

<b>SSE POWER DISTRIBUTION</b>	<b>PROCEDURE FOR INSTALLATION OF LOW VOLTAGE SUPPLIES USING 3 CORE BUNCHED WAVECON CABLES</b>	Page 1 of 12
Applies to Power Systems Staff and New Connections		PR-PS-151
Prepared by Network Services		Rev 2-03

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## 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 insure 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.

185 mm<sup>2</sup> 3 core bunched Wavecon cable will be used on all installations with the exception of 1500kVA transformers where 300 mm<sup>2</sup> bunched Wavecon cable must be used where the buried length is greater than 5m.

## 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 multiple customers metered at LV is 1000 kVA. Single customers can be supplied from a 1500kVA transformer. 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.

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### 3 Bunched Wavecon Cables

#### 3.1 Sizes and Ratings

The standard for supplying large loads is to use either 185 mm<sup>2</sup> or 300 mm<sup>2</sup> 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. 3 core 185 mm<sup>2</sup> Wavecon low smoke zero halogen is also available for indoor substations within buildings where fire regulations require these cable to be used.

**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 mm <sup>2</sup>	1	1	840	660	500
185 mm <sup>2</sup>	2	1	1685	1325	1250
185 mm <sup>2</sup>	3	2	2530	1990	1500
Cables buried and maximum length of 100 metres					
185 mm <sup>2</sup>	1	1	730	575	500
185 mm <sup>2</sup>	2	1	1280	1010	800
185 mm <sup>2</sup>	3	2	1650	1300	1250
300 mm <sup>2</sup>	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.

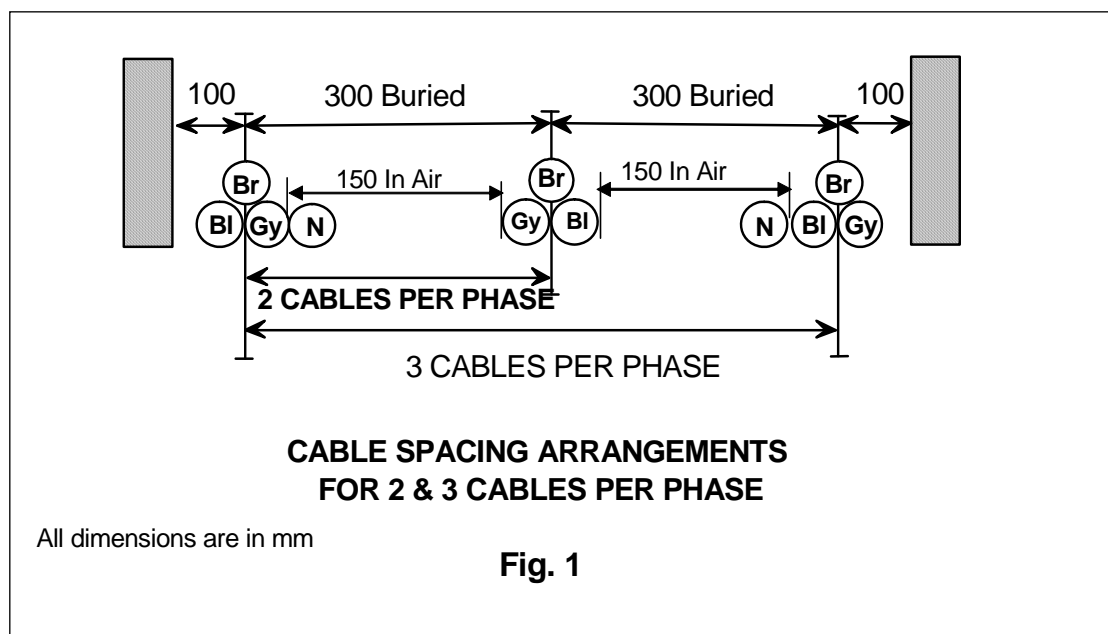
It is important that the cables are laid in tight trefoil formation bound together to minimise the magnitude of magnetic field emitted from the cable. Cable routes should not be run through buildings and the customer's intake position should be on an outside wall.

