建材

內政部建築新技術、新工法、新設備及新材料認可通知書

發文日期	中華民國 105 年 9 月 21 日	核准文號	內授營建管字第 1050813372 號

受 文 者：伯特利實業社

副本收受者：中華民國全國建築師公會、中華民國電機技師公會、台灣區綜合營造工程工業同業公會（以上請轉知全體會員）、財團法人台灣建築中心、財團法人成大研究發展基金會、臺北市政府、新北市政府、臺中市政府、臺南市政府、高雄市政府、基隆市政府、新竹市政府、嘉義市政府、彰化縣政府、南投縣政府、桃園市政府、新竹縣政府、苗栗縣政府、宜蘭縣政府、花蓮縣政府、臺東縣政府、屏東縣政府、雲林縣政府、嘉義縣政府、澎湖縣政府、金門縣政府、連江縣政府、行政院農業委員會屏東農業生物技術園區籌備處（屏東縣長治鄉德和村德和路 28 號）、科技部新竹科學工業園區管理局、交通部台灣區國道高速公路局、經濟部加工出口區管理處、經濟部水利署台北水源特定區管理局、科技部南部科學工業園區管理局、科技部中部科學工業園區管理局、本部消防署、建築研究所、營建署、玉山國家公園管理處、金門國家公園管理處、雪霸國家公園管理處、墾丁國家公園管理處、太魯閣國家公園管理處、陽明山國家公園管理處、海洋國家公園管理處、台江國家公園管理處

主 旨：貴公司申請認可事項准依下列所載內容認可使用，請查照。

一、核准內容：

申請案件資料	產品名稱	澳洲 LPI（Lightning Protection International Pty Ltd.）公司生產之 Stormaster ESE 避雷針
	產品種類	建築物避雷設備
	規 格	ESE-15、ESE-30
	主要用途及性能	1. 適用於建築物避雷設備。 2. 具雷擊保護性能。
認可使用內容	1. 本避雷設備同意使用於建築物上。 2. 裝置使用依下列規定： （1）保護半徑對照表如附件 1，為取精確之保護角及保護範圍，在使用上仍應由建築師或電機技師，依建築技術規則建築設備編第 21 條之規定，針對建築物作個案之分析計算，並對其計算結果負全責。 （2）有關避雷導線及設備安裝，應依建築技術規則建築設備編第 24 條及第 25 條之規定辦理。 （3）使用者每年至少作 1 次定期構造檢查，颱風後並應立即檢查。 3. 安裝使用時應依本產品標準施工方法之規定辦理，伯特利實業社應善盡指導之責及提供檢查安裝維護手冊（含自主檢查表，如附件 2），並對其構材之規格、材質及系統之性能負責。	

二、注意事項：

（一）本認可案件之有效期限自 105 年 9 月 21 日至 108 年 9 月 20 日為止，並逐年辦理產品責任險。自 105 年 9 月 21 日起每年 9 月前將該年份使用情形，依建築物使用狀況統計表填報建築物之使用者、名稱、地址、電話、數量、施工日期及安裝狀況，並檢附投保產品責任險證明文件及審核認可通知書影本乙份，函報本部營建署備查。營建署得函復備查情形，並為確保認可案件之品質，得以電話或邀請有關人員實地抽驗，其抽驗費用由該公司負擔。使用狀況經抽驗不合格或未按期報備者，得由本部註銷認可使用。

（二）本審核認可之案件，僅為對申請人所提之文件圖說或測試證明內容予以審定。申請人、發明人、出品人或檢驗測試機構團體，如有偽造文書、出具不實證明、侵害他人財產、實際設計、施工與所申請資料不符，肇致危險或傷害他人時，應視其情形，撤銷核可證明文件，並分別依法負其責任。

內政部

收文	105 年 10 月 13 日 第 733 號				
承辦人	秘書	主委	財務	常務	理事長

全國建築師公會	
收文	105 年 9 月 30 日 第 2707 號

建材

內政部建築新技術、新工法、新設備及新材料認可通知書

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內政部

【附件 1】

Stormaster ESE 避雷針保護半徑表

（單位：m）

保護等級	LEVEL Ⅰ r=20m		LEVEL Ⅱ r=30m		LEVEL Ⅲ r=45m		LEVEL Ⅳ r=60m	
避雷針型式	Stormaster ESE-15	Stormaster ESE-30	Stormaster ESE-15	Stormaster ESE-30	Stormaster ESE-15	Stormaster ESE-30	Stormaster ESE-15	Stormaster ESE-30
h(m)	Rp(m) Radius of protection 有效保護半徑(m)							
2	13	19	15	22	18	25	20	28
4	26	38	30	44	36	50	41	57
5	32	48	37	55	45	63	51	71
6	32	48	38	55	46	64	52	72
8	33	49	39	56	47	65	54	73
10	34	49	40	57	49	66	56	75
15	35	50	42	58	52	69	60	78
20	35	50	44	59	55	71	63	81
30			45	60	58	73	69	85
45					60	75	73	89
60							75	90

本表數據為廠商建議值

本避雷針保護半徑計算採用之△T 值如下表

避雷針型式	Stormaster ESE-15	Stormaster ESE-30
△T 值（μs）	15μs	30μs

本保護半徑表之有效保護半徑範圍依 NF C 17-102 規定計算公式如下：

$R_P(h)=\sqrt{2rh-h^2+\Delta(2r+\Delta)}$ for $h \geq 5m$

nd

$R_p = h \times R_p(5) / 5$ for $2m \leqq h \leqq 5m$

說明

$R_P(h)$：有效保護半徑

h：避雷針實際安裝高度（避雷針針尖高出受保護物體之垂直距離，且至少應高出受保護範圍 2 公尺以上）

r：保護等級

LEVEL Ⅰ r=20m

LEVEL Ⅱ r=30m

LEVEL Ⅲ r=45m

LEVEL Ⅳ r=60m

△：避雷針上端向上前導電荷所達成之虛擬高度

△T：電避雷針向上脈衝起始增值時間平均值

$\triangle = \triangle T * 10^6$

※避雷設備的支持棒及施工細節依據建築技術規則規定辦理。

澳洲 LPI 公司
所生產之 Stormaster ESE 放電式避雷針

Stormaster ESE (15、30)檢查安裝維護手冊
(含自主檢查表)

台灣總代理
伯特利實業社
台南市北區公園南路 71 號 2 樓
TEL：06-2224603　FAX：06-2228781
E-mail: lpi.btc@gmail.com

www.lpi-btc.com.tw

伯特利實業社

BTC Technology Company

TEL:886-6-2224603 FAX:886-6-2228781

台南市北區公園南路71號2樓

E-mail：lpi.btc@gmail.com

LPI避雷設備 ESE 15-30 安裝自主檢查表

工程名稱：

工程地點：

施工日期：

設備安裝承包商：

設備安裝承包商聯絡人：

設備安裝承包商聯絡電話：

★檢查項目：

1. 避雷設備是否依照設計圖的位置及數量安裝。 是 □ 否 □
2. 避雷設備的外觀是否有毀損或凹陷。 是 □ 否 □
3. 避雷針的安裝高度是否依照設計圖的高度安裝。 是 □ 否 □
4. 下導線係採用高壓遮蔽電纜(HVSC)或銅導線。 (HVSC) □ 銅導線 □
5. 避雷針與下導線是否確實的連結與固定。 是 □ 否 □
6. 下導線的安裝是否依照設計圖的位置安裝固定。 是 □ 否 □
7. 下導線與避雷接地是否確實連結。 是 □ 否 □
8. 所有避雷設備(含零配件)是否確實的安裝固定，且無鬆脫之虞。 是 □ 否 □
9. 避雷針接地電阻值是否小於10歐姆。 是 □ 否 □

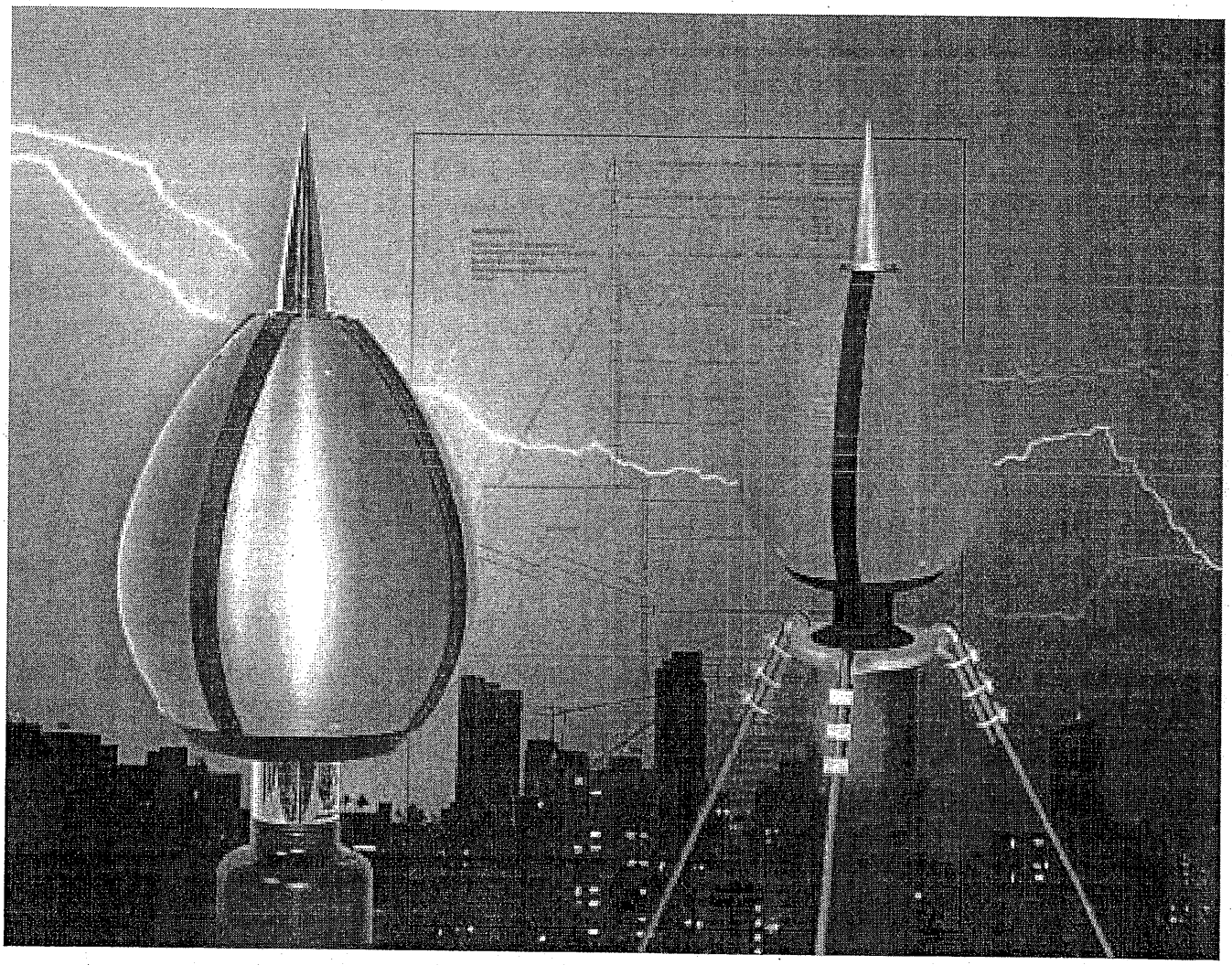
安裝檢查人員： （簽名）

安裝檢查單位： （蓋章）

檢查日期： 年 月 日

Stormaster ESE 15-30(放電式)

檢查安裝維護手冊



國際避雷 LPI 股份有限公司

網址 www.lpi.com.au

統一編號：ABN 11 099 190 897

Stormaster ESE 15-30(放電式)
檢查安裝維護手冊

本說明書為針對雷擊與雷擊防護領域，進行持續的研究與產品開發所得到之成果，本說明書的任何細項內容，本公司 LPI 保留不須通知即可隨時予以變更之權利。

在安裝本 Stormaster ESE 系統之前，安裝者必須與本公司 LPI 或經授權之經銷商核對，以確認擁有本 Stormaster ESE 安裝說明書的最新版本。

請留意：由於雷擊放電之過程係屬於自然的大氣現象，對直擊雷之防護要達到 100%之程度(位準)，或提供此等級之防護配備，是不可能的事。

Stormaster ESE15-30 放電式雷擊防護 LP 系統

系統之擁有者(所有人)：

安裝日期：

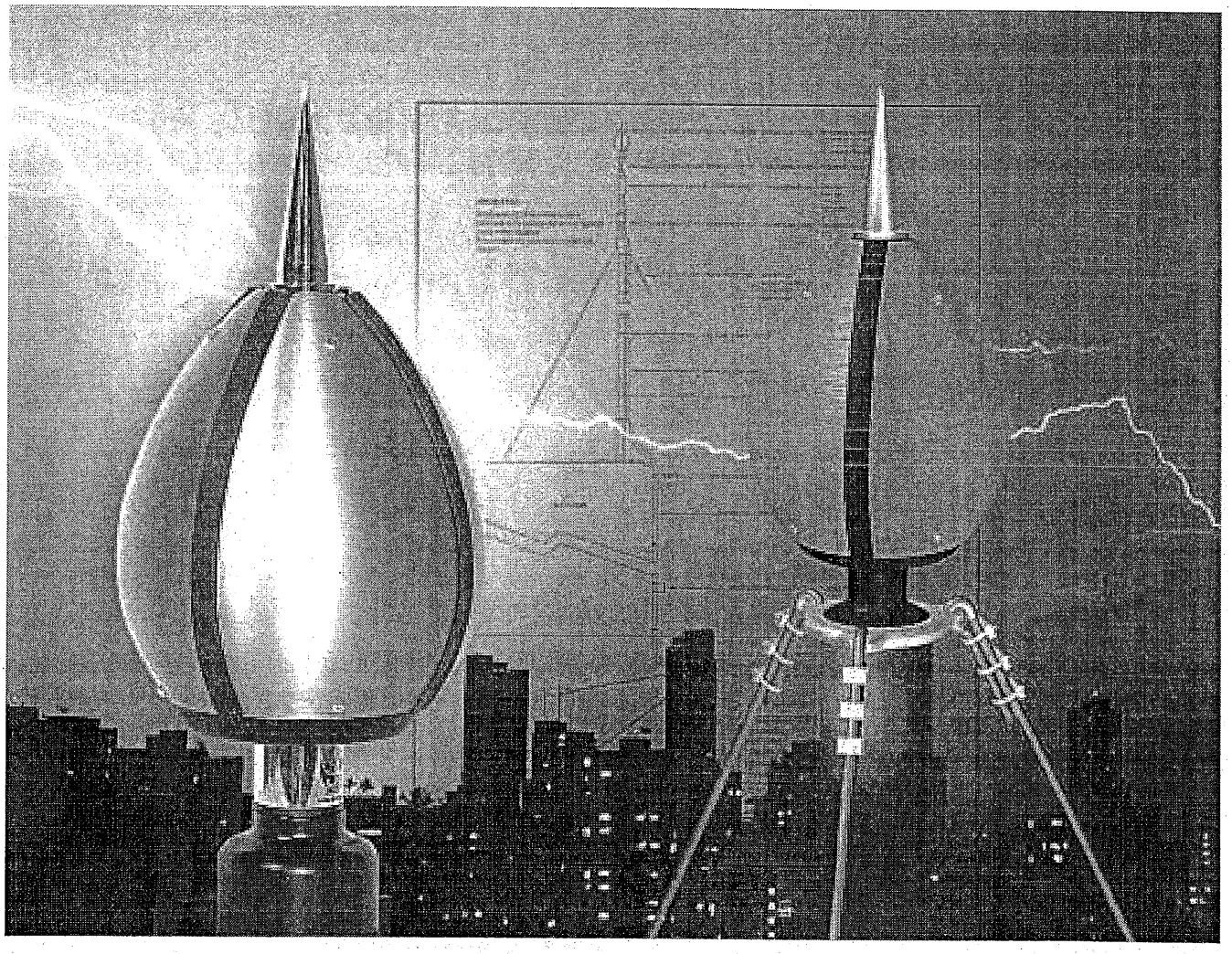
安裝之承包商：

供應者：

安裝地點：

國際避雷 LPI 股份有限公司
統一編號:ABN 11 099 190 897
澳洲 7051 塔斯馬尼亞 京仕頓 郵政信箱 379
電話：+61 3 62271955
傳真：+61 3 62291900
電子郵箱：info@lpi.com.au
網址：www.lpi.com.au

