

ANNEXURE-A**Detailed specification of K-13 Rated 100KVA Isolation transformer****PART 1 – GENERAL****1.1 DESCRIPTION**

K-Rated isolation transformer is intended to protect against strong lightning, impulse electrical noise, common mode noise, spikes, to arrest the effects of instability of ground potential at high frequencies, etc. Hence K-rated isolation transformer shall be designed to attenuate common mode noise, traverse mode noise, normal mode power line noise, consistent with the transfer of fundamental frequency, blocking all higher frequencies, blocking transfer of electrical noises due to static charge, RF noises.

This specification describes the design of a copper wound, multi-shielded, three phase, K-factor rated, high efficiency, power conditioning isolation transformer. The power conditioning transformer specified shall be a continuous duty rated, 415 volt, convection cooled, dry type, isolation transformer to support harmonic rich non-linear loads while maintaining safe operating temperatures and shall include superior transverse and common mode noise attenuation. The power conditioning transformer shall meet NEMA TP 1-2002 dry type transformer efficiency standards / IS:11171 – 1985 with latest amendments as per table -4.

1.2 STANDARDS

The K rated isolation transformer shall be designed in accordance with applicable portions of the following standards:

- A. NEMA TP 1-2002 Dry Type Distribution Transformer Efficiency Standards
- B. Institute of Electrical and Electronic Engineers (IEEE 519-1992)
- C. National Fire Protection Association (NFPA) 70
- D. National Electrical Code (NEC)
- E. Bureau of Indian standards IS: 2026
- F. Bureau of Indian standards IS: 11171

1.3 SUBMITTALS

1. The supplier/ vendor/ contractor shall supply documentation for the installation of the system, including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output connection locations and required clearances.
2. GA drawings and Mounting Arrangement. Submittals shall be specific for the equipment furnished and shall include as-built information.
3. Necessary test certificates

1.4 SCOPE

- Supply, installation, testing and commissioning of 2 No. of 415V/415V, 3phase, 50Hz, K-13 rated 100KVA isolation transformer at ISTRAC, Bangalore.
- Supply, installation, testing and commissioning of 2 No. of 415V/415V, 3phase, 50Hz, K-13 rated 100KVA isolation transformer at SDSC,SHAR in Shriharikota.
- Design, fabrication, pre-dispatch inspection , packing and forwarding, loading at factory, transportation, delivery at site, unloading, storing at site, shifting to installation site, installation, testing at site, commissioning and handing over.
- Supply of 1000 mtrs of size 1 Uninyvin Copper cables (MIRACLE make) for connecting between isolation transformer and UPS Input panel.
Note: The quantity of cable indicated above i.e 1000mtr is for 4 No. of Isolation transformers.
- The laying of Uninyvin Copper cables in good condition with supply of suitable size Steel wired reinforced (SWR) PVC flexible conduit pipes and necessary materials such as brackets, clamps, MS spacers.
- Providing end terminations for Uninyvin cables including supply of PVC cable glands, 3D long barrel heavy duty tin plated copper lugs, neoprene bushes and other materials and tools required complete with terminal connection.
- Conducting commissioning checks, training the operators at site and handing over the operation and maintenance manual, operating instructions and warranty certificate.
- Cost implication due to above needs to be included in the offer.

PART 2 - PRODUCTS

2.1 Manufacturers

The equipment specified is the K rated isolation transformer manufactured by the Companies as listed in the list of approved makes, which is enclosed herewith.

2.2 Input Specifications

- A. The nominal AC input voltage rating shall be 415VAC 3 phase with sufficient margin to sustain a constant input of +10% without saturation.
- B. The nominal operating frequency shall be 50 Hertz \pm 3 Hertz.
- C. The K rated isolation transformer primary shall be configured in a three phase delta.
- D. When energized, the current inrush shall not exceed a maximum of 10 times the full load input current for a 1/2 cycle.

2.3 Output Specifications

- A. The nominal AC output voltage rating of the K rated isolation transformer shall be 415V AC wye derived, 50 Hertz.
- B. The output impedance of the K rated isolation transformer shall be 8% - 10% typical.
- C. The K rated isolation transformer shall be K-13 rated in accordance with: $K = \sum I_h(\text{pu})^2 h^2$
- D. The K-13 rated isolation transformer shall provide a continuous duty, full load output power.

2.4 Performance Specifications

- A. The output voltage of the K rated isolation transformer shall be maintained within $\pm 3\%$ or less of nominal from no load to full load.
- B. The overload rating of the K rated isolation transformer shall be 500% for 10 seconds, and 1000% for one cycle.
- C. The K rated isolation transformer shall not add more than 1% total harmonic distortion to the output waveform under a linear load.
- D. Output voltage shall remain sinusoidal with no flat topping when high crest factor (3 : 1) non-linear loads are present at the output.
- E. The audible noise of the K-rated isolation transformer shall not be greater than 60dB measured at 1 meter.

