

目录

1. 适用范围	General	4
2. 设计基础	Design Basis	4
2.1	缩略语 ABBREVIATION	4
2.2	环境要求 ENVIRONMENTAL REQUIREMENTS	5
2.3	测量单位 MEASURING UNITS	6
2.4	标准规范 STANDARD AND CODE	7
2.5	动力供应 POWER SUPPLY	7
2.7	仪表防护 INSTRUMENT PROTECTION	9
2.8	仪表防爆 INSTRUMENT EXPLOSION PROOF	9
2.9	仪表信号 INSTRUMENT SIGNAL	11
2.10	仪表接地及防雷 INSTRUMENT GROUNDING AND LIGHTENING PROTECTION	12
3. 控制系统设计原则	Design Principle of Control System	13
3.1	控制水平 LEVEL OF AUTOMATIC CONTROL	13
3.2	网络安全 NETWORK SAFETY	16
3.3	控制系统 CONTROL SYSTEM	17
4. 仪表盘柜设计原则	Design Principle of Instrument Cabinets and Panels	21
4.1	机柜要求 CABINETS REQUIREMENTS	22
4.2	中心控制室安装的机柜 CABINETS INSTALLED IN CCR	23
4.3	现场机柜室安装的机柜 CABINETS INSTALLED IN FAR	24
4.4	现场安装的仪表盘柜 FIELD MOUNTED INSTRUMENT PANELS	24
5. 现场仪表设计原则	Design Principle of Field Instrument	26
5.1	一般原则 GENERAL PRINCIPLE	26
5.2	流量仪表 FLOW INSTRUMENT	29
5.3	物位仪表 LEVEL INSTRUMENT	33
5.4	压力仪表 PRESSURE INSTRUMENT	36
5.5	温度仪表 TEMPERATURE INSTRUMENT	38
5.6	调节阀 CONTROL VALVE	42
5.7	特殊材质选择要求 SPECIAL MATERIAL SELECTION REQUIREMENT	47

6. 现场安装及安装材料	Instrument Installation and Bulk Material	48
6.1 概述 GENERAL		48
6.2 流量仪表 FLOW INSTRUMENT		50
6.3 液位仪表 LEVEL INSTRUMENT		50
6.4 压力仪表 PRESSURE INSTRUMENT		50
6.5 温度仪表 TEMPERATURE INSTRUMENT		50
6.6 调节阀 CONTROL VALVE		50
6.7 导压配管 PRESSURE HOOKUP PIPING AND TUBING		51
6.8 空气配管 INSTRUMENT AIR PIPING		51
6.9 仪表配线 INSTRUMENT CABLING		52
6.10 伴热配管 HEAT TRACING		58
6.11 仪表与设备/配管专业接口 INSTRUMENT CONNECTIONS TO VESSEL OR PIPING		58
7. 卖方设计及供货范围	The Seller's Scope of Supply and Design	61
7.1 现场仪表设备及其安装材料 FIELD INSTRUMENT AND BULK MATERIAL		61
AND PROVIDE THE TOTAL INSTRUMENT AIR CONSUMPTION.		62
7.2 控制室/机柜室内仪表及控制系统 INSTRUMENT AND CONTROL SYSTEM INSIDE CCR/FAR62		
7.3 测试与验收 TESTING AND ACCEPTANCE		63
8. 买方设计及供货范围	The Buyer's Scope of Supply and Design	64
9. 文件交付	Document Delivery	65
9.1 卖方交付文件 DOCUMENTS DELIVERED BY SELLER		65
10. 项目采用的标准、规范	Project Applicable Standard and Code	69
10.1 中国标准 CHINESE STANDARD AND CODE		69
10.2 国外标准 INTERNATIONAL STANDARD AND CODE		74

附录一： P&ID 仪表及控制系统图例符号、缩写和通用说明

Annex 1: P&ID instrument and control system symbols, abbreviation and general notes

附录二： 包设备仪表汇总表模板

Annex 2: The Demo of Instrument List for PACKAGE Unit.

附录三： CCS&MMS 系统配置图（供参考）

Annex 3: CCS & MMS configuration diagram for Reference

1. 适用范围 General

本设计规定规定了九江石化分公司 300 万吨/年 PTA 项目设备包的仪表及控制系统的设计、采购、建造、测试和开车的最低技术要求。

This document defines the minimum technical requirements for design, purchase, construction, testing and startup of Equipment Package Instrument and Control system for Jiujiang Petrochemical.3000 KTA PTA Project.

卖方所提供仪表及控制系统应满足本规定要求。如出现偏差, 卖方应提出书面说明, 由买方确认。

The Seller shall fully meet the requirements of this document. In case of any deviation, the Seller shall provide explanation and other viable options in writing for Buyer's approval.

如果本设计规定中文和英文表述存在不一致, 以中文表述为准。

If inconsistencies exist between English and Chinese item statement, the Chinese statement takes precedence.

2. 设计基础 Design Basis

2.1 缩略语 Abbreviation

缩略语	英文描述	中文描述
CCR	Central Control Room	中心控制室
FAR	Field Auxiliary Room	现场机柜室
DCS	Distributed Control System	分散控制系统
SIS	Safety Instrumented System	安全仪表系统
CCS	Compressor Control System	压缩机控制系统
PLC	Programmable Logic Controller	可程序控制器
IDM	Intelligent Device Management	智能设备管理系统
MMS	Machine Monitoring System	机组监测系统
UPS	Uninterruptible Power Supply	不间断电源
GPS	General Power Supply	一般电源

缩略语	英文描述	中文描述
EPCS	Equipment Package Control System	设备包控制系统
MCC	Motor Control Center	电机控制中心

2.2 环境要求 Environmental Requirements

本项目环境设计条件如下:

The project environmental requirements are as follows:

2.2.1 环境温度 Ambient temperature

夏季极端最高气温 (2003 年 7 月 31 日): 40.9℃

冬季极端最低气温 (1969 年 2 月 6 日): -9.7℃

全年平均温度 17℃ (20 年) 17.85℃ (10 年)

历年最热月平均温度 (7 月): 29.7℃

历年最冷月平均温度 (1 月): 5.0℃

夏季月平均温度 (6、7、8 月): 28.2℃

冬季月平均温度 (12、1、2 月): 6.4℃

最低环境设计温度 -10℃

年连续 5 天最冷日平均气温: -3.1℃

年连续 5 天最冷日最低气温: -9.7℃

月平均最低气温的最低值 (1995-2024 年): 0℃ (2011 年 1 月)

Summer Extreme Maximum Temperature (July 31, 2003): 40.9℃

Winter Extreme Minimum Temperature (February 6, 1969): -9.7℃

Annual Average Temperature: 17℃ (20-year average) 17.85℃ (10-year average)

Hottest monthly average temperature (July): 29.7℃

Coldest monthly average temperature (January): 5.0℃

Summer monthly average temperature (June, July, August): 28.2℃

Winter monthly average temperature (December, January, February): 6.4℃

Minimum Ambient Design Temperature -10℃

Coldest 5-Day Consecutive Average Daily Temperature: -3.1℃

Coldest 5-Day Consecutive Minimum Daily Temperature: -9.7°C

Lowest Monthly Average Minimum Temperature (1995-2024): 0°C (January 2011)

2.2.2 相对湿度 Relative humidity

年平均相对湿度: 74%

最热月平均相对湿度: 74%

最冷月平均相对湿度: 75%

月平均最高相对湿度: 78% (6 月)

月平均最高相对湿度: 71% (12 月)

Annual mean relative humidity 74%

Average relative humidity of the hottest month: 74%

Average relative humidity of the coldest month: 75%

Monthly average maximum relative humidity: 78% (June)

Monthly average maximum relative humidity: 71% (December)

2.2.3 大气压力 Atmospheric pressure

年平均气压: 1010.2hPa

Annual mean atmospheric pressure 1010.2hPa

2.2.4 地震烈度 Earthquake Intensity

地震设防烈度: VI度

Earthquake Intensity: VI

2.3 测量单位 Measuring Units

按 S. I. 制国家计量局颁布的计量标准执行。

The project measuring units shall be International System of Units per Chinese National Bureau of Metrology

流量 flow:

蒸汽 Steam kg / h、t / h

液体 Liquid kg / h、t / h

气体 Gas	$\text{Nm}^3 / \text{h} @ 0^\circ\text{C}, 1013.25\text{hpa}$
压力 Pressure:	Pa、kPa、MPa、bar (专利商要求单位 Lisensor's required unit)
液位 Level:	mm、%
密度 Density:	kg / m^3 、 $\text{kg} / \text{Nm}^3 @ 0^\circ\text{C}, 1013.25\text{hpa}$
温度 Temperature:	$^\circ\text{C}$
动力黏度 Kinetic viscosity:	$\text{mPa} \cdot \text{s} (\text{cP})$
运动黏度 Kinematic viscosity:	$\text{mm}^2 / \text{s} (\text{st})$
成份分析 Concentration:	ppm、% (wt、vol)、 mg/m^3 、ppb
酸碱度 PH value:	pH
电导率 Conductivity:	$\mu\text{s} / \text{cm}$
转速 Rotation speed:	r.p.m
重量 weight:	kg、t

2.4 标准规范 Standard and Code

参见第 10 部分：项目采用的标准、规范。

Refer to section 10: Project Applicable Standard and Code

2.5 动力供应 Power Supply

2.5.1 仪表电源 Instrument power supply

仪表电源采用交流 220V AC 及直流 24V DC 两种。

Instrument Power is of 2 kinds, 220V AC and 24V DC

(1) 交流电源:

UPS 电源: $220\text{V} \pm 5\%$ 、 $50 \pm 0.5 \text{ Hz}$ AC;

GPS 电源: $220\text{V} \pm 10\%$ 、 $50 \pm 1.0 \text{ Hz}$ AC.

(1) AC Power Supply:

UPS Power supply: $220\text{V} \pm 5\%$ 、 $50 \pm 0.5\text{Hz}$ AC;

GPS Power supply: $220\text{V} \pm 10\%$ 、 $50 \pm 1\text{Hz}$ AC;

(2) 直流电源: 24V DC $\pm 1\text{V}$ DC

(2) DC Power Supply 24V DC $\pm 1\text{V}$ DC

对于随机提供设备包控制系统（EPCS）的包设备，买方仅为 EPCS 提供两路冗余的 UPS 和一路 GPS 电源。冗余 24V DC 电源装置由卖方提供，设备包仪表的供电由 EPCS 提供。

供电回路中各空开需设置空开状态监测设施，并将报警信号接入设备包控制系统中。

For equipment package with EPCS, buyer supplies dual redundant UPS and single GPS 220V AC instrument power for EPCS only. Redundant 24V DC power devices shall be within Seller's scope of supply. And equipment packaged instrument power supply shall be provided by EPCS.

It is necessary to install the status monitoring facility for each circuit-breaker for the power supply loop and connect the alarm signal into EPCS.

对于由 DCS/SIS 系统操作、监视、控制和联锁保护的包设备，设备包仪表的供电由买方提供。

For equipment package which is operated, monitored, controlled and safeguarded by DCS/SIS, equipment packaged instrument power supply will be supplied by buyer.

2.5.2 仪表气源 Instrument air supply

买方提供的仪表气源应符合如下要求：

正常操作压力：0.6~0.65 MPag（表压，进入界区处，数值待定）。

温度：环境温度

含油量：≤10 mg/m³

含尘量：≤11 mg/m³

含尘粒径：≤3 μm

露点：-40℃（正常操作压力下，数值待定）

The instrument air supplied by buyer meets the following requirements:

Normal operating pressure (Nor): 0.6~0.65 MPa-g at the plant battery limit (HOLD)

Temperature: Ambient temperature

Oil contention: ≤10 mg/m³

Particle contention: ≤11 mg/m³

Particle diameter: ≤3 μm

Dew point: -40℃ at normal operating pressure (HOLD)

2.6 仪表位号编制原则 The Principle for Instrument Tag Numbering

仪表位号编制原则如下（待定）。

最终位号编制原则将在开工会上确定。

The final instrument tag numbering system shall be confirmed on the kick-off meeting.

2.7 仪表防护 Instrument Protection

现场仪表的选用应满足现场温带海岸性气候的环境要求（空气中含有盐雾、灰尘、碳氢化合物以及微量的硫化氢）。现场安装的电子式仪表和接线箱应至少满足 IEC60529 和 GB/T 4208 标准规定的 IP66 的防护等级；其他非电子式的现场仪表应至少满足 IP55 的防护等级。在仪表井、阀门井等地面下及水池内安装的仪表，防护等级应满足 IP68 防护等级。室外安装带操作按钮的仪表设备，需配备防护罩等防雨措施。

Field mounted instrument shall be suitable for location in a temperate coastal climate environment (Air of instrument mounting location shall be considered corrosive for the presence of salt atmosphere, dust, hydrocarbons and trace of H₂S). Field mounted electronic instrument and junction box shall be weatherproof to IP66, per IEC 60529 and GB/T 4208, as a minimum. Field mounted non-electronic instrument shall be weatherproof to IP55, per GB/T 4208, as a minimum. The instrumentation installed under the ground in the instrumentation well, valve well, etc. and in the pool shall be weatherproof to IP68. Outdoor instrument with pushbutton shall be supplied with raincover.

2.8 仪表防爆 Instrument Explosion Proof

所有现场安装的电子式仪表应根据危险区域的等级划分，应选用符合 IEC60079 标准和/或 GB/T 3836 标准，具有中国国家授权防爆认证机构颁发防爆合格证的产品。项目认可的防爆认证机构有 IECEx 和 NEPSI、CQST，仪表防爆形式与危险区域的关系应符合 GB 50058 标准的规定。

All electrical equipment for field instrumentation shall be designed, furnished and certified to meet the hazardous area classification in which they are to be installed in accordance with IEC 60079 and/or GB/T 3836. The acceptable certification agencies

are IECEx, and NEPSI, CQST. Instrument explosion-proof type and the relationship between the hazardous area should be consistent with the provisions of the GB 50058 standard.

凡列入强制性认证产品范围的防爆电气产品还应取得《中国国家强制性认证产品认证证书》。

The explosion-proof electrical products listed in scope of Chinese Compulsory Certification (CCC) products shall obtain the 《China National Compulsory Certification Products Certification Certificate》.

- 1) 安装在 0 区内的电子仪表应选用本安型仪表 (Ex ia Ga)。
- 2) 安装在 1 区和 2 区优先选择隔爆型 (Ex db Gb) 仪表:
- 3) 安装在 2 区的仪表接线箱选择增安型 (Ex eb Gb), 也可选用隔爆型 (Ex db Gb) (适用于 1 区和 2 区)。
- 4) 本安回路采用隔离型安全栅。
- 5) 当爆炸危险区域同时满足爆炸性气体环境和爆炸性粉尘环境要求时, 电子式仪表和仪表防爆接线箱应同时符合爆炸性气体 1 区、2 区和可燃性导电粉尘 21 区、22 区的防爆设计要求 (执行标准为 IEC 60079 或 GB/T 3836)。

- 6) 电子式仪表的防爆温度等级不低于 T4, 防爆设备等级不低于 IIC。

1) Intrinsic safety type instrument (Ex ia Ga) is the only acceptable practice for Zone 0.

2) Explosion-proof type instrument (Ex db Gb) is the preferable practice for Zone 1 & Zone 2.

3) Increased safety type (Ex eb Gb) junction box is the preferable practice for Zone 2. Explosion-proof type junction box (Ex db Gb) is acceptable for Zone 1 & Zone 2.

4) Isolation type safety barriers shall be used for intrinsic safety circuits.

5) When the hazardous area classification meets the requirements of both explosive gas environment and explosive dust environment, the electronic instrument and instrument explosion-proof junction box should meet the explosion-proof design

requirements of both explosive gas zone 1, zone 2 and combustible conductive dust zone 21 and 22 (the implementation standard is IEC 60079 or GB/T 3836).

6) The explosion-proof temperature class of the electronic instrument is not lower than T4, and the explosion-proof equipment class is not lower than IIC.

2.9 仪表信号 Instrument Signal

1) 模拟量信号采用 4~20Ma DC 叠加 HART 协议信号 (版本 7 及以上)。

2) 控制阀的位置信号原则上采用接近开关 (接近式干接点信号)。

3) 来自 MCC 开关量输入信号和去 MCC 开关量输出信号均采用继电器隔离。6kV 及以上电机, 去 MCC 控制应采用大功率直流中间继电器隔离。来自/去 MCC 的模拟量信号应采用信号隔离器隔离。

4) EPCS (CCS、PLC 等)、SIS, GDS, CCS, MMS, PLC 与 DCS 系统之间采用冗余通信方式进行信号传输 (Modbus-RTU/RS485)。

5) 自现场的开关量输入 (DI) 应为干接点信号, 原则上不采用中间继电器隔离。

6) 原则上包设备控制系统的开关量输出信号 (DO) 通过继电器 (可以集成在 DO 卡上或 FTA 上) 隔离驱动低功耗电磁阀 ($\leq 4W$)。

1) Analogue type signals shall be isolated 4~20 mA signals at 24V DC with superimposed HART signal (version 7 and above).

2) Proximity type switches shall be used for control valve position switches in principle. (Proximity dry contact signal).

3) Discrete signals to/from MCC shall be isolated with interposing relays supplied by Seller. Interposing relay with large contact ratings (220V DC 5A) shall be used for discrete input/output signals controlling motors, the power rating of motors shall be 6kV or above. Analogue signals to/from MCC shall be isolated with signal isolator supplied by Seller.

4) SIS, GDS, CCS, MMS, PLC shall be capable of communicating with DCS via dual redundant RS-485 (Modbus-RTU).

5) Discrete input signals from field instrument shall be volt free dry contact.

Interposing relay is generally not required.

6) Discrete output signals shall be via relays (may integrated with D0 module or FTA-Field Termination Assembly) to power solenoid valves, which shall be low power consumption type (4 watts or less) where feasible.

2.10 仪表接地及防雷 Instrument Grounding and Lightning Protection

仪表接地采用等电位接地方式。DCS/SIS/GDS/CCS/MMS/PLC 系统侧设有仪表工作接地和仪表保护接地二种接地板, 各个接地板分别引至用户仪表网型接地板, 然后由电气专业统一接到电气接地网络。

1) Instrument grounding shall be equal-potential type. DCS/SIS/GDS/CCS/MMS/PLC shall be furnished with instrument signal earth bars and instrument protective earth bars. Every earth bars shall be separately wired to instrument net type earth bars by End user that connected to plant electrical grounding network by electrical discipline uniquely.

2) 现场就地盘、仪表电缆桥架、仪表设备、仪表接线箱和仪表密封接头等的保护接地在现场通过接地导线就近接至接地网或连接到已经接地的金属电缆槽、支架、框架、平台等金属构件; 仪表工作接地和电缆屏蔽接地应在仪表控制系统侧接至仪表工作接地汇流条上。

2) Local control panel, Instrument cable tray, Instrument device, Instrument junction box and Instrument gland ,etc, shall be furnished with protective earth, which is connected to plant electrical grounding network locally via grounding wire or connected to the already grounded metal cable tray, bracket, steel frame, platform and other metalconstruction. All instrument signals and cable screens shall only be wired to instrument signal earth bar at the control system side.

3) 仪表电缆桥架中各段之间, 采用接地电缆跨接, 并在现场与电气地相连接, 直线段应每隔不超过 30 米重复接地。

3) Each segment of instrument cable trays shall be connected with adjacent segment using jumper grounding cables and shall be connected to electrical grounding in the field at intervals of straight not more than 30 meters.

4) 仪表现场接线箱、金属电缆保护管等, 应采取相应可靠的接地措施, 可就近接至钢结构

的金属构件上。

4) Instrument junction boxes, metal conduits, etc. shall be properly grounded. Wiring to adjacent metal framework of steel construction is acceptable.

5) 仪表现场接线箱内应安装用于连接仪表电缆屏蔽线的汇流排, 保证现场接线箱至现场仪表侧的仪表电缆屏蔽线良好连接。仪表电缆屏蔽线应按照 SH/T 3081-2019 的设计要求在设备包控制系统侧接至仪表工作接地或保护地。

5) Instrument junction box shall be furnished with bus-bar for instrument cable screen connection. This is to ensure the cable screen between junction box and instrument to be properly wired. All cable screens shall be wired to instrument signal earth bar or protective earth bar at the EPCS system side based on the design requirement of SH/T 3081-2019.

6) 电气防雷保护区外的仪表设备、装置或公用工程边缘、罐区等空旷区仪表侧和设备包控制系统侧均应设置电涌保护器, 电涌保护器的设置, 应符合 SH/T 3164 标准的规定。

6) Surge protective device shall be equipped for instrument mounted outside electrical lightening protect zone, at the edge of plant or utility area or in open area such as tank farm. In case SPDs are required, they shall be equipped on both sides, instrument side and EPCS side. SPDS settings should be in line with the provisions of SH/T 3164 standard.

7) 仪表及控制系统的接地电阻不应大于 $4\ \Omega$, 接地连接电阻不应大于 $1\ \Omega$ 。

The earthing resistance of the instrument and control system should not be greater than $4\ \Omega$, and the bonding resistance should not be greater than $1\ \Omega$.

3. 控制系统设计原则 Design Principle of Control System

3.1 控制水平 Level of Automatic Control

设备包控制系统完成过程控制、操作、监视、联锁保护和管理, 其控制系统采用基于可编程程序控制器(PLC)的系统。PLC 应为“故障安全”型设计, 满足 IEC61508/61511 的标准要求, 并具有 TÜV/IEC SIL 3 安全认证。控制器、参与控制和联锁的 I/O 以及参与控制或联锁计算的 I/O、电源单元及通讯系统应采用冗余配置。设备包控制系统能与 DCS 系统进行数据通信, 操作

人员可以在 DCS 操作站上对设备包进行监视。

The operation, monitoring, control, safeguarding and management of the equipment package shall be implemented in Equipment Package Control System (EPCS). The EPCS shall be based on programmable logic controllers (PLC) which is certified by TÜV/IEC SIL 3. PLC shall be “fail safe” type and meet the requirement of IEC61508/61511 standard. The controller, I/O module for control, safeguarding and calculation related to control and safeguarding, power supply unit and communication system shall be redundant. The EPCS control system shall be capable of communicating with DCS, so that the operating crew can monitor the equipment package on DCS operator station.

设备包控制系统由操作员站(双屏)、工程师站、打印机、系统机柜、辅助机柜及网络设备等组成。中心控制室和/或现场机柜室设置工程师站用于组态维护, 故障诊断、SOE 等工作。

Equipment Package Control System is composed of operator station (dual screen), engineer station, printer, control system cabinet, auxiliary cabinet and network equipment. Engineer station is installed in CCR and/or FAR for EPCS system maintenance and fault diagnosis, SOE etc.