Stormaster ESE 15-30(放電式)
檢查安裝維護手冊

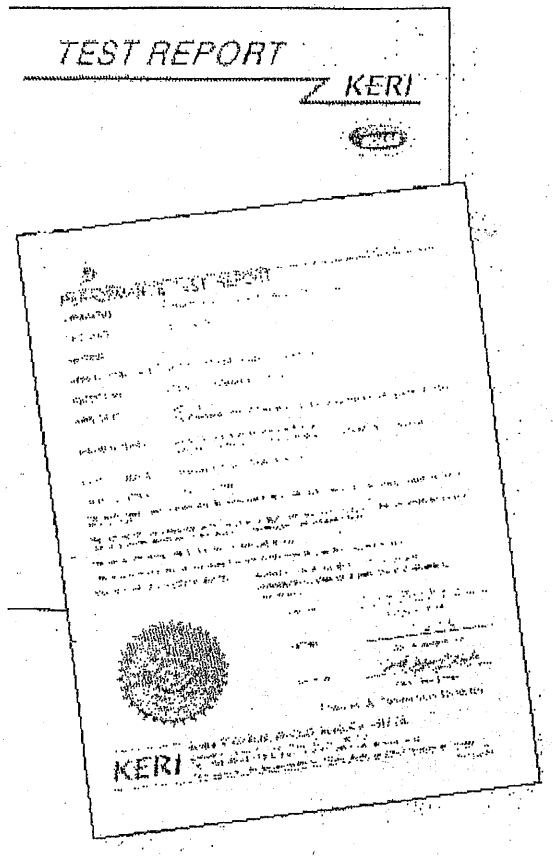


國際避雷 LPI 股份有限公司

目錄

防護半徑 Rp(米)										
避雷針端子超過待保護區高度	2	4	5	6	10	15	20	30	45	60
防護位準 1										
Stormaster 15	13	26	32	32	34	35	35			
Stormaster 30	19	38	48	48	49	49	50			
防護位準 2										
Stormaster 15	15	30	37	38	40	42	44	45		
Stormaster 30	22	44	55	55	57	58	59	60		
防護位準 3										
Stormaster 15	18	36	45	46	49	52	55	58	60	
Stormaster 30	25	50	63	64	66	69	71	73	75	
防護位準 4										
Stormaster 15	20	41	51	52	56	60	63	69	73	75
Stormaster 30	28	57	71	72	75	78	81	85	89	90

防護之功能表現



Stormaster ESE 放電式避雷針端子之防護半徑 Rp 係採用法國國家標準 NF C 17-102(2011 年 9 月)定義之下列公式所計算出來

$R_P(h)= \sqrt{2rh-h^2+\Delta(2r+\Delta)}$　高度 h≧5 米時才適用下列關鍵參數，決定出 Rp 之計算值：其中

ΔT 係測試期間得到之數值，

Stormaster- ESE-15 =ΔT(μs) 15

Stormaster -ESE-30 =ΔT(μs) 30

$\Delta=\Delta T*10^6$

高度 h= Stormaster 避雷針端子超過待保護區之實質高度(米)

r (米) 其數值根據所選定之防護位準而定，防護位準在標準 NF C 17-102 之附錄 B 中有規範

r＝20 米；保護位準 1

r＝30 米；保護位準 2

r＝45 米；保護位準 3

r＝60 米；保護位準 4

保證書

本公司 LPI 的 Stormaster ESE 放電式避雷針端子保證材質與工藝均無缺陷，自本公司 LPI 或經授權之經銷商處採購之初始銷售日起為期五年。

本保證僅限於設備之替換之出廠成本，但須設備已安裝好且經過 LPI 或其經銷商驗證後方生效，貨運、重新安裝、利潤損失、保險金等全部其他成本不包括在內。

其他直接或間接損害或死亡等責任，也被特定排除在保證範圍。

Stormaster ESE 避雷針端子之系列產品(或就我們知識所及任何其他雷擊防護系統)都無法提供 100%的防護，因此不能推定有保證到前段之確認事項，係參照法國標準 NF C 17-102。

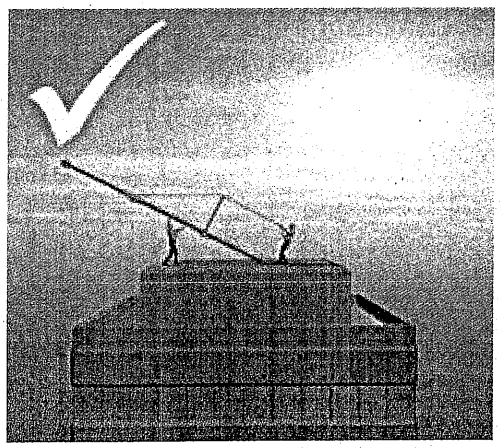
雷擊防護

對法國標準 NF C 17-102 之評論。

茲參照到該標準內「前言」之段落，有提到下列：

如同任何與自然大氣現象(天氣)相關之案例，雷擊防護系統雖依據本標準進行設計與安裝，並無法保證能對建物/人員/物件提供絕對之保護，然而若能應用本標準，欲保護建物被雷擊損害之風險將可顯著地降低。

LPI Stormaster ESE 放電式避雷針端子只有在沒有雷暴發生的期間才可進行安裝。



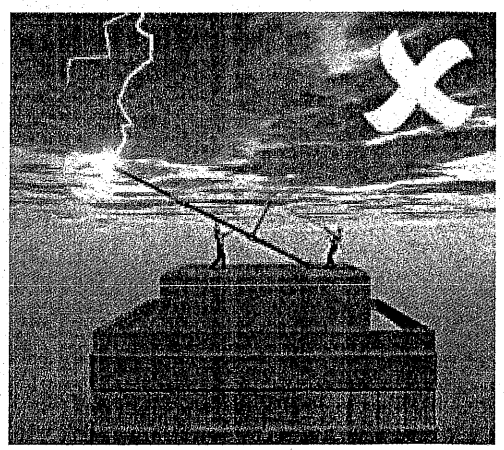


圖 1

安全一般性之指導綱要

- 確保工作環境是安全的且依據當地法典規範進行實務作業。
- 在安裝期間須配戴個人防護裝具 PPE。
- 桅桿抬昇及安裝高度超過六米時須採用機械式方法。
- 在安裝點下方的區域須隔離且封鎖閒人進出。
- 吊高或抬昇之前須點檢注意是否有架空之電力線或任何其他的阻礙物。
- 確保有足夠的人力以安全地執行安裝的全部層面。
- 安裝必須遵守全部相關之當地標準與規定。

建議安裝之方法

參照自第六頁到十二頁的插畫圖 STA-01、STA-02、STA-03、STA-04、STA-05、STA-06、HVS-1 可有助於 Stormaster ESE 放電式避雷針端子與其附件之安裝。

1. 雷擊接地之安裝。
2. 高電壓遮蔽電纜 HVSC 下導體之安裝。
3. 高電壓遮蔽電纜 HVSC 下導體之底部的束紮且連接到雷擊接地。
4. 高電壓遮蔽電纜 HVSC 下導體之頂部的束紮且連接到 Stormaster ESE 放電式避雷針端子。
5. 準備並將桅桿抬昇到固定位置。

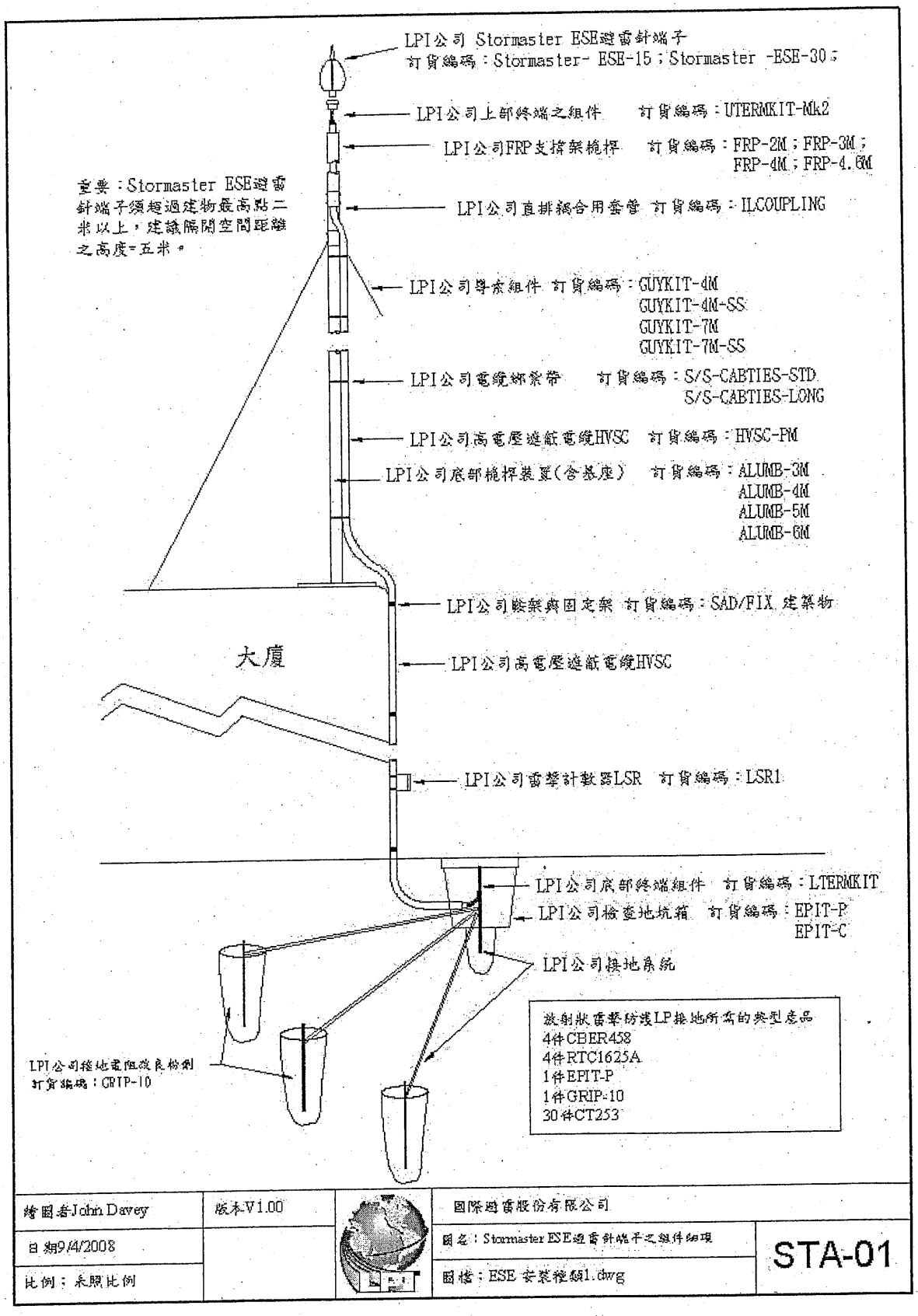

LPI公司 Stormaster ESE避雷針端子
訂貨編碼：Stormaster- ESE-15；Stormaster -ESE-30；
LPI公司上部終端之組件 訂貨編碼：UTERMKIT-Mk2
LPI公司FRP支撐架桅桿 訂貨編碼：FRP-2M；FRP-3M；
FRP-4M；FRP-4.6M
重要：Stormaster ESE避雷針端子須超過建物最高點二米以上，建議隔開空間距離之高度=五米。
LPI公司直排耦合用套管 訂貨編碼：ILCOUPLING
LPI公司導索組件 訂貨編碼：GUYKIT-4M
GUYKIT-4M-SS
GUYKIT-7M
GUYKIT-7M-SS
LPI公司電纜綁紮帶 訂貨編碼：S/S-CABTIES-STD
S/S-CABTIES-LONG
LPI公司高電壓遮蔽電纜HVSC 訂貨編碼：HVSC-PM
LPI公司底部桅桿裝置(含基座) 訂貨編碼：ALUMB-3M
ALUMB-4M
ALUMB-5M
ALUMB-6M
LPI公司腋架與固定架 訂貨編碼：SAD/FIX 建築物
大廈
LPI公司高電壓遮蔽電纜HVSC
LPI公司雷擊計數器LSR 訂貨編碼：LSR1
LPI公司底部終端組件 訂貨編碼：LTERMKIT
LPI公司檢查地坑箱 訂貨編碼：EPIT-P
EPIT-C
LPI公司接地系統
放射狀雷擊防護LP接地所需的典型產品
4件CBER438
4件RTC1625A
1件EPIT-P
1件GRIP-10
30件CT253
LPI公司接地電阻改良粉劑
訂貨編碼：GRIP-10
繪圖者John Davey
版本V1.00
國際避雷股份有限公司
日期9/4/2008
圖名：Stormaster ESE避雷針端子之組件細項
STA-01
比例：未照比例
圖檔：ESE 安裝程類1.dwg

