



Exploration & Production

## GENERAL SPECIFICATION

### CORROSION

#### GS COR 202

**Supply of measurement of cathodic protection of an offshore structure by monitored sacrificial anodes**

|      |       |                               |
|------|-------|-------------------------------|
|      |       |                               |
|      |       |                               |
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| 00   | 02/01 | First issue                   |
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## 1. Scope

This document describes a device for monitoring the cathodic protection of offshore platforms, and specifies the quality, checking points and acceptance criteria governing its supply and installation.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

### Standards

| Reference   | Title                                                                                       |
|-------------|---------------------------------------------------------------------------------------------|
| PrEN 12496  | Sacrificial anodes for cathodic protection in sea water                                     |
| ISO 62-1980 | Water absorption resin plastics                                                             |
| IEC 243     | Method of test for dielectric strength of solid insulating materials                        |
| IEC 79-7    | In creased safety "e"                                                                       |
| IEC 502     | Energy transport cables with solid extruded insulation for rated voltage from 1 kV to 30 kV |
| NF C 32-311 | Rigid reticulated polyethylene insulated cables, series 1000 RG PFV                         |

### Professional Documents

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

### Regulations

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

### Codes

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

### Other documents

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

## Total General Specifications

| Reference  | Title                                                      |
|------------|------------------------------------------------------------|
| GS COR 201 | Supply of sacrificial anodes                               |
| GS COR 350 | External protection of structure and equipment by painting |

## 3. Equipment design

### 3.1 The monitoring device

This cathodic protection monitoring device shall comprise:

- For the submerged part:
  - Two sacrificial anodes, isolated from the structure and shunted
  - A reference zinc electrode on each of the anodes
  - A gathering box for all the measurement cables. This unit shall bear a reference zinc electrode
  - At least one reference zinc electrode on each level of the jacket
  - A multicore cable linking the gathering unit to the connection unit.
- For the above-water part
  - A connection unit located on the first level above sea level
  - A measuring instrument located in the electrical rooms
  - A multicore cable linking the connection unit to the measuring instrument.
- Number of sets to install
  - For sea depths between 0 and 60 m, the jacket should have one set of anodes with instrumentation (two anodes)
  - For sea depths between 0 and 120 m, the jacket should have two sets of anodes with instrumentation
  - For greater depths, the jacket should have one or more additional sets of anodes with instrumentation for each additional 60 m of sea depth.

### 3.2 Description of the components

#### 3.2.1 Shunted sacrificial anodes

Two sacrificial anodes, taken at random from the batch of anodes provided for the protection of the structure, shall be installed as described in Appendix 1.

Each anode shall have two insulating joints. One of the two shall be by-passed by a shunt for measuring the current output by the anode. The resistance of the shunt shall be no more than  $2.5 \times 10^{-3}$  ohms (0.5% accuracy from 0 to 30°C).

In order to use the "opposed current" method, two cables are connected to the power circuit of the shunt (Appendix 1, detail 2).

### 3.2.2 Zinc reference electrode

#### 3.2.2.1 Composition

The chemical composition of the zinc alloy used for the reference electrodes shall comply with type Z2 as defined in [EN 12496](#).

#### 3.2.2.2 Position

##### Reference electrodes on monitored anodes

The reference electrodes on these anodes shall be mounted as shown in Appendix 1 (detail 1).

##### Reference electrodes on the marshalling unit

A reference electrode shall be installed on the gathering box as shown in Appendix 2.

##### Reference electrodes on the structure

The minimum number of reference electrodes to be installed depends on the number of the jacket's submerged horizontal levels that are below sea level. Their positions shall be defined in the cathodic protection job specification.

These reference electrodes shall be connected to the nearest gathering box. The wiring diagram for these electrodes is given in Appendix 2. The electrodes shall be electrically insulated from the structure.

### 3.2.3 Gathering box

This steel unit shall be coated using system P08 described in [GS COR 350](#). The gathering box shall be mounted on a plate welded to the structure, mid-way from the monitored anodes.