设备包控制系统的操作站(双屏)、工程师站、数据存贮设备、打印机等安装在中心控制室内; 过程控制站、辅助机柜等安装在现场机柜室。中心控制室与现场机柜室之间用冗余的单模铠装光缆连接。

The EPCS operator station (dual screen), EPCS engineer station, EPCS data storage equipment and EPCS printer are installed in CCR. Process control station and auxiliary cabinet are installed in FAR. Dual single mode fiber optic armored cables shall be used for connecting the equipment in CCR and the equipment in FAR.

设备包控制系统与 DCS 系统采用冗余的通信接口, 通信采用 RS-485 接口, Modbus-RTU 协议或者 RJ45 接口, Modbus TCP 协议。

EPCS shall be equipped with dual redundant RS-485 communication interfaces, Modbus-RTU protocol or RJ45 communication interfaces, Modbus TCP protocol for communicating with DCS.

现场的手动操作仅限于开车、紧急停车、现场监视及维护。

Field manual operation shall be limited to startup, emergency shutdown, field monitoring and maintenance only.

设备包的紧急停车应由现场盘的紧急停车按钮完成，也可以在控制室内辅助操作台上的紧急停车按钮完成。紧急停车按钮/开关应有 3 个干触点（3 取 2 表决）用硬接线连接到 SIS/EPCS 的冗余 I/O 卡上。

The emergency shutdown of the equipment package shall be accomplished by emergency stop push button mounted on local control panel in the field and/or on auxiliary console in CCR. Emergency shutdown pushbutton/switch shall have 3 sets of dry contacts (2oo3 voting) which are hardwired to SIS/EPCS redundant I/O cards.

设备包控制系统根据工艺操作要求，设置操作旁路开关（OOS）。

EPCS shall be equipped with Operation Override Switches (OOS) as per process operation requirements.

所有开关、按钮动作时应在 DCS 画面上显示并打印输出。

All changes of state of switches and push buttons shall be able to be displayed on DCS display graphic and shall be printed.

设备包控制系统应有第一故障报警功能，卖方应提供打印机用于打印报警及操作信息。

EPCS shall have “first-out alarm” indication function. The Seller shall supply printer for printing alarms and operation messages.

由设备包卖方供货的仪表应选用 4~20mA DC 带 HART 信号智能电子式仪表，由设备包卖方供货的智能阀门定位器应具有在线诊断功能。设备包控制系统的 AI、AO 卡应能采集 HART 信号（HART 7.0 或以上版本），并通过 RJ45 interface, Modbus TCP 协议通信至 DCS 中的 IDM 系统。

Instrument supplied by equipment package seller shall be 4~20mA DC with HART protocol smart type electronic instrument, and the smart positioner supplied by equipment package seller shall be with on-line diagnostic function. The HART signal (At least HART 7.0 version) shall be picked up by AI、AO modules of EPCS and sent to IDM system via RJ45 communication interface with Modbus TCP protocol

卖方提供的详细 P&ID 图应按买方的图例符号（见附录一）进行编制，明确仪表供货范围和设计分工。

The seller shall provide detailed P&ID drawing, which shall follow Annex 1 provided by Buyer. The P&ID drawing shall identify the instrument scope of supply and split of design.

所有仪表、接线箱、电缆、仪表盘柜等编号应按买方要求编制。

All instruments, junction boxes, cables and cabinets shall be tag numbered as per Buyer's requirements.

3.2 网络安全 Network Security

3.2.1 设备包控制系统内的网络安全 Network Security within EPCS

1) 设备包控制系统由现场机柜室（FAR）至中心控制室（CCR）的通信应采用工业级网络交换机并冗余配置。

1) The internal communication of EPCS between FAR and CCR shall be via redundant network switches of industrial grade.

2) 设备包控制系统应采用分层控制网络，各层之间应有严格的访问控制权限，应采用工业级网络交换机和网络冗余容错技术，使通信具有多路径选择能力。

2) EPCS control network shall be of layered structure. The access control permission between layers shall be highly restricted. The EPCS control network shall be redundant and fault-tolerant therefore enables the control network communication to be multi-routings.

3) 设备包控制系统应具有网络状态的实时诊断功能，应设置网络安全监控措施。

3) EPCS shall be capable of diagnosing network status in real time and network Security monitoring.

4) 工业级网络交换机应具有预设置功能，使内部数据优先通信，控制器信息应具有最高优先级。

4) The industrial grade network switches shall be able to be preset in a way that internal data communication is prioritized and controller information shall be of the

highest priority.

3.2.2 DCS 系统与设备包控制系统间的网络安全 Network Security between DCS and EPCS

DCS 系统与设备包控制系统的通信采用 RS485 接口, Modbus-RTU 协议, 不应将服务器作为网络交换机来使用。

EPCS shall be capable of communicating with DCS via dual redundant RS-485, Modbus-RTU protocol. The use of servers as network switches is prohibited.

3.3 控制系统 Control System

3.3.1 压缩机控制系统 (CCS) Compressor Control System & 机组监测系统 (MMS) Machine Monitoring System

根据生产装置生产的需要, 设置压缩机控制系统 (CCS), 完成透平/压缩机组的调速控制、防喘振控制、负荷控制及超速保护等安全联锁保护等功能, 并与装置的 DCS 进行通信使操作人员能够在 DCS 操作站上对机组进行监视。压缩机控制系统采用三重化 (TMR) 或四重化 (QMR) 的冗余、容错系统。CCS 系统的过程控制站设置在现场机柜室 (FAR)。建议的 CCS、MMS 系统配置图参见附录三

The Compressor Control System (CCS) shall be equipped per plant operation requirement. The speed regulating control, anti-surge control, load control and safety interlock of turbine/compressor train shall all be implemented in CCS. The CCS shall be able to communicate with DCS so that the operating crew can monitor the compressor train on DCS operator station. CCS shall be Triple Modular Redundant (TMR) or Quadruple Modular Redundant (QMR), failure-tolerant system. The process control station of CCS shall be installed in Field Auxiliary Room (FAR). For reference, see Annex 3 for the CCS and MMS configuration diagrams.

CCS 系统的防喘振控制由特殊的、高速的模块来完成, 并存储带有工艺气体变化补偿的喘振模型曲线。

The anti-surge control shall be implemented in CCS system by special, high speed modules. Surge model curve of process gas with temperature & pressure compensation shall

be stored in CCS system.

机组监测系统（MMS）用于透平、压缩机和泵等主要转动设备的在线状态监测与机械保护，转动设备的主要运行参数，至少包括轴振动、轴位移、轴温、键相等信号直接传送至 MMS 系统。三取二、二取二联锁信号的输入、输出点应分配到不同的卡件。轴振动、轴位移等进入 MMS 系统的信号，需通过 4-20mA 输出到 CCS 系统中。轴振动、轴位移等进入 MMS 系统并参与联锁的信号，需由 MMS 通过继电器卡输出到 CCS 系统，并在 CCS 系统中实现逻辑的组态。机组监测系统(MMS)需提供接入机组监测系统(MMS)对应的上位机监控软件的授权。

On-line condition monitoring and mechanical protection of main rotating equipment such as turbines, compressors and pumps shall be implemented in MMS. The major operation parameters, including but not limited to axial vibration, axial displacement, axial temperature, key-phasor signals etc. shall be transmitted to MMS system directly. "2 out of 3" or "2 out of 2" interlock signals shall be hardwired to separated redundant I/O cards. Signals connected into MMS system, such as axial vibration and axial displacement, shall be hardwired to CCS system via 4-20mA signals. Axial vibration and axial displacement and other signals connecting to the MMS system and participating in safeguarding logic shall be output by MMS to CCS system through the relay cards, and the logic configuration function shall be implemented in the CCS system. Signals connected into MMS system, such as axial vibration and axial displacement, shall be hardwired to CCS system via 4-20mA signals. MMS shall provide authorization for the upper computer monitoring software corresponding to access the MMS system.

在工厂调试完成后，至少有 15%已经接好线的输入/输出(I/O)点作为备用，在 CCS/MMS 系统机柜中，至少有 20%的裕量空间用于安装 I/O 卡件。

No less than 15% of all wired inputs/outputs (I/O) shall be as spare. There shall be no less than 20% clear space inside the CCS/MMS system cabinets for future expansion.

CCS/MMS 系统的负荷和扩展：在工厂调试完成后，处理器、数据存贮器和数据通信网络的负荷应低于 40%；电源单元的负荷最多达到其能力的 50%（指单电源负荷）；应用软件和通信系统要有 50%的扩展能力。

The load and expandability of CCS/MMS: The CCS/MMS controller load, data storage, and data communication network load shall be low than 40%. The load of power supply units shall be up to 50% (the load of single power supply unit). The expandability of software and network system shall be more than 50%.

工业级 PC 机：用于系统组态与修改。

Industrial grade PC is used for system configuration.

CCS 系统和 DCS 系统之间的通信选用冗余 RS-485 接口、Modbus-RTU 协议。

The communication between CCS and DCS shall be in accordance with redundant RS-485 interfaces per Modbus-RTU protocol.

CCS/MMS 系统软件应是已经正式发布与认证的软件，软件的版本和升级版本必须得到买方的认可，采用基于微软 Windows 的操作系统。

All software of CCS/MMS system shall be of formal issued and certified version. The software version and upgraded version shall be approved by Buyer. The software shall be based on Microsoft Windows operating system.

CCS/MMS 系统在工业 PC 机中提供画面显示软件、报表生成软件，同时提供系统故障自诊断软件。

The CCS system shall provide software for graphic display and software for report creation in industrial PC. Software for system fault self-diagnosis shall also be provided.

对蒸汽透平驱动的压缩机应提供独立于 CCS 的专用三取二超速保护装置，并具备 SIL3 认证。

Dedicated 2oo3 over speed trip device independent of CCS for steam turbine driven compressor shall be supplied, which is certified by SIL 3

CCS 应按照故障安全型原则设计，参与联锁回路的继电器和电磁阀，需具备 SIL3 的认证。

CCS shall be designed to fail safe mode, Relay and solenoid valve for interlocking loop shall be certified by SIL 3.

CCS 系统需提供经过 CCS 系统厂家软件兼容性认证的防病毒软件。防病毒软件具备离线更新

病毒库和病毒库分发管理功能。

CCS shall provide anti-virus software certified by CCS manufacturer for software compatibility. Anti-virus software should provide off-line update virus database and virus database distribution management functions.

3.3.2 其他设备包控制系统 Other EPCS

操作控制相对比较独立或大型设备包的控制、监视、操作和安全保护原则上采用独立的 PLC 系统。与 DCS 系统进行数据通信，操作人员能够在 DCS 操作站上对设备包的运行进行监视。

In general, a dedicated Programmable Logic Controller System shall be used for the control, monitoring, operation and safety interlock of large complex equipment package or equipment package that is relatively independent from other process unit of the plant.

在工厂调试完成后，至少有 15%已经接好线的输入/输出 (I/O) 点作为备用，在 PLC 系统机柜中，至少有 20%的裕量空间用于安装 I/O 卡件。

No less than 15% of all wired inputs/outputs (I/O) shall be as spare. There shall be no less than 20% clear space inside the PLC system cabinets for future expansion.

卖方提供的控制系统的负荷和扩展：在工厂调试完成后，处理器、数据存贮器和数据通信网络的负荷应低于 40%；电源单元的负荷最多达到其能力的 50%；应用软件和通信系统要有 50% 的扩展能力。

The load and expandability of EPCS: The controller load, data storage, and data communication network load shall be low than 40%. The load of power supply units shall be up to 50%. The expandability of software and network system shall be more than 50%.

卖方提供工业级 PC 机：用于系统组态与修改。

Industrial grade PC for system configuration shall be provided by Seller.

EPCS 和 DCS 系统之间的通信选用冗余 RS-485 接口、Modbus-RTU 协议。

The communication between EPCS and DCS shall be in accordance with redundant RS-485 interfaces per Modbus-RTU protocol.

4. 仪表盘柜设计原则 Design Principle of Instrument Cabinets and Panels

在仪表盘柜正面及背面设置盘柜铭牌，内容包括位号及说明，采用不锈钢激光雕刻板以螺钉固定，其安装高度距离地面 1700mm。仪表盘柜内应留有必要的净空，以便于维修。下图为仪表盘柜铭牌的具体要求：



铭牌尺寸：320mm x 70mm

材料：316SS 不锈钢，1.5mm 厚

底色：不锈钢本色

字体颜色：黑色

字体高度：第一行字高 20mm, 字粗 4mm. 第二行字高 10mm, 字粗 2mm.

字体：Arial

印刻类型：雕刻方式制作，不锈钢本色背景正面印刻

固定：不锈钢螺钉固定

第一行信息：机柜编号（正面/背面）

第二行信息：机柜功能描述

铭牌位置：从柜门下沿起算往上 1.7 米处为铭牌中心（居中安装）

Nameplate, which contains information of tag number and description, shall be mounted on the front and rear side of every cabinet and/or panel. The nameplate shall be of stainless steel laser engraving plate and be fixed with screw. The installation height is 1700mm from the ground. There shall be necessary clear space inside cabinets or panels for maintenance. The following chart shows the specific requirements of the instrument cabinets and panels nameplate.



Nameplate size: 320mm x 70mm

Material: 316SS stainless steel, 1.5mm thick

Base color: stainless steel

Font color: black

Font height: 20mm high, 4mm thick in the first line. 10mm high, 2mm thick in the second line.

Font: Arial

Printing type: made by engraving, engraved on the front of stainless steel background

Fixing: stainless steel screw fixing

The first line of information: cabinet number (front/back)

The second line of information: cabinet function description

Position of nameplate: 1.7m up from the lower edge of the cabinet door for the center of the nameplate (centered installation)

4.1 机柜要求 Cabinets requirements

机柜首选如下形式: 2100 mm (含 100 mm 底座) × 800mm × 800mm (高 × 宽 × 深), 独立安装型, 前后单开门, 右轴方式, 防护等级不低于 IP20 (在 FAR 或 CCR 内) or IP54 (在工业厂房内)。规格型号如下:

Manufacturer: 制造厂

Rittal 或相当

Model 型号

TS8 系列标准机柜或相当的

Locker/Handle 门锁/把手

TS 8611 或相当的

Colour 颜色

RAL 7035

服务器柜和电脑主机柜选用 TS-IT 系列标准机柜或相当, 服务器柜尺寸为 2100 mm (含 100 mm 底座) × 800 mm × 1000 mm (高 × 宽 × 深), 其余要求同控制机柜。

The preferred form of cabinet is as follows: 2100 mm (including 100 mm base) x 800 mm x 800 mm (Height x Width x Depth), freestanding type, single door at front and rear, right axis mode, weatherproof not less than IP20 (in FAR or CCR) or IP54 (in industrial workshop) .

Manufacturer: Rittal or equivalent

Model : TS8 series standard cabinet or equivalent

Locker/Handle: TS 8611 or equivalent

Colour: RAL 7035

TS-IT series standard cabinet or equivalent is used for server cabinet and computer mainframe cabinet. The dimensions of server cabinet are 2100 mm (including 100 mm base) × 800 mm × 1000 mm (height × width × depth), and the rest of requirements are the same as control cabinet.

4.2 中心控制室安装的机柜 Cabinets installed in CCR

在控制室安装的设备包控制系统操作站、控制及辅助机柜等应留有必要的净空以便于操作、维修、安装。所有机柜及内部安装的所有元器件、安全栅、继电器、开关、信号灯等必须有名牌框标志。每个操作站、控制及辅助机柜等均应设有接地端子和接地板。各种机柜内应有照明、风扇等辅助设施。操作站及各种机柜外形尺寸、颜色和结构应一致。仪表接地采用等电位接地方式, 设备包控制系统柜内设有工作接地和保护接地两个汇流条, 汇总后用两根接地电缆分别与用户 DCS/SIS 仪表网型接地板连接。

The EPCS operator stations, EPCS control cabinets and auxiliary cabinets installed in CCR shall contain necessary clear space for operation, maintenance and installation. All cabinets and components mounted inside, safety barriers, relays, switches and beacons shall be with nameplates. Each operation station, control cabinet and auxiliary cabinet etc. shall be furnished with grounding terminals and/or bars. All cabinets shall

contain lighting, fan and other necessary auxiliary equipments. The same dimension, color and structure shall be used for all the operator stations and all the cabinets. Instrument grounding shall be of equal-potential type. EPCS Cabinets shall be furnished with instrument signal earth bar and instrument protective earth bar. Each earth bar shall be separately wired to DCS/SIS instrument net type earth bar by Enduser.

4.3 现场机柜室安装的机柜 Cabinets installed in FAR

在现场机柜室安装的设备包控制系统机柜、网络柜、端子接线柜、继电器柜、安全栅柜、辅助机柜等应留有必要的净空，以便于维修和安装。所有机柜应采用相同的规格、尺寸以及统一的颜色（RAL7035）。机柜内应有照明、风扇等辅助设施。仪表接地采用等电位接地方式，设备包仪表控制系统侧设有工作接地和保护接地两个汇流条，汇总后用两根接地电缆分别与用户 DCS/SIS 仪表网型接地板连接。

The control cabinets, network cabinets, terminal cabinets, relay cabinets, safety barrier cabinets and auxiliary cabinets of EPCS installed in FAR shall contain necessary clear space for operation, maintenance and installation. All cabinets shall be of the same specification, dimension and color which shall be RAL 7035. All cabinets shall contain lighting, fan and other necessary auxiliary equipment. Instrument grounding shall be of equal-potential type. EPCS system shall be furnished with instrument signal earth bar and instrument protective earth bar. Each earth bar shall be separately wired to DCS/SIS instrument net type earth bar by end user.

4.4 现场安装的仪表盘柜 Field Mounted Instrument Panels

现场安装的仪表盘柜由卖方成套提供。

Field mounted instrument panels shall be supplied by Seller.

安装在危险区，应考虑防爆仪表盘柜，盘柜上的电动仪表、开关、按钮、灯等防爆等级应选用符合防爆区域的产品。

现场安装的所有仪表需提供不锈钢位号铭牌。所有开关、按钮、灯需在下方标识位号和中文/英文的功能说明。

Explosive proof instrument panels shall be used for panels mounted in hazardous

area. The electrical instruments, switches, pushbuttons and indicators, etc. shall meet the hazardous area classification in which they are to be installed.

Field instrument shall be provided with stainless steel nameplate. All switches, buttons and lamps shall be marked with tag number and function description in Chinese/English.

卖方提供现场仪表盘柜，集成后整体供货。仪表盘柜的防护等级不低于 IP65，盘面/内仪表的防护等级不低于 IP66。

The field instrument panels supplied by seller shall be integrated with all components and instruments in the factory. The loose supply of panel mounted components or panel mounted instruments is prohibited. The Seller supplied instrument panels shall be weather proof to IP65, as a minimum. The instrument mounted on/inside the panel shall be weather proof to IP66, as a minimum.

现场仪表盘柜安装在设备包附近，应留有必要的净空，以便于维修。

Field instrument panel shall be installed near the equipment package to which the panel belongs. The instrument panel shall contain necessary clear space for maintenance.

现场仪表盘柜采用带后开门的柜式仪表盘，电缆/管线自底部进入，应配有防爆电缆密封接头及穿板接头，机柜颜色采用 RAL 7035。

Field instrument panel shall have doors on the rear side. Cable and piping entries shall be at the bottom of the panel. The panel shall be furnished with explosion proof cable glands and bulkhead unions. The panel shall be of RAL 7035 color.

现场仪表盘柜应按接地类型（工作、保护）分设接地端子排。柜内应有照明、风扇等辅助设施。

Field instrument panel shall be furnished with dedicated grounding terminal strips per each type of grounding (signal grounding and protective grounding). Field instrument panel shall be equipped with lighting, fan and other necessary auxiliary equipment.

5. 现场仪表设计原则 Design Principle of Field Instrument

5.1 一般原则 General Principle

1) 设备包仪表选用 HART 协议智能电子式仪表(优先带一体式 LCD 就地显示器)。接入 SIS/CCS 系统的仪表原则上应具有 SIL 2 认证的仪表。

Instrument supplied by seller shall be smart type electronic instrument and in accordance with HART protocol (With integral LCD local indicator if possible). Packaged instrument connected with SIS/CCS should be SIL 2 certified in principle.

2) 与设备包安全联锁有关的仪表应独立设置, 重要的安全联锁信号采用“三取二”、“二取一”或“二取二”等冗余配置。。

Dedicated instrument shall be used for equipment package safety interlock. Critical interlock signal shall be of “2 out of 3”, “1 out of 2” or “2 out of 2” redundancy.

3) 现场仪表不采用气动仪表。

Pneumatic instrument shall not be used.

4) 压力、差压式变送器优先选用毛细管隔膜式变送器, 并配备冲洗/排放环。

Diaphragm sealed with metal capillary type pressure and differential pressure transmitters are preferred, and supplied with flushing/bleeding ring.

5) 如果卖方要求必须使用本规定中未涵盖的仪表类型, 需买方确认批准。

If Seller requires the use of instrument type not included in this document to be necessary, which shall be approved by the Buyer.

6) 用于 SIS/CCS 的仪表, 原则上独立设置。仪表的供电由 SIS/CCS 提供。现场仪表一般采用 24VDC 回路供电。当 24VDC 回路供电不满足要求时, 也可采用 220VAC 外供电。

Instruments used in SIS/CCS systems are, in principle, set up independently.

The power for instrument is supplied by SIS/CCS. Generally, the field instrument shall be loop powered by 24V DC. Where the 24V DC loop power supply can not meet the requirements, the 220V AC external power supply shall be used.

7) 现场仪表的公称压力或耐压等级应高于或等于仪表所安装的工艺管道或设备的压力等级或法兰等级。

The pressure rating of the field instrument should be no less than the pressure rating or flange rating of the process piping or equipment in which the instrument is installed.

8) 凡列入《强制性产品认证目录描述与界定表（2023 年修订）》（国家市场监督管理总局 2023 年第 36 号公告）的仪表产品，应取得《中国国家强制性产品认证证书》。

8) The instrument production listed in <The catalogue description and scope subject to compulsory certification production (2023 revision)> (Announcement No.36 of year 2023 published by State Administration for Market Regulation) shall obtain <China National Compulsory Product Certification Certificate>.

9) 凡列入《实施强制管理的计量器具目录》（国家市场监督管理总局 2020 年第 42 号公告）的计量器具，应取得《中华人民共和国计量器具型式批准证书》和/或进行强制检定。

9) The measuring instruments listed in <The catalogue of measuring instruments subject to compulsory administration> (Announcement No.42 of year 2020 published by State Administration for Market Regulation) shall obtain <Type Approval Certificate for measuring instruments of the People's Republic of China>.

