antam	SPECIFICATION	WIKA
	General Instrument Specification	PT WIJAYA KARYA (Persero) Tbk

GENERAL INSTRUMENT SPECIFICATION

P3FH antam
Proyek Pembangunan Pabrik Feronikel Haltim
CONTRACTOR DOCUMENT REVIEW

APPROVED	✓
APPROVED AS NOTED	
NOT APPROVED	
INFORMATION	

APPROVED DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY FOR ERROR OR DEVIATIONS FROM CONTRACT REQUIREMENTS

By : Khaliim
Date : 6-3-17
INITIALS

REV	DATE	DESCRIPTION	CONTRACTOR PRE	CHK	APP
1	24-FEB-2017	Re-issued for Approval	HU	BA	GPS
0	17-FEB-2017	Issued for Approval	HU	BA	GPS
A	23-JAN-2017	Issued for Internal Review	HU	BA	GPS

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PROYEK PEMBANGUNAN PABRIK FERONIKEL HALMAHERA TIMUR (P3FH)

Contract Number : 430/92/DAT/2016 | **Item No : A-01**

Document No. :

P3FH-IN-9000-SPE-1001-R1

TABULATION OF REVISION SHEET

SHEET	REVISION						REMARKS	SHEET	REVISION						REMARKS
	0	1	2	3	4	5			0	1	2	3	4	5	
1		X						45							
2								46							
3								47							
4								48							
5								49							
6								50							
7		X						51							
8								52							
9								53							
10								54							
11								55							
12		X						56							
13								57							
14		X						58							
15								59							
16								60							
17								61							
18								62							
19								63							
20		X						64							
21								65							
22								66							
23								67							
24								68							
25								69							
26								70							
27								71							
28								72							
29		X						73							
30								74							
31								75							
32								76							
33								77							
34								78							
35								79							
36								ATTACHMENT							
37								1							
38								2							
39								3							
40		X						4							
41								5							
42								6							

COMMENT RESPONSE SHEET

NO	PAGE	OWNER COMMENT	CONTRACTOR RESPONSE	REV.
1	1	Project Name	Noted and reflected	0
2	7	& KHI	Noted and reflected	0
3	12	No support shall be allowed to sit on grating	Noted and reflected	0
4	14	Junction box shall be manufactured of die cast material	No change, we'd like to keep the requirement as it to give the project a chance to look at material that has good corrosion resistance for outdoor application in coastal area yet durable, light weight, easy to maintain, and more economical such us GRP/Polycarbonate. This obviously will offer long term benefit for plant operation. However, we will consider die cast material for further study and see if significant benefits can be identified.	0
5	20	Welded thermowells are only acceptable if it is not possible to be manufactured by solid forge bar stock.	Noted and reflected	0
6	20	~~If possible~~	Noted and reflected	0
6	29	What ???	Valve and damper **types** referred on section 6.1.14 are listed as point 6.2 to point 6.17. The selection criteria/requirement of each type are as stated on their respective sub-points. To avoid further confusion, we revised section 6.1.14 to the following: "*Generally, the selection of valve and damper shall conform to the following (see section 6.2 to 6.17)"*	0
7	41	What ???	The **accessories** referred on section 7.1 are listed as point 7.2 to 7.12. The requirements of each accessory are as stated on their respective sub-points. To avoid further confusion, we decided to revise section 7.1 to the following: *"These accessories shall be as a minimum conform to the following criteria (see section 7.2 to 7.12):"*	0

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1. INTRODUCTION

1.1 Project Description

The High Carbon Ferronickel Processing Plant (Feni Plant) for the east Halmahera Ferronickel Development, written in Indonesian as “Proyek Pembangunan Pabrik Feronikel Halmahera Timur (P3FH), is designed for the production of 13,500 metric tons per annum of nickel in high carbon ferronickel shots. The project is located in the island of Halmahera, East Halmahera Regency, North Maluku Province, Indonesia.

1.2 Scope

This specification specifies the minimum requirements to meet in the selection, design, sizing and installation of field instrumentation, valve, damper and safety relief valve system under WIKA scope (System-2, System-3 and System-4). The scope of this document is to include all content of instrument and related equipment, engineering, design, documentation, supply, installation and testing.

1.3 Conflicts and Deviations

1.3.1. Any inconsistency, conflict or disagreement between the requirements specified in this document, datasheets, ANTAM Standards, industry standards and/or manufacturer’s standards, shall be brought to the attention of the Contractor for resolution.

1.3.2. Any deviation from requirement stated herein shall require written approval by the Contractor.

2. DEFINITION

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OWNER : PT ANTAM (Persero) Tbk.

CONTRACTOR/ PURCHASER : Consortium WIKA – KAWASAKI

PROJECT : Proyek Pembangunan Pabrik Feronikel Halmahera Timur (P3FH)

SUPPLIER : Company supplying material, equipment, or services to the Contractor / Purchaser

3. CODES, STANDARDS & REFERENCES

Equal or better codes and standards are acceptable. When different codes and standards are applied, Contractor shall be notified for approval. However, such approval shall not relieve the Supplier of full responsibility of the integrity for all equipment and materials supplied.

PUIL	:	Persyaratan Umum Instalasi Listrik (General Requirements for Electrical Installation)
SNI	:	Standar Nasional Indonesia (Indonesian National Industrial Standards)
ISO	:	International Organization for Standardization
ISA	:	Instrumentation System and Automation Society
IEC	:	International Electro-technical Commission
EIA	:	Electronic Industries Association
ANSI	:	American National Standard Institute
API	:	American Petroleum Institute
AGA	:	American Gas Association
ASTM	:	American Society for Testing & Materials
ASME	:	American Society of Mechanical Engineers
NEMA	:	National Electrical Manufacturers Association
NFPA	:	National Fire Protection Association
IEEE	:	Institute of Electrical and Electronics Engineers
NEC	:	National Electrical Cord
IPC	:	Instrument & Process Control Engineer’s Association
JIS	:	Japanese Industrial Standards
JEC	:	Japanese Electro-technical Committee
JEM	:	Japan Electrical Manufacturers' Association
JCS	:	Japanese Cable Makers’ Association Standard

4. SPECIFICATION

4.1 General

4.1.1. Instrument shall be specified and furnished in accordance with the criteria given in this specification and with the applicable standards listed herein. These criteria shall apply uniformly to all instrumentation supplied to the project.

4.1.2. Compliance with this specification shall not relieve the Supplier of the obligation to follow sound engineering practice throughout.

4.1.3. Instrumentation shall be of electronic or electric, with the exception of certain pneumatically actuated components. Standardization of the various types of instruments shall be applied, where possible, in order to obtain maximum interchangeability.

4.1.4. The Supplier shall come up with the type of instruments. The Contractor reserves the right to refuse certain proposed types. All instruments shall be of fail-safe design.

4.1.5. Fully open or fully closed indication caused by loss of power or a device fault shall depend on the process application and requirement of the individual instrument datasheet/list.

4.1.6. Transmission signal of electronic and electric type instruments shall be smart type with 4–20 mA DC output or digital 24 VDC for on / off signals. Signal of temperature measurements shall be direct signal such as ohm (for RTDs), mV (for thermocouples), etc. Transmission signal of pneumatic type instruments shall be 3-15 psi.

4.1.7. All materials in contact (wetted part) with process gases, fluids, solids or other mediums shall be suitable to withstand the associated pressure, temperature, vibration, corrosion, shock, abrasion, and any other physical properties and effects. It is Supplier responsibility to verify the suitability of selected material based on the process media / operating conditions.

4.1.8. As a minimum, the wetted part shall be stainless steel. Other material may be acceptable provided it meets process fluid condition.

4.1.9. Inline instruments such as venturi flow element, control & actuated valves, and dampers which shall have body materials in accordance with the relevant piping class specification.

4.1.10. Appropriate sealing material shall be used to prevent reaction where dissimilar metals are in contact.

4.1.11. Electrical enclosures for transmitters as a minimum shall be low copper aluminum alloy coated with anti-corrosion agent, and shall be finished with project's or supplier's standard marine paint system.

4.1.12. Generally, the minimum acceptable degree of protection provided for field instruments located outdoors shall be IP54 if the condition does not require better protection.

4.1.13. Instrument housings and panels for outdoors service shall be weatherproof and rated to IP54 requirement as a minimum. Additional protection hoods and sunshades shall be provided where environmental conditions dictate such requirement e.g under direct exposure of the sun light.

4.1.14. Transmitters shall be supplied with full factory calibration in accordance with individual instrument datasheets/list.

4.1.15. When remotely mounted, transmitters shall be supplied with mounting bracket suitable for 2" pipe stand or dedicated instrument rack as indicated on the datasheet.

4.1.16. Neither mercury nor asbestos shall be permitted in any component of supplied instruments or installation materials.

4.1.17. Generally, instruments shall be suitable for hazardous area it is rated if applicable. When compliance to certain hazardous area protection technique is required, Instruments shall be furnished with compliance documentation (e.g certificates), and bear the mark and certificate number on its body.

4.1.18. Instrument shall be immune from electromagnetic interference (EMI) and radio frequency interference (RFI).

4.1.19. Instrument impulse lines shall be stainless steel material using high-quality compression back-nut and olive tube fitting of approved material.

4.1.20. Material used for supporting instrument impulse tubing or piping and rack/local support shall be constructed of welded structural steel members that are primed and coated with a corrosion inhibiting paint or are galvanized.

