

**WATER SUPPLIES DEPARTMENT**

**STANDARD SPECIFICATION E-80-01**

**INSTRUMENTATION EQUIPMENT - GENERAL**

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1. GENERAL

1.1 Electricity Supply

The a.c. supply to the equipment shall be 220V 50Hz and may vary within the limits of plus and minus 6% of voltage and plus and minus 2% of frequency.

The d.c. supply to the equipment shall be as detailed in the related WSD Standard Specification and Particular Specification.

1.2 Storage and Operating Conditions

Instruments supplied shall be capable of withstanding any combination of the following environmental conditions in which it can be stored or operated without mechanical or electrical damage or degradation of performance:

(a) Indoor Equipment

0 - 40°C ambient.

0 - 98% humidity with condensation due to temperature change.

(b) Outdoor Equipment

0 - 40°C ambient under tropical sunlight.

0 - 100% humidity with condensation due to temperature change.

Instruments designed for panel mounting shall be suitable for grouping together with other instruments of similar design without requiring specific clearance for heat dissipation.

1.3 Standards

The equipment supplied shall comply with the latest version of the relevant international standards currently enforced on the date of tender invitation. The international standards referred to in the specification shall also mean similar standards issued by internationally recognised engineering institutions or organisations. Manufacturers offering equipment to other standards shall supply a copy of such standards in English together with full details of any deviations from the standards referred to in this Specification. The equipment shall comply with the following specific standards where applicable:

BS 88	Cartridge fuses for voltages up to and including 1000V a.c. and 1500V d.c.
BS 4800	Schedule of paint colours for building purposes
IEC 60381-1	Analogue signals for process control systems. Direct current signals
IEC 60529	Degree of protection provided by enclosures (IP code)
IEC 60947-7-1	Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment - Terminals blocks for copper conductors
IEC 61007	Transformers and inductors for use in electronic and telecommunication equipment. Measuring methods and test procedures

## 2. MATERIALS AND COMPONENTS

### 2.1 Materials - General

The selection of materials for use in the manufacture and construction of equipment shall be based upon the following criteria:

- (a) Materials shall be corrosion resistant and fire & flame retardant in compliance with their related international standards.
- (b) The instrument shall be made of durable material.
- (c) The use of dissimilar metals in contact should be avoided whenever possible.

### 2.2 Metallic Materials

Metallic components except when enclosed in enclosures complying with IEC 60529, IP 55 (totally enclosed) shall have a finish for extreme severity of climatic condition e.g. ferrous parts shall be galvanised or zinc plated and have heavy protective paint finish.

Ferrous screws, nuts, bolts and springs for panel exterior shall be of stainless steel or chromium plated. Instrument screws not forming part of a magnetic circuit shall be of brass, bronze or stainless steel.

### 2.3 Components

Components shall be adequately rated and circuits shall be designed so that change of components characteristics within the manufacturer's tolerances shall not affect the performance of equipment.

External control, alarm or indication shall be provided by 'volt-free' contacts

electrically isolated from the equipment.

Relays shall be hermetically sealed if the design is such that access to their internal parts is not necessary. Where relays are not hermetically sealed, they shall be housed in a dust-proof and totally enclosed case to IEC 60529, IP 54. Relay contacts shall be rated at not less than 2A at 220V 50 Hz, 0.5A at 110V d.c. and 3A at 24V d.c..

Timers shall be of solid state, plug-in type, provided with cable connection sockets and anchored by quick fastening vibration-proof devices.

Transformers for electronic devices shall comply with IEC 61007.

Fuse bases and carriers for HBC fuses shall be of plastic moulded insulating material and all live terminals and contacts shall be effectively shrouded. Fuse links shall be to BS 88.

### 3. CONSTRUCTIONAL FEATURES

#### 3.1 General

Panel-mounted instruments shall be flush-fitting without front fastenings.

Wiring between instruments or major sub-assemblies within the same enclosure shall be neatly run in plastic trunking or secured by insulated cleats.

