

PERFORMANCE SPECIFICATION FOR STATIC CONVERTER

- 1) **SCOPE** :- Our specification covers design, manufacturing, inspection, testing, supply of the DRIVE.
- 2) **INPUT SYSTEM** :-
 - a) Normal Voltage : 415V +/- 10%
 - b) No of phases : Three phase, four wire
 - c) Frequency : 50Hz +/- 2%
 - d) Fault level : 20KARMS at 415 V.
 - e) Neutral earth : Solidly earthed.
- 3) **TECHNICAL PARTICULARS** :-

3.1) Output Voltage.

- a) Armature : 440V DC Max.
- b) Field : 220V DC
- c) DC Motor Blower : 415V +/-10%, 50Hz +/-2%, 3Ph.

3.2) Output Current.

- a) Armature :
- b) Field :

3.3) Speed Control.

3.4) Accuracy of speed control. +/-2% under Arm. Voltage feedback.

3.5) Soft start. Acceleration and deceleration control from 5sec to 30sec adjustable.

3.6) Type of control : Tacho/Arm. Voltage feedback.

3.7) Direction of rotation.:

3.8) Braking.

3.9) Type of cooling : Forced air cooling

4) CONVERTER MODULES.

It consists of the following modules.

- a) Input module
- b) Thyristor module
- c) Regulation module
- d) Output module
- e) Excitation module
- f) Indicating and operating module
- g) Protection module

4.a Input module

The incoming 415V 3PH four wire supply will be brought into this module. It consists of

- a) Tripple pole and neutral incoming AC heavy duty isolator switch.
- b) Three nos. HRC fuse link for mains.
- c) Main contactor
- d) Line surge suppressor consisting of capacitors, resistors & MOVs.

4.b Thyristor module

It will consist of three phase, full wave, fully controlled thyristor bridge assembly comprising of

- a) Six nos. derated thyristors each mounted on Aluminium heat sinks
- b) RC Snubber circuit for power semi-conductors.
- c) MOVs to protect thyristors against spikes.
- d) Pulse transformers to isolate the control circuit from power circuit.
- e) Forced cooling arrangement.

4.c Regulation module

It consists of modular glass-epoxy based printed circuit boards of height 4U with plug-in type gold plated connectors for easy replacement and servicing.

These are green masked, legend printed PCBs housed in a card frame and interconnected by a mother PC Board.

The different blocks are as under.

- a) Power supply and regulator.
- b) Ramp generator with adjustable accn. Decn. Circuit.
- c) Voltage and current control amplifier which controls the output voltage with adjustable voltage and current limiting.
- d) Pulse amplifier feeding the pulse transformer primary and the gate trigger circuits.
- e) Tripping circuit for single phasing, phase sequence, under voltage, field failure and Electronic overload.

The settings petentiometers (presets), coloured test points and LED indicators are located at the front of the cards.



Note: Specifications are subject to change.

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4.d Output module

It consists of a shunt for DC Ammeter and current feedback components.

4.e Excitation module

This module consists of the following

- a) Step down transformer 415/220V
- b) Link type HRC fuses.
- c) Single phase full wave diode bridge.

4.f Indicating and operating module.

It consists of operational controls

- a) Start push button
- b) Stop push button
- c) Emergency stop push button.
- d) Set speed potentiometer.
- e) Fault Reset push button
- f) Mains ON Indicator
- g) Motor ON indicator
- h) Drive tripped
- i) DC Voltmeter for Armature
- j) DC Ammeter for Armature
- k) Motor RPM Indicator
- l) AC Voltmeter with selector switch for mains supply.

4.g Protection module

This module protects the Drive against various faults....

- a) MOVs (Metal Oxide Variastors) for mains voltage spikes.
- b) Electronic Overload for DC Motor.
- c) Bimetallic thermal overload relay for DC Motor blower.
- d) Bimetallic thermal overload relay for Converter blower (if used)
- e) Electronic instantaneous overcurrent trip.
- f) Single phasing or negative sequence trip which blocks the gate triggering pulses to the thyristors.
- g) Electronic current sensing type field failure protection.

HIGHLIGHTS OF SYSTEMS.

I. Protectional features.

- a) Single phasing. If one of the line voltages is absent the load is shared by the other two lines and the corresponding thyristors get overloaded. To prevent this, single phasing preventor trips the main contactor.
- b) Phase reversal. If the incoming mains are not connected in proper sequence the main contactor cannot be switched on.
- c) Soft start features. The system will consist of soft start, so that on giving the 'start' command the motor builds up to the set speed gradually. The rate of acceleration is adjustable. In case of step changes, the overshoot will not exceed 8% of the rated speed.
- d) Surge suppression. The system devices will be protected against line surges and switching surges by RC noise suppression networks.
- e) dv/dt protection. To avoid accidental triggering of the thyristors due to high dv/dt, RC snubber circuits are provided across each thyristor. These are properly designed so as to limit dv/dt rating to less than 200 volts per sec.
- f) di/dt protection. A.C line chokes are connected in series with the supply lines connected to the thyristor bridge. These chokes limit the maximum di/dt rating to 50Amp. Per sec.
- g) Peak inverse voltage. The power semiconductor devices will be so selected that their PIV rating will be 2.5 times the normal voltage.
- h) Blocking of pulses. In the event of fault, the pulse to the converter thyristors will be blocked. There is no transfer of power from a.c mains to motor and motor eventually stops.

