PROJET CAREMAG

INSTRUMENT GENERAL SPECIFICATION

MTK045-ARTM-INS-0001-SPG

PROJET CAREMAG

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1. INTRODUCTION

1.1. PROJECT OVERVIEW

Caremag Project consists in building a grassroot environmentally friendly production unit for pure rare-earth oxides in France from two main sources:

Permanent magnets to be recycled

Rare earth concentrates from mines to fill the plant in the first few years and support the economic ramp-up of recycling.

1.2. PURPOSE OF THE DOCUMENT

The purpose of this document is to define the detailed design requirements for instrumentation and measurements for the CAREMAG Project.

1.3. HOLD LIST

Number	Description
HOLD 1	Site conditions. Ambient indoor (technical rooms, CCR…) temperature Min/Max (°C) and Maximum indoor hygrometry (%)

2. REFERENCE DOCUMENTS

The reference documents listed below form an integral part of this procedure.

The related equipment of this procedure shall be compliant with the legislation and standards of the country of installation even if not specified or referenced in this document.

The reference documents listed in this section are the minimum requirements, which shall govern the design, manufacturing and supply of the facilities. These, however, do not relieve to use sound engineering judgment and best industry practice if any requirements are not specifically addressed.

2.1. LOCAL LAWS, INTERNATIONAL CODES & STANDARDS

Ref.	Classification Company	Document Title
[1]	ANSI/FCI 70-2	Control valve seat leakage
[2]	ANSI/FCI 70-3	Regulator seat leakage testing
[3]	ASME B16 36	Orifice flanges
[4]	ASME PTC 19.3	Part 3: Temperature Measurement Instruments and Apparatus
[5]	ASME PTC 19.3 TW	Thermowells - Performance Test Code
[6]	ATEX 2014/34/EU	European Directive on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres
[7]	EN 10204	Metallic products - Types of inspection documents
[8]	EN 13190	Dial thermometers
[9]	EN 60584	Thermocouples (All parts)
[10]	EN 60751	Industrial platinum resistance thermometers and platinum temperature sensors
[11]	EN 60754	Test on gases evolved during combustion of materials from cables (All parts)
[12]	EN 61034	Measurement of smoke density of cables burning under defined conditions (All parts)
[13]	EN 837	Pressure gauges (All parts)
[14]	IEC 60079	Explosive atmospheres (All parts)
[15]	IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems (All parts)
[16]	IEC 60529	Degrees of protection provided by enclosures (Ingress Protection Code)
[17]	IEC 60534	Industrial process control valves (All parts)
[18]	IEC 60751	Industrial platinum resistance thermometers and platinum temperature sensors
[19]	IEC 60584	Thermocouples (All parts)
[20]	IEC 61000	Electromagnetic compatibility (All parts)
[21]	IEC 61511	Functional safety – Safety instrumented systems for the process industry sector (All parts)
[22]	IECEx	IEC System for Certification to Standards relating to Equipment for use in Explosive Atmospheres (IECEx System)
[23]	ISA 5.1	Instrument Symbol and Identification
[24]	ISA 5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems

Ref.	Classification Company	Document Title
[25]	ISA 5.5	Graphic Symbols for Process Displays
[26]	ISA 18.2	Management of Alarm Systems for the Process Industries
[27]	ISO 4126	Dispositifs de sécurité pour protection contre les pressions excessives (All parts)
[28]	ISO 5167	Measurement of fluid flow by means of differential devices (All parts)
[29]	ISO 5168	Measurement of fluid flow –Procedure for evaluation of uncertainties
[30]	ISO 15848	Industrial valves — Measurement, test and qualification procedures for fugitive emissions (All parts)
[31]	ISO 28300	Petroleum and Natural Gas Industries - Venting of Atmospheric and Low Pressure Storage Tanks
[32]	ISO/TR 3313	Measurement of fluid in closed conduits
[33]	NFC-15-100	Low voltage electrical installation
[34]	NFC 32-070	Insulated cables and flexible cords for installations - Classification tests on cables and cords with respect to their behaviour to fire
[35]	NFC 32-321	Insulated cables and flexible cords for installations. Crossed-linked polyethylene insulated cables covered with a polyvinyl chloride sheath.
[36]	NFC-87-202	Petroleum industry instrumentation cables specifications
[37]	NAMUR NE43	Standardization of the Signal Level for the Failure Information of Digital Transmitters

