**30MW HFO Power Plant Proposal**

**(Iraqi cement plant)**

**30MW 重油电站方案(伊拉克水泥厂)**

**(20220607)**

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# 1. GENERAL DESCRIPTION总则

## 1.1 GENERAL综述

**（1）Power plant**

According to owner’s requirement, HFO power plant, consists of 6unit x MAN10L3244 5.4MW gen-sets ,combined to the grid .

 Total power: 6\*5.4MW=32.4MW

Voltage: 11kV

Frequency: 50Hz

PF: 0.8(Lagging)

**电站选型**

根据用户要求:6台MAN 10L3244 5.4MW,发电机组,并网运行

总功率: 6\*5.4MW=32.4MW

电压: 11kV

频率: 50Hz

功率因数: 0.8(滞后)

## 1.2 DESIGN CONDITION AND PERFORMANCE DATA设计条件和工作特性

**(1) DESIGN AMBIENT CONDITION**

Refer to ISO 3046

The standard environmental condition:

|  |  |
| --- | --- |
| Environmental temperature  | 25℃ |
| Barometric pressure  | 1bar |
| RH (relative humidity) | 30％ |
| Gross Output AT Generator Terminal | 32.4MW |
| Fuel consumption at Generator Terminal | 189g/kW.h，tolerance +5%  |
| Note: Tolerance + 5%, LCV= 42700 kJ/kg, Load 100%, 50 Hz, PF = 0.8 |

**(1)设计环境条件**

参考ISO 3046

标准环境条件:

|  |  |
| --- | --- |
| 环境温度 | 5-45℃ |
| 大气压力 | 1bar |
| 相对湿度 | 60-95％ |
| 发电机端总输出功率 | 32.4MW |
| 发电机端的燃油消耗率 | 189g/kW.h，公差 +5%  |
| 注：公差+ 5%，低热值=42700 kJ/kg， 100%负荷，50 Hz，PF = 0.8 |

## 1.3 FUEL OIL FOR ENGINE发动机用的燃油

(1) HFO and DO

The viscosity of Diesel oil shall be of≥2 -15cSt at Engine inlet under the power plant operating.

 (2) 重油/**柴油**

发动机运行时的柴油机进口柴油的粘度应该在≥2-15cSt

##

## 1.4 LUBRICATING OIL FOR ENGINE发动机用的润滑油

The Lubricating oil for engine shall be selected from the list of recommended lubricating oil for engine, which shall be of SAE 40.

发动机用润滑油应该从发动机的推荐润滑油列表中选择，SAE 40。

##

## 1.5 COOLING WATER FOR ENGINE发动机冷却水

The cooling water system is designed for using normal fresh water with corrosion inhibitor, in order to prevent incrustation and corrosion attack.

The following water quality shall be valid:

**For Engine (circulation water)**

|  |  |  |  |
| --- | --- | --- | --- |
| Property/ feature | Characteristics | Unit | Remark |
| Type of water  | Distillate or freshwater, free from foreign matter. Not to be used: Sea water, brackish water, river water, brines, industrial waste water and rain water  |  -  | 1) 1°dH (German hardness):10mg CaO/litre17.9mg CaCO3/litre0.357mval/litre0.179mmol/litre2) 1 mg/l 1 ppm |
| Total hardness  | max. 10  |  °dH 1) |
| PH-value  | 6.5 - 8  |  -  |
| Chloride ion content  | max.50  |  mg/l 2) |

为了防止水锈和腐蚀，冷却水系统采用带有防腐剂的淡水。

以下是水质要求:

**发动机（循环水）**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 要求 | 单位 | 备注 |
| 水的类型 | 蒸馏水或淡水，无杂质。不能用：海水、淡盐水、河水、卤水、工业废水和雨水 |  -  | 1) 1°dH (德国硬度):10mg CaO/litre17.9mg CaCO3/litre0.357mval/litre0.179mmol/litre2) 1 mg/l 1 ppm |
| 总硬度 | max. 10  |  °dH 1) |
| PH值  | 6.5 - 8  |  -  |
| 氯离子含量  | max.50  |  mg/l 2) |

##

## 1.6 STANDARDS标准

Unless there are specified standards or codes, all design, manufacturing, quality control and tests shall be in accordance with the applicable portions of below listed prominent international and national Standards and Manufacturer's Standards :

- GB Chinese standards

除非有规定的标准和编码，所有的设计、制造、质量控制和测试应该与以下列出的国际、国家标准和制造商保准一致。

- GB 中国国家标准

## 1.7 UNIT AND LANGUAGE单位和语言

**(1) Units**

In all correspondences of technical documents, schedules and drawings, metric units of all measurements shall be used.

**(2) Language**

The Chinese and english language shall be used in all documents, drawings, name plates and correspondences between contractor and owner.

**(1)单位**

所有来往的技术文档、计划表和图纸中的测量值均采用公制单位。

**(2)语言**

承包人和业主之间，所有的文档、图纸、铭牌和函件均应采用中文和英文。

##

## 1.8 PAINTING涂装

All equipment will be painted in accordance with manufacturer's standard and painting color will be informed to the Owner.

所有设备的涂装依据制造商的标准，喷漆颜色通知业主。

# 2. CONFIGURE OF POWER PLANT SYSTEM电站系统配置

Configure of power plant system contains as follows:

|  |  |
| --- | --- |
| 1 | Generating sets  |
| 2 | mechanical auxiliary system  |
| 3 | electrical auxiliary system  |

电站系统配置包含以下内容：

|  |  |
| --- | --- |
| 1 | 发电机组 |
| 2 | 机械辅助系统 |
| 3 | 电气辅助系统 |

## 2.1 GENERATING SETS发电机组

2.1.2 MAN 10L3244

MAN Gen-set The generating sets mainly include engine, duplex bearing generator, high elasticity shaft coupling and public housing. Diesel and duplex bearing generator are connected by high elasticity shaft coupling, which are also supported and fixed by common bed.



