



**HELLENIC GAS
TRANSMISSION
SYSTEM OPERATOR**

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**TECHNICAL JOB
SPECIFICATION**

784/3

REVISION 0

DATE 05/04/2011

**HIGH PRESSURE (HP) TRANSMISSION
SYSTEMS**

**CATHODIC PROTECTION, TRANSFORMER
RECTIFIER CABINETS AT ANODE BEDS**

Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 2/36

QUALITY ASSURANCE PAGE

CHANGES LOG:

REVISIONS LOG

0	05-04-2011	FIRST ISSUE	PQ DPT	V.G.
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CONTENTS

EU LEGISLATION

REFERENCE DOCUMENTS

1.0 SCOPE

2.0 TRANSFORMER RECTIFIER CABINETS

3.0 QUALITY CONTROL

4.0 SPARE PARTS

5.0 DOCUMENTS

6.0 PACKING

DRAWINGS

Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 4/36

EU LEGISLATION

94/9/EC ATEX
[Equipment Explosive Atmospheres Directive]
2004/108/EC EMC
[Electromagnetic Compatibility Directive]
2006/95/EC LVD
[Low Voltage Directive]

REFERENCE DOCUMENTS

Job Specification 700/1
[General Notes for Electrical Equipment and Materials]
Job Specification 970/2
[Shop Inspection of Equipment and Materials for NGT Project]
Std Drawing No. STD-00-78-01
[Cathodic Protection for Pipelines - Transformer Rectifier Cabinet]
Std Drawing No. STD-3-78-02
[Cathodic Protection for Pipelines - Installation of Transformer / Rectifier Cabinet]
Std Drawing No. STD-4-43-13
[Cathodic Protection for Pipelines - Concrete Piers for P.P.C. KWh Meter and T/R Cabinet]
ELOT EN 12954
[Cathodic protection of buried or immersed metallic structures - General principles and application for pipelines]
ELOT EN 50022
[Low voltage switchgear and control gear for industrial use. Mounting rails. Top hat rails, 35 mm wide, for snap-on mounting of equipment]
ELOT EN 50035
[Low voltage switchgear and controlgear for industrial use. Mounting rails, G-profile for the fixing of terminal blocks]
ELOT EN 60079 series
[Electrical apparatus for explosive gas atmospheres]
ELOT EN 60617
[Graphical symbols for diagrams]
ELOT EN 61000 series
[Electromagnetic compatibility (EMC)]
ELOT EN 61000-4-3
[Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test]

Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 5/36

ELOT EN 61000-4-5

[Electromagnetic compatibility (EMC) - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test]

ELOT EN 61558-2-4

[Safety of power transformers, power supply units and similar - Part 2-4: Particular requirements for isolating transformers for general use]

ELOT EN 61643-11

[Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and tests]

ELOT EN 61643-21

[Low voltage surge protective devices - Part 21: Surge protective devices connected to telecommunications and signalling networks - Performance requirements and testing methods]

ELOT EN 61643-22

[Low-voltage surge protective devices - Part 22: Surge protective devices connected to telecommunications and signaling networks - Selection and application principles]

ELOT EN 61663-2

[Lightning protection - Telecommunication lines - Part 2: Lines using metallic conductors]

ELOT EN 62305-1

[Protection against lightning - Part 1: General principles]

ELOT EN 62305-2

[Protection against lightning - Part 2: Risk management]

ELOT EN 62305-3

[Protection against lightning - Part 3: Physical damage to structures and life hazard]

ELOT EN 62305-4

[Protection against lightning - Part 4: Electrical and electronic systems within structures]

CEN/TS 15280

[Evaluation of a.c. corrosion likelihood of buried pipelines - Application to cathodically protected pipelines]

DVGW Afk No 6

[Errichtung von Fernstromanlagen für den kathodischen Korrosionsschutz; Schutz gegen gefährliche Körperströme]

DVGW Afk No 8

[Kathodischer Korrosionsschutz für Stahlrohre von Hochspannungskabeln]

DIN/VDE 0845-1

[Protection of telecommunication systems against lightning, electrostatic discharges and overvoltages from electric power installations]

DIN/VDE 0847

[Electromagnetic Compatibility (EMC) Testing and Measuring Techniques]

HELLENIC GAS TRANSMISSION SYSTEM OPERATOR



Job Spec. No	784/3
Revision	0
Date	05-04-2011
Page	6/36

DIN 4065
[Gas pipelines indicating labels]

1.0 SCOPE

This Specification specifies Transformer Rectifier Cabinets at anode beds, in Impressed Current Cathodic Protection Installations.

The requirements of the following apply for the manufacturing and documentation of the transformer rectifier cabinet:

- This Specification,
- Applicable EU and Greek legislation, regulations, etc.

1.1 CONTRACTOR'S DOCUMENTATION

At the tendering the Contractor shall submit a principle drawing of the transformer rectifier cabinet installation, including main cable connections, and state the name of the Supplier.

Before installation Contractor shall forward to Owner's Representative, for approval, the following but not limited to documents:

- Detailed drawing showing anode bed, reference electrode and earth electrode locations and detailed specification of the transformer rectifier cabinet installation.
- Detailed specifications of transformer rectifier overvoltage protection.
- Wiring diagram.
- Detailed user's manual, including test and maintenance instructions
- Type factory test certificates

2.0 TRANSFORMER RECTIFIER CABINETS

Transformer rectifier cabinets shall be installed and positioned as shown on **Standard Drawing STD-3-78-02** and it shall be delivered with a detailed user's manual.

Cabinets shall be constructed of 1.5 mm galvanized sheet steel, with corrosion resistant phosphate primer and light grey epoxy finish. All hardware shall be plated to prevent corrosion.

The transformer rectifier cabinet shall be installed outside hazardous areas otherwise **ELOT EN 60079 series** apply. A degree of protection IP 65 applies.

The cabinet shall be suitable for outdoor installation within an ambient temperature range from -25°C to +50°C.

Cabinets shall be provided with space heater and exhaust fan controlled via thermostats, for winter (-25°C) and summer (50°C) conditions.

Cabinets shall be provided with precast concrete foundation pad and suitable opening for cable passage as shown on **Std Drawing No STD-4-43-19**. Precast concrete foundations shall be supplied with the cabinet as an assembly. The cabinets shall be equipped with sun/rain canopy. The lower parts of the cabinet must be designed suitably for anchoring into the concrete footing without disturbing the function of the cabinet.

The port of the ground plate with the cable glands will have the required cable glands for each incoming or outgoing cable and 20% spares for future extension.

The Transformer-Rectifier Cabinet shall be provided with door locking device suitable for the size of the door, which will lock the door preferably at three places (the center of the door, the upper part and the lower part). The locking device shall be strong enough to withstand attempts to open the door by unauthorized personnel (See **Scheme 1**).

The cabinet doors shall be provided with a safety cylinder lock and shall be able to open up to 90° and they shall be supplied with holder to be held in open position.

The T/R Cabinet must be equipped with a pocket in the back side of its door for the Operation and Maintenance Manual.

Details for construction of the cabinet and low voltage part are given in the relevant drawings attached (See **Schemes 2 to 17**).

Each cabinet shall be equipped with an identification plate which shall be offered in the tender documents and it shall be according to **DIN 4065** with Owner's firm, telephone, CP station number, etc.

The mounting rails for the clip-on terminals will have provision for additional future terminals. The terminals will be delivered with 4 mm test sockets and bridges.

The transformer rectifier cabinet installation shall be in accordance with the following:

2.1 LOW VOLTAGE PART CONSISTING OF

Connection to 230 V service line of the public electricity supply network.

In case of solar panel electricity supply preventive measures shall be taken for solar panel protection from theft or vandalism.

Metering arrangement.

One (1) main incoming 2 pole switch 32 A.

Two (2) panel switches, 2 pole, 6 A and 16 A.

Two (2) sockets for tools and metering equipment.

One (1) GFI relay, 40 A, release current 30 mA.

Auxiliary earth $R_g < 10 \text{ Ohm}$.

Surge Protective Devices -

The Transformer Rectifier Unit supply must not be affected by the GFI.

2.2 TRANSFORMER RECTIFIER UNIT

The unit should have a stable performance for the present output voltage or current values for both automatic and manual operation independently of any variation of input voltage or any influences from the pipeline [e.g. on varying input voltage (230V) 10% the output current - on galvanostatic control - varies max. 1mA; on potentiostatic control the potential varies max. 10mV].

The Transformer-Rectifier Unit shall be of a draw-out or plug-in type.

The performance of the unit must not be affected by supply voltage variations within a range $\pm 15\%$.

