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Instrument Design Criteria

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1 INTRODUCTION

1.1 SCOPE

This specification covers the minimum requirements used for design, procurement, inspection and installation to ensure required quality, maintainability and safety of instrument system in III Copper-Concentrator Plant.

The rules for selection of instrumentation devices and components, connections, documentation, spare part selection, numbering, labeling ... are defined within this document.

1.2 DEFINITION OF TERMS

Throughout this document the words **“will”**, **“shall”**, **“should”** and **“may”** will be used for the following intended meanings:

Shall	Requirement is mandatory, contractor asserts the provision/realization
Will	Client/MC scope of provision
Should	Solution is preferred but other solutions can be utilized with notice
May	Solution is not highly superior to other alternatives and other alternatives can be utilized without notice.

1.3 TERMINOLOGY

When referring to contractual parties in this document the following meanings is intended:

Client	
Consultant	
Contractor	
Supplier	Any third party hired for supplying devices and components.

1.4 ABBREVIATIONS

The following abbreviations are used throughout this specification:

CCR	Central Control Room
FAR	Field Auxiliary Room
FAT	Factory Acceptance Test
CE	Clean Earth
I/O	Input/Output
IP	Ingress Protection
ITR	Instrument Technical Room
JB	Junction Box

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LCP	Local Control Panel
LCR	Local Control Room
LV	Low Voltage
MV	High Voltage
MCC	Motor Control Center
NPT (M, F)	National Piping Thread (Male, Female)
PB	Push Button
PC	Personal Computer
PCB	Printed Circuit Board
PE	Protective Earth
PCS	Process Control System
PLC	Programmable Logic Controller
PMS	Piping Material Specification
PVC	Polyvinyl Chloride
RFI/EMI	Radio Frequency Interference/Electromagnetic Interference
RIO	Remote I/O Cabinet
SAT	Site Acceptance Test
SPDT	Single Pole/Double Throw
SS	Stainless Steel
TB	Terminal Box
UPS	Uninterruptable Power Supply
Y/G	Yellow/Green

2 CODES AND STANDARDS

All Mechanical and electrical components, equipment, systems and subsystems shall be designed, manufactured and tested in accordance with the latest applicable sections of the following regulations, codes, standards or specification. Equipment specifications shall include references to specific sections of the following codes and standards where appropriate.

- ANSI American National Standards Institute
- API American Petroleum Institute
- ASME American Society of Mechanical Engineers
- ASTM American Society for Testing and Materials
- BS British Standards
- CENELEC European Committee for Electrotechnical Standardization
- DIN Deutsche Industrie Normen
- IEC International Electro Technical Commission
- IEEE Institute of Electrical and Electronics Engineers

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- ISA The Instrumentation, Systems and Automation Society
- ISO International Organization for Standardization
- NACE National Association of Corrosion Engineers
- NEMA National Electrical Manufacturers Association
- NEC The National Electrical Code
- NFPA National Fire Protection Association
- OIML International Organization of Legal Metrology
- UL Underwriters Laboratories

2.1 UNITS OF MEASUREMENT

In general SI system of units shall be used throughout the plant design. Regular SI coefficients shall be used to modify the units to the proper range. The exceptions are listed in the alternative column of the following table. For conduit diameter “Inches” is the preferred unit.

Property	Category	Symbol	Unit	Alternative
Conductivity		1/ohm	mho	Siemens
Density	Absolute	Kg/m ³	Kilogram per cubic meter	
	Relative			
Energy		J	Joule	
Flow	Gas	Nm ³ /h	Normal Cubic meter per hour	m ³ /h
	Liquid	m ³ /h	Cubic meter per hour	
	Steam	Kg/h	Kilogram per hour	
Force		N	Newton	
Level		M	Meter	mm
Mass		Kg	Kilogram	
Power		W	Watt	
Pressure	Absolute	Pa(a)	Pascal	Bar(a)
	Gauge	Pa(g)	Pascal	Bar(g)
	Differential	Pa	Pascal	Bar
Radiation	Source	Bq	Becquerel	
	Exposure	R	Roentgen	
	Absorbed	Gy	Gray	
Temperature		°K	Kelvin	°C
Time		S	Second	Min, h
Torque		Nm	Newton meter	
Viscosity	Dynamic	Pa.s	Pascal second	Cp
	Kinematic	m ² /s	Square meters per second	Cs
Velocity	Linear	m/s	Meters per second	
	Angular	Hz	Hertz	rpm

