INTERPLANT STANDARD - STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR CONTROLLING AND SIGNALLING FACTORY BUILT ASSEMBLIES** (*First Revision*)	**IPSS:1-04-038-02**
	Based on IS 8623 (Part 1):1993	Formerly : IPSS:1-03-010-87

0. FOREWORD

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 Controlling and Signalling FBAs and was adopted in January 2002.

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 for existing equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on the inventories, it is advisable to select a fewer number of sizes (or types) of products mentioned in this standard, in the form of company standard of individual steel plants. It is not desirable to make deviations in technical requirements.

0.3 This standard was earlier published in 1987. This has been reviewed and updated by the Standards Committee.

1. SCOPE

1.1 This Interplant Standard covers the requirement of factory built assemblies (FBAs) for controlling and signalling like control desks, mimic boards, annunciation panels, etc, for voltages up to 415 V ac and 230 V dc.

1.2 This standard does not apply for such FBA as intended for explosion hazardous areas and installations on moving mechanisms like overhead cranes and vibrating platforms.

2. TERMINOLOGY

2.1 For the purpose of this standard, following definitions in addition to those given in IS 1885 (Part 17):1979 `Electrotechnical vocabulary: Part 17 Switchgear and controlgear' and IS 8623 (Part 1):1993 `Low voltage switchgear and controlgear assemblies : Part 1 Requirements for type tested and partially type tested assemblies (first revision)' shall apply.

Note: Desks and boards are FBA of one or more vertical sections bolted together, to provide facilities for operating, controlling, protecting or recording a set of electrical, electro-mechanical or electro-pneumatic equipment for any given process.

3. SERVICE CONDITIONS

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

3.1.1 *Ambient Temperature* - The reference ambient temperature shall be 40°C. For 50°C temperature, derating factor shall be mentioned.

3.1.2 *Altitude* - The altitude shall not exceed 1000 m.

3.1.3 *Ambient Air* – Pollution degree shall be 3, as per clause 6.1.3.2 of IS 13947 (Part 1):1993 unless otherwise specified.

3.1.4 Humidity - Maximum relative humidity shall be 100%. However, the maximum humidity and temperatures are not likely to occur simultaneously.

4. ELECTRICAL CHARACTERISTICS AND RATINGS

4.1 Preferred rated operational voltages are:

ac : 250 V, 240 V, 110 V at 50 Hz
dc : 220 V, 110 V, 48 V, 24 V

Note: Suitable conversion equipment from 240 V ac supply shall be included unless otherwise specified.

4.2 Rated insulation voltage shall be 1100 V.

5. GENERAL ARRANGEMENTS

5.1 General

5.1.1 Functionally, controlling and signalling FBA are classified into the following types for the purpose of this standard:

a) *Control desks* - For operator's control of different process/mechanisms.

b) *Mimic panels* - For indicating/recording the status of different process/mechanism.

c) *Annunciation* - For annunciation of abnormal operating conditions.

Note: FBA incorporating VDUs, key boards, etc, are not considered for the present.

5.1.2 These functional units may exist separately or any combination of these may be integrated into one FBA as specified by the customer. Hereafter the term FBA will be used to designate any of the 5.1.1(a), 5.1.1(b) and 5.1.1(c) while requirements different to a type will be indicated specifically.

5.1.3 The controlling and signalling FBA generally will include one or more of the following components:

a) Control devices like push buttons, switches, master controllers, selsyns, potentiometers, thumb-wheel switches, etc;
b) Signalling lamps;
c) Measuring/recording instruments, both analog and digital;
d) Mimics, graphics;
e) Annunciators;
f) Hooters/horns/buzzers;
g) Auxiliary contactors, timers, etc; and
h) Control transformers, MCBs, fuses, diodes, etc, for power supply.

5.1.4 All components and devices shall be so mounted and wired as to facilitate easy access for maintenance.

5.1.5 The lower most mounted component/device shall not be lower than 250 mm and the upper most not more than 1800 mm from the floor level, to facilitate inspection and maintenance.

5.1.6 The lower most located indicating instrument shall not be lower than 700 mm and the upper most not more than 2000 mm above the floor level to facilitate easy reading.

5.1.7 Live part of any component shall be approachable only after opening of door or cover of FBA.

5.1.8 Suitable lamps shall be provided for interior illumination of the FBA. Wherever, required, the interior of the panel shall be painted white to enhance illumination.

5.2 **Mimic Panels (where applicable)**

5.2.1 The mimic panel shall depict the process being monitored with the help of flow diagrams, lamps, meters, etc.

5.2.2 The base sheet shall be sheet steel on which the flow diagram shall be depicted by fixing metallic coloured strips (minimum 2 mm thick and 10 mm width) painted strips with countersunk screws.