4.1.21. Differential pressure instruments shall be provided with three-way or five-way valve manifold as applicable. Pressure measuring instrument shall have two-way valve manifold. Instrument manifold shall be of stainless steel construction with needle valves and connected directly to the instrument. Connection to process or instrument shall be PT JIS B0203

4.2 Units of Measurement

Instrument ranges and scale calibrations shall be in SI units as follow:

Length	:	meter (m)
Area	:	square meter (m^2)
Volume	:	cubic meter (m^3)
Mass	:	kilograms (kg)
Time	:	second, hour (s, h)
Temperature	:	celcius (ºC)
Level	:	meter (m)
Pressure (Absolute)	:	kilopascal (kPa-a)
Pressure (Gauge)	:	kilopascal (kPa-g)
Differential Pressure	:	kilopascal (kPa)
Mass Flow	:	kg/h
Volumetric Flow (Gas)	:	normal cubic meter per hour (Nm^3/h (@0ºC, 1 atm))
Volumetric Flow (Liquid)	:	cubic meter per hour (m^3/h)
Viscosity	:	centipoise (cP)
Electrical Conductivity	:	siemens per meter (S/m)
Thermal Conductivity	:	watts per meter-degree celcius (W/m ºC)
Heating Value	:	killojoules per kilogram (kJ/kg)
Mass density	:	kilograms per cubic meter (kg/m^3)
Velocity	:	meter per second (m/s)
Concentration	:	mol per cubic meter (mol/m^3)
Rotational Frequency	:	rotation per minute (rpm)

4.3 Instrument Range

4.3.1. Instrument maximum span should be selected suitable for the required precision and accuracy.

4.3.2. Unless otherwise specified, the calibrated instrument ranges shall be selected such that the normal value will be between 30% and 70% of the calibrated span, taking into account the specified minimum and maximum values of the process conditions and associated alarm and trip set points. In addition to the normal operational flow, flow meter ranges shall be selected to cover start-up, circulation and upset conditions. Refer to section 5.4 for the selection of DP Flow measurement instrument.

4.3.3. The setting of the trip action should be between 10% and 90% of the transmitter output. The ranges of certain trip instruments, such as those for high level, shall be selected such that the trip point accuracy is not degraded.

4.3.4. With the exception of differential pressure level measurements, elevated or suppressed ranges shall be avoided.

4.4 Instrument Support

4.4.1. Instrument support for remotely mounted transmitters, local indicator, etc., will be fabricated and hot dipped galvanized 2” carbon steel (mild) pipe or a dedicated instrument rack, in accordance with the standard hook-up and standard installation drawing.

4.4.2. The base of the support will be directly bolted in concrete foundation/slab or welded or bolted on steel structure or column depending on the location. No support shall be allowed to sit on grating.

4.5 Painting

4.5.1. Surfaces of Instrument shall be painted and or coated in accordance with Project Specification P3FH-MS-9000-SPE-1002, Specification for Painting.

4.5.2. Instrument devices and valve may be painted and coated using Manufacturers standard painting and coating specification upon written approval by the Contractor.

4.5.3. The valve/damper stem or spindle and gasket contact surface of flanges shall not be painted. These parts shall be protected against corrosion by application of a suitable protective coating.

4.6 Certification of Instrumentation and Related Documentation

4.6.1. The supplier shall supply documentation relating to the design, construction and testing of all instrumentation, such as material inspection, certification and marking. Such requirements shall be specified in the requisition package.

4.6.2. The following certification shall be provided as minimum:

a. Inspection certificates.
b. Hydro or pneumatic test certificate as applicable (inline instrumentation).
c. NDT certification (inline instrumentation).
d. Electrical certification for hazardous area equipment (if applicable).
e. Calibration certificate.
f. Alloy Verification/Material Certificate for the instrument and its parts.

4.7 Environmental Conditions

4.7.1 Design and selection of materials and equipment shall be suitable for the environmental conditions as follows:

a. Geographical Situation

Location	: Coastal Environment
Ambient	: Tropical

b. Air Temperature and Humidity

Maximum air temperature	: 34°C
Minimum air temperature	: 24°C
Average air temperature	: 28°C
Design ambient air temperature	: 30°C
Design ambient wet bulb temperature	: 29°C
Minimum relative humidity	: 47.9 %
Maximum relative humidity	: 66.2 %
Design relative humidity	: 90 %

c. Wind Speed

The local wind speeds are the following	:
Maximum wind speed	: 5.0 m/s
Minimum wind speed	: 1.0 m/s
Average wind speed	: 3.0 m/s
Design Wind Pressure	: 100 kg/m^2

4.8 Junction Boxes

4.8.1. Junction boxes shall be of the weather proof type. Junction box doors shall be hinged, either multipoint or piano (continuous) type, and secured by means of bolts (one per corner). Glands shall only be positioned at the bottom. The minimum degree of ingress protection for junction boxes located outdoor shall be IP54 if it doesn't need better protection.

4.8.2. All spare cores and shields shall be terminated and labelled.

4.8.3. Junction shall be equipped with necessary accessories that all metallic part continuity to grounding point is ensured. As minimum M10 earth boss connection shall be provided for grounding connection to plant safety earth.

4.9 Instrument Identifications

4.9.1. All instrumentation shall be provided with identification name plate firmly attached to the body, with the following information, as a minimum, clearly indicated on the plate:

a. Tag Number
b. Manufacturer's name or Trade Mark
c. Manufacturer's Model Number
d. Manufacturer's Serial Number
e. Hazardous Area Certification (if applicable)
f. Hazardous Area Certifying Authority (if applicable)
g. Year of Manufacture
h. Rating (inline instrumentation)
i. Material (inline instrumentation)
j. Calibrated Range
k. Power Supply

4.9.2. Additionally, instruments shall also be supplied with tag plate showing its corresponding tag number on the body.

4.9.3. The exception is orifice plates which shall be provided with a tab on, stamped or engraved the following detail:

a. the word "UPSTREAM"
b. tag number
c. Nominal line size DIN
d. Rating
e. internal line diameter

f. measured orifice diameter
g. plate thickness
h. plate material
i. plate type

4.9.4. For flow elements, direction arrow must be a permanent mark cast, forged, stamped, or otherwise permanently attached. Painted markings are not permitted.

4.9.5. Refer to section 6.16 for valve and damper identification, certificate and testing requirement.

4.9.6. Refer to section 10 of this specification for name and tag plate material minimum requirement.

4.10 Inspection and Testing

4.10.1 Internal Test

4.10.1.1. All instrumentation shall comply with the following Supplier's internal tests and checks:

a. Inspection method for all instruments shall be in accordance with the Supplier's standard, and norms.
b. Check of the conformity certificate for all classified equipment.
c. Check that the instruments comply with the specification(s) and data sheet(s) attached to the requisition.
d. Check of labelling, legal stamping and nameplates.

4.10.1.2. All inline instruments together with all related accessories, when part of supply, shall be subjected to the following further checks/tests as a minimum:

a. Dimensional check as per supplier issued drawings
b. Hydrostatic test in accordance with ASME B31.3
c. alloy verification
d. material NDT test (as required)
e. impact test (as required)

4.10.2 Factory Acceptance Test (FAT)

4.10.2.1 Only upon the successful of Supplier's internal test, the FAT to verify that all equipment and devices function properly with integrity in accordance with the project requirements and specifications shall be commenced.

4.10.2.2 Before the commencement of the FAT, The Supplier shall supply an inspection and test plan for review and approval defining points, inspection and document reviews.

4.10.2.3 Supplier shall provide notification to the Contractor and Company for attending the Factory Acceptance Tests.

4.10.2.4 Test instruments and equipment, test leads, temporary wiring, tools, etc. shall be made available by Supplier, as required to permit 100% inspection and testing. All the above items are to remain the property of Supplier.

4.10.2.5 All the testing shall be carried out on the procedure approved by the Contractor. All hardware failures and problems shall be resolved before shipment to site. All series of actions shall be taken in accordance with FAT procedure.

4.10.2.6 FAT Test certificate shall be issued by the Supplier at the successful and of the test activities.

5. FIELD INSTRUMENTATION

5.1 Pressure Instrument

5.1.1 Pressure Gauge

5.1.1.1. Gauges shall be direct reading and be of safety pattern design in accordance with ASME B40.100 or EN837-1 with nominal dial size of 100 mm (4”) with class 1 accuracy.

5.1.1.2. Gauges shall be suitable for ½” PT JIS B0203 bottom connection.

5.1.1.3. Pressure measuring elements may be of the bourdon tube or equal.

5.1.1.4. Case material shall be either phenolic or other anti-corrosion rated material.

5.1.1.5. Gauges shall be furnished with shatterproof glass window, external pointer adjustment, white dial with black marking, scale range calibrated in Pa or kPA.

5.1.1.6. Where general purpose pressure gauges are not suitable for use due to corrosive media, or where risk of plugging may be encountered, pressure gauges with chemical seal shall be used.

5.1.1.7. Pressure gauge shall be selected that the operating pressure is between 30% to 70% of scale and design pressure.

5.1.2 Pressure Transmitter

5.1.2.1. Pressure Transmitter shall be SMART type with 2 wire, 4–20 mA, 24 VDC loop powered.

5.1.2.2. All transmitter shall have a local output meter of LCD type.

5.1.2.3. Accuracy shall be better than ± 0.5% of span.

5.1.2.4. Process connection shall be ½" PT JIS B0203.

5.1.2.5. Electrical connection shall be ½" NPTF.

5.1.2.6. Diaphragm type transmitters shall be used as a standard.

5.1.2.7. Calibrated range shall be selected that the operating pressure is between 30% and 70% of the range.

5.1.2.8. Chemical seal capillary shall be considered if used in viscous, slurries or corrosive application or where the fluid is not compatible with the sensing element.