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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 ducts 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. A duct for each cable must be of sufficient diameter to allow the each group of cables to be laid in trefoil plus neutral as shown in 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.**

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#### BUNCHED WAVECON CLEATS

<b>3 Core Wavecon Cable Size</b>	<b>No. Cables in Group</b>	<b>Stock No.</b>	<b>Ellis Patents Part No.</b>
185 mm <sup>2</sup>	3 (Trefoil)	068683	VRT-07
185 mm <sup>2</sup>	4 (Quad)	068684	VRQ-06
300 mm <sup>2</sup>	3 (Trefoil)	068685	VRT-10
300 mm <sup>2</sup>	4 (Quad)	068686-	VRQ-08

**Table 2**

#### 5 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.

#### 6 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 630 A feeder ways are required in addition to the BWC.

The cabinet will house the MCCB, ACB and 630 A outgoing ways as required.

#### 7 Customer's Equipment

The BWC is to be terminated at the customer's 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's switchgear 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.

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- c) These drawings are typical and the customer can arrange to have any type of unit constructed providing the dimensions and sizes where stated on the drawings are met. The unit must be supplied with three potential protection fuses and a link for CT metering. (Refer to table 3 for construction drawings for details).

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.

## 8 Provision of Earthing for Customer's Equipment

SNE (Separate Neutral and Earth) will be used for all new installations where 3 core bunched Wavecon cables (BWC) are required.

- 8.1 Any other services taken out from the LV cabinet into the **same building** will also be SNE. Other mains and services to different buildings can be PME providing that they comply with the requirements for PME (see TG-PS-072 in the Earthing Manual).

### 8.2 LV Cable Boxes where earth resistance is less than or equal to 1 ohm

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 earth electrode will be connected to the transformer incomer neutral busbar. This electrode must be segregated from the transformer HV steelwork earth by at least 5 metres using a PVC covered earth conductor. The resistance of this electrode shall be as low as possible, but, shall not exceed 40 ohms .

An additional 70 mm<sup>2</sup> copper earth wire is to be laid with the bunched Wavecon service . This earthwire must be segregated from the transformer HV steelwork earth by at least 5 metres using a PVC covered earth conductor. Outside of this area bare copper can be used This earthwire is to be connected to the transformer neutral bar and customer's earth bar or terminal. Buried joint shall be of the compression type only.

### 8.3

At the customer's end, the BWC copper screen wires will be cut flush with the outer covering of the cable and fully taped to form an insulated end. Care must be

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taken to ensure that any vibration of the cables following installation will not let the covering of the cable or taped end abrade through (the copper screens must not be allowed to make contact with the customer's earthed metalwork or the incoming phase or neutral conductors). On no circumstances must the copper screen wires of the BWC be earthed at both ends.

#### 8.4 **LV Cable Boxes where earth resistance is above 1 ohm**

The link between the transformer incomer neutral busbar and the cable box earth terminal shall not be installed.

The remainder of the installation is as per 8.2.

#### 8.5 **LV Cabinets overall earth resistance less than or equal to 1 ohm**

In the LV cabinet the copper screen wires of the BWC shall be made off onto the earth bar using the connectors provided.

The BWC neutral shall be terminated on the cabinet neutral bar.

An additional 70 mm<sup>2</sup> copper earth wire is to be laid with the bunched Wavecon service. This earthwire must be segregated from the transformer HV steelwork earth by at least 5 metres using a PVC covered earth conductor. Outside of this area bare copper can be used. This earthwire is to be connected to the cabinet earth bar and customer's earth bar or terminal. Buried joints shall be of the compression type only.

