Instrumentation Design Criteria

S.Mostafavi Q.Mohtasham H.R.M

REV.	Date	Purpose of Issue	ORIG.	BY	PREP'D	CHECK'D	APP'D	COMPANY APP'D
04	10-Jan-24	Approved for Construction	IOEC	-	S.M	Q.M	HR.M	-
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TABULATION OF REVISED PAGES

Sheet	Revisions						Sheet	Revisions						Sheet	Revisions					
	00	01	02	03	04	05		00	01	02	03	04	05		00	01	02	03	04	05
1	X	X	X	X	X															
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REVISION RECORD SHEET

REV. NO.	PURPOSE	LIST OF UPDATED MODIFIED SECTIONS IF ANY
00	Issued for Comment	-
01	Issued for Approval	Section 4, 7.4, 7.6.1, 7.6.2, 8.1, 8.2, 8.2.4, 9.1, 14
02	Issued for Approval	Section 7.4
03	Approved for Construction	Section 1.1
04	Approved for Construction	Section 8.3, Section 4

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1. INTRODUCTION

1.1. Development Overview

The Resalat Field previously known as Rakhsh Field, is located in the Persian Gulf, some 80 km to the South of Lavan Island, in water depth of 65-75 meters. The facilities which were originally developed in 1968 have sustained some damage due to the Iran/Iraq war and adverse climate conditions thereafter.

To increase oil production capacity from this field (adding 12,000 stock barrels per day to current production), Iranian Offshore Oil Company (IOOC) has defined new project which includes Engineering, Drilling, Procurement, Construction for following items:

- New satellite Wellhead Platform (WHP1) with totally nine (9) conductor slots.
- Development and renovation of Existing offshore complex consist of new power generation, control system, HVAC, Electrical /control room, electrical panels(LV &MV),process & utility piping, and all necessary activities which shall be done for connection to existing facilities(Tie in requirements)
- Drilling of two new production wells in R1 and three wells in WHP1 platform and Re-entry and work-over of one existing well in R1 platform.
- One 10" productions submarine pipeline from WHP1 to PP and a single submarine cable (power and data) from SP to WHP1
- Inspection, Strengthening, Modification and Repair of existing R1 complex Jackets and topsides and replacement of boatlanding and Barge Bumpers.

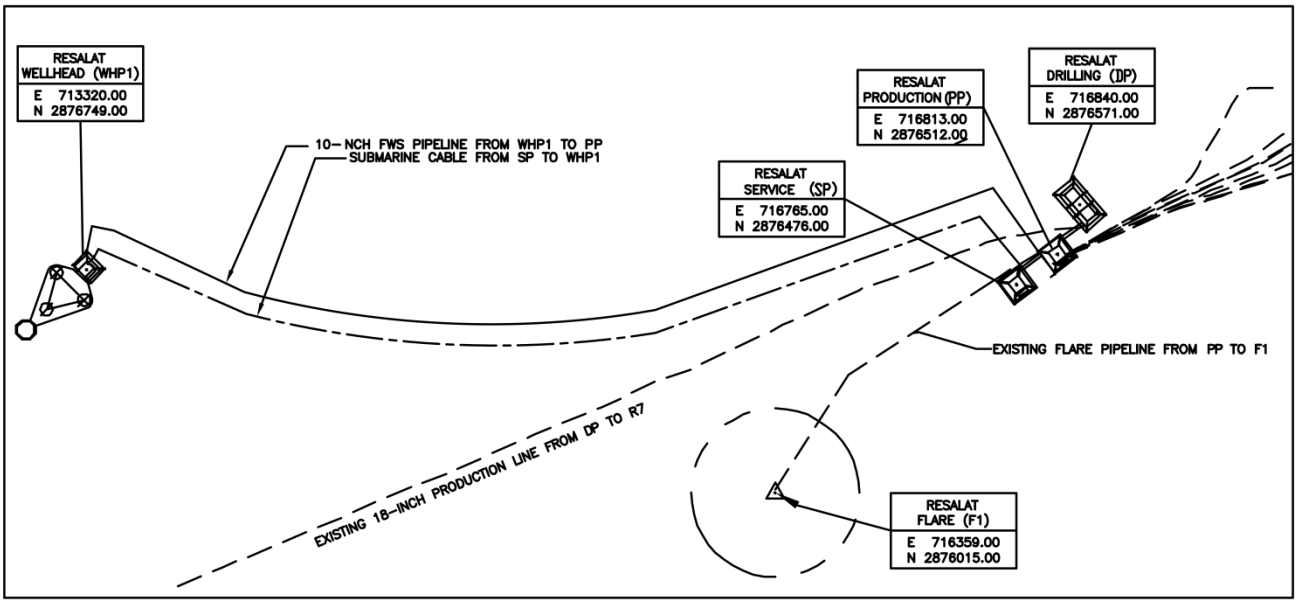

Figure 1: Resalat Development Field Layout (Datum ED 77, Zone 39, Cent. Meridian 51° East)

1.2. Purpose of Scope

The purpose of this specification is to define the basis criteria required for the design, manufacture, and inspection/testing of all instruments to be installed on Resalat Oil Field Development Project Phase 1.

The VENDOR/Manufacturer shall be responsible for the design, sizing, manufacture, testing and documentation of any kind of instrument. These rules are to be considered as minimum requirements and any omission shall not relieve the VENDOR of his responsibility to deliver instrument devices and accessories that are complete and fully satisfy the Project requirements.

