

**OMAN WASTEWATER
SERVICES COMPANY S.A.O.C**



**الشركة العمانية
لخدمات الصرف الصحي ش.م.ع.م**

OMAN WASTEWATER SERVICE COMPANY

ELECTRICAL STANDARD SPECIFICATION

SECTION 06

LV MOTOR CONTROL CENTERS

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1-0 SCOPE

This Specification defines the requirements for the design, construction, inspection and testing of Low-voltage Switchgear and Control gear Assembly, to be installed within Oman Wastewater Services Company projects.

2-0 STANDARDS SPECIFICATIONS

The design, construction, inspection and testing of the Assembly shall comply with all relevant Statutory Regulations, and the latest editions (current at the time of Tender) of all relevant British and Harmonised European Standards, including:

- a) British Standard:
 - BS EN 60439 - Specification of Low Voltage Switchgear and Control Gear Assemblies
 - BS EN 60204 - Safety of Machinery. Electrical Equipment of Machines
 - BS EN 60947 - Specification for Low-Voltage Switchgear and Control gear
 - BS EN 60529 - Specification for Degrees of Protection Provided by Enclosures (IP code)
 - BS 7671 - Requirements for Electrical Installations. IEE Wiring Regulations. Sixteenth Edition and Associated Guidance Notes Published by The IEE and
 - BS EN 60079 - Code of Practice for the Selection, Installation and Maintenance of Electrical Apparatus for use in Potentially Explosive Atmospheres.
 - BS EN 7430 – Code of Practice for Earthing
- b) All relevant IEC recommendations relating to electrical equipment
- c) National Fire Protection Association (NFPA)
- d) Omani Electrical Standards

The Assembly shall also comply with the particular specification.

Where the particular specification imposes additional requirements to a British or harmonised European Standard, the requirements of the particular specification shall prevail.

Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.

The Manufacturer shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the Assembly.

3-0 SERVICE AND ENVIRONMENTAL CONDITIONS

The MCC shall, in all respects, be suitable for operation under service conditions stated on Electrical Standard Specification – Section 01

4-0 ELECTRIC SYSTEM

- 4-1 The electrical arrangement of the MCC's, protection, metering, control, interlocking, intertripping etc. shall be shown on the MCC single line diagrams.
- 4-2 The MCC electrical rating (voltage, current, frequency, fault current, etc.) shall be quoted on the basis of the starters being housed in enclosures under natural ventilation conditions. The ratings of units shall take full account of all heat sources within the enclosure.
- 4-3 MCC's Shall be suitable for operation, without deleterious effect, with variations of voltage and frequency.
- 4-4 Transient voltage depressions down to 80% of rated voltage shall not affect MCC performance.

5-0 STRUCTURAL & MECHANICAL REQUIREMENTS

- 5-1 The motor control centres shall be switchboard type construction. MCC cubicles shall be metal-enclosed, free standing, floor mounting, flush fronted and arranged to form a single structure with a common busbar assembly.
- 5-2 Each motor starter, feeder switch and fuse unit, etc. shall be housed in a separate compartment within the MCC.
- 5-3 The MCC structure, including doors and panels, shall be capable of withstanding the internal pressures by faults within the structure without danger to operating personnel.
- 5-4 Shipment shall be made in sections to facilitate field handling, and the shipped sections shall be joined together to form a complete back-to-wall or back-to-back unit assembly.
- 5-5 Vertical sections shall contain adequate space for connecting the incoming power supply circuits, outgoing branch circuits, motor circuits and control circuits to terminals, horizontal and vertical power bus bars, horizontal earth bus, circuit breakers, magnetic starters, contactors, control stations, pilot lights, timers, terminals, transformers, panels, relays, ammeters, voltmeters, meter switches, earth leakage protection, space heaters, thermostats, fans, vents, screens, filters and switches.
- 5-6 The vertical sections shall be fabricated from heavy gauge steel (minimum thickness of 1.5 mm), with uniform surfaces.
- 5-7 Holes shall be provided in the structural base of each section for anchor bolts.
- 5-8 Sections shall contain wireways, brackets, supports, plates, trims, barriers, gaskets, doors, base channels, lifting angles and hardware.
- 5-9 Horizontal wireways (top and bottom) shall extend through the width of each section.
- 5-10 Wire way openings shall be provided between sections with closing plates on the end sections.
- 5-11 Each vertical section shall contain its own individual full height vertical wire way separated from the vertical bus by a metal barrier, and also separated from the individual control units by the side pan of the control unit.
- 5-12 Wire ties shall be furnished in the vertical wireways to group and securely hold the conductors in place.