The following requirements as of paras 2.2.1, 2.2.3, 2.2.4 shall be applied:

2.2.1 CONNECTION AND PERFORMANCE

- Input, AC : Power supply, 230 V, 50 Hz.
- Output, DC : Voltage 0-12V,
Current 0 -1 A, or
Current 0 -1 A and 0-5 A via a selector switch.
- Metering Input/Output : as per 2.2.2.

The connection to the unit shall be of a plug-in type, except external metering connections which are described in **para 2.2.2**.

The isolation between the AC-input/DC- output shall be based upon an isolating dry type AN cooling safety transformers with separate windings according to **ELOT EN 61558-2-4**.

Protection against contact hazard shall be class II.

The output terminals shall be permanently labeled/engraved in accordance with the label figures shown on **Standard Drawing STD-00-78-01**. Additionally the terminals shall be labeled with the following:

"ΑΝΟΔΟΣ" - "ANODE" for the positive pole (terminals A1 to A4)

" ΚΑΤΑΣΚΕΥΗ ΥΠΟ ΠΡΟΣΤΑΣΙΑΝ - "UNDER PROTECTION STRUCTURE for the negative pole (terminals K)

There shall be no parallel or alternative current path for the output current.

The output current and the output voltage shall be continuously adjustable with a maximum resolution of less than 2% of the output ranges.

The variation of the output current and voltage due to temperature shall be less than 0,05% per °C of actual setting.

It shall be possible to lock the settings of the output current and voltage in such a manner that release will only be possible by authorized personnel with proper tool use.

The transformer rectifier unit shall be able to withstand arbitrary interruption of the output current.

During an on/off operation on the output side of the transformer rectifier unit, no cut-in peak current exceeding the pre-set output current must occur.

The unit shall be able to keep the output current constant ($\pm 0,1\%$) at preset value (galvanostatic control) or the pipeline cathodic protection potential (on and/or off) constant ($\pm 0,1\%$) at preset value (potentiostatic control).

The transformer rectifier unit operation must not affect the ac voltage level of the pipeline with the exception of an acceptable level of ripple not exceeding 15 mV_{rms}. It should either supply no current to the protected structure or should supply a minimum pre-set current level (base current) in case of fault such as disconnection of the reference electrode.

2.2.2 MEASURING INSTRUMENTS

The transformer rectifier unit shall be equipped with two built-in digital voltmeters and one digital ammeter monitoring the output voltage, the pipeline potential and the true current from the unit, as follows:

Digital output voltmeter DC 3½ digits with fuse protection.

Digital DC 3½ digits with shunts.

The accuracy of both instruments must be of class 1,0 or better.

The unit shall be equipped with a built-in digital voltmeter for potential measuring of the primary construction with reference to a stationary reference electrode.

The internal resistance of the potential voltmeter shall be > 10 MOhm.

The potential voltmeter must have a voltage range of 0 - 2,5 V DC or 0 - 3 V DC 3½ digits with fuse protection.

The accuracy of the potential voltmeter must be of class 1,0 or better.

All parts of the measuring leads for the potential voltmeter shall be exclusively reserved for the potential measuring. All instruments shall have external metering Jacks (4mm) on the front plate of the unit, allowing for external measuring.

2.2.3 INDUCED VOLTAGES ON THE PIPELINES

The transformer rectifier unit shall be able to function with a permanent alternating voltage up to 50 V (50 Hz) between the primary construction and the earth.

The transformer rectifier unit shall be able to withstand an alternating voltage up to 3500 V (50 Hz) between the primary construction and the earth with a duration of 0,5 seconds.

Alternating current/voltage on the pipelines must not be rectified by the transformer/rectifier unit and transferred to the direct current/voltage supply side of the transformer/ rectifier unit.

The transformer/rectifier unit shall be effectively protected against 50 Hz including voltage between anode (earth) and cathode (pipeline) via an additional or a built-in low-pass AC filter (min 35dB at 50 Hz attenuation) – see **standard DVGW Afk No 6**.

To prevent contact danger during occurrence of induced voltages on the pipeline, the isolation between all accessible parts of the installation shall be equivalent to class II.

2.2.4 OVERVOLTAGE PROTECTION

The transformer rectifier unit shall be protected against lightning surges both on the input and the output terminals of the DC side or on the AC 230V power supply side.

The overvoltage protection must fulfill the requirements given in **DIN/VDE 0847, DIN/VDE 0845-1, ELOT EN 61643-21, applicable parts of ELOT EN 61000- series and DVGW Afk No 6**.

The surge/lightning protection devices shall be mounted on DIN 35 mm rail according to **ELOT EN 50022** or alternatively on 35 mm G-form DIN rail (**ELOT EN 50035, G-32**).

The surge/lightning protection devices shall be dedicated to protect the impressed

current cathodic protection rectifiers from surge/lightning overvoltage.

In case that solar panel power supply is provided special lightning protection shall be installed dedicated to solar panel installations.

2.3 TERMINAL STRIP FOR THE FOLLOWING CONNECTIONS

4 terminals for measuring cable, primary construction	2.5 mm ²
4 terminals for measuring cable, secondary construction	2.5 mm ²
2 terminals for measuring cable for reference electrode	2.5 mm ²
4 terminals to be available	2.5 mm ²
4 terminals for cathode cable	10.0 mm ²
4 terminals for anode cable	10.0mm ²
4 terminals to be available	10.0 mm ²
1 terminal for earthing	16.0 mm ²

The terminals shall be separating terminals with metering jacks (4 mm).

3.0 QUALITY CONTROL

At least the following tests and inspection procedures shall be carried out for the cathodic protection transformer rectifier:

- Performance type and factory test
- Inspection of installation and marking of components
- Inspection of cable and cable installations Inspection of quality of component materials

Owner Representative shall approve the transformer rectifier drawing before commencement of fabrication, and reserves the right to be present at all checks and to carry out all checks and tests considered necessary.

Type test shall be carried out for the cabinets and transformer rectifier units. All cabinets shall be visually checked and certified according to the applicable EU legislation, before release for shipment. Supplier shall furnish the detailed type test program for Owner's approval, at least one month before the date of tests according to **Job Specification 700/1** and **Job Specification 970/2**.

The Supplier shall, without any charge to the Owner, provide all necessary check and test facilities.

4.0 SPARE PARTS

Supplier shall propose spare parts list for two years' operation for Cathodic Protection T/R cabinet. Unit prices valid for one (1) year for spare parts shall be submitted by the Supplier with the quotation.



Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 12/36

5.0 DOCUMENTS

Supplier shall submit type and factory test certificates, together with construction and "as built" drawings according to **Job Specification 700/1** and **Job Specification 970/2**.

Supplier shall also submit Operation and Maintenance Manual including test procedures of the transformer rectifier operation.

6.0 PACKING

Packing should be durable enough to withstand strikes and frequent handling, vertical overhead loads when stacked and transportation to the site.

Packing material should be suitable for storage for a period of approximately one year.

All equipment shall be completely drained of water, thoroughly dried and cleared prior to packing and shipment to prevent freezing and damage.

