INTERPLANT STANDARD - STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR SINGLE MOTOR CONTROL UNITS FOR VOLTAGES NOT EXCEEDING 1000 V ac** (*FIRST REVISION*)	**IPSS:1-04-039-03**
	BASED ON IS 8623 (PART 1):1993	Formerly : IPSS : 1-03-009-87

0. FOREWORD

1.

0.1 This Interplant Standard has been prepared by the Standards Committee on Switchgears and Controlgears, IPSS 1:4, with the active participation of the representatives of the steel plants, major consulting organizations and established manufacturers of single motor control units (SMCUs) and was adopted in June 2003.

0.2 Interplant Standards for steel industry primarily aim at achieving rationalization and unification of parts and sub-assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or equipment for existing or new installations by individual steel plants. For exercising effective control on the inventories, it is advisable to select a few number of sizes (or 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 standard is to be read in conjunction with IPSS:1-04-040-99 `Motor control centres (MCCs) (*first revision*)' to cover specific requirement of single motor control units (SMCUs).

0.4 This standard is generally based on :

a) IS 8623 (Part 1):1993 “Low-voltage switchgear and controlgear assemblies; (Part 1) requirements for type tested and partially type tested assemblies (*first revision*)”

b) IS 13947 (Part 1):1993 “Low-voltage switchgear and controlgear; (Part-1) general rules (*superseding IS 4237*)

c) IS 13947 (Part 2):1993 “Low-voltage switchgear and controlgear; (Part-2) circuit breakers [*superseding IS 2516 (parts 1 & 2 Sec 1):1985]*

d) IS 13947 (Part 3):1993 “Low-voltage switchgear and controlgear; (Part-3) Switches, disconnectors, switch disconnectors and fuse combination units [*superseding IS 4064(parts 1 & 2*)]

e) IS 13947 (Part 4/Sec1):1993 “Low-voltage switchgear and controlgear; (Part 4) contactors and motor starters, section-1 electro-mechanically contactors and motor starters (*superseding IS 2959 & IS 8544 All Parts*)”.

f) IS 13947 (Part 5/Sec1):1993 “Low-voltage switchgear and controlgear; (Part 5) control circuit devices and switching elements, sec-1 electro-mechanical control circuit devices [*superseding IS 6875 (all parts)]*”.

1. SCOPE

1.1 This Interplant Standard covers the requirements of direct-on-line control of general purpose squirrel cage induction motors, for voltages up to and including 1000 V ac used in steel industry and intended to start and accelerate a motor to normal speed and to provide means of protecting the motor and its associated branch circuits against overloads and short circuits and intentionally cause the motor to stop.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS 1885 (Part 17):1979 `Electrotechinical vocabulary : Part 17 Switchgear and controlgear (*first revision*)' shall appl;y.

3. SITE CONDITIONS

3.1 The following shall constitute the normal service conditions for the purpose of this standard :

a) *Ambient Temperature* - Reference ambient temperature shall be 40^{o}C. For 50^{o}C requirement, derating factor shall be given.

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

c) *Altitude* - The altitude shall not exceed 2000m.

d) *Ambient Air* – Pollution degree shall be `2’ as per clause 6.1.3.2 of IS 13947 (Part-1):1993 unless otherwise specified.

4. DUTY AND RATINGS

4.1 Preferred rated operational voltage of main circuit shall be 415 V $\pm$ 10% ac.

4.2 Preferred rated operational voltage for control circuit shall be 110 V and 240 V ac.

4.3 *Preferred Rated Operational Current* - The rated operational current (corresponding to the rating of contactors) shall be as per Table-1. Other ratings are also acceptable if agreed between the purchaser and manufacturer.

4.4 Rated frequency shall be 50 Hz $\pm$6%.

4.5 *Rated utilization category* :

4.5.1 Rated utilization category of SMCU shall be AC 3 unless otherwise specified.

4.5.2 *Rated making and breaking capacity* - Rated making and breaking capacities of SMCU shall be in accordance with Table-VII of IS 13947 (Part 4/Sec 1): 1993 `

4.5.3 *Electrical durability* - The number of on-load operating cycles corresponding to the conditions given in Table-B1 at Appendix-B of IS 13947 (Part 4/Sec 1):1993 for AC 3 shall be not less than one tenth of the number of no-load operating cycles corresponding to the mechanical endurance of the Contactor/starter.

4.6 *Mechanical durability* - The Contactor/starter shall be capable of with-standing ten million number of no-load operating cycles before it becomes necessary to service or replace any mechanical part. However, normal maintenance including replacement of contacts as specified in B.2.2.1 and B.2.2.3 of IS 13947 (Part 4/Sec 1):1993.

