气专业内的问题；

（12）Report to the commissioning command centre promptly on problems that the team cannot solve, and to propose technical opinions;

对本组无法解决的难题及时向开工指挥部汇报，并提出专业意见；

（13）Handle all various of tasks assigned by the commissioning command centre.
处理试车指挥部下达的各项工作任务。

5.4.9 Materials Supplies Group 物资供应组

5.4.9.1 Materials Supplies Group Members 物资供应组成员
Group Leader: Zhang Liqun
组 长：李启龙
Deputy Group Leader: Li Qilong
副组长：方大义
Members: Karen Goh, Wang Chong, Wang Tao, Amy Ang Yueh Shya, Zhou Zhe, Wang Hong
成 员：Karen Goh、王 聪、王 涛、Amy Ang Yueh Shya、周 哲、王 红
5.4.8.2 Job Responsibilities 工作职责
（1）Responsible for the supply of three chemicals agent;
负责化工三剂供应；
（2）Responsible for the supply of spare parts, and tools;
负责备品备件、工器具等的供应；
（3）Responsible for timely supply of all kinds of urgently required materials and parts during commissioning;
负责试运中所需材料、配件等急需的各类物资及时供应；
（4）Complete all tasks assigned by the commissioning command centre.
完成试车指挥部下达的各项工作任务。

5.4.10 Marketing Support Group 运销保障组

5.4.10.1 Marketing Support Group Members 运销保障组成员名单
Group Leader: Zhou Hui
组 长：邹 慧
Members: Commercial Team
成 员：商务团队
5.4.9.2 Job Responsibilities 工作职责
（1）Reponsible for product sales plan and plan optimization;
负责产品销售计划及方案优化；
（2）Responsible for the preparation of all kinds of raw (oil) materials, fuels and other starting materials needed for start-up;
负责开工所需的各类原（油）料、燃料等开工物料准备；
（3）Responsible for the pre-sale and export coordination of start-up intermediate materials, semi-finished products, finished products, etc.
负责对开工中间物料、半成品、成品等预销售及出厂协调工作；

（4）Responsible for obtaining permit of product sales qualification of PMB Project;
负责 PMB 项目产品销售资质的取证工作；
（5）Complete all tasks assigned by the commissioning command centre.
完成试车指挥部下达的各项工作任务。

5.4.11 Finance Support Group 财务保障组

5.4.11.1 Finance Support Group Members 财务保障组成员名单
Group Leader: Jin Danwen
组 长：金丹文
Members: Finance Team
成 员：财务团队
5.4.11.2 Job Responsibilities 工作职责
（1）Responsible for implementing the funding source and preparation of commissioning costs.
负责落实试车费用资金来源及准备。
（2）Responsible for organizing the commissioning cost and economic benefit accounting during commissioning.
负责组织试运期间的试车成本及经济效益核算。
（3）Complete all tasks assigned by the commissioning command centre.
完成试车指挥部下达的各项工作任务。

5.4.12 Personnel Support Group 人员保障组

5.4.12.1 Personnel Support Group Members 人员保障组成员名单
Group Leader: Alan Goh Kheng Boon
组 长：Alan Goh Kheng Boon
Deputy Group Leader: Zhao Fuzhen
副组长：赵辅珍
Members: Suhaila Amalina Hj Mohd Sanusi, Yuan Jundi, Xiang Xuemei, Fanglu, Mabel Yapp Yong Chan, Siti Nur Khadijah Bte Khalid, Mohammad Nasrun Nadiy Awg Jamil
成 员： Suhaila Amalina Hj Mohd Sanusi、袁均娣、向雪梅、方露、Mabel Yapp Yong Chan、Siti Nur Khadijah Bte Khalid、Mohammad Nasrun Nadiy Awg Jamil
5.4.12.2 Job Responsibilities 工作职责
（1）Responsible for the training, assessment and post assignment of all employees of the project;
负责项目所有员工的培训、考核及定岗；
（2）Responsible for the management and review of labor service and outsourcing labor;
负责劳务用工及业务外包用工的管理、审核；
（3）Responsible for carrying out inspection of labor discipline and attendance, and supervising

the implementation of the regulations of asking for leave from various departments;
负责开展劳动纪律和考勤情况的检查，监督各部门请销假制度执行情况；
（4）Responsible for business trip entry and exit matters and personnel review;
负责因公出入境事项和人员的审核；
（5）Responsible for reviewing and issuing employee's work-related injury insurance and death pension;
负责员工工伤保险、死亡抚恤金的审核发放；
（6）Responsible for salary adjustment of employees and review of employees working overtime during legal holidays;
负责员工薪酬调整、法定节假日加班人员的审核；
（7）Complete all tasks assigned by the commissioning command centre.
完成开工指挥部布置的各项工作任务。

5.4.13 Information Support Group 信息保障组

5.4.13.1 Information Support Group Members 信息保障组成员名单
Group Leader: Zhu Zhejun
组　长：朱浙军
Deputy Group Leader: Yap Boon Hui, Yan Wu, Xiao Xin Hua
副组长：叶本辉（Yap BoonHui）、严　武、肖新华、
Members: Goh Yih Jen, Sun Yanlin, Zhan Yeyong, Lin Weijie, Lv Tao, Yang Kang, Li Lulu, Li Feng, Lin Denghui, Zhou Xiaowen
成　员：吴逸仁（Goh Yih Jen）、孙彦霖、占叶勇、林伟杰、吕　涛、杨　康、李路路、李　峰、林登辉、周晓文
5.4.13.2 Job Responsibilities 工作职责
（1）Responsible for solving any communication faults during commissioning, to ensure the normal communication between the digital trunking system and the administrative dispatch telephone system. To promptly solve problems such as the blindsplots of the public address system and disconnection of regional calls. To debug and optimize the allocation of telephone numbers, such as the dispatch numbers, fire alarm within the plant, and emergency numbers
负责解决试车过程中通讯联络保障，确保数字集群对讲系统和行政调度电话系统的通讯正常，及时处理并解决扩音呼叫系统的盲点和区域呼叫错位等问题，调试并优化调度、厂内火警、应急等电话号码配置等问题；
（2）Responsible for solving the connectivity of the office network. To solve the personnel application system account number as well as the roles of each system account and authorization configuration;
负责解决办公网络的联通，解决有关试车过程中的人员应用系统账号及各系统账号角色、权限配置；
（3）Responsible for solving and ensure the operation of systems such as PIMS, APS, MES, PI,

LIMS and others are normal and stable;

负责解决试车过程中 PIMS、APS、MES、PI、LIMS 等生产信息系统的运行保障工作；

（4）Complete all tasks assigned by the commissioning command centre.

完成试车指挥部下达的各项工作任务。

5.4.14 General Affairs Support Group 综合保障组

5.4.14.1 Genearl Affairs Support Group Members 综合保障组成员

Group Leader: Li Peng

组　长：李鹏

Deputy Group Leaders: Lv Xiaoyan, Sun Jin, Lim Chin Ling, Siah Beng Fui

副组长：吕小燕、孙　进、Lim Chin Ling、Siah Beng Fui

Members: Bai Xiaohua, Yang Haibin, Lv Wenyuan, Zhao Tongchao

成　员：白小华、汤海滨、吕文远、赵通超

5.3.13.2 Job Responsibilities 工作职责

（1）Responsible for solving the problems of employees' office, food, accommodation and transportation during commissioning;

负责解决试运期间员工办公、吃、住、交通等；

（2）Responsible for the reception and living services of foreign personnel;

负责外方人员的接待及生活服务工作；

（3）Responsible for the publicity and reporting works of production events during commissioning period;

负责试运期间的生产事件宣传报道工作；

（4）Responsible for the publicity and reporting works of good achievement during commissioning period;

负责试运期间的优秀事迹宣传报道工作；

（5）Responsible for on-site slogan and slogan publicity during commissioning period;

负责试运期间现场标语和口号宣传；

（6）Responsible for organizing and carry out various cultural and sports activities during commissioning period;

负责组织开展试运期间各项文化、体育等活动；

（7）Responsible for media access and media emergency handling works during commissioning period;

负责试运期间媒体准入及媒体应急攻关工作；

（8）Complete all tasks assigned by the commissioning command centre.

完成试车指挥部下达的各项工作任务。

6 Commissioning Progress试车进度

The commissioning schedule is based on the overall test network compiled on August 30. According to the progress of the project, the follow-up will be adjusted. The actual time is subject to the latest version of the network.

试车进度以 8 月 30 日编制的总体试车网络为依据进行编制，根据工程进度，后续将有所调整，实际时间以最新版网络为准。

6.1 Arrangement Principles of the Commissioning Progress 试车进度的安排原则

The general commissioning procedure follows a set of principles: early pre-commissioning, strict purging and gas leak teasting, complete and stable commissioning, and good economic benefits. At the same time, according to the characteristics and requirements of the mutual supply of feedstock between units, and the actual conditions of the smaller capacity intermediate tanks of the PMB project, other than the use of outsourced diesel as the Atmospheric and Vacuum Distillation Unit start-up oil, and for boiler start-up and CFB boiler, other production units rely on the gasoline, diesel and vacuum gas oil (VGO) produced by the Atmospheric and Vacuum Distillation Unit during the initial start-up. The arrangement for the start-up procedure is as follows: Start the ulitilies system, then start the production units, start the upstream units, then start the downstream units, enabling the start-up of all units to be stable and reliable, achieving start-up safety, stability, efficiency, and punctuality. Considering the factor of small intermediate capacities, achieve a principle where upstream and downstream units take action when the intermediate feedstocks capacities reach half of the storage capacity during the start-up.

总体试车的程序遵循单机试车要早、吹扫气密要严、联动试车要全、投料试车要稳、经济效益要好的原则，同时根据装置间互供原料的特点和要求，以及 PMB 项目中间罐罐容较小的实际情况，常减压装置开工油运用柴油和开工锅炉、CFB 锅炉用柴油外购以外，其他装置开工油运用油依托常减压装置首次投料试车产出的汽油、柴油和蜡油。在开工进程安排上，先开公用工程，再开生产装置，先开上游装置，再开下游装置，做到走上步，看下步，稳扎稳打，使各装置的投料试车建立在稳定、可靠的基础上，实现开工安全、平稳、高效、正点。考虑到中间库存小的因素，在全厂装置投料试车过程中本着中间原料库存达到满库存一半时其物料关联的上游及下游装置开始动作的原则。

6.2 General Idea of Commissioning Progress 试车进度的总体思路

6.2.1 Utilities and Auxiliary Facilities. Put into service first, the utilities such as water, electricity, gas, air and nitrogen; environmental protection units such as wastewater treatment, sulfur recovery unit and sour water stripping unit start-up is normal, is the start-up prerequisites of process units.

公用工程及辅助设施。水、电、气、风、氮等公用工程系统先行投用，污水处理、硫磺、酸性水汽提等环保装置开工正常，作为工艺装置开车的必要条件。

6.2.2 Jetty and tank farm. Put into service the Coal jetty, Western petrochemical jetties, Eastern chemical jetties, main plant area tank farm and Western tank farm, ensuring stable supply of fuel, feedstocks and other preparations for commissioning and start-up.

码头及罐区。煤码头、西区石化码头、东区化工码头、主厂区罐区和西罐区的投用，确保试车准备和投料试车期间燃料和原料的平稳供应。

6.2.3 Atmopheric and Vacuum Distsillation Unit start-up and crude oil selection. “Start-up in stages” is to prepare feedstock for downstream units, reducing the procurement of feedstock, and reducing the cost for commissioning; selecting low-sulfur crude oil for start-up to prepare high quality feedtock for the downstream units, and to improve the safety and operability of the first commissioning.

常减压分段开工和原油选择。“分阶段开工”为下游装置备开工原料，减少原料采购量，节约试车成本；选择低硫原油开工，为后续装置准备好优质的原料，提高首次试车的安全性及可操作性。

6.2.4 With an approach of early operation, thorough arrangement, high standards, and strict requirements each unit should carefully organise all inspections and preparations feedstocks are fed into the plant. During the start-up, it should also be ensured that all the major control points should be on schedule, ensuring the success of the first start-up, supplying qualified feedstocks or products for start-up of downstream units, thus ensuring the smooth operation of the whole plant, and achieving qualified products.

各装置本着早动手、细安排、高标准、严要求的态度，精心组织投料前的各项检查和准备工作，并力保在投料试车过程中，各主要控制点的正点到达和一次投料试车成功，为下游装置的投料试车，供应符合设计要求的合格原料或产品，确保达到全厂操作平稳、全部产品质量合格。

6.2.5 To ensure a successful start-up, the goals of high standard, high level and high efficiency should be realised. To make certain the control points are on schedule for the start-up, the commissioning progress is divided into the following three stages:

为了确保投料试车的一次成功，实现高标准、高水平、高效益的目标，保证每个装置投料试车正点到达控制点，将试车进度分为以下三个阶段：

6.2.5.1 First stage: Pre-commissioning stage 第一阶段：单机试车阶段

Although the pre-commissioning is more towards the construction unit, operators should also participate in the pre-commissioning to ensure the quality of the pre-commissioning, at the same time, achieving the purpose of on-site learning and training by understanding the operation performance of the equipment at an earlier time. Intermediate handover should be completed after the Pre-commissioning and equipment surging and washing. Practical measures should also be formulated for post-work. The first stage works should be ensured to be completed on as scheduled.

单机试车阶段虽以施工单位为主，但操作人员也要参加以确保单机试车的质量，同时使操作工及早了解设备的运转性能，达到现场学习和练兵的目的。在单机试车及设备吹扫、清洗后要完成中间交接，并对工程扫尾工作制定出切实可行的措施。保证第一阶段工作按期完成。

6.2.5.2 Second stage: Commissioning stage 第二阶段：联动试车阶段

At this stage, all units should complete the system’s gas leak testing, drying, dynamic testing,

and the loading of the three agents; the performance and quality of facilities, automatic control instruments, signal interlocking, pipeline valves, and power supply should be checked to determine whether the design and specification requirements are met.

在这个阶段，各装置要完成系统的气密、干燥、联运和三剂装填；并要对设施、自控仪表、信号联锁、管道阀门、供电性能和质量进行检查，检验其是否达到设计和规范要求。

6.2.5.3 Third stage: Start-up and operation assessment stage 第三阶段：投料试车及生产考核阶段

This stage includes the feeding of feedstock, production of qualified products and trial production. During this period, a comprehensive assessment is arranged for this unit. During the start-up process, high standard, high level, stability, safety and success should be required. For the commissioning process to run smoothly, there should be proper coordination of utilities, feedstock supply, and production delivery.

此阶段包括装置投料、出合格产品和试生产，期间安排装置的全面考核。在投料试车过程中，要求高标准、高水平、安全稳妥、一次成功，在试车过程中，还要协调好公用工程、原料供应、产品出厂工作，使其顺利进行。

6.3 Major Control Point 主要控制点

6.3.1 All commissioning plans should be prepared and printed out prior to the start-up, through continuous editing and optimising to achieve scientific and practicality. The process technical regulations and operation method are to be completed in Oct 2018.

各种试车方案，要在投料试车半年以前编制印刷出来，并经过反复修改和不断优化，达到科学合理、切实可行。工艺技术规程和操作法在 2018 年 10 月完成。

6.3.2 Feedstock and start-up materials volume and scheduled arrival time. Procurement of start-up feedstocks such as crude oil, refined naphtha, and diesel, their scheduled arrival time and volume are listed in Table 6-1.

原料及开工外购物料购货量、到货时间。开工购买原油、精制石脑油、柴油等原料，到位时间及购货量见表 6-1。

Table 6-1 Details of procurement of feedstocks, volume and time of arrival

表 6-1 开工原料购买到货数量及时间明细

No. 序号	Material name 物料名称	Supplied quantity(t) 供货数量（吨）	Order arrival time 到货时间
1	Low-sulfur crude 低硫原油	220000	Consumption during first month of start-up (first shipment in February 2019) 开工首月消耗（2019 年 2 月）
2	Heavy oil	85000	Consumption during first month of start-up (arrives on

No. 序号	Material name 物料名称	Supplied quantity(t) 供货数量（吨）	Order arrival time 到货时间
	重质油		30th June 2019) 开工首月消耗（2019 年 6 月 30 日进厂）
3	Medium oil 中质油	100000	Consumption during first month of start-up (arrives on 30th June 2019) 开工首月消耗（2019 年 6 月 30 日进厂）
4	Light oil 轻质油	400000	Consumption during first month of start-up (arrives on 30th June 2019) 开工首月消耗（2019 年 6 月 30 日进厂）
5	Liquefied Petroleum Gas (cylinder) 液化气（瓶装）	12	3 tonnes arrive on 6th March 2019, daily delivery of 1 tonne from 7th ~13th July 2019, the remaining 2 tonnes is dependent on the on-site commissioning and LPG unloading operation time node. Notify 3 days in advanced on the quantity to arrive. 2019 年 3 月 6 日进厂 3 吨，3 月 7 日～13 日每日交付 1 吨，剩余 2 吨根据现场调试及液化气卸船操作时间节点，提前 3 天通知到货量。
6	Liquefied Petroleum Gas (LPG) 液化气	22000	First shipment on 13th April 2019 首船进厂 2019 年 4 月 13 日
7	Mixed Xylene 混合二甲苯	15000	3th May 2019 2019 年 5 月 3 日
8	Reformate oil 重整生成油	10000	26th April 2019 2019 年 4 月 26 日
11	Refined Naphtha 精制石脑油	35000	19th April 2019 2019 年 4 月 19 日
12	FCC gasoline 催化汽油	20000	30th June 2019 2019 年 6 月 30 日
13	Coal 煤	100000	Consumption of 2018 (first batch before 10th November 2018) 2018 年消耗量（2018 年 11 月 10 日前第一批）
14	Diesel (Start-up boiler and generator)	15300	Until end of 2018, arrange land transport to enter plant. Diesel generator: 2,000t, start-up boiler: 7,800t, CFB boiler: 400t.

No. 序号	Material name 物料名称	Supplied quantity(t) 供货数量（吨）	Order arrival time 到货时间
	柴油（启动油锅炉及发电机）		至 2018 年底，安排汽车进厂。柴油发电机 0.02 万吨，启动锅炉 0.78 万吨，CFB 锅炉 0.04 万吨。
15	Diesel (Atmospheric and Vacuum Distillation Unit start-up) 柴油（常减压油运）	5000	8rd May 2019 2019 年 5 月 8 日
Note: Refer to Basic Design for the estimate of the crude oil composition 备注：原油结构参考基础设计估算。			

6.3.3 Main control points schedule for auxiliary systems, see Table 6-2；Follow up optimization and adjustment according to the construction schedule；Follow up optimization and adjustment according to the construction schedule.

系统工程主要控制点时间表，见表 6-2；根据工程施工进度，后续优化调整。

Table 6-2 Auxiliary systems main control points schedule

表 6-2 系统工程主要控制点时间表

No. 序号	Project 项目 Name 名称	Handover time 中间交接时间	Feed into unit time 装置投料时间
1	Crude oil tank farm and pump station (1) 原油罐区及泵站（一）	2018/12/30	2019/4/3
2	Crude oil tank farm and pump station (2) 原油罐区及泵站（二）	2018/11/30	2019/4/3
3	Hydrogenation Feedstock tank and pump station 加氢原料罐区及泵站	2018/10/30	2019/6/5
4	Aromatics Feedstock tank farm and pump station 重整芳烃原料及泵站	2018/12/06	2019/4/15
5	Feedstocks tank for Coking/ Hydrogenation and pump station 焦化原料、加氢裂化原料罐区及泵站	2018/12/18	2019/6/5
6	Tank farm for Gasoline and pump station (1)	2018/11/11	2019/4/15

No. 序号	Project 项目 / Name 名称	Handover time 中间交接时间	Feed into unit time 装置投料时间
	汽油罐区及泵站（一）		
7	Diesel/ jet fuel tank farm and pump station (1) 柴油、航煤罐区及泵站（一）	2018/10/30	2019/4/1
8	Propylene tank farm and pump station 丙烯罐区及泵站	2018/11/30	2019/4/20
9	Iso-butane tank farm and pump station 异丁烷罐区及泵站	2018/12/15	2019/4/5
10	LPG tank farm and pump station (2) LPG 罐区及泵站（二）	2018/12/20	2019/4/20
11	Raffinate oil/ Light Naphtha tank farm and pump station 非芳烃抽余油、轻石脑油罐区及泵站	2018/12/15	2019/4/5
12	Blending stocks/ pentane tank farm and pump station 轻烃汽油调和组分、戊烷油罐区及泵站	2018/12/22	2019/4/5
13	Heavy aromatics/ Light oil tank farm and pump station 重芳烃、轻污油罐区及泵站	2018/10/15	2019/5/30
14	Tail oil/ Heavy waste oil tank farm and pump station 尾油、重污油罐区及泵站	2018/12/05	2019/5/30
15	Plant-wide process/ heat piping network 全厂工艺及热力管网	2018/12/30	2018/12/30
16	Condensate deodorization unit 扫线油脱臭设施	2018/10/30	2019/5/30
17	Flare Facility 火炬	2019/1/20	2019/4/19
18	Flare/ flare gas recovery unit 火炬气回收设施	2018/12/30	2019/7/31
19	Flexicoking Flare 灵活焦化火炬	2019/3/30	2019/8/22
20	Seawater Desalination Plant 海水淡化设施	2018/10/1	2018/11/15
21	Water supply and fire water pressurization pump station 给水及消防稳压泵站	2018/10/30	2019/1/2
22	Cooling water unit Ⅱ 循环水场	2018/10/30	2018/11/10
23	Cooling water unit Ⅰ 循环水场	2018/11/30	2019/3/10
24	Foam station 泡沫站	2018/11/14	2019/1/2
25	Fire station and gas protection station 消防站及气防站	2018/10/30	2019/1/2

No. 序号	Project 项目 / Name 名称	Handover time 中间交接时间	Feed into unit time 装置投料时间
26	The rainwater monitoring and accident reservoir 雨水监控及事故池	2018/12/30	2018/12/30
27	The drainage pumping station 污水提升泵站	2018/10/02	2018/12/30
28	Sewage and wastewater recycling facilities 污水处理及污水回用设施	2018/12/30	2018/12/30
29	Waste alkali treatment 碱渣处理	2018/12/30	2018/12/30
30	Radiation source warehouse 放射源库	2018/9/30	2018/9/30
31	66KV power substation (1) 66KV 区域变电所（一）	2018/10/30	2018/10/30
32	66KV power substation (2) 66KV 区域变电所（二）	2018/10/30	2018/10/30
33	Plant-wide power supply and distribution system 全厂供配电系统	2018/12/30	2018/12/30
34	Telecommunication systems 厂区电信系统及电路	2018/12/30	2018/12/30
35	Plant-wide information system 全场信息化系统	2018/12/30	2018/12/30
36	Power plant 煤电站	2018/11/30	2018/11/30
37	Hot water station 热水站	2018/12/15	2019/1/30
38	Administration zone refridgeration station 厂前区制冷站	2018/11/30	2019/1/30
39	Refridgeration station for process area 装置区制冷站	2018/12/15	2019/4/30
40	Air separation and air compression 空分、空压设施	2018/11/30	2018/11/30
41	Central laboratory and environmental monitoring centre 中心化验室及环境监测站	2018/10/30	2018/10/30
42	Office building 办公楼	2018/12/30	2018/12/30
43	Maintenance station 维修站	2018/10/30	2018/10/30
44	Cylinder warehouse 钢瓶库	2018/10/31	2018/10/31
45	Central Control Room (CCR) 中心控制室	2018/11/20	2018/11/20
46	Field Operator Building (1) 外操间（一）	2018/11/30	2018/11/30
47	Field Operator Building (2) 外操间（二）	2018/9/30	2018/9/30
48	Tank farm for Gasoline and pump	2018/12/30	2019/4/25

No. 序号	Project 项目 / Name 名称	Handover time 中间交接时间	Feed into unit time 装置投料时间
	station (2) 汽油罐区及泵站（二）		
49	Diesel/ jet fuel tank farm and pump station (2) 柴油、航煤罐区及泵站（二）	2019/1/30	2019/4/1
50	Aromatics tank farm and pump station (2) 芳烃罐区及泵站（二）	2018/12/30	2019/4/22
51	Light Naphtha tank farm and pump station 轻石脑油罐区及泵站	2018/11/30	2019/7/30
52	Truck Loading Station 汽车装车站	2018/12/18	2019/7/30
53	Oil vapor recovery systems 油气回收设施	2018/11/15	2019/7/22
54	Tank farm process/heat piping network 罐区工艺及热力管网	2018/9/30	2019/2/15
55	Fire water pump station 消防加压泵站	2018/11/30	2019/1/2
56	Foam station 泡沫站	2018/11/16	2019/1/2
57	Fire station 消防站	2018/10/31	2019/1/2
58	The rainwater monitoring and accident reservoir 雨水监控及事故池	2018/11/05	2018/11/16
59	Piping network for water supply/ drainage and firefighting 给排水及消防管网	2018/10/30	2019/12/2
60	Drainage pumping station 污水提升泵站	2018/10/04	2019/3/31
61	10KV power substation 10KV 区域变电所	2018/10/30	2018/10/30
62	Power supply and distribution system 供配电系统	2018/11/15	2018/12/30
63	Telecommunication and Wiring Systems 电信系统及线路	2018/10/15	2018/12/30
64	Petrochemical jetty in Eastern area 东区石化码头	2018/12/30	2019/3/7
65	Petrochemical jetty in Western area 西区石化码头	2018/12/30	2019/3/31
66	Coal jetty 煤码头	2018/9/30	2018/11/10
67	Single Point Mooring 单点系泊	2018/12/15	2019/3/7
68	Subsea crude oil pipeline 原油海底管道	2018/12/15	2019/3/7

6.3.4 Main control points schedule of the main production units is listen in Table 6-3; Follow up optimization and adjustment according to the construction schedule.
主体生产装置主要控制点时间表，见表 6-3；根据工程施工进度，后续优化调整。

Table 6-3 The main production units' main control points schedule
表 6-3 主体生产装置主要控制点时间表

No. 序号	Project 项目 / Name 名称	Handover time 中间交接时间	Feed into unit time 装置投料时间
1	8 MMTA Atmospheric and Vacuum Distillation Unit 800 万吨/年常减压蒸馏	2019/2/28	2019/5/18 2019/6/25
2	2.35 MMTA Light Ends Recovery Unit 235 万吨/年轻烃回收	2019/2/28	2019/6/5 2019/6/28
3	Acid Gas & LPG Ends Recovery Unit 产品精制	2019/2/28	2019/6/5 2019/6/28
4	1.3 MMTA Kerosene Hydrotreating unit 130 万吨/年煤油加氢精制	2019/2/28	2019/6/30
5	2.2 MMTA Diesel Hydrotreating unit 220 万吨/年柴油加氢精制	2019/2/28	2019/6/29
6	2.2 MMTA Hydrocracking Unit 220 万吨/年加氢裂化	2019/4/15	2019/6/29
7	600 KMTA LPG Fractionation Unit 60 万吨/年气体分离	2019/2/28	2019/7/2
8	1.5 MMTA Aromatics unit 150 万吨/年芳烃联合	2019/2/28	2019/5/22
9	Light Naphtha Isomerization unit 轻石脑油异构化	2019/2/28	2019/7/11
10	180kN m3/h PSA unit 180000Nm^3 /h PSA 氢提纯	2019/2/28	2019/6/26
11	1.0 MMTA Flexicoking unit 100 万吨/年灵活焦化	2019/5/15	2019/7/26
12	180 t/h Sour water stripping unit 180 万吨/小时酸性水汽提	2018/12/15	2019/6/26
13	500 t/h Solvent Regeneration unit 500 吨/小时溶剂再生	2018/12/15	2019/6/26

No. 序号	Project 项目 / Name 名称	Handover time 中间交接时间	Feed into unit time 装置投料时间
14	60+60 kta Sulfur recovery & tail gas treatment unit 6+6 万吨/年硫磺回收及尾气处理装置	2018/12/15	2019/6/26

6.3.5 Initial material preparation 首次备料

The initial start-up of the Atmospheric and Vacuum Distillation Unit processes 60,000 tonnes of a mixture of Low-sulfur crude oil, to supply start-up oil for other units, and pre-sulfurization and passivation for the hydrogenation units. During this initial start-up, the Sour water stripping unit, Solvent Regeneration unit, and Sulfur recovery and tail gas treatment unit are not being started-up. Therefore wastewater produced is stored in wastewater drums, and the solvents only absorb but do not undergo regeneration. The wastewater treatment plant starts-up after the Atmospheric and Vacuum Distillation Unit. The Sour water stripping unit starts-up after the Solvent Regeneration Unit, together with the Sulfur recovery and tail gas treatment unit. The material conditions of the first stage is listen in the table below.

常减压首次开工加工 6 万吨低硫原油，为其它装置准备试运油运和加氢装置预硫化、钝化用油。在常减压首次开工时污水汽提、溶剂再生、硫磺装置不开工，所产污水存在污水罐，溶剂只吸收不再生，污水处理厂随常减压开工。污水汽提装置随溶剂再生、硫磺装置随同一起开工，第一阶段的物料情况见下表。

Table 6-4 Atmospheric and Vacuum Distillation Unit's initial start-up material preparation

表 6-4 常减压首次开工备料

No. 序号	Material name 物料名称	Yield/t 产量/吨	Use 用途	Storage 储存
1	LPG	550	Fuel for self-use 燃料自用	Stored into LPG tank after desulfurization at Acid gas & LPG Ends Recovery Unit. 双脱精制后储存在 LPG 罐
2	Naphtha 石脑油	9456	As Naphtha Hydrotreating Unit feedstock 供预加氢原料	Naphtha Hydrotreating Feedstock tank 2 x 20,000 t, can store 26,400t. 预加氢原料罐 2×2 万可存 2.64 万吨

No. 序号	Material name 物料名称	Yield/t 产量/吨	Use 用途	Storage 储存
3	Aviation Kerosene 航煤	8308	As start-up, sulfurization and passivation oil for Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit and Hydrocracking Unit 供煤柴油加氢、加氢裂化油运硫化、钝化用油	Kerosene Hydrotreating Feedstock tank 2 x 10,000t, can store 14,400 kt. 煤油加氢原料罐 2×1 万，可存 1.44 万吨
4	Diesel 柴油	12383	As start-up, sulfurization and passivation oil for Diesel Hydrotreating Unit 供柴油加氢油运、硫化和钝化用油	Diesel Hydrotreating feedstock tank 2 x 10,000m^3 can store 15,300t. 柴油加氢原料罐 2×1 万 m^3 可存 1.53 万吨
5	Vacuum gas oil (VGO) 蜡油	14402	Diesel for Hydrocracking Unit’s start-up and catalyst-sulfurization, remaining as feedstock for Hydrocracking Unit 柴油供加氢裂化油运和催化剂硫化，其余做加氢裂化原料	Hydrocracking feedstock tank 3 x 20,000m^3, can store 55,700 t. 加氢裂化原料罐 3×2 万 m^3，可存 5.57 万吨
6	Residual oil 渣油	4850	As Flexicoking Unit feedstock 灵活焦化原料	Enter into Residual oil tank, have two 20,000m^3 tanks. 进渣油罐，有 2 台 2 万 m^3 罐

6.3.6 Full Commissioning Phase 全面试车阶段

During the full commissioning phase, the first product of the high platinum hydrogen production is used as hydrogen-gas leak testing for the Hydrocracking Unit, Diesel Hydrotreating Unit and Kerosene Hydrotreating Unit. Reforming Unit starts-up after the 2-stage hydrogen-gas leak testing of the Hydrocracking Unit. After the PSA produces qualified hydrogen, the hydrogen is supplied to Hydrocracking Unit, Diesel Hydrotreating Unit and Kerosene Hydrotreating Unit，Naphtha Hydrotreating Unit spectacle blind line switching, Naphtha Hydrotreating Unit (presulfurization) feeding to produce refined oil; At the same time, Atmospheric and Vacuum

Distillation Unit Flexicoking Unit, Sulfur Recovery Unit, Sour water Stripping, Solvent Regeneration Unit, Xylene Fractionation, Light Naptha Isomerization unit, Sulfolane unit, Tatoray unit, and Parex unit undergoes start-up one after the other.

在全面试车阶段，高铂制氢投产供加氢裂化、柴油加氢和煤油加氢装置氢气气密，加氢裂化二次氢气气密合格重整装置投料，PSA 产氢合格供加氢裂化、柴油加氢和煤油加氢装置预硫化，预加氢倒盲板，预加氢（预硫化）投料生产精制油；同时，常减压、灵活焦化、硫磺回收、酸性水汽提、溶剂再生、二甲苯分离、轻石异构化、芳烃抽提、歧化和吸附分离单元陆续开工。

Table 6-5 Full Commissioning Material Balance

表 6-5 全面试车物料平衡

Name 名称	No. 序号	Category 类目	Storage Capacity 库容（t）	Initial inventory 期初库存（t）	Quantity in/out of plant 进/出厂量（t）	Input/Output 投入/产出（t）	Final inventory 期末库存（t）	Storage capacity ratio 占库容比例	Remarks 备注
Feedstock 原料	1	Crude oil 原油	873000	168000	1100000	610500	657500	75%	/
	2	FCC (fluidized catalytic cracking) gasoline 催化汽油	27300	0	45200	30200	15000	55%	/
	3	Start-up diesel 开工柴油	/	3500	/	3500	/	/	/
	4	Refined naphtha 精制石脑油	/	33700	/	33700	/	/	/
	5	Mixed xylene 混二甲苯	/	15000	/	15000	/	/	/
	6	Reformate oil 重整生成油	/	1500	/	1500	/	/	/

Name 名称	No. 序号	Category 类目	Storage Capacity 库容（t）	Initial inventory 期初库存（t）	Quantity in/out of plant 进/出厂量（t）	Input/Output 投入/产出（t）	Final inventory 期末库存（t）	Storage capacity ratio 占库容比例	Remarks 备注
	7	Iso-octane 异辛烷	4400	/	2000	730	1270	29%	/
	8	Start-up LPG 开工液化气	/	2687	12000	14687	/	/	/
	9	Subtotal 小计	904700	/	/	709817	673770	74%	/
Intermediate feedstocks 中间原料	1	Pentane 戊烷	3340	0	/	1274	1274	38%	/
	2	Light Naphtha 轻石脑油	3280	0	/	2362	2362	72%	/
	3	Iso-pentane 异戊烷	13000	0	/	1170	1170	9%	/
	4	Isomerization oil 异构化油	12700	0	/	3107	3107	24%	/
	5	Non-aromatics raffinate oil 非芳抽余油	12200	0	/	1908	1908	16%	/
	6	Hydrogenation gasoline 加氢汽油	13600	0	/	4380	4380	32%	/
	7	Straight-run Naphtha 直馏石脑油	40500	9456	10000	1797	21253	52%	/
	8	Straight-ru	14600	8308	/	-1286	7022	48%	/

Name 名称	No. 序号	Category 类目	Storage Capacity 库容（t）	Initial inventory 期初库存（t）	Quantity in/out of plant 进/出厂量（t）	Input/Output 投入/产出（t）	Final inventory 期末库存（t）	Storage capacity ratio 占库容比例	Remarks 备注
		n kerosene 直馏煤油							
	9	Straight-run Diesel 直馏柴油	16700	12383	/	-6115	6268	38%	/
	10	Straight-run vacuum gas oil 直馏蜡油	51600	14402	/	-306	14096	27%	/
	11	Straight-tun Residual oil 直馏渣油	37000	4850	/	7645	12495	34%	/
	12	Straight-run Naphtha 焦化石脑油	2850	/	/	632	632	22%	/
	13	Coker diesel 焦化柴油	3650	/	/	909	909	25%	/
	14	Coker VGO 焦化蜡油	17800	/	/	1339	1339	8%	/
	15	Toluene 甲苯	25000	/	3000	987	3987	16%	/
	16	Reforming Feedstock 重整原料	40500	/	/	13049	13049	32%	/
	17	Light Reforming oil 轻重整油	13100	2471	/	1500	3971	30%	/

Name 名称	No. 序号	Category 类目	Storage Capacity 库容（t）	Initial inventory 期初库存（t）	Quantity in/out of plant 进/出厂量（t）	Input/Output 投入/产出（t）	Final inventory 期末库存（t）	Storage capacity ratio 占库容比例	Remarks 备注
	18	Clay treater feedstock 白土塔进料	2100	/	/	858	858	41%	/
	19	C8+ Aromatics C8+芳烃	18500	2345	/	2912	5257	28%	/
	20	C9+ Aromatics C9+芳烃	16800	1020	/	14923	15943	95%	/
	21	Heavy Aromatics 重芳烃	5200	84	/	754	838	16%	/
	22	Tail oil 尾油	600	0	/	332	332	55%	/
	23	Light slop oil 轻污油	3280	1840	/	-958	882	27%	/
	24	Heavy slop oil 重污油	2700	1060	/	183	1243	46%	/
	25	Subtotal 小计	370600	/	/	53356	124575	34%	/
Products 产品	1	Benzene 苯	33000	/	12936	28506	15570	47%	/
	2	Para-xylene 对二甲苯	124400	/	34637	93097	58460	47%	/
	3	Propylene 丙烯	4040	/	/	55	55	1%	/
	4	LPG	8830	550	11683	1702	5888	67%	/

Name 名称	No. 序号	Category 类目	Storage Capacity 库容（t）	Initial inventory 期初库存（t）	Quantity in/out of plant 进/出厂量（t）	Input/Output 投入/产出（t）	Final inventory 期末库存（t）	Storage capacity ratio 占库容比例	Remarks 备注
		液化气				1			
	5	Iso-butane 异丁烷	10500	/	9344	12896	3552	34%	/
	6	88# Gasoline 88#汽油	22800	/	21595	39161	17566	77%	/
	7	92# Gasoline 92#汽油	43000	/	22701	52368	29667	69%	/
	8	95# Gasoline 95#汽油	21100	/	4858	22594	17736	84%	/
	9	97$ Gasoline 97#汽油	23100	/	/	12678	12678	55%	/
	10	Chemical Light oil 化工轻油	29800	/	1004	14914	13910	47%	/
	11	Diesel 柴油	96500	3500	76636	121943	45307	47%	/
	12	Aviation kerosene 航煤	89700	/	56758	98052	41294	46%	/
	13	Sulfur 硫磺	/	/	2000	4466	2466	/	/
	14	Petroleum coke 石油焦	/	/	90	90	/	/	自用
	15	Vacuum Residue	/	/	47512	47512	/	/	/

Name 名称	No. 序号	Category 类目	Storage Capacity 库容（t）	Initial inventory 期初库存（t）	Quantity in/out of plant 进/出厂量（t）	Input/Output 投入/产出（t）	Final inventory 期末库存（t）	Storage capacity ratio 占库容比例	Remarks 备注
		减压渣油							
	16	Subtotal 小计	506770	/	/	565353	264149	52%	/
Fuel 燃料	1	Fuel gas 燃料气	/	/	/	28948	/	/	Self-use 自用
	2	Flexigas 灵活气	/	/	/	1484	/	/	Self-use 自用
	3	LPG 液化气	/	/	/	21729	/	/	Self-use 自用
	4	Iso-pentane 异戊烷	/	/	/	9600	/	/	Self-use 自用
	5	Heavy aromatics 重芳烃	/	/	/	1608	/	/	Self-use 自用
	6	Subtotal 小计	/	/	/	63369	/	/	/
Inventory 垫料			/	/	/	24977	/	/	/
Loss 损失			/	/	/	2762	/	/	/
Total 合计			1782070	/	/	709817	1062494	60%	/

6.3.6.1 Naphtha Hydrotreating (High Platinum Hydrogen Production) Unit

预加氢（高铂制氢）装置

（1）High platinum sphere type reactor uses refined oil to produce hydrogen for hydrogen-gas

leak testing of the three hydrogenation units namely the Hydrocracking Unit, Diesel Hydrotreating Unit and Kerosene Hydrotreating Unit. The first stage gas leak test lasts for 7 days while the second stage gas leak test has a duration of 4 days. The high platinum hydrogen production operates for 11 days, requiring 26,400 t of refined oil. It is planned to enter the plant in 2 batches, stored in 2 storage tanks (with tank bottom volumes of 2,400 t/tank). The tank bottom volume, pipeline storage capacity and 2-days preserved storage capacity of refined oil for hydrogen gas leak test (in case when gas leak is unqualified) is considered.

（1）高铂小球反应器用精制油产氢气加氢裂化、柴油加氢和煤油加氢三套装置气密，第一次氢气气密 8 天、第二次氢气气密 4 天，高铂制氢运行 12 天共需精制油 2.64 万吨。计划按照两批进厂，使用两个储罐（罐底量 2400 吨/罐），考虑罐底、管线储量以及预留 2 天氢气气密精制油原料（应对气密不合格）。

（2）The Naphtha Hydrotreating Unit starts-up simultaneously with the Continuous Catalytic Reforming Unit (CCR) after the second stage gas leak test has been qualified for the Hydrocracking Unit. This supplies feedstock for the CCR and at the same time, the Atmospheric and Vacuum Distillation Unit starts-up to produce feedstock for the Naphtha Hydrotreating Unit.

（2）预加氢在加氢裂化二次氢气气密合格后，与连续重整装置同步开工，为连续重整提供原料，同时常减压投料为预加氢供应原料。

6.3.6.2 Continuous Catalytic Reforming (CCR) 连续重整装置

The CCR utilizes the post-reaction oil from the high platinum hydrogen production for start-up, lowering hydrogen production of the reforming unit, thus reducing discharge of hydrogen. During the start-up of CCR, the usable inventory level of refined oil is 26,500 t, after subtracting the tank bottom volume of 7,200 t from the inventory level of 33,700 t. It takes 5 days for the pre-hydrogenated refined oil to meet the requirements for reforming and feeding.

连续重整装置利用高铂制氢反后油进油开工，降低重整产氢量，以减少氢气放空。连续重整投料按 50%负荷运行，精制油库存 3.37 万吨，扣除罐底 0.72 万吨，可用 2.65 万吨，能加工 5.5 天，预加氢精制油合格需 5 天，可满足重整供料需求。

6.3.6.3 Hydrogenation Unit 加氢装置

Kerosene and diesel for initial start-up preparation of the Atmospheric and Vacuum Distillation Unit is used for start-up, catalyst-sulfurization and as passivation oil.

加氢装置用常减压首次开工备料的煤油和柴油进行油运、催化剂预硫化和钝化。

6.3.6.4 Atmospheric and Vacuum Distillation Unit 常减压装置

The crude oil tank inventory level is 168,000 t for the second start-up, able to sustain the Atmospheric and Vacuum Distillation Unit processing for 10.5 days after subtracting the tank bottom volume, 1,100,000 t of crude oil is planned to enter the plant for the full stage.

常减压装置二次开工原油库存 16.8 万吨，扣除罐底可供常减压加工 10.5 天，全阶段原油计划进厂 110 万吨。

6.3.6.5 Aromatics Unit 芳烃联合装置

During the commissioning phase, the aromatics unit uses outsouced reformate oil and mixed

xylene as start-up oil, achieving start-up conditions to accept feedstock from upstream units before feed is introduced into the reforming unit. Other units undergo start-up following the start-up of the reforming unit, adjusting operation towards trial operation.

芳烃装置在试车阶段，外购重整生成油、混合二甲苯供芳烃装置进行油运试车，在重整进油前达到接收上游物料开工条件，随重整装置进油，各装置陆续投料，调整操作转入试生产。

6.3.6.6 LPG Fractionation Unit 气分装置

There is a shortage of fuel gas in the earlier stage. The reforming unit is able to achieve fuel gas balance three days after start-up of the unit. The LPG Fractionation Unit starts-up by introducing LPG from the tank farm as feed on the fourth day, after the three hydrogenation units have started-up and operating normally for three days.

由于前期燃料气缺口较大，待重整装置开工三天后燃料气达到平衡，气分装置在三套加氢装置开工正常后第四天收罐区液化气开工。

6.3.6.7 Flexicoking Unit 灵活焦化装置

Flexicoking Unit undergoes feeding 30 days after the second start-up of the Atmospheric and Vacuum Distillation Unit, during this period, 48,000 t of vacuum residue is planned to exit the plant.

灵活焦化装置在常减压二次开工 30 天后投料，期间减压渣油计划出厂 4.8 万吨。

6.3.6.8 Sulfur Recovery and Environmental Protection Units 硫磺回收及环保装置

Following the successive start-ups of each unit, the Sour Water Stripping Unit and Solvent Regeneration Unit starts-up to produce acid gas for start-up of Sulfur Recovery Unit.

随各装置逐步进油后酸性水汽提和溶剂再生投料，产生酸性气供硫磺回收装置开工。

6.3.7 Key Point Start-up Conditions 重要节点开工条件

6.3.7.1 Conditions to be met for the initial material input of Atmospheric & Vacuum Distillation Unit

常减压装置首次投料应具备的条件

（1）All utilities are operating normally.

公用工程全部运行正常。

（2）Storage and transportation system operates normally and crude oil analysis is qualified.

储运系统全部运行正常，原油分析合格。

（3）All DCS systems of the whole plant are operating normally.

全厂 DCS 系统全部运行正常。

（4）Hot oil commissioning of Atmospheric & Vacuum Distillation Unit is completed and the conditions for start-up are met.

常减压装置热油运结束，具备开工条件。

（5）Water commissioning of Light Ends Recovery Unit is completed, large device unit commissioning is qualified, and nitrogen gas leak test of system is qualified.

轻烃回收装置水联运结束，大机组试运合格，系统氮气气密合格。

（6）Acid Gas & LPG Ends Recovery Unit and Solvent Regeneration Unit establishes normal circulation of amine solution and alkali solution, and has met the condition for receiving LPG.

Sourwater Stripping Unit has met the conditions for receiving sour water containing sulfur from Atmospheric & Vacuum Distillation Unit.

产品精制、溶剂再生装置建立胺液、碱液循环正常，具备接收液化气条件。酸性水汽提装置具备接收常减压含硫酸性水条件。

6.3.7.2 Conditions to be met for initial material input of Continuous Catalytic Reforming

连续重整装置投料应具备的条件

（1）The loading of Hydrocracking catalyst is progressing normally and secondary hydrogen leak test is qualified.

加氢裂化催化剂装填进展正常，二次氢气密合格。

（2）Refined oil produced by Naphtha Hydrotreating Unit is qualified.

预加氢装置生产精制油合格。

（3）PSA nitrogen displacement is qualified and has met the condition for start-up.

PSA 氮气置换合格，具备开工条件。

（4）Xylene Fractionation Unit, Extractive Distillation Unit, Parex Unit, Isomar Unit and Par-Isom Unit have met the start-up conditions for feed input.

二甲苯分离、芳烃抽提、吸附分离、二甲苯异构化和轻石异构化具备进料开工条件。

7 Material Balance 物料平衡

7.1 General Principles of Load Arrangements in Commissioning

试车负荷安排的总体原则

7.1.1 According to the general idea and progress arrangements of the project, there are a few aspects that needs to be considered, such as important loop parameters in each unit that needs to be adjusted and reset, the period of time of adjusting between units and units, units and storage systems, and units and utilities. The start-up principle is as follows, “link up the process flow, produce qualified products, production operates with stability, optimise and adjust the operation, gradually increases the operation load”. According to objectives and tasks of different time periods, the start-up process can generally be divided into the following three stages:

根据项目试车的总体思路和进度安排，考虑到各装置的重要调节回路参数需要进行整定，装置与装置间、装置与储运系统间、装置与公用工程间需要一段时间的磨合期，投料试车以“打通全流程，产出合格产品，生产运行稳定，运行优化调整，逐步提高运行负荷”为原则。依据不同时间段的目标任务，投料试车大致可分为以下三个阶段：

7.1.2 Material preparation stage: Crude oil is scheduled to be introduced initially into the Atmospheric and Vacuum Distillation Unit from 30th March 2019, following the trial operation of the Light Ends Recovery Unit and Acid Gas & LPG Ends Recovery Unit, to prepare the second start-up materials for the downstream units such as Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit, Hydrocracking Unit and Flexicoking Unit.

物料准备阶段：安排常减压装置于 2019 年 5 月 30 日第一次引原油开工，轻烃回收及产品精制同步试运行，为煤油加氢、柴油加氢、加氢裂化和灵活焦化等下游二次装置准备开工物料。

7.1.3 Full commissioning stage: From 25th June 2019 to 1th August 2019, utilizing the stored and prepared start-up feedstocks to proceed with start-up and trial operation of each unit successively according to the general commissioning network with a load of around 70%, to link up the whole process flow and to produce qualified products.

全面试车阶段：2019 年 6 月 25 日至 2019 年 8 月 1 日，利用储备的开工原料，各生产装置根据总体试车网络安排，按照 70%左右的试车负荷陆续投料试运行，直至打通全流程，产出合格产品。

7.1.4 Otimising and adjusting phase: From 1th August 2019 to 1th September 2019, all units should make adjustments to the operation and optimise production operation according to the start-up conditions, and achieve balances such as fuel and power according to the production planning arrangements, gradually increase load while maintaining stable operation.

优化调整阶段：2019 年 8 月 1 日至 2019 年 9 月 1 日，各主要生产装置根据投料试车情况，做好装置操作调整，优化生产运行，并根据生产计划安排，结合燃料、动力等平衡情况，逐步提高负荷，并保持稳定运行。

7.2 Selection of Start-up Low Sulfur Crude Oil 开工低硫原油的选择

Considering the flexibility of processing scheme, inherent quality of crude oil, product quality index, crude oil cost, China-ASEAN most favored nation policy and other factors, Brunei crude oil and Qatar crude oil are mixed for the initial start-up crude oil. The sulfur content of mixed crude oil was 0.13wt&%, API 36.04, and the residue yield was 8.66wt%.

综合考虑加工方案灵活性、原油内在品质、产品质量指标、原油成本、中国-东盟最惠国政策等因素，首次开工原油采用文莱原油与卡滨达原油混合。混合原油硫含量 0.13 wt%，API°36.04，渣油收率 8.66wt%。

7.3 Load Arrangements for Commissioning of All Stages 各阶段试车负荷安排

Table 7-1 shows the timetable for the loads and operation duration of commissioning in all stages.

各阶段试车负荷和运行时间见表 7-1。

Table 7-1 Load and operation duration of all commissioning stages

表 7-1 各阶段试车负荷和运行时间

No. 序号	Unit 装置/单元	Material preparation stage 物料准备阶段	Full commissioning stage 全面试车阶段	Optimising and Adjusting stage 优化调整阶段

		Load 负荷	Duration (days) 时间（天）	Load 负荷	Duration (days) 时间（天）	Load 负荷	Duration (days) 时间（天）
1	Atmospheric and Vacuum Distillation 常减压	61%	4	69%	39	70%	31
2	Kerosene Hydrotreating 煤油加氢	/	/	69%	39	70%	31
3	Diesel Hydrotreating 柴油加氢	/	/	64%	39	70%	31
4	Flexicoking 灵活焦化	/	/	49%	4	57%	31
5	Hydrocracking 加氢裂化	/	/	62%	39	69%	31
6	Light Ends Recovery 轻烃回收	41%	4	61%	39	63%	31
7	Acid Gas & LPG Ends Recovery 产品精制	30%	4	49%	39	69%	31
8	LPG Fractionation 气分	/	/	62%	36	72%	31
9	Sulfur Recovery 硫磺回收	/	/	33%	39	46%	31
10	Light Naphtha Isomerization 轻石异构	/	/	56%	37	62%	31
11	Naphtha Hydrotreating 预加氢	/	/	90%	51	56%	31
12	Continuous Catalytic Reforming 连续重整	/	/	60%	42	66%	31
13	PSA	/	/	55%	42	61%	31
14	Xylene Fractionation 二甲苯分馏	/	/	60%	41	70%	31
15	Sulfolane Extractive Distillation 芳烃抽提	/	/	51%	41	59%	31
16	Tatoray 歧化	/	/	53%	35	56%	31
17	Benzene-Toluene	/	/	68%	39	79%	31

No. 序号	Unit 装置/单元	Material preparation stage 物料准备阶段		Full commissioning stage 全面试车阶段		Optimising and Adjusting stage 优化调整阶段	
		Load 负荷	Duration (days) 时间（天）	Load 负荷	Duration (days) 时间（天）	Load 负荷	Duration (days) 时间（天）
	Fractionation 苯、甲苯分馏						
18	Parex 吸附分离	/	/	60%	35	61%	31
19	Isomar 异构化	/	/	59%	35	60%	31

7.4 Input and Output of Main Materials 主要物料投入产出

7.4.1 The crude oil to be processed during the commissioning period totals to 1,157,900 tonnes. This amount contains 80,000 tonnes of Brunei light oil, 140,000 tonnes of Cabinda crude oil, 690,300 tonnes of light oil, 99,700 tonnes of medium oil, and 147,900 tonnes of heavy oil; the products produced totals up to 1,010,600 tonnes. This includes 169,000 tonnes of para-xylene, 51,000 tonnes of benzene, 248,100 tones of gasoline, 224,200 tonnes of diesel, and 169,400 tonnes of aviation kerosene.

试车期间加工原油总计 115.79 万吨，其中文莱轻油 8 万吨，卡宾达原油 14 万吨，轻质油 69.03 万吨，中质油 9.97 万吨，重质油 14.79 万吨；产品产量总计 101.06 万吨，其中对二甲苯 16.90 万吨，苯 5.10 万吨，汽油 24.81 万吨，柴油 22.42 万吨，航煤 16.94 万吨。

7.4.2 Limited by the sources and quality indicators of outsourced FCC gasoline, iso-octane and other gasoline blending components, the actual difficulties of gasoline blending during the commissioning period is considered. During this period, temporary arrangements were made to blend 77,800 tonnes of 88# gasoline, 105,800 tonnes of #92 gasoline, 42,700 tonnes of 95# gasoline and 21,600 tonnes of #97 gasoline. The remaining 31,000 tonnes exits the plant as chemical light oil.

