1 Introduction

This engineering instruction details the procedures to be followed when installing supplies to LV customers using single core cables.

A copy of this procedure should be sent to prospective developers and/or their consultants to ensure that a suitable access for SSEPD supply cables and metering equipment is agreed at an early stage. The meter position should be on an outside wall and preferably within 15 metres of the substation. Any other arrangement must be agreed in detail by the SSEPD Planning Engineer.

Where possible 185 mm² 3 core bunched Wavecon cable should be used to simplify the cable installation and jointing.

2 General

Transformers are currently purchased with the following ratings; 315, 500, 800, 1000 and 1500 kVA. A winter cyclic rating of up to 30% can be accommodated on the transformers when situated outdoors. The maximum size transformer which can be used to feed customers metered at LV is 1500 kVA. On transformers up to and including 1000 kVA, 500A, fused, 3 core feeder ways can be used to supply the network in addition to any 800A or larger feeder ways.

Any transformer sizes greater than 1500 kVA should be connected with busbar trunking.

3 Bunched Wavecon Cables

3.1 Sizes and Ratings

The standard for supplying large loads is to use either 185 mm² or 300 mm² 3 core Wavecon cable with the three cores bunched together (referred to as BWC). The following table gives the ratings of these cables referred to the size of transformer.

THE NUMBER AND SIZE OF THE CABLES ARE CRITICAL AND MUST NOT BE CHANGED FROM THAT SHOWN IN TABLE 1.

Size of Bunched 3 Core Wavecon	Number of Cables		Winter Cyclic Rating	Continuous Summer Rating	Maximum Transformer Size
	Phase	Neutral	kVA	kVA	kVA
Cables in free air with up to 5 metres buried and maximum length 100 metres					
185 mm²	1	1	840	660	500
185 mm²	2	1	1685	1325	1250
185 mm²	3	2	2530	1990	1500
Cables buried and maximum length of 100 metres					
185 mm²	1	1	730	575	500
185 mm²	2	1	1280	1010	800
185 mm²	3	2	1650	1300	1250
300 mm²	3	2	2315	1820	1500

Table 1

4 Installation

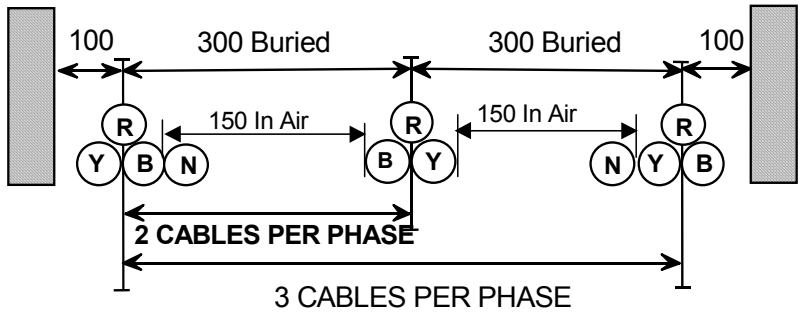
Diagram 1 shows how the cables shall be installed to get the required rating. In all cases the neutral cable/s must be installed close to a 3 phase bunch of cables.

It is important that the cables are laid in tight trefoil formation bound together to minimise the magnitude of magnetic field emitted from the cable. Cable routes should not be run through buildings and the customer's intake position should be on an outside wall.

If the intake position is not on an outside wall and the customer insists that the intake is within the building, then the customer must be warned that the magnetic fields radiated by the cables may interfere with sensitive electronic equipment placed close to the cables and that SSEPD will not accept any liability for any problems caused by magnetic fields.

In such cases the cables will only be laid in cable trenches (see page 7) and never through or under office floors.

To get the rating of the cables as shown in the table it is important that they are direct buried. Short runs of duct up to 10 metres are acceptable. If it is necessary to install the cables in long runs of duct then these will have to be Bentonite filled. Unfilled ducts will lead to a derating of up to 20% of the above figures. Ducts must be of sufficient diameter to allow the cables to be laid in trefoil plus neutral as shown in Fig. 1



CABLE SPACING ARRANGEMENTS FOR 2 & 3 CABLES PER PHASE

All dimensions are in mm

Fig. 1

Groups of cables are to be cleated in trefoil or quad formation on cable trays (see Table 2) with 150 mm spacing between the groups of cables. With free air movement and an average ambient temperature of 15 °C or less they will not be derated assuming normal spacing of the group. **Cables cannot be installed in situations where the ambient temperature is above 25 °C.**

BUNCHED WAVECON CLEATS

3 Core Wavecon Cable Size	No. Cables in Group	Stock No.	Ellis Patents Part No.
185 mm²	3 (Trefoil)	068683	VRT-07
185 mm²	4 (Quad)	068684	VRQ-06
300 mm²	3 (Trefoil)	068685	VRT-10
300 mm²	4 (Quad)	068686-	VRQ-08

Table 2

BWC Protection Requirements

For BWC up to 15 metres long the transformer HV or time limit fuses provides the protection. Lengths greater than 15 metres will be protected using an LV MCCB or ACB. The maximum length of singles is 100 metres.

