PAKISTAN STANDARD

PLUGS AND SOCKET-OUTLETS FOR HOUSEHOLD AND SIMILAR PURPOSES –

PART 2-6: PARTICULAR REQUIREMENTS FOR SWITCHED SOCKET-OUTLETS WITH INTERLOCK FOR FIXED ELECTRICAL INSTALLATIONS

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PLUGS AND SOCKET-OUTLETS FOR HOUSEHOLD AND SIMILAR PURPOSES - PART 2-6: PARTICULAR REQUIREMENTS FOR SWITCHED SOCKET-OUTLETS WITH INTERLOCK FOR FIXED ELECTRICAL INSTALLATIONS

0. FOREWORD

0.1 This Pakistan Standard was adopted by the authority of the Board of Directors for Pakistan Standards and Quality Control Authority after approval by the Technical Committee for "Plugs and socket-outlets for household and similar purposes - Part 2-6: Particular requirements for switched socket-outlets with interlock for fixed electrical installations" had been approved and endorsed by the Electrotechnical National Standards Committee on _____.

0.2 This Pakistan Standard was adopted on the basis of IEC: 60884-2-6 since IEC Standard have been established in 1997, hence it is deemed necessary to adopt the International standard to keep abreast with the latest technology and as per with IEC standard.

0.3 This Pakistan Standard is an adoption of IEC: 60884-2-6 "Plugs and socket-outlets for household and similar - Part 2-6: Particular requirements for switched socket-outlets with interlock for fixed electrical installations" and its use hereby acknowledged with thanks.

0.4 This standard is subject to periodical review in order to keep pace with the development in industry. Any suggestions for improvement shall be recorded and placed before the revising committee in due course.

0.5 This standard is intended chiefly to cover the technical provisions relating to this standard and it does not include all the necessary provisions of a Contract.

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PLUGS AND SOCKET-OUTLETS FOR HOUSEHOLD AND SIMILAR PURPOSES –

Part 2-6: Particular requirements for switched socket-outlets with interlock for fixed electrical installations

1 Scope

Replace this clause of part 1 by the following:

This part of IEC 60884 applies to switched socket-outlets with interlock for a.c. only, for fixed electrical installations, with or without earthing contact, with rated voltage above 50 V but not exceeding 440 V and a rated current not exceeding 32 A, intended for household and similar purposes, either indoors or outdoors.

Switched socket-outlets with interlock according to this standard consist of a combination of socket-outlets according to IEC 60884-1, interlocked with a switch according to IEC 60669-1 and/or IEC 60669-2-1 supplied as a complete unit.

The rated current is limited to 16 A maximum for fixed accessories provided with screwless terminals.

This standard does not cover requirements for flush mounting boxes.

However, it covers those requirements for surface-type mounting boxes which are necessary for the tests on socket-outlets.

NOTES

1 General requirements for mounting boxes are covered by IEC 60670.

2 Interlocked socket-outlets incorporating devices according to IEC 60898, IEC 61008 and IEC 61009 are not covered by this standard. This standard may be used as a guide for the requirements and tests of these accessories where relevant.

This standard does not apply to

– interlocked socket-outlets for industrial purposes;
– interlocked socket-outlets for SELV.

Accessories complying with this standard are suitable for use at an ambient temperature not normally exceeding 25 °C, but occasionally reaching 35 °C.

2 Normative references

This clause of part 1 is applicable, except as follows:

Add to the list of normative references:

IEC 60669-1: 1993, *Switches for household and similar fixed-electrical installations – Part 1: General requirements*

IEC 60669-2-1: 1996, *Switches for household and similar fixed-electrical installations – Part 2: Particular requirements – Section 1: Electronic switches*

IEC 60884-1: 1994, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

3 Definitions

This clause of part 1 is applicable, except as follows:

Add the following definitions:

3.101 **interlock**: Device, either electrical or electronic or mechanical or a combination of these, which prevents the pins/contacts of a plug from becoming live before the plug is in proper engagement with a socket-outlet and which either prevents the plug from being withdrawn while its pin/contacts are live or makes the contacts of the socket-outlet dead before the plug is withdrawn.

3.102 **switched socket-outlet with interlock:** Factory-assembled unit consisting of a socket-outlet with an integral switching device controlling the socket-outlet, which is provided with an interlock.