1.3. Definitions

PROJECT	Resalat Oil Field Development – Phase 1
COMPANY	Iranian Offshore Oil Company (IOOC)
CONTRACTOR	Consortium of Iranian Offshore Engineering and Construction Company (IOEC) and Intelligent Solutions Inc. (ISI)
SUB-CONTRACTOR	Tehran Raymand Consulting Engineers (TRCE)
PURCHASER	Any firm who buy services, material and/or equipment for execution of the project within a dedicated contract.
SUPPLIER	Any vendor, manufacturer who supply any Service, Material or Equipment for the project
SHALL	Refer to a mandatory requirement
SHOULD	Refer to a recommendation
MAY	Refer to one acceptable course of action

2. CODES AND STANDARDS

The latest editions of instrumentation codes and standards listed as referenced in this specification:

Reference	Title
[1] API RP 554	Process Instrumentation and Control
[2] API RP 14C	Recommended practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems for Offshore Production Platforms.
[3] BS 3573	Specification for polyolefin copper conductor telecommunication cables.
[4] BS 5345	Code of practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres.
[5] BS 5501	Electrical Equipment for Potentially Explosive
[6] BS 6651	Code of practice for protection of structures against
[7] IEC 60079	Electrical Apparatus for Explosive Gas Atmospheres
[8] IEC 60331	Fire-resisting characteristics of electric cables
[9] IEC 60092	Electrical installations in ships
[10] IEC 60381	Analog signals for Process Control Systems.
[11] IEC 60529	Classification of Degree of Protection Provided by
[12] IEC 60801	Electromagnetic compatibility for Industrial Process measurement and control equipment (Parts 2, 3 & 4)
[13] IECTR 61000-5-2	Electromagnetic Compatibility (EMC) Part 5: Installation and mitigation guidelines Section 2: Earthing and cabling
[14] IEC 61131-2	Programmable Controllers; Equipment Requirements
[15] IEC 61131-3	Programmable Controllers: Programming Languages
[16] IEC 61508	Requirements for Electrical/Electronic/Programmable Electronic Systems
[17] EN50081-2	Radio Frequency Immunity Requirements
[18] EN 300386	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Telecommunication network equipment; Electromagnetic Compatibility (EMC) requirements
[19] IPS	Iranian Petroleum standards
[20] ISA S75.01	Flow Equations for Sizing Control Valves
[21] ISA 75.02	Control Valves Capacity Test Procedure
[23] API RP 500	Recommended Practice For Classification of locations for Electrical Installation at Petroleum facilities Classification as Class 1, Zone 0, Zone 1 and Zone 2.
[24] API RP 521	Guide for Pressure Relief and Depressurizing Systems
[25] API RP 526	Flanged Steel Pressure Relief Valves
[26] API RP 527	Seat Tightness of Pressure Relief Valves
[27] API PR 552	Transmission Systems
[28] BS 381C	Specification for Colors for Identification Coding and Special Purpose

Reference	Title
[29] BS EN 837-1	Pressure Gauges Bourdon Tube Pressure Gauges, Dimensioning, Metrology Requirement and Testing
[30] BS EN 837-2	Pressure Gauges Selection and Installation Recommendations for Pressure Gauges
[31] BS EN 60529	Specification for Degree of Protection Provided by Enclosure (IP Code)
[32] IEC 600 92-375	Electrical Installation in Ships. Shipboard telecommunication cables and radio frequency. Cable General Instrumentation, Control and Communications
[33] IEC 60228	Conductors of Insulated Cables
[34] IEC 60331	Fire-resisting characteristics of electric cables
[35] IEC 60332	Test on Electrical Cable under Fire Conditions
[36] IEC 60529	Classification of Degree of Protection Provided by
[37] IEC 60754	Test on Gases Evolved during Combustion of Materials from Cables
[38] IEC 61131-2	Programmable Controllers; Equipment Requirements
[39] IEC 61131-3	Programmable Controllers: Programming Languages
[40] IEC 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety Related Systems
[41] ISA	Instrument Society of America
[42] ISA S5.1	Instrumentation Symbols and Identification
[43] ISA S20	Specification Forms for Process Measurement and Control Instruments
[44] ISO 5167	Measurement of Fluid Flow by Means of Pressure Differential Devices
[45] NACE MR01-75-90	Sulphide stress cracking resistance metallic materials for oil field instruments
[46] NFPA	National Fire Protection Association
[47] SOLAS	Safety of Live At Sea
[48] DIN V 19250	Control Technology Fundamental Safety Aspects to be considered for Measurement and Control Equipment
[49] EN 50014 (BS 5501 Part 1)	Electrical apparatus for potentially explosive atmospheres. General requirements.
[50] EN 50018 (BS 5501 Part 5)	Electrical apparatus for potentially explosive atmospheres. Flameproof enclosures ‘d’
[51] EN 50019 (BS 5501 Part 6)	Electrical apparatus for potentially explosive atmospheres. Increased Safety ‘e’
[52] EN 50020 (BS 5501 Part 7)	Electrical apparatus for potentially explosive atmospheres. Intrinsic Safety ‘i’
[53] EN 50039 (BS 5501 Part 9)	Electrical apparatus for potentially explosive atmospheres. Intrinsically Safe electrical system ‘i’
[54] IEC 60079	Electrical Apparatus for Explosive Gas Atmospheres.
[55] ISA S5.4	Instrument Loop Diagrams
[56] API RP 551	Process Measurement Instrumentation
[57] NEK 606	Cables for offshore installations 155 halogen-free and/or, mud resistant

