طرح نگهداشت و افزایش تولید 27 مخزن

INSTRUMENT & CONTROL SYSTEM DESIGN CRITERIA

نگهداشت و افزایش تولید میدان نفتی بینک

D03	MAY. 2023	AFD	P.Hajisadeghi	M.Fakharian	A.M.Mohseni	
D02	OCT. 2022	IFA	P.Hajisadeghi	M.Fakharian	M.Mehrshad	
D01	MAY. 2022	IFA	P.Hajisadeghi	M.Fakharian	M.Mehrshad	
D00	JAN. 2022	IFC	P.Hajisadeghi	M.Fakharian	M.Mehrshad	
Rev.	**Date**	**Purpose of Issue/Status**	**Prepared by:**	**Checked by:**	**Approved by:**	**CLIENT Approval**

Class:2	**CLIENT Doc. Number: 'F0Z-707366**

Status:

IDC: Inter-Discipline Check
IFC: Issued For Comment
IFA: Issued For Approval
AFD: Approved For Design
AFC: Approved For Construction
AFP: Approved For Purchase
AFQ: Approved For Quotation
IFI: Issued For Information
AB-R: As-Built for CLIENT Review
AB-A: As-Built –Approved

REVISION RECORD SHEET

PAGE	D00	D01	D02	D03	D04
1	X	X	X	X	
2	X	X	X	X	
3	X				
4	X				
5	X	X			
6	X				
7	X				
8	X				
9	X	X			
10	X	X			
11	X				
12	X			X	
13	X		X	X	
14	X		X		
15	X		X	X	
16	X		X		
17	X		X		
18	X		X		
19	X		X		
20	X		X		
21	X		X		
22	X		X		
23	X				
24	X		X		
25	X				
26	X				
27	X				
28	X		X		
29	X				
30	X				
31	X				
32	X				
33	X	X			
34	X	X	X		
35	X	X		X	
36		X			
37		X			
38		X			
39		X			
40		X			
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					
63					
64					
65					

PAGE	D00	D01	D02	D03	D04
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					
106					
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					
121					
122					
123					
124					
125					
126					
127					
128					
129					
130					

CONTENTS

1.0 INTRODUCTION 5
2.0 SCOPE 5
3.0 NORMATIVE REFERENCES 6
3.1 LOCAL CODES AND STANDARDS 6
3.2 INTERNATIONAL CODES AND STANDARDS 7
3.3 THE PROJECT DOCUMENTS 9
3.4 ENVIRONMENTAL DATA 9
3.5 ORDER OF PRECEDENSE 10
4.0 ABBREVIATION 10
5.0 CONTROL SYSTEM BASIS OF DESIGN 11
5.1 INSTRUMENT/CONTROL DESIGN CRITERIA FOR WELLHEAD AREA 11
5.1.1 WELLHEAD CONTROL PANEL 11
5.2 INSTRUMENTATION/CONTROL/SAFETY SYSTEM BASIS OF DESIGN FOR MANIFOLD AREA 12
5.2.1 GENERAL REQUIREMENTS OF CONTROL AND SAFETY SYSTEM 12
5.2.2 FIRE ALARM PANEL 13
5.2.3 PANELS AND WIRING 15
6.0 GENERAL INSTRUMENT REQUIREMENTS 15
6.1 GENERAL INSTRUMENT REQUIREMENTS FOR WELLHEAD AREA 15
6.1.1 TEMPERATURE MEASUREMENT 16
6.1.2 PRESSURE MEASUREMENT 17
6.1.3 PRESSURE SWITCHES 17
6.1.4 NITROGEN BOTTLE 17
6.1.5 INSTRUMENT HOOKUP/INSTALLATION 18
6.1.6 SERVICES 18
6.1.6.1 INSTRUMENT AIR 18
6.1.6.2 POWER SUPPLIES 18
6.2 GENERAL INSTRUMENT REQUIREMENTS FOR MANIFOLD AREA 18
6.2.1 INSTRUMENT/ELECTRICAL INTERFACES 18
6.2.2 EARTHING 19
6.2.3 GENERAL INSTRUMENT REQUIREMENTS 19
6.2.4 TEMPERATURE MEASUREMENT 21
6.2.5 LEVEL MEASUREMENT 22
6.2.6 PRESSURE MEASUREMENT 24
6.2.7 FLOW MEASURMENT 25
6.2.8 CORROSION COUPON/PROBE 27
6.2.9 MAINTENANCE SYSTEM 27
6.2.10 INSTRUMENT HOOKUP/INSTALLATION 27
6.2.11 CONNECTION ON PIPING AND EQUIPMENT 28
6.2.12 ACTUATED VALVES 29
6.2.12.1 CONTROL VALVES 29
6.2.12.2 SELF ACTUATED REGULATOR VALVES 31
6.2.12.3 SAFETY RELIEF VALVES 31
6.2.12.4 ESD VALVES 32
6.2.12.5 PROCESS ISOLATION VALVES 33
6.2.13 SERVICES 34
6.2.13.1 INSTRUMENT AIR 34
6.2.13.2 POWER SUPPLIES 34

7.0 ACCESSORIES 35

7.1 JUNCTION BOXES 35
7.2 CABLING 36
7.3 CABLE TRAYS & ACCESSORIES 37

8.0 ELECTRO-MAGNETIC COMPATABILITY 38

9.0 SPARE CAPACITY 38

10.0 FACTORY ACCEPTANCE TESTING (FAT) 38

11.0 SITE ACCEPTANCE TEST 40

11.1 INTERFACE TESTING 40
11.2 PRE-COMMISSIONING AND COMMISSIONING SUPPORT 40

12.0 SPARE PARTS AND SPECIAL TOOLS 40

12.1 SPARE PARTS 40
12.1 SPECIAL TOOLS 41

13.0 TRANING 41

1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – General Facilities
EPD/EPC CONTRACTOR(GC):	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of : Hirgan Energy – Design & Inspection(D&I) Companies
VENDOR:	The firm or person who will fabricate the equipment or material.
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
THIRD PARTY INSPECTOR (TPI):	The firm appointed by EPD/EPC CONTRACTOR (GC) and approved by CLIENT (in writing) for the inspection of goods.
SHALL:	Is used where a provision is mandatory.
SHOULD:	Is used where a provision is advisory only.
WILL:	Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

2.0 SCOPE

This document covers minimum necessary requirements for the design and selection of instrumentation and control/safety system of wellhead area and manifold for the “Preservation and Production Increase of Binak oilfield”.

In wellhead area, control system and instrumentation, have been limited to Hydraulic WHCP and local monitoring (gauges).

repeated IN-01: The IRP control system to be clarify.
H.R. Modified

Manifold area scope is dedicated to a new located on Binak cluster unit existing control room and required instrument /F&G devices.

It shall be used in conjunction with data/requisition sheets for present document subject.

IN-02: The NISOC comment reply is not found in transmittal. H.R. Document is approved by NISOC.

3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

- IPS-E-IN-100 Engineering standards for general instrumentation
- IPS-E-IN-105 Instrument Workshop, Layouts, Test and Calibration Tools
- IPS-E-IN-110 Engineering standard for pressure instruments
- IPS-E-IN-120 Engineering standard for temperature instruments
- IPS-E-IN-130 Engineering standard for flow instruments
- IPS-E-IN-140 Engineering standard for level instruments
- IPS-E-IN-160 Engineering Standard for Control Valves
- IPS-E-IN-190 Engineering standard for Transmission systems
- IPS-C-IN-100 Construction and inspection standard for general instrument field inspection, calibration and testing of instrument and instrument system
- IPS-C-IN-110 Construction standards for pressure instruments
- IPS-C-IN-120 Construction and installation standard for temperature instruments
- IPS-C-IN-130 Construction and installation standard for flow instruments
- IPS-C-IN-140 Construction and installation standard for level instruments
- IPS-C-IN-160 Construction Standard for Control Valve
- IPS-C-IN-190 Construction Standard for Transmission Systems
- IPS-G-IN-200 General Standard for Instruments Air System
- IPS-I-IN-100 Inspection Standard for General Instrument Systems
- IPS-M-IN-110 Material and equipment standard for pressure instruments
- IPS-M-IN-120 Material and equipment standard for temperature

instruments

- IPS-M-IN-130 Material and equipment standard for flow instruments
- IPS-M-IN-140 Material and quality control standard for level instruments
- IPS-M-IN-160 Material and Equipment Standard for Control Valve
- IPS-M-IN-190 Material and equipment standard for transmission systems
- IPS-G-IN-210 General standard for instrument protection
- IPS-G-IN-230 General standard for Analysers
- IPS-G-IN-220 Engineering And Installation Standard For Control Centres
- IPS-G-IN-260 Engineering And Installation Standard For Indicating Lights, Alarms And Protective Systems
- IPS-G-IN-290 Engineering And Construction Standard For Programmable Logic Controllers (PLC)
- IPS-D-IN-101~119 Instrument standard drawings