- F. The K rated isolation transformer shall incorporate a solid copper foil with double electrostatic shield to minimize inner winding capacitance, transient and noise coupling between primary and secondary windings.
- G. Transformer shall be double-shielded and capable of 100dB common mode noise attenuation.
- H. The K rated isolation transformer shall have an efficiency of **>=90%** typical and shall meet NEMA TP 1-2002 dry type transformer efficiency.
- I. The K rated isolation transformer shall be provided with a fused (with front panel mounted, blown fuse lamp indicator) 3 phase, secondary connected, spike suppression network. The suppressor shall be comprised of high energy metal oxide varistors with less than a 5 nanosecond response time and a maximum peak current handling capability of 40,000 amps (8x20μsec) per mode. The suppression network system shall remain functional when subjected to IEEE C62.41 Category B-3 waveforms.

2.5 Main Transformer Construction

- A. The transformer windings shall be all copper conductor construction, with separate primary and secondary, isolated windings. The transformer shall conform to NEC article 250, that specifies a separately derived power source. The neutral conductor shall be provided at 2 times the ampacity of the phase conductor.
- B. Terminals shall be provided for isolated three phase output conductors, neutral conductor and ground.
- C. Output neutral shall be bonded to ground via a removable bus bar.
- D. Terminals shall be provided for three phase input conductors and ground.
- E. All leads, wires and terminals shall be labelled to correspond with the circuit wiring diagram.
- F. Mean Time Between Failure (MTBF) shall be not less than 200,000 hours.
- G. Class F insulation system shall be utilized throughout with a maximum temperature rise as per IS 11171 Table-4 at ambient of 50°C under a linear load, not to exceed temperature rise 90°C under non-linear loading.

- H. The transformer shall be designed for natural convection cooling or fans may be provided for cooling. Suitable overload protection with switchgears shall be provided for fans.

2.6 Cabinet Construction

- A. The cabinet shall be a IP 44, floor mounted with suitable wheels, indoor type enclosure.
- B. Cabinets shall be manufactured from 14 gauge steel with base sub-structure suitable for fork lifting.
- C. The cabinet shall have a baked on powder coat paint finish with proper pre-treatment.
- D. Input and output power connections shall be hardwired to copper standoff bus located behind the front panel of the transformer cabinet. Input and output locations shall be available on either side of transformer cabinet with clear markings.
- E. Suitable current rated MCCB shall be provided in the input and output side having overload and short circuit protection and fully wired and ready to terminate input and output cables in the respective MCCB.
- F. Digital microprocessor based multifunction meter for input and output parameter measurements with RS485 port
- G. Suitable rated fans shall be provided for cooling if necessary. If fans are provided, suitable protective switchgear shall be provided for the fans

2.7 Environment

- A. Temperature: The transformer with enclosure shall be required to operate without overheating in an ambient temperature range of -20°C to +50°C.
- B. Humidity: The power conditioning system shall operate in a relative humidity of 0 to 95% non-condensing.
- C. Altitude: The power conditioning system shall operate up to 1000M above sea level without de-rating.

2.8 Warranty

Manufacturer shall guarantee the K-rated isolation transformer to be free from defects in material and workmanship for a period of 12months from the date of commissioning and acceptance at site by ISTRAC.

Note: The vendor shall quote for extended warranty of 2 years as indicated in the tender. ISTRAC reserves the right to exercise the extended warranty of 2 years.L1 criteria shall be based on the sum of the following items as indicated in the tender :

Item No.-1 i.e. Supply installation testing & commissioning of 'K-13' rated 100KVA isolation transformer at IDRSS facility in ISTRAC,Bengaluru.

Item No-2, Supply installation testing & commissioning of 'K-13' rated 100 KVA isolation transformer at IDRSS facility in SDSC SHAR, Shriharikota

Item No-3, Extended warranty of 2 years for 'K-13' rated 100KVA isolation transformer at IDRSS facility in ISTRAC,Bengaluru

Item No-4. Extended warranty of 2 years for 'K-13' rated 100KVA isolation transformer at IDRSS facility in SDSC,SHAR.

Tenderers shall furnish the compliance in the following format and furnish the data sheet of their offer

Sl. No.	Description	Tender specification	Compliance (Yes/ No)	Tenderer's specification
1	KVA rating and quantity	100 kVA: 04 sets		
2	Approved makes of isolation transformers: CROMPTON GREAVES, ESSENAR, HAMMOND POWER SOLUTIONS (HPS), KEL, RAYCHEM-RPG, SERVOMAX, VOLTAMP, APC, PILLER, NUMERIC (LEGRAND), RIELLO, SOCOMEK and VERTIV.			
3	Transformer ratio	1:1		
4	K rating	K-13		
5	Conductor material	Copper		
6	Input voltage line to line	415V, 3phase, delta connection, 3wire, 50Hz, AC		
7	Acceptable input voltage range	± 10%		
8	Acceptable line frequency	47 to 53 Hz		
9	Energizing inrush current	Energizing inrush current shall not exceed 10 times the full load input current for ½ cycle		
10	Output voltage line to line	415Volts, 3 phase with neutral star connection, 4wire, 50Hz, AC		
11	Output voltage regulation	Within ±3% or less of nominal from no load to full load		
12	Output voltage wave form	Output voltage shall remain sinusoidal with no flat topping when high crest factor 3:1 and non- linear loads present at the output		
13	Vector group	DY11n		
14	Overloading	500% for 10 seconds and 1000% for one cycle		
15	Audible noise	Less than 60dB at 1 meter distance		

