INTER PLANT STANDARD – STEEL INDUSTRY		
I P S S	**SPECIFICATION FOR STATIC EXCITATION CONVERTORS FOR SYNCHRONOUS MOTORS** (*FIRST REVISION*)	**IPSS: 1-10-036-12**
	Corresponding IS does not exist	

0 FOREWORD

0.1 This Inter Plant Standard has been prepared by the Standards Committee on Electrical components and equipment, IPSS 1:10 with the active participation of the representatives of the steel plants, major consultancy organizations and established manufactures of static exciters for synchronous motors and was adopted in January 2012.

0.2 Inter Plant Standards for steel industry primarily aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes/types from among those mentioned in this standard, for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

1 SCOPE

1.1 This Inter Plant Standard covers the requirement and tests of Static Excitation convertors for synchronous motors in steel plants .

1.2 Individual devices and components incorpoated inside the panels shall conform to relevant IPSS, IS or IEC 146-1-1(1991-04) specification.

1.3 This Inter Plant Standard includes the isolation/rectifier transformer unit.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions in IS 1885 (Part 17) : 1979 'Electrotechnical vocabulary : Part 17 Switchgear and Controlgear (first revision)' and IS 3156 (Part-1): 1992 “Voltage transformers: Part 1 General requirements (second revision)” shall apply.

3. SITE CONDITIONS

3.1 The following shall constitute the normal site conditions for the purpose of this standard as mentioned in IPSS:1-02-020-84 "Basic parameters for standardization of steel plant equipment".

3.1.1 *Ambient Temperature* - The reference ambient temperature shall be 40°C. Maximum ambient temperature can be 50°C.

3.1.2 *Ambient Air* - The ambient air in both indoor & outdoor installations may contain fair amount of conductive & corrosive dust.
The equipment should also withstand Saline atmospheric conditions

3.1.3 *Altitude*- The altitude shall not exceed 1000m above sea level.

3.1.4 *Relative Humidity*- The maximum relative humidity shall be 100%. However, the maximum temperature and maximum relative humidity may not occur simultaneously.

4. ENCLOSURE

4.1 The Static Excitation cubicles shall have IP41 degree of protection for assemblies without cooling fans and IP30 for assemblies with cooling fan. Suitable ventilation system shall be provided for reliable performance.

Assemblies with cooling fan shall be provided with dry cleanable filters.

5. POWER SUPPLY SYSTEM

5.1 The Static Excitation Convertor equipment shall be suitable for operation from the following power supply system :

a) *Rated Voltage* : 415 V 3 phase ac , variation +10%, -15%.

b) *Rated Frequency* : 50 Hz , variation $\pm$6%.

5.2 Suitable stepdown/isolation transformers shall be used as required. The transformer secondary voltage shall be selected based on the rated dc excitation voltage of the synchronous motor. Dry type Transformer with temperature monitoring devices are to be provided.

6. RATINGS

6.1 The Static excitation convertor shall have an assigned value for nominal rated voltage and current for continuous duty and peak rated voltage and current for a specified duration.

6.2 The preferred nominal dc output ratings shall be as follows. However, exact ratings shall be as per purchaser's requirement:

a) 36 V 160 A b) 70 V 320 A
b) 145 V 320 A c) 205 V 450 A

6.3 The convertor shall be capable of field forcing upto 150% of nominal field current for 1 minute duration..

6.4 Derating factors above 40°C ambient temperature should be applicable.

7. EQUIPMENT DETAILS

7.1 Basic Features required are :

7.1.1 A dry type stepdown/isolating transformer supplied from 415 V ac mains through input circuit breaker. The primary winding shall have tappings for 10% variation (±5% & ±10%) of supply lines. The transformer secondary voltage and current shall be selected based on the rated field voltage and current of the field winding of the synchronous motor.

7.1.1.2 The stepdown/isolating transformer shall conform to IS 2026 (Part 1): 1977 Power Transformer: Part 1 General (first revision).Should also confirm to IS 1117-1985 in case of dry type of transformer

7.1.2 A 3 phase six pulse fully controlled thyristorised rectifier convertor capable of supplying the rated field current for continuous duty cycle and short-time maximum field current during field forcing duration. In case of more than one thyristor bridge being used in parallel for achieving higher current rating then suitable line/branch chokes are to be provided to ensure current sharing,along with suitable indicating meters showing individual bridge currents in addition to total dc currents.

7.1.2.1 The class of protection for thyristor convertor shall be as IEEE 444 (Part-1) : 1973

7.1.2.2 Unless otherwise specified the over load capacity of the thyristor convertor shall meet the requirement of duty class IV of IEC-146-1-1(1991-04).

7.1.2.3 The convertor shall have RC filter circuit at the input side for transient/surge suppression.

7.1.2.4 The convertor shall have RC snubber circuit across each thyristor and semiconductor fuse for protection and interlock with fuse monitoring unit for each thyristor. The thyristor heat sink shall also be monitored by thermal switches.

7.1.2.5 The convertor shall have full self-diagnostic features and pulse presence monitoring .

7.1.2.6 It shall have one Auto channel and one Manual channel (In tracking with auto channel for smooth change over in case of auto channel failure)

7.1.2.7 The control supply shall have EMI filters and transient suppressors and should be so arranged that the control scheme and the pulse triggering can be checked without applying mains power to the thyristors.