受外购催化汽油、异辛烷等汽油调合组分来源和质量指标的限制，考虑试车期间汽油调合的实际困难，试车期间暂安排调和 88#汽油 7.78 万吨，92#汽油 10.58 万吨，95#汽油 4.27 万吨，97#汽油 2.16 万吨，其余 3.10 万吨以化工轻油的形式出厂。

7.4.3 Considering the possible negative effects of the first utilization of storage tanks and pipelines on product quality, a part of the products are withdrawn as displacement oil. These oils include 10,000 tonnes of gasoline, 8,000 tonnes of aviation kerosene, and 8,000 tonnes of diesel which is included in heavy oils after displacement; 3,000 tonnes of benzene and 8,000

tonnes of para-xylene are included in C8+ aromatics after displacement.

考虑储罐和管线首次投用可能对产品质量的影响，计提部分产品作为置换用油，其中 1.0 万吨汽油、0.8 万吨航煤和 0.8 万吨柴油置换后计入重油，0.3 万吨苯和 0.8 万吨对二甲苯置换后计入 C8+芳烃。

7.4.4 The main technical and economic indicators during commissioning are as follows: Commodity rate of 76.99%, self-use of 9.09%, processing losses of 0.85%.

试车期间主要技术经济指标如下：综合商品率 76.99%，综合自用率 9.09%，加工损失 0.85%。

Table 7-2 Input and Output

表 7-2 投入产出

No. 序号	Category/ Name 类别/名称	Amount (tonnes) 数量（吨）	No. 序号	Category/ Name 类别/名称	Amount (tonnes) 数量（吨）
One 一	Feedstock 原料	Imput amount 投入量	5	Heavy aromatics 重芳烃	3690
1	Brunei light oil 文莱轻油	80000	Four 四	Inventory 垫料	Amount 数量
2	Cabinda 卡宾达	140000	1	Inventory 垫料	29190
3	Light oil 轻质油	690317	Five 五	Loss 损失	Amount 数量
4	Medium oil 中质油	99707	1	Loss 损失	11127
5	Heavy oil 重质油	147876	Six 六	Intermediate material 中间物料	Tank inventory level variation 库存变化量
6	Start-up diesel 开工柴油	5000	1	Pentane 戊烷	1275
7	Refined naphtha 精制石脑油	35000	2	Light naphtha 轻石脑油	2362
8	Mixed xylene 混合二甲苯	15000	3	Iso-pentane 异戊烷	1170
9	Reformate oil 重整生成油	10000	4	Isomerization oil 异构化油	3107
10	FCC gasoline 催化汽油	64058	5	Non-aromatics raffinate oil 非芳抽余油	1908

No. 序号	Category/ Name 类别/名称	Amount (tonnes) 数量（吨）	No. 序号	Category/ Name 类别/名称	Amount (tonnes) 数量（吨）
11	Toluene 甲苯	2189	6	Naphtha Hydrotreating Feedstock 预加氢原料	653
12	Iso-octane 异辛烷	1548	7	Reforming Feedstock 重整原料	15137
13	Start-up LPG 开工液化气	22000	8	Aviation Kerosene Material 航煤料	7022
Two 二	Products 产品	产出量	9	Straight-run diesel 直馏柴油	5318
1	Refined propylene 精丙烯	922	10	Vacuum Gas Oil (VGO) 减压蜡油	14106
2	LPG 液化气	35001	11	Vacuum Residue 减压渣油	12495
3	Iso-butane 异丁烷	24623	12	Coker Naphtha 焦化石脑油	1895
4	88# gasoline 88#汽油	77857	13	Coker Diesel 焦化柴油	2727
5	92# gasoline 92#汽油	105870	14	Coker VGO 焦化蜡油	4016
6	95# gasoline 95#汽油	42717	15	Hydrogenation gasoline 加氢汽油	4380
7	97# gasoline 97#汽油	21686	16	C9+ Aromatics C9+芳烃	16872
8	Chemical light oil 化工轻油	31051	17	Heavy Aromatics 重芳烃	838
9	Benzene 苯	51004	18	Tail oil 尾油	332

No. 序号	Category/ Name 类别/名称	Amount (tonnes) 数量（吨）	No. 序号	Category/ Name 类别/名称	Amount (tonnes) 数量（吨）
10	Para-xylene 对二甲苯	168978	19	Light slop oil 轻污油	882
11	Diesel 柴油	224220	20	Heavy slop oil 重污油	641
12	Aviation kerosene 航煤	169445	21	Light reforming oil 轻重整油	3972
13	Sulfur 硫磺	8811	22	B/T Feedstock B/T 原料	858
14	Petroleum coke 石油焦	896	23	C8+ Aromatics C8+芳烃	14457
15	Vacuum Residue 减压渣油	47512	24	Heavy oil 重油	26000
Three 三	Fuel 燃料	消耗量	Seven 七	Technical economic indicator 技术经济指标	
1	Fuel gas 燃料气	56207	1	Commodity rate 综合商品率	76.99%
2	LPG 液化气	31965	2	Self-use rate 综合自用率	9.09%
3	Flexigas (Without coke) 灵活气（折焦炭）	14800	3	Processing losses 加工损失	0.85%
4	Iso-pentane 异戊烷	12700	/		

Table 7-3 Schedule for products leaving the plant

表 7-3 产品出厂时间

No. 序号	Product name 产品名称	First time to exit plant 首次出厂时间	Principle for controlling tank inventory level 库存控制原则
1	Refined propylene 精丙烯	2019/9/10	Leaves the plant after the inventory level meets the shipment loading quantity. 待库存满足一次装船量后出厂。

No. 序号	Product name 产品名称	First time to exit plant 首次出厂时间	Principle for controlling tank inventory level 库存控制原则
2	LPG 液化气	2019/8/1	Arrange first shipment to leave plant when tank inventory level is more than 8,000 tonnes, the tank inventory level can be lowered appropriately after commissioning is normal. 库存高于 8000 吨时安排首次装船出厂，试车正常后库存可适当降低。
3	Isobutane 异丁烷	2019/8/1	Leaves the plant after the inventory level meets the shipment loading quantity requirement, tank inventory level is temporarily controlled at 4,000 tonnes. 库存满足一次装船需求即安排装船出厂，库存暂定按 4000 吨控制。
4	Isopentane 异戊烷	调合汽油	Used in gasoline blending, arrange to be loaded onto ship to leave the plant when tank inventory level is more than 6,000 tonnes. 用于调合汽油，如库存高于 6000 吨时安排装船出厂。
5	92# gasoline 92#汽油	2019/9/1	Leaves the plant after the inventory level meets the shipment loading quantity requirement, tank inventory level is temporarily controlled at 10,000 tonnes. 库存满足一次装船需求即安排装船出厂，库存暂定控制 10000 吨。
6	97# gasoline 97#汽油	2019/9/1	Leaves the plant when the first tank is qualified, tank inventory level is temporarily controlled at 3,000 tonnes. 首罐合格即装车出厂，库存暂定按 3000 吨控制。
8	Benzene 苯	2019/8/10	Leaves the plant after the inventory level meets the shipment loading quantity requirement, tank inventory level is temporarily controlled at 8,000 tonnes. 库存满足一次装船需求即安排装船出厂，库存暂定控制 8000 吨。
9	Toluene 甲苯	调合汽油	To be confirmed according to the units' operating and gasoline blending conditions, is temporarily not arranged to leave the plant. 根据装置运行和汽油调合情况确定，暂不安排出厂。
10	Para-xylene 对二甲苯	2019/7/25	Leaves the plant after the inventory level meets the shipment loading quantity requirement, tank inventory

No. 序号	Product name 产品名称	First time to exit plant 首次出厂时间	Principle for controlling tank inventory level 库存控制原则
			level is temporarily controlled at 15,000 tonnes. 库存满足一次装船需求即安排装船出厂，库存暂定控制 15000 吨。
11	Diesel 柴油	2019/7/19	Leaves the plant after the inventory level meets the shipment loading quantity requirement, tank inventory level is temporarily controlled at 15,000 tonnes. 库存满足一次装船需求即安排装船出厂，库存暂定控制 15000 吨。
12	Aviation kerosene 航煤	2019/8/15	Leaves the plant after the inventory level meets the shipment loading quantity requirement, tank inventory level is temporarily controlled at 15,000 tonnes. 库存满足一次装船需求即安排装船出厂，库存暂定控制 15000 吨。
13	Sulfur 硫磺	2019/8/1	Leaves the plant after the inventory level meets the shipment loading quantity, time for solid sulfur to leave the plant is yet to be confirmed. 库存满足一次装船量后出厂，固硫出厂时间待定。
14	Petroleum coke 石油焦	2019/8/7	To Power Plant 去煤电站。

Material balance during the commissioning period is shown in Appendix, table 4.
试车期间物料平衡见附表 4。

7.5 Hydrogen Balance 氢气平衡

According to general commissioning network plan, hydrogen usage plan and hydrogen supply plan are roughly arranged in three stages:
根据总体试车网络计划，氢气使用计划和供氢安排大致按三个阶段安排：

7.5.1 First stage: The high platinum catalyst hydrogen production reactor of Naphtha Hydrotreating Unit is arranged to operate at a load of 100t/h with a hydrogen production of about 6,000Nm^3/h. In this stage, the hydrogen resources are limited, and Hydrocracking Unit, Kerosene Hydrotreating Unit and Diesel Hydrotreating Unit are arranged to conduct hydrogen gas leak test at the same time so as to reduce venting and save hydrogen consumption.
第一阶段：安排预加氢装置高铂制氢反应器按 100t/h 负荷运行，氢气产量约 6000Nm^3/h，该阶

段氢气资源有限，安排加氢裂化、煤油加氢和柴油加氢同时进行氢气气密，减少放空，节约氢气消耗。

7.5.2 Second Stage: Before the feeding of Continuous Catalytic Reforming Unit, the high platinum catalyst hydrogen production reactor of Naphtha Hydrotreating Unit is arranged to operate at a load of 100t/h, and the hydrogen production is about 6,000Nm³/h, supplying hydrogen for secondary hydrogen gas leak test of three hydrogenation units and hydrogen gas leak test displacement of the reaction part of Continuous Catalytic Reformer Unit can meet the feeding conditions of Continuous Catalytic Reformer Unit.

第二阶段：连续重整装置投料前，安排预加氢装置高铂制氢反应器按 100t/h 负荷运行，氢气产量约 6000Nm³/h，供三套加氢装置二次氢气气密和连续重整装置反应部分氢气气密置换，满足连续重整装置投料条件。

7.5.3 Third Stage: After Continuous Catalytic Reforming Unit was put into operation, the high platinum catalyst hydrogen production reactor of Naphtha Hydrotreating Unit was arranged to be shut down and isolated. The Continuous Catalytic Reforming Unit was operated at a low load of 200t/h with a reforming hydrogen output of about 90,000 Nm³/h for supplying hydrogen for displacement of Tatoray Unit and Isomar Unit reactor and the presulfiding of Naphtha Hydrotreating Unit, Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit and Hydrocracking Unit.

第三阶段：连续重整装置投料后，安排预加氢高铂制氢反应器停工并隔离，连续重整装置按 200t/h 低负荷运行，重整氢产量约 90000Nm³/h，供歧化和异构化装置反应器置换，及预加氢、煤油加氢、柴油加氢、加氢裂化的预硫化。

7.6 Unqualified Oil Products During the Start-up Period 开工期间不合格油品

Slop oil reprocessing is arranged to enter the Flexicoking Unit, the slop oil can enter the crude oil tank under accident conditions; All sulfurization oils from the hydrogenation units should first be treated at the stripper before entering light slop oil tank; stabilized naphtha from Light Ends Recovery Unit, light naphtha from Hydrocracking Unit, and coker naphtha from Flexicoking Unit exiting their respective units must not entrain light hydrocarbons. The flow directions of the light and heavy slop oils produced in the initial start-up is arranged as follows:

污油回炼安排进灵活焦化装置，事故状态下污油可进原油罐；各加氢装置硫化油必须经汽提塔处理,才可进轻污油罐区；轻烃回收装置稳定石脑油、加氢裂化装置轻石脑油、灵活焦化装置焦化石脑油出装置不可携带轻烃。首次开工过程中产生的轻重污油及去向安排如下表：

Table 7-4 Slop oil treatment at the initial commissioning

表 7-4 首次试车污油处置表

No. 序号	Unit 装置	Slop oil quantity (t) 污油量（吨）	Normal flow 正常流程	Flow direction during Initial commissioning period 首次试车期间去向
1	Atmospheric and Vacuum Distillation 常减压	10717	Straight-run naphtha to light slop oil tank. Unqualified kerosene to Diesel Hydrotreating Feed drum or light slop oil tank. Unqualified diesel to light slop oil tank. Underground slop oil tank to light slop oil tank. 直馏石脑油去轻污油罐 煤油不合格进柴油加氢料罐或轻污油罐 柴油不合格去轻污油罐 地下污油罐去轻污油罐	Unqualified oil during initial start-up of Atmospheric and Vacuum Distillation Unit is used for displacement of pipelines and storage tanks. Unqualified oil during second start-up period is sent to light slop oil tank. 常减压装置首次开工不合格油用于置换管线和储罐 二次开工期间不合格油去轻污油罐
2	Light Ends Recovery 轻烃回收	1365	Unqualified stabilized naphtha is sent to underground light slop oil tank of Atmospheric and Vacuum Distillation Unit. Unqualified LPG is sent to Light Ends Recovery Unit. 稳定石脑油不合格去常减压装置地下轻污油罐 液化气不合格至轻烃回收	Naphtha hydrotreating is stored and prepared for start-up of refined naphtha, sent to light slop oil tank. 预加氢原料已储备开工精制石脑油，去轻污油罐
3	Aromatics Complex 芳烃联合	300	Underground slop oil tank to light slop oil tank. 地下污油罐去轻污油罐	To Unit's feed drum 去装置原料罐
4	Kerosene Hydrotreating 煤油加氢	700	Unqualified kerosene sent to Diesel Hydrotreating Unit's feed drum. 航煤不合格至柴油加氢原料罐	Sulfurized oil must undergo stripping before entering light slop oil tank. Unqualified kerosene enters Diesel Hydrotreating Unit's

No. 序号	Unit 装置	Slop oil quantity (t) 污油量（吨）	Normal flow 正常流程	Flow direction during Initial commissioning period 首次试车期间去向
				feed drum after start-up. 硫化油必须经汽提再进轻污油罐 投料后航煤不合格进柴油加氢原料罐
5	Diesel Hydrotreating 柴油加氢	1052	Unqualified diesel is sent to Diesel Hydrotreating Unit's feed drum. Underground slop oil tank to light slop oil tank. 柴油不合格去柴油加氢料罐 地下污油罐去轻污油罐	Sulfurized oil must undergo stripping before entering light slop oil tank in tank farm. 硫化油必须经汽提再进罐区轻污油罐
6	Hydrocracking 加氢裂化	2225	Unqualified naphtha is sent to Naphtha Hydrotreating Unit's feed drum. Underground slop oil tank to light slop oil tank. 石脑油不合格去预加氢原料罐 地下污油罐去轻污油罐	Sulfurized oil must undergo stripping before entering light slop oil tank. When appearance of naphtha is unqualified, it is sent to light slop oil tank. 硫化油必须经汽提再进轻污油罐 石脑油外观不合格去轻污油罐
7	Flexicoking 灵活焦化	300	Enters light slop oil tank, Atmospheric and Vacuum Distillation undergo reprocessing, and stop production of aviation kerosene. 进轻污油罐，常减压回炼，停产航煤	Used for displacement of pipelines and intermediate tanks, and is sent to downstream units for processing according to index from analysis. 用于置换管线和中间罐，根据分析指标确定是否供下游装置加工
8	Total Light slop oil	16659	To Atmospheric and Vacuum Distillation Unit for reprocessing	To Crude oil tank. 去原油罐

No. 序号	Unit 装置	Slop oil quantity (t) 污油量（吨）	Normal flow 正常流程	Flow direction during Initial commissioning period 首次试车期间去向
	轻污油合计		or to crude oil tank. 去常减压装置回炼或原油罐	
9	Atmospheric and Vacuum Distillation Unit heavy slop oil 常减压重污油	2853	Unqualified straight-run VGO is sent to heavy slop oil tank. Underground slop oil tank to heavy slop oil tank. 直馏蜡油不合格去重污油罐 地下污油罐去重污油罐	Unqualified oil during initial start-up of Atmospheric and Vacuum Distillation Unit is used for displacement of pipelines and storage tanks. Unqualified oil during second start-up period is sent to heavy slop oil tank before entering flexicoking feed drum. 常减压装置首次开工不合格油用于置换管线和储罐 二次开工期间不合格油去重油罐，再进焦化原料罐
10	Hydrocracking Unit heavy slop oil 加氢裂化重污油	200	Underground slop oil to heavy slop oil tank. Unqualified tail oil enters tail oil tank. 地下污油罐去重污油罐 尾油不合格去尾油罐	Enters tail oil tank for displacement of pipelines and storage tanks. 进尾油罐用于置换管线和储罐
11	Flexicoking Unit heavy slop oil 灵活焦化重污油	200	Start-up VGO is sent to heavy slop oil tank (does not enter underground slop oil tank). Underground slop oil enters heavy slop oil tank. 开工蜡油去重污油罐（不进地下污油罐） 地下污油去重污油罐	To heavy slop oil tank 去重污油罐
12	Total Heavy	3252	To undergo reprocessing in	To Flexicoking Unit for

No. 序号	Unit 装置	Slop oil quantity (t) 污油量（吨）	Normal flow 正常流程	Flow direction during Initial commissioning period 首次试车期间去向
	slop oil 重污油合计		Flexicoking Unit or Atmospheric and Vacuum Distillation Unit. 去焦化装置回炼或至常减压装置回炼	reprocessing. 去焦化回炼

8 Power and Fuel balance 动力、燃料平衡

8.1 Consumption of Utilities 公用工程消耗

This chapter explains the power and fuel demand and balance of the initial start-up. According to the start-up points in the general commissioning network, the supply capacity of the utilities, and the peak consumption of the commissioning period of each unit is calculated to produce a plant-wide utilities balance. The power balance of the initial commissioning period is divided into 3 stages: water and electricity balance of the initial equipment start-up in the power plant; power balance during the commissioning material preparation stage; and the power balance during the full commissioning stage. In terms of fuel, #0 diesel is used as fuel for start-up boiler and generating set; where coal is used as fuel for the 5 circulating fluidized bed boilers. LPG is used as fuel for plant-wide furnace and equipment drying, with peak consumption of 515 t/day, the peak consumption can rise to 580 t/day during the units' start-up stage. After Flexicoking Unit and Acid Gas & LPG Ends Recovery Unit have achieved normal operation to produce purified dry gas, link up production process flow for the whole plant, and operate with load of 70%. The fuel gas consumption will be stable at 1,336 t/day.

本章节对首次开工的动力需求和试车燃料、动力平衡进行说明。根据试车网络开工节点核算公用工程供给能力，重点找出各装置试车期间消耗峰值，对全厂动力进行平衡。首次试车期间动力平衡分为三个阶段，电站首台机组开工的水、电平衡；试车准备期间的动力平衡；全面试车期间的动力平衡。燃料方面，启动锅炉和自备发电机以 0#柴油作为燃料；5 台循环流化床锅炉主要用煤作为燃料。全厂烘炉烘器用液化气作为燃料最高峰达到 515 吨/天，装置热油运阶段最高峰达到 580 吨/天,灵活焦化及产品精制装置运行正常产出净化干气后，打通全厂生产流程并按 70%负荷运行时每天燃料气使用量稳定在 1336 吨/天。

8.1.1 Design Conditions 设计工况

Table 8-1 Design conditions for utilities consumption

表 8-1 设计工况公用工程消耗

No. 序号	Item name (Index) 项目名称（指标）	Unit 单　位	Quantity 数　量	Remarks 备　　注
1	Desulfurized dry gas 脱硫干气等	10^4t/a	47.41	Fuel gas 燃料气
2	Flexigas 灵活焦化气	10^4t/a	166	Fuel gas 燃料气
3	Electricity 电	MW	160	Power plant to generate own electricity 动力站自发电
4	Production water 新鲜水	t/d	37500	Desalination Unit 海水淡化
5	Cooling water 循环冷却水	m^3/h	27000	Cooling tower 1 Ⅰ循
		m^3/h	5000	Cooling tower 2 Ⅱ循
6	Demineralised water 脱盐水	t/h	349	/
7	Steam 蒸汽：	/	/	/
	3.5MPa	t/h	723	Self-produced 自产
	1.0MPa	t/h	252	Self-produced 自产
	0.5MPa	t/h	396	Self-produced 自产
8	Instrument air 净化风	Nm^3/h	14528	Continuous normal consumption 连续正常用量
9	Plant air 非净化风	Nm^3/h	193	Continuous normal consumption 连续正常用量
			15123	Purging consumption 吹扫用量
10	Nitrogen 氮气	Nm^3/h	13000	0.6MPa Nitrogen 0.6MPa 氮气
			670	0.85MPa special-use

No. 序号	Item name (Index) 项目名称（指标）	Unit 单 位	Quantity 数 量	Remarks 备 注
				nitrogen 0.85MPa 专用氮
11	Wastewater treatment quantity 污水处理量	t/h	400	/
	Wastewater discharge quantity 污水排放量		167	
12	Total Consumption 综合能耗	kg standard oil/t of crude oil kg 标油/t 原油	144.33	/

8.1.2 Commissioning Preparation Stage 试车准备期间

Table 8-2 Utilities consumption of commissioning preparation stage

表 8-2 试车准备期间公用工程消耗

No. 序号	Item name (Index) 项目名称（指标）	Unit 单 位	Quantity 数 量	Remarks 备 注
1	Fuel gas 燃料气	t	36964	Outsourced + self-produced 外购+自产
2	Electricity 电	kWh	52340000	Electricity from external 岛外电
			96773920	Power plant generator and diesel generator 动力站发电和柴油发电机
3	Production water 新鲜水	t	4764074	Self-produced 自产
4	Cooling water 循环冷却水	t/h	3311 1732	Cooling tower 1 Cooling tower 2 Ⅰ循

No. 序号	Item name (Index) 项目名称（指标）	Unit 单　位	Quantity 数　量	Remarks 备　　注
				Ⅱ循
5	Demineralised water 脱盐水	t/h	150	Mean value 均值
6	Steam 蒸汽	t	744547	0.5MPa
			876888	1.0MPa
			862237	3.5MPa
7	Instrument air 净化风	Nm^3/h	4010	Mean value 均值
8	Plant air 非净化风	Nm^3/h	8670	Mean value 均值
9	Nitrogen 氮气	Nm^3	23587752	Convert according to 0.6MPa nitrogen 按 0.6MPa 氮气折算

8.1.3 Full Commissioning Stage 全面试车期间

Table 8-3 Utilities consumption of start-up stage

表 8-3 投料试车期间公用工程消耗

No. 序号	Item name (Index) 项目名称（指标）	Unit 单　位	Quantity 数　量	Remarks 备　　注
1	Fuel gas 燃料气	t	10418	Self-produced 自产
2	LPG 液化气	t	18700	Outourced 外购
3	Electricity 电	kWh	2937443	Power plant generator and diesel generator 动力站自发电和柴油发电机
4	Production water 新鲜水	t	689052	Self-produced 自产
5	Cooling water 循环冷却水	t/h	19559 5000	Cooling tower 1 Cooling tower 2 Ⅰ循 Ⅱ循
6	Demineralised water	t/h	167	Mean value

No. 序号	Item name (Index) 项目名称（指标）	Unit 单　位	Quantity 数　量	Remarks 备　　注
	脱盐水			均值
7	Steam 蒸汽	t	117596 153374 211436	0.5MPa 1.0MPa 3.5MPa
8	Instrument air 净化风	Nm^3/h	6586	Mean value 均值
9	Plant air 非净化风	Nm^3/h	193	Mean value 均值
10	Nitrogen 氮气	Nm^3	6541192	Convert according to 0.6MPa nitrogen 按 0.6MPa 氮气折算

8.2 Fuel Balance 燃料平衡

8.2.1 Design conditions 设计工况

There is a fuel gas pipeline network and a flexigas pipeline network for the whole plant. The fuel gas pipeline network mainly comprises dry gas from Acid Gas & LPG Ends Recovery Unit, tank farm LPG gasifier, Xylene Fractionation Unit C5/LPG gasifier, PSA Unit desorbed gas, and fuel gas from Aromatics Unit's Isomar Unit and Tatoray Unit, Light Naphtha Isomerization Unit, and LPG Fractionation Unit. The fuel gas pipeline network pressure is controlled at 0.4 – 0.6MPa. The flexigas pipeline network mainly comprises the flexigas produced from the Flexicoking Unit, mainly used for the Aromatics Unit's Xylene reboiler. In order to prevent fluctuations in the fuel gas system during production, one 20t/h LPG gasifier is installed at 4206-LPG tank farm. LPG is self-pressurized into the gasifier by the spherical tank's own pressure. A 25t/h C5/LPG gasifier is also installed at the Aromatics Unit's xylene column reboiler, to be used as high heating value gas source for the xylene column.

全厂设有一路燃料气管网，一路灵活气管网。其中燃料气管网主要以产品精制的干气、罐区 LPG 气化器、二甲苯装置 C5/LPG 气化器、PSA 装置解析气及芳烃联合装置中的异构化装置、歧化装置产燃料气、轻石异构化装置产燃料气、气分装置产燃料气组成，燃料气管网控制压力为 0.4-0.6MPa。其中灵活气管网为灵活焦化装置产的灵活气为主，主要用于芳烃联合装置内的二甲苯重沸炉使用。为防止生产运行中出现的燃料气波动，在储运 4206-LPG 罐区设置一台 20t/h 的 LPG 气化器，依靠球罐自身压力，自压 LPG 进入气化器。同时在联合芳烃装置二甲苯塔重沸炉设置一台 25t/h 的 C5/LPG 气化器，可作为二甲苯塔补充高热值气源。

Table 8-4 Design conditions for fuel gas balance

表 8-4 设计工况燃料气平衡

Name 名称	Unit 装置	Pipeline network fuel gas × t/h 管网燃料气 ×t/h	Flexigas × t/h 焦化灵活气 ×t/h
Production 产出	Acid Gas & LPG Ends Recovery Unit saturated dry gas 产品精制饱和干气	1.82	/
	Acid Gas & LPG Ends Recovery Unit coker dry gas 产品精制焦化干气	9.05	/
	Hydrocracking 加氢裂化	1.40	/
	LPG Fractionation 气体分馏	3.55	/
	Isomar 异构化	1.82	/
	Aromatics Complex 芳烃联合	20.23	/
	PSA	18.57	/
	Flexicoking 灵活焦化	/	198.13
	Total 合计	56.44	198.13
Consumption 消耗	Atmospheric and Vacuum Distillation 常减压	7.36	/
	Kerosene Hydrotreating 航煤加氢	0.75	/
	Diesel Hydrotreating 柴油加氢	1.13	/
	Flexicoking 灵活焦化	0.23	24.7
	Light Ends Recovery 轻烃回收	/	/
	Hydrocracking 加氢裂化	/	/
	LPG Fractionation 气分	/	/

Name 名称	Unit 装置	Pipeline network fuel gas × t/h 管网燃料气 ×t/h	Flexigas × t/h 焦化灵活气 ×t/h
	Surfur Recovery 硫磺回收	0.62	/
	Isomar 异构化	/	/
	Acid Gas and LPG Ends Recovery 产品精制	/	/
	Aromatics complex (Tatoray, Isomar, Xylene fractionation) 芳烃联合（歧化、异构化、二甲苯分馏）	11.13	/
	Aromatics complex (Xylene Fractionation Reboiler) 芳烃联合（二甲苯重沸炉）	6.75	173.43
	Aromatics complex (Naphtha Hydrotreating, Reforming, Sulfolane Extractive Distillation) 芳烃联合（预加氢、重整、抽提）	28.48	/
	Total 合计	56.44	198.13

8.2.2 Fuel Requirements During Commissioning Stage 试车期间燃料需求

The total supplying capacity of the one 20t/h and one 25t/h gasifiers totals up to 45t/h (1080 t/d), and is able to satisfy the fuel gas consumption demand during the initial start-up stage. The fuel gas consumption conditions are as follows:

一台 20t/h 和一台 25t/h 汽化器，合计供应能力 45t/h(1080t/d),可以满足首次试车期间燃料气用量需求，燃料气消耗情况如下：

8.2.2.1 Furnance and equipment drying, 6,900 tonnes of LPG needs to be outsourced;

烘炉烘器，需外购液化气 0.69 万吨；

8.2.2.2 Initial start-up material preparation of Atmospheric and Vacuum Distillation Unit, start-up and catalyst drying of the three hydrogenation units, Parex Unit PDEB preparation. feed into Reforming reaction, Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit and Hydrocracking Unit are able to produce qualified dry gas and LPG to make up to the fuel gas pipeline network. Considering economic operation, heavy aromatics produced is supplied to Atmospheric and Vacuum Distillation Unit as fuel, Light Naphtha Isomerization C5 is supplied

to Aromatics Complex as fuel, with the objective of reducing LPG consumption. After optimization, this stage requires 15,100 tonnes of outsourced LPG.

常减压首次开工备料、三套加氢热油运和催化剂干燥，吸附分离装置制备 PDEB，重整反应进料、煤油加氢、柴油加氢和加氢裂化所产干气和液化气合格，补充燃料气管网。考虑经济运行，重芳烃产出后供常减压装置作为燃料，轻石异构 C5 供芳烃联合装置作为燃料使用，尽可能减少液化气用量，优化后此阶段需外购液化气 1.51 万吨。

8.2.2.3 Total outsourced LPG is 22,000 tonnes. 合计外购液化气 2.2 万吨。

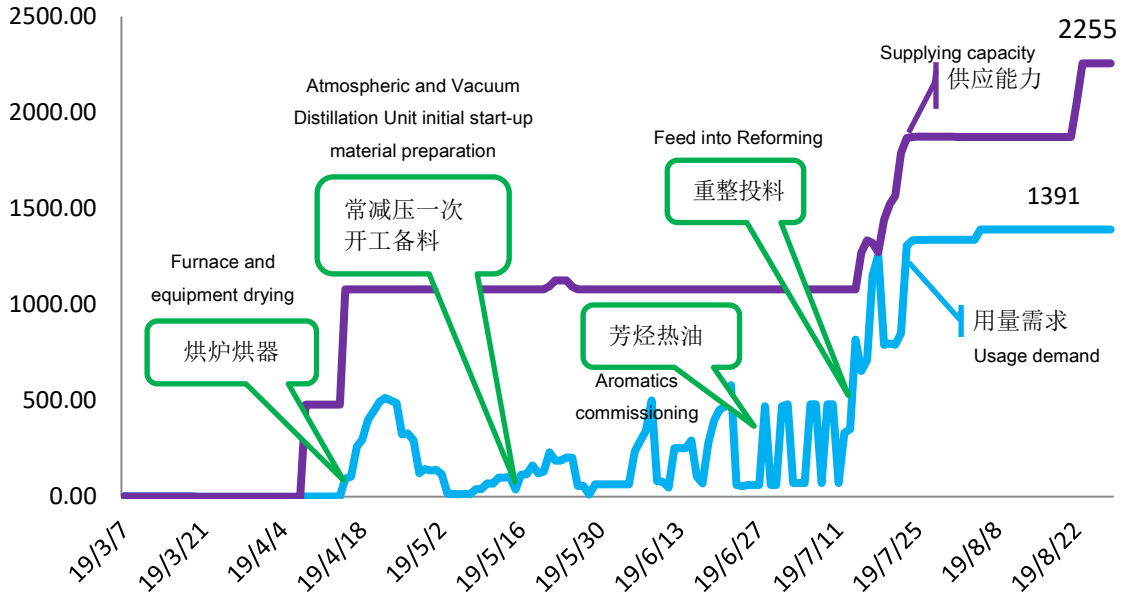


Diagram 8-1 Initial commissioning stage fuel gas consumption conditions (unit: t/d)

图 8-1 首次试车期间燃料气用量情况(单位：t/d)

8.3 Electricity Balance 电平衡

8.3.1 Design conditions for electricity balance 设计工况电平衡

The PMB Co-Generation Unit is configured with 5 CFB boilers of 380t/h, 4 steam turbine generator sets of 55MW, and for waste heat generating units, 2 sets of 7MW steam turbine generator set. The whole capacity of the Co Generation Unit is 234 MW. Brunei power grid introduces 2 standby power supply with 66KV capacity of 20MVA for start-up of Co Generation Unit, and as back-up power source during plant-wide accident conditions. Due to poor reliability of the Brunei centralised power grid, the PMB Co-Generation Unit adopts an isolated network system. The whole plant consists of 1 general electric substation of 66kV, 4 power substations of 66kV, 6 substations of 10kV, and 15 low voltage distribution rooms of 0.4kV. The Co-Generation Unit uses 4 generator sets to supply power simultaneously principle. Each generator set contributes to 25% of the whole grid's capacity, at the same time prepare a certain capacity for back-up heat. Boiler requires 1 cold back-up, totaling to 5 boilers and 4

steam turbines. Under normal operation, 4 boilers and 4 steam turbines are operating; when 1 steam turbine is under maintenance, 4 boilers and 3 steam turbines are operating; when 1 boiler is under inspection, 1 boiler and 1 steam turbine is under maintenance, 3 boilers and 3 steam turbines are operating.

PMB 电站配置 5 台 380t/h CFB 锅炉+4 台 55MW 汽轮发电机组,余热发电 2 台 7MW 汽轮发电机组，电站总装机容量 234MW。文莱电网引入两路 66KV 容量 20MVA 备用电源作为电站启动及全厂事故情况下的备用电源，由于文莱电网可靠性较低，PMB 电站正常采用孤网运行方式。全厂设 1 座 66kV 总变电所，4 座 66kV 联合装置或区域变电所，6 座 10kV 变电所，15 座 0.4kV 低压配电间。电站选用 4 台机组同时供电的原则，每台机组占全网容量的 25%，同时具备一定的热备用容量。锅炉要多 1 台冷备用，共 5 炉 4 机。正常情况下 4 炉 4 机运行，当 1 台汽机故障维修时 4 炉 3 机运行；当 1 台炉停炉检修，再有 1 炉 1 机故障时是 3 炉 3 机运行。

Table 8-5 Design conditions for power operation

表 8-5 设计工况热电运行

Operating method 运行方式	4 boilers, 4 steam turbines 4 炉 4 机	4 boilers, 3 steam turbines 4 炉 3 机	3 boilers, 3 steam turbines 3 炉 3 机
External power supply 外供电量（KW）	122834	122834	122834
Co-Generation Unit plant power consumption 电站厂用电（KW）	39267	37397	33447
Total power consumption 总用电量（KW）	162101	160231	156281
Minimum power produced by each steam turbine 每台机最少发电量（KW）	39817	52466	51149
Each generator set’s normal operating power 单台机组额定功率（KW）	55000	55000	55000
Maximum power produced 最大发电量（KW）	220000	165000	165000
Co-Generation Unit hot back-up power consumption 电站热备用电量（KW）	60733	7603	11553
Generator load rate 发电机负荷率	73.68%	97.11%	94.72%

Table 8-6 Design conditions for plant-wide power consumption load

表 8-6 设计工况全厂用电负荷

No. 序号	Name 名称	Load 负荷 (kw)	Remarks 备注
1	Production units 生产装置	88291	14 production units 14 套生产装置
2	General Plan and transportation 总图运输	80	Fence/Gate and the security room 厂区围墙及大门警卫室
3	Oil storage and transportation 油品储运	6666	Eastern tank farm and flare system 东罐区及火炬系统
4	Utilities and Auxiliary Facilities 公用工程及辅助设施	21256	For water discharge, firefighting water, environmental protection and telecommunications 给排水、消防、环保和电信
5	Auxiliary Production Facilities 辅助生产设施	3190	Buildings and warehouses 楼宇及仓库
6	Off-site works 厂外工程	8363	Western tank farm and Eastern jetty 西码头库区及东码头
7	Co-Generation power consumption 电站厂用电	28435	Excluding Desalination Unit 不包括海淡
Total 合计		156281	/

8.3.2 Commissioning StageElectricity Balance 试车期间电平衡

Commissioning of Boiler Make-up Water Treatment System. Boiler Make-up Water Treatment System and start-up boiler uses the Co-Generation Unit's diesel generator to perform commissioning. Commissioning of Start-up boiler, Boiler #1, and Steam turbine #1.The Start-up boiler produces steam for the Waste Heat Power Generator, the Co-Generation Unit uses black start-up mode. During the commissioning stage, the electric consumption insufficiency of other units is compensated by restricting part of the construction works' electricity consumption, meeting the demand of the electricity consumption of the whole plant during this stage.

Steam turbine #1 generates electricity and is connected to the grid. Steam turbine #1 is connected to the grid, while the Co-Generation Unit Diesel Generator and Waste Heat Power

Generator stops operating.

Steam turbine #2, remaining boilers and steam turbines overall start-up. Steam turbine #2 generates electricity and is connected to the grid, power generated is able to satisfy electricity consumption during the commissioning stage, external power supply is cut off and operates as isolated network. Steam turbines #3 and #4 generates electricity and are connected to the grid, and is able to produce excess electricity.

化水单元调试。化水单元和启动锅炉利用电站内部柴油发电机进行调试；

启动锅炉、1#锅炉、1#汽机调试。启动锅炉产汽供余热发电，电站用黑启动方式进行调试。调试期间其他单元用电缺口通过切除部分施工用电进行调整，通过调整可以满足全厂整体试车用电的需求；

1#汽机发电并网。1#汽机发电并网电站柴油发电机及余热发电机停运；

2#汽机并网发电及剩余锅炉汽机整体投运。2#汽机发电并网，自产可满足试车期间用电需求，切除厂外电，孤网运行；3#、4#汽机发电并网，供电出现富余。

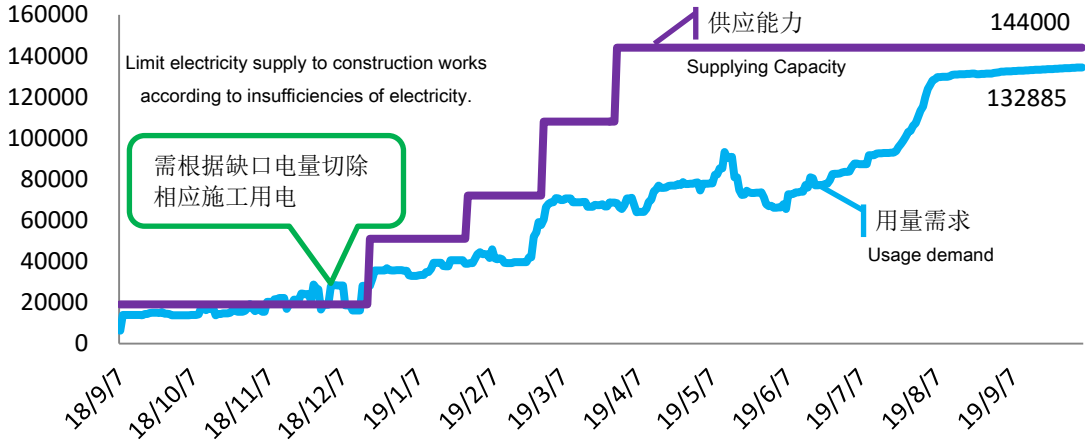


Diagram 8-2 Power usage conditions of initial commissioning stage

图 8-2 首次试车期间用电情况

8.4 Steam Balance 蒸汽平衡

8.4.1 Design Conditions 设计工况

There are 3 steam pipeline networks with different pressure grades, namely the 3.5MPa, 1.0MPa, and 0.5MPa. 3.5MPa steam is known as middle pressure steam, 1.0MPa steam is known as low pressure steam, and 0.5MPa steam is known as low low pressure steam. Also, there is a 9.8MPa steam pipeline network within the Co-Generation Unit, produced by the CFB boilers to be sent to the 60MW steam turbine set.

全厂共设三个压力等级蒸汽管网，蒸汽管网有 3.5MPa，1.0MPa，0.5MPa。3.5Mpa 蒸汽称为中压蒸汽，1.0Mpa 蒸汽称为低压蒸汽，0.5Mpa 蒸汽称为低低压蒸汽。同时电站内部设有 9.8Mpa 蒸汽管网，主要是将 CFB 锅炉所产的 9.8MPa 蒸汽输送至 60MW 汽轮发电机组。

Table 8-7 Three steam pipeline networks with different pressure grades

表 8-7 三个压力等级蒸汽管网

Name 名称	Pressure MPa (g) 压力 MPa(g)	Temperature ℃ 温度 ℃
Middle Pressure Steam 中压蒸汽（MPS）	3.5	390
Low Pressure Steam 低压蒸汽（LPS）	1	250
Low Low Pressure Steam 低低压蒸汽（LLPS）	0.5	210

When the whole plant's power usage demands have been met, 3.5MPa steam is pumped by generators to supply to all units in the refinery plant. When there is insufficiency, the Go-Generation Unit hot back-up desuperheater acts as make-up. Desuperheaters are installed between steam pipeline networks to act as a back-up regulating means between steam pipe networks of the different pressure grades.

全厂在满足用电的情况下，依靠发电机抽汽 3.5MPa 蒸汽供炼厂各装置使用，用量不足部分，由电站热备减温减压器补充。各蒸汽管网之间设置减温减压器，作为各压力等级蒸汽管网之间的备用调节手段。

Table 8-8 Desuperheaters of each steam pressure grades

表 8-8 各压力等级减温减压器

Name 名称	Pressure MPa(g) 压力 MPa(g)	Unit×model 台数×型号	Location 位置
HP to MPS 高压至中压蒸汽	9.8 减至 3.5	2×123t/h	Co-Generation Unit's internal 热电站内部
MP to LPS 中压至低压蒸汽	3.5 减至 1.0	1×100t/h	Co-Generation Unit's internal 热电站内部
LP to LLPS 低压蒸汽至低低压蒸汽（LLPS）	1.0 减至 0.5	1×100t/h	Sulfur Recovery Unit 硫磺回收

The 3.5MPa MPS is mainly used for turbine driven large-scale pumps of various units and as process steam in some units. This steam is mainly supplied by PMB's Co-Generation unit, with a part produced by the waste heat boiler of the Reforming Unit and Sulfur Recovery Unit.

(Steam produced from waste heat boilers of Flexicoking is for self-use, and is not connected to the system).

3.5MPa 中压蒸汽主要用于各装置的汽轮机驱动大型机泵和部分装置的工艺用汽。这部分蒸汽除重整装置与硫磺装置的余热锅炉产生一部分外，主要由 PMB 电站供应（灵活焦化装置的余热锅炉产汽自产自用，不并入系统）。

The 1.0MPa LPS is mainly used for process heating, heat tracing, and oxygen removal of various units and systems. This steam is partly provided by the back pressure exhaust steam of the steam turbine of the Flexicoking and Aromatics Unit and waste heat steam production of each unit, while the other part is provided by Co-Generation Unit's condensed water flash distillation device and desuperheaters.

1.0MPa 低压蒸汽主要用于各装置与系统单元工艺加热、伴热，除氧等。这部分蒸汽一部分由灵活焦化和芳烃联合装置的汽轮机背压排汽与各装置余热产汽提供，另一部分由热电站凝结水闪蒸和减温减压提供。

The 0.5MPa steam is mainly used for Desalination Unit, waste heat steam production, and process heating in some units. This steam in mainly provided by Flexicoking Unit's blower, Hydrocracking Unit's recycle hydrogen steam turbine, and Reforming Unit's recycle hydrogen steam turbine's back pressure exhaust steam, and is partly produced by the Aromatics Unit's flash distillation device and Sulfur Recovery Unit's desuperheater.

0.5MPa 蒸汽主要用于海水淡化厂、余热发电及部分装置工艺加热。这部分蒸汽主要由灵活焦化风机、加氢裂化循环氢汽轮机、重整循环氢汽轮机背压排汽提供，另一部分由联合芳烃闪蒸及硫磺装置减温减压提供。

Table 8-9 Design conditions of steam balance

表 8-9 设计工况蒸汽平衡表

Department 部门	3.5MPa Steam (t/h) 3.5MPa 蒸汽（t/h）		1.0MPa Steam (t/h) 1.0MPa 蒸汽（t/h）		0.5MPa Steam (t/h) 0.5MPa 蒸汽（t/h）	
	Steam produced 产汽	Steam consumption during producttion 生产用汽	Steam produced 产汽	Steam consumption during producttion 生产用汽	Steam produced 产汽	Steam consumption during producttion 生产用汽
Co-Generation Unit 热电站	-466	/	-80	/	/	/
Atmospheric and Vacuum Distillation Unit 常减压	/	/	/	9.5	/	3.5

Department 部门	3.5MPa Steam (t/h) 3.5MPa 蒸汽（t/h）		1.0MPa Steam (t/h) 1.0MPa 蒸汽（t/h）		0.5MPa Steam (t/h) 0.5MPa 蒸汽（t/h）	
	Steam produced 产汽	Steam consumption during producttion 生产用汽	Steam produced 产汽	Steam consumption during producttion 生产用汽	Steam produced 产汽	Steam consumption during producttion 生产用汽
Light Ends Recovery Unit 轻烃回收	/	/	/	5.9	/	/
Acid gas & LPG Ends Recovery Unit 产品精制	/	/	/	/	/	/
Kerosene Hydrotreating Unit 煤油加氢	/	/	/	/	/	/
Diesel Hydrotreating Unit 柴油加氢	/	/	-16	3.5	/	/
Hydrocracking Unit 加氢裂化	/	56	/	61.7	-56	12
LPG Fractionation Unit 气分	/	/	/			21
Aromatics Unit 芳烃联合	-111	482.1	-120.8	24.9	-208	4.3
Light Naphtha Isomerization Unit 轻石异构	/	24.1	/	3	/	110.9
PSA	/	/	/	5.6	/	/
Flexicoking	-76.7	161.2	-42.5	100.3	-111.5	59.2

Department 部门	3.5MPa Steam (t/h) 3.5MPa 蒸汽（t/h）		1.0MPa Steam (t/h) 1.0MPa 蒸汽（t/h）		0.5MPa Steam (t/h) 0.5MPa 蒸汽（t/h）	
	Steam produced 产汽	Steam consumption during producttion 生产用汽	Steam produced 产汽	Steam consumption during producttion 生产用汽	Steam produced 产汽	Steam consumption during producttion 生产用汽
Unit 灵活焦化						
Sulfur Recovery Unit 硫磺回收	-36	/	/	29.7	/	77.4
Storage and Transportation 储运	/	/	/	8	/	/
Desalination Unit 海淡装置	/	/	/	/	/	108
Total 合计	-689.7	723.4	-259.3	252.1	-375	396.3
Desuperheater make-up 减温减压补充	33.7		-7.2		21.3	

8.4.2 Steam Consumption During the Commissioning Stage 试车期间蒸汽用量

8.4.2.1 0.5MPa Steam Pipeline Network

0.5MPa 蒸汽管网

（1）Before the start-up of Hydrocracking Unit, Reforming Unit, and Flexicoking Unit, the 0.5MPa steam pipeline network relies on the Co-Generation Unit's start-up boiler and Sulfur Recovery Unit's desuperheater.

0.5MPa 蒸汽管网。在加氢裂化、重整和灵活焦化投料试车前，依靠热电部启动锅炉、硫磺回收减温减压器供应。

（2）Steam consumption of Desalination Unit. Start-up boiler produced qualified steam (50t/h), 0.5MPa temporary pipeline network purging, supply to Desalination Unit for test-run and commissioning, Desalination Device #2 test-run consumed 50t/h of 0.5MPa steam. Later, supply to Waste Heat Power Generator #5 for test-run and commissioning. Steam turbine #1 generates power and is connected to the grid, the source of the 0.5MPa steam is from

Co-Generation Unit's desuperheater (100t/h) and start-up boiler (50t/h).

海淡用汽。启动锅炉产汽合格（50t/h），吹扫 0.5MPa 临时管网，供海淡装置调试和试车，2#海水淡化调试投产消耗 0.5MPa 蒸汽 50t/h。其后，供 5#余热发电机调试和试车。1#汽机发电并网，0.5MPa 蒸汽汽源为热电站低压减温器（100t/h）和启动锅炉（50t/h）。

（3）Purging steam consumption. 0.5MPa steam pipeline network undergoes purging, peak steam consumption reaches 120t/h. Desalination device #2 operates with low load. During purging of ends of pipelines, the Desalination Unit is shutdown, the start-up water of Atmospheric and Vacuum Distillation Unit is temporarily stopped, while other desalinated water users are supplemented by lakewater and firefighting water tanks.

吹扫用汽。0.5MPa 蒸汽管网吹扫，蒸汽用量峰值 120t/h，2#海淡低负荷运行，管线碰头吹扫时海淡停工暂停常减压装置开工用水，其它淡水用户以湖水和消防水罐补充。

（4）Steam consumption during material preparation. Atmospheric and Vacuum Distillation Unit undergoes start-up material preparation. The initial production of the Light Ends Recovery Unit and Acid Gas & LPG Ends Recovery Unit consumes 3 t/h of steam. During this time, 1 Desalination device is operating, consuming 50t/h of 0.5MPa steam, thus total consumption is 53 t/h. The source of steam is from Sulfur Recovery Unit's LPS desuperheater (100 t/h), which can satisfy the steam consumption demand for the initial material preparation stage.

备料期间用汽。期间常减压开工备料，轻烃回收、产品精制投产用汽 3t/h，期间 1 台海淡运行消耗 0.5MPa 蒸汽 50t/h，合计消耗 53 t/h，汽源为硫磺回收低压减温减压器（100t/h），可满足首次备料期间用汽需求。

（5）Steam consumption during start-up stage. The start-up of Hydrocracking and Aromatics Unit has started consumption of 1.0MPa, which can not supplement the 0.5MPa steam pipeline network. Arrange the start-up of Light Naphtha Isomerization Unit to operate with load of 70%, requiring 77 t/h of 0.5MPa steam. This steam is produced by back pressure of the Reforming Unit's recycle hydrogen compressor to supply to Light Naphtha Isomerization Unit for operation. The Hydrocracking Unit steam turbine uses back pressure to produce steam to make-up for the Desalination Unit's steam consumption, achieving overall heat balance.

投料试车期间用汽。1.0MPa 蒸汽加氢裂化和芳烃联合装置开工已消耗，不能补充 0.5MPa 蒸汽管网，安排轻石异构化热油运按 70%负荷需 0.5MPa 蒸汽 77t/h，重整循环氢压缩机运行背压产汽供轻石异构化运行，加氢裂化汽轮机运行背压产汽补充海淡用汽，达到整体热平衡。

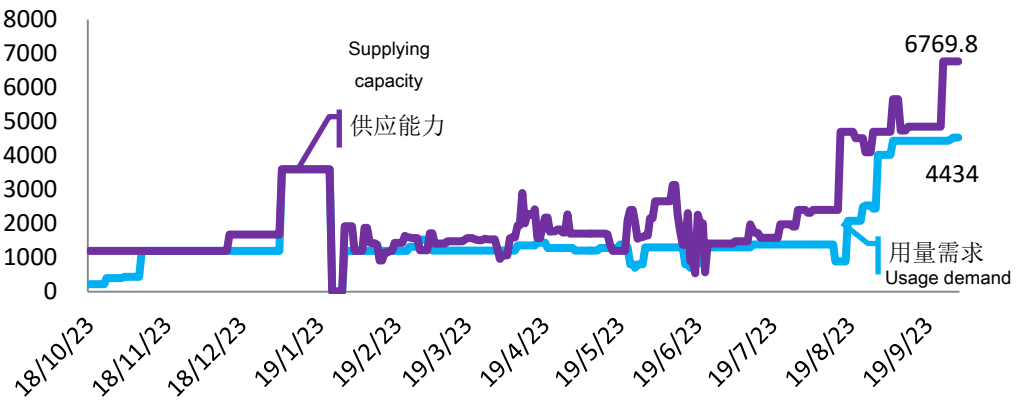


Diagram 8-3 0.5MPa steam consumption of the initial start-up stage (Unit: t/d)
图 8-3 首次试车期间 0.5MPa 蒸汽用量（单位 t/d）

8.4.2.2 1.0MPa Steam Pipeline Network

1.0MPa 蒸汽管网

（1）Purging steam consumption. 1.0MPa steam pipeline is performed, consuming 80t/h.

吹扫用汽。1.0MPa 蒸汽管网吹扫消耗 80t/h。

（2）0.5MPa make-up steam pipeline network. 0.5MPa steam pipeline network to start purging, with purging consumption of 120 t/h. LP desuperheater supplements 100t/h, start-up boiler to produce 50t/h of steam. Steam consumption of Desalination Unit is 30 t/h, total consumption of 150 t/h.

补充 0.5MPa 蒸汽管网。0.5MPa 蒸汽管网开始吹扫，吹扫消耗 120t/h。通过低压减温减压器补充 100t/h，启动锅炉产汽 50t/h，海淡运行消耗蒸汽 30t/h，消耗合计 150t/h。

（3）Steam consumption during material preparation stage. Atmospheric and Vacuum Distillation Unit’s start-up material preparation, Light Ends Recovery Unit, with purging consumption of 120 t/h .Acid Gads & LPG Ends Recovery Unit, and hot water station. The source of steam is the Go-Generation Unit’s steam turbine 2nd stage extraction condensing unit, producing 40t/h of steam. The low pressure desuperheater of 100t/h is for the 0.5MPa make-up steam pipeline network. Steam is temporarily not supplied to other units.