5.1.3 Pressure Switch

5.1.3.1. Pressure switch shall normally be diaphragm or bellow sensing element type.

5.1.3.2. Pressure switch contact shall be SPDT or other suitable type recommended by the manufacturer taking account process & operation requirement, hermetically sealed and rated for 24 VDC @ 5 amp.

5.1.3.3. Process connection shall be ½" PT JIS B0203 Female.

5.1.3.4. Electrical connection shall be ½ in NPTF.

5.2 Temperature Instrument

5.2.1 General

5.2.1.1. Resistance temperature detectors (RTDs) shall only be used for low vibration services from -200°C to a maximum process temperature of 500°C. If the maximum operating temperature is not defined on the data sheet, then a normal operating temperature of 400°C shall be used as the cut off between RTDs and T/Cs.

5.2.1.2. Thermocouples shall be used for high vibration services and for all temperatures above and below the RTD cut off. Fired heaters shall use thermocouples, and skin tube measurements shall use Refracto-Pad type thermocouple assembly or equally in mechanism type.

5.2.1.3. All temperature devices installed on process lines or equipment where there is inherent high risk of mechanical damage to the sensor shall do so via a thermowell. All pipeline

mounted thermowells shall have wake frequency calculations carried out by the Supplier in accordance with ASME PTC 19.3.

5.2.1.4. Temperature elements shall be spring loaded to ensure efficient thermal contact with the tip of the thermowell. Connection between transmitter/connection head and thermowell shall be made via a 1/2" PT JIS B0203 male, stainless steel nipple-union as a minimum.

5.2.1.5. Where accessibility is an issue or for applications where high ambient temperature or vibration is encountered, RTD's or thermocouple assemblies shall be supplied wired into a connection head. Connection head shall have ½" PT JIS B0203 Female.

5.2.1.6. Connection heads shall have a minimum of three terminals for thermocouples and four for RTD's.

5.2.2 Temperature Transmitter

5.2.2.1. Temperature Transmitter shall be SMART type with 2 wire, 4–20 mA, 24 VDC loop powered.

5.2.2.2. All transmitter shall have a local output meter of LCD type.

5.2.2.3. Accuracy shall be better than ± 0.5% of span.

5.2.2.4. Temperature element connection shall be ½" PT JIS B0203 Female.

5.2.2.5. Electrical connection shall be ½ in NPTF.

5.2.2.6. Calibrated range shall be selected that the operating pressure is between 30% and 70% of the range.

5.2.2.7. Remote mounted temperature transmitters shall be supplied with a mounting bracket suitable for mounting on a nominal 2" pipe stand.

5.2.3 Resistance Temperature Detector (RTD)

5.2.3.1 Resistance temperature detector (RTD) shall be single sensor of three-wire type having PT100 of 100 ohms at 0 deg.C with temperature coefficient of 0.00385 ohms/deg.C and comply with IEC 60751 (equivalent to DIN 43760, ASTM E1137).

5.2.3.2 Element sheath material shall be stainless steel as a minimum.

5.2.3.3 Electrical connection shall be ½" NPTM.

5.2.3.4 Thermowell connection shall be ½" PT JIS B0203 Male.

5.2.3.5 Accuracy shall be better than ± 0,5% of span.

5.2.4 Thermocouple

5.2.4.1 Thermocouple elements shall be of ungrounded type.

5.2.4.2 Generally, thermocouple elements shall be single sensor K type. Where process condition doesn't allow, other type of thermocouple may be considered following standard thermocouple type selection table.

5.2.4.3 Element sheath material shall be stainless steel as a minimum.

5.2.4.4 Electrical connection shall be ½ in NPTF.

5.2.4.5 Thermowell connection shall be ½ in PT JIS B0203 male.

5.2.4.6 Accuracy shall be better than ± 0.5% of span.

5.2.5 Temperature Gauges

5.2.5.1 Local temperature gauges shall be of the bimetallic type to DIN EN13190 with 100 mm (4 inch) dial or equal. Indicators shall be supplied and assembled with matching thermowell.

5.2.5.2 Temperature gauges shall be furnished with the following:

a. Shatterproof glass window,
b. Phenolic or other anti-corrosion rated material Case,
c. 6mm stem diameter,
d. External pointer adjustment,
e. White dial with black markings,
f. Scale graduations in °C,
g. Standard scale ranges with normal operating temperature in middle third of scale (between 30% and 70%),
h. Class 1 Accuracy,
i. 1/2" PT JIS B0203.

5.2.6 Thermowell

5.2.6.1 Thermowells shall be flanged in accordance with the relevant piping class and manufactured from stainless steel as a minimum except where process conditions dictate the use of other alloys. Thermowell connection sizes shall be as stated in Section 5.8 or as stated in the datasheets.

5.2.6.2 Should other type of connection is be considered (e.g threaded), the Contractor shall be consulted for approval.

1 5.2.6.3 Thermowells shall be manufactured from a solid forging bar stock. Welded thermowell is only acceptable if it is not possible to be manufactured by solid forge bars stock. Welded thermowells shall have the body and flange of the same material and shall have full penetration welds. Thermowell material shall be stainless steel as a minimum.

5.2.6.4 Sensor Connection shall be ½" PT JIS B0203 Female.

5.2.6.5 Thermowell design shall be either parallel or tapered shank.

5.2.6.6 DN100 shall be the minimum line size for thermowell installations. For temperature monitoring applications in lines smaller that DN100, the pipework shall be swaged up to DN100 locally.

5.2.6.7 Thermowells for static equipment such as electric furnace, burner chamber, columns, vessels and pump casings etc shall be of sufficient length to ensure good thermal conductivity of the fluid.

5.2.6.8 Thermowells shall be marked either by stamping or engraving around the edge of the flange and shall include tag number, flange size, pressure rating, material, length, and heat number.

5.2.6.9 Test thermowells (if any) shall be supplied complete with stainless steel, 1/2" PT JIS B0203 Male plug which shall be securely attached via a chain.

5.2.6.10 Special attention shall be given to the location of temperature points in mixing applications. Proper mixing and proper heat exchange between the fluid components should have taken place at the location of the temperature sensor. Minimum distance from mixing tee to temperature sensing point is 10 metres.

5.2.6.11 Temperature points shall never be installed directly downstream of flashing or cavitating valves, due to the risk of breakage as a result of excessive vibration.

5.3 Level Instrument

5.3.1 General

1 5.3.1.1 The use of level measurement techniques for continues level monitoring (excluding level switch) shall be based on the following order of preference. Other level measurement techniques shall require approval from the Company:

a. Differential pressure type instruments (without remote chemical seals);
b. Differential pressure type instruments (with remote chemical seals);
c. Guided wave radar;
d. Displacer type instruments;

e. Capacitance and admittance type probes;
f. Ultrasonic type instruments;
g. LTO level measurement.

5.3.1.2 The process normal, abnormal and start-up conditions, required accuracy, purpose of the measurement, physical properties of the fluid, range and physical location interpolated with cost requirement shall be the main governing factor should one would to differ from the criteria as outlined above.

5.3.1.3 The use of chemical seals shall be minimized and shall not be used for applications where the design temperature of the equipment is below -50°C and above +400°C.

5.3.1.4 Indirect level transmitters, such as radar and ultrasonic meter, shall be considered. where impulse line plugging is a concern, or where process conditions prevent the use of DP cells.

5.3.2 Level Transmitter

5.3.2.1. Level Transmitter shall be SMART type with 2 wire, 4–20 mA, 24 VDC loop powered.

5.3.2.2. Diaphragm type transmitters shall be used as a standard

5.3.2.3. All transmitter shall have a local output meter of LCD type.

5.3.2.4. Accuracy shall be better than ± 0.5% of span.

5.3.2.5. Process connection shall be ½" PT JIS B0203.

5.3.2.6. Electrical connection shall be ½" NPTF.

5.3.2.7. Calibrated range shall be selected that the operating value is between 30% and 70% of the range.

5.3.2.8. Remote mounted temperature transmitters shall be supplied with a mounting bracket suitable for mounting on a nominal 2" pipe stand.

5.3.3 Level Switch

5.3.3.1. Level switch contact shall be SPDT or other suitable type recommended by the manufacturer taking account process & operation requirement, hermetically sealed and rated for 24 VDC @ 5 amp.

5.3.3.2. Level switch shall have adjustable ranges with the adjustment located externally.

5.3.3.3. Electrical connection shall be ½ in NPTF.

5.3.3.4. Process connection follow data sheet and P&ID.

5.3.4 Level Gauge

The following level gauge types are available for consideration:

5.3.4.1 Magnetic Gauges

a. Magnetic gauges will not be used in dirty or plugging service.
b. Magnetic Gauge float will be designed for the range of process fluid specific gravity per the process conditions.
c. Ball Float and chamber will be designed to meet the design conditions of the vessel.
d. Vented float will not be used.
e. Magnetic Gauges will be provided with ½" PT JIS B0203 Female vent connection along with ½" PT JIS B0203 Female ball valve with ½" PT JIS B0203 Male plug. The drain will have flanged connection along with flanged ball valve.
f. Magnetic indicators material will be corrosion resistant and will be suitable for use for offshore environmental.
g. Contractor will provide support cleat for Magnetic Gauges where the chamber dimension is more than 48".