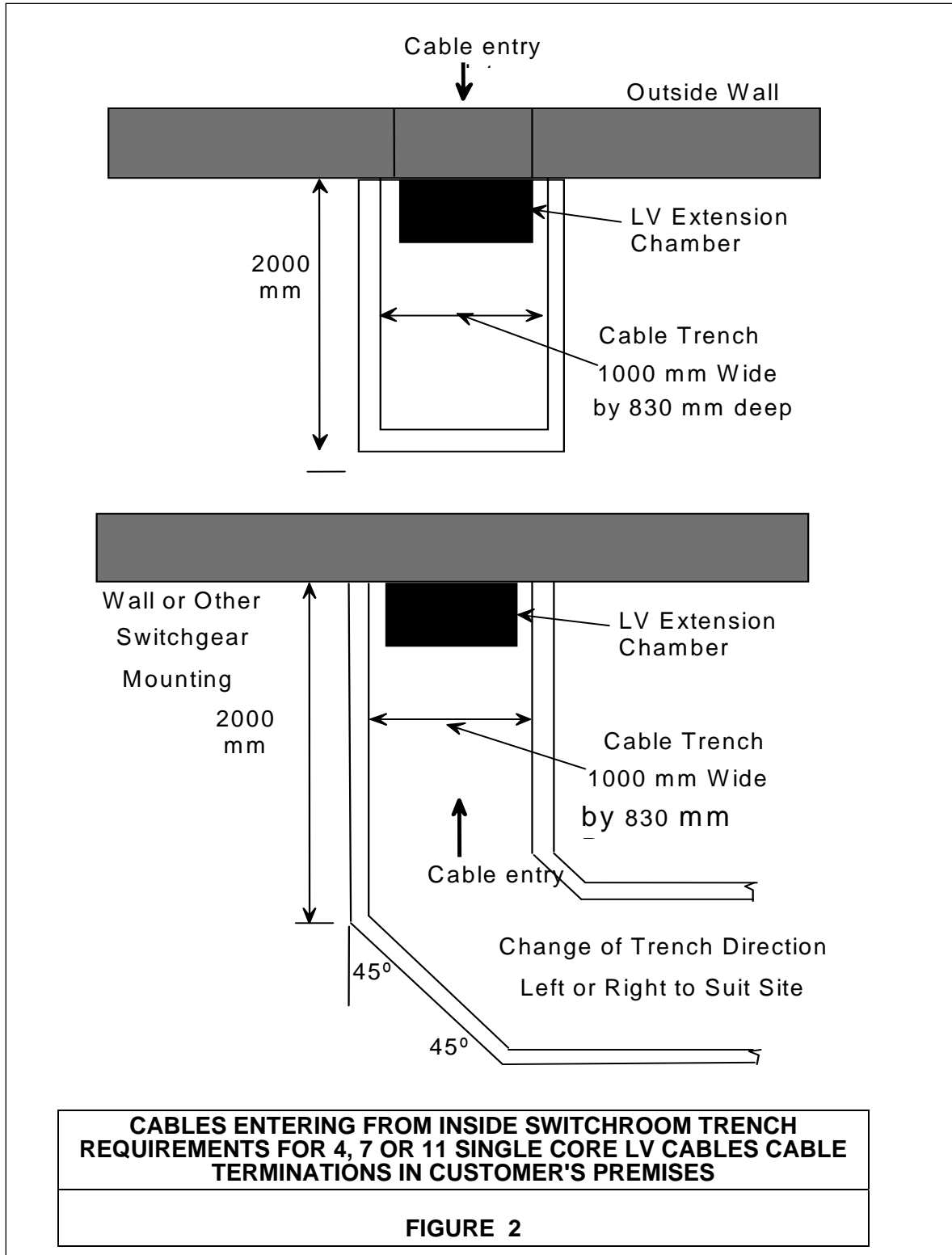
At the customer's end the BWC copper screen wires will be cut flush with the outer covering of the cable and taped to form an insulated end. Care must be taken to ensure that any vibration of the cables following installation will not let the covering of the cable or taped end abrade through (the copper screens must not be allowed to make contact with the customer's earthed metalwork or the incoming phase or neutral conductors). On no circumstances must the screen of the BWC be earthed at both ends.

The neutral earth link shall not be removed.

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

In addition to the requirements of section 8.4 the neutral earth link shall be removed.