Job Spec. No	784/3
Revision	0
Date	05-04-2011
Page	13/36

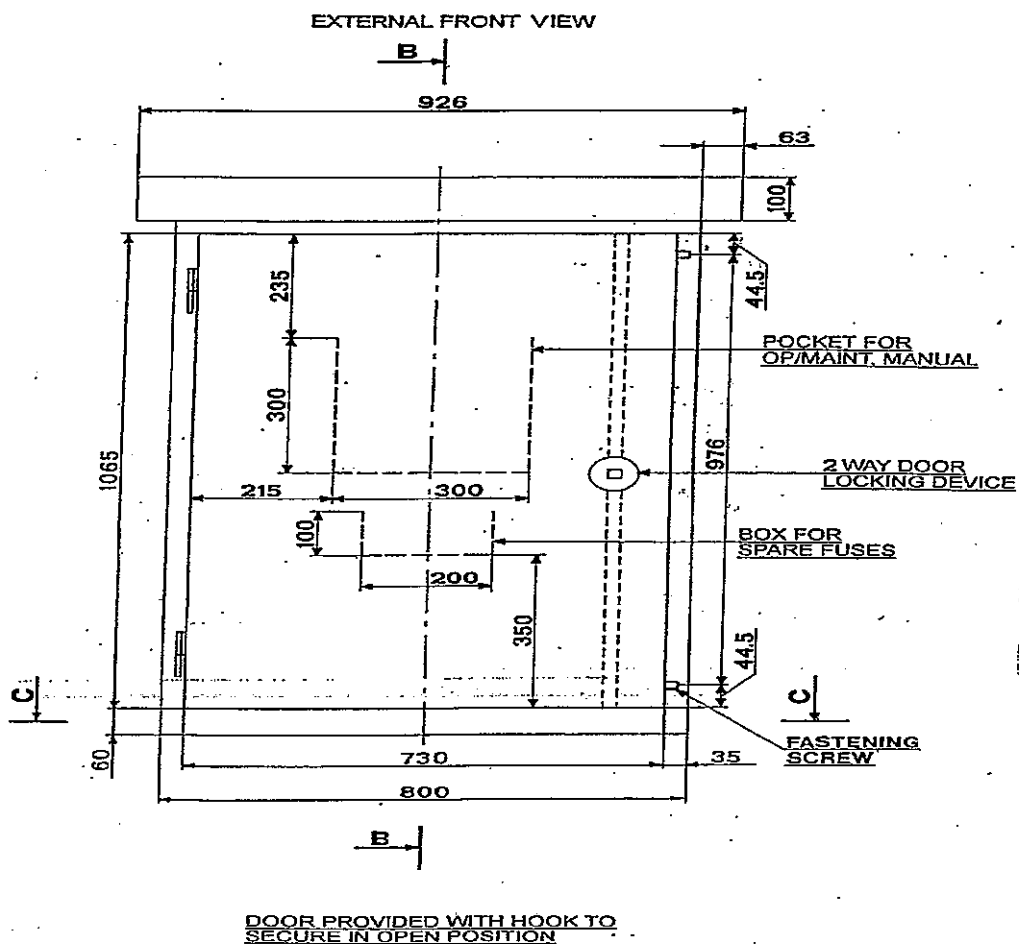
DRAWINGS

SCHEMES 1 - 23

Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 14/36

SCHEME 1

T/R CABINET MODEL

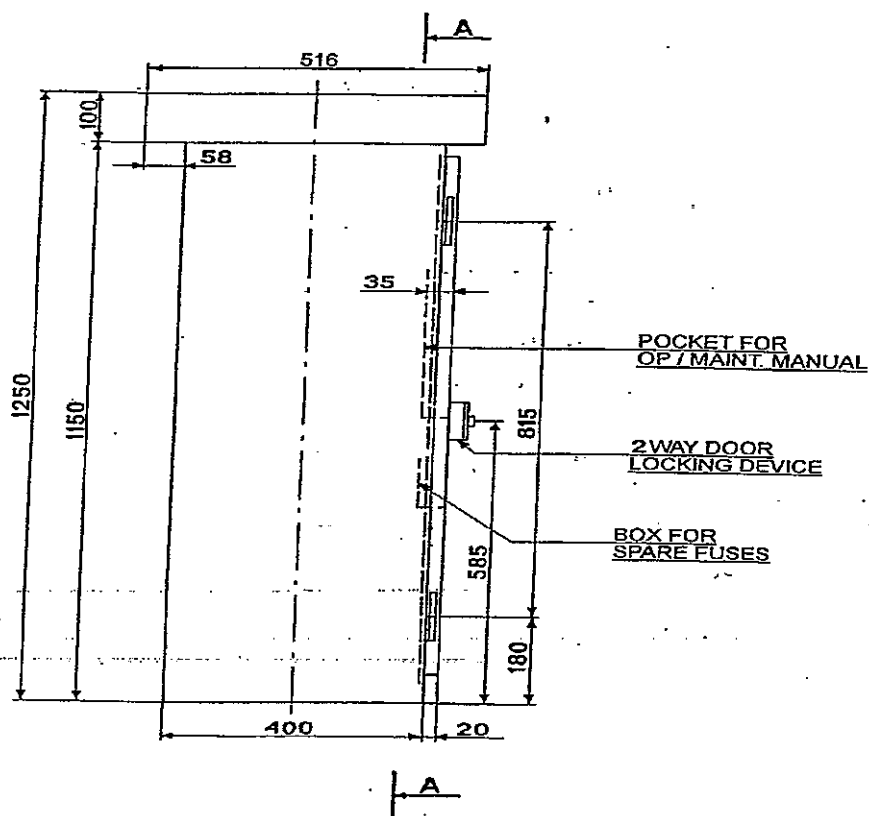


Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 15/36

SCHEME 2

T/R CABINET MODEL :

EXTERNAL SIDE VIEW

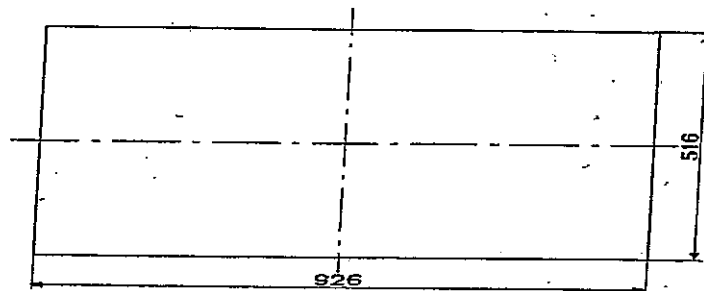


Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 16/36

SCHEME 3

T/R CABINET MODEL

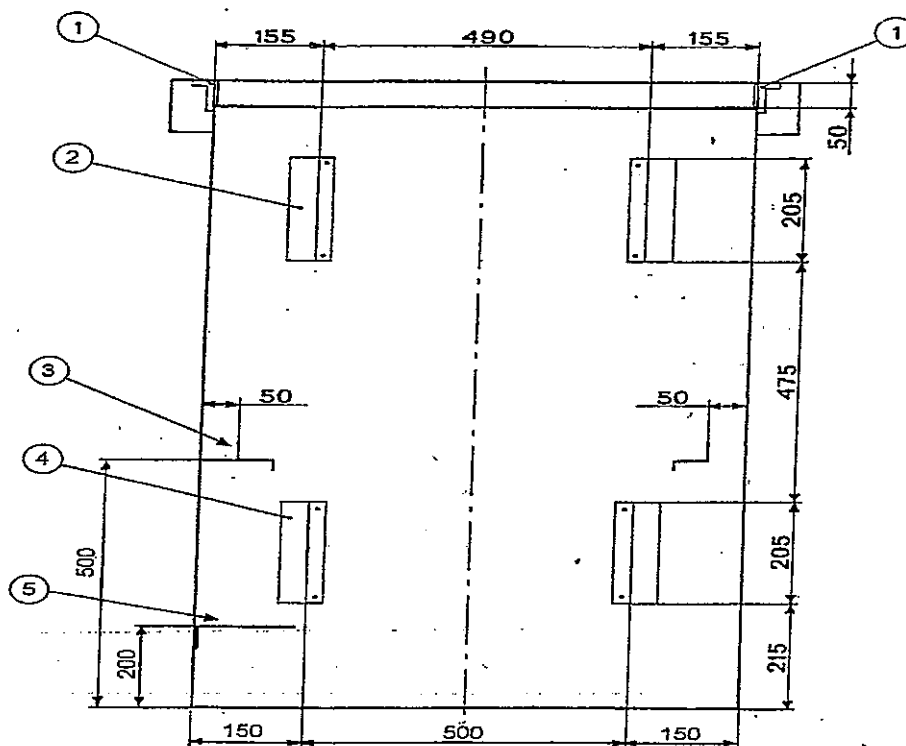
EXTERNAL TOP VIEW



SCHEME 4

T/R CABINET MODEL

SECT. A-A



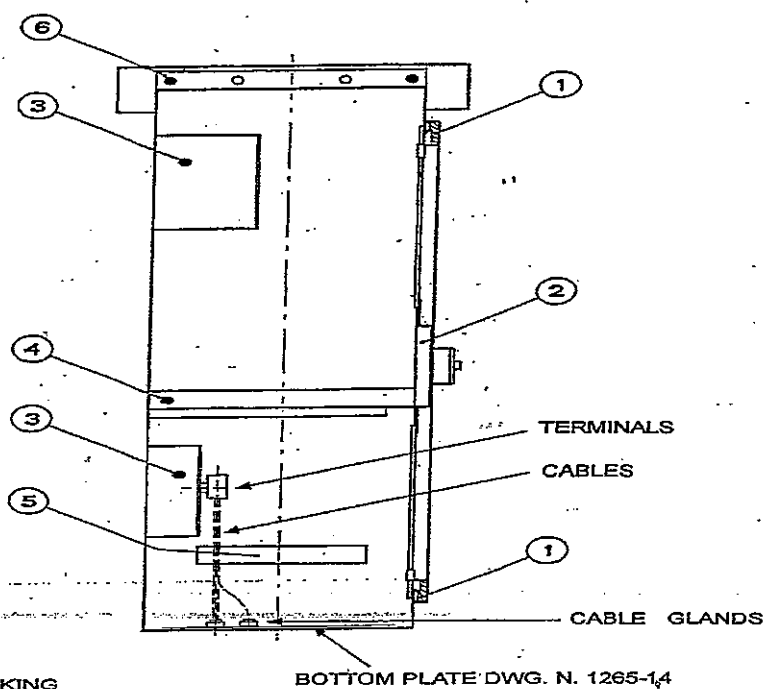
- ① ROOF STAND-UP SEE DWG. N. 1265-24 REV. 4
- ② PANEL STAND-UP SEE DWG. N. 1265-20A REV. 4
- ③ T/R GUIDE SEE DWG. N. 1265-21 REV. 4
- ④ PANEL STAND-UP SEE DWG. N. 1265-20B REV. 4
- ⑤ HEATER STAND-UP SEE DWG. N. 1265-22 REV. 4

Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 18/36

SCHEME 5

T/R CABINET MODEL

SECT. B-B



- ① NEOPRENE PACKING
- ② TWO WAY CYLINDER LOCK
- ③ PANELS STAND - UP SEE DWG. N. 1265 - 20 REV. 4
- ④ T / R GUIDE SEE DWG. N. 1265 - 21 REV. 4
- ⑤ HEATER STAND - UP SEE DWG. N. 1265 - 22 REV. 4
- ⑥ HOOKING PLATE SEE DWG. N. 1265 - 23 REV. 4

HELLENIC GAS TRANSMISSION SYSTEM OPERATOR

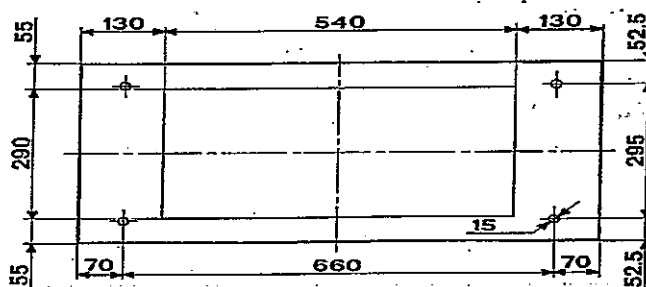


Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 19/36

SCHEME 6

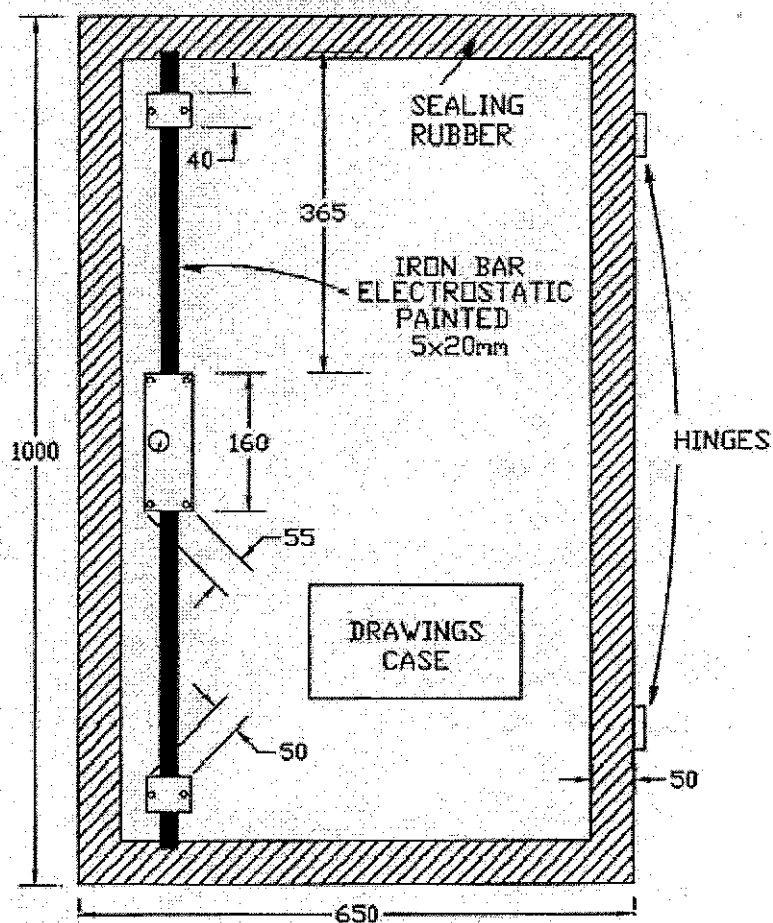
T/R CABINET MODEL

SECT. C-C



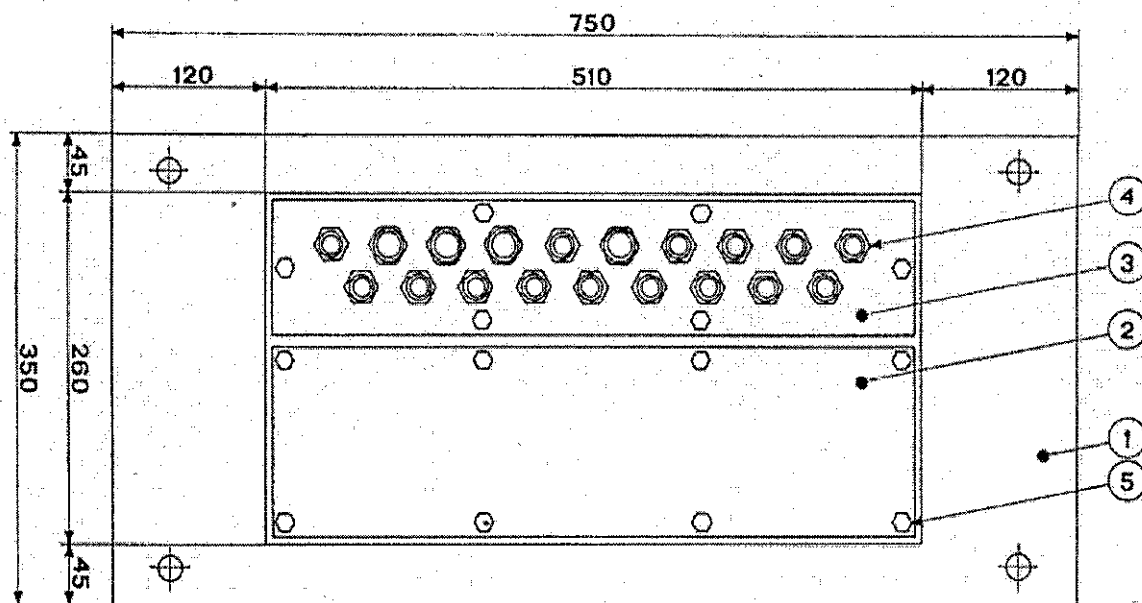
SCHEME 7

T/R CABINET DOOR ELEVATION (interior of cabinet)



