



Petrochemical Industries
Design & Engineering Co.

PROJ. NO. : 1203

SABALAN METHANOL PROJECT

COVER SHEET



OWNER :

SABALAN PETROCHEMICAL
INDUSTRIES CO.

PROJ. NO. : 89/S-G/102

ENGINEERING STANDARD SPECIFICATION FOR

HVAC Control System

DOCUMENT NO : **1203-00-HV-ESS-783**

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SABALAN METHANOL PROJECT

ESS for HVAC Control System

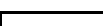
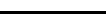
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1. PURPOSE

This specification together with the referenced codes and standards define the minimum requirements for Heating, Ventilation and Air Conditioning Equipment Electrical & Control System Panels of Sabalan Methanol Project including the following buildings:

- Main Control Building
- Main Substation
- Laboratory
- Administration
- Analyzer

2. STANDARDS AND CODES

BASEEFA	(BRITISH APPROVALS SERVICE FOR ELECTRICAL EQUIPMENT FOR FLAMMABLE ATMOSPHERES)
CENELEC	(COMITÉ EUROPÉEN DE NORMALISATION ELECTROTECHNIQUE)
EEC	(EUROPEAN ECONOMIC COMMUNITY)
EMC- Directive 89/336/EEC	"Electromagnetic Compatibility"
EN	(EUROPEAN STANDARDS)
EN 55022	"Specification For Limits And Measurement Of Radio Interference Characteristics Of Information Technology Equipment"
FM	(FACTORY MUTUAL)
IEEE	(INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS)
IEEE C37.90.1	"Surge Withstand Capability (SWC) Tests"
IEEE 802.3	"Local Area Network carrier Sense Multiple access with Collision Detecting (CSMA/CD) Access Method and Physical Layer Specification"
IEEE 802.4	"Token Passing Bus Access Method and Physical Layer Specification"
IEC	(INTERNATIONAL ELECTRO-TECHNICAL COMMISSION)
IEC 60751	"Industrial Platinum Resistance Thermometer Sensors"
IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4	"Electromagnetic Compatibility (EMC)"
IEC 61499-1, IEC 61499-2	"Function Blocks For Industrial Process Measurement And Control Systems"
IEC 61158-2	"Foundation Field-bus Standard For Use In Industrial Control Systems - Physical Layer Specification And Service Definition"
IEC 61131-3	"Sequential Function Charts"
IEC 61151	"Functional Safety – Safety Instrumented Systems For The Process Industry Sector"
IEC 60332	"Test On Electric Cables Under Fire Conditions"
IEC 60529	"Classification Of Degree Of Protection Provided By Enclosures"
IEC 60068	"Basic Environmental Testing Procedures"

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IEC-1000-4:	"Electromagnetic Compatibility For Industrial Process Measurement And Control Equipment"
IEC-60-605:	"Equipment Reliability Testing"
ISA	(INSTRUMENTATION, SYSTEM, AUTOMATION SOCIETY OF AMERICA)
ISA - S 5.1	"Instrument Symbols And Identifications"
ISA - S 5.2:	"Binary Logic Diagrams For Process Operations"
ISA - S 5.3:	"Graphic Symbols For Distributed Control/Shared Display Instrumentation, Logic And Computer Systems"
ISA - S 5.4:	"Instrument Loop Diagrams"
ISA RP 55-1:	"Hardware Testing Of Digital Process Computers"
ISA- S18.1:	"Annunciator Sequences And Specification"
ISA- S50.1	"Compatibility Of Analogue Signals For Electronic Industrial Process Instruments"
ISA- S84	"Application Of Safety Instrumented Systems (SIS) For The Process Industry"
IPS	(IRANIAN MINISTRY OF PETROLEUM STANDARDS)
IPS-M-IN-220	"Material Standard For Control Panels And System Cabinets"
ISO	(INTERNATIONAL STANDARD ORGANISATION)
ISO 9000	"Quality Systems"
NFPA	National Fire Protection Association
NFPA 70	"National Electrical Code"
PTB	(PHYSIKALISCH TECHNISCHE BUNDESANSTALT)
TIA	(TELECOMMUNICATION INDUSTRY ASSOCIATION)
TIA/EIA-485	"Electrical Characteristics Of Generators And Receivers For Use In Balanced Digital Multipoint Systems"
TIA/EIA-310 C	"19 inch Rack standard"
U.S. MILITARY	(U.S. MILITARY HANDBOOK)
U.S. Military Handbook -217	"Reliability Prediction Of Electronic Equipment"
U.S. Military Handbook -472	"Maintainability Prediction"