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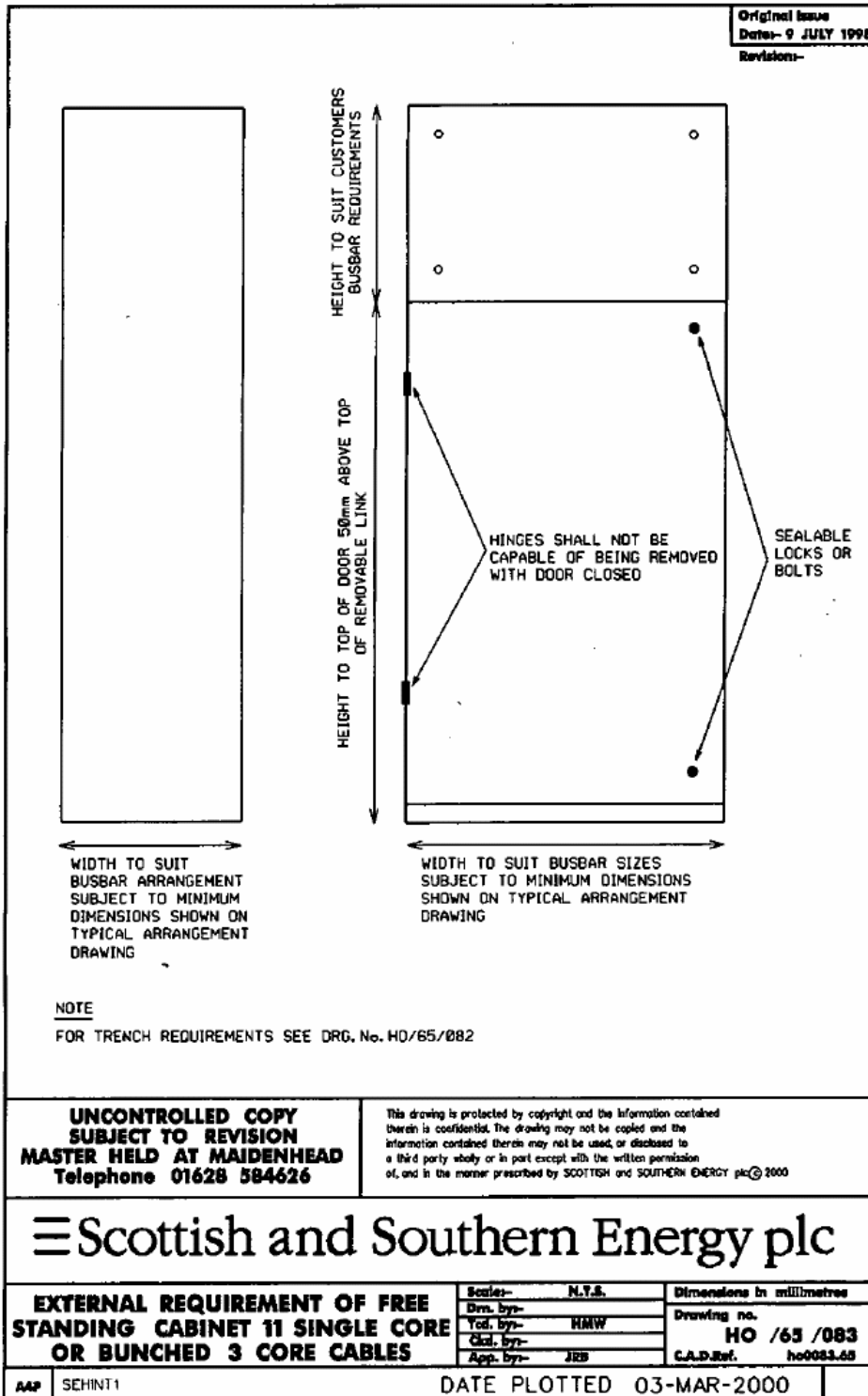
## 9 DRAWINGS

The drawings in table 3 below are for information purposes only. Master documents are held at New Forest. Contact 02380 817441 for current version.