5 Low Voltage Equipment

Transformer Mounted Equipment

The LV cables will be terminated in either of the following ways :

a) 4, 7 or 11 way cable box where the BWC length is up to 15 metres

b) A purpose built cabinet where the BWC length is in excess of 15 metres or 500 A feeder ways are required in addition to the BWC.

The cabinet will house the MCCB, ACB and 500 A outgoing ways as required.

6 Customer's Equipment

The BWC is to be terminated at the customers end in a purpose made housing which is designed to accommodate SSEPD metering CTs. The following arrangements are permitted:-

a) An adapter chamber is built under the customer's incomer switchgear as shown on drawings HO/65/037 for terminating up to 2 cables per phase or HO/65/081 for terminating up to 3 cables per phase.

b) Free standing termination cabinet built to stand along side the customer'sswitchgear with busbar entry to the customer's gear at the top. Drawing HO/65/083 shows the housing requirements and HO/65/084 details the busbar requirements.

These drawings are typical and the customer can arrange to have constructed any type of unit providing the dimensions and sizes where stated on the drawings are met.

Drawing Fig. 2 details the minimum trench requirements at the customer's end. Again dimensions shown shall not be reduced as this will cause difficulties for the cable installation crew. Where the cable trench enters the building from the outside and runs under the switchgear it shall be continued in front of the gear for at least 2000 mm from the wall to the end of the trench.

It should be noted that where we have an MCCB or an ACB and the customer has an incoming MCCB or ACB then the customer shall ensure that there is adequate discrimination between the customer's breaker and SSEPD.

7 Provision of Earthing for Customer's Equipment

7.1 LV Cable Boxes where earth resistance is less than or equal to 1 ohm.

Where the earth resistance at our transformer is less than or equal to 1 ohm then the BWC copper screen wires shall be terminated in the armour clamps of the cable box. A link shall be installed between the transformer neutral bar and the cable box earth lug. An HV steelwork earth electrode will be connected to the steelwork earth of the transformer. (A workshop fitted copper bar will have been installed to connect the cable box earth to the transformer earth).

On the customer's equipment a link must be installed between the incoming neutral busbar and the earth connection. An additional earth electrode will be connected to the neutral busbar.

The BWC copper screen wires will be cut flush with the outer covering of the cable and taped to form an insulated end. On no circumstances must the copper screen wires of the BWC be earthed at both ends.

This type of installation will be PME (Protective Multiple Earthing).

7.2 LV Cable Boxes where earth resistance is greater than 1 ohm.

Where the earth resistance at our transformer is greater than 1 ohm the BWC copper screen wires will be cut flush with the outer covering of the cable and taped to form an insulated end. The armour clamp rings shall be discarded and the covering of the cable at the armour clamp position built up using hessian tape until it can be securely clamped by the armour clamps. **On no account must a connection be installed between the transformer neutral bar and the cable box earth stud.** An HV steelwork earth electrode will be connected to the steelwork earth of the transformer. (A workshop copper bar will have been installed to connect the cable box earth to the transformer earth and this shall remain).

On the customer's equipment a link must be installed between the incoming neutral busbar and the earth connection. An earth electrode will be connected to the neutral busbar. This electrode must be segregated from the transformer HV steelwork earth by at least 3 metres. The resistance of this electrode shall not exceed 40 ohms.

The copper screen wires of the BWC will be connected to the earth electrode at the customer's end by connecting them to the earth stud connection in the customer's switchgear.

This type of installation will be PNB (Protective Neutral Bond).

7.3 **LV Cabinets (PME) overall earth resistance less than 1 ohm**

In the LV cabinet the copper screen wires of the BWC shall be made off into the neutral connectors provided.

On the customer's equipment a link must be installed between the incoming neutral busbar and the earth connection. An earth electrode will be connected to the neutral busbar. The BWC copper screen wires will be cut flush with the outer covering of the cable and taped to form an insulated end. On no circumstances must the screen of the BWC be earthed at both ends.