#### 3.2 Degree of Protection

Instruments shall be provided with a degree of protection to IEC 60529 of -

IP 22	when mounted within the panel.
IP 54	when separately mounted indoors, or for external faces of panel mounted equipment.
IP 65	when mounted outdoors.
IP 68	5 metres for 8 hours submersion, when mounted in a pit below ground level.

#### 3.3 Fabricated Enclosures

Fabricated enclosures shall be provided for housing instruments or equipment consisting of a number of components.

(a) The enclosure shall meet the following design requirements:

- (i) The degree of protection shall be in accordance with Clause 3.2. Enclosures requiring air ventilation for cooling purposes shall be of approved types.

- (ii) The design and layout of the enclosure shall be such as to permit easy access to components for maintenance and ease of cable termination.
  - (iii) Exterior edges and corners shall be smoothly rounded and all external welding shall be ground smooth so as not to be visible through the paint finish.
  - (iv) The exterior of enclosures shall not have crevices or grooves, in which dust or moisture can accumulate.
  - (v) For floor standing panels, undrilled cable gland plates shall be provided for bottom entry of cables and shall be fixed by bolts and nuts or by fixed studs and nuts such that they may be easily removed for drilling. Gland plates shall be not less than 250 mm above the base of the panel. For small wall-mounted enclosures with front dimensions less than 200 x 300 mm, knock-outs for 20 mm conduit shall be acceptable in lieu of cable gland plates.
- (b) The custom built enclosure shall also meet the following design requirements:
- (i) Covers shall be hinged and fitted with recessed neoprene seals to prevent the ingress of dust and vermin. Hinges shall be stainless steel 316 grade.
  - (ii) Riveting methods shall not be used and parts requiring removal during maintenance shall be joined by bolts and nuts.
  - (iii) Cutting, drilling and de-burring of metal work shall be completed with all traces of rust and grease thoroughly removed prior to application of a zinc chromate or other approved rust inhibiting primer.
  - (iv) Two undercoats and two finishing coats of corrosion resistant paint, colour reference as specified to BS 4800 shall be applied to give a durable matt or semi-matt finish except for stainless steel cubicles.
  - (v) Cubicles for indoor applications shall be fabricated from 2 mm mild steel.
  - (vi) Cubicles for use outdoor or in chemical areas shall be fabricated from 2 mm stainless steel. For wall mounted cubicles not exceeding 1000 mm in height or 800 mm in width, the enclosures shall be fabricated from 1.5 mm stainless steel.

#### 4. DESIGN FEATURES

##### 4.1 Design - General

The equipment shall be designed for maximum reliability in service and ease of

maintenance.

Maintenance and fault finding on the equipment shall be facilitated by the provision of test points and indicators on the function boards, and by assembly techniques that allow rapid and easy replacement of components or sub-assemblies.

Instruments shall be standard production models and be capable of attaining the specified performance without special calibration or production control.

All components or items of equipment within the same instrument loop forming a working system shall be compatible with each other.

Equipment which performs a similar function shall, as far as possible, be of uniform type and manufacture in order to facilitate maintenance and stocking of spare parts. Corresponding parts shall be interchangeable.

#### 4.2 Analogue Signal Transmission

Analogue signal transmission shall be by 4-20 mA d.c. signals, unless otherwise specified and comply with IEC 60381-1.

All transmitters and associated power units shall be suitable for driving a maximum circuit load of 1600 ohms.

#### 4.3 Modular Rack-mounted Equipment

Modular rack-mounted equipment will be preferred to discrete instruments for complex signal processing applications. The modules incorporating the circuit boards for individual functions shall be housed in a rack with the degree of protection and mounting method given in the related WSD Standard Specification and Particular Specification for the component equipment.

The modules shall be of plug-in type, using gold-plated contacts and shall be easily accessible for withdrawal and installation. All inputs to the modules within the same rack shall have a common negative bus. The signal conditioning resistors for analogue current signal inputs shall be installed at the input terminal block to permit removal of the associated module without interruption to the process loop.

When isolated output signals are required, three-way isolation shall be provided between the power supply and the input and output signals.

