IPSS	SPECIFICATION FOR MANUALLY OPERATED CONTROL SELECTOR SWITCHES FOR VOLTAGES NOT EXCEEDING 1000 V ac AND 15.00 V dc *(First Revision)*	IPSS:1-04-002-03
	BASED ON IS 13947(Part 5 / sec.1):1993	Formerly: IPSS:1-04-002-93

0. FOREWORD

0.1 This Interplant Standard has been prepared by the Standards Committee on Switchgear and Controlgear, IPSS 1:4 with the active participation of the representatives of the steel plants, reputed consulting organizations and established manufacturers of control switches and was adopted in June 2003.

0.2 Interplant 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 (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 generally based on IS 13947 (Part 5 / Sec 1):1993 Specification for low voltage switchgear and controlgear – Part 5: Control circuit devices and switching elements – Sec.1: Electromechanical control circuit devices (superseding IS 6875).

---

1. SCOPE

1.1 This Interplant Standard covers the requirements of manually operated control selector switches for voltage up to and including 1000 V ac and 1200 (1500) V dc used in the Steel Industry and intended to be used in control circuits of auxiliary circuits for the purpose of controlling, signalling and interlocking and for electronic applications.

1.2 Technical aspects for meeting the special needs of the Steel Industry are covered in this standard.

1.3 This standard does not cover the micro switches, pressure switches, or any other mechanical devices used for circuit selection.

2. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS 1885 (Part-17):1979 `Electro-Technical Vocabulary: Part-17 Switchgear and Controlgear(first revision)', IS 13947(Part 4/Sec 1):1993 shall apply. Some important definitions are reproduced in Appendix-A for ready reference.

3. SITE CONDITIONS

3.1 The service conditions for which the control switches conforming to this standard are suitable are given below:

3.2 The control switches shall be suitable for operation in tropical humid climate with a reference ambient temperature of 40^{o}C, maximum relative humidity of 100% and maximum altitude of 1000m above sea level. However, maximum humidity and maximum temperature conditions may not occur simultaneously.

3.3 The ambient air is likely to contain fair amount of conductive dust and oxides of Sulphur.

4. MATERIAL

4.1 Material of all components shall be suitable for 55^{o}C ambient temperature and 40^{o}C duty as specified in Clause 5.3 and shall be able to withstand endurance tests as specified in Clause 5.6 and 5.7.

4.2 The component parts made of steel shall be protected suitably against rusting by nickel/chrome/cadmium/zinc/tin plating or painting.

4.3 The insulating parts shall be made from materials which can withstand mechanical and electrical stresses and have good electrical and anti - tracking properties as per IS 13947 (Part 5) :1993 .

4.4 Fixed and moving contacts shall be of such quality so as to give desired performance stipulated in this standard. Copper flexible insulated wires shall conform to IS 694:1990 (IS 1554 – Part 1 / IS 9968 – Part 1) `Specification for PVC Insulated Cables for working voltages upto and including 1100 V (*third revision*)' and shall have copper sockets rivetted or crimped to the ends.

4.5 The individual switch packs, operating cams, arc separator, etc, shall be moulded in self extinguishing plastic compounds with inherent arc quenching and high insulating properties.

4.6 The operating handle of the switch shall be preferably of a thermosetting insulating material having comparative tracking index not less than 150.

4.6.1 The handle, if metallic, shall be fully insulated from the circuit and shall be effectively earthed, for example, by contact with the enclosure.

4.7 The escutcheon plate shall be manufactured from block anodized aluminium or pressure die cast light alloy.

5. DUTY AND RATING

5.1 **Preferred Rated Current** - The preferred rated operational current shall be as follows:

For ac - 10 A and 16 A, at 50 Hz at 415 V

For dc - 0.5 A & 1 A

5.2 **Rated Duty** - The switches up to 8 packets shall be suitable for 300 and switches above 8 packets shall be suitable for 120 on-load operating cycle per hour when carrying operational current at operational voltage.

5.3 **Utilization Category** - For on load operation, the utilization category shall be as follows:

a) For ac, contacts shall be suitable for utilization category AC 15 (IS 13947 (Part 5 / Sec I) :1993.

b) For dc, contacts shall be suitable for utilization category DC 14 (IS 13947 (Part 5 / Sec I): 1993.