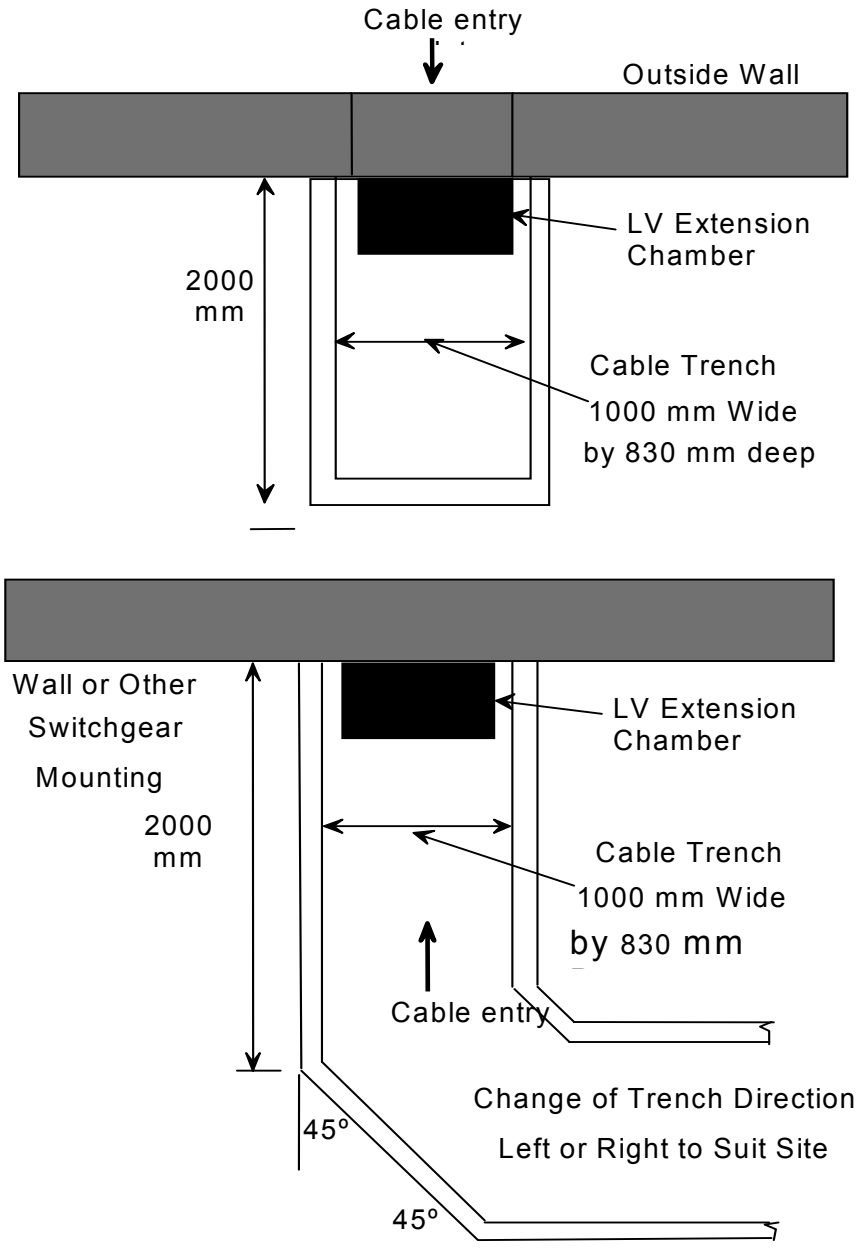
7.4 **LV Cabinets (PME) overall earth resistance greater than 1 ohm**

The earthing arrangement for LV cabinets supplying single customers will be PME.

In the LV cabinet the copper screen wires of the BWC shall be made off into the neutral connectors provided. **The neutral earth / HV steelwork earth link shall be removed.**

On the customer's equipment a link must be installed between the incoming neutral busbar and the earth connection. An earth electrode will be connected to the neutral busbar. This electrode must be segregated from the transformer HV steelwork earth by at least 3 metres if necessary using a thermoplastic (PVC) covered earth conductor. The resistance of this electrode shall not exceed 40 ohms.

The BWC copper screen wires will be cut flush with the outer covering of the cable and taped to form an insulated end. On no circumstances must the screen of the BWC be earthed at both ends. An additional earth electrode will be connected to the neutral earth stud and segregated from the HV steelwork earth by 3 metres using a thermoplastic (PVC) covered earth conductor.