10) 压力管道元件（包括压力管道阀门、元件组合装置）应按下表的要求取得 TS《中华人民共和国特种设备生产许可证》（压力管道元件）、TSX《特种设备型式试验证书》、《特种设备监督检验证书（压力管道元件制造）》。

10) The pressure pipe elements (including pressure pipe valves, assemble device of elements) shall obtain TS <Special Equipment Production License of the People's Republic of China >(pressure pipe elements), TSX <Type Test Certificate of Special Equipment>, <Special Equipment Supervision and Inspection Certificate (manufacturing of pressure pipe elements)>.

压力管道元件类别 Type of pressure pipe elements	许可参数级别 Permission parameter level	境内 Onshore	境外 Offshore
压力管道阀门 Valves of pressure pipe	A1: 公称压力大于或者等于 10MPa 且公称直径大于或者等于 300mm 的金属阀门 A1: The metal valves of nominal pressure greater than or equal to 10MPa and nominal diameter greater than or equal to 300mm A2: 公称压力大于 4.0MPa 且设计温度低于或者等于零下 101℃ 的金属阀门 A2: The metal valves of nominal pressure greater than 4.0MPa and design temperature lower than or equal to -101℃ B: 公称压力大于 4.0MPa 且公称直径大于或者等于 50mm 的其他金属阀门 B: The other metal valves of nominal pressure greater than 4.0MPa and nominal diameter greater than or equal to 50mm	TS+TSX	
	金属阀门 (公称压力小于或者等于 4.0MPa) The metal valves (nominal pressure lower than or equal to 4.0MPa)	TSX	
元件组合装置 Assemble device of elements	减温减压装置、流量计 (壳体) Temperature de-superheating and pressure reducing device, flowmeter(shell)	TS+监检证书 TS+ <Special Equipment Supervision and Inspection Certificate >	监检证书 <Special Equipment Supervision and Inspection Certificate >

11) 仪表接触工艺介质的材质最低为 316SS, 若介质特性要求选取更好的材质, 应与配管

材料等级规定一致或选择更好的材质，应满足所在工况的要求。

11) The wetted part material of instrument shall be 316SS as minimum. The better materials shall be selected according to the features of process fluids, the materials shall be better than or equal to <Piping Material Grade Specification>, and shall meet the requirements of working condition.

5.2 流量仪表 Flow Instrument

5.2.1 总则 General

1) 流量测量优先选用节流装置和涡街流量计，也可选用面积式流量计（仅用于就地指示）、电磁流量计、科里奥利质量流量计、超声波流量计等流量仪表。

Flow throttling devices and vortex flow meters are preferred for flow rate measurement. Rotameter (local indication only), magnetic flow meter, Coriolis mass flow meter and ultrasonic flow meter are acceptable.

2) 测量元件的材质最低为 316SS 不锈钢，若介质特性要求选取其它材质，应与配管材料等级规定一致或选择更好的材质。

Measuring element material of flow instrument shall be minimum 316SS. The material shall be in accordance with Piping Material Grade Specification when 316SS is not applicable to the process fluid or better material shall be selected.

3) ANSI 900Lb 及以下管道上安装的仪表采用法兰连接，法兰形式与等级应与所在管道的配管材料等级规定一致(法兰取压孔板最低压力等级为 300Lb)。安装于 ANSI 1500Lb 及更高等级管道上,采用对焊形式（BW）或根据配管管路等级要求。

All in-line instruments of which pressure rating are equal or lower than ANSI 900Lb shall have flange connections of rating and type in accordance with piping specification (The pressure rating of flange tapping orifice shall be as least ANSI 300Lb) Butt welding type shall be used for in-line instruments of which pressure rating are equal or greater than ANSI 1500Lb or follow piping specification.

4) 原则上不采用流量开关。如果卖方要求必须采用时，流量开关的接点应为双刀双掷

(DPDT)。

In general, flow switch should not be used. The flow switch contact shall be DPDT type if Seller requires the use of flow switch to be necessary.

5) 流量计（壳体）制造监督检验

Supervision and Inspection Certificate for flowmeter(shell)。

安装在压力管道中且符合下列条件的流量计（壳体）的检查等级应为符合 GB/T 20801.5-2020 规定的 I 级，其余的检查等级应为 II 级：

The inspection class of flowmeter(shell) installed in pressure piping and meets the following conditions shall be class I specified by GB/T 20801.5-2020, the other inspection class shall be class II:

- a) 管道级别定义为 SHA1、SHB1 和 SHC1
- a) The piping class defined as SHA1, SHB1 and SHC1.
- b) 压力管道级别为 GC1
- b) The piping class defined as GC1.
- c) 安装在夹套管上带夹套流量计的内壳体
- c) The jacket flowmeter(shell) installed in jacket piping.

5.2.2 刻度选择 Scale type

方根刻度范围：满刻度读数为 0~10 方根

Square root scale range: Full scale reading is 0~10 square roots.

- 1) 最大流量的刻度读数不应超过 9.5;

The scale reading of maximum flow rate shall be less than 9.5.

- 2) 正常流量的刻度读数应为 6.0~8.0;

The scale reading of normal flow rate shall be 6~8.

- 3) 最小流量的刻度读数不应小于 3。

The scale reading of minimum flow rate shall be no less than 3.

线性刻度范围：满刻度读数为 0~100% 线性

Linear scale range: Full scale reading is 0~100% linear.

- 1) 最大流量的刻度读数不应超过 90%;

The scale reading of maximum flow rate shall be less than 90%.

- 2) 正常流量的刻度读数应为 40%~70%;

The scale reading of normal flow rate shall be 40%~70%.

- 3) 最小流量的刻度读数不应小于 10%。

The scale reading of normal flow rate shall be no less than 10%.

5.2.3 差压式流量仪表 Differential Pressure type flow instrument

标准节流装置

Standard flow throttling device

流量测量通常选用标准节流装置。标准节流装置应符合国际标准 ISO 5167 或国家标准 GB/T2624。

In general, standard flow throttling device shall be used for flow rate measurement. The design and manufacture of the standard flow throttling device shall be in accordance with ISO 5167 and/or GB/T 2624.

取压方式

Tapping type

- 1) $50\text{mm} (2'') \leq D \leq 300\text{mm} (12'')$ 法兰取压, 法兰标准采用 ANSI B16.36。

Flange tapping shall be used for orifice sizes equal or greater than DN 50mm up to equal or less than DN 300mm. The orifice flange shall be in accordance with ANSI B16.36.

- 2) $D \geq 350\text{mm} (14'')$ 径距取压 (径距取压位置: 上游侧孔板至取压中心距 $1.0D$, 下游侧孔板至取压中心距 $0.5D$)。

Radius tapping shall be used for orifice sizes DN 350mm and above. Tapping positions are $1.0D$ upstream side and $0.5D$ downstream side.

通常标准节流装置不带前后直管段, 孔板的 β 值应在 $0.2 \sim 0.7$ 之间。通常差压范围选用: $0 \sim 25\text{kPa}$ (用于液体), 也可按: 5kPa 、 10kPa 、 16kPa 、或 50kPa 选用。

In general, upstream meter runs and downstream meter runs are not specified to be included for standard flow throttling devices. The β value of orifice shall be 0.2~0.7. The differential pressure range of 0~25kPa(for liquid) is preferred. 0~5kPa, 0~10kPa, 0~16kPa and 0~50kPa are also acceptable for differential pressure ranges.

小口径(DN40 或以下)或特殊场合选用带前后直管段(Meter-Run)的节流装置或内藏孔板差压流量变送器。

For orifice plate measurement on process pipe equal or less than DN 40mm, the meter runs shall be supplied or select integral orifices with DP flow transmitter.

低压损流量测量的场合采用文丘里管, 高压过热蒸汽场合采用流量喷嘴或文丘里管。

Venturi tube should be used in lines where low pressure loss measurements are required. Flow nozzle or venturi tube should be used for high pressure superheated steam service.

差压变送器成套带三阀组。变送器的测量元件材料最低选用 316SS 不锈钢。

Differential pressure transmitter shall be furnished with 3-valves manifold. Measurement element material of transmitter shall be minimum 316SS.

原则上, 差压流量的开方、线性化在现场差压变送器中完成。

In general, differential pressure transmitter for flow rate measurement shall have square root output function and output linearization function.

用于蒸汽、过热蒸汽和高压蒸汽场合的差压型流量仪表采用冷凝罐。

Condensate pot shall be used for differential pressure type flow instrument in steam, superheated steam and high pressure steam services.

5.2.4 转子流量计 Rotameter

当要求精确度等级不高于 1.5 级, 管径小于 DN80, 量程比不大于 10:1 的流量测量, 可选用金属转子流量计。

Metallic rotameter can be used only when required instrument accuracy is not less than 1.5%, required range ratio is 10:1 or less and line size is DN50 or less.

5.2.5 涡街流量计 Vortex flow meter

洁净气体、蒸汽和液体的流量测量,尤其是测量范围宽(量程比大于 10:1)的气体或液体测量可选用涡街流量计。可能产生振动的场合(如泵出口)不宜选用涡街流量计。

Vortex flow meter is preferred for clean gas, steam and liquid flow services, especially when required range ratio is larger than 10:1. Vortex flow meter is not recommended at places where vibration might occur, i.e. pump outlet.

5.3 物位仪表 Level Instrument

5.3.1 总则General

就地液位指示应优先选用磁浮子液位计,也可选用玻璃板液位计。

Magnetic float level gauge is the preferred practice for Level local indication, and gauge glasses can also be used.

液位远传测量优先选用差压式液位仪表,也可选用浮筒液位变送器、电容式、超声波、雷达、伺服液位计等其它液位仪表。

Differential pressure type level instrument is the preferred practice for level measurement. The acceptable practices for level measurement are as follows: displacer transmitter, capacity level instrument, ultrasonic level instrument, radar level instrument and servo level instrument, etc.

仪表的量程应根据测量对象实际需要显示的范围或实际变化的范围确定。除计量用的物位仪表外,正常物位应处于仪表量程的 50%左右。

Level instrument range shall be determined by required display range or fluctuation range of the measured level. Normal operating level shall be around 50% of the instrument range, except for custody transfer services.

对于高温高压等特殊场所应选取适合的液位计型式及附件。

Appropriate type of level instruments and accessories shall be used for high temperature, high pressure or other special applications.

测量元件的材料一般为 316SS 不锈钢,若介质特性要求选取其它材质,应与配管材料等级规定一致。

Measuring element material of level instrument should be 316SS in general. The material shall be in accordance with piping material specification when 316SS is not applicable to the process fluid.

5.3.2 磁浮子液位计 Magnetic float level gauge

磁浮子液位计的指示宜选用磁耦合式。

Magnetic float level gauge of magnetic coupling type is preferred.

磁浮子液位计的最大测量长度不大于 4.5m。法兰中心线的距离应以 100mm 为步进单位。通常选用侧侧法兰连接方式。放空、放净阀尺寸为 ANSI 1/2" (1/2"NPTF 或 1/2"RF 法兰), 并加 1/2"NPT 堵头或 1/2"RF 配对盲法兰。

The maximum measured length of magnetic float level gauge shall not be greater than 4.5 meters. The distance of flange center lines shall be rounded to 100mm, i.e. "Side-Side" type flanges connection is preferred. The drain valve and vent valve should be of ANSI 1/2" (1/2"NPTF or 1/2"RF flange), and with plug or blind flange.

当测量低温介质时磁浮子液位计应带有绝热和防霜措施。

Magnetic float level gauge shall be heat insulated and frost protected for cryogenic services.

5.3.3 玻璃板液位计 Gauge glasses

就地界面测量、高压低密度、高温、非有毒等介质, 宜选用玻璃板液位计。

Gauge glasses are preferred for interface local indication, fluids of high pressure and low density 、 fluid of high temperature and fluid of Non-toxic

洁净、透明、低黏度和无沉积物无色和浅色介质的液位指示选用反射式, 其它场合选用透光式。透光式液位计宜带照明。

Reflex type gauge glasses should be used for level indication of process fluids that are clean, transparent, low viscosity, sediment-free, and light colored or non-colored. Transparent type gauge glasses should be used for other occasions. The Transparent type gauge glasses should be equipped with illumination.

玻璃板液位计的长度最大允许到 2000 mm。对更大的测量范围, 采用 2 个或 2 个以上的液位计, 并使可视部至少有 50mm 的重叠。玻璃板液位计管口法兰中心线间距宜采用 300mm, 500mm, 800mm, 1100mm, 1400mm, 1700mm 和 2000mm, 玻璃板液位计选用无盲区型。

In general, the distance of gauge glasses flange center lines is 2000mm as maximum. Two or more gauge glasses shall be used for measuring length larger than 2000mm. The visible sections of every two gauge glasses shall be overlapped for 50mm or larger. The preferred distances of gauge glasses flange center lines are as follows: 300mm, 500mm, 800mm, 1100mm, 1400mm, 1700mm and 2000mm. Gauge glasses should be selected in a non-blind-zone type.

玻璃板液位计配有锥形阀, 并带钢球自封装置。放空、放净阀尺寸为 ANSI 1/2" (1/2"NPTF 螺纹或 1/2"RF 法兰), 并加 1/2"NPT 螺纹堵头或 1/2"RF 配对盲法兰。

Gauge glasses shall be furnished with needle valve and steel ball check device. The drain valve and vent valve should be of ANSI 1/2" (1/2"NPTF screw thread or 1/2"RF flange), and with screw thread plug or blind flange.

5.3.4 差压式液位仪表 Differential pressure type level instrument

差压式液位仪表优先选用膜片密封带毛细管差压变送器, 当测量介质高黏度、易结晶、含固体颗粒时可选用插入式法兰膜片密封带毛细管差压变送器。

. DP transmitter with remote diaphragm seals with capillary is preferred. DP transmitter with insertion type flanged remote diaphragm seals with capillary shall be used when measured fluid is high viscous, easily crystallized or contains solid practices.

差压式仪表测量汽包液位时, 应配有温度补偿平衡容器。

When DP transmitter is used to measure steam drum level, it shall be equipped with temperature compensation pot.

差压式液位仪表测量元件材料最低为 316SS 不锈钢。

The measuring element material shall be minimum 316SS.

普通差压液位变送器测量液位时应带三阀组。膜片密封差压变送器应带冲洗/排放环。

Normal DP transmitter (without remote diaphragm seals) shall be furnished with 3-valves manifold for level measurement. Diaphragm sealed differential pressure transmitter shall be supplied with flushing/bleeding ring.

5.3.5 浮筒式液位计 Displacer Transmitter

对于满量程差压小于 5kPa 且测量范围小于 1200mm, 比密度为 0.5~1.5 的液体的测量范围小于 2000mm, 比密度差为 0.1 及以上的液体界面的测量。

The Displacer Transmitter shall be used for full range DP less than 5kPa and measurement range less than 1200mm, the measurement range of liquid with 0.5~1.5 specific density is less than 2000mm, the differential of specific density is equal or greater than 0.1.

浮筒式液位计优先采用“侧—侧”法兰连接, 浮子材料最低为 316SS 不锈钢; 在温度高于 200℃ 或低于 0℃ 时, 扭力管部分应带散热片或延长管。

“Side-side” type flange connection is preferred for Displacer. The material of displacer shall be 316SS as minimum. Displacer torque tube shall be furnished with radiation fin or extension pipe where the temperature is higher than 200℃ or lower than 0℃.

尽量避免采用内浮筒式液位计。

The use of internal cage type displacer shall be avoided as much as possible.

5.3.6 液位开关 Level switch

液位开关选用音叉或浮球液位开关, 开关接点应是双刀双掷 (DPDT) 干接点。

Tuning fork or float type level switch with DPDT dry contact shall be used.

5.4 压力仪表 Pressure Instrument

5.4.1 总则 General

量程选择

Instrument Range Selection

1) 测量稳定压力时, 正常操作压力应为量程的 1/3~2/3。

Normal operating pressure shall be at 1/3~2/3 of full range when measured pressure

is expected to be stable.

2) 测量脉冲压力时, 正常操作压力应为量程的 $1/3 \sim 1/2$ 。

Normal operating pressure shall be at $1/3 \sim 2/3$ of full range when measured pressure is expected to be pulsating.

压力仪表测量元件的材料最低为 316SS 不锈钢。若介质特性要求选取其它材质, 应与配管材料等级规定一致或更高。

Measuring element material of pressure instrument is 316SS in general. The material shall be in accordance with piping material specification when 316SS is not applicable to the process fluid.

原则上不采用压力开关。如果卖方要求必须采用时, 需买方确认批准。压力开关的接点应为双刀双掷 (DPDT)。

In general, pressure switch should not be used. if Seller requires the use of pressure switch to be necessary, which shall be approved by the buyer. The pressure switch contact shall be DPDT type

5.4.2 压力表 Pressure gauge

就地压力指示一般选用 $\Phi 100\text{mm}$ 弹簧管压力表, 小量程及绝对压力测量选用膜盒压力表, 有腐蚀或易堵介质压力测量选用膜片隔离式压力表。压力表精度最低要求为 $\pm 1.5\%$ 。公称压力小于等于 PN110 (Class600) 的压力表, 接口规格宜为 $M20 \times 1.5$; 公称压力大于 PN110 (Class600) 的压力表, 接口规格应为 $1/2''$ NPT(M)。外壳材质为不锈钢, 带安全玻璃。在照明条件较差、安装位置较高、观察距离较远或安装于就地仪表盘时, 刻度盘直径可选用 $\Phi 150\text{mm}$ 。

Bourdon pressure gauge of $\Phi 100\text{mm}$ dial size shall be used for local pressure indication in general. Capsule pressure gauge shall be used for small range or absolute pressure measurement. Diaphragm sealed pressure gauge shall be used for pressure measurement of corrosive or easily clogged process fluids. The accuracy of pressure gauge shall be at least $\pm 1.5\%$. The process connection of pressure gauge less than CL600 should be $M20 \times 1.5$ thread. The process connection of pressure gauge greater than CL600

should be 1/2" NPT(M). The case of pressure gauge shall be of SS material and with safety glass. The dial size can be $\Phi 100\text{mm}$ on the occasion of poor illumination, high mounting position, long observance distance or local panel mounting..

5.4.3 压力/差压变送器 Pressure/Differential Pressure Transmitter

远传优先选用远传膜片密封式压力/差压变送器，测量微压选用差压变送器。

Diaphragm sealed pressure and differential pressure transmitter shall be preferred for pressure and DP measurement. Differential pressure transmitter shall be used for micro-pressure measurement.

测量腐蚀性或易堵介质的选用膜片密封压力/差压变送器，必要时应设置冲洗措施。

Diaphragm sealed Pressure/Differential Pressure Transmitter shall be used for pressure measurement of corrosive or easily clogged process fluids. Flushing devices shall be used when necessary.

变送器的测量元件材料最低选用 316SS 不锈钢。

Element material of transmitter shall be minimum 316SS.

普通差压变送器应带三阀组。普通压力变送器应带两阀组。

Normal DP transmitter (without remote diaphragm seals) shall be furnished with 3-valves manifold. Normal pressure transmitter (without remote diaphragm seals) shall be furnished with 2-valves manifold.

5.5 温度仪表 Temperature Instrument

5.5.1 总则 General

温度仪表正常测量值应为量程的 30%~70%，最高测量值不应超过量程的 90%。

The normal operating temperature shall be at 30%~70% of full instrument range. The maximum operating temperature shall be less than 90% of full instrument range.

原则上不采用温度开关，如果卖方要求必须采用时，温度开关的接点应为双刀双掷 (DPDT)。

In general, temperature switch should not be used. The temperature switch contact shall be DPDT type if Seller requires the use of temperature switch to be necessary.

5.5.2 温度计 Temperature Gauge

就地温度指示选用 $\Phi 100\text{mm}$ 万向型双金属温度计, 并带金属温度套管。若安装地点不易通行或观察时, 或测量高温介质时, 可选用毛细管充填式温度计, 毛细管长度不宜超过 6m。

Universal type bimetal temperature gauge with $\Phi 100\text{mm}$ gauge shall be used for local temperature indication and equipped with metal thermowell. Thermometer with capillary shall be used when instrument is hard to be approached or observed, or when measured fluid is of high temperature. The length of capillary should not exceed 6 meters.

5.5.3 温度变送器 Temperature transmitter

温度测量优先选用带弹簧压紧式铠装热电阻/热电偶及一体式温度变送器, 也可选用分体式温度变送器。

In general, temperature transmitter integrated with spring-loaded type armored resistance temperature detectors (RTD) /thermocouple (TC) should be used for temperature measurement in priority. Temperature transmitter separated with spring-loaded type armored resistance temperature detectors (RTD) /thermocouple (TC) could be used as well.

关键场合 (如控制、联锁或计算用), 测温元件采用双支, 温度变送器采用双通道冗余型。

For critical applications, such as interlock service, control and/or calculation service and so on, The temperature measurement sensor shall be dual elements type and the temperature transmitter shall be capable of connecting both dual elements and with redundant function.

在铠装温度元件顶部接线盒环境温度超过 60°C 、工艺过程有特殊要求或安装位置不易观察的场合, 采用分体式温度变送器。

Separate type temperature transmitter shall be used if ambient temperature of the terminal box at temperature element head exceed 60°C , process specially require or temperature sensor is not easily observed.

5.5.4 温度元件 Temperature Element

铠装热电阻元件的测温范围为 $-200^{\circ}\text{C} \sim 500^{\circ}\text{C}$ 。热电阻元件 Pt100、三线制。

The sensor range of armored RTD is $-200^{\circ}\text{C} \sim 500^{\circ}\text{C}$. The RTD shall be of Pt100 type, 3-wire platinum.

铠装热电偶元件的测量范围为：

The sensor ranges of armored thermocouple are as follows:

名称 Name	分度号 Type	可测温度范围($^{\circ}\text{C}$) Allow temperature measurement range	推荐采用温度范围($^{\circ}\text{C}$) Recommended temperature measurement range
铂铑 30-铂铑 6 PtRh30- PtRh6	B 型 Type B	$0 \sim +1600$	$+1000 \sim +1600$
铂铑 13-铂 PtRh13-Pt	R 型 Type R	$0 \sim +1300$	$+800 \sim +1300$
镍铬-镍铝 NiCr-NiAl	K 型 Type K	$0 \sim +1000$	$+500 \sim +1000$
镍铬-康铜 NiCr- konstantan alloy	E 型 Type E	$0 \sim +750$	$0 \sim +600$
铜-康铜 Cu- konstantan alloy	T 型 Type T	$-200 \sim 300$	$-200 \sim 300$

热电偶元件一般选用非接地型，特殊要求场合可选用接地型。

Thermocouple element shall be of un-grounded type in general. Grounded type thermocouple can be used on special applications.