3. REFERENCE DOCUMENTS

Project documents as referenced in this specification:

Reference	Title
LRSL-000-MW-SP-673	Specification for Painting
LRSL-000-PR-DB-706	Process Design Basis
LRSL-000-EL-DB-603	Electrical Design Criteria

4. ABBREVIATIONS

The following abbreviations are used in this document:

AK	Anforderungs Klasse (Safety Requirement Class by TUV)
API	American Petroleum Institute
ANSI	American National Standard Institute
ASME	American Society for Mechanical Engineers
BS	British Standard
CCR	Central Control Room
TER	Technical Equipment Room
CIST	Composite Instrument System Test
DIN	Deutsche Industrie Norm (German Industrial Standards)
DHSV	Down Hole Safety Valve
EMI	Electromagnetic Interference
EN	European Norm
EWS	Engineering and Maintenance Work Station
DCS	Distributed Control System
ESD	Emergency Shut Down
F&G	Fire and Gas
GTG	Gas Turbine Generator

ICSS	Integrated Control and Safety System EWS Engineering Work Station
FFCP	Fire Fighting Control Panel
FAT	Factory Acceptance Test
SAT	Site Acceptance Test
TPA	Third Party Administrator
FLD	Functional Logic Diagram
PVC	Polyvinylchloride
GSWB	Galvanized Steel Wire Braid
PLC	Programmable Logic Controller
PC	Personal Computer
HV	High Voltage
LV	Low Voltage
LCP	Local Control Panel
HVAC	Heat Ventilation & Air Conditioner
HW	Hard Wired
HMI	Human Machine Interface
IPS	Iranian petroleum Standard
IEC	International Electrotechnical Commission
IEEE	International Electrical and Electronic Engineers
ITP	Inspection and testing procedure/plan
I.S.	Intrinsically Safe
N.I.S.	Not intrinsically safe
NACE	National Association of Corrosion Engineers
IP	Ingress Protection
LER	Local Equipment Room
SWGR	Switchgear Room

MCT	Multi Cable Transit
MOV	Motor Operated Valve
MOS	Maintenance Override Switch
MTU	Master Terminal Unit
QC	Quality Control
NDT	Non Destructive Test
RTD	Resistance Temperature Detector
RFI	Radio Frequency Interference
RAM	Random Access Memory
RP	Recommended Practice
RTU	Remote Terminal Unit
TUV	Technischer Ueberwachungs Verein
SDV	Shutdown Valve
SER	Sequence of Event Recorder
SOV	Solenoid Valve
SIL	Safety Integrity Level
SIF	Safety Instrumented Function
SPDT	Single Pole Double Throw
SPIR	Spare Parts and Interchangeability Records
SSV	Surface Safety Valve
UCP	Unit Control Panel
USD	Unit Shutdown
UPS	Un-interruptible Power Supply
VDE	Association of German Electrical Engineers
WHSC	Wellhead Safety Cabinet
HPU	Hydraulic Power Unit

5. CONFLICT

Any conflicts between requirement of this specification, related contract documents, national standards and codes of practice shall be referred to the COMPANY for clarification. Where conflicts occur, the order of precedence shall be:

- Statutory requirements
- Contract scope of work
- This specification
- Other specifications
- Minimum code standard requirements
- CONTRACTOR's quality plan

6. ENVIRONMENTAL CONDITIONS

Refer to Process Design Basis; LRSL-000-PR-DB-706.

7. SELECTION OF INSTRUMENT

7.1. DESIGN BASIS

Instrumentation shall be provided to satisfy the following requirements:

- Provide information and control to enable the platform process systems and utilities to meet the specified requirements for safety, product quality, throughput, efficiency and economic operation.
- Provide local indication of process variables, which will allow local adjustment of control and bypass valves, for start-up, shutdown and emergency conditions.
- Enable safe and convenient plant start-up, uninterrupted operation, and controlled shutdown.
- Provide automatic protective action where deviation of plant variables could result in a hazard to personnel or equipment.

- Provide means for processing and recording plant variables for plant operation, fault diagnosis and for the prevention of unscheduled shutdowns.
- Provide information to enable early detection of any degradation of plant or equipment due to fouling, wear or other malfunction.

Equipment shall be selected on the basis of both field proven ability for the application and manufacturers support for the product.

Selection of device and the accuracy of measurement for each device shall be consistent with both instrument's function on the plant and latest version of API/IPS. The accuracy and range of measurement required shall be stated on data sheets and procurement documentation.

All wetted parts of instruments shall be in accordance with NACE MR-01-75-90 for sour services. Instrument selection shall be according to IPS and API 551 guidelines.

7.2. UTILITY INFORMATION

All field instrumentation shall be supplied from ICSS panels. The available power supply for ICSS panels is:

- Normal Power Supply: 230VAC ±1%, single phase, Rated frequency 50Hz ± 1%.
- UPS Power Supply: 230VAC ±1%, single phase, Rated frequency 50Hz ± 1%.
- Instrumentation: 24 VDC

There shall be a distribution board for each type and level of electrical supply such as AC, DC and from UPS. Transmitters and actuators shall be powered directly from the control panel, if separate 24VDC power required for filed transmitter and actuators, it shall be provided by panel vendor.

