

Technical specification for of 50 Volts, 100 Amp. 12 pulse rectifier stack assembly.

1. **Scope of tender:** Design, development, drawing approval, fabrication, testing, pre-dispatch inspection, packing, supply, safe delivery and warranty of 12 pulse rectifier stack assembly. **(Please note firing circuit shall not be part of this tender).**
2. **Description of item:** 12 pulse rectifier stack assembly shall comprise of three phase step down rectifier transformer, two SCR bridge type configuration connected in parallel through Inter phase transformer, LC filter, input MCCB/MCB, fuses, power contactors, protection of SCR like snubber, semiconductor fuse, shunt, measuring and indicating instruments, copper bus bar, Incomer cable terminal, DC output bus plate, terminal block section to form 12 pulse controlled rectifier without controller as per Fig 1.0

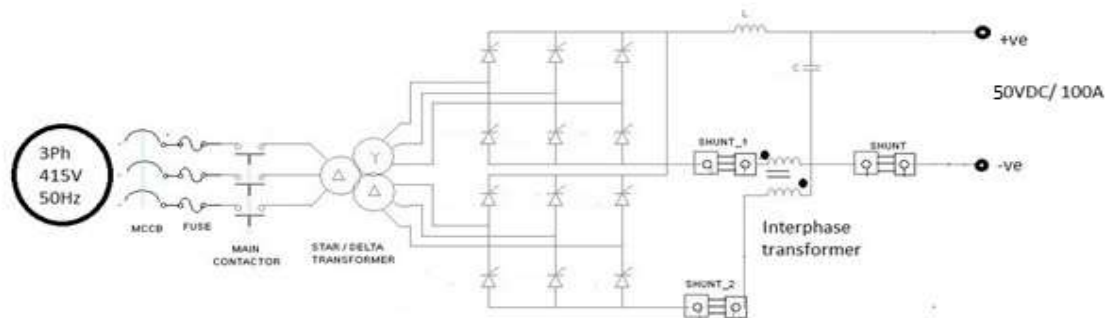


Fig 1.0

3. Technical Specifications

3.1. Input Power Supply

Nominal Voltage : 415V AC $\pm 10\%$, Three Phase & Neutral
Frequency : 50Hz $\pm 3\%$

3.2 Output Power supply

Output Voltage : 0 – 50 Volt DC
Output Current : 0 – 100 Amp DC

3.3 Efficiency

The overall efficiency for the complete unit at full load and rated voltage shall be more than 86% and efficiency of transformer shall be more than 96% at unity power factor.

3.4 Overload Capacity

The unit shall meet the overload requirements of up to 10% of rated capacity for at least 1 hour without failure of any component and equipment in the unit. In case of any momentary overloads beyond 10% of full capacity, the unit shall be capable of withstanding the situation before the protection switchgear trips.

3.5 Ambient Condition

Maximum temperature : 50°C
Relative humidity : 95%

The power components such as MCCB, fuses, power contactor, thyristor rectifier, interphase transformers, output filter unit, DC current sensor, etc. and all the control components like local/remote selector switch, power supply ON/OFF push buttons, acknowledgement/reset/lamp test push buttons, alarm annunciators, terminal blocks, indicating digital meters and lamps, etc. along with transformer, filter **without** control circuit shall be assembled and housed in single cubicle(**IP 31**). The panel shall have four wheel and suitable lifting lug.

3.6 Rectifier bridge

- a) SCR gate and cathode terminal shall be accessible at outside terminal block
- b) The rectifier will be Thyristor controlled forced air cooled.
- c) SCR shall be mount on copper bus bar

- d) The rectifier stack assembly shall have two three-phase bridge connected in parallel through Interphase transformer and fed from three phase input supply through star delta transformer to get 12 pulse output. The thyristor devices used shall have identical characteristics.
- e) These devices shall be mounted on liberally designed, good quality heat sink for adequate heat dissipation. The forced air-cooling shall be provided for indoor installation.
- f) Suitably rated semiconductor fuses shall protect the individual semiconductor device with fuse fail indication / alarm in combination with trip indicating fuse and micro switch.
- g) The RC snubber circuit shall be provided to protect individual Thyristor device against high voltage surges and hole storage effect.
- h) The equipment shall deliver its rated load continuously meeting the specifications.
- i) The unit shall be capable of withstanding momentary overloads of such magnitude and for such duration as is necessary till protective and regulatory devices are effectively in the operating range.