2.2. PROJECT DOCUMENTS

Ref.	Classification Company	Document Title
[38]	S48310-SEM-000-INS-PRO-5001	Instrument identification & numbering procedure
[39]	S48310-SEN-000-INS-PHI-5002	Instrumentation and Control Systems Philosophy
[40]	S48310-SEM-000-INS-DWG-5005	DCS & Safety System Architecture
[41]	S48310-SEM-000-INS-DWG-5006	Hook-up Standard
[42]	S48310-SEM-000-INS-DWG-5007	Typical Loop Diagrams
[43]	S48310-SEM-000-INS-DTS-5009	Instrument Datasheets for Analysers
[44]	S48310-SEM-000-INS-DTS-5010	On/Off Typical Valves Datasheets with List
[45]	S48310-SEN-000-INS-LIS-5011	Instruments list
[46]	S48310-SEM-000-INS-DWG-5012	Interconnexion Diagram
[47]	S48310-SEN-000-INS-LIS-5013	I/O List
[48]	S48310-SEM-000-INS-LAY-5014	Instrumentation Technical Room Arrangement
[49]	S48310-SEM-000-INS-LAY-5015	Control Room & Server Room Arrangement
[50]	S48310-SEN-000-INS-SPE-5017	Automation & Control System Specification
[51]	S48310-SEN-000-ELE-PHI-4001	Philosophie Electricité
[52]	S48310-SEN-000-SAF-PHI-6001	Safety Concept
[53]	S48310-SEN-000-SAF-LAY-6002	Safety Equiment Layout
[54]	S48310-SEN-000-PCD-PID-1004	PID – Legend sheet - Instrument
[55]	S48310-SEN-000-PVV-LIS-2002	Piping Class
[56]	S48310-SEN-000-MEC-SPE-7001	General Equipment Specification
[57]	S48310-SEN-000-CHA-SPE-2510	Equipment Specification (Painting, electrical tracing, insulation)
[58]	S48310-SEN-000-PMT-LIS-0004	Vendor list per discipline and package

3. DEFINITIONS, ABBREVIATIONS AND ACRONYMS

3.1. DEFINITIONS

For the purposes of this specification, the following definitions shall apply:

CLIENT: ***CAREMAG S.A.S.***

Owner/ Client is the Party, that awarded the Project to the ENGINEERING, and CLIENT will be the final recipient of the equipment.

ENGINEERING: ***ARTELIA INDUSTRIE***

The Engineering is the Party that carries out all or part of the design, the engineering, the procurement and the construction management of the Project.

SUPPLIER: The party who manufactures and/or supplies equipment, technical documents/drawings, and services to perform the duties specified by ENGINEERING.

SUB-SUPPLIER: The party who carries out all or part of the design, procurement, manufacturing and testing of the System under the responsibility of the SUPPLIER.

EQUIPMENT/PACKAGE: Shall mean the package itself and its associated auxiliaries.

3.2. ACRONYMS AND ABBREVIATIONS

AC	Alternative Current
ATEX	Explosive Atmosphere (ATEX Directive)
CCR	Central Control Room
DC	Direct Current
DCS	Distributed Control System
ESD	Emergency ShutDown
F&G	Fire & Gas
FGS	Fire & Gas System
HART	Highway Addressable Remote Transducer
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
IA	Instruments Air
ICSS	Integrated Control and Safety System
I/O	Input / Output
IP	Ingress of Protection
IS	Intrinsically Safe
JB	Junction Box
MCC	Motor Control Centre
NPT	National Pipe Thread
P&ID	Piping & Instrument Diagram
PCS	Process Control System
PLC	Programmable Logic Controller
PSS	Process Safety System
SIL	Safety Integrity Level
SIS	Safety Instrumented System
UCP	Unit Control Panel
UPS	Uninterruptible Power Supply
XSV	Safety On/Off Valve
XV	Process On/Off Valve

4. GENERAL PRINCIPLES AND INPUT DATA

4.1. DESIGN SERVICE LIFE

Facilities shall be designed for an expected design service life of 20 years.

4.2. SITE CONDITIONS

The instruments shall be suitable for installation and operation indoor and outdoor under the prevailing following environmental conditions.

Area	Conditions
Atmosphere	Oceanic
Ambient indoor (technical rooms, CCR…) temperature Min/Max (°C)	HOLD 1
Ambient outdoor temperature Min/Max (°C)	-14°C / 40°C
Maximum indoor hygrometry (%)	HOLD 1
Maximum outdoor hygrometry (%)	55 / 80 / >95%

5. GENERAL INSTRUMENT SPECIFICATION

Instruments for use in hazardous areas shall be selected for use in the appropriate class zone.

Instruments located in a non-hazardous area will not be ATEX certified.