5.4 **Rated Making and Breaking Capacities** - The rated making and breaking capacities for the selector switches for utilization categories specified in clause 5.3 shall be in accordance with Table 1-A & Table 1-B.

5.5 **Electrical Endurance** - With respect to its electrical resistance to electrical wear a selector switch shall be characterized by the number of on-load operating cycles which shall not be less than $1/10^{th}$ of the number of no-load operation cycles specified for mechanical endurance of switches.

5.6 Mechanical Endurance - The mechanical endurance shall be of the following classes corresponding to Clause 3.4.2 of IS 13947 (Part 5/ Sec 1):1993).

Switches having number of Packets	Mechanical Duty Class	Number of No load Operations	Number of On load Operations/ Hour
Up to and including 8	3	$3x10^6$	300
More than 8	1	$1x10^6$	120

6. GENERAL REQUIREMENTS

6.1 Switch Types - The angle of rotation for all types of switches shall be generally 45 degree, unless otherwise specified by the user.

6.2 The programme for different types of standard switches shall be according to the requirements of the user.

6.2.1 Operation of the handle shall be either of the following types :

a) Stay put type

b) Spring return type

c) Pull and spring return type, and

d) Memory type

6.2.2 *Stay Put Type* - The switch shall remain `stay put' in the position to which it is turned. This type shall be designated as "SP".

6.2.3 *Spring Return Type* - The spring return action shall be designed in order to return the switch to the central position. This type shall be designated as "SR".

6.2.4 *Pull and Spring Return Type* - The action of the switch starts when the handle is pulled out. Otherwise the operation is similar to spring return switch. In pulled out condition some contacts are also made.

6.2.5 *Memory Type* - In this type of operation, some contacts remain closed/open when the handle is turned to the required position and left as such while the handle returns to `O'-Position. These contacts are designated as `M'.

6.3 **Sequence Device** - A mechanical sequence device may be fitted to `SP' or `SR' type to prevent two successive movements to the same position. The code shall be SPS or SRS.

6.4 **Lost Motion Device** - Lost motion device may be fitted in the switch so that the set of contacts at the rear of the switch may have lost motion facility if required. The code designation for such feature shall be SPSL or SRSL.

6.5 **Locking** - Locking arrangement may be provided in any one or all of the positions of the selector switch, if required and shall be mutually agreed upon between the customer and the manufacturer.

6.6 **Handle Type** - The operating handle of the switch shall be as specified by the purchaser.

6.7 **Designation** - The switches shall be designated by the following elements:

1) Single break or double break by SSB (switch - single break) or SDB (switch - double break)

2) A number, denoting number of positions for the anti-clockwise rotation of the switch handle

3) Initial position denoted by the number `O'

4) A number denoting number of positions for the clockwise rotation of the switch handle

5) Mode of operation denoted, for example, by SP (Stay Put), SR (Spring Return), SRS (Spring Return Type with sequence devices), SRSL (Spring return type with sequence and lost motion devices), M (Memory Type), etc

6) A number denoting the angle in degrees between successive switch handle positions, if it is other than 45 degree

Example 1 : SDB-101-SR denotes a switch which has double break contacts, one anticlockwise handle position, zero or initial handle position, one clockwise handle position, and is spring return type.

Example 2 : SSB-006-SP-30 denotes a switch which has single break contacts, no anticlockwise handle position, a zero of initial handle position, 6 clockwise handle positions, and is stay put type with 30 degree angle between two successive positions of the switch handle.

7. DESIGN AND CONSTRUCTION

7.1 Contacts

7.1.1 Selector switches shall have electrically separated contact elements.

7.1.2 Perfect self alignment combined with wiping action of the contact shall be ensured.

7.1.3 All contacts shall be preferably of the double break type.

7.1.4 Each switch packet shall be provided with facility for quick make and break of the selector switches.

7.2 Make & Break - Snap action mechanism shall be provided to facilitate quick make and break of the selector switches.

7.3 Terminals

7.3.1 Terminals shall be suitable for connecting cable of minimum 2.5 sq.mm solid copper conductor for 10 A selector switch and minimum 4 sq.mm stranded copper conductor for 16 A selector switch. They shall be of strong mechanical construction and shall provide efficient electrical contact.