Inside, it shall have a terminal block for connecting the two anodes and the reference electrodes, and cable entry glands. Wiring details are given in Appendix 2.

**Note:** When the cables have been connected to the terminal block, and the wiring and insulation have been checked, the unit shall be filled with epoxy resin on the construction site.

### 3.2.4 Resin

The epoxy resin shall meet the following specifications:

- Water absorption, 24 hours at 23°C, 3 mm thickness: 0.5%
- Transverse dielectric strength (3 mm thickness), minimum: 20 kV/mm according to [243](#).

### 3.2.5 Multicore cable

A 19 x 2.5<sup>2</sup> copper multicore cable, type U 1000 RGPV in accordance with [NF C 32-311](#), shall link the gathering box to the connection unit of the above-water level.

### 3.2.6 Connection unit

The multicore cable or cables from the submerged part shall be terminated inside a connection unit.

This shall be rated Eex"e" II B.T6, IP 667, according to [IEC 79-7](#), for use in potentially explosive areas. The same applies for the terminal block and cable glands.

The unit shall be installed approximately 0.5 m higher than the first above-water level, after the jacket has been installed on site.

The unit's wiring principles are set out in Appendix 3 (one or two sets). The unit shall be of steel, coated using system P09 as described in **GS COR 350**, or polycarbonate, or reinforced polyester.

### 3.2.7 Multicore cable

The cable linking the connection unit to the measuring instrument in the electrical plant rooms shall be type U 1000 R 02 V according to **IEC 502**.

The cable shall have  $19 \times 2.5 \text{ mm}^2$  conductors for one monitoring device.

If there are two monitoring devices, it shall have  $30 \times 2.5 \text{ mm}^2$  conductors if the number of zinc reference electrodes is no more than 6.

Otherwise, it shall include  $37 \times 2.5 \text{ mm}^2$  conductors, or may comprise two  $19 \times 2.5 \text{ mm}^2$  conductor cables.

### 3.2.8 Measuring instrument

This shall be installed in an electrical room (or in the instrumentation room). It shall comprise a 19" x 6 U standard rack. The front of the instrument shall include a measuring device and a mimic. This is shown in Appendix 4.

#### 3.2.8.1 Mimic

This is shown in Appendix 4.

#### Structures with just one set of anodes

The wiring principles for the measuring instrument are given in Appendix 5.

#### Structures with two sets of anodes

A switch shall be installed so that measurements can be taken from each of the two sets.

The switch controller shall be located on the front of the measuring instrument. The wiring principles are set out in Appendix 6.

The reference electrodes located on the levels of the structure shall be connected directly to the mimic (regardless of the switch position).

#### 3.2.8.2 Measuring instruments

The layout of the measuring instruments on the front of the system is given in Appendix 4.

The measuring instruments shall include:

- Two digital voltmeters with high input impedance  $> 1 \text{ M Ohm}$ :
  - 1 voltmeter - 200 mV - 2 000 points
  - 1 voltmeter - 2 000 mV - 2 000 points.
- A stabilised PSU (15 V, 20 A) with two measurement outputs across 10 A, 100 mV shunt.

The on/off switch shall control the stabilised PSU and the digital voltmeters.

### 3.2.9 Cable protection

The cables shall be protected by carbon steel conduit (schedule 80), screw jointed:

- 1"1/2 diameter for the cables of the zinc reference electrodes located on the levels and for the cables linking the anodes to the gathering box
- 3" diameter for the 19-core cables linking the gathering box to the connection unit, located on the first above-water level.

The cable protection conduits shall be welded to the structure by steel plates measuring 100 x 50 x 7 mm:

- At one-metre intervals between +4 m and -5 m
- At two-meter intervals below -5 m.

In the above-water area, the 19 x 2.5 mm<sup>2</sup> cable or cables shall be secured in such a way that they cannot slip inside the protective conduits (for example, by stainless steel draw tape).

