

RFQ No. RAJBOS0090 – Pre Qualification Criteria

1) The manufacturer should have experience of supply of transformers of cumulative Capacity of 50MVA (minimum rating of each transformer 2.5MVA, 33KV) within last 5 Years prior to the publication of this tender.

As evidence to this, vendor shall submit completion or commissioning certificates from end user (Developer/EPC Company) along with copies of Purchase Orders for transformers.


2) The manufacturer should have experience of supply of at least 1 No. of transformer of the following rating to SPV Plants within last five years prior to the publication of this tender:

MVA Rating: 5 MVA or higher

Voltage Class: 33kV or more

Type: 3-Winding or more

As evidence to this, vendor shall submit completion or commissioning certificates from end user (Developer/EPC Company) along with copies of Purchase Orders for transformers.

	PURCHASE SPECIFICATION FOR ONAN TYPE, 3-PHASE, 3-WINDING, 8.8MVA & 6.4MVA, 33KV / 690V – 690V INVERTER DUTY TRANSFORMER	PS-439-1355
		REV No.02
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Amendment to purchase specification PS-439-1355 Rev. 02 dtd 30.01.2021

S. No	Specification clause	Description as per Existing Clause	Amendment made / To be read as
1	Clause 3.0 (27), Highest system voltage	LV side: 1.1 kV HV side: 36 kV	LV side: 3.6 kV HV side: 36 kV
2	Clause 3.0 (28), Insulation Class (Winding and bushing)	LV side winding and bushing insulation class shall be of at least 3.6 kV	LV side winding and bushing insulation class shall be of at least 3.6 kV
3	Clause 3.0 (33), Provision of shield	Shield bushing shall be rated for 1.1 kV	Shield bushing shall be rated for 3.6 kV

Note: All other clauses shall remain same as per PS-439-1355 Rev. 01 30.11.2020

Prepared:

a. Nand Lal Kishor

Approved:

Bach



PURCHASE SPECIFICATION FOR
ONAN TYPE, 3-PHASE, 3-WINDING, 8.8MVA & 6.4MVA, 33KV
/690V – 690V INVERTER DUTY TRANSFORMER

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TECHNICAL SPECIFICATION

FOR

ONAN TYPE, 3-PHASE, 3-WINDING, 33KV / 690V – 690V

INVERTER DUTY TRANSFORMER

REVISION: 00

R01 dtd 30.11.2020
Changes highlighted

Approved: Prachi Rao V

Prepared

Issued

Date

L.Nanda Kishore

SC&PV-Engg

04.11.2020



**PURCHASE SPECIFICATION FOR
ONAN TYPE, 3-PHASE, 3-WINDING, 8.8MVA & 6.4MVA, 33KV /
690V – 690V INVERTER DUTY TRANSFORMER**

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1.0 INTRODUCTION

This document details the technical specifications, supply conditions, erection and commissioning and post-commissioning requirements for ONAN type, ~~5-MVA~~ **8.8 MVA & 6.4 MVA**, 33kV/ ~~xxxV-~~ **690V-690V**, 3-phase, 3-winding, inverter duty transformers for solar PV grid connected power plants.

2.0 LIST OF ITEMS

2.1	<p>ONAN type, 3-phase, 3-winding, Inverter Duty Transformer with two identical LV windings and one HV winding (a) Rating 8.8 MVA (LV1-4.4MVA+LV2-4.4MVA), 33kV / 690V-690V (b) Rating 6.4 MVA (LV1-4.4MVA+LV2-2MVA), 33kV / 690V-690V</p> <p>Vector group: YNd11d11</p>	<p>Qty as per BHEL tender requirement</p>
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2.2 Spares shall be offered as per list below:

