

	GOLGOHAR STEEL PROJECT TECHNICAL SPECIFICATION FOR CONTROL AND INSTRUMENTATION FOR TRANSFER LINE	
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TECHNICAL SPECIFICATION FOR CONTROL AND INSTRUMENTATION FOR TRANSFER LINE

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1.Introduction

1.1. Project

GOL-GOHAR Iron & Steel Development CO. (GISD) located in Kerman Province of IRAN including three DRI and one Steel Making Plant intends to implement waste water transfer lines for further recycle. Blowdown wastewater from SMP, brine water of SMP RO unit and backwash streams and drains are collecting from the related TOPs and transferring to waste water treatment plant and raw water storage tank located at Kowsar unit.

1.2. Scop

This document contains the owner's minimum technical requirements for automation and instrumentation system design, hardware/software & component selection, system integration & testing, erection, commissioning and PLC-based system with DCS interface for monitoring and control of the transfer line.

Deviation from these specifications shall be raised and approved by client.

1.3 Use of Language & Abbreviation

1.3.1 General Definition

Shall: Shall is used in conjunction with an action.

Will: Will is used to indicate a statement of fact.

May: used to indicate possibility or probability.

1.3.2 Language

Drawings, technical specification, reports, manuals and other technical data shall be in English language.

2. Abbreviation & Definitions

DCS Distributed Control System

EIA Electronics Industries Association

IEC International Electro Technical Commission

IEEE Institution of Electrical and Electronics Engineers

IP Ingress Protection

IS Intrinsic Safety

LAN Local Area Network

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NIS Non-Intrinsically Safe

OLE Object Linking & Embedding

3. Standards and Codes

3.1 Terms and definition

- DIN 19226: Control engineering definitions and terms.
- ANSI/ISA S5.2: Binary logic diagram for process operations.
- ANSI/ISA S5.5: Graphic symbol for process display
- ANSI/ISA S88: process modeling & control system structuring
- ANSI C85-1: Terminology for automatic control.
- ANSI/IEEE STD: Graphic symbol for logic diagrams.
- PCE-406-XX-TNDR-EL-GENR-MELT-INSTRUMENTATION STANDARDREV00.DOC
- ISO 31: Size, units, symbols, conversion factors and conversion tables

Signals for process control (analog/digital)

- IEC 381: Analogue signals for process control system
- IEC 382: Analogue pneumatic signal for process control system

Controller

- PLC: Programmable Logic controller
- Industrial control apparatus (general, control device, controller)
- Control equipment (limit control, main control center)
- IEC 546: Controller with analogue signal for use in industry
- IEC 1131: Programmable controllers
- ANSI/UL 508: Industrial control equipment
- ANSI/NEMA ICS.2: Industrial control devices, controllers, and assemblies
- ANSI C19.3: American national standard for industrial control apparatus
- IEEE 802.3: Information Processing Systems – Local Area Networks

Control Protocols

- ANSI/ISA S72.01: PROWAY-LAN industrial data highway
- IEC 1158: Field bus standard for use in industrial control system

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- 7498 Information processing system-open system interconnection.
- ISO-8348 Information processing system-data communication network service definition.
- ISO-8473 Information processing system-data communication protocol for devising connection less mode network service.

Test of industrial control

- ANSI/ISA RP 55.1: Hardware testing of digital process computers
- ISA/S26: Dynamic response testing of process control
- IEEE STD 74: Test code for industrial control

Safety Requirement

- IEC 1010: Safety requirement for electric measurement & control
- ANSI/ISA 91.01-2001: Identification of Emergency Shutdown Systems and controls
- ANSI/ISA S82.01: Safety standard for electrical & electronic test
- NFPA 77: Recommended practice on static electricity
- IEC-61508: Functional safety of safety-related systems.
- IEC 839: Alarm systems

Software Requirements

- IEEE-830 Guide to software requirements specification.
- IEEE-1012 Standard for software verification and validation plans.
- IEEE-1016 Recommended practice for software design descriptions.

4.Control & Automation description

4.1. General

The control system shall include all required hardware to enable complete operation and supervision of the the transfer line, including alarm indication, protective functions, and data recording capabilities.

RIO Panel shall be provided and Interface signals shall be provided to RO Kowsar Plant for alarms, status, and remote start/stop as required.

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4.2.Automation Levels

A complete plant automation system is a sequence of layers, organized into a pyramid shape, where each level is superimposed the lower one, starting from the field instrumentation:

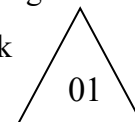
Level 0: Field Instrumentation

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This level includes all field-mounted instruments, switches, actuators, and status signals required for measurement, protection, and operation of the transfer line .