5.2.3 The colour scheme shall be as specified by the purchaser.

5.2.4 A few suggested symbols for mimic diagrams are given in **Fig-1.**

5.2.5 The illumination scheme provided shall be such that the light does not spread or spill outside its functional area or graphic part of the mimic, and it provides a clear and glare-free indication.

5.3 Control Desks (where applicable)

5.3.1 The control desk shall usually have components like push buttons, meters, control switches, master controllers, lamps, etc. It may also have a mimic.

5.3.2 Control desks shall have a top plate (hinged unless otherwise specified) on which various pilot devices shall be mounted. No operating device shall be mounted more than 600 mm away horizontally from the front of the desk.

5.3.3 The desk shall have a front door with handle.

5.3.4 Facility shall be provided to keep the hinged cover in the open position for maintenance and inspection.

5.3.5 *FBA incorporating only a desk*

5.3.5.1 Such a desk shall have screwed covers on the sides and rear and shall be suitable for installation having no rear approach.

5.3.5.2 The cable entry facility shall be from bottom. The wiring shall be accessible from the front and also when the top cover is lifted. The wiring shall be kept as much to the rear as possible.

5.2.5.3 If the desk also incorporates a mimic diagram, the mimic shall be according to 5.2.2 to 5.2.5.

5.4 Annunciators

5.4.1 The annunciators shall be of solid state circuitry.

5.4.2 The stabilized dc power supply necessary shall be derived from 240 V single phase supply available with suitable transformation, rectification and regulation equipment. The dc power supply shall be short-circuit proof and provided with surge protection.

5.4.3 Each channel shall consist of a facia type window display unit with lighting unit and the associated control circuits.

5.4.4 The facia window shall be of white heat resistant plastic material with inscriptions engraved in black. the lighting unit shall have dual lamps operating in parallel. The facia window with the lighting unit shall be interchangeable with other units in the same FBA.

5.4.5 The control circuits of the individual annunciator channels shall be mounted on glass epoxy coated plug-in type printed circuit boards (PCB). The PCB

shall be mounted on pin assemblies such that a defective PCB can be withdrawn and substituted by another without disturbing any other circuits. One PCB may accommodate more than one channel. However, all such PCB in the same FBA shall be interchangeable. Plug sockets shall be mechanically coded to avoid wrong insertion.

5.4.6 *Annunciation Scheme* - Unless otherwise specified, the following annunciation sequence, which has been depicted diagramatically in **Fig-2** shall be provided.

5.4.6.1 A common hooter, ACCEPT push button, RESET push button and TEST push button shall be available for each signalling system.

5.4.6.2 On incidence of a fault, the lamp of the corresponding window shall start flashing and the hooter shall come `ON'. This will continue till the ACCEPT button is pressed even if the fault is cleared by them.

5.4.6.3 On pressing the ACCEPT button, the lamp shall become steady and hooter shall go `OFF'.

5.4.6.4 When the fault is cleared, the RESET button shall be pressed when the lamp shall go `OFF'. If the RESET button is pressed before the fault is cleared, it shall be ignored.

5.5 The following colour code shall be followed for push buttons and lamps.

5.5.1 *Colour of push buttons shall be:*

Accept	-	Blue
Reset	-	Black
Test	-	Yellow
On/Start	-	Green
Off/Stop	-	Red

5.5.2 *Colour of lamps shall be :*

On	- Red	
Off	- Green	*Also applicable to luminous push buttons*
Circuit Healthy	- White	
Fault/Warning	- Amber	

6. MECHANICAL DESIGN AND CONSTRUCTION

6.1 FBA shall be sheet steel clad and of floor mounting, free standing design.

6.2 Sheet steel used shall be minimum 2 mm thick for all members except for:

a) doors and covers which may be 1.6 mm thick; and

b) partition plates with no components mounted thereon and having no structural function, where it may be 1.0 mm thick.

6.3 All doors and covers shall be of cold rolled sheet steel.

6.4 Enclosures shall be of folded construction and assembled on base frame or channel.

6.5 Base frame or channel shall preferably be of rolled section having minimum height of 50 mm and 2.5 mm thick, to prevent corrosion of sheet steel enclosure and facilitate cleaning of floors.

6.6 All fasteners shall be zinc plated and passivated. All bolts shall have spring washers.

6.7 Design and workmanship shall be such as to present a neat appearance outside and inside with no welding, rivets, bolt-heads apparent from the exterior surfaces.