All instrumentation signals will be connected on ICSS systems via field junction boxes.

5.1. UNIT

Process Variables		Unit	Scales
Flow	Liquids	Kg/h, m3/h	Direct reading
	Gas	Kg/h, Nm3/h	Direct reading
Level	General	mm	Direct reading
	Tank Measure	Meter, %	Direct reading
Pressure	Atmospheric pressure	Bar g.	Direct reading
	Below Atmospheric pressure	Bar a	Direct reading
	Differential	mbar, bar	Direct reading
Detection		Ppm	Direct reading
Analysis			Direct reading
Temperature	General	°C	Direct reading

5.2. PROCESS CONNECTIONS

The instrument process connections shall be in accordance with “Piping class” Standard Specification.

Level instrumentation shall be flanged connection as per vessel nozzle in accordance with Vessel supplier drawing.

Pressure, Temperature instrumentation shall be NPT connection rating as per piping spec.

Each instrument (except for on-line instruments) shall be connected to the process through one or several dedicated taps.

Each tap shall be fitted with a piping block valve (piping specification) in order to allow for safe live intervention on the instrument.

Tubing shall be metric size.

Instrument mounting shall be in accordance with Hook-up drawing, refer to S48310-SEN-000-INS-DWG-5006 - Hook up Standard.

Instruments take-off connections shall comply with the following:

Instrument Device	Connection On Equipment			Instrument Connection	Vent and Drain
	Pressure Vessel	Piping	Storage Tank		
Press. Gauge	2" Flg (*)	½" NPT	2" Flg (*)	½"	½"
Press. Trans and DPT	2" Flg (*)	½" NPT	2" Flg (*)	½"	½"
Press. Gauge, Press. Trans and DPT with diaphragm	2" or 3" Flg (*)	½" NPT	2" or 3" Flg (*)	½"	½"
Level with DP Transmitter	HP: Flg (**) BP: ½" NPT or Flg (**)		HP/ Flg (**) BP: ½" NPT or Flg (**)		
Level Ultrasonic Radar	Flg (**)		Flg (**)	Flg (**)	
Level (Float or bypass)	Flg (**)		Flg (**)		½" NPT
Gauge Glass	Flg (**)		Flg (**)		Vent 1" NPT Drain ½" NPT
Thermowell	2" Flg (*)	2" Flg (*)	2" Flg (*)	½" NPT	
Local Indicator	2" Flg (*)	½" NPT	2" Flg (*)	½" NPT	
In-Line Indicator		Line size (*)			
Rotameter		Line size (*)		Line size	

(*) Flange type and rating as per Piping class.
(**) Flange size, type and rating as per vessel/tank data sheet.

5.3. INSTRUMENTS POWER SUPPLY

Transmitters shall be powered at 24 VDC from DCS.

Positioners and solenoid valves shall be powered at 24 VDC from DCS.

When more power is needed, it shall be powered at 230 VAC-50Hz.

Electrical power for all instrumentation and ICSS equipment shall be mainly sourced from Uninterruptible Power Supply (UPS).

5.4. INGRESS PROTECTION

All field-mounted instrumentation, in all aspects, shall be suitable for continuous and reliable operation in the service conditions.

All field instruments shall have an ingress protection at as per IEC 60529

Enclosures degree of protection shall be:

- Indoor: the minimum degree of protection shall be IP 42 minimum,
- Outdoor: the minimum degree of protection shall be IP 62 minimum.

5.5. AREA CLASSIFICATION

All equipment shall have at least to comply with the requirements of the specific hazardous area where they are installed.

Concerning the instruments installed outside hazardous areas (e.g. restricted area), it is preferred to select the same type of instruments as those installed in zones 1 or 21 and 2 or 22 hazardous areas, for standardization of maintenance and operation the instrumentation shall be suitable for zone 1, unless their quantity may justify different stock.

By default, it is recommended that all instruments in the processing building where it is possible to be in the presence of dust that all instruments are planned for zone 22

For any installation, ATEX European Directive shall be followed.

Instrumentation equipment in Gas Hazardous area type 1 or 2 shall be in compliance with European guidelines ATEX directives:

- Apparatus Category 2G
- Gas Group II C
- Temperature class T1

Instrumentation equipment in Dust Hazardous area shall be in compliance with European guidelines ATEX directives:

- Apparatus Category 2D
- Dust Group IIIC (conductive dust)
- Temperature class T85°C (to be confirmed with powders and swarf inflammation properties)

Field instrument/equipment not certified for zone 1 shall be de-energized in case of gas detection.