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- Protective Earth (PE): This is the primary earthing system used to connect the metallic bodies, casing ... of the instruments and panels to the ground. The network resistance shall be within 2 ohms. Each PE distribution earth-bar shall be connected to the electrical network with a Y/G PVC insulated copper wire with conductor diameter not less than 35mm².
- Clean Earth (CE): This grounding network shall be used to connect instrument shields to the ground. Network resistance shall be equal or less than 1 ohms, and it should be connected to PE in just one point using a surge arrester. The location and distance of connection point will be illustrated in electrical documents. Each CE distribution earth-bar shall be connected to the network with a Y/G PVC insulated copper wire with conductor diameter not less than 25mm².

4.4 INSTRUMENT AIR REQUIREMENTS

The minimum requirements for characteristics of the instrument air will be as follows:

Supply Pressure: 7 bar(g), min: 5.5 bar(g)

Temperature: Ambient

Instrument air quality can generally be considered to be class 3 as per DIN ISO 8573- 1 and ISA S7.3.

Instrument air headers and sub-headers generally have the following sizes:

- ½" for up to 5 consumers
- 1" for 6 to 20 consumers
- 1 ½" for 21 to 50 consumers
- 2" for 51 to 100 consumers
- 3" for 101 to 300 consumers

Material used for instrument air distribution shall be in line with related piping class specifications.

4.5 SIGNAL LEVEL

The following signal levels are the only signals allowed throughout the plant design:

- Analogue signal: 4...20mA loop powered, HART protocol
- Binary signal: 0/24 Vdc
- 0/230Vac (Preferred for solenoid valves)
- Pneumatic Signal: 0.2 ... 1.0 Bar(g)

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4.6 SAFETY AND ENVIRONMENTAL PROTECTION

4.6.1 Protection against fire and explosion

In general, the selection of type of enclosure for instruments and cabinets shall follow the rules explained in IEC 79 when located in hazardous area.

For different zones of hazard the following table will be used as a minimum requirement for selection of degrees of protection:

ELECTRONIC TYPE	ZONE 0	ZONE 1	ZONE 2
Analogue instruments	EEXia	EEXe	EEXd
Switches/Buttons	EEXia	EEXe	EEXe
Solenoids/Lamps/ Horn/...	Not allowed	EEXe	EEXe
Local panels/Junction boxes	Not allowed	EEXe	EEXd
Thermocouples	EEXia	EEXe	EEXd
LEDs	EEXia	EEXe	EEXe

4.6.2 Protection against dust and humidity

Enclosures of instruments and cabinets shall be in accordance and suitable with IEC 529 standard according to the location of installation and amount of dust, wind and moisture release and at no condition will be less than the following limits:

Item	Type	Location	Ingress Protection
1	Instruments	Inside the Room	IP42
		Indoor installation	IP54
		Outdoor installation	IP65
		deluge release conditions	IP66
		Submersion installation	IP68
2	Panel and JB	Inside the Room	IP42
		Indoor installation	IP54
		Outdoor installation	IP65
3	enclosure/housing	control valves housing	IP65
		MOV	IP65

* Instruments shall be protected from freezing and sun light where necessary.

4.6.3 Protection against corrosion and erosion

All PCB shall be protected against corrosion and humidity by means of appropriate varnished coating and gold-plated contacts on connectors.

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All material supplied under this specification shall be adequate for the proposed service. Proper consideration shall be given to their function with regard to the environmental conditions, corrosion and chemical attack.

4.6.4 Protection against RFI/EMI

All Instruments and microprocessor-based system shall meet the following Radio Frequency Immunity requirements that shall be tested at the acceptance test stage. Basic reference standards will be IEEE-518 and IEC-801 for design and manufacturing considerations.

