MARSHALLS ENERGY COMPANY, INC.

TECHNICAL SPECIFICATION

FOR

13,800 VOLT & 4,160 VOLT

3-PHASE & 1-PHASE PADMOUNT

DISTRIBUTION TRANSFORMERS

JANUARY 2011

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TENDER TECHNICAL SPECIFICATION

PADMOUNT 3-PHASE & 1-PHASE DISTRIBUTION TRANSFORMERS

1.0 GENERAL

This specification covers the minimum requirements for MEC's padmount, 60 Hertz, 3-phase and 1-phase, self-cooled, oil-immersed, outdoor distribution transformers, suitable for operation on the Company's various 13,800 Volt and 4,160 Volt distribution systems located on a number of atolls within the Republic of the Marshall Islands.

3-phase padmount transformers are to be rated at either 13,800 Volts or 4,160 Volts DELTA primary voltage stepping down to 480/277 Volts or 208/120 Volts WYE secondary voltage as needed. 1-phase, 2-bushing padmount transformers are to be rated at either 13,800 Volts or 4,160 Volts primary voltage stepping down to 120/240 Volts. Primary and secondary voltages will be specified in the tender advertisement.

The tender will be awarded on the basis of the lowest cost of operation over the service life of the transformer, based on the guaranteed figures for iron and copper losses provided.

2.0 STANDARDS

All material and equipment furnished under these specifications shall conform to the latest applicable IEEE or ANSI standards.

In their tenders, all bidders must list the relevant standards that the transformers being offered have been manufactured to.

3.0 RATINGS

3.1 Heat Rise:

All transformer ratings shall be capable of continuous operation at rated kVA without: -

- The winding temperature rise exceeding 65^{o}C rise over a 30 ^{o}C ambient;
- The insulating oil temperature rise exceeding 65^{o}C rise over a 30 ^{o}C ambient; or
- A maximum winding hot spot temperature of 80^{o}C.

3.2 Basic Impulse Levels:

- Primary: 95kV
- Secondary: 30kV

4.0 CONSTRUCTION

4.1 Vector Configuration:

3-phase transformers are to be DELTA connected on the primary and WYE connected on the secondary. The neutral shall be brought out through a fully insulated bushing provided in the secondary compartment and grounded externally.

4.2 Impedance:

The guaranteed impedance measured at 75 ^{o}C and at rated voltage shall not exceed 3% for transformers 100kVA and below, or 5% for transformers greater than 100kVA.

4.3 Transformer Type:

Transformers shall be loop feed construction, in accordance with Fig. 2, IEEE C57.12.26. The primary voltage shall be loop fed into and out of the transformer, with the transformer capable of being isolated from the primary voltage via a load-break switch.

4.4 Core Construction:

The laminated core shall be manufactured preferably using Amorphous steel; however, bidders may offer grain orientated steel as an alternative.

4.5 Cubicle Enclosure:

4.5.1 The transformer shall be fully and safely enclosed in a metal enclosure, which shall be fabricated in stainless steel, inclusive of all hinges, latches and fittings.

4.5.2 No fittings, bushings or accessories shall be exposed, or shall protrude from the external surface of the enclosure except for the cooling fins, hinges, latches, and lifting or jacking points.

4.5.3 All required protrusions shall be within the securable primary and secondary power enclosures.

5.0 BUSHINGS

5.1 High Voltage Bushings:

5.1.1 Transformers shall come equipped with high voltage bushing wells and corresponding load break inserts (preferably for dead front application).

5.1.2 The bushing wells shall be externally clamped, 200-amp rated, separable, and rated for primary switching as per IEEE 386.

5.1.3 The bushings shall conform to ANSI C57.12.25 Type 2 arrangement.

5.1.4 The load-break bushing inserts shall be Cooper Power Systems (Catalog No. LBI 215, Elastimold (Catalog No. 1601A4) or equivalent.

5.1.5 Parking stands are to be fitted for the load break inserts. Parking stands are to be of the 3 inch, 304 SS type.

5.1.6 Inserts shall be shipped with physically wired down & secured duct caps.

5.2 Low Voltage Bushings:

Transformers shall be equipped with fully insulated, LV bushings, in accordance with Fig. 8(a) of IEEE C57.12.26; and be fitted with four (4) hole, NEMA spade type terminals.

6.0 FUSING

6.1 Fusing Provisions:

6.1.1 Transformers shall be provided with Bay-O-Net type fuse holders.

6.1.2 Transformers shall be provided with Bay-O-Net, dual sensing, load break, externally removable fuses.

6.1.3 Transformers shall be provided with internally mounted partial range current limiting fuses which shall be placed in series with the Bay-O-Net fuse holder and be mounted internally under oil. Partial range current limiting fuses shall have a nominal voltage rating of 8.3kV.