3.103 **retaining device**: Mechanical arrangement which holds a plug in position when it is in proper engagement, and prevents its unintentional withdrawal.

4 General requirements

This clause of part 1 is applicable.

5 General notes on tests

This clause of part 1 is applicable, except as follows:

5.4 *Add after the fourth paragraph:*

For the test of clause 15, three additional specimens may be necessary.

6 Ratings

This clause of part 1 is applicable.

7 Classification

This clause of part 1 is applicable, except as follows:

7.2 *Add the following subclauses:*

7.2.101 Switched socket-outlets with interlock are classified:

7.2.101.1 According to the method of actuating the switch:

- rotary;
- tumbler;
- rocker;
- push-button;
- touch;
- proximity;
- optical;
- acoustic;
- other external influences.

7.2.101.2 According to the number of poles of the switch:

- single-pole;
- double-pole;
- three-pole;
- three-pole with neutral.

7.2.101.3 According to the type of interlock:

- mechanical;
- electrical;
- electronic;
- a combination of any of these.

7.2.101.4 According to the retaining device:

- without device;
- with device.

8 Marking

This clause of part 1 is applicable, except as follows:

8.1 *Add before note 2:*

- symbol of mini-gap construction, if applicable;
- symbol of micro-gap construction, if applicable;
- symbol for semiconductor switching device, if applicable.

8.2 *Add before the notes:*

- Mini-gap construction..... ..... m
- Micro-gap construction..... ..... µ
- Semiconductor switching device..... ..... (under consideration)
- "OFF" position..... ..... O
- "ON" position..... I

Add the following subclauses:

8.101 Terminals of switched socket-outlets with interlock intended for the connection of the phase conductors shall be identified, unless the method of connection is of no importance or is self-evident or is indicated in a wiring diagram. Such identification may take the form of a letter *L* or in the case of more than one terminal, the letters L_1, L_2, L_3, etc., which may be accompanied by an arrow pointing to the relevant terminal(s).

Alternatively, the surface of such terminals shall be bare brass or copper, other terminals being covered with a metallic layer of another colour.

These indications shall not be placed on screws or any other easily removable parts.

8.102 Switched socket-outlets with interlock shall be so marked that the direction of movement of the actuating member to its different positions or the actual switch position, is clearly indicated.

These indications shall be clearly visible on switched socket-outlets with interlock fitted with their cover or cover plate as for normal use. If these indications are placed on the cover or cover plate, it shall not be possible to fix the cover or cover plate in a position such that the indications are incorrect.

For indicating the direction of movement of the operating means, the symbols "O" and " I " may be used.

The short, straight line indicating the "ON" position shall be radial for rotary switches, perpendicular to the axis of rotation of the dolly for tumbler switches and rocker switches, and vertical for push-button switches when mounted vertically in its intended position.

9 Checking of dimensions

This clause of part 1 is applicable.

10 Protection against electric shock

This clause of part 1 is applicable, except as follows:

Add the following subclauses:

10.101 Knobs, operating levers, push-buttons, rockers and the like, for operating switches in switched socket-outlets with interlock shall be of insulating material, unless their accessible metal parts are separated from the metal parts of the mechanism by double insulation or reinforced insulation, or in the case of switched socket-outlets with interlock with earthing terminals, they are reliably connected to earth.

Compliance is checked by inspection and by the tests of clauses 17 and 21.

NOTE – For definition of the terms "double insulation" and "reinforced insulation", see IEC 60536.

10.102 Metal parts of the switch mechanism, such as the spindle or the pivot of the dolly or rocker, that are not insulated from live parts, shall not protrude from the enclosure.

Compliance is checked by inspection. If necessary, the actuating member may be removed or broken.

If the actuating member has to be broken, compliance is checked after the test of clause 28.

10.103 Metal parts of the switch mechanism, such as the spindle or the pivot of the dolly or rocker, shall not be accessible when the switched socket-outlet with interlock is mounted as for normal use.

In addition, these metal parts shall be insulated from accessible metal parts, including metal frames supporting the base of flush-type switched socket-outlets with interlock, liable to be mounted in a metal box, and also from screws used for fixing the base to its support.

This additional requirement does not apply if the metal parts of the mechanism are separated from live parts in such a way that the creepage distances and clearances have at least twice the values specified in 27.1, or as an alternative for switched socket-outlets with interlock provided with earthing terminals, if they are reliably connected to earth.