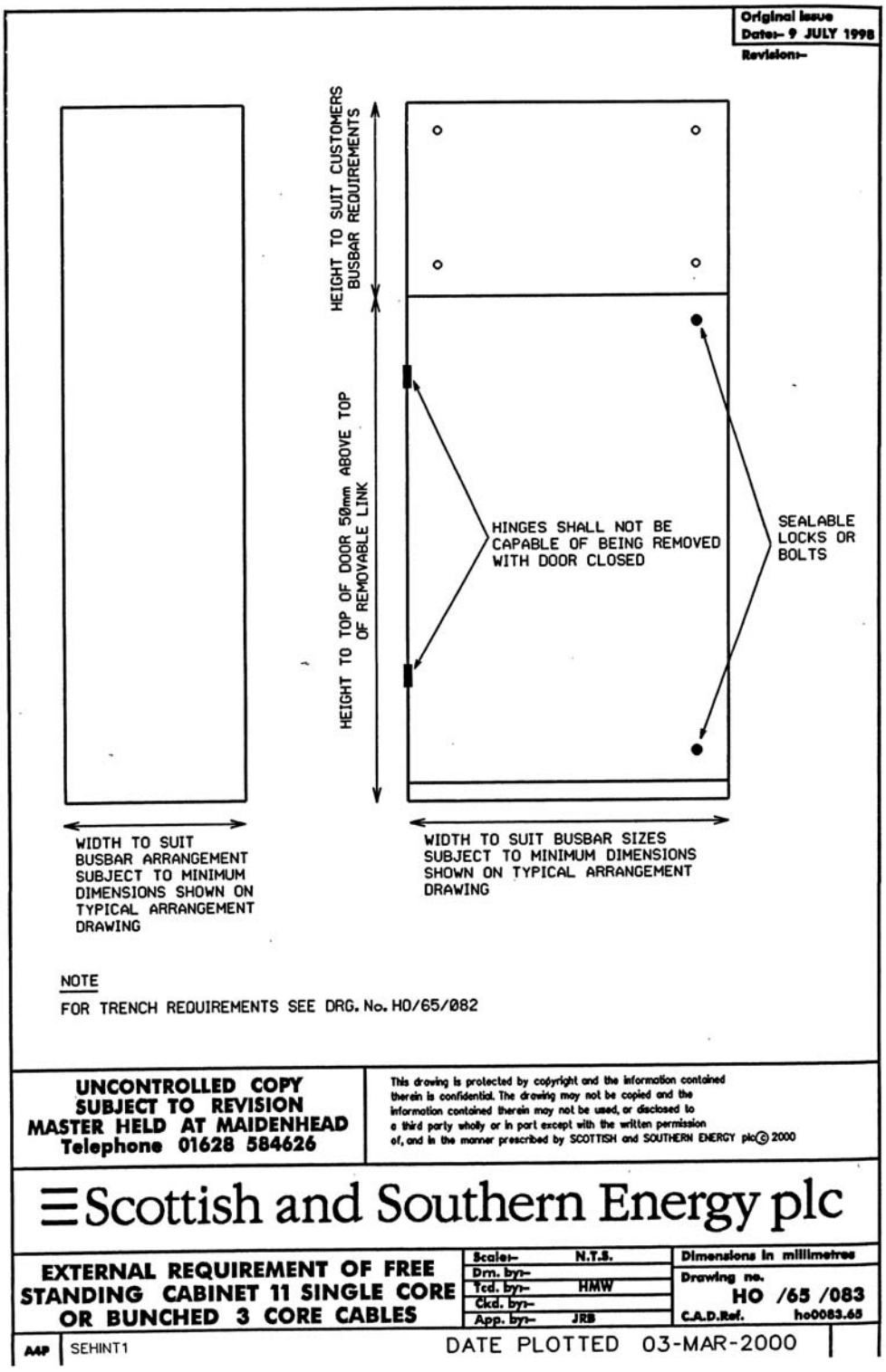
CABLES ENTERING FROM INSIDE SWITCHROOM TRENCH REQUIREMENTS FOR 4, 7 OR 11 SINGLE CORE LV CABLES CABLE TERMINATIONS IN CUSTOMER'S PREMISES