测量多点温度时，选用多点(支)式铠装热电偶。

The armored thermocouple shall be multi-point type for multi-point temperature measurement.

除非另外说明，所有温度元件都带铠装护套，材质至少为 316SS。

Unless special description, all the temperature element shall be supplied with armored sheath, at least 316SS material.

5.5.5 温度计套管 Thermowell

除特殊情况外, 所有温度元件应有保护套管, 保护套管锥形整体钻孔, 材料不低于 316SS, 采用 ANSI 1-1/2" 法兰连接, 公称压力最低为 ANSI 150Lb 且不低于管道等级。

All temperature elements shall be furnished with protective thermowell except for special applications. Thermowells shall be bored from solid bar stock. Material for thermowells shall be in accordance with requisition requirements for piping and process design conditions but shall be minimum 316SS. Flange connection shall be used for thermowell. Flange shall be ANSI 1-1/2" in size The pressure rating of flange is ANSI 150Lb as minimum and not lower than process piping.

原则上保护管长度在管道上为 150~400mm (插入管道内壁不小于 50mm), 在设备上为 400mm (插入设备内壁不小于 150mm)。

In general, thermowell shall be 150~400mm in length when mounted on process pipe (Insertion length from internal wall of pipe cannot be less than 50mm) and 400mm when mounted on equipment (Insertion length from internal wall of equipment cannot be less than 150mm).

工艺管道的公称直径小于 4" 或 6" 的场合, 应采用管道局部扩径的方式。管道公称压力小于等于 PN110 (Class600) 时, 扩径到 4"; 当管道公称压力大于 PN110 (Class600) 时, 扩径至 6"。

When the nominal pressure of the pipe is less than or equal to PN110 (Class 600), Process pipe size shall be enlarged to DN100 (4") where the pipe size is less than 4". When the nominal pressure of the pipe exceeds PN110 (Class 600), Process pipe size shall be enlarged to DN150 (6") where the pipe size is less than 6".

管道上安装的温度仪表, 保护套应进行振动频率和应力符合性计算。当尾流频率 (Strouhal) 超过套管固有频率的 80% 时, 应缩短插入深度或增大取源部件直径。

Vibration frequency and stress shall be conformity calculated for thermowell

mounted on process pipe. The wake frequency (Strouhal) shall not exceed 80% of the natural frequency of the thermowell. Otherwise the thermowell insertion length shall be shortened or the thermowell outside diameter shall be enlarged.

测量高流速气体或超高压蒸汽温度时, 应选用特殊的焊接式温度计套管。

Special welded thermowell shall be used for temperature measurement of high speed gas or high pressure steam.

5.6 调节阀 Control Valve

调节阀通常选用气动薄膜或气缸执行机构, 直通、角型、蝶型或偏心旋转型调节阀。优先选用等百分比特性, 也可选用线性特性或近似等百分比特性。

Air operated diaphragm actuators or piston type actuators are preferred for control valves. Control valve should be of globe, angel, butterfly or eccentric plug type. Equal percentage flow characteristic is preferred. Linear characteristic and approximate equal percentage flow characteristics are acceptable.

8"和 8"以下的调节阀优先选用普通调节阀(单/双座或套筒式)。

Control valve of single/double seated type or cage type is preferred for valve of up to 8" body size.

10"和 10"以上口径或低差压情况, 可选用蝶型阀或偏心旋转阀。

Butterfly or eccentric plug type control valve can be used for valve of at least 10" body size or cases of low differential pressure across valve.

对于介质中含有固体粉末或黏度较大的场合, 采用 V 型球阀或偏心旋转阀。

V type ball valve or eccentric plug valve shall be used for viscous or solid containing process fluids.

对于噪声较大的情况, 采用低噪音调节阀内件。

Where valve noise exceeds maximum allowable noise level (85dBA in general), Seller shall reduce valve noise level by using low noise valve trim.

根据工艺介质及操作要求也可选用角型阀、三通阀、波纹管密封阀等。对于高压差、闪蒸、空化、腐蚀、高噪声等情况, 可选用特殊设计的阀芯和阀座。

Angle valve, 3-way valve and bellow seal valve can be used according to process fluid or operation requirement. In cases of high differential pressure, flashing, cavitation, corrosion or high noise level, special designed valve plug and seat shall be used.

阀门阀杆填料选择要求:

Stem packing material selection requirement of valves:

当 PTFE 填料不适用时, 应选用石墨填料。

If PTFE is not suitable, graphite packing shall be used.

一般情况宜选用单层填料函结构; 对于真空或含氢气介质的场合, 应选用双层填料函结构; 下列场合的调节阀应选用符合 ISO 15848-1 标准要求的低逸散密封结构:

The single layer stuffing box structure should be used for common case; The double layer stuffing box structure should be used for vacuum or hydrogen-containing medium case; The low emission sealing structure conformed with ISO 15848-1 standard shall be selected for following control valves:

- 1) 介质的综合毒性等级为极度危害或高度危害;

The compound toxicity of fluid shall be extreme hazard or high hazard.

- 2) 介质的火灾危险性类别为甲、乙类可燃气体、液化烃 (甲 A 类)、甲 B 类可燃液体且设计压力大于或等于 4.0MPa;

The classification of fire hazard risk shall be combustible gas of class A, class B, liquefied hydrocarbons (class A_A), combustible liquid of class B and design pressure greater than or equal to 4.0MPa.

- 3) 介质为挥发性有机物 (VOC)。

The fluids shall be Volatile Organic Compounds (VOC).

低逸散密封结构调节阀的密封等级要求应符合下表的规定:

The sealing class requirements of low emission sealing structure regulating control valves shall conform with the specification of following table:

阀杆密封类别	阀杆密封等级	机械循环等级	温度循环等级
--------	--------	--------	--------

Type of stem sealing	Class of stem sealing	Class of Mechanical circulation	Class of temperature circulation
直行程或多回转 Straight stroke or multi-turn	BH 或 CH ^注 BH or CH ^{note}	CC1	t200℃
部分回转 Partial turn	BH	CC1	t200℃
波纹管 Bellow	AH	CC1	t200℃

注：介质的综合毒性等级为极度危害或高度危害时选用 BH，其余场合选用 CH。开关阀低逸散密封结构的选用原则及密封等级要求与调节阀相同，机械循环等级为 C01。

Note: The BH shall be selected for compound toxicity of fluid for extreme hazard or high hazard, the CH shall be selected for other case. The selection philosoph and sealing class requirements of low emission sealing structure for on/off valves shall same as regulating control valves, class of mechanical circulation shall be C01.

进入 SIS 系统/CCS 系统中涉及到联锁的控制阀，其阀体、执行机构、电磁阀、气控阀等主要部件应具备 SIL2 认证。其中机组的速关阀及相关组件（含电磁阀等）应具备 SIL3 认证。

Control valves involved interlocks in the SIS /CCS system shall be SIL 2 certified for valve body, actuator, solenoid valve, air control valve etc.

The quick closing valves and accessories including solenoid valve for the compressor unit shall meet the requirement of SIL 3 certification.

除开关阀以外，调节阀需提供出厂调校相关的数据，作为买方进行在线诊断的初始数据。

In addition to the on-off valve, the regulating control valve is required to provide data related to the factory calibration as the initial data for the buyer to perform on-line diagnostics.

等百分比特性调节阀最小流量开度应大于 15%；正常流量开度应小于 80%；最大流量开度不应超过 90%。线性特性调节阀最小流量开度应大于 20%；正常流量开度不应超过 60%；最大流量开度不应超过 85%。

Preferred guideline for regulating control valves of equal percentage flow characteristic is that valve opening at minimum flow rate shall be greater than 15%, at normal flow rate shall be less than 80% and at maximum flow rate shall be less than 90%. Preferred guideline for regulating control valves of linear flow characteristic is that valve opening at minimum flow rate shall be greater than 20%, at normal flow rate shall be less than 60% and at maximum flow rate shall be less than 85%.

调节阀设计应使调节阀下游 1 米处和管道表面 1 米处的噪声等级不超过 85dBA。间歇使用或紧急操作的调节阀在上述位置的噪声不超过 105dBA。

The maximum allowable noise level of control valve is 85dBA at 1 meter valve downstream and at 1 meter from pipe surface. The valve noise shall not exceed 105dBA temporarily during the occasional and/or emergent operation phase.

除开关阀外，调节阀应带 4~20mA DC 带 HART 协议输出的智能电 / 气阀门定位器。一般选用正作用阀门定位器。阀门定位器应配置阀位变送器，4~20mA 对应 0~100% 阀位回讯。

All regulating control valves shall be furnished with smart type electro-pneumatic positioner of 4~20mA DC with HART protocol except for on/off valves. Valve positioner should be direct action type in general. The valve positioner shall be equipped with a valve position transmitter, with 4~20mA corresponding to 0~100% valve position feedback.

用于安全仪表系统要求严密关闭的阀门应选用单座阀、球阀、蝶阀和闸阀等。气缸执行机构带弹簧返回装置，或双作用气缸执行机构带空气储罐，保证仪表气源故障时可使阀座处于故障安全位置。紧急停车系统及顺序控制用阀门应装有开/关限位开关。

Tight shut-off valve for safety interlock shall be single seated globe valve, ball valve, butterfly valve or gate valve etc. Piston actuators shall be spring opposed type or double acting type with air volume tank. This is to ensure the valve is in fail-safe position when instrument air supply failed. Control valves and/or on-off valves used for emergency shutdown or sequence control shall be furnished with on/off limit switches.

空气储罐的制造应符合 ASME VIII 或相当的中国标准（如 TSG 21-2016）。

The manufacture of valve air volume tank shall be in accordance to ASME VIII standard

or equivalent Chinese standard (eg. TSG 21-2016).

当操作温度超过 225℃或低于 0℃时，阀颈应带散热片或延长颈型。

The valve shall be furnished with radiation fin or extension bonnet when valve operating temperature is higher than 225℃ or lower than 0℃.

阀体和阀芯材料应符合工艺介质要求，应按管道材料等级规定执行，阀体材料应不低于碳钢，禁止选用铸铁材料。阀芯的材质应满足设计条件，且至少应为 316 不锈钢。按 NACE 标准要求时，与工艺介质接触部件应符合 NACE MR0175 或 NACE MR0103 规定。

Material for control valve and on-off valve body and Trim shall meet process fluid requirements and be in accordance with piping material specification but shall be minimum carbon steel. Cast iron for valve body is prohibited. The valve trim material shall meet design requirements and shall be at least 316 stainless steel. Where NACE standards apply, components in contact with process fluid shall comply with NACE MR0175 or NACE MR0103 specifications.

调节阀泄漏等级通常为金属密封 CLASS IV (ANSI/FCI 70-2 Standard)，参与联锁的调节阀，阀门泄漏等级应为 CLASS V，当工艺要求为严密关闭 (TSO) 时，应选用 CLASS VI 或 CLASS V。开关阀泄漏等级应至少为 CLASS V。

Control valve leakage class should be metal seals CLASS IV per (ANSI/FCI 70-2) in general. participating in interlocking systems, the valve leakage rating shall be CLASS V. Leakage class shall be CLASS VI or CLASS V when tight shutoff is required. On/off valve shall be at least CLASS V.

在气源故障时，应保证阀门处于“故障安全”位置。

The valve design shall ensure valve to be at fail-safe position when air supply fails.

操作温度低于 200℃密封填料可选用聚四氟乙烯人字型填料或聚四氟乙烯混合填料，不适用聚四氟乙烯的工艺介质，可选用石墨填料。操作温度为 200℃或更高时选用石墨填料。

V type or mix type PTFE packing material may be used for valve operates at temperature lower than 200℃. Graphite could be used when PTFE is not suitable for fluid. Graphite packing material shall be used for valve operates at 200℃ or higher temperature.

限位开关类型应为接近式干接点，至少为单刀双掷 (SPDT) 接点。

Valve limit switches shall be of proximity dry contact type. The switch contact shall be minimum SPDT type.

电磁阀应选用 24V DC 长期带电、低功耗 ($\leq 4W$)、316SS 不锈钢电磁阀。其中专用的压缩机组停机电磁阀按照三取二进行配置，并具备在线测试功能。

Solenoid valve shall be 24V DC power supply normally energized and low power consumption ($\leq 4W$) type. SOV body material shall be 316 stainless steel. Dedicated trip solenoid valves for compressor train shall be 2oo3 setting up at least which are provided on-line test function.

自力式调节阀只适用于 N_2 、空气、低压蒸汽和其它公用工程流体等调节要求不高的场合。

Self acting regulator can only be used for N_2 , air, low pressure steam and other utilities fluid services that don't require higher control reliability.

阀门连接应采用法兰连接 (全法兰连接型式优先)，应避免采用法兰对夹式或螺纹连接方式，连接法兰等级应不低于配管材料等级规定。支耳和半支耳式法兰应该采用光孔型式的螺栓孔。

Process connection of valves shall be flanged type (full flange type in priority). Wafer flange and/or screw type shall be avoided. The rating of valve flange shall not be lower than the piping material classification specification. Lugged and semi-lugged type valve flanges shall have holes through drilled.

过滤减压阀应满足环境温度 $-30\sim 60^{\circ}C$ 的要求，整体材质应为不锈钢，带不锈钢压力表。安装支架、安装螺丝、安装板材质应为不锈钢。

Instrument air set (Filter & Regulator) shall meet the requirements of ambient temperature $-30\sim 60^{\circ}C$. Instrument air set (Filter & Regulator) shall be stainless steel material with stainless steel pressure gauge. The material of mounting rack, screw and plate shall be stainless steel as well.

5.7 特殊材质选择要求 Special Material Selection Requirement (HOLD)

1) 根据工艺要求，在含有较高氯离子工艺介质的场合，严禁使用奥氏体不锈钢 304L 和 316L 材质；可以替代使用超级奥氏体不锈钢 254SMO (UNS S31254)、超级双相钢 2507 或钛材。

1) In contact with chloride (Cl^-) containing fluids based on process requirement, austenitic stainless steels such as SS 304L and SS 316L shall not be used. A super austenite material such as for example 254SMO (UNS S31254) or super duplex alloy such as 2507 (UNS S32750, S32760) or titanium should be applied.

2) 阀门材质 (KTS 3.5.5.2 e)

Body material	Gland-follower components
Titanium	Duplex 1.4462
Hastelloy®	304L
Duplex	304
Stainless steel	Same as valve

钛材阀门不应接触铁离子环境 (KTS 3.1.2.10)。

3) 氧化和 R2R 单元不得选用如下材质:

17-4PH type alloys, ie precipitation hardening stainless steels

AISI 400 series martensitic stainless steels

Nickel and chromium plating

Metal-sprayed coatings

Copper alloys

Low melting point coatings such as cadmium or indium

4) 介质含有甲醇的工况, 不得选用钛材。

6. 现场安装及安装材料 Instrument Installation and Bulk Material

6.1 概述 General

所有现场仪表及调节阀的位置确定应满足下列要求:

The following requirements shall be met for all field instruments and control valves field installation:

1) 在操作通道能方便读出指示数据。

Instrument readings can be easily observed from operating passageway.

2) 足够的操作空间, 便于安装、操作和维护。

There is enough operating room for installation, operation and maintenance.

3) 安全并容易接近。

The instrument can be safely and easily accessed.

对低温介质的压力测量，变送器应高于取压点的位置；对于测量液体和蒸汽的场合，变送器应低于取压点；对于测量气体的场合，变送器应高于取压点。

For low temperature fluid pressure measurement, transmitter elevation shall be higher than tapping point. For liquid and steam fluid pressure measurement, transmitter elevation shall be lower than tapping point. For gas fluid pressure measurement, transmitter elevation shall be higher than tapping point.

除直接安装在工艺配管上的仪表外，现场仪表安装高度应为仪表中心到地面(或平台)的距离为 1.2m（导压配管连接的压力和差压变送器应优先满足上述变送器的安装高度要求）。现场仪表不设仪表保护箱，特殊场合除外。当仪表需要保温伴热时采用仪表保温箱。

Field instrument, except for in-line instruments, shall be mounted at 1.2 meter above ground or platform (Impulse line type pressure and differential pressure transmitter should meet the transmitter elevation requirement above in priority). Instrument protective box should not be used except for special occasions. Instrument insulation box with steam tracing shall be used when heat tracing and insulation are required for the instrument.

管道安装的仪表设备（包括流量计、调节阀等）均采用 ASME 标准连接，与配管材料等级规定一致。

In-line instrument, including flowmeters, control valves etc., shall bear process connection of ASME standard and in accordance with piping material classification specification.

现场仪表应有独立的取源点和取源部件。

Two or more instruments sharing one tapping point or tapping part is not allowed.

当压力取源部件与温度取源部件在同一管段时，压力取源部件应安装在温度取源部件的上游侧。

Pressure tapping part shall be mounted on the upstream side of the temperature tapping part when pressure and temperature tapping parts are mounted on the same process piping segment.

现场仪表安装支架等应采用镀锌碳钢材质。

The mounting brackets of field instrument shall be of galvanized carbon steel.

应对毛细管进行保护。

Instrument capillary shall be properly protected.

6.2 流量仪表 Flow Instrument

原则上节流装置安装在水平管道上, 节流装置前后应留有足够的直管段长度(根据节流装置形式, 按 GB/T 2624 标准确定)。

Flow throttling device shall be installed on horizontal pipe in principle. And upstream and downstream meter run shall be considered based on GB/T 2624.

转子流量计应安装在垂直管道上, 流体自下而上流动。科里奥利质量流量计根据制造厂的要求进行安装。

Rotameter shall be installed on vertical pipe with process fluid flowing upwards. Coriolis mass flow meter shall be installed per manufacturer standard.

6.3 液位仪表 Level Instrument

通常安装在设备上(或连通管上)的液位仪表应配有根部阀、放空或排污阀, 便于操作和维护。

All level instruments mounted on vessels or bridge pipes shall be equipped with root valves and vent or drain valves for operation and maintenance.

与设备相连的差压液位仪表取压口与玻璃板液位计取压口应分别设置。

Shared nozzle for DP type level instrument and gauge glasses is prohibited.

6.4 压力仪表 Pressure Instrument

压力仪表取压口应避免静态液柱压影响, 测量有脉冲的压力应设置针型阀或阻尼器。

The position of pressure tapping shall avoid influence of static liquid column pressure. Needle valves or dampers shall be furnished with pressure instrument for pulsating pressure application.

6.5 温度仪表 Temperature Instrument

温度仪表的测温部件应保证充分接触到被测介质。

The sensing parts of temperature instruments shall in proper contact with measured fluids.

6.6 调节阀 Control Valve

调节阀应垂直安装在水平管道上, 且便于操作和维护, 必要时设支撑。在高处安装的调节阀应设置维修平台。

Control Valves shall be installed on horizontal pipe and perpendicular to the ground or platform. The position of control valve shall be easy to operate and maintain. Maintenance platform shall be set for the control valve installed on the higher position.

6.7 导压配管 Pressure Hookup Piping and Tubing

导压配管一般选用 $\Phi 12 \times 1.5\text{mm}$ 316LSS TUBE 管, 采用双卡套式阀门与管件。当管道等级大于等于 CL 900 时, 应采用 1/2" PIPE 管, 承插焊或对焊连接, 必须采用双根部阀串联取压。仪表连接侧采用 1/2" O.D. 导压配管材料最低为 316LSS。导压配管材质应等于或高于工艺管道材质, 若工艺介质特性需要, 选用高级合金钢、耐腐蚀等材料。

$\Phi 12 \times 1.5\text{mm}$ 316LSS TUBE should be used for instrument pressure hookup tubing. The tube fitting and valve shall be of double compressed ferrule type. When pressure rating is ANSI 900LB and higher, 1/2" PIPE with socket weld or butt weld connection and double root valves with serial connection shall be used for instrument pressure hookup piping. The instrument connection with pressure hookup piping and tubing should remain as 1/2" O.D tubing. The material of TUBE should be equal to or higher than the material of the process piping, High class alloy steel or corrosion resistant material shall be used when 316LSS is not suitable for the measured process fluid.

导压配管排净阀及堵头应配置在导压管的最低点, 放空阀及堵头应配置在导压管的最高点。

The drain valve and plug shall be at the lowest position of the entire pressure hookup piping. The vent valve and plug shall be at the highest position of the entire pressure hookup piping.

导压配管应与水平面呈 1 / 10 或更大的坡度。

The pressure hookup piping shall be a grade of 1 in 10 or larger to the ground or platform. 冷凝罐用于蒸汽以及易凝气体的场合。

Condensate pot shall be used for the service of steam or other easily condensed gases.

6.8 空气配管 Instrument Air Piping

仪表用供气总管从根部阀后采用 316SS 不锈钢 PIPE 管, 不锈钢 PIPE 管之间的连接方式为承插焊连

接, 配 316 不锈钢气源球阀, 气源球阀后的供气配管一般采用 $\Phi 12 \times 1.5\text{mm}$ 316SS TUBE 管, 采用双卡套式连接件。对于特殊调节阀或开关阀, 可根据阀门制造厂要求配置合适的供气管线。

IA main pipe shall be 316SS pipe, equipped with ball valve of 316SS material. Stainless steel pipe between the connection method for socket welding connection. $\Phi 12 \times 1.5\text{mm}$ 316SS TUBE shall be used for IA pipe with double compressed ferrule type fittings after IA ball valve. For special IA users, such as special control valve or on/off valve, IA piping shall be in accordance with the requirement of valve manufacture.

在气源用户较集中的场合, 仪表供气采用气源分配器, 气源分配器出口配备 $\Phi 12\text{mm}$ 304 不锈钢卡套气源球阀, 采用 $\Phi 12 \times 1.5\text{mm}$ 316SS Tube 管及双卡套连接。气源球阀应具有手柄锁扣结构。

IA distribution header shall be used for occasions of concentrated IA users. The outlet of IA distribution header shall be $\Phi 12\text{mm}$ O. D. IA ball valve of 304SS material, with the connection of $\Phi 12 \times 1.5\text{mm}$ 316SS Tube fitting of double compressed ferrule type. Hand lever lock should be provided with IA ball valve.