The pneumatic/hydraulic supply will be made available by CLIENT.

In both cases, operating condition of the pneumatic or hydraulic supply shall be officially enquired from PURCHASER/CLIENT as follows before design/manufacturing:

1. Minimum Pressure
2. Normal pressure
3. Maximum pressure
4. Design Pressure"

Safety factors shall be considered for design pressure of actuators for hydraulic supplied and air supplied services.

7.3. SYSTEM OF UNIT

ISO system will be used. (SI units with some possible exceptions for production flow units) e.g.:

Liquid:	Actual Barrels per Days (BPD)
Gas:	Standard Cubic Feet per Day (SCFD)
Pressure:	General in Bar gauge (Barg) Vacuum in Bar absolute (Bara)
Differential Pressure:	bar or mbar in flow measurement
Temperature:	Degree Celsius (°C)
Level:	meter / millimeter (or % of range)
Flow:	MMSCFD / m3/hr (Gas Flow) M3/hr (Liquid Flow)
Viscosity:	Centipoise (cP)
Analyzer:	Determined by individual application

7.4. HAZARDOUS AREA INSTRUMENTS

Instrument equipment shall be selected with protection appropriate to the degree of risk and the hazardous area classification zone 1, Gas group IIA & IIB, Temperature Class T3.

Signals to and from the technical room shall be electronic. The standard analogue signal shall be 4~20mA using a two-wire intrinsically safe (I.S) EEx'ia' transmitter. Instrument equipment shall generally be of 'Smart' transmitter type, 2-wire output signal of 4~20mA with digital communication (HART FSK protocol superimposed).

Explosion proof EEx'd' shall be applied on solenoid valves. Field emergency pushbuttons to be supplied by EEx'd' enclosure.

All instrument voltage shall be a maximum 24 volts D.C. and intrinsically safe instrument equipment shall be isolated by I.S. barriers on all appropriate input/output signals to/from the central unit, which is located at the safe area equipment room.

7.5. ENVIRONMENT PROTECTION

The ingress protection according to IEC-60529 for instrumentation equipment shall be a minimum:

IP 66: All Field Instrumentation / Outdoor enclosure

IP 42: Indoor enclosure

7.6. DESIGN REQUIREMENT FOR CABLING

7.6.1. JUNCTION BOX

Field mounted junction boxes shall be certified EEx'e', and made of heavy duty construction stainless steel. Aluminum shall not be used.

Junction boxes shall include a minimum of 20% spare capacity. Terminals shall be provided such that only one conductor is terminated on each side.

Non-metallic junction boxes shall be provided with an internal earth continuity plate.

Separate junction boxes shall be provided for the DCS, ESD & F&G signals. Further, for each type of following signals, separate junction boxes shall be provided:

- I.S signals (Analogue)
- Non I.S signals

7.6.2. CABLE AND ACCESSORIES

Cable systems and accessories shall be installed, as far as practicable, in positions that will prevent them being exposed to mechanical damage and to corrosion or chemical influences (solvents) and to the effects of heat. Cables shall be oil resistant. Where exposure of this nature is unavoidable, protective measures shall be taken or appropriate cables selected.

All cables shall be flame retardant, low smoke, halogen free construction and oil resistant according to IEC 60092 and IEC 60332. Also, the cables shall be Mud resistant to NEK 606 and the armor shall be GSWB. Cables for life support and safety systems functions (such as cabling for ESD/F&G) shall be fire resistant type in accordance with IEC 60228, IEC 60754 & IEC 60331.

For more details of Instrumentation cables shall be referred to Specification for Instrument Cables (Endorsement); LRSL-000-IN-SP-647.

Earthing cables are considered non-current carrying cables. Earthing cables shall be colored yellow/green.

Cables shall be segregated and suitably identified in the applicable cable category:

- LV Power and Control
- Instrumentation (Control and Monitoring)
- Fire and Gas / Shutdown (detection and protection)

Power Cables	Distance from 24V DC Power & Signal Cables
110 VDC or 10A	300 mm
110 VAC or 10A	300 mm
250 VAC or 50A	500 mm
440 VAC or 200A	750 mm
6.6 kVAC or 500A	1500 mm

The above-mentioned categories shall be further sub-divided into:

- I.S. - Analogue / Digital
- Non-I.S. - Analogue / Digital

Where power and instrument cable routes cross wherever possible these shall be at 90 degrees, a vertical separation of 300 mm minimum will be allowed.

7.6.3. CABLE RACK AND TRAY

All cable rack and tray shall be SS316/L or GRP. Stainless steel cable rack and tray shall be properly insulated from the steel structure to prevent corrosion caused by dissimilar materials.

The cable rack and tray shall have equipotent bonding. Cable extensions from cable racks to equipment shall be supported and protected against mechanical damage. Sun shade / Tray Lids shall protect cables in direct sunlight.

In exposed location, cable rack and tray shall be provided with additional protection against mechanical damage or chemical hazard.

Only cable trays for top decks shall have covers.

7.6.4. CABLE GLANDS

Cable glands shall be selected to suit the type of cable and termination box or enclosure, and shall be of the appropriate type of protection, e.g. EEx'd', EEx'e'. Effective earth Continuity shall be ensured between the cable armor or braid and the gland plate or the internal earth terminal. The cable gland material shall be nickel platted brass.

