



**HELLENIC GAS  
TRANSMISSION SYSTEM  
OPERATOR**

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**TECHNICAL JOB  
SPECIFICATION**

**758/1**

**REVISION 0**

**DATE 05/04/2011**

# **HIGH PRESSURE (HP) TRANSMISSION SYSTEMS**

## **FIRE ALARM SYSTEM**

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QUALITY ASSURANCE PAGE

CHANGES LOG

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**REFERENCE DOCUMENTS**

ELOT EN 60086-1

[Primary batteries - Part 1: General (IEC 60086-1:2006)]

ELOT EN 60086-2

[Primary batteries - Part 2: Physical and electrical specifications (IEC 60086-2:2006)]

EN 60189

[Low-frequency cables and wires with PVC insulation and PVC sheath - Part 1: General test and measuring methods (IEC 46C/694/CD:2004)]

ELOT EN 60332-3-10 + A1

[Tests on electric and optical fibre cables under fire conditions - Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables - Apparatus (IEC 60332-3-10:2000 + A1:2008)]

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## 1.0 SCOPE

This specification covers the general design, erection and testing criteria for electrical installations relevant to fire alarm system, which shall included the monitoring of protective and signaling system (\*).

## 2.0 GENERAL

This specification shall be read in conjunction with the general telecommunication specification which shall be considered as complementary.

## 3.0 LOCAL AUTHORITY APPROVAL

Where a general or a particular regulation, issued by the local authority having jurisdiction, which shall be supplied by Owner, requires approval prior to installation, the following procedure must apply, unless otherwise required by the local Authority.

Submit to the authority:

- a) general description of the apparatus to be installed together with detailed information and drawings necessary for the complete understanding of the operation of the system;
- b) diagrams showing the manner in which the various equipment shall be supplied and connected to the central station and, if required, the signals delivered to the local fire brigade;
- c) instructions for checking and maintenance of the system.

(\*) Throughout this specification different degrees of authority and emphasis are denoted by the use of the words "must", "shall", "should", and "may". The following interpretations apply in the three cases:

- a) "must" implies either a legal obligation which is totally-binding or, alternatively, a requirement which can be relaxed only which the express authorization by Owner;
- b) "shall" implies a strong recommendation bases good engineering experience or upon the position adopted by recognised authorities;
- c) "should" implies a recommendation based upon experience, but recognises that some discretion is appropriate
- d) "may" is used in the permissive sense.

## 4.0 RELIABILITY CONDITION

To secure the greatest measure of protection and reliability of operation of protective signaling systems all wires outside buildings shall be placed underground; aboveground runs shall be in metallic conduit.

## 5.0 POWER SUPPLY

### 5.1 POWER SOURCES

The fire alarm system shall have a sole centralized D.C. power supply.

This system shall be considered as a priority load and requires a back-up battery supply.

The A.C. supply shall be by the normal power supply existing for the building in which the central station is installed.



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**5.2 A.C. POWER SUPPLY**

The A.C. power supply shall be from the UPS of the building and not from the sub distribution switchboard of the building.

Three phase three wire or a single phase two wire power supply shall be directly from the subdistribution switchboard of the building and shall enter the supply unit through a circuit breaker.

The main circuit breaker shall be so installed that it will be accessible only by authorized personnel.

The main circuit breaker shall assure overcurrent and short circuit protection of the complete supply unit.

**5.3 D.C. POWER SUPPLY**

The rectifier used as primary source for the supply of the fire alarm system shall be of adequate capacity to maintain voltage regulation between 130 and 100% of rated voltage (no load and maximum rated load).

The same rectifier shall serve as battery charger.

The rectifier shall be separated from the supply system through an insulating transformer, having a supply circuit of no more than 500 V.

In case of power failure, a 24V DC (12 hours autonomy) rechargeable battery pack, installed inside the panels, will automatically (without system interruption) supply the system.

**5.4 STORAGE BATTERIES**

Storage batteries shall be Pb or NiCd type and located in a separate battery room, or shall be enclosed, so that the fire alarm system supply unit will not be affected adversely by battery gases.

Storage batteries shall comply with **ELOT EN 60086 parts 1 and 2.**

Supervisory devices shall be provided as specified in the Material Requisition; in any case one ammeter and one voltmeter.

Batteries shall be capable of operating the whole system for not less than 24 hours with normal load and shall have, in addition, at the conclusion of this 24 hours period, a residual capacity sufficient to operate the system through at least one complete cycle of alarm initiation, transmission and registration.