5.6. ELECTROMAGNETIC COMPATIBILITY (EMC)

To ensure acceptable immunity from stray electromagnetic fields, all instrument control systems and associated equipment shall be compliant with Electromagnetic Compatibility (EMC) IEC 61000.

The above requirements are to be considered as a minimum.

5.7. INSTRUMENT AIR

Operating pressure will normally be 5.5 to 7 bar g.

Instruments and actuators shall be designed to work at a minimum pressure of 5 bar g.

The design pressure to be considered is 10 bar g

5.8. ELECTRICAL INSTALLATION AND WIRING

Electrical installation shall be done in accordance with NFC – 15-100.

Electrical cables for Instrumentation shall be mainly:

- 01 IP 09 EG FA
- 01 IT 09 EG FA
- 01 IQ 09 EG FA
- 07 IP 09 EG FA
- 12 IP 09 EG FA
- 19 IP 09 EG FA
- 27 IP 09 EG FA

type selected according to NFC 87-202.

Cables sheath color shall be Light blue for intrinsically safe signals.

Cables sheath color shall be grey for not intrinsically safe signals.

Wires colors for instrumentation cables shall be as follow:

- White for - signal of 24VDC (system common)
- Red for + signal of 24VDC

Electrical power cables for field instrumentation supply shall be ”U1000R2V” according to NFC 32-321. Power cables sheath color shall be black.

Process control cables shall be of the fire retardant type “C1” according to NFC 32-070.

Safety cables shall be of the fire resistant-type fire retardant type “CR1-C1” according to NFC 32-070.

Cables in the technical room shall be low smoke and halogen free (LSZH) according to EN 61034 and EN 60754.

5.9. SIGNALS SEGREGATION

Instrumentation signals shall be segregated according to their type and the control or safety system which they belong, as follows.

Signals within cables shall be segregated following their nature and magnitude:

High level signal :
- Analogue input & output and digital input signals

Low level signal :
- Low level signals (PT 100 Ohm, thermocouple)
- Frequency signals

Intrinsecally safe signal :
- I.S. signals

Power and command signal :
- Instrument power supplies.
- Digital output signals

Telecom :
- System cable (e.g. network cable).

Cables shall be segregated according to their function:
- Control and Monitoring
- Process Safety / Emergency Shutdown
- Fire and Gas.

5.10. INSTRUMENTS EARTHING

All electrical devices shall be earthed to protect the personnel and equipment against electrical discharges.

Three different earthing networks shall be installed on the field and in instrument technical rooms:

- IPE (Instrumentation protection earth): protection of personnel, earthing of:
  - Cabinets metal frames
  - Metallic cable trays
  - Bonding of cable trays
  - Supports of instruments
  - Instrument enclosure

- IE (Instrument earth): earthing of non I.S. devices cable shields, and of voltage references for earthed 0 VDC.

- ISE (intrinsically safe earth): earthing of all I.S. devices including cable shields and voltage references.

5.11. CABLE TRAYS

Cable tray will be designed according quantity and size of cable or multicable.

Instrumentation signals shall be segregated according to their type as defined in § 5.9.

Cable routing shall be designed to facilitate possible extensions. Overall spare space will be between 15 to 20%.

Cable tray will be perforated type hot dip galvanization.

Secondary cable tray will include width 50 or 100 mm and main cable tray include width over 100 mm.

5.12. JUNCTION BOXES

Junction boxes shall be grouped on frame and all apparatus and instrumentation shall be wired on junction boxes.

Junction boxes shall be made of fiberglass reinforced polyester (GRP) or AISI 316L stainless steel with 316L stainless steel screw fastenings and shall be "Ex e" type as per ATEX European Directives

Cables glands for junction boxes and instruments shall be nickel plated brass material, compression type.

Junction boxes shall be provided with terminals for all conductors and screens including Spares and with earthing facilities.

The ingress protection degree for junction boxes and cable glands shall be IP 66. Cables shall enter at the bottom of junction box; spare entries shall be provided with plugs to meet Ex and IP requirements.

Junction boxes routing shall be designed to facilitate possible extensions. Overall spare space will be between 15 a 20%.

6. GENERAL INSTRUMENT CHARACTERISTICS

6.1. GENERAL

In the interest of flexibility and standardization, the components shall be in accordance with following common characteristics:

- All sensors/transmitters and controlled final receivers shall be 4-20 mA, 24 VDC, 2 wires and loop powered.
- Solenoid valves shall be powered 24 VDC.
- Sensors/transmitters and valve positioners shall be "Smart" type with a communication protocol based on the Hart standard.