Function of generating sets:

Rated power ---------------------------------------------------------------5400kW

Rated speed ---------------------------------------------------------------750rpm

Rated voltage --------------------------------------------------------------11kV

Rated frequency -----------------------------------------------------------50Hz

PF(Power factor) ----------------------------------------------------------0.8（lagging）

Boundary dimension）---------------------------------------------------约12750×3635×4840（mm）

Dry weight -------------------------------------------------------------------95 t

Steady-state voltage adjusting rate -----------------------------------≤2.5%

Transient voltage adjusting rate ---------------------------------------+20%~-15%

Sudden load changing voltage steady time ------------------------1.5S

Voltage fluctuation rate --------------------------------------------------0.5%

Steady-state frequency adjusting rate -------------------------------≤0.5%

Transient frequency adjusting rate -----------------------------------+10%~-7%

Sudden load changing frequency steady time ---------------------≤5S

Frequency fluctuation rate ----------------------------------------------≤0.5%

Waveform distortion ------------------------------------------------------≤3%

发电机组主要包含发动机、双轴承发电机、高弹性联轴器和公共底盘。发动机和双轴承发电机通过高弹性联轴器连接，被安装固定在公共底盘上。

额定功率---------------------------------------------------------------------5400kW

额定转速---------------------------------------------------------------------750rpm

额定电压--------------------------------------------------------------------11kV

额定频率--------------------------------------------------------------------50Hz

功率因数--------------------------------------------------------------------0.8（lagging）

外形尺寸（长x宽x高）-----------------------------------------------约12750×3635×4840（mm）

干量--------------------------------------------------------------------------95t

稳态电压调整率------------------------------------------------------------≤2.5%

瞬态电压调整率------------------------------------------------------------+20%~-15%

电压恢复时间---------------------------------------------------------------1.5S

电压波动率-------------------------------------------------------------------0.5%

稳态频率调整率-------------------------------------------------------------≤0.5%

瞬态频率调整率------------------------------------------------------------+10%~-7%

频率恢复时间---------------------------------------------------------------≤5S

频率波动率------------------------------------------------------------------≤0.5%

波形畸变率------------------------------------------------------------------≤3%

 **Engine**

|  |  |
| --- | --- |
| Brand and model of engine | MAN 10L3244 |
| Pattern | L10, four stroke, direct injection, turbocharger, water cooled, compressed air starting  |
| Cylinder bore | 320mm |
| Stroke | 440mm  |
| Compressed ratio | 14.2 |
| MCR (Most Continuous Power) | 5600kW |
| Speed | 750r/min |
| Direction of rotation | Crankshaft clock-wise rotation (as viewed from output end)  |
|  |  |
| Fuel consumption rate (When MCR happens)  | 189g/kW.h，tolerance +5%  |
| Air intake flow | 23.84kg/kW.h |
| Exhaust gas flow | 40.75t/ h |
| Exhaust gas temperature after supercharger | 350℃ |
| Supercharger air pressure | 3.04 bar |
| Supercharger air temperature before cylinder  | 45~55℃ |
| Engine inlet lube pressure | 0.42~0.5MPa  |
| Engine inlet lube temperature | 68~73℃ |
| H.T. water into-machine pressure | 0.2~0.5MPa |
| H.T. water out-machine temperature | 68~73℃ |
| L.T. water into-machine pressure | 0.25~0.45MPa |
| L.T. water into-machine temperature | 30~40℃ |
| Fuel into-machine pressure | 0.3~0.6MPa |

**发动机**

|  |  |
| --- | --- |
| 发动机品牌 | MAN 10L3244 |
| 模式 | L10、四冲程、直接喷射、增压中冷、压缩空气启动  |
| 缸径 | 320mm |
| 行程 | 440mm  |
| 压缩比 | 14.2 |
| MCR (最大连续功率) | 5600kW |
| 转速 | 750r/min |
| 旋转方向 | 顺时针（从功率输出端）  |
|  |  |
| 燃油消耗率（当MCR时） | 189g/kW.h，公差 +5%  |
| 空气进气量 | 23.84kg/kW.h |
| 排气量 | 40.75t/ h |
| 增压器后排气温度 | 350℃ |
| 增压器空气压力 | 3.04 bar |
| 进缸前增压器空气温度 | 45~55℃ |
| 润滑油进机压力 | 0.42~0.5MPa  |
| 润滑油进机温度 | 68~73℃ |
| 高温水进机压力 | 0.2~0.5MPa |
| 高温水出机温度 | 75~85℃ |
| 低温水进机压力 | 0.25~0.45Mpa |
| 低温水进机温度 | 30~40℃ |
| 燃油进机压力 | 0.3~0.6MPa |

**Alternator**

|  |  |
| --- | --- |
| Brand | ABB/TFC |
| Rated power | 5400kW |
| Rated voltage | 11kV |
| Rated frequency | 50Hz |
| Rated speed | 750 r/min |
| Direction of rotation | Counter clock-wise (as viewed from input end)  |
| PF | 0.8(Lagging)  |
| Efficiency | 96% |
| Grade of Protection | IP23  |
| Winding temperature sensory | 2×6Pt100 (sensory) (1 set standby)  |
| Anti-freezing heater | AC230V  |
| Coolant method | Self-fan coolant  |
| AVR (Automatic Voltage Regulator) | Installed on generator  |