**6.0 FIRE ALARM SYSTEM**

**6.1 GENERAL DESCRIPTION OF THE SYSTEM**

The fire alarm system shall consist of the following parts:

- a) central station with the central control board and relevant auxiliary devices;
- b) plant signal circuits, including:
  - fire alarm circuits,
  - monitoring circuits relevant to the fire-fighting system;
- c) fire alarm station
- d) automatic fire detectors;



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- e) monitoring devices on fire fighting system;
  - f) acoustic alarm device
- Devices c), d), e) are called "sending devices".

**6.2 TYPE OF SCHEME**  
**6.2.1 NON CODED SCHEME**

The system consists of a certain number of sending devices connected in series on a single wire loop.

Each loop shall be used in a defined plant area or zone. A common optic and a general acoustic alarm shall be given on the central control board.

This system does not permit localization of the position of sending device which has operated.

The maximum number of sending devices connected to the same loop shall be compatible with sufficient selectivity in localization of the abnormal situation.

**6.3 CENTRAL STATION**  
**6.3.1 GENERAL**

The central station consists mainly of a central control board and shall be installed in a suitable room, located in the fire brigade house or in a permanently attended location. Access to the room shall be restricted to only authorized. The room or rooms shall be provided with normal emergency and safety lighting.

**6.3.2 CENTRAL CONTROL BOARD**

The central control board shall be equipped with the following devices:

- a) relay units for receiving signals from:
  - manual fire alarm stations,
  - automatic sending devices;

These relays actuate distinctive luminous annunciators, general fire alarm in the central station and local fire alarm in the endangered area;
- b) optic annunciators for individual or group signal of originating points;
- c) monitoring devices relevant to general services of the fire alarm system:
  - A.C. power supply,
  - D.C. power supply;

These devices shall actuate individual optic annunciators and a common audible signal (buzzer-point 6.3.3.b)

- d) monitoring devices relevant to external circuits (see 6.4.3 a,b,c).  
 These devices shall actuate individual optic annunciators and the common audible signal (point 6.3.3.b);
- e) meters required for the supervision of active circuits:
  - voltmeter and ammeter on D.C. supply,
  - ammeter for supervision of external circuits;



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- f) power and auxiliary control switches;
- g) auxiliary relays for different operational and supervision purposes;
- h) chronological event recorder;
- i) silencing switches for buzzer, general alarm siren and local alarm horns or bells;
- j) alarm test switches
- k) reset switches;
- l) test and check device for external circuits continuity, insulation condition and earth fault.

6.3.3 CENTRAL STATION

The central station shall be equipped with:

- a) power supply unit (see **para 5.0**)
- b) station or system trouble audible signal (buzzer);
- c) station bell for general and local fire alarm condition;
- d) paper support for manual recording of events;
- e) other required accessories.

6.4 **PLANT SIGNAL CIRCUITS AND MONITORING OF THE SAME**

6.4.1 GENERAL

Signal circuits shall connect the sending devices in the plant with the central control board.

The loop circuits shall be energized at functional extra low voltage (< 75 V D.C.); the D.C. circuits shall be completely isolated in respect to earth.

Wire cross sectional area shall be such not to exceed the maximum loop resistance, specified by equipment manufacturer.

Circuits for different services shall be supplied via individual overload and short circuit protective circuit breakers, complete with signaling contacts, to activate the "power failure" visual and audible alarm.

In the 3 wire systems the third wire (earth connection at control board) may be connected to the protective conductor of each device, only if local protective earthing is interconnected throughout the entire industrial installation (common earthing system).

6.4.2 CONNECTION SCHEME

The circuit shall be two wires with devices connected in parallel and an end- of-line resistor at the end of the line (see **FIGURE 1 and 2, page 17**).

6.4.3 MONITORING OF SIGNAL CIRCUITS

In general signal circuits, shall be continuously supervised from central station for:

- a) wire continuity,
- b) short circuit





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- c) earth fault  
Such abnormal conditions shall be individually monitored with visual indication and common audible alarm buzzer; the audible alarm shall be different from the general audible alarm and shall serve for this scope and for conditions of supply, listed in **para 6.3.2d**.
- d) general signal shall be by operator, unless automatic fire detectors operated simultaneously in several different areas of rooms.

**6.5 SENDING DEVICES SHALL BE OF THE FOLLOWING TYPES**

In general they shall be consistent with the uncoded system.