This level shall include:

- Level transmitter / level switches on RO brine water basin
- Pressure transmitters / pressure switches on pump suction and discharge lines
- Flow transmitter on RO brine water transfer line to Raw Water Tank
- Valve open / close status signals
- Pump run / trip / fault feedback signals
- Local push buttons and selector switches installed on the package
- All hardwired analog and digital input/output signals between field devices and the local control station



In addition, this level devices shall provide the process measurements and equipment status required for monitoring, alarms, interlocks, and protection .

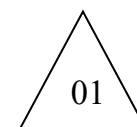
The maximum reliability and availability shall be provided .

Field instruments used for control and monitoring shall be separated from those used for protection.

Level 1: Basic control, automation and supervision

Level 1 includes the local control and functions including :

- Execution of control logic, permissives, interlocks, and trip functions
- Pump start/stop control
- Duty / standby pump logic and automatic changeover
- Valve control logic
- Alarm generation and event handling
- Local / remote operation selection
- Interface with local HMI
- Communication of RO Brine water signals to RO Kowsar plant for control ,supervisory ,monitoring and remote command.



4.3.Control System

The Transfer Line shall be controlled by Kowsar RO Unit control system and RIO modules .

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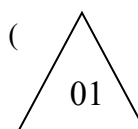
The control system shall include required digital and analog I/O modules, power supplies, communication interface, terminal assemblies, and all accessories necessary for complete operation, protection, alarm handling, and interface with the RO Kowsar PLC .

The transfer line I/O modules shall be Siemens ET200M Series installed in the Local Control Panel , including the required digital and analog I/O for pumps, valves, pressure switches, level switches, pressure transmitters, flow transmitter, and level transmitter.

For communication distances exceeding 80 meters or where required by environmental conditions, optical fiber cables shall be used.

All field instrumentation signals shall be hardwired to the RIO Panel.

The RIO Panel shall communicate with the RO kowsar control center (Upstream) via PROFIBUS (Fiber Optic).



4.3.1.Cybersecurity and Data Protection Requirements

The control system shall include basic cybersecurity measures to protect against unauthorized access and operation.

The control system shall comply with IEC 62443 cybersecurity principles and shall achieve a minimum Security Level SL1. Where the system is connected to plant networks, Security Level SL2 shall be considered.

The RIO Panel shall be physically secured with restricted access.

Communication with plant systems shall be via a secure industrial network (Profibus/Ethernet), with network segregation from non-industrial networks.

All programs and configurations shall be backed up and protected against unauthorized modification.

Direct internet access to the control system shall not be permitted

User access levels shall be implemented (operator / engineer)

Unused services and ports shall be disabled.

4.4.Control & Automation Hardware

All field instrumentation and control signals for the Transfer Line shall be hardwired directly to the RIO Panel.

The system shall include the following signal types:

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Digital Inputs (DI): Pressure switches (PS), level switches (LS), pump status signals, valve position feedback signals.

Digital Outputs (DO): Pump start/stop commands, valve open/close commands.

Analog Inputs (AI) with HART compatibility: level transmitter (LIT), flow transmitter (FIT), using 4–20 mA signals.

All field signals shall be wired using suitable industrial cables and terminated on marshalling terminals inside the RIO Panel.

For signals located in hazardous areas, appropriate intrinsic safety barriers shall be provided.

Communication between the RIO Panel and the plant control system shall be via industrial Ethernet network and is separate from field hardwired signals.

4.5. Software requirements

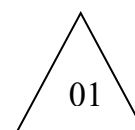
The control system software shall be added to engineering and monitoring RO Kowsar control system software.

General Requirements

All software shall be original, licensed, and legally supplied

The software and firmware versions shall be:

- Latest stable version available at the time of commissioning
- Compatible with supplied hardware



4.6. System spare capacity and expansion

The system shall be designed to facilitate future expansion with no major modification. The following spare capacity shall be provided in the design of the system unless otherwise stated elsewhere in this specification.

- RAM Back up Battery: Minimum 2 weeks
- Spare fully wired and installed I/O: minimum 20 % of total I/O channels (Including I.S. barrier)
- Spare space for future expansion: minimum 20% of total I/O
- Each power supply shall be sized So that not to carry more than 75% load of its capacity under normal operation.
- The system supplied shall have a minimum installed spare capacity of 30% including memory, data communication links & disk storage.
- Each Ethernet Switch shall have 20% spare ports.