Hazard due to the lightning shall be considered in the installation of instruments and cables.

Noise susceptibility levels will fall into either of four categories:

CATEGORY	DESCRIPTION	EXAMPLES
CAT.I High Susceptibility	Analogue signals < 50V Digital signals < 16V	4...20mA HART Signal Telephone Lines
CAT.II Medium Susceptibility	Analogue signals >50V Switching Circuits<50V	24V Digital Signals DC Supply for Inst.
CAT.III Low Susceptibility	Switching Circuits >50V LV Power Lines<20A	MCC control circuit Power lines<20A
CAT.IV Power	AC and DC LINES >20A	Power lines >20A

Separation of different signal levels shall be done according to IEEE 518 as the following tables:

	CAT.I	CAT.II	CAT.III	CAT.IV
CAT.I	0	0+separator	15cm	65cm
CAT.II	0+separator	0	15cm	45cm
CAT.III	15cm	15cm	0	0+separator
CAT.IV	65cm	45cm	0+separator	0

Spacing between cable trays/ladders carrying different categories of signals/power

	CAT.I	CAT.II	CAT.III	CAT.IV
CAT.I	0	2.5cm	7.5cm	30cm
CAT.II	2.5cm	0	7.5cm	22.5cm
CAT.III	7.5cm	7.5cm	0	15cm
CAT.IV	30cm	22.5cm	15cm	0

Spacing between cable conduits carrying different categories of signals/power

All analogue and Serial signals shall be carried with STP, and shield must be grounded to CE at one end.

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4.7 INSTRUMENT CONNECTIONS

The following table will be used as a general guide. Other ranges are acceptable in case of conflict with vendor's drawings:

INSTRUMENT TYPE	PROCESS SIDE	INSTRUMENT SIDE
Pressure Gauges	Pipe connection : 1/2" G	1/2" NPT
	Vessel connection: 2" RF	1/2" NPT
	Slurry : 2" G	2" NPT
Pressure Transmitters	Pipe connection : 1/2" G	1/2" NPT
	Vessel connection: 2" RF	1/2" NPT
	Slurry : 2" G	2" NPT
Diff. Pressure Transmitters	Pipe connection : 1/2" G	1/2" NPT
	Vessel connection: 2" RF	1/2" NPT
	Slurry : 2" G	2" NPT
Level Transmitters	2" NPT	2" NPT
	4" #150 RF Flanged	4" #150 RF Flanged
Level Gauge	2" #150 RF Flanged	2" #150 RF Flanged
Float Level Switch	2" #150 RF Flanged	2" #150 RF Flanged
Capacitive Level Switch	2" #150 RF Flanged	2" #150 RF Flanged
Microwave Level Switch	1" G	1" G
Temperature Transmitter	Pipe connection : 1½" #150 RF Flanged	1½" #150 RF Flanged
	Vessel connection: 2" #150 RF Flanged	2" #150 RF Flanged
Inline Transmitter	According to PMS	According to PMS
Valve Positioner	½" or ¾" NPT	¼" NPT

The material of connection and pulsation lines shall comply with Piping Material Specifications or better alternatives.

5 INSTRUMENTATION DESIGN CRITERIA

5.1 RANGE SELECTION

Unless otherwise specified, the instrument ranges shall be selected such that the normal value is between 50 and 75 percent of span for linear scale and 60 to 80 percent of span for square root inputs scale. When threshold is derived from an analogue signal, set point shall be 10 and 90 % of adjustable range.

5.2 DENSITY INSTRUMENTS

Vibrating type shall be used for clean liquid services and selection will be limited to ultrasonic or capacitance type densitometers for measurement of slurry services. Nuclear type shall be avoided in accordance with health and safety regulations, unless special considerations like high accuracy is required.

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The selection shall be fitted for the specific process requirements and characteristics. The most important process requirements that should be taken into consideration are maximum allowed inaccuracy, maximum allowed response time of instrument plus transmission line, sensitivity and corrosive fluids or agents.