3.2 INTERNATIONAL CODES AND STANDARDS

- AGA American Gas Association
- IEC-60584 Thermocouples
- IEC-60529 Classification of Degree of Protection Provided by Enclosures
- IEC-60751, BS1904 Industrial Platinum Resistance Thermometer Sensors
- ANSI-MC 96.1 Temperature Measurement Thermocouples
- BS EN 837 Specification for Bourdon Tube Pressure Vacuum Products
- IEC 60079 Electrical Apparatus for Explosive Gas Atmospheres
- IEC 60144 Ingress Protection for Dust and Water Jets
- IEC 60079 (Relevant Sections) Code of Practice for the Selection, Installation and Maintenance of Electrical Apparatus for use in Potentially Explosive Atmospheres
- ASME VIII Unfired Pressure Vessels
- ANSI B1.20.1 Pipe Threads, General Purpose
- BS 1042 Measurement of fluid flow in closed conduits
- ISO 5167 Measurement of fluid flow by means of orifice plates,

nozzles, and Venturi tubes inserted in circular cross- section, conduits running full

- NACE MR-0175 — Sulphide stress cracking resistant metallic materials for oilfield equipment
- NACE RP-0775 — Preparation, Installation, Analysis and Interpretation of Corrosion Coupons in oil field operation.
- ANSI B16.5 — Pipe flanges and flanged fittings. inserted in circular cross section conduits running full
- API RP-521 — Guide for Pressure-Relieving and Depressuring Systems
- API RP-526 — Flange Steel Pressure Relief Valves
- API 527 — Seat Tightness of Pressure Relief Valve
- API-607 — Fire Test for Soft-Seated Quarter-Turn Valves
- API RP 550 Part I — Installation of Refinery Instruments and Control Systems
- ANSI/FCI 70-2 — Control Valve Seat leakage
- ANSI/ASME B16.36 — Orifice Flanges
- ASTM D3230 — Standard Test Method for Salts in Crude Oil
- ISA S.5.1 — Instrumentation symbols and identification
- ISA S.5.4 — Instrument Loop Diagrams
- ISA RP7.3 — Quality Standard for Instrument Air
- ISA S18.1 — Annunciators - sequences and specification
- ISA S.20 — Specifications forms for process measurement and control instruments, primary elements and control valves.
- ISA S75.01 — Flow equations for sizing Control Valves.
- ISA S75.02 — Control Valve capacity test procedure.
- ISA S75.03 — Uniform face to face dimensions for flanged globe type Control Valves.

IEEE (Inst. of Electrical and Electronic Engineers)

- IEEE-C62 — Guides and standards for surge protection.
- IEEE 802 — Local area networks
- IEEE-830 — Guide to software requirements specification.

- IEEE-1012 Standard for software verification and validation plans.
- IEEE-1016 Recommended practice for software design descriptions.

European Codes

- CENELEC For electrical equipment in hazardous areas (for European Manufacturers only):
- EN 50.014 General Rules
- EN 50.018 Explosion-proof Equipment
- EN 50.020 Intrinsic Safety Equipment
- EN 50019, 50039 Electrical apparatus for potentially explosive atmospheres,

The latest published version or amendment shall apply unless otherwise stated.

3.3 THE PROJECT DOCUMENTS

- BK-GNRAL-PEDCO-000-PM-RT-0001 Endorsement Report For Basic Design & Scope of Work
- BK-GNRAL-PEDCO-000-PR-DB-0001 Process Basis of Design
- BK-SSGRL-PEDCO-110-PI-SP-0001 Piping & Pipeline Material Specification
- BK-GNRAL-PEDCO-000-SA-SP-0002 Spec. For Hazardous Area Classification

3.4 ENVIRONMENTAL DATA

Refer to "Process Basis of Design; Doc.No.BK-GNRAL-PEDCO-000-PR-DC-0001,for environment data and site conditions , which is summarised as per the following :

- Barometric pressure(Winter):13.7 Psia
- Barometric pressure(Summer):13.2 Psia
- Solar radiation: 946 W /m^2
- Maximum ambient temperature (°C) : 50
- Minimum ambient temperature (°C): -5
- Maximum steel surface exposed to sun (°C): 85
- Maximum Design relative humidity (%): 100
- Minimum Design relative humidity (%): 0

3.5 ORDER OF PRECEDENSE

The order of precedence shall be as follows (from higher to lower level):

- Data sheets

- Particular project specifications

- This specification

- The OWNER specifications and standard documents

- The codes and standards

IN-03: OWNER to be defined or the CLIENT to be used
H.R: modified

It shall be the CONTRACTOR responsibility to raise to OWNER any discrepancy between documents. The CONTRACTOR shall not proceed with any such aspect of the work until he has received any necessary confirmation in writing from the OWNER

4.0 ABBREVIATION

Industry standard abbreviations shall take their usual meaning. Outlined herein are the most common, which may be used in this and other project documents:

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Material
BDV	Blow down Valve
BS	British Standard
CCR	Central Control Room
CSA	Community , Supported Agriculture
DCS	Distributed Control System
EMC	Electromagnetic Compatibility
EMF	Electromotive Force
ESD	Emergency Shutdown
ESDV	Emergency Shutdown Valve
FACP	Fire Alarm Control Panel
F&G	Fire and Gas
FAT	Factory Acceptance Test
GA	General Alarm
HART	Highway Addressable Remote Transmission

HAZOP	Hazard and Operability Study
HMI	Human Machine Interface
HSE	Health ,Safety & Environment
HVAC	Heating Ventilation and Air Conditioning
IEC	International Electrotechnical Commission
IEE	Institution of Electrical Engineers
IP	Ingress Protection
IPS	Iranian Petroleum Standard
IRP	Interpose Relay Panel
IS	Intrinsic Safety
ISO	International Organization for Standardization
LAN	Local Area Network
NACE	National Association of Corrosion Engineers
PC	Personal Computer
PCS	Process Control System
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
PSU	Power Supply Unit
RTD	Resistance Thermometers Detectors
SIL	Safety Integrity Level
SS	Stainless Steel
UCP	Unit Control Panel
UPS	Uninterruptable Power Supply
UV	Ultraviolet
WHCP	Wellhead Control Panel

5.0 CONTROL SYSTEM BASIS OF DESIGN

5.1 INSTRUMENT/CONTROL DESIGN CRITERIA FOR WELLHEAD AREA

5.1.1 WELLHEAD CONTROL PANEL

The control and safety equipment located at wellhead area shall be self- sufficient. The area is un-manned so the WHCP/HPU shall be designed in order to protect the area automatically in absence of personnel and also provide/Indicate enough data during the presence of operators for operation and maintenance purposes.

The Wellhead panel will be located outdoor. The panel shall be installed on concrete floor & under a shelter. It shall be designed to operate continuously at mentioned site / environmental conditions.

There is no utility available in area so all the requirements shall be considered in the package.

repeated IN-08: A section for IRP wellheads to be added.
H.R: description has been added but no section has been considered .

There is no utility available in area so all the requirements shall be considered in the package.

D03

For wells which are controlled by, no control / instrument devices is required to be considered for them except pump vendor scope of work. All other related details will be considered in concerned documents if any.

IN-04: the paragraph is not clear. According to previous comment about IRP, the list of wells which are supplied with WHCP and those which are supplied with IRP control system to be clarified.
H.R: modified in above sections.

5.2 INSTRUMENTATION/CONTRO MANIFOLD AREA

In this section, the basis will be expanded regarding the design of Process Control System, Emergency Shutdown System and FACP for new/extended manifold of Bink oil field.

Binak
H.R:
modified

The principle aims and objectives of the control and safety systems are:

- The protection of personnel
- Respect for the environment
- Safeguarding of the assets
- To ensure the plant is controllable
- To allow the safe start-up and shutdown of all plant and equipment
- To provide automatic protective action where deviation of plant variables could result in a hazard to personnel, environment or equipment
- To provide the operations personnel with sufficient information to allow the plant to be controlled safely and effectively.

The DCS system will implement all graphics in order to cover all aspects of normal plant operation, maintenance and engineering requirements of the facilities.

The objective in using such a configuration is to standardise the operator interface, configuration and hardware components. These systems shall integrate all instrumented systems to serve plant monitoring, control, safety and operations of the facilities.