**发电机**

|  |  |
| --- | --- |
| 品牌 | ABB/TFC |
| 额定功率 | 5400kW |
| 额定电压 | 11kV |
| 额定频率 | 50Hz |
| 转速 | 750 r/min |
| 旋转方向 | 顺指针（从输入端看） |
| 功率因数 | 0.8（滞后） |
| 效率 | 96% |
| 防护等级 | IP23  |
| 绕组温度传感器 | 2×6Pt100（传感器）（1套备用） |
| 防冷凝加热器 | AC230V  |
| 冷却方式 | 风冷 |
| AVR（自动电压调节器） | 安装在发电机上 |

## 2.2MECHANICAL AUXILIARY SYSTEM机械辅助系统

**2.2.1 LUBRICATING OIL SYSTEM**

The engine has it’s own internal lubricating oil system. Lube oil service tank is mounted on common-bed.

|  |  |
| --- | --- |
| Lube oil filter | Duplex type |
| Lube oil pump | Engine driven, mounted on engine |
| Lube oil cooler | Plate type, mounted on engine |
| Pre-lubricating pump | Electric Motor driven |
| Thermostatic valve | Mounted on engine |

**滑油系统**

发动机有自己的内部润滑油系统，润滑油工作油箱安装在机组的公共地盘上。

|  |  |
| --- | --- |
| 滑油滤清器 | 双联滤清器 |
| 滑油泵 | 机带 |
| 滑油冷却器 | 板式冷却器 |
| 滑油预供泵 | 电马达驱动 |
| 恒温阀 | 装机 |

**2.2.2 COOLING WATER SYSTEM**

The engine cooling water system consists of two cooling water circuits, which are Low temperature(LT) and High temperature(HT) water circuits. The heat transfer to engine cooling water is discharged to atmosphere by Radiator Cooling.

|  |
| --- |
| Low temperature water circuit comprises: |
| LTCW pump | Mounted on engine |
| Charge air cooler | Mounted on engine |
| Lubricating oil cooler | Plate type |
| LTCW radiator | Air cooling |
| LTCW expansion water tank |  |
| High temperature water circuit comprises: |
| HTCW pump | Engine driven, mounted on engine |
| Engine water jackets/cylinder head | Mounted on engine |
| Thermostatic valve | Mounted on engine |
| HTCW expansion water tank |  |

**冷却水系统**

发动机冷却水系统由两路冷却水组成，低温冷却水和高温冷却水。传递发动机冷却水中的热量通过散热器释放到大气中。

|  |
| --- |
| 低温水路的组成 |
| 低温水泵 | 机带 |
| 中冷器 | 装机 |
| 滑油冷却器 | 板式 |
| 低温水散热器 | 水冷却塔 客户自购 |
| 低温膨胀水箱 | 客户自制 |
| 高温水路的组成 |
| 高温水泵 | 机带 |
| 发动机缸套/缸头 | 装机 |
| 恒温阀 | 装机 |
| 高温膨胀水箱 |  |

**2.2.4 COMPRESSED AIR SYSTEM**

The compressed air supply system consists of starting air receiver and air compressor as follows.

The compressed air supply system provides also the control air to the related auxiliaries through pressure-reducing valve.

|  |  |
| --- | --- |
| Engine starting | Compressed air, 7 bar |
| Air compressor | Electric Motor driven, 30 bar |
| Air receiver | Cylindrical, 30 bar |

**压缩空气系统**

压缩空气供应系统由启动空气瓶和空气压缩机组成。

压缩空气系统还通过减压阀提供相关辅助设备控制空气。

|  |  |
| --- | --- |
| 发动机启动 | 压缩空气，0.7MPa |
| 空气压缩机 | 电马达驱动3MPa |
| 空气瓶 | 圆柱型，3MPa |

**2.2.5INTAKE AIR SYSTEM**

Intake air filter is dry and washable type filter to be mounted on turbocharger.

**进气系统**

进气滤清器为干式、可洗型滤清器，安装在增压器上。

**2.2.6 EXHAUST GAS SYSTEM**

Exhaust gas of the engine flows out from turbocharger to atmosphere via expansion joint and silencer.

- Total pressure loss in the exhaust gas system : max. 2.5kPa

- Exhaust gas silencer : absorption & resonance Type

- Exhaust gas boiler unit : Smoke tube type,7 bar.

**排气系统**

发动机排气系统通过膨胀节和消音器从增压器流出到大气中去。

排气系统排气背压：最大2.5kPa

排气消音器：吸收共振型

排气锅炉：烟道型，0.7MPa

## 2.3 ELECTRICAL AUXILIARY SYSTEM电气系统

Electrical system mainly includes medium voltage system, low voltage system, control system, etc.

电气系统主要包括了中压系统、低压系统和控制系统等。

**2.3.1PLANT SYSTEM VOLTAGE**

|  |  |
| --- | --- |
| Generator | AC 11kV, 3PH,  |
| Secondary distribution | AC 400V,3PH, |
| Motors | AC 400V,3PH,  |
| AC control | AC 230V, 1PH,  |
| DC control | DC 110V, 2W or 24V,  |
| Grid | AC 11kV, 3PH,  |

**电站系统电压**

|  |  |
| --- | --- |
| 发电机 | AC 11kV, 3PH,  |
| 二次分配 | AC 400V,3PH, |
| 马达 | AC 400V,3PH,  |
| 交流控制 | AC 230V, 1PH,  |
| 直流控制 | DC 110V, 2W or 24V,  |
| 电网 | AC 11kV, 3PH,  |

**2.3.2 11kV SWITCHGEARS**

**General description**

1. 11kV switchgear shall be indoor, metal-enclosed, floor mounted, draw out type.

Meters, relays, switches and lamps will be flush mounted on the respective cubicle door or on control cabinet. The degree of protection enclosure will be of IP 41x.

