PROJECT	Shenhua Baotou Coal To Olefins Upgrading Demonstration Project	ITEM	1216-PA-101
CLIENT	CHINA ENERGY BAOTOU COAL CHEMICAL COMPANY LIMITED	DES.PHAS	Basic Design
PLANT	350 KT/A PP PLANT		

TECHNICAL REQUISITION
FOR CATALYST METERING UNIT

						会签 COUNTERSIGNED		
0		2023.11.28.	陈鑫	于芳	李莉			
修改 Rev.	说 明 Des.	日 期 Date	编 制 BY	校 核 CHK.	审 核 APP.		会签 专业 DISC.	会签人 SIGN.

Instruction：

Symbols instruction

1. It marks "*" before the serial number in the main important clauses of the bidding technology document, which means the reject of the bidding technology documents in case of inconformity to these clauses.
2. There are 2 important clauses with the mark of "*" in this bidding technology document which are as follows:

   *1) The calculation method for materials design thickness must be in accordance with ASME Standards / Code Sec. VIII Div. 1.

   *2) Potential bidders should satisfy the following requirement for qualification and experience, and submit copies and the correspondences in the proposals, Bidders should have at least 3 sets manufacturing experience of catalyst metering system unit for 300,000 tons /year or above in last 5 years, not subcontracting partly or wholly. Bidders should provide the experiential copies of contract certification, including, but not limited, project name, equipment name, equipment specifications (diameters, height and gross weight,etc.),Material as well as the copy pages with signature and stamp. It should be assumed invalid if the copies of contract certification are not clear and cannot be provided.

1. This technical appendix of the Contract consists of Purchaser's REQUISITION, Vendor's Quotation and Minutes of Meeting between Purchaser and Vendor. If any conflicts arise among REQUISITION, Quotation and Minutes of Meeting, following priority shall be governed.

a. Minutes of Meeting
b. Purchaser's REQUISITION
c. Vendor's Quotation

Purchaser's REQUISITION and Minutes of Meeting shall be regarded as final basis.

2. In addition to scope of supply by Vendor stipulated in REQUISITION (including language description and diagram illustration), Vendor shall supply complete packages with all necessary accessories in order to meet Purchaser's all requirements.

3. After receipt of the drawings and documents submitted by Vendor, Purchaser shall return one copy of drawings and documents with checking comments to Vendor within 4(four) weeks. Vendor must not start to fabricate until Vendor receive the above-said return drawings and documents with checking and approval comments from Purchaser. However, such checking and approval comments by Purchaser do not mean relieving Vendor's execution of technical specification and requirements stipulated in the Contract and Vendor's responsibility. Purchaser shall not be liable for correctness and accuracy of dimension and construction shown in Vendor's drawings.

4. Each drawing and document to be submitted by Vendor shall be clearly indicated as following:

a. For Reference
b. For Approval
c. Final Edition (for filing)

*5. The calculation method for materials design thickness must be in accordance with ASME Standards / Code Sec. VIII Div. 1.

*6. Potential bidders should satisfy the following requirement for qualification and experience, and submit copies and the correspondences in the proposals,Bidders should have at least 3 sets manufacturing experience of catalyst metering system unit for 300,000 tons /year or above in last 5 years, not subcontracting partly or wholly. Bidders should provide the experiential copies of contract certification, including, but not limited, project name, equipment name, equipment specifications (diameters, height and gross weight,etc.),Material as well as the copy pages with signature and stamp. It should be assumed invalid if the copies of contract certification are not clear and cannot be provided.

APPENDIX TO INSTRUCTION TO BIDDERS

Bidder's proposal shall include all of the following information indicated by [x].

[x] Completed Purchaser's Data Sheet
The Bidder shall fill up the Purchaser's data sheet attached in the individual specification.
For Each Data Sheet, Material, PWHT and Plate Thickness of Major Parts shall be filled.

[x] Preliminary Foundation Design Data

[x] Catalogue

The following are applicable to metering cylinders and metering pumps with motor.

[x] Technical Specification of metering cylinders and metering pumps Including:
[x] Type, Model No., Materials and Major Construction Features
[x] Design Conditions
[x] Utility Consumption (including Lubricant & Consumables)
[x] Motor Data
[x] List of Accessories
[x] Inspection Procedure

[x] Outline Drawings of Catalyst Metering Unit showing Principal Dimensions and Materials of Major Parts.

The following are applicable to only metering cylinders and metering pumps.

[x] Estimate Weight List (include metering cylinders and metering pumps, skit, etc.)

[x] Amount of all materials (main) used in the Construction of Catalyst metering unit.

MANUFACTURER:

ITEM : PA-101
SERVICE : oil operated package unit for catalyst metering to the reaction, consisting of 2 continuously. Operating cylinders, with alternate loading and unloading operations, as shown on the sketches.

SCOPE OF SUPPLY

- PIPINGS INSIDE THE PACKAGE
- INSTRUMENTS
- ELECTRIC EQUIPMENT
- PAINTING
- WINTERIZING

The supply of Catalyst Metering Unit PA-101 will be composed as follows:

2.1 **No.1 FRAME** executed with carbon steel (type Fe360) tubulars and reinforced plates, suitable for ground anchoring and on which the following components will be assembled :

2.2 **No.2 METERING CYLINDERS**

--- double effect operation

--- cooling jacket

--- mechanical level gauge items LI-141 A/B

--- rod Ø 50 mm

--- bore Ø 250 mm

--- stroke 2000 mm

--- capacity 0.098 m^3

--- material: stainless steel AISI 304

--- working / design / test pressure:

-- cylinder side 5 MPag / 8Mpag / 12 Mpag

-- cooling jacket side 0.4 MPag / 0.8 Mpag / 1.2 Mpag

--- working / design / MDMT temperature: 5 °C / 100 °C / -19.2°C

--- nozzles:

-- oil inlet/outlet: DN 1/2" ANSI 600 NPT-F

-- catalyst inlet/outlet: DN 1" ANSI 600 NPT-F

-- water inlet/outlet: DN 1" ANSI 150 RF

--- standing clamp

--- rod brass bushing

--- rod sealing gasket type Lubroring E/GR

--- items: D-101-1AX/1BX

each one provided with :

No.2 PROXIMITY SWITCHES

--- housing: stainless steel AISI 304

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- contact: SPDT gold-plated

--- cable conduit connection: DN 1/2" NPT-F

--- mechanical protection: IP68

--- items: LSH-141 A/B – LSL-142 A/B

--- type: C75-1-SB-TL2

2.3 **No.2 <u>METERING PUMPS</u>** in accordance with API 675 standard second edition and with reciprocating piston :

--- adjustable flow rate 0 ÷ 14 litres / hours

--- discharge pressure: 6.16 Mpag

--- design pressure: 7 Mpag

--- working / design / MDMT temperature: 25 °C / 100 °C / -19.2°C

--- automatic flow control by pneumatic positioner suitable for proportional signal drive with standard pressure of 3 ÷ 15 psig (0.02 ÷ 0.1 MPag)

--- material execution in stainless steel AISI 316 for internal parts in contact with process liquid

--- seals: reinforced PTFE

--- suction nozzle: DN 3/4” ANSI 150 RF

--- discharge nozzle: DN 1/2” ANSI 600 RF

--- gear reducer suitable to be connected to a 0.75 kW electric motor

--- type: DOXA.L-A10x25 / API 675 with pneumatic positioner

--- items: P101-1AX/1BX

2.4 **No.2 <u>ELECTRIC MOTORS</u>** assembled on metering pumps :

--- power: 0.75 kW – 4 poles

--- voltage: 380 Vac / 50 Hz / 3 Phase

--- mechanical protection: IP 55 - tropicalized - terminal box IP55

--- insulation: class F

--- temperature rise: class B

--- protection: EExd-IIB-T4

--- certification: IEC / CENELEC

--- items:M101-1AX/1BX

2.5 **No.3 <u>BALL VALVES</u>** assembled on suction line of metering pumps :

--- material: stainless steel AISI 304

--- nozzles: DN 3/4" ANSI 150 NPT-F

--- type: ALFA20T

2.6 **No.2 <u>CHECK VALVES</u>** assembled on discharge line of metering pumps:

--- material: stainless steel AISI 316

--- design pressure: 120 barg

--- nozzles: DN 1/2" NPT-F

--- type: ANSI800 ½" 316 Soft Seat

2.7 **No.2 <u>SAFETY VALVES</u>** assembled on discharge line of metering pumps :

--- discharge set pressure: 7 MPag

--- nozzles: inlet DN 3/4" NPT-F x outlet DN 1" NPT-F

--- standard: API / ASME

--- certification: China's AQSIQ

--- type: 7000 – SMFN (SS4)

--- Item: PSV-141 A/B

2.8 **No.2 <u>SAFETY VALVES</u>** assembled on oil line of metering cylinders :

--- discharge set pressure: 8MPag

--- nozzles: inlet DN 3/4" NPT-F x outlet DN 1" NPT-F

--- standard: API / ASME

--- certification: China's AQSIQ

--- type: 7000 – SMFN (SS4)

--- Item: PSV-142 A/B

2.9 **No.4 <u>MANUAL BALL VALVE</u>** type L.O. (locked open) for isolation of PSV during maintenance :

--- material: stainless steel AISI 304

--- nozzles: DN 3/4" ANSI 600 NPT-F

--- with locking device and lockpad

--- type: ALFA20T

2.10 **No.4 <u>PRESSURE GAUGES</u>** assembled on discharge line of metering pumps and on oil line of metering cylinders :

--- materials: stainless steel AISI 304

--- filling fluid: silicon oil bath

--- measurement element type: Bourdon spring

--- nozzle: DN 1/2" NPT-M

--- dial diameter: 150 mm

--- range scale: 0 ÷ 16 MPag

--- precision class: 1 % FS (EN 837.1)

--- mechanical protection: IP67 (IEC 529)

--- safety: solid front + blow out disk

--- type: 01.20.3A.G/0-16 Mpag/43M.S10

--- items: PI-141 A/B – PI 143 A/B

2.11 **No.2 <u>BALL VALVES</u>** assembled on discharge line of metering pumps :

--- material: stainless steel AISI 304

--- nozzles: DN 1/2" ANSI 600 NPT-F

--- type: ALFA20T

--- Items: HV-147 HV-148

each one provided with :

No.1 PROXIMITY SWITCHES

--- housing: stainless steel AISI 304

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- contact: SPDT gold-plated

--- cable conduit connection: DN 1/2" NPT-F

--- mechanical protection: IP68

--- items: ZS-147 / ZS-148

--- type: C75-1-SB-TL2

2.12 **No.6 MANIFOLD VALVE** for isolate / drain of pressure gauges and switches :

--- material: stainless steel AISI 316

--- nozzle: DN 1/2" NPT-F

--- type: C2V1M21

2.13 **No.2 DIAPHRAGM ACCUMULATOR** dumpers assembled on discharge line of metering pumps :

--- body material: stainless steel AISI 316 L

--- capacity: 0.5 litres

--- nozzle: DN 1/2" NPT-F

--- nitrogen preloading: 4.8 MPag

--- type: LAV 1 0.5 X.S.A NPT

--- items: Z-141 A/B

2.14 **No.6 <u>ELECTRO-PNEUMATIC 5-WAYS / 2 POSITIONS VALVE</u> with double solenoid :**

--- nozzles: DN 1/4" NPT-F

--- material: AISI 316

--- solenoids type: EExd-IIB-T6 – tropicalized

--- voltage: 24 Vdc / 11 Watts

--- certification: IEC / CENELEC

--- mechanical protection: IP65

--- isolation class: H

--- type: D05I70DOD

--- items: YV-142 A/B – YV 143 A/B – YV 141 – YV 145

2.15 **No.2 <u>BALL VALVES</u>** assembled on catalyst line of metering cylinders for catalyst drain or sampling :

--- material: stainless steel AISI 304

--- nozzles: DN 1/2" NPT-F

--- type: ALFA20T

2.16 **No.4 <u>BALL VALVE</u>** assembled on catalyst outlet line of metering cylinders :

--- material: stainless steel AISI 304

--- nozzles: DN 1/2" ANSI 600 LG

--- type: ALFA10HP-1/2"-GTDE

--- items: XV-143 A1 / A2 XV-143 B1 / B2

each one provided with :

No.1 PNEUMATIC ACTUATOR

--- type: GT-DE 63 x 90°

No.1 PROXIMITY SWITCHES

--- housing: stainless steel AISI 304

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- contact: SPDT gold-plated

--- cable conduit connection: DN 1/2" NPT-F

--- mechanical protection: IP68

--- items: ZS-143 A1 / A2 ZS-143 B1 / B2

--- type: C75-1-SB-TL2

2.17 **No.4 BALL VALVE** assembled on catalyst inlet line of metering cylinders :

--- material: stainless steel AISI 304

--- nozzles: DN 1" ANSI 600 LG

--- type: ALFA10HP-1"-GTDE

--- items: XV-142 A1 / A2 XV-142 B1 / B2

each one provided with :

No.1 PNEUMATIC ACTUATOR

--- type: GT-DE 75 x 90°

No.1 PROXIMITY SWITCHES

--- housing: stainless steel AISI 304

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- contact: SPDT gold-plated

--- cable conduit connection: DN 1/2" NPT-F

--- mechanical protection: IP68

--- items: ZS-142 A1 / A2 ZS-142 B1 / B2

--- type: C75-1-SB-TL2

2.18 **No.2 DISTANT STROKE CONTROL DEVICE** for metering cylinders catalyst level measurement :

--- output signal: 4 ÷ 20 mA

--- digital protocol: HART

--- execution: EExd-IIC-T6 / EExia-IIC-T6

--- certification: IEC / CENELEC

--- mechanical protection: IP65

--- type: 3051T-G1A2B21K8T1Q4Q8

--- item: LT-145 A/B

2.19 **No.2 PRESSURE SWITCHES** assembled on oil lines of metering cylinders :

--- contacts: SPDT gold-plated sealed in inert argon gas

--- rating: 1 A @ 125 Vac / 0.5 @ 24 Vdc

--- material in contact with process fluid: AISI 316

--- nozzle: DN 1/2" NPT-F

--- adjustment range: 1.4 ÷ 7 MPag

--- maximum pressure: 17 MPag

--- execution: EExd-IIC-T6 – tropicalized

--- mechanical protection: IP65

--- certification: IEC / CENELEC

--- type: 9B3-AF5-M4-C2A-TT-VV-YY-CL

--- item: PSA-141 A/B

2.20 **No.1 <u>4-WAYS BALL VALVE</u>** V1 assembled on oil lines of metering cylinders :

--- nozzles: DN 1/2" NPT-F

--- body material: stainless steel

--- material of seal gasket on the shutter: P.O.M.

--- material of seal gasket on the shaft: Perbunan

--- type: VSS4-4/6-AI6-NB

--- item: XV-141

<u>provided with :</u>

No.1 <u>PNEUMATIC ACTUATOR</u>
--- type: GT-DE 75 x 90°

Manufacturer: GT (Italy)

No.2 <u>PROXIMITY SWITCHES</u>

--- housing: stainless steel AISI 304

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- contact: SPDT gold-plated

--- cable conduit connection: DN 1/2" NPT-F

--- mechanical protection: IP68

--- items: ZS-141 A / B

--- type: C75-1-SB-TL2

2.21 **No.1 <u>3-WAYS BALL VALVE</u>** V4 assembled on oil lines of metering cylinders :

--- nozzles: DN 1/2" NPT-F

--- body material: stainless steel

--- material of seal gasket on the shutter: P.O.M.

--- material of seal gasket on the shaft: Perbunan

--- type: VSS4-4/6-AI6-NB

--- item: XV-145

<u>provided with :</u>

No.1 <u>PNEUMATIC ACTUATOR</u>

--- type: GT-DE 75 x 90°

No.2 PROXIMITY SWITCHES

--- housing: stainless steel AISI 304

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- contact: SPDT gold-plated

--- cable conduit connection: DN 1/2" NPT-F

--- mechanical protection: IP68

--- items: ZS-145 A / B

--- type: C75-1-SB-TL2

2.22 **No.4 BALL VALVE** assembled on inlet / outlet cooling water lines of metering cylinders :

--- material: stainless steel AISI 304

--- nozzles: DN 1" ANSI 150 RF

--- type: ALFA10N

2.23 **No.2 BALL VALVE** for drain of cooling water lines :

--- material: stainless steel AISI 304

--- nozzles: DN 1/2" NPT-F

--- type: ALFA20T

2.24 **No.1 AIR FILTERING GROUP** assembled on compressed air network inlet (A5 flange) :
no.1 AIR FILTERING / LUBRICATION DEVICE WITH PRESSURE REDUCER:

--- type: AS3-FR+L-G1/2" (mesh 40 micron)

--- nozzle: DN 1/2” GAS

--- range: 0.05 ÷ 0.8 MPa

--- code: R412007307

no.1 FLIP-FLOP CHECK VALVE:

--- nozzle: DN 1/2” GAS

--- code: 0821002002

no.1 SLIDE VALVE SELECTOR:

--- nozzle: DN 1/2” GAS

--- code: 6060

provided with :

No.1 BALL VALVE for above group by-pass :

--- material: stainless steel AISI 304

--- nozzles: DN 1/2” NPT-F

--- type: ALFA20T

2.25 **No.1 AIR FILTER ON A3 CONNECTION**

type: AS2FR+L-G1/2” (mesh 40 micron)

2.26 **No.1 PNEUMATIC PRESSURE REDUCER** assembled on instrument air network inlet (A3 flange) for manual metering pumps stroke control :

--- type: ND 7 G1/4”

--- nozzle: DN 1/4” GAS

--- range: 0.01 ÷ 0.11 Mpag

--- code: 3610607000

2.27 **No.6 <u>BALL VALVE</u>** assembled on air compressed lines of metering pumps :

--- material: stainless steel AISI 304

--- nozzles: DN 1/4" NPT-F

--- type: ALFA20T

2.28 **No.1 <u>OIL FILTERING GROUP</u>** assembled on inlet pressurized oil line (A12 flange) :

--- type: FMP 038-2-B-AG2-A25N/S

<u>provided with :</u>

No.2 <u>BALL VALVE</u> for by-pass of above group :

--- material: stainless steel AISI 304

--- nozzles: DN 1/2" NPT-F

--- type: ALFA20T

No.1 <u>CHECK VALVE</u> for by-pass of above group :

--- material: stainless steel AISI 316

--- design pressure: 120 barg

--- nozzles: DN 1/2" NPT-F

--- type: ANSI800 ½" 316 Soft Seat

2.29 **<u>No.1 MASS FLOW METER</u>** assembled on metering pumps discharge oil line :

--- measurement principle: Coriolis acceleration

--- flow element model: CMF010-M-323-N-Q-B-Z

--- nominal adjustable flow range: 0 to 82 l/h

--- range setting: 0 to 10 kg/h

--- accuarcy: +/- 0.1 % of flow rate

--- repeatability: +/- 0.05 % of flow rate

--- flow tube pressure rating: 10 Mpag

--- temperature range fluid (ambient): -50 to +125 °C (-40 to +120 °C)

--- material: stainless steel AISI 316L

--- process connections: DN 1/4" NPT-F Swagelok size 4 VCO pipe fitting

--- electrical connection: 2 x 1/2" NPT – F

--- item: FE-141

--- transmitter model: 1700

--- output signal: 4 ÷ 20 mA

--- digital signal protocol: HART

--- input supply voltage: 220 Vac 50Hz

--- execution: EExd-IIC-T6

--- certifications: ATEX

--- mechanical protection: IP66

--- item: FT-141

2.30 **No.4 <u>BALL VALVES</u>** for mass flow meter isolation, by-pass and drain:

--- material: stainless steel AISI 304

--- nozzles: DN 1/2" NPT-F

2.31 **No.1** **TEMPERATURE SWITCH** for power cut-off of piping electrical tracing system :

--- set temperature range: +5°C ÷ +107°C

--- contacts: SPDT gold-plated sealed in air

--- rating: 11 A @ 250 Vac / 5 @ 30 Vdc

--- nozzle: DN 1/2" NPT-F

--- mechanical protection: IP65

--- execution: EExd-IIC-T6

--- certification: IEC / CENELEC

--- with termowell type FB1B24 in stainless steel AISI 304

--- type: 201B3-AF125-TT-VV-YY-CL

--- item: TS-140

2.32 PIPING, FITTINGS, FLANGES

Piping, Fittings and Flanges with surface finishing of 125-200-AARH for Sch.40 or Sch.80 pipelines will be in stainless steel AISI 304 according to ANSI B16.5 Standard.，

Oil pipelines will be realized by using AISI 304 stainless steel precision pipes and HY-LOK pipe fittings and incident ring unions according to ANSI B31.3 Standard. Connections among the several air pneumatic instruments will be executed by using AISI 304 stainless steel precision pipes and incident ring unions according to ANSI Standard. All the bolts and nuts ,piping fittings and flanges will be in stainless steel AISI 304.

2.33 COUNTER FLANGES

All package's flanges at battery limit will be provided with counter-flanges, spiral metal gaskets (with PTFE filling) and necessary bolts / nuts for quickly connection to the rest of the plant.

2.34 ELECTRIC EQUIPMENT

Input Power Supplied by Client for :

- Motors 380 Vac / 50 Hz / 3 Phase

- Local Panel 220 Vac / 50 Hz / 1 Phase + Neutral from UPS Line

- Auxiliary (Electrical Tracing) 220 Vac / 50 Hz / 1 Phase + Neutral

Output Power Supplied by package for :

- solenoid valves 24 Vdc

The electrical system on package unit will be provided with electric control equipment for automatic / manual cycle of the catalyst metering unit.

Control equipment will be in conformity with IEC with at least mechanical protection IP55.

The control and shutdown sequences of operations will be as per Interlock System Description I-102 and will be executed by PLC system type SIEMENS S7-400 (redundant CPU) provided with redundant digital input / output cards and with redundant serial link card type RS-485 / MODBUS-RTU for communication with Client's DCS system.

The PLC configuration will be as described hereinafter with a complete redundant configuration:

SIEMENS S7-400

No. 2 RACKS - 6ES7-390-1AJ30-0AA0

No. 2 CPU 6ES7-412-2AG10-0AB0

No. 4 Digital Input Cards - 6ES7-321-1BL00-0AB0

No. 2 Digital Output Cards - 6ES7-322-1BL00-0AB0

No. 2 Flash Memory Cards - 6ES7-953-8LG11-0AA0

No. 2 Communication Cards - 6ES7-341-1CH01-0AE0

The communication cards will be wired directly to terminal strips in the junction box.

The PLC will be completed with No.1 software licence Siemens Step 7 – 5.4 for the programming of the system.