4.7 *Rated Short Circuit Breaking Capacity* - The SMCUs covered under this specification shall also be capable of breaking the prospective short circuit currents as specified by the purchaser at the locations. Preferred values shall be 50 kA.

5. DESIGN AND CONSTRUCTION

5.1 **General** – While the single motor feeder control unit shall generally conform to IPSS:1-03-010-87 `Controlling & signalling factory built assemblies (under revision). and 7.1 of IS 13947 (Part 1):1993, certain important aspects are indicated in this specification for guidance.

5.2 Enclosures

5.3

5.3.1 The degree of protection provided by the enclosure shall be IP54 for indoor and IP65 for outdoor application unless otherwise specified conforming to Table-CI and CII of IS 13947(Part 1):1993.

5.3.2 The enclosures shall be so arranged that when opened the terminals are readily accessible. Sufficient space shall be left in the interior of the enclosure for accommodating and clamping neatly the external cables from the point of entry into the panels up to the terminals. The incoming terminals shall be shrouded.

Distance between closed panel door and fuse/live parts shall be sufficient so as not to cause short circuit.

5.3.3 The movable parts of the protective enclosures shall be firmly secured to the fixed parts by a device such that they cannot be accidentally loosened or detached owing to the efforts of operation of the equipment.

5.3.4 The covers of the enclosures shall be so secured that it is not possible to open them without the use of tools, unless suitable means are provided to prevent accidental contacts with live points.

5.4 Contacts and their associated current carrying part subject to wear shall be readily accessible and replaceable.

5.5 The terminals shall be of substantial mechanical construction and shall provide adequate electrical contact for the appropriate size of cable used. The use of aluminium conductors should be taken into account.

5.6 The motor control unit shall be front wired.

5.7 Each component shall be clearly labelled on the base plate as per the schematic diagram by durable marking; PVC/paper stickers are not acceptable.

5.8 **Installation** - The SMCU shall be suitable for mounting on wall, pedestal, pole or floor. Provision shall be made on top of SMCU for lifting.

5.9 Earthing

5.10

5.8.1 The metal enclosure of the single motor feeder control unit shall be provided with two separate earthing terminals.

5.8.2 The earthing terminals shall be readily accessible and so placed that the earth connection of the enclosures is maintained when the cover or any movable part is removed.

5.8.3 The earthing terminal shall be of adequate size, be protected against corrosion and shall be metallically clean. Under no circumstances shall a movable part of the enclosure be insulated from the part carrying the earthing terminal when the movable part is in place.

5.8.4 *Clearance and creepage* - Clearance and creepage distance shall conform to Table-XIII and Table- XV of IS 13947 (Part 1):1993.

6. LIMITS OF TEMPERATURE RISE

7.

7.1 For the purpose of temperature-rise allowable for the various part of SMCU, 7.2.2 of IS 13947 (Part 1):1993 shall be applicable.

8. LIMIT OF OPERATION

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9.1 The limit of operation for the SMCU shall comply with 7.2.1 of IS 13947 (Part 1):1993.

8. GENERAL REQUIREMENTS OF COMPONENTS

8.1 Motor Power Circuit Components

8.1.1 *General* - The selection of components for continuous duty cage motors only are covered (selection for intermittent duty and wound rotor motors are under consideration). The power circuit components shall be selected based on the following particulars of the drive to be indicated by the purchaser :

a) Motor's rated capacity in kW (and preferably rated current) together with reference ambient temperature.

b) Preferably motor's starting current and starting time. In the absence of this information a maximum starting current of 6.5 times the rated current at 40^{o}C and lasting a maximum period of 5 seconds may be assumed for heavy starting application, this should be mutually decided by purchaser & supplier.

c) *Power contactors* – The minimum ratings for different motor feeders are indicated in Table-1. These ratings shall correspond switching to minimum 120 operations/hour and a minimum contact life of one million cycles with 99 percent at AC 3 and 1 percent at AC 4 utilization category.

8.1.2 *Overload relay* - The tripping characteristics of thermal overload relay shall be selected to provide protection to the motors under overload, single phasing and stalling. The relay should not cause undue tripping while starting. The relay range shall be selected such that it is self protecting through contactor upto take over current at which S.C.P.D. takes over from overload relay .

Over-load relays should have N.O & N.C as per IPSS:1-04-014-87 `Bi-metallic overload relays for ac and dc motor protection' (*under revision*). Other provisions mentioned in 8.1.3 should also not contradict the above mentioned IPSS. For selection of auto or manual setting, also please refer IPSS:1-04-014-87."

NOTE: The use of MCCB for overload protection may also be considered as a backup.