1. The breakers shall be triple pole, single throw and vacuum circuit breaker
2. All the external cables will enter the switchgear through adequate openings at the bottom.
3. Current transformers(CT) will be epoxy-resin type. All current transformer secondary will be connected to short circuiting terminal blocks.
4. Potential transformers(PT) will be epoxy-resin type with primary and secondary fuses.
5. The accuracy class for CT & PT will be of 1.0 cl. for metering 5P20 for protection.
6. The vacuum circuit breaker operating and control circuit will be for 110V DC supplied from 110V DC station which is normally floated with battery and battery charger.
7. The switchgear cubicle will be provided with space heaters to prevent condensation of moisture within the switchgear.
8. For generator feeders, the necessary electrical parameters are to be measured or displayed in each generator control panel.

**Particulars**

|  |  |
| --- | --- |
| Type | KYN28-24 |
| Rated voltage  | 24kV 3PH, 50Hz |
| Service voltage  | 11kV 3PH, 50Hz |
| Ground system  | Solidly grounded  |
| Control power  | DC110V |
| Switch gear main bus current  | 630A/1250A |
| Material of busbar  | Copper  |
| Circuit breaker  | Type: Draw out type, VCB Rated voltage: 24kV, 3PH Rated current: 630ARated interrupting current: 25kA |

**开关柜**

**综述**

1. 11kV开关柜是户内、金属密封、地板安装、抽出性型

仪表、继电器、转换开关和指示灯安装在各自的柜体面板和控制柜内。柜体的防护等级为IP4x。

1. 断路器是三极、单掷的真空断路器。
2. 所有的外部电缆通过底部足够的开孔进入开关柜。
3. 电流互感器（CT）为环氧树脂型。所有电流互感器的二次侧连接到短路的接线端子上。
4. 电压互感器（PT）带有一次和二次熔断器的环氧树脂型。
5. CT和PT的精度等级是为保护测量5P20用的1.0级。
6. 真空断路器的运行和控制线圈是来自于110V直流站供应的DC110V。
7. 开关柜内安装有空间加热器，以防止柜内的水汽凝结。
8. 对于发电机馈线，在每个发电机控制屏上测量和显示必要的电气参数。

**详情**

|  |  |
| --- | --- |
| 型号 | KYN28-24 |
| 额定电压 | 24kV 3PH, 50Hz |
| 供电电压 | 11kV 3PH, 50Hz |
| 接地系统 | 直接接地 |
| 控制电源 | DC110V |
| 开关主母线电流 | 630A/1250A |
| 母线材料 | 铜 |
| 断路器 | 型号：抽出型，真空断路器额定电压：24kV, 3PH额定电流：630A/1250A额定分断电流：25kA |

**2.3.3 400V SWITCHGEARS/MCC/DISTRIBUTION BOARDS**

**General description**

1. L.V switchgear will be metal-enclosed, free-standing, dead front structure with electrically operated draw out type air circuit breaker suitable for indoor installation.
2. The air circuit breaker will be 3-pole, 600V class air circuit breaker (ACB) with suitable rating of continuous current rating and interrupting rating respectively.

**Specification**

|  |  |
| --- | --- |
| Type | Metal enclosed type for indoor service |
| Rated voltage | 600VAC,3PH,50Hz |
| Service voltage | 400VAC,3PH,50Hz |
| Ground system | Solidly grounded |
| Control power | 110VDC for ACB and 230VAC, 1Ph  |
| Bus | Copper bus with current rating as required |
| Circuit breaker | Air circuit breaker |
| 1. Type : Draw out type
2. Rate voltage: 600V, 3PH, 50Hz
3. Rated current: 630A
4. Rated interrupting current : 65kA SYMM.
5. Operating type : Motor spring type
6. Over current trip : Direct acting trip device
7. No of poles: 3p
 |

**400V开关柜/MCC/配电板**

**综述**

1）低压开关柜是带有可操作的抽出式空气断路器，适合户内安装的，金属密封的、独立的、框架式结构。

2）空气断路器是3极，600V空气断路器(ACB)，带有连续和分断电流额定值合适的等级。

**规格**

|  |  |
| --- | --- |
| 型号 | 为屋内检修的金属密封型 |
| 额定电压 | 600VAC,3PH,50Hz |
| 供电电压 | 400VAC,3PH,50Hz |
| 接地系统 | 直接接地 |
| 控制电源 | 110VDC for ACB and 230VAC, 1Ph |
| 母线 | 按照规定额定电流的铜母线 |
| 断路器 | 空气断路器 |
| 1. 型号：抽出型
2. 额定电压: 600V, 3PH, 50Hz
3. 额定电流: 630A
4. 分断电流 : 65kA SYMM.
5. 操作形式：电马达弹簧型
6. 过流跳闸：直接动作脱扣装置
7. 极数: 3p
 |

**2.3.5 POWER TRANSFORMER**

**Particulars**

|  |
| --- |
| Aux. Transformer  |
| a) Rated voltage  |  |
| H.V  | 11kV |
| L.V  | 0.4kV |
| b) Winding  |  |
| H.V  | Delta  |
| L.V  | Wye  |
| c) Vector group  | Dyn11 |
| d) Capacity  | 350kVA |
| e) Cooling  | oil-immersed |
| f) Tap changer  | NLTC 2 ×±2.5% TAPS |

**电力变压器**

**详情**

|  |
| --- |
| 辅助变压器 |
| a) 额定电压 |  |
| 高压侧 | 11kV |
| 低压侧 | 0.4kV |
| b)绕组 |  |
| 高压侧 | 三角形 |
| 低压侧 | 星形 |
| c)矢量组 | Dyn11 |
| d) 容量 | 500kVA |
| e)冷却 | 油浸式 |
| f)分接头 | NLTC 2 ×±2.5% TAPS |

**2.3.6 DC SYSTEM**

**Batteries**

|  |  |
| --- | --- |
| Rated voltage | 110V DC & 24V DC |
| Type | Lead-Acid |
| No. of cell | As required |
| Capacity | As required |
| No minal voltage | 12V/cell |
| Back-up time | 60 Minutes |
| \* Capacity shall be adjusted during the detail design |