Instruments using mercury are forbidden.

For inserted instruments like thermowell, vortex, pitot tubes, stress calculations shall be carried out by the SUPPLIER and shall be conform to ASME PTC 19.3 calculations.

All instruments containing important fluid capacities will be installed with vent and drain facilities and for hazardous and/or polluting fluids the vent/drain of instruments shall be piped to the vent/drain networks.

When fluids characteristics and/or temperature conditions can alter performance and reliability of the system, instruments shall be insulated and/or heated and/or fitted with process separators. The measurement capillaries shall be provided with heat insulation and mechanical protection.

In case of dual transmitters (one for Safety, one for Control) for the same process measurement, they shall have same range and span and the process connections will be fully independent but shall be close together to allow comparison of measurements. On vessels, level transmitters tapping points shall be at the same elevation.

Wetted metallic parts and gaskets shall be suitable for the process media and for the chemicals injected in the process stream.

In general wetted part shall be 316 stainless steel min.

For wetted parts, SUPPLIER to provide material certificate Type 3.1 as per EN10204.

Local instruments shall generally be supplied with a 2" pipe-mounting device except for pressure gages and instruments mounted directly on the line.

All instrument electrical connections shall be in metric threated with applicable ISO Standards. Electrical connection for instrument shall be ISO M20 x 1.5.

Unless otherwise specified, instrument pneumatic entries shall be 1/2" NPT.
Process connections in accordance with Hook-up diagrams S48310-SEN-000-INS-DWG-5005.
Diaphragm seals may be used for process connection in following cases :

- Viscous liquid
- Liquid which may freeze
- Corrosive product

- Product with a risk of polymerization.

When required, a flushing ring shall be provided with 1/2" NPT F rinsing connection.

For remote seals application, Capillary tubing shall be stainless steel armoured shall be kept as short as possible and shall not exceed 6m. They shall be SS 316L armoured sleeve.

SUPPLIER shall supply instruments with standard hand-held HART communicators. SUPPLIER to provide HART device description files for each device. Communicator shall be suitable for use in hazardous area, zone1 classified.

Electrical interface trip signals shall use volt free contacts in the tripping system and be powered by the receiving system. Electrical interface alarm signals shall use volt free contacts in the alarming system and be powered by the receiving system.

Pressure and differential pressure transmitters shall be supplied with suitable supports. SUPPLIERS shall provide, when associated with sunshades or housings, complete assemblies easy to install, calibrate, remove and maintain.

Instrument technologies listed here below are the most common ones so this list is not exhaustive. Other types of instruments could be used according to the interest or context of the project.

Cable glands could be made of PVC for non-armoured cable

Cable glands shall be made of nickel plated brass for armoured cable

All instruments will be provided with engraved nameplates, indicating at least:
- Tag Number
- Serial Number
- Model Number
- Manufacturer Name
- Body material
- Range of measurement
- ATEX certification if applicable

6.2. PROCESS TRANSMITTERS

Process transmitters will be electronic type

Electronic transmitters will be foreseen with local digital display. Local indicators in field shall have the same scale as that used in the control room.

To identify faulty sensors by control system, transmitters shall run complete diagnostic routine. On transmitter failure, output signal shall be over 4-20mA range (as per NAMUR NE43).

Temperature sensors shall be provided with ambient temperature compensation.

6.3. SAFETY TRANSMITTERS

Safety transmitters will have same characteristics than Process transmitters.

Instruments used for shutdown shall be individual and independent sensors at independent tapping point.

Safety transmitters shall be protected by password for HART maintenance and modifications

6.4. FIRE AND GAS TRANSMITTERS

Fire and Gas transmitters will have same characteristics than Safety transmitters and will be connected on SIS System.

Optical Smoke detectors located in building area will be addressable type and be managed by building Fire & Gas System.

Fire and Gas transmitters will be certified to be used in a SIL2 safety loop. Refer to Safety Concept - S48310-SEN-000-SAF-PHI-6001

6.5. FLOW

6.5.1. ORIFICES

Orifice plates shall be specified and calculated in accordance with international codes, standards and recommendations and mainly with:

- ISO 5167 / ISO 5168 / ISO/TR 3313

Orifice plates are required to be made of 316 Stainless Steel minimum

Orifice plates with flange taps shall be used for lines size from and above 2".

For lines size below 2", integral orifice flowmeter shall be used.

In case of risk of fouling, flange taps shall only be used.