圖 2

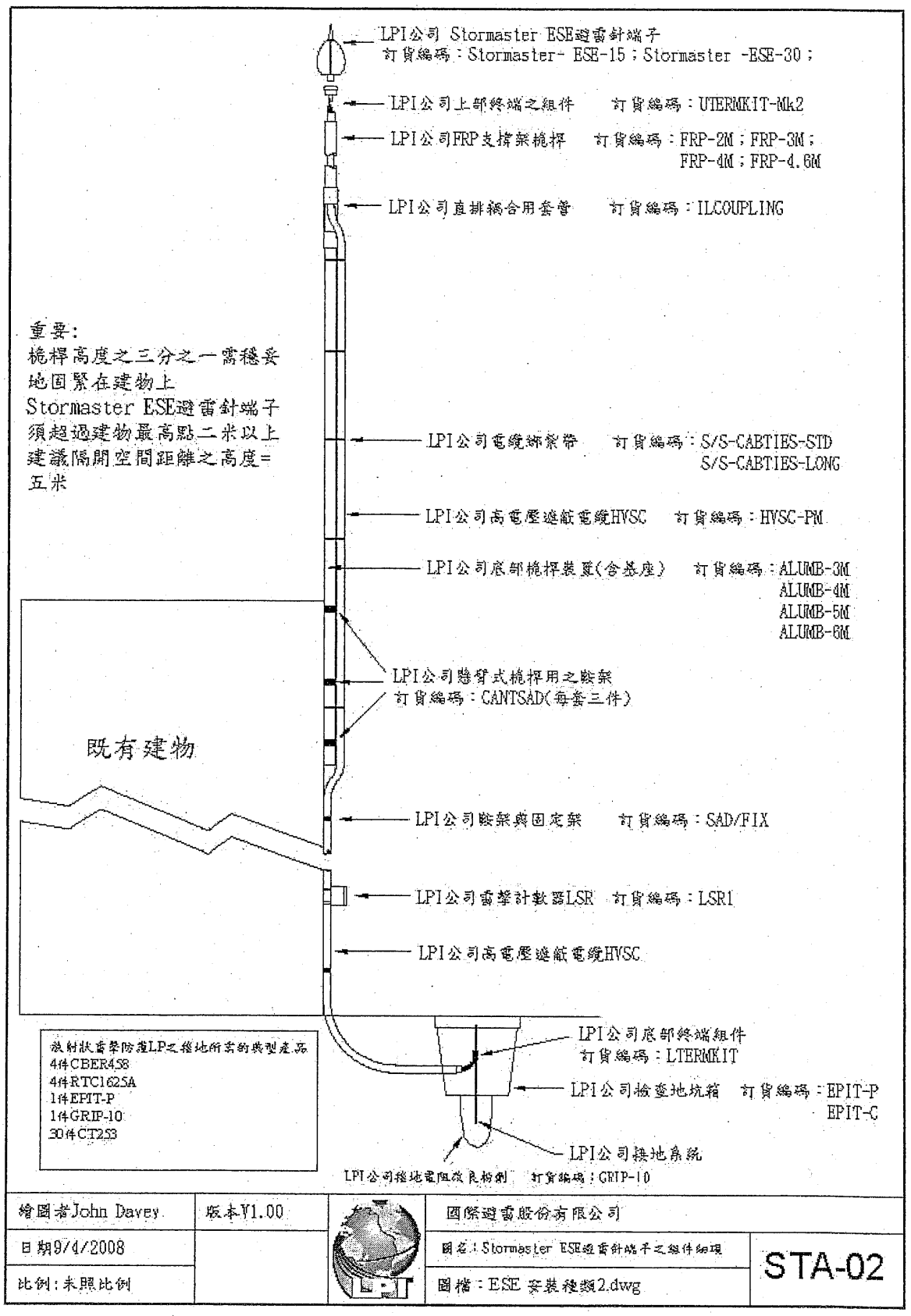

LPI公司 Stormaster ESE避雷針端子
訂貨編碼：Stormaster- ESE-15；Stormaster -ESE-30；
LPI公司上部終端之組件 訂貨編碼：UTERMKIT-Mk2
LPI公司FRP支撐架桅桿 訂貨編碼：FRP-2M；FRP-3M；
FRP-4M；FRP-4.6M
LPI公司直排鎖合用套管 訂貨編碼：ILCOUPLING
重要:
桅桿高度之三分之一需穩妥
地固緊在建物上
Stormaster ESE避雷針端子
須超過建物最高點二米以上
建議隔開空間距離之高度=
五米
LPI公司電纜綁紮帶 訂貨編碼：S/S-CABTIES-STD
S/S-CABTIES-LONG
LPI公司高電壓遮蔽電纜HVSC 訂貨編碼：HVSC-PM
LPI公司底部桅桿裝置(含基座) 訂貨編碼：ALUMB-3M
ALUMB-4M
ALUMB-5M
ALUMB-6M
LPI公司懸臂式桅桿用之跛架
訂貨編碼：CANTSAD(每套三件)
既有建物
LPI公司跛架與固定架 訂貨編碼：SAD/FIX
LPI公司雷擊計數器LSR 訂貨編碼：LSR1
LPI公司高電壓遮蔽電纜HVSC
放射狀雷擊防護LP之接地所需的典型產品
4件CBER458
4件RTC1625A
1件EPIT-P
1件GRIP-10
30件CT253
LPI公司底部終端組件
訂貨編碼：LTERMKIT
LPI公司檢查地坑箱 訂貨編碼：EPIT-P
EPIT-C
LPI公司接地系統
LPI公司接地電阻改良粉劑 訂貨編碼：GRIP-10
繪圖者John Davey
版本V1.00
日期9/4/2008
比例：未照比例
國際避雷股份有限公司
圖名：Stormaster ESE避雷針端子之組件細項
圖檔：ESE 安裝種類2.dwg
STA-02

圖 3

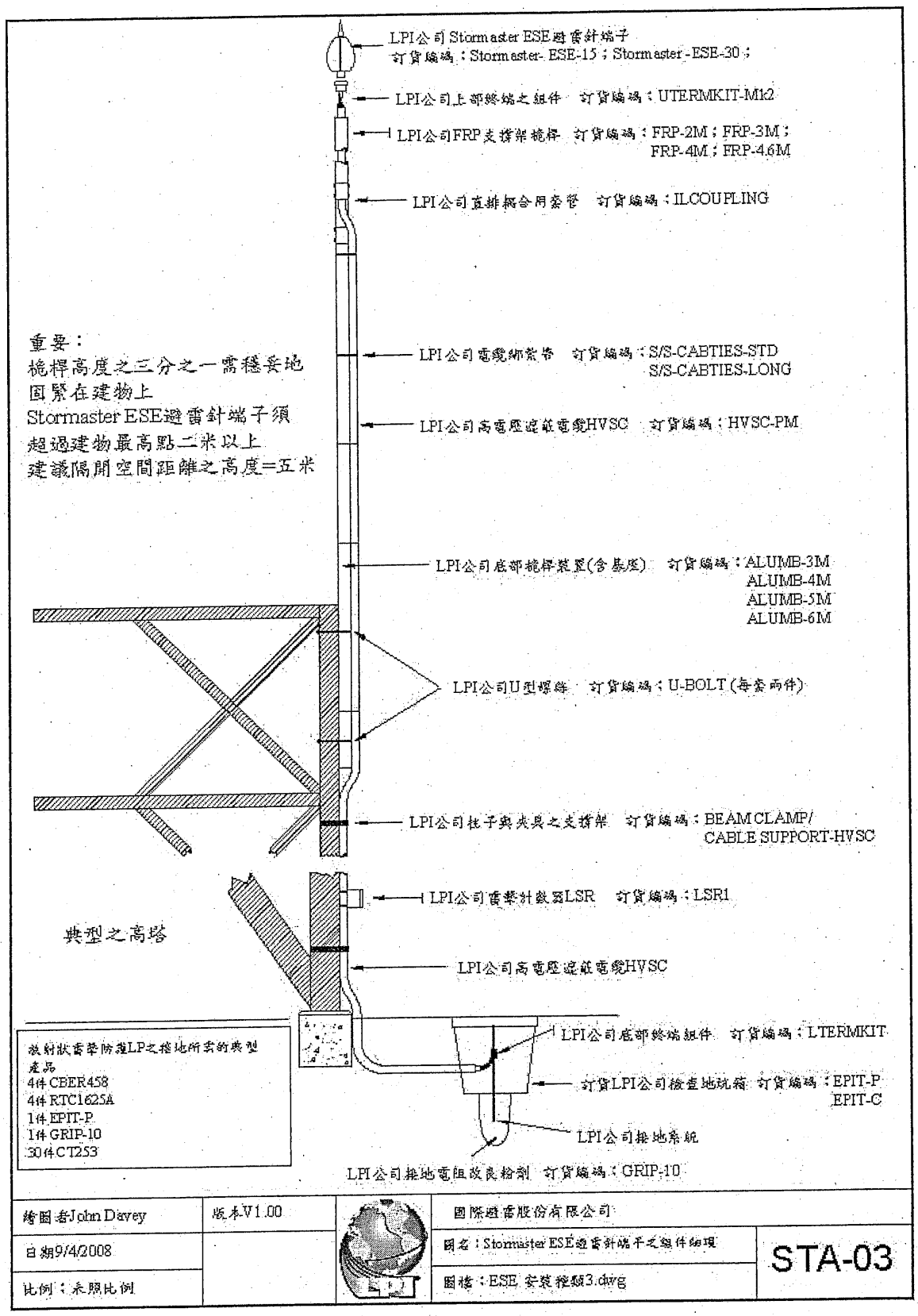

LPI公司 Stormaster ESE避雷針端子
訂貨編碼：Stormaster- ESE-15；Stormaster -ESE-30；
LPI公司上部終端之組件 訂貨編碼：UTERMKIT-M12
LPI公司FRP支撐架桅桿 訂貨編碼：FRP-2M；FRP-3M；
FRP-4M；FRP-4.6M
LPI公司直排耦合用套管 訂貨編碼：ILCOUPLING
重要：
桅桿高度之三分之一需穩妥地
固緊在建物上
Stormaster ESE避雷針端子須
超過建物最高點二米以上
建議隔開空間距離之高度=五米
LPI公司電纜綁紮帶 訂貨編碼：S/S-CABTIES-STD
S/S-CABTIES-LONG
LPI公司高電壓遮蔽電纜HVSC 訂貨編碼：HVSC-PM
LPI公司底部桅桿裝置(含基座) 訂貨編碼：ALUMB-3M
ALUMB-4M
ALUMB-5M
ALUMB-6M
LPI公司U型螺絲 訂貨編碼：U-BOLT (每套兩件)
LPI公司柱子與夾具之支撐架 訂貨編碼：BEAM CLAMP/
CABLE SUPPORT-HVSC
LPI公司雷擊計數器LSR 訂貨編碼：LSR1
典型之高塔
LPI公司高電壓遮蔽電纜HVSC
放射狀雷擊防護LP之接地所需的典型
產品
4件 CBER458
4件 RTC1625A
1件 EPIT-P
1件 GRIP-10
30件 CT253
LPI公司底部終端組件 訂貨編碼：LTERMKIT
訂貨LPI公司檢查地坑箱 訂貨編碼：EPIT-P
EPIT-C
LPI公司接地系統
LPI公司接地電阻改良粉劑 訂貨編碼：GRIP-10
繪圖者John Davey
版本V1.00
日期9/4/2008
比例：未照比例
國際避雷股份有限公司
圖名：Stormaster ESE避雷針端子之組件細項
圖檔：ESE 安裝程顯3.dwg
STA-03

圖 4

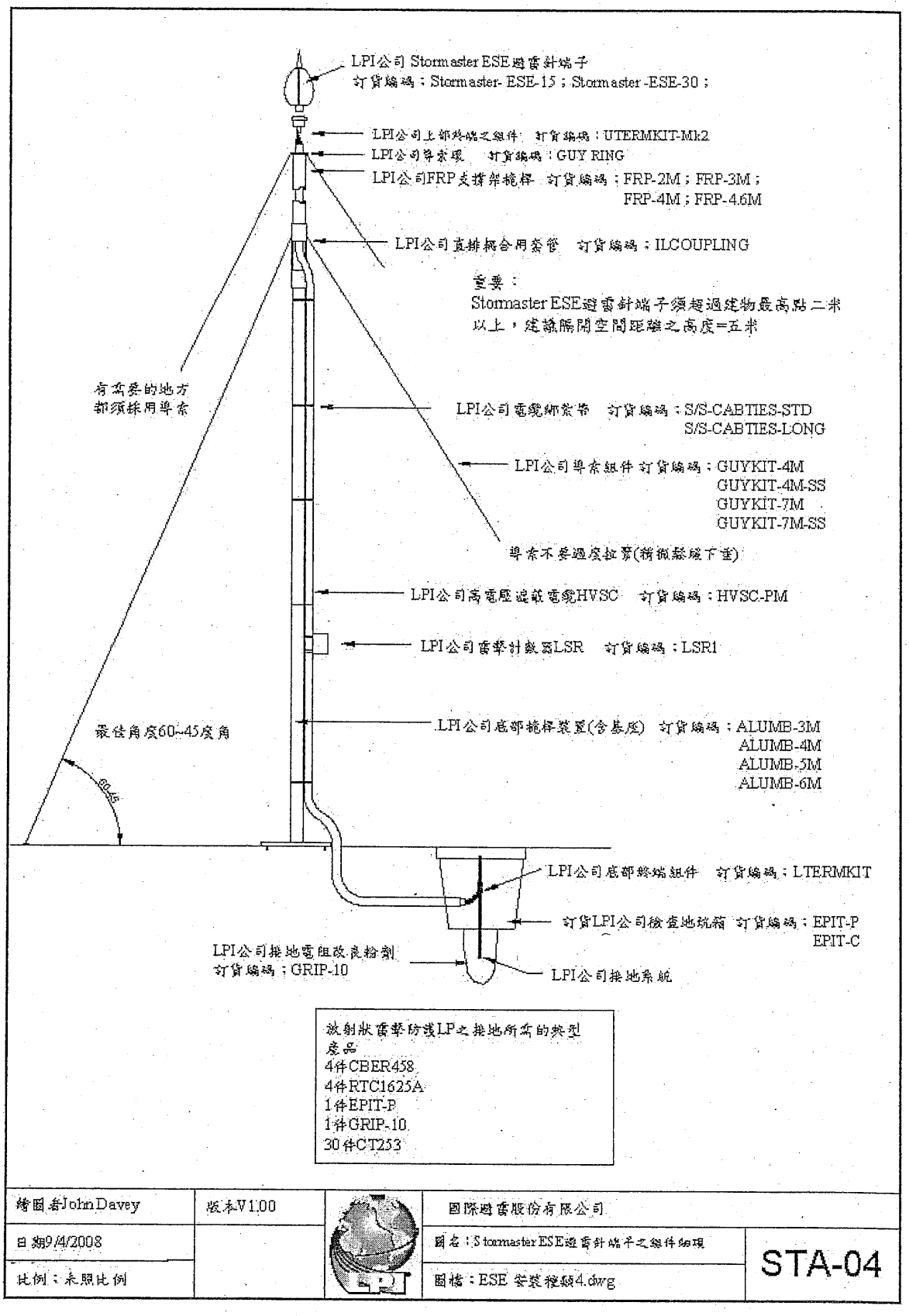

LPI公司 Stormaster ESE避雷針端子
訂貨編碼：Stormaster- ESE-15；Stormaster -ESE-30；
LPI公司上部終端之組件 訂貨編碼：UTERMKIT-Mk2
LPI公司導索環 訂貨編碼：GUY RING
LPI公司FRP支撐架桅桿 訂貨編碼：FRP-2M；FRP-3M；
FRP-4M；FRP-4.6M
LPI公司直排耦合用套管 訂貨編碼：ILCOUPLING
重要：
Stormaster ESE避雷針端子須超過建物最高點二米
以上，建議隔開空間距離之高度=五米
有需要的地方
都須採用導索
LPI公司電纜綁紮帶 訂貨編碼：S/S-CABTIES-STD
S/S-CABTIES-LONG
LPI公司導索組件 訂貨編碼：GUYKIT-4M
GUYKIT-4M-SS
GUYKIT-7M
GUYKIT-7M-SS
導索不要過度拉緊(稍微鬆弛下垂)
LPI公司高電壓遮蔽電纜HVSC 訂貨編碼：HVSC-PM
LPI公司雷擊計數器LSR 訂貨編碼：LSR1
最佳角度60~45度角
LPI公司底部桅桿裝置(含基座) 訂貨編碼：ALUMB-3M
ALUMB-4M
ALUMB-5M
ALUMB-6M
LPI公司底部終端組件 訂貨編碼：LTERMKIT
訂貨LPI公司檢查地坑箱 訂貨編碼：EPIT-P
EPIT-C
LPI公司接地電阻改良粉劑
訂貨編碼：GRIP-10
LPI公司接地系統
放射狀雷擊防護LP之接地所需的典型
產品
4件CBER458
4件RTC1625A
1件EPIT-P
1件GRIP-10
30件CT253
繪圖者John Davey
版本V1.00
國際避雷股份有限公司
日期9/4/2008
圖名：Stormaster ESE避雷針端子之組件細項
STA-04
比例：未照比例
圖檔：ESE 安裝裡頭4.dwg