**Battery Charger**

|  |  |
| --- | --- |
| TYPE | Metal-enclosed, indoor, floor mounted Float charger combined booster charger |
| Quantity | One set for 110V DC system |
| Rated output  | 24V DC, 50A & 110V DC, 50A |
| Feeder  | Molded case circuit breaker |
| No. of pole | 2P |

**直流系统**

**蓄电池**

|  |  |
| --- | --- |
| 额定电压 | 110V DC & 24V DC |
| 类型 | 铅酸 |
| 电池组数目 | 按照需要 |
| 容量 | 按照需要 |
| 单元蓄电池电压 | 12V/块 |
| 备用时间 | 60分钟 |
| \* 容量根据详细设计调整 |

**电池充电器**

|  |  |
| --- | --- |
| 类型 | 金属密封、户内、地板安装浮充电结合大电流充电 |
| 数量 | 为110V直流系统的一套 |
| 额定输出 | 24V DC, 50A & 110V DC, 50A |
| 馈线 | 模式断路器 |
| 极数 | 2P |

**2.3.7 MOTOR**

**General Description**

1. AC motors will be suitable for operation on 3-phase, 400V, 50Hz.
2. Unless otherwise specified, all the AC motors will be squirrel cage induction motors suitable for full voltage direct starting.

|  |
| --- |
| **Technical Specifications for LV Motors.** |
| Rated voltage | 400V, 3PH, 50Hz |
| Enclosure | Indoor area Outdoor area  |
| Insulation class | F |
| Space heaters | Outdoor motors, 37.5KW & larger |
| Starting type | Direct on line starting |
| Others | Tropical design |

**2.3.7马达**

**总则**

1. 交流电动机适合3相400V/50Hz
2. 除非另有说明，所有的交流电动机采用鼠笼式感应电动机，适合于全压直接启动。

|  |
| --- |
| **低压电动机的技术规格** |
| 额定电压 | 400V, 3PH, 50Hz |
| 外壳 | 户内: IP54户外: IP55 |
| 绝缘等级 | F |
| 空间加热器 | 户外电动机，37.5kW或更大 |
| 启动类型 | 直接启动 |
| 其他 | 热带设计 |

**2.3.8 Cables**

**2.3.8.1 HV Power Cables**

|  |  |
| --- | --- |
| Type | 24 kV, XLPE, PVC sheathed |
| Core | 3C |
| Minimum size | As per calculation |
| Conductor | Copper |

**2.3.8.2 L.V Power Cables**

|  |  |
| --- | --- |
| Type | 0.6/1.0kV XLPE, PVC sheathed |
| Core | Multiple (3C or 4C) |
| Conductor | Copper |

**2.3.8.3 Control Cables**

|  |  |
| --- | --- |
| Type  | 600V CVV (PVC/PVC) |
| Shielding | As needed |
| Multiple Core | Multiple (2C through 30C) |
| Conductor | Copper |

**2.3.8.4Instrumentation cables**

|  |  |
| --- | --- |
| Type  | 600V CVVS  |
| Shielding | Shielded |
| Core | 1 pair and multi-pair |
| Conductor | Copper |

**电缆**

**2.3.8.1高压电源电缆**

|  |  |
| --- | --- |
| 类型 | 24 kV, XLPE, PVC 护套 |
| 芯数 | 3C或1C |
| 最小尺寸 | 根据计算 |
| 导体 | 铜 |

**2.3.8.2低压电源电缆**

|  |  |
| --- | --- |
| 类型 | 0.6/1.0KV XLPE, PVC 护套 |
| 芯数 | 多芯（2C、3C 或4C）或单芯（1C） |
| 导体 | 铜 |

**2.3.8.3控制电缆**

|  |  |
| --- | --- |
| 类型 | 600V CVV（PVC/PVC） |
| 屏蔽 |  |
| 芯数 | 多芯（2C-30C） |
| 导体 | 铜 |

**2.3.8.4仪表电缆**

|  |  |
| --- | --- |
| 类型 | 600V CVVS |
| 屏蔽 | 带屏蔽层 |
| 芯数 | 一对及多对 |
| 导体 | 铜 |

**2.3.10 Conduits and trays**

1) Cables will be installed in above ground conduits, cable trays, underground conduits

or cable trenches or direct buried.

2) Conduits will be rigid steel conduits.

3) Separate trays for instrumentation cables will be provided to separate them from

power cable.

4) Trays for cables for different voltage levels will be stacked in descending order with the

higher voltage above. Instrumentation trays will always be at the bottom.

5) Trays will be made of hot-dip galvanized steel for outdoor and indoor.

**管道和电缆桥架**

1）电缆可安装于地面管道、电缆桥架、地下管道或电缆槽上方，或直接埋入地面。

2）管道应为硬钢管。

3）应提供单独的仪表电缆桥架，将仪表电缆和电源电缆分开。

4）不同电压的电缆桥架按降序叠放，电压高的置于上方。仪表电缆架桥始终置于底部。

5) 室内外的架桥均应采用热浸锌钢。

**2.3.11 INSTRUMENT & CONTROL SYSTEM**

**2.3.11.1 ENGINE/ GENERATOR CONTROL PANEL**

Engine/ Generator control panel will be metal-enclosed, free-standing, IP40, indoor installation.

a) Control and Monitoring

- Engine RPM display

- T/C RPM display

- Engine pressure display

Starting air pressure

FO engine inlet pressure

LO engine inlet pressure

- Engine temperature display

FO engine inlet temperature

HT water outlet temperature

Exh. Gas T/C inlet temperature

- D/G set emergency stop

- Engine start and stop

- Engine speed control

- Generator voltage control

b) Annunciator

c) Synchronizing

d) Protection relay (Multi or single protective type)