No. 200mt communication cable RS485 for the connection between PLC and DCS will be included in the scope of supply.

The alarm sequence will be executed by PLC and will be in accordance with “ISA F1A” Standard in configuration with contact signal “open to alarm or trip”.

The alarms will be repeated to Client’s DCS system by above mentioned serial link.
However, any cables and wiring operations from Local Control Panel to Client’s DCS / MCC systems are excluded from our scope of supply and will be provided by Buyer.

The signals between MCC and LCP need to have an isolation relay in LCP cabinet.
Push-buttons and signal lamps of local control panel will be assembled on the electric cabinet containing the control devices of the electrical sequence.

The signal lamps and the push-buttons will be installed on the front side of the local control panel and the lamps will be protected from accidental shocks through a transparent protection cover in tempered glass, easily accessible by opening it.

Local control panel will be provided with start / stop push-buttons of electric motors assembled on metering pumps, but the cables and wiring of above motors is excluded from your scope of supply.
The electric cabinet will be assembled on package unit and will be provided with adequate anti-condensation resistances.

As protection from explosion atmosphere, if any, the cabinet is protected by using internal overpressure system EExp.

The pressurization system will be provided with pressure switch and visual / acoustic alarm and will be executed in accordance with NFPA 496 Standards with purge system of type “Z” suitable to be installed in dangerous area of type NEC / Class 1 - Div. 2 – Gas Group C & D.

The internal overpressure system EExp will be composed of following items :

--- n.1 VENT BALL VALVE (type ALFA20T 1/4” NPT-F material S.S.)

--- n.1 BY-PASS BALL VALVE (type ALFA20T 1/4" NPT-F material S.S.)

--- n.1 PRESSURE GAUGE (type Magnehelic series 2000 10mm)

--- n.1 DIFFERENTIAL PRESSURE SWITCH

--- n.1 PRESSURE REGULATOR

--- n.1 FLOW METER

--- n.1 PURGE REDUCTOR

The equipment with internal overpressure will be complete with n.1 junction box in EExd IIB T5 IP65 execution and complete with relays necessary for the cut off of all the connection lines outside the electric box in case the overpressure equipment is in failure.

The equipment will also be complete with a key-selector for the by-pass of the pressure switch for the control of the pressurization system.

The electric equipment will be designed for the repetition in control room of the following alarms :

- operations / permissions sequence failure

- cylinders D101-1AX/1BX full / empty

- pump P101-1AX/1BX running

Wiring inside the package between the solenoid valves, pressure switches, others electric component and their relative Junction Boxes or Local Control Panel will be executed using flexible armoured cables and explosion proof cable glands in stainless steel with metric type entries.

Armoured cables will be routed in cable trays.

All electric instruments / components will be IEC Certified and at least type EExd-IIB-T4 / IP55.

No. 2 Junction Boxes EExd IIB T5 IP65 execution in painted copper free aluminium will be installed on board of the package for the separate connection of Digital Input signals (No. 18 proximity switches and No. 2 pressure switches) and Digital Output signals (No. 12 Solenoid Valves and No. 1 horn).

No. 1 Junction Box EExd IIB T5 IP65 execution in painted copper free aluminium will be installed on the package for Electrical Tracing System wiring and control (No. 1

Temperature switch).

Due to the package design only three junction boxes will be installed on board of the package in order to allow easy accessibility and correct wiring between JBs and LCP.

2.35 PAINTING

The equipment frame and other structural tubular / plates will be painted as per Hydroservice standard painting specification.
The Client will provide to Vendor after 4 (four) weeks from Purchase Order only the final RAL colours.

2.36 WINTERIZING

The scope of the electric tracing is to keep the oil temperature stable at 25 °C also with ambient temperature of 1.2°C.

The heating electric cable will be of self-limiting type model 5BTVB2, and will be suitable for to be installed in IEC / CENELEC dangerous area of Zone 2 – Group IIB – Temperature Class T3.

The heating system will be complete of a temperature switch (TS-140) in EExd execution for the power supply cut-off of the heating cable when the oil will be at the working temperature (+25 °C).

I-102-INTERLOCK SYSTEM DESCRIPTION

CATALYST PASTE INJECTION

1. First filling of the cylinders D101-1AX and D101-1BX.

OPERATIONS

1.1 The valve V1 will show either cylinder aligned with D-107 (e.g. D101-1AX).

1.2 V4 is switched towards D-107 by HS 142A (opening).
When confirmation is received form the limit switch HZS 145 A, the V2A are automatically opened.

PERMISSIONS

The operation under 1.2 can only be performed if:

1.3 The switch valves V1 shows D101-1AX aligned with the tank D-107 (permission by HZS 141/A).

1.4 The discharge valves V3A are already closed (HZSL 143A).
(Should either permission fail to be given, the operation under 1.2 must not be performed).

Filling of the cylinder D101-1AX can start now.

When filling is complete, LASH 141A gives an acoustic signal in the local control panel and closes the valves V2A.

Should it be necessary to stop the cylinder filling operation:

1.5 The operator closes the valves V2A by HS 142A (closure) and, after permission has been given by the limit switch HZSL 142A, V4 automatically switches to the pressure oil line.
(Should filling have been stopped by LSAH 141A, the operator must actuate HS 142A/C (closure) in any case to pressurize the cylinder).

NOTE:

If it is necessary to transfer the contents of the cylinder to D-106, proceed as follows:

1.6 Actuate HS 142A/O (opening) (for the steps, see 1.2).

1.7 Actuate HS 145 to switch V4 to the pressure oil line (B direction)

1.8 When the cylinder is empty, actuate HS 142A/C (closure).

To re-fill the cylinder D101-1AX, start again form 1.2.

FILLING OF THE SECOND CYLINDER (D101-1BX)

The step under 1.5 pressurizes D101-1AX and, through PSA 141A, permits V1 switching by HS 141A/B.

OPERATIONS

1.9 Prepare D101-1BX for filling by means of HS 141A (connection of the A cylinder to reaction).

1.10 Repeat the operations performed for the A cylinder starting form 1.2, namely:

1.11 By means of HS 142B/O (opening), switch V4 toward D-107(A direction) and open the valves V2B when confirmation is received form the limit switch HZS -145A

PERMISSIONS

The following conditions must be fulfilled for the operation under 1.11. To take place:

- The switch valve V1 must show D101-1BX aligned with the tank D-107 (permission by HZS-141B).

- The discharge valves V3B must be already closed (permission by HZSL-143B).

Filling of the cylinder D101-1BX can start now.

At completion of filling, LASH-141B gives an acoustic signal in the local control panel and closes the V2B valves.

1.12 As an alternative, the operator closes the valves V2B by means of HS-142B/C (closure) and, after permission has been given by the limit switch HZSL-142B, V4 switches automatically to the pressure oil line (B direction).

NOTE
If it is necessary to empty the cylinder into D-106A/B, proceed as follows:

1.13 Actuate HS-142B (opening)(for the steps, see 1.11).

1.14 Actuate HS-145 which switches V4 to the pressure oil line (B direction).

1.15 When the cylinder is empty, actuate HS-142B (closure).
To re-fill the cylinder D101-1BX, re-start again form 1.11.

2. CATALYST METERING TO THE REACTORS

OPERATIONS

2.1 Start the pump P101-1AX/1BX at minimum stroke

2.2 By means of HS-141A/B select the cylinder to be fed to reaction (e.g. HS-141B which lines up D101-1BX to the reaction).

With this operation:

- The V3A valves close automatically
  After permission form the limit switches HZSL-143A,

- V1 switches over
  After permission form the limit switches HZS-141A,

- The valves V3B open automatically

In the mentioned sequence.

PERMISSIONS

The above switching can only occur if:

- The valves V2B are already closed (HZSL-142B).

- PSA-141B gives permission (cylinder D101-1BX under pressure).

3. AUTOMATIC SWITCHING CYCLES

It is assumed that D101-1BX is metering catalyst to the reaction.

The limit switch LSAL-142B or HS-141A (connection of the cylinder D101-1AX to the reaction) starts the automatic switching cycle:

The following operations are performed one after the other:

a) The discharge valves V3B close.
After permission by the limit switches HZSL-143B,

b) V1 switches over.
After permission by the limit switch HZS-141B,

c) The valves V3A open.

Above switching cycle can start only if:

- The pressure switch PSA-141A gives permission (cylinder D101-1AX already under pressure).

- The valves V2A are already closed (HZSL-142A).

The switching cycle must proceed from a) to c). Failure to perform an operation will stops the sequence and sounds an alarm.

NOTES

- HS 141A/B provides switching operation by means of a push button (HS-141A) to feed the catalyst in A cylinder into the reaction, and by means of the other push button (HS-141B), to feed the catalyst in B cylinder into the reaction.

- Both HS-142A and HS-142B have two push buttons, one to open and the other to close the corresponding valves.

- HS-145 has two push buttons: one to align V4 toward D-107 (HS-145A) (A direction) the other one to align V4 toward the pressurizing system (HS-145B) (B direction).

The operation of HS-145 always causes V4 switching, till a new operating of HS-142A (or HS-142B) of which V4 is slave (see parag.1.2. through 1.5. and 1.1. through 1.14).

- Lack of permission to perform an operation stops the relevant sequence and sounds an alarm.

- A manual/automatic switch is provided, when on manual position, it will be permitted to control the valve individually:
V1-V4-V2A group, V2B group -V3A group and V3B group.

Site condition

1. Temperature :

c. Min. month average temp. : -19.2 ℃
e. Extremity Min. temp. : -27.9℃

2. EARTHQUAKE LOADS:
SEISMIC INTENSITY 8 degree (MERCALLI: degree)

3. DESIGN WIND LOADS:
q=WIND PRESSURE q=0. 55 KN/M^2 (at 10 m HEIGHT)

ATTACHMENT I

Connection sheet

POS.	PIPING CLASS	MATERIAL	GASKET
P1	ANSI	150# -RF	Carbon Steel Asbestos free
P2	ANSI	150# -RF	304 S.S. Asbestos free for H.C.
P3	ANSI	600# -RF	304S.S. Spiral - wound
P4	ANSI	150# -RF	304S.S. Asbestos free for H.C.
P5	ANSI	600# -LTG-T	304S.S Spiral - wound
P6	ANSI	150# -RF	304S.S Asbestos free H.C.

Instrumentation requirements (Limit of supply, standard execution , materials, connections, documentation)

Package tag : PA-101 CATALYST METERING UNIT

1. Introduction

Instrumentation shall be provided in compliance with prescription of general technical specification and this special technical specification.
Any modification shall be pointed out by the package's supplier when submitting the offer.
Instrumentation installed on skid.

2. Operation

Field operated

[x] Fully operated
[ ] Start-up and shut-down only
Control and measuring instruments
[x] Local panel mounted
[ ] Local push-button
[x] Local panel-mounted alarms
[x] Emergency shut-down

Control room operated

[ ] Fully operated
[ ] only running operated
[x] Alarms : LAL-142A ; LAL-142B
[ ] Common alarms
[x] Trip common alarms : QA-141(sequence fault alarm)
[x] Indication and measurements LIR-145A/B
[ ] Emergency shut-down from interlock system
[x] Pump running signal YLH-141A/B

3. Instruments and panel boards included in the package supply

[ ] All instruments are excluded from the supply

[x] All instruments shown on the supplier's flow-sheet approved by SEI

[ ] Only the instruments identified with special identification symbol on the flow-sheet.

[x] Completely wired local panel provided with cable-glands and fittings for external connections.

[ ] Completely wired cabinets to be installed in the instrument room

[ ] Completely wired control panel board to be installed in the control room.

[x] Junction boxes provided with terminals, cable glands or bulkhead union fittings.

[x] Local measuring equipments including installation

4. **Erection material**	By others	By pk. Vendor
Erection material for process connections	[ ]	[x]
Erection material for instrument air supply network inside the package	[ ]	[x]
Erection material for electric and pneumatic connections inside the package	[ ]	[x]
Material for electric and/or pneumatic connections between		
Package and relevant local panel	[ ]	[x]
Package and j .boxes	[ ]	[x]
Package and control room	[x]	[ ]
Local panel and control room	[x]	[ ]
J.boxes and control room	[x]	[ ]
Materials for connection in control room	[x]	[ ]
Materials for instrument and electrical equipment earthing	[ ]	[x]
Supports and/or frame for panel boards, cabinets and j.boxes	[ ]	[x]

5. Connection and erection

Instrument erection on the machine and/or unit	[ ]	[x]
Execution of instrument process connections with the machine and/or unit	[ ]	[x]
Execution of instrument air supply connections with the machine and/or unit	[ ]	[x]
Execution of electric and/or pneumatic connections inside the package	[ ]	[x]

Execution of electrical and/or pneumatic connections between	**By others**	**By Pk. Vendor**
Package and relevant local panel	[ ]	[x]
Package and j.boxes	[ ]	[x]
Package and control room	[x]	[ ]
Local panel and control room	[x]	[ ]
J.boxes and control room	[x]	[ ]
Execution of connections in control room	[x]	[ ]
Execution of instrument and electrical equipment earthing	[ ]	[x]
Local panel positioning and erection	[ ]	[x]
Cabinet positioning and erection in control room	[x]	[ ]

6. Instrument supplies

[ ] In conformity with Supplier's standard
[x] In conformity with Supplier's Vendor List approved by SEI

7. Typical for erection works and materials included in the Package supply

[x] In conformity with Supplier's standard approved by SEI.

8. Instrument connections

[x] In conformity with Supplier's standards for: (To be approved by SEI)

Connection to machine [x]
Taps on service fluids (oil, water, etc.) [x]
Taps on process lines [x]

9. The alarm system circuits shall be:

[ ] Relay type [x] Solid state type

[x] Power supply 220v 50Hz

The alarm sequences shall be according to ISA S 18.1

[x] A1 For alarm occurrences only
[x] F1A (First out) for package trip occurrences
[ ] Warning lamps only with lamp test device
[ ] .....

10. The shut-down system and control sequences circuits shall be:

[x] Fully relay type
[ ] Solid state type
[ ] Microprocessor
[ ] Power supply
[x] 220v 50Hz

Alarms and interlock contacts will open in case of alarm or trip conditions.

To be provided two different instrument for alarm and shut-down.

11. Power supply for control and measuring instruments

[x] 220v 50Hz (for solenoid valve also, if any)
[x] 24v DC (for solenoid valve also, if any)

12. Signals for repetition/indications of the measurements in control room (if any)

[x] 4 to 20 mA
[ ] Negative pole to ground system
[ ] .....
[x] Insulated

13. Instrument air pressure(*)

Normal : 0.6 MPa.g Minimum : 0.4MPa.g Design : 1.0MPa.g
(*) The pneumatic actuators shall be sized taking into account the minimum air pressure (0.4 MPa.g)

14. The package shall be installed in :

Zone 2 GAS GROUP II B TEMPERATURE CLASS T3

According to [ ] CEI
[x] IEC

[ ] NPFA

15. Electric installation according to :

[x] IEC (*)
[ ] .....
[ ] .....
(*) Or. other internationally recognized institutions recommendation

16. Electric execution according to :

[x] IEC (*)
[ ] .....
[ ] .....
(*) Or other internationally recognized institutions recommendation

17. Degree of mechanical protection :

[ ] IP 54
[ ] IP 55
[x] IP 65

According to

[x] .IEC 529
[ ] .....
[ ] .....

Note : 1) The interconnection cables between instruments and j.b. shall be armored type.

2) The instrument must be in Ex-d execution ,and the protection shall be IP65.

18. Local control panel and cabinets

[x] General characteristics according to Vendor's standards approved by SEI
[x] Local panel electrical execution: Ex-d (pressurized)
[x] Construction details as per Vendor's standards approved by SEI
[x] Painting inside panel (Smooth Finish)
Outside Panel (See Finish) The Color will be Decided Later.

19. Identification tag plates installed on panels are to be in

[x] English

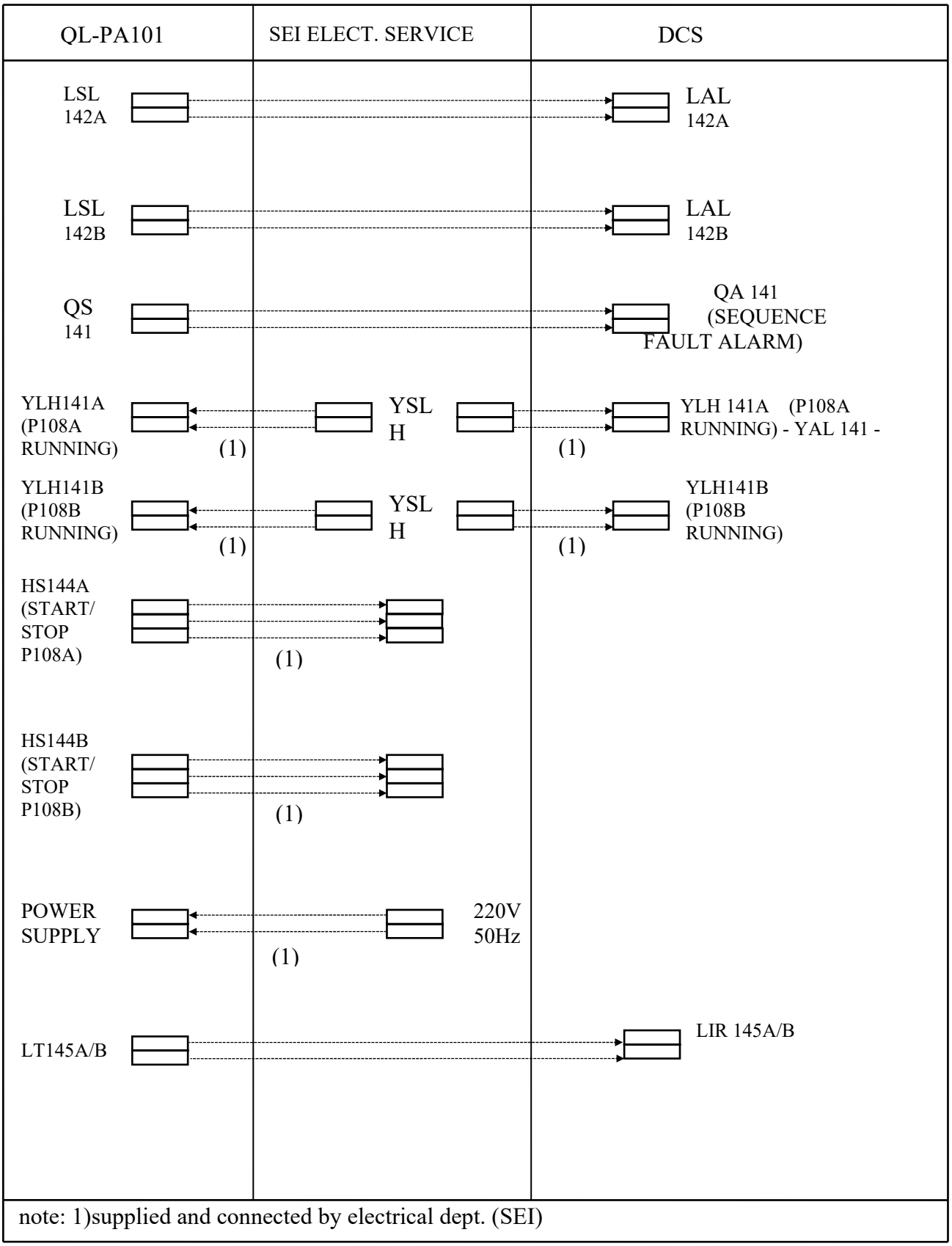
20. Checking the guaranteed values and design

	Responsibility	
	SEI	VENDOR
Calibration check and test with power on of the control and measuring loops supplied with the package	[ ]	[x]
Testing with power supply on of the alarms and safety circuits and of all electrical circuits between field, local panel and/or j.boxes relating to the package	[ ]	[x]
Testing of interconnections between the package and control room	[x]	[ ]
Hydraulic testing of the process connections	[ ]	[x]
Pneumatic testing of the pneumatic connections	[ ]	[x]

All the limit switches included in the scope of supply, as per vendor P&ID, shall be as per the following spec.

ELECTRIC LIMIT SWITCH SPECIFICATION

- Cylinder type
- Sensing distance : 2.54 mm
- Ambient temperature : -19.2/+40℃
- Contacts : SPDT gold plated
  Rating 2 A at 250 Vac
  0.5 A at 250 Vdc
- Electrical connections : 1/2” NPTF
- Electrical construction : Eex-d IIB T3 acc. to CENELEC Std. EN 50.014/EN. 50.018
- Degree of protection IP 65
- Housing stainless steel



DOCUMENTS TO BE SUBMITTED

The vendor shall be submitting the following documents indicated by [x] offer receipt of the order.