Sl. No.	Description	Tender specification	Compliance (Yes/ No)	Tenderer's specification
16	Efficiency	>=90%. Energy efficient transformer will be preferred.		
17	Input and output connection	Input: Delta 3wire Output: Star 4 wire		
18	Operating power factor	0.75 lagging to 0.75 leading		
19	Dielectric strength	Not less than 2500V for 2minutes		
20	Coupling capacitance	0.1 pico-farads or less		
21	DC Galvanic isolation	Greater than 1000 mega ohms between any windings or windings to ground		
22	Common mode noise and transient rejection	Better than 100 dB		
23	Shielding	Multiple shielding techniques shall be used to minimize the inter-winding capacitance and maximize DC galvanic isolation		
24	Permissible temp rise of winding above ambient temperature 50 ⁰ C	90 ⁰ C		
25	Operating temperature range, humidity, Altitude	0 ⁰ C to 50 ⁰ C, 0 to 95% non- condensing, up to 1000m above sea level without de-rating		
26	Degree of Ingress protection	IP 44		
27	Full load loss and efficiency	Please furnish the full loss and efficiency		
28	Basic impulse insulation level (V peak)	Not less than 10,000volts		
29	Type of cooling	Air natural. If fan is provided, suitable protective switchgear shall be provided for the fans		
30	Class of insulation	Class F		
31	Cable Termination facility at both input and output	Cable adaptor box shall be provided for terminating the cables.		
32	Moulded case circuit breakers	MCCB of suitable rating		

Sl. No.	Description	Tender specification	Compliance (Yes/ No)	Tenderer's specification
	(MCCB)	and breaking capacity of 36kA shall be provided in the input and output side having overload and short circuit protection and fully wired and ready to terminate the above mentioned cables in the respective MCCB. MCCB make shall be of ABB, Legrand, L&T, Schneider ,Siemens.		
33	Multifunction meter	Digital microprocessor based multifunction meter shall be provided for input and output parameter measurements which include voltage, current, frequency, Power factor active power (P), reactive power (Q), apparent power (S) & THD .The Digital microprocessor based multifunction meter shall be provided with RS485 port for remote monitoring. The make shall be department approved make. The department approved makes are attached in the tender.		
34	Painting	RAL 7032 powder coated paint after seven tank corrosion resistance treatment		
35	Indications lamps	LED lamps with MCB control indicating the input supply availability		
36	Fittings	Lifting hooks or eye bolts, 4nos bi-directional rollers or suitable legs ready to install on the cable trench or on finished floor.		
37	MTBF	More than 200,000 hours		

Sl. No.	Description	Tender specification	Compliance (Yes/ No)	Tenderer's specification
38	Overall dimension and weight	Please furnish the details.		
39	Pre-dispatch inspection at factory:	<p>The following tests shall be carried out at factory in the presence of ISTRAC authorized engineer.</p> <p>a. Coupling capacitance, noise attenuation b. Insulation resistance c. Winding resistance d. Voltage ratio e. Polarity test f. Efficiency</p> <p>Upon clearance by ISTRAC authorized Engineer, isolation transformer shall be supplied. Department has the right to waive off the inspection for any reasons whatsoever.</p>		
40	<p>Supply of 1000 mtrs of size 1 Uninyvin Copper cables (MIRACLE make) shall be supplied for connecting between the isolation transformer & UPS and laying of Uninyvin Copper cables in good condition with supply of suitable size Steel wired reinforced (SWR) PVC flexible conduit pipes and necessary materials such as brackets, clamps, MS spacers.</p> <p>Note: The quantity of the cable i.e 1000mtr indicated is for 4 No. of isolation transformers.</p>			
41	Providing end terminations for Uninyvin cables including supply of PVC cable glands, 3D long barrel heavy duty tin plated copper lugs, neoprene bushes and other materials and tools required complete with terminal connection.			

Sl. No.	Description	Tender specification	Compliance (Yes/ No)	Tenderer's specification
42	Warranty	12months from the date of commissioning and acceptance at site by ISTRAC. The vendor shall quote for extended warranty of 2 years as indicated in the tender. ISTRAC reserves the right to exercise the extended warranty of 2 years.		
43	Handing over	Operation and maintenance manual, Detail wiring diagrams, Cabinet outlines, Heat load, Input/ Output connection locations, Factory test results and Warranty certificate.		
44	Place of delivery and installation including packing, forwarding freight charges: 02 sets of 100 kVA Isolation Transformer at ISTRAC, Bengaluru and 02 sets of 100KVA Isolation Transformer at SDSC,SHAR			