- Under/ over voltage protection

- Reverse power protection

- Loss of excitation

- Over current protection

- Over current ground protection

- Under and over frequency protection

- Lock out relay(separate type)

- Differential Protective Relay(87G)

However, the above shall be adjusted subject to detail design

**2.3.11.1发动机/发电机控制屏**

发动机/发电机控制屏金属密封型、独立的、IP40、户内安装。

a)控制和监控

-发动机转速显示

-增压器转速显示

-发动机压力显示

启动空气压力

发动机燃油进机压力

润滑油进口压力

-发动机温度显示

发动机进口温度

高温水出机温度

增压器口的排气温度

-机组紧急停机按钮

-发动机启动和停机

-发动机转速控制

-发电机电压控制

b)报警器

c)同步

d)保护继电器（多个或单个保护型）

-欠/过压保护

-逆功保护

-失磁

-过流保护

-过流接地保护

-欠/过频保护

-闭锁继电器（分离型）

-差动保护(87G)

然而，以上要求根据详细设计调整。

**2.3.11.2 Field instrumentation**

Necessary local instrumentation for field tanks and pipe lines will be provided properly for efficient and reliable plant operation, subject to our standard. Instrumentation will be tropicalized to suitable the conditions of the plant environment.

But, the instruments for tanks will be supplied by tanks supplier when tanks are out of contractor`s scope Wherever possible, instruments which perform similar functions in similar applications will be of uniform type and manufacturer. However package mounted instruments will be subject to manufacture standard and practice.

Each instrument will be identified and tagged with a tag number, according to job standards. Local indicators will be graduated to in engineering units of the measures variable. Instrument scale ranges will be expressed in S.I. Engineering units.

All the instruments will be the industrial type and field proven design.