Number of copies and reproducible prints are as follows:

[ ] reproducible print(s)
[x] 4 copy(ies)
[x] 1 copy PDF files (can be sent by email)

		Due date form the order
1	SPECIFICATION	SPECIFIED LATER
	[x] Technical specification	
	[x] Specification for fabrication	month(s)
	[x] Inspection and test procedure (at shop)	month(s)
	[ ] Welding procedure specification (including for repair welding)	month(s)
	[ ] Welding procedure qualification records	month(s)
	[x] Welding qualification records	month(s)
		month(s)
2	DRAWING & LIST	
		month(s)
	[x] Document list	
	[x] Outline dimensional drawing/arrangement drawing of equipment	month(s)
	[x] Cross sectional drawing of equipment with parts list	month(s)
	[x] Assembly drawing of equipment	month(s)
	[x] Equipment loading data	month(s)
	[x] Detail drawing of equipment	month(s)
	[x] Drawing of motor	month(s)
	[x] Layout drawing of junction box (terminal box)	month(s)
	[x] Other necessary drawings	month(s)
	[x] Spare parts list	month(s)
	[x] Spare parts list with sketch	month(s)
	[x] Lubricant list	month(s)
	[x] Special tool list	month(s)
	[x] Painting schedule	month(s)
	[x] Rust prevention schedule	month(s)
	[x] Specification of motor	month(s)
	[x] Strength calculation	month(s)

[ ] List of all necessary machinery, Equipment tools jigs and utility consumption for erection — month(s)

[ ] Shop pre-fabrication schedule (including sketch drawings) — month(s)

3 Manual

[x]	Handing instruction for transportation	month(s)
[ ]	Instruction for storage at site	month(s)
[x]	Installation manual	month(s)
[x]	Inspection and test manual (at site)	month(s)
[x]	Operation and maintenance manual	month(s)
[ ]	Other instruction manual	month(s)
[ ]	Jigs sketch drawings for erection	month(s)
[ ]	Pickling procedure at site	month(s)

4 INSPECTION AND TEST RECORD

[x]	Inspection report	as per
[x]	Quality certificate	"GENERAL SPECIFICATION FOR INSPECTION"

5 OTHERS

[x]	Noise data	month(s)
[x]	Overall schedule	month(s)
[x]	Work progress report	month(s)
[x]	Shipping data	"SHIPPING INSTRUCTION TO VENDOR"
[ ]	Minutes of meeting	after each meeting
[x]	Any other information	requests of purchaser

6 FINAL DOCUMENTS

After getting documents approved or reviewed by the purchaser, the vendor shall submit the final documents as follows:

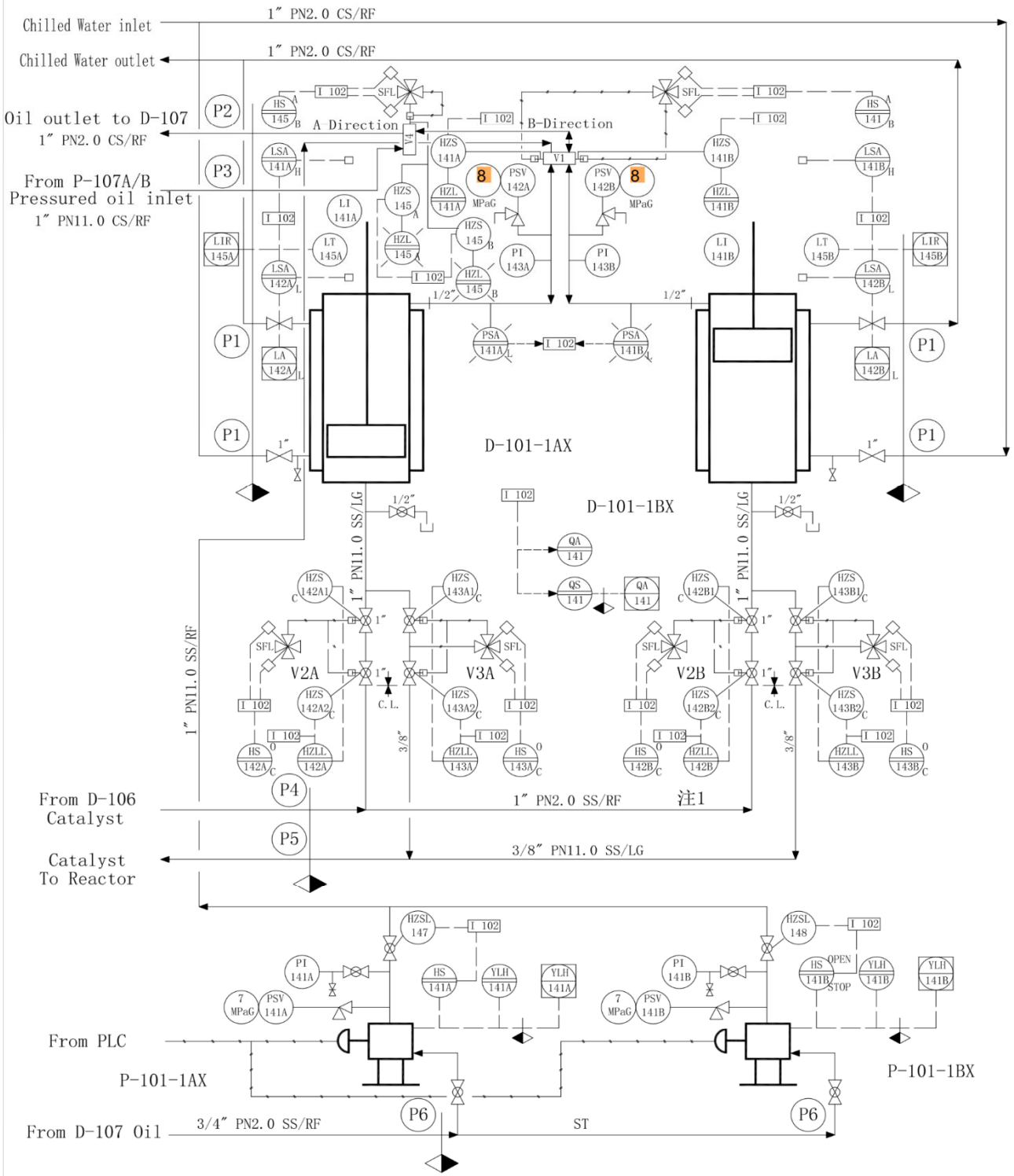
[x] 2 reproducible print(s)
[x] 7 copy(ies)
[ ] ___sets of microfilm
[x] 2 sets CD-Rom (PDF files)_

Purchaser's required spare parts

- "Set" is intended the total quantity of parts for each single equipment.
- "Each type" is referred to spare part and not to equipment unless specifically stated.

Description	Quantities for two years
Catalyst metering unit	
- Set of gaskets for metering cylinders	2
- Solenoid valve	1 (each type)
- Proximity switch	1 (each type)
- Four way globe valve (s.s.) with pneumatic actuator	1 (each type)
- 1/2" two-way globe valve with pneumatic actuator and limit switch	2 (each type)
- 1" two-way globe valve with pneumatic actuator and limit switch	2 (each type)
- 1/4" s.s. globe valve	2 (each type)
- 1/2" s.s. globe valve	2 (each type)
- S.S. Safety valve	2 (each type)
- S.S. Check valve	2 (each type)
- S.S. Diaphragm accumulator	1 (each type)
- Manometer with electric contact	1 (each type)
- Manometer in glycerin bath	1 (each type)
Electric motor	
- Sleeve bearing (if necessary)	2 (each type)
- Ball and roller bearings	100% (min 1 each type)

Sketch No.1



POSITION	PIPING CLASS	MATERIAL	GASKET
P1	PN2.0 RF	C.S.	Non-Asbestos
P2	PN2.0 RF	304SS	Non-Asbestos
P3	PN11.0 RF	304SS	SPIRAL WOUND GASKET
P4	PN2.0 RF	304SS	Non-Asbestos
P5	PN11.0 LMF	304SS	SPIRAL WOUND GASKET
P6	PN2.0 RF	304SS	Non-Asbestos

Note 1 as short as possible

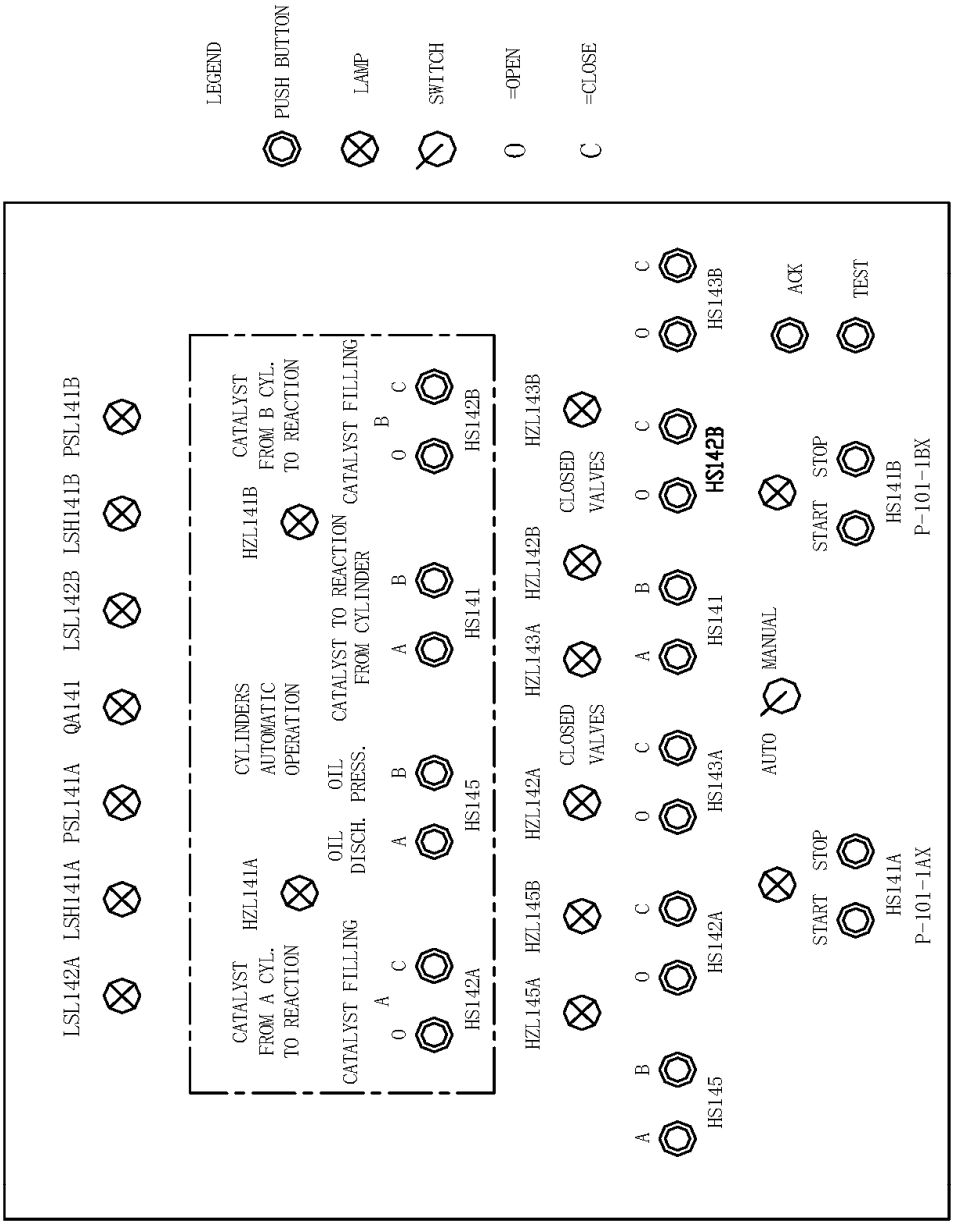
ST: Steam Tracing

STEAM

Pop=0.35MPaG Top=147℃

Pdes=0.7MPaG Tdes=260℃

SKETCH No. 2



中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION	D101-1AX/1BX Data Sheet	Proj.No.	47203-03BD	
		File No.	121600EQ-DS-D101-1AX/1BX	Rev. 0
		SHEET	1 OF 3	
PROJ.	Shenhua Baotou Coal To Olefins Upgrading Demonstration Project	Plant	350 KT/A PP PLANT	
Owner File	CHINA ENERGY BAOTOU COAL CHEMICAL COMPANY LIMITED	ITEM	1216-D101-1AX/1BX	
		DES.PHASE	Basic Design	

VESSEL DATA			
Capacity	0.098		m^3
Contained Fluid Catalyst MUD Sp. Gravity 1000			kg/m^3
External Press.	MPa.g at		ºC
Hydro-test Press.	MPa.g field		MPa.g
	SHELL	JACKET	
Opera. Temp. ºC	5.0	5.0	
Design Temp. ºC	100	100	
Opera. Press. MPa.g	5.0	0.4	
Design Press. MPa.g	8	0.8	
Stress relieving	/	/	
Radiography	No	No	
Welling eff.	/	/	
Corrosion Allow. mm	0	0	
Insulation	No	No	
Classification	/	/	
Code/STANDARD	ASME SBC. VIII DIV. 1		
Hydraulic test Mpa.g	12	1.2	

MATERAL		
Head		AISI 304
Shell		AISI 304
Reinf. Plates		
Covers	Forging	
Nozzles	Plate	
Flanges	Pipe	
Bolts	Ext. Studs/Nuts	
	Int.	
Externals / Int. Gaskets		
Internals		AISI 304
Stiffening rings		
Tray or Grid Supports		
Vessel Supports		

(*) Min. Metal Temperature: 1.2℃

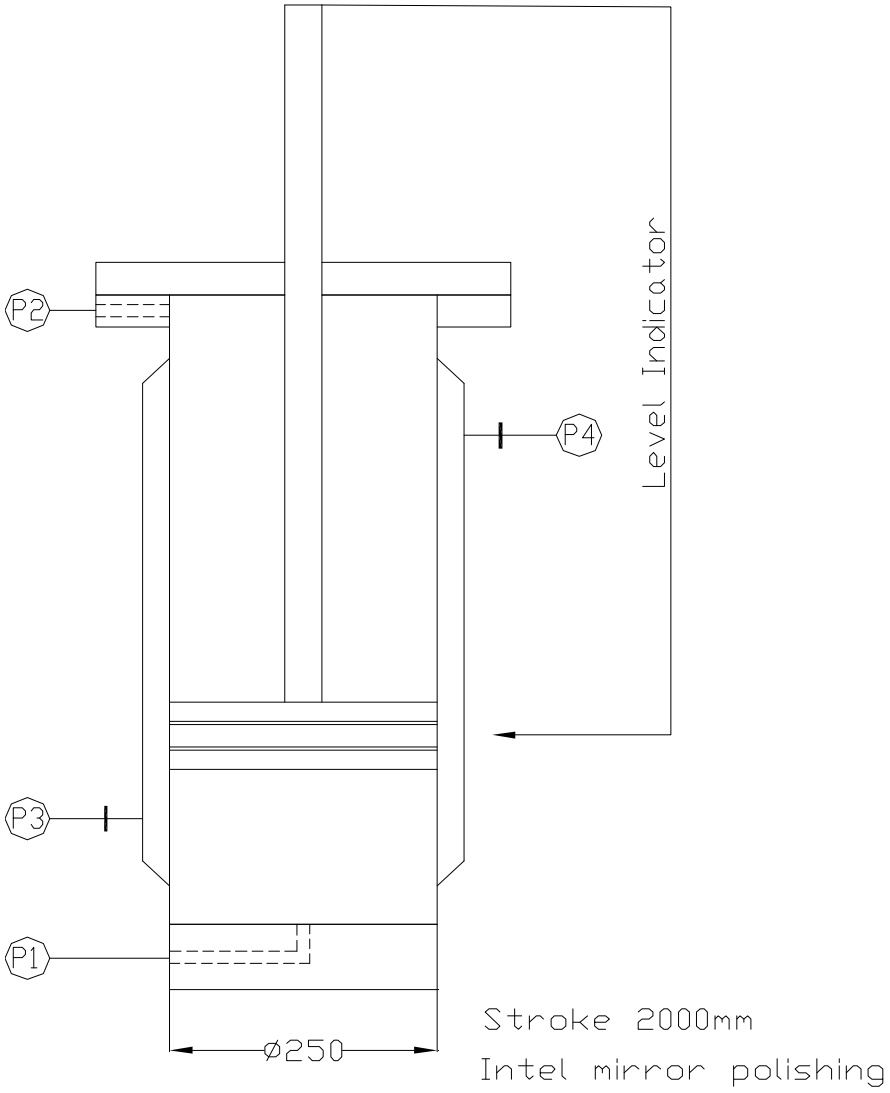
For more design data see our dwg. 1216-PA-101-SKETCH-A

NOZZLE DATA

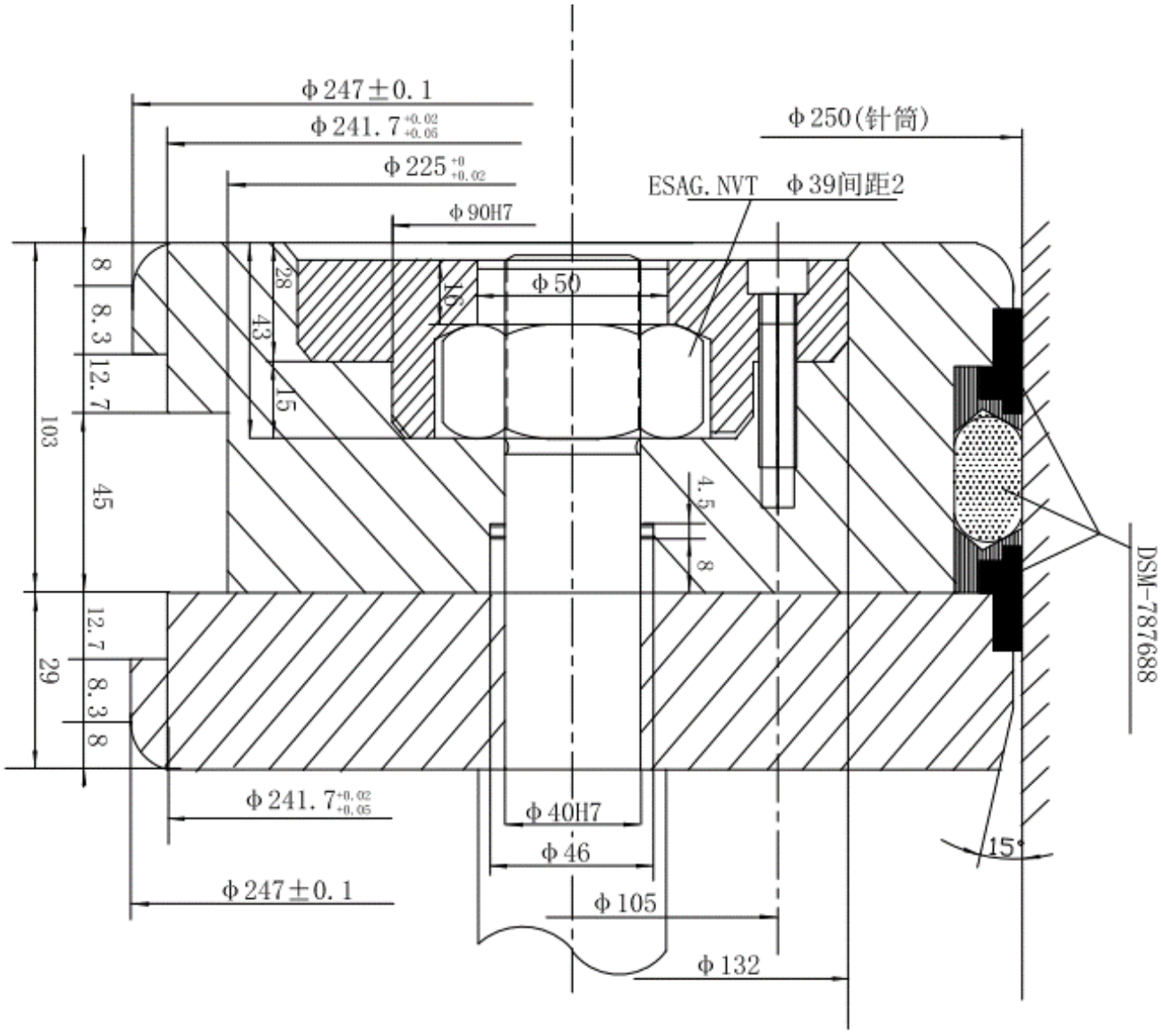
Nozzle Service	Qt.	Pos.	Size	Rating	Type
Feed/Out Catalyst	1	P1	1”/3/8”	600#	NPT-F
Out / Oil Feed	1	P2	1/2”	600#	NPT-F
Jacket In	1	P3	1”	150#	RF
Jacket Out	1	P4	1”	150#	RF
Manhole					
Hand hole					
Stand Pipe					
Level Indicator					
Level Regulator					
Temperature					
Pressure					
Safety Valve					
Vent					
Drain					

REV.	0	1	2	3	4	5	6	7	8
DATE									
BY									
CHK.									
APP.									

SKETCH No.3



SKETCH No.4



MATERAL : A[S] 304

CONFIRMED BY VENDOR

中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION		Proj. No.:	47203-03BD
		File No.:	121600EQ-DS-P101-1AX/1BX Rev.
		SHEET	1 OF 1
PROJ.	Shenhua Baotou Coal To Olefins Upgrading Demonstration Project	Plant	350 KT/A PP PLANT
OWNER FILE	CHINA ENERGY BAOTOU COAL CHEMICAL COMPANY LIMITED	ITEM	1216-P-101-1AX/1BX
		DES.PHASE	Basic Design

Rev.

DATA of MOTOR

General features according:		Particular features:	
Dimensions drawings (1)		Item : 1216-MP-101-1AX/1BX	
Required Quantity	No. 2	Type and size (1)	
Rated output (1)	0.75 KW	Rated output	380 V 50 Hz
Number of poles	No. 4	Shape	
Type of duty (2)	CONTINUOUS		
Type of rotor	☐ Wound rotor	☐ Squirrel cage	☐
Starting (2)	■ Direct on line	☐ Star-Delta	
	☐ With autotransformer	☐	
Reversal of rotation (2)	☐ Yes ☐ No	Degree of mechanical protection	IP55 (3)
Type of safety protection	Ex-d-ⅡB	Class of temperature (1)	T4
Accessories			
Order and supplier (1)	CEMP	Delivery term	
Forwarding address			

Data of driven machine

Type of machine	METERING PUMPS		
Order and supplier	OFFICENE MECCANICHE	Item	P101-1AX/1BX
Input	KW	Output required for the motor	KW
Coupling	☐ Stir coupling	■ Flexible coupling	
	☐ Belt Drive	☐	
R.P.M..		Max resisting torque (2)	
Starting resisting torque (2)	%	PD^2 of rotating masses at motor speed (2)	

Notes: (1) Data never necessary for inquiry

(2) Data necessary for inquiry only in particular cases

(3)TERMINAL BOX IP 65

REV.	0	1	2	3	4	5	6	7	8
DATE									
BY									
CHK.									
APP.									