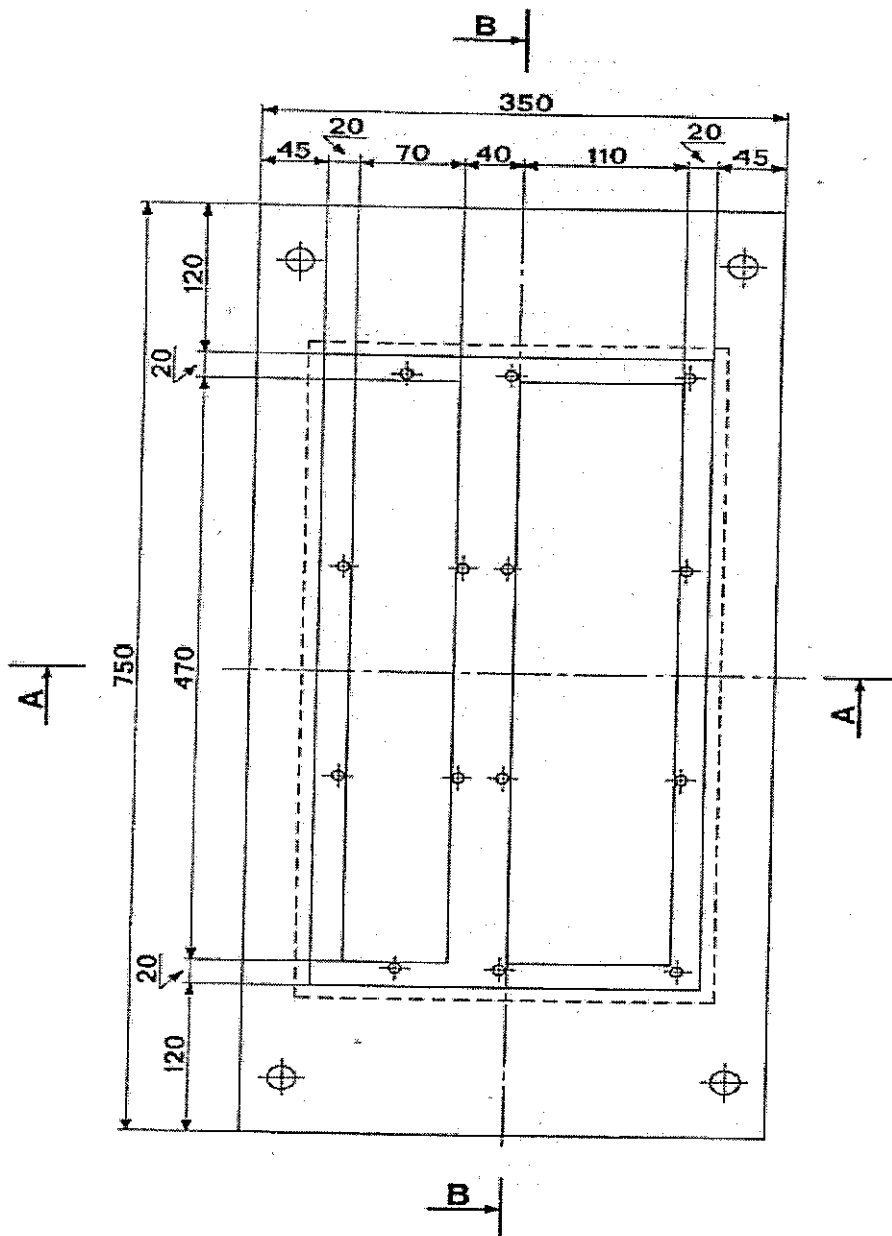
SCHEME 8

**T/R CABINET BASE PLATE
PLAN**



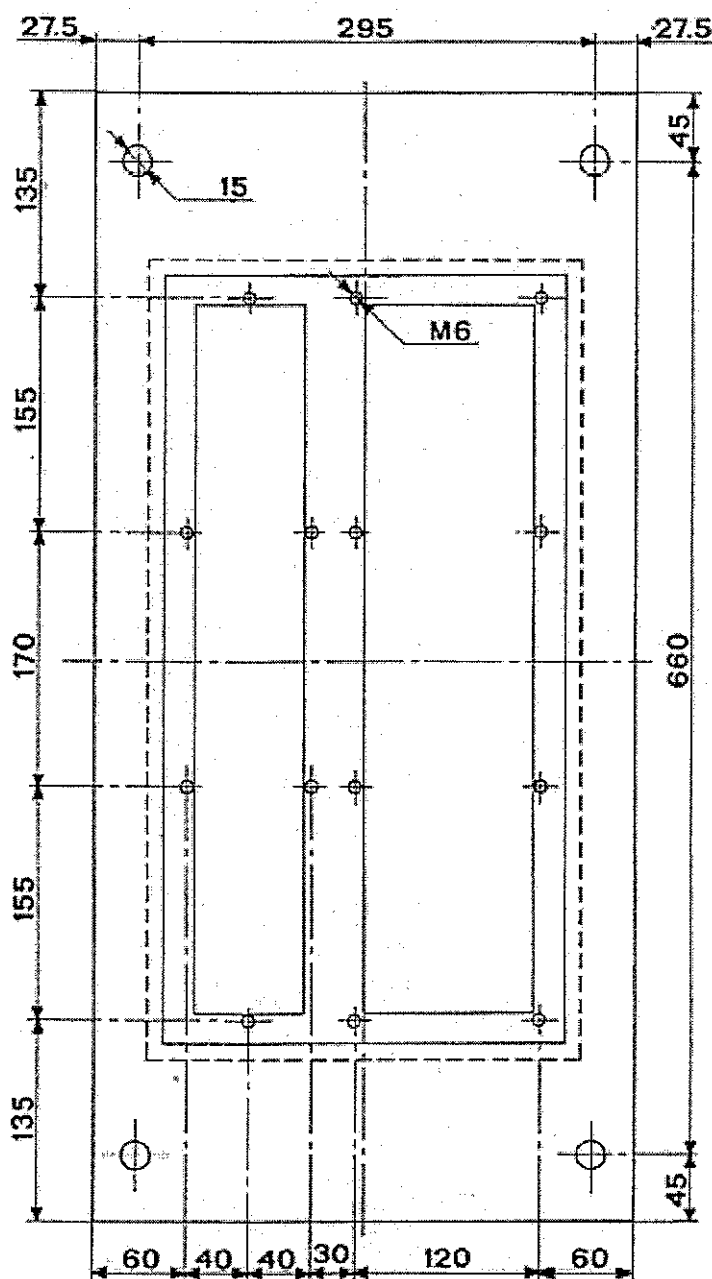
- 1 DETAIL "A", SEE SCHEMES 3, 4 AND 5
- 2 DETAIL "B", SEE SCHEME 6
- 3 DETAIL "C", SEE SCHEMES 7 AND 8
- 4 POLYMER CABLE GLAND TYPE PG16-PG21
- 5 STAINLESS STEEL HEXAGON SCREW M6X10 COMPLETE WITH PLAIN WASHER AND LOCK WASHER

SCHEME 9
T/R CABINET BASE PLATE
DETAIL "A"
PLAN



Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 23/36

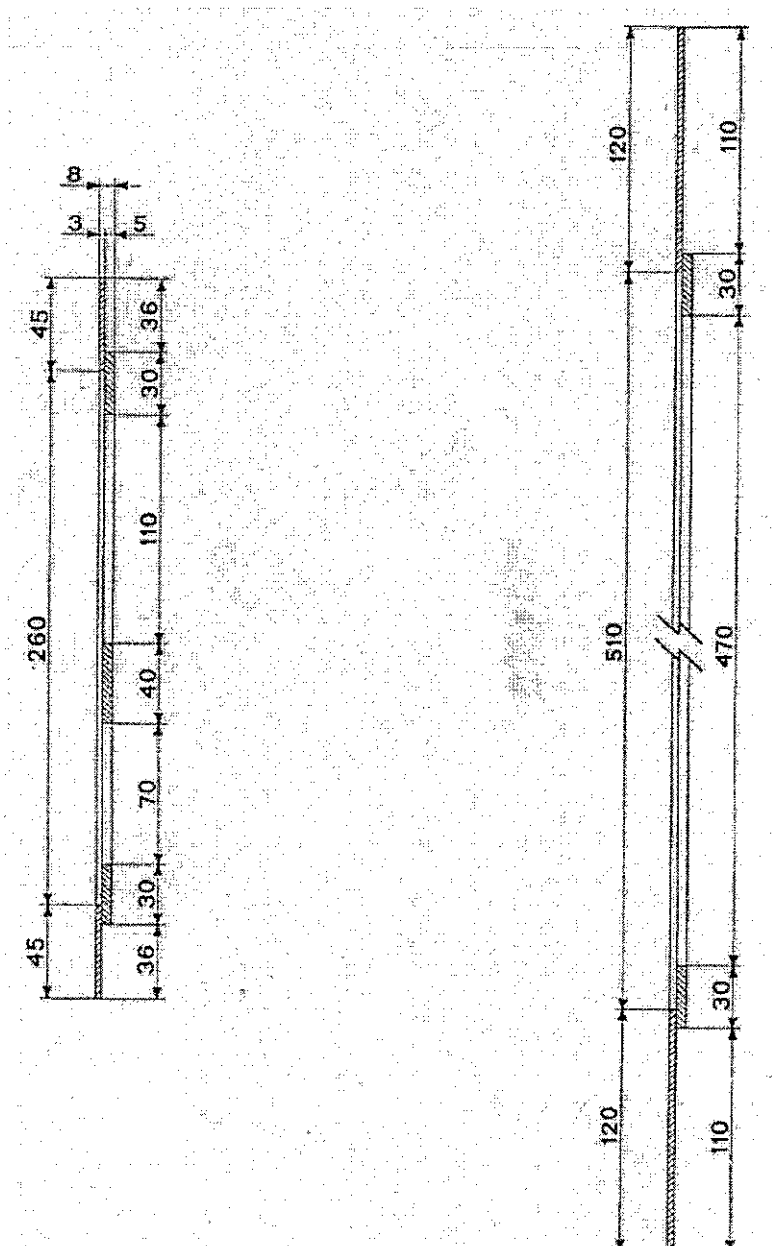
SCHEME 10
T/R CABINET BOTTOM PLATE
PARTICULAR "A"
PLAN



SCHEME 11
T/R CABINET BASE PLATE
DETAIL "A"

