ARAB ENGINEERING BUR

5 CONTROL PANELS AND CONTROL ROOM HARDWARE

5.1 GENERAL

5.1.1 Scope

1 This Section covers control panels for work of the ICA Sections, and all unit panels unless modified under other Sections.

2 For voltages and frequencies, regulations and requirements of Kahramaa and relevant authorities should be taken into account.

3 Related Sections and Parts

This Section
Part 1, ... General

5.1.2 Reference Standards

1 The following standards are referred to in this Part:

BS 88.....Fuses
BS 546.....Electrical outlets
BS 7430 .....Code of practice for earthing
EN 60898 .....Design of MCBs
EN 60529, ...Ingress protection
EN 60439 .....Low voltage switchgear and controlgear assemblies
EN 50288-7 .....Code of practice for Instrumentation and control cables

5.1.3 Submittals

1 Submittals shall be in accordance with Part 1 of this Section.

2 Shop Drawings. The ICA Subcontractor shall submit shop drawings for all control panels, including details for the following items, as applicable:

(a) electric power wiring circuits and schematics
(b) air supply piping schematics
(c) electric signal wiring circuits and schematics
(d) pneumatic signal tubing schematics
(e) fabrication drawings
(f) details of all panels accessories
(g) listing of all panel mounted (both front and rear) instruments
(h) control panel layouts and nameplate inscriptions

ARAB ENGINEERING BUR

3 The submittal shall be subject to approval by the Engineer. The Contractor shall submit the final documentation based on the Engineer's comments. The Engineer's comments/approval shall be issued to the Contractor within 21 calendar days of the submittal.

4 Factory Test Reports. The Contractor shall submit from the equipment manufacturer, or his authorised representative, a certified test report in accordance with the requirements of the relevant test procedure.

5.1.4 Quality Standards

1 All equipment furnished shall be of a design that has been used in similar applications and shall be demonstrated to the satisfaction of the Engineer that the quality is equal to the specified equipment. The manufacturer shall have successfully designed and furnished similar sized or larger panels for a similar application.

2 The Engineer or his representative may inspect the panel at the factory. The Contractor shall notify the Engineer at least three weeks prior to shipment so that the factory inspection may be arranged. Factory inspection will be made after the manufacturer has performed satisfactory checks, adjustments and tests. Approval of equipment at the factory only allows the manufacturer to ship the equipment to the site and does not constitute final acceptance.

5.1.5 Approved Manufacturers

1 Control panels and all the associated hardware shall be provided by approved, prequalified manufacturers and suppliers designated in the Project Specification.

5.1.6 Delivery, Storage and Handling

1 Control panels shall be assembled and shipped in sections, properly packed to prevent damage during shipment. Panel sections shall facilitate easy handling and Site installation. Panels and associated instrumentation shall be handled carefully to avoid damage. Proper lifting and handling equipment and accessories such as grounding straps for handling electronic cards, shall be used.

2 ICA equipment shall only be delivered to Site just prior to their installation to minimise the possibility of damage. Delivered instrumentation shall be protected and not scattered or left unprotected on the Site.

3 Materials and equipment not required for immediate installation shall be stored in a separate store protecting them from shock, weather, dust and damage from chemical and construction material

4 ICA equipment shall not be stacked unless crated.

5.2 PRODUCTS

5.2.1 Panels General

1 Control panels shall be free standing and floor mounted cabinets of console or desk pattern. Console layouts shall permit the operator to readily observe all instruments.

ARAB ENGINEERING BUR

2 The panels shall be manufactured to a high standard of quality in terms of visual appearance, colour and finish. The panels located in the main control room shall have an appearance and quality suitable for a pumping installation environment.

3 The panel design including colour, style and appearance and detailed specifications of panel instruments shall be submitted to the Engineer for approval prior to manufacture.

4 Control voltage. Panel instruments and controls shall operate from 110 V a.c. power supply, unless otherwise specified in Project Specification. A separate 24 V d.c. circuit shall be provided for the indicating lamps and panel instruments, as necessary.

5 Where specified in the Project Specification, panel space shall be provided for instruments supplied by others. Installation and wiring of such instruments shall be carried out by the panel manufacturer. Coordination of instrument delivery shall be the Contractor's responsibility.