3.7 Rectifier Transformer

- a) The input of the rectifier transformer shall be 3 phase, 415V, 50Hz ac supply.
- b) The output of the transformer shall be Delta/ Delta Star 6 phase, 50 Hz ac supply. The output voltage & KVA rating shall be suitable for our application.
- c) The transformer shall be suitable for rectifier / thyristor duty and continuous operation.
- d) The transformer shall be forced air cooled transformer.
- e) Insulation class: Type F (Temperature rise to be limited to 70 deg. C)
- f) Type of cooling: Forced air
- g) Termination: through bus-duct
- h) Winding connection: Dd0y11
- i) The windings of the transformer shall be copper conductor. Windings shall be impregnated under vacuum.
- j) Superior grade low loss CRGO silicon steel laminations should be used for transformer core fabrication.
- k) Transformer shall give long and trouble-free service under adverse climatic conditions.
- l) The transformer shall be suitable for operation at continuous maximum ambient temperature of 50 °C and the maximum relative humidity of 95%.
- m) The transformer shall be suitable for operation at seashore atmospheric conditions.

3.8 DC Filter

LC filter circuit should be designed such that output current ripple should not exceed 1% and 0.5% at full load and at 60% voltage respectively. The filter reactor should be air cored type and rated for continuous current of 110A. The insulation should be Class-F or above and the temperature rise to be limited to 70 °C. The reactor shall be forced air cooled type / air natural type. The filter circuit may be fitted in separate enclosure so that it can be shifted easily in future.

3.9 Protection

The unit shall be provided with potential free contact at terminal blocks for following protections.

- a) Phase fail, phase unbalance & phase reversal (trip & alarm)
- b) SCR over temperature (trip & alarm)
- c) SCR fuse fail (trip & alarm)
- d) Ventilation blower fail (trip & alarm)
- e) Transformer overload, short-circuit and earth fault (trip & alarm)
- f) Transformer over temperature (trip & alarm)

3.10 Metering

- a) Multifunction meter for input voltage, current, power factor, energy, reactive power etc
- b) DC voltmeter for output voltage
- c) DC ammeter for output current
- d) 6-channel temperature scanner for transformer winding temperature
All the meters to be fixed on the front of the panel shall be digital, flush mounting type. All the meters provided will be of $\pm 1\%$ accuracy.
- e) Shunt for individual bridge and overall sensing. Also, Output voltage sensing is required.

3.11 Indications

LED type indicating lamps with fuse protection are to be provided for the following.

- a) AC Mains ON / OFF
- b) R-Y-B phase indication
- c) Rectifier ON / OFF/trip
- d) 16 channel Alarm annunciator

3.12 Controls

Unit shall be manufacture without any type of control circuit (Firing/feedback) however suitable provision shall be made for terminal blocks for control, indication and measurement to interface user's controller.

4 Ambient temperature: Equipment shall be designed for 50⁰ C Ambient.

5 Conductor material shall be only copper for cables and busbar.

6 Drawing approval: Vendor shall submit detailed GA drawings, fabrication drawings, power circuit drawings to Engineer in charge for approval within two weeks of the date of release of purchase order for approval. Vendor shall submit list of component with rating along with make/ model of the component that shall be used in the system. Vendor shall prepare Terminal blocks diagram in consultation of Engineer in charge.