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- Panels, Junction Boxes, LCBs shall have 20% spare space
- 30% power supply capacity

4.7. Modes of operation

The normal mode of operation of plant is fully automatic, so the operator shall retain a supervisory role such that he remains aware of the control requirements and operational procedures. Also the possibility of operator intervention at each control stages shall be considered via operator console keyboard and high resolution LCD displays.

The following mode of operation selectable from the operator console:

a) Manual

The output will be manipulated directly from the operator station.

b) Automatic

The output will be computed by the DCS controller.

c) External/internal set-point

The set point will be the output from another controller loaded with another algorithm. Bump less transfer between different modes shall be provide in the controllers.

d) Local /Remote

Local push buttons and local remote key type selector switches for electrical users shall be provided. All electrical users shall have remote push buttons too.

Local/Remote permission shall be considered through Control system.

The system configuration shall, basically, comprise of the following building block sub-systems:

- Process interface and data acquisition system
- Man-Machine Interface
- Data highway ports for interfacing with PLC's
- Data highway interface to higher level automation computer system

5. Field Instrument

5.1.General Requirement

The instrumentation equipment is designed suitable for continuous outdoor industrial service and for installation in corrosive brine water environment.

Analog signals shall be 4-20 mA (HART) for transmission of process data to the control system, where applicable 2-wire or 3-wire transmitters shall be used.

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Electronic transmitters shall be 24VDC, 4-20 mA, with HART capability for integration with the control system.

All instruments shall be supplied with 316 stainless steel name plate with identification tag number permanently fixed, and not glued to all casing. Movement parts for instruments shall be 316 stainless steel or better when specified.

Wetted parts shall be SS316L, Hastelloy, or equivalent corrosion-resistant material suitable for brine service.

All instrument will be included mechanical box protection, this box used for protecting of equipment from undesirable impact.

Level measurement on brine tanks/basins shall be radar type with independent switch provided for low and low-low level protection and interlock duty.

Pressure transmitters shall be provided for pump suction and discharge service ,suitable for corrosive brine water service with diaphragm seals to protect against corrosion and salt crystallization.

Pressure switches shall be used for interlock or protection shall be mechanical with corrosion-resistant wetted parts and adjustable setpoint.

Flow Indicator Transmitter shall be used on Brine water Transfer line to Raw water Tank (TK-K01) for monitoring the online flow rate and also daily water consumption of RO Brine water .

5.2.Level Measurement

Level measurement on brine tanks/basins shall be non-contact radar type level transmitter

This type transmitters emit microwave signals toward the liquid surface , the signal is reflected back from the liquid surface. The time for radar waves to travel and return is used to calculate the level of liquid.

System accuracy shall be 0.1% of span & shall not be affected by wind vibration, noise, and changes in temperature due to sun radiation and ambient condition.

This transmitter shall be suitable for water-tight and dust-tight (IP65 min.).

The sensors shall be outdoors, exposed to the weather and micron sized metal particles.

The instrument shall be equipped with a horn antenna suitable for reliable continuous level measurement of RO brine water in tanks and process vessels. The horn antenna shall be designed

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to provide focused microwave signal transmission and reception to ensure stable measurement in the presence of vapor, dust, or process disturbances.

The antenna and all wetted parts shall be manufactured from corrosion-resistant materials such as SS316L, Stainless Steel, or equivalent suitable for brine service. The design shall minimize fouling and salt deposition.

The level transmitter shall be equipped with digital LCD display.

The Radar level transmitters shall have 24 VDC, 2-wire, 4~20 mA, HART protocol output.

5.3.Pressure Measurement

As far as required and specified in the scope of supply and depending on the use the following devices are foreseen:

Pressure Gauge

Pressure gauges shall normally be Bourdon tube-type with external part filled with glycerin or silicone oil where required to damp vibration and pulsation . The liquid filling shall be suitable for ambient temperature conditions.

Diaphragm seal shall be supplied where required to protect the sensing element from corrosion ,fouling ,or salt crystallization .

The pressure gauge shall be designed to withstand overpressure of at least 1.3 to 1.5 times the design pressure without loss of accuracy or damage.

All wetted parts shall be manufactured from corrosion-resistant materials suitable for brine service, such as: SS316L.

The gauges shall have dial diameter size of 100 mm. The numerals shall be printed in black with 270° rotation on white laminated plastic background.

Case material shall be constructed from corrosion – resistant material (stainless steel or suitable coated aluminum) with black color, and shall have minimum IP65 protection for outdoor installation.