5.3.4.2 Reflex Glass Gauges

a. Reflex gauges will have a minimum pressure/temperature rating of 69 barg (1000 psig) at 260 deg C.
b. Tempered borosilicate, Pyrex glass or equal glass will be used in applications at or below 260 deg C.
c. Reflex Glass Gauges will be provided with ½" PT JIS B0203 Female drain and vent connections. Drain and vent connections will be provided with ½" PT JIS B0203 Female ball valve with plug.
d. Reflex Glass Gauge process connection to the vessel will be 2" flanged connection while reflex glass gauge connection to the gauge cock and ball check valve will be ¾" PT JIS B0203.

5.3.4.3 Transparent Type Glass Gauges

a. Transparent armored gauges will have a minimum pressure/temperature rating of 40 barg (580 psig) at 260 deg C.
b. Gauges will have plastic frost shields for applications in which the process liquid has a temperature below 0 deg C.

c. If illuminators are provided, they will be suitable for the electrical area classification.
d. Tempered borosilicate, Pyrex glass or equal glass will be used in applications at or below 260 deg C. Tubular glass gauges will not be used. Transparent Type Glass Gauges will be provided with ½" PT JIS B0203 Female drain and vent connections. Drain and vent connections will be provided with ½" Female ball valve with plug.

5.3.4.4. Gauge Cocks and Ball Checks

a. Gauge cocks and ball checks will be offset angle type purchased as assemblies as part of each glass gauge.
b. Gauge cocks with ball checks will not be used in vacuum applications.

5.4 Flow Instrument

5.4.1 General

5.4.1.1. Flow element shall be selected based on process condition and ISO 5167 minimum straight length requirement.

5.4.1.2. To ensure proper flow meter selection, correct process data such as flow rate, temperature, pressure and density shall be provided for minimum, normal and maximum operating conditions (including start-up and emergency conditions if applicable). Required accuracy of the measurement and the maximum allowable pressure loss under all process conditions shall also be available before the proper flow meter can be selected.

5.4.1.3. P&IDs shall show the type of flow meter used for each service. Flow measurements shall only be compensated for pressure and temperature in the PLC where shown on the P&IDs. Multi-variable transmitters shall be used for flow measurement where pressure and/or temperature compensation is required.

5.4.1.4. Taking process requirement into consideration, the following flow measurement techniques may be considered. The use of other type of flow meter requires contractor approval:

5.4.2 DP Flow Transmitter with Orifice Plate

5.4.2.1. Square edge orifice plates, with flange taps, shall be used wherever possible. Only for special applications, e.g. due to low pipe Reynolds Number, should a quarter circle or a conical entrance plate be used.

5.4.2.2. The normal flow readings should be between 30% and 70% of meter maximum scale.

5.4.2.3. The Beta ratio (ratio of orifice bore diameter to pipe internal diameter) will differ for different flow meters but generally shall be greater than or equal to 0.2 and less than or equal to 0.75 in accordance with ISO 5167.

5.4.2.4. Orifice plates in horizontal DN 50 or larger piping shall have drain holes for gas service having entrained liquids; vent holes for liquid service having entrained gas; effects of such holes on measurement accuracy noted or compensated for in the calculations.

5.4.2.5. Orifice meter flange sets shall have a minimum ASME Class 300 rating. The flange taps shall be welded connections.

5.4.2.6. Minimum pipe size for orifice meter runs shall be DN 50.

5.4.2.7. Integral orifices may be used for flow metering in line sizes smaller than DN 50. Supplier standard orifice bores shall be used.

5.4.2.8. The use of straightening vanes or flow conditioners shall require approval.

5.4.2.9. DP flow Transmitter shall be SMART type with 2 wire, 4–20 mA, 24 VDC loop powered.

5.4.2.10. Diaphragm type transmitters shall be used as a standardThe square root extraction shall be performed by the transmitter.

5.4.2.11. Tubing impulse line connection shall be ½" PT JIS B0203 Female.

5.4.2.12. Electrical connection shall be ½ in NPTF.

5.4.3 Magnetic Flow Transmitter

5.4.3.1. Electromagnetic flow meters shall be normally used for water based and conductive liquid only.

5.4.3.2. Magnetic flow transmitter shall be SMART type with 2 wire, 4–20 mA DC output.

5.4.3.3. Magnetic flow transmitter shall use external power supply 220 VAC / 50Hz or as per vendor advice. The 220 VAC is non-UPS supply & will be provided by the Purchaser.

5.4.3.4. Accuracy shall be better than ± 0.5% of span.

5.4.3.5. Electrical connection shall be ½ in NPTF.

5.4.4 Positive Displacement Flow Transmitter

5.4.4.1. Process connection shall be flanged following connection size as detailed on the datasheet.

5.4.4.2. Accuracy shall be better than ± 0.2% of span.

5.4.5 Variable Area Flow Meters

5.4.5.1. The use of variable area flow meters shall be restricted to simple applications such as measurement of purge, bubble-type level measurements, cooling or sealing fluids, or in sample conditioning systems for analyzers.

5.4.5.2. Variable area flow meters Wetted part and diaphragm shall be stainless steel as a minimum unless the process conditions dictate allowance of other material.

5.4.5.3. Transmitting type Variable Area flow meters requires approval from Contractor.

5.4.6 Flow Switch

5.4.6.1. Flow switch contact shall be SPDT or other suitable type recommended by the manufacturer taking account process & operation requirement, hermetically sealed and rated for 24 VDC @ 5 amp

5.4.6.2. Electrical connection shall be ½ in NPTF.

5.4.6.3. Process connection follow data sheet and P&ID.

5.5 Limit Switch

5.5.1. Limit switch contact shall be SPDT or other suitable type recommended by the manufacturer taking account process & operation requirement, hermetically sealed and rated for 24 VDC @ 5 amp.

5.5.2. Electrical connection shall be ½ in NPTF.

5.6 Load Cell

5.6.1. Measuring system method shall be super precision beam cell.

5.6.2. Load Cell Connect. Type shall be free on plate.

5.6.3. Type of Load Cell shall be Tension load cell.

5.6.4. Accuracy shall be better than ± 0,2% of maximum range.

5.7 Rotation Detector

5.7.1. Type of Rotation detector shall be Inductive proximity sensor or other type as applicable.

5.7.2. Type of output signal shall be discrete with 3 wire, PNP or as per manufacturer's recommendation.

5.8 Instrument Connection

5.8.1. For installation details and piping/tubing requirements reference should be made to specification for Instrument Hook-up Drawing P3FH-IN-9000-STD-1002.

5.8.2. Instrument connections on piping and equipment.

The following table summarizes the connections to be used to interface instruments to piping and equipment. With pertaining to Instrument Hook-up drawing, for details on piping/instrument interfaces refer to Piping Material Class P3FH-PP-9000-SPE-0001.

CONNECTION			**SIZE**	
Pneumatic Signal Connection			¼", 3/8", ½" NPT (Female) as necessary	
Electronic Signal	General Transmitters, Thermocouple & RTD signal terminal heads		½" NPT (Female)	
INSTRUMENT		**Type & Size of Primary connection to Piping or Equipment**	**Type and size block valve / monoflange**	**Piping Connection presented to Instrument**
Connected to Piping	Orifice Flanges	Flange	As per piping Specification	½" PT JIS B0203
	Thermowells – Flanged	DN40 Flange	N/A	DN40 Flange
	Thermowells – Threaded	N/A	N/A	N/A
	Pressure instruments and bourdon tube (equal type) pressure gauge	Flange (note 1) DN20	As per piping specification	½" PT JIS B0203

Connected to Equipment	Thermowells	Flanged	DN50 Flange (note 1)	N/A	DN50 Flange (note 1)
		Threaded (Note 4)	¾" PT JIS B0203	N/A	½" PT JIS B0203
	Pressure instruments and bourdon tube (equal type) pressure gauge		Flange (note 1) DN50	As per piping specification	½" PT JIS B0203
	Displacer	External (via chamber)	DN50 Flange (note 1,3)	As per piping specification	N/A
		Vent/Drain	DN20 Flange (note 1)	As per piping specification	N/A
		Internal (or direct)	DN100 Flange	As per piping specification	DN100
	Float	External (via chamber)	DN50 Flange (note 1,3)	As per piping specification	N/A
		Internal (or direct)	DN100 Flange	As per piping specification	N/A
	Differential pressure		DN50 Flange (note 1,3)	As per piping specification	½" PT JIS B0203
	Differential pressure direct flange mounted with flat diaphragm (level)		DN80 Flange (note 1,3)	As per piping specification	N/A
	Differential pressure direct flange mounted with extension diaphragm (level)		DN80 Flange (note 1,3)	As per piping specification	N/A
	Gauge glasses		Flange (note 1, 3)	As per piping specification	¾" PT JIS B0203

Notes:

1. Rating for connection shall be in accordance with the relevant piping class specification or equipment datasheet for the service. Minimum flange rating shall be ANSI 300#.
2. In-line instrument connections for flow elements and control valves shall have a minimum flange rating of 300# with the exception of actuated *on/off* and pressure relief valves which shall be flanged in accordance with the relevant piping class specification.

3. All level instruments inclusive of those mounted within a chamber may be connected via a level bridle or mounted directly on to the vessel.
4. For un-pressurized furnace application only. The use of this connection method shall require pre-requisite Contractor approval.
5. Connection facility to be provided for Instrument impulse tubing at both piping side (such us tapped ½" PT flange) and instrument side (such as manifold) shall be stainless steel.