**6.5.1 MANUAL FIRE ALARM STATION**

It shall consist of a push-button station, enclosed in a red enameled cast-iron or die-cast case, with a push-button mounted behind a replaceable smashing glass panel.

The opening of the door shall be by means of a special tool (for tests purpose).

Alarm station has a push-button only, (see **FIGURE 3 and 4 page 18**).

**6.5.2 AUTOMATIC DETECTORS**

**6.5.2.1 SMOKE AND COMBUSTION GAS AUTOMATIC DETECTOR**

It shall consist of the smoke and combustion gas sensor, ionization chamber type or photoresistance type, housed in a metallic or plastic die-cast base. The operation indicating lamp shall be housed in the same base.

Mounting may be on ceiling or on wall, flush or projecting.

**6.5.2.2 AUTOMATIC FLAME DETECTOR**

It shall consist of a flame detector, replaceable fusible element type, housed in a metallic or plastic die-cast base.

Mounting may be on ceiling or on wall, flush or projecting.

**6.5.2.3 AUTOMATIC TEMPERATURE DETECTOR**

It consists of:

- replaceable fusible element, or
- bimetallic fixed setting temperature detector, or
- break glass temperature rise detector.

Mounting may be on ceiling or on wall, flush or projecting.

**6.6 POSITIONING AND INSTALLATION OF SENDING DEVICES**

**6.6.1 MANUAL FIRE ALARM STATIONS**

Alarm stations shall be distributed throughout the protected area, in strateg positions, readily accessible, located in the normal path of exit from the area, so that they are unobstructed and they are accessible with an horizontal travel distance not exceeding about 60 m. to the nearest station. The boxes shall be

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installed :

- a) in locations classified with hazard of explosion or fire, within building and in open areas;
- b) within buildings, also if not classified, when dictated by the presence of persons

In addition to the above :

within buildings one station shall be located on the first floor and on each subfeeding alternate floor, except that one station shall be provided for each floor having an area exceeding about 1000 m<sup>2</sup>; in open plant areas, stations shall be located preferably at road crossings; one station shall be located at each electrical substation, electrical room and in the control rooms.

The type of installation (wall or column) shall depend on local conditions.

When alarm stations are installed in points not provided with safety lighting, they shall include a lamp connected to safety lighting circuit.

### 6.6.2

#### AUTOMATIC DETECTORS

Unless otherwise required by local Authorities, automatic detectors shall be located in the following locations.

- a) in closed or protected rooms classified with presence of hazard of explosion or fire and in addition :
  - offices and filing rooms,
  - warehouses,
  - laboratories,
  - electrical rooms, substations, and transformer boxes (\*\*),
  - control rooms and adjacent cable rooms.

In general at least one detector shall be installed in each room or partition;

- b) outdoor electrical transformer yards (\*\*);
- c) closed shelter for turbo-generators, turbo compressors and alike.

Particular care shall be given to the selection of detector type in relation to the possibility of duct deposits on the detector surface.

In general detectors shall be so located and adjusted to operate reliably in case of smoke or fire at any part of the protected area. Location of detectors, application and number of detectors to provide adequate coverage of the room shall be based on air velocity, diffusion or stratification of smoke, presence of exhaust, temperature variations, and the like.

Such conditions vary with different installations and should be dealt with on the basis of experience of similar installations.

The selection of the type, position and number of automatic detectors to be used for the specific application shall be in accordance with Manufacturer's instructions.

(\*\*) Not applicable in case of non flammable oil type transformers.



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**6.7 DIRECT ACTING OF AUTOMATIC SENDING DEVICES**

Where required for safety reasons, automatic monitoring devices shall be equipped with a dual sending contact (or with an auxiliary relay) suitable give control signals to operating the auxiliary machines.

This situation may be present for example:

- in rooms with forced ventilation, - in rooms with air conditioning,
- in electrical machines with forced ventilation.

The presence of smoke or fire shall determine shutdown of fans and blowers and closing of air intake or discharge shutters.

**6.8 AUDIBLE SIGNALING APPLIANCES**

Associated with the manual and automatic fire alarm system, audible signaling appliances shall be foreseen to inform all persons present in the plant about the hazard situation. Two types of alarms shall be foreseen:

- a) general fire alarm, which corresponds to a general evacuation order, to be given in case of catastrophe :
- b) local fire alarm, which corresponds to a localized hazard situation, to given only in the endangered are and possibly in adjacent areas.

**6.8.1 GENERAL ALARM**

The general alarm as shall be by means of high power sirens, located in suitable positions to permit clear heard from any point of open areas and of closed rooms, regardless to the maximum noise level obtained from machinery or other equipment.