圖 5

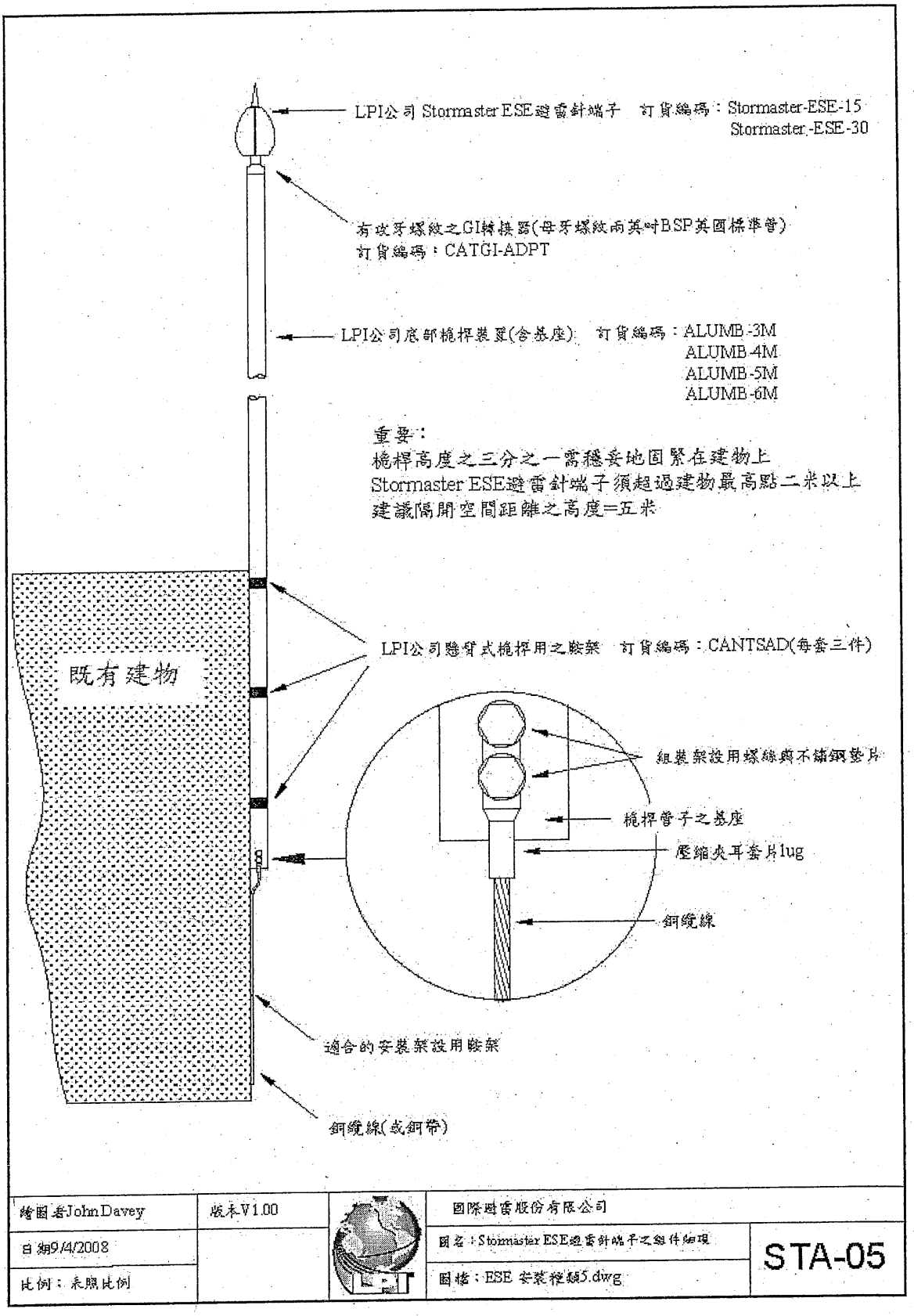


圖 6

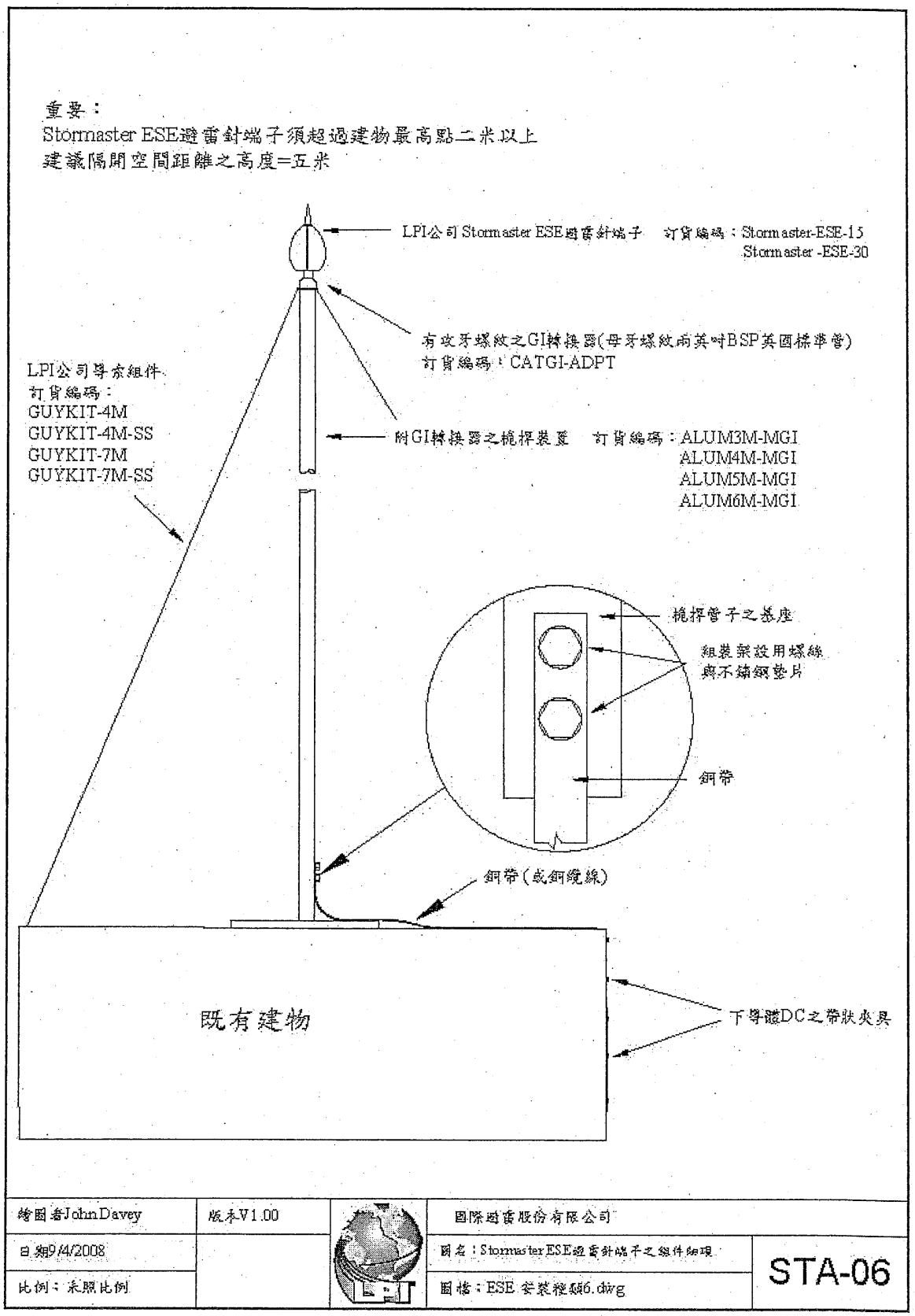

重要：
Stormaster ESE避雷針端子須超過建物最高點二米以上
建議隔開空間距離之高度=五米
LPI公司 Stormaster ESE避雷針端子 訂貨編碼：Stormaster-ESE-15
Stormaster -ESE-30
有攻牙螺紋之GI轉換器(母牙螺紋兩英吋BSP英國標準管)
訂貨編碼：CATGI-ADPT
LPI公司導索組件
訂貨編碼：
GUYKIT-4M
GUYKIT-4M-SS
GUYKIT-7M
GUYKIT-7M-SS
附GI轉換器之桅桿裝置 訂貨編碼：ALUM3M-MGI
ALUM4M-MGI
ALUM5M-MGI
ALUM6M-MGI
桅桿管子之基座
組裝架設用螺線
與不鏽鋼墊片
銅帶
銅帶(或銅纜線)
既有建物
下導體DC之帶狀夾具
繪圖者JohnDavey
版本V1.00
國際避雷股份有限公司
日期9/4/2008
圖名：StormasterESE避雷針端子之組件細項
STA-06
比例：未照比例
圖檔：ESE 安裝種類6.dwg

圖 7

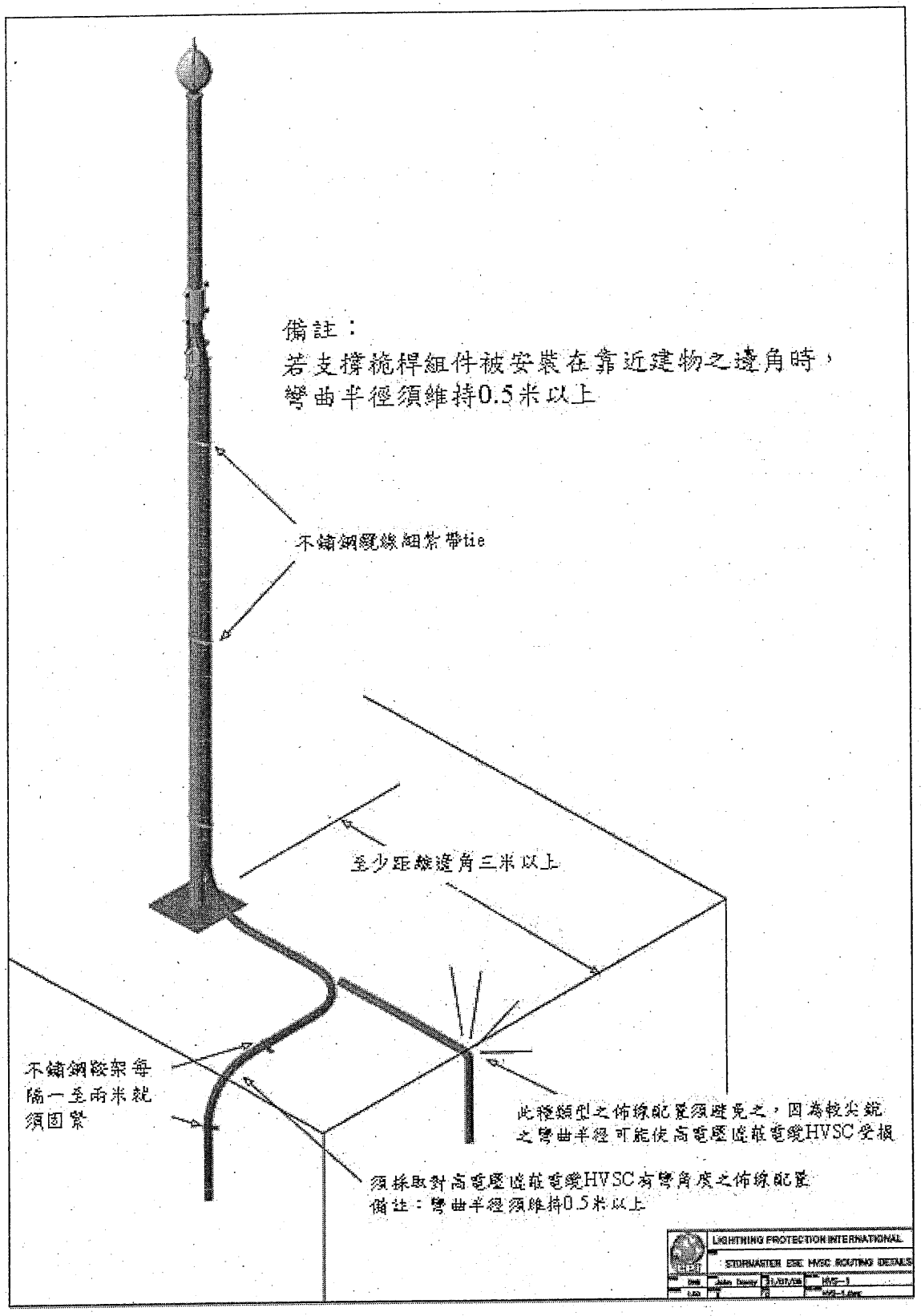


圖 8

查核所供應之雷擊防護組件是否完整無缺

所收到之 LPI Stormaster ESE 放電式避雷針組件，須根據材料表加以核對是否在裝運期間丟失或是否有受損。

查核下項：

避雷針端子

- 在傳送其間端子沒有凹入或任何形式之損傷。
- 說明書、警告標示、保證書、測試報告、相關的桅桿基座組件是否都有提供。

下導體

- 高電壓遮蔽電纜 HVSC 的鼓狀轉輪若有提供時不得受損。
- 所提供的高電壓遮蔽電纜 HVSC 其長度須正確。
- 高電壓遮蔽電纜 HVSC 沒有明顯的損傷。
- 若廠內已完成上部終端之高電壓遮蔽電纜 HVSC，查核其終端沒有受損且確認終端之內側或外側。
- (若在一個鼓狀轉輪有多條不同長度之)高電壓遮蔽電纜 HVSC 之長度與數量之訂單(順序)，須顯示在纜線鼓狀轉輪之側面。

LPI 公司 Stormaster ESE 放電式避雷針之安裝

在安裝 Stormaster ESE 放電式避雷針期間全部的場地與安全之規定都須遵守。

安裝之正確順序如下：

1. 雷擊接地之安裝。
2. 高電壓遮蔽電纜 HVSC 下導體之安裝。
3. 高電壓遮蔽電纜 HVSC 之底部終端處理且連接到雷擊接地。

4. 高電壓遮蔽電纜 HVSC 之上部終端處理，且連接到 Stormaster ESE 放電式避雷針端子。

5. 準備好並將桅桿抬昇到固定位置。

LPI 公司 Stormaster ESE 放電式避雷針只可在無風暴期間進行安裝

若 Stormaster ESE 放電式避雷針須在連接到雷擊接地之前就予以抬昇，或無法立即連接時，可將下導體之下端連接到建築物之鋼筋，或其他適當之接地點。

雷擊接地之安裝

在安裝雷擊防護接地之前須諮詢現場之地下(例：電力公司、自來水公司，瓦斯公司及電信線路)之現場圖面，以避免在接地系統安裝期間損害到這些管線。

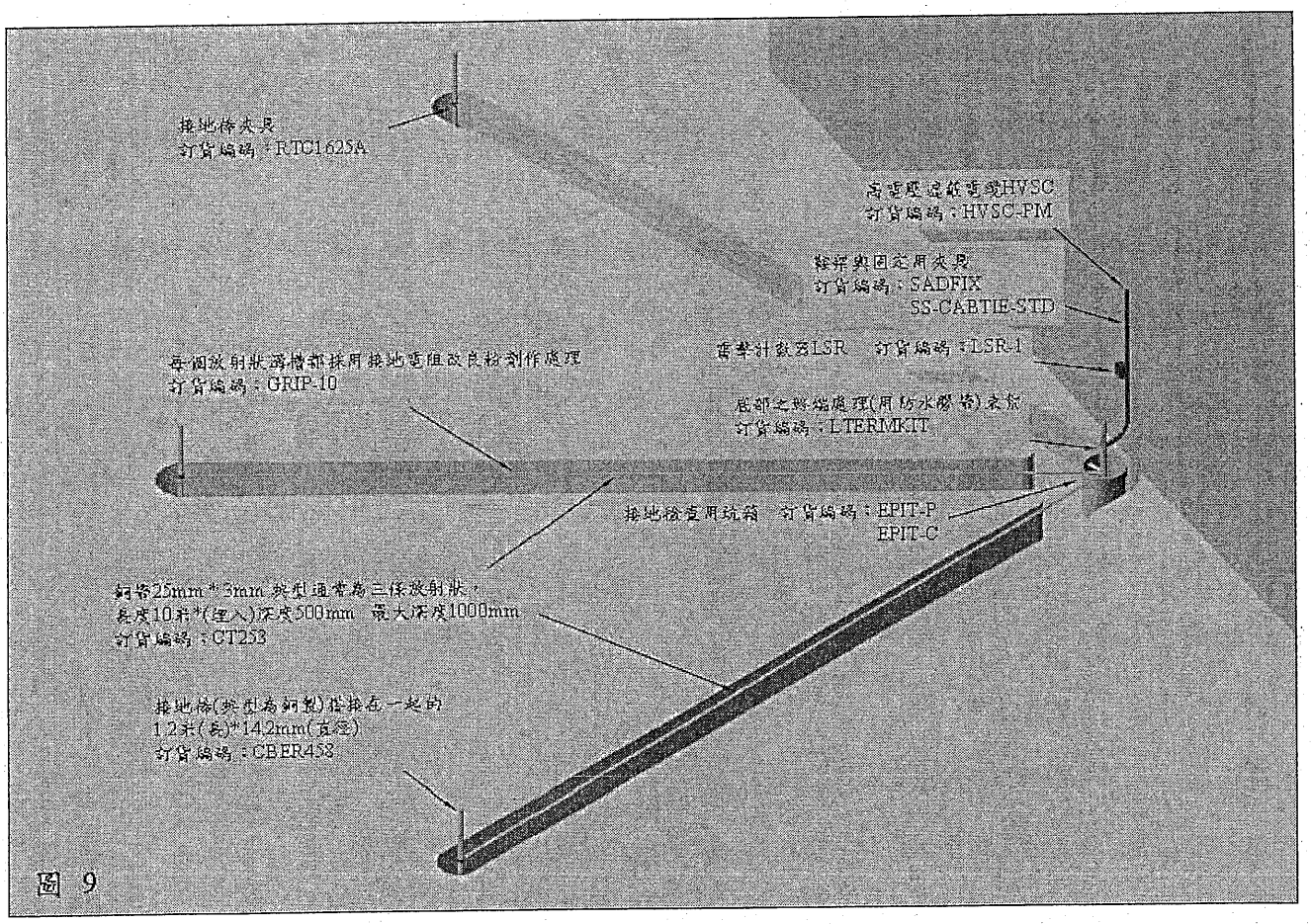


圖 9

LPI 公司的 Stormaster ESE 放電式避雷針要能成功地操作，接地之直流電阻(通常小於十歐姆)，且阻抗(通常小於三十歐姆)是必須的。

LPI 公司建議安裝放射狀之雷擊接地如圖 9 所示。

- 建議安裝三條十米長之放射狀溝槽。
- 每個放射狀線須包含一個溝槽(大約深 500mm 寬 200mm 長十米)。
- 在每個溝槽末端都須鑽入一個接地棒。
- 全部的接地棒都須用銅帶(25mm*3mm)搭接在一起，建議採用接地棒夾具將銅帶固緊在接地棒上。
- 在全部的機械連接處表面都須採用防水之乳香 mastic。
- 採用接地改善藥劑，如 LPI 公司的 RESLO 或 GRIP 有助於降低土壤電阻率，使其降低到低於十歐姆的建議值。
- 在下導體底部終端處理束紮到雷擊接地處(如圖 9)，須安裝一個接地檢查用坑箱，要斷接或於未來做測試時能提供一個可觸及的點。
- 在此時不可將下導體的底部經由此點(終端處理束紮)連接到接地系統。