6.9 仪表配线 Instrument Cabling

仪表主电缆 (现场接线箱或就地盘到现场机柜室)

Instrument main cable (from field junction box or local panel to FAR)

1) 模拟量信号电缆选用多股绞合铜芯聚乙烯绝缘聚氯乙烯护套阻燃双绞线对屏总屏计算机电缆, 采用铝塑复合带或铜丝编织屏蔽, 导线截面积为 $1.0 \sim 1.5\text{mm}^2$ 。

1) Instrument cable for analogue signal shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, individual pair shielded and/or overall cable shielded DCS Cable. The cable shield shall be composite aluminum-plastic tape or copper wire. The conductor size shall be $1.0 \sim 1.5\text{mm}^2$.

2) 热电阻信号电缆选用多股绞合铜芯聚乙烯绝缘聚氯乙烯护套阻燃双绞线分屏总屏计算机电缆, 采用铝塑复合带或铜丝编织屏蔽, 导线截面积为 1.5mm^2 。

2) Instrument cable for thermal resistance signal shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, individual triad shielded and overall cable shielded DCS Cable. The cable shield shall be composite aluminum-plastic tape or copper wire.

The conductor size shall be 1.5mm^2 .

3) 数字量信号、电磁阀控制信号、24VDC 供电电缆选用多股绞合铜芯聚乙烯绝缘聚氯乙烯护套阻燃总屏计算机或控制电缆, 采用铝塑复合带或铜丝编织屏蔽。数字量信号导线截面积为 $1.0\sim 1.5\text{mm}^2$; 电磁阀控制信号导线截面积为 2.5mm^2 ; 24VDC 供电导线截面积应根据用电负荷及电缆敷设距离进行计算确定。

3) Instrument cable for discrete signal, including discrete input signal and solenoid valve control signal and 24VDC power shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, overall cable shielded control Cable. The cable shield shall be composite aluminum-plastic tape or copper wire. The conductor size of discrete input signal cable shall be $1.0\sim 1.5\text{mm}^2$. The conductor size of solenoid valve control signal cable shall be 2.5mm^2 . The conductor size of 24VDC power cable shall be calculated and determined by power supply load and cable routing distance.

4) 220VAC 供电电缆选用铜芯交联聚乙烯绝缘聚氯乙烯护套阻燃电力电缆, 导线截面积根据用电负荷及电缆敷设距离进行计算确定。

Instrument cable for 220VAC power shall be copper conductor, flame-retardant, XLPE insulated, PVC sheathed power Cable. The conductor size of 220VAC power cable shall be calculated and determined by power supply load and cable routing distance.

仪表分支电缆 (现场接线箱/现场盘到现场仪表) 和仪表直拉电缆 (现场仪表到现场机柜室)

Instrument branch cable (from field junction box or local panel to field instrument) and Instrument cable from field instrument to FAR directly

1) 模拟量、数字量信号电缆选用多股绞合铜芯聚乙烯绝缘聚氯乙烯护套阻燃钢丝铠装屏蔽计算机电缆, 采用铝塑复合带或铜丝编织屏蔽, 导线截面积为 $1.5\sim 2.5\text{mm}^2$ 。

1) Instrument cable for analogue and discrete signal shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, SWA armored, individual pair shielded and/or overall cable shielded DCS Cable. The cable shield shall be composite aluminum-plastic tape or copper wire. The conductor size shall be $1.5\sim 2.5\text{mm}^2$.

2) 热电阻信号电缆选用多股绞合铜芯聚乙烯绝缘聚氯乙烯护套阻燃钢丝铠装屏蔽计算机电缆, 采

用铝塑复合带或铜丝编织屏蔽, 导线截面积为 1.5mm^2 。

2) Instrument cable for thermal resistance signal shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, SWA armored, individual triad shielded and/or overall cable shielded DCS Cable. The cable shield shall be composite aluminum-plastic tape or copper wire. The conductor size shall be 1.5mm^2 .

3) 热电偶信号电缆选用多股绞合聚乙烯绝缘聚氯乙烯护套阻燃钢丝铠装屏蔽补偿电缆, 导线截面积为 1.5mm^2 , 采用铝塑复合带或铜丝编织屏蔽, 补偿导线材质应与热电偶类型相匹配。

3) Instrument cable for thermocouple signal shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, SWA armored, individual triad shielded and/or overall cable shielded and precision class extension wire. The conductor size shall be $1.5\sim 2.5\text{mm}^2$. The extension wire shall be compatible with the thermocouple to which it's connected. The cable shield shall be composite aluminum-plastic tape or copper wire.

4) 电磁阀控制信号电缆选用多股绞合铜芯聚乙烯绝缘聚氯乙烯护套阻燃钢丝铠装控制电缆, 采用铝塑复合带或铜丝编织屏蔽, 导线截面积至少为 2.5mm^2 。

4) Instrument cable for solenoid valve control signal shall be multi-strand copper conductor, flame-retardant, PE insulated, PVC sheathed, SWA armored, individual pair shielded and/or overall cable shielded DCS Cable. The cable shield shall be composite aluminum-plastic tape or copper wire. The conductor size shall be at least 2.5mm^2 .

本安系统与非本安系统应分开配线。本安系统配线外护套颜色应为天蓝色。

The cabling of intrinsically safe cable and non-intrinsically safe cable shall be laid separately. The outer sheath color shall be blue for intrinsically safe cable.

不同电压的仪表电缆应分开敷设在不同的仪表槽板中, 或在槽板中设隔板, 同一根多芯电缆所传输的信号应为同类信号。

Instrument cables of different voltage level shall be laid in different cable duct or properly segregated with metallic partition plate in the same cable tray. Signals of different voltage level shall not be in the same multi-pair/triad cable.

不同信号类型的仪表电缆应接入不同的现场接线箱。

Instrument cables of different signal types (analogue, discrete etc.) shall not share one field junction box.

用于安全联锁信号（进/出 SIS）的接线箱应单独设置。

Dedicated junction boxes shall be used for instrument cables of safety interlock signals(Input/Output SIS).

从接线箱到现场仪表电缆选用带盖槽盒。

The cable duct for instrument branch cable routing shall be with cover.

仪表电缆进出仪表设备和接线箱，采用仪表防爆电缆密封接头（Ex de Gb）。现场仪表电气接口通常采用 1/2” NPT(F) 或 3/4” NPT(F)，接线箱分支电缆侧电气接口通常为 M20x1.5(F)，主电缆侧采用公制 M 螺纹，尺寸根据电缆外径进行确定。电缆进线口需至少预留 20% 的备用量。

Explosion proof cable glands (with Ex de Gb certification) shall be used for every cable entry of instrument and junction boxes. The cable entry of field instrument is 1/2” NPT(F) or 3/4” NPT(F) in general. The branch cable entries of junction box are M20x1.5(F) in general. metric screw threads (M) should be used for the main cable entry, the size of which should be determined by cable outside diameter. There shall be no less than 20% spare for cable entries

仪表电缆槽板采用封闭式结构，其中氧化单元采选用不锈钢槽板，其它区域选用铝合金槽板。表面应进行防腐处理，带盖板、隔板及连接件等，槽板规格：100×50mm、200×100mm、300×150mm、400×200mm 等。

The material of instrument cable duct shall be stainless steel (oxidation unit) and aluminum alloy(other unit). Instrument cable duct shall be provided with covers, segregated plates and connections which shall be anti-corrosion on surface. The specification of cable duct should be defined as follows:

100×50mm, 200×100mm, 300×150mm, 400×200mm and so on.

现场仪表接线箱选用增安型(Ex eb Gb)或隔爆型(Ex db Gb)，增安型（Ex eb Gb）接线箱的材质宜选用 316SS 不锈钢，隔爆型（Ex db Gb）接线箱的材质宜选用铝合金。现场仪表接线箱应配有防爆电缆密封接头，材质选用黄铜镀镍或 316SS 本安回路采用认证的兰色端子。现场仪表接线箱严禁从顶部进线。

现场仪表接线箱正面配置位号铭牌，显示进入接线箱的仪表位号清单，位号铭牌采用 316SS 不锈钢，并采用有效的方式固定在接线箱上。

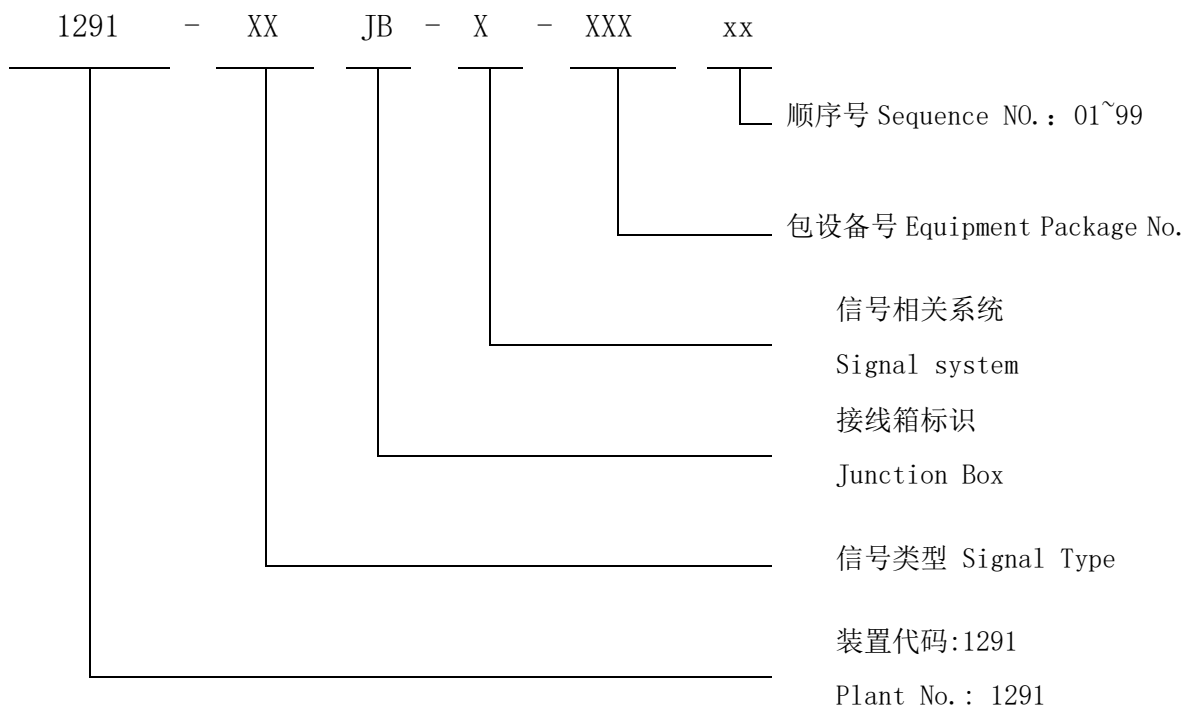
现场仪表接线箱需至少预留 20%的备用空间。

Field instrument junction box should be explosion proof with increased safety (Ex eb Gb) (316SS material) or flame-proof (Ex db Gb) (aluminum alloy material) certification. Field instrument junction box shall be furnished with explosion proof cable glands of nickel coated brass or 316SS. Blue terminals shall be used for intrinsic safety circuits. Cable entry on the top of field instrument junction box is strictly prohibited.

The front side of the field instrument junction box shall be furnished with tag number nameplate, which displays the list of instrument tag number connected into the junction box. The tag number nameplate shall be of 316SS material and fixed on the junction box in an effective way.

No less than 20% spare terminals shall be reserved for field instrument junction box.

- 包设备仪表接线箱编号命名原则: Packaged instrument junction box numbering system:



信号类型 Signal Type:

- 模拟信号 (4~20mA DC、1~5V DC、脉冲等): 本安-IS; 非本安-S

Analogue Signal (4~20mA DC, 1~5V DC, Pulse etc) :

Intrinsical Safe-IS; None Intrinsical Safe-S

- 数字信号 (24VDC 接点、脉冲信号或电源等): -E

Digital Signal (24VDC Power, Dry Contact, Pulse, 24VDC Power etc): -E

- 温度信号 (RTD 和 TC): 本安-IT; 非本安-T

Temperature Signal (RTD or TC) :

Intrinsical Safe -IT; None Intrinsical Safe -T

- 可燃气体检测信号 : -G

Gas Detector Signal -G

- 电源 (220VAC 接点信号或电源): -P

Power Supply (220VAC Dry Contact, Power etc) -P

信号相关系统 Signal system:

D - DCS; S - SIS; G - GDS; P-PLC; C-CCS; M-MMS; O - 其它 Other;

- 包设备仪表主电缆编号命名原则: Packaged instrument main cable numbering system:

仪表接线箱编号加 Cn;

Junction box number “ Cn” ;

n- 当同一接线箱所用主电缆数多于 1 时标注。

n- More than 1 piece of main cables for one same JB.

- 仪表分支电缆编号命名原则: Packaged instrument branch cable numbering system:

仪表位号加 “Cn” ;

Instrument tag number “Cn” ;

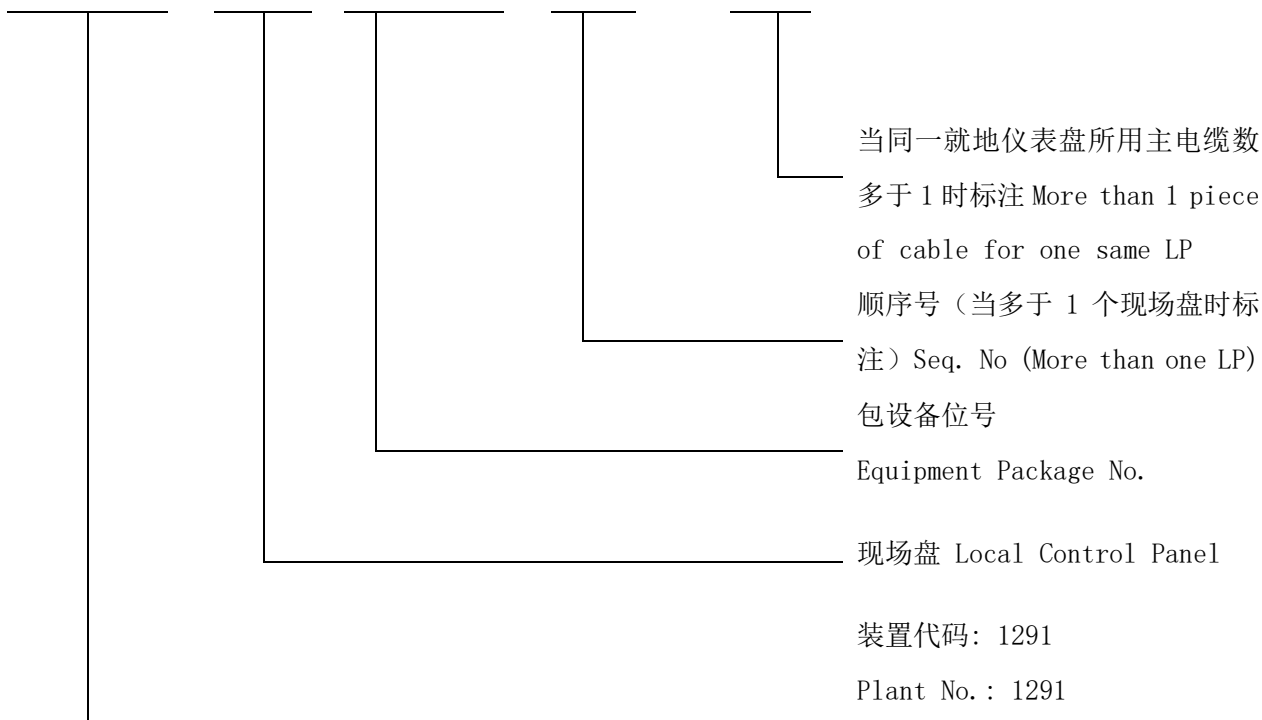
当有多根电缆接入同一仪表时用 n 标注, n=1, 2, 3, ……。

More than 1 piece of branch cables for one same instrument.

- 包设备随机就地仪表盘电缆编号命名原则:

Packaged instrument local control panel numbering system:

1291 - LP- XXXXX - XX Cn



6.10 伴热 Heat Tracing

采用蒸汽伴热、或带温控的电伴热(Ex db Gb)，并在电伴热尾端设置指示灯。(待定)

Steam tracing or Electrical tracing shall be used and indicator light is set at the end of electric heat tracing

当管道采用电伴热时，管道上的仪表伴热也采用电伴热。

When electrical tracing is used for process pipe, the instrument installed on that particular pipe shall be electrical traced.

6.11 仪表与设备/配管专业接口 Instrument Interfaces to Equipment or Piping

仪表与设备/配管接口规定原则如下：(仪表过程连接压力等级不低于设备或配管等级要求)

The interfaces between instrument and equipment, instrument and piping shall be specified as following (The pressure rating of instrument process connection shall be not lower than the pressure rating of vessel and piping) .

参数 data	仪表 instrument	过程连接接口 process interface 设备 Vessel 管道 piping	仪表接口 inst. nozzle	备注 note
流量 flow	差压流量变送器 DP flow transmitter		1/2"或 or 3/4"SW	1/2"NPT(F) 注 note 3

	膜片密封差压流量变送器 DP flow transmitter with diaphragm sealing		2"法兰 flange	2"法兰 flange	
温度 temp.	一般温度仪表 general temp. inst.	法兰 2" flange	法兰 2" flange	法兰 2" flange	注 note 4
	耐磨热电偶 anti-erotion TC	法兰 2" flange	法兰 2" flange	法兰 2" flange	注 note 4
	红外测温仪 infrared thermometer	法兰 3" flange	法兰 3" flange	法兰 3" flange	
	多点温度元件 multi-point temperature elements	法兰 3" flange	法兰 3" flange	法兰 3" flange	
压 力 press.	一般压力表 general pressure gauge	法兰 2" flange	法兰 2" (注 2) flange	1/2"NPT(M)	
	隔膜压力表 diaphragm pressure gauge	法兰 2" flange	法兰 2" flange	法兰 2" flange	
	压力/差压变送器 pressure/DP transmitter	法兰 2" flange	法兰 2" (注 2) flange	1/2"NPT(F)	
	法兰膜片密封压力/差压变送器 flanged diaphragm seal pressure/DP transmitter	法兰 3" flange	法兰 3" flange	法兰 3" flange	
	插入式法兰膜片密封压力/差压变送器 insertion flanged diaphragm seal pressure/DP transmitter	法兰 4" flange	法兰 4" flange	法兰 4" flange	
液位 level	玻璃板液位计 gauge glasse	法兰 2" flange		法兰 2" flange	≤2000mm
	磁浮子液位计 magnetic float level gauge	法兰 2" flange		法兰 2" flange	≤3000mm
	磁浮子液位计 magnetic float level gauge	法兰 3" flange		法兰 3" flange	> 3000mm
	液位连通管 level connecting pipe	法兰 3" flange			
	外浮筒液位计 External displacer level instrument	法兰 2" flange		法兰 2" flange	≤2000mm
	差压液位变送器/DP level transmitter	法兰 2" flange		1/2"NPT(F)	
	法兰膜片密封差压液位变送器 flanged diaphragm seal DP level transmitter	法兰 3" flange		法兰 3" flange	
	插入式法兰差压液位变送器 insertion flanged DP level transmitter	法兰 4" flange		法兰 4" flange	
	雷达液位计 radar level instrument	法兰 4"或 6" flange		法兰 4" 或 6" flange	

参数 data	仪表 instrument	过程连接接口 process interface 设备 Vessel 管道 piping		仪表接口 inst. nozzle	备注 note
流量 flow	差压流量变送器 DP flow transmitter		1/2”或 or 3/4”SW	1/2”NPT(F)	注 note 3
	膜片密封差压流量变送器 DP flow transmitter with diaphragm sealing		2”法兰 flange	2”法兰 flange	
	伺服液位计 servo level instrument	法兰 6”		法兰 6” flange	
	内浮球液位计 internal float level gauge	法兰 3” flange		法兰 3” flange	
	外浮筒液位开关 external displacer level switch	法兰 2” flange		法兰 2” flange	
	顶装的浮筒液位计 top mounted displacer level instrument	法兰 3” flange		法兰 3” flange	
	顶装的磁浮子液位计（地下罐） top mounted magnetic float level gauge（underground tank）	法兰 6” flange		法兰 6” flange	
	音叉液位开关 turning fork level switch	法兰 2” flange		法兰 2” flange	
	分析 analyzer	分析仪取样 analyzer sampling	法兰 2” flange	法兰 2” flange	
	氧化锆分析仪 zirconia analyzer	法兰 4” flange		法兰 4” flange	

注 note:

1. 法兰标准采用 ASME B16.5, 法兰压力等级不低于设备或配管材料等级要求。

The flange standard shall adopt ASME B16.5. The pressure rating of flange shall not be lower than the pressure rating of vessel and piping material specification.

2. 小于 2" 的管线, 管口尺寸应按照管道等级规定。

The nozzle size of less than 2" piping shall conform to the piping material specification.

3. 当大于 CL600 时, 取压口连接尺寸应 3/4"。

The tapping size shall be 3/4" where the pressure rating is greater than CL600.

4. 高压场合 ($\geq$ CL900) 采用 1" 承插焊接。

The 1" socket welding shall be adopted for high pressure case ($\geq$ CL900).

7. 卖方设计及供货范围 The Seller's Scope of Supply and Design

卖方应在 P&ID 图标注供货范围, 并负责供货范围内所有仪表及设备包控制系统的工程设计、制造、集成、测试、安装、调试、开车及保运等工作。

The Seller shall identify its scope of supply on detailed P&ID. The Seller shall be responsible of engineering design, manufacture, integration, testing, installation, commissioning, start-up and operation guarantee of the entire instrumentation and EPCS within the Seller's scope of supply.

7.1 现场仪表设备及其安装材料 Field Instrument and Bulk Material

1) 底座(撬块)内安装的所有仪表、接线箱、就地盘、操作柱、仪表电缆槽板、保温伴热、供气及其安装材料的设计、供货与安装;

The design, supply and installation of all instruments, junction boxes, local panels, control stations, instrument cable trays, insulation and trace heating, gas supply systems and bulk material within the scope of baseplate (Skid);

2) 机泵内部相连管道上安装的所有仪表、接线箱、就地盘、操作柱、仪表电缆槽板、保温伴热、供气及其安装材料的设计、供货与安装;

The design, supply and installation of all instruments, junction boxes, local panels, control stations, instrument cable trays, insulation and trace heating, gas supply systems and bulk material that are installed on pump internal piping.

3) 底座(撬块)外安装的所有仪表、接线箱、就地盘、操作柱、仪表电缆槽板、保温伴热、供气及其安装材料的设计、供货;

The design and supply of all instruments, junction boxes, local panels, control stations, instrument cable trays, insulation and trace heating, gas supply systems and bulk material outside baseplate (Skid) but within the scope of equipment package;

4) 底座(撬块)内或设备包内安装的所有仪表至就地盘或接线箱之间的电缆及安装附件的设计、供货与安装;

The design, supply and installation of instrument cables and cable accessories between

instruments and junction boxes and/or local panels within the scope of baseplate (Skid) and equipment package.