Each instrument shall have an over-protection of at least:

- 130% of scale of the measured variable
- 130% for applied pressure
- 130% for applied process temperature

Special consideration shall be given to vibration-free mounting position, up-stream and down-stream straight pipe run, installation orientation, protection lining material for provision and installation. Installation shall be performed according to vendor specific instructions as the highest priority reference guide.

5.3 FLOW INSTRUMENTS

In general, indirect differential methods will be used for measurement of gases and clean liquids when high accuracy is not an issue. The following list illustrates the selection options:

Service	criteria	Flow measurement
Gas or clean liquid	Inaccuracy: 1-10%	Orifice plate Variable Area
Gas or clean liquid	Inaccuracy: <1%	Turbine Ultrasonic
Viscose liquid/Slurry	Any	Magnetic Oval wheel
Low flow services, gas or clean liquid	$Q < 0.2 \text{ m}^3/\text{h}$	Thermal
Flow switches for gas or clean liquid	Any	Variable Area Paddle
Flow switch for slurry	Any	*Avoided

The selection shall be fitted for the specific process requirements and characteristics. The most important process requirements that should be taken into consideration are maximum allowed inaccuracy, maximum allowed response time of instrument plus transmission line, sensitivity, corrosive agent in the process line.

Each instrument shall have an over-protection of at least:

- 130% for maximum fluid flowrate
- 130% for applied pressure
- 130% for applied process temperature

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Special consideration shall be given to vibration-free mounting position, up-stream and down-stream straight pipe run, installation orientation, protection lining material for provision and installation.

Remote head type shall be considered when ease of maintenance is required.

5.3.1 Orifice Plates

The Orifice Plates shall be sized according to ISO 5761 codes of standard. The fabrication material shall be SS316 as a general rule, and for particular services with corrosive fluid or agents, it shall be selected according to NACE standard recommendations.

Common Tapping method is flange tap,

in either case, the tapping connection shall be ½" or ¾" NPT depending on pipe class, and isolated from pulsation line with ball valves (liquid) or gate valves (gas).

The minimum orifice flange rating shall be ANSI #300 RF. All the plugs (if used) shall be of the same materials as that of the flanges.

Pulsation line shall be ½" and material shall be selected according to PMS recommendations or better.

5.3.2 Variable Area

Generally armored tubes, magnetic sensing type variable area meter shall be used. Tube construction shall be beaded, ribbed or flat except for the plain tapered tubes used for armored type. Plain tapped tubes shall have internal guiding. Meter bodies shall be equipped with inlet and outlet float stops, and where feasible, clean out plugs, which may be utilized as connection taps.

Variable area flowmeters shall be completely assembled with all accessories before shipping with the orientation of connections as noted on the individual datasheet.

Flanged instruments shall comply with ANSI B16.5 requirements. Flanges shall be protected over the entire gasket surfaces adequately for shipping.

When any transmitters are specified on the individual datasheet, Variable area flowmeters shall be supplied with their associated transmitters.

The flow direction shall be clearly and permanently stamped on the meter body.

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5.3.3 Magnetic Type

Magnetic flow meters shall be used to measure the volumetric of flow of any liquid that has the required measure of electrical conductivity. Magnetic flowmeters with linings of suitable materials shall be used for conductive corrosive fluids. The electrodes shall be flush mounted to avoid erosion. They are suitable for very viscous fluids or where negligible pressure drop is desired.

The transducer for magnetic flowmeters shall normally be mounted locally and preferably transducers shall not be mounted on metering tube to avoid transmission of vibrations to the converter.

5.3.4 Thermal Mass Flow Meter

It operates by monitoring the cooling effect of a gas stream as it passes over a heated transducer. Thermal mass flow meters are especially suited for a wide range of gas applications. Mass flow however is inferred from the thermal behavior and properties of the fluid.