7.3.2 The terminal connections shall be such that the conductor may be connected by means of screws for maintaining necessary contact pressure permanently.

7.3.3 Terminals shall be such that they do not turn or get displaced when connections are made.

7.3.4 The terminals shall be so mounted that appropriate conductor may be connected without impairing the normal performance of the unit. They shall be easily accessible.

7.3.5 No contact pressure shall be transmitted through insulating materials and the gripping of the conductor shall take place between metal faces.

7.4 Looping shall be provided between contacts wherever necessary.

7.5 Enclosure - The selector switches may be in open execution or housed in an enclosure as required. The enclosure shall either provide a degree of protection IP 50 or IP 54 according to IS 13947 Part 1:1993 or it shall constitute a flame proof enclosure conforming to IS 2148:1981.

NOTE: Standardization of mounting dimensions and length of switch packets are under consideration.

7.6 For electronic circuits, the switches shall have PLC compatibility of operating on 24 V, 5-100 mA current with contact resistance of the order of 4 m-Ohms at the terminals and a bounce of 5 m.sec.

8. LIMITS OF TEMPERATURE RISE

8.1 The temperature rise of various parts of selector switch during a test carried out in accordance with IS 13947 (Part 5/Sec 1):1993 shall not exceed limiting values as given in Table 2 of this standard.

9. INTERCHANGEABILITY OF PARTS

9.1 The following components of different types of programme switches of one manufacturer shall be interchangeable.

a) Switching packs

b) Fixing and moving contacts

c) Springs

d) Spacers

e) Cams

f) Lock for fixing the position of the handle, and

g) Handle

10. EARTHING

10.1 The Earthing terminal shall be identified by means of the symbol marked in a legible and indelible manner on or adjacent to the terminal.

10.2 Earthing arrangement shall be provided on the body of the selector switch according to IE Rules.

10.3 Earthing terminals and its size shall conform to those specified in clause 12.3.2 of IS 3043:1987 `Code of Practice for Earthing (*first revision*)'/ clause 7.1.9 of IS 13947 (Part 1) : 1993 .

11. TESTS

11.1 Type Tests

a) General mechanical inspection (IS 13947 Part 5/sec 1 & IS 13947 (part 1) : 1993.

b) Temperature rise test (IS 13947 Part 5/sec 1) : 1993..

c) Test for rated making and breaking capacities (IS 13947 Part 5/sec 1) : 1993..

d) High voltage test (IS 13947 Part 5/sec 1 & IS 13947 (part 1) : 1993..

11.2 Routine Tests

a) General mechanical inspection [IS 13947 (Part 5/sec 1)]: 1993.

b) High voltage test (IS 13947 Part 5/sec 1): 1993.

11.3 Special Tests

11.3.1 Load Operation Test - The switch shall withstand the number of load operations as per clause 5.6 of this standard without repair and replacement of switch parts. This test shall be carried out corresponding to site condition and utilization category specified in this standard.

11.3.2 Verification of Mechanical Duty Class

11.3.2.1 Condition of Switch Before Test - The switch shall be installed and connected in the same manner as for normal use or service. During the test there shall be no voltage or current in the circuits. The switch may be lubricated before test if lubrication is prescribed in normal use.

11.3.2.2 *Test Procedure* - The test shall be carried out to verify the number of operations according to clause 5.7 of this standard. Maintenance work during test according to clause 8.1.4.3 of IS 13947 (Part 4/Sec 1):1993 is permissible, where applicable.

11.3.2.3 *Requirements* - Following the test of mechanical duty class there shall be no loosening of parts in the switch.

12. DESIGNATION AND MARKING

12.1 **Designation**

a) Rated operational voltages,

b) ac or dc

c) Rated operational current,

d) Number of poles,

e) Number of ways, and

f) Number of position.

Example : 2-way, 4-position, single pole selector switches for operation at 240 V ac and rated for 16 A operational current, shall be designated as follows:

`2-way, 4-position, single pole, selector switch, 240 V ac, 50 Hz, 16 A (Ie) - IPSS:1-04-002-03(F)'.

12.2 Dial Plate - Dial plate shall be supplied with marking as specified by the purchaser to indicate the functional position of the switch.