Service **Catalyst Metering Pump**

Item No. **1216-P-101-1AX/1BX**

Quantity **2**

Rev	0	1	2	3	4	5	6	7	8
Date									
Prep									
Check									
Appr									

中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION	Metering Pump Data Sheet Item No: 1216-P-101-1AX/1BX	Proj. No.: 47203-03BD File No.: 121600EQ-DS-P-101-1AX/1BX Rev.0 Page 2 of 3

Note: ○ By Purchaser ☐ By Manufacturer △ By Mnaufacture or Purchaser

Service: Catalyst Metering Pump Qty:2 Operating:1 Spare:1

Manufacture: Type:plunger Model: Applicable Standard **API675**

○ Operating Conditions

1	Liquid Pumped								
2	Corrosive/Erosive Agent	yes/no			yes				
3	Suction Temperature	℃	Min.		Normal	**25**	Max.		
4	Specific Gravity @PT	kg/m^3			Normal	**870**			
5	Viscosity @ PT	mPa.s			Normal	**70**			
6	Vapor Pressure @ PT	MPaA			Normal	**-**			
7	Suction Pressure	MPaG	Min.		Normal	**0.15**	Max.		
8	Discharge pressure	MPaG	**1AX/1BX**			**6.16**			
9	Differential Pressure	MPa				**6.01**			
10	Differential Head	m							
11	Capacity	L/h	Min.	**5**	Normal	**8**	Max.	**14**	
12	NPSHA	m	**>5**		Eff. HP	KW			
13	Location		○ Indoor		● Outdoor		○ Corrosion Class:		
14	Electric Area Classification		○ Class	Group:	Division:		○ Temperature Class:		

☐ Performance

15	Rated Flow:	L/H			1/min	
16	Discharge pressure	MPaG		Rod Diameter	mm	
17	Shaft HP.	KW			mm	
18	NPSHR	m		Measureing Accuracy	%	
19	Hydrostatic Test Pressure	MPaG		Flow Adjustment Range	%	
20						

○ Construction

21	Main Nozzle	Location	Size	Flange Rating	Facing	Position
		Suction	**20**	**ANSI150#**	**RF**	
		Discharge	**15**	**ANSI600#**	**RF**	
22	Casing Conn.		☐ Vent	☐ Drain	☐ Gauge	☐Flush
		Type				
		Size				
23	Nozzle Standard.					
24	Liquid End	■ Plunger	☐ Single Diaph	☐ Three Diaph	■ Single Action	☐ Double Action
		☐ Cylingder Quantity		☐ Valve-Type	☐	
25	Drive End	☐ Crank-Connecting rod	☐ Eccentric	☐ Direct-Connect		
26	Drive Type	☐ Crank-Coupling Rod		☐	○ Driven By Air	
27	Coupling	○ Resilient bolt	○ Reflexable Disc	○	○ Lastern Pin	
28	Lubricate Type	☐ Bath Type	☐ Force-Feed	☐	☐ Oil Trademark	
29	Baseplate	■ Shared	☐ Sperated	☐		
30	Inlet Buffer	☐ Diaphragm Type	☐ Gas and Liquid contacted	☐ Volume	m^3/h	☐ Pressu MPaG
31	Outlet Buffer	☐ Diaphragm Type	☐ Gas and Liquid contacted	☐ Volume	m$^{3/h}$	☐ Pressu MPaG
32	Reducer	☐ Type	☐ Model	☐ Reduction Ratio	☐ Manufacture	
33	Working Medium	☐ Driving Liquid		☐ Interstitial Liquid		
34	Safety Valve	☐ In Pump	☐ Seperated	■ Set Pressure	**7** MPaG	
35	Other	■Alarm Unit for Diaphragm Broken		☐Intermediate Fulid		
	NOTES:					

☐ Material

36	Cylinder		Cylinder Liner		Valve Ball	
37	Plunger	**316SS**	Piston Rod		Valve Seat	
38	Postion Ring		Hydra. Diaphragm		Valve Spring	
39	Other:		Process Diaphragm		Packing	
	NOTES: AISI 316(In contact with liquid)					
	Packing of seal: Asbestos free + PTFE					

中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION	Metering Pump Data Sheet Item No：tem No.： **1216-P-101-1AX/1BX**	Proj. No.: 47203-03BD File No.: 121600EQ-DS-P-101-1AX/1BX Rev.0 Page 3 of 3

●Flow Controls

40	Capacity Adjustment Type	○Local ●Remote 0~100% ●Manual ●Automatic		○Speed Variable ●Adjust Stroke % ●Penumatic Signal ○Electric Signal ○		
41	Accuracy:					

□Seal

42	Packing Material		Packing Ring Quantity	
43	Other:			

△Cooling And Heating

44	Piping Material	○ CS Seamless Pipe ○SS Seamless Pipe			
45	Cooling/Heating Position	○Bearing Box ○Stuffing Box ○Jacket ○			
46	Cooling/Heating Medium	○CW ○FW ○Condensate ○Hot Water ○Steam			
47	□Total Cooling/Heating Water Flow m3/h	P101-1AX/1BX MPaG	○Inlet/Outlet Temp. / ℃		
48	Other:				

△Motor

49	○Manufacture		○Power Rated(kW)	
50	○Mounting Type	○B3 ○V1 ○	○Model	
51	○Explosion Proof Grade		○Protection/Insulation	
52	○Entrance Type	○Conduit ○	●Start Method	●Direct ○Y—△
53	●Power Source	380V/3Ph/50Hz	○Speed (r/min)	
54	□Start Time (s)		□Lock Time (s)	
55	□Start Current (A)		□Lock Current (A)	
56	□Rated Current (A)		□Power Factor	

○Inspection and Test

57	Test		OB	REQ,	Witness	Check	○Shop Inspection
		Performance Test	○	○	○		○Post Test Inspection
		Hydraulic Test	○	○	○		○
		NPSH	○	○	○		○
		Running Test	○	○	○		

□Weight(kg)

58	Total		Pump		Motor		Baseplate		Aux. Equip.	

○Main Scope Of Supply

59	●Pump ●Motor	○Common Baseplate Anchor Bolts,Nut,Gasket	○Monitoring Device
	○Coupling	●Safety Valve ○Inlet Damper	○Outlet Damper
	○Reducer ○Belt Drive Device	○Mating Flanges With Bolts,Nuts and Gasket	○Lube Oil System
	○Auxilary Piping Within Confine of Baseplate		

○Contract Data

60	Outline Drawing		Filled Data Sheet
61	Section Drawing		Seal Assembly Drawing
62	Performance Curve		Manual
63	Auxiliary Piping Dwg.		

△Remarks

1	Application Standard:
2	Accuracy: <±1%
3	pump body: design pressure7MPa.G design temp. 100℃
4	
5	
6	
7	
8	
9	
10	
11	
12	

中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION	**LV CAGE INDUCTION MOTOR DATA SHEET**	PROJ.No. 47203-03BD DOC.No. Rev. SHEET 1 OF 2

PROJ.	Shenhua Baotou Coal To Olefins Upgrading Demonstration Project	PLANT	350 KT/A PP PLANT	R
OWNRE'S DOC.No.	CHINA ENERGY BAOTOU COAL CHEMICAL COMPANY LIMITED	ITEM		e
		DES.PHASE	Basic Design	v.

Equipment No.

Quantity

Client

Plant

Cage induction motor data sheet
Refer to specification for the general Requirement.

Site condition
Area classification _____
Gas group _____
Temperature class _____
Location ☐ Indoor ☑ Outdoor

Driven equipment characteristics
Torque characteristic ☐ In proportion to square speed ☑ Constant
Inertia related to motor speed _____ kgm^2
Drive system ☐ direct ☐ gearbox ☐ pulley
Max. Radial force on shaft _____ kg
Max. Axial force on shaft _____ kg
Coupling

Supply system data
Voltage 380 V
Numberof phases 3
Frequency 50 Hz
Short circuit capacity _____ MVA

Test requirement

	Witnessed	Unwitnessed
Rotor balancing test		
Routine test		
Performance test		
Noise test		
Special test		

Terminations
Feeder cable type _____
Size ____ x _____ mm^2
Overall diameter _____ mm
Entry type
☐ Direct ☐ Bushing
Space heater cable type _____
Size ____ x _____ mm^2
Overall diameter _____ mm
Entry type
☐ Direct ☐ Bushing
Protective device cable type _____
Size ____ x _____ mm^2
Overall diameter _____ mm
Entry type
☐ Direct ☐ Bushing

Starting methods
☑ Direct ☐ Restarting
☐ Reduced voltage start

Protective devices
☐ Stator temperature detecter
☐ Limit switch
☐ Torque switch

Basic performance requirement
Min.required output rating _____ kW
Synchronous speed _____ r/min
Mounting type _____
Direction of rotation facing DE
☐ CW ☐ CCW ☐ Both

Notes

REVIEWED	1	2	3	4	5	6	7	8
DATE								
BY								
CHECKED								
APPROVE								

中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION	LV CAGE INDUCTION MOTOR DATA SHEET	PROJ.No. 47203-03BD DOC.No. Rev. SHEET 2 OF 2

Seller information

Make
Type
Serial number

Basic information

Frame size
Rated output kW
Type of enclosure prot. Motor
Terminal boxes
Type of explosion prot . Motor
Terminal boxes
Certificate no.
Method of cooling
Insulation thermal class F
Temperature rise class B

Electrical performance

Full load current A
Full load speed r/min
Efficiency@100/75/50%Load / /
Power factor@100/75/50%Load
/ /
Locked rotor current@Un/0.8Un
100%load / A 75%load / A
50%load / A
L_R power factor@Un/0.8Un
100%load / 75%load /
50%load /
Run-up time(Loaded)@Un/0.8Un:
100%load / s 75%load / s
50%load / s
Allowable run-up time@Un/0.8Un
100%load / s 75%load / s
50%load / s
Min.cool-down time for 1 restart S
t_E time s
Rated rotor torque@Un/0.8Un / kgm
Locked rotor torque@Un/0.8Un / %
Max torque@Un/0.8Un: / %
Min torque@Un/0.8Un: / %
Min./max torque@Un/0.8Un: / %

Construction and mechanical 350 KT/A PP PLANT

Space heater ☐ Yes — ☑ No

DE- bearing Make
Type
NDE- bearing Make
Type

Rotor end float mm
Lubrication system
☐ Gearse ☐ Oil ☐ Forced oil

Re-lubrication system without stopping the motor
☐ Yes ☐ No

Lubrication interval Hour
Max. Bearing temperature ℃
Bearing temperature rise K
Bearings insulated ☐ Yes ☐ No
Vibration severity mm/s
Top coat color
Motor/rotor weight kg
Rotor inertia kgm^2

Noise data

Sound preasure level@1 meter dB
A -weighted sound power level dB(A)

Related drawings

Outline drawing No.
Terminal box drawing No.
Connection diagram No.
Speed torque curve(package)@Un/0.8Un/0.7Un
Drawing No.
Current-time curve(package)@Un/0.8Un/0.7Un
Drawing No.
Tas-Is/In Curve(Package)
Drawing No.
Tas-allowable starting time Is-motor starting current

Notes

INSTRUMENT SPECIFICATION FOR PACKAGE UNIT (WITH PLC)

修改	日期	说明	编制	校核	审核	
5						
4						
3						
2						
1						
0	2023.3.16		马晓柯	朱江明	刘国欣	

1. General

This document defines the minimum general requirements for package unit instrumentation on the PP Plant**.**

Package vendor shall supply a complete, reliable, control philosophy best, satisfactory and safe operation instrument and control system for package. The Control System should be consisted of the local instruments and local control panel. The control system will accomplish operation control, monitoring, alarm and emergency shutdown about the package.

All instrumentation and control system in the package shall meet the requirements of the attachment:

Attachment A: SPECIFICATION FOR INSTRUMENT PANELS AND CABINETS;

Attachment B: INSTRUMENT GENERAL SPECIFICATION;

Note:

1. The attachments above are the general documents for the PP plant, so some parts could not be included in the package vendor's scope of supply and package vendor will not follow these parts of the attached specification.

2. The content in page2~8 of this document is special for this package instrument specification and this part should be prior to the attachments in case of there are some difference between these two parts.

Definitions and Abbreviations

CCR	Central Control Room
FAR	Field Auxiliary Room
SIS	Safety Instrument System (by customer)
DCS	Distributed Control System (by customer)
UPS	Uninterruptible Power Supply (by customer)
MCC	Motor Control Center
PLC	Programmable Logic Controller (for control system of the package by package vendor)
LCP	Local Control Panel (by package vendor)
MMS	Machine Protection System (by package vendor)

2 Requirement Items

Scope of package vendor's supply:

- Control System (PLC) included hardware, system software and application software
- MMS (if required)
- Local instruments and valves according to PID
- Anti-surge controller and anti-surge control valve (if required)
- Local Control Panel and/or PLC cabinet, site junction box
- Cable connection from instrument to junction box or local control panel (for the loose shipped instrument, package vendor shall supply the suitable cable)
- Impulse line and air line connection (for the loose shipped instrument, package vendor shall supply the bulk material)
- Spare part for commissioning (package vendor recommendation)
- 2-years spare parts (**quoted as option**)
- Documentation (paper copy and CD-ROM)
- Site service and commissioning

2.1 PLC requirements

The control system of the package shall be designed as '**fail to safe**' system.

De-energized to trip logic shall be used unless otherwise approved by customers.

PLC hardware requirement

- If required, vendor shall provide a PLC system which should match the suitable Safety Integrity Level (SIL) according the IEC 61508/61511. SIL should be stated by vendor.

- Redundant elements include: CPU, Power supply units, communication system and so on.

- Communication protocol between this PLC and plant DCS shall be Modbus RTU (RS485) and redundant. The vendor shall provide wire connection terminals for RS485 cables inside the PLC cabinet.

Communication cables (Max.50m) between PLC and DCS shall be supplied by vendor.

-PLC shall supply HART multiplexers and communicate with AMS (Asset Management System) via MODBUS RS485.Communication cable (Max.50m) between PLC and AMS shall be supplied by PLC.

- Spare I/O points, should be provided with at least 15% to total number of each item required. Terminal, relay and installation space in PLC cabinet shall be provided 20% spare. These spare parts, which are different from commissioning spare parts, shall be installed in PLC cabinet and wiring completely if possible.

- PLC will be installed in the FAR (safe area). PLC cabinet enclosure protection class is Min.IP54.

- The color of the PLC cabinets shall be RAL 7035 and RAL7022 for plinth. The cabinets cooling shall be fans cooled. The size of each cabinet unit shall be 800x800x2100 (WxDxH (including a plinth of 100mm)) and maximum width for pre-assembled enclosure is 2400mm. Rittal cabinets (TS8 series) or equal shall be used (with lamp, fans and sockets). The PLC cabinets shall be free standing type, with front and rear accessible, and bottom entry for cables.

- No indications and operation switches will be installed on PLC cabinets. If it's needed that some switches for emergency shut down or other action, the switches can be installed on the Auxiliary operation Console (By customer, in CCR). Vendor shall give the design condition to customer.

- The touch panel in the PLC Cabinets will be used for maintainance.

Vendor shall supply the topology drawings of control system as a part of technical quotation. The topology drawing shall show the all the hardware of the control system.

PLC software requirement

Package vendor shall supply the following software:

- PLC system software package by CD-ROM and enough licenses for the engineering function.

- PLC application software and source code by CD-ROM with enough right to read, copy and modify.

- Touch screen support software and configuration software by CD-ROM.

PLC I/O

- All DO (digital output) and DI (digital input) from/to MCC should be isolated by relays, and all of these relays shall be installed in PLC cabinets and powered by the separate circuit-breaker.

- DO for solenoid valve shall be provided with fuse switch terminals. Isolating relays shall be provided for solenoids as far as possible.

- Interface between PLC and MCC shall be hard wired relay installed in PLC cabinet shall be used. Interposing relays for high tension switch gear**(≥6000V)** control shall be DC24V coil voltage and DC220V, 5A contact rating.Interposing relays for low voltage MCC control shall be DC24V coil voltage and AC220V, 5A contact rating.

- The relays in PLC cabinet should be 24VDC, DPDT.

- All the analog signals form/to MCC shall be isolated by isolator.

- All of the I/O (Input/Output) wiring should be connected to the terminals by Vendor (including the spare part).

Power supply.

Customer will supply 2 UPS (220VAC 50Hz 1 phase) power to the LCP or PLC cabinet. Vendor shall supply the incoming circuit breaker for each power supply. To match the 2 UPS power supply, vendor shall supply the redundant power system for the control system of package.

Customer will supply the other city net power(220VAC 50Hz 1 phase) to LCP or PLC cabinet for lamp and fans.

The power of all the instruments and control devices in the package will be supplied from the PLC cabinet.

Communication between PLC and DCS

All signals like status, alarms, measured values, setpoints shall be sent to DCS via redundant serial link RS 485 / Modbus RTU. So all the signals shall be included in the **standard Modbus** address list. The communication module shall be redundant. At same time, Modbus communication data (**slave address, odd/even, band rate, stop bit,** etc) shall be supply by package vendor. RS-485 shall be 2-wire type and vendor shall supply the wiring diagram. **Vendor shall supply the connection terminals for RS-485 cable connecting to DCS.** Communication test between PLC and DCS will be executed at job site by vendor's engineer and DCS vendor.

RS-485 communiction cable shall be armoured cable and be supplied by package vendor.

PLC system loading

The system shall not be loaded beyond 50% of its maximum recommended capacity. This shall apply to storage (memory and power) and processing power (controller, application processors, and interface unit).

Vendor shall also ensure that the worst case loading of the system communication buses is less than 50% of the maximum recommended loading.

Maximum load of power supply of total unit (CPU, Communication and I/O's) should be less than 50%.

2.2 Local Instrument requirements.

2.2.1 Electrical Hazardous Protection

Hazardous area classification will be in other part of the package specification and all electronic instruments, junction box and wiring shall be suitable for use in the relevant hazardous area classification.

In hazardous area, for analogue signal instrument the explosion proof type shall be Exi type if possible. Exd type could be used when Exi type is not available. For digital signal instrument, the explosion proof type shall be Exd type.

2.2.2 Weather-Proof Protection

Field mounted electronic devices shall be weatherproof to IP66(IEC) or equivalent, and pneumatic devices shall be weatherproof to IP55(IEC) or equivalent.

2.2.3 Junction box (JB)

The JB installed in hazardous area shall be increased safety type (Exe) or explosion proof (Exia) . In unclassified areas weather-proof JB can be used.

The material of the JB shall be stainless steel.

JB shall carry only one multi-core cable each.

The quantities of the signals in one JB shall be 8 or 16.So the JB with 8 signals shall have 8 cable entry ports for single cable and 1 cable entry port for multi-core cable; the JB with 16 signals shall have 16 cable entry ports for single cable and 1 cable entry port for multi-core cable.

Separate JB shall be separated and segregated as per the signal type and votage level:

- Analog signals
- Digital signals
- Solenoid valve power supply (24V DC)
- Intrinsically safe signals
- 220V AC power supply
- Signals to/from SIS

The number of terminals in each JB shall be sufficient for terminating all cores, including screens. Quantities of spare terminals in JB shall be 15% after plant start. The spare cable entry ports shall be plugged with stainless steel plugs.

Terminals in intrinsically safe circuits shall be of light blue color. Terminals in non-intrinsically safe circuits shall be of the Exe type and be of brown or grey color.

The JB shall be provided with an external earthing stud.

2.2.4 Local Control Panel (LCP) and PLC cabinet

LCP in hazardous area shall be explosion proof, increased safety or purge type. Because customer will use the single pair cable for connection between LCP and DCS, LCP shall provide one cable entry port for each signal or power supply cable.

3 sets contacts shall be provided for emergency shutdown push button for 2oo3 vote logic.

Package vendor also can supply the PLC cabinets installed in FAR for the package unit.

2.2.5 Cable glands

Suitable cable glands for JB, LCP and instruments will be scope supply of package vendor. Cable glands shall be stainless steel or brass with NICKEL-PLATE.
Instrument will be 1/2" NPT(Femal) cable entry port for 2-wire instrument.
Instrument will be 2 sets 1/2" NPT(Femal) cable entry ports for 4-wire instrument.Standard

Note:

2-wire instrument – 2 wires for signal and loop powered.

4-wire instrument – 2 wires for signal and other 2 wires for power supply.

cable entry port size to instruments shall be 1/2" NPT(Female) where possible.

Standard cable entry port size for single cable to JB shall be M20x1.5 and for multi-core cable to JB shall be M32x1.5, M40x1.5 or M50x1.5.

2.2.6 Local instruments

Analog signal shall be 4~20mA with Hart, normally 2-wire. Digital signal shall be dry contact with 220VAC,3A/24VDC 3A, SPDT.

For the power supply of 4-wire instrument, 24VDC is prior to 220VAC.

Pressure transmitter shall be used instead of pressure switch where possible.

Temperature transmitter shall be used instead of temperature switch.

The limit switch of the valve shall be proximity dry contact type(Exd). If there are 2 limit switch on 1 valve, the terminal box with 2 cable entry ports shall be provide and be mounted on the valve body.

The power supply of solenoid valve should be 24VDC. Solenoid valve shall be stainless steel with integrative terminal box. In hazardous area Exd type shall be used as far as possible. If possible the solenoid valve which used shut off instrument air shall be **low power type(<=4W).**

Electrical connection entry for instrument will be 1/2 inch NPT(Female).

Process connection for pressure gauge shall be M20 x 1.5(male).

Instrument air set will be supplied with the control valve. The instrument air connection for control valve will be NPT type.

The instrument air will be 0.4~0.6MPaG. But pneumatic instrument and device shall be designed at 0.4 MPa min.

For the connecting interface of inline instrument, flanges should follow ANSI Standard.

For SIF loop(SIL≥1), measuring instrucment shall be 2oo3 type.

2.2.7 Instrument tag no. and marking

The instrument naming conventions are as follow：

XXXX-NNNNN-CCYYYBB

where：

XXXX – PP plant No.

NNNNN－Instrument type or function, (shall follow GB/T 2625-1981 Process detection and control flow chart – symble and letter codes, or ISA S5.1 Instrumentation Symbols and Identification)

CC- Unit No. or Package No,shall be 1 or 2 digits.

YYY-Component Number： 01~99 or 001~999.

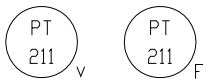
BB- Instrument Tag Suffix shall be 1 or 2 letters.

For example:

2106-FIC-3501A，PP plant flow control

2106-LSH-25501A，PP plant level switch

Instrument symble in P&ID of the package shall be noted by ‘V’ or ‘F’. Where ‘V’ means loose shipped part, ‘F’ means already installed in skid.



The vendor shall provide all field mounted instruments in the scope of supply with a permanently stainless steel engraved with the following information:

- Tag number
- Engineering range and/or trip setting
- Model number
- Manufacturer
- Hazardous protection code
- Weather-proof class

Tag No. will be discussed at KOM.

2.3 Instrument Wiring and Installation

2.3.1 Cable and Wiring

The wiring working interface between vendor and customer is the terminals in JB or LCP.

Package vendor shall supply all cables within their package scope of supply. These cables include:

- Cable between field instrument and JB or LCP.

- Cable between JB and LCP.

The cable from JB or LCP to FRR shall be down by customer and are out of the scope of vendor’s supply. The cable from JB to FRR will use the multi-core cable. The cable from LCP to FRR will use the single pair cable.

Multi-cores cables shall be used for transmission of electric or electronic signals, such as 4–20mA, thermocouples, RTD, contacts, solenoid valves or pulse, etc. from local junction boxes to LCP.

Single pair cable shall be used for transmission of signals from individual local instruments to local junction boxes.

PE insulated, PVC sheathed stranded copper conductor **armoured cables** shall be used. Signal cables shall be pair-twisted and overall shielded. Core section of multi-core cable will be 1.0~2.5mm^2 and core section of single cable between JB and field instruments will be 1.0~2.5mm^2 for electric or electronic signal transmission lines except electric power supply lines of which sectional area shall be decided by power consumption.

As to special cable vendor could follow their manufacturer's standard.