## 4. Technical content of the bids

The technical bid shall include the characteristics and references of the various instruments and materials used, as listed below:

- Voltmeter
- Stabilised PSU
- Resin
- Reference electrode
- Shunt characteristics
- Monitoring system MANUFACTURER
- Wiring diagrams
- Description of units (material, coating, size).

## 5. Inspections

### 5.1 Factory acceptance

Acceptance testing of all the various monitoring devices shall be carried out on the premises of the SUPPLIER chosen by the CONTRACTOR, in the presence of a representative of the OWNER.

#### 5.1.1 Shunted anodes and measuring instrument

Each set shall be acceptance tested when finished (insulating seal resins poured). It shall be submerged in a tank filled with 30 g/l NaCl salt water. The core of the anode on the shunt side shall be linked electrically to a frame ground (or to the tank itself if made of steel) via an ammeter.

The measurement cable for each anode shall be connected to the gathering box which shall in turn be linked to the measuring instrument (the electrical diagrams must be checked).

The following measurements shall be taken for each subsystem after calibrating the zinc electrodes regarding the sea water Ag/AgCl electrode:

- Potential of anodes and zinc reference electrodes relative to the sea water Ag/AgCl electrode
- Resistance of shunt/sacrificial anode system and of shunts by direct measurement of the voltage across the terminals of the shunt, and by opposed current measurement
- Inspection of all insulating joints
- Verification of electrical connections (shunt cable colour).

### 5.1.2 Zinc reference electrodes

Verification of the insulation resistance of the zinc relative to the electrode mounting.

Measurement of the potential of the zinc in 30 g/l salt water compared to a sea water Ag/AgCl electrode.

Inspection of electrode identification details (number, cable length, level).

### 5.1.3 Documents to be submitted

- Drawings of all subsystems with details of insulating joints, cables and shunt values
- Wiring diagrams, layout and fixing drawings for the various boxes, and a plastic laminated drawing inside each box
- Wiring and dimension drawings of the measuring instrument, references and components
- Spare fuses (two sets)
- Acceptance test reports.