7.1.3 Electrically/manually operated isolating unit for disconnecting the thyristor convertor from the transformer.

7.1.4 Adequately rated Starting/discharge resistance with suitable solid state switching provision (diodes / thyristors / Surge supressors) for partial bypass of resistance as per the specific requirement of motor is to be provided along with the converter for connecting across motor field for facilitating current flow in rotor circuit during asynchronous starting and dissipating inductive energy while switching off of the motor. The full resistance shall remain connected across the field during normal running of motor. Otherwise the system shall be as per the requirement / specification of the indentor.

7.1.5 All transducers, shunts and measuring instruments on the 415 V side required for the excitation control and regulation shall be supplied.

7.2 Protection to be provided for

- Input power phase failure
- Input phase sequence

- Transient over voltage
- Earth leakage /earth fault of rotor circuit
- Synchronising supply failure
- Asynchronous run with time delay trip
- Rotor/field over current and voltage
- limiting of field forcing current
- limiting of field forcing time
- Convertor short circuit
- Protection against cooling fan failure
- Out of step

7.3 Indicating meters – The following indicator meters shall be provided:

- ac input voltmeter with selector switch
- ac input ammeter with selector switch
- ac stator voltage kV meter
- ac stator current meter
- dc excitation voltmeter
- dc excitation current meter
- Power factor meter
- Earth leakage meter
- Null balance meter for matching auto/manual channels.
- Indicating lamps should be of LED type

7.4 Alarm and annunciation for first event display:

- Main power On/Off
- Control supply On
- Earth fault
- dc current overload
- Thyristor fuse failure
- Thyristor failure
- Thyristor over temperature
- Phase fail/reversal
- Motor ready to start
- Motor Asynchronous run
- Field forcing ON
- Motor synchronised
- Loss of stator voltage
- Cooling fan failure
- Rotor/field over voltage
- Failure of interlock between armature and excitation
- Loss of field indication

7.5 The fault diagnostic system should preferable have self diagnostics feature and shall store and display last 5 faults with description , fault value and time stamping. Configurable

data/event recorder with proper connectivity for display and analysis of recorded data is preferable.

8. OPERATION

8.1 The static convertor should have the following modes of operation;

8.1.1 *Manual Mode*: In this mode the excitation current is set manually and the convertor operates in constant current mode, through suitable current regulator. Field current forcing and forcing time are adjustable. In manual mode the exicitation current setting shall be done through digital reference value generator (adjustable / settable) .

8.1.2 *Auto Mode* : In this mode the excitation convertor operates in constant power factor mode. Stator current and voltage sensing is done and Power factor can be manually set.

8.1.3 *Test Mode*: This mode is meant for checking the control system of the excitation convertor and dc injection.

8.2 During starting of the synchronous motor the application of dc excitation current can be selectable as a function of the following or a combination thereof :

- stator current
- rotor slip
- time

8.3 The range of power factor control shall be from 0.8 lag to 0.8 lead in auto mode.

9. PANEL WIRING

9.1 Clause 6.0 of IPSS: 1-04-041-03 “General requirements for control panels for cranes” shall apply.

9.2 For regulating and other electronic circuits, wiring shall be of PCB back plane type or wire wrapping type.

10 TERMINATION

10.1 Clause 6.0 of IPSS: 1-04-041-03 shall apply.

10.1 Plug-in type electronic cards shall have connections through plug and receptacle arrangement.

10.2 The connection shall be poly carbonated glass grilled nylon with gold plated pins for good electrical contacts specially with low voltage and weak current signals.

10.3 The connectors shall be mechanically polarized to prevent wrong insertion of the modules/cards.

10.4 The electronic cards shall be provided with identification plates, test point brought out for checking input/output parameters, signals monitoring at critical points along with suitable handle for drawing out the cards.

10.5 The cards shall be housed in regular bins which shall be metal rack with hinged swiveling arrangement confirming to the dimension as given in IEC 50297-1(1986-09). The electronic cards shall be provided with self-locking screws to secure them firmly in the bins with sufficient space between them for electrical isolation and proper cooling.

11. EARTHING

11.1 Provision of clause 9 of IPSS: 1-04-041-03 shall apply.

11.2 The body of each plug-in module shall be connected on separate terminal of plug to common earth bus.

12. TEST

12.1 The tests shall include but not limited to the following:

12.1.1 Tests at Manufacturer's premises :

- Visual inspection
- Insulation test
- High voltage test
- functional test
- Light load test
- Power loss/power efficiency test
- Full load and temperature rise test

12.1.2 Test at site to be done in presence of purchaser:

- Visual inspection
- Insulation test
- Functional test

- Light load test and actual running of motor with load
- Interlocking system checking
- Annunciation system checking
- Protection system checking
- Field forcing system checking
- Manual and Auto mode checking

12.2 Test certificates of all tests carried out shall be furnished.

13. INFORMATION TO BE FURNISHED

13.1 The provision of clause 10 of IPSS :1-04-041-03 shall apply.

13.2 Detailed drawings and Manuals (Installation , Operation , Maintenance & trouble shooting etc) along with ratings and makes of critical Components / cards shall have to be submitted by the equipment supplier.