SECT. A-A

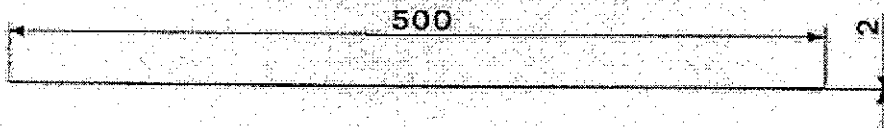
SECT. B-B



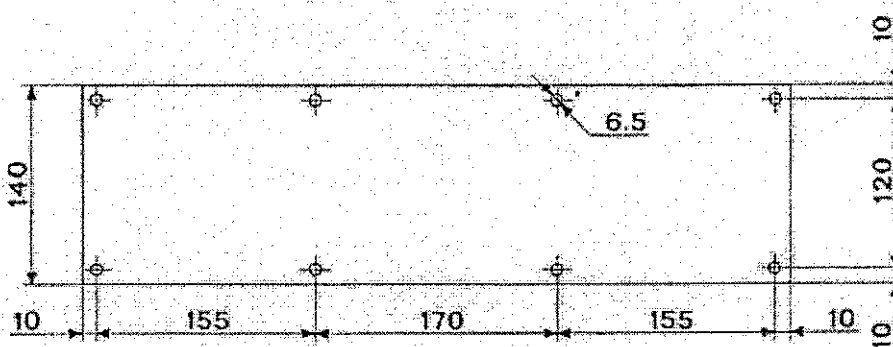
Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 25/36

SCHEME 12
T/R CABINET BASE PLATE
DETAIL "B"

LONGITUDINAL ELEVATION



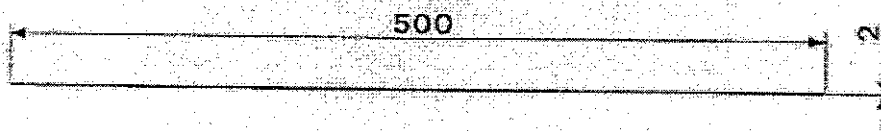
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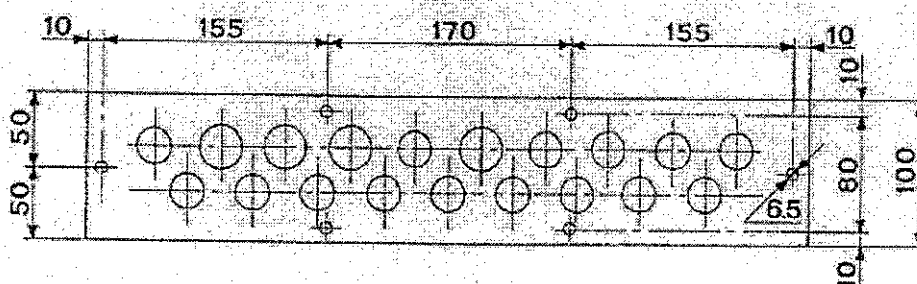
Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 26/36

SCHEME 13
T/R CABINET BASE PLATE
DETAIL "C"

LONGITUDINAL ELEVATION

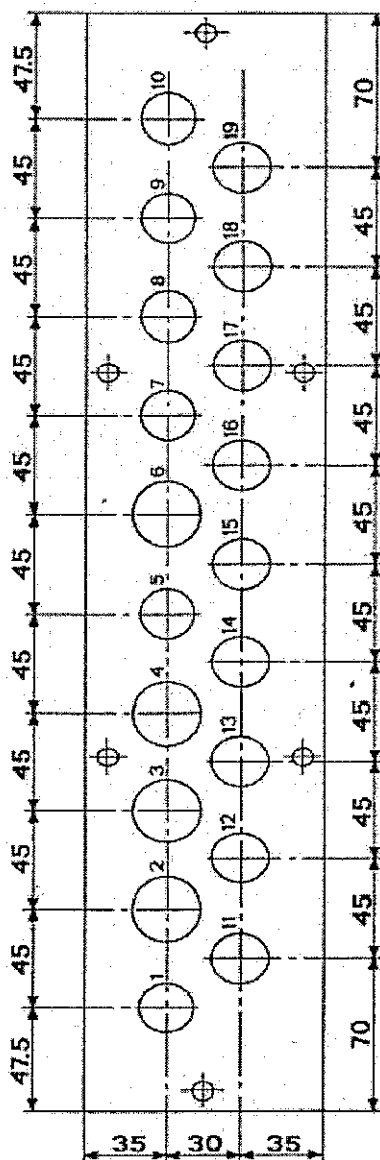


PLAN



Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 27/36

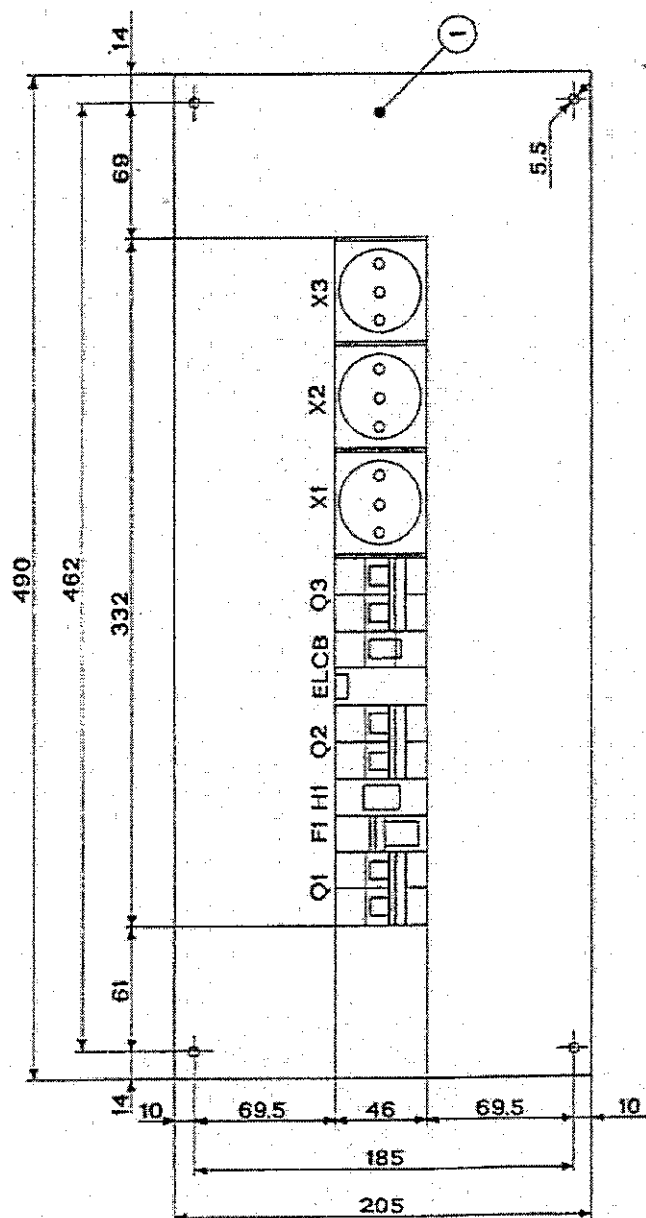
SCHEME 14
T/R CABINET BASE PLATE
DETAIL "C"
PLAN



CABLE GLAND PG 21 – HOLES \varnothing 29 - No 2-3-4-6
CABLE GLAND PG 16 – HOLES \varnothing 23 - No 1-5-7 to 19