- 5-13 A separate cover shall be provided on the vertical wire way.
- 5-14 Control units shall be isolated from one another by horizontal steel barriers.
- 5-15 Front to rear bracing shall not interfere with the cable entrance areas.
- 5-16 Hinged doors shall be equipped with screwdriver operated quarter-turn latches that catch automatically when the door is pushed closed. Large doors shall be equipped with additional latches.
- 5-17 Provision shall be included to add a vertical section on either end of the line up in the future.
- 5-18 The power supply compartment shall be sized to accommodate the incoming power conductors. The compartment shall be located at the top or bottom of the vertical section as shown on the Drawings. The power compartment shall be covered by a hinged door and shall be held closed with quarter-turn pawl type latches.
- 5-19 Busbars shall be provided for the power and earth systems. When shown on the Drawings, provide full length full capacity and insulated neutral bus and cable connectors. Bus joints shall be connected with bolts, nuts and spring washers.
- 5-20 The main horizontal power bus shall be located in the centre or near the top of each section, joined together to form a continuous bus for the full length of the motor control centre.
- 5-21 The horizontal power bus shall be copper and the current rating shall be as shown on the Drawings.
- 5-22 The vertical power buses shall be copper full height and rated for the section total load. The minimum current rating for the vertical power buses shall be 300 amperes or as specified in the Project Documentation. Small openings in the vertical barriers shall permit the plug-on control unit contacts to pass through and engage with the vertical bus bars. Unused plug-on openings in the vertical barriers shall be equipped with plastic snap-in closing plugs.
- 5-23 MCC and busbars shall be arranged to permit future extension at both end.
- 5-24 The MCC structure shall be provided with barriers to prevent transfer of ionized gases between compartments.

- 5-25 Interlocks, busbar shutters, covers, etc. shall be provided to prevent incorrect or unsafe operation.
- 5-26 MCC's shall be designed and constructed to facilitate inspection, cleaning, repair and maintenance and to ensure absolute safety during operation, inspection and maintenance.
- 5-27 Similar parts and components shall be interchangeable wherever practicable.
- 5-28 Enclosure of degree of protection shall be as stated on the one line diagram.
- 5-29 Structural arrangement of MCC vertical tiers shall permit rearrangement of compartment sizes after installation on site.
- 5-30 Provide 10% unequipped spare cubicle space for future use.

6-0 MOTOR STARTERS

- 6-1 Motor starters shall be direct-on-line starting unless otherwise stated. All starters shall be arranged for remote control in addition to any controls specified at the MCC.
- 6-2 Motor starters shall be withdrawable type.
- 6-3 Motor starters shall be provided with:
 - 6-3.1 Protective devices affording thermal overload and single phasing protection, and instantaneous ground fault relays for motors rated 37kW and above,
 - 6-3.2 Stop pushbutton, mounted flush with the front of the starter to prevent inadvertent operation,
 - 6-3.3 Overload reset pushbutton operable without opening the starter door,
 - 6-3.4 Red "running" indicator light.
- 6-4 Withdrawable starters shall be provided with suitable interlocks to prevent chassis withdrawal or insertion when the starter isolator is in the "on" position.

6-5 The motor starter isolator shall be padlockable in the open position.

7-0 BUSBARS

7-1 Busbars and connections shall be manufactured from hard drawn copper.

7-2 Each busbar shall be completely insulated.

7-3 Busbars shall be of same cross sectional area throughout the length of the MCC.

7-4 All busbars shall be marked to indicate the phase colouring.

7-5 An earthing busbar shall be provided along the full length of the MCC structure with provision for earth cable connections at each end.

8-0 EARTHING

8-1 All metallic non-current carrying parts of the MCC shall be bonded together and connected to the MCC earth busbar.

8-2 Doors having components mounted on them shall be bonded to the main structure by means of flexible copper connection arranged so that it cannot be trapped as the door is opened or closed.

8-3 Withdrawable parts shall be effectively earthed until they are completely withdrawn with all power and control connections disconnected.

9-0 SECONDARY WIRING

- 9-1 Secondary wiring shall be XLP insulated 600V grade.
- 9-2 Secondary wiring within the MCC shall be securely held in position.
- 9-3 Secondary wiring layout shall permit alterations to individual circuits without requiring shut down of the complete MCC.
- 9-4 Bus wires for control, motor heaters, etc. shall be run within the MCC.
- 9-5 Wiring identification shall be by numbered, and/or lettered, ferrules, of insulating material adjacent to the terminals.
- 9-6 All wiring of external connections shall be brought out to individual terminals on a readily accessible terminal block.
- 9-7 Wiring connections to door mounted equipment shall be carried out using flexible cables, which shall be loomed, wrapped in flexible PVC conduit and be firmly clamped at both ends to prevent movement at terminations.
- 9-8 The minimum cross-sectional area of the secondary wiring shall be 1 mm².

10-0 CABLE TERMINATIONS

- 10-1 Cable terminating facilities and terminals shall be suitable for the specified cable type, gland and conductor size.
- 10-2 The following cable terminating facilities shall be provided:
 - Adequate space to be able to terminate the specified cables.
 - Undrilled gland plates for top entry cables.
 - Direction of cable entry shall be as stated on the MCC single line diagram.
- 10-3 Cable support shall be provided (where practicable) by the vendor to avoid undue strain on the cable termination.
- 10-4 Termination of single core cables shall be brought to an insulating or non-magnetic gland plate.