Compliance is checked by inspection. If necessary, measurement and the tests of clauses 17 and 20 may be used.

11 Provision for earthing

This clause of part 1 is applicable.

12 Terminals

This clause of part 1 is applicable.

13 Construction of fixed socket-outlets

This clause of part 1 is applicable, except as follows:

Add the following subclauses:

13.101 Switches shall be constructed to match the number of poles of the socket-outlet, except that the neutral pole is not switched in unswitched neutral socket-outlets.

The earthing contact is not considered as a pole and the earth circuit shall not be switched.

The position of the switch operating member shall be such that it does not prevent, nor shall its correct operation be prevented by, the proper insertion of the corresponding plug or plugs.

NOTE – This may be checked by reference to the appropriate standard sheets for the system of plugs and socket-outlets used in the country in question.

Compliance is checked by inspection and by a manual test.

13.102 Knobs of rotary switches shall be securely coupled to the shaft or the part operating the mechanism.

Compliance is checked by the following test:

The knob is subjected for 1 min to an axial pull of 100 N.

After this, knobs of switches having only one direction of operation are turned, if possible, without undue force, 100 times in the reverse direction.

During the test the knob shall not become detached.

13.103 The actuating member of a switch, when released, shall automatically take up the position corresponding to that of the moving contacts, except that, for those with a single push-button, the actuating member may take up a single rest position.

13.104 Switches shall be so constructed that the moving contacts can come to rest only in the "ON" or "OFF" position, an intermediate position being, however, permissible if it corresponds to the intermediate position of the actuating member and if the insulation between the fixed and moving contacts is then adequate.

When in the intermediate position, the insulation between the fixed and moving contacts is checked by applying a voltage of substantially sine wave form, having a frequency of 50 Hz or 60 Hz, for 1 min across the switch gap, the test voltage being 1 250 V for switched socket-outlets with interlock having a rated voltage up to and including 130 V, or 2 000 V for switched socket-outlets with interlock having a rated voltage exceeding 130 V.

Compliance with the requirements of 13.103 and 13.104 is checked by inspection, by manual test and for switches with the intermediate position by the above electrical test.

13.105 Switches shall be constructed so that undue arcing cannot occur when the switch is operated slowly.

Compliance is checked by causing the switch, at the end of the test of clause 21, to break the circuit a further ten times, the actuating member being moved steadily by hand over a period of 2 s and the moving contacts being stopped, if possible, in an intermediate position, the actuating member then being released.

During the test, no sustained arcing shall occur.

13.106 Switched socket-outlets with interlock with switches operating more than one pole shall make and break all poles virtually simultaneously, except that for multiple switches with switched neutral, the neutral shall not make after or break before other poles.

Compliance is checked by inspection and by a manual test.

13.107 The action of the mechanism, if the covers or cover plates are removable for installation purposes, shall be independent of the presence of the covers or cover plates.

Compliance is checked by connecting the switch, without cover or cover plate, of the switched socket-outlet with interlock in series with a lamp and by normally pressing the actuating member without undue force.

During the test the lamp shall not flicker.

14 Construction of plugs and portable socket-outlets

This clause of part 1 is not applicable.

15 Interlocked socket-outlets

This clause of part 1 is replaced by:

Switched socket-outlets with interlock shall be so constructed that a plug cannot be inserted into or completely withdrawn from the socket-outlet while the socket contacts are live, and the socket contacts of the socket-outlet cannot be made live until a plug is almost completely in engagement.

Compliance is checked by carrying out the tests of 15.1 or 15.2 as applicable after the test of clause 21.

15.1 Switched socket-outlets with interlock without retaining devices shall be:

– so constructed that the moving contacts of the switch are mechanically coupled with the socket-outlet in such a way that, during the withdrawal of the plug, they break before or substantially at the same time that the pins of the plug are disconnected from the socket contacts of the socket-outlet;

– so designed that, after engagement with the relevant plugs the interlock operates correctly;

– so designed that the operation of the interlock is not impaired by normal wear of the plug.

Compliance is checked by the test of 15.1.1 and clause 21.

15.1.1 *Switched socket-outlets with interlock are connected as shown in figure 101.*

The test is carried out as follows:

Without the plug inserted an attempt shall be made to close the switching device. The switch contacts shall not close.