General alarm sirens and local alarm horns or bells shall be generally energized with a functional extra low voltage (< 75 V D.C.), supplied from the central station power supply unit.

If general alarm sirens demand more than about 100 W, they shall be supplied at 220 V, single phase or at 380 V, three phase, 50 Hz: this service shall be considered as a "priority load".

Unless otherwise specified the following procedure shall be considered; signal shall be a continuous series of sounds as follows:

\_\_\_\_\_  
 16"      4"      16"      4"      16"      4"      16"

stop of signal shall by operator in the central station.

**6.8.2 LOCAL FIRE ALARMS**

Local fire alarm signals shall be by means of horns or bells, installed within each area or room, in which the plant has been divided from fire protection point of view.

Automatic operation of local alarm shall be by means of manual or local sending devices, through relays in the central control board. Stop of signals shall be by operator in the central station. Local horns or bells may be sounded also for general alarm.



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**7.0 CABLES AND CORES**

The following paragraphs shall be considered.

Cables used for all functional extra low voltage circuits shall be 1 KV grade: cables used for auxiliary circuits at 220 V or at 380 V or at 380 V, 50 Hz shall be 4 KV grade.

All cables shall be of the flame retardant type (\*), unless when installation in explosion proof type conduit or underground.

**8.0 ELECTRICAL FIELD TESTS**

Upon completion of installation, a satisfactory test shall be made in presence of the authority having jurisdiction, if required by Owner.

**9.0 PERIODICAL PERFORMANCE TESTS**

**9.1 DAILY TESTS AT CENTRAL STATION**

Facilities shall be provided at the central station on all circuits extending from the central control board and on all current sources of the\* central station for making the following daily tests:

- a) current value on each circuits;
- b) voltage between earth and active circuits;
- c) voltage across terminals of each circuit downstream of each protective circuit breaker.

Check shall be by insertion of voltmeter connected to power supply.

**9.2 QUARTERLY TESTS**

Test of all sending devices shall be made quarterly from the central station. Manual sending devices shall be tested at site, by acting on the push-button.

A complete record shall be kept of all tests. The record shall be available for examination and where required, reported to the Authority.

**10.0 MONITORING OF FIRE FIGHTING SYSTEM**

**10.1 GENERAL**

In this chapter are considered the criteria and recommendations relevant to remote monitoring from the fire alarm central control board of conditions and functions essential to safe operation of the fire fighting system. Provisions and means required to assure safe and proper operation of the fire fighting system are not in the scope of this specification.

To the purpose of detecting conditions and functions to be under continuous control, suitable sending devices shall be provided.

Characteristics of sending devices shall be in accordance with the type of monitors in the control station and of transmission circuits.

The criteria and recommendations of this chapter shall be properly adopted to other fire fighting systems which are not herein specifically considered.

**10.2 MONITORING OF FIRE PUMPS AND NETWORK**

**10.2.1 ELECTRIC MOTOR DRIVER AND AUTOMATIC CONTROLLER**

The following conditions and functions shall be remotely monitored in the fire alarm central station:

- a) power availability to pump motor (presence of voltage controlled at the motor starter unit);
- b) pump motor run;
- c) failure on pump motor starter unit (overload, short circuit, earth fault, etc.) or on automatic control unit;
- d) availability of automatic control unit;
- e) failure of pump motor to start automatically.

**10.2.2 INTERNAL COMBUSTION DRIVER**

In addition to monitoring devices relevant to the internal combustion driver, the following conditions and functions shall be remotely monitored in the fire alarm control station;

- a) availability of fuel, lubricating oil, cooling water;
- b) availability of supply power to automatic control units;
- c) availability of starting power (D.C. battery or compressed air);
- d) pump motor run;
- e) control unit or drive failure;
- f) failure of driver to start automatically.

**10.2.3 FIRE FIGHTING PUMP AND NETWORK**

The following conditions and functions shall be remotely controlled from the fire alarm central station:

- a) disturbance on the pumps; (e.g. trouble, failure, etc.)
- b) pressure in the fire water network;
- c) position of gate valves (if necessary only).

**10.3 MONITORING OF SPRINKLERS NETWORK**

Unless otherwise specified, sprinklers local network shall be provided with pressure switches, suitable to send any alarm to the central control board, in order to permit monitoring of operation of sprinklers and localization of danger.

Number and position of pressure switches shall be in accordance with requirements of specific situations.