备料期间用汽。常减压开工备料，轻烃回收、产品精制和热水站合计消耗蒸汽 40t/h。气源为热电汽机二级抽凝产汽 40t/h，低压减温减压器 100t/h 用于补充 0.5MPa 蒸汽管网，其它装置用汽暂停。

（4）Steam consumption during start-up stage. Co-Generation Unit’s low pressure desuperheated and 4 steam turbines’ 2nd stage extraction condensing unit produces 160t/h of steam, Diesel Hydrotreating Unit produces 12.5t/h of steam, Tatoray Unit and Isomar Unit’s steam turbine uses back pressure to produce 66t/h of steam, total steam production is 239t/h. After Flexicoking Unit starts to produce steam, the desuperheater is shutdown, 1.0MPa steam pipeline network achieves balance.

投料试车期间用汽。热电部低压减温减压器和 4 台汽机二级抽凝产汽 160t/h，柴油加氢产汽 12.5

t/h，歧化和异构化汽轮机背压产汽 66 t/h，合计产汽 239 t/h，灵活焦化产汽并网后，停减温减压器，1.0MPa 蒸汽管网达到平衡。

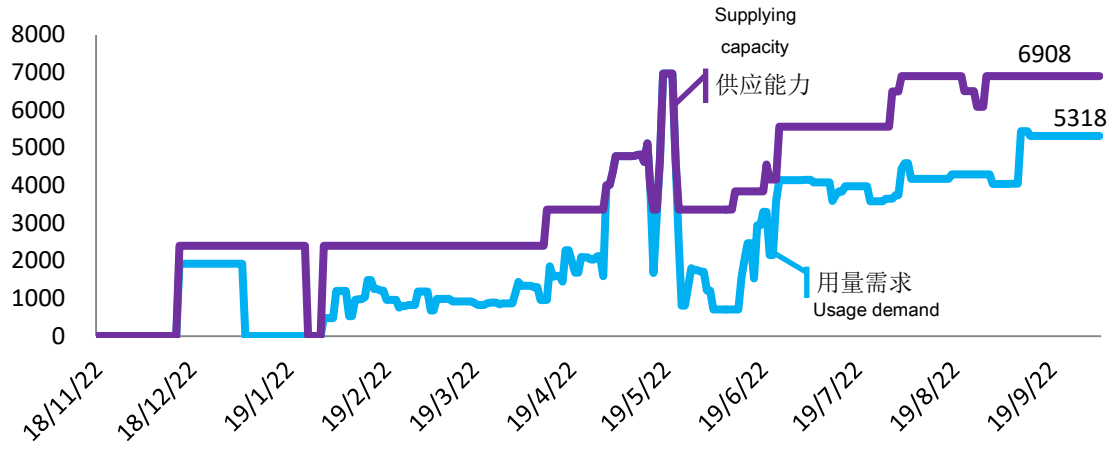


Diagram 8-4 1.0MPa Steam consumption of initial commissioning stage (Unit: t/d)

图 8-4 首次试车期间 1.0MPa 蒸汽用量（单位 t/d）

8.4.2.3 3.5MPa Steam Pipeline Network

3.5MPa 蒸汽管网

The source for 3.5MPa steam pipeline network comes from 4×122t/h steam turbine extraction condensing unit, and 2×123t/h middle pressure desuperheater, total of 734t/h. This is able to satisfy the steam consumption during the commissioning material preparation stage and start-up stage.

3.5MPa 蒸汽管网气源为汽机抽凝 4×122t/h，中压减温加压器 2×123t/h，合计 734 t/h，可满足试车准备和投料试车期间的用汽需求。

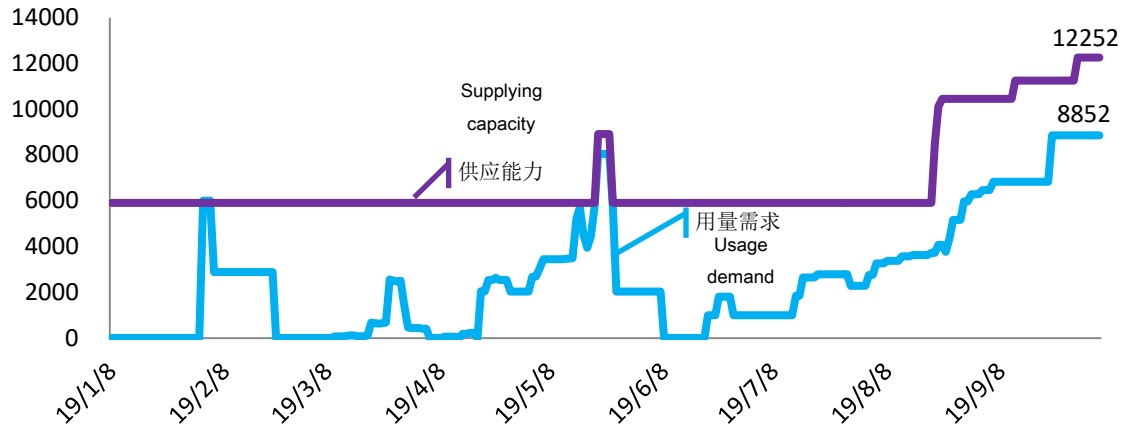


Diagram 8-5 3.5MPa Steam consumption conditions for initial commissioning stage (Unit: t/d)

图 8-5 首次试车期间 3.5Mpa 蒸汽用量情况（单位 t/d）

8.5 Desalinated Water and Cooling Water 淡水和循环水

8.5.1 Desalinated Water 淡水

8.5.1.1 Design Conditions 设计工况

Desalinated water is mainly supplied by the Desalination Unit, which is equipped with 3 seawater desalination devices, with a water production capacity of 1250m³/d each; the unit adopts multi-effect distillation with thermal vapour compression technology to produce desalinated water, which is known as 1st stage demineralized water.

淡水由海水淡化装置供应为主，海水淡化装置设 3 台海淡装置，单台产水能力为 12500m³/d；装置采用低温多效蒸馏工艺制备淡水，产出水为一级除盐水。

Table 8-10 Design conditions for desalinated water balance

表 8-10 设计工况淡水平衡表

Item 项目	Unit 单元	Name 名称	Quantity 数量 t/h
Consumption 消耗	Co-Generation Unit's water usage 电站用水	Co-Generation unit self-use 电站自用	48.5
		Demineralized water for Air cooler 空冷用除盐水	416.3
		Demineralized water for Unit 装置用除盐水	44
		Deaerated water for Unit 装置用除氧水	292.2
		Output as steam 以蒸气形式输出	634.2
		Water/steam loss 水汽损失	104.6
		Subtotal 小计	1539.8
	Mineralization and Disinfection 矿化及消毒	Cooling Water Unit 1 make-up water Ⅰ循补水	378
		Cooling Water Unit 2 make-up water Ⅱ循补水	76
		Firefighting water 消防用水	50
		Domestic water 生活水	6.7
		Production water 生产水	10
		Subtotal 小计	520.7
	Total		2060.5

Item 项目	Unit 单元	Name 名称	Quantity 数量 t/h
	合计		
Production 产出	Plan 1 (2 desalination devices are operating, with 1 backup) 方案 1（海淡两开一备）		1040
	Plan 2 (all 3 desalination devices are operating) 方案 2（海淡三套全开）		1560
	Reuse of process condensed water 工艺凝结水回用		108
	Cooling water for Middle reflux 中水回用循环水		165
	Reuse of steam turbine condensed water 汽机蒸汽凝结水回用		760.5
	Total 1 合计 1		2073.5
	Total 2 合计 2		2593.5

8.5.1.2 Desalinated Water Consumption of Commissioning Stage 试车期间淡水用量

（1）A Lakewater Treatment Facility is set up, as well as utilizing water from offsite supply to satisfy the water consumption of construction and flushing during the commissioning stage.
增设湖水利用和外接岛外水源以应对试车准备期间的施工用水、冲洗用水缺口。

（2）The lake on the island has a size of 430m×330m and has a water depth of about 1.8 – 2.5m. The source of water for the lake is natural rainfall, combined with manual collection. The designed treatment capacity of the lakewater is 250t/h. The maximum operation flexibility is 120%. The water production rate is calculated as 90%, and normal water production is 225t/h.
岛上湖泊规模为 430×330m，水深约 1.8-2.5m 之间，湖水补充水来源为自然降雨结合人工收集。湖水利用设计处理水量 250t/h，操作弹性为最大 120%，装置产水率按 90%计算，装置正常产水量为 225t/h。

（3）Domestic water is supplied by Brunei, outside PMB, into a water tower to supply for this project. The water supply pipeline is DN200, supplying 400t/d of water. The pipeline is connected to two routes. One route goes into the domestic water tank (500m^3 x2) and the other route is connected to all domestic water tanks in the operation area, to satisfy domestic water supply suring the construction stage.
从文莱本岛外接一路生活用水，经岛上设有一座自来水塔，供应本项目使用，供水管线 DN200，供应量为 400t/d，管线进入 PMB 岛后，一路接入厂区生活水罐（500m^{3}x2），另一路接临时管线，接入营区各生活水箱，作为施工期间生活用水。

（4）Water consumption during commissioning stage. During the commissioning stage, desalinated water is mainly used for steam production and power generation by the

Co-Generation Unit, flushing of unit pipelines, and domestic water for contruction workers on the island. desalinated water demand is 353,000 tonnes. The initial capacity of the lake is 330,000m^3, and available lakewater is 150,000m^3. From August to December, Brunei experiences dry season, the rainfall is calculated to be 200mm per month, able to replenish 127,000m^3 of rainwater, totaling up to 277,000m^3 of available lakewater. External water supply has been connected, supplying 59,700 tonnes of desalinated water. Considering that subsequent pipeline purging and joining will affect desalinated water production by the Desalination Unit, arrangements will be made to start the Desalination Unit immediately after the commissioning of the Waste Heat Power Generator, to produce desalinated water. At the same time, the Lakewater Treatment Facility will be stopped to undergo storing of water.

试车期间水量统计。试车期间淡水主要用于热电站产汽发电、装置管线冲洗、岛上施工作业人员生活用水等。热电站 1#汽机发电并网前，淡水用量需求 35.3 万吨，湖水初期容量 33 万 m^3，可用淡水 15 万 m^3，8 月至 12 月在文莱属于旱季，降雨量按每月 200mm 计算，可补入湖中 12.7 万 m^3 雨水，湖水合计可用淡水 27.7 万 m^3，补充淡水 5.97 万吨；考虑后续的管线吹扫及碰头会影响海淡产水，故在余热发电机调试完成及海淡具备产水能力后马上安排海淡开工产水，同时停湖水利用装置，湖水单元进行蓄水。

（5）Water Balance During Commissioning

Lakewater Treatment Facility. The Lakewater Treatment Facility supplies water for commissioning of Chemical Water Treatment Unit, Start-up boiler, and Seawater Desalination Device #2.

Seawater Desalination Device #2.Desalinated water produced by Seawater Desalination Device #2 is qualified, the commissioning of Waste Heat Power Generator #5 is completed, Start-up boiler produces steam to start-up Seawater desalination Device #2, Lakewater Treatment Facility is stopped for water storing. The Desalination Unit operates intermittently according to the desalinated water demand.

Steam turbine #1 is connected to the grid. After the steam turbine #1 has been connected to the grid, pipeline purging and blowing, and flushing of the Atmospheric and Vacuum Distillation Unit are undergone. Seawater Desalination Device #2 begines continuous operation.

Shutdown of Desalination Unit and pipeline joining. The Desalination Unit is shutdown due to pipeline joining and purging of the LP steam pipeline and the LLP steam pipeline. Clean water tank, Demineralised water tank and Firefighting water tank has been filled before the shutdown of the Desalination Unit. The Atmospheric and Vacuum Distillation Unit water for flushing will be cut off at this time. The Lakewater Treatment Facility will supply water to insufficient water areas during this stage.

Pipeline purging and blowing。After pipeline purging and blowing, desalinated water supply is able to meet water consumption of whole plant.

试车期间水平衡

湖水利用。化水、启动锅炉和 2#海淡装置调试用水由湖水利用装置产水提供；

2#海水淡化。2#海水淡化产水合格，5#余热发电机开始调试完成，启动锅炉产汽开 2#海淡制水，

湖水利用单元停工蓄水。海淡装置根据淡水需求量间歇运行；

1#汽机发电并网。1#汽机发电并网后，随着管线吹扫打靶及常减压装置开始水冲洗，2#海淡转入连续生产。

管线碰头海淡停工。因低压蒸汽管线和低低压蒸汽管线碰头吹扫，海淡装置停工，停工前将清水罐、除盐水罐、消防水罐储满水，同时暂停常减压装置冲洗用水并安排湖水利用单元开工，期间不足用水由湖水利用单元产水补充。

管线吹扫及打靶.系统管网吹扫打靶完成后，淡水供应可满足全厂用量需求。

（6）Optimization of Water Usage During Commissioning.

The system pipeline network purging and steam blowing is completed, desalinated water demand can be satisfied. During this period, it is advised to maximize use of lakewater, where pipeline flushing and water test-run of each unit is supplied in proportion to the Desalination Unit, so as to reduce the commissioning and start-up cost.

试车期间用水优化

蒸汽系统管网吹扫打靶结束 ，淡水供应可满足用量需求，期间尽量消耗湖水，与海淡产水配比供应各单元装置管线冲洗和水联运，最大限度的使用湖水降低试车开工成本。

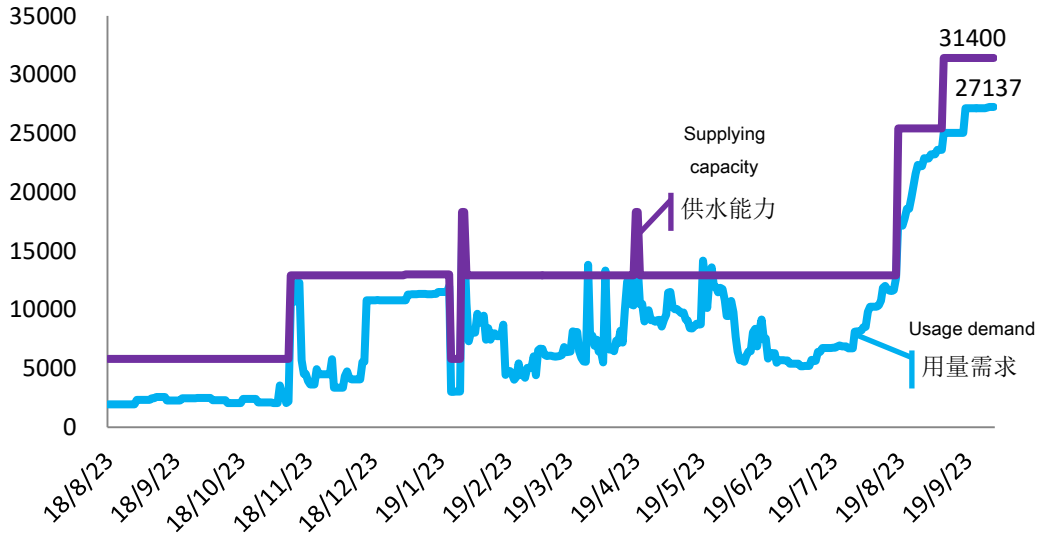


Diagram 8-6 Desalinated water consumption of the initial commissioning stage (Unit: t/d)图 8-6 首次试车期间淡水用量（单位：t/d）

8.5.2 Cooling Water 循环水

8.5.2.1 Design Conditions 设计工况

（1）The whole plant has 2 Cooling Water Units, namely Cooling Water Unit 1 and Cooling Water Unit 2; Other than that, the Co-Generation Unit also has an independent Cooling water Unit. According to the plant layout and the main cooling medium of each unit, the Cooling Water Unit supplies cooling water to different areas; Cooling Water Unit 1 supplies cooling water to the unit area and the main plant area; Cooling Water Unit 2 supplies cooling water to the administration area refridgeration station, and the Air Separation Unit.

全厂共有两个循环水场，分别 I 循环水场（主厂区）、II 循环水场（厂前区）；同时电站还建立有一套独立的循环水系统。根据厂区平面布置及各单元主要冷却介质，循环水场分区域供水：I 循供给装置区及主厂区各单元循环冷却用水；II 循供给厂前区制冷站、空分空压单元循环冷却用水。

（2）Cooling Water Unit 1 is located near the plant area. The designed cooling water supply temperature is 33℃, returning water is 43℃, condensation factor is 6, maximum circulating capacity is 27,000m³/h, bypass filtering quantity is 800m³/h, and the maximum make-up water quantity is 470m³/h. Cooling Water Unit 1 is configured with 6 Reinforced Cement Concrete (RCC) packing cooling tower with treatment capacity of 4,500m³/h, 6 cooling fans, 6 cooling water pumps (4 large, 2 small). The large pump has flow rate of 8,000m³/h, head of 50m; the small pump has flow rate of 4,500m³/h, head of 50m. The designed cooling water supply is ≤33℃, returning water is ≤43℃. Cooling Water Unit 1 is also configured with 4 water supply pipelines, 1 from desalination unit, 1fromWater from fire production tanks，1 from treated oily wastewater, which is qualified, and another 1 is from lakewater treatment facility recycle water.

I 循环水场位于装置区附近，循环水设计给水温度 33℃，回水温度 43℃，浓缩倍数 6，最大循环量为 27000m³/h、旁滤量 800m³/h、最大补水量 470 m³/h。I 循配套设置了 6 台单台处理量为 4500 m³/h 的钢筋混凝土填料冷却塔，配套设置了 6 台冷却风机，6 台循环水泵（4 大 2 小），大泵单台流量 8000 m³/h，扬程 50m，小泵单台流量 4500 m³/h，扬程 50m；设计供水水温≤33℃，回水水温为≤43℃。I 循设置了 4 条补水管线，一条来自海淡矿化池后来水，一条来自消防生产水罐用水，一条来自经处理合格后的污水（含油污水），一条来自中水湖水回用水。

（3）Cooling Water Unit 2 is located near the Air Separation Unit. The designed cooling water supply temperature is 33℃, returning water is 43℃, condensation factor is 6, maximum circulating capacity is 5,000m³/h, bypass filtering quantity is 150m³/h, and the maximum make-up water quantity is 100m³/h. Cooling Water Unit 2 is configured with 2 Reinforced Cement Concrete (RCC) packing cooling tower with treatment capacity of 2,500m³/h , 2 cooling fans, 4 cooling water pumps (3 large, 1 small). The large pump has flow rate of 2,200m³/h, head of 40m; the small pump has flow rate of 800m³/h, head of 40m. The designed cooling water supply is ≤33℃, returning water is ≤43℃. The Cooling Water Unit 2 produces make-up water for the desalination unit.

II 循环水场位于厂前区空分空压装置附近，循环水设计给水温度 33℃，回水温度 43℃，浓缩倍数 6，最大循环量为 5000 m³/h、旁滤量 150 m³/h、最大补水量 100 m³/h。II 循配套设置了 2 台单台处理量为 2500 m³/h 的钢筋混凝土填料冷却塔，配套设置了 2 台冷却风机，4 台循环水泵（3 大 1 小），大泵单台流量 2200 m³/h，扬程 40m，小泵单台流量 800 m³/h，扬程 40m；设计供水水温≤33℃，回水水温为≤43℃。II 循补水为海淡产水。

Table 8-12 Design conditions for cooling water consumption

表 8-12 设计工况循环水用量

Cooling Water Unit 循环水场	Water Supply Capacity 供水能力	Supplied Unit 供应装置	Normal Consumption 正常用量，m³/h	Maximum consumption 最大用量，m³/h

Cooling Water Unit 循环水场	Water Supply Capacity 供水能力	Supplied Unit 供应装置	Normal Consumption 正常用量，m³/h	Maximum consumption 最大用量，m³/h
Cooling Water Unit 1 I 循	27000 m³/h	Atmospheric and Vacuum Distillation 常减压蒸馏	1909	3466.76
		Light Ends Recovery 轻烃回收	599.15	872.12
		Acid Gas & LPG Recovery 产品精制	679	679
		Kerosene Hydrotreating 煤油加氢	254.9	268.4
		Diesel Hydrotreating 柴油加氢	606.5	606.5
		Hydrocracking 加氢裂化	2390.1	3003.6
		LPG Fractionation 气体分馏	520	520
		Aromatics 芳烃联合	5064.7	5698
		PSA	340	340
		Light Naphtha Isomerization 轻石异构化	588	650
		Flexicoking 灵活焦化	5300	5300
		Sulfur Recovery 硫磺回收	1462	1754
		Plant area Refridgeration Station 装置区制冷站	1200	1800

Cooling Water Unit 循环水场	Water Supply Capacity 供水能力	Supplied Unit 供应装置	Normal Consumption 正常用量，m³/h	Maximum consumption 最大用量，m³/h
		Hot water station 热水站	3.5	/
		Wastewater treatment 污水处理场	7	10
		Flare Facility 火炬设施	200	300
		Subtotal 小计	21123.85	25268.38
Cooling Water Unit 2 II 循	5000 m³/h	Administration Zone Refridgeration Station 厂前区制冷站	3600	3600
		Air Separation 空分空压	659	839
		Subtotal 小计	4259	4439

8.5.2.2 Start-up Stage 投料试车期间

The Cooling Water Unit 2 is put into service to provide for the start-up of Air Separation Unit. Cooling Water Unit 2 supplies water for the Administration Zone's Refridgeration Station's start-up. The peak consumption of the Cooling Water Unit 2 is 2,659m³/h, with a load of 53%. II循环水场投用，供空分空压开工；厂前区制冷站投用，II循环水向厂前区制冷站供水，II循环水耗量峰值 2659m³/h，负荷 53%。

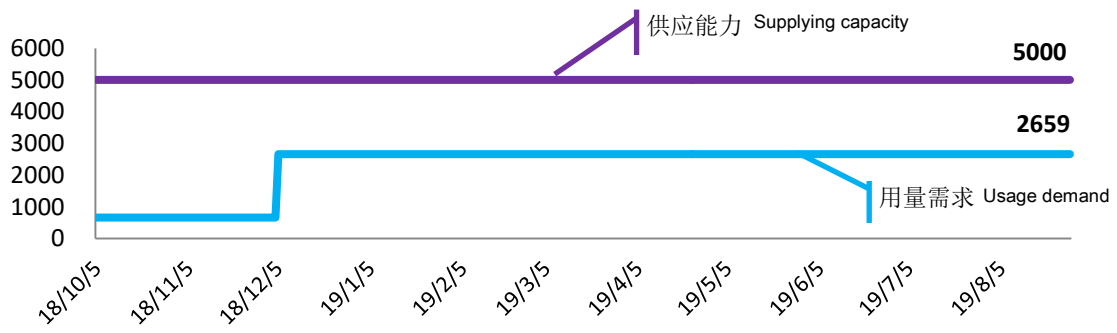


Diagram 8-7 Water consumption of Cooling Water Unit 2 during initial start-up stage 图 8-7 首次

试车期间II套循环水用量

The Cooling Water Unit 1 handovers, trim coolers in all units will be connected to network to undergo flushing and pre-filming. The Cooling Water Unit 1 completes pre-filming. The unit start-up will start. The peak water consumption of Cooling Water Unit 1 is 19,559m³/h, with a load of 72.4%.

Ⅰ循环水场中交，各装置开始水冷器并网冲洗、预膜；Ⅰ循环水场完成预膜，装置开始投料试车，Ⅰ循环水耗量峰值 19559m³/h，负荷 72.4%。

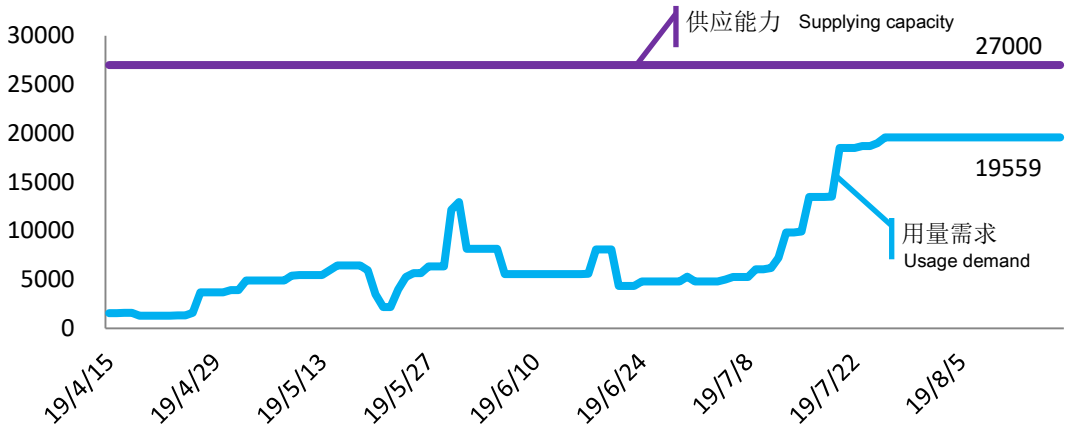


Diagram 8-8 Water consumption of Cooling Water Unit 1 during initial start-up stage

图 8-8 首次试车期间I套循环水用量

8.6 Demineralised Water and Deaerated Water 二级除盐水和除氧水

8.6.1 Design Conditions 设计工况

8.6.1.1 A boiler makeup water treatment unit is set up in the whole plant, located inside the Co-Generation Unit. Desalinated water from desalination unit is the water source for the boiler makeup water treatment unit. After undergoing mixed bed treatment, this demineralized water is supplied to the Co-Generation Unit’s boiler and other units. Co-Generation Unit’s demineralized water designed production capacity is 1860t/h, this system includes 6 mixed beds. The mixed bed capacity is 310t/h. 2 demineralised water tanks of 1,500m³ is also built to satisfy production requirements.

全厂设有一座化学水处理站，位于电站内部。化水处理站的水源为海淡所产的一级除盐水，经混床进行处理后，供电站锅炉及厂区各装置使用。电站化水设计产二级除盐水能力为 1860t/h，共设 6 台混床。混床单台能力为 310t/h。同时设有两台 1500m3 除盐水箱用以满足生产需求。

8.6.1.2 A condensed water recovery system is built in the plant area inside the Co-generation unit to recover condensed water from the whole plant. The condensed water includes turbine

condensed water of 84t/h, process condensed water of 538.2t/h (continuous 492.3t/h, semi-batch 45.9t/h). After the condensed water has been treated, it enters the clean water tank in Co-generation Unit, along with the Desalination Unit water as desalinated water.

厂区设有一套凝结水回收系统，位于电站内部，用于回收全厂凝结水。其中回收透平凝结水 84t/h，工艺凝结水 538.2t/h（连续 492.3t/h，间断折连续 45.9t/h）。凝结水经处理后进入电站清水箱，与海淡产水一起生产一级除盐水。

8.6.1.3 The whole plant is equipped with two deaerating water pipe networks, one low-pressure de-oxidizing water pipe network, the pressure is 2.0MPa, one is medium-pressure de-oxidizing water pipe network, and the pressure is 5.8MPa. Deaerated water is mainly used for steam generators or desuperheaters. Among them, 5.8MPa medium-pressure deaerator water mainly produces 3.5MPa steam, and 2.0MPa low-pressure deoxidized water mainly produces 1.0MPa steam. There are three sets of deaeration systems in the whole plant, which are located inside the power station, reforming unit and flexible coking unit. Among them, the power station deaerator and the flexible coking deaerator are used by themselves; the deaerator water desulfurizer produced by the reformer deaerator is used for self-use, and the kerosene hydrogenation unit, diesel hydrogenation unit, hydrocracking unit, and pumice are also externally supplied. Brain oil isomerization device, sulfur recovery combined device.

全厂设有两条除氧水管网，一条低压除氧水管网，压力为 2.0MPa，一条为中压除氧水管网，压力为5.8MPa。除氧水主要用于蒸汽发生器或减温减压器。其中5.8MPa中压除氧水主要产3.5MPa蒸汽，2.0MPa 低压除氧水主要产 1.0MPa 蒸汽。全厂共设有三套除氧系统，分别位于电站内部、重整装置和灵活焦化装置。其中电站除氧器与灵活焦化除氧器自用；重整装置除氧器产出的除氧水除装置自用外，还外供煤油加氢装置、柴油加氢装置、加氢裂化装置、轻石脑油异构化装置、硫磺回收联合装置。

8.6.2 Consumption During Commissioning Stage 试车期间用量

8.6.2.1 The demineralized water is mainly used for Co-generation Unit’s boiler, and Reforming Unit and Flexicoking Unit’s deaerator. The demineralized water consumption is proposed only after the deaerated water consumption is firstly calculated according to the steam consumption during the commissioning and overall start-up stage.

二级除盐水主要供热电锅炉、重整和灵活焦化除氧器制备除氧水，根据试车准备和全面投料试车期间蒸汽消耗先计算除氧水用量，再反推二级除盐水用量。

8.6.2.2 Demineralized water consumption. The peak consumption occurs during July to August 2019, the 0.5MPa steam is mainly supplied by back pressure of Reforming Unit and Flexicoking Unit’s steam turbines. Before the Reforming Unit and Flexicoking Unit are put into service, the 0.5MPa steam is supplied by the 1.0MPa desuperheater of Co-generation Unit. During this period, the two-way consumption of demineralized water by commissioning and steam supply closes to 930t/h. The consumption of demineralized water returns to normal after the back pressure production of steam of the Reforming Unit and Flexicoking Unit has been connected to the network. (Steam consumption details is shown in section 8.4, demineralized water consumption is shown in Diagram 8-9).

二级除盐水消耗。消耗峰值出现在 2019 年 7 月～8 月，主要是 0.5MPa 蒸汽由重整和灵活焦化汽轮机背压产汽供应，在重整和灵活焦化装置未投产前，0.5MPa 蒸汽由热电站 1.0MPa 减温减压供给。在此期间装置调试和蒸汽供应双向消耗二级除盐水，用量接近最大供给量 930t/h，重整和灵活焦化汽轮机背压产汽并网后，二级除盐水消耗恢复正常。（蒸汽用量详见 8.4 小节，二级除盐水消耗见图 8-9）

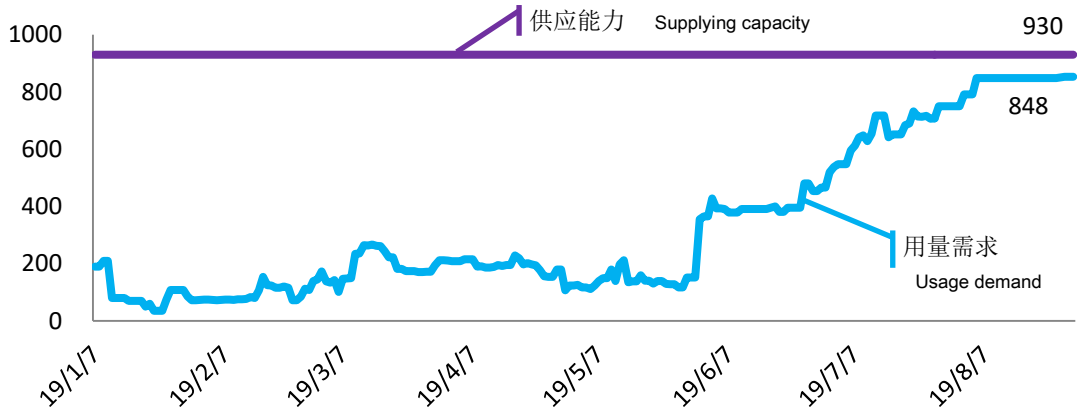


Diagram 8-9 Demineralized water consumption during initial commissioning stage

图 8-9 首次试车期间除盐水用量

8.7 Instrument Air and Plant Air 净化风和工厂风

8.7.1 Design Conditions 设计工况

8.7.1.1 There are 6 centrifugal air compressors in the Air Separation Unit for this project, with air supply capacity of 15000Nm³/h each, 5 operating and 1 standby. After filtration and compression, total air to be supplied is 75,000 Nm³/h. 1 route is sent to the Air Separation Unit (50,500 Nm³/h) for cryogenic separation, the other route (24,500Nm³/h) enters instrument air surge drum after drying. (Instrument air and plant air used in the Co-Generation Unit is to be self-produced)

本项目空分空压站共有 6 台离心式空气压缩机，单台供风能力为 15000Nm³/h，5 开 1 备。空气经过滤后再经压缩机压缩后总供气 75000 Nm³/h，一路送至空分装置（50500Nm³/h）进行深冷分离，另一路经净化风（24500Nm³/h）干燥器后再进入仪表空气缓冲罐。（动力中心使用的净化风和非净化风由内部自行解决）

8.7.1.2 Plant-wide air system includes instrument air and plant air, both supplied to the air pipeline network. Instrument air is mainly used by instruments and control valves of various units. Plant air is mainly used for purging, pneumatic conveying and gas leak tests during unit start-up and shutdown. Instrument air is divided into 3 routes: 1 for plant area compressor air pipeline network to supply for all compressed air users in the plant; 1 for plant area instrument air pipeline network to supply for instrument air users in the plant; and 1 route to instrument air compressor to be pressurized to 3.75MPa to be sent to instrument air accident tank of 200m³, so that when accidents occur and instrument air pipeline network has stopped supply, this

accident tank instrument air can be sent to the pipeline and used for shutdown.

全厂风系统包括净化风和工厂风二个供风管网。净化风主要是各装置仪控阀使用，工厂风主要是装置开停工时吹扫、气力输送以及作密封气用。净化风三路，一路送入厂区压缩空气管网，供全厂压缩空气用户使用；一路送入厂区仪表空气管网，供全厂仪表空气用户使用；另一路经净化风增压机增压至 3.75MPa 送入仪表空气事故罐 200m³，当事故状态下，仪表空气管网中断供气，事故罐送出仪表空气进入仪表空气管网，供事故状态下装置停车使用。

8.7.1.3 Instrument air’s designed load is 14,528Nm³/h, and maximum of 18,305Nm³/h; Plant air’s designed normal load is 193Nm³/h, maximum is 15,123Nm³/h.

净化风设计负荷为 14528Nm³/h，最大 18305 Nm³/h；工厂风设计正常为 193Nm³/h，最大 15123Nm³/h。

Table 8-13 Consumption of instrument air and Plant air

表 8-13 净化风和工厂风消耗

Unit name 单元名称	Instrument air consumption 仪表风用量（Nm³/h）		Plant air consumption 工厂风用量（Nm³/h）	
	Continuous 连续	Batch 间断	Continuous 连续	Batch 间断
Atmospheric and Vacuum Distillation 常减压装置	200	300	/	800
Light Ends Recovery 轻烃回收	160	/	/	180
Acid Gas & LPG Ends Recovery 产品精制	60	100	165	300
Kerosene Hydrotreating 煤油加氢	90	/	/	2000
Diesel Hydrotreating 柴油加氢	300	300	/	1200
Hydrocracking 加氢裂化	452	600	/	35
Aromatics 芳烃联合	5500	2900	/	5000
Light Naphtha Isomerization 轻石异构化	400	/	/	1500
PSA	200	/	/	500
Flexicoking	500	980	28	2008

Unit name 单元名称	Instrument air consumption 仪表风用量（Nm³/h）		Plant air consumption 工厂风用量（Nm³/h）	
	Continuous 连续	Batch 间断	Continuous 连续	Batch 间断
灵活焦化				
Sulfur Recovery Complex 硫磺回收联合装置	1040	160	/	1200
LPG Fractionation 气体分馏	300	/	/	400
Storage and Transportation 储运罐区	1563	/	/	/
Flare Facility 火炬系统	500	/	/	/
Refridgeration Station 制冷站	150	/	/	/
Desalination 海水淡化	840	/	/	/
Water supply and drainage 给排水	500	/	/	/
Hot water station 热水站	150	/	/	/
Jetty 码头	60	/	/	/
Total 总计	12965	5340	193	15123

8.7.2 Commisioning Stage Consumption 试车期间用量

Instrument air and plant air's designed supplying capacity is able to satisfy the consumption demand of the initial commissioning stage, see Diagram 8-10 and Diagram 8-11 for details.

净化风和工厂风设计供应能力可以满足首次试车期间用量需求，详见图 10、图 11

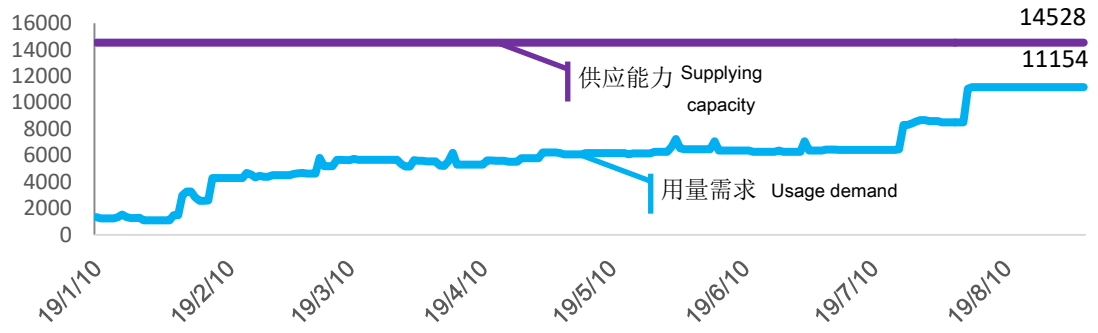


Diagram 8-10 Instrument air at initial commissioning stage

图 8-10　首次试车期间净化风

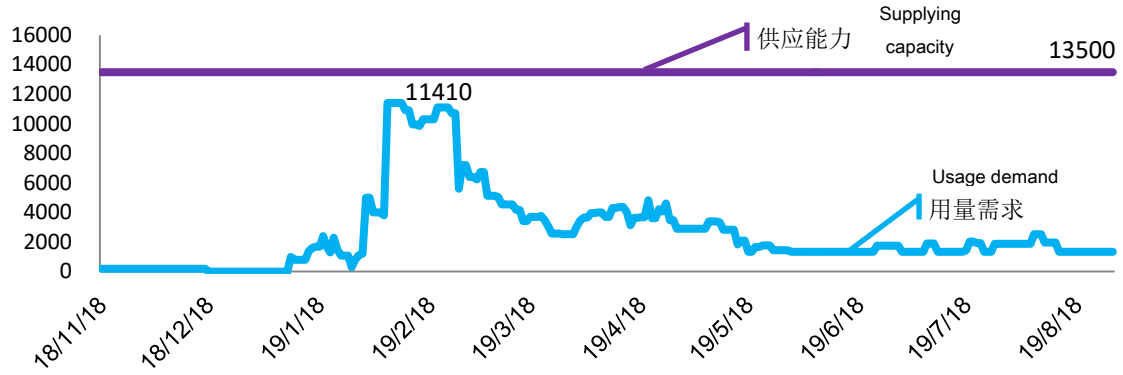


Diagram 8-11 Plant air consumption at initial commissioning stage

图 8-11　首次试车期间工厂风用量表

8.8　Nitrogen Gas Balance　氮气平衡

8.8.1　Design Conditions　设计工况

8.8.1.1　The Air Separation Unit adopts cryogenic nitrogen production technology, with designed nitrogen production capacity of 15,000Nm³/h. The unit includes precooling system, purification system, expander system, distillation system, product delivery system and back-up nitrogen system. The production nitrogen gas and liquid nitrogen purity is 99.99%. After recovering cold energy through the main heat exchanger nitrogen is sent to plant area low pressure nitrogen (0.6MPa) pipeline network to supply nitrogen to nitrogen users. There are 2 nitrogen pipeline networks in the whole plant, namely the 0.6MPa and 2.5MPa pipeline networks. 1 route is supplied exclusively to the 0.85MPa nitrogen pipeline network of the catalyst regeneration of the Reforming Unit.

空分装置采用深冷制氮工艺，设计氮气产量 15000Nm³/h，包括预冷系统、纯化系统、膨胀制冷系统、精馏系统、产品送出系统和后备氮系统。生产氮气、液氮，氮气的纯度为 99.99%。经主换热器换热回收冷量后，送入厂区低压氮气（0.6MPa）管网，供氮气用户使用。全厂设置 0.6MPa、2.5MPa 两个氮气管网及一条专供重整装置催化剂再生用的 0.85MPa 氮气管网。

Table 8-14 Air Separation designed load

表 8-14 空分设计负荷

Product name 产品名称	Production capacity 产量 Nm³/h	Purity 纯 度	Cooling box outlet temperature 出冷箱温度 ℃	Cooling box outlet pressure 出冷箱压力 MPa(G)	Remarks 备注
Nitrogen gas 氮 气	18000	≥99.99%N2 ≤5PPm O2	Atmospheric temperature 常温	0.7	Continuous 连续
Liquid nitrogen 液 氮	1500 (折合气态)	≥99.99%N2 ≤5PPm O2	Saturated 饱和	0.7	To storage tank 去贮槽

8.8.1.2 The back-up nitrogen system is equipped with a 2,000m³ atmospheric Liquid nitrogen tank and two 200m³ middle pressure liquid nitrogen tank. During normal operation, liquid nitrogen is pumped by middle pressure liquid nitrogen pump into middle pressure liquid nitrogen tank. From the liquid nitrogen tank, nitrogen enters the water type gasifier and air type gasifier, and is sent to the 2.5MPa nitrogen gas pipeline network. During accident, when nitrogen gas is cut-off, liquid nitrogen will be pumped by low pressure liquid nitrogen pump into the water and air type gasifiers to be gasified and sent into the 0.6MPa nitrogen gas pipeline network, to provide for emergency shutdown use. The back-up nitrogen system is also equipped with a liquid nitrogen truck loading system, to sell excess liquid nitrogen.

后备氮系统设置一座 2000m³ 的常压液氮储罐和两座 200m³ 的中压液氮储罐。正常生产中，液氮经中压液氮泵打入中压液氮储罐，自中压液氮储罐送出，经水浴式汽化器和空浴式汽化器，将氮气送入 2.5MPa 氮气管网；在事故状态下，当氮气中断时，液氮经低压液氮泵打入水浴式汽化器和空浴式汽化器，气化后送入 0.6MPa 氮气管网，供紧急停车状态下使用。后备氮系统还配备了一套液氮装车系统，当液氮量富余时外售。

8.8.1.3 The normal consumption of 0.6MPa nitrogen gas is 11,163Nm³/h. The main users are the storage and transportation department tank farms, Aromatics Unit and Flexicoking Unit; The normal consumption os 0.85MPa nitrogen gas is around 674Nm³/h with its main users being Aromatics Unit and Flexicoking Unit; The 2.5MPa nitrogen gas is used during accidents, other uses are pressurization and purging, consuming around 4,000Nm³/h.

0.6MPa 氮气正常情况下用量约 11163Nm³/h，主要用户为储运部罐区、芳烃联合及灵活焦化装置；0.85MPa 氮气正常情况下用量约 674Nm³/h，主要用户为芳烃联合和灵活焦化装置；2.5MPa 氮气为事故用氮，间断补压或吹扫用量约 4000Nm³/h。

Table 8-15 Design conditions of 0.6MPa nitrogen gas consumption

表 8-15 设计工况 0.6MPa 氮气消耗表

Unit 装置/单元	0.6MPa nitrogen consumption 0.6MPa 氮气用量 Nm³/h		Remarks 备注
	Normal 正常	Batch 间断	
Atmospheric and Vacuum Distillation 常减压	/	/	/
Light Ends Recovery 轻烃回收	/	86	/
Acid Gas & LPG Ends Recovery 产品精制	45	80	/
Kerosene Hydrotreating 煤油加氢	/	/	/
Diesel Hydrotreating 柴油加氢	90	/	/
Hydrocracking 加氢裂化	12	/	/
LPG Fractionation 气体分馏	/	2328	/
Aromatics 联合芳烃	3000	5000	/
Light Naphtha Isomerization 轻石脑油异构化	100	4229	/
PSA	360	800	/
Flexicoking 灵活焦化	566	9182	/
Sulfur Recovery Complex 硫磺回收联合	200	400	/
Hot water station 热水站	100	/	/
Storage and Transportation 储运系统	5600	10500	/
Flare Facility 火炬系统	160	10000	/
Flexicoking Flare facility 焦化火炬系统	300	1000	/
Pipeline network losses 管网损失	630	/	/

Unit 装置/单元	0.6MPa nitrogen consumption 0.6MPa 氮气用量 Nm³/h		Remarks 备注
	Normal 正常	Batch 间断	
Subtotal 小计	11163	/	/

Table 8-16 Design conditions of 0.85MPa nitrogen gas consumption

表 8-16 设计工况 0.85MPa 氮气消耗表

Unit 装置/单元	0.85MPa consumption 0.85MPa 用量 Nm³/h		2.5MPa consumption 2.5MPa 用量 Nm³/h	
	Normal 正常	Batch 间断	Normal 正常	Batch 间断
Hydrocracking 加氢裂化	/	/	/	150000 (Total quantity during start-up)（开停工总量）
Aromatic 联合芳烃	389	3350	/	/
Light Naphtha Isomerazation 轻石异构化	/	/	/	1500 (Gas leak testing) （气密）
PSA	/	/	/	800
Flexicoking 灵活焦化	253	/	/	/
Sulfur Recovery Complex 硫磺回收联合	/	/	/	1000 (purging) （吹扫）
Jetty 码头	/	/	/	3000 (purging) （吹扫）
Pipeline network losses 管网损失	32	/	/	/
Subtotal 小计	674	/	/	/

8.8.2 Nitrogen gas consumption at initial commissioning stage 首次试车期间氮气用量

During the initial commissioning period, the 2.5MPa nitrogen pipeline network requires 6,374m³ of liquid nitrogen to be used for gas leak testing of spherical tanks and reaction systems of units. To avoid venting 0.6MPa nitrogen during liquid nitrogen production, centralized nitrogen usage is adopted to maintain balance. The Air Separation Unit operates intermittently under the working conditions of producing liquid nitrogen at lowest operating load. The specific conditions

are as follows:

首次试车期间 2.5MPa 氮气管网需 6374m³ 液氮用于球罐和装置反应系统气密，为避免生产液氮期间 0.6MPa 氮气放空，采取集中用氮进行平衡，空分装置按最低负荷产液氮工况间歇运行，具体情况如下：

8.8.2.1 Displacement and pressure testing of the Storage and Transportation department's spherical tank and storage tanks that require nitrogen seal.

港储部球罐、需氮封储罐的置换和试压

（1）Displacement and pressure testing together with the unit's reaction systems, with centralized nitrogen usage to reduce venting of 0.6MPa nitrogen gas. (After the handover of spherical tanks, firstly undergo pressure testing using plant air, while storing plant air to prepare for pipeline purging.)

与装置反应系统置换、试压同步进行，集中用氮，减少 0.6MPa 氮气放空。（球罐中交后先用工厂风进行试压，并储备工厂风用于管线爆破吹扫）

（2）Spherical tanks and flare systems require conditions before the first LPG ship enters the factory.

球罐和火炬系统要求在 LPG 首船进厂前达到条件。

8.8.2.2 Nitrogen displacement and gas leak testing of unit.

装置氮气置换和气密

（1）The 0.6MPa nitrogen usage reaches a trough during. When the 0.6MPa nitrogen usage reaches a trough. However liquid nitrogen continues to be produced, to ensure consistent suppy of 2.5MPa nitrogen pipeline network for the gas leak testing of the unit's reaction systems, to avoid the overall start-up stage to be affected.

0.6MPa 氮气用量波谷。0.6MPa 氮气用量波谷期间富余氮气需放空，继续生产液氮，保证装置反应系统气密 2.5MPa 氮气管网的液氮供应，避免整体试车进度受到影响。

（2）After the hydrogen gas displacement of the 3 hydrogenation units is completed, during the catalyst loading stage the 2.5MPa nitrogen gas usage reaches a trough. LP 2,000m³ liquid nitrogen storage tank liquid level will rise gradually.

在三套加氢装置一次氢气气密结束，催化剂装填期间，2.5MPa 氮气用量出现波谷，低压 2000 m³ 液氮储罐液位将逐步升高。

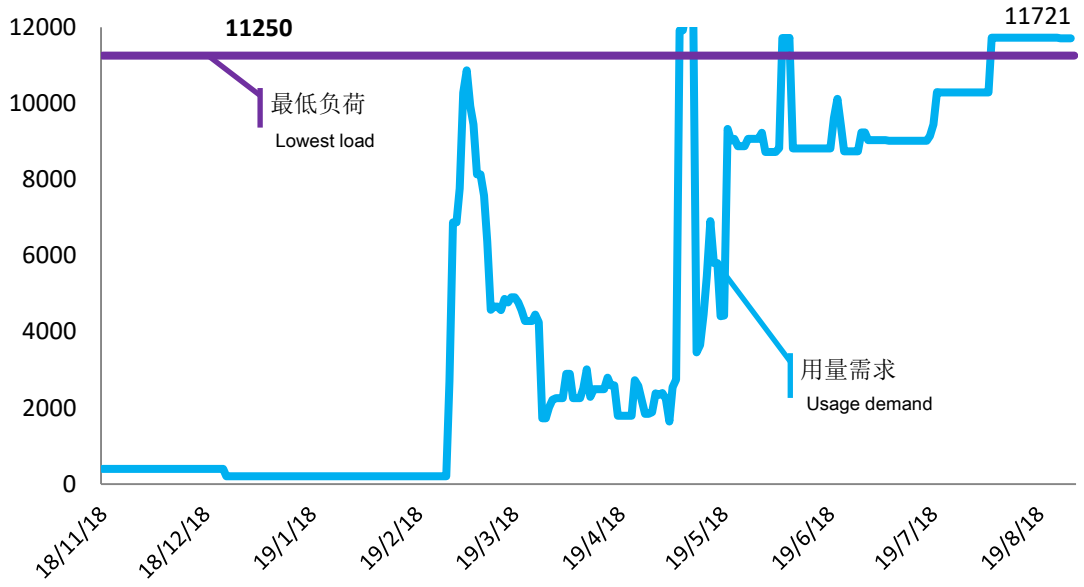


Figure 8-12 Initial commissioning stage's 0.6MPa nitrogen consumption

图 8-12 首次试车期间 0.6Mpa 氮气用量

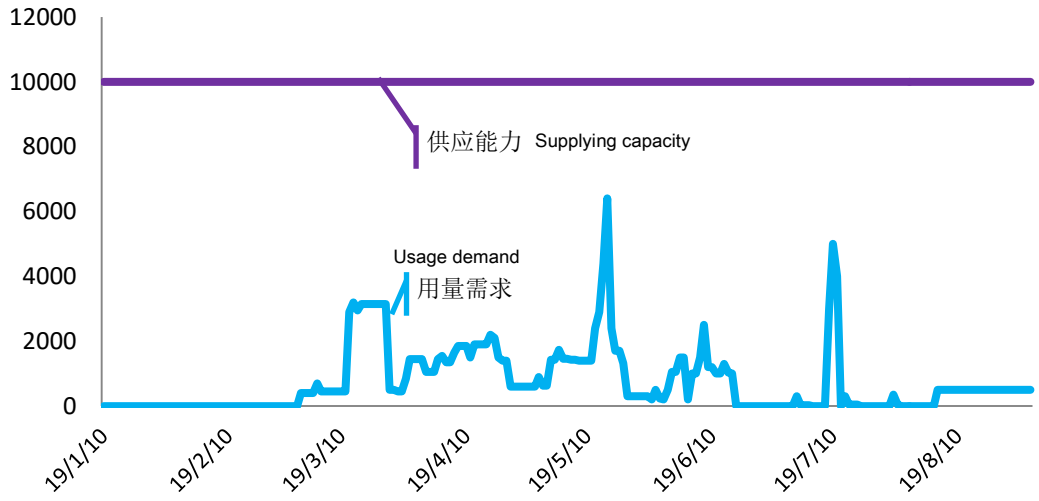


Figure 8-13 Initial commissioning stage's 2.5MPa nitrogen consumption

图 8-13 首次试车期间 2.5Mpa 氮气用量

8.9 Firefighting Water 消防水

8.9.1 Storage Capacity of Production Water and Firefighting Water in Main Plant Area 主厂区生产给水及消防水储水量

The quantity of firefighting water is calculated as the sum of the maximum firefighting water consumption in one area and the firefighting water consumption in one production auxiliary area. According to calculations, the maximum firefighting water consumption in the plant is by the 3,000m³ spherical tanks in LPG spherical tank farm. The firefighting water consumption is 560L/S, and the water supply time is 6h, firefighting water consumption is about 12100m³. Flow rate of firefighting water in auxiliary production area is 50 L/S, and has a water supply time of

2h, the amount of water used for firefighting is about 360m³, and the time for make-up water for firefighting reserve does not exceed 48h. Production water accident storage capacity is 434*12=5208m³, and firefighting water storage capacity is 12460m³. Adjustable storage capacity is 2332m³ where 2 sets of 10000m³ steel dome water tank are set-up.

消防水量按一处最大消防用水量和一处生产辅助区消防用水量之和计算。根据计算，厂内最大消防用水量为液化气球罐区内 3000m³ 球罐，其消防用水量为 560L/s，供水时间 6h,其消防时用水量约为 12100m³；辅助生产区 50 L/s，供水时间 2h，其消防时用水量约为 360m³，消防贮备水的补水时间不超过 48h。生产水事故贮存量 434*12=5208m³；消防水贮量 12460m³；调节贮量 2332m³ 设置 10000m³ 钢质拱顶水罐 2 个。

8.9.2 Firefighting Water Capacity of Firefighting Water Pump Station in Western Jetties Tank Farm

西码头库区消防加压泵站消防水储水量

Firefighting water in western jetties uses desalinated water which is supplied by pipe network of main plant area. The capacity of firefighting water is designed at 864 m³/h and the maximum water consumption in western jetties is 3,000 m³. 2 water storage tanks were set-up, where a single volume is 5,000 m³, and total volume is 10,000 m³. The flow rate of make-up firefighting water is 220 m³/h and its make-up time is less than 48h.