備註：若因受限於空間不夠，無法依據本建議安裝放射狀接地時，請洽詢 LPI 公司或授權之經銷商，以便提供進一步之建議。

當採用接地棒時：

- 採用鑽地保護頭以免接地棒之頂端如蘑菇狀開花。
- 採用耦合互連之接地棒時須採用鑽地保護頭。
- 須採用柱狀或橫柱之鑽地器(post/picket driver)。

對接地系統組件之搭接的建議事項列舉如下：

- 採用熱熔焊接處理 EXOWELD 是安全有效率之方式以提供各導線之間永久性的連接，熱熔焊接處理的連接點長久時間下也不會腐蝕或生鏽。
- 不得採用鋁製之夾耳套片 lug 或耦合互連 couplings。

降低接地電阻值的化合物

- 若既有的土壤團塊之電阻值很高時，有供應降低接地電阻值的藥劑，諸如 LPI 公司之 RESLO 或 GRIP。
- 採用該降低接地電阻值的藥劑可降低接地電阻/阻抗。
- 該降低接地電阻值的藥劑須用到水與可使其混合的容器。
- 採用該降低接地電阻值的藥劑時，隨產品附送之全部的安裝與安全說明都須遵守。

雷擊接地之搭接

若有個別分開之接地時，諸如建物、電力、通信、雷擊防護等之接地，這些接地都須搭接在一起，以形成等電位的地面，在暫態情形下可防止形成接地迴路且避免產生電位差。

將這些接地進行搭接之前須確保已獲得適當之授權。

搭接用電纜線須 70mm 平方(2/0AWG)以上並符合當地之標準，可能會用到暫態箝制器(TEC 100)，以便在暫態情形下可將全部的接地都搭接成為等電位。

更進一步之資訊建議採用當地適用之標準，亦即：國際電工委員會 IEC 61024-1、英國 BS 6551、澳洲 AS 1768-2007、美國防火協會 NFPA 780、加拿大 C22.1-98 及美國電工法規 NEC。

標示

接地測試坑箱、或接地系統，依據當地規定作標示是客戶或安裝者之責任。

高電壓遮蔽電纜 HVSC 之安裝

在安裝 LPI 公司的高電壓遮蔽電纜 HVSC 時，HVSC 下導體可由 LPI 公司在裝運前，在該纜線之指定末端處於廠內就做好該纜線之上部終端處理束紮。

在移除高電壓遮蔽電纜 HVSC 之外包裝時，不要用刀片或以任何方式作切開之動作，以免損害到其終端的外保護層。

LPI 公司的高電壓遮蔽電纜 HVSC 有外保護層，大約 2mm(1/16 吋)厚，請注意勿損害這個外保護層。

高電壓遮蔽電纜 HVSC 下導體之拖拉

將高電壓遮蔽電纜 HVSC 下導體之纜線鼓狀輪軸放在靠近欲安裝之處。

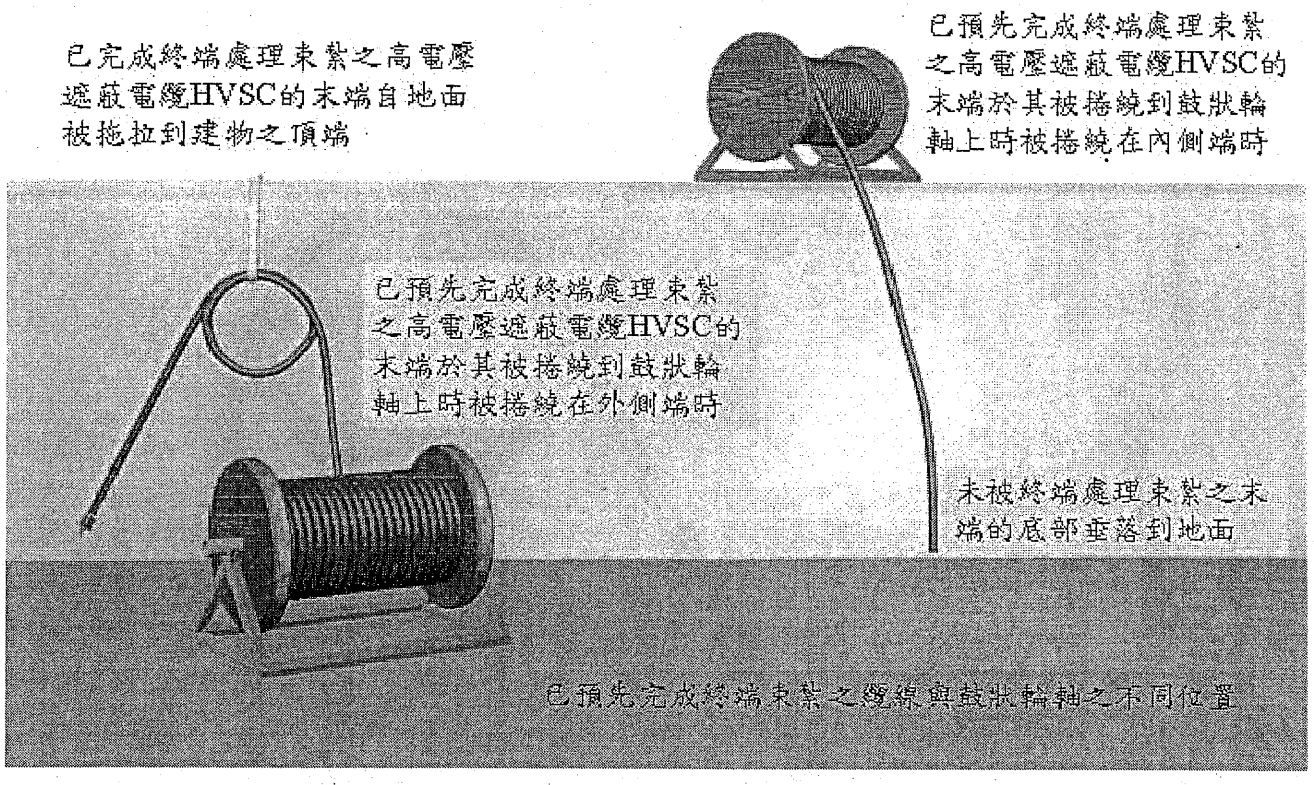


圖 10

- 確保纜線之鼓狀輪軸是處於可用之狀態。
- 檢查其提供之高電壓遮蔽電纜 HVSC 下導體之長度正確，其長度會被標示在鼓狀輪軸上。
- 高電壓遮蔽電纜 HVSC 下導體其上端已終端處理束紮在鼓狀輪軸之外側時，則在將該 HVSC 下導體拖拉到建物上時該鼓狀輪軸須留在地面。
- 高電壓遮蔽電纜 HVSC 下導體其上端已終端處理束紮在鼓狀輪軸之內側時，則須先將該鼓狀輪軸帶到建物之頂端或接近頂端處，然後該 HVSC 下導體可自該鼓狀輪軸處被拖拉到地面。

- 任何吊拉用之升降索套或繩索須穩固地接好。
- 不得從 HVSC 下導體之終端處理束紮處進行拖拉，如圖 11。
- 在移動 HVSC 下導體時任何時間都須保護之。

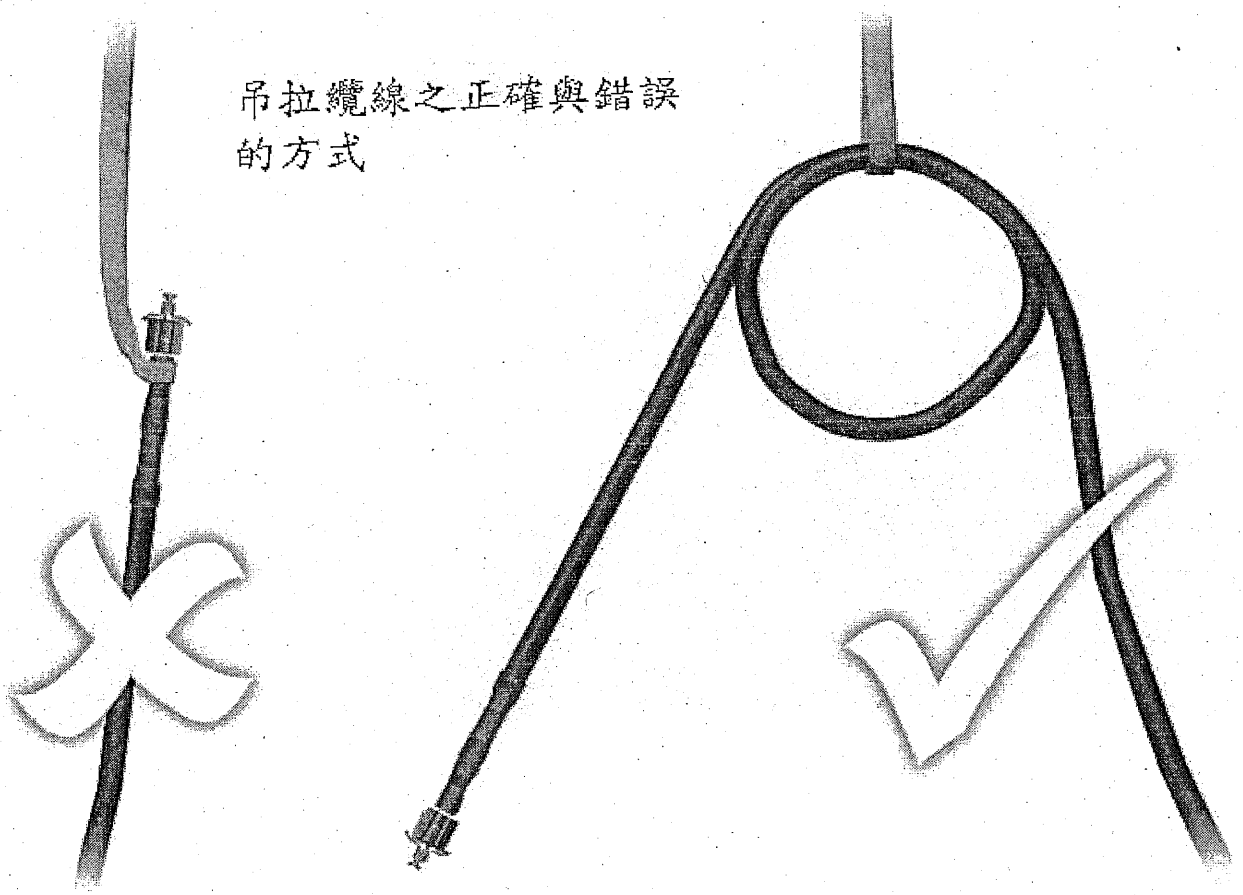


圖 11

HVSC 下導體之餘隙孔

在將 HVSC 下導體穿過任何餘隙孔之前須確保：

- 孔圈之直徑至少為 60mm (2 又 3/8 吋)。

- 須提供足夠的保護使 HVSC 下導體在安裝期間與安裝後都不會受損。
- 若該孔圈須為防水時須採用防水封膠或密封套襯 gland。

佈線配置

HVSC 下導體之佈線配置須遵守這些指導綱要：

- HVSC 下導體之佈線配置須如同其在初始設計時，確保沒有結構上的變更(如已有安裝了新的天線或桅桿、空調用冷卻水塔、導管等)。
- 在改變方向後不可以使 HVSC 下導體變成背貼背，亦即成 180 度角。
- HVSC 下導體可被安裝在建物之內部與外部。
- HVSC 下導體須盡可能靠近(貼平)到建物。
- 使彎曲之次數減到最少且採用最直接的路徑到地面。
- 使 HVSC 下導體受到之應力降到最低。
- 確保最小之彎曲半徑大於 500mm (20 吋)。
- 與其他公共服務採平行之佈線配置，最小間隔距離兩米，請參看第二十頁上之圖 12。
- 若 HVSC 下導體必須跨過其他公共服務管線(例如：電力、電信線路時)，確保其導管以直角跨過，且該導管須超過公共服務管線的每一側一米以上。
- HVSC 下導體之底部末端其終端束紮處須盡量靠近雷擊接地之初始灌入點。
- 在 HVSC 下導體之頂部末端須確保有足夠之鬆弛度，以便連接到 Stormaster ESE 放電式避雷針端子，且能豎起桅桿。
- 若須讓 HVSC 下導體與建物絕緣隔開時，將纜線穿入絕緣導管，其管壁厚度 3mm (1/8 吋) 與建物絕緣隔開之最大。

