

ANNEX IV

4. Metering Equipment

Requirements for Indoor Ring Main Units (only).

4.1 *Design*

Energy metering units (4-wire) shall be suitable for direct connection to adjacent extensible switch-disconnectors and fuse-switches or circuit breaker RMUs.

The design shall include a sealed and lockable marshalling enclosure that may be safely accessed from the front of the metering unit with the main busbars live. The bottom of the marshalling enclosure shall be located between 1.0 to 1.5 metres above ground level for easy access to secondary terminations during commissioning and testing. Only metering components and terminations as specified below shall be contained inside the marshalling enclosure. Such ancillary equipment as panel heater wiring and fusing shall be excluded from this compartment. An earth stud shall be provided within the marshalling enclosure with connection to the earth system via the main earth bar or conductor.

The Metering units shall have a continuous primary rating of 400 A at 11 kV, be equipped as detailed in sub-clauses set out below and shall be wired with ferrules numbered.

The metering unit design and construction shall facilitate the replacement of CT's and VT's in situ. The design shall also be such that all internal busbars lengths between CT's and VT's are minimised.

The Vendor shall submit with the Proposal, dimensioned outline drawings, schematic, layout and wiring diagrams of the metering units for review by Horizon Power.

Strong preference shall be given to Vendors offering metering units with all exposed busbars and associated mounting hardware fully shrouded and insulated from the environment.

4.1.2 *Current Transformers*

Three current transformers (CT) shall be provided with ratio 200/100/1 A for 11 kV metering units, of Class 0.5ME2 to AS 60044.1-2007, 15 VA output at unity burden. The CT shall comprise of two cores one for use by Horizon Power and the other by an MV Customer.

Accuracy requirements for both directions of current flow (P1 to P2 and P2 to P1), MUST be met at the marshalling enclosure terminals.

One CT shall be connected in each of the three phases and shall comply in all respects with AS 60044.1-2007. The current ratio change shall be made by tapped secondaries with all ratios brought out to the metering terminal block within the marshalling enclosure.



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The terminals provided within the marshalling enclosure shall be provided.

The CT terminal box shall have provision for sealing facilities.

4.1.3 Voltage Transformer

One three-phase or 3 single-phase voltage transformer(s) (VTs) shall be provided of ratio:

- 1) $11/\sqrt{3}$ kV : $110/\sqrt{3}$ V for 11 kV, and
- 2) 15 VA per phase, star/star connected, and
- 3) Class 0.5 M, and
- 4) Uniformly insulated secondary star point brought out and terminated in the metering cubicle as per drawing.

It is important to note that all secondary earthing points on the VT's shall be removed from inside the cubicle and terminated on the metering terminal block as indicated on M/D/4/08/4/1 (Rev A) (two meter connection diagram).

The accuracy requirement MUST be met at the marshalling enclosure terminals.

The voltage transformer must be suitable for operation with the high voltage star point connected to ground. The rated voltage factor shall be determined in accordance with AS 60044.2-2007. The voltage transformer(s) shall comply in all respects with AS 60044.2-2007. The VT terminal box shall have provision for sealing facilities.

The voltage transformer(s) shall be of the encapsulated type in air with substantial fault rated busbar connections and must NOT be fitted with fuse protection.

All connections from busbars to the voltage transformer(s) shall be rigid and self-supporting.

4.1.4 Secondary Wiring

All small secondary wiring within the metering unit shall be 4 mm² of stranded 7/0.85 mm cable, so laid up and restrained that there is no possibility of it coming in contact with the busbars or other live apparatus. VT and all tapped CT secondary terminations shall be wired out from their respective terminal boxes to the marshalling enclosure in their respective colours for the individual phases they represent. The S1 terminals from the three CT's shall be earthed locally to the main earth bar.

Terminals or intermediate connectors between CT or VT terminal boxes and marshalling enclosure shall not be used. Insulated crimp type lugs/connectors are not to be used in any of the CT / VT secondary wiring terminations. Non-insulated crimp connectors are permissible.

The terminals shall accommodate wire size up to 6 mm² and be provided with test plug sockets and short circuit bridges for the CT's secondary taps.



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Wire identification shall be with white wire marking ferrules with engraved letters and numerals filled with non-deteriorating black paint. Ferrules shall be mounted as close as practicable to the termination point at both ends of the wire and assembled so that they may be read right-way-up from the normal viewing position.

Wiring must be installed such that it cannot suffer damage from stretching, pinching, fatigue or accidental interference during normal operation or maintenance. Mechanical barriers or protection shall be installed to prevent such wire damage.

The marshalling enclosure shall be accessible at all times while the busbars are live and have provision for sealing and locking the enclosure.

The marshalling enclosure provided with the extensible metering units shall be provided with a conduit hole 25 mm diameter for connection to a remotely mounted meter panel.

The marshalling enclosure provided with the metering unit shall be located within the metering cubicle provided by the Vendor.

The bottom of the marshalling enclosure shall be located between 1.0 to 1.5 metres above ground level for easy access to disconnect the secondary terminations during commissioning and testing. Only metering components and terminations shall be contained inside it. Such ancillary equipment as panel heater wiring and fusing shall be excluded from this compartment. An earth stud shall be provided within the marshalling enclosure with connection to the earth system via the main earth bar or conductor.

NOTE: The Vendor shall supply details of the current and voltage transformers and their characteristics. Factory test results are to be provided indicating compliance with the class of accuracy as specified below.

4.1.5 Terminal Markings of CT's and VT's

The following terminal markings are required and shall be clearly and indelibly marked or engraved and must be clearly visible from inside the MV chamber:

- 1) Voltage transformers (VT)
 - a) Primary Winding:
 - i) 'A, N' for Red Phase
 - ii) 'B, N' for White Phase
 - iii) 'C, N' for Blue Phase
 - b) Secondary Winding:
 - i) 'a, n' for Red Phase
 - ii) 'b, n' for White Phase
 - iii) 'c, n' for Blue Phase



c) Phasing:

Ensure that when 'A' is positive with respect to 'N', 'a' is positive with respect to 'n' and similarly for 'B' and 'C'.

NOTE: Where 3 x single-phase electromagnetic VT's are star-connected the terminals 'N' and 'n' form the primary and secondary star points respectively.

2) Current transformers (CT)

a) Primary Winding:

P1 to P2 in the normal direction of current flow.

b) Secondary winding:

s1, s2, s3 - The polarity shall be arranged so that current flow into terminal P1 induces current flow out of terminal s1.

3) Labels P1 and P2 are to be placed inside the adjacent marshalling cubicle walls to indicate the orientation of Primary Current flow in the CT's with relation to the RMU housing.

4.1.6 Rating Plates of CT's and VT's

Rating plates shall be permanently attached to the CT's and VT's and copies of these labels shall be securely attached to the inside of the metering cubicle and shall be clearly visible while in service. The markings on these plates shall comply fully with the requirements of AS 60044.1-2007 and AS 60044.2-2007 respectively.



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