5) 特殊仪表及控制电缆的设计与供货;

The design and supply of special instrument/control cable;

6) 现场仪表及就地盘调试工作;

The commissioning of field instrument and local panel

7) 负责所供货的底座(撬块)内所有现场仪表的供气及其材料的设计、供货和安装,并提供总的仪表风消耗量。

Vendor shall be responsible for or the design, supply and installation of the air assignment and its materials for all field instruments within the supplied scope of baseplate (Skid) . and provide the total instrument air consumption.

7.2 控制室/机柜室内仪表及控制系统 Instrument and Control System inside CCR/FAR

卖方负责设备包控制系统工程设计、集成、供货、组态、测试、验收、包装、运输、安装、调试、开车及保运等工作。

The Seller shall be responsible of engineering design, integration, supply, configuration, test, FAT, packaging, transportation, installation, commissioning, start-up and operation guarantee of the Equipment Package Control System (EPCS).

1) 设备包控制系统应包括常规监控、防喘振控制、调速控制、负荷控制、超速保护、轴位移轴振动监视、安全联锁等;

Equipment Package Control System (EPCS) shall include the functions of daily monitoring, anti-surge control, speed control, load control, overspeed protection, axial vibration and displacement monitoring, and safety interlock etc.;

2) 设备包控制系统的组态、调试、FAT、SAT 及开车;

The system configuration, commissioning, FAT, SAT and start-up of EPCS;

3) 控制及辅助机柜,要求集成后整体供货,保证机柜完整性,对外接口为端子排,端子规格应与外部接线电缆截面积一致,出厂前应完成测试;

The control and auxiliary cabinets of EPCS shall be supplied after all integration is

completed in the factory. Jobsite integration of cabinet components is not allowed. This is to ensure the integrity of the cabinets. The interface between EPCS and field cable shall be terminal strips inside EPCS cabinets. The terminal specification shall be in accordance with field cable wire size and shall be tested in the factory;

- 4) 与 DCS 通信串行接口的组态包括组态参数、地址及通信协议等;

The configuration of serial communication with DCS shall include configuration parameters, addresses and communication protocol etc.

- 5) 参与 DCS 的工厂测试, 以保证 DCS 与设备包控制系统的正常通信;

The Seller shall take part in DCS FAT to ensure proper communication between DCS and EPCS;

- 6) 特殊电缆 (如 Profibus-DP, MODEBUS-RTU 通讯电缆) 的设计与供货;

The design and supply of special cable, i.e. Profibus-DP, MODEBUS-RTU communication cable;

- 7) 光缆的设计与供货;

The design and supply of fibre optic cable;

- 8) 控制室和机柜室内系统柜与辅助机柜之间采用带 ELC0 型接插件的连接电缆进行连接;

The control cabinets and auxiliary cabinets inside CCR and FAR shall be connected by ELC0 (plug-in) type connection cable.

7.3 测试与验收 Testing and Acceptance

- 1) 卖方供货的仪表, 调校工作由卖方负责;

The instrument supplied by Seller shall be commissioned by Seller;

- 2) 卖方提供仪表应在制造厂安装并测试;

The instrument supplied by Seller shall be installed and tested in the factory;

- 3) 卖方应提供验收测试程序并经买方确认, 用于验收测试;

Seller shall prepare and provide FAT procedure for Buyer's approval;

- 4) 卖方应提供调校用的特殊工具;

Seller shall provide special tools for commissioning;

- 5) 设备包控制系统的 FAT, 应在卖方工厂完成测试;

The FAT of EPCS shall be done in Seller's factory;

6) 卖方完成其控制系统与 DCS 通信的测试。

Seller is responsible of testing communication between EPCS and DCS

8. 买方设计及供货范围 The Buyer's Scope of Supply and Design

1) 确认卖方提供的技术文件包括仪表及设备包控制系统;

Confirmation and approval of technical document provided by Seller about field instrument and EPCS;

2) 仪表工程设计规定;

To provide instrument engineering specification

3) 标准图格式;

To provide format of standard drawing

4) CCR/FAR 至卖方提供的接线箱或现场就地盘的电缆 (主电缆) 的敷设及供货;

The supply and routing of cables from field instrument, junction boxes or local panel supplied by Seller to CCR/FAR;

5) 设备包控制系统操作站、工程师站和机柜的安装

The installation of EPCS operation stations, engineer stations and cabinets;

6) 在底座 (撬块) 外的仪表、设备包控制系统、就地盘和操作柱的安装;

The installation of field instrument, EPCS, local panels and control stations outside baseplate (Skid);

7) 220VAC 电源至设备包控制系统机柜电源电缆及敷设;

The supply and routing of 220V AC main power cable to EPCS cabinet;

8) 气源总管至底座 (撬块), 气源总管预留过程连接形式为 ANSI RF 法兰, 预留过程连接尺寸开工会进一步确认。

Main pipe of instrument air supply to baseplate (Skid); Main pipe is reserved for process connections in the form of ANSI RF flanges. The reserved process connection size shall be further confirmed by the kick-off meeting.

9) 机柜接地;

Grounding from EPCS cabinet to CCR/FAR main earth bar.

9. 文件交付 Document Delivery

9.1 卖方交付文件 Documents Delivered by Seller

卖方应提供用于设备包仪表及控制系统的安装、调试、开车、维护等所有文件，文件应采用标准 A1 至 A4 尺寸，首选 A4 或 A3 尺寸。

Seller shall provide all documents for the installation, commissioning, start-up and maintenance of Seller supplied instrument and EPCS. The documents shall be of standard A1, A2, A3 and/or A4 sizes. A3 and A4 size are preferred.

卖方同时提供可编辑和 PDF 电子文件。

Seller shall provide editable version and PDF version of all documents mentioned above.

9.1.1 报价文件至少包括但不限于：

The quotation documents shall include but not limited to:

文件清单及文件交付进度表；

仪表设计工程规定；

设备包控制系统说明；

设备包控制系统配置

仪表设备清单（模板文件详见附录三）；

偏差表；

P&ID；

控制及联锁策略功能设计规格书；

卖方供货的仪表和控制系统的电源容量、散热量及耗气量；

DCS/SIS 系统 I/O 汇总清单；

设备包控制系统 I/O 汇总清单；

设备包控制系统和主要仪表制造厂清单。

Document list and delivery schedule；

Instrument engineering design specification；

Description of EPCS;

Hardware and software list of EPCS;

Instrument list (See Annex 3 for template file) ;

Deviation list;

P&ID;

Control and safeguarding strategy function design specification;

Power consumption, heat dissipating capacity and air consumption of Seller supplied instrument and EPCS;

DCS/SIS I/O list of the equipment package;

EPCS I/O list;

Manufacturer list of EPCS and major instrument;

9.1.2 工程文件:

Engineering documents

仪表索引表;

仪表数据表;

仪表计算书 (调节阀、流量仪表);

防喘振调节阀、流量元件及变送器数据表;

防喘振控制、负荷控制、调速控制等系统的所有元件及操作程序的说明及计算;

控制系统的说明;

联锁逻辑图;

安全联锁说明;

报警及联锁设定值清单;

DCS/SIS 系统 I/O 汇总清单;

设备包控制系统 I/O 清单;

仪表盘柜布置 (包括外型尺寸、内部布置及详细接线图);

EPCS 与 DCS 的通讯协议、通讯地址表、参数等;

仪表回路图;

仪表安装图（导压配管、电/气、伴热等安装图）；

仪表铭牌表；

供电系统图；

接地系统图；

接线箱图；

仪表电缆表；

仪表材料表

仪表制造厂文件及样本；

卖方供货的仪表和控制系统的 FAT 程序；

仪表设备的校验报告；

控制系统的组态、操作维护手册；

仪表操作手册、安装手册、维护手册；

设备包控制系统工艺及操作画面；

控制系统的组态程序文件。

备件清单；

质量控制计划；

Instrument index；

Instrument datasheet；

Instrument calculation sheet (control valve and flow instrument)；

Datasheet of anti-surge control loop instrument, including control valves, transmitters and flow instruments；

Calculation sheet for valve and flow element of Anti-surge, load control and speed control, and description for control and operation of anti-surge, ,load control and speed control, complex loop and electronic governing；

Description of EPCS；

Interlock logicdiagram；

Description of safety interlocks；

Alarm and trip setpoints list;

DCS/SIS I/O list of the equipment package;

EPCS I/O list;

Layout drawing of instrument panels and cabinets, including dimensions, internal layout and detailed wiring diagram;

The EPCS communication protocol with DCS, address (Mapping) list and parameter list;

Loop diagram;

Instrument hookup drawing, including pressure hookup, electrical/pneumatic hookup and heat tracing hookup drawing;

Instrument nameplate list;

Instrument power system drawing;

Instrument grounding system drawing;

Junction box layout drawing;

Instrument wiring diagram;

Instrument bulk material list;

Instrument manufacturer document and catalogue;

FAT procedure for instrument and control system supplied by Seller;

Instrument calibration report;

Control system configuration, operation and maintenance manual;

Instrument operation, installation and maintenance manual;

EPCS process and operation graphic;

Control system configuration documents;

Spare parts list;

Quality control plan;

9.1.3 竣工文件

As-built document

卖方应提供竣工文件, 准确反映施工及开车期间的修改及增加的内容。

Seller shall prepare and provide documents of as-built version, which shall include all modification and addition during construction and star-up.

9.1.4 文件数量

The number of copies of documents.

文件交付数量详见项目要求。

The number of copies of delivered documents shall be as per project requirements.

10. 项目采用的标准、规范 Project Applicable Standard and Code

10.1 中国标准 Chinese Standard and Code

序号	标准编号	标准名称	有效版本
A	中国国家标准 (GB)		
1	GB/T 2624.1 (ISO 5167-1: 2003,IDT)	用安装在圆形截面管道中的差压装置测量满管流 体流量 第 1 部分: 一般原理和要求	2006
2	GB/T 2624.2 (ISO5167-2: 2003,IDT)	用安装在圆形截面管道中的差压装置测量满管流 体流量 第 2 部分: 孔板	2006
3	GB/T 2624.3 (ISO 5167-3: 2003,IDT)	用安装在圆形截面管道中的差压装置测量满管流 体流量 第 3 部分: 喷嘴和文丘里喷嘴	2006
4	GB/T 2624.4 (ISO 5167-4: 2003,IDT)	用安装在圆形截面管道中的差压装置测量满管流 体流量 第 4 部分: 文丘里管	2006
5	GB/T 2625	过程检测和控制流程图用图形符号和文字代号	1981
6	* GB 3100	国际单位制及其应用	1993
7	GB/T 3836.1 (IEC 60079-0: 2017, MOD)	爆炸性环境 第 1 部分: 设备 通用要求	2021

8	GB/T 3836.2 (IEC 60079-1: 2014, MOD)	爆炸性环境 第 2 部分：由隔爆外壳 “d” 保护的設備	2021
9	GB/T 3836.3 (IEC 60079-7: 2015, MOD)	爆炸性环境 第 3 部分：由增安型 “e” 保护的設備	2021
10	GB/T 3836.4 (IEC 60079-11:2011, MOD)	爆炸性环境 第 4 部分：由本质安全型 “i” 保护的設備	2021
11	GB/T 3836.5 (IEC 60079-2: 2014, MOD)	爆炸性环境 第 5 部分：由正压外壳 “p” 保护的設備	2021
12	GB/T 3836.8 (IEC 60079-15:2017, MOD)	爆炸性环境 第 8 部分：由 “n” 型保护的設備	2021
13	*GB 3836.14 (IEC 60079-10-1:2008, IDT)	爆炸性环境 第 14 部分：场所分类 爆炸性气体环境	2014
14	*GB 3836.15 (IEC 60079-14:2007, MOD)	爆炸性环境 第 15 部分：电气装置的设计、选型和安装	2024
15	GB/T 3836.18 (IEC 60079-25:2010, MOD)	爆炸性环境 第 18 部分：本质安全电气系统	2024
16	GB/T 4208 (IEC60529: 2013, IDT)	外壳防护等级（IP 代码）	2017
17	GB/T 4213	气动调节阀	2024
18	GB/T 4830	工业自动化仪表气源压力范围和质量	2015
19	*GB 15577	粉尘防爆安全规程	2018

20	*GB 14052	安装在设备上的同位素仪表的辐射安全性能要求	1993
21	*GB 17167	用能单位能源计量器具配备和管理通则	2006
22	GB/T 18268.1	测量、控制和实验室用的电设备 电磁兼容性要求 第 1 部分: 通用要求	2025
23	GB/T 18268.31 (IEC 61326-3-1:2017, IDT)	测量、控制和实验室用的电设备 电磁兼容性要求 第 31 部分: 安全相关系统和预期执行安全相关功能 (功能安全) 设备的抗扰度要求 一般工业应用	2022
24	GB/T 20719.1 (ISO 18629-1: 2004,IDT)	工业自动化系统与集成 过程规范语言 第 1 部分: 概述与基本原理	2006
25	GB/T 20727 (ISO 14511: 2001,IDT)	封闭管道中流体流量的测量 热式质量流量计	2006
26	GB/T 20728 (ISO 10790: 2015,IDT)	封闭管道中流体流量的测量 科里奥利流量计的选型、安装和使用指南	2021
27	GB/T 20901	石油石化行业能源计量器具配备和管理要求	2007
28	GB/T 21109.1 (IEC 61511-1: 2016,IDT)	过程工业领域安全仪表系统的功能安全 第 1 部分: 框架、定义、系统、硬件和软件要求	2022
29	GB/T 21109.2 (IEC 61511-2: 2016,IDT)	过程工业领域安全仪表系统的功能安全 第 2 部分: GB/T 21109.1-2022 的应用指南	2023
30	GB/T 21109.3 (IEC 61511-3: 2003,IDT)	过程工业领域安全仪表系统的功能安全 第 3 部分: 确定要求的安全完整性等级的指南	2026
31	* GB 50016	建筑设计防火规范 (2018 年版)	2014 (2018 年版)
32	*GB 50030	氧气站设计规范	2013
33	* GB 50057	建筑物防雷设计规范	2010
34	* GB 50058	爆炸危险环境电力装置设计规范	2014

35	*GB 50074	石油库设计规范	2014
36	*GB 50093	自动化仪表工程施工及质量验收规范	2013
37	*GB 50116	火灾自动报警系统设计规范	2013
38	*GB 50160	石油化工企业设计防火标准 (2018 年版)	2008 (2018 年版)
39	*GB 50166	火灾自动报警系统施工及验收标准	2019
40	GB/T 50493	石油化工可燃气体和有毒气体检测报警设计标准	2019
41	GB/T 50770	石油化工安全仪表系统设计规范	2013
42	GB/T 50779	石油化工建筑物抗爆设计标准	2022
43	GB/T 50087	工业企业噪声控制设计规范	2013
44	*GBZ 125	含密封源仪表的放射卫生防护标准	2009
45	TSG 21	固定式压力容器安全技术监察规程	2016
46	*GB 17681	危险化学品重大危险源安全监控技术规范	2024
B	石化行业标准 (SH)		
1	SH/T 3004	石油化工采暖通风与空气调节设计规范	2011
2	SH/T 3005	石油化工自动化仪表选型设计规范	2016
3	SH/T 3006	石油化工控制室设计规范	2024
4	SH/T 3020	石油化工仪表供气设计规范	2013
5	SH/T 3021	石油化工仪表及管道隔离和吹洗设计规范	2013
6	SH/T 3097	石油化工静电接地设计规范	2017
7	SH/T 3126	石油化工仪表及管道伴热和绝热设计规范	2013
8	SH/T 3007	石油化工储运系统罐区设计规范	2014
9	SH/T 3019	石油化工仪表管道线路设计规范	2016
10	SH/T 3081	石油化工仪表接地设计规范	2025
11	SH/T 3082	石油化工仪表供电设计规范	2019
12	SH/T 3092	石油化工分散控制系统设计规范	2013
13	SH/T 3101	石油化工流程图图例	2025
14	SH/T 3104	石油化工仪表安装设计规范	2013

15	SH/T 3105	石油化工仪表管线平面布置图图形符号及文字代号	2018
16	SH/T 3146	石油化工噪声控制设计规范	2004
17	SH/T 3164	石油化工仪表系统防雷设计规范	2021
18	SH/T 3174	石油化工在线分析仪系统设计规范	2013
19	SH/T 3181	石油化工仪表远程监控及数据采集系统设计规范	2016
20	SH/T 3183	石油化工动力中心自动化系统设计规范	2017
21	SH/T 3184	石油化工罐区自动化系统设计规范	2017
22	SH/T 3188	石油化工 PROFIBUS 控制系统工程设计规范	2017
23	SH/T 3198	石油化工空分装置自动化系统设计规范	2018
24	SH/T 3199	石油化工压缩机控制系统设计规范	2018
25	SH/T 3206	石油化工设计安全检查标准	2019
26	SH/T 3225	石油化工安全仪表系统安全完整性等级设计规范	2024
28	SH/T 3551	石油化工仪表工程施工质量验收规范	2024
29	SPMP-STD-EM2001	石油化工装置工艺设计包（成套技术工艺包）内容规定	2015
30	SPMP-STD-EM2002	石油化工大型建设项目总体设计内容规定	2016
31	SPMP-STD-EM2003	石油化工装置基础工程设计内容规定	2016
32	SPMP-STD-EM2004	石油化工工厂基础工程设计内容规定	2016
33	SPMP-STD-EM2005	石油化工装置详细工程设计内容规定	2016
C	化工行业标准（HG）		
1	HG/T 20570.15	管路限流孔板的设置	1995
D	安全生产行业标准（AQ）		
1	AQ 3059	化工企业液化烃储罐安全管理规范	2023

注： 标注*的标准为强制性规范和标准，或其中含有强制性条文。

Note: standard or specification with “*” mark is compulsory, or contains compulsory articles.

10.2 国际和国外标准 International and Overseas Standard and Code

序号	标准编号	标准名称	有效版本
A	ISO标准 ISO Standard		
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	2022
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	2022
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	2022
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	2022
5	ISO 5167-6	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full— Part 6: Wedge meters	2022
6	ISO 15848-1	Industrial valves - Measurement, test and qualification	2015+A1 :2017

		procedures for fugitive emissions - Part 1: Classification system and qualification procedures for type testing of valves	
7	ISO 15848-2	Industrial valves - Measurement, test and qualification procedures for fugitive emissions - Part 2: Production acceptance test of valves	2015
B	IEC标准 IEC Standard		
1	IEC 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements	2017
2	IEC 60079-1	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”	2014
3	IEC 60079-2	Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure “p”	2014
4	IEC 60079-7	Explosive atmospheres - Part 7: Equipment protection by increased safety “e”	2015+AM D1:2017
5	IEC 60079-10-1	Explosive atmospheres - Part 10-1: Classification of areas -Explosive gas atmospheres	2020
6	IEC 60079-10-2	Explosive atmospheres - Part 10-2: Classification of areas - Combustible dust atmospheres	2015
7	IEC 60079-11	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety “i”	2023
8	IEC 60079-14	Explosive atmospheres - Part 14: Electrical installations design, selection and erection	2013

9	IEC 60079-15	Explosive atmospheres – Part 15: Construction, test and marking of type of protection “n” electrical apparatus	2017
10	IEC 80079-20-1	Explosive atmospheres –Part 20-1: Material characteristics for gas and vapour classification – Test methods and data	2017
11	IEC 60079-25	Explosive atmospheres – Part 25: Intrinsically safe electrical systems	2020
12	IEC 60079-29-1	Explosive atmospheres – Part 29-1: Gas detectors – performance requirements of detectors for flammable gases	2016+AM D1:2020
13	IEC 60079-29-2	Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen	2015
14	IEC 60079-29-4	Explosive atmospheres – Part 29-4: Gas detectors – Performance requirements of open path detectors for flammable gases	2009
15	IEC 60079-31	Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure “t”	2022
16	IEC 60304	Standard Colours for Insulation for Low-Frequency Cables and Wires	1982
17	IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)	1989+AM D1:1999 +AMD2:2 013
18	IEC 60534-1	Industrial-Process Control Valves Part 1: Control Valve Terminology and General Considerations	2023

19	IEC 60534-2-1	Industrial-Process Control Valves - Part 2-1: Flow-Capacity - Sizing Equations for Fluid Flow under Installed Conditions	2011
20	IEC 60534-2-3	Industrial-Process Control Valves - Part 2-3: Flow Capacity - Test Procedures	2015
21	IEC 60534-2-4	Industrial-process control valves - Part 2-4: Flow capacity - Inherent flow characteristics and rangeability	2009
22	IEC 60534-3-1	Industrial-Process Control Valves - Part 3-1: Dimensions - Face-to-Face Dimensions for Flanged, Two-Way, Globe-Type, Straight Pattern and Centre-To-Face Dimensions for Flanged, Two-Way, Globe-Type, Angle Pattern Control Valves	2019
23	IEC 60534-3-2	Industrial-Process Control Valves - Part 3-2: Dimensions - Face-to-Face Dimensions for Rotary Control Valves Except Butterfly Valves	2001
24	IEC 60534-3-3	Industrial-Process Control Valves - Part 3-3: Dimensions - End-to-End Dimensions for Buttweld, Two-Way, Globe-Type, Straight Pattern Control Valves	1998
25	IEC 60534-4	Industrial-Process Control Valves - Part 4: Inspection and Routine Testing	2021
26	IEC 60534-5	Industrial-process control valves - Part 5: Marking	2004
27	IEC 60534-7	Industrial-Process Control Valves Part 7: Control Valve Data Sheet	2010
28	IEC 60534-8-3	Industrial-process control valves - Part	2010

		8-3: Noise considerations - Control valve aerodynamic noise prediction method	
29	IEC 60534-8-4	Industrial-process control valves - Part 8-4: Noise considerations - Prediction of noise generated by hydrodynamic flow	2015
30	IEC 60534-9	Industrial-process control valves - Part 9: Test procedure for response measurements from step inputs	2007
31	IEC 60584-1	Thermocouples Part 1: EMF specifications and tolerances	2013
32	IEC 60584-3	Thermocouples - Part 3: Extension and compensating cables - Tolerances and identification system	2021
33	IEC 60654-1	Industrial-process measurement and control equipment - Operating conditions - Part 1: Climatic conditions	1993
34	IEC 60654-2	Operating conditions for industrial-process measurement and control equipment. Part 2: Power	1979+AM D1:1992
35	IEC 60654-3	Operating conditions for industrial-process measurement and control equipment. Part 3: Mechanical influences	1983
36	IEC 60654-4	Operating conditions for industrial-process measurement and control equipment. Part 4: Corrosive and erosive influences	1987
37	IEC 60751	Industrial platinum resistance thermometers and platinum temperature sensors	2022
38	IEC 61131-1	Programmable Controllers - Part 1: General Information	2003

