INTERPLANT STANDARD – STEEL INDUSTRY

IPSS	SPECIFICATION FOR BIMETALLIC OVERLOAD RELAYS FOR ac AND dc MOTOR PROTECTION (*First Revision*)	IPSS:1-04-014-03
	Based on IS 13947 (Part 4 /Sec.1):1993	Formerly: IPSS:1-04-014-87

0. FOREWORD

0.1 This interplant Standard has been prepared by the Standards Committee on Switchgears & Controlgears IPSS 1:4 with the active participation of the representatives of the steel plants, reputed consultancy organisations, established manufacturers of electrical relays and was adopted in June 2003.

0.2 Interplant Standards for steel industry aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or requirement (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 (or types) from among those mentioned in this standard, for the purpose of company standards deviations in technical requirements

0.3 This interplant standard was originally published in 1987. In view of the difficulties in the implementation as well as an account of inclusion of the item in IS, the second revision has been carried out.

0.4 In the preparation of this standard, assistance has been derived from the following.

a) IS 13947 (part 4/Sec1): 1993 - Specification for low voltage switchgear and control gear – Part 4 : Contactors & Motor Starters – Section 1: Electromechanical Contactors & Motor Starters (Superseding IS 2959, IS 8544 : Part 4 (All Parts))

1 SCOPE

1.1 This Interplant Standard covers the performance requirements of bimetallic overload relays used for protection of ac and dc motors against injurious heating.

2 TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:1885 (Part 9)-1992 'Electrical vocabulary' : Part 9 'Electrical relays', and IS: 5834 (part 1):1994 and (part 2-1993) electrical timer relays for industrial purposes, Part 1 Pneumatic and Part 2 Motorized, shall apply.

3 APPLICATION

3.1 These relays are, in general , used to protect continuous duty ac and dc motor against running overloads, stator current unbalance and prolonged stalling. It is to be understood that for protection, the relay characteristics must envelope the thermal damage curves of both the stator and the motor of the ac motor or of the armature of the dc motor. The relays shall correctly protect the motors even when they are started 15 times (max) per hour.

4 SELECTION

4.1 The relays shall be so selected that the motor rated current is less than what is closer to the maximum rating of the relay.

5. SERVICE CONDITIONS

5.1 **Ambient Temperature**: The reference ambient temperature shall be 40 deg C. The relay should have ambient temperature compensation upto 55 deg C.

5.2 **Altitude**: The altitude shall not exceed 1000 m.

5.3 **Ambient Air**: The ambient air may contain a fair amount of conductive dust and corrosive fumes.

5.4 **Humidity**: The maximum relative humidity shall be 100%. However, both maximum ambient temperature and maximum relative humidity may not occur simultaneously.

5.5 The relay shall be suitable for operation in open or an IP 54 enclosure and shall operate satisfactory in an industrial atmosphere.

5.6 The bimetallic over-load relay shall be suitable for operation in environment conditions conforming to Pollution Degree 3 which covers generation of persistent conductivity by conductive dust or rain or snow.

6 CONSTRUCTION

6.1 The relay shall be of block type construction and designed so as to prevent accumulation of dust which may cause short circuits between power terminals, control terminals or ground. The insulation shall have good tracking resistance which can be restored easily by simple cleaning. The creepage path shall be 12 mm/KV (min.) . The current carrying parts shall be electroplated for good resistance against corrosion.

6.2 It shall be possible to mount the relay directly on the contactor or separately.

6.3 The terminals shall be suitable for both multistrand or solid conductors. The control terminals shall be suitable to receive one conductor of 2.5 or 4 mm^2 cross section.

6.4 A change over contact shall be provided between the control terminals for indication and tripping. 1 NO + 1 NC potential free contacts shall begiven.

6.5 It shall be possible to reset the relay from outside without disturbing the relay.

6.6 The manufacturers shall supply relay compensated to work upto an ambient of 55^0 deg. C, for use in an enclosed cubicle, installed away from the motor. The manufacturers shall supply relays without correction, for use near the motor if required by the purchaser.

6.7 The terminals of the main circuits of overload relays shall be marked by single figure numbers and an alphanumeric system.

e.g.

The terminals of the auxiliary circuits of over-load relays shall be marked by double digit number.

- The number in the unit place is a function numbers, Function numbers (1,2) and (5,6) are for NC contracts whereas (3,4) and (7,8) are for NO contracts.
- The number in the tenth place is a sequence number . The sequence number shall be 9 and if a second number is required, it shall be 0.

e.g.

7 OPERATIONAL REQUIREMENTS

7.1 The relays shall be suitable to protect motors which have low thermal inertia against abnormal heating (of stator and rotor of induction motors and of armatures of d.c motors). For d.c. application all the three elements shall be connected in series to carry the load current.

7.2 The relays shall be classified into following trip classes, according to the time of tripping.

TABLE-1

TRIP CLASS	Tripping time (Tp) in seconds
10A	2<Tp<10
10	4<Tp<10
20	6<Tp<20
30	9<Tp<30

7.3 The relays shall be governed by the stipulations, limits of operation, as laid down in Table 2 (when envisaged on all poles) and as laid down in Table 3 (When envisaged on two poles only).