5.4 LEVEL INSTRUMENTS

Selection of type will be according to the following table:

Service	criteria	Level measurement
Continuous measurement (Liquid)	Inaccuracy: 1-5%	Hydrostatic
	Inaccuracy <1%	Ultrasonic or Radar
	Corrosive	Ultrasonic or Radar
Continuous measurement (Solid)	Any	Ultrasonic
Continuous measurement (Solid and Dusty)	Any	Radar
Point measurement (switch) (Liquid)	Clean Coating/Slurry	Ultrasonic/Conductive/Float Capacitance
Point measurement (switch) (Solid)	Any Slurry	Capacitance Fork
Gauging	Any	Transparent glass
	Toxic liquids	Magnetic

The selection shall be fitted for the specific process requirements and characteristics. The most important process requirements that should be taken into consideration are maximum allowed inaccuracy, maximum allowed response time of instrument plus transmission line, sensitivity and corrosive agent in the process line.

For Corrosive applications hydrostatic should be avoided. If there are no other options available, oil filled capillary sensors shall be supplied for corrosive applications.

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Special consideration shall be given to installation orientation and access for proper operation and ease of maintenance.

All the gauge glasses should be of transparent type with heat resistance glass. Reflection type may be used only if the liquid is clean, clear and non-coating. Gauge glasses may be equipped with integrated lighting system for night vision. In such circumstances the power supply should be 230VAC.

Remote head type shall be considered when ease of maintenance is required.

5.5 PRESSURE INSTRUMENTS

The flowing selection table will be used as a guide; other types may be furnished with special care.

Service	criteria	Pressure measurement
Continuous measurement transmitters	Normal App.	Capacitance Piezoelectric
Continuous measurement transmitters	High Pressure App. (P>500 Bar(g))	Manganin cell
Continuous measurement transmitters	Absolute	Bellows
Gauging	Normal App.	C-Burden
Gauging	Absolute	Bellows
Point measurement	Any	*Same criteria as continuous measurement applies

At least 130% over-range protection shall be considered for design. In differential pressure measurement applications 5-way manifolds shall be used for safe draining and equalizing purposes.

The selection shall be fitted for the specific process requirements and characteristics. The most important parameters that should be taken into consideration are maximum allowed inaccuracy, maximum allowed response time of instrument plus transmission line, maximum allowed dead-band, sensitivity, corrosive agent in the process line.

All the pressure measuring devices shall be provide with chemical seal for corrosive, slurry and coating liquids. When the process line is supposed to be pulsating a pulsation dampener shall be considered.

All pressure instruments will be equipped with block and bleed valves except those with diaphragm seal, and drain/vent lines should deliver the waste to nearest safe location.

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Pressure switches should have integrated range adjustment.

Remote head type shall be considered when ease of maintenance is required.

5.6 TEMPERATURE INSTRUMENTS

All the temperature sensors should be connected to a field mounted transducer, integrated or remote type. Thermocouple extension cables are not permitted as a general rule.

Service	criteria	Temperature measurement
Continuous measurement	T<600°C	RTD (3/4-wire PT-100)
	1200°C>T>600°C	Thermocouple (Type J or K)
	T>1200°C	Spectroscopic Types
Point measurement	High Pressure App. (P>500 Bar(g))	Manganin cell
Gauging	Any	Bi-metal/expansion type
Motor Control	*Special case	PT-100 (preferred) /PTC

All the temperature sensors must be protected from the fluids by means of thermo-wells. When the response time is the important issue the thermo-well shall be made of Bronze, and when the corrosion is the important factor SS316 should be used. Special consideration shall be made to select the material of the well when the response time should be limited with a corrosive application.

For the measurement of fluid temperature below 0°C, the length of the head extension shall suit the insulating thickness but the head shall extend at least 200 mm outside the insulation. The insertion length of the Sensor inside the process line/equipment shall be adjusted according to vendor documentation. When such recommendation is not present, insertion length shall be at least 10 times the outside diameter of sensor as a rule of thumb.

Where high velocity gases are present, it will be necessary to check thermo-wells for the vortex shedding effect.

Remote head type shall be considered when ease of maintenance is required.

5.7 pH ANALYZERS

Ion selective sensors shall be used to achieve the best accuracy and repeatability of pH instruments. Instruments shall cover the following requirements:

- maximum allowed inaccuracy: 0.1 pH
- minimum required repeatability: 0.75% of span (this does not cover errors caused by hysteresis)
- range: 0...14 pH

The remote type transmitter head is the preferred type. Special STP cable shall be furnished to transmit the signal from sensor to transmitter head.