The following control and safety functions are required:

- DCS function
- ESD function
- F&G alarm by FACP

All ESD system inputs, outputs, secondary events and operator actions will be time stamped at I/O modules. All ESD modules shall be failed safe.

5.2.1 GENERAL REQUIREMENTS OF CONTROL AND SAFETY SYSTEM

Currently, the technical room in existing in Binak cluster plant but still there are extra spaces available for other projects. Considering the number of I/Os , new control system and ESD system

for Manifold area shall be provided. No software and hardware modification shall be considered in existing control and ESD systems of Binak cluster plant since no communication is required and new systems are totally independent from existing systems.

A new wall mounted fire alarm panel in existing control room (for addressable alarm /detection loops of existing control, switchgear and battery building) shall be considered for fire alarm which has no action for ESD.

All the marshaling and system cabinets will be installed in existing technical room and the workstations will be located in existing control room. From this point of control it will be possible to monitor, control and take safety related actions covering the entire plant including new and extended manifold. The console may be supplied with some pushbuttons and lamps for shutdown purposes.

D03

One dual monitor workstations to be used for DCS/ESD systems with industrial keyboards which is configured for operation of DCS/ESD system by DCS vendor.

2 No. Individual engineering workstation for DCS/ESD, one laptop and 3 No. printers and required furniture shall be provided as a part of DCS vendor's scope of supply. This shall be located in the Control Room, and shall be used for development and configuration of the DCS network and associated devices. Workstations shall be provided with all necessary software and hardware locks.

By using DCS based process control system, the process or utility systems will not be entirely automated.

IN-05: The paragraph is not clear. It should be reworded or deleted.
H.R. Modified

All equipment, laptop and other accessor

Refer to Specification for Control System Doc.No.BK-GNRAL-PEDCO-000-IN-SP-0002 and Specification for ESD system, Doc.No.BK-GNRAL-PEDCO-000-IN-SP-0003 for more detail and other system specifications.

5.2.2 FIRE ALARM PANEL

A new wall mounted fire alarm panel in existing control room shall be considered for fire and gas alarm which has no action for ESD.

Fire alarm system shall be microprocessor based addressable and conventional fire detection type in accordance to the EN 54, BS 5839 and IPS-G-IN-270.

Fire alarm systems, whereby specify space and zone identification, or both, is provided by individually identifiable initiating devices, shall be arranged to meet the following minimum criteria:

- Means are provided to ensure that any one fault (e.g., open circuit, short circuit, or ground) occurring in the signaling line circuit will not render any initiating devices in any fire zone inactive.
- All arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g., electrical, electronic, information).
- Signaling line circuits shall be capable of supporting 100 percent of the initiating devices connected to them if all are activated simultaneously without any loss of signal.
- A signaling line circuit shall be arranged.
- All activated detectors shall be shown on the display.
- It shall have local LCD display & keypad / pushbuttons for operator interface to view status & alarms of panel & detectors. There shall be adequate security level defining the access level for preventing any unauthorized access.
- It shall be possible to locally isolate any detector or alarming device for maintenance purpose.
- It shall be possible to configure or modify system through the LAPTOP. Normal operation shall not be affected during modification.
- The required software shall comply with the NFPA or any other recommended standard for fire alarm system.
- Shall be capable of performing required logic functions based on C&E matrix.
- All the addressable detectors inside the building such as smoke detector and manual call points shall be connected in a supervised loop. Fault in the loop shall be reported at the panel.
- Activate Acoustic (bells) & Visual (Flashing light) for alarming purpose can be considered.
- FACP will be programmed according to Cause & effect for addressable loop definitions.
- FACP shall be capable to support required addressable loop (loop length of 1000 meter as minimum for each loop).
- FACP will be connected to New DCS system via redundant Modbus RTU serial link (RS-485) for alarm monitoring.

5.2.3 PANELS AND WIRING

Panels located in rooms or enclosures shall be IP 54 minimum. Field Panels shall be certified suitable for the hazardous area specified and IP 65 as a minimum. The panels shall be EMC compliant with the requirements of IEC 61000.

Marshalling cabinets shall be considered as back of panel type

Panels colour shall be RAL7035 and shall be equipped with applicable fan, filter, heater and hydrostat

D03

Cabinets shall be in accordance with "Specifications for ESD System" document number "BK-GNRAL-PEDCO-000-IN-SP-0003"and "Specifications for Control System" document number "BK-GNRAL-PEDCO-000-IN-SP-0002".

6.0 GENERAL INSTRUMENT REQUIREMENTS

6.1 GENERAL INSTRUMENT REQUIREMENTS FOR WELLHEAD AREA

This section is describing the general requirements of instrument used in wellhead facilities however, Instruments specifications shall follow requirements of ''Specification for instrumentation Doc.No.BK-GNRAL-PEDCO-000-IN-SP-0001'' for selected devices as per specific wellhead P&IDs.

All instrumentation for installation in exposed locations shall be rated for the hazardous conditions that shall be experienced on the platform. Any instrumentation that cannot be supplied with weatherproofing (IP rating) suitable for the specified conditions shall be protectively housed accordingly. Instruments and equipment externally mounted shall be rated to a minimum of IP65 and also shall be applicable to work on temperature range of -5~55°C and humidity range of 0~100% RH. Indoor/Outdoor mounted instruments shall be rated to a minimum of IP 54/IP65 respectively.

The Temperature Range is -5 ~ 85°C on the sun.

The Temperature Range is -5 ~ 55°C on the shadow.

All instruments that may be exposed to direct sunlight shall be provided with sunshades to prevent the temperature of the instrument rising above ambient temperature.

The preferred material for wetted parts of instruments and fittings is 316/316L stainless steel.

The use of plastic shall be avoided due to the degradation of the material when exposed to high levels of UV radiation.

Stainless steel subjected to temperatures higher than 60degC and a saline atmosphere will suffer from stress corrosion cracking. Process conditions in general will not subject the instrument process connections to temperatures higher than 60°C. Instrument tubing and fittings in external locations that are subject to direct sunlight may rise above this temperature. Where this can take place the tubing and fittings shall be provided with suitable shading or insulation.

All devices shall be provided with a nameplate, showing the identification data and stamped as follows and as applicable:

- Vendor's name
- Model number
- Serial number
- Instrument tag number (Well Number)
- Instrument operating range
- hazardous area certification & certification agency name
- Pressure rating
- Device Set point

All the wetted parts in sour service shall be in accordance with NACE MR-01-75/ISO 15156 standard as per "Piping & Pipeline Material Specification", Doc. No. BK-SSGRL-PEDCO-110-PI-SP-0001.

6.1.1 TEMPERATURE MEASUREMENT

Bi-metallic every angle dial thermometers shall be used for local indication. Dial size shall be 150 mm diameter unless otherwise specified in the data sheet.

Casing and pointer shall be AISI 316 or aluminum, safety glass front with gasket. Dial material shall be aluminum, unless otherwise specified.

Dial colour shall be white, non-rusting metal with black figures.

Local zero adjustment shall be possible.

Thermowells shall be constructed in accordance with project standards from one-piece Stainless Steel 316/316L material as minimum.

Flanged Connection: 1 ½" Flanged Type for Pipe Connection.

Instrument Connection: ½ "NPT

Thermowell shall be used for all temperature instruments.

6.1.2 PRESSURE MEASUREMENT

Dials shall have diameter of 150 mm and shall be white with black figures, non-rusting metal. Blow out disc shall be located in the back of the casing.

Over-range stops shall be provided for the over-range limit.

Unless otherwise specified, Min SS 316L alloy shall be used for pressure elements, sockets, Movement and tips material.

All gauges shall be equipped with screw driver slot type adjustment for calibration purposes.

Min SS 316L, 2 valve block manifold shall be provided.

Pressure elements shall be designed to have an over range protection rating of at least the design pressure of the process line or vessels, and as a minimum 130% of full scale

Process connection shall be ½" NPT screwed bottom connection and the vent/drain connection is 1/4" NPT female.

Dials shall have diameter of 60 mm for pressure gauges of hydraulic panel. The gauges shall be oil-filled and suitable for ¼" NPT back connection to be installed on face of panel.

All gauges shall be equipped with screw driver slot type adjustment for calibration purposes.

The accuracy of pressure gauges shall be minimum than 0.6% of full scale.

Casing and pointer shall be AISI 304 or aluminum. Dial material shall be aluminum, unless otherwise specified.