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3. GENERAL

- 3.1. Site conditions should be as mentioned in "Ambient and Site Condition & utility Data, 1203-00-PR-ESS-101".
- 3.2. Where two or more items of the same kind or category of equipment or devices are required, these items shall be products supplied by the same manufacturer and shall also be interchangeable when they are of the same size, capacity, performance, specifications and standard. Materials and equipment shall be catalogued products of reputable manufacturers regularly engaged in production of such materials or equipment and shall be manufactured of latest design and must have been in satisfactory commercial industrial use. No substitution of submitted materials and equipment.
- 3.3. No substitution of manufacturer and models of submitted materials and equipment that have been reviewed and accepted by the Client shall be implemented in supplying the items. Use of different type of items, shall be submitted to the Client for review and approval.

4. ELECTRICAL

- 4.1. For minimum requirements for design, manufacture, and quality control of low voltage cage induction motors refer to "1203-00-EL-MSS-521", Material Standard Specification for Low Voltage Induction Motors.
- 4.2. For general technical requirements for the design, fabrication, assembly and installation of electrical equipment, and materials on skid-mounted or package units refer to "1203-00-EL-MSS-524", Material Standard Specification for Electrical Equipment as Part of Package.
- 4.3. Each building will be equipped with a HVAC Electrical Panel which shall be supplied by vendor. Two feeders (3Ph+N, 400V, 50Hz) for each HVAC electrical panel will be provided. Separate earth cable will also be provided for each building. All electrical activities within the vendor battery limit and also supply and design of HVAC distribution boards and control panels shall be in vendor scope.
- 4.4. All motors shall be 3 phase, 400V, and star connection.
- 4.5. Motor insulation shall be class F, and temperature rise class B.
- 4.6. All electrical equipment shall conform to IEC recommendation.
- 4.7. Mains for power distribution panels will be 3Ph+N+E, 400V, 50Hz, Rated short time withstand current: 40 kA/1sec, Rated peak withstand current: 100 kA/1sec, Protection degree: Enclosure: IP41 & Partitions between functional units: IP3X
- 4.8. HVAC panel of each building shall be metal enclosed with permanently installed components. All component of the panel shall be sized and selected in due consideration of site condition, safety, and type of loads. HVAC panels shall be MCC type, designed for 40 kA R.M.S. short circuit current; main busses shall be suitably rated and insulated with flame retardant non hydroscopic insulation. HVAC panel shall be floor mounted. Panels shall comprise single dedicated sections for power distribution and automatic control of the HVAC equipment. Protection degree for indoor HVAC power distribution panels shall be IP41 and for outdoor panels IP54
- 4.9. Supply feeder shall be completely disconnect-able by a load break switch in the HVAC package panel. Also it shall be equipped with ammeters and voltmeters.
- 4.10. All outdoor and indoor electric equipment shall have protection type IP55 & IP41 respectively.