#### 4.4 Reliability of Equipment

The reliability of the equipment is of paramount importance and shall comply with the related international design, quality and manufacturing standards. Its degree of reliability shall be attained under the following conditions:

- Parts of equipment shall be of corrosion-resistant materials and shall maintain their properties for a minimum period of 25 years.



- Storage and operating conditions as specified in Clause 1.2.

The required degree of reliability shall be ensured by a combination of design, quality control and final testing, which shall include specifically the following:

- (a) Design
  - (i) All electronic components shall be commercially available, with alternative sources of supply.
  - (ii) Solid state components shall be selected to ensure a long life expectancy with consistent performance.
  - (iii) Large scale integrated circuits shall be used where commercially available.
  - (iv) Metal-film, metal-oxide and wire-wound resistors shall be used where permitted by the application. Carbon resistors shall only be used where their application is unavoidable and they shall be of high-stability type.
  - (v) The use of electrolytic capacitors shall be minimised as far as practicable. For high capacitance values, computer grade types shall be used. For low capacitance values, solid tantalum, polypropylene, and monolithic ceramic types shall be used.
  - (vi) All components shall be located on high grade printed circuit boards (PCB). Removable PCB's shall be fitted with gold-plated edge connectors for insertion into gold-plated, spring-loaded, bifurcated connectors located in a chassis.
  - (vii) A mechanical keying system shall be adopted to prevent incorrect insertion of the PCB's into the chassis.
- (b) Quality Control and Testing
  - (i) To ensure satisfactory quality control the manufacturer shall only use components of an appropriate and known quality/reliability and all such reliability information shall be included in the technical manuals.
  - (ii) Functional and reliability tests shall be carried out on all completed PCB's to ensure satisfactory operation.
  - (iii) Final quality assurance shall be guaranteed by the system acceptance tests.

## 5. CABLE TERMINATIONS AND WIRING

Cable glands shall be provided to allow cable entry to the instrument enclosures without degrading the required degree of protection.

Terminal blocks shall be used for the connection of all external cables. Power supply terminals of all equipment and terminals of equipment contained within fabricated panels or cubicles shall comply with IEC 60947-7-1. It shall be single-level feed-through, screw or screwless type connection, DIN rail-mounted, vibration and corrosion resistant, and modular design suitable for harsh industrial environment.

Terminals shall be permanently identified by number or letter, and shall be so positioned as to permit convenient access for wiring. Adjacent rows of terminals shall not be closer than 150 mm. Power supply terminals shall be segregated from signal terminals and shall be shielded to prevent accidental contact.

Access to the terminals of instruments shall not expose internal components, require the disassembly of the instruments or removal of the instruments from the installation as a whole.

Internal panel wiring shall be coloured black for a.c. connections, grey for d.c. connections and green/yellow for earth connections.

At least 10% spare terminals shall be provided.

## 6. ACCESSORIES

### 6.1 Mounting

All equipment shall be supplied with the necessary mounting brackets and fixing accessories to suit the method of mounting detailed in the WSD Standard Specification and Particular Specification.

### 6.2 Locks

All cubicles and panels shall be provided with door locks. Where integral locks are specified, chromium plated brass cylinder locks shall be provided with engraved labels. Two sets of keys shall be provided for each lock.

### 6.3 Labels

All components such as push-buttons, lamps, relays and printed circuit boards shall be clearly identified by the use of labels. Labels shall be of stainless steel or laminated plastic with engraved legends or of clear perspex with back-filled legends. Danger and warning labels shall have a red background with white lettering. Labels shall be fixed by screws or adhesive in a position adjacent to the items being identified.

6.4 Panel Heaters

For all panels and cubicles where condensation may occur, an anti-condensation panel heater complete with a humidity sensor and 16A double-pole isolating switch shall be fitted to each separate enclosure.

6.5 Extension PCB

An extension PCB shall be provided to facilitate on site maintenance and fault finding of plug-in circuit boards.

7. DOCUMENTATION

The drawings and manuals shall be as detailed in the related WSD Standard Specification and Particular Specification.

- End of this Specification -