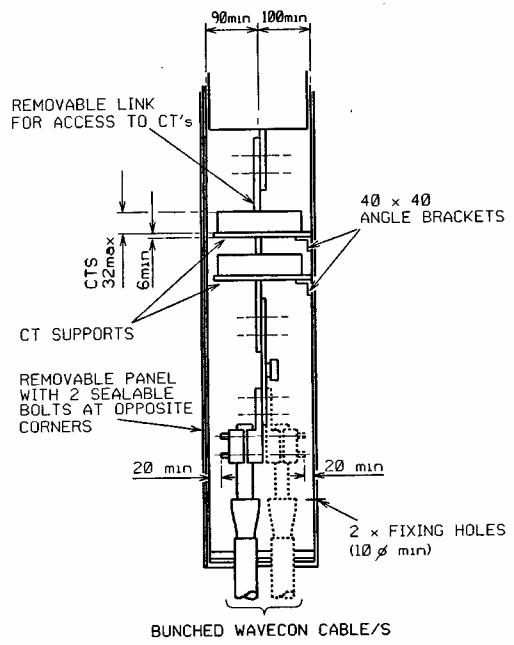
FIGURE 2

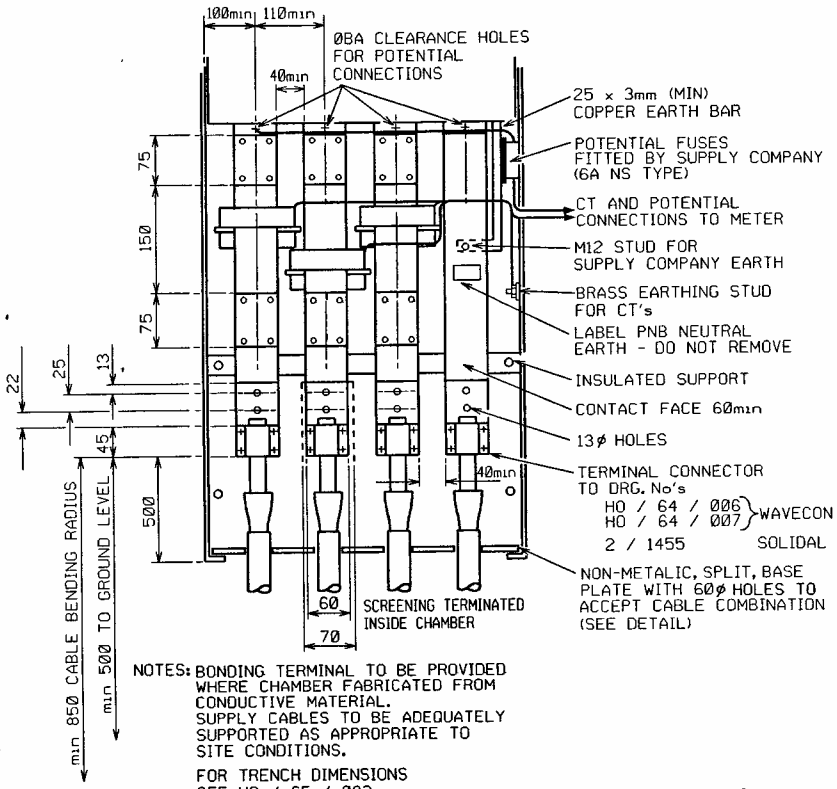
8 DRAWINGS

Drawing Number	Title
HO/65/037	Typical requirements of extension chamber to provide CT accommodation and space for terminating single core cables.
HO/65/081	Typical requirements of extension chamber to provide CT accommodation and space for terminating 11 single core or bunched 3 core cables.
HO/65/083	External requirements of free standing cabinet, 11 single core or bunched 3 core cables.
HO/65/084	Typical requirements for free standing cabinet to provide CT accommodation and space for terminating 11 single core or bunched 3 core cables.

Table 3

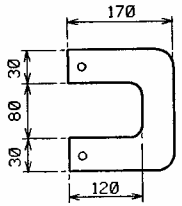

Original Issue
Date:- 9 JULY 1998
Revision:-
HEIGHT TO SUIT CUSTOMERS BUSBAR REQUIREMENTS
HEIGHT TO TOP OF DOOR 50mm ABOVE TOP OF REMOVABLE LINK
HINGES SHALL NOT BE CAPABLE OF BEING REMOVED WITH DOOR CLOSED
SEALABLE LOCKS OR BOLTS
WIDTH TO SUIT BUSBAR ARRANGEMENT SUBJECT TO MINIMUM DIMENSIONS SHOWN ON TYPICAL ARRANGEMENT DRAWING
WIDTH TO SUIT BUSBAR SIZES SUBJECT TO MINIMUM DIMENSIONS SHOWN ON TYPICAL ARRANGEMENT DRAWING
NOTE
FOR TRENCH REQUIREMENTS SEE DRG. No. HO/65/082
UNCONTROLLED COPY
SUBJECT TO REVISION
MASTER HELD AT MAIDENHEAD
Telephone 01628 584626
This drawing is protected by copyright and the information contained therein is confidential. The drawing may not be copied and the information contained therein may not be used, or disclosed to a third party wholly or in part except with the written permission of, and in the manner prescribed by SCOTTISH and SOUTHERN ENERGY plc© 2000
Scottish and Southern Energy plc
EXTERNAL REQUIREMENT OF FREE STANDING CABINET 11 SINGLE CORE OR BUNCHED 3 CORE CABLES
Scale:- N.T.S.
Drn. by:-
Tcd. by:- HMW
Ckd. by:-
App. by:- JRB
Dimensions in millimetres
Drawing no. HO /65 /083
C.A.D.Ref. ho0083.65
A4P SEHINT1
DATE PLOTTED 03-MAR-2000