6.1.4 Oil drip shields shall be provided with the Bay-O-Net fuse holder and be designed to catch and hold oil in preference to those oil drip shields that redirect oil.

6.1.5 The Bay-O-Net Fuse size and type shall be painted on the inside of the primary side cabinet door. In addition, the bayonet and current limiting fuse part numbers will be displayed on the nameplate.

6.1.6 Transformer fuses shall meet the current specifications shown in the table below: -

3-Phase	**Bay-O-Net Fuse Continuous Rating**	**Current Limiting ELSP Backup, Rating**
75 kVA	8A	30A
150 kVA	15A	65A
300 kVA	25A	100A
500 kVA	50A	100A
1-Phase	**Bay-O-Net Fuse Continuous Rating**	**Current Limiting ELSP Backup, Rating**
15 kVA	3A	n.a.
25 kVA	8A	40A
50 kVA	15A	80A
75 kVA	25A	125A
100 kVA	25A	125A

7.0 ACCESSORIES

7.1 Pressure Relief Device:

All transformers shall be designed to relieve excessive pressure build-ups without damage to the tank by means of a pressure relief device, in accordance with IEEE C57.12.26; and equipped with a pressure relief device such as Tomco Series 1776K or similar device.

7.2 Load Break-Switch:

All transformers shall be provided with load-break switches, capable of isolating the transformer from the primary voltage via a 2-position, on-off, load-break switch.

7.3 Tapchanger Switch:

Transformers are to be provided with a 5-position, off-load tapchanger switch, with J-tap settings of: 14,400, 13,800, 13,200, 12,870 & 12,540 Volt.

7.4 Gauges:

Transformers shall be fitted with the following gauges: -

- Oil level site glass. Alternatively, a 2 inch dial gauge.
- Temperature dial gauge with maximum temperature indicator.
- Pressure dial gauge with maximum pressure indicator.

7.5 Cooling Radiators:

Transformers rated 100 kVA and above shall come fitted with cooling radiators.

7.6 Current Transformers:

Transformers shall be equipped with internally mounted instrument class CT's suitably rated for the transformer's primary current, and providing a 5 Amp secondary current. As the CT's are intended to be connected to maximum demand metering, they are to be connected to an externally mounted terminal box complete with short-circuiting links.

7.7 Maximum Demand Meters:

If called for in the tender, transformers shall be equipped with single-phase MDI's on each phase, designed for outdoor applications and readily visible when the cubicle door is opened. MDI's shall be the duel needle type, one indicating instantaneous demand on the phase and the other, which can be manually reset, recording the maximum demand. Meter scales shall indicate primary amps.

7.8 Grounding Lugs:

Transformers shall be furnished with one ground lug for low-voltage grounding of the transformer and two ground lugs for high-voltage grounding of the transformer. Grounding lugs shall be of the 2-hole, horizontal NEMA type.

7.9 Lifting Lugs & Jacking Point Provisions:

All transformers are to be fitted with lifting lugs and jacking point provisions.

7.10 Oil Level & Drain Valve:

Transformers shall come equipped with oil level plugs and oil drain/sampler valves; the valves having a 1 inch minimum diameter and be gate or ball activated.

7.11 Transformer Tanks:

Transformer tanks shall be constructed in accordance with IEEE C57.12.26.

7.12 Removable Sill:

All transformer cubicles shall have a removable sill at the base and along the width of the access door face of the cubicle. The sill shall be 6 inch in height.

7.13 Compartmental Locking:

All hinged or removable cabinet access lids or doors shall have a three-point latch and be provided with a stainless steel Pentahead captive bolt locking device and provisions for padlocking. The Pentahead bolt shall be coordinated so that it must be engaged before a padlock can be inserted into or removed from the hasp.

7.14 Metal HV/LV Shield:

All transformers shall be provided with a metal shield designed to fully separate the high-voltage compartment from the low-voltage compartment. The shield shall run from the top to the base of the cubicle and extend out to the door of the cubicle.

7.15 Labeling:

A readily visible danger label, complying with ANSI Z535, shall be located on the inside of the transformer cubicle. For ease of identification, all transformers shall have an exterior label denoting the kVA rating of the transformer.

7.16 Nameplates:

7.16.1 Nameplates shall be made of stainless steel or anodized aluminum and permanently marked with essential operating data.

7.16.2 Nameplates shall be mounted on the inside of the transformer cubicle door with the serial number of the transformer mounted on the LV side of the transformer.

7.16.3 The transformer nameplate shall specifically state that the transformer is mineral oil filled and the number of gallons of oil it contains.

7.16.4 The nameplate shall certify the oil used and that the transformer oil is PCB free.

7.16.5 The bayonet and current limiting fuse part numbers will be displayed on the nameplate for all Padmount units

8.0 TRANSFORMER OIL

8.1 Oil Properties:

8.1.1 Transformers shall be insulated with new (unused) mineral oil, which meets the requirements of ANSI C57.12.00, Article 6.6.1 (1), ANSI C57.106 and ASTM 3487 Type II.