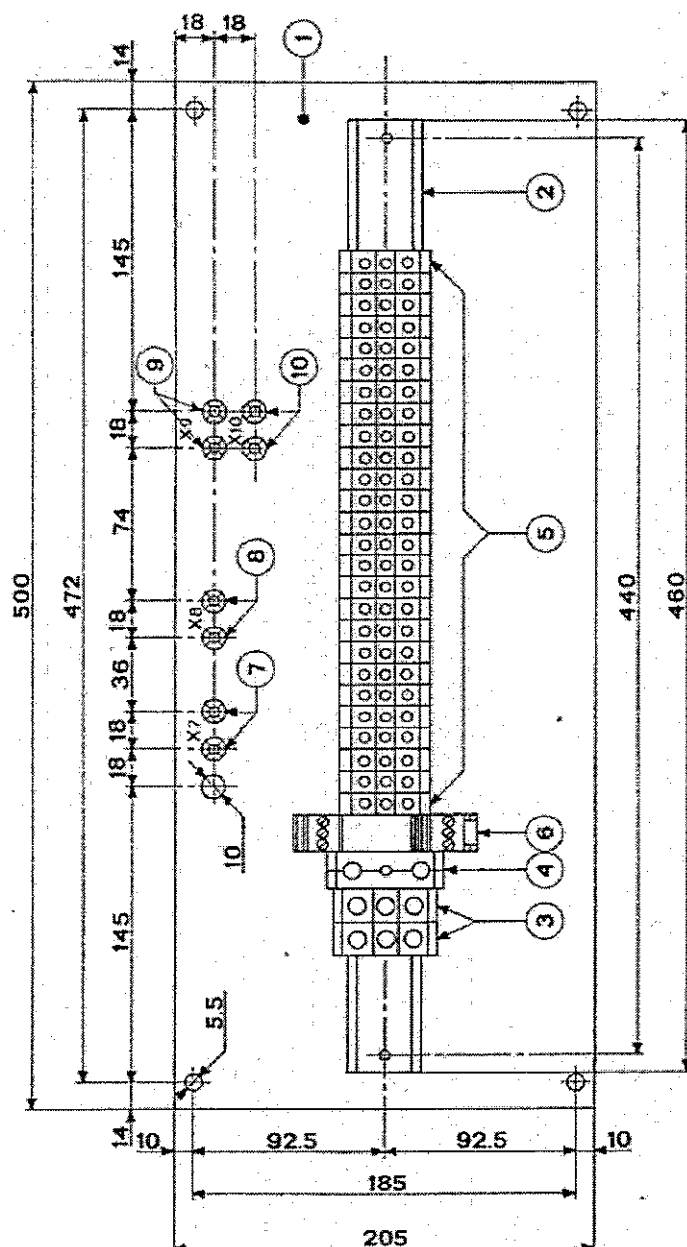
Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 28/36

SCHEME 15
GENERAL DISTRIBUTION PANEL



- (1) : ALUMINIUM PANEL (THICKNESS 3 MM)
- Q1 - Q2 - Q3 : AUTOMATIC BREAKER
- F1 : FUSE HOLDER
- H1 : LAMP
- ELOB : DIFFERENTIAL BREAKER
- X1 - X2 - X3 : SOCKET'S SCHUKO TYPE

SCHEME 16
INPUT CONNECTION PANEL

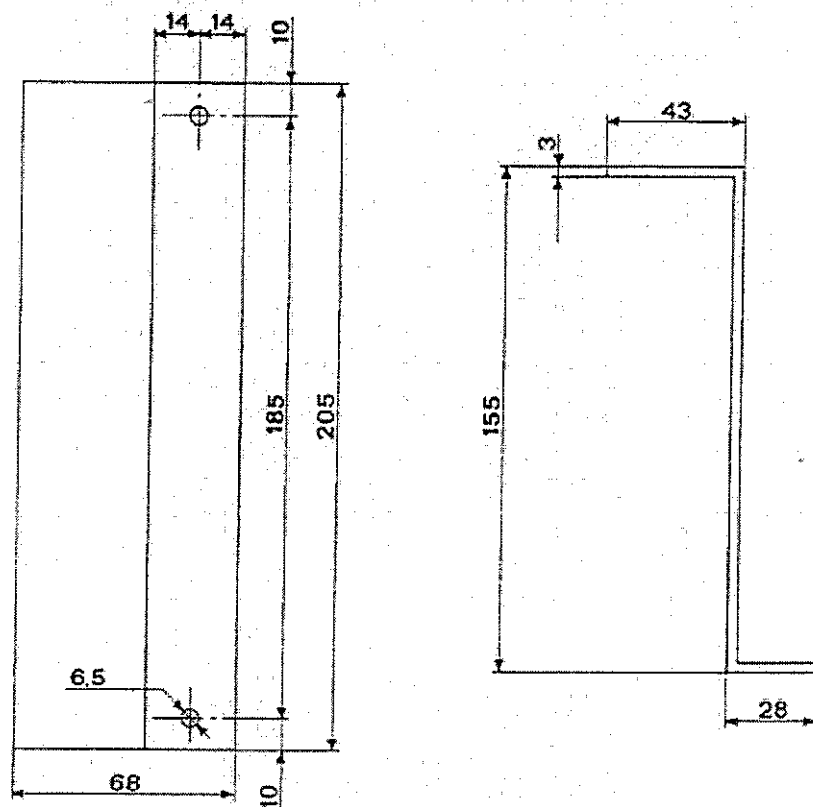


- | | |
|--|--|
| ① FIBER-GLASS (thickness 5 mm.) | ⑥ SURGE ARRESTER |
| ② MOUNTING RAILS EN 50.022 | ⑦ TEST SOCKETS WITH BRIDGE X7 (red) |
| ③ TERMINAL BLOCKS 25 sq.mm. (with cover) | ⑧ TEST SOCKETS WITH BRIDGE X8 (black) |
| ④ EARTH TERMINAL BLOCK 35 sq.mm. | ⑨ FILTER SOCKETS WITH BRIDGE X9 (red) |
| ⑤ TERMINAL BLOCKS 10 sq.mm. | ⑩ FILTER SOCKETS WITH BRIDGE X10 (black) |

SCHEME 17
PANEL STAND-UP FOR DISTRIBUTION PANEL

ELEVATION

PLAN

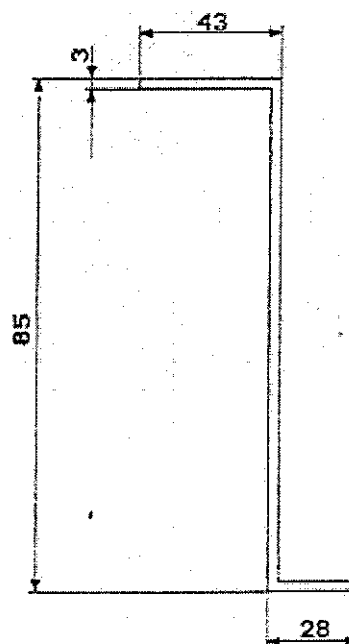
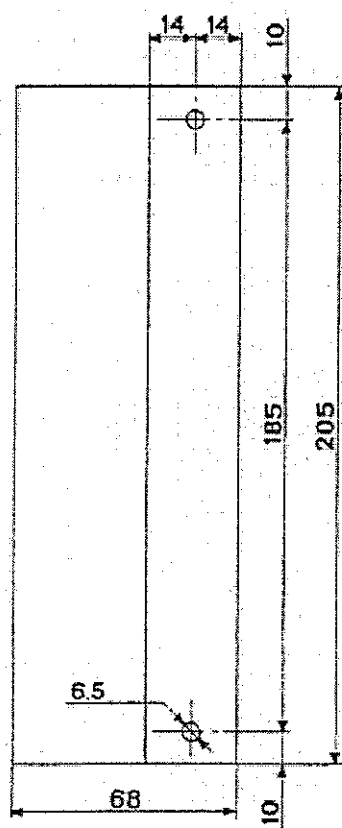