Pressure Switch

Pressure Switch shall be a mechanical type designed for reliable pressure monitoring and protection. The pressure switch shall have an adjustable setpoint with field calibration capability . The adjustment mechanism shall be provided with suitable locking device to prevent unauthorised changes. The switch shall provide a snap-acting SPDT contact .

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Mercury switch type shall not be used.

All wetted parts including the sensing element shall be manufactured from corrosion resistant material such as SS316, or equivalent material suitable for brine water service. Where required for corrosive or fouling service, the pressure switch shall be provided with a diaphragm seal to protect the sensing element from corrosion and salt crystallization. The enclosure shall be weatherproof with a minimum protection rating of IP65, suitable for outdoor installation. The case material shall be corrosion-resistant, such as stainless steel or suitably coated aluminum.

Pressure sensing elements shall be bourdon tube, spiral, helical, bellows or diaphragm type depending pressure range and service condition.

The accuracy of the switches shall be better than $\pm 1\%$ of full scale and the switch shall have a repeatability of $\pm 0.5\%$ of overall range.

5.4.Flow Measurement

Magnetic flowmeters shall be used to measure and monitoring the flow rate of Brine water

In addition, flow meter shall measure daily water consumption of RO Brine water and recoded data will be processed in order to report the average weekly RO brine water consumption.

The magnetic flowmeter shall have 24 VDC, 2-wire, 4~20 mA, HART protocol output.

Enclosures shall be weatherproof (IP65 or higher) .

Flow tubes shall be lined with corrosion-resistant material (e.g., PTFE or rubber) compatible with the process fluid.

Mounting of transmitter shall be remote from metering body, and thus a special sensor cable shall be provided by the Vendor.

Electrodes shall be made of stainless steel (SS 316L) or Hastelloy according to Vendor advise .

5.5. Valves

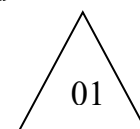
All Electrical parts of valves shall be minimum IP65.

On/Off Valves

The type of On/Off valves shall be selected considering the process condition, full bore Ball Valve or Butterfly Valve depending on line size and piping specification..

All valves shall be suitable for isolation service in RO brine water applications.

The valve body and all wetted parts shall be suitable for brine service.



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Each valve shall be equipped with a pneumatic actuator suitable for remote operation, operating on instrument air supply.

The actuator shall be sized with a minimum 25% torque margin above the maximum required torque at maximum differential pressure.

The actuator shall be provided with spring return to achieve a defined fail-safe position (fail-open or fail-closed as required by process conditions).

By loss of signal/supply the valve shall take the specified safe position.

Limit switches will be provided for on/off valves to show the open/close status and to make the manual operation possible.

The valve shall include the following accessories:

- Solenoid Valve (24 VDC)
- Limit Switch Box for valve position indication (Open/Close)

5.6. Instrument Installation

All installation shall be according to international standards.

Instruments shall be installed such that walkways and access to other equipment is not obstructed.

Transmitters shall be installed on robust pipe stands, which in turn shall be welded to structural steelwork, or shall form part of a built-in item embedded in concrete.

All instruments shall be accessible from front or rear or both sides.

Tubing and capillaries shall be adequately supported and protected from mechanical damage.

Impulse lines shall be suitable for any movement between instrument and transmitter.

Local protection boxes (with glass door for e.g. transmitter boxes) with IP 54 for outdoor installation.

5.7. Electrical Power supply

The control and instrumentation system for the Transfer Line shall be supplied from an industrial AC UPS system.

A separate feeder at 230 VAC standard, 50Hz, +/-5% shall be provided as Non-UPS electrical power for Panel lighting, socket outlets, heaters and ventilation fans.

The AC UPS shall supply the power for I/O modules, Field instrument, transmitter, valve and solenoid, communication and network equipment.

Individual protection (fuses or MCBs) for field circuits and proper separation of AC and DC shall be considered.

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6. Control Cable

Control cables shall be supplied by shielded or unshielded cables accordance with international standards and the type of cables shall be suitable for the specified environmental condition.

Cross section 1.5mm² for cables shall be considered.

Separate instrument and control cabling path from electrical cabling path and separate cable tray without dividers shall be considered.

Analog cables shall have individual shields in addition to the overall shield, and with proper grounding. Overall shield for more than 1 pair cable shall be considered.

The conductor insulation shall be suitable for 70 C.

An individual tinned copper with drained wire shield shall be provided in each pair.