For power supply lines, core sectional area shall be decided by power consumption. Power supply cable will have no shielded.

Spare core quantities of cables for signal line between junction boxes and control room will have minimum 15%.

Multi-cores cables and single-pair cables shall be mainly laid in overhead metallic ducts with cover. From the duct to the junction box and from junction box to each instrument, cables shall be protected by metal conduit pipes and flexible conduit.

2.3.2 Instrument installation

Vendor shall supply the hook-up drawings for the process connection, air connection and electrical connection about all loose shipped instrument supplied by vendor.

2.3.2.1 Instrument Impulse line

Vendor shall supply all the impulse line, isolate valve and fittings.

Impulse lines shall be use metric tubing type at least 316SS.The O.D. of the tubing will be 12mm O.D. x1.5mm. Fitting should be the dual compress type.

2.3.2.2 Instrument air line

The air line should be use metric tubing type at least 316SS.The O.D. of the tubing will be 6mm O.D. x1.0mm or 12mm O.D. x1.5mm which decided by air consumption. Fitting should be the dual compress type.

2.3.2.3 Loose shipped instrument installation

Loose shipped instruments shall be installed by customers. But install material shall be supplied by vendor.

2.4 Machine Protection System (MMS)

Package vendor will confirm if equip the MMS for the machine or not according to character of the machine. MMS signals include viberation, displacement and motor temperature, etc.

The sensor, monitor, cable (between sensor and proximitor) and junction boxes with proximitor shall be also supplied by vendor.

MMS controller installed in the cabinet will be provided by package vendor if required.

2.5 Anti-Surge Control

Package vendor will confirm if require the Anti-Surge control and Anti-surge valve or not according to character of the machine. If required, the Anti-Surge control will be accomplished by package control system and the Anti-Surge valve will be supplied by the package vendor.

2.6 Surge Protection

Surge Protection Device (SPD) shall be provided for the following sited device:

- Analog signal instrument
- RTD (excluding RTD motor winding
- Pulse signal instrument (excluding MMS instrument)
- Solenoid valve
- Electronic Switch
- Power supply for local panel
- Communication Device

Surge Protection Device (SPD) shall be provided for all the signal and power supply from/to site device insded the PLC cabinets.

The signals between MMC and PLC could not be equieped with SPD

3 Document requirements

Vendor shall supply the following documents or the same information for instrumentation at least:

- Process and instrument diagram
- Instrument index and data sheet
- Process control philosophy
- Logic diagram
- Interlock description or cause and effect diagram
- Alarm and trip list
- LCP layout diagram, inside arrangement diagram
- Hoop-up drawing for process connection, electrical connection and instrument air line connection.
- Bulk material list
- Loop diagram
- Wiring diagram and cable list
- PLC configuration diagram
- PLC program print out and CD-ROM
- Terminal block configuration diagram
- Junction box layout diagram and terminal block configuration diagram
- Power supply consumption list
- Modbus communication address list

- Specific interface diagram

4 Service and Commissioning

For the control system design and configuration, vendor engineer shall attend the following activies:

- Control system design laision meeting at DCS vendor office or SEI office, process and instrument engineer, 1 person 3 working days.
- Control system FAT at DCS vendor workshop, process and instrument engineer, 1 person 5working days.
- Sit service and commissioning, detail defined in other part of this MR.

Attachment A

SPECIFICATION FOR
INSTRUMENT PANELS AND CABINETS

修改	日期	说明	编制	校核		
5						
4						
3						
2						
1						
0	2023.10.18		陈明	李江明	刘国欢	

1.0 SCOPE

This document specifies the minimum requirements for the design and purchasing of the control panels and cabinets located in the field, CCR, FAR and LCR.

2.0 GENERAL REQUIREMENTS FOR CONTROL PANELS AND CABINETS

2.1 General

2.1.1 The instrument panels & cabinets and control panels & cabinets shall be called by a joint name as control panels & cabinets.

2.1.2 All control Panels & Cabinets installed in the CCR, FAR and LCR shall be standard and have the same specification and the same physical dimensions. They shall be of standard design: 2100 mm height (including a plinth of 100mm), 800mm width and 800mm depth, free standing type, with front and rear accessible, and bottom entry for cables. Ingress protection class shall be at least IP 21. The specification and model are as follow:

- Manufacturer: Rittal or equal
- Model: TS or equal
- Locks: SZ 2450 or equal
- Color: RAL 7035 (Plinth RAL 7022)

2.1.3 The console structure of operator workstations and engineer workstations shall be fabricated in accordance with manufacturer's standard.

2.1.4 The interior/exterior arrangement of equipment, instrumentation, and auxiliary devices, components shall be designed as the following considerations:

- Ergonomic factors including visibility, accessibility, usability, location, spacing, and arrangement;
- Special requirements related the location and segregation of electrical elements, terminal blocks, and wiring;
- Voltage level and signal type segregation;
- Heat dissipation;
- System maintenance;
- Trouble-shooting of circuits;
- Spare space for future expansion.

2.1.5 The installation height of the devices installed on the control panels & cabinets such as instruments, switches and pushbuttons etc. shall be such that it is accessible for reading and operating when the operators are standing.

2.1.6 Equipments, instruments, terminal blocks, and other device components should not be mounted on interior swing-frames or swing-out doors.

2.1.7 When the FAT is finished, all control panels & cabinets should be reserved at least 15% of installed spare capacity and at least 15% of spare space.

2.1.8 The installed spare capacity inside all control panels & cabinets should be designed as that when it is in use, there is no need to move any existing (pre-installed) components and wiring. There should be 40% of reserved spare space in the cable ducts in cabinet.

2.1.9 The Vendor shall be responsible for sizing and the design of cabinet ventilation/cooling systems. Overheating shall not occur even when I/O housings have the maximum number of I/O modules inserted (all card slots used including future space for housings and modules), with all I/O modules operating at maximum design current.

2.1.10 2 sets cabinet thermostat shall be provided with cabinet, 1 set for control fan and 1 set generate cabinet high temperature alarm.

2.1.11 Internal lighting should be installed in the cabinet and a contact switches should be installed on the doors. When the door of the cabinet is opened, the internal lighting will be switched on automatically.

2.1.12 Components installed inside the cabinet should be selected from a manufacturers list submitted by the Seller and approved by the Buyer. Before completing the design of the control panels & cabinets, any changes and supplement to the list put forward by the Seller shall be approved by Buyer in advance.

2.1.13 System cabinets, marshalling cabinets, and other substantial floor mounted equipment shall not be installed directly on anti-static removable floors (computer room floors). Instead, they shall be installed on the channel steel foundation of cabinets by the building construction contractor.

2.1.14 The foundation of cabinets shall be of welded hot dipped galvanized channel steel construction and anchored to the sub-floor using bolts.

2.1.15 The foundation of cabinets shall be designed to support twice the weight of the installed equipment and shall have adequate support to withstand lateral and other directional stresses that may be induced during assembly, transport and installation. The width and depth of foundation shall be suitable for the installed equipment. The height of foundation shall be such that the bottom of the installed equipment will be flush with the top of the anti-static removable floor. The cabinets shall be bolted to the foundation channel steel with bolts.

2.1.16 All Cabinets shall have bottom entry for cables.

2.1.17 Nitrogen or other inert gases shall not be piped into the panels and cabinets located in CCR, FAR or LCR.

2.2 Panels or cabinets with equipment package

2.2.1 The panels/cabinets supplied with equipment package are usually installed in CCR, FAR or LCR.

2.2.2 The panels/cabinets supplied with equipment package are generally used for the controls of the package equipment and can also be used as operator interface for remote startup and shutdown.

2.2.3 The panels/cabinets supplied with equipment package shall include all logic and control hardware, such as controllers, indicators, switches, lights, VDUs and annunciators etc. installed on the vertical panel and other miscellaneous electronic components installed at the back of panel.

2.2.4 The equipment installed in the cabinets shall be suitable for a 19” chassis so as to accommodate all required power supply and system units, analogue and digital input/output cards, serial interface cards, terminal blocks, wiring channels, dual power supply units, safety bus-barriers, relays (DIN rail mounted), and signal processing cards with multiple plugs & sockets for connecting to the marshalling cabinet, grounding bus-bar as well as the required internal wiring shall be provided.

2.3 Control system panels and cabinets

2.3.1 The Control system panels & cabinets are usually installed in CCR, FAR or LCR.

2.3.2 The Control system panels & cabinets usually include the electronic modules for an independent system. These cabinets should have front door and back door.

2.3.3 The equipment installed in the cabinets shall be suitable for a 19" chassis so as to accommodate all required power supply and system units, analogue and digital input/output cards, serial interface cards, terminal blocks, wiring channels, dual power supply units, safety barriers (isolating type), relays (DIN rail mounted), and signal processing cards with multiple plugs & sockets for connecting to the marshalling cabinet, grounding bus-bar as well as the required internal wiring shall be provided.

2.4 Marshalling cabinets

2.4.1 Marshalling cabinets are usually installed in CCR, FAR or LCR. The function of marshalling cabinets is to connect field cable and reasonably distribute signals to other cabinets and panels such as control system cabinets.

2.4.2 These cabinets should have front door and back door.

2.4.3 The equipment installed in the cabinets shall be suitable for a 19" chassis so as to accommodate all required power supply and system units, analogue and digital input/output cards, serial interface cards, terminal blocks, wiring channels, dual power supply units, safety bus-barriers (isolating bus-barriers), relays (DIN rail mounted), and signal processing cards with multiple plugs & sockets for connecting to the marshalling cabinet, grounding bus-bar as well as the required internal wiring shall be provided.

2.5 Power distribution cabinets

2.5.1 Power distribution cabinets should be installed in the CCR, FAR or LCR.

2.5.2 Power distribution cabinet shall receive dual UPS 220V AC, 50Hz feeders, and distribute them into the system users in the CCR, FAR or LCR and the associated site equipment.

2.5.3 Power distribution cabinet shall have front door and back door.

2.5.4 The electrical equipment installed in the power distribution cabinet shall include: main circuit breakers (MCB), L/N/PE bus bus-bars and output circuit breakers (double-pole air switches).

2.5.5 The output circuit should be connected to the terminal blocks that is located on the bottom of power distribution cabinet and marked clearly. The wiring channels for internal cables shall be installed cross the back of power distribution cabinet for the access of cables and wiring.

2.6 Interposing relay cabinets

2.6.1 The interposing relay cabinets (I/E interface cabinets) are usually installed in the CCR, FAR or LCR.

2.6.2 The interposing relay cabinets shall be provided with two doors one in front and one in the rear.

2.6.3 The electrical equipment installed in the interposing relay cabinets shall include interposing relays for isolating electrical 220V AC circuits and instrument 24V DC circuits.

2.6.4 The interposing relay cabinets shall include some terminal blocks for connecting multi-core cables from the marshalling cabinets, some terminal blocks for connecting electrical circuits between the CCR/FAR/LCR and MCC as well as all needed wiring.

2.7 Local control panels (LCP)

2.7.1 General

2.7.1.1 Local control panels shall be designed to furnish the minimum instrumentation and controls required for a localized safe and reliable operation and startup/shutdown of the associated process section or dedicated process equipment or package unit.

2.7.1.2 Local control panels to be installed outdoors in open areas and within the confinements of an electrically classified area, including skid mounted control panels shall be designed in accordance with the IEC 60079 standard.

2.7.1.3 The protection class of local control panels shall be IP65 class per IEC 60529 standard of Degrees of Protection Provided by Enclosures.

2.7.1.4 Local control panels containing electronic and electrical equipment that could be affected by external electromagnetic and radio frequency interference shall be designed per the requirements of IEC 61000.

2.7.1.5 Local control panels shall be designed so as to be completely piped (with required piping insulation if required) and wired, requiring only connection to the external piping and wiring circuits. A high-density arrangement furnished in standard racks is preferred for pint-sized instruments.

2.7.1.6 The instruments or control devices that the operators normally use (such as indicators, recorders, etc.) shall be arranged on vertical surface of local control panels so that instruments are readable and operable by the operator in a standing position. The instruments that require manual adjustments shall be located with their centerlines between the height of 1630mm and 840mm above the floor. Outdoor mounted local control panels shall minimize effects of glare from sunlight on operator displays. Using a sun shield to eliminate the glare as required. Local control panels shall be adequately lighted internally and externally as to allow continuous and clear view, without glare, for all panel mounted instruments and controls.

2.7.1.7 When required, the annunciator pushbuttons shall be located together on the local control panel within reach of the operator and within readable distance of the respective annunciator window displays. The protection class of annunciators shall be minimum IEC IP65. Annunciator visual displays (e.g., alarm windows and status indicators, including any graphics) shall have sufficient light intensity when lighted to be visible at any time by an operator at a reasonable distance from the local control panels.

2.7.1.8 When required, human machine interface (HMI) devices shall be located on the local control panels within reach and viewable distance of the operator. The HMI device shall be suitable for mounting and operation in a hazardous area. The protection class of HMI devices shall be below the requirement of IEC IP66.

2.7.1.9 Local control panels shall be mounted on the location of free of vibration. The doors on the rear of the panels, the doors on wall-mounted panels, or the doors on equipment facing clearance aisles shall be opened without any blocking and shall give free access to the interior of the panels.

2.7.1.10 The front of local control panels shall be convenient to the operator to view the equipment or unit control from the local panels and shall convenience to escape in case of emergency. No obstacles shall be near the local control panels.

2.7.1.11 Any serial communications interface devices such as optical/electrical converters, converter power supplies, fiber optic patch panels, etc. shall be provided by the local control panel manufacturer and installed on one side of the local control panels.

2.7.2 Structure of local control panels

2.7.2.1 All local control panels installed outdoors should be free-standing structures, made of cold-rolled steel or stainless steel. Other structural details should adjust to the actual load of the local control panel. The surface of the finished local control panel should be smooth and flat.

2.7.2.2 Field mounted local control panels should be constructed of cold-rolled steel or stainless steel, unless other materials are required for a hot, humid, and corrosive environment. The thickness of panels shall be consistent with the load requirement. In any case its thickness shall not be less than 3mm. To avoid sagging and warping, internal supports shall be provided.

2.7.2.3 In hot, humid, and corrosive environments, special considerations for field-mounted local control panels are as follows:

a) Considering of use of white painted panels, double-skinned structure (excluding panel face instrument section) with polyurethane insulation to reduce absorption of solar radiation;

b) Use of sun shield and air intake on top of panel;

c) Considering of use of non-hygroscopic, non-nutrient materials as practicable to reduce fungus growth susceptibility;

d) Proposals to use other materials and material thickness shall be submitted to the Owner's engineer for approval. Such proposals shall include test data documenting the fire resistance, corrosion resistance, and mechanical strength of the proposed local control panels and construction materials;

e) Local control panel access doors shall be provided with gasketing to seal and support a slight positive pressure inside the panel to prevent moisture and gases from entering the panel. The doors will also be provided with a mechanical stop and panic safety bus-bar for panels large enough to permit operator entry. These doors shall be removable by lifting them off the hinges;

f) Instruments installed in local control panels shall be certified or approved by a nationally recognized testing agency for use in the electrical area classification where they will be installed;

g) The minimum and maximum operating temperatures of the local control panel mounted instruments shall not be exceeded. Low noise fans/blowers, vortex coolers, air-conditioners, heaters, or solid-state coolers shall be used if necessary to maintain the required range of operating temperatures and humidity. If some form of the electrical heating and/or cooling devices is used, the device shall be rated for the electrical area classification in where it is installed;

h) Fans shall also be provided for personnel comfort within panels, when there is space large enough for operator entry and the average ambient temperature is higher than 30°C.

i) Instrument cases shall not rely on grounding through the steel of the local control panel. Each frame section shall be provided with two soft copper, solid bus-bars, grounding buses, with the size of 6mm x 25mm at least;

1) The first bus shall be an instrument signal ground.

2) The second bus shall be an equipment ground.

j) The ends of the buses shall be arranged so that when all sections of the panel-board are in place, each grounding bus shall be one continuous system. The grounding buses shall be bonded to the site grounding system;

k) Instruments to be mounted in the inclined sections of local control panels shall be provided with latches to lock the chassis in the recessed, intermediate, and fully extended positions, regardless of the angle of mounting;

l) All holes on local control panel shall be plugged for shipment to prevent water or dirt from entering during shipment or storage prior to installation;

m) For outdoor installation, the local control panel shall be furnished with a weather canopy of minimum 4 mm metal at top of front panel to protect panel face controls and instrumentation from rain and excessive sunlight. LCD displays shall be protected by a sunshade.

2.7.2.4 Lifting facilities shall comply with following requirements:

a) All local control panels should have removable lifting eyebolts to facilitate lifting;

b) The lifting eyebolt should be fixed on the top of local control panel, but not the sides of the control panel;

c) Eye bolts shall be suitable for the total weight of a cabinet, with all components installed, and include a safety factor of 2;

d) The Supplier shall ensure that the local control panel design is such that it can be safely lifted without damage due to deformation, deflection, or structural failure.

2.7.2.5 The doors of local control panel shall comply with following requirements:

a) The door of a local control panel shall be reinforced to avoid twist and deformation and with gaskets to protect it against dust and moisture entering the panel;

b) Local control panels with single doors should have a hinged door;

c) The hinge shall be on the left side unless otherwise specified or approved;

d) All local control panels should have locks of the removable type;

e) All locks for the panel door should be the same;

f) All doors should be able to be opened with an angle of at least 90 degrees;

g) The mechanical guard (baffle plate) should be in position when the cabinet is delivered;

h) The opening and closing of the door shall be free form blocking by middle beam-columns or structures;

i) Local control panel doors shall have at least three hinges and shall be removable by lifting them off the hinges;

j) All doors shall be electrically bonded to associated local control panel steel framework using braided grounding bus-bars;

k) A drain valve shall be provided at the lowest point inside the local control panel.

2.7.2.6 The design of local control panel shall comply with following requirements:

a) The design of local control panels should facilitate all electrical and mechanical connections;

b) The supplier shall provide recommendations for ventilation, heat dissipation, and the possible panel wiring method by means of side-to-side or back-to-back approach;

c) The rear wiring of local control panel shall not interfere with possible future instrument installation on or within the local panel, or with accessibility for maintenance;

d) Switches on the front of the local control panel for emergency shall be guarded to prevent accidental operation. Switches for regular process operation shall be a type not easy to accidental operation;

e) Power supply and signal cable entries, power and signal segregation, and other electrical design features shall be in accordance with this specification, section 4, Internal Design;

f) Switch contacts for use on local control panels shall be hermetically sealed type contacts.

2.7.3 Terminals and Wiring

2.7.3.1 All terminals shall be marked. Terminal blocks shall have block identification markers to indicate polarity and grounding connections.

2.7.3.2 Some terminals shall be provided for shield and drain wire connections. Terminal blocks shall be arranged with adequate separation to permit clear wiring identification. Terminal blocks shall have the field wiring on one side of blocks and panel internal wiring on another side of blocks. Wiring at terminal blocks shall be tagged with permanent sleeve-type tags.

2.7.3.3 Entry of cables, conduit, or tubing to a local control panel shall be bottom entry or side entry through a gland plate. Top entry is not allowed. Spare entry ports shall be plugged and capped to allow for future use, and to prevent the ingress of water. A sealed gland plate with 20% spare plugged entries shall be furnished to allow field modifications and addition of cables.

2.7.3.4 Voltage levels inside local control panels should be limited to a maximum nominal circuit voltage of 220VAC or 24VDC.

2.7.3.5 All local control panels shall be supplied with an isolated copper ground bus bus-bar for instruments, located at the bottom of the panel.

2.7.3.6 Color-coded wire shall be used for all internal control panel wiring to identify the signal type (e.g., 220V AC or 24V DC Power supplies, 220V AC or 24V DC Control signals, Thermocouple mV signals, RTD, Pulse, 4mA-20mA DC, etc.).

2.7.4 Instrument and wiring identification

2.7.4.1 Each local control panel shall have a laminated plastic identifying nameplate on both the front and back of the panel.

2.7.4.2 Each instrument, switch, and similar device located on the front of the local control panel shall have a laminated plastic nameplate on or adjacent to the device showing its process identification and services. Each instrument, switch, or similar device mounted in the interior of the panel or terminal blocks shall have a laminated plastic or stainless steel nameplate showing identification.

2.7.4.3 All plugs and sockets used for instrument connection shall be labeled with the appropriate corresponding identification. Plugs and sockets shall be matched mutually.

3.0 STRUCTURE

3.1 Mechanical manufacturing

All control panels installed indoor should be made of cold-rolled steel and quenched low carbon steel. Other structure details should follow the requirements of manufacturer. The surface of the finished panels and cabinets should be smooth and flat.

3.2 Color of panels and cabinets

3.2.1 The inside and outside of carbon steel panel shall be painted. The surface color of inside and outside of panels shall be RAL 7035 (calcareousness color) unless otherwise specified in project standard.

3.2.2 Cabinet interior sub-panels / mounting plates shall be painted white or as required by project standards. Recommended paint type, color, and finish is as follows: smooth powder coat or lacquer enamel, white color (RAL 9010), and satin finish.

3.2.3 Vendor shall provide the appropriate spare paints with each different color for the future mending together with the equipment.

3.3 Lifting points

All control panels should have removable lifting ear bolts to facilitate lifting. The lifting ear bolts shall be fixed on the top of control panel, other than the sides of the control panel. Ear bolts shall be suitable for the total weight of a cabinet, with all components installed, and include a safety factor of 2. The vendor shall ensure when the cabinet is fabricated entirely, such that it can be safely lifted without damage due to deformation, deflection, or structural damaged.

3.4 Panels and cabinets doors

3.4.1 The door of a panel or cabinet shall be reinforced to avoid twist and deformation and with gaskets to protect it against dust and moisture entering the cabinet. The panel or cabinet with single door shall install hinges on the left side unless other statement is specified or approved.

3.4.2 All cabinets should have locks and be of the removable type. All locks for the cabinet door should be the same. All cabinet doors should be able to be opened with an angle of at least 90 degrees. The 180 degrees opening is preferred. The mechanical guard (baffle plate) should be in position when the cabinet is delivered.

3.4.3 Each door shall be equipped with a file holder capable of accepting at least 25mm thickness of size A4 documents.

3.4.4 The opening and closing of the door shall be free form blocking by middle beam-columns or structures.

3.4.5 Cabinet doors shall have at least three hinges and shall be removable by lifting them off the hinges.

3.4.6 All doors shall be electrically bonded to associated cabinet steel framework using braided grounding wiring.

3.5 Design of panels

3.5.1 The design of the panels should facilitate all electrical and mechanical connections. The supplier shall provide recommendations for ventilation, radiation, and the panel interconnection by means of side-to-side or back-to-back approach.