長度須為 2.5 米(9 呎)，HVSC 下導體之整體長度不可都穿入該絕緣導管內。

- 自地平面起不超過二米之段落須安裝管狀外罩覆蓋(top hat mount cover)使 HVSC 下導體之底部末端免於受損。

HVSC 下導體若於安裝期間受損時須由 LPI 公司之代表執行檢查，探視該損傷是否會影響到其功能表現。

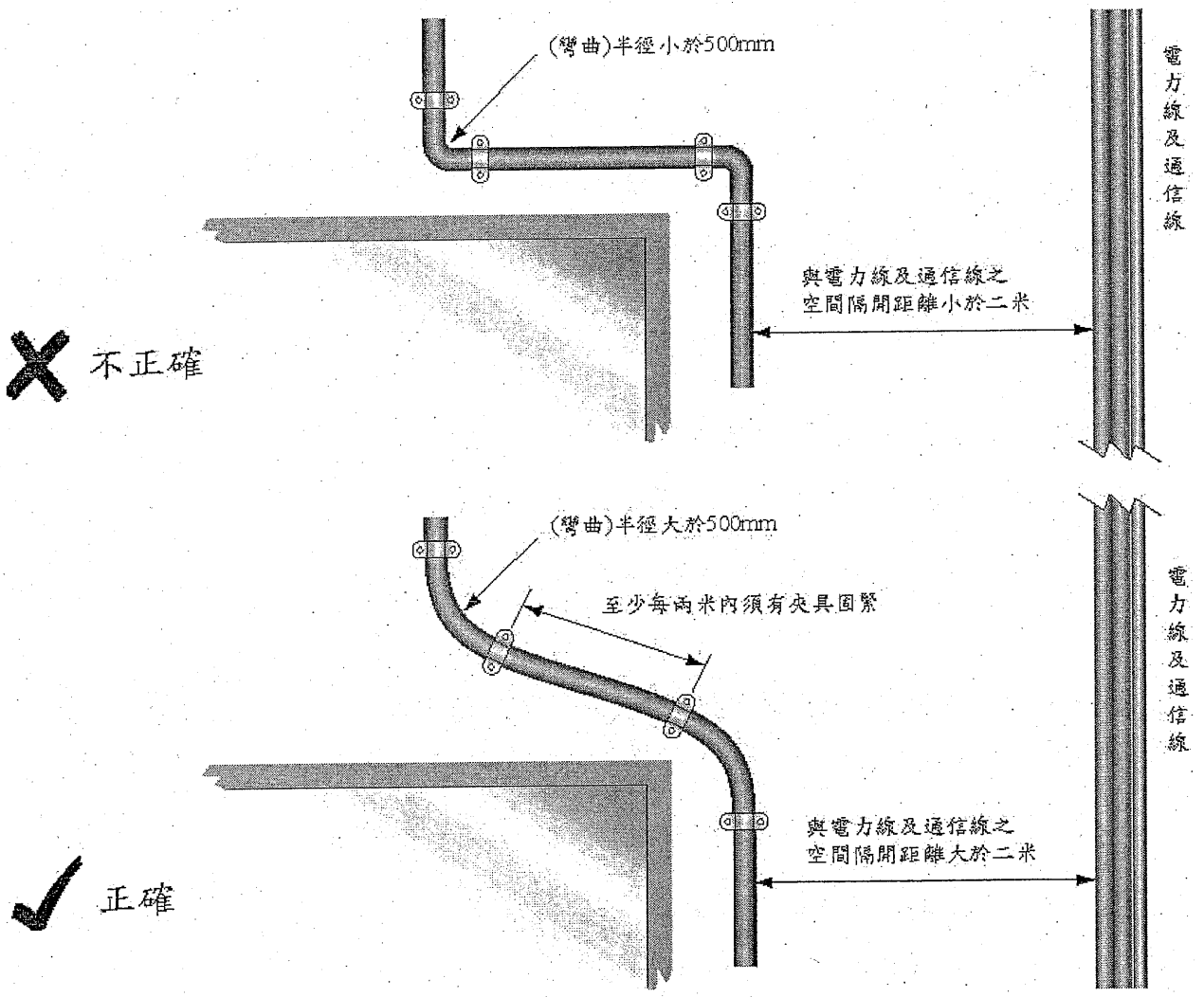


圖 12

高電壓遮蔽電纜 HVSC 下導體之固緊

若採用非屬 LPI 公司之鞍架可能會使下導體之外側鞘套受到損害。

- 高電壓遮蔽電纜 HVSC 下導體整個長度全程都須每隔二米固緊在建物上，採用 LPI 公司供應或建議之鞍架、固定夾具與纜線之綑綁帶。
- 磚瓦牆壁或屋頂採用 LPI 公司供應之鞍架，這些鞍架可以與磚瓦之固定錨，適用於木頭、玻璃纖維與金屬表面之紮緊帶，或自攻螺絲共同使用。
- 建議採取最直接到地之路徑避免尖銳之彎曲(參看第十二頁之 HVS-1)。
- 要固緊到圓形的部分上(如管子、塔腳、桅桿等)時採用纜線之綑綁帶。
- 若高電壓遮蔽電纜 HVSC 下導體要將其佈線配置在暫時替代的天花板時，要確保其已被固緊在鋼筋混凝土樓板層 slab 的下側。
- 在 LPI 公司之鞍架或高電壓遮蔽電纜 HVSC 下導體上都不得採用具爆炸性之綁緊方法。

傳統下導體之安裝

在某些安裝中採用銅帶或絕緣之絞銅線可被當作下導體進行安裝，在此狀況下，可能須安裝多條之下導體才可符合當地標準及或國際標準(NF C 17-102、AS1768-2007、BS 6651、IEC 62305)，進一步之資料請參看下列有逗點之文句。

Stormaster ESE 放電式避雷針端子有提供一個螺栓以讓夾耳套片 lug 作連接，連到桅桿最底部轉接器之下側避雷針尖連接器，傳統下導體全部都須依據第二十二頁圖 13 以夾耳套片紮束在一起並固定到端子處。

下列各款為在安裝傳統下導體時須考量之建議與要點：

- 在建物之每個外部角落處須安裝下導體，且每隔不超過二十米距離就須安裝額外之下導體。
- 建議採取最直接到地之路徑並避免尖銳之彎曲度。
- 下導體須沿著建物之外牆進行安裝，不建議將下導體安裝在建物之內側。

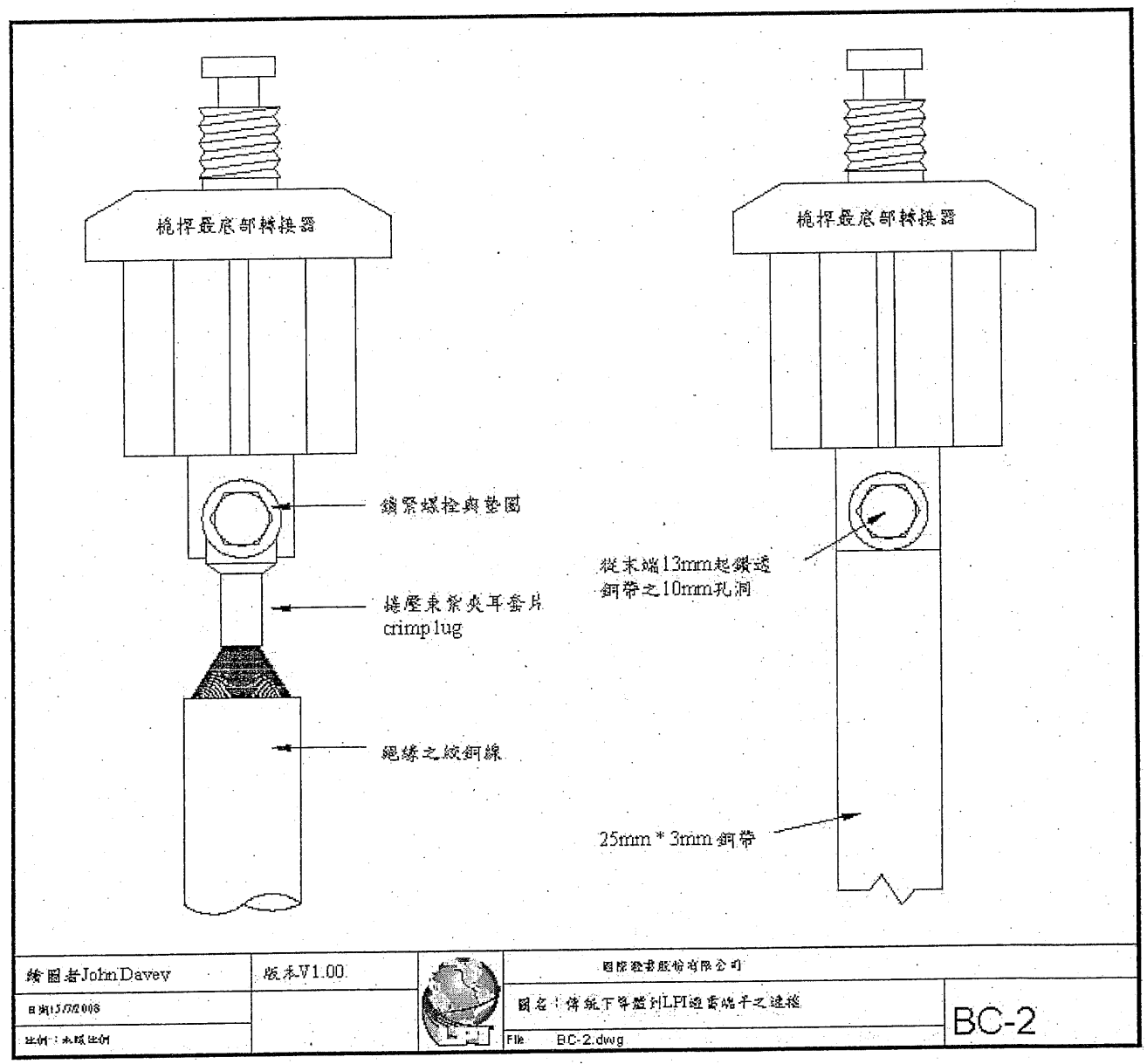


圖 13

- 不建議將下導體安置在人員常會集結之區域。
- 任何伸展之金屬垂直穿過建物時，都須在建物之頂部與底部搭接到雷擊專用下導體。
- 每一條下導體都須連接到接地系統。
- 實務上可行時建物內之鋼骨結構與鋼筋須依據國際標準之建議的間隔距離全部搭接到下導體系統。

- 建議採用銅線且其截面積不得小於 35mm 平方，此外遵照絕大多數國際標準是准許採用 PVC 銅線、裸鋁線、不鏽鋼來當作下導體。
- 建議銅導線之尺寸為 25mm * 3mm。
- 銅須採通常用在商業電力工程的等級。
- 須有適當的綁緊帶使全部的下導體都妥適地穩固。
- 下導體水平拉伸時每不超過一米，垂直拉伸時每不超過二米就須綁緊。

將 Stormaster GI 避雷端子安裝到有攻牙螺紋的管子內

LPI 公司提供的 Stormaster 避雷端子的系列產品中有 GI 的版本，設計可採已攻牙螺紋之連接，連接到二吋之 BSP(英國標準管子)GI 管子，進一步之資料請參看圖 10 的 STA-05 及圖 11 的 STA-06 並與圖 14 共同參照。

Stormaster GI 避雷端子附有一個已攻牙螺紋之轉接器(母牙螺紋)固定到端子上且設計好用來連接到 2 吋的管子(公牙螺紋)。

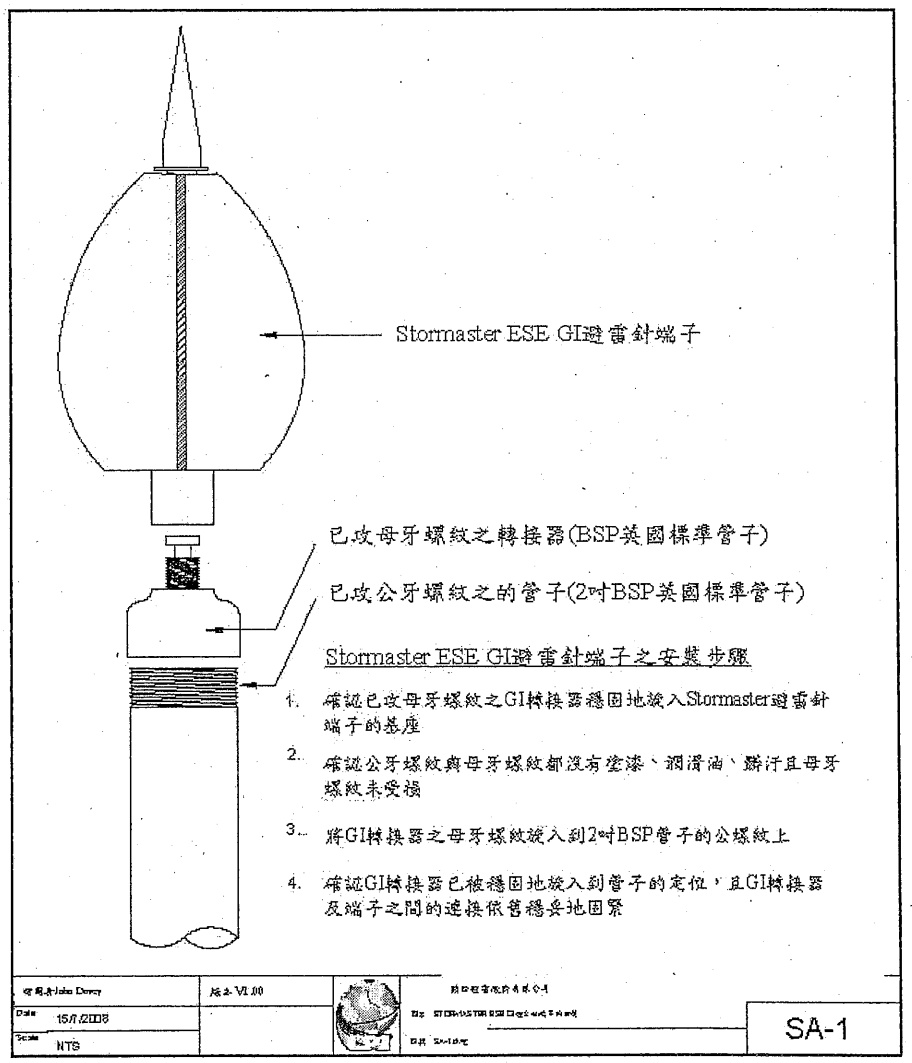


圖 14

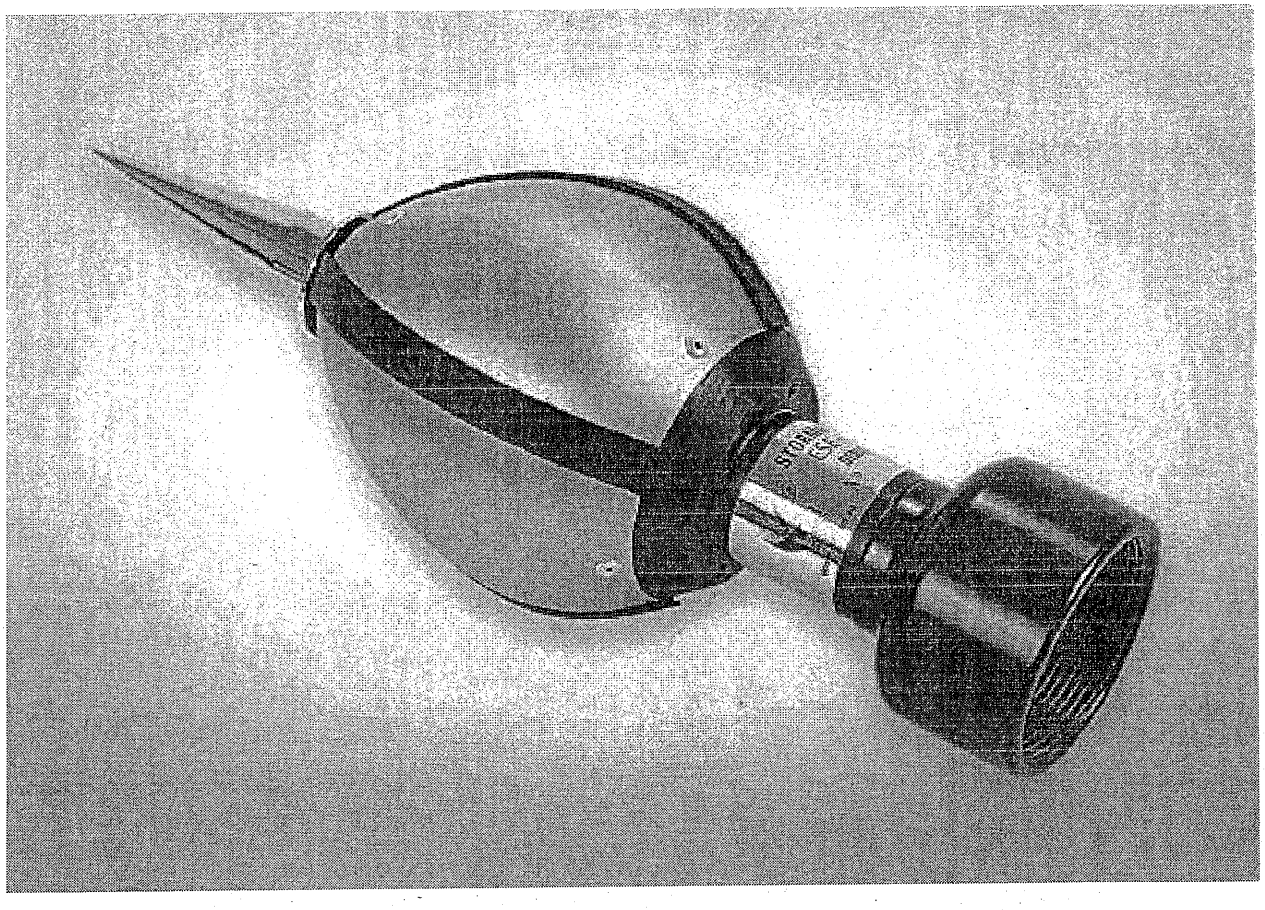


圖 15

- 依據圖畫 STA-05 與圖 14 將 Stormaster GI 避雷針端子安裝到已攻牙的管子上，然後就須將金屬管連接到傳統式下導體，以便將雷擊能量輸送到接地系統。