7.6.5. EARTHING PHILOSOPHY

A dedicated earthling system shall be designed for all platforms in order to earth instrument equipment enclosures and process equipment. A separate isolated earthling system shall be provided for electronic instrument system. Earthing system resistance to earth shall be in accordance to API RP 552 and in any case shall not exceed 1 ohm. Two separate earthing networks are foreseen for the instrumentation equipment;

- Safety/Protective Earth- PE
- Non IS Instrument Earth- NIS IE
- IS Instrument Earth- IS IE

Each of the above mentioned grounding system shall be individually wired to a common instrument ground reference point.

The instrument earth system (functional grounding) shall be designed to prevent unwanted circulating current in the control room and field cable conductors and screens.

All screens shall be floating and isolated at the field instrument head and be continuous throughout the connection system back to the control room where will be connected to the functional grounding network.

All cabinets, racks, control panels, and power distribution systems shall have separate instrument earth and safety grounding bars.

The functional grounding bar shall be electrically isolated from the cabinet chassis and connected to the relevant network only.

The safety-grounding network shall be connected to all doors, racks, gland plates, instrument enclosures and other metallic device.

All field instrument enclosures, cable tray, junction boxes, field panels, instrument stands and other loose instrument metallic components shall be connected to the platform metallic structure.

Field supports, process piping and hydraulic supplies to instruments shall follow conventional API RP 550 practice.

Field mounted instruments shall be suitable for the maximum ambient temperatures and if exposed to sun provided with sunshield.

Sealed protective enclosures shall be provided to minimize the number of exposed moving parts such as limit switch actuators.

Package units shall follow the same concept for field instruments as used on the main plant.

7.6.6. MULTI CABLE TRANSITS (MCT)

The cable entry into the Local Equipment Room penetration and all fire rated surfaces shall be through Multi Cable Transit Blocks (MCT).

The MCT frames provided shall be suitable for the applicable fire rating and Steel construction.

The MCT shall be supplied with minimum 30% spare insert block of each size for future use.

7.7. ELECTRICAL INTERFERENCE (NOISE)

The Instrument Equipment shall be protected against control errors and hardware damage from electrical transients on power, ground or signal wiring. These transients include radio frequency interference, power line faults, extraneous voltages, and lightning induced surge.

7.8. LOCAL EQUIPMENT ROOM LER

The local equipment room shall be considered "safe area" and shall employ air lock and positive pressure techniques to ensure that the ingress of wind-blown gases and dust is prevented. Gas detection at the air inlet to the HVAC system shall be included in the F&G system. Fire detection elements shall be strategically placed within the building to give early warning of a hazardous incident.

The cable entry to the instrumentation cabinets shall be through sealed transits.

The equipment layout shall be properly studied to obtain the best operability of the units, to facilitate their maintenance and minimize the interconnections.

The instrument panel inside the local equipment room shall be with a minimum protection degree of IP-42 and provided with cooling fans and air inlets with filters.

The possibility of integrating Interposing Relay Panel (IRP) and Marshaling Panels or Power Distribution Panel (PDP) in a single panel shall be studied in order to reduce required space for LER.

7.9. CONTROL ROOM

The OWSs will be installed in control room. The provisions for standard control room such as proper lighting and ventilation shall be considered for this room and requirements of Ergonomic Design Specification for Control Room; LRSL-R1X-IN-SP-002 shall be followed accordingly.

7.10. INSTRUMENTATION DESIGN LIFE

The equipment and installation design lifetime shall be minimum 25 years. Instrument equipment and control systems shall be readily available and not be obsolescent for the next 5 years after implementation of the project. Control systems spares and support shall be valid for next 10 years after implementation of the project.

8. ICSS DESIGN OVERVIEW

8.1. GENERAL REQUIREMENTS

Integrated control and safety system, named as ICSS will provide process control and monitoring, safeguarding and fire and gas system.

The ICSS shall be a standalone and fault tolerant system and operate. ICSS shall have independent redundant control network which is dedicated for communication among ICSS sub systems, DCS, safety system (ESD and F&G System) and operator/engineering workstations.

The data transmission between R1 Complex and WHP1 platform shall be via submarine fiber optic cable. The interface media between ICSS and WHSC in R1 and WHP1is hardwired.

ICSS shall function and fully integrated as one complete system, which include the function of platforms' process monitoring and control, safety shutdown and fire & gas detection.

The ICSS approach will provide a fully integrated monitoring, control, protection and safety system functionality. It will also ensure that the facility has a common operator interface, common interface protocols and technology that can be used throughout the development. This also ensures a standard approach to standardization of hardware equipment and software components and in consequence to reduce cost of ownership for the life expectation of the equipment.

The ICSS system shall have approved configuration and functionality to TUV class AK6 SIL-3 and NFPA-72 requirement.

The Overall availability of ICSS shall be between 99.9% and 99.99% for ESD and FGS system.

Both ICSS of R1 Complex and WHP1 shall have GPS-based clock. The ICSS and any related control panels that pass time and date related data such as alarm and trip status over a communication interface shall be time synchronized with ICSS by means of Time Synchronized signal received from ICSS.

