SECTION-I

Control Philosophy
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1.0 Scope

This specification outlines the instrument control philosophy of the complete Project Covered by this specification are the DCS system and their interfaces to other systems. This philosophy is not intended as a technical specification and is restricted to the description of the overall philosophy; detailed technical requirements are not specified. For detailed specifications, pls. refer other sections of these documents.

2.0 ABBREVIATIONS Used in this document:

- CPU = Central Processing Unit
- DCS = Distributed Control System
- FGS = Fire & Gas System
- HMI = Human Machine Interface
- HVAC = Heating, Ventilation and Air Conditioning
- IMCS = Intelligent Motor Control System
- LEL = Lower Emission Level
- MCC = Motor Control Centre
- MCR = Master Control Room
- MS = Microsoft
- OPC OLE = (Object Linking and Embedding) for Process Control
- PLC = Programmable Logic Controller
- VDU = Video Display Unit (Always 21” TFT /LCD type color monitor)

3.0 Control and Safeguarding Systems Objectives:

The main objective of the plant and its control system is to, safely and reliably, continuously produce on-specification product. Without compromising these objectives, the control systems shall also be designed to maximize plant availability, minimize plant energy consumption, adverse environmental impact and requirements for operator interventions. The principle objective of the safeguarding systems is the protection of personnel, environment, plant and equipment and the maintenance of safe operating conditions compatible with production requirements. Addition of all required instruments (field or control system) shall be done after HAZOP study.

This shall result in control and safeguarding system design that is:

- Safe
- Simple to maintain
- Simple to operate
- Flexible to accommodate changes in technology and operating requirements
- Flexible to provide for expansion during 30 years of design life
- Reliable

4.0 Control and Operation philosophy:

4.1 Operation:
4.1.1 All process and utility units and related facilities for the entire project shall be monitored and controlled from the Central DCS located at local control room near the PAC plant. This Control Room shall provide adequate space and means to ensure safe and efficient control and monitoring of the plant. Every major and minor unit of the PAC plant shall be operated independently from its dedicated console, consisting of one or more VDU-based DCS operator interfaces. Each of these Operator consoles shall be with dual LED monitors, stacked vertically and shall have 22”, WLED, Color Monitors only. Conventional CRTs are not acceptable. There shall be no other DCS/skid mounted PLC or dedicated control systems other than PAC plant DCS in the whole project.

4.1.2 The DCS operator interface (VDU based) shall be the primary integrated window for operation of the control and safeguarding systems and shall provide access to:

- Process control
- Sequence control status
- Equipment status
- Alarm overview
- Trip status overview - Override status (Visible from Aux. hardwire console)
- Real-time trending
- Historical data trending
- Fire and Gas detection status

4.1.3 There shall be min. 2 nos. of operator stations for operator, each of them shall have dual monitors stacked vertically with 22” color WLED monitors. There shall not be any engineering station in the proposed DCS, as the DCS hardware and software provided for PAC plant shall be extension of existing Honeywell DCS, presently installed at TDI complex-Dahej. The detail specifications of DCS hardware and software are given in other section of this ITB.

4.2 EQUIPMENT LOCATIONS

4.2.1 All operator stations and auxiliary hardwire console shall be located in PAC plant local central control room.

4.2.2 PAC plant control room shall be provided with HVAC, Ventilation and air conditioning as well as false flooring (with min. depth of 800 mm) and false ceiling. There shall be dyke wall of suitable size around MCT blocks for cable entry area.

4.2.3 All IRC (Interposing Relay Cabinets or Digital Interface cabinet) and IFC (Interface cabinet or simply Analog Interface Cabinet) between Electrical and Instruments shall be located in PAC plant central cabinet room adjacent to central control room only.

4.2.4 The central cabinet room layout shall be sized in such a way that there shall be min. 1800 mm space between two consecutive rows of panels/cabinet and between
panel and wall. All DCS and other control systems’ Panel shall be openable from front and back side. There shall be panel segregation for various I/Os meant for DCS system.