12.3 Rating Plate - A legible and indelibly marked rating plate shall be fixed on the body of the switch and shall give the following minimum information:

a) Manufacturer's name or trade mark,

b) Type designation,

c) Operational voltage, ac and dc,

d) Operational current, ac and dc,

e) Number of poles,

f) Number of positions including `off' position,

g) Number of ways, and

h) Utilization category.

13. INFORMATION TO BE SUPPLIED AT TIME OF ENQUIRY/ORDER

13.1 The following particulars in respect of the switch and other additional features shall be supplied at the time of enquiry/order :

a) Angle of rotation,

b) Type of handle operation,

c) Sequence device,

d) Lost motion device,

e) Type of handle,

f) Rated voltage and current,

g) Number of poles,

h) Number of ways,

j) Type of enclosure, and

k) Class of mechanical duty.

TABLE 1 A (reproduced from IS 13947 (Part 5/Sec 1)

Verification of making and breaking capacities of switching elements under normal conditions corresponding to the utilization categories[1)]

Utilization category	Normal condition of use								
	Make[2)]			Break[2)]			Number and rate of making and breaking operations		
	I/I_e	U/U_e	cos φ	I/I_e	U/U_e	cos φ	Number of operating cycles[3)]	Operating cycles per minute	On-time[5)] (s)
AC-12	1	1	0.9	1	1	0.9	6 050	6	0.05
AC-13[6)]	2	1	0.65	1	1	0.65	6 050	6	0.05
AC-14[6)]	6	1	0.3	1	1	0.3	6 050	6	0.05
AC-15[6)]	10	1	0.3	1	1	0.3	6 050	6	0.05
DC			$T_{0.95}$			$T_{0.95}$			
DC-12	1	1	1 ms	1	1	1 ms	6 050	6	0.05[5)]
DC-13	1	1	6 P[4)]	1	1	6 P[4)]	6 050	6	0.05[5)]
DC-14[6)]	10	1	15 ms	1	1	15 ms	6 050	6	0.05[6)]

I_e **Rated operational current**
U_e **Rated operational voltage**
$T_{0.95}$ **Time to reach 95% of the steady-state current**, in milliseconds

$P = U_e I_e$ Steady-state power consumption, in watts
I Current to be made or broken
U Voltage before make

[1)] See Sub-clause **8.3.3.5.2.**
[2)] For tolerances on **test quantities, see** Sub-clause 8.3.2.2.
[3)] The first 50 **operating cycles shall be run** at $U/U_e = 1.1$ with the loads set at U_e.
[4)] The value "6 × P" **results from an empirical** relationship which is found to represent most d.c. magnetic loads to an upper limit of $P = 50$ W, viz. $6 \times P = 300$ ms. Loads having power-consumption **greater than 50 W are** assumed to consist of smaller loads in parallel. Therefore, 300 ms is to be an upper limit, irrespective of the power-consumption value.
[5)] The on-time shall be **at least equal to** $T_{0.95}$.
[6)] Where the break current **value differs from the** make current value, the on-time refers to the make current value after which the current is reduced to the break current value for a suitable period, e.g. 0.05 s.

TABLE 1B (Equivalent from IS:13947 (Part 5) : 2001)

Verification of making and breaking capacities of switching elements under abnormal conditions corresponding to the utilization categories[1)]

Utilization category	Emergency (abnormal conditions of use)[2)]								
	Make[3)]			Break[3)]			Number and rate of making and breaking operations		
	I/I_e	U/U_e	cos φ	I/I_e	U/U_e	cos φ	Number of operating cycles	Operating cycles per minute	On-time (s)
AC-12									
AC-13[6)]	10	1.1	0.65	1.1	1.1	0.65	10	6	0.05
AC-14	6	1.1	0.7	6	1.1	0.7	10	6	0.05
AC-15	10	1.1	0.3	10	1.1	0.3	10	6	0.05
DC			$T_{0.95}$			$T_{0.95}$			
DC-12									
DC-13[6)]	1.1	1.1	6 P[5)]	1.1	1.1	6 P[5)]	10	6	0.05[4)]
DC-14	10	1.1	15 ms	10	1.1	15 ms	10	6	0.05[4)]

I_e Rated operational current
U_e Rated operational voltage
$T_{0.95}$ Time to reach 95% of the steady-state current, in milliseconds
$P = U_e I_e$ Steady-state power consumption, in watts
I Current to be made or broken
U Voltage before make