8.2. SYSTEM INTERFACE REQUIREMNTS

8.2.1. INTEGRATED CONTROL AND SAFETY SYSTEM

Both DCS and Safety System of ICSS controller nodes shall be connected to redundant control network as a node. Exchange of non-safety related parameters between DCS and Safety System shall be via the redundant control network.

Exchange of safety related parameters shall be via TÜV certified safety application related communication network if any or via hardwired.

All devices connected to the redundant control network shall be monitored for failures. A system alarm shall be generated for each failure detected.

8.2.2. OWS AND EWS

Both OWS and EWS shall be integrated with ICSS via redundant control network. Retrieval of safety related parameters for monitoring purpose and control/monitoring function of DCS-ICSS shall be via the redundant control network. Failure of OWS shall be detected and a system alarm shall be generated for each failure detected.

8.2.3. MOTOR CONTROL CENTER

Interface between DCS and MCC shall be hardwired.

As specified by P&IDs, following signals from/to MCC shall be made available at OWS and HMI workstations as a minimum:

- Motors Statuses
- Motors Start / Stop Commands
- Motors Fault Alarms
- Local / Remote Indication

8.2.4. WELLHEAD SAFETY CABINET

As a minimum, the following hardwired signals from WHSC of R1 Complex shall be considered to ICSS and shall be made available at OWS and HMI workstations:

- Hardwired to DCS-ICSS:
  - Surface Safety Valve Statuses
  - Down Hole Safety Statuses

- Hydraulic Circuit Pressure Alarm and Indication

- Hardwired to Safety-ICSS:
  - Surface Safety Valve Close Command
  - Down Hole Safety Valve Close Command
  - Hydraulic Reservoir Level Trips and Indication
  - ESD Signals

8.3. PACKAGE UNITS

The packages shall be categorized in four types as stated below.

Type P1: This Package unit shall be without Junction Box, Local Control Panel, dedicated control panel or dedicated control system. Control and shutdown included in Platform ICSS.

Type P2: This Package unit shall be with Junction box only. Control and shutdown included in Platform ICSS.

Type P3: This Package unit shall be with Junction box and Local Control Panel. Control Monitoring and critical shutdown by Platform ICSS.

Type P4: This Package unit shall be with junction Box. Control and shutdown is by package UCP. In addition, remote Shutdown from plant ICSS system shall be available (one hardwired signal to the UCP).

Note: HVAC and Gas Turbine Generator are P4 type. Fire Extinguishing packages and Crane are P3 type. Chemical package is P2 type.

The interface signals between packages and ICSS are mainly hardwired. The soft link shall be provided for P4 type packages. The details of interfaces shall be finalized during the detail design.

For more details refer to Specification for Instrument & Control System for Package Units; LRSL-000-IN-SP-645.

9. FIELD INSTRUMENT

9.1. GENERAL

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

- Solenoid valves: Operating voltage shall be 24 VDC loop-powered from ICSS.
- All transmitters: shall be SMART-HART protocol type linked by means of 4-20 mA 24 VDC. Transmitters shall be designed specifically for safety applications. All transmitters shall be equipped with local indicator in engineering units.
- Switches: Position switches shall be of proximity hermetically sealed type. Switches operating without isolating amplifier are preferred Field Process switches shall have hermetically sealed SPDT micro-switch. Mercury type switches are not allowed.
- Instruments using Mercury shall not be used.
- All instruments will be installed with vent and drain facilities and for hazardous and / or polluting fluids the drain of instruments shall be piped to the drain network.
- Instrument with Aluminum material shall not be used.

9.2. TEMPERATURE MEASUREMENT THERMOWELLS

All measuring elements will be installed in flanged thermowells unless otherwise required for special applications. The sheathings shall be deep enough to have the sensible elements completely immersed in the fluid to be measured. Thermowells shall be AISI 316, unless the process fluid requirements call for high-strength materials; the coupling flange material shall be in compliance with the line specification.

Temperature Indicators

Bi-metallic temperature indicators shall be supplied as complete assemblies comprising indicator extension nipple and thermowell. Scale graduations, zero adjustment and over-range protection shall be manufacturer's standard.

Temperature Elements and Transmitters

- Thermocouples

The type of thermocouples and the relevant fabrication characteristics shall be in compliance with ANSI/ISA MC 96.1. As far as possible shall be "K" type and the measuring junctions of the thermocouple shall be mineral insulated and stainless steel sheathed.

- Resistance Temperature Detectors (RTDs)

RTDs shall be used for narrows spans and whenever an accurate measurement is required.

- Temperature Transmitters

The transmitter shall be connected to the measuring element for RTDs and thermocouples, in order to make the connection to the control room by a 2 wire transmission system.

9.3. PRESSURE MEASUREMENT

Measuring Elements

The measuring elements of pressure instruments will be sized to withstand a pressure exceeding by the 30% that of the full-scale value. they shall be in compliance with the different Manufacturer's standards. The measuring elements will be AISI 316, unless the process fluid calls for a higher quality material. Generally, the following measuring elements shall be used: bourdon type, for a wide range of pressure services (they shall normally be used for pressure gauges, repeaters and local controllers)

- Diaphragm and bellow elements shall be used for low pressure local measurements,
- Diaphragm and strain gauge, shall be generally used for pressure transmitters,

Pressure Gauges

Pressure gauges shall be selected in accordance with ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

Pressure Transmitters

All wetted parts shall be 316SS as a minimum. Transmitters shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with Hart protocol.