This is checked by a continuity test made between the supply terminals and the contact assembly of the socket-outlet.

The plug connected as in figure 101 is inserted and the switching device is then closed. The lamps A1 shall not light, the lamps A2 shall light.

The plug is then withdrawn slowly in the most unfavourable direction and then the lamps A1 shall light.

The test is considered to be fulfilled if these conditions are met.

NOTES

1 A reduction of the brightness of the lamps A2 may occur during the time that the lamps A1 are illuminated.

2 In case of doubt in determining the lumination time of the lamps, the test may be repeated using oscilloscopes.

The above test shall be carried out three times on each of the three specimens.

NOTE 3 – For this test, specimens specially prepared by the manufacturer may be used.

15.2 Switched socket-outlets with interlock with retaining devices shall be:

– so constructed that the interlock is mechanically linked with the operation of a switching device so that the plug can neither be withdrawn from the socket-outlet while the contacts are alive, nor be inserted while the switching device is in the ON position;

– so designed that with any complementary accessory the interlock operates correctly.

Compliance is checked by inspection, by a manual test and by the test of 15.2.1.

15.2.1 *Switched socket-outlets with interlock with a mechanical retaining device locking the plug into the socket-outlet are subjected to the following test:*

An axial pull is applied to an appropriate plug inserted in the switched socket-outlet with interlock, with the mechanical retaining device in the locked position. The switched socket-outlet with interlock is fixed to mounting plate A of an apparatus as shown in figure 13 so that the axis of the socket-contacts are vertical and the entry holes for the pins of the plug face downwards.

The test plug according to the relevant standard sheets shall have finely ground pins of hardened steel, having a surface roughness not exceeding 0,8 µm over their active length and spaced at the nominal distances, with a tolerance of ± 0,05 mm.

The diameter of round pins or the distance between contact surfaces for other types of pin shall be in accordance with the minimum dimension(s) given in the relevant standard sheets, with a tolerance of $^{+0,01}_{0}$ *mm.*

The pins are wiped free from grease before use.

The test plug is inserted into and withdrawn from the socket-outlet ten times. It is then again inserted, a mass being attached to it by means of a suitable clamp D. The total mass of the plug, the clamp and the carrier, shall exert a pull force equal to 120 N.

During the test the plug shall not come out of the socket-outlet and the mechanical retaining device shall remain in the locked position.

After the test, the switched socket-outlet with interlock shall show no damage within the meaning of this standard.

For the purpose of this test, the earthing contact is considered as one pole.

16 Resistance to ageing, to harmful ingress of water and to humidity

This clause of part 1 is applicable.

17 Insulation resistance and electric strength

This clause of part 1 is applicable, except as follows:

17.1 *Add at the end the following:*

For items g) and h) of 17.1.1, the insulation resistance shall not be less than 2 MΩ.

17.1.1 *Replace the last paragraph before the notes by:*

For switches of a switched socket-outlet with interlock the insulation resistance is measured consecutively:

f) *between all poles connected together and the body, with the switch in the "ON" position;*

g) *between each pole in turn and all others connected to the body, with the switch in the "ON" position;*

h) *between the terminals which are electrically connected together when the switch is in the "ON" position, the switch being in the "OFF" position.*

The term body includes accessible metal parts, metal frames supporting the base of flush-type switched socket-outlets with interlock, operating keys, metal foil in contact with the outer surface of accessible external parts and operating keys of insulating material, the point of anchorage of the cord, chain or rod for switches operated by such means, fixing screws of bases or covers and cover plates, external assembly screws, earthing terminals and any metal part of the mechanism if required to be insulated from live parts (see 10.102).

18 Operation of earthing contacts

This clause of part 1 is applicable.

19 Temperature rise

This clause of part 1 is applicable.

20 Breaking capacity

This clause of part 1 is applicable, with the following addition:

20.101 Switches incorporated in switched socket-outlets with interlock shall be in accordance with IEC 60669-1 or IEC 60669-2-1.

21 Normal operation

This clause of part 1 is replaced by:

Switched socket-outlets with interlock shall withstand without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring in normal use.