6.1.3 PRESSURE SWITCHES

Pilot valves shall be used as hydraulic pressure switches to activate hydraulic logics depends on the flow-line pressure at specific set point. The actuation side (sensing) of the valve are wetted part which is in contact with the flow-line fluid. The wetted parts shall be suitable for NACE MR0175/ISO15156-1 requirements where ever specified in "Piping & Pipeline Material Specification", Doc. No. "BK-SSGRL-PEDCO-110-PI-SP-0001".

The acceptable reliability of set point is less than 2% of full scale. The narrow dead band should be less than 15% of full scale.

6.1.4 NITROGEN BOTTLE

SSV and SSSV hydraulic lines shall be pressurized by nitrogen bottles. Two sets of nitrogen bottles shall be supplied with suitable reservoir pressure levels to actuate the valves at worst scenario.

The WHCP is responsible for design of suitable pressure and volume of Nitrogen for SSV and SSSV on\off operation. For calculation of bottle sizes below notes to be considered,

- At least two times actuation of each valve are required
- At least six months operation of WHCP without refill is needed.

Necessary requirements shall be provided by vendor for changeover between sets of nitrogen bottles so reserved one could be in service without any interrupt so low pressure bottles could be recharged or replaced

6.1.5 INSTRUMENT HOOKUP/INSTALLATION

Process impulse connections up to and including the primary isolation valve shall conform to the piping, vessel or equipment specification. The tubing and fittings up to the instrument shall conform to the General Instrumentation Specification. All pressure measuring devices shall have 2 valve manifolds and all differential pressure measuring devices shall have 5 valve manifolds. As general, Instrument Hookup/Installation to be performed in accordance with IPS standards

Where possible, manifolds shall be of the type suitable for direct mounting to the instrument.

Instruments can be close coupled to the tapping point and supported by the process connection as long there is good maintenance access and the instrument is not subjected to detrimental vibration.

6.1.6 SERVICES

6.1.6.1 INSTRUMENT AIR

There is no instrument air available.

6.1.6.2 POWER SUPPLIES

24 VDC /DC charger (new) shall be provided for new wall mounted FACP.

6.2 GENERAL INSTRUMENT REQUIREMENTS FOR MANIFOLD AREA

6.2.1 INSTRUMENT/ELECTRICAL INTERFACES

The type of instrument/electrical interface to the motor starters and feeders will be hardwired to interface compartments. Interface between MCC and ESD/DCS shall be considered via IRP.

The local control panel interface with motor starters shall be limited to following commands and status indications/alarms:

- Start/Stop command (High/Low)
- Trip command (low signal for trip)
- Run/Stop Status (high signal for run status/Low signal for stop status)

- Local/Remote status (high signal for local status)
- Tripped on Fault (high signal for fault status)
- Available for remote control (high signal for available status)

The type of signal selected for each electrical device shall be shown on P&ID.

6.2.2 EARTHING

For instrumentation, three (3) dedicated earthing network shall be used.

- Instrument Protective Earth (IPE) :

  Field instrument enclosures, cable armor, supporting arrangements, tray and junction boxes, cabinets shall be earthed to the IPE.

- Instrument Earth (IE) :

  It shall be used for earthing the screens of cables, except those carrying intrinsically safe signals.

- Intrinsically safe earth (ISE) :

  It shall be used for earthing the screens of cables carrying intrinsically safe signals through the galvanic isolated barriers bus bar.

Impedance of IE & ISE shall be less than 0.5 Ohm.

6.2.3 GENERAL INSTRUMENT REQUIREMENTS

This basis will be expanded in the General Specification for Instrumentation.

All instrumentation for installation in exposed locations shall be rated for the hazardous conditions that shall be experienced on the platform. Any instrumentation that cannot be supplied with weatherproofing (IP rating) suitable for the specified conditions shall be protectively housed accordingly. Instruments and equipment externally mounted shall be rated to a minimum of IP65 and also shall be applicable to work on humidity range of 0~100% RH. The temperature range is -5°C ~ 85°C below direct sun light and between -5°C ~ 55°C in the shadow. For items that can be subjected to direct deluge the rating shall be IP66. Internally mounted instruments shall be rated to a minimum of IP 54.

All instruments that may be exposed to direct sunlight shall be provided with sunshades to prevent the temperature of the instrument rising above ambient temperature.

The preferred material for wetted parts of instruments and fittings is 316/316L stainless steel.

The use of plastic shall be avoided due to the degradation of the material when exposed to high levels of UV radiation.

Stainless steel subjected to temperatures higher than 60degC and a saline atmosphere will suffer from stress corrosion cracking. Process conditions in general will not subject the instrument process connections to temperatures higher than 60°C. Instrument tubing and fittings in external locations that are subject to direct sunlight may rise above this temperature. Where this can take place the tubing and fittings shall be provided with suitable shading or insulation.

Frost protection for instruments on fresh water service is not required.

All instruments to be located in external locations hazardous shall be certified for a minimum protection of Zone 1 IIB T4.

General instrumentation, excluding solenoid valves, IR flame detectors and UV gas detectors which shall be EExd, shall by preference be made safe by intrinsic safety using galvanic isolation. If intrinsic safety is not available then explosion proof enclosures (EExd) shall be used.

Instruments used in safety applications may require fire proofing. This requirement is to be identified during HAZOPs.

All process value measurement signals (4-20 mA) such as PT , TT , FT , LT, Control valve positioner and control valve feedback signal shall be supported by hart protocol and shall be with digital local indicator. The transmitter communication technology shall be fully matched with process control system. Reveres Polarity Protection shall be Provide for All Transmitters.

All field instruments shall be furnished with a stainless steel corrosion resistant nameplate permanently fastened with screws and stamped as follows and as applicable:

- Vendor’s name
- Model number
- Serial number
- Instrument tag number
- Supply voltage
- Operating range
- Output
- hazardous area certification & certification agency name
- Pressure rating
- Set point (if required)

All transmitters, local panels, auxiliary racks, cabinets, junction boxes, cables and etc, shall be provided with a nameplate, showing the identification data.

All transmitter housing material shall be die cast aluminium. All JBs shall be EExd/e manufactured from Die cast aluminium with epoxy coating.

All Transmitters Must be have Zero and Span Adjustment From out Side

6.2.4 TEMPERATURE MEASUREMENT

Bi-metallic every angle dial thermometers shall be used for local indication. Dial size shall be 150 mm diameter unless otherwise specified in the data sheet.

Casing and pointer shall be AISI 304 or aluminum. Dial material shall be aluminum, unless otherwise specified.

Dial colour shall be white, non-rusting metal with black figures.

Local zero adjustment shall be possible.

Where Bi-metallic types are not suitable, gas or liquid filled capillary instruments may be used. Mercury filled systems shall not be used. Guaranteed gauge accuracy shall be ±1% of full scale range.

RTD shall be used as means of temperature measurement. The choice between resistance thermometers and thermocouples shall take the following into consideration:

- Where accuracy of measurement is required greater than obtainable with a thermocouple, a resistance thermometer shall be used.
- Resistance thermometers shall not be used where high frequency vibration is present, e.g. in high velocity steam or gas streams.
- Where narrow range duty is required i.e. less than 100°C range a resistance thermometer shall be used.

RTD’s shall be platinum preferably 3-wire. Two-wire is not permitted. RTD PT100 shall comply with BS 1904 and have a resistance of 100 ohms at 0°C and a fundamental interval of 38 ohms. They shall be of the grade of accuracy appropriate to the application.

Thermocouples shall be two wire types. Thermocouple elements shall be in accordance with ISA/ANSI-MC 96.1 except where averaging or differential thermocouples are required.

Thermocouples and resistance thermometers pocket assemblies shall be provided with weatherproof terminal heads certified for the appropriate area classification. Heads shall be orientated to prevent ingress of water.

Thermowells shall be constructed in accordance with project standards from one-piece Stainless

Steel 316/316L material as minimum.

Flanged Connection: 1 ½" Flanged Type for Pipe Connection.

Instrument Connection: ½ "NPT

Thermowell shall be used for all temperature instrument

On small lines where adequate immersion cannot be obtained by the thermowell inserted perpendicular to the line, the well shall be inserted at 90 degrees bend in the line.

Transmitter shall be designed to allow the fitting of either an integral or remote located process variable indicator, where specified on the instrument Data Sheet. The design of transmitter and local indicator combination shall be such that failure of the indicator electronics will not affect the operation of the transmitter.

The input signal shall be galvanically isolated from the output and ground. Accuracy of the transmitter shall be ±0.1% percent of calibrated span, includes combined effects of linearity, hysteresis and repeatability. Electrical connection shall be ISO M20 x1.5.