6 Unit Control Panels for mechanical and electrical equipment can be the manufacturers standard panels. Details of such panels shall be submitted to the Engineer for approval, prior to manufacture. The Contractor shall be responsible for interfacing the unit control panels with the main control panel or central control system, as necessary.

7 All PLC control panels shall be installed in Air-conditioned room, unless otherwise stated in the project specification.

5.2.2 Panel Construction

1 All consoles and auxiliary cabinets shall be fabricated of cold rolled sheet-steel and be of rigid and stable construction without bows and ripples. The front surface shall be flat and the corners and edges shall be rounded to give a smooth appearance.

2 The panel construction/fabrication shall meet generally the requirement as specified in section 21 Electrical Works Part 02,MV Factory Built Assemblies (FBA's) clause 2.2.1 2 construction item no. c

3 Panels shall be of sufficient size to enclose all the panel instruments with ample interior clearance to allow for installation and maintenance of instruments. Annunciator displays shall be located in the top portion of the console assembly. Control panels shall be of sectional design with provision for easy extension. Pushbuttons shall be provided to enable acknowledgement and resetting of alarm annuciators and lamps on the console.

4 Panels shall be formed of IP55 panel sections and each enclosure shall be a maximum of 2100 mm high, 800 mm wide and 600 mm deep unless otherwise specified in the Project Specification. Each section shall be fully enclosed including the top and bottom with no visible seams on the front. Externally visible screws and bolts shall not be acceptable.

5 Each panel section shall be provided with rear access door if the panel is rear access type. Door hinges shall be knuckle type. Handles and other hardware shall be chromium plated. Where necessary, removable access covers secured by quick release fasteners shall be provided to facilitate easy maintenance.

6 Undrilled gland plates shall be fitted at a sufficient height above the floor level to provide easy access under the gland plate. Suitable side covers shall provide access to the gland plates and also provide the specified ingress protection.

ARAB ENGINEERING BUR

7 Electrical general purpose outlets for test and repair purpose shall be provided in all consoles and cabinets. The outlets shall be in accordance with BS 546.

8 All consoles and auxiliary cabinets shall be ventilated mechanically or by natural circulation to maintain the internal equipment working temperature to below 10°C above ambient.

9 Panel lighting shall be provided to ensure adequate illumination for carrying out delicate adjustments or repairs on small items of equipment.

10 Finish. After fabrication, all external welds must be ground smooth. The entire unit shall be thoroughly degreased, then filled and sanded. At least one coat of synthetic primer shall be applied, baked on, and sanded. This first coat shall be followed by two coats of baked-on synthetic enamel. The first coat shall be sanded after baking. The final two coats shall provide a glossy or semi-matt finish to a colour and finish approved by the Engineer. The average overall finish shall be at least 1.25 micrometres in thickness. Any minor damage to the finish during installation shall be touched up at Site, provided such remedial works are to the approval of the Engineer.

11 Panel Earthing. A copper earth bar shall be provided within the panel for earthing of the panel, all the panel instruments and the cables to BS 7430, code of practice for earthing.

12 Panel Isolation. Isolating switches shall be provided for all incoming power supplies. These switches shall be clearly identified, labelled and suitably protected from inadvertent operation.

13 Provide separation wall between adjacent compartments /sections of the panel with same material of panel construction. The holes for interconnecting cables in the separation wall shall be of minimum size necessary. All such holes shall be filled with insulating grommets.

14 Panel Protection. MCBs to BS 3871, shall be provided for the distribution of electrical power within the panel. The MCBs shall be arranged to minimise disruption to the equipment operation and also to prevent unsafe operating conditions. Power supplies from control panels shall conform to BS 5486.

5.2.3 Panel Wiring and Termination

1 Panel wiring shall be carried out in PVC insulated multi-strand cable of adequate grade and rating. Wiring within each panel shall be done in a structured manner, grouped and supported to give a neat appearance.