6.8 Each hinged door shall have minimum of two hinges. Distance between two hinges or two bolts or screws on removable covers shall not be more than 60 mm. Further, hinge or bolt or screw shall not be placed more than 150 mm away from the corner of hinged door or bolted cover.

6.9 Covers, size of which does not exceed 150 mm x 500 mm may have only two fasteners, one on each of two opposite sides.

6.10 Removable gland plate of minimum 2 mm thick shall be provided at the bottom. The gland plates shall be undrilled unless otherwise specified.

6.11 If required, more than one units shall be located side by side and bolted together to form a compact unit.

6.11.1 Joints of two bolted units shall be smooth, unobstrusive and close fitting.

6.11.2 All bolted sections forming one unit shall have uniform height and uniform depth throughout its entire length.

6.12 Durable synthetic rubber gasket shall be provided for all doors, covers and partition plates. The gasket shall be adequately secured.

6.13 The door or cover locks and latches shall be of such design as shall provide adequate pressure against the gasketed part coming in contact with enclosure frame, while securing or tightening.

6.14 Provision shall be made for lifting and handling of each of transportable unit, for example by eye bolt or lifting angle.

6.15 Each transportable section of FBA shall not exceed 3.2 m in length.

6.16 Unless otherwise specified the degree of protection provided by the enclosure shall not be inferior to IP 52 of IS 13947(Part-1):1993 `Low voltage switchgear and controlgear : Part 1 General Rules'.

6.17 An identification name plate, indicating the designation, function, or operation of FBA shall be affixed at an appropriate location and height. Each letter in the said name plate shall be of 25 mm height.

6.18 Inscriptions shall be provided for every single device mounted on door, cover or front plate, such as switch, indicating light, etc, indicating its function and/or mode of operation such as `Control supply on' `Motor on', `Motor off', etc, on the front and along side the device. If an inscription plate is used, each letter in the said plate shall be of 3 mm height.

6.19 Durable lables shall be provided for every single component and device, on the base plate, indicating its legend given in the schematic drawing. PVC or paper stickers are not acceptable for this purpose. Each letter in the said legend shall be of 3 mm height.

6.20 All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing and phosphatising and then sprayed with a corrosion resistant primer followed by stove enamelling. Two coats of final paint shall be given thereafter and shall be further stove enamelled. Any other process of metal treatment may also be accepted subject to specific agreement with the purchaser. Thickness of coating shall be not less than 30 microns.

7. WIRING AND TERMINATION

7.1 FBAs shall be completely factory assembled and wired in accordance with the schematic diagrams.

7.2 Control wiring shall be done by 1100 V grade single core PVC insulated stranded copper wires as per IS 694 having a minimum cross-section of 1.5 mm^2 except for electronic circuit wiring.

7.3 All wires shall be run and fixed neatly and shall allow clear access to all components. Control wires shall be bunched.

7.4 All wiring shall be arranged and supported in such a manner that there shall be no strain on termination.

7.5 Wiring between the two devices shall have no splices or soldered joints. Connections shall be made at fixed terminals only. Not more than two wires shall be terminated at one control terminal.

7.6 Each wire shall be identified at each end in accordance with the schematic diagram in an indelible manner. Ferrules when used shall preferably be of interlocked type

7.7 The following colour coding shall be adopted for identification of control wiring:

ac	-	Light grey
dc	-	Black

7.8 All connections external to the FBA as well as to components mounted on the hinged doors shall be brought to accessible terminals. Terminals at different potentials shall be seggregated.

7.9 All the connections to CTs shall also be brought to terminals for ease of maintenance.

7.10 Terminals to which connections from CTs are brought shall be provided with shorting links.

7.11 All such terminals shall be multiway terminals complete with necessary mounting channel, screws, washers, end plates, shorting links, terminal markers, etc.

7.11.1 Sufficient number of supports/supporting brackets shall be provided for these terminals blocks as well as for wires which are being connected to these terminals.

7.12 Terminals shall be suitable for receiving 2 x 2.5 mm^2 cable.

7.13 Not more than two cables shall be terminated at one terminal.

7.14 In case of such requirement, terminals with permanent shorting links shall be provided for distribution of number of such cables.

7.15 Terminals shall be rated for 10 Amps.

7.16 Each block/strip of terminals shall have 20% or 4 Nos. whichever is more, as spare terminals.

7.17 Wherever FBAs are transported in more than one transportable section, inter sectional wiring shall be carried out through two separate terminal blocks. Further wires shall be connected at one end and other end shall be so labelled that inter section wiring can be done easily at site.