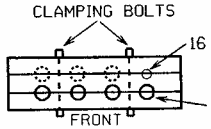


NOTES: BONDING TERMINAL TO BE PROVIDED WHERE CHAMBER FABRICATED FROM CONDUCTIVE MATERIAL.
SUPPLY CABLES TO BE ADEQUATELY SUPPORTED AS APPROPRIATE TO SITE CONDITIONS.

FOR TRENCH DIMENSIONS SEE HO / 65 / 082



NON-METALIC CT SUPPORT DETAIL



NON-METALIC BASE PLATE DETAIL

C.T. DIMENSIONS

RATIO	MIN. INTERNAL DIAMETER mm	MAX. EXTERNAL DIAMETER mm
400/5	65	125
500/5	77	125
600/5	77	130
800/5	77	130
1000/5	77	130

Original issue
Date:- 15 MAY 1992

Revision:- A
REDRAWN ON CAD AMENDED TO M.U.P.
HMW /JRB
15 JULY 1998

Revision:- B
DIMENSION CHANGED.
DEF /JRB
27 NOV 1998

Revision:- C
2 /1455 WAS 1 /976.
DEF
14 JUN 2001

Revision:- D
MINOR TEXT MODS.
DEF/SC
15 NOV 2001

UNCONTROLLED COPY
SUBJECT TO REVISION
MASTER HELD AT VASTERN RD.
Telephone 0118 953 4649

This drawing is protected by copyright and the information contained therein is confidential. The drawing may not be copied and the information contained therein may not be used, or disclosed to a third party, wholly or in part except with the written permission of, and in the manner prescribed by SCOTTISH and SOUTHERN ENERGY plc © 2004

Scottish and Southern Energy plc

TYPICAL REQUIREMENT FOR EXTENSION CHAMBER TO PROVIDE C.T. ACCOMMODATION AND SPACE FOR TERMINATING SINGLE CORE L.V. CABLES

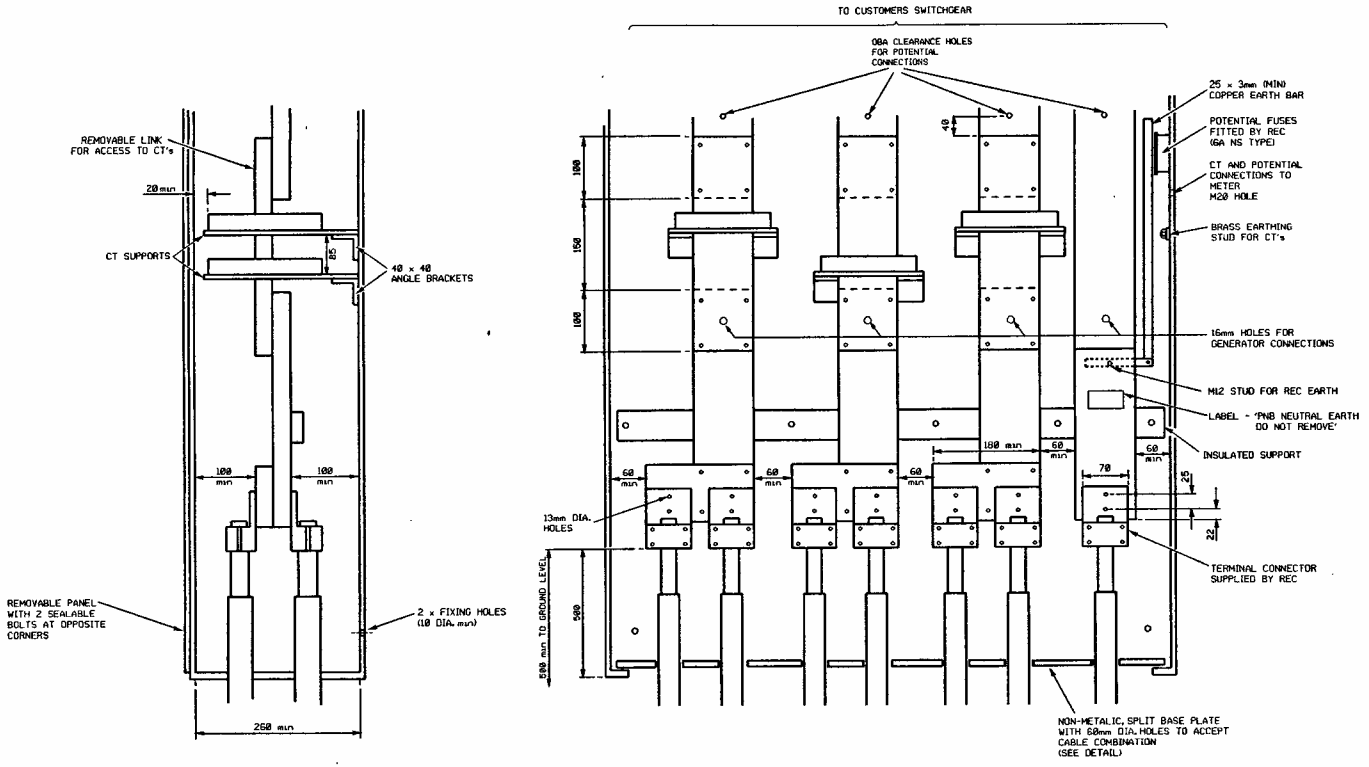
Scale:-	N.T.S.
Drn. by:-	
Tcd. by:-	D.K.B.
Ckd. by:-	
App. by:-	D.P.