2 110 V a.c. wiring shall be colour coded with black-unswitched live phase, red-switched live phase, white-neutral and green-ground. Signal and d.c. wiring shall also be neatly segregated under an approved colour coding scheme. Wiring shall be bundled and laced or tied with plastic ties and supported to prevent ragging or damage.

3 All control and auxiliary cabinets shall be manufactured and assembled with all internal wiring connected to terminals blocks, requiring only connection to external wiring at Site.

ARAB ENGINEERING BUR

4 Separate terminal blocks shall be provided for incoming and outgoing analogue and digital signals and power supply connections. Each terminal block shall be clearly identified and labelled. Layout shall permit convenient access to terminals and wires and enable ferrule numbers to be easily read. Terminals shall be at sufficient height from the cable gland to facilitate easy routing of wires. Terminals shall clamp the wire between two plates using a captive screw. Where wires are terminated on screw terminals, insulated crimp spade lugs shall be used.

5.2.4 Instrument Labelling

1 All panel instruments shall have engraved nameplates showing their tag number and service in the English language.

2 Materials for nameplates shall be selected in accordance with the relevant environmental conditions and shall be of non-metallic material, with black inscription on a white background.

3 Name plates on control panels shall be mounted on or near the relevant instruments to ensure clear identification

4 An additional nameplate engraved with the instrument tag number only, mounted at the rear of the panel, shall be provided for each panel mounted instrument. These plate shall be attached to the instrument, the panel or instrument support near the instrument.

5 For panels where opening the circuit breaker does not shut off all of the power, the following sign shall be provided:

"THIS CABINET CONTAINS CIRCUITS SUPPLIES FROM EXTERNAL SOURCES." "OPENING THE CIRCUIT BREAKER DOES NOT TURN OFF ALL POWER".
Letters shall be 6 mm high, red colour on a white background.

5.2.5 Control Desk

1 SCOPE

(a) This section defines the minimum requirements for the manufacture, supply, inspection, installation, testing of control desks or consoles required to be used on this Contract. Control desks or consoles shall be of the custom made industrial type and material for construction shall comply with MCC's panel construction as specified in QCS Section 21 Part 2. The requirements for lockable doors, ventilation fans, anti-condensation heaters etc. shall complied with as specified in this section.

2 CODES AND STANDARDS

(a) The following list of standards indicates the minimum requirements. Any other standards not listed below or elsewhere in these documents shall be subject to review and approval by the Engineer.

EN 527-1 Office furniture, Work tables and desks

EN 1335-1 Office furniture, Office work chair

ISO 26800 Ergonomics, General approach, principles and concepts

3 SITE CONDITIONS

ARAB ENGINEERING BUR

(a) It is the Contractor's responsibility to furnish and install the control desks or consoles to withstand and operate properly under the prevailing ambient conditions as described in the General Technical Requirements. This Specification serves as a guideline to the Contractor. The Contractor shall include all the necessary equipment based on his previous experience on similar installations. Control desks or consoles shall be able to operate continuously without their normal physical and functional reliability being affected by the tropical environment.

4 DESIGN CONSIDERATIONS AND FABRICATION REQUIREMENTS

(a) The control desks and consoles shall be designed so that it is comfortable to use, thus enabling operators to maximize their efforts, incorporating the latest principles of ergonomic design, as described in ISO 26800.Monitors (and instruments if applicable) shall ideally be arranged so that they are all are equidistant from the operator's eyes. Similarly, all the associated controls should be equidistant from the operator's shoulder pivot points. This arrangement avoids any body movement, but demands a convex panel in both planes. If this is not a practical proposition then flat panels shall be provided which are angled to each other and which require only some limited body movements, such as bending the trunk or pivoting a chair, to operate the keyboards or view the VDUs (monitors) .The display area shall be divided either vertically or horizontally. Vertical division shall be utilized for mounting VDUs. If small instruments are fitted then parallax errors may be introduced are mounted above or below eye level, although this danger can be avoided by using those with digital displays. In most cases horizontal division is the simplest and gives the greatest area of panel space free from parallax errors within the operator's control. When a large number of instruments or controls are involved, horizontal and vertical division shall be combined. The desk shall then become a winged console.