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5.8 CONTROL & ON-OFF VALVES

5.8.1 General

Control Valve usage should be limited to regulating, throttling, injection and continuous letdown applications. All intermittent letdown and shutdown applications will be handled with on-off valves.

Control Valves shall be sized to have a Cv that falls between 20% and 80% open stem travel.

The regular style of control valves will be flanged single seat globe with the body made of cast construction. Where low pressure drop or high recovery cannot be achieved by globe valves, butterfly or characterized ball valves may be considered.

5.8.2 Body & Bonnet

Selecting body type and characteristics of a control valve will be performed by considering three major criteria:

5.8.2.1 Trim Type Considerations

The following criteria shall be considered before the final decision on selection of control valves:

1. Body pressure rating and limits
2. Size and flow capacity
3. Rangeability
4. Temperature limits
5. Shutoff leakage
6. Pressure drop (shutoff and flowing)
7. End connection requirements
8. Material compatibility and durability

5.8.2.2 Characteristics Considerations

The following table shall be used as a guide:

Loop Type	$(\Delta p_{max} / \Delta p_{min}) < 2$	$5 > (\Delta p_{max} / \Delta p_{min}) > 2$
Flow	Linear	Equal %
Level	Linear	Equal %
Pressure	Linear	Equal %
Temperature	Equal %	Equal %

5.8.2.3 Project and Market Considerations

1. Lifecycle cost
2. Market availability

Vendor shall quote the trim material in accordance with control valves datasheets. The vendor shall take in due consideration the overall material selection philosophy and the specified data of corrosion, suspended solids, cavitations flashing and fluid velocity. The trim material on control valves data sheets shall be considered as a minimum requirement. Suitable material shall be furnished as trim where sever service require greater hardness, special alloys or coatings to prevent excessive erosion or corrosion.

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The valve body rating should be equal to or better than the flange rating specified in the data sheets and the flange finish shall be in accordance with ANSI B46.1.

The material selection of the body (including bonnet and/or bottom flange) shall be as specified in individual data sheets.

Stellited stainless steel trims to be used in all liquid and vapor services where cavitation or flashing exist. Full stellited trim to be supplied when stellited is specified.

Components exposed to process fluid shall be guaranteed as fully suitable for the specified application. Anyhow hardened metal facing shall be provided for flashing liquids and cavitations flow conditions.

The trim and particularly the seat ring(s) shall be of the easy/quick replaceable type.

Flow direction shall be permanently and clearly marked on the valve body.

Guide bushings shall be of corrosion resistant material.

Bonnet Packing material will be PTFE or similar compounds where the temperature service is below 200°C. For Slurry Fluids and services over 200°C, graphite compounds shall be used. No asbestos is allowed in packing composition. In addition, for when the service temperature exceeds 200°C, Extended bonnet type shall be furnished.

Control valve seat leakage shall be designed and constructed in accordance with the requirements specified on the individual data sheet and classified according to ANSI B16-104.

Control valve shut off class, as a minimum shall be class IV on venting applications, where the valve is closed most of time. Control valves shall have class V or class VI leakage as per ANSI shut off classes.

Actuator stems shall have adequate strength to withstand maximum developed thrust of actuator.

Painting shall be in accordance with project painting specification.

Reduced trims in oversized bodies shall be used for situations where the calculated flow coefficient would result in a standard valve two or more sizes smaller than the line. Also, any service with predictable flashing or cavitations conditions, slurry services and when calculated valve size is below one inch a reduced trim size may be furnished.

5.8.3 Actuator

Valve actuator shall normally be spring and diaphragm type. Piston, electric or electro-hydraulic or self-regulated types may be considered in special cases where specified.

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Actuator shall be sized for the shut off differential pressure indicated in data sheets and /or maximum upstream pressure given on the data sheet and assume zero downstream pressure or if vacuums specified whichever is greater.

The actuator spring shall be fully enclosed in a metal housing and permanently treated to resist atmospheric corrosion.