Each pair is black & white and conductors shall be tinned copper and number Coded (for more than 1 pair) and twisted pair.

7. Termination

Each conductor shall be terminated using pre-insulated crimped lugs or ferrules of the correct size.

Only one conductor per terminal shall be allowed. In-line joints or tee connections in wiring are not permitted. All field signals shall be terminated through marshalling terminals within RIO Panel.

Analog signals shall be wired using shielded cables, with shields grounded at one end only (typically at panel side).

Terminal fuse with LED indicators shall be considered for all analog and digital, input and output signals (AI, AO, DI, DO).

Interposing relays shall be considered for “all” DO signals.

Separation shall be considered for analog and digital terminal strips, Separation of motor and instrumentation type signal terminal strips, Separation of all AC and DC level cables, wires and terminal strips.

8. Earthing System

Each panel section shall be provided with two 5 mm * 25 mm twinned copper earthing bars. One shall be used as a signal wire screen earth (isolated from panel frame) and the other shall be used as an equipment earth.

Each panel-mounted module shall be electrically connected to the earthing bars.

The ends of the earthing bars shall be connected so that when all modules on the panel are in place, each earthing bar shall form part of one continuous system.

Each control panel shall be provided with separate earthing bars for:

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- Protective Earth (PE) – for equipment grounding
- Instrument Earth (IE) – for signal shielding and clean earth (less than 1Ω resistance)

The Earth bar will be connected to the central earthing point with earthing wire.

Continuous ground bus bar attached to the panel is required.

All metal parts, e.g., doors, swing- out racks, enclosures, etc. shall be earthed to PE.

Earth bars shall be used as follow:

The following earthing system shall be used:

All earth bars shall be clearly labeled.

The earthing is performed as a site run and connected to the main earth in the plant.

9. Protection Degree

Local instruments shall be dust weather proof, explosion proof if necessary, suitable for use under ambient conditions prevalent in a specific plant. Minimum Protection degree for instruments and control devices (Control Panels,...) and JB's, LCS, etc,.. shall generally be:

Indoor installation IP54

Outdoor installation IP65

Instruments IP65

10. Factory Acceptance Test (FAT) and Inspection

The factory acceptance test procedure, will be used as a guideline to conduct the factory acceptance test. During the factory acceptance test, the Vendor will demonstrate the completeness and proper of the DCS system. The factory acceptance test will be a 100% visual and functional inspection including all inputs / outputs.

The factory inspection will be executed as follows:

- That all equipment specified (documents, specification, requisition, etc) will be present during the inspection
- The identification of cards, equipment, etc
- The good presentation of equipment (cards, racks, cabinets, wiring, cables, etc.)
- The overall documentation has been submitted, accepted and fits the delivered hardware
- All system functions including service functions of supplied diagnostic equipment
- Accuracy and operation of all I / O cards
- Complete system reloads
- Power failures and restarts

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- Failure diagnostic, automatic back-up and recovery for all redundant devices
- Electrical insulation of internal circuits
- 100% logic schemes
- Connections and interfaces with other systems

11. Site Acceptance Test (SAT)

After successful factory installation of the DCS system, a site acceptance test will be performed.

The SAT shall comprise a hardware function test and an integration test with other systems.

The site acceptance test procedure shall be used as the guideline to conduct the site acceptance test.

The purpose of the SAT is to test the functionality of all installed devices and software to ensure that the requirements and specifications of the installation are met. Detected defects are identified and corrected in this way. If the SAT has been carried out to the customer's satisfaction, the customer accepts the commissioning of the tested hardware and software.

A final inspection of the list of defects is carried out before acceptance of the SAT.

Tests will be included (but not limited) as follow:

- Sat Schedule
- SAT Duration
- Duration of Pre _SAT
- Duration of SAT
- Test Procedure
- Rack/Remote I/O
- Profibus
- Communication

Documentation Check

- HARDWAR AND SOFTWARE
- Inventory Inspection
- I/O Loading

System Inspection

- System Startup & General System Functions
- System Alarm Test

Application Inspection For Human Machine Interface

- Analog Window

	GOLGOHAR STEEL PROJECT	
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- Trend Window
- Graphics Window

Application Inspection For Human Machine Interface
Station Load Function (Offline)

12. Spare Part

Considering at least 20% of the total number of each type of instrument and control system equipment as 2 years SPARE PARTS (if 20% of the total number of each type used is less than one, at least one of them shall be considered as 2 years SPARE PARTS).

13. Training

Training for Instrumentation and control system shall be considered.