**2.3.11.2现场仪表**

应按照我们的标准，为油罐和管道提供必要的本地仪表，以确保电站的高效、可靠运行。仪表应适合热

带气候以适应电站环境条件。

但当油罐不在承包商供货范围内时，油罐的仪表应由油罐供应商提供。如有可能，应用于类似领域、功

能相近的仪表应为统一类型、由统一的生产商提供。但是，打包安装的仪表应受服从生产商的标准和惯例。

每台仪表都应通过鉴定并根据工作标准贴上标签号。本地指示器应使用工程单位，仪表刻度范围应采用

国际单位表示。

所有仪表均应为工业型，并经现场验证。

# 3.SCOPE OF SUPPLY供货范围

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ITEM No.序号** | **DESCRIPTION名称** | **SPECIFICATION技术规格** | **REQUIRED 必需的** | **SCOPE责任方** |
| **Qty数量** | **Unit单位** | **Supply供应商** | **OWNER业主** |
| **1** | **GENERATOR SET发电机组** | 　 | 6 | 　 | 　 | 　 |
| 1.1 | Diesel engine 柴油机 |  | 6 | Unit(s) | ■ | 　 |
| 1.2 | Alternator with AVR发电机带AVR | 8750kW, 0.8PF, 11kV, 50Hz | 6 | Unit(s) | ■ | 　 |
| 1.3 | Common bed公共底盘 | For engine and alternator, with lube oil sump tank | 6 | Unit(s) | ■ | 　 |
| 1.4 | Flexible coupling assembly高弹性联轴器 | 　 | 6 | Set(s) | ■ | 　 |
| **2** | **MECHANICAL AUXILIARY SYSTEM机械辅助设备** | 　 | 　 | 　 | 　 | 　 |
| **2.2** | **fuel SYSTEM 燃油系统** | 　 | 　 | 　 | 　 | 　 |
| 2.2.1 | 重油供应单元HFO supply unit |  | 3 | Unit(s) | ■ |  |
| 2.2.2 | 重油分离单元HFO separation unit |  | 3 | Unit(s) | ■ |  |
| 2.3.3 | 废气锅炉exhaust gas boiler |  | 3 | Unit(s) | ■ |  |
| **2.4** | **LUBRICATING OIL( LO)SYSTEM 润滑油系统** | 　 | 　 | 　 | 　 | 　 |
| 2.4.1 | Lube Oil (Centrifuge) Separator unit 润滑油分离单元 | Effective capacity 0.8m3/h per separator. |  6 | Unit(s) | ■ | 　 |
| **2.5** | **COMPRESSED AIR SYSTEM压缩空气系统** | 　 | 　 | 　 | 　 | 　 |
| 2.5.1 | Starting Air Compressor Unit启动空气压缩机单元 | 37m3/h,30bar | 2 | Unit(s) | ■ | 　 |
| 2.5.2 | Starting Air Receiver Unit 启动空气瓶 | 500L, 30kg/cm2, with 40kg/cm2 relief valve. | 2 | Set(s) | ■ | 　 |
| **2.6** | **WATER COOLING SYSTEM 水冷却系统** | 　 | 　 | 　 | 　 | 　 |
| 2.6.1 | Radiator散热器 | 　 | 6 | Unit(s) |  | ■ |
| 2.6.2 | HT Expansion Tank高温水膨胀水箱 | 300L | 6 | Unit(s) |  | ■ |
| 2.6.3 | LT Expansion Tank低温水膨胀水箱 | 300L | 6 | Unit(s) |  | ■ |
| **2.7** | **EXHAUST GAS SYSTEM 排气系统** | 　 | 　 | 　 | 　 | 　 |
| 2.7.1 | Silencer消音器 | 　 | 6 | Pc(s) | ■ | 　 |
| 2.7.2 | Expansion Bellows膨胀节 | 　 | 6 | Pc(s) | ■ | 　 |
| **2.8** | **INTAKE AIR SYSTEM进气系统** | 　 | 　 | 　 | 　 | 　 |
| 2.8.1 | Air intake filter unit空气进气滤清器单元 | Dry and washable type filter to be mounted on turbocharger. | 6 | Unit(s)  | ■ | 　 |
| **2.9** | **OTHER EQUIPMENT AND MATERIALS 其他设备和材料** | 　 | 　 |  | 　 |  |
| 2.9.1 | System Piping & Fitting & Auxiliary material系统管路、管件和辅助材料 | System Gauges\control & Fitting | 6 | Pc(s) |  | ■ |
| 2.9.2 | System Valves & Fitting系统阀门和管件 | 　 |  6 | Pc(s) |  | ■ |
| 2.9.3 | System Gauges\control & Fitting系统仪表、控制和管件 | 　 |  6 | Pc(s) |  | ■ |
| **3** | **ELECTRICAL AUXILIARY SYSTEM电气辅助系统** | 　 | 　 | 　 | 　 | 　 |
| **3.1** | **MV ELECTRICAL SYSTEM中压电气系统** |  | 　 | 　 | 　 |  |
| 3.1.1 | Generator Circuit Breaker Panel (GB)发电机开关屏 | KYN28-24, 630A, 25KA | 6 | sets | ■ |  |
| 3.1.2 | Station service transformer 11Side CB Panel 厂用电变压器11进线屏 | KYN28-24, 630A, 25KA | 1 | sets |  | ■ |
| 3.1.3 | Station Service Transformer 厂用电变压器 | 500KVA, 11/0.4KV, Dyn11 | 1 | sets |  | ■ |
| **3.2** | **LV ELECTRICAL SYSTEM低压电气系统** |  | 　 | 　 | 　 |  |
| 3.2.1 | LV Input CB Panel低压进线屏 | ACB,0.4kV, 1000A, 60Hz | 1 | Unit  |  | ■ |
| 3.2.3 | Auxiliary Equipment Control Panel辅助设备控制屏 | 　 | 3 | Units  |  | ■ |
| **3.3** | **CONTROL & PROTECTION SYSTEM 控制和保护系统** |  | 　 | 　 | 　 | 　 |
| 3.3.1 | Diesel Engine local control panel柴油机就地控制屏 |  | 6 | Units | ■ |  |
| 3.3.2 | Central Operating System 集中操作系统 | Including parallel machine device 包括并机装置 | 1 | Unit  | ■ |  |
| **3.4** | **DC SYSTEM直流系统** |  | 　 | 　 | 　 |  |
| 3.4.1 | DC System Control Panel (DCC)直流控制屏 | 　 | 1 | Unit  |  | ■ |
| 3.4.2 | Accumulator Battery Panel 蓄电池屏 | 　 | 1 | Unit  |  | ■ |
| **3.5** | **INSTALLATION MATERIALS安装材料** | 　 | 　 | 　 | 　 | 　 |
| 3.5.1 | Power Cable 动力电缆 | 　 | 1 | lot |  | ■ |
| 3.5.2 | Control Cable控制电缆 | 　 | 1 | lot |  | ■ |
| 3.5.3 | Cable Bridge & Stand & Install auxiliary materials电缆桥架、支架和安装材料 | 　 | 1 | lot |  | ■ |
| **4** | **Spare Part备件** |  | 　 | 　 | 　 |  |
| 4.1 | Standard Spare Parts for Engine发动机标准备件 |  | 2 | Set(s) | ■ |  |
| 4.2 | Standard Spare Parts for Generator发电机标准备件 |  | 2 | Set(s) | ■ | 　 |
| **5** | **Tool工具** |  | 　 | 　 | 　 | 　 |
| 5.1 | Standard Tools for Engine标准工具 |  | 2 | Set(s) | ■ |  |