Where the stroking time requirements in any one direction cannot be met, a volume booster (for a modulating control valve) or a quick exhaust valve (for on/off valve) shall be considered.

5.8.4 Valve Positioner

All control valves for throttling, injecting and letdown applications shall be provided with electro-pneumatic valve positioners.

Valve-positioners shall be force balance type and shall be actuator yoke mounted. If necessary, special type cam shall be provided to maintain linearity. They shall be easily field converted from direct to reverse acting.

Positioner air connection shall be ¼" NPTF. Vendor shall provide the suitable connector if original positioned design is different.

5.8.5 Limit Switches

Where specified on the individual datasheet, limit switches shall be installed on the control valves. Limit switches shall be magnetic or inductive type and shall be equipped with housing box with protection IP 65.

Contact shall be SPDT type with rating capacity of 24V DC 2A.

5.8.6 Solenoid Valves

Solenoid valves shall be fitted in air lines to the control valve only if specified in the individual datasheets.

The air passages in the solenoid valves shall be large enough to achieve the opening or closing time of the valve as stated in the requisition. If this would lead to unrealistically large passages and consequently high-power consumption of the solenoid valve, consideration should be given to the use of quick exhaust valves.

The capacity of solenoid shall be checked against the instrument air requirement of the particular actuator.

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5.9 MOTORIZED ACTUATOR

Motorized actuator shall be supplied complete with control circuit. The enclosure shall be IP65 or higher mechanical protection degree.

Actuator control voltage shall be 230VAC, 50Hz or 24 V DC.

Where remote commands are necessary, relevant control circuits shall be inside actuator.

Actuator shall be complete with end travel limit and torque switches. Adjustable limit switching shall be provided for remote position indication.

This type of actuator is used for dart valve controlling.

5.10 PRESSURE REDUCING REGULATORS VALVE

Pressure reducing regulators control outlet pressure by balancing an adjustable spring force against the forces caused by inlet and outlet pressures. The spring force is adjusted by turning the stem/handle, which sets the desired outlet pressure. Pressure reducing regulators is reliable pressure control over a broad range of pressures, control ranges, and control requirements. The set pressure is also maintained constant, even when there is wide inlet pressure fluctuation.

Piston-sensing or diaphragm-sensing type shall be chosen according to fluid.

5.11 BELT SAFETY INSTRUMENTS

5.11.1 Pull Rope Switches

Pull rope switches will be used for emergency and maintenance situations. Pulling the rope prevents from unwanted or accidental start of conveyor while maintenance staff is working there. They shall follow the following specifications as minimum requirements.

- Contact arrangements: DPST (1 NC contact to MCC & 1 NC contact to PCS)
- Dust proof housing with surface mounting capability (IP 65)
- The length of cord shall be same as belt length of related conveyor

5.11.2 Zero Speed Switch

The speed detector will be used to detect zero or low speed of conveyors. This device will be included a proximity sensor and pulse counter unit (if specified in data sheet). The proximity sensor shall be installed on the drum of conveyor in front of the mounted target iron to detect the rotation of conveyor drum.

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5.11.3 Misalignment Switch

The Belt Misalignment Switches will be used in conveyor installations for monitoring the true running of conveyor belts. The switches, when mounted at the running edges of a conveyor belt, will be operated if the belt deviates from its designed running line by more than a permissible distance. The switches will then stop the conveyor drive, avoiding spillage of material or damage to the plant. All switches shall be maintenance free and shall have minimum two SPDT Auxiliary Contacts.

5.12 METAL DETECTORS

The metal detector is designed especially for applications on belt conveyors moving materials to detect the presence of metal on the belt. The detector uses a magnetic field, detector generator and receiver coils. A primary field is generated between the primary and receiver coils. The tramp metal will produce a secondary magnetic field; an output signal will be generated by the receiver coil. Tramp metal detection will activate alarm contacts.