Compliance is checked by the following test:

a) *The switch shall comply with the appropriate clauses of IEC 60669-1 or IEC 60669-2-1.*

b) *The specimens are checked by carrying out 5 000 load cycles at rated voltage and rated current with a power factor 0,8 ± 0,05, with the interlocking device in operation.*

During the test the specimens are not lubrificated and shall function correctly.

After the test the specimens shall withstand an electric strength test as specified in clause 17, and a temperature rise test as specified in clause 19, the test current being reduced to the rated current value.

After these tests the specimens shall not show:

– *wear impairing their further use;*

– *discrepancy between the position of the actuating member and that of the moving contact, if the position of the actuating member is indicated;*

– *deterioration of enclosures, insulating linings or barriers to such an extent that the switch cannot be further operated, or that the requirements of clause 10 are no longer complied with;*

– *loosening of electrical or mechanical connections;*

– *seepage of sealing compound;*

– *relative displacement of the moving contacts of the switches.*

The humidity treatment according to 16.3 is not repeated before the electric strength test of this subclause.

Than the test of clause 15 shall be performed to check the interlocking mechanism.

22 Force necessary to withdraw the plug

This clause of part 1 is applicable except as follows:

Add after the third paragraph the following note:

NOTE – For switched socket-outlets with interlock with a retaining device the test is made with the retaining device unlocked.

23 Flexible cables and their connection

This clause of part 1 is not applicable.

24 Mechanical strength

This clause of part 1 is applicable.

25 Resistance to heat

This clause of part 1 is applicable.

26 Screws, current-carrying parts and connections

This clause of part 1 is applicable.

27 Creepage distances, clearances and distances through sealing compound

This clause of part 1 is applicable with the following addition:

Add the following subclause:

27.101 For switches incorporated in switched socket-outlets with interlock, the creepage distances, clearances and distances through sealing compound shall be in accordance with the relevant clause of IEC 60669-1 or IEC 60669-2-1.

Compliance is checked by measurement.

28 Resistance of insulating material to abnormal heat, to fire and to tracking

This clause of part 1 is applicable.

29 Resistance to rusting

This clause of part 1 is applicable.

30 Additional tests on pins provided with insulating sleeves

This clause of part 1 is not applicable.

Figures

Add the following figure:

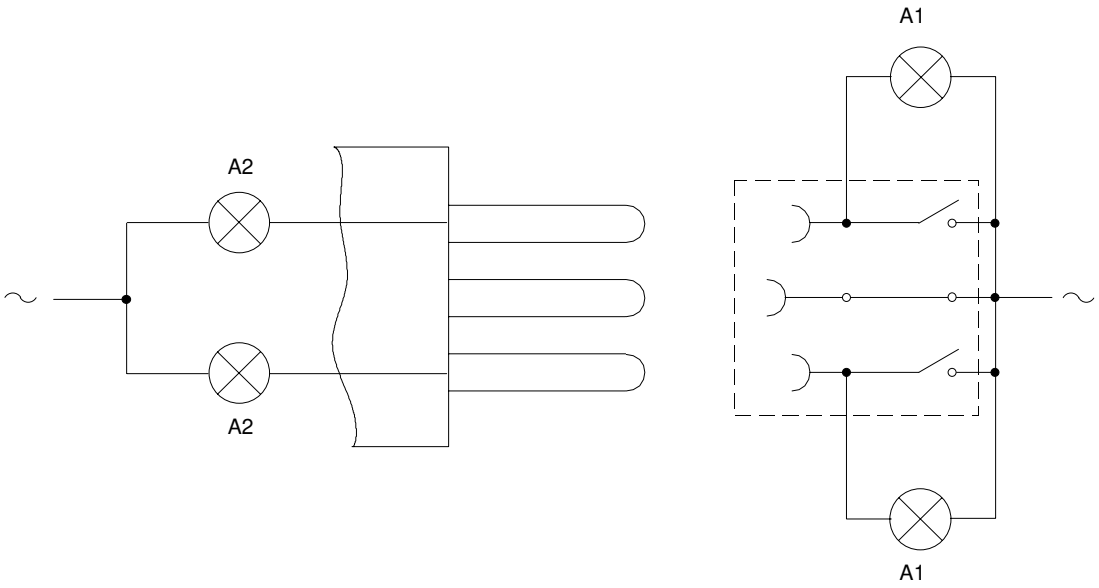

Figure 101 – Circuit for the tests of 15.1