7.18 Terminals shall be accessible only after opening of door/cover.

8. EARTHING

8.1 Whenever a separate earthing circuit is shown in the drawing such as CT secondary or mid point of potential transformers, a single and separate wire shall be run independently to the earth bus and connected to it.

8.2 25 x 5 mm copper or equivalent aluminium or GI bus shall be run as horizontal earth busbar, throughout the entire length of the panel/desk/board, effectively earthing all metal structure.

8.3 Such earth busbar (horizontal) shall have provision of two terminals at two separate points, for connection to the earth conductor system at the installation.

8.4 The sheet steel enclosure shall have two earthing bolts.

9. TESTS

9.1 These test shall be applicable to the assembled FBA only. Individual components and self contained units incorporated in the FBA need not be tested again once they have been tested as per their relevant specifications.

9.2 **Type Test** - The following shall constitute type tests to be carried out once on each of FBA:

a) Verification of degree of protection for the enclosures as per 7.1 of IS 13947(Part 1):1993.

b) Verification of temperature rise limits, dielectric properties, continuity of protective circuits, clearances and creepage distances, etc, as per relevant clauses of IS 8623 (Part 1):1993.

9.3 **Routine Tests** - The following shall constitute routine tests and are to be carried out on each FBA:

a) Physical inspection generally as per 8.3.1 of IS 8623 (Part 1):1993 and shall include:

i) Checking with respect to general arrangement like overall dimensions, components layouts, terminations, wireways, etc,

ii) Checking of mechanical work, for example, proper closing and opening of doors, gaskets, finish of paint, etc.

b) Checking of components with respect to bill of materials for their make, type and rating; and

c) Checking of proper functioning of the system as a whole including, sequencing, interlocking, etc.