(b) Sufficient rack space shall be provided in the base to enclose all control desk equipment and permit access for installation and maintenance purposes. Cable entry shall be via floor mounted cable gland plates with facility to route cables through desk sections as required. All servers/works stations shall be placed inside the control desk with lockable doors. Ventilation louvers and fans are to be fitted in the desk for sufficient air circulation.

5 PANEL LAYOUTS

(a) Where indicators ,Monitors and controls are to be fitted on panels then the actual arrangement must receive careful consideration. When designing the layout, the center of the various instruments should be arranged so as to be opposite the operator's eye position. Controls should be mounted below shoulder level. Space above this level shall preferably be utilized to house indicators, or infrequently used controls.

6 DESK SIZING

(a) The design shall such that when the operator is sitting correctly (trunk erect, but shoulders relaxed) elbows shall be about level with the working surface. Desks used for keyboards shall be slightly lower than one used for general duties, so as to bring the actual working surface to the correct level. Draw out type tray arrangement shall be provided for keyboard and mouse. Care shall be taken that the underside of the desk will allow the thighs of an operator to fit comfortably between it and the top of the seat; a minimum of 200 mm clearance shall be allowed. The front surface shall be flat and the corners and edges shall be rounded to give a smooth appearance

(b) Desk thickness shall be as specified in Section 21 Part 2 MV Factory Built Assemblies (FBA's).

ARABENGINEERING BCR

(c) Generous leg space shall be provided to ensure operator comfort. It shall be possible for the operator(s) to move easily to and from the desk to this end a minimum a minimum of 400 mm clearance is to be provided.

7 SEATING

(a) The seat height shall be no higher than the length of the lower leg when it forms a right angle with the upper leg and the foot is resting flat, to ensure operator comfort,. An adjustable seat shall be provided to achieve this. If this leads to a large difference between the eye positions of short and tall operators then as an alternative a fixed height seat shall be provided which will suit the tall operator together with an adjustable foot rest for the use of others.

8 CONSTRUCTION

(a) Materials of construction shall generally comply with the MCC's panel construction requirements specified in the Section 21 Part 2 MV Factory Built Assemblies (FBA's). Consoles shall be built on a plinth fabricated from rolled steel. They shall consist of a closed skeletal steel or forged aluminium framework with rigid panels screwed or bonded in place or alternatively hinged or fixed with quick release fasteners . Consoles shall be prefabricated in the factory. Assembly on site is acceptable but on site fabrication is not acceptable.

(b) Console sizes shall be determined by equipment sizes, number of operators. Where practicable, the unit shall be designed in individual modules, which are then bolted together. Apertures shall be sized and finished to accept specific equipment and/or fitted with standard rack mount fixings. All components shall be protected against corrosion by means of passivation, fusion bonded epoxy coating or high grade epoxy factory applied spray baked finish. Brush painting is not acceptable. Color shall be a RAL shade as directed by the Engineer. Areas subject to abrasion or wear shall be suitably protected with replaceable rubber mats, stainless steel finishes, or similar.

(c) The desk or console IP rating shall be IP 54 as a minimum or higher to match the grade of any installed equipment.

5.3 INSTALLATION

5.3.1 General

1 Installation, testing, calibration, validation, commissioning, and instructions shall be in accordance with Part 1 of this section.

5.3.2 Site Inspection

1 Each instrumentation item shall be checked by the Contractor upon receipt for compliance with purchase specifications, damage, shortage and shortage of components. Items shall be repaired, replaced or the vendor notified of non-conformance as instructed by the Engineer.

5.3.3 Testing and Commissioning

1 All control panels and instruments shall be tested and commissioned by the Contractor according to procedures outlined in Part 1 of this Section, prior to final inspection and acceptance by the Engineer.

2 Calibration of all panel instruments shall be tested and corrected as necessary.

ARAB ENGINEERING BUR

3 Panel wiring shall be tested to ensure that wiring is done as per the submitted wiring schedules. Correct identification on ferrules and tag plates shall also be verified.

4 Panel power supply voltages shall be checked to ensure that they are within the operational limits of each instrument.

5 Damaged or defective instruments and equipment shall be identified and replaced.

END OF PART

ARAB ENGINEERING BUR