INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR PROTECTIVE PANELS FOR dc CRANES** (*Second Revision*) Corresponding IS does not exist	**IPSS:1-10-013-11** Formerly : IPSS: 1-10-013-03

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 switchgears & controlgears 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 This Inter Plant Standard is intended to cover protective panels for dc cranes keeping in view the specific needs of the steel industry.

A protective panel is a device for receiving the main power for the EOT crane and distributing to the different mechanism such as hoist travel, cross traverse etc through contactors and overcurrent relays. At the discretion of the user plant, fuses for individual drives can be provided in the protective panel if not provided in the individual panel. It is also possible to isolate the power to all the crane mechanisms by remotely located safety switches and emergency switch.

0.3.1 The service conditions with which panels covered by this standard comply with, are given in clause 4. Special panels such as those intended for explosive atmosphere locations are not covered.

1. SCOPE

1.1 This Inter Plant Standard covers the requirements of protective panels for dc EOT cranes with rated main circuit voltages of 230 and 460 V dc, transfer car, ground chargers & any other such mobile equipment.

1.2 This Inter Plant Standard also covers the salient features of the control scheme employed for protective panel.

1.3 Individual devices and components incorporated inside the protective panel shall conform to relevant IPSS/IS standards. Specifications for the same are not covered in this standard.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions contained in IS 1885 (Part-17) :1979 “Electrotechnical vocabulary: Part 17, switchgear and controlgear (*first 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.

3.1.3 *Relative humidity* - The maximum relative humidity shall be considered as 100%. However, both maximum temperature and 100% relative humidity may not occur simultaneously.

3.1.4 *Ambient air* - The ambient air may contain fair amount of conductive dust, smoke, steam, corrosive or inflammable gases.

4. ELECTRICAL CHARACTERISTICS OF PROTECTIVE PANEL

4.1 **Rated voltage of the main and control circuits** – The Rated voltage of the main circuit shall be 230/460 +6% –10% and for control circuit shall be 110V/230V+6% –10%.

4.2 **Rated current** – The rated currents of the contactors shall be selected from 300, 600, 900, 1350, 2000 and 2400 A.

5. GENERAL REQUIREMENTS OF DESIGN AND CONSTRUCTION

5.1 Mechanical Design

Protective panels shall be designed and manufactured to provide safety, efficient, reliable and trouble free service in iron and steel works where continuity of operation is of prime consideration.

i) The panels shall either be of open execution or in an enclosure as specified by the purchaser.

ii) The enclosed execution panel shall generally conform to IPSS:1-04-041-003 `General requirements for control panels for cranes'.

5.1.1 The panel shall be free standing and of base mounting design.

5.1.2 The panel shall be designed and manufactured to perform satisfactorily under such variation of load and atmospheric conditions as may occur at site during operation including transient conditions of short circuit.

5.1.3 The protective panel shall be designed to withstand heavy vibrations and shocks encountered in the usage of EOT cranes, transfer cars, ground chargers and any other such mobile equipment; and shall be able to withstand vertical impact 2g and horizontal impact 1g.

5.1.4 The enclosed type panel shall be sheet steel enclosed. The sheet steel used for fabrication shall be cold rolled and of thickness not less than 2 mm except for doors, which may be of 1.6 mm thick sheet.

5.1.5 All components shall be easily accessible and capable of being removed from the front.

5.1.6 The panel shall have two hinged doors at the front and shall have pad locking arrangements.

5.1.7 The degree of protection provided by the enclosure shall be IP 54 as per IS 12063:1987 `Classification of degrees of protection provided by enclosures of electrical equipment'.

5.1.8 Neoprene gaskets or better quality gaskets shall be provided for the doors. The gasket shall be mechanically supported on grooves apart from pasting with synthetic adhesive paste and firmly secured.

5.1.9 Cable entry shall be from the bottom only.

5.1.10 Removable cable gland plates of sheet steel not less than 2 mm thick shall be provided at the bottom of the panel, which shall be suitable for the cable sizes indicated in the purchase order. Undrilled plates shall be provided in the absence of specific information.

5.1.12 All the foundations and other fixing bolts, nuts, plates and other hardware necessary for the erection of the equipment shall form part of the panel and shall be cadmium coated.

5.1.13 The overall height of the panel shall not exceed 1800 mm.

5.1.14 The panel enclosure shall be sprayed with one coat of corrosion resistant primer and two coats of final paint and shall be stove enamelled after the

primer coat and finish coat as per IS 5:2007 `Colours for ready mixed paints and enamels (*Fifth revision*)'.

5.1.15 All the components shall be mounted on insulating board of thickness not less than 25 mm or it should be as per 5.5.3 of IPSS:1-04-041-03.

5.1.15.1 Material of the insulating board shall comply with IS 4248:1967 `Non ignitable and self extinguishing boards (with mineral base) for electrical purposes'.