6. ACTUATED VALVES & DAMPERS

6.1 General

6.1.1. While pertaining to datasheet and piping specification P3FH-PP-9000-SPE-0001 requirement, generally, body construction material, body size sizing, end connection, and face to face dimension shall conform to the applicable standards recognized by the project.

6.1.2. Valve and damper bodies and trim shall be of the material specified on the Instrument data sheets. It is the supplier's responsibility to confirm that the material specified is suitable for the design conditions.

6.1.3. Special alloy bodies that may differ from the piping specification may be required in conditions such as high temperature, severe erosion, corrosion or critical applications such as oxygen.

6.1.4. All pressure retaining parts of the valve and damper, including body material selection, end connections, pressure rating, bonnet, gaskets, bolting, and packing shall be as a minimum conform to the applicable piping specification.

6.1.5. Generally, all valves and dampers shall be flanged to its piping specification with minimum end connection size of DN 25, unless otherwise specified on the instrument datasheet.

6.1.6. Bonnet flange and gasket shall comply with Supplier design, and be suitable for the process pressure and temperature of the associated piping specification.

6.1.7. For applications in temperatures above 230 deg C or below 0 deg C, an extended bonnet will be used to protect the positioner and actuator from heat.

6.1.8. Packing shall conform to manufacturer's sizing and selection criteria for temperature/pressure curves. The packing material shall be in compliance with the piping specification.

6.1.9. Asbestos, in any condition, shall not be used.

6.1.10. The area classification and protection degree shall be as identified on the relevant datasheet.

6.1.11. Unidirectional valves and dampers shall have a mark indicating flow direction. Direction arrow must be forged, stamped, or otherwise permanently attached to the valve body. Painting mark is not acceptable.

6.1.12. Valves and dampers shall be sized to the desired performance criteria taking account cavitation, flashing and excessive noise generating factors. It is the supplier's responsibility to size the valve as per process condition accordingly and confirm that the sized valve is suitable for the intended design criteria.

6.1.13. The following considerations shall apply to rotary valves:

a. The valve disk shall be positively attached to the shaft, and the shaft shall preferably be a one-piece, through design.
b. The actuator end of the valve shaft shall be splined or keyed and shall not have a shear pin.
c. The valve shaft bearing shall be designed to prevent the shaft guide bushing from rotating in the valve body.
d. The bearing material shall be selected to prevent galling of the bearing or valve shaft.
e. Since the disk in wafer style valves may project beyond the valve body during part of the disk rotation, clearance shall be maintained between the disk and the pipe wall, particularly if the pipe is of heavy wall construction.
f. For butterfly valves, the vane as a minimum shall be of the same material as the valve body, unless otherwise specified.
g. Wafer valves shall not be specified.

△1 6.1.14. Supplier shall be responsible to verify and confirm that the selected valve and damper type makes the best fit for the intended design and process requirement. Generally, the selection of valve and damper shall conform to the following (see section 6.2 to 6.17 below):

6.2 Globe Valve

6.2.1. Globe valve shall be generally selected for control / modulating valve application unless process condition dictates the otherwise.

6.2.2. For normal service, control valves shall be cage guided globe type. However, where operating conditions cause excessive noise, cavitation or flashing, tortuous path trim technology shall be used as stated previously on section 6.1.

6.2.3. When considering globe valve for on/off application, the valve may only be used for blowdown application. It shall not be used for other on-off application.

6.3 Angle Valve

6.3.1. Angle valves shall be considered for the following severe service applications:

a. High pressure drop applications
b. Severe cavitation or flashing
c. Anti-surge valves

6.4 Ball Valve

6.4.1. Ball valves are the preferred valve type for safety on-off applications. However, due to cost implications, the use of ball valve shall only be limited to DN 200 only. Butterfly valves shall be preferred in lines sizes of DN250 and above with a pressure rating of 600# and below.

6.4.2. Ball valves with hollow ball construction shall not be permitted.

6.4.3. Weld repair of a cast ball is not acceptable

6.4.4. All valves shall comply with API 6FA for metal to metal seated valves and with API 607 for soft seated valves, or to other equivalent project recognized standards.

6.4.5. Reduced bore ball valves shall be standard. Full bore through conduit requirements shall be specified on the datasheet. Floating ball valves shall be of a seat supported design.

6.5 Butterfly Valves

6.5.1. Butterfly valves shall be preferred on-off application in lines sizes of DN250 and above with a pressure rating of 600# and below.

6.5.2. When used for throttling control valves, butterfly valves shall be considered in applications which require low pressure drop characteristics, or in which size and pressure rating, make them a viable alternative.

6.5.3. Butterfly valves for flammable, toxic, or corrosive service may be provided with ‘lugged wafer’ bodies.

6.5.4. “Double Flanged” bodies shall additionally be used for all butterfly valves having a “Fail Open” action. Where a ‘spring fail open‘ valve has a body which does not encompass the open disk, a hand wheel or jacking screw shall be fitted to close the valve.

6.6 Self Acting Regulators

6.6.1. Direct operating pressure reducing regulators shall only be applied on simple applications (e.g. reducing instrument air supply pressure or inert gas blanketing of storage tanks).

6.6.2. Direct operating back pressure regulators shall only be considered for clean fluids and simple applications. Direct operating differential pressure regulators shall only be considered for clean fluids and simple applications (e.g. secured instrument air systems or compressor bearing sealing services).

6.7 Dampers

6.7.1. The respective functions, types, material selection and general constructional requirements of dampers shall be in accordance with the associated piping / mechanical specification and design requirement unless otherwise indicated, sufficient dampers shall be provided to regulate and balance the system.

6.7.2. All dampers shall be of flanged type unless otherwise indicated.

6.7.3. All manually and automatically operated dampers shall include a means for indicating externally the position of the blades. Manual dampers shall include a device for positioning and locking the damper blades. The positions of all dampers 'as-set' after final regulation shall be indelibly marked at the adjusting device.

6.7.4. Access openings with readily removable air sealed covers shall be provided adjacent to all dampers. Subject to limitations of the surrounding equipment the dimensions of access openings shall not be less than 300 mm x 300 mm and they shall be located so as to afford easy access for inspection and maintenance.

6.7.5. Stainless steel spring tempered flexible gasket shall be inserted between the blade and the casing for elimination of closing friction. Provision shall be made to accommodate expansion of the damper blades within the casing, e.g in the event of fire conditions, to prevent jamming and to retard the system fluid.

6.7.6. Damper assemblies for installations in corrosive environments shall be fabricated from suitable materials resistant to the corrosive substances and environments indicated.

Alternatively, the material may be coated with a protective finish to produce the same effect. It is Supplier responsibility to confirm that the materials selected in the datasheet is suitable for the intended service and process condition.

6.7.7. The closing force for the selected dampers shall be provided by stainless steel spring or springs.

6.7.8. automatic locking device shall be provided to ensure that the blades are held in the closed position after release.

6.7.9. Multi-bladed dampers shall be provided with a means to ensure that all the blades close simultaneously.

6.7.10. Fire or Smoke dampers shall be rated in accordance with the fire rating of the associated equipment such as furnace, supply duct, the wall, ceiling etc.

6.7.11. Unless otherwise indicated, each Fire or Smoke damper shall be held in the open position by a corrosion resistant retaining device incorporating a fusible element set at intended actuated point.

6.7.12. Dampers shall be provided with suitable blade seating suitable for the rated leakage class.

6.7.13. For automatic dampers, the blades shall be driven by externally mounted and totally enclosed stainless steel gearbox and drive mechanism providing accurate blade control with minimum torque and without accumulative backlash.

6.8 Trim Requirement

6.8.1. All valves shall have removable cages, seat rings, and plugs. Threaded seat rings are not acceptable. The valve shall have quick change type trim utilising top entry design for ease of maintenance. No components shall be screwed or welded to the body or bonnet.

6.8.2. The control valve trim (consisting of plug, seat rings and stem) shall be stainless steel as a minimum unless otherwise stated.

6.8.3. The required globe control valve characteristic may be obtained through a characterised trim or cage. Rotary valve characteristic may be obtained through a characterised cam in the actuator.

6.8.4. All dampers shall have trim characteristic suitable for the designated piping or mechanical class specification

6.9 Leakage and Tight Shut-off Requirement

6.9.1. Tight shutoff and leakage class for valves and dampers shall be rated to process requirement and the applicable standards. Generally, for valves, leakage class shall be ANSI Class IV as a minimum. Only control valves in critical applications that require minimum leakage will have ANSI Class VI seat leakage rating. This requirement shall be clearly stated on the datasheet. For dampers, it should be rated to the associated AMCA class or equal.

6.9.2. Where soft (resilient) inserts are required to meet the leakage rate specified in the data sheet, they should be suitable for the specified process conditions and preferably be glass-fiber filled or graphite filled PTFE.

6.10 Noise Consideration

6.10.1. Noise calculation shall be performed to the applicable code / standard.

6.10.2. Generally, valves and dampers shall be sized that the resulted noise does not exceed 85 dB(A) based on a measurement one (1) meter downstream and one (1) meter from the surface of the attached piping. Exceptions may be made for emergency depressurising and blowdown valves, where a maximum of 110 dB(A) shall be maintained. In addition, brief excursions from the normal operating range of a control valve which results in exceeding the 85 dB(A) value for a brief duration may be allowed subject to Contraktor approval.