## 5.2 Acceptance testing on site

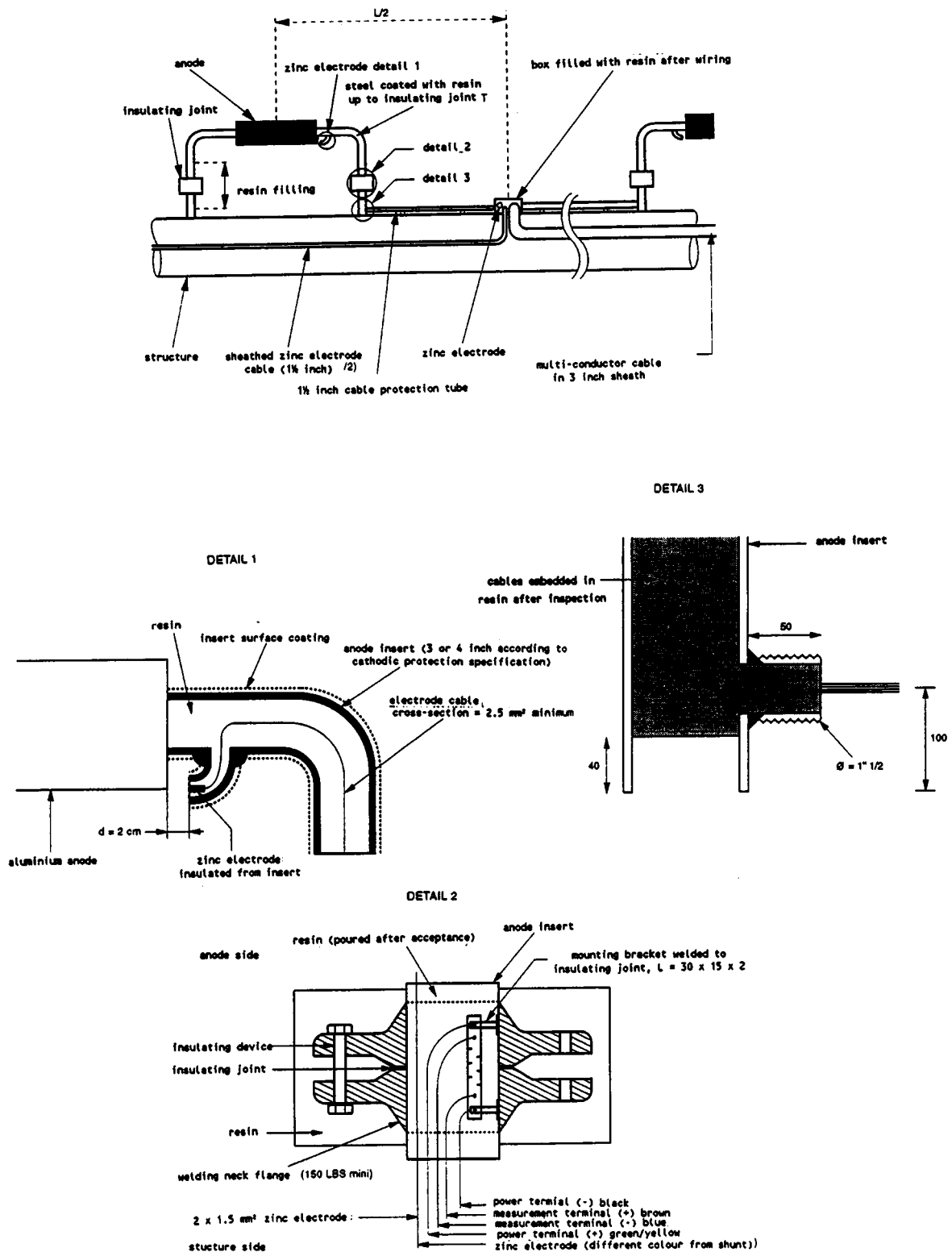
After assembly, all the following points shall be checked:

- Cable insulation
- Electrical continuity
- Wiring
- Fixing of cable supports
- Reference electrode/structure insulation resistance
- Securing of the cable on the top level
- Verification of compliance of the positioning of the anodes with instrumentation and reference electrodes on the structure
- Documents to be submitted
- Drawing of conduits (position, assembly details and fixing details) for protecting cables
- Drawing of cable gathering boxes (materials, dimensions, type of cable glands)
- Drawing of the connection unit on the first above-water level
- Name of the SUPPLIER of the monitoring device

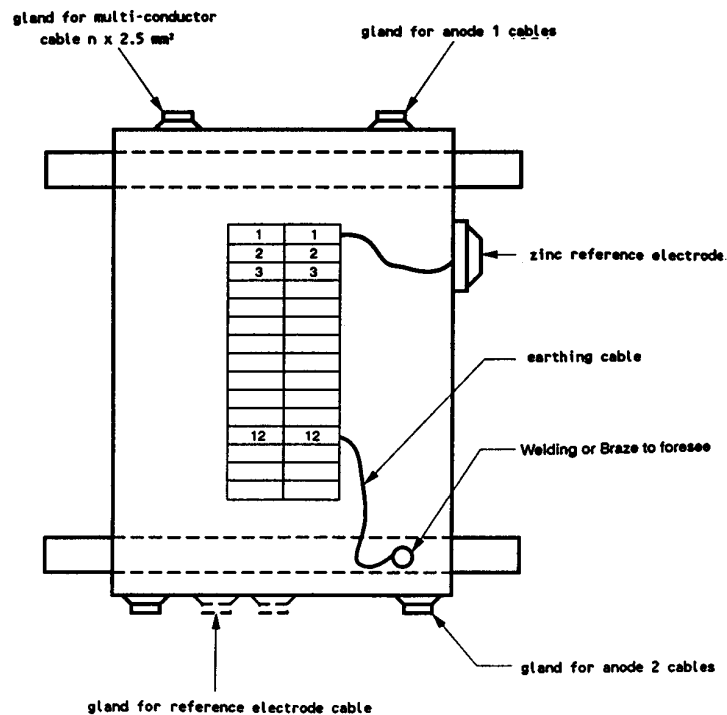


- Exact positioning drawing of the anodes with instrumentation and the reference electrodes
- Documents listed in section 5.1.3.