## 附件 1 标准随机备件清单 annex 1 the list of standard spare parts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 序号No. | 中文名称Designation | 英文名称Designation | 单位Unit | 每平台数量Qty/Plat | 备注Remark |
| 1 | 进气阀 | Inlet valve cone,plasma-nitrided | 件(PIECE) | 2 |  |
| 2 | 排气阀 | Exhaust valve cone,plasma-nitrided | 件(PIECE) | 4 |  |
| 3 | 气阀导套 | Valve guide | 件(PIECE) | 4 |  |
| 4 | 气阀内弹簧 8×51×178 | Pressure spring8×51×178 | 件(PIECE) | 6 |  |
| 5 | 气阀外弹簧 12×81×193 | Pressure spring12×81×193 | 件(PIECE) | 6 |  |
| 6 | 进气阀座 | Inlet valve seat ring | 件(PIECE) | 1 |  |
| 7 | 排气阀座 | Outlet valve seat ring | 件(PIECE) | 2 |  |
| 9 | 转阀机构（进气） | Valve rotating device | 套(SET) | 2 |  |
| 10 | 转阀机构（排气） | Axial bearing | 套(SET) | 4 |  |
| 11 | 气阀卡块 | Valve cone piece two-part | 套(SET) | 2 |  |
| 12 | 起动阀及安装组件 | Assembly starting valve | 套(SET) | 1 |  |
| 13 | 密封圈 38×3.2 | Set of gaskets | 件(PIECE) | 6 |  |
| 15 | O 型密封圈 56.52×5.33 | Round seal ring | 件(PIECE) | 18 |  |
| 16 | O 型 密 封 圈 72.62×3.53 Q/SC362-1979-MS29513/233-F105 | Round seal ring 72.62×3.53 | 件(PIECE) | 30 |  |
| 17 | O 型密封圈 94.92×2.62Q/SC362-1979-MS29513/154-F 105 | Round seal ring 94.92×2.62 | 件(PIECE) | 12 |  |
| 18 | O 型密封圈 59.69×5.33Q/SC361-1979-AN35-F105 | Round seal ring59.69×5.33 | 件(PIECE) | 12 |  |
| 19 | O 型密封圈 23.40×3.53Q/SC361-1979-AN18-F105 | Round seal ring23.40×3.53 | 件(PIECE) | 24 |  |
| 20 | O 型 密 封 圈 405.26×5.33 Q/SC362-1979-MS29513/385-F105 | Round seal ring 405.26×5.33 | 件(PIECE) | 12 |  |
| 21 | O 型密封圈 18.64×3.53Q/SC361-1979-AN15-F105 | Round seal ring18.64×3.53 | 件(PIECE) | 6 |  |
| 25 | O 型密封圈 354.97×5.33Q/SC362-1979-MS29513/383-F 105 | Round seal ring 354.97×5.33 | 件(PIECE) | 24 |  |
| 26 | O 型密封圈 37.47×5.33 | Round seal ring | 件(PIECE) | 24 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Q/SC361-1979-AN28-F105 | 37.47×5.33 |  |  |  |
| 27 | 火焰环 | Fire land ring | 件(PIECE) | 1 |  |
| 28 | O 型 密 封 圈 405.26×5.33 Q/SC362-1979-MS29513/385-F105 | Round seal ring 405.26×5.33 | 件(PIECE) | 12 |  |
| 29 | 密封环 H=10 | Seal ring H=10 | 件(PIECE) | 1 |  |
| 31 | 曲轴轴承(上瓦) | Upper bearing shell | 件(PIECE) | 1 |  |
| 32 | 曲轴轴承(下瓦) | Lower bearing shell | 件(PIECE) | 1 |  |
| 33 | 横向拉紧螺柱 M42×3 | Stud screw M42×3 | 件(PIECE) | 2 |  |
| 34 | 螺母 M42×3 | Nut M42×3 | 件(PIECE) | 2 |  |
| 35 | 止推块 | Stop piece | 件(PIECE) | 2 |  |
| 36 | 螺钉 M24×280 | Hexagon bolt M24×280 | 件(PIECE) | 2 |  |
| 37 | 螺钉 M24×560 | Hexagon bolt M24×560 | 件(PIECE) | 2 |  |
| 38 | 螺母 M24GB/T6177.1-2000-M24-10 | Hexagon nut M24 | 件(PIECE) | 4 |  |
| 39 | 圆柱销 12m6×32GB/T119.2-2000-A12m6×32-钢 | Cylinder pin 12m6×32 | 件(PIECE) | 2 |  |
| 40 | 螺栓 M24×180GB/T5782-2000-M24×180-8.8 | Hexagon bolt M24×180 | 件(PIECE) | 24 |  |
| 41 | 螺栓 M12×80GB/T5782-2000-M12×80-8.8 | Hexagon bolt M12×80 | 件(PIECE) | 4 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 42 | 止推轴承 | Thrust bearing ring | 件(PIECE) | 2 |  |
| 43 | 螺栓 M20×180GB/T5782-2000-M20×180-8.8 | Hexagon boltM20×180 | 件(PIECE) | 8 |  |
| 44 | 螺母 M48×3 | Nut M48×3 | 件(PIECE) | 8 |  |
| 45 | 垫片 | Gasket | 件(PIECE) | 6 |  |
| 47 | O 型密封圈 55×3 | Round seal ring | 件(PIECE) | 12 |  |
| 48 | O 型密封圈 126.59×3.53 | Round seal ring | 件(PIECE) | 6 |  |
| 49 | 喷油嘴总成 | Injection nozzle | 套（SET） | 1 | . |
| 51 | O 型密封圈 59.92×3.53 | Round seal ring | 件(PIECE) | 30 |  |
| 52 | 密封环 | seal ring | 件(PIECE) | 12 |  |
| 53 | 高压油管总成 | Fuel injection pipe covered | 套（SET） | 1 |  |

**附件 2 标准随机工具清单 annex 2 the list of standard tools**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 序号NO. | 中文名称Designation | 英文名称Designation | 每船数量Qty/Plat | 备注Remark |
| **1** | 027 部件专用工具 | Tools for sub-assembly 027 | 1 套 SET |  |
| **2** | 连杆 030 部件专用工具 | Tools for sub-assembly 030 connecting rod | 1 套 SET |  |
| **4** | 曲轴 021 部件专用工具 | Tools for sub-assembly 021 crankshaft | 1 套 SET |  |
| **5** | 曲轴 020 部件专用工具 | Tools for sub-assembly 020 crankshaft | 1 套 SET |  |
| **7** | 连杆 030 部件专用工具 | Tools for sub-assembly 030 connecting rod | 1 套 SET |  |
| **8** | 缸盖 055 部件专用工具 | Tools for sub-assembly 055 cylinder head | 1 套 SET |  |
| **9** | 缸套 050 部件专用工具 | Tools for sub-assembly 050 cylinder line | 1 套 SET |  |
| **10** | 活塞 034 部件专用工具 | Tools for sub-assembly 034 piston | 1 套 SET |  |
| **11** | 高压油管 434 部件专用工具 | Tools for sub-assembly 434 injection pipe | 1 套 SET |  |
| **12** | 起动阀 161 部件专用工具 | Tools for sub-assembly 161starting valve | 1 套 SET |  |
| **14** | 喷油泵 200 部件专用工具 | Tools for sub-assembly 200 injection pump | 1 套 SET |  |
| **15** | 示功阀 419 部件专用工具 | To‰ols for sub-assembly 419 indicator vale | 1 套 SET |  |
| **16** | 进排气阀 113/114 部件专用工具 | Tools for sub-assembly 113/114 inlet/out | 1 套 SET |  |
| **17** | 喷油器 221 部件专用工具 | Tools for sub-assembly 221 injection valve | 1 套 SET |  |
| **20** | 爆压表 419 部件专用工具 | Tools for sub-assembly 419 ignition pressure | 1 套 SET |  |