TABLE –2

(Limits of operation of time delay, when all poles are energised)

Type of Overload relay	Multiples of Current Settings				Reference Ambient air temperature
	A	B	C	D	
Thermal type not compensated for ambient air temperature variation	1.0	1.2	1.5	7.2	$+40^0$ C
Thermal type compensated for ambient air temperature variation	1.05	1.2	1.5	7.2	$+ 20^0$ C

TABLE –3

(Limits of operation of time delay, when two poles are energised)

Type of Overload relay	Multiples of Current Settings		Reference Ambient air temperature
	A	B	
Compensated for ambient temperature variations. Not phase loss sensitive	3 poles 1.0	2 poles 1.32 1 pole 0	$+20^0$ C
Not compensated for ambient air temperature variations. Not phase loss sensitive	3 poles 1.0	2 poles 1.25 1 pole 0	$+40^0$ C
Compensated for ambient air temperature variations. Phase loss sensitive	2 poles 1.0 1 pole 0.9	2 poles 1.15 1 pole 0	$+20^0$ C

7.4 The overload relays shall conform to the requirements of **Table-2** as under-

i) If the relay, fitted normally in its enclosure, is loaded A times the current setting, tripping shall not occur in less than 2 hours, starting from the cold state, at the corresponding value of reference ambient air temperature. However if the overload relay terminals reach thermal equilibrium at the test current in less than 2 hours, the test duration can be reckoned as time needed to reach such thermal equilibrium.

ii) When the setting current is subsequently raised to B times the set value of current, tripping shall occur in less than 2 hours.

iii) For class 10A , overload relays envisaged at C times the current setting, tripping shall occur in less than 2 minutes, starting from thermal equilibrium at the current setting.

iv) For class 10, 20, and 30 overload relays envisaged at C times the current setting, tripping shall occur in less than 4,8 and 12 minutes respectively, starting from thermal equilibrium at the current setting.

v) At D times the current setting, tripping shall occur within the limits recommended in table 1, for the appropriate trip class starting from the cold state

However, in case of overload relays, having a current setting range, the limits of operation shall apply when the relay is carrying the current associated with maximum and minimum settings only.

7.5 An overload relay is regarded as compensated , if it complies with the relevant requirements of Table 2 at +20°C and is within the limits shown in **figure 1** at other temperatures.

For non-compensated overload relays, the current multiple/ambient air temperature characterstics shall not be greater than 1.2%/k which incidentally is also the derating characteristic of PVC insulated conductors.

8 RATINGS

8.1 The relays shall be with directly heated elements upto 110 A. Higher ranges shall be of C.T. operated type.

8.2 CTs used for relays, shall provide the complete trip characteristic upto-8-10 times the setting range, without saturation. C.T. operated bimetallic relay shall be provided with a clear label in front, giving the actual current corresponding to the scale setting-Ratio of the current transformer shall be stated.

8.3 For motors having long accelerating time upto 60 seconds, a class 10/10A relay with suitable saturable CTs shall be used. This will avoid tripping of the motor while accelerating, but will protect against sustained overload.

8.4 The primary windings of CTs shall be capable of withstanding 50 KA (suitable for type II coordination.

8.5 Overload relays shall be designated by their current setting range (if adjustable) and their trip class. Current setting range shall be marked on the relays in the front.

8.6 Typical time-current characteristics shall be given in the form of curves, by the manufacturer. The same shall depict variation of tripping time (seconds) against multiples of current setting (atleast upto eight times the full load current of the motor to be protected) for both cold start and hot start condition in log-log graph.

8.7 The time –current characteristics should be for 40^0C ambient temperature and the same be clearly indicated on the curve.

8.8 The overload relays should operate satisfactorily within the ambient temperature, ranging from -5^0 to 55^0 C. without any changes in tripping characteristics. The manufacturers should furnish tripping characteristic (multiples of overload current setting Vs ambient air temperature) of the overload relays for the above range. The tolerance shall be within limits as indicated in Figure 7 of IS 13947(Part 4 /Sec1): 1993.

8.9 Contact Ratings

8.9.1 *For a.c application* – The contact shall be rated for not less than 6 A ($I_{thermal}$), ($I_{continuous}$) = 2A, 415 V, 50 Hz for a rated duty of AC 15 of IS 13947 (Part 5/Sec1) : 1993 'Specification for low voltage switchgear & controlgear – Part 5 Control Circuit Devices & switching elements – Section 1 : Electromechanical Control Circuit Devices (superseding IS 6875).

8.9.2 *For d.c application* – the contacts shall be rated for not less than 0.5 A, 230 V for a rated duty of DC 13 [as per IS 13947(Part 5/Sec 1.]

9 PROTECTION

9.1 The relays shall be self-protecting for currents upto 10 times the maximum setting. The manufacturer shall specify the maximum i^2 t values of the fuses for protection of the relay to type 2 coordination according to IS:13947 (part 1)- 1993 specification for low voltage switch gear and control gear, part 1 - general rules. However, fuse shall be selected by permissible current rating.

10 LIFE

10.1 The thermal elements shall have a minimum life of 7 years without deviation of there parameters when carrying the maximum rated current at 40 ^{0}C ambient. Accelerated ageing tests and extrapolated results are acceptable to satisfy this clause.

10.2 The auxiliary contacts shall have a minimum electrical life of 10.5×10^5 operations.

11 TEST

11.1 Type test

a) Tripping requirements as per clause 7.3 and 7.4 .
b) Test of accuracy of compensation against ambient temperature as per clause 7.5.
c) Test for C.T. surge current withstand capability as per clause 8.4.

11.2 Routine Tests.

a) In batches

b) Power frequency over voltage test.

For the test, 2 KV (r.m.s) shall be applied between power terminal control terminals as well and fixing bolts by turn for 1 minute each. The relay shall successfully withstand the same.

12 MARKING

a) Manufacturer's name and type
b) Year of manufacturer
c) Reference to this IPSS
d) Setting indication
e) I^2t values of back-up fuse
f) Whether ambient temperature compensated
g) Terminal marking.

Figure- 1

PERFORMANCE TOLERANCES