西区码头采用淡水消防，由主厂区管网供应，设计消防水量 864m³/h。西区码头最大一次消防水量 3000m³。设置储水罐 2 个，单个容积 5000m³，总容积 10000m³。消防补水量为 220m³/h，消防补水时间少于 48h。

8.9.3 Seawater Firefighting Pump Room in Eastern Jetties 东码头海水消防泵房

A seawater firefighting pump room is set-up on the approach bridge of the 5# berth. Two seawater firefighting pumps are installed in the pump room, one in operation and another on standby. The water pump adopts submerged long shaft type and is driven by a motor. The seawater firefighting pump has a water supply flow rate of 255L/S and a lift of 160m. When fire accident occurs, the firefighting pump can automatically start by relying on the pressure drop signal of the pipe network, or using berth manual fire button to alarm the comprehensive room, firefighters can start-up firefighting pump in duty room of firefighting room or can directly start-up firefighting pump on site. The 2# foam station of No. 2 general building in eastern jetties are equipped with a set of pressure stabilizing facilities, comprising two sets of pressure stabilizing firefighting pumps, one for operation and another on standby, as well as a set of pressure tank. Pressure stabilizing pump water supply capacity is 10L/S and head is 90m.

在 5#泊位引桥上设置海水消防泵房一座，泵房内设置海水消防泵两台，1 用 1 备，取水泵采用液下长轴式，均为电动机驱动。海水消防泵供水能力为 255L/S，扬程 160m。火灾发生时，消防水泵可依靠管网压降信号自动启动，或由泊位手动火灾按钮向综合室报警，核实火灾后向消防队员可在消防泵房值班室启动消防泵，也可在消防泵房现场直接启动。在东区 2#综合楼 2#泡沫站内设置稳压设施一套，配置 2 台稳压消防泵，1 用 1 备，1 台气压罐。稳压泵供水能力 10L/S，扬程 90m。

8.9.4 Firefighting Water Wystem at Coal Jetty 煤码头消防水系统

One fire-fighting pump room was added at the substation location to provide a firefighting sprinkle system. The pump room is set with with a 300m³ firefighting water pool, 2 sets of XBD5.8/50-150-410 model firefighting pumps (1 for operation and 1 on stanby), 1 set of ZW (W)-II-Z-C pressurizing and pressure stabilizing unit. One DN100 pipe is connected to the production water pipeline from the rear plant area to the jetty as firefighting water pool inlet pipe. Firefighting pump flow is 50L/S, head is 58m, motor power is 55KW. Indoor and outdoor firefighting water is introduced from the seawater firefighting system at the eastern jetties, with a pipe diameter of DN100, and a water pressure of not less than 0.60 MPa.

在变电所位置新增 1 座消防水泵房，用于提供喷淋灭火系统。泵房配套有 300m³ 消防水池 1 座，XBD5.8/50-150-410 型号消防泵 2 台（1 用 1 备），ZW（W）-Ⅱ-Z-C 增压稳压装置 1 套。从后方厂区至码头生产用水管线中接出 1 根 DN100 管道作为消防水池进水管。消防泵流量为 50L/S，扬程 58m，电机功率为 55KW。室内外消防用水从东区码头海水消防系统引入，接管管径为 DN100，要求接管管径为 DN100，要求接管水压≮0.60MPa。

8.10 Foam Station 泡沫站

Foam stations are set up in the tank farm of main plant area, western jetties tank farm area, and eastern jetties area. Foam liquid storage tanks are also set up in the main plant area and western tank farm area.

主厂区罐区、西码头罐区、东码头均设置泡沫站，在主厂区和西码头库区消防站内设置泡沫液储罐。

8.10.1 Main Plant Area Foam Station 主厂区泡沫站

Three foam stations, namely the 1# foam station, 2# foam station, and 3# foam station are set up in the main plant tank farm area. 1# foam station is located near to unit 4001, 2# foam station is located near unit 4201, and 3# foam station is located near unit 4103. In the tank farm serviced by 1# foam station, the largest foam mixture user in the case of fire is 100,000m³ external floating-roof tank; the largest flow rate of foam mixture in the case of fire is 454 m³/h; the designed flow rate of firefighting water for foam mixture preparation is 427 m³/h; the fire water consumption for foam mixture preparation is 242 m³; the foam solution capacity is 16m³. In 2# and 3# foam stations, the largest foam mixture user in the case of fire is 20,000m³ dome/internal floating-roof tank with the largest flow rate of foam mixture being 605 m³/h; the designed flow rate of firefighting water for foam mixture preparation is 568 m³/h; the fire fighting water consumption for foam mixture preparation is 440 m³; the foam solution capacity is 29 m³. For the purpose of uniformity, the three foam solution tanks are 30 m³ in volume.

在主厂区罐区共设置 3 座泡沫站，1#泡沫站、2#泡沫站、3#泡沫站。1#泡沫站位于 4001 单元附近，2#泡沫站位于 4201 单元，3#泡沫站位于 4103 单元附近。1#泡沫站服务范围内的罐区一次

火灾最大泡沫混合液用户为 100000m³ 外浮顶罐，一次火灾最大泡沫混合液流量为 454m³/h，配置泡沫混合液的消防水设计流量为 427m³/h，配置泡沫混合液的消防水用量为 242m³，泡沫液贮量为 16m³。2#泡沫站和 3#泡沫站服务范围内的罐区一次火灾最大泡沫混合液用户为 20000m³ 拱顶/内浮顶罐，一次火灾最大泡沫混合液流量为 605m³/h，配置泡沫混合液的消防水设计流量为 569m³/h，配置泡沫混合液的消防水用量为 440m³，泡沫液贮量为 29m³。为了统一，3 座泡沫站泡沫液罐均采用 30m³，泡沫液贮量为 30m³。

8.10.2 Western Tank Farm Area Foam Station 西库区泡沫站

There are two foam stations set up in the western jetties tank farm area: 1# foam station and 2# foam station. The 1# foam station located near to unit 8021, while the 2# foam station located near to unit 8023. In the tank farms serviced by 1# foam station, the largest form mixture user in the case of fire is 15,000 m³ internal floating-roof tank; the largest flow rate of foam mixture is 425 m³/h; the designed flow rate of firefighting water for foam mixture preparation is 452 m³/h; the firefighting water consumption for foam mixture preparation is 320 m³; foam solution capacity is 20 m³. In the tank farm serviced by 2# foam station, the largest foam mixture user in the case of fire is 20,000 m³ internal floating-roof tank; the largest flow rate of foam mixture is 605 m³/h; the designed flow rate of firefighting water for foam mixture preparation is 569 m³/h; the firefighting water consumption for foam mixture preparation is 440 m³; the foam solution capacity is 29 m³. For the purpose of uniformity, both the 1# and 2# foam solution tanks are 30 m³ in volume.

设置 2 座泡沫站，1#泡沫站和 2#泡沫站。1#泡沫站位于 8021 单元附近，2#泡沫站位于 8023 单元附近。1#泡沫站服务范围内的罐区一次火灾最大泡沫混合液用户为 15000m³ 内浮顶罐，一次火灾最大泡沫混合液流量为 425m³/h，配置泡沫混合液的消防水设计流量为 452m³/h，配置泡沫混合液的消防水用量为 320m³，泡沫液贮量为 20m³。2#泡沫站服务范围内的罐区一次火灾最大泡沫混合液用户为 20000m³ 内浮顶罐，一次火灾最大泡沫混合液流量为 605m³/h，配置泡沫混合液的消防水设计流量为569m³/h，配置泡沫混合液的消防水用量为440m³，泡沫液贮量为29m³。为了统一，1#泡沫站和 2#泡沫站泡沫液罐均采用 30m³，泡沫液贮量为 30m³。

8.10.3 Western Jetties Foam Station 西码头泡沫站

A balance-type foam ratio mixing equipment is set up in 1# foam station within 1# general building, near to the western 1# and 2# berth bridgeheads; Two balance pressure type foam ratio mixing equipment and one 12 m³ stainless steel atmospheric foam solution tank are set up at the foam station; the electric pump is used as foam solution pump. The DN250 water inlet pipe of foam ratio mixing equipment receive the water from firefighting cooling water pipe located near to the berth. The designed supply volume of mixing equipment is 90 L/s; the continuous supply time is 40 minutes; the one-time firefighting foam solution consumption is 8 m³. The burn resistance level of 3% fusibility aqueous film forming foam extinguishing agent

used is not lower than Grade C regulated in currently valid national standard "Foam Extinguishing Agent" (GB15308).

在西区 1#、2#泊位引桥靠近泊位侧 1#综合楼 1#泡沫站内设置平衡式泡沫比例混合装置，泡沫站内设置平衡压力式泡沫比例混合装置两套及 1 台 12m³ 不锈钢常压泡沫液罐，泡沫液泵均采用电动泵，泡沫比例混合装置的 DN250 进水管就近引自泊位消防冷却水管道，混合装置设计供给量为 90L/S,连续供给时间为 40 分钟，一次消防泡沫液用量约为 8m³，采用 3%非抗溶性水成膜泡沫液灭火剂，其抗烧水平不低于现行国家标准《泡沫灭火剂》（GB15308）规定的 C 级。

8.10.4 Eastern Jetties 东码头

A balance-type foam ratio mixing equipment is set up in 2# foam station in 2# general building located at eastern 4# - 5# jetties. Two balance pressure type foam ratio mixing equipment and one 12 m³ stainless steel atmospheric pressure foam solution tank are set up at the foam station; Electric pump is used as foam solution pump. The DN250 water inlet pipe of foam ratio mixing equipment receive water from firefighting cooling water pipeline nearby. The design supply volume of mixing equipment is 90 L/S; the continuous supply time is 40 minutes; the one-time firefighting foam solution consumption is 8 m³. The 3% fusibility aqueous film forming foam extinguishing agent are used. The burn resistance level of the 3% fusibility aqueous film forming foam extinguishing agent used is not lower than Grade C regulated in currently valid national standard "Foam Extinguishing Agent" (GB15308). A balance-type foam ratio mixing equipment is set up at 3# foam station located in 3# general building at 6# eastern jetty; 2 balance pressure-type foam ratio mixing equipments and one 12 m³ stainless steel atmospheric pressure foam solution tank are set up at foam station; electric pump is used as foam solution pump. The DN250 water inlet pipe of foam ratio mixing equipment receive water from firefighting cooling water pipeline located nearby. The design supply volume of mixing equipment is 60 L/s; the continuous supply time is 40 minutes; the one-time firefighting foam solution consumption is 6 m³. The 3% fusibility aqueous film forming foam extinguishing agent are used. The burn resistance level of the 3% fusibility aqueous film forming foam extinguishing agent used is not lower than Grade C regulated in currently valid national standard "Foam Extinguishing Agent" (GB15308).

在东区 4#-5#码头 2#综合楼 2#泡沫站内设置平衡式泡沫比例混合装置，泡沫站内设平衡压力式泡沫比例混合装置两套及 1 台 12m³ 不锈钢常压泡沫液罐，泡沫液泵均采用电动泵。泡沫比例混合装置的 DN250 进水管就近消防冷却水管道，混合装置设计供给量为 90L/S，连续供给时间为 40 分钟，一次消防泡沫液用量为 8m³ 。采用 3%非抗溶性水成膜泡沫液灭火剂。其抗烧水平不低于现行国家标准《泡沫灭火剂》（GB15308）规定的 C 级。在东区 6#码头 3#综合楼 3#泡沫站内设置平衡式泡沫比例混合装置，泡沫站内设平衡压力式泡沫比例混合装置两套及 1 台 12m³ 不锈钢常压泡沫液罐，泡沫液泵均采用电动泵。泡沫比例混合装置的 DN250 进水管就近消防冷却水管道，混合装置设计供给量为 60L/S，连续供给时间为 40 分钟，一次消防泡沫液用量为 6m³。采用 3%非抗溶性水成膜泡沫液灭火剂。其抗烧水平不低于现行国家标准《泡沫灭火剂》

（GB15308）规定的 C 级。

9 Environmental Protection 环境保护

Hengyi Petrochemical PMB 8.0 MMTA oil refining project mainly includes 14 sets of production units such as Atmospheric and Vacuum Distillation Unit, Light Ends Recovery Unit, Hydrocracking Unit, Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit, Flexicoking Unit, Sulfur Recovery & Tail Gas Treatment Unit and Aromatics Unit, and other supporting utilities. The characteristic of the entire production process has high temperature and pressure, as well as complexity of material properties and process etc., there are many factors of uncertainty for start-up commissioning, it is likely to cause environmental pollution if it is not properly controlled. In order to ensure that the whole process of the commissioning is reasonable, legal, compliant, minimizing the impact of commissioning process on the environment, setting an example of Chinese enterprises for green commissioning, HYBN SDN.BHD. has established a green commissioning plan with comprehensive control, overall prevention, level responsibility, index management, energy saving and emission reduction.

恒逸文莱石化 PMB 800 万吨/年炼油项目主要包括常减压、轻烃回收、加氢裂化、煤油加氢、柴油加氢、灵活焦化、硫磺回收、芳烃联合等 14 套生产装置及其配套工程，整个生产过程中具有高温高压、物料性质和工艺过程复杂等特点，开工试车不可确定因素多，若控制不当很可能对环境造成污染。为确保试车全过程合理、合法、合规，最大限度地降低试车过程对环境的影响，塑造中国企业绿色试车典范，HYBN SDN.BHD.制定了全程控制、整体预防、层级负责、指标管理、节能减排的绿色试车方案。

9.1 Commissioning Environmental Protection Objective 试车环保目标

9.1.1 “Three wastes” treatment rate is 100%;
“三废”处理达标率 100%；

9.1.2 Operation rate and intact rate of environmental facilities are 100%;
环保设施投运率、完好率 100%；

9.1.3 No environmental pollution accident occurs, and the accident rate is zero;
不发生任何环境污染事故，事故率为零；

9.1.4 Legal compliance;
合法合规；

9.1.5 No environmental complaints occur;
不发生环保投诉事件；

9.1.6 Realize green start-up.
实现绿色开工。

9.2 Principal of Environmental Protection 环境保护原则

9.2.1 Principal of Green Start-up 绿色开工原则

The project will strictly implement “the environmental protection three simultaneous” and various cleaning production plan as well as environmental protection management system, clean fuel will be use and various environmental protection control and monitoring facilities will be put into use promptly to reduce the emission of various pollutants.

本项目将严格落实环保三同时和各项清洁生产方案及环保管理制度，将采用清洁燃料和及时投用各项环保控制及监控设施，减少各类污染物的排放。

9.2.2 Principle of Sewage Drainage for Clear Water/Wastewater Separation and Quality Separation Treatment 清污分流、分质处理原则

The drainage system of each unit of the project follows the drainage principle of “clear water/wastewater separation, oily wastewater/saline wastewater separation, quality separation treatment, multi-usage of single water”. Reduce the amount of wastewater as much as possible, wastewater optimizing treatment and recycling shall be done.

项目各装置排水系统遵循“清污分流、污污分流、分质处理、一水多用 ”的排水原则。尽可能地减少污水量、做到污水优化处理与回收利用。

9.2.2.1 Principle of Solid Waste Reduction, Resource Utilization and Innocuity 固废减量化、资源化、无害化原则

Solid waste should be recycled as much as possible according to the principle of quality classification, resource utilization, and reduction, for solid waste that cannot be reuse needs to be send to qualified unit for further processing.

固废本着按质分类、资源化、减量化的原则尽量回收利用，不能利用的委托有资质的单位进行处理。

9.2.2.2 Principle of Wastewater Classification Control 污水分级控制原则

Adopt various measures such as source indicator control, high-concentration wastewater pretreatment, reclaimed water reuse or cascaded use, centralized Wastewater Treatment Plant quality separation treatment, and multi-level of compliance, so that the stripped purified water can obtain a high ratio of utilization, full recycle of oily wastewater, low-concentration of purified wastewater obtained high ratio of recycle, high-concentration of saline wastewater obtained a stable standard treatment, and ensures that the wastewater treatment site is protected from shocks and achieves the purpose of saving water and reducing emissions.

采取源头指标控制、高浓度污水预处理、中水回用或串级使用、集中式污水处理场分质处理、层级达标等多种措施，使汽提净化水获得高比例的利用、含油污水全部回用、低浓度清净废水得到高比例回用、高浓度含盐污水得到稳定达标处理，保证污水处理场免受冲击、达到节水减排的目的。

9.2.2.3 Principle of Optimization for Start-up 优化开工原则

The overall planning of commissioning was carried out to optimize the start-up sequence to ensure that the Wastewater Treatment Plant was operated in advance to achieve the

conditions for receiving and processing the sewage in advance. Unit process gas such as dry gas, off-gas, flexi gas and etc. were desulfurized and fully recycled to reduce the amount of flare relief.

进行试车总体策划，优化开车顺序，保证污水处理装置提前运行，达到提前具备污水接收及处理条件；装置工艺干气、低分气、灵焦气等得到脱硫并充分回收利用，减少放火炬量。

9.2.2.4 Principle of Legal Compliance 合法合规原则

This project is a petrochemical project invested by Hengyi Petrochemical in the development of the “One Belt One Road” strategy. During the commissioning, we will strictly implement various environmental protection measures of EIA to ensure that the pollutants are legally and compliantly treated to meet the discharge standards.

本项目是恒逸石化响应一带一路发展战略，在文莱投资建设的石化项目，试车过程中我们将严格落实 EIA 中的各项环保措施，确保污染物得到合法合规处理实现达标排放。

9.3 Environmental Protection Facilities and “Three Waste” Treatment Plan 环保设施及“三废”处理方案

9.3.1 Wastewater 废水

9.3.1.1 Wastewater System Division 废水系统划分

（1）Oily Wastewater System (OD - gravity flow/OD1 – pressure flow)含油污水系统（OD-重力流/OD1-压力流）

The oily wastewater mainly comes from the unit's mixed condenser drainage, flushing water of the vessel containing oil of each unit, unit’s internal column zone, furnace zone, pump zone, ground flushing water in the cofferdam of the cold exchange zone, pump drainage, laboratory oily wastewater and etc. The oily wastewater is sent to Wastewater Treatment Plant after being pressurized by an oily wastewater lift pump.

含油污水主要来自装置的混合冷凝器排水、装置及各单元含油容器的冲洗水，装置及单元内塔区、炉区、泵区、冷换区的围堰内的地面冲洗水、机泵排水，化验室含油污水等。含油污水经含油污水提升泵加压后送往污水处理场。

（2）Saline Wastewater System (SAD - gravity flow/SAD1 - pressure flow) 含盐污水系统（SAD-重力流/SAD1-压力流）

Saline Wastewater of the entire plant mainly comes from wastewater discharged from the Cooling Water Unit, water removal of oil tank in the crude oil tank farm, electric desalting of the Atmospheric and Vacuum Distillation Unit and etc. Saline wastewater is pumped to saline wastewater system in the entire plant through the lifting pump station in each unit and is pressurized to Wastewater Treatment Plant saline wastewater treatment series. The electric desalting wastewater from Atmospheric and Vacuum Unit is sent directly to the wastewater treatment plant.

全厂含盐污水主要来自循环水场排污水、原油罐区油罐切水、常减压装置电脱盐等，通过各自单

元内的提升泵站提升至全厂含盐污水系统，压力送至污水处理场含盐污水处理各级系列统一处理。常减压装置电脱盐污水由装置直接提升单独送往污水处理系列。

（3）Sulfur-Containing Wastewater Series 含硫污水系列

Sulfur-containing wastewater from each unit is sealed and sent to Sourwater Stripping Unit. The treated purified water is returned to Atmospheric and Vacuum Unit. The parts that are not reuse are discharged to Wastewater Treatment Plant's oily wastewater treatment series.

各装置的含硫污水密闭送至含硫污水汽提装置。处理后的净化水回用于常减压装置。回用不完的部分排至污水处理场含油污水处理系列。

（4）Domestic Wastewater System (SD - gravity flow/SD1 - pressure flow) 生活污水系统（SD-重力流/SD1-压力流）

Domestic wastewater from toilets, canteens, and bathrooms is discharged into biochemical pool of Wastewater Treatment Plant via pressure.

来自厕所、食堂、浴室的生活污水，压力流排至污水处理场的生化池。

（5）Initial Rainwater System (FRD - gravity flow/FRD1 - pressure flow) 初期雨水系统（FRD-重力流/FRD1-压力流）

The initial rainwater on the floating disk in the contaminated area and external floating roof tank area of the unit is collected by gravity flow pipes into the initial rainwater collection pool in each area and is pumped to Wastewater Treatment Plant for treatment.

装置内污染区、外浮顶油罐区浮盘上的初期雨水，经重力流管道汇集至各区域内的初期雨水收集池，经泵提升输至污水处理场统一处理。

（6）Rainwater System (RD - gravity flow/RD1 - pressure flow)雨水系统（RD-重力流/RD1-压力流）

The rainwater from the tank farm area (excluding floating disk of external floating roof tank), administration area and other clean area units is directly collected into rainwater system of the entire plant and is then collected into the rainwater monitoring pool of the entire plant. Drainage is discharged after monitoring and analysis are qualified.

罐区（外浮顶浮盘除外）、厂前区等其它清净区域单元的雨水直接收集至全厂雨水系统，最终汇集至全厂的雨水监控池，监控分析合格后外排。

（7）Production Wastewater System (ND) 生产废水系统（ND）

Production drainage that is not contaminated with oil, including local systems such as overflowing of production water (firefighting water) is discharged into clean rainwater pipelines or stormwater ditch nearby. Water overflowing of water tanks for water supply and firefighting water pressurization pump station unit as well as cleaned and vented water shall be drained into clean stormwater ditch outside the boundary area. When Cooling Water Unit starts trial operation, wastewater can be discharged into the clean storm ditch outside the boundary.

不受油品污染的生产排水，包括生产用水(消防水)溢流水等局部系统，就近排入清净雨水管道或雨水沟。生产给水及消防加压泵站单元内水罐溢流水、清洗放空水就近排入界区外的清净雨水沟。循环水场试运行时，排污可就近排入界区外的清净雨水沟。

（8）Water Recycling System (RUD) 回用水系统（RUD）

The plant is equipped with water recycling system, which is mainly used to make-up the water for Cooling Water Unit.

厂区设回用水，主要用于循环水场补充水。

（9）Offsite Stormwater Drainage System 外排污水系统（TD）

Water that had met the standard is drained to water drainage system after treated by Wastewater Treatment Plant.

污水处理场处理后达标水排放水系统。

9.3.1.2 Sulfur-Containing Wastewater Treatment Plan 含硫污水处理方案

PMB's new Sourwater Stripping Unit has processing capacity of 180 t/h, annual operating time of 8400 hours, and an operating flexibility of 50% to 110%. The unit uses a single column low-pressure stripping process, where acid gas at the top of the column is used as raw material for Sulfur Recovery Unit. The treated purified water is normally returned to Atmospheric and Vacuum Unit for water injection and Flexicoking Unit for recycling, and the unused purified water is discharged into Wastewater Treatment Plant for advance treatment.

PMB 新建酸性水汽提装置，酸性水汽提装置处理能力为 180 吨/小时，年开工时数为 8400 小时，装置操作弹性：50%～110%。装置采用单塔低压汽提工艺，塔顶酸性气作为硫磺回收装置的原料。处理后的净化水正常情况下大部分返回常减压装置作注水及灵活焦化装置回用，回用不完的净化水排入污水处理场的含油污水系列进行深度处理。

9.3.1.3 Wastewater Centralized Treatment and Recycling Plan 污水集中处理及回用方案

（1）Wastewater Treatment Plant supporting this project uses oil isolation, air flotation, biochemical, and filtration processes to treat oily wastewater and saline wastewater discharged from refinery process unit and auxiliary facilities. After treatment, the oily wastewater can be used as make-up water source for cooling water, and saline wastewater can be discharged when standard is met. Wastewater collected by Wastewater Treatment Plant undergoes dewatering process and sent to slop oil tank farm of the plant. The remaining activated sludge, oil sludge, and scum generated from the Wastewater Treatment Plant undergoes dewatering process after gravity thickening. After dewatering, they are sent to power plant for blending.

本项目配套的污水处理场，采用隔油、气浮、生化、过滤等处理工艺对炼油工艺装置及辅助设施排出的含油污水和含盐污水进行处理。含油污水经过处理后可以作为循环水补水水源，含盐污水达标排放。污水处理场收集的污水经脱水后送至厂污油罐区。污水处理场产生的剩余活性污泥、油泥及浮渣经重力浓缩后进行脱水处理，脱水后送至煤电站进行掺烧。

（2）The total treatment scale for Wastewater Treatment Plant is 400m^3/h, of which the treatment scale of the oily wastewater treatment series is 200m^3/h, and the scale of saline wastewater treatment is 200m^3/h.

污水处理站总处理规模：400m^3/h，其中含油污水处理系列处理规模为 200m^3/h，含盐污水处理规模为 200m^3/h。

（3）Wastewater treatment and wastewater recycling facilities are divided into two series, oily wastewater and saline wastewater, which are divided into four parts: pretreatment, biochemical, advanced treatment, and auxiliary systems (including dosing, slop oil, sludge, waste gas

treatment and etc.) Specific composition is as follows.

污水处理及污水回用设施分为含油、含盐两个系列，划分为四个部分，即预处理部分、生化部分、深度处理部分、辅助系统（包括加药、污油、污泥、废气处理等），具体组成如下。

Table 9-1 Wastewater Treatment Plant Function Division Table

表 9-1 污水处理场功能划分表

No. 序号	Unit Name 单元名称	Remark 备注
1	Pre-treatment Section 预处理部分	Homogeneous Conditioning + Oil/Water Separation + Cavitation Air Flotation (CAF) + Dissolved Air Flotation (DAF) 均质调节+油水分离+涡凹气浮+溶气气浮
2	Biochemical Treatment Section 生化处理部分	A/O Pool, Secondary Sedimentation Pool and etc. A/O 池、二沉池等
3	Advance Treatment Section 深度处理部分	Adopts Quartz Sand Filtration 采用流砂过滤
4	Auxiliary System 辅助系统	Dosing, dewatering of slop oil storage, sludge concentration and dewatering, waste gas treatment and etc. 加药、污油储存脱水、污泥浓缩及脱水、废气处理等。

Table 9-2 Wastewater Treatment Plant Design Inlet and Outlet Water Quality Table

表 9-2 污水处理场设计进、出水水质表

Name 名称	Unit 单位	Saline Wastewater 含盐污水		Oily Wastewater 含油污水	
		Inlet Water Quality 进水水质	Outlet Water Quality ① 出水水质①	Inlet Water Quality 进水水质	Recycle Water Quality ② 回用水水质②
PH	-	6-9	6-9	6-9	6-9
Temperature 温度	℃	25-～35	≤45	25～35	③
CODcr	mg/l	1000	120③	800	≤60
BODs	mg/l	240	30③	320	≤10
SS	mg/l	120	70③	120	≤30

Name 名称	Unit 单位	Saline Wastewater 含盐污水		Oily Wastewater 含油污水	
		Inlet Water Quality 进水水质	Outlet Water Quality ① 出水水质①	Inlet Water Quality 进水水质	Recycle Water Quality ② 回用水水质②
Petroleum 石油类	mg/l	300	≤3	300	≤2
Sulfur Compound 硫化物	mg/l	20	≤1③	5	≤0.1
Total Nitrogen 总氮	mg/l	-	≤100	-	④
Ammonia Nitrogen 氨氮	mg/l	45	≤100	35	≤10
Nitrate Nitrogen 硝酸盐氮	mg/l	-	≤50	-	④
Total Phosphorus 总磷	mg/l	-	≤30	-	④
Phenol 苯酚	mg/l	50	≤1	10	≤0.5
Calcium Stiffness 钙硬	mg/l	-	④	-	50～300
Total Alkalinity 总碱度	mg/l	200	④	-	50～300
Chloride 氯化物	mg/l	500	≤5000	50	≤200
Sulfate 硫酸盐	mg/l	50	④	50	≤300
Total Iron 总铁	mg/l	-	≤20	-	≤0.5
Conductivity	mg/l	7000	④	500	≤1200

Name 名称	Unit 单位	Saline Wastewater 含盐污水		Oily Wastewater 含油污水	
		Inlet Water Quality 进水水质	Outlet Water Quality ① 出水水质①	Inlet Water Quality 进水水质	Recycle Water Quality ② 回用水水质②
电导率					
Total Dissolved Solid 总溶解固体（TDS）	mg/l	4000	④	300	④

Note: （1）The quality of wastewater outlet satisfies the criteria of “Wastewater Discharge Directly into The Environment Recommended Standards” “Brunei Economic Development Pollution Control and Control Guideline” index for discharge into the sea, and refers to the national standard “Comprehensive Wastewater Discharge Standard” Table 4 secondary standards “GB8978-1996 (1999)”;

（2）The quality of recycled water refers to Sinopec’s “Assessment Index of Water Saving and Emission Reduction and Recycle Water Quality Control Index in Refining and Chemical Enterprises” “Q/SH0104-2007” index for the quality of recycle cooling water;

（3）Refer to national standard "Comprehensive Wastewater Discharge Standard" Table 4 secondary standard “GB8978-1996 (1999)”;

（4）There is no requirement in the standard.

注：①污水出水水质满足《污水直接排入环境推荐标准》（文莱经济发展污染控制控制指导目录）中的排海指标，并参考国标《污水综合排放标准》表 4 二级标准（GB8978-1996（1999））；②回用水水质参考中石化《炼化企业节水减排考核指标与回用水质控制指标》（Q/SH0104-2007）中回用循环水水质指标；③参考国标《污水综合排放标准》表 4 二级标准（GB8978-1996（1999）；④标准中无要求。

9.3.1.4 Wastewater Offsite Discharge Control Index 污水外排控制指标

Table 9-3 Wastewater Offsite Discharge Control Index List

表 9-3 污水外排控制指标一览表

Analysis Item 分析项目	Unit 单位	Control Index 控制指标	Frequency of Analysis 分析频次	Remark 备注
PH	Dimensionless 无量纲	6～9★	1 time/day 1 次/日	1） Internal Control/Assessment/Reporting. 内控/考核/上报。 2） “★” for Assessment Index. “★”为考核指标。
Petroleum 石油类	mg/L	3★	1 time/day 1 次/日	
CODcr	mg/L	80/100★/120	1 time/day 1 次/日	
BOD_5	mg/L	30★	1 time/week 1 次/周	
Volatile 挥发份	mg/L	0.5★	1 time/day 1 次/日	
Suspended Matters 悬浮物	mg/L	70	1 time/day 1 次/日	
Ammonia Nitrogen 氨氮	mg/L	15/20★/30	1 time/day 1 次/日	
Total Phosphorus 总磷	mg/L	2	1 time/day 1 次/日	

9.3.1.5 Rainwater Collection Plan 雨水收集方案

（1）Rainwater Collection Plan During Normal Operation 正常运行时雨水收集方案

1）The initial rainwater in the contaminated area of the unit and the floating disk of external floating roof tank flows into the initial rainwater collecting pool in each area. After the rain stopped, the rainwater in the pool is pumped into Wastewater Treatment Plant for treatment.

装置内污染区、外浮顶罐浮盘内初期雨水流入各区域初期雨水收集池，雨停后水池内雨水经泵提升后进入污水处理场处理。

2）The rainwater shut-off valve outside the fire protection dike of the tank farm is normally closed. After the rain stops, the shut-off valves will open one by one if the rainwater in the fire dike is not contaminated, and the rainwater will be drained to the clean rainwater pipe network (RD).

罐区防火堤外雨水切断阀正常时常关，雨停后防火堤内雨水如无污染逐个开启切断阀，雨水排至清净雨水管网（RD）。

3）The rainwater collected by the clean rainwater pipe network is converged to the rainwater

monitoring pool, and the online oil analyzer is set up in the monitoring pool. If the rainwater monitoring is qualified, the rainwater can be directly pumped and discharge to offsite.

通过清净雨水管网收集的雨水汇流至雨水监控池，监控池内设置在线油分析仪，如雨水监测合格直接经泵提升排出厂外。

4）The rainwater in the clean water unit area such as cooling water area, seawater desalination, administration area, outside the tank area and etc. is pumped and discharged directly to offsite without monitoring.

循环水场、海水淡化、厂前区、罐区外等清净区单元雨水不经监控经泵直接排出厂外。

（2）Rainwater Collection Plan During Accident 事故时雨水收集方案

1）Accident drainage mainly refers to the leakage of materials in the event of an accident, spray water after firefighting, cooling water and rainwater of equipment and etc.

事故排水主要是指发生事故时的物料泄漏、消防后的喷淋水、设备的冷却水及雨水等。

2）When a general accident occurs in the unit area, the accidental drainage will be collected in the initial rainwater collection pool through the initial rainwater pipeline in unit area, and is then pumped up and sent to the Wastewater Treatment Plant. When major accident occurs, a large number of accidental drainage will be produced. Contaminated rainwater is collected in contaminated rainwater pool, and the remaining part of the accidental drainage is sent to the rainwater monitoring and accident pool through the clean rainwater pipeline (when rainwater monitoring pools and accident pools collecting accident water, clean rainwater should be controlled to enter the initial rainwater pool and accident pool as required by the plan).

当装置区发生一般事故时，事故排水主要通过装置区初期雨水管道收集进入初期雨水收集池，然后由泵提升后送污水处理场；当发生较大事故时，会产出大量的事故排水，经污染雨水收集池收集，剩余部分的事故排水则通过清净雨水管道进入雨水监控及事故池（在雨水监控池及事故池收集事故水时，应按预案要求控制清洁雨水进入初期雨水池及事故池）。

3）The accidental water collection in the tank farm principally uses effective volume of the fire dike. When a fire breaks out, the self-flowing pipeline valve (rainwater/oily wastewater) leading to the outside of the fire dike will be shut off, and the fire accident water will be stored in the fire dike. The direction of fire accident water will be determined when the accident is over. If the fire accident dike can not store all the accident water, the rainwater pipeline valve can be opened and drained into the rainwater monitoring and accident pool through the clean rainwater pipe network (RD).

油罐区事故水收集原则上利用防火堤有效容积，当发生火灾时，切断通向防火堤外部的自流管道阀门（雨水/含油污水），把消防事故水储存在防火堤内，待事故结束后再确定存液的去向。事故较大防火堤不能储存全部事故水时，可开启雨水管道阀门，经清净雨水管网（RD）排入雨水监控及事故池。

4）After the accident, accident water in rainwater monitoring and accident pool were pumped into Wastewater Treatment Plant.

事故结束后，雨水监控及事故池内事故水经泵提升后进入污水处理场处理。

5）When a major accident occurs and the clean area is also contaminated by accident water,

rainwater is prohibited from discharge out of the plant.

当出现特大事故，清净区也被事故水污染时，禁止雨水排出厂外。

9.3.1.6 Rainwater Monitoring and Accident Water Collection Pool 雨水监控及事故水收集

（1）According to Sinopec's “Design Guidelines for Water Contamination Prevention and Control Emergency Measures”, PMB project is set up with rainwater monitoring and accident pool in the main plant area and rainwater monitoring and accident pools in wastern tank farm.

根据中石化《水体污染防控紧急措施设计导则》，PMB 项目设有：主厂区雨水监控及事故池；西码头罐区雨水监控及事故水池。

（2）The main plant area has two rainwater monitoring and accident pools, which are arranged next to each other and is shared with accident pools. Two rainwater monitoring pools monitor rainwater in the tank farm of the main plant area and rainwater in the units of the main plant area as well as the surrounding areas.

主厂区设置 2 座雨水监控及事故池，贴邻布置，事故池共用。2 座雨水监控池分别监控主厂区的罐区区域雨水及主厂区装置区和附近区域雨水。

（3）The effective volume of rainwater monitoring and accident pool in western tank farm is 11000m^3. The design of Western tank farm storage area maximum accidental water volume: 8000m^3.

西码头罐区雨水监控及事故水池有效容积 11000m^3。西码头库区设计最大事故水量：8000m^3。

（4）Contaminated rainwater and accident water can be pumped to Wastewater Treatment Plant by lift pump.

污染雨水、事故水可通过提升泵送至污水处理场。

9.3.2 Waste Gas 废气

In order to reduce the amount of sulfur dioxide emissions in waste gas, a full hydrogenation process is adopted in the process, so that the sulfur in the crude oil is separated from the oil in the form of hydrogen sulfide as much as possible, and Sulfur Recovery Unit is set-up, which most of the sulfur in crude oil is recovered as resource, also preventing it to enter the atmosphere polluting the environment in the form of gas and achieves the purpose of protecting the environment.

为了降低废气中二氧化硫的排放量，工艺流程采取全加氢工艺，使原油中的硫最大限度地以硫化氢的形式从油品中分离出来，同时设置硫回收装置，既可使原油中的大部分硫作为资源得以回收，又避免其以气体的形态进入大气污染环境，达到保护环境的目的。

9.3.2.1 Combustion Flue Gas Emission Control 燃烧烟气排放控制

（1）The furnace of this project uses desulfurized fuel gas as fuel to fundamentally reduce the emission of sulfur dioxide; the furnace is equipped with a low-nitrogen burner to reduce the emission of nitrogen oxides in the flue gas; at the same time, by setting up chimneys of an appropriate height, the pollutant emissions in the flue gas of the heating furnace can meet the requirements of local standards in Brunei. The commissioning will be controlled according to

the following index: 1) particulate matter: 25 mg/m³ (IFC); 2) sulfur dioxide: 100 mg/m³; 3) nitrogen oxide ④: 150 mg/m³.

本工程加热炉以脱硫燃料气为燃料，从根本上减少二氧化硫的排放；加热炉设置低氮燃烧器，降低烟气中氮氧化物排放量；同时，设置适当高度的烟囱，加热炉燃烧烟气中的污染物排放可符合文莱当地标准的要求。试车将按以下指标进行控制：1）颗粒物：25mg/m^3（IFC）；2）二氧化硫：100mg/m^3；3）氮氧化物④：150mg/m^3。

（2）The self-built power plant of this project is configured as 5 × 380t/h CFB boiler and a 55MW steam-generator set, with 4 boilers on operation and 1 on standby. The flue gas adopts seawater desulfurization where its efficiency is designed according to 97%. It also adopts SNVR (SNCR) denitrification unit, reducing agent adopts urea solution and denitration efficiency is 40% as well as adopting electric-bag filter to remove dust where the dust removal efficiency is higher than 99.9%. The emission concentrations of SO2, NOx, and dust are controlled to be less than 100 mg/Nm³ and 30 mg/Nm³ respectively where flue gas is emitted into the atmosphere through a stack of 150 meters high.

本工程自建燃煤电站，配置为 5×380t/h CFB 锅炉+55MW 汽轮发电机组，锅炉为 4 运 1 备。烟气采用海水脱硫，海水脱硫效率按按 97%设计；采用 SNVR(SNCR)脱硝装置，还原剂采用尿素溶液，脱硝效率 40%；采用电袋除尘器除尘，除尘效率＞99.9%，最终 SO_2、NOx 和烟尘的排尘的排放浓度分别控制在小于 100mg/Nm³ 和 30mg/Nm³，烟气经 150 米高的烟囱排入大气。

9.3.2.2 Vented Gas Emissions Control 放空气体排放控制

（1）The hydrocarbon gases emitted by the safety valves of each unit are emitted into the flare system. The gas emitted during the accident and during the start-up/shutdown phase are also emitted into the flare gas system. The flare gas emitted from the normal emission of the unit is emitted into a gas holder, and this flare gas enters fuel gas pipeline network of entire plant to achieve the recovery of the flare gas.

各装置安全阀启跳放出的烃类气体，均排入火炬系统。在事故状态下排出的和开停工阶段排出的气体也排入火炬系统。装置正常排放时的火炬气排入气柜，然后进入全厂燃料气管网，实现火炬气的回收。

（2）The flare of this project is set-up according to “high, low and acid gas”. The entire plant has 3 sets of high-rack flare, one set of high-pressure flare that serves high-pressure flare gas emitted from Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit, Hydrocracking Unit and etc. where its processing capacity is 261.6t/h. The other set is low-pressure flare that serves low-pressure flare gas emitted from Atmospheric and Vacuum Unit, Light Ends Recovery Unit, Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit, Flexicoking Unit, Parex Unit, Sulfur Recovery Unit and etc. and its processing capacity is 1910.6t/h. It also serves low-low pressure flare system from PSA Unit, Aromatics Unit, Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit and Hydrocracking Unit and etc. where the downstream of this system is merged into the low-pressure flare gas system. Acid gas flare of the entire plant is responsible for the acidic flare gas emitted by units such as Sourwater Stripping Unit, Solvent Regeneration Unit, and Sulfur Recovery Unit. The high pressure, low pressure and acid gas flares are bundled together

and have a height of 155m.

本项目火炬按高、低、酸性气设置，全厂设置三套高架火炬，一套为高压火炬，服务于煤油加氢、柴油加氢、加氢裂化等装置排放的高压火炬气，处理能力为 261.6t/h；另一套为低压火炬，服务于常减压、轻烃回收、煤油加氢、柴油加氢、灵活焦化、对二甲苯、硫磺回收等装置排放的低压火炬气，处理能力为 1910.6t/h；另设置有低低压火炬系统，服务于 PSA 装置、芳烃联合装置、煤油柴油加氢装置和加氢裂化装置，后路并入低压火炬气系统。全厂酸性气火炬负责酸性水汽提、溶剂再生、硫磺回收等装置排放的酸性火炬气。高、低压和酸性气火炬采用捆绑共架，高度为 155m。

（3）Flexi gas produced by the Flexicoking Unit is normally sent to furnace of Aromatics Unit, and the excess part is sent to the power station oil boiler for use. When the Aromatics Unit is shut down or when accidents occur, flexi gas is sent to flexi gas flare which is located in its own units for treatment. The acid gas generated by the unit is normally returned to Sulfur Recovery Unit for treatment, or to the acid gas flare if it is under accident state.

灵活焦化装置产生的灵活气，正常情况下灵活气去芳烃联合装置加热炉，过剩部分送至油锅炉使用。当芳烃联合装置停工或事故时，灵活气去本装置灵活气火炬处理。装置产生的酸性气正常情况下去硫磺回收装置回收处理，事故状态下去酸性气火炬处理。

9.3.2.3 Unorganized Emission Control 无组织排放控制

（1）To reduce unorganized emissions of hydrocarbons, Class IA liquids (LPG), pentane oils, and light gas oil blending components use pressure spherical tanks; Class IB and IIA liquids (such as gasoline, aviation kerosene, heavy naphtha, aromatic and light oil products) use internal floating roof tanks; crude oil tanks are used for external floating roof tanks; condensate oils uses internal floating roof tanks which are made of steel; Class IIB and C liquids (light wax oil, diesel oil, vacuum heavy oil and other heavy oil products) use dome roof tanks. Hydrogenation feedstock, reforming feedstock, aromatic feedstock and other storage tanks are nitrogen sealed. Non-leakage pumps and sealed samplers are used for toxic medium such as benzene and etc.

为减少烃类无组织排放，甲 A 类液体（LPG）、戊烷油、轻质气油调和组分，选用压力球罐；甲 B 和乙 A 类液体（如汽油、航空煤油、重石脑油、芳烃及轻质油品）选用内浮顶罐；原油选用外浮顶罐；凝析油选用带钢制的内浮顶拱顶罐；乙 B 和丙类液体（轻蜡油、柴油、减压重油等重质油品）选用拱顶罐。加氢原料、重整原料、芳烃原油等储罐设氮封。苯等有毒介质采用无泄漏泵和密闭采样器。

（2）The use of submerged loading operations reduces the splash and disturbance of liquids and reduces the volatilization losses in the process of loading ships.

采用浸没式装船的作业方式，减少液体的飞溅与扰动，降低装船舶过程中的挥发损耗。

（3）A total of two oil vapor recovery facilities have been set up in the plant, where oil vapor recovery facility (2) is located in the western jetties truck loading station to recover volatile gas during loading such as gasoline and aviation kerosene. The processing capacity is considered in accordance with the maximum simultaneous loading amount which is 600m^3/h. The oil vapor recovery facility (1) is located at Western Jetties and is used for recycling waste gas during loading for berths #1 and #2 gasoline, diesel, aviation kerosene, paraxylene, heavy aromatics,

and chemical light oil (light naphtha, raffinate), refined naphtha oil (raffinate), and its processing capacity shall be considered as the maximum loading capacity of a 50,000 tons ship which is 5700m³/h;

全厂共设置 2 处油气回收设施，其中油气回收设施（二）位于西码头汽车装车站内，对汽油、航空煤油的装车挥发气体进行回收，处理量按照最大同时装车量考虑，处理量为 600m³/h。油气回收设施（一）位于西码头，用于 1#、2#泊位汽油、柴油、航空煤油、、对二甲苯、重芳烃、化工轻油（轻石脑油、非芳）、精制石脑油（非芳）装船废气的回收，处理量按最大装载一艘 5 万吨级船考虑，处理量 5700m³/h；

（4）Oil vapor recovery facilities (1) and (2) adopt the oil vapor recovery method of activated carbon adsorption + solvent absorption. A set of activated carbon adsorption system consists of two activated carbon adsorption column and a vacuum regeneration system. The hydrocarbons in oil vapor are adsorbed through an activated carbon adsorption column. Another adsorption column simultaneously undergoes vacuum regeneration and desorbed hydrocarbons. The hydrocarbons recovered by vacuum desorption are sent to an absorption column in the regeneration section where hydrocarbons are absorbed by the liquid solvent. The solvent is gasoline.

油气回收设施（一）、（二）采用活性炭吸附+溶剂吸收的油气回收方式。一套活性炭吸附系统包括两个活性碳吸附塔和一个真空再生系统，油气通过一个活性炭吸附塔吸附其中的碳氢化合物，另外一个吸附塔同时进行真空再生，解析碳氢化合物。被真空解析回收的碳氢化合物被送至再生工段的一个吸收塔，在吸收塔内碳氢化合物被液体溶剂吸收，溶剂为汽油。

Table 9-4 Oil Vapor Recycle Facilities Gas Emissions Control Index

表 9-4 油气回收设施排放气控制指标

Item 项目	Control Index 控制指标
NMHC	≤10g/Nm³
Benzene 苯	≤5mg/Nm³
Toluene 甲苯	≤40mg/Nm³
Xylene 二甲苯	≤70mg/Nm³

9.3.2.4 Hydrogen Sulfide Gas Treatment 含硫化氢气体的处理

The Sulfur Recovery Unit scale of this project is 60,000 tons/year, adopting "two series of Sour Recovery Unit and two series of Tail Gas Treatment Unit" treatment technology. Among them, two series of Sulfur Recovery Unit share one set of Solvent Regeneration Unit, and the operation elasticity is 30 to 110%, and the annual operating hours are 8400 hours. The unit adopts “ZHSR” sulfur recovery technology from Zhenhai Petrochemical Engineering Co., Ltd.,

which consists of two parts: Claus, tail gas hydrogenation, absorption, and incineration. Tail gas heating method is as follows: Claus unit 2 stages reactor, and the hydrogenation reactor is heated with steam. Incinerator waste gas will be controlled according to the following index; 1) smoke dust: 30 mg/m^3; 2) sulfur dioxide: 150 mg/m^3; 3) hydrogen sulfide: 5 mg/m^3; 4) nitrogen oxide: 200 mg/m^3

本项目硫磺回收规模为 6+6 万吨/年，采用“两头两尾”+两列尾气处理工艺。其中两系列硫磺共用一套溶剂再生，操作弹性 30～110%，年开工时数为 8400 小时。装置采用镇海石化工程公司的“ZHSR”硫回收技术，由二级克劳斯、尾气加氢还原+吸收和焚烧三部分。尾气加热方式为：克劳斯单元一二级反应器、加氢反应器采用蒸汽加热。 焚烧炉废气将按以下指标控制;1）烟尘：30mg/m^3；2）二氧化硫：150mg/m^3；3）硫化氢：5mg/m^3；4）氮氧化物：200mg/m^3

9.3.2.5 Odoros Gas Control 恶臭气体的控制

（1）Sourwater Stripping Unit, Solvent Regeneration Unit and Sulfur Recovery Unit of this project forms a desulfurization complex unit. The odoros gases of the complex unit mainly come from Sourwater Stripping Unit and raw water tanks. The light oil vapor is degassed from the top of the raw water tank and is emitted to the low-pressure fuel gas system outside the plant. Sourwater Stripping Unit is equipped with a total of 4 acid water tanks, and water absorption and amine absorption method are adopted. After absorption, the rich amine is regenerated by Solvent Regeneration Unit.

本项目酸性水汽提装置、溶剂再生装置和硫磺回收装置组成脱硫联合装置。联合装置的恶臭气体主要来自酸性水汽提装置和原料水罐。原料水罐脱气罐顶的轻油气，排至装置外的低压瓦斯系统。酸性水汽提装置共设有 4 个酸性水罐，采有水封加胺吸收法，吸收后的富胺液经溶剂再生装置再生。

（2）The facilities such as oil separation, flotation tanks, aeration tanks, slop oil tanks, sludge thickening tanks, and sludge tanks of Wastewater Treatment Plant adopt sealing measures. The collected odoros gases are washed with water and biological packing column to remove the total hydrocarbons, hydrogen sulfide, odoros gases and other pollutants in the waste gas, and are emitted after being adsorbed by activated carbon fibers, where the emitted gas meets the requirements of GB31570-2015.

污水处理场隔油、浮选、曝气池、污油罐、油泥浓缩罐、污泥罐等设施均采用密闭措施，收集的恶臭气体通过水洗和生物填料塔去除废气中的总烃、硫化氢、恶臭等污染物，再经活性炭纤维吸附后排放，排放的废气达到 GB31570-2015 要求。

Table 9-5 Wastewater Treatment Plant Odoros Gas Emission Control Index

表 9-5 污水处理站恶臭气体排放控制指标

Analysis Item 分析项目	Control Index 控制指标	Analysis Frequency 分析频次	Remark 备注
Ammonia 氨	4.9 kg/l	1 time/month 1 次/月	GB14554-93，Grade 1 一级

Hydrogen Sulfide 硫化氢	0.33kg/l	1 time/month 1 次/月	GB14554-93，Grade 1 一级
Odor Concentration 臭气浓度	2000（无量纲）	1 time/month 1 次/月	GB14554-93，Grade 1 一级
Non-methane Total Hydrocarbons 非甲烷总烃	120	1 time/month 1 次/月	GB31570-2015
Methyl Mercaptan 甲硫醇	0.12 kg/l	1 time/month 1 次/月	“Emission Standard of Odoros Pollutants” GB14554-93, Grade 1 《恶臭污染物排放标准》GB14554-93，一级
Dimethyl Sulfide 甲硫醚	0.9 kg/l	1 time/annum 1 次/年	GB14554-93，Grade 1 一级
Dimethyl Ether 二甲二醚	1.2 kg/l	1 time/month 1 次/月	GB14554-93，Grade 1 一级
Carbon Disulfide 二硫化碳	4.2 kg/l	1 time/month 1 次/月	GB14554-93，Grade 1 一级
Benzene 苯	4	1 time/month 1 次/月	GB31570-2015
Toluene 甲苯	15	1 time/month 1 次/月	GB31570-2015
Xylene 二甲苯	20	1 time/month 1 次/月	GB31570-2015

9.3.3 Solid Waste 固体废物

9.3.3.1 Solid Waste Classification and Disposal Direction 固体废物类别及处理去向

The wastes generated in this project are first considered for comprehensive utilization. Wastes without comprehensive utilization value shall be considered for incineration for power plant boilers or sent to qualified units outside the company for harmless treatment.

本项目产生的废物首先考虑综合利用，无综合利用价值的废物再考虑送煤电站锅炉焚烧或外委有资质的单位进行无害化处理。

（1）Wastewater Treatment Plant “Three Sludge” 污水场“三泥”

The oil sludge, scum and residual activated sludge generated in Wastewater Treatment Plant will be sent to power plant boiler for incineration treatment after centrifugal dewatering in Wastewater Treatment Plant.

污水处理场产生的油泥、浮渣、剩余活性污泥，在污水场进行离心脱水后送煤电站锅炉焚烧处理。

（2）Alkali Waste 碱渣

The alkali residue from this project mainly comes from the refining unit and Flexicoking Unit. Alkali reisude of Flexicoking Unit is prioritized to send to Sourwater Stripping Unit, the refined alkali residue is sent to saline wastewater treatment series of Wastewater Treatment Plant for treatment.

本项目碱渣主要来自精制装置与灵活焦化装置，灵活焦化碱渣优先考虑去酸性水汽提装置；精制碱渣送往污水处理场含盐污水系列进行处理。

（3）Spent Catalyst and Its Carrier 废催化剂及其载体

1）All catalysts should be sufficiently purged prior to discharge to remove as much hydrocarbons as possible which are entrained onto the surface of catalyst. Different treatment methods will be use on the spend catalyst depending on the properties of their components. The catalyst will be temporarily stored in temporary transfer warehouse for recycling during the unloading and unprocessed period.

所有催化剂在卸出之前都应经充分的吹扫，以尽量除去附在上面的烃类。废催化剂将根据其组分性质采用不同的处理方法。催化剂在卸出未处理期间，将暂存在回废临时中转库。

2）The project will cooperate with patent-related manufacturers to go through the export procedure where precious metals and spent catalyst is required for recycled. Other spent catalysts, waste ceramic balls and etc. that cannot be recycled will be outsourced to undergo further treatment.

含贵重金属以及涉及专利的厂家要求回收的废催化剂，项目将配合其办理出境手续。对其它不能回收的废催化剂和废瓷球等将外委进行处理。

3）Waste white clay discharged from Paraxylene Complex Unit will be sent to power plant to undergo treatment by blending and incineration.