4.2.5 All the various system earth pits like System Ground, Safety Ground, Intrinsic ground, etc. shall be constructed in the peripheral area of cabinet room outside the control/cabinet room building. Enough space with 5 mtr. wide road shall be dedicated for various earth pits. If the required earth pit resistance is not achieved with one earth pit, there shall be multiple earth pit connected in parallel. Similarly, if diff. system requires diff. earth pits, there shall be a group of multiple earth pits in the area outside the control room/cabinet room. In general, the system earth pits’ resistance shall be less than 1 OHM and that of safety earth pits shall be less than 5 OHM.

4.2.6 The PAC plant control room and central cabinet room shall be located at ground floor only.

4.3 **Basic Monitoring and Control**

This level comprises basic control and monitoring of process, utility, equipment and auxiliary systems and is implemented in the DCS. These functions can be categorized as follows:

- **Unit Monitoring**

Unit monitoring comprises all Human Machine Interface (HMI) functions provided to those responsible for monitoring and control of the process and it’s environment. These include alarm and monitoring displays, group and detail displays, custom graphic displays, data historisation and retrieval, reporting, etc.

- **Regulatory Control**

Basic regulatory control provides closed loop control functions for stable and safe operation around steady points of operation. The basic control functions comprise mainly of flow, level, pressure and temperature control loops required as a minimum to operate and control the process. These loops may also include extended regulatory control functions such as: split range control, override control, ratio control, cascade control. They may also include control based on calculated variables, such as heat duty control, pressure compensated temperature control, etc. All of these shall be realized in the central DCS system only.

- **Basic Sequence Control, Logic and interlocks**

All Sequence controls, interlock and logic shall be realized in central DCS to provide automatic performing of tasks, such as, opening and closing of valves, starting and stopping of pumps, etc. - in a defined sequence.
4.4 FIELD INTERFACE

Multi-core cables connected to junction boxes in the field, transmitting conventional 4-20 mA dc signals (HART superimposed) from all type of field transmitters, individually, will be connected to marshalling racks. In the marshalling racks the signals will be routed to the system cables, connected to the I/O cards of the DCS systems. No Field Bus/PROFIBUS, clustered I/O or multiplexers are allowed in complete project or part thereof.

4.5 POWER SUPPLY

Required quantity of dual redundant feeder of 110 V AC UPS supply shall be provided at PAC plant central cabinet room up to PDB by Bidder Electrical group. In central cabinet room, there shall be 110 V AC UPS system and non-system UPS PDB, installed separately. One or more 110 V AC System UPS PDB shall be exclusively used for various DCS system related loads and one or more non-system related 110 V AC UPS PDB shall be used for other field loads, other control systems, PA system, etc. Bidder Electrical shall provide 110 V AC UPS power feeders at one location at various PDB incomers only. Further sub-distribution within various system and non-system UPS PDB shall be carried out by DCS vendor.

The 24 V DC redundant power supply shall be generated from these 110 V AC UPS supply, by individual system vendors, wherever it is required. These shall also be accommodated in the panels at central cabinet room, having the same specifications of panels.

220 VAC utility supply for various cabinets shall be distributed via separate central PDB located at central cabinet room only. This shall be used only for panel illumination purpose.

5. CONTROL AND SAFEGUARDING DESIGN CRITERIA

5.1 EXPANDABILITY

5.1.1 Systems shall be designed with 20% installed pre-wired spare capacity for all I/O type cards of each category for project development. The sparing supplied shall be for “complete loop”; i.e. marshalling, power supply, terminals/prefab cables, relays and panel cut outs where appropriate, etc.

5.1.2 Communication networks and cables shall have a spare load capacity of 50% as a minimum.

5.2 DCS DESIGN CRITERIA

5.2.1 The DCS, for the proposed project shall be an extension of existing Honeywell DCS installed at main TDI project, which is @ 1 km away from the proposed location of the new PAC project. The same DCS with same
hardware and software shall be used and by employing distributed intelligence and database techniques, shall provide highly secure, safe, reliable, maintainable, effective process / safety monitoring and control of the production/ancillary facilities, from a permanently manned Master Control Room (MCR) or central control room. The proposed DCS for new PAC project shall not have any engineering station but the existing plant's DCS engineering station shall be used for the purpose of engineering of the new project. The proposed project shall use 2 nos. new Operator consoles, both of them with dual stack type 22" WLED screens, min. 1 no. of new redundant controller and all required IOs to carry out complete plant operation, monitoring, control and interlock/logic for the proposed PAC project. The detail specifications of existing TDI DCS system, including hardware and software BOM shall be given to all prospective BIDDERs.

5.2.2 There shall be 2 nos. of operator stations for operator. Each of these shall be independent of engineering station, i.e. in absence of engineering stations also these shall present the plant’s real time data and control/monitoring facility to both operators. Each of these operator stations shall be console based hardware. Each of this operator station shall be equipped with dual stacked 22” color WLED monitors with their own mouse, touch screen and operator & engineering keyboards. There shall be min. 1 no. of redundant C300 controller with all redundant central part hardware and non-redundant IO cards in required qty with 20% installed spare IO in each category. The detailed hardware, software requirement, make / model and type of various DCS components, etc. are given at relevant DCS specifications in this ITB. Bidder to strictly follow the same for this PAC project.

5.2.3 The system shall be 100% fault tolerant and dual redundant, except the redundancy at I/O cards levels for all open loops. This means, all central control processors, all communication processors and all other central rack and individual node's common cards, all the communication cards, networks and cables, and all closed loops I/O Cards, power supplies, etc. shall be 100% fault tolerant and dual redundant. Since redundancy at I/O card level for open loops is not envisaged, the failure of a single card from complete system shall not affect more than the I/Os supported by that particular I/O card. It means all the hardware except open loop I/O cards shall be 100% fault tolerant and dual redundant. All the hardware including control/communication processors, networks, cables, all type of system cards, all type of I/O cards shall be hot replaceable.

5.2.4 I/O cards’ type and channel density shall not exceed the specified type/limits and model at relevant section of DCS specification of this ITB. There shall be only Analog input, Analog output, and Digital Input and Digital Output type cards in the DCS. There shall not be any RTD or T/C input cards in the proposed DCS.

5.2.5 The scan time of all type of analog/digital input/output cards & DCS algorithm (Scan time means the sum of total time required for reading an input, running control algorithm and writing the output values) shall be better than the required scan time of the fastest running control/closed loop like anti surge algorithm in
the plant for various turbo machinery etc. However, in any case, this shall not be more than 250 milliseconds for any type of channel/loop.

5.2.6 There shall not be any engineering station in the proposed DCS hardware as the existing TDI project DCS system engineering station shall be used for performing all routine engineering related activities of this project. The proposed operator station and controller network shall be expanded from new control room/cabinet room of PAC project to existing control room/cabinet room of existing TDI project via redundant fiber optic network from two different routes and all PAC related DCS nodes of the DCS shall be integrated in the existing TDI project Honeywell DCS seamlessly. In routine, if engineering is required for PAC project related database, the same can be performed from any one of the operator station of the PAC from PAC control room, if the central database is not locked by any other operator station or engineering station of TDI project control room. Also the history of all parameters of all tags of new PAC project (including all installed and spare IO) shall be maintained at main engineering station/redundant PHD server of TDI project control room for all tags of PAC project, which shall become available to both operator stations of PAC control room.

5.2.7 All operator stations shall be OPC compliant without any upper limit on number of tags. However, if there is any specific limit applicable on the proposed system, it is to be specified at early stage. The minimum requirement of OPC is to transfer minimum 2000 tag per second to client application in real time mode, without affecting operator station/engineering station performance.