6.10.3. Where operating conditions cause unavoidable excessive noise, cavitation or flashing, tortuous path trim technology shall be used. Acoustical insulation shall be used only if all other means of noise attenuation possible in the valve design have been implemented and further noise reduction is still required.

6.10.4. The use of low noise restriction plates, diffusers, mufflers and silencers, either inside the valve body or downstream of the control valve are not allowed, other than in blowdown service when the valves are expected to be operated less than twice per year.

6.11 Severe Service Requirement

6.11.1. Valves in flashing water service shall be fabricated using hardened body material or lining such as 5 Cr-1/2 Mo. Plated bolting material shall not be used for pressure-containing parts.

6.11.2. In flashing applications, hardened plug and seat rings (e.g. stellited) shall be selected for the following applications:

a. erosive services

b. wet gas or wet steam service with a pressure drop greater than 5 bar
c. other services whether the pressure drop is greater than 10 bar at design conditions.

6.11.3. small size valves for erosive services shall have plugs and seat rings of solid stellite.

6.11.4. Where cavitation is unavoidable and dependent upon the cavitation level, one of the following methods should be considered to avoid valve damage:

a. trim material selection
b. weld overlay of trim parts (e.g.stellite)
c. special, anti-cavitation trims.

6.11.5. Where operational conditions require exotic materials (e.g. Hastelloy, Stellite, Monel) consideration should be given to a composite construction Internal lining of the fluid impact area may be required for:

a. fluids containing erosive particles (slurries)
b. ported plugs for wet gas service with a pressure drop across the valve exceeding 10 bar
c. other services where the pressure drop exceeds 40 bar.

6.11.6. Internal lining of the whole body shall be considered for valves in sea water services (such as deluge valves).

6.12 Valve and Damper Actuator

6.12.1. The actuator shall drive the valve / damper to a pre-determined safe position on loss of signal or motive power. The actuator shall have a mechanism (e.g an enclosed spring) to achieve the fail-safe action. Valve / damper failure position shall be as indicated on the P&IDs and data sheet. When sizing the spring, the process pressure shall not be considered if this pressure assists in achieving the fail-safe position.

6.12.2. Actuators shall be sized for positioning the closure member against the maximum differential pressure at all process conditions with the valve / damper fully closed and the downstream pressure at atmospheric or a vacuum as applicable.

6.12.3. Actuator shall be sized by the valve supplier to meet control, shutoff, and leakage requirements of the valve, at minimum air supply.

6.12.4. Actuator and associated accessories shall be completely assembled, piped, wired, mounted on the control valve, aligned, tested, and shipped as a complete unit.

6.12.5. The material of the actuator case/ housing shall be of carbon steel, as a minimum. The Supplier shall obtain the written approval of the Purchaser for the use of aluminium alloys in the construction of actuators, regardless of location or service. Where the use of aluminium alloys is permitted, it shall have anti-corrosion characteristic.

6.12.6. Internal parts, fasteners, and hardware shall be resistant to corrosive effects of the environment.

6.12.7. Each actuator shall be equipped with all necessary tools required to set travel limit switches, torque switches, position transmitters or other items required by the Instrument Data Sheets. Each special tool shall be tagged with valve tag number and purchase order.

6.12.8. Unless otherwise specified on the data sheet, as a minimum actuator shall be capable of providing a complete stroke of the valve in either direction as follows:

a. Body sizes (up to) DN 50 10 seconds
b. Body size DN 80 15 seconds
c. Body size DN 100 15 seconds
d. Body size DN 150 20 seconds
e. Body size DN 200 25 seconds
f. Body size DN 250 35 seconds
g. Body size DN 300 45 seconds

6.12.9. For damper, stroking time requirement shall be indicated on the datasheet.

6.12.10. Valves and dampers and its actuator shall be designed to be self-supportive in the horizontal position. If this is not possible then the contractor shall be notified for the alternative method proposed.

6.13 Pneumatic Actuator

6.13.1. Generally, pneumatic actuator shall be piston or diaphragm type, unless indicated otherwise on the datasheet.

6.13.2. Actuator shall drive the valve / damper to a safe position on loss of signal or motive power. Actuator shall have an enclosed spring to achieve fail-safe action if necessary.

6.13.3. Valve opening/closing times shall be specified on the instrument datasheet.

6.13.4. Where spring-less type cylinder actuators are required (e.g. high thrust applications), the actuators shall be furnished with the necessary volume (capacity) tank and accessories to provide the correct valve action on air supply or signal failure. Tank capacity shall be sized to

deliver 3 complete strokes (open-closed-open-closed-open-closed) including the final re-seating torque. The requirement shall be specified on the datasheet.

6.13.5. Instrument air capacity tanks, if required due to the above point, shall be designed, manufactured and tested in accordance with AS 1210. The capacity tanks shall be stamped and be equipped with a pressure relief device. In addition to a relief valve, instrument air capacity tanks shall be complete with pressure transmitter (by Purchaser), Pressure Gauge (By Purchaser) and non-return valve at the inlet.

6.13.6. For butterfly valves, the rotary intermediate linkages between valve and actuator shall be of the integral type and enclosed in a protected metal housing.

6.13.7. Cylinder actuators shall be provided with adjustable end-limit travel stops in both directions. Bolt adjustment type limit stops shall be applied with a locking facility (e.g. a locking nut) to prevent tampering.

6.13.8. Piston and cylinder actuators shall have O-ring sealing and shall be designed for low shaft and piston friction.

6.13.9. Actuators shall be equipped with a direct-coupled adjustable travel or position indicator for local status indication.

6.13.10. As minimum, on – off pneumatic actuator shall be furnished with digital 24 VDC Solenoid Operated Valve for actuation, 24 VDC Open and Close Position Limit Switches and smart 4-20 mA Position Indicator Transmitter. For throttling application, the actuator shall be furnished with smart 4-20 mA positioner in place of the SOV.

6.14 Electric Motor Actuator

6.14.1. Electric motor actuators shall include the following features:

a. 380 VAC, 50 Hz, 3-phase feeder (by Purchaser) to an integral reversing contactor starter in the actuator
b. Automatic phase correction circuitry to provide automatic rotation correction.
c. Automatic lost phase protection
d. Separately sealed compartments for power and control terminations, with a
e. minimum of one 1/2” for control and one 1” for power cable gland entry per compartment
f. Integral over-temperature burnout protection.
g. Automatic motor overload protection due to over-torque (jammed valve) in either direction

h. Motor and actuator insulation rating capable of continuously cycling the valve for up to 5 continuous cycles and also capable of up to 12 consecutive applications of locked rotor current for 5 seconds each occurrence

i. Integral space heater shall be drived internally from electric motor, but capable of being powered by a separate 220 VAC, 50 Hz connection.

6.14.2. Gearing shall be fully enclosed.

6.14.3. Equipment items shall meet the Hazardous area classification specified on the Instrument Data Sheets. (if applicable)

6.14.4. Gearboxes shall be designed to permit stroke times of less than 2 seconds per inch.

6.14.5. Actuator shall stroke the valve full travel in either direction in the time specified on the Instrument Data Sheets.

6.14.6. Actuator local controls must include the following, as a minimum:

a. Mechanical valve/damper position indication

b. Pad-lockable selector switch for LOCAL-OFF-REMOTE operation of the valve

c. OPEN-STOP-CLOSE local control with mid-travel stop and mid-travel reversal

d. Permanently attached handwheel of the automatic de-clutching type that precludes mechanical engagement of the handwheel while the driver is in operation

e. Smart 4-20 mA Position Indicator

f. 24 VDC Position Limit Switches

g. 24 VDC Torque Limit Switches

h. 24 VDC LOCAL-OFF-REMOTE Mode Switches

6.14.7. In on-off application, actuator shall be able to receive the following command from Purchaser's control room action:

a. An OPEN signal, 24 VDC, momentary contact, energize to operate

b. A CLOSED signal, 24 VDC, momentary contact, energize to operate

c. A STOP Signal, 24 VDC, 24 VDC, momentary contact, energize to operate

6.14.8. For throttling application, the actuator shall be capable of receiving smart 4-20 mA analog output from the control room in place of 24 VDC OPEN-CLOSED-STOP command.

6.14.9. Actuator for damper may be of Motorized Cylinders and Electro Hydraulic Motor application with rated voltage of 380 VAC, 3 phase, 50 Hz.

6.15 Hydraulic Actuators

6.15.1. Hydraulic system used in combination with electric motor forming electro–hydraulic actuator is inclusive in this requirement.

6.15.2. Cylinders of hydraulic actuators shall be designed in accordance with the corresponding standard. Power storage accumulators and hydraulic fluid reservoir(s) where specified shall be suitably rated for the system design pressure.

6.15.3. The type of hydraulic actuator and mounting orientation shall be as defined on the Data Sheet. The valve actuator, power pack, accumulator, nitrogen bottle, instrumentation and local panel shall be directly mounted on the valve / damper.

6.15.4. All materials in contact with the hydraulic fluid shall be compatible with the fluid and any additives contained therein. The Supplier shall provide details of the hydraulic fluid at the time of bid for Company approval.

6.15.5. All actuator seal materials shall be resistant to wear and deterioration due to the operating fluids, expected operating temperatures and environmental conditions. Details of the seal materials shall be provided to the Company for Approval.

6.15.6. Each actuator shall, where specified on the data sheet, have the facility for local manual control in case of loss of control signal and / or actuator failure. The type of local manual control shall be as specified on Data Sheet and will be via a mechanical device. Such local control shall be protected from inadvertent operation by a lockable device. The local manual control shall be capable of opening / closing with the maximum differential across the valve being equal to the upstream line pressure.