8. Acceptance criteria: Retifier stack assembly shall be tested at vendor's site before dispatch as per various Indian and international codes and standard mentioned in para 9 of this document

9. The design, manufacture, inspection, testing and performance of the equipment covered by this specification shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the supplier of his responsibility. Where no standards are available, the supply items shall be of good quality and workmanship and backed by test results. Any bought out items shall be procured from manufacturers only after due approval of Purchaser

1. IS: 5 – Colours for ready mixed paints and enamels
2. IS: 191– Copper for electrical purposes
3. IS: 513 – Cold rolled low carbon steel sheets and strips
4. IS: 613 – Copper rods and bars for electrical purposes
5. IS: 694 – PVC insulated cables for working voltages upto and including 1100 V
6. IS: 1271 – Thermal evaluation and classification of electrical insulation
7. IS: 1477 – Code of practice for painting of ferrous metals
8. IS: 1554 – PVC insulated electric cables: For working voltages upto& including 1100V
9. IS: 1897 – Copper strip for electrical purposes
10. IS: 2026 – Power transformers
11. IS: 2062 – Steel for general structural purposes
12. IS: 2147 – Degree of protection to enclosure
13. IS: 2629 – Recommended practice for hot dip galvanizing on iron and steel
14. IS: 2705 – Current transformers (CT)
15. IS: 3136 – Semiconductor rectifier equipment
16. IS: 3156 – Potential transformers (PT)
17. IS: 3231 – Electrical relays for power system protection
18. IS: 5082 – High conductivity aluminium alloy of grade WP 63401 for busbars
19. IS: 5469 – Code of practice for use of semiconductor junction devices
20. IS: 6005 – Code of practice for epoxy painting of panels
21. IS: 6297 – Transformers for electronic equipment: Pulse and switching transformers
22. IS: 6553 – Environmental requirements for semiconductor devices and integrated circuits
23. IS: 6619 – Safety code for semiconductor rectifier equipment
24. IS: 7098 – XLPE insulated electric cables: For working voltages from 1.1 kV to 33 kV
25. IS: 8588 (part 1) – Thermostatic bimetals, general requirements & methods of tests
26. IS: 8623 – Procedure for short circuit withstand test of power panels
27. IS: 9000 – Basic environmental testing procedures for electronic and electrical items

28. IS: 9224 (part 4) – Specification for HRC fuse: Requirement for fuse link for the protection of semiconductor devices
29. IS: 10028 Code of practice for selection, installation and maintenance of transformer.
30. IS: 10118–Code of practice for selection, installation & maintenance of switchgear & control gear
31. IS: 11171– Dry type power transformers
32. IS: 13703– Low voltages fuses for voltages not exceeding 1000 V AC or 1500 V DC
33. IS: 13947 & IEC: 947 – L.V. switchgear & control gear
34. IEC: 60146–Semiconductor converters: Semiconductor self commutated converters
35. IEC: 60326–Printed circuit boards
36. IEEE: 428 –IEEE standard definitions & requirements for thyristorised AC power controllers
37. IEEE:519–IEEE guide for harmonic control and reactive compensation of static power converters
38. ASME: Section 9 – Welding and brazing qualifications
39. BS: 6493 (Section 1.2) – Recommendation for rectifier diodes
40. BS: 6493 (Section 1.6) – Recommendation for use of thyristors
41. Indian Electricity Rules

10. Bidder's qualification criteria:

- a) The bidders shall be reputed and regular in the field of manufacturing solid state variable DC power supplies of high current & power rating.
- b) The bidders shall have valid ISO : 9001 certificate.
- c) The bidders shall have complete test facilities to test the power supply units. The bidders shall submit the details of testing equipments available with them. The bidder shall submit the type test reports of similar types of power supplies they have manufactured of similar or higher capacities.
- d) The bidders shall have the in-house facilities / infrastructure to manufacture and assembly of the equipment. The bidders shall submit the details of manufacturing equipments and facilities available with them.
- e) The bidders shall have adequate qualified manpower to manufacturing, testing and quality surveillance.