5.13 BELT WEIGHING SYSTEMS

Belt Scale system shall consist of load cells, speed sensors, and weigh transmitter. Belt scale shall be designed for accuracy class II, and installed preferably completely horizontal section, for best accuracy. When enough horizontal run is not available, installing in a ramp with no curvature is possible. In this case special consideration for supporting the idler is required.

The manufacturer's installation instructions should be followed for the string-line alignment of weighing, approach, and retreat idlers.

Load cells shall be strain gauge type. Vendor shall propose the best type that suits the application.

Speed sensors maximum inaccuracy shall not exceed 1% of full scale.

6 Spare Space & spare parts

Datasheets shall be designed to contain vendor's recommended spare parts. Vendor recommendations shall make for the most of spare part lists. The selection shall be done according to vendor's proposed MTBF for that device. This spare will be used as commissioning and 10 years operation of the plant.

All terminal, strips shall have at least 20% spare for commissioning and future modifications, this applies to CE and PE earth-bars, too.

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7 DOCUMENTATION

All parts of the instruments and equipment shall be fully documented. Operation procedure and configuration to follow for parts replacement shall be fully documented.

All Vendor documentation, manual or other technical documents shall be issued in English language. Only standard document sizes A1 through A4 shall be used. All documents shall use IS units for measurements unless otherwise stated.

8 PACKING AND MARKING

Goods must be export packed in compliance with the best-established practice for overseas construction jobs in accordance with British Standard (BS), Japanese Standard (JIS) or European Countries Standard such as SEI France, HPE Germany, UNI Italy, etc. or equivalent. In the event of any divergence from these standards, this instruction will govern.

Materials shall be suitably packed and protected "Seaworthy & tropical proof", according to international standards, from damage under sea transportation and truck transportation inside to ensure safe arrival at destination. The contents must also withstand 1 year transit conditions without suffering damage, and Vendor shall give recommendations for a further 2 years storage under site conditions. Required storage facilities should be advised by Vendor, in advance.

All the packages shall be clearly marked for the considerations that shall be taken during shipment. Supplier shall mark all the cases that contain fragile, explosive, hazardous, ... material and substances clearly with internationally accepted signs.

Vendor shall submit a "Cargo Handling Chart" to purchaser before 45 days of readiness to ship on all items.

IMPORTANT NOTICE TO VENDORS:

Vendor shall not use the words "Spare Parts" on the packages and packing lists. The proper word that shall be used is "Accessories".

9 GUARANTEE AND PERFORMANCE

The Vendor shall assume the complete responsibility of all instruments included in the scope of supply. The vendor shall guarantee a smooth and safe operation in all operating conditions specified and shall guarantee the full availability and reliability of his supply.

Performance data in the Vendor's proposal are at site conditions and implicitly at the vendor's factory.

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10 REQUIRMENTS FOR VENDOR PACKAGES

This specification applies to all the instruments supplied inside equipment packages. In addition, vendors and suppliers shall fully consider the requirements listed here:

-Tag numbers for instruments inside the package supply shall follow the tag procedures specified in section 4 (Numbering procedures). Vendors shall notify the tag numbers used before manufacturing to avoid duplicate tags within the whole project.

-All analogue signals shall be 4...20mA, HART protocol. Using any other field communication shall be with prior notice and written approval from CLIENT.

-Vendor shall supply all documentation required for installation, start-up, operation and maintenance of the package instruments.

-Instruments shall be selected according to approved project vendor lists. Any deviation shall be with prior notice and written approval from CLIENT.

-The Vendor shall be responsible for the engineering, selection, purchase, fabrication, calibration, functional testing and documentation of the instrumentation and control systems within the package.

-The performance/accuracy of the instruments shall not be adversely affected by electrical system variations ($\pm 5\%$ of voltage variation and $\pm 2\%$ of frequency variation).

- The vendor shall ensure that instruments inside panels are suitable for the resultant additional temperatures.

- All the wetted parts in sour services shall be in accordance with NACE MR-01-75 standard.

-When the instrument is located inside hazardous area, vendor shall supply the instrument within the ranges defined in article 4.6.1 of this document. Vendor shall also notify the contractor if hazards are caused by the existence of some equipment within the scope of package supply in advance, to help better system integration.