11-0 AUXILIARY SUPPLIES

- 11-1 Auxiliary supplies (control, indication, heaters, etc.) shall be in accordance with the MCC single line diagram.
- 11-2 Bus-wired auxiliary supplies shall be individually protected by fuses within each motor starter.
- 11-3 Anti –condensation heater supplies, for starters and motors, shall be fed from a separate external source.

12-0 INSTRUMENT TRANSFORMERS

- 12-1 Voltage and current transformers shall be provided. They shall be of the appropriate ratio, output, class and accuracy for the protection and metering being used.
- 12-2 The vendor shall provide details of ratio, output, class and accuracy for all instrument and protection transformers in his supply.
- 12-3 The secondary windings of instrument transformers shall be earthed at one point, with provision for attaching test links.
- 12-4 Current transformers shall be rated to withstand the thermal and magnetic stress resulting from the maximum available through fault current.
- 12-5 Bridging terminals for current transformers shall be provided at the outgoing terminals where external connections are required.
In addition, terminal blocks shall be provided to permit secondary injection tests on protective relays.
- 12-6 Voltage transformer primary and secondary windings shall be protected by fuses.
- 12-7 Current and Voltage transformer nameplates shall be fixed in a position so that details can easily be read when fitted in the cubicle.

13-0 METERING, PROTECTION, CONTROL AND INDICATION

- 13-1 Metering, protection, control and indication shall be provided as shown on the MCC single line diagram.
- 13-2 Meters and relays shall be flush mounting and fitted on the front of the MCC.
- 13-3 Meters and relays shall be capable of withstanding, without damage, the secondary currents associated with the maximum available through fault current.
- 13-4 External zero adjustment shall be possible on all indicating instruments to facilitate adjustment without dismantling the instrument.
- 13-5 Start/Stop control of motors shall be carried out remotely from starters.

14-0 ANTI-CONDENSATION HEATERS

- 14-1 Heaters suitably rate to prevent condensation shall be provided within the MCC cubicles.
- 14-2 Heaters on-off switches shall be and provided for control cubicles anti-condensation heaters.
- 14-3 Motor anti-condensation heaters shall be controlled by auxiliary contacts on the contactor. Contacts shall be arranged so that when the motor is energized the heater is off and when the motor is de-energized the heater is on. Additionally, switches shall be provided to energize the heaters when the contactor trucks are withdrawn from their cubicles.

15-0 LABELS

- 15-1 Motor starters and components shall be identified by labels. The designations and tag numbers shall be in accordance with MCC single line diagram.
- 15-2 A main label shall be affixed in a prominent position on each MCC giving the following information:

- Manufacturers name and type
- System voltage, phases, wires and frequency
- MCC designation
- Rated fault current
- Busbar rating
- Year of manufacture

15-3 Each feeder circuit shall be fitted with a label giving the following:

15-3.1 Circuit designation and tag number

15-3.2 Current and kW rating

15-4 Labels shall have black characters on white background and be made by non-corrodible material.

16-0 FINISH

The colour, finish and corrosion protection shall be in accordance with the vendor's specification.

17-0 SPECIAL TOOLS

A complete set of any special tools required for operation, maintenance and testing of the MCC shall be provided.

18-0 SPARES

The vendor shall provide separate lists of recommended commissioning and operating spares.

19-0 INSPECTION AND TESTING

19-1 The vendor shall provide test certificates for each type and rating of interrupting device. Tests shall be those listed in the relevant standards.

19-2 The buyer reserves the right to witness the following tests:

19-2.1 Routine tests on all MCCs/components as stated in the relevant standards and:

- Operational (electrical and mechanical) test on all components
- Secondary injection tests to prove correct operation of relays.

19-2.2 Type tests, where specified, or if there is no type test certificate available.

19-3 The vendor shall give two weeks notice of tests prior to commencement.

20-0 SHIPPING, HANDLING AND STORAGE

20-1 MCCs shall be shipped in sections to suit ease of handling for transportation and installation.

20-2 Preparation for shipment shall protect the MCC auxiliary devices accessories, etc. Against corrosion, breakage or vibration injury during transportation and handling.

20-3 Each shipping container shall be identified with the contents, purchase order number and item number.

20-4 Instructions shall be provided for reassembly of sections in the field.

21-0 DRAWINGS AND DATA

21-1 The vendor shall provide drawings and data in accordance with relevant standards.

21-2 Full details for installation and setting up shall be included

21-3 Recommended test data shall be stated, covering initial and regular testing.

22-0 DEVIATIONS

Deviations from this specification are only acceptable where the vendor has listed in his quotation the requirements he cannot or does not wish to comply with and the purchaser has accepted, in writing.

In the absence of a list of deviations it will be assumed by the purchaser that the vendor complies fully with this specification

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