5.1.16 Clearance and creepage distances shall be in accordance with IS 60947(Part-1):2004 `Low voltage switchgear and controlgear Part-I General Rules.

5.1.17 Provisions of IPSS:1-04-041-03 and IPSS:1-04-043-03` Particular requirements of control panels for dc cranes' shall be applicable wherever relevant.

5.2 **Apparatus in the Panel**

5.2.1 The protective panel shall consist of the following minimum devices :

a) Two pole knife switch with spring latched arcing contact of adequate capacity for isolating the main dc power ON-LOAD with provision for mechanically locking switch in the off-position. The switch shall have a continuous rating not less than the continuous rating of the contactor used. In case two contactors are used per pole, twice the rating shall apply.

b) Two pole knife switch with spring latched arcing contact of 60 A capacity for isolating the control power.

c) HRC fuses of adequate capacity for the control circuit.

d) Separate single pole power contactor in the –ve and +ve lines for the main dc power. Use of 2 contactors in parallel is permissible for contactor above 900 A rating but the coils of contactors shall be connected in series. The insulated wires shall be clamped on the structural work of the panel.

e) Control relays for operation of the main power contactors (for higher capacity) on the protective panel, connected to both emergency and safety switches.

f) Over current relay.

g) Separate terminal blocks for power and control circuits.

h) Voltmeter of range 0-500 V dc.

j) Provision of earth fault monitoring through a milli-ammeter.

5.2.2 Ratings of contactors – The ratings of the line contactors used on protective panel shall be governed by the following considerations :

a) The continuous rating shall not be less than 75% of the combined intermittent current ratings of all motors.

b) In no case shall the line contactors of the protective panel be of smaller rating than the largest contactor used on any of the panels protected thereby.

c) Start and stop push button with indication lamps shall be included on protective panel door and a provision for remote start and stop also should be made.

5.3 **Wiring**

5.3.1 The panel shall be completely factory assembled and front wired.

5.3.2 All power wiring shall be done by adequate size of copper flats, the minimum size being 25 mm wide x 5 mm thick. There should be enough space to handle the power cable. All power connections should be through copper strips mounted on insulator.

5.3.3 Control wiring shall be done by 1100 V grade HR PVC insulated stranded copper cable of size not less than 2.5 sq mm in hot metal cranes. HR PVC to be used.

5.3.4 All wires shall be neatly dressed and shall allow clear access to all components.

5.3.5 Insulated conductors shall not rest against bare live parts of sharp edges.

5.3.6 All wirings shall be arranged and supported in such a manner that there shall be no strain on the terminations.

5.3.7 Wiring between two devices shall have no joints. Connections shall be made at fixed terminals only.

5.3.8 Wire ways shall be smooth and entirely free from sharp edges, burrs, fins, etc that may cause abrassion to the insulation of cables.

5.3.9 Each wire shall be identified by numbered ferrules at both ends, in accordance with the wiring diagram. For easy identification, wires shall not be bunched but clipped flat on the surface at every 25 cms.

5.3.10 All wires / cables shall be terminated through copper lugs.

5.4 **Termination**

5.4.1 All connections external to the cubicle shall be brought to readily accessible terminals.

5.4.2 All terminals shall be of adequate current rating to suit individual feeder/control circuit requirement.

5.4.3 All connections to the terminals shall be arranged in a logical manner.

5.4.4 All power and control terminals shall be properly segregated and shall have indelible terminal number inscribed on them.

5.4.5 The control terminal block shall be of moulded open type and suitable for accommodating 2.5 mm^2 copper cables.

5.4.6 Power cables shall be terminated on brass studs mounted on phenol formaldehyde boards/fibre glass reinforced thermo setting plastics. The minimum diameter of the studs shall be 12 or 16 mm depending on the current rating. The distance between adjacent power studs shall be such as to allow a minimum distance of 25 mm between the outermost portions of the terminal ends mounted on them.

5.4.7 There shall be at least 4 numbers spare terminals for the power and control circuits.

5.4.8 The power terminals shall be provided with compression type terminal ends suitable for the size of the cables they are to receive, (see IPSS:1-10-033-93).

6. EARTHING

6.1 All panels shall have two separate and distinct earth connections conforming to IS 3043:1987 `Code of practice for earthing'.

7. MARKING

7.1 **Name plate** – Each protective panel shall be provided with a name plate with the following information :

a) Type of panel followed by rated current e.g. PROTECTIVE PANEL 600 A in letters of at least 37 mm size.
b) Manufacturer's name or trade mark,
c) Identification number
d) Year of manufacture,
e) Reference to this IPSS,
f) Rated voltage, main and control circuit,
g) Degree of protection, and
h) Weight.

7.2 **Labelling**

7.2.1 Each component shall be clearly and permanently identified near and on the component by writing with paint as per the schematic diagram. The designation shall also be painted on the component so as to be visible from the front.