- 金屬管與傳統式下導體之間的連接最理想的做法是沿著管子的長度上之可行的點，將下導體以束紮夾耳套片或熱熔焊接(LPI EXOWELD)到其上。

- 將下導體連接到金屬管上時須特別注意確保採用相匹配之金屬。

- 傳統式下導體之安裝的細節請參閱第二十一頁標題為傳統式下導體之安裝其中細述之說明與意見。

高電壓遮蔽電纜 HVSC 底部末端進行終端處理(termination)

要完成高電壓遮蔽電纜 HVSC 底部末端之終端處理需要的工具如下：

- (95mm 平方之壓捲束紮耳狀片用的)壓縮或機械式壓捲工具。
- 銳利的刀子。
- 螺絲起子兩支(用來作摩擦式切割工具之把手)。
- 活動板手。
- 軟尺(精密度：公分)。

HVSC 底部末端之終端處理套件包括：

防水膠帶一捲。

95mm 壓捲束紮耳狀片一具。

警告貼紙二片。

接地夾具一件。

將絕緣以摩擦切割開之工具一件。

下列步驟列出大綱，高電壓遮蔽電纜 HVSC 底部末端進行終端處理連到雷擊接地。

內側與外側屏蔽用銅線都須連接到接地系統。

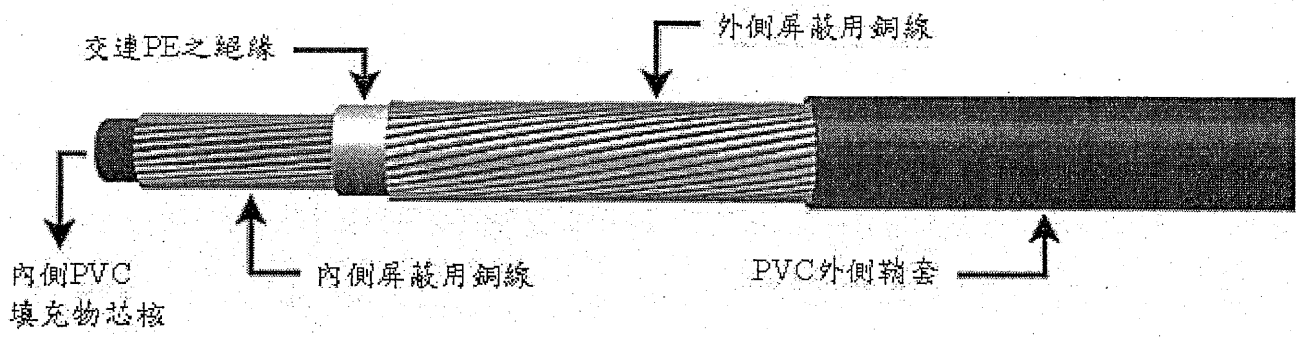


圖 16

1. 利用所提供之將絕緣以摩擦切割開來的工具，自高電壓遮蔽電纜 HVSC 的底部末端起，以輻射狀切割，移除掉長度 15 公分之外側鞘套(此方法比起用銳利刀子輻射狀切割法較不容易會損害到各條銅線)，沿著長度方向上之切割則可用刀子完成。

2. 自高電壓遮蔽電纜 HVSC 的底部末端起長度 15 公分之(第二層)透明夾束膠帶須移除掉，以使外側屏蔽銅線暴露出來，如圖 17 所示。

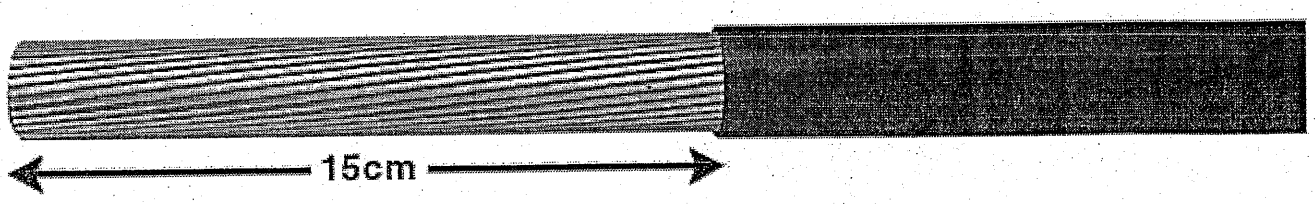


圖 17

3. 將外側屏蔽銅線折彎向外但不可傷到該些銅線，自高電壓遮蔽電纜 HVSC 的底部末端起長度 5 公分，移除第四層的交聯 PE，以及第五層的內側夾束膠帶，以使內側屏蔽銅線暴露出來，要確保在此步驟時不可連同外側屏蔽銅線也移除掉，此步驟建議採用將絕緣以摩擦切割開來的工具。

4. 將內側屏蔽導線彎回來但不可傷到這些導線，自高電壓遮蔽電纜 HVSC 的底部末端起長度 5 公分，移除在內側屏蔽導線下方之內側 PVC 填充物芯核，內側屏蔽銅線須仍留在原位不動。

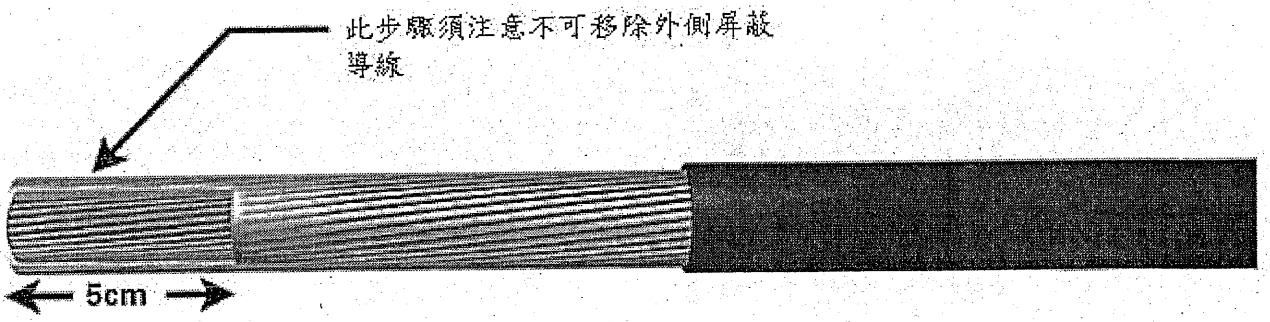


圖 18

5. 將內側與外側屏蔽導線都綁在一起，若依據圖 21 直接連接到接地系統時，綁在一起的導線須被連接到接地棒之夾具，該夾具須夾緊使導線都穩妥地被夾在定位，要避免此連接點氧化採用該組件內提供之防水膠帶將該連接點密封起來。

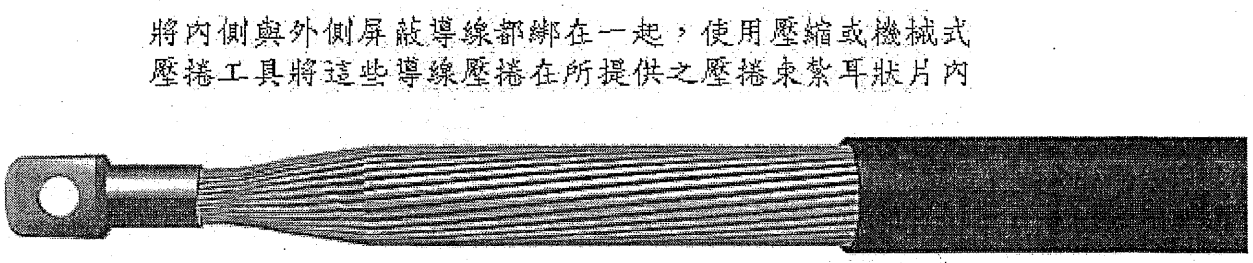


圖 19

6. 若將高電壓遮蔽電纜 HVSC 之底部末端進行終端處理，連接到匯流排(bus bar)時，須依據圖 20 將內側及外側屏蔽導線綁在一起，且以壓縮或機械式壓捲工具，將之壓捲入所提供之 95mm 平方之壓捲束紮耳狀片內且連接到匯流排。

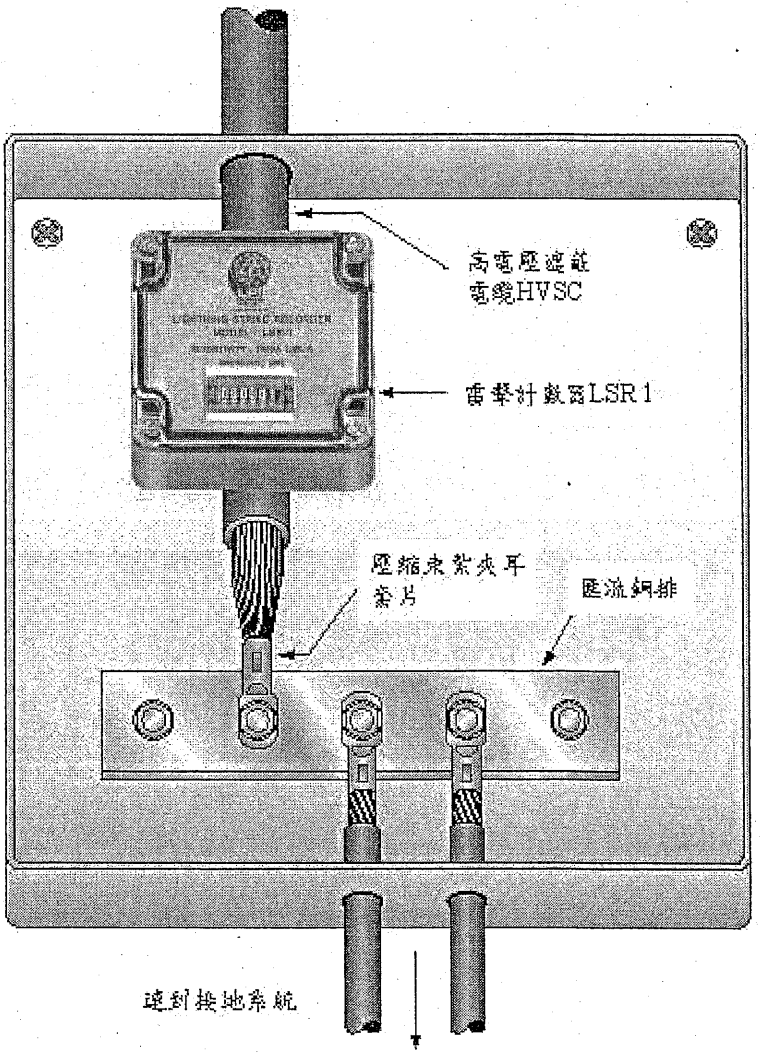


圖 20

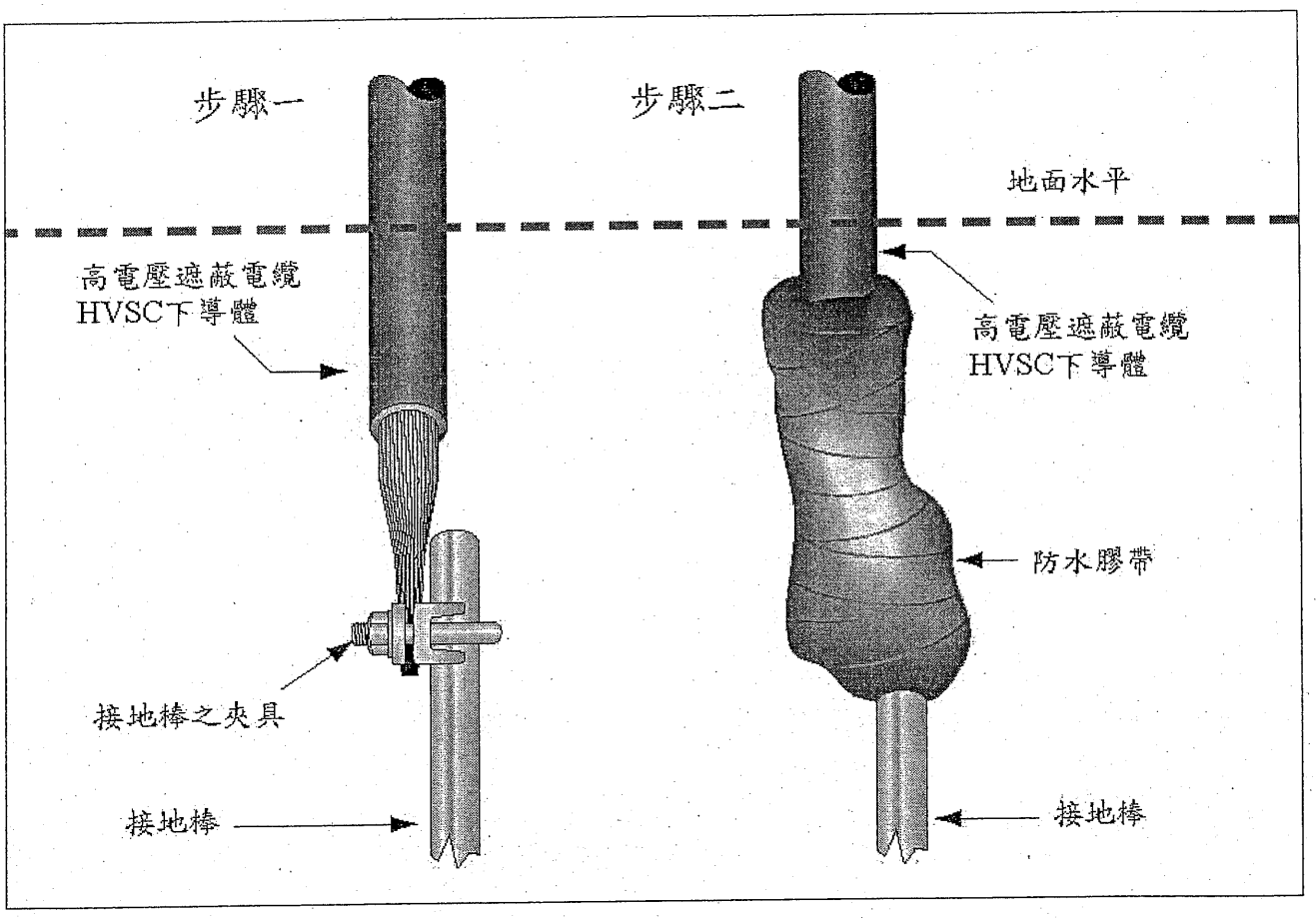


圖 21

傳統式下導體之底部做終端處理且連接到雷擊接地

- 若安裝絞銅線作為下導體時則須透過採用接地棒之夾具，將下導體之底部末端連接到雷擊接地，然後用防水膠帶將其包紮起來以防止氧化。
- 若安裝 25mm * 3mm 銅帶作為下導體,則須採用適當的接地棒之夾具將其底部末端直接連接到雷擊接地，然後用防水膠帶將其包紮起來以防止氧化。

高電壓遮蔽電纜 HVSC 之頂部末端的終端處理

要完成高電壓遮蔽電纜 HVSC 之頂部末端的終端處理所需的工具與零件包括：

- (50mm 平方之壓捲束紮耳狀片用的)壓縮或機械式壓捲工具。
- 銳利的刀子。
- 十字頭螺絲起子。
- 活動板手或 14mm 之固定板手/底座 socket。
- 螺絲起子兩支用來作摩擦切割工具之把手。
- 熱熔槍或(液態石油氣 LPG)瓦斯噴槍。
- 軟尺(精密度：公分)。
- 麥克筆(奇異筆)或筆。
- 鉗子/斜口剪。
- (隨同 Stormaster 避雷針端子一起供應之)終端之基座的組件。

高電壓遮蔽電纜 HVSC 之頂部末端的終端處理之套件包括：

- 說明書。
- 半導電之膠帶：一捲。
- 壓捲束紮夾耳套片 50mm 平方：一個。
- 熱縮套管 1.5 (長度 1200mm; 600mm 各一)。
- 以摩擦切開絕緣之工具。
- 絕緣膠帶一捲。