39	IEC 61131-2	Industrial-process measurement and control - Programmable controllers - Part 2: Equipment requirements and tests	2017
40	IEC 61131-3	Programmable Controllers - Part 3: Programming Languages	2013
41	IEC 61131-5	Programmable Controllers - Part 5: Communications	2000
42	IEC 61131-7	Programmable Controllers - Part 7: Fuzzy Control Programming	2000
43	IEC 61158-2	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	2023
44	IEC 61285	Industrial-Process Control - Safety of Analyser Houses	2015
45	IEC 61508-1	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 1: General Requirements	2010
46	IEC 61508-2	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 2: Requirements for Electrical/Electronic/Programmable Electronic Safety-Related Systems	2010
47	IEC 61508-3	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 3: Software Requirements	2010
48	IEC 61508-4	Functional Safety of	2010

		Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 4: Definitions and Abbreviations	
49	IEC 61508-5	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 5: Examples of Methods for the Determination of Safety Integrity Levels	2010
50	IEC 61508-6	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 6: Guidelines on the Application of IEC 61508-2 and IEC 61508-3	2010
51	IEC 61508-7	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 7: Overview of Techniques and Measures	2010
52	IEC 61511-1	Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements	2016+AM D1:2017
53	IEC 61511-2	Functional safety – Safety instrumented systems for the process industry sector – Part 2: Guidelines for the application of IEC 61511-1	2016
54	IEC 61511-3	Functional safety – Safety instrumented systems for the process industry sector – Part 3: Guidance for the determination of the	2016

		required safety integrity levels	
C	美国标准 American Standard		
1	ANSI/ISA-5.1	Instrumentation Symbols and Identification	2022
2	ISA-5.2	Binary Logic Diagrams for Process Operations	1976 (R1992)
3	ISA-5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems	1983
4	ISA-5.4	Instrument Loop Diagrams	1991
5	ISA-5.5	Graphic Symbols for Process Displays	1985
6	ISA-7.0.01	Quality Standard for Instrument Air	1996
7	ISA-18.1	Annunciator Sequences and Specifications	2024
8	ISA-20	Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves	1981
9	ANSI/ISA-75.01.01	Flow Capacity - Sizing Equations for Fluid Flow Under Installed Conditions	2012
10	ANSI/ISA-75.02.01	Control Valve Capacity Test Procedures	2008
11	ANSI/ISA-75.05.01	Control Valve Terminology	2019
12	ISA-75.07	Laboratory Measurement of Aerodynamic Noise Generated by Control Valves	1997
13	ANSI/ISA-75.08.01	Face-to-Face Dimensions for Integral Flanged Globe-Style Control Valve Bodies (Classes 125, 150, 250, 300, and 600)	2016
14	ANSI/ISA-75.08.02	Face-to-Face Dimensions for Flanged and Flangeless Rotary Control Valves (Classes 150, 300, and 600, and PN 10, PN 16, PN 25,	2003 (R2017)

		PN 40, PN 63 and PN 100)	
15	ANSI/ISA-75.08.03	Face-to-Face Dimensions for Socket Weld-End and Screwed-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)	2001 (R2013)
16	ANSI/ISA-75.08.04	Face-To-Face Dimensions for Buttweld-End Globe-Style Control Valves (Class 4500)	2001 (R2013)
17	ANSI/ISA-75.08.05	Face-to-Face Dimensions for Buttweld-End Globe-Style Control Valves (Class 150, 300, 600, 900, 1500, and 2500)	2016
18	ANSI/ISA-75.08.06	Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (Classes 900, 1500, and 2500)	2002 (R2013)
19	ANSI/ISA-75.08.07	Face-to-Face Dimensions for Separable Flanged Globe-Style Control Valves (Classes 150, 300, and 600)	2001 (R2013)
20	ANSI/ISA-75.08.08	Face-to-Centerline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (ANSI Classes 150, 300, and 600)	2015
21	ANSI/ISA-75.08.09	Face-to-Face Dimensions for Sliding Stem Flangeless Control Valves (Classes 150, 300, and 600)	2016
22	ANSI/ISA-75.11.01	Inherent Flow Characteristic and Rangeability of Control Valves	2013
23	ANSI/ISA-75.13.01	Method of Evaluating the Performance of Positioners with Analog Input Signals and Pneumatic Output	2013
24	ANSI/ISA-75.19.01	Hydrostatic Testing of Control Valves	2013
25	ISA TR96.05.01	Partial Stroke Testing of Automated Valves	2017
26	ASME B1.20.1	Pipe Threads, General Purpose (Inch)	2013

27	ASME B1. 13M	Metric Screw Threads: M Profile	2005 (R2020)
28	ASME B16. 5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard	2020
29	ASME B16. 10	Face-to-Face and End-to-End Dimensions of Valves	2022
30	ASME B16. 11	Forged Fittings, Socket-Welding and Threaded	2021
31	ASME B16. 25	Buttwelding Ends	2022
32	ASME B16. 34	Valves - Flanged, Threaded and Welding End	2020
33	ASME B16. 36	Orifice Flanges	2020
34	ASME B16. 47	Large Diameter Steel Flanges NPS 26 Through NPS 60 Metric/Inch Standard	2020
35	ASME B36. 10	Welded and Seamless Wrought Steel Pipe	2022
36	ASME B36. 19	Welded and Seamless Wrought Stainless Steel Pipe	2022
37	ASME BPVC-VIII-1	RULES FOR CONSTRUCTION OF PRESSURE VESSELS - DIVISION 1	2023
38	API Std 6FA	Standard for Fire Test for Valves	2020
39	API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2	2018
40	API STD 520 PT I	Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries Part I - Sizing and Selection	2020
41	API STD 520 PT II	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries Part II - Installation	2020

42	API STD 521	Pressure-relieving and Depressuring Systems	2020
43	API STD 526	Flanged Steel Pressure-relief Valves	2023
44	API RP 551	Process Measurement Instrumentation	2016 (R2024)
45	API RP 552	Transmission Systems	1994 (R2022)
46	API RP 553	Refinery Valves and Accessories for Control and Safety Instrumented Systems	2012 (R2020)
47	API RP 554 PART 1	Process Control Systems - Functions and Functional Specification Development	2021
48	API RP 554 PART 2	Process Control Systems— Process Control System Design	2023
49	API RP 554 PART 3	Process Control Systems— Project Execution and Process Control System Ownership	2021
50	API RP 555	Process Analyzers	2013 (R2020)
51	API RP 556	Instrumentation and Control Systems for Fired Heaters and Steam Generators	2011 (R2024)
52	API RP 557	Guide To Advanced Control Systems	2013
53	API Std 598	Valve Inspection and Testing	2023
54	API Std 607	Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats	2022
55	API Std 609	Butterfly Valves: Double-flanged, Lug- and Wafer-type, and Butt-welding Ends	2021
56	API Std 670	Machinery Protection Systems	2014 (R2022)
57	API Std 6FA	Specification for Fire Test for Valves	1999 (Err2008)
58	ANSI/FCI 70-2	Standard for Control Valve Seat Leakage	2021

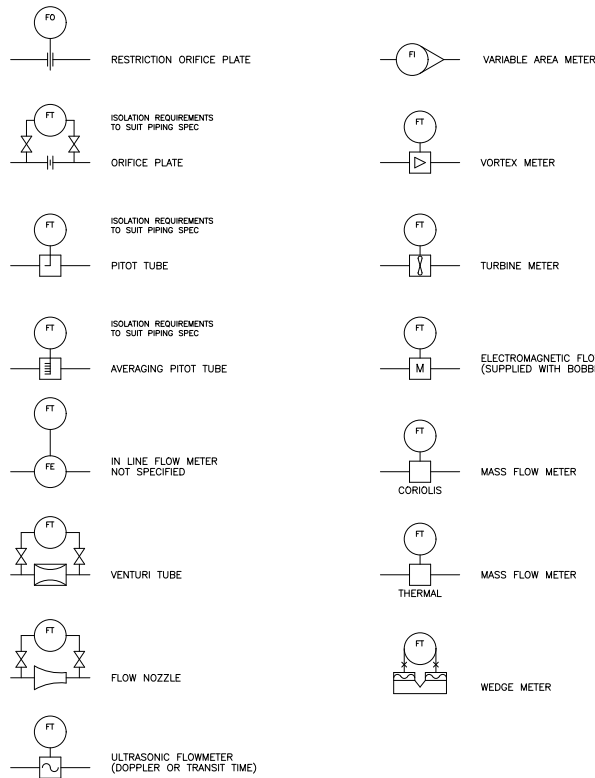
		Testing	
59	NEMA ICS1	Industrial Control and Systems: General Requirements	2022
60	ANSI/ NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)	2020
61	NFPA 72	National Fire Alarm and Signaling Code	2022
D	英国标准 UK Standard		
1	BS 6121-1	Mechanical cable glands Part 1: Armour glands Requirements and test methods	2005 (R2016)
2	BS EN837-1	Pressure Gauges Part 1: Bourdon Tube Pressure Gauges - Dimensions, Metrology, Requirements and Testing	1998
3	BS EN837-2	Pressure Gauges Part 2: Selection and Installation Recommendations for Pressure Gauges	1998
4	BS EN837-3	Pressure Gauges Part 3: Diaphragm and Capsule Pressure Gauges - Dimensions, Metrology, Requirements and Testing	1998
5	BS EN 50288-7	Multi-element metallic cables used in analogue and digital communication and control - Part 7: Sectional specification for instrumentation and control cables	2005
E	德国标准 Germany Standard		
1	RAL	Colour cords	

Annex 1: P&ID instrument and control system symbols, abbreviation and general notes

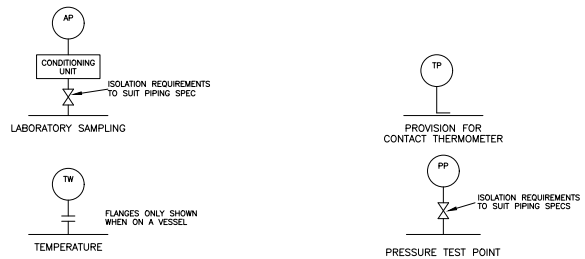
FIRST LETTER	INITIATING OR MEASURED VARIABLE	WELL	TEST POINT	VIEWING DEVICE GLASS/GAUGE	PRIMARY ELEMENT	SWITCH	TRANSMITTER	READOUT INDICATOR	DEVICES INDICATING ALARM	ALARM	NOT INDICATING	CONTROLLERS INDICATING	INDICATING & ALARM	COMPUTING DEVICE / CONVERTER	CONTROL VALVE	TRIP INITIATING SWITCH	INDICATING LIGHT	LOGIC	ORIFICE	TRIP ALARM	SAFETY ELEMENT	SAFETY VALVE	NON MODULATING VALVE
A	ANALYSIS		AP		AE	AS	AT	AI	AIA	AA	AC	AIC	AICA	AY	ACV	ASS				ASA			
AD	ANALYSIS/DIFFERENCE								ADIA														
B	BURNER/COMBUSTION	BW		BG	BE	BS	BT	BI	BIA	BA	BC	BIC	BICA	BY	BCV	BSS	BL			BSA			
C	USERS CHOICE																						
D	DENSITY				DE	DS	DT	DI	DIA	DA	DC	DIC	DICA	DY	DCV	DSS				DSA			
E	VOLTAGE				EE	ES	ET	EI	EIA	EA	EC	EIC	EICA	EY	ECV	ESS	EL			ESA			
F	FLOW RATE			FG	FE	FS (FIS*)	FT (FIT*)	FI	FIA	FA	FC	FIC	FICA	FY	FCV	FSS			FO	FSA			
FQ	TOTAL FLOW					FQS	FQT	FQI	FQIA	FQA	FQC	FQIC	FQICA	FQY	FCV	FQSS				FQSA			
FF	FLOW RATIO					FFS		FFI	FFIA	FFA	FFC	FFIC	FFICA	FFY	FFCV	FFSS				FFSA			
G	GAUGING LENGTH OR POSITION				GE	GS	GT	GI	GIA	GA	GC	GIC	GICA	GY	GCV	GSS	GL			GSA			
H	HAND							HI	HIA	HA	HC	HIC	HICA	HY	HCV	HSS				HSA		HSV	HV
I	CURRENT/INTERLOCK				IE	IS	IT	II	IIA	IA	IC	IIC	IICA	IY	ICV	ISS		I		ISA			
J	POWER				JE	JS	JT	JI	JIA	JA	JC	JIC	JICA	JY	JCV	JSS				JSA			
K	TIME/SEQUENCE				KE	KS	KT	KI	KIA	KA	KC	KIC	KICA	KY	KCV	KSS	KL	K		KSA			KV
L	LEVEL			LG	LE	LS	LT	LI	LIA	LA	LC	LIC	LICA	LY	LCV	LSS				LSA			
LD	LEVEL DIFFERENCE						LDT		LDA			LDC	LDCA		LDCV					LDSA			
M	MOISTURE/HUMIDITY				ME	MS	MT	MI	MIA	MA	MC	MIC	MICA	MY	MCV	MSS				MSA			
N	USERS CHOICE																						
O	USERS CHOICE																						
P	PRESSURE/VACUUM	PP		PG	PE	PS	PT	PI	PIA	PA	PC	PIC	PICA	PY	PCV	PSS				PSA	PSE		PSV
PD	PRESSURE DIFFERENCE				PDE	PDS	PDT	PDI	PDIA	PDA	PDC	PDIC	PDICA	PDY	PDCV	PDSS				PDSA			
Q	QUANTITY						QT	QI	QIA														
R	RADIATION	RW			RE																		
S	SPEED/FREQUENCY				SE	SS	ST	SI	SIA	SA	SC	SIC	SICA	SY	SCV	SSS				SSA			
T	TEMPERATURE	TW	TP	TG	TE	TS	TT	TI	TIA	TA	TC	TIC	TICA	TY	TCV	TSS				TSA			
TD	TEMPERATURE DIFFERENCE				TDE	TDS	TDT	TDI	TDIA	TD	TDC	TDIC	TDICA	TDY	TDCV	TDSS				TDSA			
U	MULTIVARIABLE				UE	US	UT	UI	UIA	UA	UC	UIC	UICA	UY	UCV	USS				USA			
V	VIBRATION	VW	VP		VE	VS	VT	VI	VIA	VA	VC	VIC	VICA	VY	VCV	VSS				VSA			
W	WEIGHT				WE	WS	WT	WI	WIA	WA	WC	WIC	WICA	WY	WCV	WSS				WSA			
X	MISCELLANEOUS	XP	XP	XP	XE	XS	XT	XI	XIA	XA	XC	XIC	XICA	XY	XCV	XSS	XL			XSA	XSE	XSV	XV
Y	STATUS				YE	YS		YI	YIA	YA				YY		YSS	YL			YSA			
Z	SAFETY-RELATED TRIP																	Z					

* REPRESENTS AN INDICATOR (EG. A SWITCH ON A ROTAMETER) WITH A SECOND FUNCTION

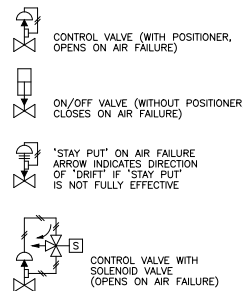
FLOW - PRIMARY ELEMENTS



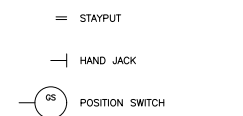
POINTS IN THE PLANT WHERE PROVISION IS MADE FOR MEASUREMENT BUT TO WHICH NO INSTRUMENT IS PERMANENTLY ATTACHED



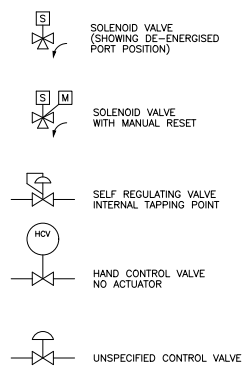
ACTUATOR SYMBOLS



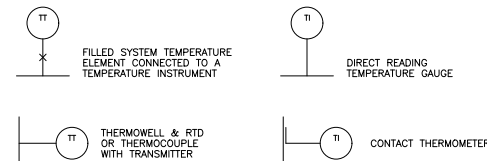
ACTUATOR ACCESSORIES



MISCELLANEOUS TYPES OF VALVES

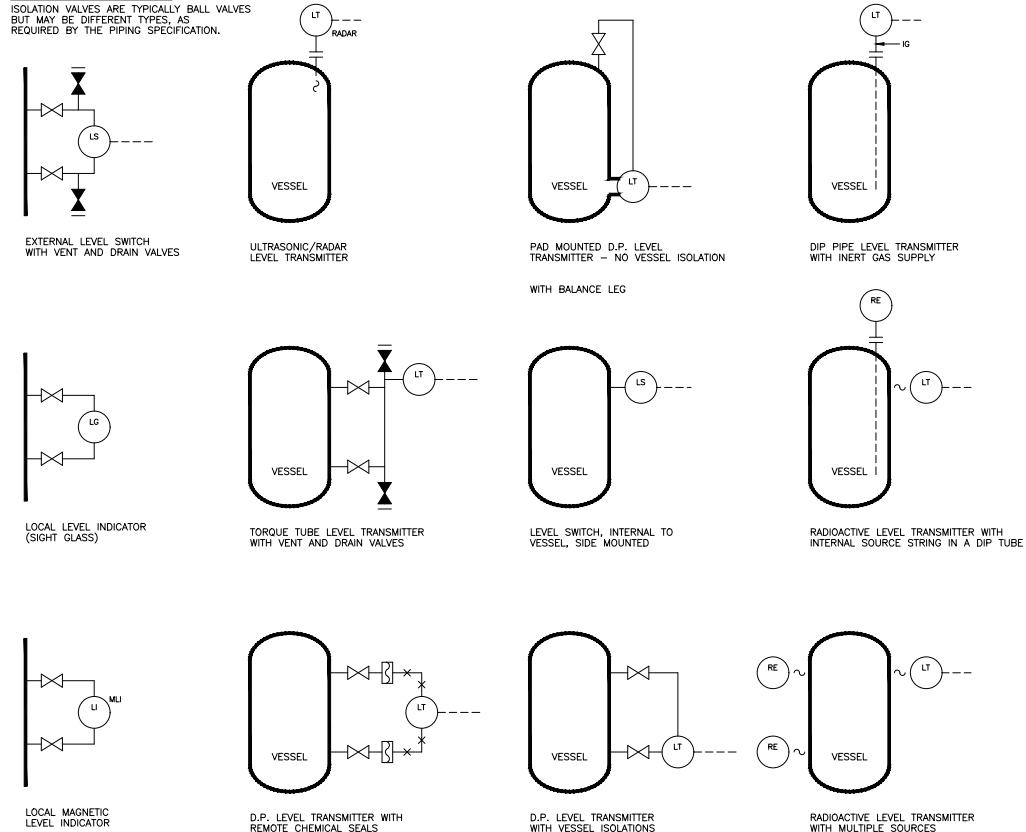


TEMPERATURE



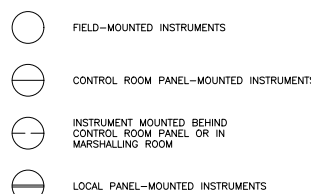
LEVEL INSTRUMENTS

ISOLATION VALVES ARE TYPICALLY BALL VALVES BUT MAY BE DIFFERENT TYPES, AS REQUIRED BY THE PIPING SPECIFICATION.

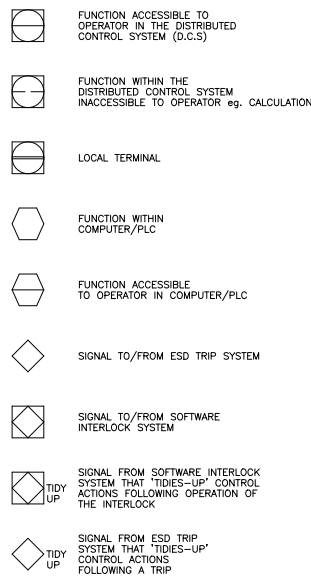


NOTE: NUMBER OF RADIOACTIVE SOURCES SHOWN ON P&IDs IS TYPICAL ONLY. VENDOR INFORMATION IS NEEDED TO CONFIRM FINAL INSTALLATION DETAILS.

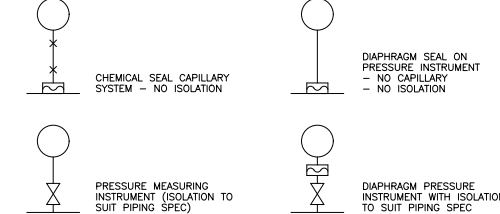
CONTROL SYSTEM COMPONENTS



DCS, COMPUTER, PLC AND TRIP SYSTEMS

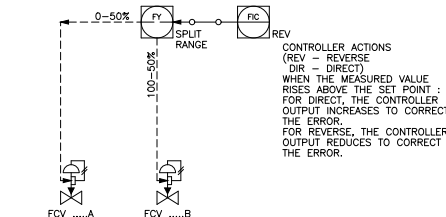


PRESSURE - PRIMARY ELEMENTS



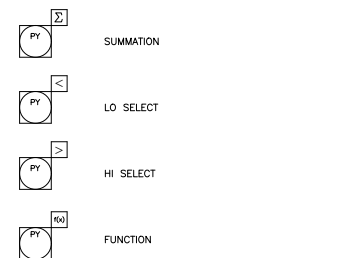
COMPLEX CONTROL

COMPLEX CONTROL LOOPS HAVE DETAILED DESCRIPTIONS IN THE P&ID VOLUME 2. DESCRIPTIONS ARE NOT PROVIDED FOR SIMPLE SPLIT RANGE CONTROL AS THE REQUIRED INFORMATION IS SHOWN ON THE P&ID, EG:-

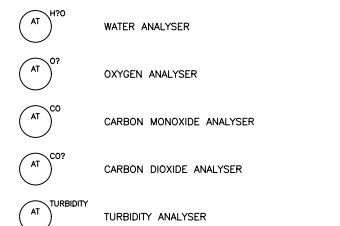


CONTROLLER OUTPUT	VALVE OPENING
0%	FCV 'A' 0% FCV 'B' 100%
50%	100% 100%
100%	100% 0%

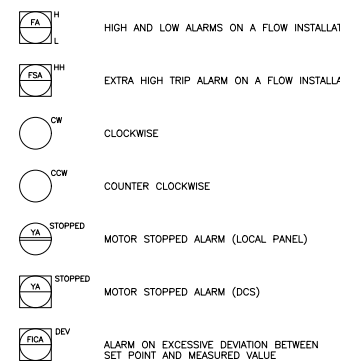
1. INPUT TRANSDUCERS, COMPUTING RELAYS, SIGNAL SELECTORS, etc. SHALL INDICATE THEIR FUNCTION OUTSIDE THE CIRCLE.