6.15.7. The actuator shall be fitted with proximity switches, covering the open and closed positions of the actuator.

6.15.8. The Supplier shall be responsible for selecting / sizing the actuator's control system pressure including minimum and maximum operating pressures, and maximum allowable working pressure such that the actuator design can meet the functional requirements under all operating conditions as specified in this Specification and the relevant data sheet.

6.15.9. The Supplier shall specify the optimum location for the HPU relative to the associated valve/damper and actuator assembly to ensure the actuator can also meet the functional requirements under all operating conditions as specified in this specification and the relevant data sheet. The HPU location shall be mutually agreed between the Company and the Supplier.

6.15.10. The actuator shall be able to function under the differential pressure, as indicated on the relevant data sheet, at the minimum supply control pressure.

6.15.11. The actuator shall include a spring design to drive the actuator and valve to the full closed fail-safe position. In the event of a loss of hydraulic supply to the actuator, the fail-safe spring shall be sized to safely close the valve and hold the valve closed against the maximum differential pressure as specified on the relevant Valve datasheets.

6.15.12. The fail-safe spring should be designed for a fatigue failure mode service and to withstand an infinite number of cycles without permanent injury.

6.15.13. The control fluid shall be water soluble and non-toxic to marine life. The Supplier shall confirm the compatibility of all the materials of construction that area in contact with the proposed control fluid. A Material Safety Data Sheet (MSDS) of the proposed control fluid shall be submitted to the Company for review and approval.

6.15.14. The actuator hydraulic system shall be built to and maintained at a cleanliness level equal to or better than SAE AS 4059 Class 3 (ISO 4406 15/12). The supplier, shall at each functional phase of construction and test, document that the required cleanliness standard is being achieved and maintained.

6.15.15. For Fail Close actuators the maximum duration for operation from the fully OPEN to the fully CLOSED position shall be as specified on the valve data sheet.

6.15.16. A local control panel shall be provided as an integral part of the actuator. The panel shall as a minimum include the following local instrumentation:

a. Hydraulic oil pressure
b. Filter differential pressure
c. Flow control valves to adjust opening and closure speeds.

6.16 Valve and Damper Identification

6.16.1 Valves and dampers shall be provided with a identification / name plate, with the bellow information, as a minimum, clearly indicated on the plate. Refer to section 10 of this specification for plate material minimum requirement.

a. Tag Number
b. Manufacturer's name or trade mark
c. Manufacturer's model/type number
d. Manufacturer's serial number
e. body rating
f. size (body and trim)
g. material (body and trim)

h. type of plug (characteristic)
i. Installed Cv value (for Valves)
j. bench setting/ spring range
k. action on air supply and/or signal failure
l. limit stop setting in % travel

6.17 Certification of Valves/Dampers and Related Materials

6.17.1. The supplier shall supply documentation relating to the design, construction and testing of all valves and dampers, such as material inspection, certification and marking. Such requirements shall be specified in the Requisition package.

6.17.2. The following certification shall be provided with the completed valve:

a. Inspection certificates
b. Hydro test certificate
c. NDT certification
d. Electrical certification for hazardous area equipment (if applicable)
e. Functional test certificate.
f. Fire Safe certificates to the applicable standard (for valve/damper in critical service only)
g. Calibration certificate
h. Fugitive Emissions as applicable (for valve)
i. Alloy Verification/Material Certificate
j. Noise Calculations (for valve)

7. ACCESSORIES FOR VALVE AND DAMPER

7.1 General

Accessories (e.g. solenoid valve, lock-up, and air filter-regulator), if required, should be installed on a corrosion resistant mounting plate and secured using stainless steel nuts, bolts and washers. The accessories shall not be adversely affected by vibration. These accessories shall as a minimum conform to the following criteria (see section 7.2 to 7.12 below):

7.2 Valve Positioners

7.2.1. Smart digital controllers utilizing 0 – 24 VDC shall be used for on-off application.

7.2.2. For throttling application, smart digital controllers utilizing 4-20 mA shall be used.

7.2.3. The valve positioner shall be provided with an identification/name plate, marked with air supply pressure and air signal.

7.3 Limit Stops

7.3.1. Limit stops shall be tamper-proof mechanical devices mounted on the actuator.

7.3.2. They shall not form part of any hand wheel mechanism. Bolts screwed in the body shall not be used as limit stop.

7.3.3. Screwed bolt-type limit stops e.g. on the on-off valve stem, adjustable over the full length of the stroke, shall be applied when requested. To prevent tampering, they shall be fitted with a locking facility e.g. a locking nut.

7.4 Lock-Up Valves

7.4.1. The lock-up valves shall have a bolt adjustment provided with a tamper-proof locking facility.

7.4.2. Unless otherwise specified, the lock-up valves shall be set at 0.5 bar above the minimum required air supply pressure.

7.4.3. The solenoid valve shall be installed between the lock-up valve and the actuator.

7.5 Proximity Switches

7.5.1. Proximity switches shall be non-ferrous, installed with suitable mounting hardware. Where practical, sensor and target shall be mounted inside a junction box or fitted with flying leads, mechanically protected and terminated in a valve mounted junction box.

7.5.2. Proximity switches shall meet the area classification and ingress protection it is rated.

7.6 Air Lubricators

7.6.1. When required, air lubricators shall be of the oil-mist type, the oil flow shall be externally adjustable and the oil buffer capacity shall be sufficient for one month’s continuous operation. In addition, the lubricator shall have oil level indication and facilities for oil refilling under pressure.

7.6.2. The lubricator shall be installed upstream of the solenoid valve.

7.6.3. Air lubricators shall be considered for pneumatic long-stroke cylinder actuators.

7.6.4. Spherical glass (bowl type) air lubricators shall not be used.

7.7 Solenoid Valves

7.7.1. Solenoid valves shall be rated for continuous duty.

7.7.2. temperature encapsulated coils. Class H shall be used in high ambient environment temperature applications only.

7.7.3. Solenoid valves shall operate on 24 VDC (floating) 3 watts maximum and be provided with an integral DC transient voltage suppression.

7.7.4. The solenoid valves shall have ½" NPTF electrical connection.

7.7.5. The solenoid valves shall be provided with a disc and/or seat of resilient material to give a tight shut-off feature and should be suitable for installing on a mounting plate.

7.7.6. 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. Where this is impracticable, consideration should be given to the use of volume boosters. Quick exhaust valves shall be avoided in applications where the valve shall be partial stroke tested.

7.7.7. Solenoid valves shall be supplied with "bug screens" to prevent insect intrusion.

7.7.8. For valves and damper with a valve positioner, the solenoid valve shall be installed between the positioner output and the actuator.

7.7.9. Pilot operated solenoid valves shall not be used.

7.8 Filter-Regulators

7.8.1 If specified, separate air filter regulators shall be installed in the instrument air supply lines to the actuator and/ or positioner or individual instruments, to regulate the instrument air supply pressure.

7.8.2 The air filter regulators shall be of the reducing-relief valve type, with drainage facility and bolt adjustment provided with a locking facility e.g. locking nut, to prevent tampering. They shall be supplied without a pressure gauge.

7.8.3 The air filter cartridges shall be of the rigid structure type to resist channelling, rupturing, shrinkage or distortion.

7.9 Quick Exhaust Valves

7.9.1. Quick exhaust valves may be provided to enable the on-off valve to achieve the required opening or closing time.

7.9.2. Quick exhaust valves shall be avoided in safety on-off applications due to the inability to

7.9.3. partial stroke test a valve / damper containing a quick exhaust valve.

7.9.4. Quick exhaust valves shall be of the non-spring return type. Pilot operated quick exhaust valves shall not be used.

7.9.5. Quick exhaust valves shall include port protectors / bug screens.

7.10 Volume Boosters

7.10.1. Volume boosters may be provided to enable the on-off valve / damper to achieve the required opening or closing time.

7.10.2. Volume boosters shall include port protectors / bug screens.

7.11 Restrictors

7.11.1. Where specified, an adjustable air flow restrictor shall be provided to enable the valve to achieve the slow opening and/or slow closing times stated in the requisition.

7.11.2. The flow restrictor shall be provided with a lockable, variable restriction adjustment facility.

7.12 Handwheel

7.12.1. Hand wheels, where specified, shall be of the declutchable type.

7.12.2. The hand wheel operating force shall not exceed 350 N on the rim of the hand wheel.

8. SAFETY RELIEF VALVE

8.1 General

8.1.1. The pressure safety relief valves shall meet the requirements of API Standard 526 Flanged Steel Pressure Relief Valves and NFPA (for firefighting system)

8.1.2. The pressure safety relief valves shall be designed and sized in accordance with API STD 520 and meet ASME Boiler and Pressure Vessel Code, section VIII.

8.1.3. The valve size shall be based on size calculations for the worst of all cases.

8.1.4. Weight loaded safety valves shall be used only for low-pressure safety valves (API STD 2000)

8.1.5. Body size and material shall be selected suitable for the relevant piping specification and in accordance with API STD 526.

8.1.6. Noise evaluation shall be based on API STD 521

8.1.7. Accumulation values shall be in accordance with the design codes used. These values are generally the following:

a. 10% for vessels containing liquid that are protected by a single pressure relief valve, and 16% for vessels that are protected by a multiple pressure relief valves (except for pumps and lines where it will be 25%).
b. 10% for vessels containing gas that are protected by a single pressure relief valve and 16% for vessels that are protected by a multiple pressure relief valves
c. 21% for vessels containing liquid and gas (for fire exposure) that are protected by single or multiple pressure relief valves.
d. Liquid thermal relief accumulation is 10%.