3.5.2 If the mutual fixing of panels can form an entity that cannot be removed, the width should not exceed 2400mm (within the allowable limit of the installed access).

3.5.3 Expansion bolt holes should be provided.

4.0 INTERNAL DESIGN

4.1 Cable entrance for control system panels and cabinets

The cables or cable bundles of control system should enter the panel from the bottom. The armored cable of 220 V AC power supply distribution panel shall be protected by the way of cable connector at the sealing plate. In cases where both AC and DC cables must enter a panel, the interior layout of the panel shall be such that physical separation of the AC / DC circuits can be maintained from the cable entry location to associated terminal blocks.

4.2 Rack of electrical equipment

If there is enough room, the electrical equipment can be installed on a fixed rack, enclosure or frame. The arrangement of the equipment should be convenient for operation and maintenance, but the distance from the sealing plate should not be within 300mm. The arrangement of all equipment should enable the circulation of cold air if necessary.

4.3 Electrical components

When an isolated PSU is mounted inside the panel, they should be put into a place where the heat flows is minimum as possible above the electrical elements.

4.4 Field terminal blocks

4.4.1 The terminals blocks of all control system panels shall be mounted with DIN rails and using a screw-clamp type of terminals. I/O circuits shall be individually fused with blown fuse indication or current limited via resistor or other passive device. When fuses with blown fuse indication are utilized, the design shall be reviewed to ensure that the leakage current required to power the blown fuse indicator is lower than the operating threshold of associated output devices or input channels. Sensor and final element fuses/current limiting devices should normally be located in the system cabinets/marshalling cabinets. In cases where a single pole device (e.g. fuse or resistor) is used to protect a circuit, it shall be installed on the leg that sends the positive pole or high voltage to the output signals; not the signal return or switched leg. The design of I/O circuits shall include a means to totally isolate individual circuits (all conductors) from the field at the point where field wiring is terminated within the system cabinets/marshalling cabinets. In cases where a conductor must be fused or current limited externally from the control system hardware (i.e. on the “Field” terminal strip in the marshalling cabinet), a lever type fuse holder, a component holder with a resistor plug, or other device approved by the Owner may be used as the disconnect mechanism; otherwise the disconnect mechanism shall be a knife disconnect switch.

4.4.2 Field terminal blocks shall be vertically installed unless there are special requirements.

4.5 Field multi-core cable

4.5.1 All conductors (whether the spare and used) of multi-core cables shall be terminated on same terminal block inside junction box and marshalling cabinet. Spare pairs/triads shall be jumped with jumpers in the system cabinet or marshalling cabinet to prevent them from being accidentally energized.

4.5.2 The field terminals shall be mounted on the vertical column.

5.0 TERMINALS AND WIRING

5.1 Internal wiring

Wiring shall have at least 7-strand annealed copper conductors with PVC insulation. The size of wires shall match the load current, but normally the cable with the size 0.75mm2 shall be used. The insulation rate shall not be lower than 600V RMS.

5.2 Color of insulation layer

The requirement of color of insulation layer for the wiring inside panel is as follows:

AC live	Brown
AC Neutral	Blue
Safety Earth	Yellow/Green
Instrument Earth	Yellow/Green
DC positive	Red

DC negative	Black
IS signals	Sky Blue
SIS signals wiring	Magenta
All other signals	Grey

5.3 Terminal identification

All wiring terminal groups should be identified separately. The printed mark shall be used and also the identifying method given by the manufacturer should be used. The mark shall be of black letter with white base.

5.4 Twisted wire

5.4.1 Where the twisted wire is used, the insulated edge-rolled connector (ferrule) shall be used to make the paired marks at the end of conductor. The edge-rolled method selected shall be suitable for the size of conductor and the approved rolling tools shall be used to ensure the safe operation.

5.4.2 Soldered joints and wire splicing is not permitted.

5.4.3 The terminal blocks that are jumped together for power distribution or grounding purposes shall be connected to their associated power supply or grounding bus at two points using the first and last terminals.

5.5 All fixed markers for wiring

All the wirings shall be applied with the appropriate size of uniform marks, which shall be done before rolling the edge (installing the ferrule). The mark shall be of black letter with white base.

5.6 Wiring identification

Both ends of each conducting wire should have the start/end markers. Reading of all words or numbers should be from left to right. When the conducting wire is installed vertically, the reading of the words or numbers should be from bottom to top.

5.7 Wiring, jumped line and power distribution wire

Wiring, jumped wire and power distribution wire should be installed through good-looking plastic cable duct. The cable duct should be securely fixed on the internal structure of the panel with bolts and nuts. The length of the cable duct cover should not be more than 1m so as to facilitate necessary moving.

5.8 Empty slots

A cover plate shall be used to cover the empty card slots.

5.9 Distance between terminals blocks and cable ducts

The distance between terminal blocks and cable ducts shall be at least 50mm so as to guarantee the visibility of the wiring markers.

5.10 Conductors and cable ducts

The conductor and cable in ducts shall be fastened along the laying route. Finally the capacity of the cable filled in the ducts shall not be more than 60%.

5.11 Wiring bundles

The wiring bundles shall be bound by nylon strips when incoming to or outgoing from the cable ducts. Be careful not to damage the cable by the sharp edge when binding. The cable gland or bushing shall be used when the wires and cables pass through the entry.

5.12 Wiring isolation

The wiring inside panel shall use the following methods for isolation so as to minimize the mutual interference.

Millivolt signal:	Shielded twist pair wires shall be used for millivolt signal cables.
	The compensation wire shall be used for thermocouple signals.
RTD signal:	Shielded twist triad wires shall be used for signal cables.
Impulse signal:	Shielded twist pair wires shall be used for impulse signal cables.
AC power incoming cable:	To be installed with black cable duct individually.
	When it is laid with the signal cables paralleled, a minimum distance of 75mm shall be kept. The insulating separator shall be used where the distance is not enough.
Intrinsic safe signals:	The sky blue cable ducts shall be used and laid separately from all the other signals and cables.

5.13 Additional requirements

5.13.1 No more than two wires shall be terminated at one side of each terminal.

5.13.2 Wiring shall be provided with a minimum of 150mm of length spare on each end to permit future modifications or adjustments.

6.0 GROUNDING

All control system panels should be equipped with instrument operating ground and safety grounding bus-bar which shall be mounted at the bottom of the panel and accessible for the bottom entry cable shield grounding. The grounding of enclosures of instruments and equipment cannot rely on the steel framework of the panel or cabinet.

6.1 Instrument operating grounding bus-bar

Instrument operating grounding bus-bar shall be isolated from the panel structure. It is used for cable shield grounding and it takes 0V as the reference base point. If there are many base-plates and bus-bars inside the panel and cabinet, select one of them as main grounding bus-bar of instrument, which will be connected with other bus-bars. The main grounding bus-bar in the panel and cabinet shall be connected with the field grounding pole through the instrument operating grounding bus-bar of CCR, FAR or LCR.

6.2 Intrinsic safe circuits

The protection of intrinsic safe circuit should be realized through safety barriers (if possible). When the safety barrier is adopted, all the shield wires and the cores of the IS cable which are not used shall be connected with instrument operating grounding bars.

6.3 Safety grounding bus-bar

The safety grounding bus-bar is used for the safety grounding. All the structures of panel and cabinet including the doors shall be connected with the safety grounding bus-bar. If there are many safety grounding bus-bars, you shall select one of them as main one, with which the other bus-bars shall be connected. The end point of each main grounding bus-bar shall be connected with the field grounding pole through the safety grounding bus-bar of CCR, FAR or LCR.

6.4 Grounding bus-bar

All connections of cabinets and grounding shall use welding or compacting bus-bars with spring gaskets. The minimum sizes for the conductor are as follows:

Insulated wire:2.5mm2

Flexible connection wire: 6 mm2

Connecting copper strip: 12mm x 1.5mm

Grounding bus-bar: Annealed copper bus-bar, at least 25mm x 6mm.

7.0 SWITCHES AND LIGHTING

7.1 Cabinet switches

The switches in front of the panel and cabinet shall be designed and arranged so that the misoperation can be avoided. Emergency shutdown switches shall be equipped with a protection device or covered.

7.2 Start-up and maintenance bypass switches

Start-Up and maintenance bypass switches shall normally be implemented as software configured switches in the DCS. In cases where hardwired switches are required, they shall be key-lock type. The bypass switches inside the panel shall be protected from moisture.

7.3 Double-pole circuit breakers

The double-pole circuit breakers shall be provided and assembled by the supplier at the entry of main power supply for each cabinet or panel. When one cabinet or panel controls two or more process units, the circuit breaking protection shall be done for each unit separately.

7.4 Micro circuit breakers

The micro circuit breaker or fuse with approved model and rating shall be provided and assembled on each electric instrument circuit by the supplier. For the instrument with fuse already, the supplier shall only provide breaking switch. The three-pole switch shall be used for alarming circuit so as to break the power supply and audio alarm circuit at the same time.

7.5 Switch sockets

The sockets of switches for portable equipment shall be arranged at the back of panel and cabinet and spaced about 3m apart. The socket shall be connected to the protection terminal of external power supply. Non-UPS power shall be used.

7.6 Internal lighting facilities

The completely enclosed panel and cabinet shall be provided with internal lighting devices and a separate fuse and wiring shall be used to be connected with the main panel insulated switch. The lighting devices shall be arranged at the place where you can get sufficient brightness for convenience of maintenance work inside the panel and the lighting devices can be controlled by the switch adjacent to the panel. Non-UPS power shall be used.

7.7 Signal lights for panel and cabinet

All the front lamp of panels, including alarm lamps shall be equipped with lamp test facilities. The light of the lamp is generated by LED.

The color of the lamp is defined as: green for motor running or valve open, red for motor stopped or valve closed. The definition of other colors shall be discussed with the buyer during the detail design phase.

7.8 Breakers, terminal blocks and fuses

All breakers, terminal blocks and fuses, etc. shall be clearly marked and be conveniently accessible from the rear of the panel.

8.0 NAMEPLATES AND TAGGING

8.1 Nameplates in the front and back of the cabinet

The front and rear of all control system panels shall be equipped with nameplates which should show the identification number and function of the panel. Its installation height should be 1700mm from floor. The nameplate of cabinet with two doors should be installed on the right door. Each cabinet shall be properly identified and tagged. The tag numbers of panels and cabinets shall be in accordance with the equipment numbering rules.

8.2 Instruments

All instruments in the front and rear of panels shall be provided with nameplates showing the tag number and function. When necessary, even equipment and equipment group should also have nameplates so as to facilitate the operation and maintenance personnel to identify.

8.3 Nameplates

Unless other agreement exists, all nameplates should be made of plastic plate (150mm x 50mm) and be secured with stainless steel screws. Usually, the letters should be in black with white background. The alarm and SIS information shall be of white letters with red background, for example, The dangerous electronic apparatus are defined as black letter with yellow background, the IS information shall be of white letter with blue background.

In places where the space is limited or requires the use of special signs, viscose nameplate can be adopted. The nameplate should be made of plastics with letters and signs that are indelible.

9.0 TESTING

9.1 Appearance inspection

The appearance inspection of panels and components should include the inspection on defects, dents, scratches and so on and the dimension should be confirmed. Meanwhile, it shall be confirmed whether all required components have been installed as per the related documents.

Before the start of testing, vendor must guarantee the easiness of reading of all related documents in Chinese or English.

9.2 Wiring inspection

Full Point-to-point checking shall be made for all wiring, including the discrimination testing between grounding wires and impulse short circuits as well as fuses.

9.3 Functional checking

The simulating inputs shall be applied to test the output to the light and indicators etc. and check the impact of power loss. The impedance to the ground between internal components and the grounding bus-bar of panel shall also be checked.

10.0 DOCUMENTS

At least the following documents and drawings should be submitted to the Buyer for confirmation prior to manufacturing.

The entire detailed design, construction and installation requirements of control system panels and other documents and drawings as defined by the project Supplier Data Requirements List (SDRL) shall be provided by Seller.

10.1 Dimensional drawing

The dimensional drawing shows the mode number, size, weight, base location, transport disassembly and lifting points.

10.2 General arrangement drawing and bill of material

Those documents describe the general arrangement of all panels and components, including the dimension, clearance and so on.

If necessary, the following documents should also be provided:

Instrument panel design;

Switch and lighting arrangement;

Process flow Diagram display arrangement;

Arrangement of annunciators, indication of letters, color and sequence

10.3 Terminal block drawing

The requirements for all terminal blocks of input and output cables shall be illuminated. Each terminal block should include the following information:

Cable number;

Tag number;

Terminal number

10.4 Wiring diagrams

The wiring diagrams shall illuminate all wiring requirements in the panel, including the power supply distribution and the following contents:

Size of wiring;

Specification and location of fuses;

All signal distribution on the terminal blocks.

10.5 Structural drawing of panel

It shall be provided as per the construction requirements.

Attachment B

INSTRUMENT GENERAL SPECIFICATION

修改	日期	说明	编制	校核	审核	
5						
4						
3						
2						
1						
0	2023.10.18		陈明	宋江明	刘国欢	

CONTENTS

1. SCOPE

1.1 The general specification shall be applied to the instrumentation and control system engineering work and installation work at the PP Plant.

1.2 General requirements for application and engineering of instrumentation and control system are included in this general specification and they are the bases of the basic design and the detailed design work.

2.0 DESIGN BASIC VALUES

2.1 Type Selection of the Instrumentation and Control System

2.1.1 Control room installed instrumentation shall be Distributed Control System (hereinafter abbreviated as DCS) for the operation, control and monitor of the plant will be used.

2.1.2 Safety and Interlock System shall be carried out by means of Safety Instrument System (hereinafter abbreviated as SIS). The SIS shall be independent of the DCS system and able to communicate with it so as to monitor, alarm on the CRT or peripheral console of the DCS system and print out.

2.1.3 The site instrumentation shall be principle electronic type. The transmitters shall be smart type. Smart type instrument shall be of two wire system with 4 to 20mA standard signal with HART protocol and communicate with DCS directly.

2.1.4 All locally mounted transmitters shall be with output signal indication, 0~100%linear or 0~10SQR.

2.1.5 Locally mounted controllers shall be pneumatic, 20 to 100Kpa standard signal.

2.2 Deleted

2.3 Electric Power Supply

2.3.1 Redundant power supply from 2 sets of Uninterrupted Power Supply Units (hereinafter abbreviated as UPS). The voltage shall be 220V.AC, 50Hz principle and the design capacity of UPS shall be 150% of the actual needs in consideration.

220V.AC, 50Hz single phase

UPS supported instrumentation and control system:

(1) DCS

(2) SIS

(3) Measurement and control instruments

(4) Sequence control system

(5) Package plant instrument and control system

UPS is requested to assure 30 minutes continuous supply in case of AC power failure.

2.4 Instrument Air Supply

(1) Normal Operation: 0.4~0.6MPaG

(2) Shall not consist of erosive and toxic gas

(3) Shall not consist of oil content and dust

2.5 Measurement Units

Unit of measurement shall be in compliance with ISO 100-1073 International System of Unit (S.I.):

(1) Flow rate measure units:

-vapors and steam:	Kg/h, t/h
-gases:	Nm3/h
-liquid:	Kg/h, t/h M3/h
(2) Pressures:	MPa
(3) Level:	mm, %
(4) Density:	Kg/m3, Kg/Nm3 (℃ and 1 ATM.)
(5) Temperature:	℃
(6) Analysis:	PPM, %
(7) Electrical Conductivity:	s
(8) Dynamic Viscosity:	cP
(9) Kinematic Viscosity:	St
(10) Rotating Speed:	R.P.M

2.6 Codes and standards

No.	Codes and Standards	Names	Notes
A	ISO		
1	ISO 5167-1	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full—Part 1: General principles and requirements	2003
2	ISO 5167-2	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full—Part 2: Orifice plates	2003
3	ISO 5167-3	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full—Part 3: Nozzles and Venturi Nozzles	2003
4	ISO 5167-4	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full—Part 4: Venturi tubes	2003
5	ISO 9001	Quality management systems - requirements	
B	IEC		
1	IEC 60079 series	Electrical apparatus for explosive gas atmosphere	2001
2	IEC 60079-0	Electrical apparatus for explosive gas atmosphere: Part0: General requirements	2001
3	IEC/TR 60079-16	Electrical apparatus for explosive gas atmosphere: Part16: Artifical ventilation for the protection of analyser(s) houses	1990
4	IEC 60304	Standard colours for insulation for low-frequency cables and wires	1982
5	IEC 60529	Degrees of protection provided by enclosures (IP code)	2001
6	IEC 60534-1	Industrial process control valves: Part 1: Control	

No.	Codes and Standards	Names	Notes
		valve terminology and general consideration	
7	IEC 60534-2-1 Part2: Flow Capacity	Industrial process control valves: Part 2: Section one - sizing equations for incompressible fluid flow under installed conditions	
8	IEC 60534-2-2	Section two - Flow capacity, sizing equations for compressible fluid flow under installed conditions	
9	IEC 60534-2-3	Section three - Teat procedure	
10	IEC 60534-3-1 Part3: Dimensions	Section one - Face-to-face dimensions for flanged, two-way, globe type control valves	
11	IEC 60534-3-2	Section two - Face-to-face dimensions for flangeless control valves except wafer butterfly	
12	IEC 60534-4	Industrial process control valves Part 4: Inspection and routine testing	
13	IEC 60534-5	Industrial process control valves Part 5: Marking	
14	IEC 60534-8-1 Part8: Noise Considerations	Section one - Laboratory measurement of noise generated by aerodynamic flow through control valves	
15	IEC 60534-8-2	Section two - Laboratory measurement of noise generated by hydrodynamic flow through control valves	
16	IEC 60534-8-3	Section three - Control valves aerodynamic noise prediction method	
17	IEC 60534-8-4	Section four - Control valves hydrodynamic noise prediction method	
18	IEC 60584-1	Thermocouples: Part 1: Reference tables	1995
19	IEC 60584-2	Thermocouples: Part 2: Tolerances	1995
20	IEC 60584-3	Thermocouples: Part 3: Extension and compensation cables- Tolerances and identification system	1995
21	IEC 60654-1	Industrial-process measurement and control	

No.	Codes and Standards	Names	Notes
		equipment; operating conditions Part 1: Climatic conditions	
22	IEC 60654-2	Operating conditions for industrial-process measurement and control equipment Part2: Power	
23	IEC 60654-3	Operating conditions for industrial-process measurement and control equipment: Part3: Mechanical influences	
24	IEC 60654-4	Part 4: Corrosive and erosive influences	
25	IEC 60751	Industrial Platinum resistance thermometer sensors	1996
26	IEC 61000 series	Electro Magnetic Compatibility	
27	IEC 61158	Digital Date communication for measurement – Fieldbus for use in industrial control systems	2003
28	IEC 61131	Programmable Controllers	2003
29	IEC 61285	Industrial-process control - safety of analyser houses	2004
30	IEC 61508	Functional safety of electrical/electronic/ Programmable electronic safety related equipment	2000
31	IEC 61511	Functional safety of electrical/electronic/ Programmable electronic safety related equipment	2003
C	American standards		
1	ISA S5.1	Instrumentation Symbols and Identification	1992
2	ISA S5.2	Binary Logic Diagrams for Process Operations	
3	ISA S5.3	Graphic Symbols for Distributed Control and Shared Display Instrumentation, Logic, and Computer Systems	
4	ISA S5.4	Instrument Loop Diagrams	
5	ISA S5.5	Graphic Symbols for Process Display	

No.	Codes and Standards	Names	Notes
6	ANSI/ISA S7.0.01	Quality Standard for Instrument Air	
7	ANSI/ISA S12.01.01	Definition and Information Pertaining to Electrical Instruments in Hazardous (Classified) Location	
8	ISA S12.10	Area Classification in Hazardous (Classified) Dust Locations	
9	ANSI/ISA S12.12.01	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III Division 1 and 2 Hazardous (Classified) Locations	
10	ANSI/ISA S12.13.01	Performance Requirements for Combustible Gas Detectors	
11	ISA S18.1	Annuncator Sequences and Specifications	
12	ISA S20	Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves	
13	ANSI/ISA S50.02	Fieldbus Standard for Use in Industrial Control Systems Part 4: Data Link Protocol Specification	
14	ANSI/ISA S75.01	Flow Equations for Sizing Control Valves	
15	ANSI/ISA S75.03	Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies (ANSI Classes 125, 150, 250, 300 and 600)	
16	ANSI/ISA S75.04	Face-to-Face Dimensions for Flangeless Control Valves (ANSI Classes 150, 300 and 600)	
17	ISA S75.07	Laboratory Measurement of Aerodynamic Noise Generated by Control Valves	
18	ANSI/ISA S75.16	Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies (ANSI Classes 900, 1500 and 2500)	
19	ISA S75.19.01	Hydrostatic Testing of Control Valves (Formerly ASME/ANSI B167.37-80)	
20	ANSI/ISA S84.01	Application of Safety Instrumented Systems for	

No.	Codes and Standards	Names	Notes
		the Process Industries	
21	ANSI/ISA TR75.25.02	Control Valve Response Measurement from Step Inputs	
22	ANSI B 1.20.1	Pipe Threads, General Purpose (Inch)	
23	ASME B1.13M	Metric Screw Threads: M Profile	2001
24	ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard	2003
25	ASME B16.34	Valves - Flanged, Threaded and Welding End	1996
26	ASME B16.36	Orifice Flanges	1996
27	ASME B16.104 / FCI 70-2	Control Valve Seat Leakage	
28	ASME MFC-3M,7M	Venturis	
29	ASME MFC-6M	Vortex meters	
30	ASME MFC-10M	Method of Establishing Installation Effects on Flowmeters	
31	ASME MFC-11M	Coriolis Type Instruments	
32	ASME MFC-16M	Electromagnetic Flow Measurements	
33	ASME SEC VIII-DI	Boiler and Pressure Vessel Code, Section VIII, Construction of Pressure Vessels, Division I	
34			
35	API 2000 4th Edition 1998	Venting Atmospheric and Low Pressure Storage Tanks	1998
36	API RP520/521	Sizing, Selection and Installation of Pressure Relieving Devices in Refineries Part I-Sizing and Selection, 7th Edition Part II-Installation, 4th Edition	1999
37	API 526	Flanged steel pressure relief valves	2002
38	API RP551	Process Measurement Instrumentation	1993
39	API RP552	Transmission Systems	1994
40	API RP553	Refinery Control Valves	1998
41	API RP554	Process Instrumentation and Control	1995
42	API RP555	Process Analyzers	2001

No.	Codes and Standards	Names	Notes
43	API RP556	Instrumentation and Control Systems for Fire Heaters and Steam Generators	1997
44	API RP557	Guide To Advanced Control Systems	2000
45	API 598	Valve Inspection and Testing	1996
46	API 607 (ISO 10497-5)	Testing of Valves-Fire Type-Testing Requirements	2005
47	API 670	Machinery Protection Systems	2000
48	ANSI/API MPMS	Manual of petroleum measurement standards	
49	U.S. NRC 49	Rules and Regulations, Title 10, Chapter 1, Code of Federal Regulations - Energy Part 19 - Notices, Instructions, and Reports to Workers: Inspections Part 20 - Standards for Protection Against Radiation	1997
50	NEMA ICS1	General Standards for Industrial Control and Systems	
51	NEMA 250	Enclosures of Electrical Equipment	2003
52	NFPA 72	National Fire Alarm and Signaling Code	2010
D	BS		
1	BS 3573	Specification for polyolefin copper conductor telecommunication cables	
2	BS 5308-1	Instrumentation cables, Part1: Specification for polyethylene insulated cables	
3	BS 5308-2	Instrumentation cables, Part2: Specification for PVC insulated cables	
4	BS 6121-1	Mechanical cable glands, Part 1: Specification for metallic glands	
5	BS 6121-3	Mechanical cable glands, Part 3: Specification for corrosion resistant glands	
6	BS EN837-1	Part 1: Bourdon tube pressure gauges – Dimensions, metrology, requirements and	1998

No.	Codes and Standards	Names	Notes
		testing	
E	German standards		
1	DIN EN61285	Process Automation Safety of Analyzer Houses	
2	DIN V19250	Control technology; Fundamental safety aspects to be considered for measurement and control equipment	
3	DIN V VDE0801	Principles for computers in safety related systems	
4	RAL	Colour cards	
F	Manufacturer standard		

3. ENGINEERING DESIGN SPECIFICATIONS

3.1 Control Rooms Design

3.1.1 All the major instruments for measurement, control, alarming and signaling, safety interlocking should be located in the control room.