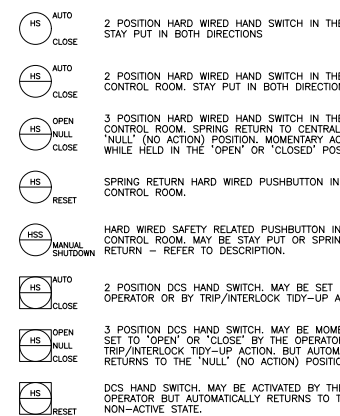
2. QUALITY OR ANALYSIS INSTRUMENTS SHALL DEFINE THE PROPERTY MEASURED OUTSIDE THE CIRCLE.



3. ALARMS SHALL INDICATE THEIR FUNCTION OUTSIDE THE CIRCLE. EXAMPLES BELOW :-



4. HAND SWITCHES SHALL INDICATE THEIR FUNCTION OUTSIDE THE CIRCLE. EXAMPLES BELOW :-



LICENSOR	INVISTA	INVISTA DRAWING No	2640/00/17/00002
CONFIDENTIAL & PROPRIETARY TO INVISTA			

中国石化工程建设有限公司 SINOPEC ENGINEERING INCORPORATION

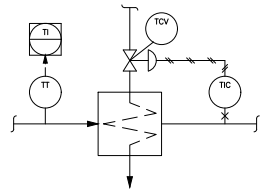
年产300万吨PTA装置 PTA装置街区
标准仪表符号
工艺管道及仪表流程图

设计阶段 DES. STAGE	合同号 CONT. NO.	共 张 OF
比例 SCALE	第 张 SHEET	
项目号 项号 NO.	图号 图号 NO.	

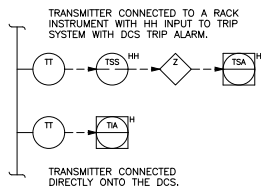
会签专业 DESIGN	会签人 SIGN	修改 REV. NO.	说明 DESCRIPTION	设计 DRAWN	校核 CHKD.	审核 APPR.	审定 FINAL APPR.	日期 ISSUE DATE
J			入库后1版					

中国石化工程建设有限公司
SINOPEC ENGINEERING CORPORATION
证书编号: 综合甲级 A11000497
发证部门: 中华人民共和国住房和城乡建设部
BPEC
B
SEI
C
D
E
F
G
H

CONTROL SYMBOLS

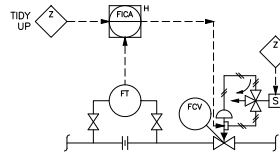


LOCAL TEMPERATURE CONTROLLER
ADJUSTING A VALVE, AND TEMPERATURE
INDICATION VIA CONTROL SYSTEM.

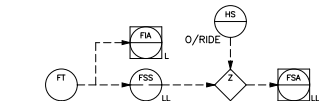


TRANSMITTER CONNECTED TO A RACK
INSTRUMENT WITH HH INPUT TO TRIP
SYSTEM WITH DCS TRIP ALARM.

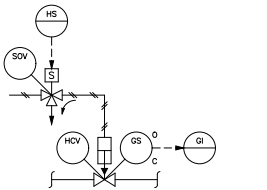
TRANSMITTER CONNECTED
DIRECTLY ONTO THE DCS.



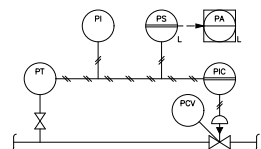
FLOW CONTROLLER WITH
A HIGH FLOW ALARM.
FCV IS TRIPPED FROM
HARD-WIRED LOGIC.
FICA IS ADJUSTED AS PART
OF TRIP TIDY UP ACTIONS.



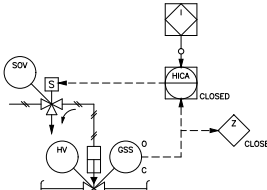
ELECTROMAGNETIC FLOWMETER CONNECTED TO THE DCS
AND A RACK INSTRUMENT WITH A LL INPUT INTO THE
TRIP SYSTEM AND PANEL-MOUNTED START-UP OVERRIDE.
(TRIP ALARM REPEATED INTO THE DCS).



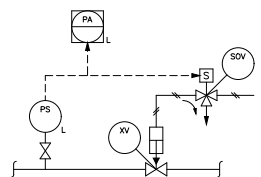
ON/OFF VALVE CONTROLLED FROM
A HAND SWITCH ON THE CONTROL PANEL.
THE VALVE POSITION IS ALSO
INDICATED ON THE CONTROL PANEL.



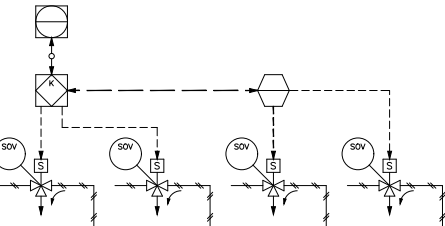
LOCAL PANEL MOUNTED PRESSURE
INDICATING CONTROLLER ADJUSTING
A VALVE. LOW PRESSURE ALARM
WITHIN THE DCS.



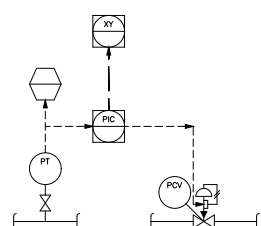
ON/OFF VALVE WITH CONTROLS AND
POSITION INDICATION IN THE DCS.
VALVE CLOSED ALARM.
INTERACTION WITH AN UNDEFINED
INTERLOCK FUNCTION WITHIN THE DCS.
"VALVE CLOSED" SWITCH FEEDS
INTO HARD-WIRED LOGIC.



LOW PRESSURE SWITCH GIVING
AN ALARM IN THE DCS AND
SWITCHING AN ON/OFF VALVE.



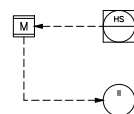
SEQUENCE CONTROL OF VALVES IN SOFTWARE.
ALSO CONTROL OF VALVES VIA PLC HARDWARE.
DATA LINK COMMUNICATIONS BETWEEN PLC
AND DCS DCS OPERATOR CONTROLS/INDICATION
ARE UNSPECIFIED.



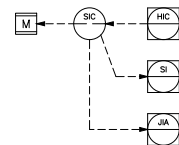
A PRESSURE CONTROLLER INTERACTING
WITH AN UNSPECIFIED FUNCTION WITHIN
THE DCS (e.g. A REAL TIME CALCULATION).
THE PRESSURE TRANSMITTER SIGNAL IS
ALSO SENT TO ANOTHER COMPUTER.

ELECTRICAL SYMBOLS

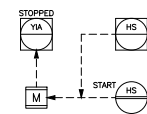
LOCAL AND MCC STOP/STARTS ARE NOT SHOWN,
BUT ALL REMOTE STOP/STARTS ARE SHOWN.
MCC AMMETERS ARE NOT SHOWN. ALL OTHER
AMMETERS INCLUDING LOCAL AMMETERS ARE SHOWN.
NOTES ARE ADDED TO P&IDs TO COVER THE PRESENCE
OF SPECIAL MOTOR PROTECTION FEATURES.
WHERE PRACTICABLE, MOTOR RUNNING LIGHTS ARE
PROVIDED ON THE DCS FOR ALL MOTORS IN THE FORM
OF A COLOUR CHANGE ON THE APPROPRIATE GRAPHIC.
THESE ARE NOT NECESSARILY SHOWN ON THE P&ID'S.



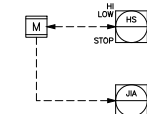
ON/OFF CONTROL OF A MOTOR FROM THE DCS.
NO FEEDBACK IS GIVEN FROM THE CONTACTOR.
THE MOTOR HAS A LOCAL AMMETER.



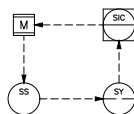
VARIABLE SPEED MOTOR WITH FREQUENCY
CONTROLLER MOUNTED IN A SWITCHROOM.
MANUAL CONTROL, POWER AND SPEED
INDICATION IS PROVIDED IN THE DCS.



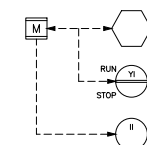
MOTOR WITH ON/OFF CONTROL AND INDICATION
AND A STOPPED ALARM IN THE DCS.
A REMOTE PANEL START IS ALSO PROVIDED.



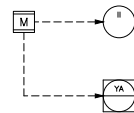
2-SPEED MOTOR WITH CONTROL IN THE DCS.
POWER INDICATION IN THE DCS
INCLUDING HIGH POWER ALARM



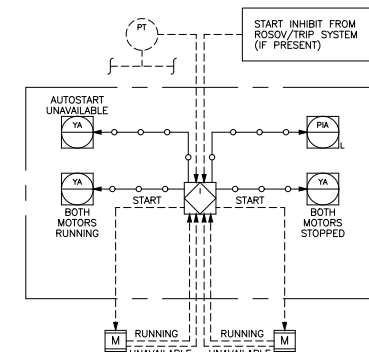
CONTROL OF A MOTOR FROM THE DCS,
WITH FEEDBACK FROM A SPEED SWITCH
(e.g. ROTATION SENSOR). THE SPEED SWITCH
ELECTRONICS/CONVERTOR IS MOUNTED
IN THE RACK ROOM.



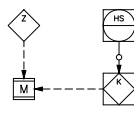
CONTROL OF A MOTOR FROM A PROGRAMMABLE
SYSTEM. THE NATURE OF THE CONTROL IS
UNSPECIFIED (e.g. SEQUENCE, INTERLOCK).
NO OPERATOR INTERACTION IS SHOWN.
A LOCAL AMMETER AND STOP/RUN INDICATION
ON A REMOTE PANEL ARE ALSO PROVIDED.



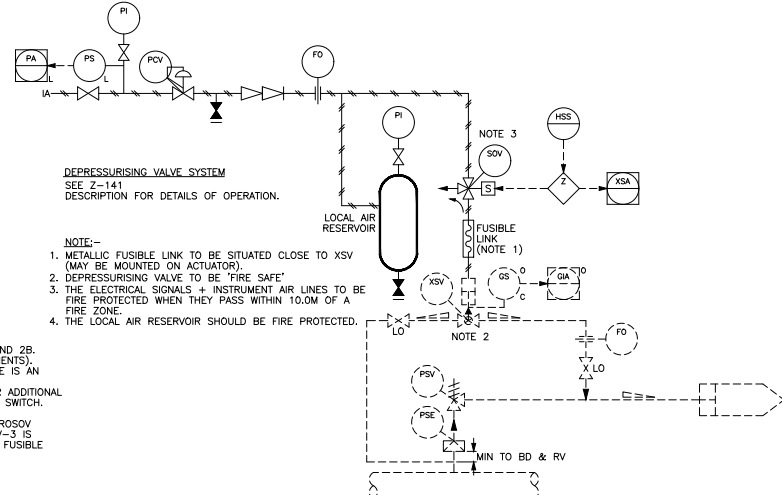
MOTOR WITH A LOCAL AMMETER AND
MOTOR STOPPED ALARM IN THE DCS.



TYPICAL MOTOR AUTOSTART



HAND CONTROL & SEQUENCE CONTROL
OF A MOTOR FROM THE DCS.
THE MOTOR IS ALSO TRIPPED BY
HARD-WIRED LOGIC.

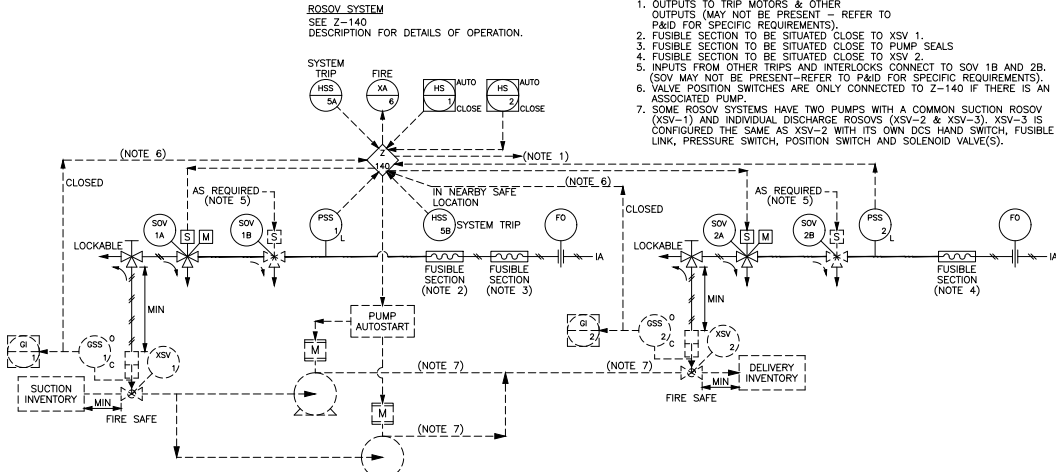


DEPRESSURISING VALVE SYSTEM
SEE Z-141
DESCRIPTION FOR DETAILS OF OPERATION.

NOTE:-
1. METALLIC FUSIBLE LINK TO BE SITUATED CLOSE TO XSV
(MAY BE MOUNTED ON ACTUATOR).
2. DEPRESSURISING VALVE TO BE "FIRE SAFE".
3. THE ELECTRICAL SIGNALS + INSTRUMENT AIR LINES TO BE
FIRE PROTECTED WHEN THEY PASS WITHIN 10.0M OF A
FIRE ZONE.
4. THE LOCAL AIR RESERVOIR SHOULD BE FIRE PROTECTED.

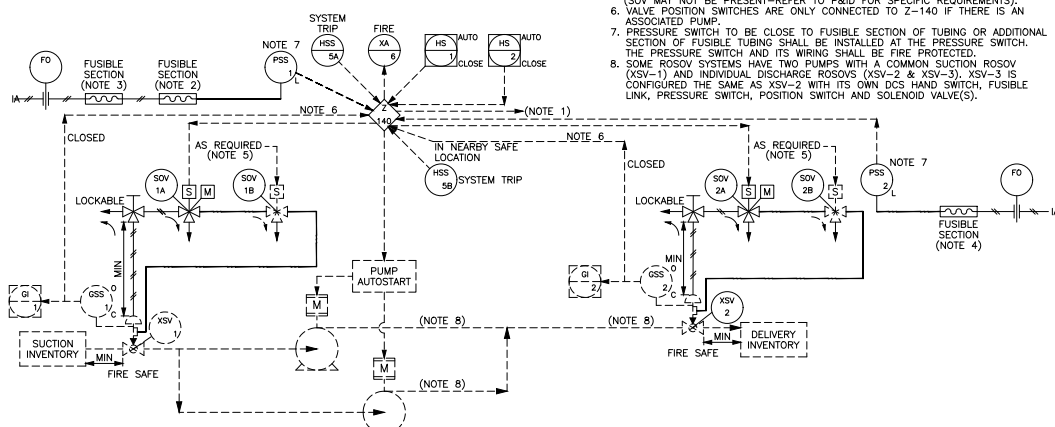
NOTE:-

1. OUTPUTS TO TRIP MOTORS & OTHER
OUTPUTS (MAY NOT BE PRESENT - REFER TO
P&ID FOR SPECIFIC REQUIREMENTS).
2. FUSIBLE SECTION TO BE SITUATED CLOSE TO XSV 1.
3. FUSIBLE SECTION TO BE SITUATED CLOSE TO PUMP SEALS.
4. FUSIBLE SECTION TO BE SITUATED CLOSE TO XSV 2.
5. INPUTS FROM OTHER TRIPS AND INTERLOCKS CONNECT TO SOV 1B AND 2B.
(SOV MAY NOT BE PRESENT-REFER TO P&ID FOR SPECIFIC REQUIREMENTS).
6. VALVE POSITION SWITCHES ARE ONLY CONNECTED TO Z-140 IF THERE IS AN
ASSOCIATED PUMP.
7. SOME ROSOV SYSTEMS HAVE TWO PUMPS WITH A COMMON SUCTION ROSOV
(XSV-1) AND INDIVIDUAL DISCHARGE ROSOV'S (XSV-2 & XSV-3). XSV-3 IS
CONFIGURED THE SAME AS XSV-2 WITH ITS OWN DCS HAND SWITCH, FUSIBLE
LINK, PRESSURE SWITCH, POSITION SWITCH AND SOLENOID VALVE(S).



NOTE:-

1. OUTPUTS TO TRIP MOTORS & OTHER
OUTPUTS (MAY NOT BE PRESENT - REFER TO
P&ID FOR SPECIFIC REQUIREMENTS).
2. FUSIBLE SECTION TO BE SITUATED CLOSE TO XSV 1.
3. FUSIBLE SECTION TO BE SITUATED CLOSE TO PUMP SEALS.
4. FUSIBLE SECTION TO BE SITUATED CLOSE TO XSV 2.
5. INPUTS FROM OTHER TRIPS AND INTERLOCKS CONNECT TO SOV 1B AND 2B.
(SOV MAY NOT BE PRESENT-REFER TO P&ID FOR SPECIFIC REQUIREMENTS).
6. VALVE POSITION SWITCHES ARE ONLY CONNECTED TO Z-140 IF THERE IS AN
ASSOCIATED PUMP.
7. PRESSURE SWITCH TO BE CLOSE TO FUSIBLE SECTION OF TUBING OR ADDITIONAL
SECTION OF FUSIBLE TUBING SHALL BE INSTALLED AT THE PRESSURE SWITCH.
THE PRESSURE SWITCH AND ITS WIRING SHALL BE FIRE PROTECTED.
8. SOME ROSOV SYSTEMS HAVE TWO PUMPS WITH A COMMON SUCTION ROSOV
(XSV-1) AND INDIVIDUAL DISCHARGE ROSOV'S (XSV-2 & XSV-3). XSV-3 IS
CONFIGURED THE SAME AS XSV-2 WITH ITS OWN DCS HAND SWITCH, FUSIBLE
LINK, PRESSURE SWITCH, POSITION SWITCH AND SOLENOID VALVE(S).



INVESTA
INVESTA DRAWING No
2640/00/17/00003
CONFIDENTIAL & PROPRIETARY TO INVESTA

中国石化工程建设有限公司
SINOPEC ENGINEERING CORPORATION
中国石化仪征化纤有限责任公司年产300万吨PTA项目
年产300万吨PTA装置 PTA装置街区
控制和电气说明
工艺管道及仪表流程图
设计阶段: 详细工程设计
比例: 1:1
图号: 51423-0220
129100PE-DW02-
共 张
第 张
REV. NO. DESCRIPTION
DESIGNER: J. 入库后出版
DATE: 2020.02.02

Annex 2: The Demo of Instrument List for PACKAGE Unit.

设备位号 (XX-XXXX) 仪表清单

[illegible]

备注:

- (1) 仪表类型: 注明仪表类型, 如: 磁翻板液位计/磁浮子液位计; 差压液位变送器/外浮筒液位变送器; 一体式温度变送器/分体式温度变送器等。
- (2) 信号类型: 注明仪表在报警或设置上的过程信号类型, 如: 模拟量/数字量。
- (3) 设备供货的系列, 设备厂家: 保证仪表过程连接的完整性, 提供从该设备或传感器取点到表头的过程连接材料并负责安装。
- (4) 仪表型号/制造商: 一次、二次仪表必须标注仪表型号及制造商。
- (5) 防爆等级: 注明所需防爆要求。
- (6) 通信信号: 根据信号类型注明 4~20mA、HART、两线制、三线制或四线制、开关量信号。无源干接点, 需注明于触点额定容量, 两线制、三线制或四线制。
- (7) 供电类型: 需注明 24VDC 回路供电, 或 220V AC 供电、两线制供电, 需选 220V AC 供电。
- (7) 报警/联锁等级: 需注明与相应的报警等级级联关系, 如果相应的报警等级为联锁级设置需注明联锁为 DCS 联锁或 SIS 联锁, 详见示例。

9. 1.1 仪表类型

D-AIR	A1 to DCS / DCS 模拟输入
D-AIR	Redundant A1 to DCS / DCS 冗余模拟输入
D-AIR (EP)	A1 to DCS with External Power / 带外部供电的DCS 模拟输入
D-AIR(EP)	Redundant A1 to DCS with External Power / 带外部供电的DCS 冗余模拟输入
D-IRB	Redundant A0 from DCS / DCS 冗余的模拟输出
DI	DI to DCS / DCS 离散输入
D-DO	DO from DCS / DCS 离散输出
FB- (AI/ AO/ DI/ DO)	Field Bus to DCS / DCS 总线信号输入
S-AI	A1 to SIS / SIS 模拟输入信号
S-DI	DI to SIS / SIS 离散输入信号
S-DO	DO to SIS / SIS 离散输出信号
C-AI	A1 to CCS / CCS 模拟输入信号
B-RTD	RTD to BN / BN 热电阻输入信号 (特殊标注时)
P-I	PI to BN / BN 脉冲输入信号
B-DO	DO from BN / BN 离散输出
C-AO	A0 from CCS / CCS 模拟输出信号
C-DI	DI to CCS / CCS 离散输入
C-DO	DO from CCS / CCS 离散输出
C-RTD	RTD to CCS / CCS 热电阻信号输入
C-PI	PI to CCS / CCS 脉冲输入
P-AI	A1 to PLC / PLC 模拟输入
P-AO	A0 from PLC / PLC 模拟输出
P-DI	DI to PLC / PLC 离散输入
P-DO	DO from PLC / PLC 离散输出

(10)控制回路中调节阀位号需填与对应控制器的设定值。

(11) 安装位置:	
L	LOCAL/现场
R	DCS AUX OR PANEL / DCS 辅操台或仪表盘
P	Back In Panel / 盘内安装
DCS	DISTRIBUTED CONTROL SYSTEM / 集散控制系统
SIS	SAFETY INSTRUMENT SYSTEM / 安全仪表系统
PLC	PROGRAMMER LOGIC CONTROLLER / 可编程控制器
LCP	LOCAL CONTROL PANEL / 就地控制盘
ALP	ANALYZER KEYS / 分析手盘
MUC	MOTOR CONTROL CENTER / 马达控制中心
CCR	CENTRAL CONTROL ROOM / 中央控制室
AC	ANALYZER CABINET / 分析柜