9.4. FLOW MEASUREMENT Flow Measuring Elements

Generally, for flow measurements, square edge orifice plates with concentric entrance and flange taps and/or carrier ring will be used. The calculation of such orifice plates and their application range will be in accordance with ISO 5167 Code or AGA-ASME.

The ratio of orifice diameter to line diameter (d/D) for orifice plates shall be between 0.20 and 0.70 with 0.6 are the preferred d/D ratio.

Measuring Instrument

The instruments for the measurement of the differential pressure shall be usually of the diaphragm type. They shall withstand with no damage the design static pressure applied to a single chamber. Transmitters shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with HART protocol. Below principle is acceptable for flow measurement.

- Differential Pressure Flow Transmitter
- Ultrasonic Flow Transmitter
- Electromagnetic Flow Meter
- Variable Area Meters
- Turbine Meters

Other types of flow meters can be acceptable with purchaser approval.

9.5. LEVEL MEASUREMENT

Stand pipes, if exist, for level measuring instruments shall be provided with isolating, vent and drain valves. For liquid/gas measurement, metering by differential pressure with separators can be

used. Level instrument may be either directly installed onto the vessels or onto a stand-pipe. Whenever level shutdown devices are required, independent, direct type level instruments will be used.

Level Glass Indicator

Level glasses shall be of the armored type with steel body and borosilicate temperate crystals. Glass tube indicators (Tubular type) shall not be utilized. The glass level indicators shall be provided complete with safety device against the break of the glass.

Magnetic Type Level Instrument

Magnetic type level instruments shall be in the form of local level indicator (level gauge) and / or level transmitter, as specified on the data sheets. Float Chamber shall have float stop springs. Spring lengths shall be adjusted to stop the float's magnet assembly at zero and span.

Guided Wave Radar Type Level Instrument

The Guided wave radar shall be based upon the Time Domain Reflectometry (TDR) technology. The level measurement shall use an accurate ultra high-speed timing circuit to measure the transit time of the electromagnetic pulses/waves. Coaxial or twin probe is to be used according to the fluid characteristics (e.g. dielectric constant) and process general parameters. The equipment shall be suitable for installation in Zone 1, Gas Group IIA & IIB, Temperature Class T3 as minimum, according to IEC recommendation.

The guided wave radar measurement shall not be affected by media variation (e.g. pH, viscosity, dielectrics, …).

The guided wave radar housing shall be 360° rotatable type and it shall be possible to dismantle the housing (including its relevant electronic) without depressurising the vessel/tank. The electronic shall be equipped with a local LCD for the local level indication.

Displacement Type Instrument

The displacement type instruments will generally be fitted with external cages, cooling fins for temperature exceeding 200°C and torque bar extension for temperature lower than - 20°C. The head of the instruments shall be of the revolving type. The displacer shall withstand, without collapsing, the design pressure of the vessel on which it is installed.

D.P. Type Level Instruments

Differential pressure instruments could be selected for range exceeding 60" (1524mm). They shall be of the same type of those used for the rate measures, except for their zero elevation and suppression device, which will be in accordance with the installation type.

Transmitters connected shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with HART protocol.

Capacitance Type Level Transmitter

These types of transmitters shall be used mainly on water base fluids or to measure interface level between water and oil. They shall be used only when differential pressure transmitter are not usable.

Other Level Measurements Elements

Ultrasonic, bubbling type, radar, conductivity type level elements and magnetic float type shall be utilized in special conditions.

9.6. MISCELLANEOUS EQUIPMENT Sand Probe/Detector

The sand probe/detector system shall be suitable for permanent use in outdoor areas with saline offshore environment and shall be manufactured with materials resistant to ambient air environment to which they are externally exposed. The sand probe/detector system shall be suitable for installation in Zone 1, Gas Group IIA & IIB, Temperature Class T3 as minimum, according to IEC recommendation.

Pig Signaler

Pig Signaler shall come with integral welded assembly for direct mounting onto the pipeline. After the pig has passed the Pig Signaler, the internal mechanism as well as the mechanical signal indicator shall only be reset manually.

Rupture Disk

The maximum burst pressure for each disk shall not exceed the maximum allowable working pressure of the equipment to be protected

Reverse buckling rupture disks may be used in vapor and partial vapor relief systems, but shall not be used in liquid hydrostatic relief systems.

Generally, insertable flanged rupture disk holders shall be specified. The holder shall be of adequate height to be fully insertable, and shall shield the disk from contact with the companion flanges.

10. CONTROL VALVES

Control valves will be sized in compliance with ISA S75.01.

The noise level, at 1m distance from the valve, shall be lower than 85 dBA, unless otherwise specified in the project documents.

The valve having an exclusive shut-off function will be line sized unless otherwise indicated in the relevant data sheet. Generally, control valve shall not be used as primary shutdown isolation valve.

The control valves shall be of the globe type, with cage guided salient stem, or with guide as per Manufacturer's standard, for differential pressure up to 5 Bar and for valves with nominal diameter up to 1 1/4".

For high DP services, with valves with a flow section equal to or larger than 1 1/4", the use of balanced trim shall be preferred.

For pipes diameter up to 1", the nominal diameter of the valves shall be equal to the pipe. For pipes diameter larger than 1", the nominal diameter of the valve shall be at least 1". The diameter of the valve connections shall never be lower than 50% of the pipe one.