#	Spares	Qty (for each transformer rating)
1	HV Bushings with metal parts and gaskets	1 sets (3 Nos)
2	LV Bushings with metal parts and gaskets	1 set (6 Nos)
3	HV Neutral Bushing	1 set (1 Nos)
4	Set of valves (Each set shall represent complete qty of different types of valves used in one transformer. Total list of valves shall be indicated by vendor during detailed Engg)	1 set
5	Pressure Relief Device with trip contacts	1 No
6	Winding temperature indicator with alarm & trip contacts along with 4-20mA transmitter	1 No
7	Oil temperature indicator with alarm & trip contacts along with 4-20mA transmitter	1 No
8	Buchholz Relay (complete unit)	1 No
9	Magnetic Oil Level Gauge (MOG)	1 No
10	Set of Gaskets (Each set shall represent complete qty of different types of gaskets used in one transformer. Total list of gaskets shall be indicated by vendor during detailed Engg)	1 set
11	Transformer Oil	10 % of total quantity of oil required for all the transformers

Notes:

- a) For each rating of transformer, 1 set of spares as per the list above shall be provided.
- b) Vendor shall provide a complete list of spares showing item-wise unit price, quantity and total price.
- c) BHEL reserves the right in selection and inclusion of the spares in the final scope of supply.

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2.3	<p>Installation and commissioning support for the transformers at site:</p> <p>BHEL scope of activities at site for installation and commissioning:</p> <ol style="list-style-type: none">(1) Movement and positioning of transformers on their respective foundations. BHEL shall arrange all necessary labour, machinery and tools.(2) Erection / assembly of transformer fittings and accessories. BHEL shall arrange all necessary labour, machinery and tools.(3) Laying of LV/HV cables, erection of HV termination kits and cable terminations at the LV/HV cable boxes. BHEL shall arrange all necessary labour and tools. Supply of cables and accessories (glands, lugs, nuts, washers) in BHEL scope. <p>Vendor scope of activities at site for commissioning:</p> <ol style="list-style-type: none">(1) Supervision of erection / assembly of transformer fittings and accessories including marshalling box wiring. This shall include providing technical guidance to BHEL erection team wherever required.(2) Commissioning / service engineer(s) shall be available at site at the time of commissioning of the power plant. All necessary guidance / support in overcoming technical problems (if any) related to the transformers. <p>A single lump-sum price on per-transformer basis shall be offered. The lump-sum price shall include all the costs that will be incurred by the vendor towards the above activities including travel, boarding, lodging and any other contingency expenses.</p>	<p>1 AU per transformer</p> <p>1 AU (Activity Unit) =</p> <p>I&C Support for 1 No. transformer</p>
2.5	<p>Service during Warranty</p> <p>Vendor shall enclose, along with technical bid, the complete scope, terms and conditions of the warranty.</p> <p>During the warranty period, whenever a technical problem is encountered with transformers, BHEL will report the same to the vendor. All parts of the transformers shall be covered under warranty. Replacement of all defective material during warranty period shall be in scope of the vendor.</p> <p>Vendor shall ensure that the problem is attended to by their service engineer within two days from the date of reporting.</p>	



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3.0 Technical specification

#	Technical parameter	BHEL specification	
1	Transformer type	Outdoor, oil-immersion type ONAN, Inverter Duty. Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD)	
2	IP class	Transformer, including the cable box and marshalling box shall be of IP55.	
3	Application	Grid-connected solar photovoltaic power plant.	
4	Governing Standards	Power Transformer	IS: 2026, IS: 6600, IEC:60076, CBIP
		Fittings and Accessories	IS: 3639
		Insulating Oil	IS:335 , IEC: 60296
		Bushings	IS: 2099, IEC: 60137
		Bushing CTs	IS:2705
		Degree of protection	IS: 2147
		Tests and tolerance of guaranteed particulars	IS: 2147
		Buchholz relay	IS: 3637
		Electrical insulation classified by thermal stability	IS: 1271
		Climate proofing	IS: 3202
		Indian Electricity Act 2003 & CEA regulations/notifications	
5	Rating in KVA	As per Clause 2.1	
6	No. of phases	3	
7	Frequency	50 Hz, +/- 3%	
8	HV winding	One 3-phase winding with Star connection. HV voltage: 33KV	
9	LV windings	<p>Two independent 3-phase windings, each with Delta connection. LV voltage: as defined at Cl. 2.1.</p> <p>Each winding shall have an identical and equal rating MVA rating as defined at Cl 2.1 (each winding shall be rated at 50% of overall transformer rated kVA).</p> <p>Design shall be such that transformer shall have identical performance for both the LV windings. Even when one LV winding is not fed from solar generation side, performance of the other (operational) LV winding shall remain unaffected.</p>	
10	Winding material	Electrolytic grade copper for both HV and LV windings.	
11	Winding Insulation	Class A	
12	Neutral on HV side	Neutral terminals of HV windings shall be brought out separately through bushings.	