5.2.8 Complete system hardware/software and communication load shall not exceed 50% system load even after the complete implementation of project and running at pick load. This includes redundant control processor load also.

5.2.9 System shall have 60% spare margin in software memory/load for future spare addition without replacing/upgrading any existing system hardware/software at all the levels. System shall be capable of loading up to 100% without any overrun/degradation of performance, etc. System shall report all type of load limit alarms, diagnostic alarms up to channel level, communication alarms, system hardware failure alarm and other global information with alarm facility on engineering/operator station in real time with 1 second resolution.

5.2.10 The system shall support all various type of control/interlock/sequence algorithm and shall also support various high level programming language like Functional block diagrams and SFC (sequential function chart) in real time control application, in addition to standard control algorithms available in the DCS.

5.2.11 System shall support various Hourly/Shift/Daily/Monthly Reports/Logs, Totalizers reports, SNAP shot reports, etc. in Microsoft excel format only. The layout and type of reports/data, nos. of tags per report, etc. shall be as per owner’s requirement. All the operator station, engineering stations shall be equipped with MS Office license copy. System shall support min. 1000 tag historian software at 1 second interval.

5.2.12 Complete system hardware shall be certified for ISA G3 class corrosion level protection and shall be compatible with various RFI/EMI immunity as per IEC. The complete system shall be supplied with mainly 1200 mm (W) x 800 mm (D) x 2100 mm (H) (or as an alternate 600 mm (W) x 800 mm (D) x 2100 mm (H) for special requirement) standard RITTAL make panels with RAL7032 color shad. Marshalling philosophy and panel segregation for various type of I/O shall be as per Owner’s requirement, which is already described above.
5.2.13 Purchaser shall provide 110 V AC +/- 10% at 50 Hz -3/+1 Hz, UPS grade, floating/grounded power supply for complete DCS system at one location in cabinet room up to PDB panels in required no. of feeders. All digital input shall have 24 V DC interrogation voltage level. All Analog cards shall be capable of accepting 2 wire and 4 wire analog inputs and shall supply 24 V DC to field transmitters in 2 wire mode. All Digital output cards shall drive 24 V DC, OMRON make, 2 NO/NC, socket mounted, interposing relays with 230 V AC/5 Amp contact ratings. All field loads from Digital Output cards, including Solenoid valves, MCC switch gear signals, etc. shall be interfaced via these interposing relays only. The digital output cards driving the MCC related output relays (which are to be wired to MCC/Sub station) shall be accommodated in Digital Interface panel as specified above, separately to avoid any interference problems in low voltage instrument signal cables. The intrinsic safe barriers and marshalling shall be done in separate IS marshalling panels. There shall not be any interposing relays for field Digital inputs but all MCC digital inputs shall be wired to DCS via interposing relays.

5.2.14 There shall be min. 20% installed spare I/O cards in the proposed system of each category and installed spare must include relevant field wiring termination units, pre-fab cables, FTA/TBA, barriers, relays, etc.

5.2.15 While preparing DCS database, all configuration like graphic symbols, color codes, control/logic schematics, etc. shall be based on ISA standards and same as those of our main TDI project philosophy.

6.0 General Civil Work Requirement:

6.1 In general the following minimum civil work/cabinets/rooms are envisaged for instrument purpose.

   a. Central Control room with Central A/C, False Flooring (min. depth 800 mm) with size as per requirement and as per designed guide lines given in this document. The size will be as required and will be decided during detail engineering.

   b. Central Cabinet room with Central A/C, False Flooring (min. depth 800 mm) with size as per requirement and as per designed guide lines given in this document. The size will be as required and will be decided during detail engineering.

6.2 All the civil works pertaining to instrumentation, basic facilities, standards, constructions, etc. shall be strictly as per the Annexure-6.5 of this enquiry Document (which is containing detail civil engineering technical specifications for the complete project).