Temperature switches shall be bracket mounted type, and should be selected as liquid / gas filled system or thermocouple actuated/differential expansion, depend on applicable working range of each type. The switches shall be fully compensated against variations in the ambient temperature. The accuracy of switches shall be better than ±1% of span. Microswitch shall be snap action type, hermetically sealed, with gold or silver plated contacts. Switch contact shall be DPDT and shall suit the electrical area classification. The contact rating shall be 10A at 110 VDC.

6.2.5 LEVEL MEASUREMENT

The following local level instrument types shall be used:

a) Gauge glasses for vessels and small tanks. Gauge glasses shall be applied where indicated on the P&ID's

b) Float type instruments for large tanks, where local indication only is necessary

c) Differential pressure instruments where float type instruments are not suitable (e.g. viscous fluids).

d) Magnetic level gauges to be used where only local indication of liquid level other than by means of level gauge glasses is required and instrument air supply or instrument electricity supply is not available.

e) Radar type measuring application shall be based on "Non-contacting Sensor (Antenna Type)" measuring approach or using of "Contacting Sensor (Guided Wave Radar Type)"

based on project requirements.

Local indication of vessel or tank level shall be achieved by means of gauge glass type.

When gauge glasses are selected the reflex type shall be selected wherever possible. The transparent type (with illuminators) shall be selected for adhesive liquids, which could give unclear readings on reflex type gauges.

Gauge glasses shall be fitted with a maximum of four sections. When a greater visible range is required multiple gauge glass units shall be installed and staggered to ensure a continuous visible length.

Min SS 316L construction shall be used for all wetted parts where process requires it. Reflux gauge glasses shall be used on colorless services.

Reflex gauges shall be used for liquid and vapour interface detection except in the following circumstances, where transparent gauges shall be used:

- Viscous, caustic or acidic service.
- Glass corrosive duty (e.g. Acid, caustic, high pressure steam or condensate), when the glass shall be protected with a mica sheet between glass and gasket.
- Colour or turbidity observation.
- Gauge glasses shall have a maximum of four (4) sections combined together to form a single gauge column. Each section shall have a visible length of approximately 300 mm. Where more than one column is required they shall overlap with a minimum of 25 mm visible length. Gauges on vaporizing service shall be manufactured with larger chambers than gauges on other services.

For fire water tanks, float and cable level gauges to be used. Vendor to provide float guide wires which shall be installed plumbed, properly centered, free of kinks or twists to be provided and pulled out under proper spring tension.

For liquid/liquid interface, corrosive liquid service or where clear indication from a distance is required, local indication shall be provided by means of magnetic follower gauges. Displacers in externally mounted chambers shall be used for displacer type level transmitter, where applicable.

Internal displacers may be used on vessels where an external arrangement is not possible (e.g. sumps).

Where the displacer is subjected to turbulence, the effect shall be minimized by shielding, guidance or other means.

Either 4-20mA-HART protocol shall be used for process value measurement. The transmitter communication technology shall be fully matched with process control system. For Emergency Shutdown System, analogue 4-20mA-write protected transmitter or digital switches to be used. Electrical connection shall be ISO M20 x1.5.

Float/Displacer type switches in externally mounted chambers shall be used. Chambers having a flanged closure for easy internal inspection shall be used. The float arm and float shall be able to pass through and clear the nozzle through which they are installed.

Connection between float and switch mechanisms shall be by use of a magnetic coupling. This coupling shall be shrouded against accumulation of magnetic particles. Contacts for switches shall be gold plated, double pole, and double throw contacts. They shall be hermetically sealed micro switches with a typical rating of 10A at 110V AC.

Vent and drain connections shall be ¾" NPT female.

All Level gauges shall be constructed with isolation valve.

Transmitter must be have Local zero and span adjustment included and accessible from outside shall be provided.

6.2.6 PRESSURE MEASUREMENT

Dials shall have diameter of 150 mm and shall be white with black figures, non-rusting metal. Blow out disc shall be located in the back of the casing.

Over-range stops shall be provided for the over-range limit.

Unless otherwise specified, Min SS 316L alloy shall be used for pressure elements, sockets, Movement and tips material.

All gauges shall be equipped with screw driver slot type adjustment for calibration purposes.

Min SS 316L, 2 valve block manifold shall be provided.

Transmitter shall be designed to allow the fitting of either an integral or remote located process variable indicator, where specified on the instrument Data Sheet. The design of transmitter and local indicator combination shall be such that failure of the indicator electronics will not affect the operation of the transmitter. The transmitter shall be 4-20mA supporting HART protocol.

Electric Three way H.R.Modified n: ISO M20 x1.5

Accura an ±0.1% of instrument scale for SMART type.

Tree-way (Two Valve) Stainless Steel manifold shall be supplied and integrated to pressure

transmitters. The manifold process connection is ½" NPT female, the vent/drain connection is 1/4" NPT female.

For pressure switches, pressure element shall be of diaphragm, Min SS 316L capsule or piston type. Pressure element connection shall be ½" NPT male and have wrench flats.

Pressure elements shall be designed to have an over range protection rating of at least the design pressure of the process line or vessels, and as a minimum 130% of full scale. The accuracy of the pressure switch assembly shall be at least 1% of span and repeatability shall be at least ±1% of full scale, the set point shall be field adjustable over the full range of the switch. The set point adjustment shall be internal.

Electrical connection shall be ISO M20 x1.5.

Switch element shall be microswitch snap action type hermetically sealed, with gold plated contact. Microswitch shall be DPDT type, Contact rating shall be 10A at 110VAC nominal.

Diaphragm seals shall be utilized for the following services,

a) High viscous heavy oils,

b) Fluid with solid materials,

c) Vapor containing H2S,

d) Corrosive chemicals.

Where capillary extension is specified for transmitters, the capillary length shall be stated on the Instrument Data Sheet and be provided with spiral wound stainless steel armor.

Process connections for clean fluids shall be ½" NPT screwed bottom connections.

Transmitter must be have Local zero and span adjustment included and accessible from outside shall be provided.

6.2.7 FLOW MEASURMENT

Orifice plates shall be used for liquid, vapor and gas services.

Manufacturing of orifice plates shall be generally in accordance with ISO 5167 standard or AGA Report No 3 for Natural Gas metering and BS 1042.

Concentric, sharp edged orifice plates with flange taps shall be used in most applications. The use of eccentric orifices shall be limited to gases containing liquid, liquids containing solid particles, or liquids containing gas.

Orifice plate material shall generally be Min SS 316L. Orifice tag number, material, direction of flow, nominal diameter and bore diameter shall be

The minimum orifice flange rating shall be ANSI 300 # RF.

Five-way Stainless Steel manifold shall be supplied and integrated to differential pressure transmitters. The manifold process connection is ½" NPT female, the vent/drain connection is 1/4" NPT female.

Differential pressure transmitter range shall be selected in accordance with the following:

a) For orifice meters, normal flow rate shall be between 70% and 80% of capacity, provided anticipated minimum and maximum flow rates will be between 30% and 95% of capacity;

b) If range ability larger than 30% to 95% is required, two differential pressure transmitters connected to the same orifice taps shall be used.

Minimum 10:1 turn down ratio is required to be considered for flow measurement equipment.

Variable area meters with suitable mechanical protection may be used on non-hazardous, low flow service with temperatures up to 130 ºC. Their use shall be limited to meters up to 1 inch in size.

The calculation of restriction orifice plate shall be in accordance with ISO 5167.

Restriction orifice plates shall be constructed with a thickness specified at full rating.

Restriction orifice plate material shall generally be Min SS 316L. Other suitable materials shall be selected depending on the process fluid and as specified on individual data sheets.

Drain/weep holes shall not be provided on the restriction orifice plates. Orifice bore shall not be beveled for the restriction orifice plates.

Electromagnetic flow meters are based on the principle that an electromagnetic force (EMF) is generated when a conductive fluid moves in a magnetic field. If the field is perpendicular to a pipe which contains a moving fluid and if the conductivity of the fluid is above a certain minimum value, a voltage can be measured between the two electrodes in the pipe wall. As this voltage is proportional to the strength of the magnetic field, the average velocity of the moving fluid and the distance between the electrodes, the volumetric flow rate is derived. The electromagnetic flow meter shall have an accuracy of ±1% of full-scale detection. Uncertainty is the summation of all the errors in the measuring system including accuracy, linearity and repeatability.

The in-line type thermal flowmeters consists of a sensor typically installed on a bypass around a restriction in the main line. The in-line element shall be supplied with two temperature elements on both sides of a separate heating element. The thermal mass flowmeter are suitable for cases

subjected to viscosity changes. The thermal mass switch shall be DPDT type, Contact rating shall be 10A at 110VAC nominal.

The usual accuracy is about 0.25% usually applied for flow instruments.