对二甲苯联合装置排放的废白土，将送煤电站进行掺烧处理。

（4）Tank Bottom Sludge 罐底油泥

Crude oil tanks will be cleaned once in 5 years, and tank bottom sludge generated during tanks cleaning will be sent to power plant boilers for incineration.

原油罐 5 年清理一次，油罐清罐时产生的罐底油泥将送煤电站锅炉进行焚烧处理。

（5）Waste Activated Carbon 废活性炭

The waste activated carbon of oil vapor recovery facilites is sent to the power plant for incineration.

油气回收的废活性炭，送煤电站进行焚烧处理。

（6）Waste Solvent 废溶剂

Sulfolane of Aromatics Unit produced by Extractive Distillation Unit will be sent to the power plant for incineration.

芳烃联合装置芳烃抽调提产生的废环丁砜，送煤电站进行焚烧处理。

（7）Boiler Ash 锅炉灰渣

Flying ash from power station boiler will transported away by the local cement mixing plant operator in Brunei for comprehensive utilization. The power plant boiler slag will be sent to the ash dump.

电站锅煤炉飞灰将由文莱当地混凝土搅拌站经营企业运走进行综合利用。煤电站锅炉炉渣将送至灰渣场。

9.4 The Difficulties and Countermeasures of Commissioning Environmental Protection Management 试车环保管理难点与对策

The PMB project is located on the island of Pulau Muara Besar. There are not many resources that can be relied on in the surrounding. For initial operation, there are many influencing factors involving environmental protection. Among them, the difficulties and countermeasures of environmental protection management are as follows:

PMB 项目地处文莱大摩拉岛，周边可依靠的资源不多。首次开工，涉及环保的影响因素较多，其中环保管理的难点与对策如下：

Table 9-6 Difficulties and Countermeasures of Commissioning Environmental Protection Management

表 9-6 试车环保管理难点与对策

No. 序号	Management Difficulties 管理难点	Countermeasures 对策
1	Chemical cleaning generates wastewater and waste chemicals about 2000m^3 化学清洗产生废水和废药剂约 2000m^3	Stores in wastewater tanks, undergoes normal treatment when operation starts, and chemical cleaning water collection management system and plan is to be established before commissioning 存放污水罐，待开工正常处理，并制定试车前化学清洗水收集管理制度与方案
2	The amount of sour water produced from the initial operation of Atmospheric and Vacuum Distillation Unit is not enough to meet the requirement for starting up Sulfur Recovery Unit 常减压首次开工备料产生的酸性水数量较	Stores in sour water tanks, undergoes treatment during full commissioning period 存放在酸性水罐，待全面试车期间处理

No. 序号	Management Difficulties 管理难点	Countermeasures 对策
	少不能满足硫磺回收开工要求	
3	The amount of dry gas and liquefied gas produced during the initial operation of Atmospheric and Vacuum Distillation Unit is relatively small, and the processed crude oil is low-sulfur, and acid gas from Solvent Regeneration Unit cannot meet the requirements for start-up of Sulfur Recovery Unit. 常减压首次开工备料生产的干气和液化气数量较少，且加工的为低硫原油，溶剂再生脱除的酸性气不能满足硫磺回收开工要求	Solvent Regeneration Unit operates according to the conditions of non-renewable absorption to avoid acid gas emitted to flares; at the same time, the operation department develops special emergency response plan 溶剂再生单元按吸收不再生的工况运行，避免酸性气放火炬；同时，运行部制定专项应急预案
4	Cultivation and acclimatization of activated sludge in Wastewater Treatment Plant 污水处理场活性污泥的培养与驯化	Develops sludge cultivation and acclimatization plan, undergo activated sludge culture and acclimatization in advance 制定污泥培养与驯化方案，提前进行活性污泥培养与驯化
5	Impacts on Wastewater Treatment Plant by water from other units 装置来水冲击污水处理场	Implement wastewater classification control 实行污水分级控制
6	Alkaline residue wastewater treatment 含碱渣废水的处理	Wastewater Treatment Plant develops alkaline residue wastewater treatment plan 污水处理场制定碱渣废水处理方案
7	Impact on Wastewater Treatment Plant by abnormal wastewater drainage 异常排污的冲击污水处理场	Develops unit's wastewater discharge management system with discharge index conduct assessment 制定装置污水外排管理制度与排放指标并进行考核
8	Oily wastewater collection and treatment 含油废物的收集与处理	Equiped with oil absorption felt, oil receiving plate, hazardous waste barrels, corresponding transfer vehicles and etc. 配备吸油毡、接油盘、危废桶及相应的转运车辆等
9	Wastewater Treatment Plant "three sludges" sent to power plant for incineration	Develops "three sludges" sent to power plant transfer and incineration plan 制定"三泥"去煤电站转运及焚烧方案

No. 序号	Management Difficulties 管理难点	Countermeasures 对策
	污水处理场“三泥”去煤电站焚烧处理	
10	Acid gas balance and timely start-up of Sulfur Recovery Unit 酸性气平衡及硫磺装置的适时开车	Optimize the start-up sequence to reduce acid gas emit to flare 优化开工顺序，减少酸性气放火炬
11	Timely operation of flare gas recovery system and control of smoke emission from flare disturbing residents 火炬气回收及时投用及火炬放空浓烟扰民的控制	Optimize the start-up sequence and timely use the flare gas recovery system to reduce the time of emission to flare. 优化开工顺序，及时投用火炬气回收系统减少放火炬时间。
12	Control of coal, flying ash, ash dust from power plant 煤电站煤、飞灰、灰渣粉尘的控制	Develops and implement coal, flying ash and ash dust control plan, and timely put dust collection facilities on operation 制定并落实煤、飞灰、灰渣粉尘控制方案，及时投运除尘设施。
13	Excessive Noise Control 噪声超标的控制	Develops noise control plan to minimize steam venting. 制定噪声控制方案，尽量减少蒸汽放空。
14	Radiation source transportation, installation and control 放射源的运输、安装与管控	Develops management system for storage, transportation, installation and detection of radioactive sources. 制定放射源贮存、运输、安装与检测管理制度。
15	Unorganized waste gas emission control 无组织废气排放控制	Timely filled nitrogen to nitrogen seal tank, put oil vapor recovery facilities and odor treatment facilities of Wastewater Treatment Plant into operation in a timely manner. 氮封罐适时充氮，油气回收设施、污水处理站臭气处理设施及时投运。
16	Handling of environmental protection related procedures 环保相关手续的办理	Communicate with government’s environmental protection department and prepare relevant data in advance. 与政府环保部门沟通，提前做好相关资料的准备。

9.5 Environmental Protection Condition for Commissioning 试车环保条件

See Table 9-7 and 9-8 for details

详见表 9-7、9-8

9.5.1 External Condition 外部条件

Table 9-7 HYBN PMB Environmental Protection External Inspection Checklist for General Commissioning

表 9-7 HYBN PMB 总体试车环保外部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
1	Safety Case has passed safety case 已通过					
2	Industrial emissions permit is being processed 工业排放许可已办理					
3	Emergency response plan is approved and filed 应急预案通过审核并备案					
4	Radiation permit is being processed 辐射许可已办理					
5	Catalyst regeneration and hazardous waste solid contracts is signed 催化剂再生及危险废固合同已签订					
6	Direction of general solid waste, domestic waste and etc. is being implemented 一般固废、生活垃圾等去向已落实					

9.5.1 External Condition 外部条件

Table 9-7 HYBN PMB Environmental Protection External Inspection Checklist for General Commissioning

表 9-7 HYBN PMB 总体试车环保外部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
7	Environmental protection information notification of trial-operation (local environmental protection department, neighboring units, communities) 开工试生产环保信息告知（地方环保部门、周边单位、社区）					
8	Written Notification of Trial-operation 试生产 Written notification					

9.5.2 Commissioning Internal Condition 试车内部条件

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
1	Utilities (water, steam, air, power and etc.) is being introduced into unit and is being supplied normally 公用工程（水、汽、风、电等）已引入装置并供给正常					
2	Production command, dispatch communication system has been established 生产指挥、调度通讯系统已建立					
3	System has been established and is able to support the operation of the plant 体系已建立并能够支持开车运行					
4	Relevant systems, procedures and specifications of the company have been developed and implemented 公司相关制度、程序和规范已制定并开始执行					
5	Various environmental protection management systems have been established in the operation department 运行部各项环保管理制度已建立					
6	Start-up organization structure has been established 开工组织架构已成立					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
7	All levels of management personnel, technicians and operators have been implemented 各级管理、技术及操作人员已落实					
8	Clear division of job responsibilities 岗位职责分工明确					
9	EIA recommendations and approvals have been implemented 环评建议及批复已落实					
10	Environmental risk identification and risk assessment have been carried out, and the countermeasures have been implemented and developed 已进行环境风险辨识与风险评估，已落实并制定应对措施					
11	Various types of production, operations and technical specifications have been prepared, reviewed and approved, and distributed to the corresponding personnel. 各类运行、操作与技术规程已编制并经审核审批，并发					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
	放至相应人员手中					
12	Basic data such as PID, PFD, interlocking manuals, operation records, and other necessary data for commissioning are compiled, reviewed and distributed to job post. 基础资料如 PID、PFD、联锁手册，操作记录等试车必需的资料编制审核完毕并分发到岗位					
13	Commissioning plan undergoes disclosure, learning and discussion 试车方案进行交底、学习、讨论					
14	EMD and plant's internal environmental protection analysis monitoring plan and analysis method have been implemented EMD 及厂内环保分析监测计划、分析方法已落实					
15	Process control index and process cards have been implemented					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

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	工艺控制指标及工艺卡片已落实					
16	The environmental protection facilities have been fully constructed according to the design without omission 环保设施按设计全面施工完毕、无遗漏					
17	The environmental protection project quality meets the requirements 涉及环保工程质量符合要求					
18	The intermediate handover procedure has been completed 中间交接手续已办理					
19	Problems found in “Punch Listing” have been amended and rectified “三查四定”发现的问题已整改，消缺完成					
20	Equipment number, medium name, flow direction signs are completed 设备位号、介质名称、流向标志齐全					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
21	Ditches, pool, tanks, wells, pits and other equipment and facilities are cleaned, and there are no debris on site 沟、池、罐、井、坑等设备设施清理干净，现场无杂物					
22	On-site clean/wastewater separation facilities have been improved 现场清污分流设施已完善					
23	System purge, cleaning, gas leak test are completed 系统吹扫、清洗、气密完成					
24	The sampling port and monitoring point meet the requirements 取样口、监测点符合要求					
25	Wastewater Treatment Plant biochemical sludge has been acclimatized and qualified to receive wastewater 污水处理场生化污泥已驯化合格并具备接收污水的条件					
26	Post tools are fully equipped					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

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	岗位工具配备齐全					
27	Accessories for environmental protection facilities have been prepared 环保设施配件已备					
28	Relevant person in charge of design unit, patent technology supplier and construction unit are in place 设计单位、专利技术供应商、施工单位相关负责人已到位					
29	The site is equipped with temporary hazardous waste storage barrels, general solid storage barrels, garbage cans, oil receiving plates and etc. 现场配备临时危险废物储存桶、一般固体储存桶、垃圾桶、接油盘等					
30	DCS configuration and instrument debugging is completed DCS 组态、仪表调试完成					
31	Computer, instrumentation detection, control,					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
	interlocking, alarm and other adjustments are completed, accurate and reliable 计算机、仪表检测、控制、联锁、报警等调校完毕、准确可靠					
32	LIMS system has been fully debugged LIMS 系统已上线调试完备					
33	Online analysis instrument is debugged and is ready for use 在线分析仪表经调试具备使用条件					
34	Preparation of all kinds of chemical dose is completed 各类药剂准备完毕					
35	Problems found during commissioning is being handled 联动试车发现的问题已处理					
36	Similar unit internship training is completed 同类装置实习培训已完成					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

No. 序号	Condition to be Met Before Feeding 投料前应具备的条件	Inspection Status 检查情况	Responsible Department 负责部门	Completion Status 完成情况	Person in Charge 负责人	Remark 备注
37	Post training, simulated training, and anti-accident training have been carried out 已进行岗位练兵、模拟练兵、反事故练兵					
38	All kinds of job training and assessment are qualified, and obtained job qualification certificate 各工种培训考核合格，取得上岗资格证					
39	Similar unit accident cases in China and countries abroad have been compiled and studied 已编制国内外同类装置事故案例并组织学习。					
40	Emergency supplies and emergency teams are prepared 应急物资、应急队伍已配备					
41	Emergency response plan has been rehearsed 应急预案已进行演练					
42	Analysis instrument are equipped and debugging is completed 分析仪器已配备并调试完毕					

Table 9-8 HYBN PMB Environmental Protection Internal Inspection Checklist for General Commissioning

表 9-8 HYBN PMB 总体试车环保内部条件检查确认表

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43	Chemicals are prepared 化学药品已备齐					
44	Analytical procedures are prepared 分析规程已配备					
45	Sampling point has been determined and sampling equipment has been implemented 采样点已确定、采样器具已落实					

9.6 Environmental Monitroing 环境监测

Environmental monitoring station is set-up inside central laboratory of HYBN PMB Project. During the commissioning, the company's environmental protection management system and environmental monitoring plan are used to carry out routine monitoring of wastewater, waste gas, solid waste, and noise emitted by various units.
HYBN PMB 项目中心化验室内设环保监测站，试车期间按公司环保管理制度及环境监测计划对各装置排放的废水、废气、固体 废物及噪声进行日常监测。

10 Health & Safety of Labor and FireFighting 劳动安全卫生及消防

10.1 Unit Start-up HSE Guideline Principle 装置开工 HSE 指导原则

10.1.1 HSE Management Policy and Objectives HSE 管理方针、目标

10.1.1.1 HSE Management Policy: HSE Management of Hengyi Industries Sdn. Bhd. is committed to implementing and continuously promoting health, safety, environmental protection, security and environmental protection for our activities and the surrounding communities.
HSE 管理方针：恒逸文莱（实业）公司 HSE 管理致力于为我们的活动和社区周边地区实施和不断促进健康、安全、环保、安保和环境保护。
（1）Health: To ensure the health and well-being of employees and surrounding communities;
健康：确保员工和周围社区的健康和福利；
（2）Security: Ensure that all risks and hazards are reduced to as low as reasonably possible (ALARP) level;
安全：确保所有风险和危害降低到合理可行的最低水平（ALARP）；
（3）Security: Ensuring a good system and good organization;
安保：确保拥有安全的系统和良好的组织；
（4）Environment: Ensure that the environment is protected according to Brunei government and international requirements.
环境：根据文莱政府和国际要求确保环境受到保护。
10.1.1.2 HSE Management Objectives: Zero harm, zero accidents, zero pollution, creating a world-class HSE performance.
HSE 管理目标：零伤害、零事故、零污染，创国际一流的 HSE 业绩。

10.1.2 HSE Management Principles HSE 管理原则

10.1.2.1 Adhere to the "safety first" principle and correctly handle the relationship between safety and quality, progress and benefits. When there is a conflict between safety and commissioning schedules, it must be subordinated to the need for safe work. The implementation of the principles of safety and health shall be such that there will be no violation of one rule; no injury to one person; no light up of fire; no mistake on opening a valve; no missing blind plate; no erroneous operation accident; no fire, explosion and pollution accidents; ensuring successful start-up in one single attempt.

坚持“安全第一”的原则，正确处理安全与质量、进度和效益的关系，当安全与试车进度发生矛盾时，必须服从安全工作的需要。安全卫生各项原则的落实，做到不出现一次违章；不伤一个人；不着一把火；不开错一个阀门；不漏掉一块盲板；不发生错误操作事故；不发生火灾、爆炸和污染事故；确保一次开车成功。

10.1.2.2 Establish and improve HSE organization and management structure, make overall plans for various HSE management work involved in coordinating the management of start-up process of the unit. Supervise and inspect the implementation of various safety management systems as well as checking and confirming all safety measures before start-up. Earnestly implement the principle of “the person in charge shall be the responsible person” to ensure the “three simultaneous” of safety facilities and main projects.

建立健全 HSE 组织管理机构，统筹协调管理装置开工过程中所涉及的各项 HSE 管理工作，监督检查各项安全管理制度的执行情况，检查确认开工前各项安全措施。认真落实“谁主管、谁负责”原则，确保安全设施与主体工程的“三同时”。

10.1.2.3 All employees participating in commissioning should establish "safety and prevention first" ideology, earnestly implement various safety management systems, define the safety responsibilities at all levels, and master safety technical operating procedures.

参加试车的全体员工树立“安全第一、预防为主”的思想，认真贯彻落实各项安全管理制度，明确各级安全责任，熟练掌握安全技术操作规程。

10.1.2.4 Strengthen personnels’ safety skills, all personnel who participate in commission-ing shall conduct a full safety technical regulation, post operating procedures, and skills on using gas protection equipmen. They are allowed to take the post only when they passed the exam.

强化员工的安全技能，对所有参加试车的人员进行全面的安全技术规程、岗位操作规程、消（气）防器材使用技能等方面的培训，经考试合格后，方可上岗。

10.1.2.5 Organize and carry out hazard identification and risk assessment activities, carefully analyze the possible hazards and environmental influencing factors in the process of start-up, and develops practical and feasible risk control measures, and implement them in the start-up plan for each unit.

组织开展危害识别、风险评估活动，认真分析查找开车过程中可能存在的危险及环境影响因素，制定切实可行的风险控制措施，落实到各装置的开工方案中。

10.1.2.6 Aiming at the dangers and harmful factors existing in the unit and accidents that may occur, prepare a practical and on-site emergency response accident plan, and organize the employees to conduct drills to familiarize the employees with the procedures and steps of the accident emergency response plan.

针对装置存在的危险有害因素和可能出现的事故，编制切实可行的现场应急处置事故预案，并组织员工进行演练，使员工熟悉、掌握事故应急处理预案的程序和步骤。

10.1.2.7 According to the characteristics of each unit, a corresponding checklist is prepared by qualified person. In accordance with the contents of the checklist to organize a comprehensive three levels of inspection and confirmation. Assign qualified person who is responsible of eliminating defects on identified problems and hazards and implement a closed-loop management.

根据各装置的特点分专业编制相应的检查表，按照检查表的内容组织全面的三级检查确认，对查出的问题和隐患落实专人负责逐项消缺，闭环管理。

10.1.2.8 Implementing grade by grade confirmation on major operation procedure system.

执行重大操作步骤逐级确认制度。

10.1.2.9 In the process of start-up, safety work must always be the first priority and start-up should not be carried out when the plan is not implemented; when the condition is not met; when the procedure is not clear; when health and safety facilities is not used, when the problems occur is not solved.

开车过程中，安全工作要始终放在第一位，切实做到六不开车：方案不落实不开车；条件不具备不开车；程序不清楚不开车；指挥不在场不开车；安全卫生设施不投用不开车；出现问题不解决不开车。

10.1.3 Health and Safety of Labor 劳动安全卫生

10.1.3.1 Since the materials of each unit can cause harm to human body, the equipment adopts closed and continuous production. In the production area, anti-corrosion and toxin protection equipment are provided as required, including H_2S and organic canisters and positive pressure air respirator. Employees should understand and grasp the properties of toxic substances, dangerous hazards of unit and the use of protective equipment, and wear personal protective equipment as required. A monitoring probe is installed at a location where H_2S leakage is likely to occur, and alarm can be displayed on DCS of the operation room, furthermore operators should wear a portable H_2S detector when on-site.

由于各装置的物料均能对人体构成伤害，所以设备采用密闭连续生产。生产区内按要求设置防腐蚀、防毒劳保用品，包括 H_2S、有机物滤毒罐及正压式空气呼吸器。职工应了解和掌握有毒物质的性质、装置的危险危害因素及防护用品的使用，并按需佩戴个人劳动防护用品。在容易发生 H_2S 泄漏的部位设置了监测探头，并在操作室 DCS 上有报警显示，操作人员佩戴便携式 H_2S 检测仪。

10.1.3.2 The maximum sound pressure level measured at a distance of 1 meter from the surface of the equipment shall not exceed 85 decibels, in accordance with the noise regulations in GB10069. Employees should wear noise-protection earplugs in a noise pollutant area. Table lighting of the control room should not be less than 300 LUX, where platform, pump room, ladder, etc. should not be less than 50 LUX

在距离设备表面 1 米处测得的最大声压水平应不超过 85 分贝，符合 GB10069 中的噪声规定。在噪声大的岗位职工应配备防噪声耳塞。控制室工作台照明不小于 300 LUX，平台、泵房、梯子等处不小于 50 LUX。

10.1.3.3 According to the environmental characteristics of each job post and the existence of toxic and harmful factors, employees are provided with all kinds of necessary protective equipment and supplies, and special labor protection apparatus cabinets are provided. Management personnel and maintenance inspection systems are provided to ensure that the equipment is always available and ready for use.

根据各工作岗位的环境特点、存在的有毒有害因素，为职工配备各种必须的防护用具和用品，并设有专用的劳动保护器具柜，设有管理人员和维修检查制度，保证器具随时处在完好待用状态。

10.2 HSE Conditions That Must Be Met Before The Start-up of Unit 装置开工前必须具备的 HSE 条件

10.2.1 Safety environmental protection equipment and facilities acceptance review was passed and filed before trial operation. In the start-up plan, the key points of the safety protection supervision are required to be clearly defined and placed in the operation room in the form of board display, clarifying the respective responsibilities of all employees.

试生产前安全环保设备设施符合性验收审查通过并备案。开车方案中，安全防护监督要点要求明确，并用看板形式放置在操作室，明确全体员工各自职责。

10.2.2 Place start-up plan on the wall. Employees had already carried out the safety operation skills, toxic and hazardous protection training, and had been placed to their post after passing the exam given by their supervisor.

开工方案上墙，岗位员工已进行了安全操作技能、有毒有害岗位防护培训，经主管部门考核合格后上岗。

10.2.3 "Punch Listing" have all been implemented and rectified. The safety acceptance inspection of Class A and Class B problems have been completed and rectified before trial start-up. All defects affecting the start-up of the unit have been completely eliminated. affecting the design and modification of the commissioning. The modification of item affecting the commissioning design has been completed and a comprehensive inspection has been carried out and confirmed. All equipment, pipelines and vessels are strictly tested for leakage and pressure. Before the sealing of equipment, it is strictly checked and

confirmed by a qualified person. Equipment number, pipeline medium name and flow direction identification are completed.

“三查四定”已全部落实整改完毕，试生产前安全验收检查 A 类、B 类问题已整改完成，影响装置开工的缺陷全部消除完毕，影响投料试车设计修改项目已经完成，并进行全面检查确认。所有设备、管道、容器均进行严格试漏、试压。设备封闭前，经专人严格检查确认。设备位号、管道介质名称及流向标识齐全。

10.2.4 The installation of the “safety warning, major hazard identification and emergency tool box” warning sign involving “two major points (equipment and process) and one major accident” section was completed. All the dangerous section in the unit were set with obvious warnings and warning signs according to the relevant regulations, and warning lines were set for crucial dangerous locations.

涉及“两重点一重大”部位 的“两牌一箱”警示标牌安装完成，装置内各危险部位按有关规范设置明显的警告、提示标志，重点危险部位设置警戒线。

10.2.5 Safety valves for SO_2 concentration in tail gas emissions and safety accessories such as front and rear cut-off valves shall be adjusted, pressure-stabilized and lead sealed as required. Rupture discs, breathing valves, water seal wells and other safety facilities should be inspected and confirmed by a qualified person.

尾气排放 SO_2 浓度安全阀及前后截至阀等安全附件应按规定进行调校、定压、铅封。爆破片、呼吸阀、水封井等安全设施应专人检查确认完好情况。

10.2.6 The safety SIS system should be adjusted and calibrated before the overall commissioning to complete the evaluation of SIL. Organize instrument personnel to carry out single instrument and system calibration for interlocks, which can only be put into use after being signed by instrument mangament engineer, reviewed by the production and safety departments, and approved by the leaders of the plant. Interlock alarm value and action value are listed in the process operation card. In the process of commissioning or production, if interlocking bypass or removal of interlocking is required, the operation department shall apply for change of procedures, and relevant departments shall confirm the review and submit it to the leaders of the plant for approval.

总体试车前应对安全 SIS 系统调效、校验， 完成 SIL 评估工作。组织仪表人员对联锁进行单校和系统联校，经仪表管理工程师签字，生产、安全部门审查，厂主管领导批准后方可投入使用；联锁报警值、动作值列入工艺操作卡片。在试车或生产过程中，需要用联锁旁路或摘除联锁，应由作业部提出申请变更手续，相关部门确认审核，报厂主管领导批准。

10.2.7 The electrical, instrumentation and telecommunication equipments in explosion hazardous sites should be selected according to the explosion-proof specifications. The cable trenches should be sealed with sand and other materials when entering a unit, plant building, power distribution room, instrument control room. Explosion hazards sites are equipped with explosion-proof tools.

爆炸危险场所的电气、仪表、电讯设备均应按防爆规范选用适合的防爆产品，电缆沟在进装置、

厂房、配电间、仪表控制室时用砂子和其他材料封死。爆炸危险场所配备了防爆工具。

10.2.8 The alarm and detection system can send an alarm signal when the unit operating pressure, temperature, flow, and liquid level exceed the standard. Operators should understand the significance of the alarm and respond to it in a timely manner.

报警、检测系统在装置操作压力、温度、流量、液位超标情况下，能发出报警信号。操作人员应了解报警的意义，并及时做出相应的处理。

10.2.9 An electronic inspection device was set up in a unit area and a detailed electronic patrol inspection system was established. A detailed accident plan is required for all various possible accidents. Operators must be proficient in handling various accidents.

装置区设置电子巡检仪，并制定详细的电子巡回检查制度。对各种可能发生的事故要有详细的事故预案，操作人员要熟练掌握各种事故处理方法。

10.2.10 When the communication system is put into use, the wireless walkie-talkie is fully prepared and easy to use, the sound system in the unit area is put into use normally and is prioritized to ensure the usage of production command system, firefighting system and safety protection system. Production unit, fire fighting foam stations in tank farm, water spray and temperature and smoke sensing alarms, interlock of instrument, automatic fire alarms and combustible gas and toxic gas detectors have all been inspected and verified and are qualified to be put into use.

通讯系统投入使用，无线电对讲机准备齐全、好用，装置区扩音系统正常投用，优先保证生产指挥系统，消防系统和安全防护系统通畅。生产装置、罐区的消防泡沫站、水喷淋以及感温感烟报警器、仪表连锁、火灾自动报警、可燃气体、有毒气体检测器及仪表联锁全部经过检验校验完毕，合格并投入使用。

10.2.11 The unit’s television monitoring system is calibrated and put into use normally to ensure that all monitoring points can be normally displayed on the monitor.

装置电视监控系统调校完毕，正常投用，保证各个监控点均能在监视器上正常反映。

10.2.12 The traffic roads and fire fighting access roads in unit shall be unblocked. The temporary facilities, scaffolds, platforms, power supply and construction equipment, and all working sheds shall be dismantled, and the ground platforms inside and outside the unit shall be leveled and cleaned. All windows, doors and walls should be cleaned. Clean and clear ditch, shaft of the equipment and all equipment shall be maintained. No rubbish, weeds, no waste and no idle scattered tools shall be seen in the unit and all insulation and paint, bolts/nuts and handwheel, doors and windows, light bulb and lamp cover, as well as ditch covers shall not be lacked in the unit.

装置内交通干道、消防道路应畅通无阻，搭设的临时设施、脚手架、平台及供电与施工机具、工棚全部拆除，装置内外地面平台平整、清洁，做到“一平、二净、三见、四无、五不缺”。

10.2.13 The emergency emission line, sewage and wastewater ditch (line) shall be ensured to be unblocked, and all the water wells, open ditch, valve well, cable trench and ditch cover shall be complete.

装置紧急放空线、污水和废水沟（线）应确保畅通，所有下水井、明沟、阀井、电缆沟、沟盖板齐全。

10.2.14 The lighting facilities are complete and easy to use, and equipment accessories, protective facilities, and vertical ladder and fences are all in place. The lightning protection and anti-static facilities of the unit must meet the specifications, in good condition, qualified and is ready to put into use.

照明设施齐全好用，设备附件、防护设施、竖梯护栏齐全完好。装置防雷、防静电设施符合规范、完好、检测合格并投入使用。

10.2.15 The operator shall wear labor protection equipment in accordance with the regulations, and the firefighting equipment, gas protection equipment, alarm system and first-aid in various unit areas shall be in placed according to the regulations to achieve availability of usage for everyone.

操作人员按规定穿戴好劳动防护用品，装置各区域的灭火器材、气体防护器材、报警系统及急救药品按规定摆放就位，做到人人会用。

10.2.16 Firefighting water systems, firefighting truck and gas prevention trucks and ambulances should be in prepared status.

消防水系统、消防车辆及气防救护车辆应处于备战状态。

10.2.17 Labor safety and occupational health facilities shall be put into use.

劳动安全、职业卫生设施投入使用。

10.2.18 Trial operation (use) process safety risk identification and pre-control measures shall be implemented.

试生产（使用）过程安全风险辨识及预控措施。

10.3 HSE Management During Start-up Process 开工过程 HSE 管理

10.3.1 Strictly abide start-up plan and operating procedures, and strictly control the process parameters of each section in accordance with the process card to ensure that no oil and gas leakage, no explosion, no injury, no pressure build up, or damage to the equipment will occur during the start-up process.

严格遵守开工方案、操作规程，严格按照工艺卡片控制各部分工艺参数，确保开工过程中不跑漏油气、不着火爆炸、不伤人、不憋压、不损坏设备。

10.3.2 Operators should correctly analyze, judge and deal with the signs of showing various accidents and eliminate the ignition of accidents before the accident occured. In the event of an accident, it must be handled decisively and truthfully reported to top management to protect the site. At the same time, various records are carefully made, and illegal command, illegal operations and violation of labor discipline are strictly prohibited.

操作人员应正确分析、判断和处理各种事故苗头，把事故消灭在萌芽状态。如发生事故，要果断处理，并如实上报，保护好现场，同时认真做好各种记录，严禁各类“三违”现象。

10.3.3 Equipment safety accessories (pressure gauges, thermometers, level gauges, safety valves, firefighting valves, rupture discs, etc.) and instrument interlocks shall not be disabled without authorization. Approval procedures must be strictly carried out in accordance with regulation when stop using.

设备安全附件（压力表、温度计、液面计、安全阀、消防阀、爆破片等）及仪表联锁不得擅自停用，停用必须严格按规定办理审批手续。

10.3.4 Check the cause of the safety valve as soon as possible after it is activated. If safety valve cannot be reset under normal pressure, the safety valve can be cut-off and repaired and shall be put into operation in time. A special person shall be assigned to monitor the site to prevent overpressure.

安全阀起跳后要尽快查找原因，如压力正常安全阀仍不能复位，方可隔断安全阀并及时修复投用。现场设专人监护，防止超压。

10.3.5 Before the start-up of unit, steam (or nitrogen) is used to undergo flow test, pressure test and gas leak test to check the smoothness and leakproofness of the system. The discovered problems are promptly dealt with to ensure the safe feeding of material into the unit. Strict control of pressure to prevent the pressure exceed the design pressure of equipment and pipelines.

装置开车前使用蒸汽（或氮气）进行贯通试压气密性试验，以检查系统畅通情况和严密性，及时处理发现的问题，保证物料安全引进装置。严格控制压力不超过设备、管线设计压力。

10.3.6 There should be an assigned person (blind flange supervisor) responsible for the assembly and disassembly of the blind flange. Position, specification, installation and dismantling of the blind flange shall be marked in the list. The blind flange shall not be put into use until is confirmed by 3 levels of management. Before the materials is fed into the unit, safety facilities such as safety valves, pressure gauges, level gauges, interlocking instruments, and explosion-proof doors shall be checked.

拆装盲板应有专人（盲板司令）负责，并列表标出盲板所在的位置、规格、安装及拆除情况，经三级确认后方可投用。物料引进装置前，要检查投用安全阀、压力表、液位计、联锁仪表、防爆门等安全设施。

10.3.7 Problems such as equipment that are prone to malfunction and leakage during the beginning of start-up, it is necessary to strengthen the patrol inspection so that leaks can be discovered and handled in time. In the case where the valve cover or flange leaks under certain temperature and pressure, do not remove the bolt or remove the packing seal cover and packing seal to prevent safety accidents.

开工初期设备易出现故障、泄漏等问题，应加强巡回检查，以便及时发现、处理泄露点。在有温度和压力状态下，阀门大盖或法兰泄露，不准拆下螺栓或卸下压盖压盘根，以防发生安全事故。

10.3.8 Fuel gas pipeline shall first undergo emission of air before the ignition of furnace, pipeline is first drawn to a safe area to ignite the small flare, and then ignites the pilot light of

the furnace. Before igniting the pilot light, it should be checked and analyzed that the combustible gas index in furnace chamber is qualified to prevent injuries caused by explosion and back-fire. Temperature rises when heating up the furnace should not be too fast, it must be strictly according to the temperature curve specified in the plan. During furnace drying process, the temperature must be strictly controlled. If necessary, the furnace tube should be filled with medium to prevent the tube from being burnt out. When the temperature rises to a certain stage, it is necessary to keep the dehydration at a constant temperature, and the person in charge shall not leave during the removal of water of the equipment to prevent the materials loss entrained in water.

加热炉在点火前首先对燃料气管线进行排空气，引管线至安全地带点燃小火炬后在点燃加热炉长明灯。点长明灯前应检验分析炉膛可燃气指标合格，防止点火爆炸、回火伤人。加热炉点火升温速度不宜过快，要严格按方案规定的升温曲线进行，烘炉过程中要严格控制温度，必要时炉管内应通以介质，防止将炉管烧坏；升温到一定阶段，要保持恒温脱水，设备切水过程不得离人，以防物料跑损。

10.3.9 Equipment, facilities, pipelines and valves must be opened and closed without excessive force. Particularly in high pressure, high temperature, cryogenic, quenching systems, steam pipe networks, and other systems with accumulated condensate must be operate slowly when activate. Preheating and precooling must be carried out according to regulations when necessary. Adhere to the valve operation confirmation system, that is, report to the supervisor and the person in charge after the post operation is completed, and the operation of the valve shall undergo review and confirmation.

设备设施、管线阀门的开、关不能用力过猛，特别是高压、高温、深冷、急冷系统和蒸汽管网及其他有冷凝液积存的系统，开启一定要缓慢操作，必要时要按规定进行预热和预冷。坚持阀门操作确认制度，即岗位操作完毕后汇报班长或分管，对阀门的操作进行复查、确认。

10.3.10 When cold exchange equipment is started, cold flow should be introduced first and before hot flow. The flow speed should be slow to prevent leakage due to uneven heat and cold inside and outside the equipment. It is not easy to find the leaks inside the equipment, and attention should be given to check the system from preventing high pressure flow leaking into low pressure flow.

冷换设备的启用，应先引进冷流，后引进热流，速度要缓慢，以防设备内外冷热不均而泄露；设备内部泄露不易发现，要注意检查压力高的漏进压力低的系统。

10.3.11 It is forbidden to use valve spanners, wrenchs, hammers, and other tools to knock and hit flammable and explosive material pipelines or equipment. If maintenance or shutdown is required, it can only be carried out after the shutdown and depressurization analysis are qualified.

禁止用阀门扳手、套把、铁锤等器具随意敲打、撞击易燃易爆物料管线或设备，需要检修、停运的应停运、撤压分析合格后方可进行。

10.3.12 It is forbidden to discharge high-temperature materials and flammable, explosive

and toxic substances on the spot or discharge them into the sewage facilities.
严禁将高温物料及易燃、易爆、有毒物质随意就地排放或排入下水设施内。

10.3.13 During commissioning, hot work operation, confined space operation, ground-breaking operation, temporary electric usage operation, high-altitude operation and etc. must be handled in accordance with regulations to apply operation permit before a construction operation can be carried out.
试车过程中动火作业、进入受限空间作业、动土作业、临时用电作业、高空作业等必须按规定办理作业许可证方可进行施工作业。

10.3.14 During the commissioning of the unit, no irrelevant personnel or vehicles are allowed to enter the area of the commissioning unit. They must go through relevant procedures and implement protective measures before entering the commissioning unit area.
装置试车过程中，无关人员、车辆一律不得进入试车装置区，进入必须办理相关手续落实防护措施后方可进入。

10.3.15 After the feedstocks enters the unit, principally it is not allowed to carry out dangerous construction operations such as hot work operation, entering vessel, ground breaking operation and etc. If construction operations are needed to be carried out, higher management must be carried out in accordance with the regulations, and relevant protective measures must be implemented before construction operations can be carried out.
原料进入装置后，装置区内原则上不允许再进行动火、进容器、动土等具有危险性的施工作业。如需进行施工作业必须按规定实行升级管理，落实相关防护措施后方可施工作业。

10.3.16 Checklist of safety conditions before commissioning (See Schedule)
试车前安全条件检查确认表（见附件）

10.4 Emergency Management 应急管理

According to the requirement of “Guidelines for the preparation of emergency response plan for safe production accidents in production management unit” and “Brunei Darussalam Environmental Protection and Management Law”, the emergency response plan system of Hengyi Industries Sdn. Bhd. is divided into comprehensive emergency response plan for production safety accidents and for emergency response plan for environmental pollution incidents, see Figure 10-1 for emergency response plan system diagram.
根据《生产经营单位安全生产事故应急预案编制导则》、《文莱达鲁萨兰国环境保护和管理法》要求，恒逸文莱实业有限公司应急预案体系分为生产安全事故综合应急预案和突发环境污染事件应急预案，详见 10-1 应急预案体系图。

Hengyi Industries Sdn. Bhd. Emergency Mangement

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Comprehensive Emergency Response Plan for Production Safety Accident (This Plan)

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Special Emergency Plan

1. Special Emergency Response Plan for Fire & Explosion Accident
2. Special Emergency Response Plan for Personal Injury Accident
3. Special Emergency Response Plan for Hazardous Chemicals Leakage Accident
4. Special Emergency Response Plan for Cut-off of Water, Electricity, Steam, Air, and Nitrogen Accident
5. Special Emergency Response Plan for Traffic Accident in Plant
6. Special Emergency Response Plan for Anti-Terrorist Attacks
7. Special Emergency Response Plan for Mass Incident
8. Special Emergency Response Plan for External-Related Incident
9. Special Emergency Response Plan for Crucial Equipment Accident
10. Special Emergency Response Plan for Fire & Explosion Accident of Ships in Western Channel
11. Special Emergency Response Plan for Natural Disaster Accident
12. Special Emergency Response Plan for Major Environmental Pollution Break-out Incident
13. Special Emergency Response Plan for Radioactive Incident
14. Special Emergency Response Plan for Off-site Oil Spill Incident

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On-site Handling Plan

1. On-site Emergency Handling Plan of No.1 Refinery Department
2. On-site Emergency Handling Plan of No.2 Refinery Department
3. On-site Emergency Handling Plan of No.3 Refinery Department
4. On-site Emergency Handling Plan of No.4 Refinery Department
5. On-site Emergency Handling Plan of Power Department
6. On-site Emergency Handling Plan of Port and Storage Department
7. On-site Emergency Handling Plan of Utilities Department
8. On-site Emergency Handling Plan of Quality Analysis Department
9. On-site Emergency Handling Plan of Electrical Operation Department
10. On-site Emergency Handling Plan of Instrument Control Department

Figure 10-1 Emergency Response Plan System of Hengyi Industries Sdn. Bhd.

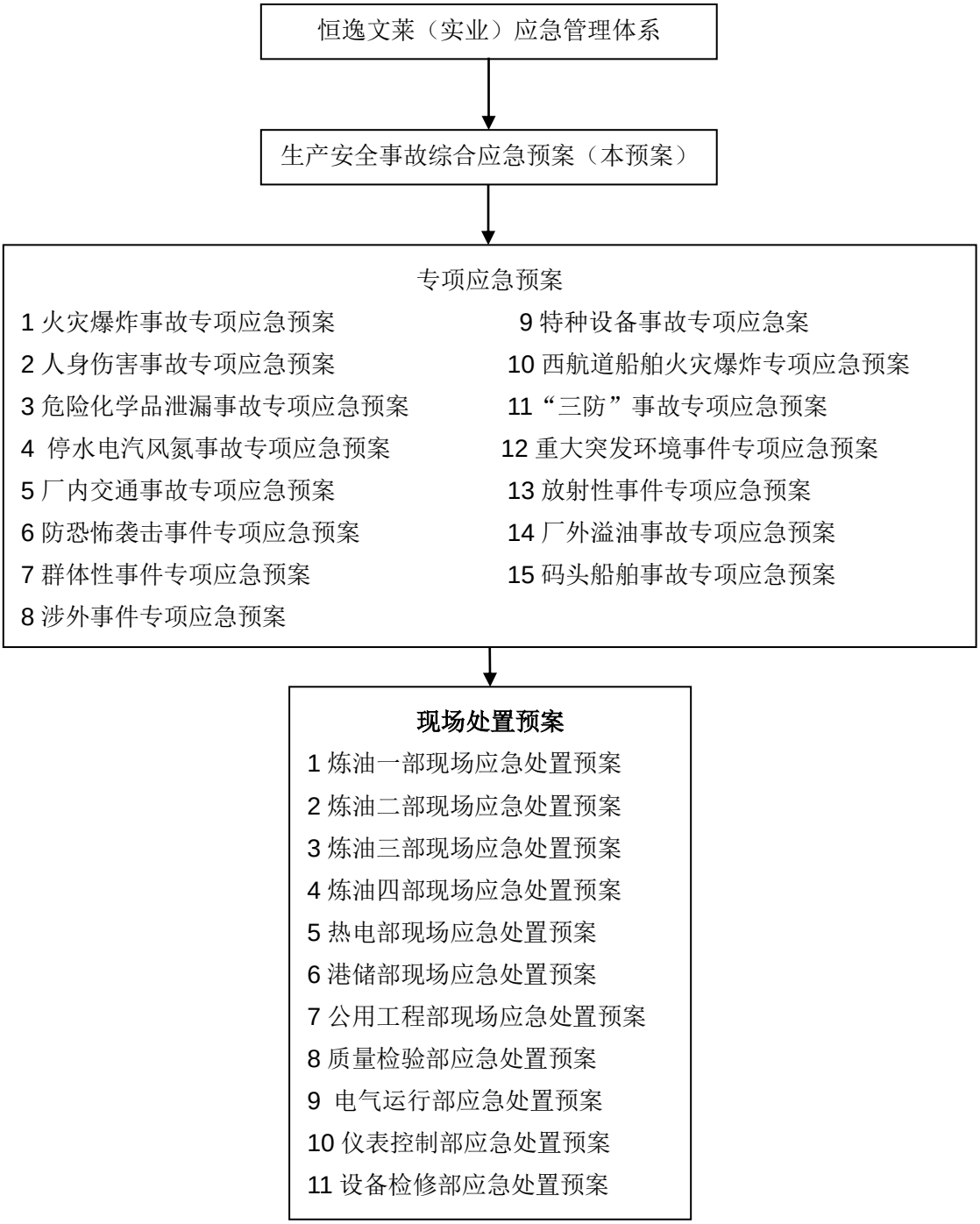

图 10-1 恒逸石化应急预案体系

10.4.2 Withdrawal Plan for Each Unit 各装置退守预案

Considering that there are many uncertain factors affecting the operation stability of production during the initial start-up, hence, withdrawal plan is established.

考虑首次开车过程中影响生产稳定运行的不确定性因素较多，故制定退守预案。

Table 10 – 1 Summary Sheet for Withdrawal Plan of Unit

表 10-1 装置退守方案汇总表

No 序号	Name of Special Plan 专项方案名称	Difficulties 难点	Countermeasures 应对措施
1	Atmospheric & Vacuum Distillation Initial Start-up Withdrawal Plan 常减压装置首次开车退守方案	Limited by storage tank capacity of the intermediate storage tank, the initial material preparation can buffer the downstream unit for up to 3 days, while the downstream unit has less buffering time 受中间储罐罐容限制，首次备料最多可为下游装置缓冲 3 天，下游装置缓冲时间少	Intermediate stock will be established during general commissioning to deal with shutdown risk of Atmospheric & Vacuum Distillation Unit 全面试车期间将建立中间原料库存应对常减压停工风险
2	Light Ends Recovery Unit Withdrawal Plan 轻烃回收装置退守方案	Naphtha contains light hydrocarbons 石脑油含轻烃	Atmospheric & Vacuum Distillation Unit undergoes pressurized operation to ensure naphtha quality, and LPG containing C5 components enters unqualified tank. 常减压装置加压操作保石脑油质量，液化气含 C5 组分进不合格罐
3	Acid Gas & LPG Ends Recovery Unit Withdrawal Plan 产品精制装置退守方案	If unqualified LPG tank is filled in 5 days, the normal production of Atmospheric & Vacuum Distillation Unit will be affected.	Light Ends Recovery Unit and Atmospheric & Vacuum Distillation Unit shall reduce the volume and undergo internal recirculation or shutdown

No 序号	Name of Special Plan 专项方案名称	Difficulties 难点	Countermeasures 应对措施
		不合格液化气罐 5 天进满，将影响上游常减压装置正常生产	轻烃回收、常减压装置降量循环或停工
4	Kerosene Hydrotreating Unit Withdrawal Plan 煤油加氢装置退守方案	Kerosene goes to diesel feedstock tank 煤油改进柴油原料罐	Enters Diesel Hydrotreating Unit for treatment 进柴油加氢装置处理
5	Diesel Hydrotreating Unit Withdrawal Plan 柴油加氢装置退守方案	Buffer time of intermediate feedstock tank is short 中间原料罐缓冲时间短	Enters Hydrocracking Feedstock Tank 改加裂原料罐
6	Hydrocracking Unit Withdrawal Plan 加氢裂化装置退守方案	Causing venting of hydrogen gas and affecting the preparation of refined naphtha 造成氢气放空及影响精制石脑油备料	Adjusting the load of all hydrogen usage unit and outsourcing stabilized naphtha ahead of schedule 调整临氢装置负荷及提前外购稳定石脑油
7	Reformer Unit Withdrawal Plan 重整装置退守方案	Hydrogen gas supply cut off 氢气中断	Plant shutdown 全厂停工
8	Aromatic Complex Unit Withdrawal Plan 芳烃联合装置退守方案	PX Unit shutdown 二甲苯装置停工	All units in plant will be at lowest load and the reformate will be used as gasoline blending component 全厂各装置降至最低负荷，重整生成油作为汽油调和组分
9	Flexicoking Unit Delay Start-up Withdrawal Plan 灵活焦化装置延迟开工退守方案	Insufficient fuel gas and system operation 燃料气缺口及系统投用	Use gasifier to make up and make statistics on blind plates required for each associated pipeline removal

No 序号	Name of Special Plan 专项方案名称	Difficulties 难点	Countermeasures 应对措施
			operation. Residual oil will be sent out. 投用汽化器补充及对各相关联管线切除操作所需盲板进行统计，渣油外发。
10	Sulfur Recovery Unit Withdrawal Plan 硫磺回收装置退守方案	Two series shutdown 双系列停工	Shutdown according to plant emergency shutdown special plan 按照全厂紧急停工专项预案处理
11	Amine Regeneration Unit Withdrawal Plan 溶剂再生装置退守方案	Can not meet the minimum load of Sulfur Recovery Unit for production 满足不了硫磺回收最低负荷生产	Shutdown all unit in the plant 全厂装置停工

11 Special Plan 专项方案

11.1 Chemical Cleaning 化学清洗

11.1.1 Purpose of Chemical Cleaning 化学清洗目的

Chemical cleaning is a process of cleaning and decontaminating by using chemical agents to react and dissolve with oil stains, rust, dirt and etc. on the inner surfaces of equipment and pipelines. After chemical cleaning, the purging time can be shortened so as to save the purging cost and time and improve product quality.

化学清洗是利用化学药剂与设备及管线内表面的有油污、铁锈、污垢等进行反应、溶解，从而达到清洁去污的过程。化学清洗后能缩短吹扫的时间，以节省吹扫成本及时间，并且提高产品品质。

11.1.2 Difficulties of Chemical Cleaning 化学清洗难点

Problem: Waste liquid is difficult to treat.

Countermeasures: The new WL-2008D type neutral degreasing agent and WL-2008C type neutral cleaning agent (3 in 1) are used for degreasing and acid wash passivation treatment, which reduces water flushing stage, does not produce any wastewater, and the waste liquid

is neutral and does not pollute the environment. The waste liquid after chemical cleaning can be directly discharged to the wastewater pool.