3.1.2 The control room should be equipped with air-conditioning device.

3.1.3 Full removable antistatic floor shall be provided for the control room, and the cable will be laid under the floor. All tubes entering the control rooms shall be sealed so as to prevent combustible or toxic gases, and even rain water from accidentally entering the buildings.

3.1.4 The CRT operation station and control panel shall have sufficient luminance of light, but which is not glaring. Emergency illumination shall be equipped for the control room.

3.1.5 Suitable entrance allowance must be provided in the buildings to introduction the sections of the panels and the cabinets.

3.2 Operation Station and Cabinets

3.2.1 Operation Station installed in the control room

(1) For the convenience of easy operation, maintenance, and installation, necessary space allowance should be provided for CRT operation station, auxiliary console, auxiliary control panel, and etc.

(2) Nameplate should be provided for instruments, switches and signal lamps.

(3) Each operation station, console and cabinet should have grounding terminal.

3.2.2 Cabinets installed in the control room

Cabinets installed in control room(or rack room) include: various types of cabinets for DCS and PLC, electric power supply distribution cabinet, marshalling terminals cabinet, cabinet with safety barriers and electronic instruments in it, cabinet containing various kinds of alarm switches and

special purpose instruments, relay cabinet and etc.. It is necessary to provide suitable space allowance for these cabinets in convenience of easy maintenance.

3.2.3 Fire alarm system, communication device, fire fighting facility should be provided in control room principally.

3.2.4 Field installed control panel

(1) Should be explosion-proof cabinet with operation panel in general.

(2) The electronic instruments, switches, and lamps which are mounted in the panel should have explosion-proof level.

(3) Control panel supplied as an integral part of mechanical device unit should be installed close to that unit for easy operation and maintenance.

3.3 Instrumentation and Control System

3.3.1 Distributed Control System (DCS)

DCS shall consist of: controller unit, man-machine interface unit, redundant communication system and peripherals device etc.

(1) Controller Unit:

It includes direct digital control, process interface (including I/O data processing), monitoring, alarming and so on. Automatic back-up shall be provided for the unit. In general it is not necessary to provide back-up system for data acquiring card.

(2) Man-machine interface unit:

Indicate, control and measure process variable, operation and control loop consist of setting point, control mode switching, output, information printing, alarm display, process dynamic graphic display and etc.. The hardware consists of large CRT colorful screen monitor, operator keyboard, engineer keyboard, printer and so on.

(3) Four operation stations with each having identical function and the ability of controlling whole plant, and they are backed up each other.

(4) Communication system

The communication system should be redundant (also for communication card, coaxial cable or optical fiber).

3.3.2 Safety interlock and Emergency Shutdown system

(1) In principle, SIS should be chosen to implement process safety interlock and shutdown system.

(2) The SIS should be able to communicate with DCS via interface direct data transference.

(3) Two or three signal sources should be provided for important safety interlocking system via “AND gate or two out of three” selector.

(4) In principle contact for alarm or interlock should be normally closed; relay and solenoid valve should be normally energized. When failure the contact opens and solenoid is de-energized.

(5) By-pass switch should be provided for input/output contact with relation to shut-off in order to avoid unexpected shut-off in case of interlock system not being put in force in that commission and on-line testing. Signal display should indicate whether the bypass is in force.

(6) Reset switch should be provided for interlock loop.

(7) Contact for interlock system should be independent to that for other system.

3.3.3 Flow Instruments

(1) In general flow instruments shall be throttle elements. In special application or throttle elements are not suitable using, the area flowmeter, positive flowmeter, mass flowmeter and etc., other non-differential pressure type flow instruments, shall be used.

(2) In principle, the standard type throttle elements shall be calculated, manufactured and inspected according to ISO5167-1(2003) standard.

(3) Normally material for throttle element shall be 316SS, also alloy or other erosive-resistant material shall be used according to process fluid requirement.

(4) Meter run shall be used for small size (<=DN40) or special throttle elements. “Beta” ratios shall not exceed 0.7 and will be not less than 0.2. Normally differential pressure range shall be 0-5, 0-10, 0-25, 0-40, 0-60kPa.

(5) The differential pressure type flow meter shall be provided with three-valve manifold.

(6) Throttle element tapping type:

<DN50 (2”) Corner taps

DN50 (2”) - DN300 (12”) Flange taps

>DN350 (14”) Radius taps

(Radius tapping position: upstream tapping 1.0D and down stream tapping 0.5D)

(7) Flow measurements of clear fluids on line size less than DN50 (2”) will be actuated by means of integral orifice D/P transmitters.

(8) Flow measurements on line size less than DN50 or for much variation of flow rate will be actuated by means of rotameter.

(9) When accurate measurement is required, flow measuring instrument shall choose positive displacement type flowmeter or mass flowmeter.

(10) For big size pipe, the annubar or magnetic flowmeter shall be used.

(11) Contact of flow switch shall be single-pole and double throw (SPDT).

3.3.4 Level Instruments

(1) For local level measures, Magnetic type gauge shall be normally used. The length of the level gauge shall be accordance with Manufacture Standard.

(2) Level transmitters in general shall be displacement type and differential pressure type.

(3) Displaces instruments shall be side-side flange mounted external cage type wherever the measure range is below 2000mm, and provided with finned or extended torque tubes according to manufacture requirements wherever the process operating temperature is above 200 °C or below 0 °C.

(4) Differential pressure type level instruments shall be normally differential pressure type transmitter. In case of slurry or viscous or toxic services, the flanged differential pressure type transmitter with extension and diaphragm shall be used.

(5) Level Switches shall be float type with single-pole double-throw contact.

(6) Vibrating rod type level switches shall be used for pellets and powders measurement in silos.

All level switches shall have SPDT contacts.

3.3.5 Pressure Instruments

(1) Pressure gauges shall be of 100mm dial type with stainless steel reinforced movement.

Capsule type pressure gauge shall be provided for small range an absolute pressure measurement.

Pressure gauges with diaphragm seals shall be provided for liquids containing suspended solids.

(2) Pressure transmitters in general shall be electronic type (4~20mA with HART protocol) and preferred.

For differential pressure or micropressure measurement, differential pressure transmitter shall be provided.

(3) In principle, all pressure measuring element shall be 316SS.

(4) Pressure switches shall be Bourdon, piston or diaphragm type with or without diaphragm seal as required.

Electrical contact shall be SPDT snap action type with fixed differential.

(5) Connections, generally, shall be 1/2" NPT female bottom or side for transmitters; M20 x 1.5 male for pressure gauges.

(6) Pulsation damper shall be used on all reciprocating pumps and compressor discharge services, if the instrument is not provided with built-in suitable device.

(7) Locally mounted pressure indication controller shall be pneumatic.

3.3.6 Temperature Instruments

(1) Local temperature indication instrument shall be used rotating type bimetal thermometer with 100mm dial.

(2) Thermowells shall be used as protection of all temperature elements, (resistance thermometers, thermocouples and bimetallic thermometer).

Normally thermowell material shall be stainless steel unless otherwise specified because of process requirement.

All the wells shall be provided with plug and chain.

(3) RTD shall be used in recording, indicating, controlling, alarm and safety functions operated from the control rooms, for low and medium temperature, -200°C to 500°C, when mechanical vibration does not exist.

Resistance thermometers shall be single or double element of platinum wire type, 100 ohm at 0 °C.

Three-wire circuit shall be provided.

Resistance bulb and extension wires shall be protected for the full length of the element, with a stainless steel sheath.

Terminal junction head shall have screwed cover, with chain.

(4) Thermocouples shall be preferred for high temperatures or where mechanical vibrations are suspected to be possible.

Preferred thermocouples and relevant operating ranges are:

Copper-Constant (Type T IEC-60584) -200~+300 °C

Nickel/chromium-Nickel/Aluminum (Type K IEC-60584) 0~+1000 °C

Other features as for resistance thermometers.

(5) Temperature alarm switches, transmitter, indicator shall be equipped with Burn-out feature for element rupture and cold junction compensation for thermocouple type.

(6) Integral temperature transmitter with RTD or TC element is preferred for measurement. The signal to control systems shall be 4-20mA with HART protocol.

(7) Normally, the insert length of the thermowell should be 1/3~1/2 of the process pipe. Considering vibration calculation, the minimum length shall be 50mm inside the pipe wall. Process pipe which is below 4 inch size should be expanded to 4 inch for thermowell installation.

3.3.7 Control Valves

(1) In general, control valves shall be spring diaphragm type Globe, Angle valve, Butterfly valve, V-ball valve, Eccentric Rotary valve and so on.

(2) Control valve shall be equipped with block and by-pass valves and shown on the P&ID. Hand wheels where required by application shall be mounted.

(3) For safety interlock using, cylinder actuators with spring return device, in case of air failure, moves the trim or ball to its fail-safe position.

(4) The control valves operated by safety and interlocking system must be equipped with position limit switches, to indicate valve position at the control room. The switches shall have single pole and double throw (SPDT) contacts.

(5) Body material and rating shall be selected in accordance with process piping specifications. The specification of connection flanges shall be the same standard with pipe standard. The material of body shall not be cast iron.

(6) When the operating temperature exceeds 200℃, suitable packing lubricators with isolating valve, and appropriate bonnet shall be provided. For temperature below 0℃ or above 200℃ extension bonnet shall be provided.

(7) Trim and seat materials shall be normally 316SS stainless steel. Hardened trim shall be used when required by high differential pressure, or other pressure and temperature conditions.

(8) In general, control valve allow leakage to be class IV, for no leakage, class V or VI.

(9) Control valve actuators shall be, in general, spring diaphragm type, and single acting cylinder type or double acting cylinder type actuators for big force required or special services.

(10) Volume tank relevant pneumatic loop shall be provided in order to assure that, on air failure, the valve will be fail-safe", i.e. it will be locked in position or will take the position, either open or closed, as required by the process. The manufacture of the volume tank shall comply with ASME VIII or equal Chinese standard GB150-1998 (2002) (2004). If the volume tank is a pressure vessel, the vendor is responsible for implementing any regulations concerning the design, fabrication or inspection of pressure vessels which are mandatory by government decree in the PRC. Vendors outside the PRC must hold a "Manufacturer Approval" Safety Quality License issued by the Chinese Ministry of Labor.

(11) When the operating temperature below 225℃, packing shall be Teflon seat V-rings, and the graphite packing for applications up to 225℃.

(12) For no vibration application, electric/pneumatic positioner shall be chosen, otherwise, the electric/pneumatic converter and pneumatic positioner must be used.

(13) Three way or four way solenoid valve for interlock must be energized at normally.

(14) Self-regulator shall be used for N2, air, fuel-gas, steam and other assisting fluid which control action is not important.

3.3.8 Battery limit Measurements

(1) B.L. liquid or gas feeds and products shall be provided high accurate mass flowmeters, or high accurate positive displacement flowmeter with temperature and pressure compensation.

(2) B.L. water, steam, gas and utilities will be provided with orifice flow rate measurement device, with temperature and pressure compensation, or other suitable flow instruments.

3.3.9 Analysis Instruments

(1) Continuous analyzers (chromatographic, O2 analyzer, pH analyzer, moisture, etc.) shall be included sampling unit, pre-processing unit, analysis unit, data processing unit with micro-processor, recorder or printer. For data communication with DCS, the interface and communication protocol (Modbus-RTU) shall be considered.

(2) Continuous analyzers, in principle, shall be mounted in the local analyzer house. The analyzer house shall be supplied by manufacture, with power supply, air supply, carry gas, standard gas and explosion devices.

(3) Gas detection system shall be provided to alarm in the control room in case of leakage of explosive and flammable gas and O2 low in the analyzer house.

4. FIELD INSTALLATIONS

4.1 General

4.1.1 All field instruments and control valve locations shall meet the requirements as follows:

(1) Can read the parameters at operating or corridor.

(2) Easy mounted, operated and maintenance.

(3) Easy to approach, and safety.

4.1.2 Except the instruments mounted on piping directly, the instruments located in the field shall be 1200mm above the floor or ground.

4.2 Flow instrument

4.2.1 In principle, the throttle element shall be mounted on horizontal piping, and the demandable length of run (straight pipe) depended on throttle type.

4.2.2 Positive displacement meter shall be equipped with filter; area flowmeter (transmitter) shall be mounted on vertical pipe and the fluid flow from down to up side; mass flowmeter (transmitter) will be mounted on horizontal pipe and the position easy to view and maintenance.

4.3 Level Instrument

4.3.1 In general, level instruments shall be mounted on the vessel (or vertical pipe) with stop valve, flush bottom outlet valve and vent top outlet valve, suit to operate and maintenance.

4.3.2 The level transmitter and level gauge shall have different tapping nozzle.

4.3.3 Pay attention to the size of connection tapping nozzle of device must be the same size and type of level instrument.

4.4 Pressure Instrument

4.4.1 Pressure instrument tap must be avoided static pressure to influence as far as possible, under pulse condition, needle valve and filler shall be used.

4.4.2 Pay attention to the size of connection tapping nozzle of device must be the same size and type of pressure instruments.

4.5 Temperature Instrument

4.5.1 The temperature elements should be mounted on the center of pipe.

4.6 Control Valve

4.6.1 In principle, control valve shall be mounted on horizontal pipe, and easy to operate and maintenance, to provide support if necessary.

4.6.2 In principle, control valve shall be equipped with stop valve and by-pass, drain valve.

4.7 Impulse Line

4.7.1 In principle, the material of impulse line shall be accomplished by 12mm O.D. x1.5mm with **dual** compress type.

4.7.2 The tapping valve (1/2") shall be provided by piping contractor. Drain valve and plug shall be arranged at the lowest point, release valve and plug shall be arranged at highest point.

4.7.3 Horizontal impulse line at measuring element shall have a slope of 1/10 degree or greater.

4.8 Air supply Piping

4.8.1 Signal tubing shall be 6mm O.D. x1.0mm or 12mm O.D. x1.5mm 316SS tube.

4.9 Wiring

4.9.1 Signal cable between the control room and local junction boxes shall be selected the multiple- stranded copper conductor, twist-pair with metallised screening or multi-conductors control cable with pair and overall metallised screening. The section: 1.0 - 1.5mm2

4.9.2 The cable of intrinsic safe from unintrinsic safe must be separated. The color of the intrinsic cable sheath must be sky blue. The cable of different voltage and signal level must be separated, and the signal transfer in multi-conductors shall be the same level.

4.9.3 For thermocouple using, extension wire shall be used, the section: 1.0 - 1.5mm2.

4.9.4 In principle, the cable shall be arranged in the cable tray with cover, to make the cable tray a figurehead, the area of the cable tray will be the 3 times of the total area of the cables. The conduit shall be used between the cable tray and local junction boxes or between the local boxes and local instruments.

4.10 Steam tracing piping

4.10.1 In principle, the steam tracing pipe shall be used Φ14 x 2.0mm stainless steel tube. The steam tracing boxes for instrument shall be stainless steel and supplied by vendor.

4.10.2 Each steam tracing condensate pipe shall be equipped with stop valve and trap.

4.11 The impulse line, air pipe, conduit pipe, cable tray, steam tracing pipe, etc. shall be not used process device or pipe to support.

4.12 Instruments Installed in Hazardous Area

4.12.1 All electronic instruments installed in hazardous area shall be of explosion-proof level suitable to the area explosion-proof class requirement (explosion proof enclosure or intrinsic safety). The preferred explosion proof class of this project is Exia IICT4.

4.12.2 The installation work of electric explosion-proof instruments shall be carried out in compliance with the concerned national standards.

4.13 Jam-proof

4.13.1 In case of large viscosity media in the process pipes, the jam-proof means shall be used with diaphragm seal and purge.

4.13.2 The element which contact with media shall be in accordance with the operation condition.

5.0 INSTALLATION DESIGN

5.1 Installation Standards

Instruments should be installed generally in accordance with API RP 550.

5.2 Instrument Piping and Cabling

The following particular aspects are drawn to the Vendor's attention.

Instrument Cabling shall be in accordance with the Vendor's standard practice for the site conditions.

Cables supplied by Vendor should be provided with suitable glands.

Wiring shall be identified with slide on plastic ferrules at instrument and intermediate terminations. "Upside down" and "Back to front" ferruling is not acceptable.

Thermocouple extension wiring shall be of the specified type to conform to thermocouple type and accuracy and color coded to ISA and ANSI standard.

Unused entries of junction boxes shall be fitted with correct stoppers.

No more than one wire per terminal is permitted. Where terminals are to be interconnected within a junction box standard links are to be used to avoid having more than one wire per terminal.

All stranded wires shall be fitted with pin crimps.

Terminals shall be provided for cable screens and for terminating Purchaser's spare conductors (when applicable).

All spare cores are to be terminated.

15% spare terminals shall be provided.

5.3 Supports

All instruments, tubing, piping, wiring and cables shall be adequately supported.

5.4 Environmental Protection

Heating and Insulation:

The Vendor shall be responsible for defining the extent of heating and insulation requirements for instrument piping and equipment to ensure satisfactory operation in the environment specified above.

Installation and provision of heating and insulation within the package shall be provided by the Vendor.
Housings shall be provided where necessary to protect Instrument equipment.

Electrical Specification for Package Units

REV.	0	1	2	3	4	5	6	7	8
DATE									
BY									
CHK.									
APP.									

Table of Contents

1 Scope

This specification covers the minimum requirements for design, material, manufacturing and inspection of the electrical installation parts of package units. It is applicable for general design, basic design and detailed design for Fujian Gulei Refining and Chemical Integrated Project.

2 Vendor's responsibilities

2.1 Any conflict between the requirements of this specification and the related codes, standards, data sheets, requisition, etc., shall be referred to the buyer.

2.2 Assumptions to cover lack of information are not allowed. Vendor is obliged to obtain reliable information from buyer or other official sources.

2.3 Vendor shall submit a list of all appliances, special tools and accessories that are necessary or incidental to the proper installation, operation and maintenance of the motors, even though these terms are not included on the specification or data sheets.

2.4 Vendor shall submit a list of all electrical power consumers that require external power supplies. The list shall indicate maximum and normal power consumption figures and the recommended upstream fuse or circuit breaker size.

2.5 Vendor shall list and fully describe all deviations from this specification, datasheets, drawings, etc., and the related codes.

3 Normative Reference

The clauses in the following documents become the clauses of this specification through this citation. Any subsequent order of changes or modifications to those documents cited here with dates shall not be applicable to this specification, while the latest versions of those documents cited here without dates or modification number (version) shall be applicable to this specification.

3.1 Electrical project engineering specifications

121900EE–SP04-0001	Specification for Low Voltage Induction Motors
121900EE–SP03-0001	Specification for Medium Voltage Induction Motors

3.2 National Standards

GB 3836.1-4-2021	Explosive atmospheres — Parts1-4
GB 3836.5-2021	Explosive atmospheres – Part 5: Equipment protection by pressurized enclosure "p"
GB 3836.6-7-2017	Electrical apparatus for explosive gas atmospheres – Parts 6-7
GB 3836.8-9-2021	Explosive atmospheres—Parts: 8-9
GB/T 4026-2019	Basic and safety principles for man-machine interface，marking and identification. Identification of equipment terminals，conductor terminations and con
GB 4208-2017	Degrees of protection provided by enclosure(IP code)

GB 5023.1-7-2008	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V – Part 1-7
GB 5226.1-2019	Electrical safety of machinery - Electrical equipment of machines - Part 1: General requirements
GB 5226.3-2005	Safety of machinery-Electrical equipment of machines-Part 11:Requirements for HV equipment for voltages above 1000Va.c.or 1500Vd.c.and not exceeding 36kV
GB 7251.1-2013	Low-voltage switchgear and controlgear assemblies—Part 1: General rules
GB 7251.12-2013	Low-voltage switchgear and controlgear assemblies—Part 2: Power switchgear and controlgear assemblies
GB/T 12666.1-3-2008	Test method on electric wires or cables under fire conditions - Parts 1-3
GB 14048	Low-voltage switchgear and controlgear All parts

3.3 International Standards

IEC 60073-2002	Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators
IEC 60079	Electrical apparatus for explosive gas atmospheres
IEC 60204-1-2016	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 60204-11-2018	Safety of machinery-Electrical equipment of machines-Part 11:Requirements for HV equipment for voltages above 1000Va.c.or 1500Vd.c.and not exceeding 36kV
IEC 60227	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V
IEC 60331	Tests for electric cables under fire conditions
IEC 60332	Tests on electric cables under fire conditions
IEC 60364	Electrical installations of buildings
IEC 61439	Low-voltage switchgear and controlgear assemblies
IEC 60445-2021	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors
IEC 60529-2019	Degrees of protection provided by enclosures (IP Code)
IEC/TR 60668-1980	Dimensions of panel areas and cut-outs for panel and rack-mounted industrial-process measurement and control instruments
IEC 60947	Low-voltage switchgear and controlgear
IEC 61000	Electromagnetic compatibility (EMC)
IEC 61082	Preparation of documents used in electrotechnology

4 Design and structure

The scope of the electrical installation belonging to the package unit will be defined by buyer.