Transmitter must be have Local zero and span adjustment included and accessible from outside shall be provided.

Electrical connection: ISO M20 x1.5

6.2.8 CORROSION COUPON/PROBE

Corrosion coupons/probes shall be located at all points as indicated in the P&ID's where significant corrosion or erosion is anticipated.

Coupons may be used to determine the average fluid corrosivity by measurement of weight loss. The method facilitates an assessment of the corrosivity of an environment with respect to the specific material of construction of that part of the plant in which the corrosion monitoring is taking place.

Careful consideration shall be given to the proposed monitoring location and coupon position during the development of the corrosion monitoring strategy.

Coupons shall be installed through on-line retrievable access fittings, with a flanged line connection. Coupon retrieval and positioning tools shall be included.

On-line corrosion monitoring should be installed at points where accessibility during scheduled maintenance is anticipated.

6.2.9 MAINTENANCE SYSTEM

The diagnostics provisions shall be provided at an engineer station in the Control Room. Additionally diagnostic interrogation shall be possible via a hand-held device at the field cable marshaling cabinets, without infringing any hazardous area certification requirements.

Refer to Specification for Control System Doc.No.BK-GNRAL-PEDCO-000-IN-SP-0002 and Specification for ESD system, Doc.No.BK-GNRAL-PEDCO-000-IN-SP-0003 for diagnostic detail and other system specifications.

6.2.10 INSTRUMENT HOOKUP/INSTALLATION

Process impulse connections up to and including the primary isolation valve shall conform to the piping, vessel or equipment specification. The tubing and fittings up to the instrument shall conform to the General Instrumentation Specification. All pressure measuring devices shall have 2 valve manifolds and all differential pressure measuring devices shall have 5 valve manifolds. As general,

Instrument Hookup/Installation to be performed in accordance with IPS standards No. IPS-D-IN-010, IPS-D-IN-100, IPS-D-IN-101…107, IPS-D-IN-112, IPS-D-IN-115, IPS-D-IN-116 and IPS-D-IN-119.

Where possible manifolds shall be of the type suitable for direct mounting to the instrument.

Instruments can be close coupled to the tapping point and supported by the process connection as long there is good maintenance access and the instrument is not subjected to detrimental vibration.

All Pressure Transmitters/ switches & Flow Transmitters / Switches must be Located 2'' Pipe Mounting Support (with bracket).

6.2.11 CONNECTION ON PIPING AND EQUIPMENT

Specifications for instrument connection on piping and block valves, minimum flange rating for instrument connection = 300 lbs

INSTRUMENT			TYPE AND SIZE OF CONNECTION
To PIPING	Orifice flange and nozzles		½ in.
	Annubar or pittot tube	Flanged	2in.
	Thermowells	Flanged	1 ½ in.
	Pressure Instrument and Bourdon tube pressure gauges		1/2 in. Flanged*[2]
To Equipment	Thermowells	Flanged	2in.
	Pressure instrument and Bourdon tube pressure gauges		2in. Flanged
	Displacer	External	2in. Flanged
		Internal	4in. Flanged
	level switch	External	2in. Flanged
		Internal	4in. Flanged
	Differential pressure		2in. Flanged*[3]
	Gauge Glasses		2in. Flanged
	Magnetic Level		2in. Flanged

STAND PIPE	Displacer	External	2 in. Flanged
	level switch	External	2 in. Flanged
	Differential pressure		2in. Flanged
	Gauge Glasses		2in. Flanged
	Magnetic Level		2 in. Flanged

Notes:

1. Valve type as per piping specification
2. Diaphragm seals on pipe and vessels for pressure/flow indicators/transmitter should be considered 2 in.
3. D/p cells for level with remote diaphragm seals dia. 3 in. Flanged connection and first block valve (except where not required by Licensors).
4. Standpipe dia. 3 in. With dia. 3 in. Vessels connection.

6.2.12 ACTUATED VALVES

6.2.12.1 CONTROL VALVES

Control valves shall be in accordance with “Specification for Control and Regulation Valve document.

Control valve body material and rating shall be in accordance with the appropriate Piping and Valve Material Specification, but shall be ANSI 300# minimum rating.

The noise level shall be attenuated to a maximum of 85 dBA at one meter downstream, and one meter measured vertically from the pipe.

The material of bonnet shall be suitable to withstand the ambient temperatures and operating temperatures indicated in the datasheets.

Cable entries shall have metric threads or be supplied with adaptors to 20 mm ISO (female). Electrical flying leads shall not be used.

Packing shall not contain any asbestos. External lubricators or grease nipples shall not be used.

Actuators shall be adequate to stroke the valve and sized based on the line rating and the maximum differential pressure to which the valve will be exposed.

For actuators, standard spring range shall be 0.2-1 barg.

Control Valves normally are fitted with pneumatic spring return diaphragm actuators. Spring and actuators shall be sized based on available supply pressure.

Electric actuators may be used (subject to CLIENT agreement) at site locations where instrument air is not available. Note that only “fail locked” operation will be available.

"Fail open", "fail close" or "fail locked" modes will be determined by process or safety requirements.

A HART type positioner(with a 4~20mA signal), compatible with control system that can provide diagnostics on the operational status of the control valve trim, shall be considered for all valves, this signal shall be displayed on HMI panel. The diagnostic data would be accessed over the Fieldbus link, otherwise position transmitter to be considered for all control valves.

Pneumatic connections shall generally be ¼"NPTF unless a high air capacity requirement dictates a larger size.

Local manual operation shall be provided by a side mounted hand wheel and declutching mechanism, only when specified.

Valve selection is generally based on application, size and cost. The globe type control valve shall be specified for the majority of applications; however butterfly, disc or ball type valves may be considered where adverse service conditions and size requirements are more cost effective.

For each application process control shall be achieved with the valve operating between 10% and 90% open.

The minimum globe control valve body size to be used shall be 1 inch and Body sizes smaller than 1 inch may be used for special applications, for valve sizes smaller than 1 inch, reduced trim in 1 inch size bodies normally will be preferable.

Special ball valves with integral attenuator or vee port have good control characteristic and give high turndown.

Full ball valves are not recommended for slurries due to the solids settling out in the body cavity.

Valves shall be sized in accordance with ISA Standard S75.01. Certified noise calculations shall be provided for each valve.

The stroking time of control valves shall be evaluated on the basis of the process control requirements. For critical analogue control systems such as surge control of compressors, the stroking time shall be less than 5 seconds. For other analogue control systems, longer stroking times may be acceptable.

The valve trim maximum allowable leakage rate shall be specified by reference to ANSI/FCI 70-2 standard, min leakage class shall be Class V.

The most common types of pneumatic control valve accessories which may be supplied with the control valve are, Solenoid Valves, Convertors, Positioners, Electro pneumatic Positioners, Booster Relays, Extension Bonnets, Hand wheels, Air Filter regulator, Limit Switch and etc.

The control valve shall be sized such that the CV value of the control valve for maximum process

flow with the pressure drop across the control valve at maximum process flow is approximately 80% of the maximum CV value for that control valve. Furthermore, the control valve shall never have less than 25% lift for minimum process flow at the specified pressure drop.

6.2.12.2 SELF ACTUATED REGULATOR VALVES

Self-actuated regulators shall be in accordance with “Specification for Control and Regulation Valve” document.

Self-actuated regulators shall have the same general requirements as control valves. Pressure Regulator valves should be able to regulate a considerable range of the pressure as the input pressure.

A regulator is a very simple control device in which all of the energy to operate it is derived from the controlled system. Self-actuated regulators can be used in the following services:

- Pressure control
- Level control
- Flow control
- Temperature control

All regulators, whether they are being used for pressure, level of flow control, fit into one of the following two basic categories:

- Direct-operated: Direct-operated regulators are adequate for narrow-range control, and where the allowable change in outlet pressure can be 10 to 20 percent of the outlet pressure setting.

- Pilot-Operated: Pilot operated regulators are preferred for broad-range control, or where the allowable change in outlet pressure is required to be less than 10 percent of the outlet pressure setting. They are also commonly used when remote set point adjustment is required for a regulator application.

6.2.12.3 SAFETY RELIEF VALVES

Safety relief valves shall be in accordance with “Specification For Pressure & Safety Relief Valve” document.

Pressure relieving devices shall be provided to protect the plant against malfunction or fire in accordance with the recommended practices included in API RP520, API RP521 and applicable vessel codes.

For each relief valve the relief case, fire, process malfunction, equipment failure, must be evaluated and the relief valve sized for the worst case.

For cases were a constant back pressure is exerted the cold set pressure shall be the required relief pressure less the constant back pressure.