Orifices plates shall be stamped with at least following information:

- Tag number
- Flange rating
- Line diameter
- Inside Diameter in mm
- Outside Diameter in mm
- Thickness in mm
- Material

Vent and drain holes shall be provided where necessary.

Calibrated range of orifice meter shall be 250mbar (500 or 1250 mbar ratings can be used only in exceptionally cases)

Straight run lengths shall be in accordance with ISO 5167

Flange tap connections shall be in accordance with ASME B16 36.

6.5.2. DIFFERENTIAL PRESSURE FLOW TRANSMITTERS

The performance of the instrument shall be as follows:

- Accuracy ± 0.1 % of span
- Repeatability ± 0.25%
- Temperature effect ± 0.1 % of span/10°C variation

The square root calculation shall be completed at the DCS level.

6.5.3. ELECTROMAGNETIC FLOWMETERS

Electromagnetic flowmeter can be used on low conductivity liquid. Cable selection and electrical connection shall be done following the SUPPLIER recommendations.

The performance of the instrument shall be as follows:

- Accuracy ± 0.5 % of flow rate

Connections shall be flanged, rating as per the piping class.

6.5.4. VARIABLE AREA METERS

The armored variable area flowmeter shall consist of an all metal metering tube with a magnetic type extension attached to the float.

Glass tube types shall not be used.

Float limit stops to be provided for over-range protection.

The performance of the instrument shall be as follows:

- Calibration accuracy ± 2 % of span
- Temperature effect ± 0.5 % of span/30°C variation

Connections shall be flanged, rating as per the piping class.

6.5.5. MASS FLOWMETERS

Coriolis type flowmeters:
The performance of the instrument shall be as follows:

- Accuracy ± 0.2 % of flowrate

Connections shall be flanged, rating as per the piping class.

6.5.6. ULTRASONIC METERS

The measuring principle shall be the "transit time differential method".
The performance of the instrument shall be as follows:

- Accuracy ± 1 % of flowrate

The online type is preferred to the clamp on type. Connections shall be flanged, rating as per the piping class.

6.6. LEVEL

Direct connecting on vessels shall be preferred for the level instruments.

Stand pipes, if exist, for level measuring instruments shall be provided with isolating, vent and drain valves.

Stand pipes shall be forbidden on safety and liquid/liquid interface measurements Tapping in the bottom of drums shall be forbidden.

For liquid/gas measurement, metering by differential pressure with separators and capillaries is strongly recommended.

For liquid-liquid interface measurement the preference shall be given to the type of instrument most currently used on field, i.e. differential pressure with separator and capillaries.

Other type of instrument, i.e. capacitance, TDR radar may also be used. Torque tubes shall be used only after formal approval of the CLIENT.

Prior to any purchase order, ENGINEERING shall provide CLIENT with level sketches for formal approval.

Differential pressure transmitters shall be used for alarm or trip functions, however on packages, package standard float type level switches shall be allowed after the CLIENT formal approval.

Special attention shall be brought to the design and installation of the differential pressure transmitters. Every hookup shall be subject to a careful selection taking in account all the input data like: the capillaries insulation, the position of the take-off connections, the wet or dry legs.

6.6.1. LEVEL INDICATORS

Magnetic type indicators, with two-colored flaps, are preferred. The reading scale position shall be adjustable.

Magnetic type gauges shall be with AISI 316/316L stainless steel tube.

If used after CLIENT formal approval, level glasses shall be of the transparent type, with illuminators when required by installation conditions. They shall be fitted with off-centered angle taps, with safety ball.

The maximum center-to-center distance for level glasses shall be 2000 mm, giving a visibility of 1760 mm. When greater ranges are required, several gauges shall be installed with and overlap of at least 50 mm.

6.6.2. LEVEL DIFFERENTIAL PRESSURE TRANSMITTERS

Level differential pressure shall be the preferred level measurement.

The use of 2 pressure transmitters or an Electronic/Digital differential pressure system (ERS Type) should be considered for a more convenient installation with a 3" flanged process connection (with Diaphragm Seals and flushing rings when required).

For level measurements in atmospheric pressure tanks, a flanged hydrostatic pressure transmitter can be used, mounted on a 3” flange (minimum) on the tank.

A shut-off valve shall be provided for removal of this apparatus.

Each differential pressure level transmitter shall be provided with a close coupled 5 valve manifold AISI 316 stainless steel except where capillaries are used.

The performance of the instrument shall be as follows:

- Accuracy ± 0.10 % of span

6.6.3. LEVEL TORQUE TUBE

Level torque tubes may be used on particular applications after the CLIENT approval. If

required by process conditions, they shall have extensions or cooling fins.