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- 4.11. All cable entries to electric equipment shall be via cable gland. All cable glands shall be double compression nickel plated brass and shall be supplied by vendor.
- 4.12. All interconnection cable within package shall be supplied by vendor. Cable list, cable interconnection drawing and cable rout drawings shall be furnished by vendor. A building equipment layout drawing is attached.
- 4.13. The grounding lugs shall be provided on skid of each part of the package.
- 4.14. Starter and Feeder Modules:
 - 4.14.1. Unless otherwise specified, the motor starters shall be of direct-on-line type in accordance with the requirements of IEC 60947-4-1.
 - 4.14.2. For motor starters, the following type of main interrupt devices within a three stage combination starter is basically acceptable
 - a) Moulded case circuit breakers, (magnetic trip adjustable setting) or HRC fuse links provided with striker pins.
 - b) Electrically operated air contactor.
 - c) Thermal overload relay.
 - 4.14.3. The starter shall also include control devices and measuring instruments.
 - 4.14.4. Outgoing feeders shall be moulded case circuit breakers fitted with protective and indicating devices. Outgoing feeders with rating of 100A and above shall be provided with one ammeter and related selector switch or three ammeters.
 - 4.14.5. The circuit breakers / thermal overload relays shall be provided with a trip auxiliary contact to open the contactor when an overload / over current occur.
 - 4.14.6. Motor contactors shall be of the magnetically operated air-break type rated for category AC3 according to IEC 60947, unless stated otherwise in the requisition, (e.g. AC4 where inching or reversing is required) and the maximum continuous current of the respective starter size. In addition to the load contacts and the auxiliary contacts required to operate the starter, a minimum of 1 N/O + 1 N/C auxiliary contacts shall be provided, wired to the terminal strip.
 - 4.14.7. Bi-metallic overload relays of the three-phase, ambient temperature compensated and adjustable type shall be used unless stated otherwise in the requisition. Uniform trip-characteristics shall be obtained between -5°C and 50°C. Adjustment range, preferably calibrated directly in Ampere, shall be at least $\pm 15\%$ of the rated motor current. Reset shall be via a door-mounted push-button. For motor starters up to 30kw thermal overload relays with direct heating element would be acceptable, for motor starters 30kw and above current transformer operated overload relays shall be provided.
 - 4.14.8. Control scheme of starters and feeders shall be manufacture's standard, unless otherwise stated in the requisition.
 - 4.14.9. Each starter module shall be equipped with one red (ON), one green (OFF), one orange (FAULT) pilot light in the door.
 - 4.14.10. Starters for motors rated 4KW and above shall be provided with one ammeter and shall be fitted with a 1 A secondary current transformer for remote indication of motor current.
 - 4.14.11. Starter and feeder modules of identical rating and control scheme shall be fully interchangeable.
 - 4.14.12. Short circuit protection coordination shall be type "C" as per IEC 60947.

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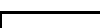
4.14.13. Starters for motors rated above 22 KW shall be provided with instantaneous earth fault relay, supplied from a core balance current transformer, which will set to trip the contactor at 10% of the full load motor current.

4.14.14. Thermal overload relays of all three phase contactors shall be equipped to trip when a single-phasing condition develops.