Spring loaded relief valves connected to a closed discharge system shall have a closed bonnet.

If the superimposed back pressure in a shared common relief header due to static conditions or due to the result of pressure coming from other connected sources result in the relief pressure increasing by more than 10% of the set pressure then a balanced bellows type relief valve shall be used.

For relief valves connected to a common header were the built up back pressure can exceed the allowable overpressure balanced bellows shall be used. However the back pressure shall not exceed 50% of the set pressure, taking into account the maximum allowable operating pressure of the bellows.

All direct activated spring loaded safety relief valves on hydrocarbon service shall be of the full nozzle, high lift type. A closed bonnet shall normally be provided on conventional safety relief valves, except as follows:

- An atmospheric vented bonnet shall be provided for all safety relief valves which vent steam, air or liquids to atmosphere.
- A piped vented bonnet shall be provided for safety relief valves having a bellows seal where the process fluid is toxic. The vents shall be piped to a safe area or relief header to cater for possible bellows failure.

Pilot operated relief valves may be considered for applications that cannot easily be met by conventional relief valves.

Relief valves shall have flanged connections in accordance with the requirements of the Piping Specification unless this conflicts with API RP 526 when this shall govern.

6.2.12.4 ESD VALVES

ESD valves shall be in accordance with “Specification for On/Off and ESD Valve” document.

The ESD valves shall be of fire safe type complying with the piping specification.

The valves shall be tight shutoff (leakage class VI), fire-safe to BS 6755 or CLIENT standard.

Single acting, pneumatic actuators with spring return to the safe position shall be employed. The type of actuator used shall be based on cost, space and weight considerations.

The valve actuators shall be sized to have 150% of the torque required to open and close the valve with an assumed maximum upstream process pressure and zero downstream pressure and with

the minimum air supply.

The actuator shall have fitted adjustable stops in the open and closed position.

The piston seal configuration shall be of a fire safe design, e.g.:

- A primary elastomeric seal
- A secondary metal seal to prevent excessive leakage across the piston in case the primary seal fails due to a fire

Actuators shall be equipped with a mechanical locking device to block valves in their safe position in case equipment maintenance, repair or testing is required. The locking arrangement shall be such that accidental actuation causing movement of a valve from its safe position is not possible. This locking device shall be clearly visible when installed. The locking device shall be designed to withstand the closing force of the actuator with the maximum specified supply pressure applied.

The actuator maximum possible torque under maximum supply pressure conditions shall not exceed 80% of the valve stem shear torque.

A manually operated three-way valve with a lock closed facility shall be provided for each actuator to enable the valve to be closed locally and be locked closed for operations / maintenance purposes. The valve shall be provided with a stainless steel label that shall indicate the normal and the locked positions.

Solenoid valves shall be 24VDC certified EExd. The valves shall be made from 316 stainless steel as minimum.

Unless otherwise specified all electrical equipment including solenoid valves and limit switches shall have a degree of ingress protection IP 65.

Partial stroking facility to be considered for ESD and BDVs.

Unless otherwise specified, the maximum valve stroking time to achieve the safety position shall be defined according to size of the body (5 seconds for body up to 4”, 1 second per inch for body greater than 4”).

ESD valves’ accessories shall be considered in accordance with Doc. No.: Specification for on/Off and ESD Valve.

6.2.12.5 PROCESS ISOLATION VALVES

Process isolation valves shall be in accordance with “Specification for on/Off and ESD Valve” document.

These valves are used to isolate a section or a line and are controlled by process control logic. The

result of process control logic is closure of valve in accordance with the P&ID and data sheets.

Isolation valves shall be designed to open and close remotely from the control room through the DCS. Failure position shall be stated on the valve data sheets and P&ID's. Actuators shall be sized to fully open and close the valves at the maximum differential pressures and within the time spans as specified in the individual data sheets.

Isolation valves shall be full bore or reduced bore ball or plug valves according to the piping specification requirements. Unless otherwise specified in the data sheets.

6.2.13 SERVICES

6.2.13.1 INSTRUMENT AIR

In general, pneumatic systems (if any) shall be designed for instrument air supply with design pressure of 11 barg and the specification at instrument air header according to below table:

Operating Conditions at Producer's Battery limit (Instrument Air Header)

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Instrument Air	-	65	-	-	8	-
Plant Air	-	65	-	-	9	-

Operating Conditions at User's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Instrument Air	-	65	-	4	7.5	8.5
Plant Air	-	65	-	4.5	8.5	9

All devices shall be designed to operate at minimum instrument air pressure of 3 barg.

6.2.13.2 POWER SUPPLIES

A battery backed 110V AC UPS will be provided for Manifold area.

The UPS's will provide the DCS and ESD with un-interrupted and stable power and will maintain power to the panels for a pre-determined time after failure of power generation. This period will be

set by timers provided in the UPS distribution board. The time period will be initially based on a minimum of 2 hours.

The UPS will provide the supply through two independent feeders. The ESD system will accept two 110VAC supplies, one from each feeder.

The panels supplied from the UPS shall derive the required voltage levels (e.g. 24VDC etc) from the incoming 110VAC using redundant rugged industrial type power supply

A 110VAC non-UPS power supply shall be provided for each panel from emergency power supply. This power supply will energize the panel lighting, heaters and socket.

The F&G system UPS 24VDC shall be considered in manifold existing battery room/charger room with capacity of 24 hour for normal load and 5 minute full load.

7.0 ACCESSORIES

7.1 JUNCTION BOXES

Junction boxes shall generally be used with multi-conductor cables to reduce the number of cables.

The minimum ingress protection of junction box and cable glands hall be IP65.

D03

Junction boxes shall be fabricated in epoxy coated aluminum or flame retardant Glass Fiber Reinforced Plastic, GRP.

Protection class of junction box shall be Eexe. Each junction box shall be sized with 20% spare terminals for the termination of spare conductors of the multi-conductor cable.

All Junction Boxes shall have external fixing lugs provided for installation. All Junction boxes shall be supplied with an internal/external earth stud for safety earth.

All junction boxes shall be supplied with an approved certificate and certification label attached to the lid.

All labels shall be securely affixed so as not to degrade IP rating of enclosure. Junction boxes shall be supplied, complete with certified screw terminals and links, assembled on terminal rails and terminals shall be labeled on both sides.

A junction box shall contain only signals of the same class. I.S. signal lines and non-I.S. signal lines shall not be contained in the same junction box. This rule shall be also applied for ESD signals, PCS signals, PSS Signals and F&G signals.

IN-06: define PSS. H.R.Modified

All Junction boxes shall be supplied pre-drilled with cable entries, suitable blanked off with certified

plugs which shall be installed on spare connection.

All junction boxes shall be manufactured from stainless steel, with a finish suitable for the environment.

Protection class of cable glands shall be Eexd. It is preferable all single and multipairs cables enter into the junction box from bottom side of it.

7.2 CABLING

Within the plant area, underground cabling shall be used generally, laid within dedicated cable trenches. However, cables shall be installed in duct banks for crossing of roads. Above-ground cabling, using cable trunking or cable trays shall be limited to connection of field instruments to field mounted junction boxes.

Above ground cables shall be armoured in accordance with IPS-M-EL-271. Underground cables shall be lead sheathed in accordance with IPS-M-EL-271 where soil contamination by hydrocarbon liquids aggressive to the cable insulation is anticipated.

Instrument signal cables shall be adequately separated from power cables and electrical power equipment to minimize noise interference. A minimum cable separation distance, segregation of trenches, terminal boxes and wiring notes shall be as per IPS-C-IN-190 guide lines.

Flame retardant cables according to IEC 60332.3 shall be used for instrument cables as a minimum requirement.

Fire resistant cables according to IEC 60331 shall be used for safety system as:

- Cables for fire-fighting equipment as:
  - Command and monitoring cables for remote operated firefighting, deluge and CO_2 systems (IF ANY).
  - Fire and gas detection circuits.
- Cables related to ESD system and F&G system equipment as:
  - Connection Cables between transmitter and ESD system
  - Connection Cables between Detectors and F&G system
  - Power supply cables to solenoid valves of all ESDV, and BDV.
  - Cables related to emergency electrical shutdown.
- Any other areas related to safety aspects.

Unless otherwise specified, equipment and cabinets/panels shall be designed for the bottom cables or cord sets, and shall be equipped with gland plates.

All wires shall be identified at both ends using plastic tie-on markers. Above-ground cables shall be marked at their termination points (outside the terminal box where applicable) with a suitable label, of engraved or embossed plastic.

Underground cables shall be marked at approx. 50 cm intervals by means of embossed strips of corrosion resistant material (e.g. stainless steel or nylon).