Drain valves and venting plugs shall be provided.

The standard ranges of torque tube levels to be used shall be as follows:

- 356 mm (14") and 813 mm (32").

6.6.4. HYDROSTATIC PRESSURE LEVEL TRANSMITTERS

The performance of the instrument shall be as follows:

- Accuracy ± 0.10 % of span

6.6.5. CAPACITIVE / ADMITTANCE LEVEL TRANSMITTERS

They can be used in some cases mainly on water base fluids or to measure interface level between liquids.

They have to be used only when differential pressure transmitter are not usable.

6.6.6. RADAR LEVEL TRANSMITTERS

Typical applications of level-radar measurement are wide measuring ranges like storage tanks gauging.

The performance of the instrument shall be as follows:

- Accuracy ± 0.15 % of span

6.6.7. NUCLEAR LEVEL TRANSMITTERS

Typical applications of nuclear level-measurement are on separators vessels, to measure interface between two phases. They have to be used when others technologies fail due to temperature, pressure, geometrical issues and hazardous fluid.

The performance of the instrument shall be as follows:

- Accuracy ± 0.5 % of span

6.6.8. LEVEL SWITCHES

Level switches can be used where point level detection is required, especially on shutdown loops.

Level switches using vibrating forks technology shall be used.

6.7. PRESSURE

Over-range protection shall be provided for pressure instruments, pilots, gauges, etc that may be subject to pressures that could damage or change the calibration of the instrument.

Instruments shall be equipped with pulsation dampeners when required by process conditions, capable of being adjusted while instruments are pressurized.

6.7.1. PRESSURE GAUGES

The over-range protection of the gauges shall be at least 25% of the maximum rated pressure flange.

The gauges shall have a minimum accuracy of ± 2 % at half range and ± 1 % at full scale.

All pressure gauges shall be glycerin oil filled to avoid vibration.

Pressure gauges shall be entirely made of 316L stainless steel and shall have 100 mm diameter dials.

They shall be fitted with shatterproof front glass.

Dial shall be of the white background type with black figures.

Measuring element shall normally be a Bourdon tube.

When range requirements cannot be satisfied, diaphragm or bellows element shall be used instead of Bourdon tube.

Bourdon tube shall be compatible with the process fluid (AISI 316 stainless steel minimum).

For gauges on corrosive services, consideration shall be given to diaphragm seal of monel or equal construction in accordance with the piping specification.

Range shall be stated on data sheets and selected as per EN 837.

Process connection shall be bottom connection and 1/2" NPT Male.

6.7.2. PRESSURE TRANSMITTERS

The performance of the instrument shall be at a minimum as follows:

- Accuracy ± 0.1 % of span
- Repeatability ± 0.25%
- Temperature effect ± 0.1 % of span/10°C variation

Process connections shall be 1/2" NPT F

Drain and vent shall be provided on each chamber.

6.8. TEMPERATURE

Thermowell type shall be one-piece thermowell, bored from one piece solid bar stock or forgings, and shall include a retaining flange. Tapered thermowell with round tip shall be selected.

The thermowell standard material is SS 316L. Other materials may have to be selected subject to the relevant piping class.

The cover flange shall always meet the relevant piping material requirements for material selection and dimension.

Pre-sizing of the well shall be performed by ENGINEERING.

Test wells for general use shall be provided with screwed stainless steel plugs permanently attached by stainless steel chain.

For pipes with a diameter below 3 inches, if a skin type temperature sensor is not recommended, an increase in pipe diameter to 3 inches shall be made (expander and reducer).

Immersion length: Generally, the tip of the thermowell shall be located within the second third of the flow line diameter.

6.8.1. TEMPERATURE INDICATORS

Bi-metallic temperature indicators with 100mm min. diameter dials and stainless steel cases shall be supplied as complete assemblies comprising: indicator, extension nipple and thermowell.

They shall have a spring mounted head, to allow viewing access from acute angles.

Scale graduations, zero adjustment and over-range protection shall be SUPPLIER standard. Accuracy shall be within ± 1 % of span.

Bi-metallic thermometers in service where vibration may be expected shall be either silicone filled or have other internal dampening means.

Range shall be stated on data sheets and selected as per EN 13190.

6.8.2. TEMPERATURE TRANSMITTERS

Thermocouples and resistance temperature transmitters shall be supplied as complete assemblies, composed of thermocouple or RTD element including terminal blocks, terminal head, extension nipple, thermowell, and converter incorporated in thermocouple or in RTD head, with a 4-20 mA output. The RTD/4-20 mA converter shall use a Hart communication protocol.