**10.4 EARTHING OF FIRE WATER NETWORK**

Generally the fire water network shall be bonded with the unique earthing electrode at the extremities of all lines.

Where the lines run outside of the unique earthing electrode, they shall suitably isolated with at least two isolating flanges.

(\*) Refer to IEC 60332

**11.0**      **CABLES**

Soft annealed copper conductors shall have minimum diameter of 0,6 mm, thermoplastic insulation with a test-voltage not less than 1 kV. Fire alarm cables shall comply with IEC recommendation 60189.

**11.1**      **CABLE FOR MAIN SECTION OF CIRCUITS**

The fire alarm cable, to be used for main section of the circuits, shall consist of:

- Solid wire copper conductor, of 0,9 mm diameter, polythene or P.V.C. insulated.
- Four (4) cores (insulated conductors) are twisted together to form a quad (called element).  
All element are twisted in concentric layers, wrapped with synthetic tape and screened with aluminium tape and P.V.C. sheathed overall.

**11.2**      **CABLE FOR THE OTHER SECTION OF CIRCUITS**

The fire alarm cable, to be used for other section of circuits, shall consist of:

- solid wire tinned copper conductor of 0.6 mm diameter polythene or P.V.C. insulated.
- Two cores (insulated conductors) are twisted together to form a pair (called element).

The element are twisted together in concentric layer(s), wrapped with synthetic tape, screened with aluminium tape and P.V.C. sheathed.

**Remarks**

For the compatibility to the different types of fire alarm central station, the maximum resistance of the circuit loop does not exceed 180 ohm.



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Figure 1

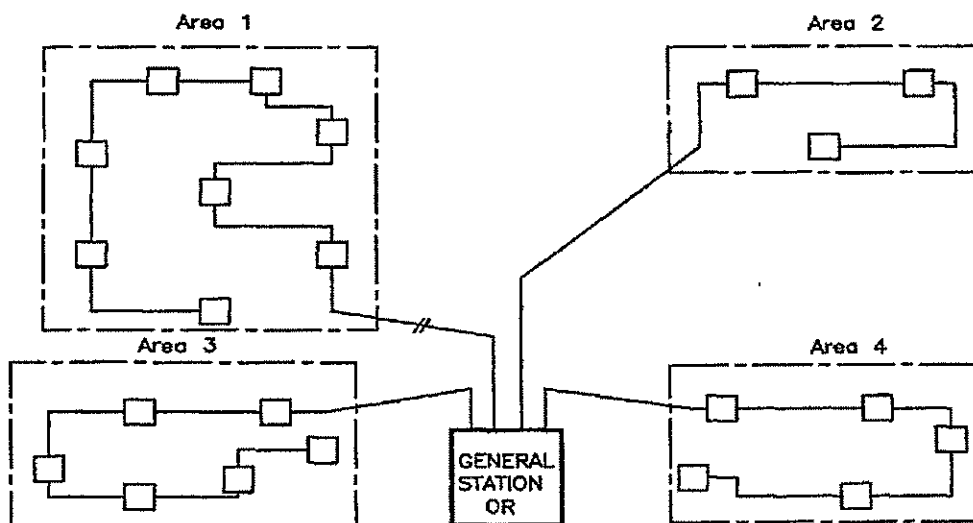
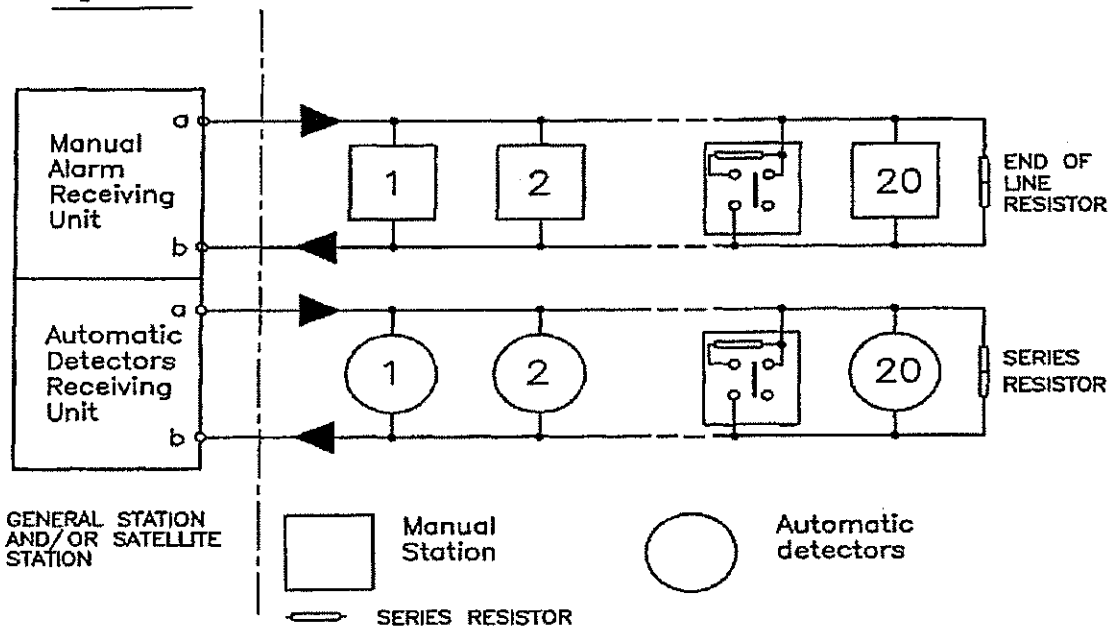