In addition, cables shall be marked either side of cable transits, building entry/exit points, etc. All wiring shall be identified by sleeve-type markers, e.g. Grafoplast or equivalent

Specialist cable types (eg, co-axial, cat. 5, fiber optic, composite etc.) required for DCS, ESD system, F&G system, vibration monitoring etc. are to be defined in conjunction with selected vendors.

Refer to ''Specification for Instrument/F&G Cables, Doc.No.BK-GNRAL-PEDCO-000-IN-SP-0010'' for more detail.

7.3 CABLE TRAYS & ACCESSORIES

Cable Trays and associated accessories including tray covers shall be pre-fabricated type galvanized steel sheets

The nominal width of cable trays selected is 50, 100, 150, 300, 450 and 600 mm. The cable trays shall be supplied in standard length of 2500 mm.

Types of trays used are Perforated type, Ladder Type & Solid type.

The Flange height shall be considered for Ladder Type as 50 mm & for perforated & solid type trays as 100 mm.

The thickness for cable trays shall be considered 2 mm and the thickness for cable tray cover shall be considered 1.6 mm.

The maximum spacing between the rungs of the ladder type cable tray shall be considered as 250 mm.

Cable tray covers shall be provided for Perforated & solid type trays as indicated in the project drawings.

Accessories: The cable tray accessories are Vertical Elbows, Horizontal Bends, Adjustable Bends, Crosses, Tees and Reducers, etc,. All accessories shall have minimum bending radius of 600 mm.

Galvanizing: All cable trays, tray accessories, tray covers & tray supports including washers, etc. shall be hot dip galvanized. Should the galvanizing of the samples be found defective the entire batch of steel shall be regalvanized at BIDDER's cost.

Grounding conductors for Cable Trays 25 x 6 GS flat conductor shall run along the trays & interconnecting the trays at every 2.5 m intervals. 95 Sq.mm stranded copper conductor shall be used to grounding trays at minimum two points and in addition at 25 meters interval for longer length of trays

Manufacturer shall perform metrological / chemical composition and mechanical test on random samples of cable trays such as :

1. Visual inspection, dimensional checks and verification of bill of material as per approved drawings.
2. test for galvanizing to ensure that materials and workmanship to the relevant standards.
3. Zinc coating thickness test
4. Copper sulphate test (uniformity test).

8.0 ELECTRO-MAGNETIC COMPATABILITY

The design of the instrumentation systems shall be such as to: -

- Avoid susceptibility to electromagnetic interference from other systems
- Avoid causing electromagnetic interference to other systems (Including telecoms).

9.0 SPARE CAPACITY

All systems shall be sized to have a minimum of 20% full wired spare and 20% installed spare I/O. CPU loading shall not exceed 50% of the maximum capacity. At least 20%, spare space shall be considered for cabinets for future extensions.

Multicore cables shall incorporate a minimum of 20% spare pairs. All unused cores in I.S. cables shall be connected to I.S. earth.

Instruments (including spares parts) shall be supplied with additional 20% of total quantity of each category (at least one item).

10.0 FACTORY ACCEPTANCE TESTING (FAT)

EPC CONTRACTOR shall be permitted to perform or witness (or both) completes testing of the system at VENDOR's premises.

VENDOR shall prepare a detailed set of procedures for the Factory Acceptance Test (FAT) for EPC CONTRACTOR review and approval at least 60 days in advance of the test date. FAT procedure shall be submitted to the Client for review and approval 30 days before the test. The

FAT must demonstrate to EPC CONTRACTOR that the system meets the functional and integrity design basis. A sample FAT procedure shall be submitted as a part of the bid.

EPC CONTRACTOR shall have the prerogative to modify the System FAT test procedures to ensure specified performance and quality is being met.

VENDOR shall ensure that all systems components are available for an integrated test at the factory. This shall include his proprietary equipment, together with bought out items such as trip amplifiers, push buttons, lamps, annunciators, power supplies, etc.

Where practicable the actual communication cables shall be used, but test cables may be substituted when specifically agreed with EPC CONTRACTOR. This substitution shall not absolve VENDOR from the need to test communication devices, when part of VENDOR's scope of work.

FAT shall be carried out for 100% of I/O, connected devices and control hardware and software. VENDOR shall ensure that adequate power supplies and acceptable I/O simulation are provided for the 100% test, and that spares are available to ensure proper continuation of testing if failures occur.

System equipment shall be heat soak tested as a part of the FAT. Heat soak test shall be for 48 hours at 48°C. VENDOR shall have completed in-house testing of the system prior to commencement of the FAT.

Evidence of the equipment passing such tests shall be made available to EPC CONTRACTOR prior to FAT commencement. Performance deficiencies noted during the FAT shall be documented and a rectification strategy agreed. All deficiencies shall be rectified by the Control and Safety System VENDOR. A complete retest of the systems shall be performed if, in EPC CONTRACTOR’s judgement, fundamental problems are discovered.

In addition to functional and integrity tests, systems shall be subjected to the following EMI immunity tests: System equipment shall operate correctly in the presence of a portable cellular telephone in the frequency band of 450MHz, keyed at a distance from the equipment to yield a field strength of at least 10 volts/metre at the equipment (This field strength typically occurs at a distance of 6 inches (15cm) for a 1 watt transmitter).

This interference shall be imposed in accordance with IEC 801-3 and at all propagation angles. Such interference shall not affect span or reading by more than 0.1% nor cause spurious systems operation or systems malfunction.

VENDOR shall provide training for CONTRACTOR's employees at initial stage of design for five (5) personnel to familiarize with the system and final training for ten (10) operations and maintenance personnel at VENDOR's works.

COMPANIE’s representative shall be participated in all the FAT progress.

11.0 SITE ACCEPTANCE TEST

EPC CONTRACTOR will require VENDOR's full Site Acceptance Test (SAT) procedure to be available for review at least 60 days in advance of the test. SAT procedure shall be submitted to the Client for review and approval 30 days before the test.

11.1 INTERFACE TESTING

All interfaces between sections of VENDOR's equipment shall be fully tested as part of the SAT.

Where VENDOR's equipment interfaces with systems from other VENDORS then the two systems shall be tested together in one location or the interface may be simulated. Generally simulation will be acceptable for hard wired interfaces. Where the system interface is via data link the use of simulators will depend on the extent and importance of the interface, and on past experience of the two VENDORs. The use of unproven hardware, software, or protocols will not be acceptable.

Where simulation of the interface is agreed, the two VENDORS, in conjunction with EPC CONTRACTOR, shall agree test procedures and acceptance criteria for the FAT, and shall provide all necessary test equipment.

11.2 PRE-COMMISSIONING AND COMMISSIONING SUPPORT

System VENDOR specialist services will be required during pre-commissioning and commissioning of the plant. A comprehensive proposal to provide the required specialists for commissioning support shall form part of EPC CONTRACTOR’s scope. Proposal shall include details of the skill and the hourly rates offered.

12.0 SPARE PARTS AND SPECIAL TOOLS

12.1 SPARE PARTS

The VENDOR shall provide lists of recommended spare parts, which shall include the original part numbers with prices for commissioning, start-up and two years operation. All spare parts shall be identified individually.

Spare parts for commissioning and start-up; a qualified and complete list based on PROJECT SPARE PART SUPPLY PROCEDURE (Doc. No. E&D-QC-SP-1).

Spare parts for two years operation; a qualified and complete list based on PROJECT SPARE PART SUPPLY PROCEDURE (Doc. No. E&D-QC-SP-1).

The VENDOR shall be able to provide spares back up and support for the plant life of at least 20 years.

SPIR form shall be approved by CLIENT prior to procurement.

12.1 SPECIAL TOOLS

The VENDOR shall provide any special tools required for the satisfactory operation and maintenance of his equipment. A complete list of special tools shall be provided by the VENDOR at enquiry stage.

13.0 TRANING

Training shall be prepared to provide suitable personnel as required for the following:

- Design configuration assistance to CONTRACTOR
- Operator training courses
- Maintenance training courses
- Site installation and commissioning support.

VENDOR shall provide detailed information of factory and onsite training courses in his proposal.

VENDOR shall furnish UNIT RATES for providing training in English for three groups of employees:

- Engineering
- Operators
- Maintenance

Training shall be for Control System, especially on Ethernet TCP/IP data highway communication protocol.

As an additional option, VENDOR shall provide an instructor to conduct operator training before the start-up of plant operations. The training will be specific to the specific facility systems, graphics, control, etc. The instructor shall be required to provide a training manual based on compilation of all configuration work done on the facility systems.