[1)] See Sub-clause 8.3.3.5.3.
[2)] The abnormal condition is to simulate a blocked open electromagnet.
[3)] For tolerances on test quantities, see Sub-clause 8.3.2.2.
[4)] The on-time shall be at least equal to $T_{0.95}$.
[5)] The value "6 × P" results from an empirical relationship which is found to represent most d.c. magnetic loads to an upper limit of P = 50 W, viz. 6 × P = 300 ms. Loads having power-consumption greater than 50 W are assumed to consist of smaller loads in parallel. Therefore, 300 ms is to be an upper limit, irrespective of the power-consumption value. For contactless switching devices the maximum time constant shall be 60 ms.
[6)] For contactless switching devices an overload protective device specified by the manufacturer should be used to verify the abnormal conditions.
[7)] See Note 6 of Table IV.

TABLE 2A (reproduced from IS 13947 Part 1)

Temperature-rise limits of terminals

Terminal material	Temperature-rise limits (K) [1) 3)]
Bare copper	60
Bare brass	65
Tin plated copper or brass	65
Silver plated or nickel plated copper or brass	70 [1)]
Other metals	2)

1) The terminal temperature-rise limit of 70 K is based on the connection of PVC cables.

The use in service of connected conductors significantly smaller than those listed in Tables IX and X could result in higher terminal and internal part temperatures and such conductors should not be used without the manufacturer's consent since higher temperatures could lead to equipment failure.

2) Temperature-rise limits to be based on service experience or life tests but not to exceed 65 K

3) Different values may be prescribed by product standards for different test conditions and for devices of small dimensions, but not exceeding by more than 10 K the values of this table.

TABLE 2B (reproduced from IS 13947 Part 1)

Temperature-rise limits of accessible parts

Accessible parts	Temperature-rise limits *) (K)
Manual operating means:	
Metallic	15
Non-metallic	25
Parts intended to be touched but not hand-held:	
Metallic	30
Non-metallic	40
Parts which need not be touched for normal operation:	
Metallic	40
Non-metallic	50
Parts not intended to be touched during normal operation **)	
Exteriors of enclosures adjacent to cable entries:	
Metallic	40
Non-metallic	50
Exteriors of enclosures for resistors	200 **)
Air issuing from ventilation openings of enclosures for resistors	200 **)

*) Different values may be prescribed by product standards for different test conditions and for devices of small dimensions but not exceeding by more than 10 K the values of this table.

**) The equipment shall be protected against contact with combustible materials or accidental contacts with personnel. The limit of 200 K may be exceeded if so stated by the manufacturer. Guarding and location to prevent danger is the responsibility of the installer. The manufacturer shall provide appropriate information, in accordance with Sub-clause 5.3.

APPENDIX - A
(Clause 2.1)

IMPORTANT DEFINITIONS

1) **Switching Devices** - A device designed to close or open one or more electric circuits.

2) **Selector Switch** - A device used to select any one or two or more circuits.

3) **Rotary Switch** - A switch or selector switch in which the movable contact members move in circular path.

4) **Pole of a Switching Device** - The portion of a switching device associated exclusively with one electrically separated conducting path of its main circuit and excluding those portions which provide a means for mounting and operating all poles together.

   NOTE: Switching device is called single pole, if it has only one pole. If it has more than one pole, it may be called multipole (two pole, three-pole, etc) provided the poles are or can be coupled in such a manner as to operate together.

5) **Number of Ways** - The maximum number of circuits for which the switch is designed.

6) **Quick Make and Break Switch** - A switch in which quick make and break of the circuit is ensured through the medium of spring or by other means independent of the speed of operation of the operator.

7) **Snap Action Contact Element** - A contact element in which the velocity of contact motion is substantially independent of the velocity of the actuating system.

   NOTE: Snap action implies means of storing energy during the first part of the travel of the actuating systems while the contacts remain at rest.

8) **Rated r.m.s. value of Making Capacity** - The rms value of breaking current that the contact element is capable of making at a stated voltage under prescribed conditions.

9) **Rated Breaking Capacity** - The rms value of breaking current that the contact element is capable of breaking at a stated voltage and under prescribed conditions.