The following materials shall be used for packing:

- PTFE based packing, suitable for operating temperatures up to 200 °C, unless a specific valve construction permits higher limits. Vendor's standard may also be considered.
- High-temperature graphite packing for temperatures above the limit for PTFE.

Generally the class of seal of the seat shall be defined in compliance with FCI 70-2. The seat shall be of metal-metal type up to, and inclusive of, class V.

In the control valves having also shutdown function the pressure fluid shall generally be coincident with the action of the valve necessary to put the plant in safe conditions for lack of power.

The control valves shall be provided with a Pneumatic Diaphragm or Hydraulic Piston and spring return type actuators and shall be fitted with Electro-Pneumatic/Hydraulic Positioner which shall be SMART type HART protocol.

Spring and actuators shall be sized based on available pneumatic or hydraulic pressure supplied by CLIENT.

In both cases, operating condition of the pneumatic or hydraulic supply shall be officially enquired from PURCHASER/CLIENT for

1. Minimum Pressure
2. Normal Pressure
3. Maximum Pressure
4. Design Pressure

The action of the Positioner shall be easily reversible.

11. PRESSURE SAFETY/RELIEF VALVES

All relief valves shall be manufacturer's standard types as recommended for the specified services.

The body material will be selected in compliance with the line specification and in accordance with the process fluid. The inner part material will be AISI 316, unless fluid type and process conditions require a different material.

Valve body shall be cast steel as minimum requirement as per Piping Material Specification.

Whenever a spare safety valve will be installed, a full bore isolating valve normally locked in closed position on the spare safety valve and one, normally locked in open position on main safety valve shall be provided. Interlocking of the two isolating valve shall be envisaged in order to allow changeover between main and spare safety valve avoiding the possibility that both isolating valves are closed at the same time.

In general, relief valves shall have metal to metal seating surfaces; i.e. seats shall usually be integral with the nozzle and shall be of ample proportion to permit several lapping or re- machining operations.

Valve trim (nozzle, disc holder, stem guide, blow-down ring, ring pin and bushing,…) shall be 316stainless steel as minimum requirement.

Normally relief valves shall have flanged inlet and outlet connections in accordance with the piping specification and API RP 526.

The sealing and balancing bellows shall be provided when the process fluid contains corrosive or toxic substances. Pilot operated valves shall be preferred where high accuracy of the set pressure is required.

Lifting levers shall be provided only for air/steam service application covered by ASME SECTION VIII.

Test gags shall be provided only if required by project datasheet for the valves. The safety valves will be sized in conformity with the API RP 520.

The safety valve shall be fabricated in conformity with API 526, "Flanged steel safety relief valves".

The springs shall be protected against the corrosion by a phosphating treatment or an equivalent system, in accordance with the Manufacturer practice. The sealing of the seat shall comply with API 527.

The pilot operated pressure safety valves shall usually have the pilot pressure filtered tap on their body.

When the maximum value of the counter pressure is larger than the operating pressure, a back flow preventer shall be provided, to avoid any back flow of gases from the blow- down manifold to the process.

The pilot discharged gas shall be piped to the blow-down manifold.

The destruction by fire of non-metallic parts, as O-ring and gaskets, shall open the shutter.

Pilot operated safety valves shall be furnished with a field test connection complete with a check valve and block valve, on the pilot supply line.

12. ACTUATED VALVES

The use of on-off valves is to divide and depressurize (if necessary) the plant in emergency conditions shall be design according to API 6D Codes and in fire safe execution according to API 6F when required. They shall be ball type and material characteristics shall fully comply with description given by the piping specification.

The nominal diameter of the valve shall be equal to the line's one.

Full-bore valves shall be utilized on line arranged for pig passage and for process requirements.

Reduced bore valves are accepted for other installations according to piping specification.

The pneumatic/hydraulic supply will be made available by CLIENT.

In both cases, operating condition of the pneumatic or hydraulic supply shall be officially enquired from PURCHASER/CLIENT for

1. Minimum Pressure
2. Normal pressure
3. Maximum pressure
4. Design Pressure

13. MOTOR OPERATED VALVES

Electrical motor operated valves may be required for process considerations and shall be conform to the following:

- Limit switches shall be furnished for stopping the motor and control of lights that indicate limit of valve stroke. A torque limit switch shall be used as a back-up switch to stop the motor when the valve is at full limit travel.
- Actuator shall have the capability to be controlled in field manually by an operator (e.g. selector switch for local-off-remote, spring return rotary knob switch and emergency stop (e.g. push button, hand portable unit etc.)
- Power supply shall be 400 V AC, 3 phases and 24 V DC for the remote command and signaling.
- Enclosures shall be in accordance with area electrical classification.
- The integral starter shall be supplied with the electrical actuator.

14. WELLHEAD SAFETY CABINET

The Wellhead Safety Cabinet philosophy has been further enhanced into an independent document named as Specification for WHSC (Endorsement); LRSL-000-IN-SP-640.

15. SPECIAL TOOLS AND INSTRUMENT SPARES

Special tools which are needed for calibration and maintenance of systems and devices (such as main software, hand held communicators etc.) shall be supplied.

For all major equipment, commissioning spares and two years' operation spares shall be provided as a part of the equipment. The Contractor shall also furnish separately, list of recommended spares for trouble free operation along with the prices for purchaser's review.