问题：废液难处理。

应对措施：采用新型 WL-2008D 型中性脱脂剂和 WL-2008C 型中性清洗剂(三合一) 进行除油、酸洗钝化处理，减少了水冲洗环节，没有任何废水产生，且废液是中性对环境污染无，化学清洗完成后的废液可以直接排放到污水池。

11.1.3 Scope of Chemical Cleaning 化学清洗范围

Table 11 – 1 Chemical Cleaning Statistic Table

表 11-1 化学清洗统计表

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
3.5 MPa Steam Pipeline 3.5MPa 蒸汽管线	Hydrocracking Unit 加氢裂化装置	Battery limit to steam turbine inlet line (400-MS-030701-11HC3-H) 边界至汽轮机进汽管线（400-MS-030701-11HC3-H）	12.00
	Naphtha Hydrotreating Unit and Reformer Unit 预加氢及重整	Inlet pipeline of Naphtha Hydrotreating Unit and Reformer Unit steam turbine 预加氢及重整汽机入口管线	12
		4 in 1 furnace steam drum steam production delivery pipeline (350-MS-23101) 四合一炉汽包产汽外送管线（350-MS-23101)	48.08
		Inlet pipeline of Reformer hydrogen recycling compressor K201 steam turbine (450-MS-021601) 重整循环氢压缩机 K201 汽轮机入口管线（450-MS-021601)	25.30
		Inlet pipeline of Reformer first stage pressurized compressor K202 turbine (250-MS-021801) 重整一级增压机 K202 汽轮机入口管线（250-MS-021801)	1.47
		Inlet pipeline of Reformer second stage pressurized compressor K203 turbine	1.47

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
		(250-MS-021901) 重整二级增压机 K203 汽轮机入口管线（250-MS-021901)	
	Tatoray Unit 歧化装置	Inlet pipeline of Tatoray hydrogen recycling compressor K501 turbine (250-MS-051101) 歧化循环氢压缩机 K501 汽轮机入口管线（250-MS-051101）	15.90
	Isomar Unit 异构化装置	Inlet pipeline of Isomar hydrogen recycling compressor K701 turbine (300-MS-071101) 异构化循环氢压缩机 K701 汽轮机入口管线（300-MS-071101）	23.20
	Sulfur Unit 硫磺装置	Sulfur Unit internal 3.5 MPa steam pipeline 硫磺装置内部 3.5MPa 蒸汽管线	5.29
		3.5 MPa steam pipeline 150-MS-030702 3.5MPa 蒸汽管线 150-MS-030702	0.76
		3.5 Mpa steam pipeline 80-MS-032703 3.5MPa 蒸汽管线 80-MS-032703	0.05
		3.5 MPa steam pipeline 150-MS-032704 3.5MPa 蒸汽管线 150-MS-032704	0.42
		3.5 MPa steam pipeline 150-MS-032701 3.5MPa 蒸汽管线 150-MS-032701	0.04
		3.5 MPa steam pipeline 150-MS-040702 3.5MPa 蒸汽管线 150-MS-040702	0.76
		3.5 MPa steam pipeline 80-MS-042303 3.5MPa 蒸汽管线 80-MS-042303	0.05
		3.5 MPa steam pipeline 150-MS-042304 3.5MPa 蒸汽管线 150-MS-042304	0.42
		3.5 MPa steam pipeline	0.34

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
		150-MS-042301 3.5MPa 蒸汽管线 150-MS-042301	
		3.5 MPa steam pipeline 200-MS-033001 3.5MPa 蒸汽管线 200-MS-033001	2.45
	Flexicoking Unit 焦化装置	Steam pipeline of main air blower turbine 400-MS-012502 主风机汽轮机蒸汽管线 400-MS-012502	12.00
		Steam pipeline of gas compressor turbine 气压机汽轮机蒸汽管线 350-MS-023003	10.00
		Pipeline of MP steam superheater F102 400-MS-012501 中压蒸汽过热炉 F102 管线 400-MS-012501	30.00
	3.5 MPa Steam System Main Line 3.5MPa 蒸汽系统主线	Main steam pipeline 主蒸汽管线	653.44
		Main steam pipeline (800-MS-010101) 1200m 主蒸汽管线（800-MS-010101）1200m	600.00
		To Sulfur battery limit (200-MS-010102) 至硫磺界区（200-MS-010102）	2.50
		To Flexicoking battery limit (500-MS-010103) 至焦化界区（500-MS-010103）	15.30
		To Aromatic Complex battery limit (700-MS-010104) 至芳烃联合界区（700-MS-010104）	30.00
		To Par-Isom battery limit (200-MS-010105) 至轻石异构界区（200-MS-010105）	2.50
		To Hydrocracking battery limit (400-MS-010106) 至加氢裂化界区（400-MS-010106）	3.14

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
	Power Department Internal (Turbine) 热电内部（汽机）	Power Department Internal Steam Turbine to 3.5 MPa steam main branch line 热电内部汽机至 3.5MPa 蒸汽母管支线	149.58
		#1 Turbine steam extraction electric valve to 3.5 MPa steam main line #1 机抽汽电动阀至 3.5MPa 蒸汽母管	0.83
		#2 Turbine steam extraction electric valve to 3.5 MPa steam main line #2 机抽汽电动阀至 3.5MPa 蒸汽母管	2.16
		#3 Turbine steam extraction electric valve to 3.5 MPa steam main line #3 机抽汽电动阀至 3.5MPa 蒸汽母管	3.48
		#4 Turbine steam extraction electric valve to 3.5 MPa steam main line #4 机抽汽电动阀至 3.5MPa 蒸汽母管	4.81
		#1 Desuperheater electric valve to 3.5 MPa steam main line #1 减温减压器电动阀至 3.5MPa 蒸汽母管	0.94
		#2 Desuperheater electric valve to 3.5 MPa steam main line #2 减温减压器电动阀至 3.5MPa 蒸汽母管	0.94
		3.5 MPa steam main line 3.5MPa 蒸汽母管	2.28
		3.5 MPa steam main line 3.5MPa 蒸汽母管	12.07
		3.5 MPa steam main line 3.5MPa 蒸汽母管	5.25
		Steam turbine building to power station battery limit 汽机厂房至电站界区	116.84
Unit Dry Gas Sealing	Light Ends Recovery Unit	Screw compressor 1012-K601ABC dry gas sealing system	0.50

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
Pipeline 机组干气密封管线	轻烃回收装置	螺杆压缩机 1012-K601ABC 干气密封系统	
	Hydrocracking Unit 加氢裂化装置	Hydrogen recycling compressor 1040-K101 dry gas sealing system 循环氢压缩 1040-K101 干气密封系统	1.00
	Naphtha Hydrotreating Unit 预加氢重整	Naphtha hydrotreating hydrogen recycling compressor K101 dry gas sealing system 预加氢循环氢压缩机 K101 干气密封系统	1.00
		Desorbed gas compressor K951ABC dry gas sealing system 解析气压缩机 K951ABC 干气密封系统	1.00
		Reformer hydrogen recycling compressor 重整循环氢压缩机 K201 干气密封系统	1.00
		First stage compressor K202 dry gas sealing system 一级压缩机 K202 干气密封系统	1.00
		Second stage compressor K203 dry gas sealing system 二级压缩机 K203 干气密封系统	1.00
	Tatoray 歧化	Tatoray hydrogen recycling compressor K501 dry gas sealing system 歧化循环氢压缩机 K501 干气密封系统	1.00
	Isomar 异构化	Isomar hydrogen recycling compressor K701 dry gas sealing system 异构化循环氢压缩机 K701 干气密封系统	2.80
	Par-Isom 轻石异构化	Hydrogen recycling compressor K101 dry gas sealing system 循环氢压缩机 K101 干气密封系统。	1.00
	Flexicoking Unit 焦化装置	Gas compressor K201 dry gas sealing system 气压机 K201 干气密封系统	0.50
Unit Lubricating Oil	Light Ends Recovery Unit	Screw compressor 1012-K601ABC lubricating system	2.00

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
System Pipeline 机组润滑油系统管线	轻烃回收	螺杆压缩机 1012-K601ABC 润滑油系统	
	Hydrocracking Unit 加氢裂化	1040-K101，1040-K102A/B/C，1040-P102A/B，1040-P104A/B Lubricating oil system 1040-K101，1040-K102A/B/C，1040-P102A/B，1040-P104A/B 润滑油系统	12.00
		Make up hydrogen compressor 1040-K102A/B/C process pipeline 新氢压缩机 1040-K102A/B/C 工艺管线	11.50
	Diesel Hydrotreating Unit 柴油加氢	1030-K101AB、1030-P102AB、1030-P104、1030-P103AB lubricating oil system 1030-K101AB、1030-P102AB、1030-P104、1030-P103AB 润滑油系统	6.00
		Make up hydrogen compressoer 1030-K101A/B process pipeline 新氢压缩机 1030-K101A/B 工艺管线	4.10
	Kerosene Hydrotreating Unit 煤油加氢	1020-(K101+K102)ABC lubricating oil system 1020-（K101+K102）ABC 润滑油系统	3.00
		Compressor process pipeline 压缩机工艺管线	2.50
	Naphtha Hydrotreating Unit 预加氢重整	Naphtha Hydrotreating hydrogen recycling compressor K101 lubricating oil system 预加氢循环氢压缩机 K101 润滑油系统	1.92
		Naphtha Hydrotreating make up hydrogen compressor K102AB lubricating oil system 预加氢补充氢压缩机 K102AB 润滑油系统	5.60
		Desorbed gas compressor K951ABC lubricating oil system	5.12

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
		解析气压缩机 K951ABC 润滑油系统	
		Reformer hydrogen recycling compressor K201 lubricating oil system 重整循环氢压缩机 K201 润滑油系统	6.00
		First stage compressor K202 lubricating oil system 一级压缩机 K202 润滑油系统	2.80
		Second stage compressor K203 lubricating oil system 二级压缩机 K203 润滑油系统	3.20
		Propane compressor lubricating oil system 丙烷压缩机润滑油系统	1.00
	Tatoray 歧化	Tatoray hydrogen recycling compressor K501 lubricating oil system 歧化循环氢压缩机 K501 润滑油系统	2.80
	Isomar 异构化	Isomar hydrogen recycling compressor K701 lubricating oil system 异构化循环氢压缩机 K701 润滑油系统	1.00
	Par-Isom 轻石异构化	Hydrogen recycling compressor K101 lubricating oil system 循环氢压缩机 K101 润滑油系统	2.20
		Make up hydrogen compressor K103AB lubricating oil system 补充氢压缩机 K103AB 润滑油系统	1.50
	Flexicoking Unit 焦化	Main air blower K101 lubricating oil system 主风机 K101 润滑油系统	1.50
		Gas compressor K201 lubricating oil system 气压机 K201 润滑油系统	1.50
Other Pipeline and Equipment 其他管线及设	Air Separation & Compression Unit 空分空压	Air compressor inlet/outlet pipeline 空压机出入口管线	14.00
	Hydrotreating Unit	Kerosene product line	50.00

Item 项目	Unit / Area 装置/区域	Equipment 设备	Volume m^3 体积 m^3
备	煤油加氢	产品航煤线	
	Reformer 重整	Propane chilling system pipeline 丙烷冷冻系统管线	50.00
	Parex 吸附分离	Adsorber bed pipeline 吸附塔床层管线	26.60
		Adsorber pump to recycling pipeline 吸附塔泵送循环管线 D602-P602B-D601	18.20
		Adsorber pressurized to recycling pipeline 吸附塔压送循环管线 D601-P602A-D602	17.30
		Adsorber recycling pump P602C inlet/outlet pipeline and common suction/discharge pipeline 吸附塔循环泵 P602C 进出口管线及公共吸入/排出管线	2.20
		Adsorber rotary valve 7 inlet/outlet pipeline 吸附塔转阀 7 股进出料管线	21.28
		Liquid filling, flushing and heating pipeline that is connected to adsorber 与吸附塔相连的充液、冲洗及升温管线	5.00
	Flexicoking Unit 焦化装置	Amine desulfurizer C304 胺液脱硫塔 C304	/
		Amine regenerator C305 胺液再生塔 C305	/
		Fresh amine tank T301 新鲜胺液罐 T301	/
		Lean amine tank T302 贫胺液罐 T302	/
		Amine pit tank D309 胺液地下罐 D309	/
		Regenerator overhead liquid separation tank D304 再生塔顶分液罐 D304	/
		新增 3.5Mpa 打靶临时管线	40

11.1.4 Chemical Cleaning Waste Liquid 化学清洗废液

The total amount of chemical cleaning waste liquid is about 1591 t, of which about 174 t (1-2% acidity of waste liquid) is generated by acid wash passivation of stainless steel pipes. About 1317 t of waste liquid (neutral waste liquid) is generated from acid wash passivation of carbon steel pipes. The waste liquid generated from vessel cleaning is about 100 t (waste liquid is oil removing agent).

化学清洗废液总量约 1591t，其中不锈钢管道酸洗钝化所产生的废液约 174t（废液的酸度 1-2%）；碳钢管道酸洗钝化所产生废液大约 1317t（废液为中性）；容器清洗产生的废液约 100t。（废液为除油剂）。

Table 11-2 Waste liquid Statistic Table

表 11-2 废液统计表

Types of Wastewater 污水种类	Volume of Water t 水量 t	Main Impurities 主要杂质	Treating Methods 处理方法	Remark 备注
Steam interstage pipeline cleaning and passivating wastewater 蒸汽级间管道清洗、钝化污水	1317	The waste liquid is neutral, and the waste residue is mainly rust 废液为中性，废渣主要是铁锈	The waste liquid is discharged to wastewater treatment plant, after analysis is qualified, it is discharged out and waste residue is filtered for centralized treatment. 废液排至污水处理厂，分析合格外排，废渣过滤集中处理	The cleaning company uses temporary pipeline or tanker to transport it to wastewater treatment plant 清洗厂家采用临时管线排或槽车运至污水处理厂
Stainless steel set pipeline acid wash and passivating wastewater 配套不锈钢管道酸洗、钝化污水	174	Acidity of waste liquid is 1 – 2% 废液的酸度 1-2%	After neutralizing with akali waste, the cleaning company will discharge it to the saline wastewater tank of wastewater treatment plant 清洗厂家用碱液废中和后，排至污水处理厂含盐污水罐	The cleaning company uses temporary pipeline or tanker to transport it to wastewater treatment plant 清洗厂家采用临时管线排或槽车运至污水处理厂

Types of Wastewater 污水种类	Volume of Water t 水量 t	Main Impurities 主要杂质	Treating Methods 处理方法	Remark 备注
Unit equipment spray cleaning wastewater 装置设备喷淋清洗污水	100	Waste liquid is neutral, non-acidic 废液为中性，无酸碱性	Discharge the filtered wastewater directly into a wastewater pool. If the analysis is unqualified, discharge it to oily wastewater tank of wastewater treatment plant. 过滤后直接排放污水池即可；如分析不合格则排至污水处理厂含油污水罐	The cleaning company uses temporary pipeline or tanker to transport it to wastewater treatment plant 清洗厂家采用临时管线排或槽车运至污水处理厂

11.2 Treatment for Process Pipe Greater Than or Equal to DN 400 大于等于 DN400 工艺管道的处理

11.2.1 Basic Introduction 基本情况介绍

When pipe diameter of the pipeline is ≥ DN 400mm, it is difficult to clean the pipeline either by water flushing or purging. In particular, due to the fact that there are several climbing gantry frames along the long-distance pipeline in the eastern-western tank farm, there will be a large amount of water residue in the pipeline after conventional water flushing or purging. At the same time, it will take at least more than half a year for the pipeline to be installed and used. Corrosion will occur in the pipeline in humid environment, and a large amount of waste oil will be produced when the product is enters tank after being put into operation. Among them, aviation kerosene pipelines have higher requirements on quality, and the industry generally uses chemical cleaning or pigging to undergo treatment.

当管线管径≥DN400mm 时，无论是采取水冲洗或爆破吹扫法均难以将管线处理干净，尤其是东西罐区的长输管线因沿途有多个爬高龙门架，经常规水冲洗或爆破吹扫处理后管线内仍将有大量的水残留，同时管线安装完毕到使用至少要半年多的时间，潮湿的环境下管线将产生腐蚀，投产后产品进罐将产生大量的污油。其中航煤管线对品质要求更高，行业内一般采用化学清洗或通球的办法进行处理。

11.2.2 Detailed List of Large Diameter Pipelines in Table 11 – 1 And Table 11 – 2: 大管径管线明细表 11-1、表 11-2：

Table 11 – 3 Long Distance Transportation Pipeline From Eastern Tank Farm to Western Tank Farm and Eastern Jetties

表 11-3 东罐区至西罐区和东码头长输线

No. 序号	Name of Pipeline 管线名称	Material 介质	Start Point 起点	End Point 终点	Pipe Diameter mm 管径 mm	Length m 长度 m	Volume m^3 容积 m^3
1	92# Product Gasoline Transfer Line 92#成品汽油转输线	92# Gasoline 92#汽油	Unit 4201 4201 单元	Western Gasoline Tank Farm 西部灌区汽油储罐	450	4750	755.1
2	Aviation Kerosene Transfer Line 航煤转输线	Aviation Kerosene 航煤	Unit 4202 4202 单元	Western Kerosene Tank Farm 西部煤油罐区	400	4600	577.7
3	Diesel Transfer Line 柴油转输线	Diesel Kerosene 柴油	Unit 4202 4202 单元	Western Diesel Tank Farm 西部柴油罐区	400	4600	577.7
4	Paraxylene (PX) Transfer Line 对二甲苯转输线	PX 对二甲苯	Aromatics Intermediate Tank Farm 芳烃中间罐区	Unit 8023 8023 单元	500	5920	1161.8
5	Benzene Transfer Line 苯转输线	Benzene 苯	Aromatics Intermediate Tank Farm 芳烃中间罐区	Unit 8023 8023 单元	400	5920	743.5
6	PX Export Line 对二甲苯出	PX 对二甲苯	Aromatics Intermediate Tank Farm	Eastern Jetties 东码头	500	2000	392.5

No. 序号	Name of Pipeline 管线名称	Material 介质	Start Point 起点	End Point 终点	Pipe Diameter mm 管径 mm	Length m 长度 m	Volume m³ 容积 m³
	厂线		芳烃中间罐区				
7	Benzene Export Line 苯出厂	Benzene 苯	Aromatics Intermediate Tank Farm 芳烃中间罐区	Eastern Jetties 东码头	400	2000	251.2

Table 11 – 4 Long Distance Transportation Line From Western Tank Farm to Western Jetties

表 11-4 西罐区至西码头长输线

No. 序号	Name of Pipeline 管线名称	Material 介质	Start Point 起点	End Point 终点	Diameter mm 管径 mm	Length m 长度 m	Volume m³ 容积 m³
1	92# Gasoline Loading 92#汽油装船	92# Gasoline 92#汽油	Unit 8021 8021 单元	Berth #1 and #2 1#、2#泊位	700	723	278.1
2	Aviation Kerosene Loading 航煤装船	Aviation Kerosene 航煤	Unit 8022 8022 单元	Berth #1 and #2 1#、2#泊位	700	569	218.8
3	Diesel Loading 柴油装船	Diesel 柴油	Unit 8022 8022 单元	Berth #1 and #2 1#、2#泊位	700	569	218.8
4	PX Loading 对二甲苯装船	PX 对二甲苯	Unit 8023 8023 单元	Berth #1 and #2 1#、2#泊位	500	1160	227.6
5	Isomerized Oil Loading 异构化油装船	Isomerized Oil 异构化油	Unit 8024 8024 单元	Berth #1 and #2 1#、2#泊位	500	906	177.8

11.2.3 Pipeline ≥DN400 Treatment Plan ≥DN400 管线处理方案

11.2.3.1 Port & Storage Department and specialized company shall undergo treatment simultaneously.

港储部与、专业公司同时进行处理。

11.2.3.2 Before the pipelines are welded, Port & Storage Department will propose which pipelines need to be treated.

在管线完成焊接以前，由港储部提出哪些管线需要处理。

11.2.3.3 The starting point and beginning point shall be clearly defined, and the specialized company shall handle the pipeline pigging, with the assistance of Port & Storage Department operator.

明确好起、始点，由专业公司进行清管通球进行处理，港储部操作人员协助配合。

11.2.3.3 Port & Storage Department appoints specialized personnel to carry tracking of the whole process to ensure the safety of operation and the quality of pigging.

港储部委派专人进行全程跟踪，确保作业安全及清管质量。

11.2.3.4 Specialized personnel shall record each operation index and sign for confirmation with specialized company at the same time.

专人对操作各项指标如实做好记录工作，并与专业公司同时签字确认。

11.2.3.5 The relevant functional department shall carry out joint inspection and acceptance when the treatment is completed and sign for confirmation before it takes effect.

处理结束由相关职能部门进行联检验收，并签字确认方可生效。

11.3 System Pipeline Treatment 系统管道处理

11.3.1 Scope 范围

Oil products, fuel gas, fuel oil, hydrogen gas, steam, instrument air, plant air, nitrogen gas, cooling water, condensate, demineralized water, deaerated water, chilled water, hot water, recycle water, oily wastewater, saline wastewater, firefighting water, domestic wastewater, low-pressure fuel gas and other pipelines outside the unit.

装置（单元）外油品、燃料气、燃料油、氢气、蒸汽、净化风、非净化风、氮气、循环水、凝结水、除盐水、除氧水、冷媒水、热媒水、回用水、含油污水、含盐污水、含硫污水、消防水、生活污水、低压瓦斯等管线。

11.3.2 Principle of System Pipeline Treatment 系统管线处理原则

11.3.2.1 Steam and condensate system pipeline belongs to Power Department.

蒸汽、凝结水系统管线隶于属于热电部。

11.3.2.2 Hydrogen gas system pipeline belongs to No. 3 Refinery Department.

氢气系统管线隶属于炼油三部。

11.3.2.3 Solvent system pipeline belongs to No. 4 Refinery Department

溶剂系统管线隶属于炼油四部。

11.3.2.4 Oil vapor system pipeline belongs to Port & Storage Department.

油气系统管线隶属于港务储运部。

11.3.2.5 Water, air, nitrogen and other utilities sytem pipeline and alkali residue system pipeline belongs to Utilities Department.

水、风、氮等公用工程系统管线及碱渣系统管线隶属于公用工程部。

11.3.2.6 The assest division interface of public pipeline entering each operation department is the first valve (inlet valve) of the pipeline entering the boundary area.

公共管线进入各运行部的资产分割界面为管线进入界区第一道阀门（进口阀）。

11.3.2.7 The asset segmentation interface sent by each operation department to the pipeline of the public pipe rack is the last valve (outlet valve) before entering the public pipe rack. The inlet valve and outlet valve (including valves and gaskets) belong to the corresponding operation department.

各运行部送出至公共管廊管线的资产分割界面为进入公共管廊前的最后一道阀（出口阀），进口阀和出口阀（包括阀门及垫片）隶属于相应运行部。

11.3.2.8 In order to avoid temporary takeover, the water supply point is the output unit for pipeline requiring water flushing treatment.

为避免临时接管，需水冲洗处理的管线，以输出单元作为给水点。

11.3.2.9 During flushing of jetty pipeline, a loop must be set up to enter the tank to avoid pollution to the environment caused by sea discharge.

码头管线冲洗，需设置回路进罐，避免排海对环境造成污染。

11.3.3 Precautions and Safety Requirements 注意事项及安全要求

11.3.3.1 Pay attention to the confirmation of steam blowing quantity, steam temperature and steam pressure. The requirements of thermometers, F spanner and other tools are reflected in each refinement plan.

注意打靶蒸汽量、蒸汽温度、蒸汽压力的确认。测温仪、F 板手等工具需求在各细化方案中体现。

11.3.3.2 Purging and steam blowing of steam pipeline is harmful to the sealing surface of the steam valve. Generally, the important isolation valve does not act as a control valve for purging and steam blowing, the temporary valve at the discharge port controls purging.

蒸汽管线吹扫打靶对蒸汽阀门的密封面损伤较大，一般重要的隔离阀不作吹扫打靶的控制用阀，以排放口临时阀控制吹扫。

11.3.3.3 Personnel participating in purging shall be equipped with necessary labor protection equipment and instrument to prevent personal safety accidents. Personnel particpate in purging 11.3.3.4 should be familiar with the system’s process flow, obey the allocation, obey the command, and stick to their jobs.

参加吹扫人员应配备必要的劳保用品和工器具，防止发生人身安全事故。参与吹扫 11.3.3.4 人员要熟悉系统工艺流程，服从分配，听从指挥，坚守工作岗位。

11.3.3.5 Check the reliability of the permanent pipe support before purging, and the

temporary pipe shall be checked in detail to confirm the reliability of reinforcement.
吹扫前检查永久管道支架的可靠情况，临时管道应详细检查确认加固可靠。

11.3.3.6 Pay attention to fully warming the pipe before purging.
在管道吹扫前，应注意充分暖管。

11.3.3.7 When disassembling, replacing and testing the steam blowing plate, the temporary valve should be closed tightly, and the control switch should be hung with a no-operation signboard to prevent accidents. In the process of purging work, the personnel of each unit should have a clear division of work and are responsible for their own duties.
拆换检测靶板时应将临时阀门关严，并在控制开关上挂严禁操作牌，以免发生事故。
在吹扫工作过程中，各单位人员分工明确，各负其责。

Safety Inspection Confirmation List Before Purging of Steam Pipeline
蒸汽管道吹扫前的安全检查确认单

No. 序号	Inspection Content 检查内容	Requirement 要求	Result 结果	Confirmation Signature 确认签字
1	Steam pipeline construction 蒸汽管线施工	Construction is completed according to design, suppression is qualified, water are drained thoroughly, good heat preservation 按设计施工完成，打压合格、彻底放水，保温加好		
2	Removal of relevant accessories 相关附件的拆除	Removal of flow orifice plate, regulating valve disk, check valve disk, etc. 流量孔板、调节阀阀芯、单向阀阀芯等拆除		
3	Pipeline acid wash 管线酸洗	The main steam pipeline and turbine steam inlet line must be qualified for acid wash by the professional unit first. 蒸汽主管线、透平机蒸汽入口线需先经		

No. 序号	Inspection Content 检查内容	Requirement 要求	Result 结果	Confirmation Signature 确认签字
		专业单位酸洗合格		
4	Temporary pipeline installation 临时管道安装	Installation acceptance and qualified certification 经安装验收签证合格		
5	Temporary pipeline and steam venting pipeline 临时管道、排汽管道	Leave expansion gap and fix firmly 留有膨胀间隙并固定牢固		
6	Drain pipe 疏水管	The installation position and steam venting direction of the drain pipe point to a safe place 疏水管的安装位置及排汽方向指向安全处		
7	Pressure gauge 压力表	Installed as required, the meter is led to a safe and convenient observation point and is reliable and firm 按要求装设，表头引至安全方便观察住处，并可靠牢固		
8	Steam blowing plate 靶板	Quantity, material, suitable size 数量、材质、尺寸适合		

No. 序号	Inspection Content 检查内容	Requirement 要求	Result 结果	Confirmation Signature 确认签字
9	Silencer 消音器	Quantity, material, suitable size 量、材质、尺寸适合		
10	Purge temporary electric valve and gate valve 吹扫临时电动阀、闸阀	The pressure level and switching time meets the requirements, and the valve switch is flexible 压力等级和开关时间满足要求，阀门开关灵活		
11	Check steam blowing plate 靶板检查	Temporary thermal insulation measures have been taken on the steam pipes at the inspectors' passages, and there is solid platform at the steam blowing plate installation 检查人员通道处的蒸汽管道上已有临时保温措施，靶板装设处已有牢固的平台。		
12	System related to construction site 与尚在施工的现场有关系系统	Reliable isolation and obvious warning signs 可靠隔绝 明显的警示标志		
13	Scaffolding and obstacles	Removed 已拆除		

No. 序号	Inspection Content 检查内容	Requirement 要求	Result 结果	Confirmation Signature 确认签字
	that obstruct traffic and fire hazard 妨碍通行和有着火危险的脚手架及障碍			
14	Safety 安全	Safety personnel and construction maintenance personnel are on duty; prepare emergency medicine according to the characteristics of purging 安全人员、及施工检修人员到现场值班；根据吹管工作的特点备足急救药品		
15	Others 其他			

11.4 Steam Purging and Blowing 蒸汽吹扫、打靶

11.4.1 Handling Principle 处置原则

1.0 MPa and 0.5 MPa are treated by conventional purging method. 3.5 MPa steam pipe network involves putting key equipment into service to ensure that the blades of the steam turbine are not damaged, and purging and blowing treatment methods are adopted.

1.0MPa 和 0.5MPa 采用常规吹扫的方法处理。

3.5MPa 蒸汽管网涉及到关键设备的投用，确保蒸汽透平的叶片不受损，采用吹扫打靶处理方式。

11.4.2 Scope 范围

1.0 MPa and 0.5 MPa steam pipe network can be seen on each operation department plan. For 3.5 MPa steam system, there are a total of 13 steam purging and blowing point, the

specific is as follows:

（1）Power Department: 3.5 MPa steam main line installed silencer at Light Naphtha Isomerization Unit for purging, with aromatic section DN 600.

（2）The end of the steam line serves as blowing point.

（3）No. 2 Refinery Department: 1 point, inlet of K101 turbine of Hydrocracking hydrogen recycling compressor.

（4） No. 3 Refinery Department: 7 points, outlet of steam production line of reforming waste heat boiler, inlet of K201 turbine of Reformer hydrogen recycling compressor, inlet of K202 turbine of Reformer hydrogen pressurizer, inlet of K203 turbine of Reformer hydrogen pressurizer, and end of DN 600 steam line of aromatic section, K701 turbine inlet for Isomar hydrogen recycling compressor and K501 turbine inlet for Tatoray hydrogen recycling compressor.

（5）No. 4 Refinery Department: 5 points, Flexicoking rich gas compressor ST 201 turbine inlet, Flexicoking fan ST101 turbine inlet, Flexicoking MP steam superheater F102 outles, Flexicoking drum D103 outlet, and Sulfur Recovery boundary valve (Sulfur Recovery MP steam superheater part with purging during commissioning to save steam consumption).

1.0MPa 和 0.5MPa 蒸汽管网见各运行部方案。

3.5MPa 蒸汽系统，共计 13 个吹扫打靶点，具体如下：

（1）热电部： 3.5MPa 蒸汽主线在轻石异构化装置处装消音器进行吹扫，以芳烃部分 DN600

（2）蒸汽管线末端作为打靶点。

（3）炼油二部：1 个点，加氢裂化循环氢压缩机 K101 透平入口。

（4）炼油三部：7 个点，重整余热锅炉产汽线出口，重整循环氢压缩机 K201 透平入口，重整氢气增压机 K202 透平入口，重整氢气增压机 K203 透平入口，芳烃部分 DN600 蒸汽管线末端；异构化循环氢压缩机 K701 透平入口，歧化循环氢压缩机 K501 透平入口。

（5）炼油四部：5 个点，灵活焦化富气压缩机 ST201 透平入口、灵活焦化风机 ST101 透平入口、灵活焦化中压蒸汽过热炉 F102 出口，灵活焦化汽包 D103 出口、硫磺回收边界阀处（硫磺回收中压蒸汽过热器部分带试车阶段吹扫，以节省蒸汽消耗）。

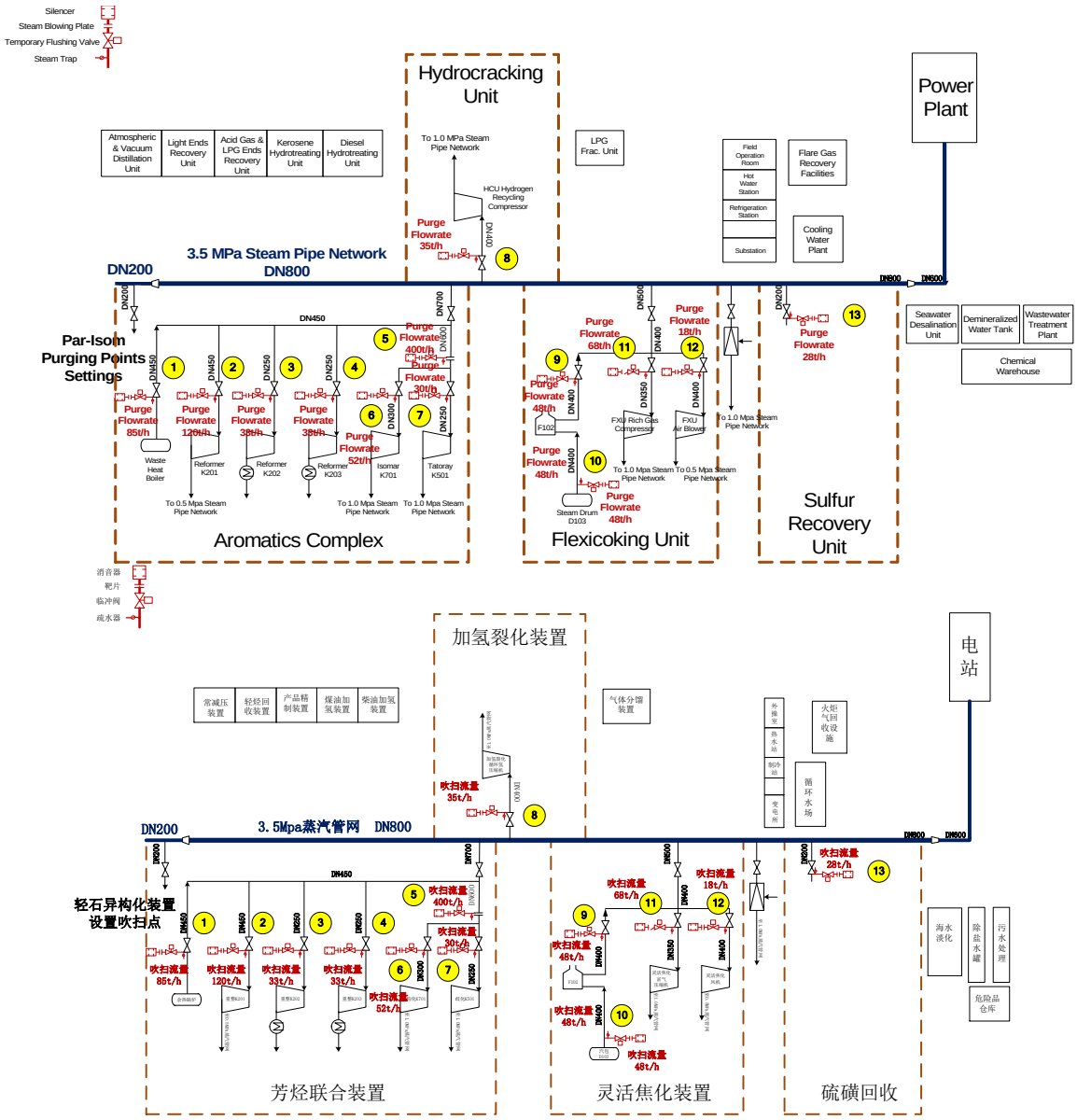

Figure 11 – 1 3.5 MPa Steam System Blowing Schematic Diagram

图 11-1 3.5MPa 蒸汽系统打靶示意图

11.4.3 Steam Purging and Blowing Network 蒸汽吹扫打靶网络

ID	Tasks Name 任务名称	Start Date 开始时间	Completion Date 完成	Duration 持续时间
1	1.0MPa Steam System Purging 1.0MPa蒸汽系统吹扫	2018/11/26	2018/12/15	20 Days 20天
2	0.5MPa Steam System Purging 0.5MPa蒸汽系统吹扫	2018/12/16	2019/1/5	21 Days 21天
3	Joining of 0.5MPa Steam Pipe Network 0.5MPa蒸汽管网碰头	2019/1/6	2019/1/10	5 Days 5天
4	3.5MPa Steam System Purging and Steam Blowing 3.5MPa蒸汽系统吹扫打靶	2019/1/11	2019/1/30	20 Days 20天

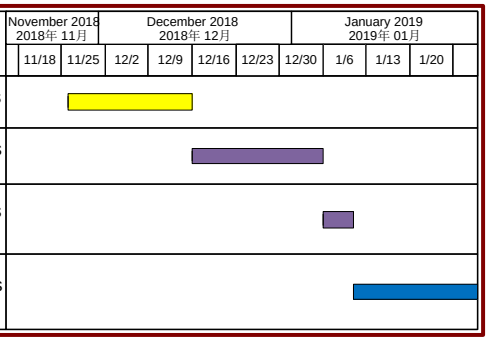

Figure 11 – 2 Steam Purging and Blowing Network Diagram

图 11-2 吹扫打靶网络图

11.4.4 3.5 MPa Purging and Blowing Acceptance Criteria 3.5MPa 吹扫打靶验收标准

（1）The data of steam flow rate, temperature and pressure for blowing inspection shall be recorded by designated personnel of the operation department.

（2）The operation department shall form a written report after the turbine steam pipeline purging and blowing is qualified, which shall be archived after Equipment Management Department confirms the purging quality and approved by Equipment Management Department.

（3）Steam turbine power piping or design documents have specified steam piping. Steam purging shall undergo steam blowing acceptance. The final acceptance blowing plate shall be marked and properly kept. The blowing plate shall be 8% of the inner diameter of the exhaust piping, not less than 25 mm in width and not less than 5 mm in thickness. The length of blowing plate shall be made of polished aluminum material. When there is no specification in the design documents or product technical documents, the quality of steam purging shall meet the following requirements in the table below:

（1）打靶检验的蒸汽流量、温度、压力数据由运行部指定专人负责数据记录。

（2）运行部在透平机蒸汽管线吹扫打靶合格后形成书面报告，并经机动部确认吹扫质量、机动部领导批准后存档。

（3）汽轮机动力管道或设计文件有规定的蒸汽管道，蒸汽吹扫应进行打靶验收，最终验收的靶板应做好标识妥善保管靶板，靶板应由宽度不小于排气管道内径的 8%，且不小于 25mm，厚度不小于 5mm，长度贯穿管道内径，靶板选用抛光铝质材料制作，当设计文件或产品技术文件无规定时，蒸汽吹扫质量应符合下表规定：

Table 11 – 2 Standard Reference for Blowing Plate Inspection (GB50517-2010)

表 11-2 靶板检验标准参照(GB50517-2010)

Item 项目	Quality Standard 质量标准
Number of Steam Blowing 打靶次数	Not less than 3 times 不宜少于 3 次
Steam Blowing Duration 打靶持续时间	15min
Size of Marking of Blowing Plate 靶片上痕迹大小	Below φ0.6mm φ0.6mm 以下
Trace Depth 痕深	<0.5mm
Number of Particles 粒数	1 个/cm^2

For details, please refer to 1.0 MPa and 0.5 MPa steam pipeline treatment section in the general plan for purging and blowing medium pressure steam system and commissioning plan of each operation department

详见中压蒸汽系统吹扫打靶总体方案和各运行部试车方案1.0MPa和0.5MPa蒸汽管线处置章节。

11.5 Catalyst Loading 催化剂装填

11.5.1 Scope of Catalyst Loading 催化剂装填范围

Whole plant equipment loading agents in Hydrogenation Unit, LPG Fractionation Unit, Aromatics Complex, Light Naphtha Isomerization Unit (Par-Isom), Sulfur Recovery Unit, Flexicoking Unit, Air Separation & Compression Unit, etc. include loading catalyst, ceramic balls, screens, packings, adsorbents, molecular sieves, etc., disassembling or replacing internal components that hinder the construction of unloading agents, cleaning and inspection in vessels (columns), etc.

加氢类、气分、芳烃联合、轻石异构化、硫磺回收、灵活焦化、空分空压等全厂装置装剂，包括装入催化剂、瓷球、筛网、填料、吸附剂、分子筛等，拆装或更换有碍卸装剂施工的内构件，容器（塔）内清理、检查等。

11.5.2 Construction Requirements for Catalyst Loading 催化剂装填施工要求

11.5.2.1 Handle all kinds of operation permits, connect temporary electricity, install life support system and communication system, and install and debug all required equipment.

办理好各类作业票，接好临时用电，安装好生命维持系统、通讯系统，对所需设备进行安装调试工作。

11.5.2.2 Before entering the reactor (column), operators shall wear long pipe breathing masks for continuous supply of air, safety helmets, safety belts, protective gloves, protective clothing, and fasten safety ropes (fall arrester) and obtain a work permit to enter confined space.

作业人员进入反应器（塔）前，配带好强制供风长管式呼吸面具、安全帽、安全带、防护手套、防护服、系好安全绳（防坠器）；并取得进入受限空间作业许可证。

11.5.2.3 A specialized person will monitor the respirator pressure gauge and be responsible for opening the stanby air supply in case of accidental power failure of the compressor. Prior to entering the reactor (column) for operation, communication methods shall be agreed to maintain internal and external contact to ensure safety.

专人监视呼吸器压力表并负责在压缩机意外断电情况下开启备用气源。进入反应器（塔）内作业前约定好联系方式，保持内外联系，确保安全。

11.5.2.4 Loading conditions for reactor (column):

（1）Reconfirm the isolation of blind plates in the reactor (column) system

（2）Before loading, the column (equipment) shall be thoroughly cleaned to remove oil stain and sundries. The reactor (column) shall carry out full inspection to eliminate defects and

confirm that it has the conditions for loading agents.

（3）According to the drawing of loading, disclose it to the operation personnel.

（4）Measuring and inspecting personnel should be in place

（5）The drawing of loading and loading sequence should be approved by technical personnel.

反应器（塔）具备装剂条件：

（1）再次确认反应器（塔）系统盲板隔离情况；

（2）装填前，对塔（器）内进行全面清理，去除油污和杂物。反应器（塔）进行全面检查，消除缺陷，确认具备装剂条件；

（3）根据装填图，向作业人员交底；

（4）计量、检查人员到位；

（5）填料的装填图、装填顺序经技术人员审定。

11.5.2.5 Under the supervision of safety personnel, the operator shall wear safety belts and professional protective masks and other labor protective equipment to enter the equipment (column) for operation.

作业人员在安全人员的监护下，佩带好安全带及专业保护面具等劳保护品进入器（塔）内作业；

11.5.2.6 Operators in the reactor (column) must control the canvas pipe or dense phase packer to ensure uniform packing to prevent accumulation or bridging or channeling.

装剂时反应器（塔）内作业人员必须控制好帆布管或密相装填器，使填料装填均匀，以防产生堆积或架桥或沟流。

11.5.2.7 The loading quality index of catalyst, ceramic balls and other packing at each height in the reactor (column) shall be confirmed to meet the requirements before loading at the next loading height.

反应器（塔）内每个高度的催化剂、瓷球等填料装填质量指标经确认符合要求后，方可进行下一个装填高度的装填。

11.5.2.8 Construction workers entering the reactor (column) shall wear dust masks, wear dust-proof clothing and special soft shoes to stand on the laid cushion or board for operation. It is strictly prohibitied to bring into the equipment items that have nothing to do with the loading agent, and the necessary packing tools and instruments that are brought into the equipment must be registered to ensure that no sundries are left in the equipment.

进入反应器（塔）内施工作业人员应佩戴防尘面具，穿防尘服、专用软鞋站在铺设的软垫或木板上作业；严禁将与装剂无关的物品带入设备内，带入设备内必需的装填工器具，必须登记，确保设备内不遗留任何杂物。

11.5.2.9 When entering the confined space for operations, the management requirements for operations in the confined space must be strictly comply. According to the standard, a positive pressure respirator (full cover) must be worn. At the same time, a soft ladder (or hard ladder), a tripod, a fall arrester and a cable winch must be equipped to ensure the rapid and safe evacuation of personnel in emergency situations.

进入受限空间作业，必须严格遵守受限空间内作业的管理要求，按标准佩戴正压式呼吸器（全面罩），必须同时配备软梯（或硬梯）、三角架、防坠落器、配备钢缆绞盘，以保证紧急情况下人员的快速安全撤离。

11.5.2.10 In case of heavy rain or severe weather, the loading of catalyst must be stopped to prevent the catalyst from from getting damped or contaminated.

遇大雨或恶劣天气时必须停止装剂，防止催化剂受潮或受污染。

11.5.3 Contractor Management 承包商管理

The contract for catalyst loading of Sulfur Unit, Hydrogenation Complex and Flexicoking Unit is agreed with Shanghai Yangshen while the contract for catalyst loading of Aromatics Complex has been signed with TCC.

硫磺装置、加氢联合及灵活焦化均定上海阳申、芳烃联合装置催化剂装填合同已经签署给中化三建。

11.6 Wastewater Treatment During Initial Commissioning 首次试车期间污水处置

Item 项目	Type of Wastewater 污水种类	Volume t 水量 t	Main Impurities 主要杂质	Treatment Method 处理方法
Cooling Water 1 Cleaning Prefilming Wastewater 一循清洗预膜污水	Pipeline Flushing and Replacement of Wastewater 管道冲洗、置换污水	21000	Solid particles such as rust, welding slag, soil, etc. 铁锈、焊渣、泥土等固体颗粒物	Discharge to initial rainwater monitoring pool, and discharge when the test is qualified. If the test is unqualified, then enters accident tank and transfer to saline homogenization tank for treatment and discharge when standard are met 排至初期雨水池，检测合格外排；不合格进事故罐，转至含盐均质罐，处理达标排放
	Acid Wash Passivated Wastewater 酸洗钝化污水	14000	Metal ions, acidity 金属离子，酸性	Discharge to saline homogenization tank for temporary storage or treat and discharge when standard are met according to water quality analysis 排至含盐均质调节罐暂存或根据水质分析情况，处理达标排放
Cooling Water 2 Cleaning Prefilming Wastewater 二循清洗预膜污水	Pipeline Flushing and Replacement of Wastewater 管道冲洗、置换污水	4300	Solid particles such as rust, welding slag, soil, etc. 铁锈、焊渣、泥土等固体颗粒物	Discharge to initial rainwater monitoring pool, and discharge when the test is qualified, transfer to crude oil tank for treatment with temporary pipeline 排至初期雨水池，检测合格外排；水质不合格，用临时管线转至原油罐处理

Item 项目	Type of Wastewater 污水种类	Volume t 水量 t	Main Impurities 主要杂质	Treatment Method 处理方法
	Acid Wash Passivated Wastewater 酸洗钝化污水	3000	Metal ions, acidity 金属离子，酸性	Production wastewater pipeline is required to be transferred to saline homogeneous water tank for temporary storage by lorry due to the fact that the transportation of large equipment in the pipe rack of lattitude 5 road is not closed, and it is treated up to standard for discharge. 生产污水管线因纬五路管廊大件运输未封闭，需用槽车转至含盐均质水罐暂存，处理达标排放
Water Commissioning Flushing on Unit 装置水联运冲洗水	Water Commissioning Wastewater 水联运污水	415000	Solid particles such as rust, welding slag, soil, etc. 铁锈，泥土等固体颗粒	Discharge to initial rainwater pool through rainwater system. Unqualified wastewater are transferred to saline homogenization tank for treatment and discharge when standard are met 经雨水系统排至初期雨水池；不合格转至含盐均质罐，处理达标排放
Commissioning Initial Wastewater 试车初期污水	Oily Wastewater 含油污水	9840	COD≤1000mg/L, oil content 300mg/L，suspended matter≤120mg/L，ammonia & nitrogen≤35 mg/L COD≤1000mg/L,油含量≤300mg/L，悬浮物≤120mg/L，氨氮≤35 mg/L	Enters oily wastewater series of wastewater treatment plant 进污水处理厂含油系列

Item 项目	Type of Wastewater 污水种类	Volume t 水量 t	Main Impurities 主要杂质	Treatment Method 处理方法
	Salty Wastewater 含盐污水	5262	COD ≤ 800mg/L, oil content ≤ 300mg/L, suspended matter≤120mg/L，ammonia & nitrogen≤45 mg/L COD≤800mg/L,油含量≤300mg/L，悬浮物≤120mg/L，氨氮≤45 mg/L	Enters saline wastewater series of wastewater treatment plant 进污水处理厂含盐系列

12 Difficulties and Countermeasures of Commissioning 试车的难点及对策

12.1 Water Supply Contradiction in the Beginning of Start-up 开工初期，供水矛盾突出

12.1.1 Problems: Before the normal operation of Seawater Desalination Unit, the fresh water source was limited, and the supply was tight. After the normal operation of Seawater Desalination Unit, there were still contradictions in the water supply during the pressure test of storage tank and unit flushing process.

问题：海淡装置开工正常之前，淡水来源有限、供应紧张；海淡开工正常后，在储罐试压、装置冲洗过程中，阶段性仍存在供水矛盾。

12.1.2 Measures: 措施：

12.1.2.1 Increase lake water treatment facilities. Using the rainwater collected from the freshwater lake formed by artificial excavation on the island, a water pump was set up at the lake, and lake/reclaimed water treatment facilities was attached to Cooling Water Unit 1 to solve the problem of freshwater sources for power plant boiler make-up water treatment system.

增加湖水利用设施。利用岛上人工开挖形成的淡水湖收集的雨水，在湖边设取水泵，在Ⅰ套循环水场附件增加湖水/中水回用设施，为电站化水开工解决淡水来源问题。

12.1.2.2 Introduced external water supply

引入岛外自来水。

12.1.2.3 Organize construction unit to excavate the collection pool in the storage tank area and periodically recover the rainwater.

组织施工单位在储罐区开挖集水池，阶段性回收雨水。

12.1.2.4 Arrange to build a few storage tanks for storing fresh water in advance.

提前安排建成部分储罐，储备淡水。

12.1.2.5 In order to save fresh water, crude oil tank above 50,000 cm^3 will be replaced for pressure test with seawater and is then washed with fresh water. Water used for pressure test for oil tanks are recycled.

为节约淡水，5 万立方以上原油罐改用海水试压再用淡水冲洗，油罐试压用水循环利用。

12.1.2.6 Before power plant is put into operation, Seawater Desalination Plant is start-up and put into operation in advance.

在电站投产前，海淡装置提前开启运行。

12.1.2.7 Some large pipelines in tank farm were switched to PIG pigging method for cleaning. Medium pressure steam pipeline and some equipment were replaced with chemical cleaning methods to reduce the usage of water for start-up.

罐区部分大管线改用 PIG 通球办法进行清洗，中压蒸汽管线、部分设备改用化学清洗办法清洗，减少开工用水。

12.2 The Contradiction of Power Supply at the Initial Stage of Commissioning is Large, and the Operation of The Isolation Grid After Power Plant is Put Into Operation 试车初期供电矛盾大，电站投运后孤网运行

12.2.1 Problems: Both power and steam are supplied by the self-contained power plant. The external power grid can only provide up to 15,000 kW of electric power. Before the power plant is connected to the grid for power generation, the island's construction and temporary use of power, power plant, cooling water unit 2, Air Separation & Compression Unit and other units start-up rely heavily on Brunei's power grid and diesel generators for power supply, during which the contradiction in power supply was prominent.

问题：用电和蒸汽都由自备电站供给，外电网最多只能提供 15000KW 电力支持，在电站发电并网前，岛上施工及临设用电、电站、II 套循环水场、空分空压等单元开工严重依赖文莱电网和柴油发电机供电，期间供电矛盾比较突出。

12.2.2 Measures: 措施：

12.2.2.1 Connect to Brunei power grid to relieve power supply contradiction before power plant could generate power and reduce diesel consumption for construction. The external power is connected to the island. It can supply up to 15,000 kW.

接入文莱电网，缓解电站发电前供电矛盾，减少施工柴油用量。岛外电接通，可供应 15000KW。

12.2.2.2 For the power plant to start boiler flushing, start-up commissioning of utilities and power used for construction shall undergoes dispatching and off-peak power consumption. Priority shall be given to ensure the demand for power used to start-up power plant, followed by ensuring power used for starting up other utilities systems and reduce the power used for construction as a means of adjustment, while other power shortage section will be solved by the diesel generator of construction unit. The utilities system that operates in advance arranges for off-peak power consumption. The commissioning and operation of coal transportation system of power plant is arranged for trough power consumption. The load of 1# Seawater Desalination Unit is reduced during daytime, full load during night time for rapid water storage.

对于热电站开工锅炉冲洗、公用工程开工调试及施工用电进行统一调度、错峰用电。优先保证电站开工用电需求，其次保证其它公用工程系统开工用电，减施工用电作为调节手段，不足部分施工单位使用自备柴油发电机自行解决。先期运行的公用工程系统安排错峰运行。电站输煤系统调试及运行安排在用电波谷进行；1#海淡白天降低负荷运行，夜间满负荷快速储水。

12.2.3 Problems: After the start of the self-contained power plant, there is the problem of “small grid” and “isolated operation”. It is difficult to adjust the balance of the steam power. If the adjustment is not on time, the power grid and steam pipe network will be strongly affected.

问题：自备电站开工后，存在“小电网”、“孤岛运行”的问题，汽电平衡调节难度较大，如调整不及时，就会拉垮电网和蒸汽管网。

12.2.4 Measures: 措施：

12.2.4.1 The network coordination system was designed so that the operation of the isolated network was technically feasible, and the quality of the power supply was comparable to that of the large network. Theoretically, the reliability was 92.68% (99.60% large network).

设计了机网协调系统，使孤网运行具有技术可行性，供电质量与大网相当，理论上可靠性达到92.68%（大网 99.60%）。

12.2.4.2 During commissioning, strengthen the start-up/shutdown management of large-scale electrical equipment, and conduct risk identification and countermeasures before starting large-scale electrical equipment.

试车过程中，加强大型用电设备开停管理，大型用电设备开停之前做好风险辨识和应对措施。

12.2.4.3 During commissioning, the contradiction between the stability and economy of a good steam and power system is taken into consideration. After the first boiler of the power plant is operating normally, increase the power load of the cooling water unit supply pump, the air compressor of Air Separation & Compression Unit, Seawater Desalination Unit and other unit that uses power, and arrange other boilers to be put into operation as soon as possible. After the second boiler operates normally, shutdown the diesel generators in power plant and construction site in time, reducing the power supply of the Brunei power grid to ensure that the boiler and the power grid are operating in a suitable load and increase the system stability.

试车过程中，兼顾好汽电系统稳定性与经济性之间矛盾。电站第一台锅炉运行正常后，适当增加循环水场供水泵、空分空压站空压机、海淡等用电负荷，尽快安排其它锅炉投入运行，第二台锅炉运行正常后，及时停运电站和施工现场的柴油发电机，适时减少文莱电网供电量，保证锅炉和电网在适合负荷运行，增加系统稳定性。

12.2.4.4 Develop plans for isolated power grid operation to effectively respond to shutdowns of boilers and generators accident. Strengthen the training and evaluation of operators, make the operators familiar with accident handling plans, conduct anti-accident drills on a regular basis, and improve the ability of operators to handle accidents. Once an accident occurs, operators can deal with the accident promptly and correctly according to the emergency respone plan to prevent the accident from worsening while recovering normal operation in a short time.

制订孤网运行预案，有效应对停炉停机事故。加强操作人员培训考核，使上岗操作人员熟练掌握事故处理预案，定期举行反事故演练，提高操作人员处理事故能力，一旦出现事故，操作人员能够及时、正确按照预案处理事故，不扩大事故，迅速恢复正常生产。

12.3 Tight Schedule and High Requirement for Hydrogen Gas Leak Test on Hydrogenation Unit 加氢装置氢气气密时间紧、要求高

12.3.1 Problems: This project only designs a high platinum catalyst for hydrogen production reactor of Sinopec RIPP (Research Institute of Petroleum Processing) technology. It is loaded with 6.5 tons of catalyst and uses externally supplied refined naphtha for start-up. When the feed is 100t/h and the operating temperature is 400°C~450°C, the amount of hydrogen produced is about 6000Nm^3/h. Due to the high cost of refined naphtha and the limitation of purchasing volume, in principle, all three sets of hydrogenation unit must be qualified for hydrogen gas leak test in one attempt. The schedule of hydrogen gas leak test of hydrogenation unit is tight, and requirement is high. Once the refined naphtha had used up and

hydrogen gas leaked test is unqualified, it will seriously affect the general commissioning time.
问题：本项目只设计一个石科院技术的高铂小球制氢反应器，装填了 6.5 吨催化剂，采用外供精制石脑油开工，当进料为 100t/h，操作温度为 400℃~450℃时，产氢量约 6000Nm³/h，由于精制石脑油成本高、采购量有限，原则上要求三套加氢装置氢气气密一次性通过，加氢装置氢气气密时间紧、要求高，一旦精制油用完氢气气密不通过，将严重影响总体试车时间。

12.3.2 Measures 措施：

12.3.3 Strengthen the monitoring of manufacture quality and construction quality of hydrogen presence equipment of hydrogenation unit to ensure that there is no hidden hazard in the construction. It is required that the construction quality of equipment, flanges, valves, and instruments of high-pressure system of hydrogenation equipment during construction be strictly checked to ensure high quality of handover, creating conditions for smooth qualification for hydrogen gas leak test.
加强加氢装置临氢设备制造质量及施工质量监管，确保施工不留隐患，要求施工期间对加氢装置的高压系统的设备、法兰、阀门、仪表的施工质量要严格把关和验收，确保高质量交工，为顺利通过氢气气密创造条件。

12.3.3.1 During nitrogen gas leak test, every effort should be made to increase the pressure of nitrogen pressure test, strictly examine and ensure the quality of nitrogen gas leak test, and try to find the leak point as much as possible during nitrogen gas leak test.
在氮气气密阶段，要千方百计提高氮气试压压力，把好氮气气密质量关，尽量在氮气气密阶段发现漏点。

12.3.3.2 The pressure is not relieved after nitrogen gas leak test is completed, the hydrogen gas is directly introduced to increase the pressure, reducing the amount of hydrogen gas used.
氮气气密结束后不泄压，直接引氢气接着升压，减少氢气用量。

12.3.3.3 If large problem is found in the process of hydrogen gas leak test, it is necessary to release the pressure and displace it. A small hydrogen production unit should be shutdown in time to avoid waste of hydrogen gas.
若氢气气密过程中发现较大问题需泄压置换，及时安排小制氢装置停工，避免氢气浪费。

12.3.3.4 Appropriately increase the amount of refined naphtha purchasing volume, leaving refined naphtha in excess. Hydrogen gas leak test is scheduled for 10 days, refined oil is planned to purchase 35,000 tons, after deducting pipeline filling and oil tank bottom oil inventory, the available amount is about 31,000 tons, according to the amount of 100t/h, it can be used for 13 days, setting aside a chance of unqualified hydrogen gas leak test.
适当增加精制石脑油采购量，留点余地。氢气气密计划 10 天，精制油计划采购 35000 吨，扣除管道填充和油罐垫底油，可用量约 31000 吨，按 100t/h 用量计算可使用 13 天，预留一次氢气气密不合格的机会。

12.4 Single Unit Series, Large Scale, and High Difficulties on Organizing Start-up 装置单系列、规模大，开工组织难度大

12.4.1 Problems: This project is a single series petrochemical plant. The scale of the plant is

large. The design is all straight feeding. The intermediate feedstock tanks have a short storage time. If there is a problem with one of the unit during the commissioning process, the timeline cannot be reached according to schedule and will disrupt the start-up procedures and affect the overall start-up process of the entire plant.