7.2.2 The schematic diagram shall be engraved on a plate or printed through paint transfer technology.

8. CONTROL SCHEME FOR THE PROTECTIVE PANEL

8.1 Fig-1 shows the elementary diagram of a typical protective panel for four motors.

LEGEND FOR FIG-1	
F1 & F2	MAIN FUSE
CF1 & CF2	CONTROL FUSES
1M, 2M	MAIN (LINE) CONTACTORS
MKS	MAIN KNIFE SWITCH
CKS	CONTROL KNIFE SWITCH
EM SW	EMERGENCY SWITCH
V	VOLTMETER
A	AMMETER
NOL	OVERCURRENT RELAY
CR	CONTROL RELAY
RL	RED LAMP
GL	GREEN LAMP
R	HOLDING RESISTANCE

NOTE: 1) The graphical symbols are as per IS 2032 `Graphical symbols used in electro-technology'.

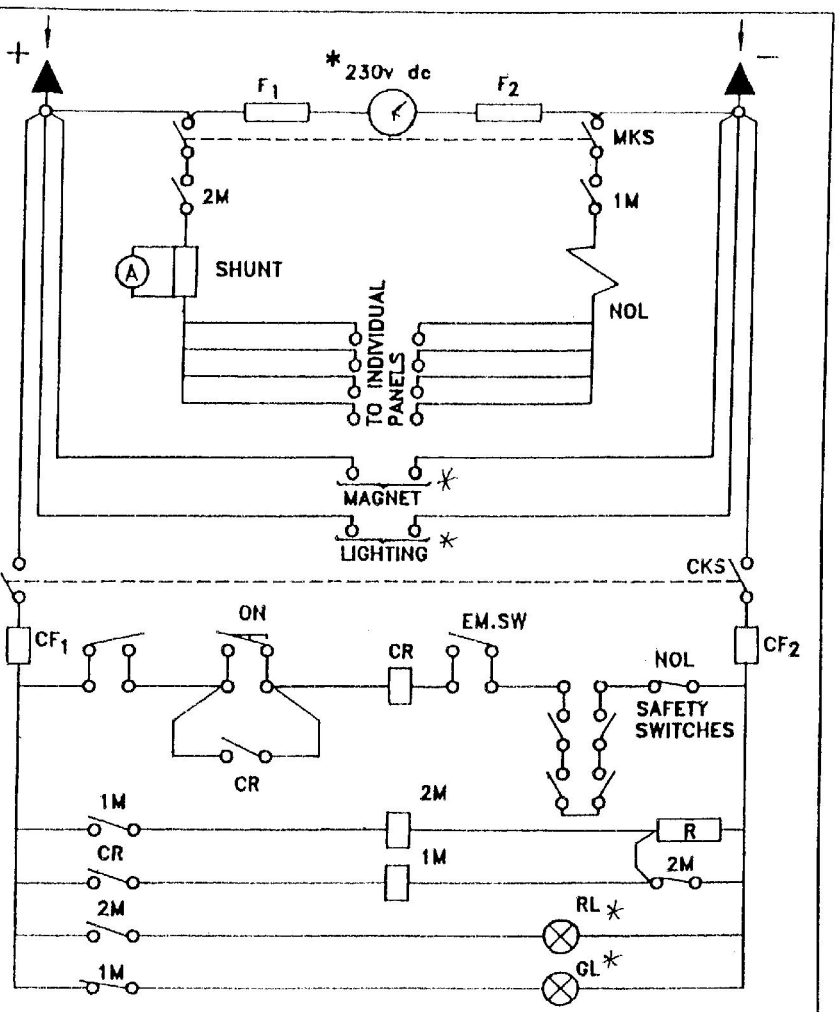
2) Components connected by the dotted lines are optional.

9. TESTS

9.1 Tests given in 8.1 of IS 8623 (Part 1):1993 `Low voltage switch gear and control gear assemblies: Part 1 Requirements for type tested and partially type tested assemblies (*first revision*)' shall apply for the purposes of this IPSS.

9.2 The components / apparatus shall comply with the tests specified in the relevant IPSS or ISs.

IPSS:1-10-013-031



NOTE:—

(1) WHERE EVER TWO CONTACTORS SHALL BE USED FOR 1M OR 2M, THE COILS OF CONTACTORS SHALL BE CONNECTED IN SERIES.

(2) FOR REMORTE OPERATION, INTERNAL WIRING IS TO BE DONE AND TERMINATED SUITABLY FOR EXTERNAL CONNECTIONS.

* (3) IN CASE OF 460V dc, SUITABLE RESISTANCE TO BE INCLUDED IN SERIES WITH THE INDICATION LAMPS AND MAGNET AND LIGHTING TO BE CONNECTED TO SUITABLE VOLTAGE

FIG. 1 PROTECTIVE PANEL FOR DC EOT CRANES

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