SCHEME 18

PANEL INPUT COLLECTION PANEL

ELEVATION

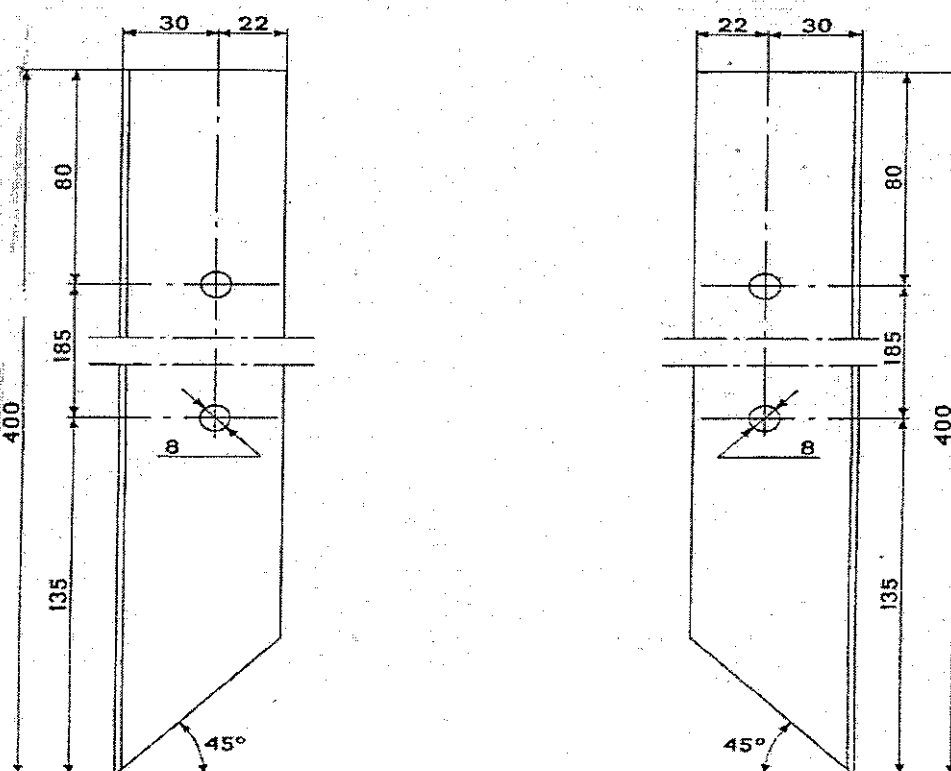
PLAN



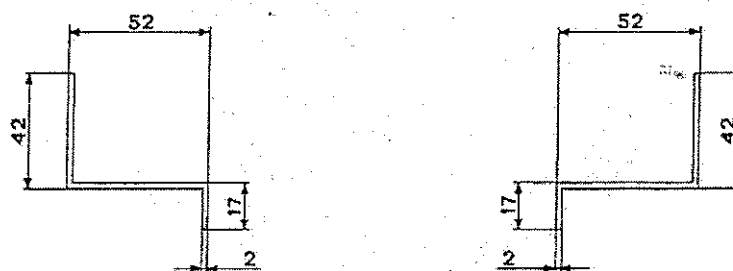
SCHEME 19

T/R GUIDE

TOP VIEW



FRONT VIEW

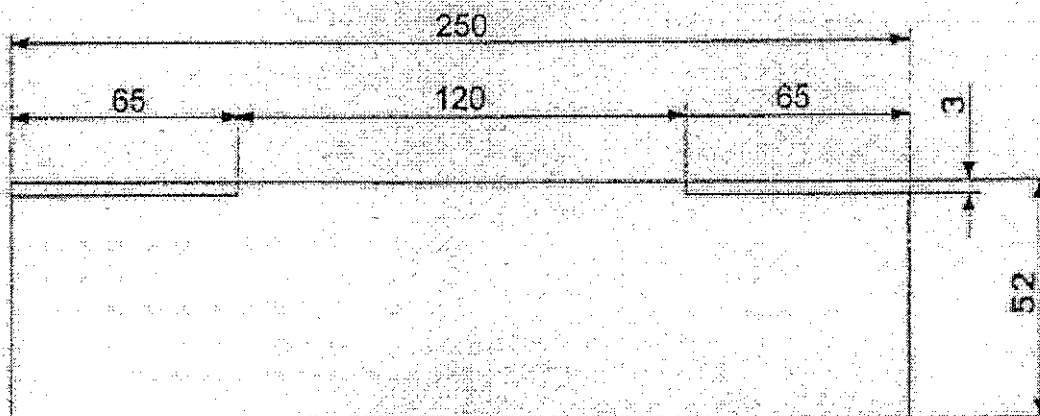


Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 33/36

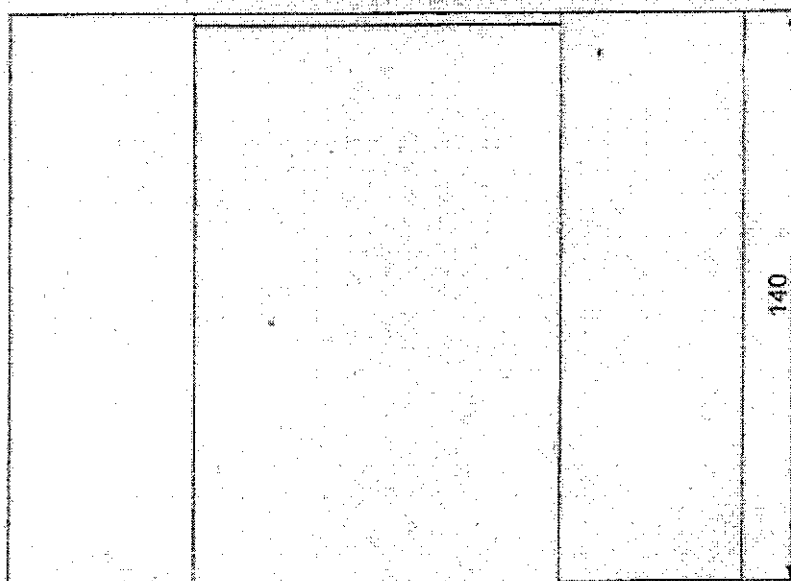
SCHEME 20

HEATER STAND - UP

FRONT VIEW



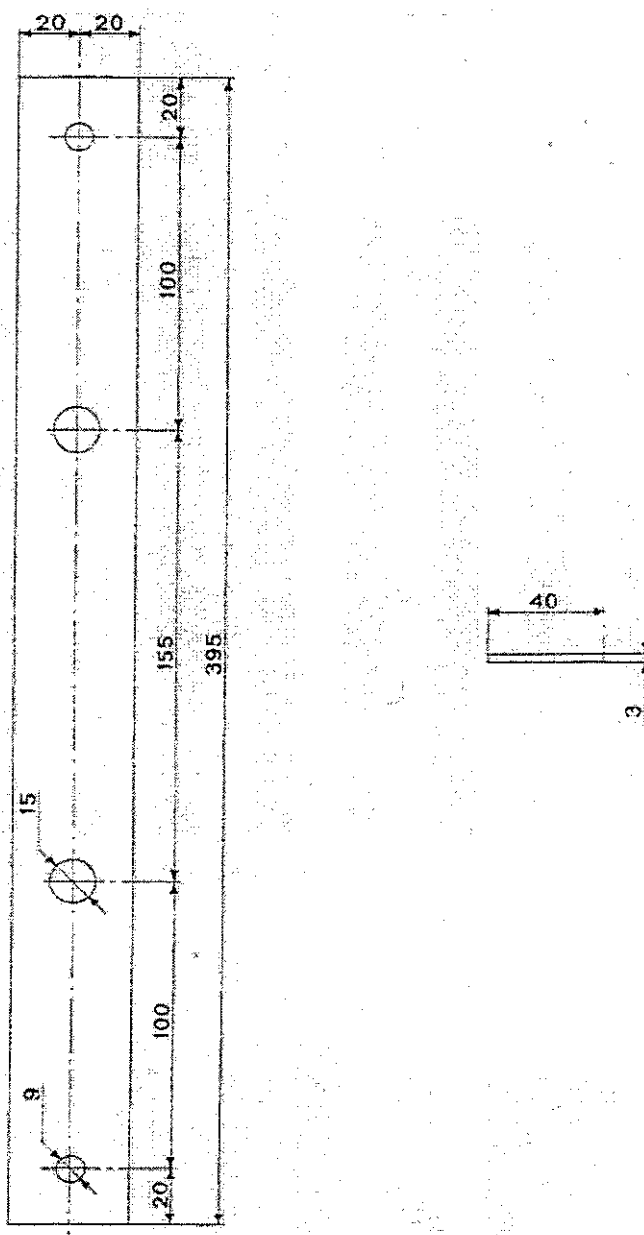
TOP VIEW



SCHEME 21
HOOKING PLATE

FRONT VIEW

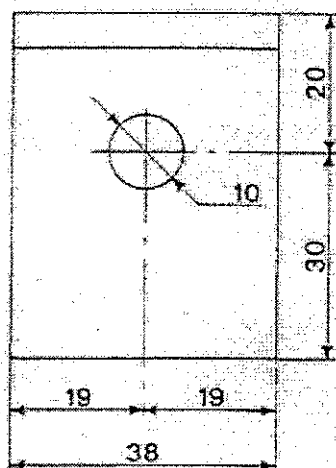
SIDE VIEW



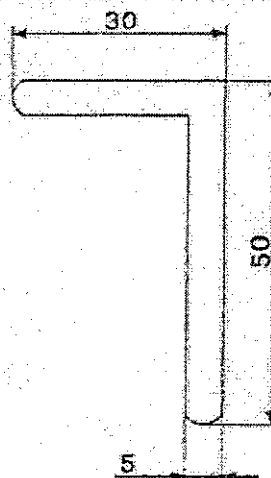
SCHEME 22

ROOF STAND – UP

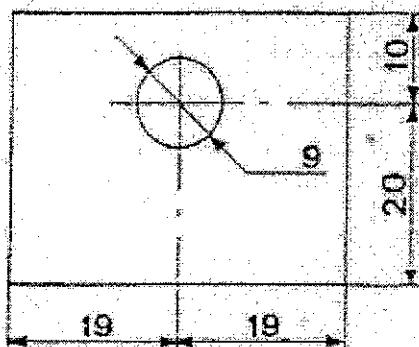
FRONT VIEW



SIDE VIEW



TOP VIEW



Job Spec. No 784/3
Revision 0
Date 05-04-2011
Page 36/36

SCHEME 23

MAIN SWITCHBOARD AND TERMINAL PANELS