问题：本项目为单系列石化厂，装置规模大，设计都是直供料，中间原料罐储存时间短，如果在试运开工过程其中一套装置出现问题，不能按照计划达到要求的时间节点，即会打乱全厂开工程序，影响整体开工进程。

12.4.2 Measures: 措施：

12.4.2.1 The overall commissioning network is planned according to the model of “Utilities, storage & transportation being implemented first, production unit uses inverse start-up”. It is required that the utilities and storage and transportation system reach the operating condition in advance before unit is put into operation. The main unit is started up in a “inverse start-up” mode, and part of the feedstock is purchased from outsource, and each unit carries out commissioning and start-up in succession. The equipment and personnel were fully evaluated before commissioning.

总体试车网络按“公用工程和储运先行、生产装置倒开车”的模式策划。要求在装置投产前公用工程和储运系统提前达到投用条件；主要装置按“倒开车”方式开工，外购部分原料油，各装置先后进行水联运、冷油运、热油运，在正式投料试车前设备、人员得到充分考验。

12.4.2.2 Reasonably control the load of commissioning unit and storage of intermediate material. During the commissioning, the load of the unit is controlled at 50% to 70%, and storage of intermediate material is controlled at about 50%.

合理控制试车装置负荷和中间料库存。试车期间，装置负荷控制在50%~70%中间料库存控制50%左右。

12.4.2.3 The commissioning work was coordinated and commanded by dispatcher, consolidate in every step, and managed steadily. Production dispatcher are responsible to organize relevant profession to confirm the conditions for crucial commissioning steps to ensure that each step is stable and far and strive for successful start-up in one attempt. At the same time, a “withdrawal plan” is developed under the condition when commissioning is not running smoothly. When commissioning of a certain set of units is not running smoothly but given the condition that if the intermediate material tank can buffer through difficulties, commissioning will continue to proceed, other unit cannot be scheduled to be stopped and be put into waiting status. Restart the commissioning after problem is solved.

试车工作由调度统一协调指挥，步步为营，稳扎稳打。由生产调度组织相关专业对关健试车步骤实行条件确认，保证每一步行稳致远，力争一次性开车成功。同时制订试车不顺利情况下“退守方案”，当某套装置试车不顺利，若中间料罐可以缓冲渡过难关则继续往下走，不能则安排其它装置停运待命，待问题解决后再重启试车过程。

12.4.2.4 Develops simulation training software for unit that is important to carry out simulation operations in advance to improve the operating proficiency of operators.

重要装置开发仿真培训软件，提前进行模拟操作，提高操作人员操作熟练程度。

12.5 Process of Flexicoking Unit is New 灵活焦化新工艺

12.5.1 Problems: 问题：

12.5.1.1 Lack of Flexicoking Unit start-up and operating experience.

缺乏灵活焦化装置开工和操作经验。

12.5.1.2 It is the first time that design institute designed a Flexicoking Unit and lacked experience. The number of design personnel is lacked, and the design progress was slow. Some design modification proposals were not adopted, and design flaws may exist.

设计院第一次设计灵活焦化装置，也缺乏经验，设计人员力量不足，设计进度偏慢，部分设计修改建议没有采纳，可能存在设计缺陷。

12.5.1.3 Some equipment was manufactured for the first time by the manufacturer, and the quality of the equipment was uncertain.

部分设备是生产厂第一次制造，设备质量存在不确定性。

12.5.1.4 The flexi gas desulfurization solvent, carbonyl sulfide conversion catalyst and other types of catalyst, addictive and solvent are used for the first time, and the effect of the usage needs to be checked.

灵活气脱硫溶剂、羰基硫转化催化剂等三剂辅材第一次应用，使用效果有待检验。

12.5.2 Measures: 措施：

12.5.2.1 Strengthen training. When shift is on duty, each shift cycle uses one day's rest time to conduct classroom training, improve management and operation levels, organize management personnel and production operators to conduct multiple review and discussion of start-up plans to develop a better start-up plan.

加强培训，班组倒班期间，每个倒班周期利用一天休息时间进行课堂培训，提高管理及操作水平，组织管理人员和生产骨干对开工方案进行多次审查讨论，制定完善的开工方案。

12.5.2.2 It is planned to arrange 12 operators to undergo training in Flexicoking Unit in Japan for 4 weeks, and 6 personnel to participate in the overhaul of Flexicoking Unit in Rotterdam, Netherlands in early October for 2 weeks.

计划安排操作骨干 12 人到日本灵活焦化装置实习 4 周，安排 6 人参加荷兰鹿特丹灵活焦化装置 10 月初的检修，时间为 2 周。

12.5.2.3 Strictly examine the review of drawings, organize several design reviews, and implement the rectification of design flaws to improve design quality.

把好图纸审查关，组织多次设计审查，落实设计缺陷整改，提高设计质量。

12.5.2.4 Carry out regular inspection on the manufacturing of crucial equipment to ensure good quality.

对关键设备制造进行定期检查，把好出厂质量关。

12.5.2.5 Flexi gas desulfurization solvents must be purchased from products with Flexicoking Unit application performance. Carbonyl sulfide conversion catalysts are recommended to purchase products with Flexicoking Unit application performance. If China’s non-performance products have an advantage in price, it is recommended to purchase half of the performance

products and half of the non-performance products respectively and load them into two carbonyl sulfide conversion reactors (one reactor in operation and the other on standby).

灵活气脱硫溶剂必须采购有灵活焦化装置应用业绩的产品，羰基硫转化催化剂建议采购有灵活焦化装置应用业绩的产品，若国内无业绩产品价格有优势，建议有业绩产品和无业绩产品各采购一半，分别装入两个羰基硫转化反应器（反应器为一开一备）。

12.5.2.6 One month before the handover, Exxon Mobil shall sent a field engineer to the site to assist in checking the construction quality. During the start-up period, four people (start-up experts, process engineers, equipment engineers, instrument engineers) were sent to the site to assist in start-up. The specific service personnel were adjusted according to the actual start-up situation.

装置中交前一个月美孚派一名现场工程师到现场协助检查施工质量，开工期间派4人（开工专家、工艺工程师、设备工程师、仪表工程师）到现场协助开工，具体服务人员根据实际开工情况进行调整。

13 Economic Benefits 经济效益

13.1 Economic Benefits Calculation 经济效益测算

13.1.1 Calculation Conditions 测算条件

13.1.1.1 Range of calculation: Benefit estimation includes three phases, commissioning preparation, full scale commissioning and optimization adjustment. Commissioning preparation is started from. Full scale commissioning starts where Atmospheric and Vacuum Distillation Unit start-up for the second time where all side-line products are qualified,and ptimization adjustment .

测算范围：效益测算包括试车准备、全面试车、优化调整三个阶段，试车准备；全面试车自常减压二次开工起，至全部侧线产品合格为止，及优化调整。

13.1.1.2 Basic of price determination: 1) The price of crude oil and purchased feedstocks is determined according to CIF price in March 2018. 2) The price of the product is determined according to FOB price in March 2018. 3) Price of semi-finished products are taken according to the internal operating cost and the price deduction according to the price of finished product.

取价基础：① 原油和外购原料取自 2018 年 3 月份文莱到岸价格。② 产品取自 2018 年 3 月文莱离岸价格。③半成品取自内部成本核算和成品折价。

13.1.2 Calculation Results and Description 测算结果及说明

13.1.2.1 Estimated results: Loss of USD 69.97 millions. (Includes: 52.34 million kWh of purchased electricity, USD 6.49 millions; 17,000 tons of purchased water, USD 150 thousands)

测算结果：亏损 6997 万美金。（包含：外购电 5234 万度，649 万美元；外购水 17 万吨，15 万美元）

13.1.2.2 Description: The losses are mainly the expenses incurred when power is generated by power plant and the commissioning of steam generation supplying to the other unit. No product is being produced during this stage, and the total consumption of fuel (coal+LPG) is

USD 93.97 millions. Full scale commissioning and optimization adjustment stage produced a benefit of USD 24 millions.

说明：亏损主要是热电站发电和产汽供装置调试期间所产生的费用，该阶段无产品产出，燃料（煤+液化气）合计消耗 9397 万美元；全面试车和优化调整阶段，产生效益 2400 万美元。

Table 13 – 6 Summary of Import/Outport Price

表 13-6 投入产出价格汇总

Name 名称	Cost, USD 10,000 价格，万美元	Name 名称	Cost, USD 10,000 价格，万美元	Remark 备注
Cost of Imported Crude Oil 原油进厂*价格	105429	Cost of Imported Crude Oil 原油进厂*价格	-105429	Expenses 支出
Cost of Imported Feedstock 原料进厂*价格	13320	Cost of Imported Feedstock 原料进厂*价格	-13320	
Fuel Consumption 燃料消耗	9397	Fuel Consumption 燃料消耗	-9397	
Cost of Product 产品*价格	54435	Cost of Product 产品*价格	54435	Income 收入
Cost of Crude Oil Storage 原油库存*价格	37249	Cost of Crude Oil Storage 原油库存*价格	37249	
Cost of Feedstock Storage 原料库存*价格	2507	Cost of Feedstock Storage 原料库存*价格	2507	
Cost of Product Storage 产品库存*价格	19533	Cost of Product Storage 产品库存*价格	19533	
Cost of Intermediate Material Storage 中间物料库存*价格	5939	Cost of Intermediate Material Storage 中间物料库存*价格	5939	
Cost of Inventory Volume 垫料量*价格	1487	Cost of Inventory Volume 垫料量*价格	1487	
Total, USD 10,000 as unit 合计,单位万美金			-6997	

13.2 Measures to Improve Efficiency of Commissioning 提高试车效益的措施

13.2.1 **Optimize the start-up preparation plan**: Arrange Atmospheric and Vacuum Distillation Unit to start ahead of schedule and prepare start-up materials for Kerosene Hydrotreating Unit, Diesel Hydrotreating Unit, Hydrocracking Unit and Flexicoking Unit, and reduce the volume of outsourced feedstocks by 13,800 tons, which will save about USD 1.38 millions in cost.

优化开工备料方案：安排常减压提前开工，给航煤、柴油加氢、加氢裂化和灵活焦化备开工原料，减少外采原料数量 1.38 万吨，约节省成本 138 万美元。

13.2.2 **Organize commissioning according to inverse start-up:** Referring to the fact that Sinopec's inverse start-up can reduce the time to produce qualified product by 3 months

compared to the normal start-up. Fuel consumption alone can save up to 240,000 tons of coal, 110,000 tons of fuel gas, with a total of USD 19.89 millions.

按倒开车组织试车：参照中石化企业倒开车比顺开车可缩短 3 个月时间产出合格产品，仅燃料消耗一项，煤可节省 24 万吨，燃料气可节省 11 万吨，合计节省 1989 万美元。

13.2.3 **Optimize power supply plan:** Before power plant could generate power, diesel generators were used for construction and commissioning. The cost of diesel generators was USD 0.19/kWh, and the cost of electricity purchased was USD 0.122/kWh. Outsourcing electricity 3 million kWh saves USD 204 thousands.

优化供电方案：电站发电之前，施工、试车电都是用柴油发电机，柴油发电机发电成本 0.19 美元/度，外购电成本 0.122 美元/度。外购电 300 万度，节省 20.4 万美元。

13.2.4 **Optimize hydrogen gas leak test for hydrogenation equipment plan:** 1) Strengthen supervision at the engineering stage to ensure that hydrogen gas leak test is successful in one attempt. 2) When nitrogen gas leak test pressure reached 5.0MPa, the pressure is not relief, directly carry out hydrogen gas leak test to reduce the time of hydrogen gas leak test and the consumption of refined oil. 3) Use high platinum catalyst hydrogen production to replace hydrogen production by reforming for three sets of hydrogenation units to undergo hydrogen gas leak test, reducing hydrogen emissions to flare. The minimum amount of hydrogen production is 8.5 tons/hour, calculate according to qualified hydrogen leak test in one attempt, reducing hydrogen from venting by 2244 tons in 11 days, and reducing costs by USD 3.49 millions.

优化加氢装置气密方案：①加强工程阶段监管，力保氢气气密一次通过；②采取氮气气密试压到 5.0MP 不卸压，直接进行氢气气密的办法，减少氢气气密时间和精制油用量；③利用高铂制氢替代重整产氢给三套加氢装置进行氢气气密，减少氢气外排火炬，重整氢气产量最低 8.5 吨/时，按一次性氢气气密合格计算，11 天共计减少氢气放空 2244 吨，降低成本 349 万美元。

13.2.5 **Optimize the material arrangement for start-up:** All slop oil produced in start-up will be returned to the crude oil tank for recycling, where slop oil and degraded product will not be sold.

优化开工物料安排：开工产生污油全部返回原油罐进行回炼，不销售污油和降级产品。

13.2.6 **Optimize the pipeline treatment plan:** 3.5MPa steam system pipeline are treated with chemical cleaning, and then undergoes steam blowing, according to the calculation of Sinopec, blowing of pipelines after chemical cleaning can normally be completed in 7 to 10 days, and pipelines that have not undergone chemical cleaning needs about 40 to 60 days which saves about USD 3.17 millions.

优化管道处理方案：3.5MPa 蒸汽系统管线采取化学清洗处理，再进行蒸汽打靶，参照中石化企业测算，经过化学清洗的管线打靶一般在 7～10 天能完成，未经过化学清洗的管线需 40～60 天左右，节约费用约 317 万美元。

13.2.7 **Flexicoking Unit start-up simultaneously:** Due to the influence of design and equipment manufacturing factors, reactor, heater and gasifier of Flexicoking Unit were originally planned to arrive at the site only by the end of 2018. In order to ensure Flexicoking Unit and

main units to start-up simultaneously, the company coordinated the design institute and the manufacturer of reactor, heater and gasifier to make every effort to make progress, and do follow up work at all time, require the manufacturing period of reactor, heater and gasifier to be shortened by 3 months.

灵活焦化同步开工：受设计和设备制造因素影响，灵活焦化三器原计划 2018 年底才能到现场，为保证焦化与主体装置同步开工，公司协调设计院和三器制造厂家千方百计抢进度，并人盯死守，要求三器制造工期缩短 3 个月。

14 Appendix 附件

Appendix 1 List Of Principal Units in The Plant

附件 1 全厂主要单元一览表

Appendix 2 List of Chemical Feedstocks for Commissioning Use

附件 2 试车用化工原料清单

Appendix 3 Overall Plan for Start-Up of Auxiliary Systems and Main Production Units

附件 3 系统工程和各主体生产装置投料试车统筹图

Appendix 4 Material Balance During Initial Commissioning of The PMB Project

附件 4 PMB 项目首次试车期间物料平衡

Appendix 5 List of Boiler and Steam Turbine Load During Initial Commissioning of PMB Project

附件 4 PMB 首次试车期间锅炉、汽机负荷表

Appendix 1 附件 1

List of Principal Units in The Plant
全厂主要单元一览表

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
I 一	1000	Production units 生产装置	V 五	6000	Auxiliary facilities 辅助设施
1	1011	8.0 MMTA Atmospheric and Vacuum Distillation Unit 800 万吨/年常减压蒸馏装置	64	6001	Central Laboratory and Environment Monitoring Centre 中心化验室及环境监测站
2	1012	2.35 MMTA Ligh Ends Recovery Unit 235 万吨/年轻烃回收装置	65	6002	Office Building 办公楼
3	1013	Acid Gas and LPG Ends Recovery Unit 产品精制装置	66	6003	Maintenance Station 维修站
4	1020	1.3 MMTA Kerosene Hydrotreating Unit 130 万吨/年煤油加氢精制装置	67	6011	Warehouse 全厂性仓库
5	1030	2.2 MMTA Diesel Hydrotreating Unit 220 万吨/年柴油加氢精制装置	68	6012	Chemical Warehouse 化学品仓库
6	1040	2.2 MMTA Hydrocracking Unit 220 万吨/年加氢裂化装置	69	6013	Hazardous Chemical Warehouse 危险化学品仓库
7	1041	600 KMTA LPG Fractionation Unit 60 万吨/年气体分离装置	70	6014	Steel Cylinder Warehouse 钢瓶库
8	1050	1.5 MMTA Aromatics Complex 150 万吨/年芳烃联合装置	71	6101	Central Control Room (CCR) 中心控制室
9	1056	Light Naphtha Isomerization Unit	72	6201	Field Auxiliary Room FAR1

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
		轻石脑油异构化装置			现场机柜室 FAR1
10	1060	180000Nm³/h PSA Unit 180000Nm³/h PSA 氢提纯装置	73	6202	Field Auxiliary Room FAR2 现场机柜室 FAR2
11	1070	1.0 MMTA Flexicoking Unit 100 万吨/年灵活焦化装置	74	6203	Field Auxiliary Room FAR3 现场机柜室 FAR3
12	1091	180 t/h Sour Water Stripping Unit 180 吨/小时酸性水汽提装置			Field Auxiliary Room FAR4 现场机柜室 FAR4
13	1092	500 t/h Solvent Regeneration Unit 500 吨/小时溶剂再生装置	75	6205	Field Auxiliary Room FAR5 现场机柜室 FAR5
14	1093	60+60 kta Sulfur Recovery and Tail Gas Treatment Unit 6+6 万吨/年硫磺回收及尾气处理装置	76	6206	Field Auxiliary Room FAR6 现场机柜室 FAR6
II 二	3000	General Plan and Transportation 总图运输	77	6207	Field Auxiliary Room FAR7 现场机柜室 FAR7
15	3011	General plot plan 厂区总平面布置	78	6208	Field Auxiliary Room FAR8 现场机柜室 FAR8
16	3012	Plant vertical planning 厂区竖向布置	79	6210	Field Auxiliary Room FAR11 现场机柜室 FAR11
17	3013	Road and Drainage/Sewage 厂区道路及排雨水	80	6212	Field Auxiliary Room FAR13 现场机柜室 FAR13
18	3014	Common pipeline 厂区管线综合	81	6301	Field Operator Room (1) 外操间（一）
19	3015	Fence/Gate and Security Room 厂区围墙大门及警卫室	82	6302	Filed Operator Room (2) 外操间（二）
20	3016	Landscaping 厂区绿化	VI 六	8000	Off-site Constructions 场外工程
III 三	4000	Oil Storage and Transportation 油品储运			Plant Boundary Section 厂际部分
21	4001	Crude Oil Tank Farm and Pump Station (1)	83	8001	Pipe Rack and Access Road (between Eastern Site and

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
		原油罐区及泵站（一）			Western Jetty) 厂际管廊及检修路（厂区至西区码头）
22	4002	Crude Oil Tank Farm and Pump Station (2) 原油罐区及泵站（二）	84	8002	Pipe Rack and Access Road (between Eastern Site and Eastern Jetty) 厂际管廊及检修路（厂区至东区码头）
23	4101	Hydrogenation Feedstock Tank and Pump Station 加氢原料罐区及泵站	85	8003	Pipe Rack and Access Road (between Eastern Site and Flare) 厂际管廊及检修路（厂区至火炬）
24	4102	Aromatics Feedstock Tank and Pump Station 重整芳烃原料及泵站	86	8004	Off-site Road (Eastern and Northern Side) 厂外道路（东侧和北侧）
25	4103	Feedstocks Tank for Coking/ Hydrogenation and Pump Station 焦化原料、加氢裂化原料罐区及泵站			Western Tank Farm 西区码头库区
26	4201	Tank Farm for Gasoline and Pump Station (1) 汽油罐区及泵站（一）	87	8011	General Layout of Tank Farm 库区总平面布置
27	4202	Diesel/Jet Fuel Tank Tarm and Pump Station (1) 柴油、航煤罐区及泵站（一）	88	8012	Vertical Layout of Tank Farm 库区竖向布置
28	4204	Propylene Tank Farm and Pump Station 丙烯罐区及泵站	89	8013	Road and Rainwater Drainage of Tank Farm 库区道路及排雨水
29	4205	Iso-butane Tank Farm and Pump Station 异丁烷罐区及泵站	90	8014	Tank Farm Common Pipeline 库区管线综合

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
30	4206	LPG tank farm and pump station(2) LPG 罐区及泵站（二）	91	8015	Fence/Gate and Security Room 库区围墙大门及警卫室
31	4208	Raffinate Oil/Light Naphtha Tank Farm and Pump Station 非芳烃抽余油、轻石脑油罐区及泵站	92	8016	Greening of Tank Farm 库区绿化
32	4209	Blending Stocks/Pentane Tank Farm and Pump Station 轻烃汽油调和组分、戊烷油罐区及泵站	93	8021	Tank Farm for Gasoline and Pump Station (2) 汽油罐区及泵站（二）
33	4210	Heavy Aromatics/Light Slop Oil Tank Farm and Pump Station 重芳烃、轻污油罐区及泵站			Newly Added Oil Vapor Recovery Facility of 8021 8021 新增油气回收设施
34	4211	Tail Oil/Heavy Slop Oil Tank Farm and Pump Station 尾油、重污油罐区及泵站	94	8022	Diesel/Jet Fuel Tank Farm and Pump Station (2) 柴油、航煤罐区及泵站（二）
35	4401	Plant-wide Process/Heat Piping Network 全厂工艺及热力管网	95	8023	Aromatics Tank Farm and Pump Station (2) 芳烃罐区及泵站（二）
36	4503	Condensate Deodorization Unit 扫线油脱臭设施	96	8024	Light Naphtha Tank Farm and Pump Station 轻石脑油罐区及泵站
37	4701	Flare 火炬	97	8025	Vehicle Loading Station 汽车装车站
38	4702	Flare Gas Recovery Unit 火炬气回收设施	98	8026	Oil Vapor Recovery Facility (1) 油气回收设施（一）
39	4703	Flexicoking Flare 灵活焦化火炬	99	8027	Oil Vapor Recovery Facility (2) 油气回收设施（二）
IV	5000	Utilities and Auxiliary Facilities	100	8028	Auxiliary Tank Farm and

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
四		公用工程及配套设施			Pump Station 辅助作业罐区及泵站
40	5001	Seawater Desalination Plant 海水淡化设施	101	8029	Tank Farm Process and Heat Pipeline Network 罐区工艺及热力管网
41	5101	Water Supply and Fire Water Pressurization Pump Station 给水及消防加压泵站	102	8041	Firefighting Pumping Station 消防加压泵站
42	5111	Cooling Water Unit 2 循环水场-2	103	8042	Foam Station 泡沫站
		Cooling Water Unit 1 循环水场-1	104	8043	Fire Station 消防站
43	5121	Foam Station 泡沫站	105	8044	Rainwater Monitoring and Accident Reservoir 雨水监控及事故池
44	5122	Fire Station and Gas Protection Station 消防站及气防站	106	8045	Piping Network for Water Supply/Drainage and Firefighting 给排水及消防管网
45	5131	Rainwater Monitoring and Accident Reservoir 雨水监控及事故池	107	8046	Drainage Pumping Station 污水提升泵站
46	5141	Piping Network for Water Supply/Drainage and Firefighting 给排水及消防管网	108	8051	10kV Power Substation 10KV 区域变电所
47	5151	Drainage Pumping Station 污水提升泵站	109	8053	Power Supply and Distribution System 供配电系统
48	5152	Sewage and Wastewater Recycling Facilities 污水处理及污水回用设施	110	8061	Telecommunication System and Wiring 电信系统及线路
49	5153	Solid Waste Transit Storage	111	8071	Field Auxiliary Room FAR10

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
		固体废物临时中转库			现场机柜室 FAR10
50	5154	Alkali Waste Treatment 碱渣处理	112	8072	Field Control Room FCR12 现场控制室 FCR12
51	5155	Storage for Radioactive Sources 放射源库	113	8081	Western Tank Farm Office 西码头库区办公室
52	5201	66kV Power Substation (1) 66KV 区域变电所（一）			Environmental Monitoring Facilities 环境监测设施
53	5202	66kV Power Substation (2) 66KV 区域变电所（二）	114	8101	Automated Atmospheric Environmental Monitoring 大气环境自动监测
54	5211	Plant-wide Power Supply and Distribution System 全厂供配电系统	115	8102	Automated Noise Monitoring 噪声自动监测
55	5301	Plant Area Telecommunication System and Wiring 厂区电信系统及线路	116	8103	Groundwater Monitoring and Sampling Wells 地下水监测井及采样井
56	5401	Plant-wide Information System 全场信息化系统	117	8104	Seawater Sampling and Monitoring 海水水质采样及监测
57	5500	General Substation 总变电所			Jetty Facilities 码头设施
58	5501	Coal Power Plant 煤电站	118	8200	Eastern Petrochemical Jetty 东区石化码头
59	5601	Hot Water Station 热水站	119	8201	Oil Vapor Recovery Facilitiy 油气回收设施
60	5602	Administration Zone Refrigeration Station 厂前区制冷站	120	8300	Western Petrochemical Jetty 西区石化码头
61	5603	Refrigeration Station for Process Area 装置区制冷站	121	8700	Coal Jetty 煤码头

No. 序号	Unit No. 单元编号	Unit Name 单元名称	No. 序号	Unit No. 单元编号	Unit Name 单元名称
62	5604	Plant-wide Heat Supply System 全厂供热系统			Single Point Mooring and Subsea Crude Oil Pipeline 单点系泊及原油海底管道
63	5701	Air Separation and Air Compression Facility 空分、空压设施	122	8401	Single Point Mooring 单点系泊
			123	8402	Subsea Crude Oil Pipeline 原油海底管道
			VII 七		Others 其它
			124	8500	Land Reclaimation 陆域形成
			125	8600	Off-site Flood Discharge 厂外排洪

Appendix 2 附件 2

List of Chemical Feedstocks for Commissioning Use
试车用化工原料清单

Atmospheric and Vacuum Distillation Unit 常减压装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Neutralizing agent 中和剂	Dosage according to chosen manufacturer as standard 中标厂家用量为准	15th March 2019 2019 年 3 月 15 日
2	Demulsifying agent 破乳剂	Dosage according to chosen manufacturer as standard 中标厂家用量为准	15th March 2019 2019 年 3 月 15 日
3	Corrosion inhibitor 缓蚀剂	Dosage according to chosen manufacturer as standard 中标厂家用量为准	15th March 2019 2019 年 3 月 15 日
4	High temperature corrosion inhibitor 高温缓蚀剂	Dosage according to chosen manufacturer as standard 中标厂家用量为准	15th March 2019 2019 年 3 月 15 日
5	Anti-scaling agent 阻垢剂	Dosage according to chosen manufacturer as standard 中标厂家用量为准	15th March 2019 2019 年 3 月 15 日

Light Ends Recovery Unit 轻烃回收装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Corrosion inhibitor 缓蚀剂	Dosage according to chosen manufacturer as standard 中标厂家用量为准	25th March 2019 2019 年 3 月 25 日

Acid Gas and LPG Ends Recovery Unit 产品精制装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	YPT-02 High Efficiency Sweetening Catalyst YPT-02 型高效脱硫醇催化剂	0.12	18th February 2019 2019 年 2 月 18 日

Kerosene Hydrotreating Unit 煤油加氢装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Corrosion Inhibitor 缓蚀剂	Dosage according to	25th March 2019

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
		chosen manufacturer as standard 中标厂家用量为准	2019 年 3 月 25 日
2	Anti-oxidizing agent 抗氧化剂	10	25th March 2019 2019 年 3 月 25 日
3	Inert ceramic balls 惰性瓷球	12	25th March 2019 2019 年 3 月 25 日
4	Aviation kerosene desulfurization agent 航煤精脱硫剂	55	25th March 2019 2019 年 3 月 25 日
5	Kerosene Hydrotreating protective agent 煤油加氢保护剂	47.5 m^3	25th March 2019 2019 年 3 月 25 日
6	GSK-19/10/6A AT405 1/10 AQ425DX 1/16 AQ catalyst 催化剂 GSK-19/10/6A AT405 1/10 AQ425DX 1/16 AQ	3.3 m^3	25th March 2019 2019 年 3 月 25 日

Diesel Hydrotreating Unit 柴油加氢装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Corrosion inhibitor 缓蚀剂	20	25th March 2019 2019 年 3 月 25 日
2	Inert ceramic balls 惰性瓷球	15.7	25th March 2019 2019 年 3 月 25 日
3	Naphtha desulfurization agent 石脑油脱硫剂	15	25th March 2019 2019 年 3 月 25 日
4	Protective agent RG-1 保护剂 RG-1	279.2 m^3	25th March 2019 2019 年 3 月 25 日
5	Main catalyst RG-2000 主催化剂 RG-2000	20.77 m^3	25th March 2019 2019 年 3 月 25 日
6	Trisodium phosphate 磷酸三钠	3.75	25th March 2019 2019 年 3 月 25 日
7	High pressure air cooler corrosion inhibitor 高压空冷缓蚀剂	To be determined 待定	25th March 2019 2019 年 3 月 25 日

Hydrocracking Unit 加氢裂化装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Corrosion inhibitor 缓蚀剂	30	25th March 2019 2019 年 3 月 25 日
2	Φ3, Φ6 Inert ceramic balls 惰性瓷球 φ3、φ6	8.7m³、24.7m³	25th March 2019 2019 年 3 月 25 日
3	Sulfiding agent DSMS (including Diesel Hydrotreating) 硫化剂 DMDS（含柴油加氢）	199.1	25th March 2019 2019 年 3 月 25 日
4	Heavy naphtha desulfurization agent ADS120 重石脑油精脱硫剂 ADS120	52m³	25th March 2019 2019 年 3 月 25 日
5	LPG desulfurization agent 液化气脱硫剂	60	25th March 2019 2019 年 3 月 25 日
6	Catalyst 催化剂	577.9 m³	25th March 2019 2019 年 3 月 25 日
7	Liquid ammonia 液氨	12	1st May 2019 2019 年 5 月 1 日
8	Quartz sand 石英砂	16.6	25th March 2019 2019 年 3 月 25 日
9	6.5% alkali 碱液 6.5%	17m³	10th March 2019 2019 年 3 月 10 日
10	Liquid Ammonia 液氨	12	1st May 2019 2019 年 5 月 1 日

LPG Fractionation Unit 气分装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Φ3 Inert ceramic balls 惰性瓷球 φ3	0.5m³	25th March 2019 2019 年 3 月 25 日
2	Φ3, Φ10 Inert ceramic balls (contain Kerosene and Diesel Hydrotreating Unit) 惰性瓷球 φ6、φ10（含煤、柴油加氢）	2.8m³、3.4 m³	25th March 2019 2019 年 3 月 25 日
3	LPG hydrolytic catalyst 液化气水解催化剂	32 m³	25th March 2019 2019 年 3 月 25 日
4	LPG desulfurization agent	17.5 m³	25th March 2019

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
	液化气脱硫剂		2019 年 3 月 25 日
5	Propylene drying agent 丙烯干燥剂	18m^3	25th March 2019 2019 年 3 月 25 日

Aromatic Complex 芳烃联合装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
1	Corrosion inhibitor 缓蚀剂	0.5	25th March 2019 2019 年 3 月 25 日
2	Φ3, Φ6, Φ13, Φ19 Inert alumina ceramic balls 惰性氧化铝瓷球，φ3、φ6、φ13、φ19	514	25th March 2019 2019 年 3 月 25 日
3	Sulfiding agent DSMS 硫化剂 DMDS	13.5	25th March 2019 2019 年 3 月 25 日
4	Trisodium phosphate 磷酸三钠	2.8	21st April 2019 2019 年 4 月 21 日
5	Protective agent, CatTrap-30 保护剂，CatTrap-30	2.55m^3	25th March 2019 2019 年 3 月 25 日
6	Protective agent, CatTrap-50 保护剂，CatTrap-50	4.25m^3	25th March 2019 2019 年 3 月 25 日
7	Catalyst, HYT-1119 催化剂，HYT-1119	38.16	25th March 2019 2019 年 3 月 25 日
8	Protective agent, T-306 保护剂，T-306	10	25th March 2019 2019 年 3 月 25 日
9	Catalyst, CB-3B 催化剂，CB-3B	6.5	25th March 2019 2019 年 3 月 25 日
10	Mercury removal agent, Axrap273 or other type 脱汞剂 Axrap273 或者其它型号	33.8	25th March 2019 2019 年 3 月 25 日
11	Dechlorination agent, CLR-204 5X8 脱氯剂，CLR-204 5X8	42.66	25th March 2019 2019 年 3 月 25 日
12	Dechlorination agent, PCL-100 8X12 脱氯剂，PCL-100 8X12	82.368	25th March 2019 2019 年 3 月 25 日
13	Catalyst, R264 催化剂，R264	304.625	25th March 2019 2019 年 3 月 25 日
14	Perchloroethylene	9.25	26th May 2019

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
	全氯乙烯		2019 年 5 月 26 日
15	Refrigerant grade propane 冷剂级丙烷	50	26th May 2019 2019 年 5 月 26 日
16	Desulfurization agent, ADS-120 脱硫剂，ADS-120	28.7	25th March 2019 2019 年 3 月 25 日
17	Desulfurization agent, ADS-121 脱硫剂，ADS-121	1.19	25th March 2019 2019 年 3 月 25 日
18	Catalyst, PURASPEC 2443M 催化剂，PURASPEC 2443M	2	25th March 2019 2019 年 3 月 25 日
19	Catalyst, PI244 催化剂，PI244	16.7	25th March 2019 2019 年 3 月 25 日
20	Catalyst, PI244 催化剂，PI244	50.1	25th March 2019 2019 年 3 月 25 日
21	Drying agent, PDG-418 干燥剂，PDG-418	16	25th March 2019 2019 年 3 月 25 日
22	Catalyst, I-500A 催化剂，I-500A	24.465	25th March 2019 2019 年 3 月 25 日
23	Catalyst, I-500B 催化剂，I-500B	40.635	25th March 2019 2019 年 3 月 25 日
24	Adsorbent, ADS-37 HY 吸附剂，ADS-37 HY	1432.158	20th February 2019 2019 年 2 月 20 日
25	Adsorbent, ADS-37L HY 吸附剂，ADS-37L HY	56.889	20th February 2019 2019 年 2 月 20 日
26	Molecular sieve, CAN-418/318/228/158 分子筛，CAN-418/318/228/158	1016.52	25th March 2019 2019 年 3 月 25 日
27	Molecular sieve, TCDTO-1 (agreement has been signed) 分子筛，TCDTO-1（协议已签订）	470	25th March 2019 2019 年 3 月 25 日
28	Extractive solvent (Sulfolane) 抽提溶剂（环丁砜）	700	25th March 2019 2019 年 3 月 25 日
29	Monoethanolamine 单乙醇胺	0.2	26th May 2019 2019 年 5 月 26 日
30	Tatoray catalyst (TA-30) 歧化催化剂（TA-30）	91.95	25th March 2019 2019 年 3 月 25 日
31	Desorbent	2600	25th March 2019

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Ready by 准备就绪时间
	解吸剂		2019 年 3 月 25 日
32	Chemical for boiler boil-out 煮炉用药剂		7th April 2019 2019 年 4 月 7 日
33	Hydrochloric acid, phosphoric acid, sodium hydroxide 盐酸、磷酸、氢氧化钠		7th April 2019 2019 年 4 月 7 日
34	Anti-foaming agent 消泡剂	1.7	25th March 2019 2019 年 3 月 25 日

Sulfur Recovery Unit 硫磺回收装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	Φ6 ceramic balls 瓷球Φ6	30m³	25th March 2019 2019 年 3 月 25 日
2	Φ9.5 COS reactor ceramic balls COS 反应器瓷球Φ9.5	26.8m³	25th March 2019 2019 年 3 月 25 日
3	High efficiency desulfurization agent MDEA 高效脱硫溶剂 MDEA	180	25th March 2019 2019 年 3 月 25 日
4	Trisodium phosphate 磷酸三钠	3.5	21st April 2019 2019 年 4 月 1 日
5	Sulfur recovery alumina catalyst 氧化铝硫磺回收催化剂	18.2m³	25th March 2019 2019 年 3 月 25 日
6	Sulfur recovery titanium dioxide catalyst 二氧化钛硫磺回收催化剂	36.4m³	25th March 2019 2019 年 3 月 25 日
7	Sulfur recovery alumina catalyst 氧化铝硫磺回收催化剂	54.6m³	25th March 2019 2019 年 3 月 25 日
8	Low temperature sulfur tail gas hydrogenation catalyst 低温硫磺尾气加氢催化剂	38m³	25th February 2019 2019 年 2 月 25 日
9	Liquid ammonia 液氨	2 cylinders 2 个钢瓶	1st May 2019 2019 年 5 月 1 日
10	Alkali 液碱	2400L	15th January 2019 2019 年 1 月 15 日
11	Sulfur packaging 硫磺包装袋	15025 units 15025 个	25th March 2019 2019 年 3 月 25 日
12	Sulfur	6	25th March 2019

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
	硫磺		2019 年 3 月 25 日
13	Ammonium Sulfate 硫酸铵	18	1st July 2019 2019 年 7 月 1 日

Solvent Regeneration Unit 溶剂再生装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	MDEA solvent 溶剂 MDEA	315	15th January 2019 2019 年 1 月 15 日
2	Anti-foaming agent 消泡剂	0.125	1st August 2019 2019 年 8 月 1 日

Flexicoking Unit 灵活焦化装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	Φ9.5mm ceramic balls Φ9.5mm 瓷球	26.4m³	25th March 2019 2019 年 3 月 25 日
2	Φ12mm ceramic balls Φ12mm 瓷球	13.2m³	25th March 2019 2019 年 3 月 25 日
3	Flexigas desulfurization solvent (100%) 灵活气脱硫溶剂（100%）	280	26th May 2019 2019 年 5 月 26 日
4	Clarifier thickening agent 澄清器增稠剂	0.25	1st July 2019 2019 年 7 月 1 日
5	Filter press thickening agent 压滤机增稠剂	1.5	26th May 2019 2019 年 5 月 26 日
6	Φ 3-6 mm spherical COS converting agent COS 转化剂 φ3-6 mm 球形	2*93.1m³	26th May 2019 2019 年 5 月 26 日
7	Antiscaling agent 阻垢剂	0.6	1st July 2019 2019 年 7 月 1 日
8	Coke for start-up use 开工用焦炭	1500	4th March 2019 2019 年 3 月 4 日
9	Corrosion inhibitor 缓蚀剂	2.5	26th May 2019 2019 年 5 月 26 日
10	Amine washing solvent 胺洗涤溶剂	280	1st July 2019 2019 年 7 月 1 日
11	Ammonium sulfate 硫酸铵	18	26th May 2019 2019 年 5 月 26 日

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
12	Coking thickening agent 焦化增稠剂	1.5	26th May 2019 2019 年 5 月 26 日
13	Coking corrosion inhibitor 焦化缓蚀剂	2.5	26th May 2019 2019 年 5 月 26 日
14	Acetoxime 丙酮肟	0.5	26th May 2019 2019 年 5 月 26 日

Port & Storage Department 港储部

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of arrival 到货日期
1	Aviation kerosene anti-static agent 航煤抗静电剂	0.2-1.85	11th April 2019 2019 年 4 月 11 日
2	Gasoline and diesel anti-static agent 汽、柴油抗静电剂	1.2-4.5	11th April 2019 2019 年 4 月 11 日
3	Aviation kerosene anti-wear additives 航煤抗磨剂	3.25-8.5	11th April 2019 2019 年 4 月 11 日
4	Diesel anti-wear additives 柴油抗磨剂	65-130.5	11th April 2019 2019 年 4 月 11 日
5	Diesel cetane improver 柴油十六烷值添加剂	347.5-437.5	11th April 2019 2019 年 4 月 11 日
6	Oil dispersant 溢油分散剂	2	18th December 2018 2018 年 12 月 18 日

Boiler 锅炉

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	Liquid ammonia (99% concentration) 液氨（浓度 99%）	1500L	15th October 2018 2018 年 10 月 15 日
2	Dimethyl ketoxime (Acetoneoxime) 二甲基酮肟（丙酮肟）	0.3	26th May 2019 2019 年 5 月 26 日
3	Sodium hydroxide (purity≥30%) (ionic membrane process) 氢氧化钠（纯度≥30%）（离子膜法）	20	15th March 2019 2019 年 3 月 15 日
4	Industrial grade hydrochloric acid (purity≥31%) 工业盐酸（纯度≥31%）	35	15th March 2019 2019 年 3 月 15 日
5	Trisodium phosphate 磷酸三钠	4.5	15th October 2018 2018 年 10 月 15 日

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
6	Sodium hydroxide (bottled, 500g/bottle) Analytical reagent grade (GB/T 209-2006) 氢氧化钠（瓶装，500g/瓶）分析纯级（GB/T 209-2006）	50 bottles 50 瓶	15th March 2019 2019 年 3 月 15 日
7	Urea 尿素	257	30th September 2018 2018 年 9 月 30 日
8	Bed Material 床料	1000	5th November 2018 2018 年 11 月 5 日

Seawater Desalination Unit 海淡装置

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	Anti-scaling agent 阻垢剂	36	20th September 2018 2018 年 9 月 20 日
2	Anti-foaming agent 消泡剂	2	20th September 2018 2018 年 9 月 20 日
3	Reducing agent (sodium sulfite) 还原剂（亚硫酸钠）	36	10th September 2018 2018 年 9 月 10 日
4	Food grade CO_2 (liquid) CO_2（液态）食品级	34	30th September 2018 2018 年 9 月 30 日
5	Food grade limestone (GB 1898-2007) 食品级石灰石食品级（GB 1898-2007）	220	30th September 2018 2018 年 9 月 30 日
		58.5	30th September 2018 2018 年 9 月 30 日
6	Quartz sand (food grade) 石英砂（食品级）	15	30th September 2018 2018 年 9 月 30 日
7	10% food grade sodium hypochlorite (domestic disinfectant) 10%次氯酸钠（生活消毒）食品级	0.25	30th September 2018 2018 年 9 月 30 日

Utilities Department – Cooling Water Unit 公用工程部-循环水场

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	10% food grade sodium hypochlorite (domestic disinfectant) 10%次氯酸钠（生活消毒）食品级	120 (Cooling Water Unit Ⅰ) 120（Ⅰ循）	25th November 2018 2018 年 11 月 25 日
		60 (Cooling	20th September 2018

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
		Water Unit Ⅱ) 60（Ⅱ循）	2018 年 9 月 20 日
2	Quartz sand 石英砂	112 (Cooling Water Unit Ⅰ) 112（Ⅰ循）	1st October 2018 2018 年 10 月 1 日
		21 (Cooling Water Unit Ⅱ) 21（Ⅱ循）	20th September 2018 2018 年 9 月 20 日
3	98% concentrated sulfuric acid 98%浓硫酸	3 (Cooling Water Unit Ⅰ) 3（Ⅰ循）	30th February 2019 2019 年 2 月 30 日
		2 (Cooling Water Unit Ⅱ) 2（Ⅱ循）	10th September 2018 2018 年 9 月 10 日
4	Anhydrous calcium chloride 无水氯化钙	7.5	10th October 2018 2018 年 10 月 10 日
		4	30th September 2018 2018 年 9 月 30 日

Note: This table does not contain chemical raw materials and outsourcing purchased with the equipment.

说明：此表中不含随设备采购的化学原材料和外包。

Utilities department – Wastewater Treatment Unit 公用工程部-污水处理

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
1	Anti-foaming agent 消泡剂	To be determined 待定	8th May 2019 2019 年 5 月 8 日
2	Quartz sand 石英砂	200	30th September 2018 2018 年 9 月 30 日
3	98% concentrated sulfuric acid 98%浓硫酸	12.5	30th February 2019 2019 年 2 月 30 日
4	30%NaOH	2	30th November 2018 2018 年 11 月 30 日
5	Oil removing agent 除油剂	0.5	10th July 2018 2018 年 7 月 10 日
6	Polyaluminium Chloride (solid) 聚合氯化铝 PAC（固体）	6	30th September 2018 2018 年 9 月 30 日

No. 序号	Material Name 物资名称	Amount, tonnes 数量，吨	Date of Arrival 到货日期
7	Polyacrylamide (solid) 聚丙烯酰胺 PAM（固体）	6	30th September 2018 2018 年 9 月 30 日
8	Sodium carbonate (solid) 碳酸钠（固体）	7.5	10th September 2018 2018 年 9 月 10 日
9	Disodium phosphate (solid) 磷酸氢二钠（固体）	6.25	20th September 2018 2018 年 9 月 20 日
10	Glucose (solid) 葡萄糖（固体）	5	20th September 2018 2018 年 9 月 20 日
11	Urea (solid) 尿素（固体）	5	20th September 2018 2018 年 9 月 20 日

Note: This table does not contain chemical raw materials and outsourcing purchased with the equipment.

说明：此表中不含随设备采购的化学原材料和外包。

Others 其他

Material Name 物资名称	Department 部门	Amount, tonnes 数量，吨	Date of Arrival 到货日期
Caustic soda flakes 片碱	No. 1 Refinery Department 炼油一部	42.5	1st March 2019 2019 年 3 月 1 日
	No. 2 Refinery Department 炼油二部	13.2	1st March 2019 2019 年 3 月 1 日
	No. 3 Refinery Department 炼油三部	1	1st March 2019 2019 年 3 月 1 日
	No. 4 Refinery Department 炼油四部	26.5	1st March 2019 2019 年 3 月 1 日
	Utilities 公用工程	2.5	30th September 2018 2018 年 9 月 30 日
		13.5	30th September 2018 2018 年 9 月 30 日
	Power Department 热电部	36	30th September 2018 2018 年 9 月 30 日

Appendix 3 附件 3

Material Balance During Initial Commissioning of PMB Project PMB

Atmospheric & Vacuum Distillation Unit

Start-up Diesel	1500.00	0.13%
Brunei Light Oil	52000.00	4.42%
Qatar Crude Oil	52000.00	4.42%
Condensate Oil	0.00	0.00%
Light Crude Oil	728316.80	61.85%
Medium Crude Oil	187707.20	15.94%
Heavy Crude Oil	155976.00	13.25%
Reprocess Light Slop Oil	0.00	0.00%
Reprocess Heavy Slop Oil	0.00	0.00%
Total	1177500.00	100.00%
Days of Operation	75 Days	
Load Rate	68.25%	

Pre-dist. OVHD Gas	0.00	0.00%
Atm. OVHD Gas	9371.20	0.80%
Pre-dist. OVHD Oil	22556.00	1.92%
Atm. OVHD Oil	265432.00	22.54%
Atm. Line 1	188428.00	16.00%
Atm. Line 2	139063.20	11.81%
Atm. Line 3	119322.40	10.13%
Atm. Line 4	70504.40	5.99%
Vac. OVHD Gas	0.00	0.00%
Vac. OVHD Oil	20806.40	1.77%
Vac. Line 1	75228.80	6.39%
Vac. Line 2	71362.40	6.06%
Vac. Line 3	62550.40	5.31%
Vac. Line 4 (Overflash Oil)	14472.40	1.23%
Vac. Residue Oil	101428.80	8.61%
Light Slop Oil	7074.20	0.60%
Heavy Slop Oil	2119.00	0.18%
Start-up Heavy Oil	5000.00	0.42%
Loss	280.40	0.02%
Material Inventory	2500.00	0.21%
Total	1177500.00	100.00%

Light Ends Recovery Unit

Start-up LPG	0.00	0.00%
Start-up Naphtha	500.00	0.16%
Pre-dist. OVHD Gas	0.00	0.00%
Atm. OVHD Gas	9371.20	3.09%
DHT OVHD Gas	1999.23	0.66%
KHT OVHD Gas	905.84	0.30%
Reformer OVHD Gas	1654.38	0.54%
Pre-dist. OVHD Oil	22556.00	7.43%
Atm. OVHD Oil	265432.00	87.43%
Unqualified LPG	0.00	0.00%
NHT Light Hydrocarbons	27.57	0.01%
DHT Light Hydrocarbons	470.41	0.15%
KHT Naphtha	670.32	0.22%
DHT Naphtha	0.00	0.00%
Total	303586.94	100.00%
Days of Operation	75 Days	
Load Rate	60.19%	

LER Dry Gas	2318.91	0.76%
LER LPG	28654.93	9.44%
LER Naphtha	271532.28	89.44%
Light Slop Oil	487.44	0.16%
Loss	0.00	0.00%
Material Inventory	593.37	0.20%
Total	303586.94	100.00%

Naphtha Hydrotreating Unit

LER Naphtha	254676.52	83.41%
Outsource Naphtha	21300.00	6.98%
Refined Naphtha	28800.00	9.43%
Reformer Hydrogen	552.86	0.18%
Total	305329.38	100.00%
Days of Operation	82 Days	
Load Rate	53.79%	

Hydrogen (High Platinum H2 Production)	257.60	0.08%
NHT Recycle Oil	27742.40	9.09%
NHT OVHD Gas	1654.38	0.54%
NHT Light Hydrocarbons	27.57	0.01%
NHT Naphtha	56717.53	18.58%
NHT Refined Naphtha	215476.45	70.57%
Unqualified Refined Naphtha	2377.71	0.78%
Light Slop Oil	0.00	0.00%
Loss	275.73	0.09%
Material Inventory	800.00	0.26%
Total	305329.38	100.00%

Continuous Catalytic Reforming

Start-up Reformer Gasoline	0.00	0.00%
HCU Naphtha	193043.69	45.01%
NHT Refined Naphtha	215476.45	50.24%
Storage Refined Naphtha	20379.86	4.75%
Tatoray Waste Hydrogen	0.00	0.00%
Start-up Hydrogen	0.00	0.00%
Total	428900.00	100.00%
Days of Operation	73 Days	
Load Rate	62.20%	

Reformer Hydrogen	37153.74	8.66%
Reformer Fuel Gas	1155.87	0.27%
Reformer LPG	11901.18	2.77%
Reformer C5	10103.16	2.36%
Reformate	364863.33	85.07%
Unqualified Reformate	2574.90	0.60%
Light Slop Oil	0.00	0.00%
Loss	347.82	0.08%
Material Inventory	800.00	0.19%
Total	428900.00	100.00%

PSA

Reformer Hydrogen	46358.23	100.00%
Tatoray Waste Hydrogen	0.00	0.00%
HCU Offgas	0.00	0.00%
Total	46358.23	100.00%
Days of Operation	72 Days	
Load Rate	57.78%	

Fuel Gas	25214.14	54.39%
Pure Hydrogen	20060.31	43.27%
Loss	1083.79	2.34%
Total	46358.23	100.00%

Kerosene Hydrotreating Unit

Start-up Naphtha	0.00	0.00%
Kerosene Feedstock	181405.60	99.80%
PSA Fresh Hydrogen	361.61	0.20%
Total	181767.21	100.00%
Days of Operation	70 Days	
Load Rate	69.68%	

Acid Gas	18.12	0.01%
KHT Waste Hydrogen	18.12	0.01%
KHT OVHD Gas	905.84	0.50%
KHT Naphtha	670.32	0.37%
Refined Kerosene	178029.27	97.94%
Light Slop Oil	1489.32	0.82%
Loss	36.23	0.02%
Material Inventory	600.00	0.33%
Total	181767.21	100.00%

Acid Gas & LPG Ends Recovery Unit

LER Dry Gas	2318.91	6.25%
LER LPG	28654.93	77.18%
Coker Dry Gas	2719.68	7.32%
Coker LPG	3435.97	9.25%
Gas Holder Flare Gas	0.00	0.00%
Total	37129.49	100.00%
Days of Operation	75 Days	
Load Rate	55.57%	

Purified LER Dry Gas	1812.93	4.88%
Purified Coker Dry Gas	2354.42	6.34%
Purfied Flare Gas	0.00	0.00%
Refined LER LPG	24347.44	65.57%
Refined Coker LPG	2960.71	7.97%
Acid Gas	5297.89	14.27%
Loss	115.40	0.31%
Material Inventory	240.70	0.65%
Total	37129.49	100.00%

Diesel Hydrotreating Unit

Start-up Naphtha	0.00	0.00%
Start-up Diesel	0.00	0.00%
Coker Naphtha	5347.85	1.81%
Coker Diesel	7697.97	2.61%
Diesel Feedstock	275540.00	93.24%
PSA Fresh Hydrogen	6918.77	2.34%
Total	295504.59	100.00%
Days of Operation	70 Days	
Load Rate	66.82%	

Acid Gas	441.01	0.15%
DHT Offgas	3498.65	1.18%
DHT OVHD Gas	1999.23	0.68%
DHT Light Hydrocarbons	470.41	0.16%
DHT Gasoline	48363.75	16.37%
Refined Diesel	237477.33	80.36%
Unqualified Diesel	1666.01	0.56%
Light Slop Oil	0.00	0.00%
Loss	88.20	0.03%
Material Inventory	1500.00	0.51%
Total	295504.59	100.00%

LPG Fractionation Unit

HCU LPG	35677.73	49.21%
Reformer LPG	10967.10	15.13%
Refined LER LPG	22889.18	31.57%
Refined Coker LPG	2960.71	4.08%
Total	72494.71	100.00%
Days of Operation	67 Days	
Load Rate	66.40%	

Fuel Gas	3967.98	5.47%
Refined Propylene	921.96	1.27%
Isobutane	25206.65	34.77%
LPG	41671.36	57.48%
Loss	158.72	0.22%
Material Inventory	568.04	0.78%
Total	72494.71	100.00%

Xylene Fractionation Unit

Reformate	364863.33	32.56%
Toluene Column Bottom Oil	174563.74	15.58%
Deheptanizer Bottom Oil	571582.31	51.00%
Storage Reformer Gasoline	8500.00	0.76%
Storage Mixed C8	1200.00	0.11%
Total	1120709.38	100.00%
Days of Operation	72 Days	
Load Rate	64.29%	