8.1.2 Transformer oil shall be PCB free.

8.1.3 The oil shall be inhibited mineral oil containing 0.2 % by weight DBPC.

9.0 PAINT FINISH

9.1 Paint Properties:

9.1.1 The transformer shall have a corrosion resistant finish that shall be capable of meeting or exceeding the paint requirements of ANSI C57.12.28.

9.1.2 Transformers shall be given a phosphatizing bath or blasted with sand, grit or shot, then primed with epoxy or vinyl prime no less than 2.0 mils dry thickness.

9.1.3 The exterior finish coat shall be semi-gloss polymer no less than one (1) mil dry thickness, and free of runs and sags, and be of a semi-gloss olive-green gray color similar to Munsel no. 7GY3.29/1.5.

9.1.4 The interior cabinet surfaces shall be primed and finished, with no less than 2.0 mils dry paint thickness.

10.0 NOISE

Transformer noise levels shall not exceed those values specified in NEMA TR 1-0.11.

11.0 DRAWINGS

The successful tenderer is to forward construction drawings for approval by MEC for each type of transformer to be manufactured, before any construction work is commenced.

12.0 INSPECTION

MEC shall, at any reasonable time, be permitted to have a representative visit the Contractor's factory for the purpose of witnessing the manufacture of the transformers to ascertain if the materials and process used conform to this Specification; and to witness the factory testing.

13.0 TESTS

13.1 Factory Testing:

Each transformer shall receive complete tests at the factory in accordance with latest ANSI standards. In particular, tests to determine core (iron) and winding (copper) losses in Watts are to be carried out in accordance with the latest ANSI standards.

13.2 Certified Test Reports:

Certified test reports shall be furnished to MEC at the time of delivery or invoicing of transformers. Invoices must reference transformer serial numbers, the bid item and quoted losses. No payment will become due until certified test reports are received by MEC.

13.3 Short-Circuit Testing:

The Vendor shall supply verification that the design has passed short-circuit test criteria in accordance with the latest revisions of ANSI C57.12.00 and C57.12.90.

13.4 Guaranteed Losses:

The values for iron and copper losses submitted by the bidder shall be considered as guaranteed losses by MEC.

14.0 DELIVERY METHODS

14.1 Destination:

The transformers shall be shipped CIF Majuro, Republic of the Marshall Islands.

14.2 Delivery Methods for Transformers:

14.2.1 Transformers shall be shipped completely assembled, mechanically protected and tarpaulin covered or otherwise protected from the elements during shipping.

14.2.2 Transformers up to 300kVA are to be mounted on individual pallets and securely attached to the pallets to facilitate handling with a forklift.

14.2.3 Transformers rated 500kVA and over shall be capable of being unloaded with an overhead crane and must be shipped on/in flatrack or opentop containers if they cannot be palletized and forklift loaded into standard or highcube containers. The supplier shall discuss the shipping method for these larger items with MEC prior to shipping due the very limited availability of equipment to unload heavy items received from ships in the Marshall Islands.

14.3 Unacceptable Methods of Shipping:

Transformers exhibiting damaged parts, broken securing devices or are dirty from lack of proper protection during shipping, shall be cause for rejection of the transformer.

SCHEDULE 1 - TECHNICAL DATA

For bids to be eligible for consideration, the following technical data shall be provided by Bidders with their Tenders for each and every bid item.

PADMOUNT TRANSFORMER	**kVA** **Phases**		
MEC Tender Number:			
Bid Item:			
Manufacturer:			
Vendor:			
PARAMETER	**SPECIFIED**		**TENDERED**
Frequency:	60 Hertz		
Vector Configuration	Delta (pri) / Wye (sec)		
Nominal Primary Voltage:	4,160V	13,800V	
Basic Impulse Level – HV: (kV)	95 kV		
Secondary Voltage:	277/480V	120/208V	
Basic Impulse Level – LV: (kV)	30 kV		
Impedance: (%):			
Core (Iron) Loss: (Watts)			
Winding (Copper) Loss: (Watts)			
Maximum L.V. short-circuit current: (kA)			
Max. LV short-circuit current at: L-L or L-N:			
L.V. Windings (interlaced or not):			
Short-circuit Impedance: (%)			
Total Weight with Oil: (lbs)			
Oil: (gallons)			
Overall Dimensions of cubicle: (LxWxH)			
H.V. and L.V. Winding Metal:	Copper		
Core Type: (amorphous/grain orientated)	Amorphous (preferably)		
Minimum Primer Paint Thickness: (mils)	2 millimeters		
Minimum Exterior Paint Thickness: (mils)	1 millimeter		
Transformer Cubicle Metal:	stainless steel		
Cubicle Steel Thickness:	2mm minimum		