## Appendix 1 Diagram of monitored anodes



## Appendix 2 Gathering box

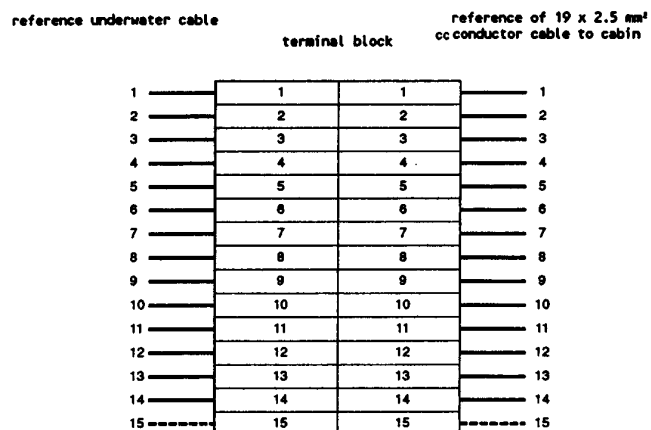


reference of 19 x 2.5 mm² conductor cable

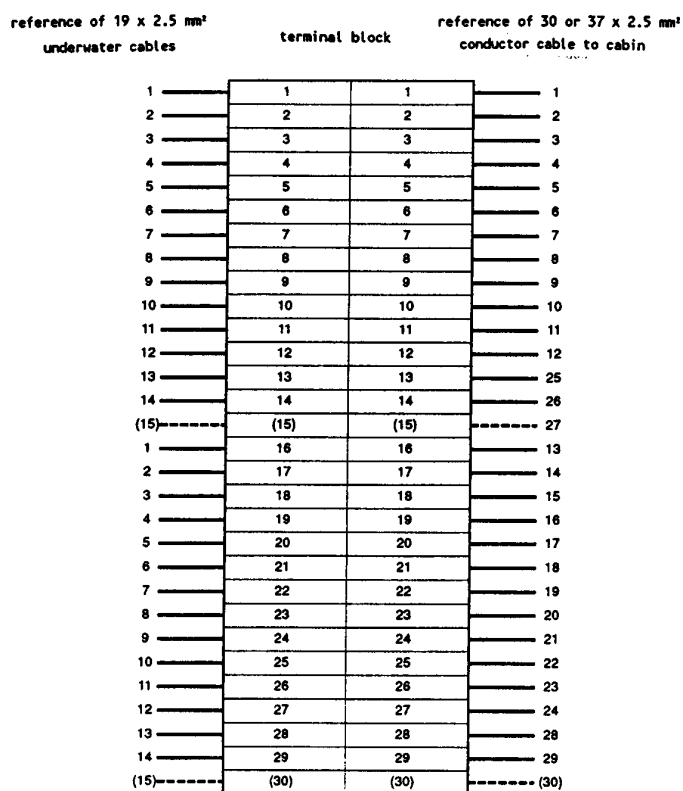
|    |    |    |                                  |
|----|----|----|----------------------------------|
| 1  | 1  | 1  | connecting box zinc electrode    |
| 2  | 2  | 2  | shunt anode 1, power +           |
| 3  | 3  | 3  | shunt anode 1, measurement       |
| 4  | 4  | 4  | shunt anode 1, measurement       |
| 5  | 5  | 5  | shunt anode 1, power -           |
| 6  | 6  | 6  | anode 1 zinc electrode           |
| 7  | 7  | 7  | shunt anode 2, power +           |
| 8  | 8  | 8  | shunt anode 2, measurement       |
| 9  | 9  | 9  | shunt anode 2, measurement       |
| 10 | 10 | 10 | shunt anode 2, power -           |
| 11 | 11 | 11 | anode 2 zinc electrode           |
| 12 | 12 | 12 | structure:                       |
| 13 | 13 | 13 | structure, reference electrode 1 |
| 14 | 14 | 14 | structure, reference electrode 2 |
| 15 | 15 | 15 | structure, reference electrode 3 |