Xylene Fractionation C6 C7	144836.24	12.92%
Mixed Xylene	787717.98	70.29%
C9 C10 Aromatics	180448.34	16.10%
Heavy Aromatics	4528.26	0.40%
Unqualified Aromatics	0.00	0.00%
Loss	0.00	0.00%
Material Inventory	3178.57	0.28%
Total	1120709.38	100.00%

Benzene - Toluene Fractionation Unit

ED C6 C7 Aromatics	126942.44	32.33%
Tatoray Stripper Bottom Oil	258754.47	65.89%
Parex Crude Toluene	6996.74	1.78%
Total	392693.65	100.00%
Days of Operation	70 Days	
Load Rate	72.72%	

Benzene	54587.70	13.90%
Toluene	163004.19	41.51%
Toluene Column Bottom Oil	174563.74	44.45%
Unqualified Aromatics	0.00	0.00%
Loss	1.61	0.00%
Material Inventory	536.40	0.14%
Total	392693.65	100.00%

Extractive Distillation Unit

Xylene Fractionation C6 C7	141764.80	90.20%
Isomar C6 C7	14796.13	9.41%
Storage C6 C7	600.00	0.38%
Total	157160.93	100.00%
Days of Operation	72 Days	
Load Rate	54.36%	

Raffinate Oil	28760.24	18.30%
C6 C7 Aromatics	127800.69	81.32%
Unqualified Aromatics	0.00	0.00%
Loss	0.00	0.00%
Material Inventory	600.00	0.38%
Total	157160.93	100.00%

Tatoray

Toluene	133500.00	48.00%
C9 C10 Aromatics	140575.00	50.54%
Reformer Hydrogen	4077.76	1.47%
Total	278152.76	100.00%
Days of Operation	66 Days	
Load Rate	54.55%	

Tatoray Waste Hydrogen	7554.88	2.72%
Fuel Gas	10471.28	3.76%
Stripper OVHD Oil	749.93	0.27%
Stripper Bottom Oil	258754.47	93.03%
Unqualified Aromatics	0.00	0.00%
Loss	222.20	0.08%
Material Inventory	400.00	0.14%
Total	278152.76	100.00%

Flexicoking Unit

Start-up Naphtha	0.00	0.00%
Start-up Diesel	500.00	0.86%
Start-up VGO	1800.00	3.09%
Start-up Petroleum Coke	0.00	0.00%
Superheated Oil	6513.60	11.18%
Vac. Residue	48796.80	83.76%
Reprocess Heavy Aromatic	0.00	0.00%
Reprocess HCU Unconverted Oil	0.00	0.00%
Reprocess Sludge	0.00	0.00%
Reprocess Light Slop Oil	0.00	0.00%
Reprocess Heavy Slop Oil	650.00	1.12%
Total	58260.40	100.00%
Days of Operation	35 Days	
Load Rate	55.96%	

Coker Dry Gas	2719.68	4.67%
Acid Gas	498.05	0.85%
FXU LPG	3435.97	5.90%
Coker Naphtha	7242.35	12.43%
Coker Diesel	10425.01	17.89%
Coker VGO	15350.69	26.35%
Petroleum Coke	896.29	1.54%
Coker Flexigas	102124.14	175.29%
Slurry Oil Discharge	0.00	0.00%
Light Slop Oil	256.75	0.44%
Heavy Slop Oil	223.09	0.38%
Loss	111.92	0.19%
Material Inventory	2300.00	3.95%
Total	58260.40	100.00%

Sulfur Recovery Unit

Acid Gas (FXU)	0.00	0.00%
Acid Gas (SRU)	9447.95	99.99%
Acid Gas (SWS)	0.00	0.00%
PSA Fresh Hydrogen	0.94	0.01%
Total	9448.90	100.00%
Days of Operation	70 Days	
Load Rate	39.14%	

Sulfur	9394.74	99.43%
Tail Gas	0.00	0.00%
Loss	54.16	0.57%
Total	9448.90	100.00%

Par-Isom

HCU Light Naphtha	42117.75	33.76%
NHT Light Naphtha	55068.47	44.14%
Raffinate Oil (ED)	27087.74	21.71%
Reformer C5	0.00	0.00%
Reformer Hydrogen	493.10	0.40%
Total	124767.05	100.00%
Days of Operation	67 Days	
Load Rate	58.78%	

Fuel Gas	1052.02	0.84%
LPG	0.00	0.00%
Isopentane	42402.59	33.99%
Isomerized Oil	74421.13	59.65%
Heavy Raffinate Oil	5631.40	4.51%
Loss	259.91	0.21%
Material Inventory	1000.00	0.80%
Total	124767.05	100.00%

Hydrocracking Unit

Start-up Naphtha	500.00	0.17%
Start-up Diesel	3000.00	1.03%
Coker VGO	11335.16	3.89%
Vac. VGO	263740.00	90.59%
PSA Fresh Hydrogen	12572.88	4.32%
KHT Waste Hydrogen	0.00	0.00%
DHT Offgas	0.00	0.00%
Total	291148.04	100.00%
Days of Operation	70 Days	
Load Rate	65.37%	

Acid Gas	3192.89	1.10%
Purified Dry Gas	2128.60	0.73%
HCU Offgas	4027.07	1.38%
HCU LPG	37164.13	12.76%
Light Naphtha	42830.79	14.71%
Heavy Naphtha	193043.69	66.30%
HCU Unconverted Oil	331.79	0.11%
Unqualified Heavy Naphtha	2719.18	0.93%
Light Slop Oil	2574.69	0.88%
Heavy Slop Oil	1048.92	0.36%
Loss	86.29	0.03%
Material Inventory	2000.00	0.69%
Total	291148.04	100.00%

Oil Blending

DHT Gasoline	43983.68	15.06%
C9+ Aromatics	36746.31	12.58%
Toluene	31692.96	10.85%
Isomerized Oil	71314.53	24.41%
C7+ Non-aromatics	5396.33	1.85%
Isopentane	28532.56	9.77%
Catalytic Gasoline	64057.75	21.93%
MTBE	0.00	0.00%
Hydrogenated C9	0.00	0.00%
Isooctane	1548.14	0.53%
Reformer Pentane	8828.76	3.02%
Total	292101.01	100.00%

88# Gasoline	80941.19	27.71%
92# Gasoline	108953.68	37.30%
95# Gasoline	45801.44	15.68%
97# Gasoline	24770.17	8.48%
Gasoline Component	0.00	0.00%
Chemical Light Oil	31634.54	10.83%
Total	292101.01	100.00%

Parex

Mixed C8	764965.70	97.60%
Start-up Mixed C8	18850.00	2.40%
Total	783815.70	100.00%
Days of Operation	66 Days	
Load Rate	60.63%	

Product Fractionator Crude Toluene	6996.74	0.89%
PX	177561.75	22.65%
Raffinate	592701.73	75.62%
Unqualified Aromatics	0.00	0.00%
Loss	155.48	0.02%
Material Inventory	6400.00	0.82%
Total	783815.70	100.00%

Isomar

Raffinate (C8 Aromatics)	593201.73	75.68%
Reformer Hydrogen	770.51	0.10%
Stripper OVHD Gas	749.93	0.10%
Total	594722.17	75.88%
Days of Operation	66 Days	
Load Rate	59.57%	

Fuel Gas	7843.73	1.32%
Isomar Stripper Bottom Oil	14796.13	2.49%
Deheptanizer Bottom Oil	571582.31	96.11%
Unqualified Aromatics	0.00	0.00%
Loss	0.00	0.00%
Material Inventory	500.00	0.08%
Total	594222.17	99.92%

Crude Oil	Initial Storage	Import Volume	Consumption	End Storage	Remark
Brunei Light Oil	0.00	80000.00	80000.00	0.00	
Qatar Crude Oil	0.00	140000.00	140000.00	0.00	
Condensate Oil	0.00	0.00	0.00	0.00	
Light Crude Oil	0.00	1000000.00	690316.80	309683.20	
Medium Crude Oil	0.00	240000.00	99707.20	140292.80	
Heavy Crude Oil	0.00	320000.00	147876.00	172124.00	
Total Crude Oil	0.00	1780000.00	1157900.00	622100.00	
Outsource Feedstock	Initital Storage	Import Volume	Consumption	End Storage	
Start-up Diesel	0.00	5000.00	5000.00	0.00	Power Plant not included
Outsource Naphtha	0.00	14800.00	(652.65)	15452.65	
Refined Naphtha	0.00	35000.00	35000.00	0.00	
Mixed Xylene	0.00	15000.00	15000.00	0.00	
Reformate	0.00	10000.00	10000.00	0.00	
Catalytic Gasoline	0.00	79057.75	64057.75	15000.00	
Toluene	0.00	5677.40	2188.77	3488.63	
Isooctane	0.00	4000.00	1548.14	2451.86	
MTBE	0.00	0.00	0.00	0.00	
Start-up LPG	0.00	22000.00	22000.00	0.00	
Product	Initial Storage	Product Volume	Export Volume	End Storage	
Refined Propylene	0.00	921.96	0.00	921.96	
LPG	0.00	35585.43	29697.20	5888.23	
Isobutane	0.00	25206.65	21654.21	3552.44	
Isopentane					
88# Gasoline	0.00	80941.19	64375.43	16565.76	
92# Gasoline	0.00	108953.68	80286.98	28666.69	
95# Gasoline	0.00	45801.44	29066.17	16735.27	
97# Gasoline	0.00	24770.17	0.00	24770.17	
Gasoline Components	0.00	0.00	0.00	0.00	
Chemical Light Oil	0.00	31634.54	17724.55	13909.99	
Benzene	0.00	54587.70	39017.24	15570.46	
PX	0.00	177561.75	119101.31	58460.44	
Aviation Kerosene	0.00	178029.27	136734.92	41294.35	
Diesel	0.00	237477.33	187497.15	49980.18	
Sulfur	0.00	9394.74	8000.00	1394.74	
Petroleum Coke	0.00	896.29	896.29	0.00	
Fuel			Consumption		
Fuel Gas			56207.06		
Coker Flexigas			102124.14		
LPG			31964.68		
Isopentane			12700.00		
Heavy Aromatics			3690.16		
Material Inventory			Material Inventory Volume		
Material Inventory			24517.09		
Loss			Loss Volume		
Loss			3535.48		
Intermediate Material	Initial Storage	End Storage	Storage Alteration		
Pentane	0.00	1274.40	1274.40		
Light Naphtha	0.00	2362.11	2362.11		
Isopentane	0.00	1170.03	1170.03		
Isomerized Oil	0.00	3106.60	3106.60		
Raffinate Oil	0.00	1907.58	1907.58		
Hydrogenated Gasoline	0.00	4380.08	4380.08		
NHT Feedstock	0.00	0.00	0.00		
Reformer Feedstock	0.00	15137.44	15137.44		
Kerosene Feedstock	0.00	7022.40	7022.40		
Straight-run Diesel	0.00	5318.01	5318.01		
VGO	0.00	14106.00	14106.00		
Vac. Residue	0.00	12494.80	12494.80		
Coker Naphtha	0.00	1894.50	1894.50		
Coker Diesel	0.00	2727.04	2727.04		
Coker VGO	0.00	4015.54	4015.54		
Light Reformate	0.00	3971.44	3971.44		
Clay Treater Feedstock	0.00	858.24	858.24		
C8+ Aromatics	0.00	3457.04	3457.04		
C9+ Aromatics	0.00	16872.27	16872.27		
Heavy Aromatics	0.00	838.10	838.10		
Unconverted Oil	0.00	331.79	331.79		
Light Slop Oil	0.00	882.41	882.41		
Heavy Slop Oil	0.00	641.01	641.01		
Start-up Recycle Heavy Oil	0.00	0.00	0.00		

PMB项目首次试车期间物料平衡

常减压装置

开工柴油	1500.00	0.13%
文莱轻油	52000.00	4.42%
卡宾达	52000.00	4.42%
凝析油	0.00	0.00%
轻质油	728316.80	61.85%
中质油	187707.20	15.94%
重质油	155976.00	13.25%
轻污油回炼	0.00	0.00%
重污油回炼	0.00	0.00%
合计	1177500.00	100.00%
运行天数	75天	
负荷率	68.25%	

初顶气	0.00	0.00%
常顶气	9371.20	0.80%
初顶油	22556.00	1.92%
常顶油	265432.00	22.54%
常一线	188428.00	16.00%
常二线	139063.20	11.81%
常三线	119322.40	10.13%
常四线	70504.40	5.99%
减顶气	0.00	0.00%
减顶油	20806.40	1.77%
减一线	75228.80	6.39%
减二线	71362.40	6.06%
减三线	62550.40	5.31%
减四线（过汽化油）	14472.40	1.23%
减压渣油	101428.80	8.61%
轻污油	7074.20	0.60%
重污油	2119.00	0.18%
开工重油	5000.00	0.42%
损失	280.40	0.02%
垫料	2500.00	0.21%
合计	1177500.00	100.00%

轻烃回收

开工液化气	0.00	0.00%
开工石脑油	500.00	0.16%
初顶气	0.00	0.00%
常顶气	9371.20	3.09%
柴油加氢塔顶气	1999.23	0.66%
煤油加氢塔顶气	905.84	0.30%
重整预加氢塔顶气	1654.38	0.54%
初顶油	22556.00	7.43%
常顶油	265432.00	87.43%
不合格液化气	0.00	0.00%
重整预加氢轻烃	27.57	0.01%
柴油加氢轻烃	470.41	0.15%
煤油加氢石脑油	670.32	0.22%
柴油加氢石脑油	0.00	0.00%
合计	303586.94	100.00%
运行天数	75天	
负荷率	60.19%	

轻烃回收干气	2318.91	0.76%
轻烃回收液化气	28654.93	9.44%
轻烃回收石脑油	271532.28	89.44%
轻污油	487.44	0.16%
损失	0.00	0.00%
垫料	593.37	0.20%
合计	303586.94	100.00%

预加氢

轻烃回收石脑油	254676.52	83.41%
外购石脑油	21300.00	6.98%
精制石脑油	28800.00	9.43%
重整氢	552.86	0.18%
合计	305329.38	100.00%
运行天数	82天	
负荷率	53.79%	

氢气（高铂制氢）	257.60	0.08%
预加氢反后油	27742.40	9.09%
预加氢塔顶气	1654.38	0.54%
预加氢轻烃	27.57	0.01%
预加氢轻石脑油	56717.53	18.58%
预加氢精制石脑油	215476.45	70.57%
不合格精制油	2377.71	0.78%
轻污油	0.00	0.00%
损失	275.73	0.09%
垫料	800.00	0.26%
合计	305329.38	100.00%

连续重整

开工重整汽油	0.00	0.00%
加裂石脑油	193043.69	45.01%
预加氢精制石脑油	215476.45	50.24%
罐区精制石脑油	20379.86	4.75%
歧化尾氢	0.00	0.00%
开工氢气	0.00	0.00%
合计	428900.00	100.00%
运行天数	73天	
负荷率	62.20%

重整氢气	37153.74	8.66%
重整燃料气	1155.87	0.27%
重整液化气	11901.18	2.77%
重整C5	10103.16	2.36%
重整生成油	364863.33	85.07%
不合格重整生成油	2574.90	0.60%
轻污油	0.00	0.00%
损失	347.82	0.08%
垫料	800.00	0.19%
合计	428900.00	100.00%

PSA

重整氢	46358.23	100.00%
歧化尾氢	0.00	0.00%
加裂低分气	0.00	0.00%
合计	46358.23	100.00%
运行天数	72天	
负荷率	57.78%

燃料气	25214.14	54.39%
纯氢	20060.31	43.27%
损失	1083.79	2.34%
合计	46358.23	100.00%

煤油加氢

开工石脑油	0.00	0.00%
航煤料	181405.60	99.80%
PSA新氢	361.61	0.20%
合计	181767.21	100.00%
运行天数	70天	
负荷率	69.68%

酸性气	18.12	0.01%
废氢	18.12	0.01%
塔顶气	905.84	0.50%
航煤加氢石脑油	670.32	0.37%
精制航煤	178029.27	97.94%
轻污油	1489.32	0.82%
损失	36.23	0.02%
垫料	600.00	0.33%
合计	181767.21	100.00%

柴油加氢

开工石脑油	0.00	0.00%
开工柴油	0.00	0.00%
焦化石脑油	5347.85	1.81%
焦化柴油	7697.97	2.61%
柴油加氢料	275540.00	93.24%
PSA新氢	6918.77	2.34%
合计	295504.59	100.00%
运行天数	70天	
负荷率	66.82%

酸性气	441.01	0.15%
低分气	3498.65	1.18%
柴油加氢塔顶气	1999.23	0.68%
柴油加氢轻烃	470.41	0.16%
加氢石脑油	48363.75	16.37%
加氢柴油	237477.33	80.36%
不合格柴油	1666.01	0.56%
轻污油	0.00	0.00%
损失	88.20	0.03%
垫料	1500.00	0.51%
合计	295504.59	100.00%

灵活焦化

开工石脑油	0.00	0.00%
开工柴油	500.00	0.86%
开工蜡油	1800.00	3.09%
开工石油焦	0.00	0.00%
过汽化油	6513.60	11.18%
减压渣油	48796.80	83.76%
重芳烃回炼	0.00	0.00%
加裂尾油回炼	0.00	0.00%
污泥回炼	0.00	0.00%
轻污油回炼	0.00	0.00%
重污油回炼	650.00	1.12%
合计	58260.40	100.00%
运行天数	35天	
负荷率	55.96%

焦化干气	2719.68	4.67%
酸性气	498.05	0.85%
焦化液化气	3435.97	5.90%
焦化石脑油	7242.35	12.43%
焦化柴油	10425.01	17.89%
焦化蜡油	15350.69	26.35%
石油焦	896.29	1.54%
焦化灵活气	102124.14	175.29%
油浆外甩	0.00	0.00%
轻污油	256.75	0.44%
重污油	223.09	0.38%
损失	111.92	0.19%
垫料	2300.00	3.95%
合计	58260.40	100.00%

加氢裂化

开工石脑油	500.00	0.17%
开工柴油	3000.00	1.03%
焦化蜡油	11335.16	3.89%
减压蜡油	263740.00	90.59%
PSA新氢	12572.88	4.32%
煤油加氢废氢	0.00	0.00%
柴油加氢低分气	0.00	0.00%
合计	291148.04	100.00%
运行天数	70天	
负荷率	65.37%

酸性气	3192.89	1.10%
净化干气	2128.60	0.73%
低分气	4027.07	1.38%
加裂液化气	37164.13	12.76%
轻石脑油	42830.79	14.71%
重石脑油	193043.69	66.30%
加裂尾油	331.79	0.11%
不合格重石	2719.18	0.93%
轻污油	2574.69	0.88%
重污油	1048.92	0.36%
损失	86.29	0.03%
垫料	2000.00	0.69%
合计	291148.04	100.00%

产品精制

轻烃回收干气	2318.91	6.25%
轻烃回收液化气	28654.93	77.18%
焦化干气	2719.68	7.32%
焦化液化气	3435.97	9.25%
气柜气	0.00	0.00%
合计	37129.49	100.00%
运行天数	75天	
负荷率	55.57%

净化轻烃回收干气	1812.93	4.88%
净化焦化干气	2354.42	6.34%
净化气柜气	0.00	0.00%
精制轻烃回收液化气	24347.44	65.57%
精制焦化液化气	2960.71	7.97%
酸性气	5297.89	14.27%
损失	115.40	0.31%
垫料	240.70	0.65%
合计	37129.49	100.00%

气分

加裂液化气	35677.73	49.21%
重整液化气	10967.10	15.13%
精制液化气（轻烃回收）	22889.18	31.57%
精制液化气（灵活焦化）	2960.71	4.08%
合计	72494.71	100.00%
运行天数	67天	
负荷率	66.40%

燃料气	3967.98	5.47%
精丙烯	921.96	1.27%
异丁烷	25206.65	34.77%
液化气	41671.36	57.48%
损失	158.72	0.22%
垫料	568.04	0.78%
合计	72494.71	100.00%

硫磺回收

酸性气（灵活焦化）	0.00	0.00%
酸性气（溶剂再生）	9447.95	99.99%
酸性气（酸性水汽提）	0.00	0.00%
PSA新氢	0.94	0.01%
合计	9448.90	100.00%
运行天数	70天	
负荷率	39.14%

硫磺	9394.74	99.43%
尾气	0.00	0.00%
损失	54.16	0.57%
合计	9448.90	100.00%

轻石异构

加裂轻石	42117.75	33.76%
预加氢轻石	55068.47	44.14%
抽余油（芳烃抽提）	27087.74	21.71%
重整C5	0.00	0.00%
重整氢	493.10	0.40%
合计	124767.05	100.00%
运行天数	67天	
负荷率	58.78%

燃料气	1052.02	0.84%
液化气	0.00	0.00%
异戊烷油	42402.59	33.99%
异构化油	74421.13	59.65%
重抽余油	5631.40	4.51%
损失	259.91	0.21%
垫料	1000.00	0.80%
合计	124767.05	100.00%

油品调合

柴油加氢汽油	43983.68	15.06%
C9+芳烃	36746.31	12.58%
甲苯	31692.96	10.85%
异构化油	71314.53	24.41%
C7+非芳	5396.33	1.85%
异戊烷油	28532.56	9.77%
催化汽油	64057.75	21.93%
MTBE	0.00	0.00%
加氢C9	0.00	0.00%
异辛烷	1548.14	0.53%
重整戊烷油	8828.76	3.02%
合计	292101.01	100.00%

88#汽油	80941.19	27.71%
92#汽油	108953.68	37.30%
95#汽油	45801.44	15.68%
97#汽油	24770.17	8.48%
汽油组分	0.00	0.00%
化工轻油	31634.54	10.83%
合计	292101.01	100.00%

二甲苯分馏

重整生成油	364863.33	32.56%
甲苯塔底液	174563.74	15.58%
脱庚烷塔底液	571582.31	51.00%
罐区重整汽油	8500.00	0.76%
罐区混合C8	1200.00	0.11%
合计	1120709.38	100.00%
运行天数	72天	
负荷率	64.29%

二甲苯分离C6C7	144836.24	12.92%
混合二甲苯	787717.98	70.29%
C9C10芳烃	180448.34	16.10%
重芳烃	4528.26	0.40%
不合格芳烃	0.00	0.00%
损失	0.00	0.00%
垫料	3178.57	0.28%
合计	1120709.38	100.00%

苯甲苯分馏

抽提C6C7芳烃	126942.44	32.33%
歧化汽提塔底	258754.47	65.89%
吸附分离粗甲苯	6996.74	1.78%
合计	392693.65	100.00%
运行天数	70天	
负荷率	72.72%

苯	54587.70	13.90%
甲苯	163004.19	41.51%
甲苯塔底液	174563.74	44.45%
不合格芳烃	0.00	0.00%
损失	1.61	0.00%
垫料	536.40	0.14%
合计	392693.65	100.00%

芳烃抽提

二甲苯分离C6C7	141764.80	90.20%
异构化C6C7	14796.13	9.41%
罐区C6C7	600.00	0.38%
合计	157160.93	100.00%
运行天数	72天	
负荷率	54.36%

抽余油	28760.24	18.30%
C6C7芳烃	127800.69	81.32%
不合格芳烃	0.00	0.00%
损失	0.00	0.00%
垫料	600.00	0.38%
合计	157160.93	100.00%

歧化

甲苯	133500.00	48.00%
C9C10芳烃	140575.00	50.54%
重整氢	4077.76	1.47%
合计	278152.76	100.00%
运行天数	66天	
负荷率	54.55%

歧化尾氢	7554.88	2.72%
燃料气	10471.28	3.76%
汽提塔顶液	749.93	0.27%
歧化汽提塔底液	258754.47	93.03%
不合格芳烃	0.00	0.00%
损失	222.20	0.08%
垫料	400.00	0.14%
合计	278152.76	100.00%

吸附分离

混合C8	764965.70	97.60%
开工混合C8	18850.00	2.40%
合计	783815.70	100.00%
运行天数	66天	
负荷率	60.63%

成品塔粗甲苯	6996.74	0.89%
PX	177561.75	22.65%
抽余液	592701.73	75.62%
不合格芳烃	0.00	0.00%
损失	155.48	0.02%
垫料	6400.00	0.82%
合计	783815.70	100.00%

异构化

抽余液（C8芳烃）	593201.73	75.68%
重整氢	770.51	0.10%
汽提塔顶液	749.93	0.10%
合计	594722.17	75.88%
运行天数	66天	
负荷率	59.57%

燃料气	7843.73	1.32%
异构化汽提塔底液	14796.13	2.49%
脱庚烷塔底液	571582.31	96.11%
不合格芳烃	0.00	0.00%
损失	0.00	0.00%
垫料	500.00	0.08%
合计	594222.17	99.92%

原油	期初库存	进厂量	消耗量	期末库存	备注
文莱轻油	0.00	80000.00	80000.00	0.00	
卡宾达	0.00	140000.00	140000.00	0.00	
凝析油	0.00	0.00	0.00	0.00	
轻质油	0.00	1000000.00	690316.80	309683.20	
中质油	0.00	240000.00	99707.20	140292.80	
重质油	0.00	320000.00	147876.00	172124.00	
原油合计	0.00	1780000.00	1157900.00	622100.00	
外购原料	期初库存	进厂量	消耗量	期末库存	
开工柴油	0.00	5000.00	5000.00	0.00	不含电站
外购石脑油	0.00	14800.00	-652.65	15452.65	
精制石脑油	0.00	35000.00	35000.00	0.00	
混合二甲苯	0.00	15000.00	15000.00	0.00	
重整生成油	0.00	10000.00	10000.00	0.00	
催化汽油	0.00	79057.75	64057.75	15000.00	
甲苯	0.00	5677.40	2188.77	3488.63	
异辛烷	0.00	4000.00	1548.14	2451.86	
MTBE	0.00	0.00	0.00	0.00	
开工液化气	0.00	22000.00	22000.00	0.00	
产品	期初	生产量	出厂量	期末库存	
精丙烯	0.00	921.96	0.00	921.96	
液化气	0.00	35585.43	29697.20	5888.23	
异丁烷	0.00	25206.65	21654.21	3552.44	
异戊烷					
88#汽油	0.00	80941.19	64375.43	16565.76	
92#汽油	0.00	108953.68	80286.98	28666.69	
95#汽油	0.00	45801.44	29066.17	16735.27	
97#汽油	0.00	24770.17	0.00	24770.17	
汽油组分	0.00	0.00	0.00	0.00	
化工轻油	0.00	31634.54	17724.55	13909.99	
苯	0.00	54587.70	39017.24	15570.46	
PX	0.00	177561.75	119101.31	58460.44	
航煤	0.00	178029.27	136734.92	41294.35	
柴油	0.00	237477.33	187497.15	49980.18	
硫磺	0.00	9394.74	8000.00	1394.74	
石油焦	0.00	896.29	896.29	0.00	
燃料			消耗量		
燃料气			56207.06		
焦化灵活气			102124.14		
液化气			31964.68		
异戊烷			12700.00		
重芳烃			3690.16		
垫料			垫料量		
垫料			24517.09		
损失			损失量		
损失			3535.48		
中间物料	期初库存	期末库存	库存变化量		
戊烷	0.00	1274.40	1274.40		
轻石脑油	0.00	2362.11	2362.11		
异戊烷	0.00	1170.03	1170.03		
异构化油	0.00	3106.60	3106.60		
非芳抽余油	0.00	1907.58	1907.58		
加氢汽油	0.00	4380.08	4380.08		
预加氢原料	0.00	0.00	0.00		
重整原料	0.00	15137.44	15137.44		
航煤料	0.00	7022.40	7022.40		
直馏柴油	0.00	5318.01	5318.01		
减压蜡油	0.00	14106.00	14106.00		
减压渣油	0.00	12494.80	12494.80		
焦化石脑油	0.00	1894.50	1894.50		
焦化柴油	0.00	2727.04	2727.04		
焦化蜡油	0.00	4015.54	4015.54		
轻重整油	0.00	3971.44	3971.44		
白土塔进料	0.00	858.24	858.24		
C8+芳烃	0.00	3457.04	3457.04		
C9+芳烃	0.00	16872.27	16872.27		
重芳烃	0.00	838.10	838.10		
尾油	0.00	331.79	331.79		
轻污油	0.00	882.41	882.41		
重污油	0.00	641.01	641.01		
开工重油	0.00	0.00	0.00		

Appendix 4 附件 4

List of Boiler and Steam Turbine Load During Initial Commissioning of PMB Project

PMB 首次试车期间锅炉、汽机负荷表

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2018/12/18	37139	1 Unit	68%	193		80		343	90%	1 Boiler
2018/12/19	37139	1 Unit	68%	193		80		343	90%	1 Boiler
2018/12/20	37139	1 Unit	68%	193		80		343	90%	1 Boiler
2018/12/21	20560	1 Unit	57%	83		80		163	43%	1 Boiler
2018/12/22	20560	1 Unit	57%	83		80		163	43%	1 Boiler
2018/12/23	20602	1 Unit	57%	83		80		163	43%	1 Boiler
2018/12/24	20600	1 Unit	57%	83		80		163	43%	1 Boiler
2018/12/25	21700	1 Unit	60%	87		80		167	44%	1 Boiler
2018/12/26	20700	1 Unit	58%	83		80		163	43%	1 Boiler
2018/12/27	20608	1 Unit	57%	83		80		163	43%	1 Boiler
2018/12/28	20609	1 Unit	57%	83		80		163	43%	1 Boiler
2018/12/29	20722	1 Unit	58%	83		80		163	43%	1 Boiler
2018/12/30	20726	1 Unit	58%	84		80		164	43%	1 Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2018/12/31	20734	1 Unit	58%	84		80		164	43%	1 Boiler
2019/1/1	20396	1 Unit	57%	82		80		162	43%	1 Boiler
2019/1/2	20401	1 Unit	57%	82		80		162	43%	1 Boiler
2019/1/3	18280	1 Unit	51%	75		80		155	41%	1 Boiler
2019/1/4	17925	1 Unit	50%	74		80		154	41%	1 Boiler
2019/1/5	17925	1 Unit	50%	74		80		154	41%	1 Boiler
2019/1/6	17925	1 Unit	50%	74		80		154	41%	1 Boiler
2019/1/7	18291	1 Unit	51%	75		80		155	41%	1 Boiler
2019/1/8	18381	1 Unit	51%	76	100			176	46%	1 Boiler
2019/1/9	18381	1 Unit	51%	76	100			176	46%	1 Boiler
2019/1/10	19810	1 Unit	55%	80	100			180	47%	1 Boiler
2019/1/11	19810	1 Unit	55%	80	100			180	47%	1 Boiler
2019/1/12	21340	1 Unit	59%	86	100			186	49%	1 Boiler
2019/1/13	24240	1 Unit	67%	95	100			195	51%	1 Boiler
2019/1/14	24240	1 Unit	67%	95	100			195	51%	1 Boiler
2019/1/15	24240	1 Unit	67%	95	100			195	51%	1 Boiler
2019/1/16	24240	1 Unit	67%	95	100			195	51%	1 Boiler
2019/1/17	22804	1 Unit	63%	90	100			190	50%	1 Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/1/18	22638	1 Unit	63%	90	100			190	50%	1 Boiler
2019/1/19	22628	1 Unit	63%	90	100			190	50%	1 Boiler
2019/1/20	25549	1 Unit	71%	99	100			199	52%	1 Boiler
2019/1/21	25552	1 Unit	71%	99	100			199	52%	1 Boiler
2019/1/22	25535	1 Unit	71%	99	100			199	52%	1 Boiler
2019/1/23	25535	1 Unit	71%	99	100			199	52%	1 Boiler
2019/1/24	25535	1 Unit	71%	99	100			199	52%	1 Boiler
2019/1/25	25535	1 Unit	71%	99	100			199	52%	1 Boiler
2019/1/26	23840	1 Unit	66%	94	100			194	51%	1 Boiler
2019/1/27	38840	2 Unit	54%	158	100			258	68%	1 Boiler
2019/1/28	39177	2 Unit	54%	160				160	42%	1 Boiler
2019/1/29	39177	2 Unit	54%	160				160	42%	1 Boiler
2019/1/30	41550	2 Unit	58%	167				167	44%	1 Boiler
2019/1/31	43550	2 Unit	60%	174				174	46%	1 Boiler
2019/2/1	44483	2 Unit	62%	177				177	47%	1 Boiler
2019/2/2	43587	2 Unit	61%	174	50	20	250	494	65%	2Boiler
2019/2/3	43513	2 Unit	60%	174	50	20	250	494	65%	2Boiler
2019/2/4	43333	2 Unit	60%	173	50	20	250	493	65%	2Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/2/5	41718	2 Unit	58%	168	50	20	120	358	47%	2Boiler
2019/2/6	45843	2 Unit	64%	182	50	50	120	402	53%	2Boiler
2019/2/7	41443	2 Unit	58%	167	50	50	120	387	51%	2Boiler
2019/2/8	41023	2 Unit	57%	166	50	50	120	386	51%	2Boiler
2019/2/9	41543	2 Unit	58%	167	50	50	120	387	51%	2Boiler
2019/2/10	41043	2 Unit	57%	166	50	22	120	358	47%	2Boiler
2019/2/11	39233	2 Unit	54%	160	50	22	120	352	46%	2Boiler
2019/2/12	39093	2 Unit	54%	159	50	40	120	369	49%	2Boiler
2019/2/13	39093	2 Unit	54%	159	50	41	120	370	49%	2Boiler
2019/2/14	39093	2 Unit	54%	159	50	41	120	370	49%	2Boiler
2019/2/15	39593	2 Unit	55%	161	50	43	120	374	49%	2Boiler
2019/2/16	39593	2 Unit	55%	161	50	62	120	393	52%	2Boiler
2019/2/17	39593	2 Unit	55%	161	50	62	120	393	52%	2Boiler
2019/2/18	39593	2 Unit	55%	161	50	52	120	383	50%	2Boiler
2019/2/19	39593	2 Unit	55%	161	50	52	120	383	50%	2Boiler
2019/2/20	39593	2 Unit	55%	161	50	50	120	381	50%	2Boiler
2019/2/21	42033	2 Unit	58%	169	50	50	120	389	51%	2Boiler
2019/2/22	42033	2 Unit	58%	169	50	40		259	68%	1 Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/2/23	52033	2 Unit	72%	202	50	40		292	77%	1 Boiler
2019/2/24	54033	2 Unit	68%	206	50	40		296	78%	1 Boiler
2019/2/25	59033	2 Unit	74%	222	50	40		312	82%	1 Boiler
2019/2/26	57733	2 Unit	72%	218	50	32		299	79%	1 Boiler
2019/2/27	60324	2 Unit	75%	226	50	33		309	81%	1 Boiler
2019/2/28	66404	2 Unit	83%	246	55	34		334	44%	2Boiler
2019/3/1	67891	2 Unit	85%	251	55	34		340	45%	2Boiler
2019/3/2	68815	2 Unit	86%	254	55	34		343	45%	2Boiler
2019/3/3	68815	2 Unit	86%	254	55	34		343	45%	2Boiler
2019/3/4	70775	2 Unit	88%	260	64	49		373	49%	2Boiler
2019/3/5	70655	2 Unit	88%	260	64	49		373	49%	2Boiler
2019/3/6	69831	2 Unit	87%	257	64	49		370	49%	2Boiler
2019/3/7	69861	2 Unit	87%	257	64	49		370	49%	2Boiler
2019/3/8	70661	2 Unit	88%	260	64	29		352	46%	2Boiler
2019/3/9	70661	2 Unit	88%	260	50	29		338	45%	2Boiler
2019/3/10	70661	2 Unit	88%	260	50	41	3	353	47%	2Boiler
2019/3/11	68794	2 Unit	86%	254	50	41	3	347	46%	2Boiler
2019/3/12	68794	2 Unit	86%	254	50	41	3	347	46%	2Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/3/13	68794	2 Unit	86%	254	50	41	4	348	46%	2Boiler
2019/3/14	68794	2 Unit	86%	254	50	41	5	349	46%	2Boiler
2019/3/15	68894	2 Unit	86%	254	50	38	5	347	46%	2Boiler
2019/3/16	68894	2 Unit	86%	254	50	38	4	346	46%	2Boiler
2019/3/17	66594	2 Unit	83%	246	50	38	3	338	44%	2Boiler
2019/3/18	66594	2 Unit	83%	246	50	38	4	338	45%	2Boiler
2019/3/19	66594	2 Unit	83%	246	50	38	5	340	45%	2Boiler
2019/3/20	67472	2 Unit	84%	249	50	38	28	366	48%	2Boiler
2019/3/21	67272	2 Unit	84%	249	50	38	27	364	48%	2Boiler
2019/3/22	67272	2 Unit	84%	249	50	37	26	361	48%	2Boiler
2019/3/23	67772	2 Unit	85%	250	50	35	27	362	48%	2Boiler
2019/3/24	66732	2 Unit	83%	247	50	35	28	360	47%	2Boiler
2019/3/25	66732	2 Unit	83%	247	50	35	107	438	58%	2Boiler
2019/3/26	68632	2 Unit	86%	253	50	36	104	443	58%	2Boiler
2019/3/27	68632	2 Unit	86%	253	50	37	103	443	58%	2Boiler
2019/3/28	68632	2 Unit	86%	253	50	37	104	445	58%	2Boiler
2019/3/29	68332	2 Unit	85%	252	50	37	61	400	53%	2Boiler
2019/3/30	66272	2 Unit	83%	245	50	35	19	350	46%	2Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/3/31	65452	2 Unit	82%	243	50	36	18	347	46%	2Boiler
2019/4/1	67352	2 Unit	84%	249	50	36	18	353	46%	2Boiler
2019/4/2	70552	2 Unit	88%	259	50	36	18	363	48%	2Boiler
2019/4/3	70552	2 Unit	88%	259	50	36	17	362	48%	2Boiler
2019/4/4	70974	2 Unit	89%	261	50	47	17	375	49%	2Boiler
2019/4/5	67174	2 Unit	84%	248	50	60		358	47%	2Boiler
2019/4/6	63979	2 Unit	80%	238	50	56		344	45%	2Boiler
2019/4/7	63994	2 Unit	80%	238	50	56		344	45%	2Boiler
2019/4/8	64058	2 Unit	80%	238	50	56		344	45%	2Boiler
2019/4/9	64123	2 Unit	80%	238	50	56	3	347	46%	2Boiler
2019/4/10	65588	2 Unit	82%	243	50	54	3	350	46%	2Boiler
2019/4/11	68852	2 Unit	86%	254	50	54	3	361	47%	2Boiler
2019/4/12	70057	2 Unit	88%	258	57	40	3	357	47%	2Boiler
2019/4/13	74062	2 Unit	93%	271	57	40		367	48%	2Boiler
2019/4/14	75026	2 Unit	94%	274	57	40	8	378	50%	2Boiler
2019/4/15	76791	2 Unit	96%	280	57	77	8	421	55%	2Boiler
2019/4/16	75726	2 Unit	95%	276	57	66	9	407	54%	2Boiler
2019/4/17	75790	2 Unit	95%	276	57	67	9	409	54%	2Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/4/18	75855	2 Unit	95%	277	57	67		400	53%	2Boiler
2019/4/19	76720	3Unit	64%	294	57	60	85	496	65%	2Boiler
2019/4/20	76784	3Unit	64%	295	60	95	85	535	70%	2Boiler
2019/4/21	76849	3Unit	64%	295	60	95	105	555	73%	2Boiler
2019/4/22	76914	3Unit	64%	295	60	83	105	543	71%	2Boiler
2019/4/23	77658	3Unit	65%	297	60	70	109	537	71%	2Boiler
2019/4/24	77123	3Unit	64%	296	54	70	105	525	69%	2Boiler
2019/4/25	78508	3Unit	65%	300	54	88	105	547	72%	2Boiler
2019/4/26	77572	3Unit	65%	297	54	87	105	543	71%	2Boiler
2019/4/27	77637	3Unit	65%	297	54	87	84	523	69%	2Boiler
2019/4/28	77702	3Unit	65%	298	54	85	84	520	68%	2Boiler
2019/4/29	77766	3Unit	65%	298	54	85	84	520	68%	2Boiler
2019/4/30	78281	3Unit	65%	299	54	88	84	526	69%	2Boiler
2019/5/1	78346	3Unit	65%	300	54	89	84	526	69%	2Boiler
2019/5/2	74520	3Unit	62%	287	54	66	84	492	65%	2Boiler
2019/5/3	77705	3Unit	65%	298	54	167	111	629	83%	2Boiler
2019/5/4	77770	3Unit	65%	298	54	167	112	630	83%	2Boiler
2019/5/5	77834	3Unit	65%	298	50	182	127	657	58%	3Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/5/6	77899	3Unit	65%	298	50	199	143	691	61%	3Boiler
2019/5/7	77964	3Unit	65%	298	50	199	143	691	61%	3Boiler
2019/5/8	82198	3Unit	68%	312	50	199	143	705	62%	3Boiler
2019/5/9	82263	3Unit	69%	312	50	199	143	705	62%	3Boiler
2019/5/10	85301	3Unit	71%	322	50	199	143	715	63%	3Boiler
2019/5/11	85185	3Unit	71%	322	50	199	144	715	63%	3Boiler
2019/5/12	93205	3Unit	78%	348	50	199	144	741	65%	3Boiler
2019/5/13	90420	3Unit	75%	339	50	200	145	734	64%	3Boiler
2019/5/14	90762	3Unit	76%	340	50	201	145	736	65%	3Boiler
2019/5/15	90827	3Unit	76%	340	54	193	217	804	70%	3Boiler
2019/5/16	80891	3Unit	67%	308	54	213	238	812	71%	3Boiler
2019/5/17	80956	3Unit	67%	308	54	164	188	714	63%	3Boiler
2019/5/18	74721	3Unit	62%	288	54	70	164	576	50%	3Boiler
2019/5/19	72385	3Unit	60%	280	54	132	184	650	57%	3Boiler
2019/5/20	72450	3Unit	60%	280	54	195	239	768	67%	3Boiler
2019/5/21	74281	3Unit	62%	286	54	291	335	966	85%	3Boiler
2019/5/22	73557	3Unit	61%	284	54	291	335	963	84%	3Boiler
2019/5/23	73272	3Unit	61%	283	58	291	335	966	85%	3Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/5/24	73337	3Unit	61%	283	58	291	335	967	85%	3Boiler
2019/5/25	73401	3Unit	61%	284	58	195	239	775	68%	3Boiler
2019/5/26	73466	3Unit	61%	284	54	102	84	524	69%	2Boiler
2019/5/27	73531	3Unit	61%	284	33	34	84	435	57%	2Boiler
2019/5/28	71140	3Unit	59%	276	33	34	84	428	56%	2Boiler
2019/5/29	67772	3Unit	56%	265	29	54	84	433	57%	2Boiler
2019/5/30	66926	3Unit	56%	263	33	75	84	456	60%	2Boiler
2019/5/31	66991	3Unit	56%	263	33	73	84	454	60%	2Boiler
2019/6/1	66094	3Unit	55%	260	33	73	84	451	59%	2Boiler
2019/6/2	66158	3Unit	55%	260	54	71	84	470	62%	2Boiler
2019/6/3	66223	3Unit	55%	260	54	71	84	470	62%	2Boiler
2019/6/4	66288	3Unit	55%	260	54	50	84	449	59%	2Boiler
2019/6/5	67852	3Unit	57%	266	54	50	84	454	60%	2Boiler
2019/6/6	65417	3Unit	55%	258	54	30	84	426	56%	2Boiler
2019/6/7	72632	3Unit	61%	281	54	30	84	449	59%	2Boiler
2019/6/8	72696	3Unit	61%	281	54	30		365	48%	2Boiler
2019/6/9	72761	3Unit	61%	281	54	30		365	48%	2Boiler
2019/6/10	73526	3Unit	61%	284	54	30		368	48%	2Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/6/11	73590	3Unit	61%	284	54	30		368	48%	2Boiler
2019/6/12	73805	3Unit	62%	285	54	30		369	48%	2Boiler
2019/6/13	73870	3Unit	62%	285	54	30		369	49%	2Boiler
2019/6/14	77193	3Unit	64%	296	54	30		380	50%	2Boiler
2019/6/15	75849	3Unit	63%	292	54	65		411	54%	2Boiler
2019/6/16	80914	3Unit	67%	308	54	86		448	59%	2Boiler
2019/6/17	80356	3Unit	67%	306	54	103		463	61%	2Boiler
2019/6/18	76971	3Unit	64%	295	33	103		431	57%	2Boiler
2019/6/19	77036	3Unit	64%	295	33	64		393	52%	2Boiler
2019/6/20	77100	3Unit	64%	296	29	123	42	489	64%	2Boiler
2019/6/21	77165	3Unit	64%	296	33	123	42	493	65%	2Boiler
2019/6/22	77580	3Unit	65%	297	33	138	42	510	67%	2Boiler
2019/6/23	77844	3Unit	65%	298	33	138	75	544	72%	2Boiler
2019/6/24	79531	3Unit	66%	303	54	90	75	522	69%	2Boiler
2019/6/25	82496	3Unit	69%	313	54	90	75	532	70%	2Boiler
2019/6/26	82560	3Unit	69%	313	54	150	75	592	78%	2Boiler
2019/6/27	82625	3Unit	69%	314	54	173	42	582	77%	2Boiler
2019/6/28	82690	3Unit	69%	314	54	173	42	582	77%	2Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/6/29	83254	3Unit	69%	316	54	173	42	584	51%	3Boiler
2019/6/30	83519	3Unit	70%	316	54	173	42	585	51%	3Boiler
2019/7/1	83584	3Unit	70%	317	54	173	42	585	51%	3Boiler
2019/7/2	83648	3Unit	70%	317	54	173	42	585	51%	3Boiler
2019/7/3	86013	3Unit	72%	325	54	173	42	593	52%	3Boiler
2019/7/4	87528	3Unit	73%	329	54	173	42	598	52%	3Boiler
2019/7/5	87592	3Unit	73%	330	54	173	42	598	52%	3Boiler
2019/7/6	87257	3Unit	73%	329	54	173	42	597	52%	3Boiler
2019/7/7	87222	3Unit	73%	328	54	173	42	597	52%	3Boiler
2019/7/8	87286	3Unit	73%	329	54	170	42	595	52%	3Boiler
2019/7/9	87351	3Unit	73%	329	54	170	42	595	52%	3Boiler
2019/7/10	91580	3Unit	76%	343	54	170	42	609	53%	3Boiler
2019/7/11	91645	3Unit	76%	343	54	170	42	609	53%	3Boiler
2019/7/12	91709	3Unit	76%	343	54	170	42	609	53%	3Boiler
2019/7/13	92474	3Unit	77%	346	54	170	42	612	54%	3Boiler
2019/7/14	92539	3Unit	77%	346	54	149	77	626	55%	3Boiler
2019/7/15	92603	3Unit	77%	346	58	156	77	636	56%	3Boiler
2019/7/16	92668	3Unit	77%	346	58	160	110	674	59%	3Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/7/17	92733	3Unit	77%	346	58	160	110	674	59%	3Boiler
2019/7/18	92797	3Unit	77%	347	58	166	110	680	60%	3Boiler
2019/7/19	92862	3Unit	77%	347	58	166	110	680	60%	3Boiler
2019/7/20	92927	3Unit	77%	347	58	166	116	686	60%	3Boiler
2019/7/21	93691	3Unit	78%	349	58	166	116	689	60%	3Boiler
2019/7/22	95456	3Unit	80%	355	58	166	116	695	61%	3Boiler
2019/7/23	97021	3Unit	81%	360	58	166	116	700	61%	3Boiler
2019/7/24	98585	3Unit	82%	365	58	166	116	705	62%	3Boiler
2019/7/25	100650	3Unit	84%	372	58	166	116	711	62%	3Boiler
2019/7/26	102975	3Unit	86%	380	58	149	116	702	62%	3Boiler
2019/7/27	103489	3Unit	86%	381	58	149	116	704	62%	3Boiler
2019/7/28	105914	3Unit	88%	389	58	149	116	712	62%	3Boiler
2019/7/29	107279	3Unit	89%	394	58	149	95	695	61%	3Boiler
2019/7/30	110043	4Unit	69%	418	58	149	95	719	63%	3Boiler
2019/7/31	113264	4Unit	71%	428	58	152	95	733	64%	3Boiler
2019/8/1	115329	4Unit	72%	435	58	152	95	739	65%	3Boiler
2019/8/2	119848	4Unit	75%	450	58	152	95	754	66%	3Boiler
2019/8/3	123940	4Unit	77%	463	58	156	115	792	69%	3Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/8/4	126005	4Unit	79%	470	58	156	115	798	70%	3Boiler
2019/8/5	128070	4Unit	80%	476	58	185	136	855	75%	3Boiler
2019/8/6	128634	4Unit	80%	478	58	191	136	863	76%	3Boiler
2019/8/7	129599	4Unit	81%	481	58	191	136	866	76%	3Boiler
2019/8/8	129664	4Unit	81%	481	58	174	140	853	75%	3Boiler
2019/8/9	129728	4Unit	81%	482	58	174	140	854	75%	3Boiler
2019/8/10	129793	4Unit	81%	482	58	174	140	854	75%	3Boiler
2019/8/11	129858	4Unit	81%	482	58	174	140	854	75%	3Boiler
2019/8/12	130123	4Unit	81%	483	58	174	149	863	76%	3Boiler
2019/8/13	130787	4Unit	82%	485	58	174	149	865	76%	3Boiler
2019/8/14	130852	4Unit	82%	485	58	174	149	866	76%	3Boiler
2019/8/15	130917	4Unit	82%	485	58	174	151	868	76%	3Boiler
2019/8/16	130981	4Unit	82%	486	58	174	151	868	76%	3Boiler
2019/8/17	131046	4Unit	82%	486	37	174	151	848	74%	3Boiler
2019/8/18	131111	4Unit	82%	486	37	174	151	848	74%	3Boiler
2019/8/19	131175	4Unit	82%	486	37	174	151	848	74%	3Boiler
2019/8/20	131240	4Unit	82%	487	37	174	155	853	75%	3Boiler
2019/8/21	131305	4Unit	82%	487	37	179	155	858	75%	3Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/8/22	131369	4Unit	82%	487	87	179	169	922	81%	3Boiler
2019/8/23	131034	4Unit	82%	486	87	179	169	921	81%	3Boiler
2019/8/24	131099	4Unit	82%	486	87	179	157	909	80%	3Boiler
2019/8/25	131163	4Unit	82%	486	87	179	182	934	82%	3Boiler
2019/8/26	131228	4Unit	82%	486	87	179	215	968	85%	4Boiler
2019/8/27	131293	4Unit	82%	487	87	179	215	968	64%	4Boiler
2019/8/28	131357	4Unit	82%	487	104	179	215	985	65%	4Boiler
2019/8/29	131422	4Unit	82%	487	106	179	249	1020	67%	4Boiler
2019/8/30	131737	4Unit	82%	488	106	179	249	1021	67%	4Boiler
2019/8/31	131871	4Unit	82%	489	106	179	261	1035	68%	4Boiler
2019/9/1	132036	4Unit	83%	489	101	179	261	1031	68%	4Boiler
2019/9/2	132239	4Unit	83%	490	101	179	261	1032	68%	4Boiler
2019/9/3	132303	4Unit	83%	490	167	168	269	1095	72%	4Boiler
2019/9/4	132368	4Unit	83%	490	167	168	269	1095	72%	4Boiler
2019/9/5	132433	4Unit	83%	490	167	168	269	1095	72%	4Boiler
2019/9/6	132497	4Unit	83%	491	167	168	284	1111	73%	4Boiler
2019/9/7	132562	4Unit	83%	491	167	168	284	1111	73%	4Boiler
2019/9/8	132627	4Unit	83%	491	167	168	284	1111	73%	4Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/9/9	132691	4Unit	83%	491	185	169	284	1129	74%	4Boiler
2019/9/10	132756	4Unit	83%	491	185	169	284	1129	74%	4Boiler
2019/9/11	132821	4Unit	83%	492	185	169	284	1130	74%	4Boiler
2019/9/12	132885	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/13	132950.03	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/14	133014.7	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/15	133079.37	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/16	133144.04	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/17	133208.72	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/18	133273.39	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/19	133338.06	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/20	133402.73	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/21	133467.4	4Unit	83%	492	185	227	284	1188	78%	4Boiler
2019/9/22	133532.08	4Unit	83%	494	185	222	369	1269	83%	4Boiler
2019/9/23	133596.75	4Unit	83%	494	185	222	369	1269	84%	4Boiler
2019/9/24	133661.42	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/9/25	133726.09	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/9/26	133790.77	4Unit	84%	494	185	222	369	1270	84%	4Boiler

Date	Power Consumption (KW/h)	Boiler and Turbine Commissioning Point	Steam Turbine Load	Steam Consumption of Steam Turbine	0.5 MPa Steam Consumption	1.0 MPa Steam Consumption	3.5 MPa Steam Consumption	Total Steam Consumption	Boiler Load	Number of Boiler for Start-up
日期	电量消耗（KW/h）	锅炉和汽机试车节点	汽机负荷	汽机用汽量	0.5MPa 蒸汽用汽量	1.0 MPa 蒸汽用汽量	3.5MPa 蒸汽用气量	总用汽量	锅炉负荷	锅炉开工个数
2019/9/27	133855.44	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/9/28	133920.11	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/9/29	133984.78	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/9/30	134049.45	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/10/1	134114.13	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/10/2	134178.8	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/10/3	134243.47	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/10/4	134308.14	4Unit	84%	494	185	222	369	1270	84%	4Boiler
2019/10/5	134372.82	4Unit	84%	494	185	222	369	1270	84%	4Boiler