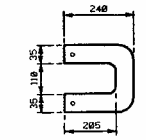
Dimensions in millimetres

Drawing no. **HO /65 /037**

C.A.D. Reference:- ho0037.65

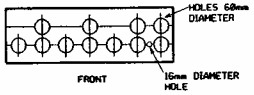
DATE PLOTTED 13-JAN-2005





NON METALLIC CT SUPPORT DETAIL

CT SIZE	
I.D.	110mm min
O.D.	170mm max
THICKNESS	37mm max



NON METALLIC BASE DETAIL

NOTES

1. BUSBARS ARE TO BE SUITABLY RATED FOR THE CIRCUIT LOAD
2. ALL M10 AND M12 NUTS, BOLTS AND WASHERS ARE TO BE PROVIDED FOR BOTH THE REMOVABLE LINKS AND CABLE TERMINAL CONNECTORS. BOLT LENGTHS ARE TO BE SIZED TO SUIT BUSBAR AND TERMINATION THICKNESS AS NECESSARY.
3. A BONDING TERMINAL IS TO BE PROVIDED WHERE THE CHAMBER IS FABRICATED FROM CONDUCTIVE MATERIAL.
4. THE SUPPLY CABLES ARE TO BE ADEQUATELY SUPPORTED AS APPROPRIATE TO THE SITE REQUIREMENTS.

Original Issue Date:- 5 JAN 1996

Revision:- A REVISED TO M.U.P. MBW / JRB 9 JULY 1998

Revision:- B DIMENSION CHAMBER. DEF / JRB 27 NOV 1998

Revision:- C NOTES ALTERED. DEF / SC 19 JAN 2005

NOTES:-

UNCONTROLLED COPY SUBJECT TO REVISION MASTER HELD AT VASTERN RD. Telephone 0118 953 4649

This drawing is protected by copyright and the information contained therein is confidential. The drawing may not be copied and the information contained therein may not be used, or disclosed to a third party, wholly or in part except with the written permission of, and in the manner prescribed by SCOTTISH and SOUTHERN ENERGY plc © 2004

Scottish and Southern Energy plc

TYPICAL REQUIREMENTS FOR EXTENSION CHAMBER TO PROVIDE C.T. ACCOMMODATION AND SPACE FOR TERMINATING 11 SINGLE CORE OR BUNCHED 3 CORE CABLES