II. **Rating of Resistors.** The wattage of the resistors used will be such that their temperature will not exceed 100deg C. The high wattage types will be wirewound on rigid cylinder of ceramic material. Potentiometer will be single turn, wirewound for high stability giving reliable contact between the moving arm and wire track.

III. **Temperature rise.** The large heat sinks and proper ventilation are provided so that the junction temperature of power semi-conductor devices do not exceed the permissible limits.

IV. **Printed Circuit boards.** It will be made of 1.6mm thick glass-epoxy, copper clad laminates having 35 micron thick copper. The copper tracks will be tin plated & green masked. PCBs will be coated on both sides with anti-corrosive solderable protective lacquer. Suitable test points and indications will be provided on the PCB.

V. **Component Selection.** All components mounted on PCB will be mostly defence approved to ensure reliability. Cores of transformers and chokes will be made of CRGO Laminations. The copper conductors will be of low loss and electrolytic grade copper. Contactors and circuit breakers will be of reputed make.

VI. **Workmanship.** The component layout will be such that it will facilitate easy maintenance. The interconnections will be made by cables

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and wires routed through PVC channels. All cables and wires will be ferruled in accordance with wiring diagrams. All the components will have suitable identification tags. Terminal strip diagram will be provided inside the panel.

- VII. Earthing and insulation.** Power earth terminals in effective contact with the cubicle frame-work will be provided outside the panel. These can be suitably connected to the external earth conductors. All metal parts that do not carry currents will be electrically connected to earth. The insulation resistance will be not less than 10Mohms, when measured at 50volts DC between
- AC input terminals of thyristor control drive and earth.
 - DC output terminals of unit to armature and earth.
 - DC output terminals of unit to field and earth.
 - AC output terminals of unit to blower motor and earth.

GENERAL SPECIFICATIONS FOR DRIVE SYSTEMS

1. Reference standard

- Design, manufacture and testing of Static converter as per the latest applicable Indian standard or equivalent.
- | | |
|----------------------|---|
| IS 1885 (part XXVII) | : Static power Converter. |
| IS 1885 (part VII) | : Thyristor. |
| IS 4253 | : General requirement for switchgear & control gear
for voltage not exceeding 1000 volts |
| IS 2959 | : Specification for Current transformers. |
| IS 1243 | : Specification for electrical indicating instruments. |
| IS 220 | : HRS Fuse links upto 650volts |
| IS 591 | : Transformers for electronic components. |
- Our static converter will also confirm to the requirement of the latest Indian Electricity rules or equivalents.

2. Site conditions.

Drive systems are designed for conditions operation under the following site conditions.

- Altitude : less than 1000 mts. From MSL.
- Maximum relative humidity : 67%
- Ambient temperature : 50degC. (maximum)
- Atmospheric conditions : dusty.
- Installation : indoor.

3. Drive systems are designed for the following load conditions.

- 100% load for continuous operation (24 hrs. per day)
- 125% load for 2 hrs.
- 200% for 60sec.

4. System Design

Static Converters are designed for the speed regulation of +/- 0.1% of base speed under tachofeedback. The system will also be designed to operate under following conditions.

- 100% change in load.
- +/- 10% variation in supply voltage.
- +/-2% variation in supply frequency.

5. Execution

The different components of the system will be housed in a cabinet which will be either floor mounting or wall mounting. The cabinet will be fabricated from M.S. sheet of 16 or 14 guage. The frame will be fabricated from 2mm. thick cold rolled sheet steel. The arrangement of different components inside the panel will be logical and various sections will be easily accessible for inspection and maintenance.

6. Painting and Finishing

All sheet Steel fabrication work will be thoroughly ceaned. It will undergo a treatment of degreasing and pickling before giving the prime coats. The prime will consist of one coat of epoxy based anticorrosive primer paint. The panels will be finished with two coats of synthetic enamel paint.

7. Cabling

We will provide cable entries at the bottom of the panel for incoming and outgoing power and control cables. The cables will be of sufficient size to carry the required electrical power.

8. Terminals

All power connections will be terminated on stud power terminals with spring washers and locknuts. For Control terminals in each module terminal blocks of suitable ratings will be provided. The PCBs terminals will be of easily removable but reliable contact type. The blower motor connections and field wires will be terminated on 16Amps. rated terminal blocks.

9. Wiring

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Internal wiring of the Thyristor control panel will be carried out with 650/1000 grade PVC insulated copper wires and cables will be provided with ferrules having numbers printed on it.

10. Name Plate

All the main components inside the panel will be provided with proper plates for quickly locating their positions. All the front mounted equipments will be provided with individual labels.

11. Earthing

The Control panel will be provided with two external earthing terminals complete with plain and spring washers suitable for connecting main earth.

12. Spares.

We will furnish a list of recommended spares to cover two years of trouble free operation.

13. Inspection and testing

We offer 'no load' test at our works for the panel prior to dispatch.

14. User handbook

We furnish one set of user handbook consisting of installation, operation fault finding chart and bill of material along with the respective drawings.

15. Guarantee.

The Drive is guaranteed against manufacturing defects for a period of 18months from the date of dispatch or 21months from the date of commissioning whichever is earlier.



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