8.1.3 *Short circuit protective device (SCPD)* - The SCPD may be either a switch-disconnector-fuse/fuse-disconnector-switch (Alternative-I) or a MCCB/Motor circuit breaker (Alternative-II). The SCPD shall meet the following requirements:

a) The manufacturer should state the take-over current at which the SCPD takes over from the overload relay. While using instantaneous trip MCCB as SCPD, due care shall be taken against any unprotected zone between the maximum current of the overload relay and the magnetic threshold.

b) The SCPD will meet the requirements of 4.6.3 from the take-over current up to maximum stipulated fault current.

c) There shall be no undue tripping of the MCCB or blowing of fuse during DOL starting. Particular care should be taken to obviate the tripping of MCCB due to the peak assymetrical current.

d) The switch-disconnector-fuse/fuse-disconnector-switch (Alternative-I)/ MCCB (if without an overload release) shall have a thermal withstand matching with the tripping characteristics of the overload relay so as to be protected by it up to the take-over current.

e) The SMCU shall have a breaking capacity at performance category ICS in excess of or equal to the stipulated fault current.

f) For Alternative-I, the switch shall have a rating at utilization category AC-23A not less than the rating given in Table 1 and not less than the rating of the associated fuse. For Alternative-II, ratings of components shall be as per successful type-2, coordination tests carried out by the manufacturer.

8.1.4 Provision of metering device, if required by the purchaser.

8.2 **Control Circuit Components** - Control circuit components like auxiliary contactors, control switches, etc, as well as auxiliary contacts of power contactors, circuit breakers, switches, etc, shall have a minimum continuous thermal rating of 10 A and an operational current of minimum 4 A at utilization category AC15 for 240 V ac and 0.5 A at DC13 for 220 V dc. However, the contacts of push button and thermal overload relay may have an AC15 rating of 1.5 A. Protective devices on primary and secondary side of control transformer shall be provided

8.3 The type of switchgear, namely; ACB, MCCB, fuse-switch, etc, as well as the rating of releases will be as specified by the purchaser.

9. TESTS

9.1 **Type Test** - The following shall constitute type test and may be carried out in any sequence on different samples :

a) Verification of temperature-rise limits [8.2.1 of IS 8623 (Part 1):1993]
b) Verification of di-electric properties [8.2.2 of IS 8623 (Part 1):1993]
c) Verification of short circuit withstand strength [8.2.3 of IS 8623 (Part 1):1993]

d) Verification of continuity of protective circuit [8.2.4 of IS 8623 (Part 1):1993]
e) Verification of clearance and creepage distances [8.2.5 of IS 8623 (Part 1):1993]

f) Verification of mechanical operation [8.2.6 of IS 8623 (Part 1):1993]
g) Verification of degree of protection [8.2.7 of IS 8623 (Part 1):1993]
h) Siesmic test shall be included in type test.

9.2 Routine Tests

a) Electrical operation tests [8.3.1 of IS 8623 (Part 1):1993]; and

b) Di-electric tests [8.3.2 of IS 8623 (Part 1):1993].

d) Verification of continuity of protective circuit and verification of mechanical operations.

10. MARKING

10.1 Each SMCU shall be provided with a name-plate or plates carrying the following data, marked in a durable manner and located in a place such that it is visible and legible when the starter is installed:

a) Reference to this standard i.e. IPSS:1-04-039-03(F)

b) Manufacturer's name and trade-mark,

c) Type designation or serial number,

d) Rated operational voltage,

e) Rated operational current and the utilisation category,

f) Rated kW, and

g) Rated control supply voltage.

10.2 A wiring diagram shall be affixed to the inside of the front cover.

11. SELECTION OF COMPONENTS AND COORDINATION

11.1 It is the responsibility of the manufacturer of the SMCU to fully coordinate the overload, contactor and short circuit devices to provide satisfactory discrimination to ensure type 2 coordination as per 7.2.5.1 of IS 13947 (Part 4/Sec1):1993.

11.2 switch-disconnector-fuse/MCCB and contractor ratings for various motor rating shall be selected based on Table 1.

TABLE 1 - RATINGS OF COMPONENTS

[*Clause 8.1.4 (f) and 11.2*]

Motor Rating At S_1 Duty in kW	Minimum Rating of Switch in A	Minimum Rating of Contactor in A	Minimum size for internal power connection per phase		Minimum size for Al power cable termination in mm^2
			Copper wire size in mm^2	Aluminium* flat size in mm x mm	
7.5	32	32	6	-	6
15	63	70	10	-	6
18.5 22	63	70	16	12x2	25
30 37 45	100 125 125	100 100 100	25 35 50	15x3 15x3 15x3	50 70 70
55 75 90 110 132 160 200	125 250 250 250 315 400/630 400/630	160 160 200 250 400 400/630 630	70 95 95 95 95 95 95	20x3 20x5 20x5 30x5 40x5 40x5 40x10	95 150 185 2x70 2x95 2x150 2x240

- Equivalent size of copper flat may also be used.

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