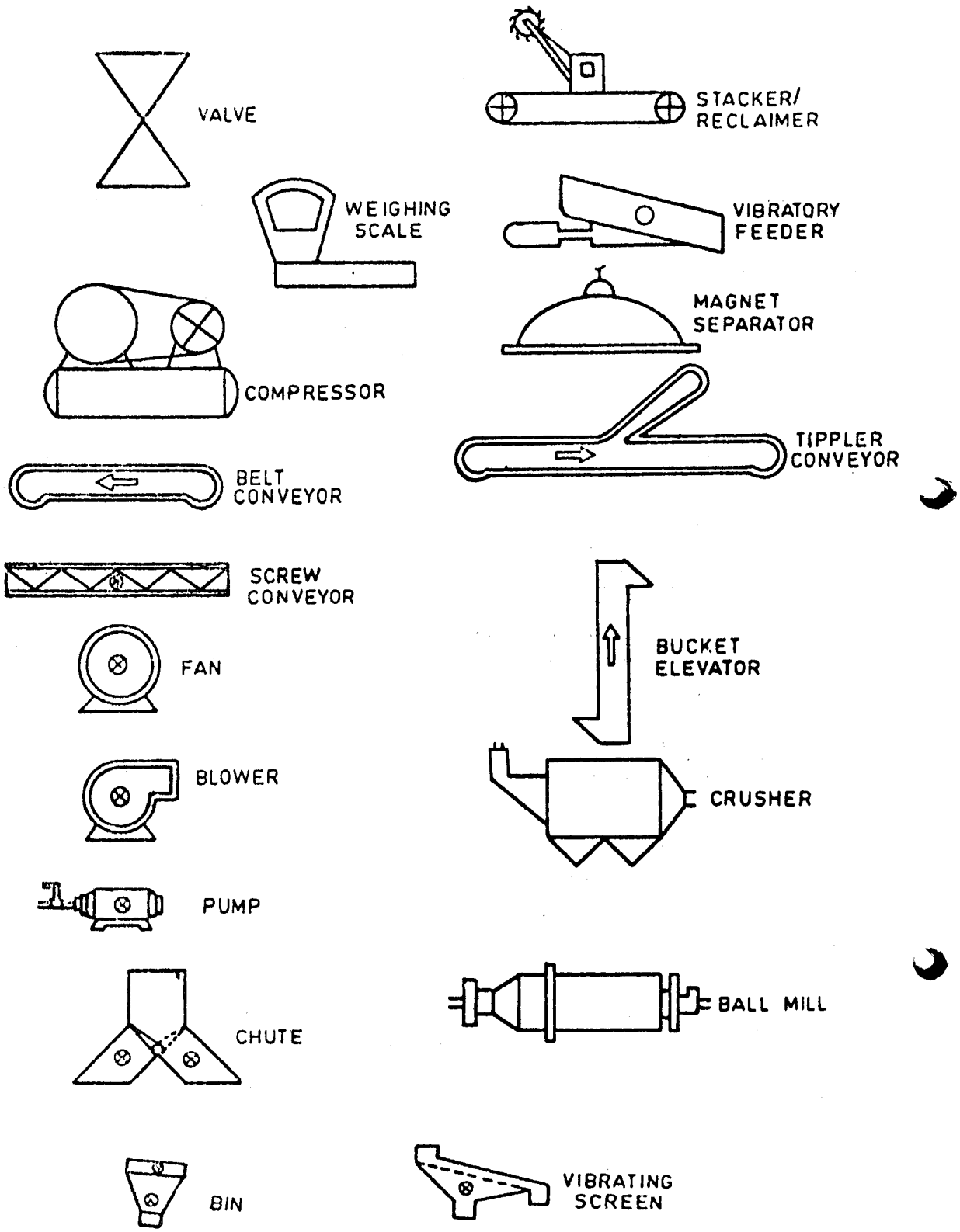

FIG. 1 SYMBOLS FOR MIMIC DIAGRAMS

5.4.5 The control circuits of the individual annunciator channels shall be mounted on glass epoxy coated plug-in type printed circuit boards (PCB). The PCB shall be mounted on pin assemblies such that a defective PCB can be withdrawn and substituted by another without disturbing any other circuits. One PCB may accommodate more than one channel. However, all such PCB in the same FBA shall be interchangeable. Plug sockets shall be mechanically coded to avoid wrong insertion.

5.4.6 *Annunciation Scheme* — Unless otherwise specified, the following annunciation sequence, which has been depicted diagramatically in Fig. 2 shall be provided.

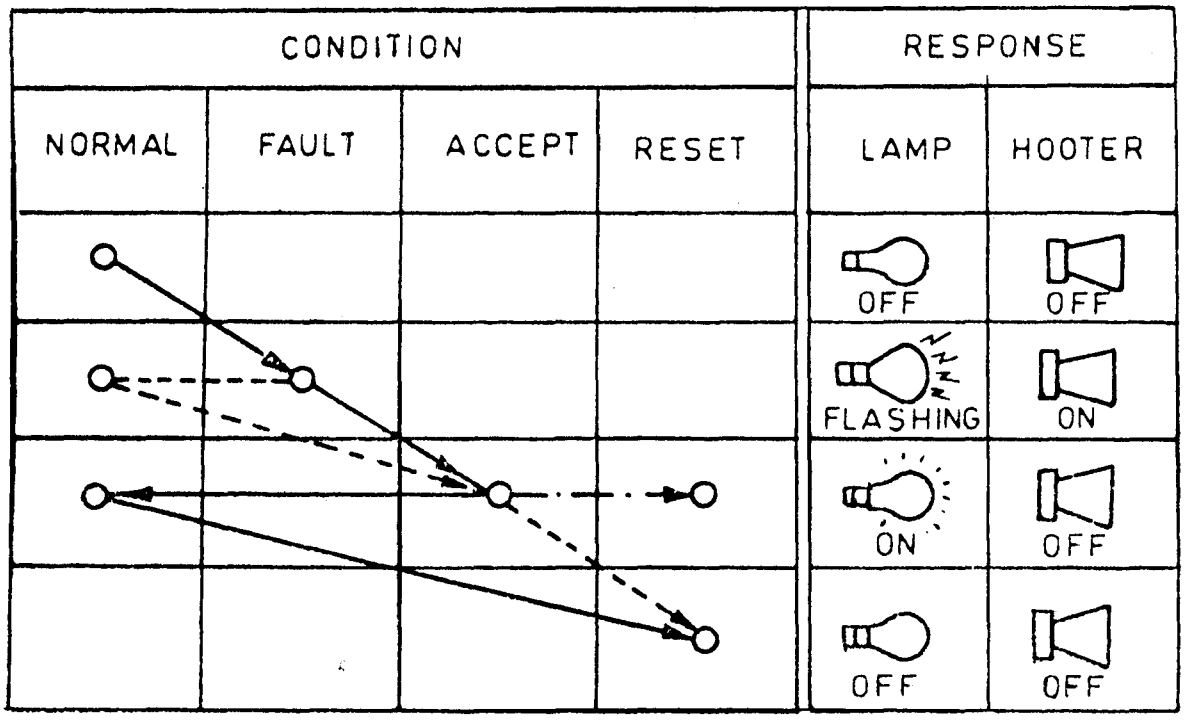

FIG. 2 ANNUNCIATION SEQUENCE