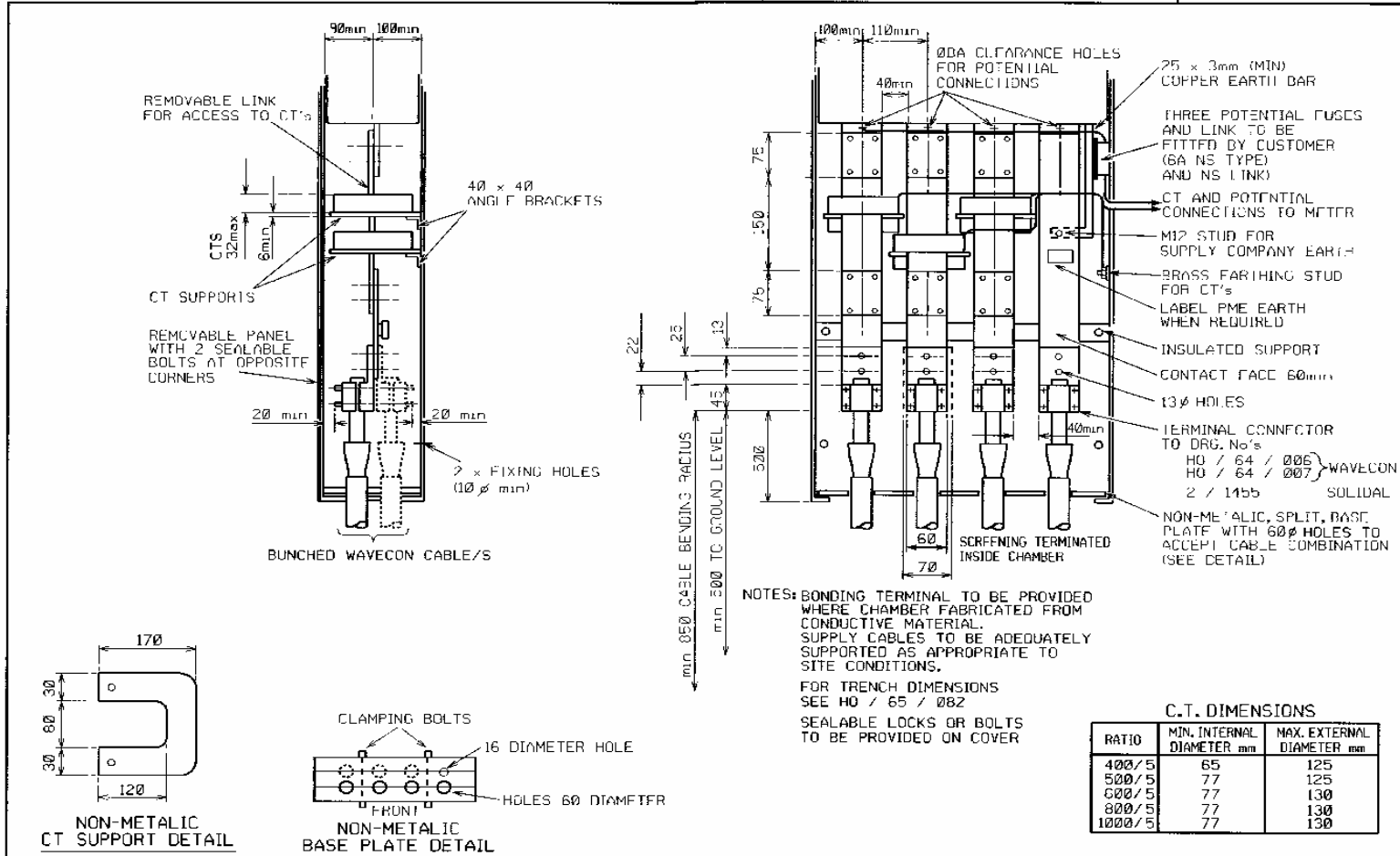
<b>Drawing Number</b>	<b>Title</b>
HO/65/037	Typical requirements of extension chamber to provide CT accommodation and space for terminating single core cables.
HO/65/081	Typical requirements of extension chamber to provide CT accommodation and space for terminating 11 single core or bunched 3 core cables.
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**