4.14.15. MCCB'S shall have trip free mechanism from the operating handle.

5. CONTROL SYSTEM

- 5.1. Instrumentation shall be in accordance with 1203-00-IN-ESS-003, ESS For General Packages.
- 5.2. The minimum requirements for the design and installation of Logic Systems, which will be based on Programmable Logic Control (PLC), should be as per 1203-00-IN-ESS-003, ESS For General Packages.
- 5.3. The general requirements for the material of control panels and system cabinets to be used in the current project should be as per 1203-00-IN-ESS-003, ESS For General Packages.
- 5.4. The air conditioning, ventilation and pressurization systems shall be monitored by automatic control. The HVAC control system shall be electronic microprocessor based. The operator interface will be achieved from the key board and video display unit.
- 5.5. The automatic control systems shall perform the control sequences expected for the operation of the various HVAC systems by means of direct digital controllers (DDC) microprocessor based.
- 5.6. The systems include mainly extended digital controllers, terminal controllers, and operating devices such as automatic operating valves, dampers actuators, etc.
- 5.7. The expanded digital controllers shall be multi-regulators with hardware and software flexibility such as to be usable in the complete range of the design applications for which they will be used. They shall operate as an independent regulation device and all regulation functions are to be guaranteed without need of additional supervising devices.
- 5.8. During operation, it shall be possible to get all necessary information from the display incorporated in the device, complete of keyboard. From the display it shall be possible to read and modify the following parameters:
 - Analogue and digital inputs;
 - Regulation modules outputs;
 - Regulation modules working set-point;
 - Pulse counters values.
 - Day-night and clock functions.
- 5.9. It shall be possible to set the outputs in auto/manual position and control them one by one.
- 5.10. Dedicated limit switches shall be provided at motorised dampers, fire and/or fire/smoke dampers for open and close status signal; switches shall be operated by actual position of damper blades. Built-in limit switches of damper actuators shall not be used for the above mentioned purpose.
- 5.11. Cables used shall be stranded conductors, twisted pairs, insulated and shielded, flame retardant, designed for automatic control systems. Multiple pair cables used for digital signals shall have overall shield. Multiple pair cables used for analogue signals shall have individually shielded pairs plus overall shields. All cables shall be laid in conduits

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or cable trays. Cables in exposed areas and subject to mechanical harm shall be installed in open-conduit system. Cables installed in external process areas shall be armoured type.

- 5.12. The HVAC control system shall be capable of discriminating and processing incoming digital and analogue signals into output action to achieve the safe execution of control and monitoring functions. This shall include:
- Process stream control of air temperature.
 - Sequencing of control devices for regulating dampers and cooling/de-humidification.
 - Set point adjustment of field devices.
 - Manual and automatic selection of duty/standby equipment
 - Permissive signals for dependent equipment
 - Sequence start-up of the systems
 - Safety interlocks between equipment upon loss of flow
 - Room pressure monitoring
 - Equipment operating status: running; stopped; fault, “not available” feedback from LFAP (Local Fire Alarm Panel).
 - Fire Damper status: open (closed feedback from LFAP as required for input to fan logic).
 - Control Damper status: open, closed and modulating
 - Air filters differential pressure monitoring and alarm.
 - Packaged equipment status: running; stopped; fault, “not available” feedback from LFAP.
 - Starters for HVAC drives including fans and refrigeration compressors shall generally be located in the MCC. The power supplies shall be provided by others and fed from the MCC directly to the HVAC motors.
 - Opening and closing of HVAC fire and gas dampers is controlled directly by the control system. Fire and gas damper “closed” status indication will be hard wired directly to the control system.
- 5.13. HVAC common fault alarms shall be provided from each HVAC panel to the FCS.
- 5.14. HVAC control system will send a low space pressure signal to FCS.
- 5.15. Each building is equipped with one flammable gas detector. Detector will send two commands to F&G panel, for 1st & 2nd gas detection steps. F&G panel will send 2nd gas detection step signal to the HVAC control system. At this stage, fresh air dampers will be closed, & miscellaneous exhaust fans will be shutdown
- 5.16. LFAP will send a fire signal to HVAC control system. All HVAC equipment should shutdown, & all fire or motorized dampers should close at this time.
- 5.17. The buildings general diagrams will be submitted to the vendor. These information will be shown on the diagrams:
- HVAC Electrical consumer list of the building including consumer list & rating, & control feature of the consumers,
 - HVAC cause & effect diagram, to show the interlocking of HVAC equipment,
 - HVAC system instrumentation & control idea.
- 5.18. If a control voltage required, it shall be produced inside the panel and shall be protected with a suitably rated fuse.

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6. VENDOR LIST FOR INDUSTRIAL LV ELECTRIC MOTOR

Motor's vendors should be selected from specified approved list on requisition.

7. PAINTING

Priming and painting of equipment, steelwork, and pipe work shall confirm the requirements of Painting Specifications.