8.1.8. In general, more than one valve will be applied when after calculation an area equal to or greater than that of a “T” orifice as defined in API STD 526 would be required. Where multiple valve installations are used set-pressures shall be staggered provided that the maximum allowable accumulation is not exceeded.

8.1.9. Spring shall be carbon steel or alloy steel for normal service fluid as a minimum. Other type of material may be required subjecting to process condition.

8.1.10. On steam service open spring bonnets shall be used. In this case spring material shall be resistant to corrosive atmosphere (carbon steel to be avoided). In all other cases bonnets shall be closed.

8.1.11. Valve trim (nozzle, disc, bellows) shall be stainless steel as a minimum. Other type of material may be allowed subjecting to process condition.

8.1.12. Valve accessories such us bonnet & cap, O-ring and lifting lever shall be provided when the applicable code and process requirement demand so.

8.1.13. End connection shall be flanged according to piping class specification and the corresponding datasheet. Threaded ends shall be in accordance with ASME B1.20.1 or equal JIS specification.

8.1.14. Pressure relief valves will be ASME "UV" or Pressure Equipment Directive (PED) stamped.

8.2 Valve Type Selection and Criteria

8.2.1. Specific operating conditions and requirements shall determine the selection of a certain valve (type) for a given service. Concurrently, selection of valve shall always be subjected to sound engineering practice and be in line with the basic principles of safety protection philosophies thereof.

8.2.2. Such operating conditions/requirements may be created by one or more of (but not necessarily be limited to) the below-mentioned circumstances:

a. Applicable relief case(s)
b. Media, blow off to atmosphere/relief system - flare
c. Pressure/temperature rating.
d. High temperature

8.3 Conventional Valves

8.3.1. Relief valves shall be of the conventional direct-acting angle pattern, spring-loaded, full nozzle entry, and high-capacity type.

8.3.2. The built-up back pressure shall not exceed 10% of set pressure.

8.4 Balanced valves

8.4.1. Where a built-up back pressure in excess of 10% of the required set pressure is specified, a balanced valve shall be used. The preferred means of balanced design shall be by balanced bellows. The use of balanced piston arrangements in conjunction with bellows will only be considered in cases where choking may occur.

8.4.2. In case of variable back pressure the highest pressure that can occur shall be taken. This pressure may be generated by other valves blowing simultaneously in the same discharge system (superimposed back pressure) and by the subject valve itself (built up back pressure).

8.4.3. The maximum back pressure (superimposed plus built up) will not exceed 50% of the set pressure (gauge pressure).

8.4.4. Balanced-type relief valves shall have a vented bonnet. The vent shall be protected against rain and dirt. Venting shall be such as to cause no hazard of any kind.

8.5 Pilot Operated valves

8.5.1. Pilot operated valves shall be considered where:

a. The back pressure (superimposed plus built-up) exceeds approximately 50% of the set pressure.
b. Operating pressure is close to set pressure (Pop ≥ 90% SP).

8.5.2. If used, pilot-operated valve will be non-flowing type and equipped with a field test facility.

8.5.3. Pilot-operated valves may be used in clean process fluid service (they shall not be used in desiccant, catalyst of entrained solids service).

8.5.4. Pilot operated valves may be used when the set point is less than 10% above the operating pressure or when quick opening or closing is required, i.e. less than 10% overpressure for liquids and 5% for gas.

8.5.5. Pilot-operated valves shall be equipped with integral pilots or have provision for external pickups.

8.5.6. Where used, pilot-operated valves shall have facilities for on-stream testing and local depressurizing.

8.5.7. Pilot operated valves shall be provided with cartridge filters suitable for service conditions.

8.5.8. Fitting and tubing used for integral pilot shall be stainless steel (316SS with minimum 2.5% molybdenum content). Pocketing of piping and tubing shall be avoided.

8.6 Liquid Expansion Valves

8.6.1. Special relief valves shall be applied to cope with the thermal expansion of liquids.

8.6.2. The discharge of liquid expansion valves shall be hooked up so as to lead to a safe location. Drain shall be led to the dedicated system for the medium.

8.7 Rupture Disc

8.7.1. Rupture discs may be used to protected vessels, piping, and other pressure containing component from excessive pressure or to protect safety/relief valve systems against corrosion.

8.7.2. Rupture discs shall feature a construction tolerance of ± 5%

8.7.3. A pressure gauge shall always be installed between rupture disc and safety/relief

8.7.4. valve system.

8.7.5. Installation of a rupture disc for the above-mentioned purpose shall never be of influence on the basic functioning of the associated safety/relief valve system.

8.7.6. Rupture discs shall be designed in accordance with ASME Boiler and Pressure vessel code, section VIII and section I where applicable.

8.7.7. Rupture discs shall be supplied complete with holders to fit between line flanges. For every rupture disc, two spare discs shall be supplied.

8.7.8. Rupture discs shall preferably be of the non-fragmenting reverse buckling type for vapor and gas services and of the tension type for liquid discharge only.

8.7.9. Vacuum supports where required shall not restrict flow on rupture.

8.7.10. Supplier shall be required to (also) calculate sizing of rupture discs using API STD520 - Part I.

8.7.11. Discs and holders shall be identified as specified in ASME, section VIII.

8.7.12. All rupture discs shall be provided mounted in protecting ring assemblies designed for installation between piping flanges. The protecting ring shall meet the ANSI pressure and temperature requirements of the companion flanges. If a purge connection is required, it shall be in the protecting ring on the pressure side of the disc.

8.7.13. The material shall be compatible with the fluid in accordance with the piping class and as a minimum AISI 316 stainless steel.

8.8 Valve Identification

8.8.1. Safety Relief Valves shall be provided with an identification/name plate firmly attached to the valve body, with the following information, as a minimum, clearly indicate on the plate:

a. Manufacturer's name or trade mark
b. Tag Number
c. Inlet/Outlet Size & rating
d. Orifice Designation
e. Set Pressure
f. Rated Capacity
g. Body, Disk & Spring Material
h. Manufacturer's model number
i. Alloy Verification / Manufacturer's serial number
j. Code stamping if required as per the data sheet
k. Back Pressure
l. Cold Set Pressure
m. Limiting Temperature

8.8.2. In addition, each Relief valve shall be provided with a tag plate, fixed with stainless steel wire, indicating the tag number and process service description of the valve.

8.8.3. Pilot operated safety relief valves shall have an additional nameplate permanently attached to the pilot. The pilot nameplate shall be stamped with the manufacturer's name, pilot type, set pressure and serial number.

8.9 Certification of Valves and Materials Traceability

8.9.1 The following certification shall as a minimum be provided with the completed valve:

a. Inspection certificates
b. Hydro test certificate
c. Set pressure test certificate
d. Tightness test certificate
e. NDE certification as applicable
f. Type Test Approval Certificate
g. Material Test certificates
h. Hardness test certificate as applicable

9. GROUNDING

9.1 Instrumentation grounding /earth system will be provided independently from electrical earth system.

9.2 A station grounding consisting of grounding rods and plates and grounding conductor shall be furnished, to limit step and touch potentials to safe values under all fault conditions. Bare copper risers shall be furnished for all electrical underground ducts and equipment, and for connections to the grounding systems within buildings.

9.3 Each building that has instrument equipment with dedicated instrument grounding system connected to the instrument grounding wire. Exception is made for field instrumentation equipment that will be bonded to the adjacent structure member with are connected to the electrical grounding system.

9.4 The design and analysis of the grounding system shall be in accordance with JIS or IEC.

9.5 The location, number, and depth of ground rods shall be consistent with soil resistivity and subsurface properties of the site. Buried ground conductors and the tops of driven ground rods shall be installed at a depth of at least 500 mm (18 inches) below final grade in earth fill.

9.6 A bare stranded copper grounding copper conductor shall be continuously installed in the cable rack. A similar grounding copper conductor shall be installed throughout the entire length of other wire-ways included in the raceway system. Splices in the ground conductor shall be connected by clump.

9.7 An isolated grounding system shall be installed to support the PLC and coordinated control systems in accordance with the manufacturer's recommendations. The lightning protection system for the plant shall be in accordance with JIS or IEC will by electrical.

10. NAME PLATE

10.1. Field Instrument

10.1.1. Name plate and tag plate for field instrument (including valves and dampers) shall be stainless steel, brass plate, or other approved corrosion resistance metals suitable for instrument body material and shall be securely attached on contrasting background.

10.1.2. Name plate and tag plate shall be provided in English.

10.2. Junction Box and Panel

10.2.1. Nameplate shall be provided for indicating the name of Instrument Panel such as PLC panel, System Panel and other designated equipment.

10.2.2. The nameplate shall be attached with counter-sunk screws or pasted to the front panel of each device or board.

10.2.3. The material of the nameplate is acrylic resin.

10.2.4. Each nameplate shall be marked with the name in black capital letter on white background, after the letters have been engraved reversely on the backside.

10.2.5. Besides name plate, number plate shall also be provided. Number plate is made from acrylic resin.

10.3. Caution Plate

10.3.1. Plate or labels for caution shall be in English.

10.3.2. It shall be non-hygroscopic materials with engraved lettering of a contrasting color or alternatively transparent plastic material with suitable colored lettering engraved on the back.