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27 NOV 1998

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DEF  
14 JUN 2001

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DEFSC  
15 NOV 2001

Revision- E  
MINOR TEXT MODS.  
DEFSC  
7 NOV 2005

Revision- F  
MINOR TEXT MODS.  
DEFSC  
12 MAY 2008

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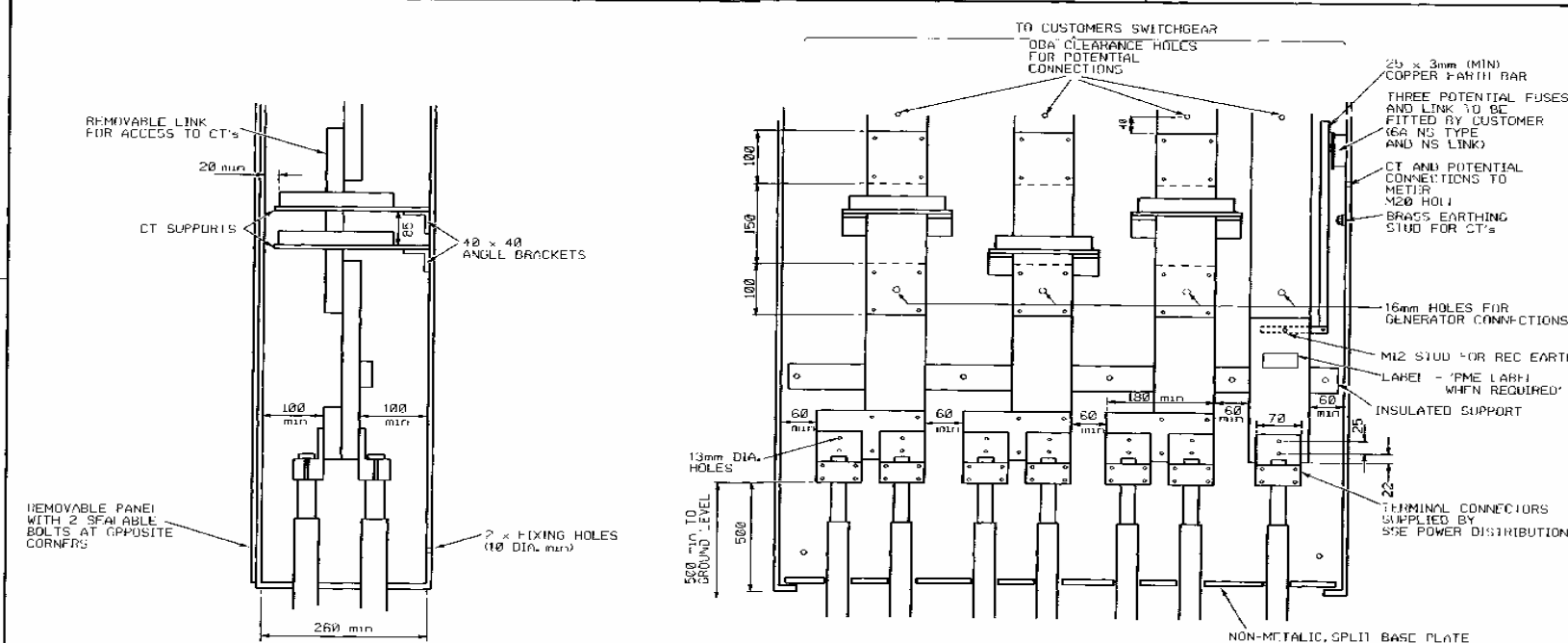
**TYPICAL REQUIREMENT FOR EXTENSION CHAMBER TO PROVIDE C.T. ACCOMMODATION AND SPACE FOR TERMINATING SINGLE CORE L.V. CABLES**

Scale:-	N.T.S.	Dimensions in millimetres
Des. by:-		Drawing no.
Tech. by:-	D.M.S.	<b>HO / 65 / 037</b>
Chk. by:-		C.A.D. Reference:- ho0037.65
App. by:-	D.P.	

A3L

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Revision: B DIMENSIONS CHANGED. DWF / JMB 27 NOV 2008
Revision: C SOME ALTERS. DWF / JMB 14 JAN 2009
Revision: D PROCS ALTERED. DWF / JMB 27 NOV 2008
Revision: E PROCS ALTERED. DWF / JMB 12 MAY 2008



- 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. SEALABLE LOCKS OR BOLTS TO BE PROVIDED ON COVER.

NOTES:  
A31

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**TYPICAL REQUIREMENTS FOR EXTENSION CHAMBER TO PROVIDE CT, ACCOMMODATION AND SPACE FOR TERMINATING 11 SINGLE CORE OR BUNCHED 3 CORE CABLES**

Author: JMB	Dimensions in millimetres
Drawn by: JMB	Drawing no. <b>HO /65 /081</b>
Checked by: JMB	C.A.D. Reference: ho0801.05
Appr. by: JMB	

DATE PLOTTED 12-MAY-2008