Figure 2



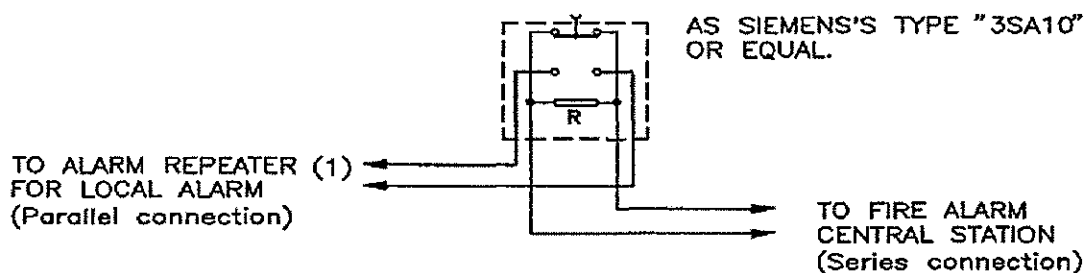
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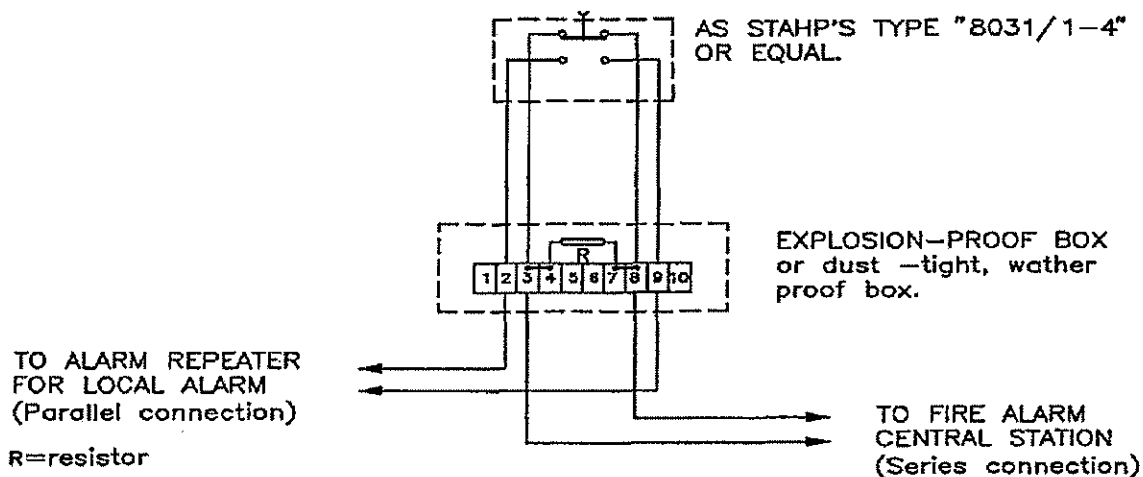
**FIGURE 3** FIRE ALARM PUSH-BUTTON STATION  
 (Typical Diagrams)

Push-button with degree of protection "IP-65"



**FIGURE 4** FIRE ALARM PUSH-BUTTON STATION  
 (Typical Diagrams)

Explosion-proof Push-button (Ex-d)



R=resistor

**NOTE**

(1) WHEN THE FIRE ALARM PUSH-BUTTON STATIONS ARE PART OF THE SATELLITE STATION CIRCUITS, THE LOCAL ALARM CIRCUIT SHALL BE OMITTED.