## Appendix 3 Wiring diagrams of connection units

### ONE SET

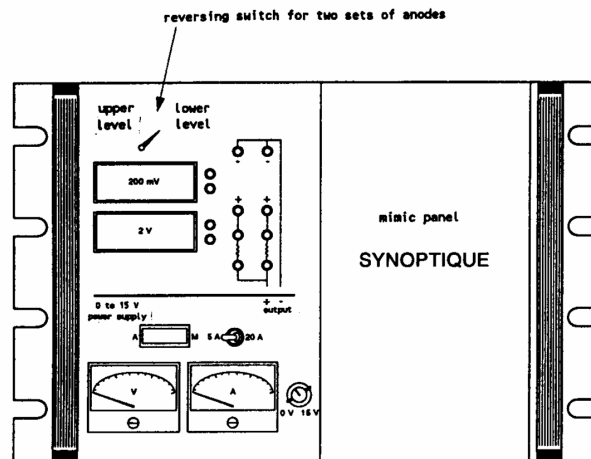


### TWO SETS

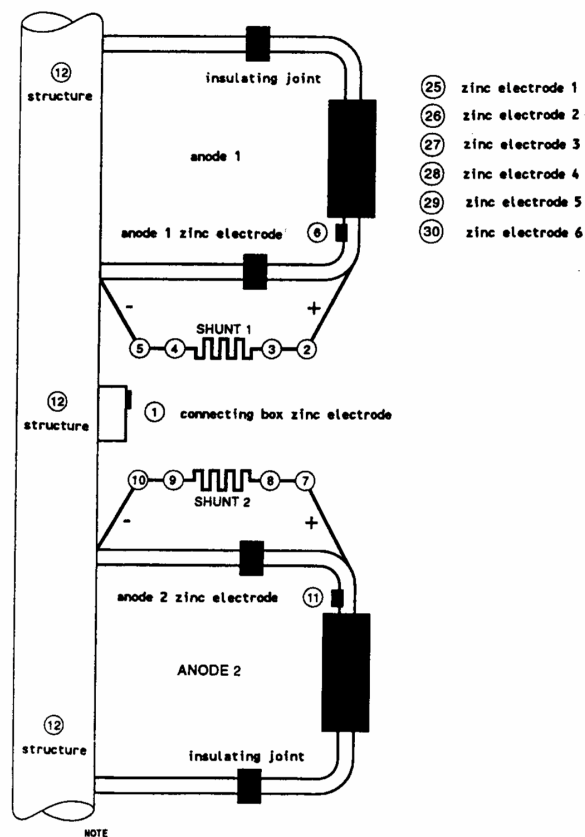


## Appendix 4 Measuring instrument

### FRONT PANEL OF MEASUREMENT UNIT



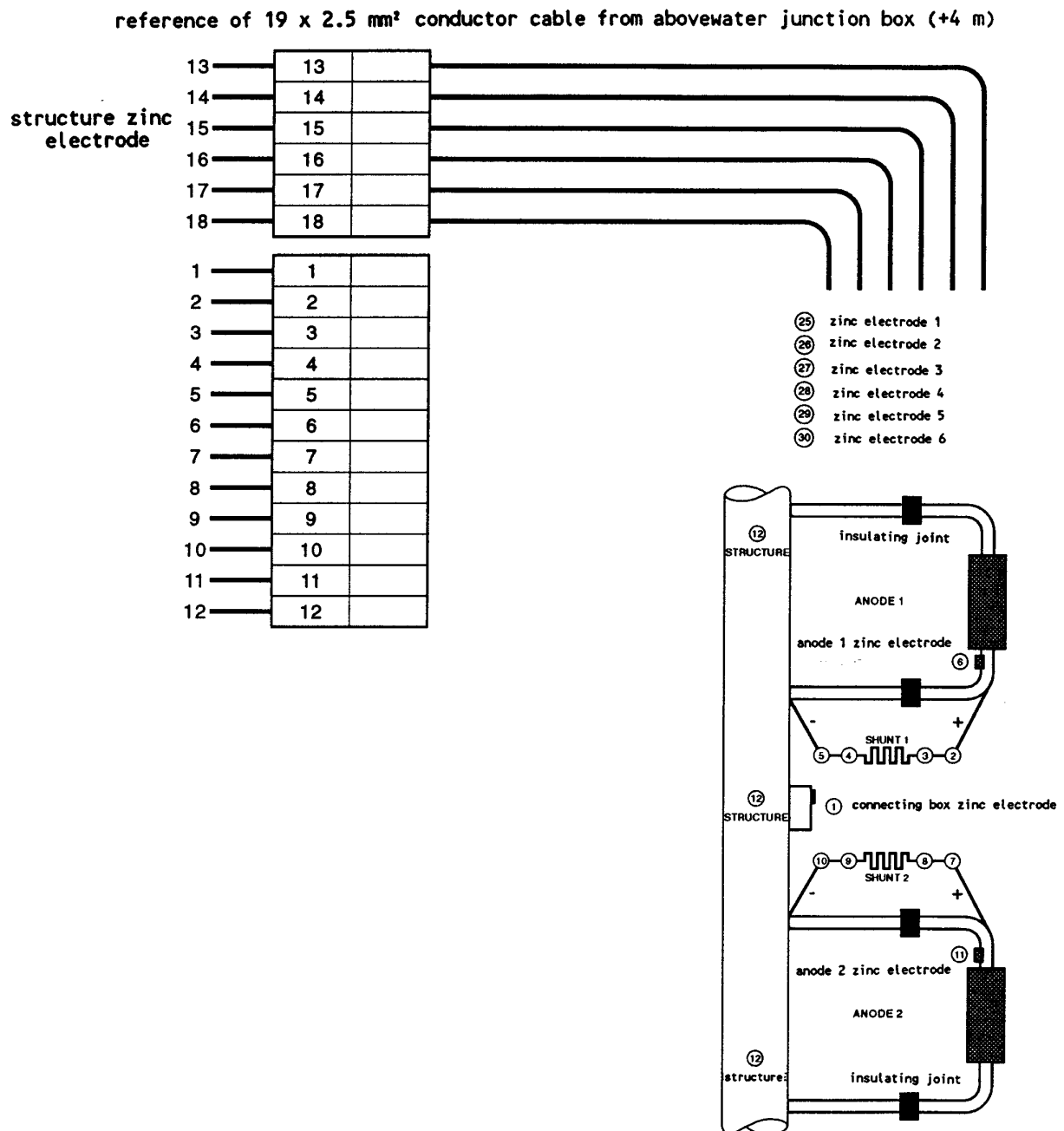
### MIMIC PANEL



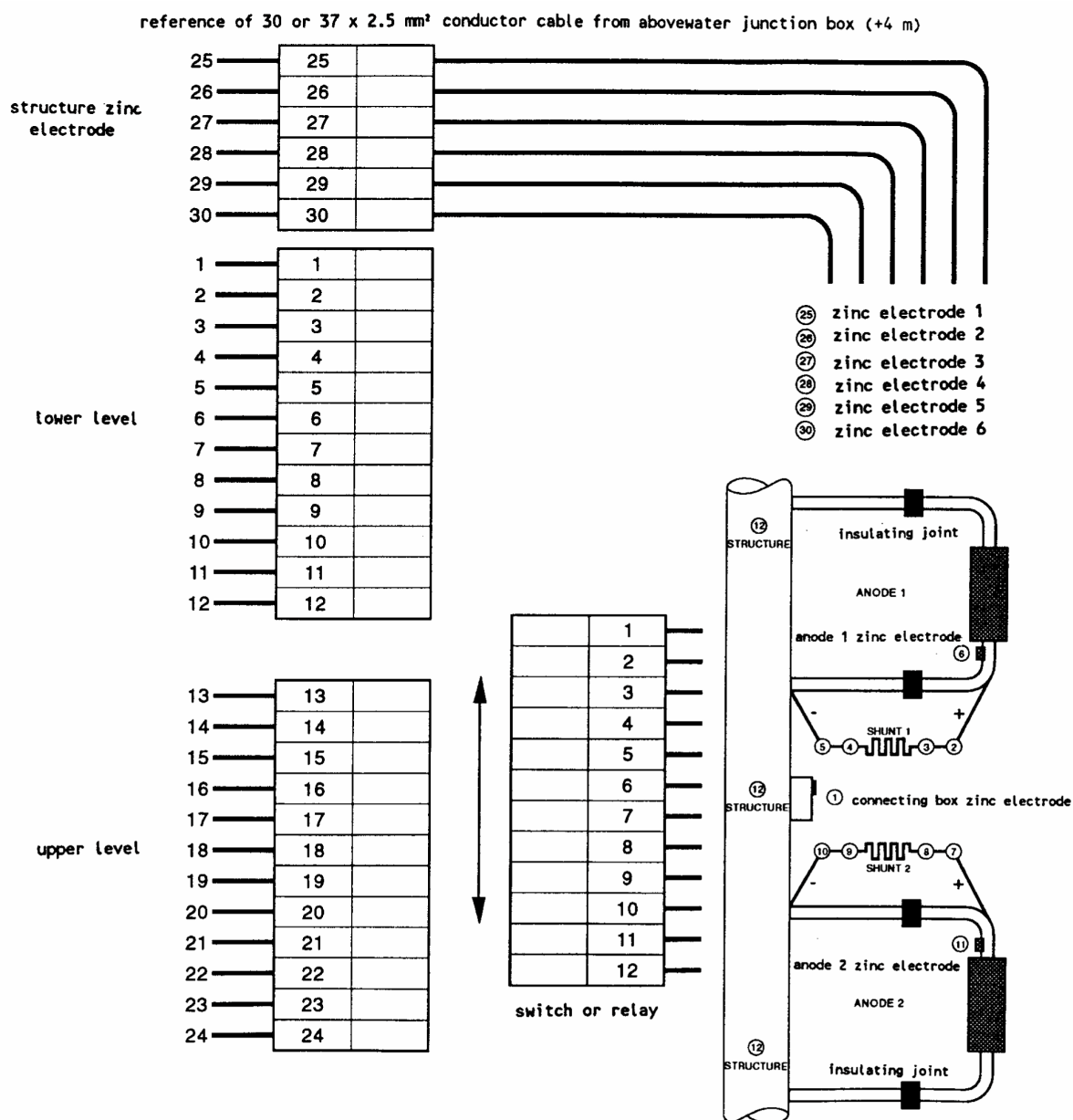
NOTE

The mimic panel shall be made on a plastic or aluminium plate. The structure, anodes and insulating joints shall be represented by different colours. The rings referenced 1, 2 etc are designed for connector plugs 4 mm in diameter.

## Appendix 5 Schematic wiring diagram of the measuring instrument (one set)



## Appendix 6 Schematic wiring diagram of the measuring instrument (two sets)



### NOTES

- (1) The switch shall be appropriate for very low potential levels (low contact resistance).
- (2) On the mimic panel, the switch or relay shall be connected at the back, similar to the reference electrodes.