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13	Vector Group	YNd11d11
14	Rated Thermal Short time current withstand time	25kA for 2 sec
15	% Impedance on principal tap (& MVA base of 50% MVA rating of LV winding as defined at Cl 2.1 transformer rating) at 75deg C and 50 deg C	HV - (LV1 + LV2): 8 % (min) HV - LV1 / LV2 : 8 % (min) LV1 - LV2 : 12 % (min) Tolerance shall be as per IS 2026 Note: MVA base for above impedance shall be considered as equal to rated MVA of transformer. is 4.4MVA & 3.2MVA (i.e 50% of the rated MVA of the two ratings under scope of supply against this tender)
16	Termination HV/LV/Orientation	Air insulated cable box with disconnecting chamber, for both HV and LV sides. Cable box / Cable box / 180°.
17	Cable entry on HV side	- Bottom entry of cables. - Cable size: 1 run per phase of 1Cx 185 sq-mm, 33kV grade, aluminum conductor, armoured, XLPE insulation, PVC sheath as per IS: 7098. - Cables, lugs, glands, termination kits etc shall be in BHEL scope. - Vendor shall provide hole on the bottom-side gland-plate of HV side cable box for cable entry. - Cable OD will be intimated to the vendor at the time of manufacturing.
18	Cable entry on LV side	- Three wire system. - Bottom entry of cables - Cable size: 7 runs per phase of 1CX630 sqmm, aluminum conductor, armoured, XLPE insulation, PVC sheath as per IS: 7098. - Cables, lugs, glands etc shall be in BHEL scope. - Vendor shall provide holes in the busbars and on the bottom-side gland-plate of LV side cable box for placement of glands. - Cable O.D shall be informed to vendor during drawings approval by BHEL. Cables shall enter the cable box straight upwards and get connected to the bus bars. After entry into cable box, cables shall not undergo any bends or turns.
19	Tapping on HV winding	Off circuit tap changer (OCTC) switch with tap positions range from -10% to +10% in steps of 2.5%.
20	Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-10%. Transformer shall be capable of being loaded in accordance with IS: 6600 / IEC 60076-7 upto a load of 150%. There shall be no limitation imposed by bushings etc. or any other associated equipment.



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21	Ambient temperature	Max 50 deg C
22	Temperature rise	For top oil: Max.50 deg C by thermometer method. For winding: Max. 55 deg C by resistance method. Both rises shall be over an ambient temperature of 50 deg C irrespective of tap position.
23	Flux density	Not to exceed 1.9 Wb/sq.m at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over-fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds Vendor shall furnish over-fluxing characteristics upto 150% during detailed engg. The transformer shall also be capable of withstanding without damage during the time, for a duration of at least two seconds the stresses caused by short circuit limited only by the transformer impedance with 110% rated voltage maintained at source end.
24	Air Clearances	As per CBIP
25	Harmonics	Shall be designed to suppress harmonics especially 3rd & 5th. Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD)
26	Noise level	As per NEMA TR-1 standard
27	Highest system voltage	LV side: 1.1kV HV side: 36 kV
28	Insulation Class (Winding and bushing)	As per relevant IS / IEC standard LV side winding and bushing insulation class shall be of at least 1.1kV
29	Insulation levels Rated Lightning Impulse withstand voltage / Short duration power frequency withstand voltage	As per relevant IS / IEC
30	Painting	Shall be finalized during drawing approval.
31	Constructional features	As per clause 4.0 of this specification
32	Fittings and accessories	As per clause 5.0 of this specification
33	Provision of shield	Shield winding shall be provided between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal