INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR dc POWER PACK FOR EOT CRANES** (*Second Revision*)	**IPSS:1-10-007-11**
		Formerly : IPSS: 1-10-007-06
	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 manufacturers of dc Power Pack and was adopted in May 2011.

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.

0.3 Certain modifications have been incorporated in this revision based on shop floor experiences.

1. SCOPE

1.1 This Inter Plant Standard covers the requirement and tests of dc power pack for use on EOT cranes in steel plants for giving common dc supply to control circuits, load lifting magnets, dc electromagnetic brakes, etc.

1.2 This Inter Plant Standard does not include special transformer rectifier unit for the use of arc furnaces, electrostatic precipitators, dc drives, etc.

1.3 The standard does not apply to power packs used in hazardous and explosive locations and any other special applications

1.4 There shall be provision for battery back up for lifting magnets if required by the purchaser.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions contained in IS 1885 (Part-7) :2001 “Electrotechnical vocabulary: Part 7. Semi conductor

devices and Integrated circuits (second 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:

3.1.1 *Ambient temperature* - The reference ambient temperature shall be 50^{o}C or 45^{o}C unless specified by the purchaser.

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

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

3.1.4 *Ambient air* - The ambient air may contain fair amount of conductive dust.

3.2 The dc power packs complying with this standard shall be suitable for continuous operation at these ratings.

4. RATING

4.1 **Rated voltage** – The rated supply at the input shall be 415 V ac 3 phase. The tolerance shall be + 10% and - 15%.

4.2 The rated supply at the output shall be not more than 240 V dc on no load and not less than 220 V dc on rated load. Output Voltage 240 dc; 440 V/240 V transformer shall be used.

4.3 The rated frequency shall be 50 Hz +6%, -6%.

4.4 **Rated Capacity** - The rated output of power packs shall be 6, 16, 40, 63 and 100 kW at a temperature of 55^{o}C with natural cooling.

4.5 Rated Short Circuit Current -The rated short circuit withstanding current shall be 50 kA for one sec.

4.6 **Enclosure** – The transformer rectifier unit shall be housed in a suitable enclosure to protect the equipment from ingress of dust and water and conforming to IP-33 as per IS 60947 (Part-1) “Specification for low-voltage switchgear – Part-1:General Rules. For outdoor applications, it should be rain proof design with suitable canopy provided over the power-pack. Double earth provision to be provided as per IS 3043:1987.

4.7 The rectifier efficiency at full load should not be less that 92%.

4.8 The overall size of unit shall be mutually agreed to by supplier and user.

4.9 **Components of power packs**

4.9.1 The recommended main constituents of the power packs shall be :

a) MCCB for the main incoming supply to the transformer. The MCCB shall have padlocking & positive isolation facility.

b) LED indication lamps to be used to indicate the presence of ac incoming supply for each phase.

c) Dry type transformer of suitable rating,

d) Diodes with heat sinks of suitable rating forming 3 phase full wave bridge,

e) Semi conductor grade fuse of appropriate capacity for protection of diodes as per IS 13703 (Part 4):1993 “Specification for low voltage fuses for voltages not exceeding 1000 V ac or 1500 V dc – Part 4:supplementary requirements for fuse links for the protection of semi conductor devices (superseding IS 9224:Part 4).

f) Transient voltage suppressor non-polarised across each secondary winding of transformer,

g) R.C. snubber circuit across each diode,

h) Polarized transient voltage suppressor across dc output,

i) HRC fuse protection of suitable rating at the secondary of the transformer,

j) Shunt with ammeter for indicating dc load, and

k) Voltmeter indicating dc output voltage

l) Contactors.

4.10 Over Load Capacity – The overload capacity of the power pack shall be :

i) 100% continuous

ii) 125% for 2 hours

iii) 200% for 10 seconds.

The components viz transformer, diodes, MCCB etc shall be designed to suit the overload capacity of the power pack.

5. DESIGN AND CONSTRUCTION

5.1 Mechanical Design and Construction of Power Pack Unit

5.1.1 Transformer rectifier unit shall be housed in a cabinet of the following limiting dimensions :

Depth	:	800 mm (Max)
Height	:	1800 mm (Max)

5.1.2 For fabricating the cabinet, sheet steel of cold rolled type and with thickness not less than 2 mm, shall be used (the cabinet will have provision of louvers with fine wire-mesh on all the sides for ventilation).

5.1.3 All openings and cut-outs shall be machine made and shall be free from burrs. Inert gas process should be used for welding and weld run should be ground smooth. Sheet steel surface shall be free from dirt and hammer marks.

5.1.4 All sheet steel work shall undergo a process of degreasing acid pickling, cold rinsing and phosphating and sprayed with a corrosion resistance paint followed by stove enamelling. Two coats of final paint shall be given thereafter and shall be stove enamelled. For outdoor applications, epoxy painting shall be done. The total thickness of coating shall be not less than 30 microns.

5.1.5 Provision shall be made for lifting the entire unit by providing adequate number and size of lifting hook/eye bolts. Provision shall also be made to lift the transformer separately from inside the enclosure.

5.1.6 The cabinet shall have arrangement to fasten rigidly by nuts and bolts of suitable size and nos. on the foundation plate to take care of jerks and vibration especially on cranes. All the foundation and other fixing bolts, nuts, plates and other hardware for the erection of the equipment shall form part of power packs and shall be of cadmium coated finish.

5.1.7 The power pack panel shall be designed to withstand heavy vibrations and shocks encountered in the usage of EOT cranes and shall be able to withstand vertical impact of 2g & horizontal impact of 1g.

5.1.8 Silicon diodes with heat sinks and RC snubber circuit shall be mounted on a separate insulation (non-hygroscopic) sheet so that the entire set can be replaced as and when required.

5.1.9 All the components shall be mounted in such a manner that they are easily accessible from the front. Two separate earthing terminals to be provided on the base of the cubicle.

5.1.10 Front cover of the cabinet on which the indicating lamps, voltmeter and ammeter are installed, will be of hinged type and with a provision to lock it. The latching arrangement shall be as per IPSS:1-04-041-03 `General requirements for control panels for cranes'.

5.1.11 The incoming circuit breaker shall be mounted on the side of cubicle in its width, with a suitable marking. The outgoing circuit breaker shall be mounted on the opposite side of incoming circuit breaker in its width with a suitable marking. There should be MCCB for the main incoming supply t o the transformer. The MCCB shall have padlocking & positive isolation facility.

5.2 Design and construction of Transformer

5.2.1 The transformer for unit shall be Dry type suitable for rectifier duty and rigidly fixed on a stable foundation by nuts and bolts. It shall conform to IS 2026 (Part 1):1977 Power Transformers :Part 1 General (first revision).

5.2.2 The transformer shall be of star-delta connection.

5.2.3 Tappings shall be provided on the primary side at $\pm$2.5%, $\pm$5%, $\pm$7.5% and $\pm$10%.

5.2.4 The material of transformer stamping shall be conforming to IS 3024:2006 Grain oriented electrical steel sheets and strips (first revision).

5.2.5 The winding wire/strip shall be of copper and not aluminium.

5.2.6 Class of insulation shall be `F'.

5.2.7 Suitable protection shall be provided against overloading and single phasing.

5.2.8 Transformer shall be provided with transient voltage suppressors non-polarised across each secondary winding.

5.2.9 Regulation of 5% to be included.

5.3 Silicon Diodes

5.3.1 The diodes (conforming to IS 3895:1966 Monocrystalline semi conductor rectifier cells and stacks) should be of standard castings and outline with suitably designed air cooled heat sink. Diodes shall be of stud-cathode design.

5.3.2 The silicon diodes shall be of good and non-ageing properties and shall be capable of operating continuously at a junction temperature of 150^{o}C.

5.3.3 The rated peak inverse voltage of the diodes shall be minimum 1500 V.

5.3.4 Diodes shall be mounted in a separate insulation sheet conforming to IS 4248:1967 “Non-ignitable and self extinguishing boards (with mineral base) for electrical purposes” and with thickness not less than 6 mm so that the entire set can be replaced, if needed.

5.3.5 dc power pack shall be supplied in fully assembled condition with complete wiring.

5.4 **Wiring**

5.4.1 The wiring shall be done with 1.1 kV grade, PVC insulated, single core, multi-strand copper conductored cable of size not less than 2.5 mm^2 conforming to IS 694:1990 `PVC insulated cables for working voltages upto & including 1100 V (third revision) (superseding IS 3035:Part1)'. The PVC used in the insulation of the cable shall be of the heat resistant grade.

5.4.2 All the wires shall be run and fixed neatly and shall allow free access to the components. The cables shall not rest or rub against sharp edges and also shall not rest against live parts. Wiring shall be arranged and supported in such a manner that there shall be no strain on the termination. Wiring between components shall not have spliced or soldered joints. Connections shall be made only at fixed terminals having screws.

5.4.3 Every insulated conductor shall be identified by numbered ferrules at both ends, in accordance with the wiring diagram. For the sake of easy identification, the insulated conductors should not be bunched but instead should be dressed and clipped flat on the surface.

5.5 **General**

5.5.1 Only open type terminals with barriers shall be used as terminal blocks.

5.5.2 Cable glands shall be provided at the bottom for cable entries and these shall be securely fixed in position.

5.5.3 The unit shall be provided with the following data imprinted on a sheet steel and rivetted or screwed on to the front cover of the unit :

a) Manufacturers's name / make
b) Year of manufacture / Sl no. of the unit
c) Rated capacity in kW
d) Rated current :

ac side in Amp.
dc side in Amp.

e) Rated voltage :
ac side in Volts.
dc side in Volts.

f) Efficiency at full load, and
g) Total weight of the unit in kg.

5.5.4 Single line diagram on laminated sheet shall be fixed inside the front door.

6. TESTS TO BE CONDUCTED

6.1 Tests shall be conducted conforming to IS 4540:1968 `Monocrystalline semiconductor rectifier assemblies and equipment'.

6.2 Following tests shall be done by the manufacturer :

a) Insulation test,
b) Open circuit test of transformer
c) Short circuit test of transformer
d) Overcurrent test at 125% load for two hours, after achieving thermal stability at full load

e) Short time over-load withstand test of unit at 200% load for 10 seconds

f) Safety standard should conform to IS 6619:1972 `Safety code for semiconductor rectifier equipment'.

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