4.1 System Voltage Levels

4.1.1 The electrical supply systems will basically meet the requirements given in IEC 60204-1, clause

4.3, however, the frequency variation will be 50Hz ± 0.5 Hz, the voltage variation will be ±10 % of nominal voltage.

4.1.2 The applicable system voltages and their range of application are indicated in table 1. For panels it is preferred to have one (1) power source, i.e. the control power to be derived from this source.

Table 1

System	Rated Voltage (V)	Frequency (Hz)	Wires	Neutral Earthing method	Description
AC	10,000	50	3	HOLD	Motor ≥185 kW
	380	50	3	Solid earthed TN-S	0.2 kW ≤ motor < 185 kW
	220	50	2	TN-S	Motor < 0.2 kW
	380/220	50	4	TN-S	Lighting, small power and UPS
	220	50	2	TN-S	Lighting, small power, control circuits and contactor coils
DC	220		2	Not earthed	Control circuits and trip coils for 10 kV system

At rated value, the utilization voltage (equipment terminal voltage) will be approximately 5 % lower than the rated voltage.

4.1.3 The system design shall be such that the system stability is maintained when the supply voltage and frequency remain within the limits given in paragraph 4.1.1.

4.1.4 When the complete power distribution system design is included in the scope the following criteria apply:

- The motor terminal voltage shall not drop below 85% of the nominal voltage during starting and 95% during normal operation.
- Voltage drop in lighting and small power circuits shall not exceed 2%.
- To allow verification of the above criteria the min. short circuit capacity of power system will be specified.

4.1.5 In TN-S system the neutral shall be insulated and separated with the PE conductor.

4.2 Degree of protection

4.2.1 The enclosure protection shall be in accordance with IEC 60529 as follows:

- Outdoor: IP 55
- Indoor: IP 44
- Panels with open doors (live parts shielded) : IP 4X (IP 20)

Floor mounted panels shall be equipped with gland plates and the proper cable glands which maintain the specified degree of protection.

In addition the installation, including the enclosures shall be suitable for the environmental conditions specified on the site and utility data sheet.

4.2.2 The explosion protection type of the electrical equipment and materials shall be in accordance with the area classification and conform IEC 60079-14, clause 12. When certain materials require to be of a particular type of protection. This will be specified in the requisition.

4.2.3 Zone classification, gas group and temperature class shall comply with the requisition to which this specification belongs. All materials installed inside a hazardous area shall have a certificate of conformity or a declaration of compliance issued by the recognized national or international authority. For each individual intrinsic safe circuit the permissible parameters of wiring external to the package unit wiring shall be specified (refer to IEC 60079-11).

4.3 General requirements

4.3.1 The package unit electrical installation shall in general follow the requirements of IEC 60204.

4.3.2 Materials that are highly persistent or toxic to the environment or considered international potential carcinogens shall not be used.

4.3.3 Distribution panels for lighting and small power systems are exclude from the scope. These installations shall be wired to connection boxes at the edge of the package units, to where buyer will bring his feeder cables. The maximum loading figures per circuit, which will be specified in the requisition, shall be taken into account.

4.4 Panels and boxes

4.4.1 The overall height of floor mounted panels shall not exceed 2300mm.

4.4.2 Walk-in type enclosures (panels), which will be installed inside a hazardous area shall be pressurize in accordance with IEC 60079-2.

4.4.3 When a panel comprises more than one (1) circuit, the diversity factor shall comply with IEC 61439-2, table 101.

4.4.4 Feeder cables to the package unit will be sized by buyer based on the power consumption figures given by vendor. Terminals and /or bus bars for the connection of external cabling shall

be suitable to connect cables as specified in the requisition. If not specified terminal sizes shall be in accordance with IEC 60439.

4.4.5 Cable access shall be from the bottom or from the sides. Cable glands shall be metallic for metallic enclosures and plastic for plastic enclosures. However, for mechanical stress relief, cables with large diameters may require installation of metallic cable glands.

4.4.6 Panels shall be equipped with an earth bar over the full width of the cable connection compartments. The armoring of cables and/or the earthing conductor shall be connected to this bar.

4.4.7 Instrumentation and electrical control and signaling devices may be contained into one (1) panel with mechanical separations.

4.4.8 Electrical control panels shall only comprise electrical components - not pressure lines, etc.

4.4.9 Space heaters shall be provided in case condensation is expected.

4.4.10 Internal wiring shall be bundled or installed in plastic ducts.

4.4.11 Panel Mounted components

- Each distribution panel shall have a supply disconnection device in accordance with IEC 60204-1, clause 5.3. When a neutral is required it shall be interrupted as well by this device.
- Signaling and control devices for outgoing circuits shall be flush mounted.
- Color coding of signal lamps and push buttons shall be in accordance with IEC 60073.
- Control circuits shall be separately protected against short circuit. Small power branch circuits shall have earth fault protection.
- When circuit breakers are used special attention shall be paid to their breaking capacity.
- Thermal overload devices shall have a manual reset.
- Signal loops shall be fail safe. Protection circuits shall operate according to the operating current principle.
- Vendor shall ensure that protective devices in his system are selective with the upstream protections.
- Spare I/O points, relays and terminal block for power/control panels shall be provided with at least 15% to total number of each item required.

4.5 Electrical motor

4.5.1 Electric motors shall be in accordance with the technical specifications for low voltage induction motors and medium voltage induction motors or other selected type of motors. Motors shall be supplied together with the driven equipment whereby the supplier of the driven equipment will

responsible for compliance with the project requirements.

4.5.2 In case motors receive power from a motor control center which is excluded from the scope, the size (type) of motor overload protection will be specified in the requisition.

4.6 Wiring installation

4.6.1 Conductor identification inside panels shall be in accordance with IEC 60204.

4.6.2 All interconnecting cabling shall as a minimum comply with IEC 60227 and shall be non-flame propagating as per relevant part (depending upon method of laying) of IEC 60332.

4.6.3 The minimum cross section of interconnecting cabling shall be as follows:

- Power cable: 4 mm^2
- Control cable: 2.5 mm^2

4.6.4 Cables shall be sized in accordance with IEC 60364-4.

4.6.5 The earthing conductor size shall be in accordance with IEC 60204-1, table 1.

4.6.6 Flexible cables shall only be used for flexible connections.

4.6.7 Aboveground cables shall be mechanically protected either by open conduits or by cable trays with covers.

4.6.8 Where practical cables shall be grouped in cable trays. Single cables may be installed in open conduit.

4.6.9 Cable trays shall be Aluminum alloy or galvanized steel. The support distance of horizontal installed cable trays shall be less than 6 m. The cable tray's make and type shall be subject to approval by buyer.

4.6.10 Cables running on cable trays shall be securely fastened in a single layer with UV resistant tie wraps.

4.6.11 The clearance between hot surfaces and cables shall be minimum 500 mm. It can be 250 mm when the cable is protected by steel conduit or by partitions.

4.7 Earthing installation

4.7.1 The earthing installation on the package unit shall include safety earthing, static earthing, lightning protection and instrument earthing systems as required in accordance with the relevant IEC standards and the area classification requirements.

4.7.2 The earthing installation shall meet the requirements of the relevant IEC standards.

4.7.3 The earthing grid on the package unit shall, when required, consist of 70 mm^2 yellow/green insulated PVC stranded copper wire.

4.7.4 The package unit shall be connected to the plants earthing grid at least two (2) points diagonally opposite of each other.

4.7.5 The minimum conductor size for earthing or bonding shall be 16 mm^2.

4.7.6 Inside hazardous areas all in-line instruments and valves that are clamped between nonconductive packings shall be bonded with a conductor of 16 mm^2. For this purpose adequate lugs shall be provide on both the instrument (valve) and the pipeline.

4.7.7 Lightning protection shall, when required, follow the requirements of IEC 61024-1.

4.8 Lighting installation

4.8.1 In general fluorescent type or LED type lighting fixtures shall be applied, either pole or ceiling mounted. On platforms pole type shall be used, fixed to steelwork.

4.8.2 The lighting system shall be designed to provide a sustained and uniform illumination level of not less than the values given in table 2 taking into consideration a fouling factor of 0.6.

Table 2

Location	Average Lux.	On Working Surface Lux.
Control panel*	N.A.	300
Platform	50	N.A.
Pump area	50	N.A.
Ladder	50	N.A.
Plant area	40	N.A.

Note: * Measure at 1 m above floor level

4.8.3 Lighting fixtures in operating area shall be mounted at least 2.5 meters above floor level. Platform lighting shall be installed such that operators are not blinded nor are bordered by their own shades.

4.8.4 Adjacent fixtures shall be connected to different feeder circuits.

4.8.5 Emergency lighting shall be provided on escape routes and in vital operator areas. The lighting level on the escape routes shall under emergency conditions be at least 30 lux. Emergency lighting fixtures shall form part of the normal lighting installation and shall have built-in nickel cadmium batteries with a back-up time of 30 minutes (if required) .

4.8.6 The maximum allowable voltage drop in the branch circuits shall be 2%, i.e. from the connection box up till the most remote fixture on the package.

4.9 Maintenance socket outlets

4.9.1 The requirement for maintenance power on the package will be specified in the requisition.

4.9.2 Socket outlets, including plugs shall be conform IEC and in accordance with the area classification requirements as follows:

- 3 phase, 63 A, 5-pin (4-pole plus earth).
- 1 phase, 16 A, 3-pin (2-pole and earth).

4.9.3 Receptacles will be connected to local installed distribution panels. For maximum voltage drop see paragraph 4.8.6.

4.10 Electric tracing

4.10.1 Heat loss calculations shall be based on the minimum design ambient temperature.

4.10.2 Detailed requirements for design, delivery, installation and test refer to specification for electrical tracing.

5 Inspection and commissioning

5.1 All equipment and material shall be tested and/or inspected in accordance with the applicable project engineering specification prior to installation on the package unit.

5.2 The package unit shall be tested at the manufacturer's workshop generally in accordance with IEC 60204-1.

5.3 After installation completion field tests shall be performed in accordance with the approved commissioning procedures.

5.4 The intention for witnessing the tests and eventual supplementary inspection items will be subject to the acceptance by the buyer.

6 Corrosion protection

6.1 All metal parts belonging to the electrical installation shall be protected against corrosion in accordance with the manufacturer's standard corrosion protection system suitable for the environmental conditions specified on the site and utility data sheet.

6.2 Color of the top coat of panels shall be vendor's standard unless a specific color is specified in the requisition.

7 Marking

7.1 Marking of wiring

7.1.1 Wiring shall be marked in accordance with IEC 60446 applying the dependent remote end marking method.

7.2 Marking of equipment terminals

7.3 Identification of equipment terminals

7.3.1 Equipment terminals shall be identified in accordance with IEC 60445.

8 Rating plates

8.1 Rating plates shall comprise all information as required by the relevant standards, and shall be attached to the equipment on a well visible place.

8.2 Plates and labels shall be of stainless steel and shall be fixed in such a way that they are easy to replace.

8.3 Rating plates for apparatus that will be installed outdoor and motor rating plates shall be of stainless steel and shall be fixed with corrosion resistant screws or rivets.

8.4 Additional plates shall be provided indicating the equipment number and/or description.

8.5 Sizes and letter heights of nameplates and equipment number plate will be specified in detail in the inquiry documents.

9 Vendor's documentation

9.1 Vendor shall, as a minimum, provide all documentation as required by buyer.

9.2 Each panel shall be shipped with an as-built set of schematics and installation, operating and maintenance instructions.

Specification for Low Voltage Induction Motors

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Table of Contents

1 Scope

This specification covers the minimum requirements for low voltage induction motors (<185 kW). It is applicable for general design, basic design and detailed design for Shenhua PP Project.

2 Vender's responsibilities

2.1 Any conflict between the requirements of this specification and the related codes, standards, data sheets, requisition, etc., shall be referred to the buyer.

2.2 Assumptions to cover lack of information are not allowed. Vendor is obliged to obtain reliable information from buyer or other official sources.

2.3 Vendor shall submit a list of all appliances, special tools and accessories that are necessary or incidental to the proper installation, operation and maintenance of the motors, even though these terms are not included on the specification or data sheets.

2.4 Vendor shall list and fully describe all deviations from this specification, datasheets, drawings, etc., and the related codes.

3 Normative Reference

The following normative documents contain provisions which, through reference in this text, constitute provisions of this specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, for undated references, the latest edition of the normative document referred to applies.

3.1 National standards

GB/T 755-2019	Rotating electrical machines – Rating and performance
GB/T 997-2022	Classification of types of construction，mounting arrangements and terminal box position (IM Code) for rotating electrical machines
GB/T 1032-2012	Test procedure for three-phase induction motors
GB/T 1971-2021	Rotating electrical machines. Terminal markings and direction of rotation
GB/T 1993-1993	Cooling methods for rotating electrical machines
GB/T 3836.1-4-2021	Explosive atmospheres – Part 1-4
GB 3836.5-2021	Explosive atmospheres – Part 5: Equipment protection by pressurized enclosure "p"
GB 3836.6-7-2017	Electrical apparatus for explosive gas atmospheres – Part 6-7
GB 3836.8-2021	Explosive atmospheres – Part 8: Equipment protection by type of protection “n”
GB 4208-2017	Degrees of protection provided by enclosures (IP code)
GB 4772.1-3-1999	Dimensions and output series for rotating electrical machines – Parts 1-3
GB/T 4942-2021	Degrees of protection provided by the integral design of rotating electrical machines (IP code). Classification

GB 10068-2020	Mechanical vibration of certain machines with shaft heights 56 mm and higher. Measurement，evaluation and limits of vibration severity
GB/T 10069.1-2006	Measurement of airborne noise emitted by rotating electrical machinery and the noise limits – Engineering method for the measurement of airborne noise
GB/T 10069.3-2008	Measurement of airborne noise emitted by rotating electrical machinery and the noise limits – Noise limits
GB/T 11021-2014	Electrical insulation – Thermal evaluation and designation
GB/T 21210-2016	Starting performance of single-speed three-phase cage induction motors
GB 18613-2020	Minimum allowable values of energy efficiency and values of efficiency grades for motors

3.2 Industrial standard

JB/T 7565.1-2011	Technical conditions for flame proof 3-phase induction motor Part 1 YB3 series flame proof 3-phase induction motor
JB/T 9595.1-2015	Technical conditions for increased safety 3-phase induction motor Part 1 YA2 series increased safety 3-phase induction motor

3.3 International standards

IEC 60034-1-2022	Rotating electrical machines - Part 1: Rating and performance
IEC 60034-5-2020	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification
IEC 60034-7-2020	Rotating electrical machines - Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM Code)
IEC 60034-8-2007	Rotating electrical machines - Terminal markings and direction of rotation
IEC 60034-9-2021	Rotating electrical machines - Part 9: Noise limits
IEC 60034-12-2016	Rotating electrical machines - Part 12: Starting performance of single-speed three-phase cage induction motors
IEC 60034-14-2018	Rotating electrical machines - Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity
IEC 60034-15-2009	Rotating electrical machines. Part 15:Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines
IEC 60034-30-1:2014	Rotating electrical machines –Part 30-1: Efficiency classes of line operated AC motors (IE code)
IEC 60072-1-2022	Dimensions and output series for rotating electrical machines - Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080
IEC 60079	Electrical apparatus for explosive gas atmospheres
IEC 60085-2007	Electrical insulation. Thermal evaluation and designation
ISO 281 AMD 2-2007	Rolling bearings. Dynamic load ratings and rating life

The above standards are not all of the standards, but main standards.

4 Design

4.1 Service conditions

The motor shall be suitable to operate under service conditions as specified on the site and utility data sheet.

4.2 Rating and performance

4.2.1 The output rating and equipment characteristics shall be as specified on the motor data sheets.

4.2.2 Motor shall be suitable for continuous running duty, type S1 in accordance with IEC 60034-1.

4.2.3 Starting torque and locked rotor apparent power shall be in accordance with GB/T 21210 IDT IEC 60034-12.

- Motor driven equipment with a torque curve varying as the square of the speed shall, as a minimum, have starting characteristics complying with design " N " as per IEC 60034-12.
- Motor-driven equipment with a constant torque shall, as a minimum, have starting characteristics complying with design " H " as per IEC 60034-12.

4.2.4 Motors shall be suitable for three (3) consecutive starts from cold and two (2) consecutive starts from hot at 100% of the nominal voltage with the actual external inertia connected.

4.2.5 Torque characteristics shall be such, that motors are able to accelerate (reaccelerate) the load, even at a motor terminal voltage of 75% (70%) of the nominal voltage. Soft startup principle is to be considered.

4.2.6 Vibration severity shall not exceed to values given in table 1 of IEC 60034-14. Balancing and measurement shall be done with a half key fitted in the key way.

4.2.7 The material of motor rotors would be copper or copper alloy.

4.2.8 Motor energy efficiency shall be better than GB18613 grade 2, or Code IE3 of IEC 60034-30-1.

4.3 Noise requirements

4.3.1 The maximum sound pressure level as measured at 1 meter from the equipment surface shall not exceed 82 dB(A).

4.3.2 In general, motors shall comply with the noise limits laid down in IEC 60034-9. However, the sound pressure level specified in paragraph 4.3.1 shall never be exceeded. When necessary, low noise designs shall be supplied.

4.3.3 When the noise limit as specified in paragraph 4.3.1 can not be met by using the low noise design, vendor shall quote a noise limiting cover / enclosure as an option for his standard noise limiting fan.

4.4 Construction

4.4.1 Motors shall be totally enclosed fan-cooled, in accordance with the relevant GB standards, IEC standards and publications.

4.4.2 The minimum degree of protection for motor and terminal box shall be IP54 and IP55 respectively, conform GB/T 4942.1 and IEC 60034-5.Vertical motors (IM-V1) shall be equipped with a rain cap over the fan cover. Motors specified for vertical installation with their shaft extension upwards (IM-V6 as per IEC 60034-7), shall have an end shield design which prevents ingress of water into the motor and /or bearing housing via the shaft or grease relief drains.

4.4.3 Motors for use in zone 1 hazardous area shall be flameproof in accordance with GB 3836 and IEC 60079.

4.4.4 Motors for use in zone 2 hazardous area shall be of the increased safety or flameproof type, in accordance with GB 3836 and IEC 60079.

4.4.5 Equipment specified for use in hazardous areas shall have a certificate of conformity according to the type of protection issued by a recognized national or international testing authority.

4.4.6 Motors shall be suitable for rotation in both directions however, when there is a noise limitation, a unidirectional fan shall be quoted.

4.4.7 Motor insulation shall be minimum class F in accordance with JB/T 7565 and IEC 60085. Temperature rise shall be limited class B.

4.4.8 Motors（≥110kW） shall be equipped with space heaters (anti-condensation), unless otherwise specified on the motor data sheet. All space heaters, if provided, shall be 220V, single phase and have a separated terminal box.

4.5 Terminal box

4.5.1 The terminal box shall either be on top of the motor or the right hand side (RHS preferred), facing the driving end of the motor. The terminal box shall be able to rotate 90 and 180 degrees.

4.5.2 The terminal box shall satisfy the power cable specifications supplied by the buyer.

4.5.3 The terminals and the cable gland or pot head shall be sized for the supply cable specified on the motor data sheet.

4.5.4 Weatherproof blanking off plugs shall be fitted to all unused entries to maintain the specified degree of protection of the terminal box.

4.5.5 The terminal box shall be provided with suitable sizes bushings.

4.5.6 The terminal box of explosion proof motor shall be provided with an earthing bolt inside and a earthing mark near it. This mark shall be permanent.

4.6 Bearings and lubrication

4.6.1 Motors shall have ball or roller bearings. The bearings shall be abrasion proof. The L10 basic rating life of ball and roller bearings shall be in excess of 100,000 hours (for horizontally installed motors), 25,000 hours (for vertically installed motors) and 50,000 hours (for belt connected motors). They can run continuously during this period. The structure of the bearing housing shall be designed for re-lubrication without stopping the motor. All motor bearings shall have grease filling and discharge devices.

4.6.2 Grease have priority of bearings lubrication. Oil lubricating can be taken while bearing life requirements cannot be fulfilled or grease-filling circle is too short.

4.6.3 Motors above 75KW shall have intelligent automatic devices of grease filling.

4.6.4 Bearings shall share lubrication system with the driven device when need forced lubrication. Motor manufactory shall provide the pressure, flow, and temperature requirement of lube.

4.7 Miscellaneous

4.7.1 Motors shall have an external earthing connection on the frame.

4.7.2 Motors weighing 25 kg and above shall have lifting eye bolts.

4.7.3 Motors shall be provided with drain holes at locations where water may collect, but the drain holes shall be suitable for the installation location.

4.7.4 The direction of rotation shall be clearly indicated by means of an arrow on the non-driving end. A painted arrow is not sufficient.

4.7.5 The material for the cooling fan of a motor shall satisfy the special environment requirements of petrochemical complex and coastal area, having good features of anti-corrosion and anti-aging to insure that it has the same lifetime as the motor.

5 Inspection and testing

5.1 In general, all motors shall be routine tested in accordance with the applicable, GB 1032, JB/T 7565 and IEC 60034-1 sections.

5.2 If not otherwise stated in the requisition the IEC 60034-1 schedule of tolerances will be applied on performance characteristics.

5.3 Testing of motors > 75 kW will be witnessed by buyer.

6 Corrosion protection

6.1 All motor parts shall be adequately protected against corrosion, based upon the environmental conditions specified on the site and utility data sheet.

6.2 Surface preparation and painting shall be vendor's standard for the environmental conditions specified on the site and utility data sheet. Vendor shall submit in his quotation his standard surface preparation and painting system for buyer's review.

6.3 Color of top coat shall be Vendor's standard unless a specific color is specified on the motor data sheet.

7 Marking

7.1 Marking shall be on stainless steel rating plates securely fastened to a non-removable part of the frame on a well visible and accessible place.

7.2 The rating plate shall show the appropriate information as required per GB 755, IEC 60034-1. In addition following information shall be provided on the rating plate:

- Make type and size of bearings
- Type and quantity of lubricant

7.3 Motors suitable for use in hazardous areas shall bear the markings as required per JB/T 7565, IEC 60079-0.

8 Vender's documentation

8.1 Vendor shall, as a minimum, provide all documentation as required by buyer, including the following:

- Certified dimension sheets for each motor or group identical motors. Sheets shall be identified

the equipment tag number and shall include weight of motor, full load and locked rotor current, starting time, space heater data and other pertinent information

- Certified motor data sheets
- Wiring diagrams (for multi-speed or special motors)