Scales:-	NTS
Drn. by:-	
Tod. by:-	
Chd. by:-	
App. by:-	J R B

Dimensions in millimetres

Drawing no. HO /65 /081

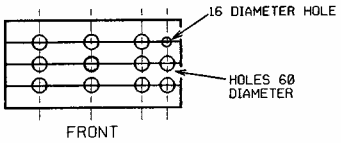
C.A.D. Reference:- hs0081.65

A2L

DATE PLOTTED 13-JAN-2005

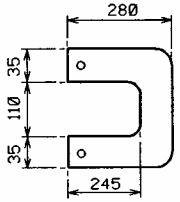
NOTES

1. BUSBARS ARE TO BE SUITABLY RATED FOR THE CIRCUIT LOAD.
2. ALL M10 AND M12 NUTS, BOLTS AND WASHERS ARE TO BE PROVIDED FOR BOTH THE REMOVABLE LINKS AND CABLE TERMINAL CONNECTORS BOLT LENGTHS ARE TO BE SIZED TO SUIT BUSBAR AND TERMINATION THICKNESS AS NECESSARY
3. A BONDING TERMINAL IS TO BE PROVIDED WHERE THE CHAMBER IS FABRICATED FROM CONDUCTIVE MATERIAL.
4. THE SUPPLY CABLES ARE TO BE ADEQUATELY SUPPORTED AS APPROPRIATE TO THE SITE REQUIREMENTS.
5. FOR THE TRENCH DIMENSIONS SEE DRG. No. HO / 65 / 082

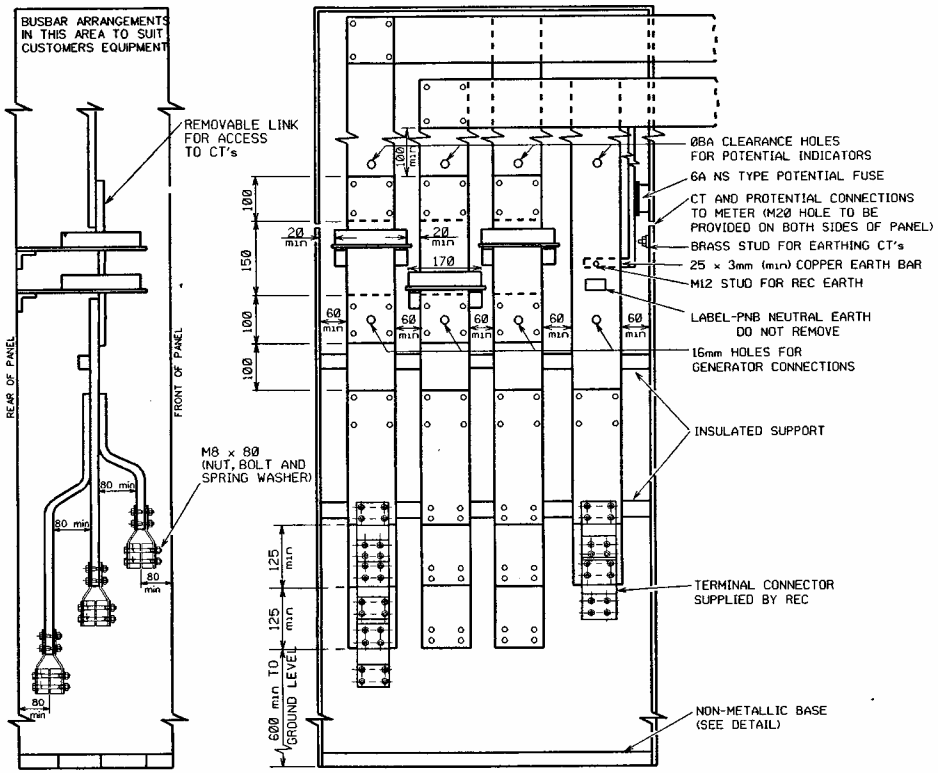


NON-METALLIC
BASE PLATE DETAIL

CT SIZE
I.D. 110mm min
O.D. 170mm max
THICKNESS 37mm max



NON-METALLIC
CT SUPPORT DETAIL



Original issue
Date:- 15 JULY 1998

Revision:-
A. DIMENSIONS ADDED.
27 NOV 98 DCJ

B. NOTES ALTERED.
10 JAN 02 DCJ

UNCONTROLLED COPY
SUBJECT TO REVISION
MASTER HELD AT VASTERN RD.
Telephone 0118 953 4649

This drawing is protected by copyright and the information contained therein is confidential. The drawing may not be copied and the information contained therein may not be used, or disclosed to a third party, wholly or in part except with the written permission of, and in the manner prescribed by SCOTTISH and SOUTHERN ENERGY plc © 2004

Scottish and Southern Energy plc

TYPICAL REQUIREMENTS FOR FREE STANDING CABINET TO PROVIDE CT ACCOMMODATION AND SPACE FOR TERMINATING 11 SINGLE CORE OR BUNCHED 3 CORE CABLES

Scale:- N.T.S.	Dimensions in millimetres
Drn. by:-	Drawing no. HO /65 /084
Tcd. by:- H.M.W.	C.A.D. Reference:- ho0084.65
Ckd. by:-	
App. by:- J.R.B.	

DATE PLOTTED 13-JAN-2005