Thermocouples and RTD shall be mineral insulated and stainless steel sheathed execution

The performance of the temperature measurement (sensor + transmitter) shall be at a minimum as follows:

- Accuracy 0.25 % of span.
- Temperature effect 0.02 % of span/10°C variation.

Except for specific applications, RTD shall be used for ranges between –200°C and +450°C

Resistance thermometers shall normally be of the platinum type PT 100, 3 wires type.

Execution and characteristics shall be in accordance with EN 60751 (resistance 100 ohms at 0°C).

Consideration shall be given to the use of thermocouple sensor only where the temperature range falls outside that which can be achieved by using RTD.

When thermocouples are used, they shall be conform to IEC 60584 standard.

6.9. ANALYSERS

Two categories of process analysers will be considered:

In-line analysers, which are in direct contact with the process without requiring the extraction and transport of the process sample

On-line analysers with a sampling line: installed locally in unit or regrouped in an analyser shelter.

For Analysers design requirements, refer to Instrument Datasheets for Analysers - S48310-SEM-000-INS-DTS-5009.

6.10. CONTROL VALVES

In general, control valves shall be globe type as standard, flanged, sized in accordance with IEC60534.1.

Control valves shall have integral end connections in accordance with the applicable piping class.

Control valve trim selection shall be such that the maximum sound pressure level at 1 meter distance from the piping and 1 meter downstream of the valve shall not exceed 80 dB (A)

Control valves shall generally be specified to meet ANSI/FCI 70-2 or IEC 60534-4 Leakage Class IV. Another leakage class could be required on datasheet for any controlled valve which operates in a shutdown mode.

Control valves handling particularly hazardous processes must include devices that limit fugitive emission

Spring-opposed pneumatic diaphragm actuators shall be a first choice or Spring-opposed pneumatic piston type can be used as a second choice. Normally, the actuator acting mode is direct-acting for fail-open valves and reverse-acting for fail-closed valves.

As per PI&D's, valve can be FO (failure open), FC (failure closed) or FL (failure locked),

Control valve shall be equipped with a visual local travel indicator.

The control valve actuators shall be electro-pneumatic operated, design provisions shall be taken to provide fail open or fail-closed valve action as detailed on datasheet. The control signal shall be 4-20 mA / 24Vdc converted to 0.2 – 1.0 bar g, direct acting

6.11. ON/OFF VALVES

All valve body shall be consistent with associated piping specifications and piping class. The valve size will be the same as the pipe diameter.

The actuator shall be mainly rotating actuators, single acting, single or double piston type, spring return. All spring return pneumatic actuators shall be equipped with a closed loop purge system.

The internal part of actuators shall be protected against corrosion from atmosphere and fully sealed to prevent corrosive fluid to enter.

The actuator spring torque shall be sized for at least 1,3 times the maximum required torque with design pressure upstream and atmospheric pressure downstream with the lower pressure air supply.

As per PI&D's, valve can be FO (failure open), FC (failure closed) or FL (failure locked)

The actuator shall be equipped with visual open/close indicator.

The actuator shall be axial piping mounted.

All On/Off valves shall be fitted with inductive proximity switches (Namur type) for indication of both positions.

The solenoid valve powered by 24VDC.

The actuator will be fitted with a hand wheel if it’s required on the PID and data sheet.

6.12. PRESSURE SAFETY VALVES

Pressure safety valves shall be designed in accordance with ISO 4126 and piping class.

Balanced bellows pressure relief valves shall be used when the back pressure is higher than that allowed for a non-balanced valve or in case of corrosive or fouling process fluid.

Relief valves associated with atmospheric tanks shall be sized base on ISO 28300.

SUPPLIER shall provide certified sizing calculations and noise calculations for each

valve.

7. PAINTING

In accordance with Equipment Specification (Painting, electrical tracing, insulation) S48310-SEN-000-CHA-SPE-2510.

8. PROCESS CONTROL PHILOSOPHY

Refer to Automation & Control System specification S48310-SEN-000-INS-SPE-5017 and DCS & Safety System Architecture S48310-SEN-000-INS-DWG-5005.

9. INSTRUMENTED PACKAGES

The project will integrate different instrumented packages. Packages could be classified in 3 types (P1, P2 & P3) according to the quantity of instruments or their process control philosophy. For more detail, refer to General Equipment Specification S47310-SEN-000-MEC-SPE-7001.

All Instrumentation must be provided by Suppliers approved by CLIENT. Refer to the SUPPLIER List per discipline and package S48310-SEN-000-PMT-LIS-0004.