UTERMKIT-Mk2(熱縮式)頂部做終端處理之說明書

在下一頁(圖 22)上的圖案展示高電壓遮蔽電纜 HVSC 之各層且顯示其名稱，此均為下列說明事項中會參照到的：

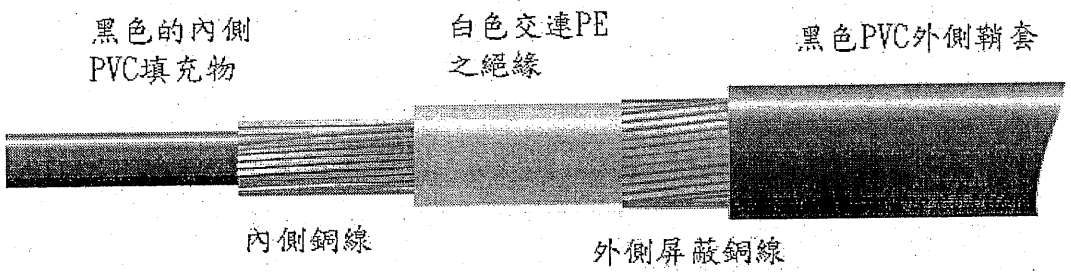


圖 22

1. 首先利用所提供之將絕緣以摩擦切割開來的工具，以輻射狀切割移除掉長度 165 公分之黑色 PVC 外側鞘套(此方法比起用銳利刀子輻射狀切割法較不容易會損害到各條銅線)，沿著長度方向上之切割則可用刀子完成，但須非常小心不可使白色交連 PE 之絕緣產生刮槽，順便將銅線上之透明的塑膠包層。
2. 量測外側屏蔽銅線，且在黑色 PVC 外側鞘套末端上的三公分處做記號(圖 23)，用切割器小心地割斷並移除電線，同樣地不可損害在其下方之白色交連 PE 絕緣。

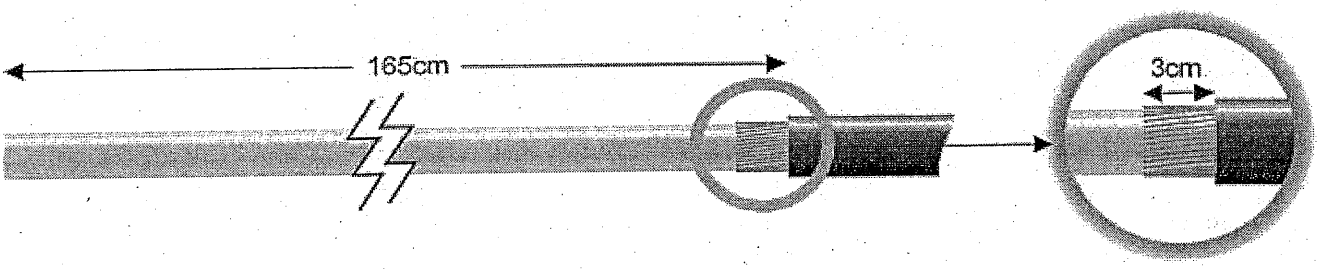


圖 23

3. 利用所提供之將絕緣以摩擦切割開來的工具將白色交連 PE 之絕緣移除掉，以讓內側銅線暴露出(自 HVSC 頂部末端算起)長度 5 公分(圖 24)，同時將銅線上方之透明塑膠包層移除掉。
4. 將內側銅線摺疊回來使填充物芯核暴露出來然後用刀子切割並移除之，以移除內側銅線下方之黑色內側 PVC 填充物芯核，將內側銅線回復到原位(圖 24)

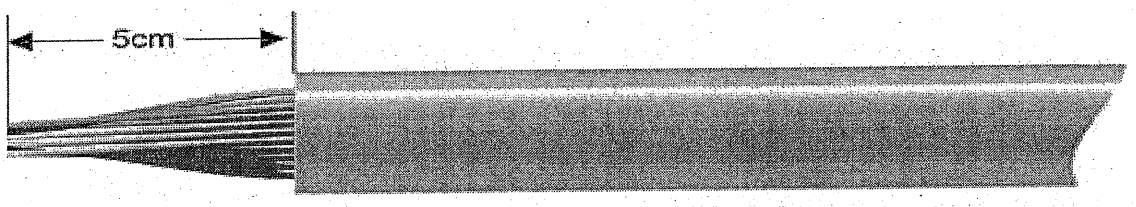


圖 24

5. 盡可能地將 HVSC 電纜理直回到黑色 PVC 外側鞘套，然後利用適當之壓窩或機械式壓捲工具，將內側銅線壓捲入(隨附提供之)50mm 平方之壓捲束紮夾耳套片中(圖 25)。

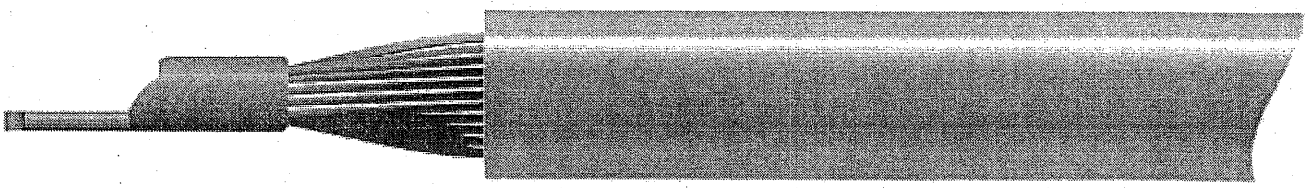


圖 25

6. 使用(隨附供應之)螺栓及墊圈將壓捲束紮耳狀片連接到 Stormaster 避雷針端子之基座組上，利用 14mm 之板手底作容器或活動板手以確保該連接正確地理順平行(圖 26)。

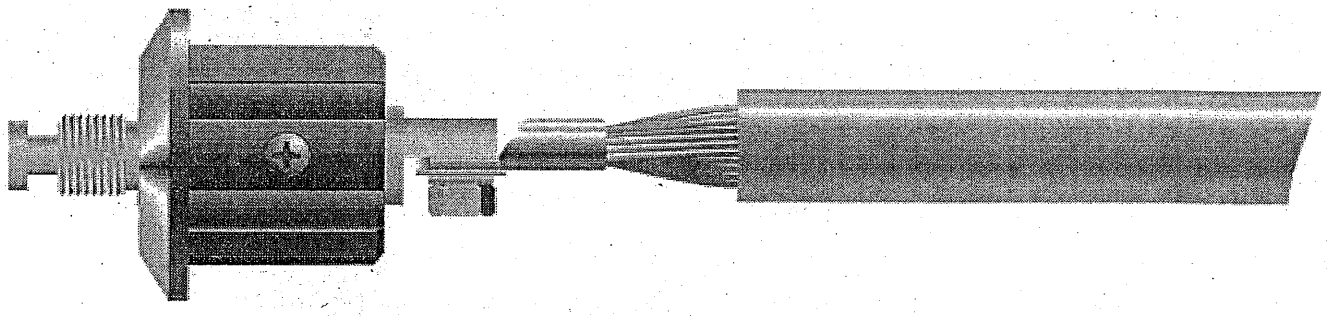


圖 26

7. 在外側屏蔽銅線之末端與壓捲之間，在白色交連 PE 絕緣用奇異筆或筆每隔 30 公分做標記，此在用半導電之膠帶朝向壓捲處以粗略之螺旋狀作包裹時可作為指引(圖 27)。

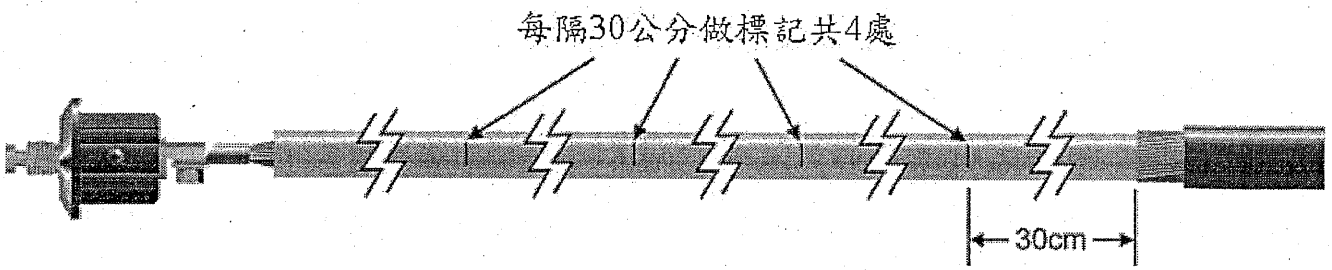


圖 27

8. 採用隨附提供之半導電的膠帶自外側屏蔽銅線之末端的前方處 2 公分(或黑色 PVC 外側鞘套之前方 5 公分處)起，將膠帶拉伸並包裹回電線上，且在黑色 PVC 上 3 公分重疊 50%，使外側屏蔽銅線穩固在定位，此時大約會用到 50 公分的膠帶(圖 28)。

備註：於此階段時絕不可以切割膠帶。

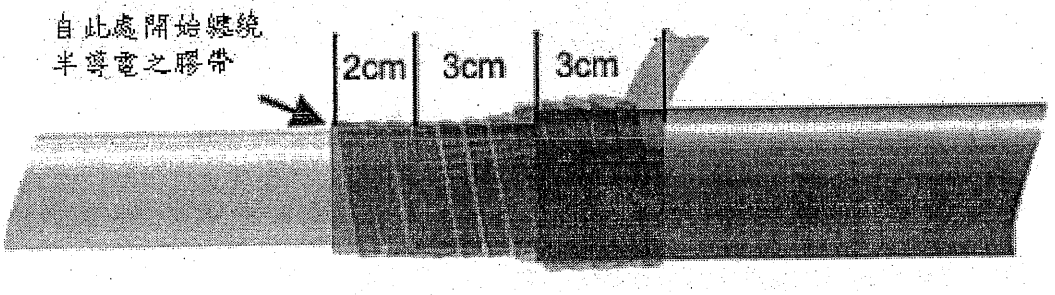


圖 28

9. 於向 HVSC 末端之壓捲處往回包裹時再次拉伸膠帶，且以 50%重疊留下 5 公分覆蓋住外側屏蔽銅線及白色交連 PE 之絕緣，且 3 公分覆蓋住黑色 PVC 外側鞘套，此會用到另外的 50 公分之膠帶，同樣地絕對不可以切割該膠帶(圖 29)。

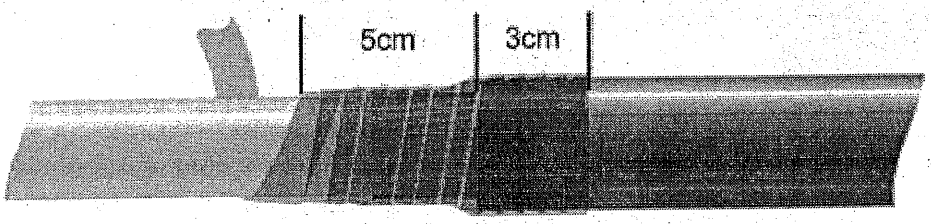


圖 29

10. 用 30 公分之標記作為指引，沿著白色交連 PE 絕緣以大略呈螺旋狀繼續纏繞該膠帶(自外側屏蔽銅線至壓捲處共五圈)，稍稍加點拉力以確保該膠帶不會太鬆弛。注意：要達到最佳功能表現該螺旋的定點繞距須平均(圖 30)。

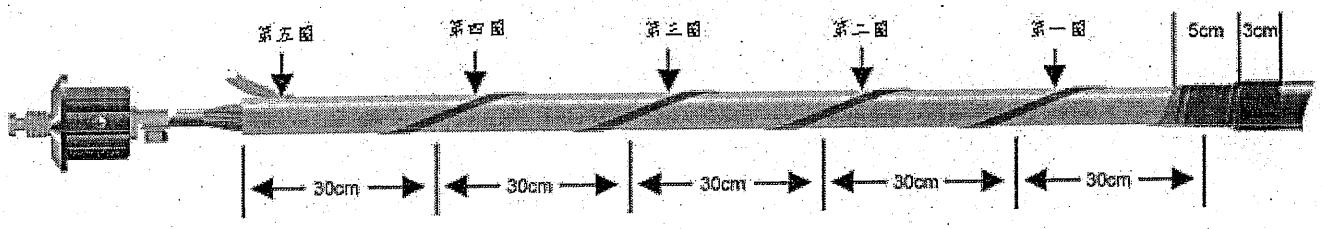


圖 30

11. 膠帶捲繞到壓捲處時開始將剩餘的膠帶拉伸，且採取 50%之重疊覆蓋住白色交連 PE 絕緣的最後 3 公分，從下方之銅質連接器直到避雷針端子基座組件的黑色塑膠部份，都做多重纏繞完全覆蓋壓捲處，且盡可能地滑順平整如在同一平面上，將尖銳的邊角都移除掉(圖 31)。

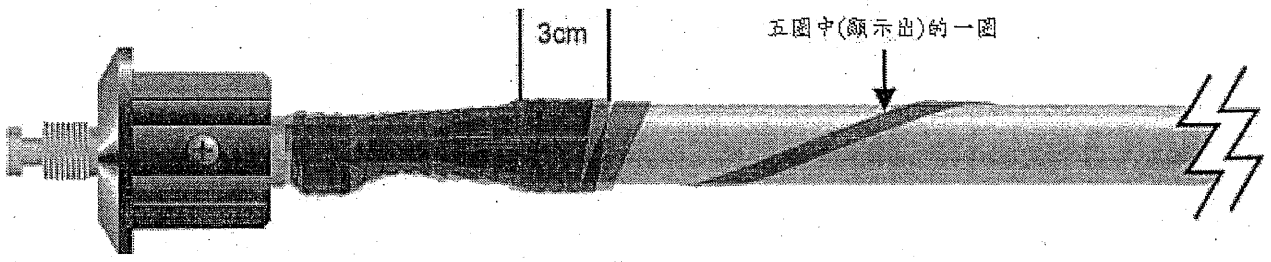


圖 31

12. 採用隨附供應之絕緣膠帶(或 50mm 之包裝膠帶)覆蓋住半導電膠帶之粗略螺旋之部分，以確保其在應用熱縮套管時仍會保持在原固定位置上，在此作業前首先覆蓋住膠帶的左半部，然後用第二段長度以覆蓋住膠帶之右半部，如此使螺旋的全長度都依此而能被覆蓋住(圖 32)。

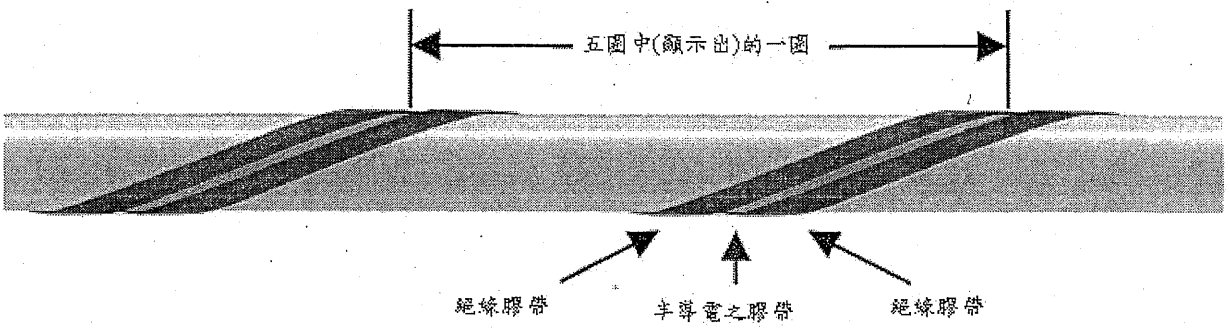


圖 32

13. 避雷針端子基座組件之塑膠的桅桿底部轉接器部分將側邊之 M6 十字頭螺絲旋鬆掉，同樣地將電纜盡可能地理直整平，且電纜上的熱縮長度最初之 1.2 米的部分須小心地略過，以確保半導電之膠帶不會受到影響，直到覆蓋住與重疊之(在黑色 PVC 外側鞘套上的)半導電膠帶的熱縮套管之末端要有 3 公分。(圖 33)採用瓦斯噴槍或熱熔槍將下部末端熱縮到正確位置，並逐漸地繼續做到熱縮之頂部為止。

備註：確保熱熔槍或瓦斯噴槍不可以對著同一區域太久，因為這會使熱縮套管燃燒，也同樣要注意套管末端之周圍，因為太熱會損害到黑色 PVC 外側鞘套、半導電膠帶及白色交連 PE 絕緣。

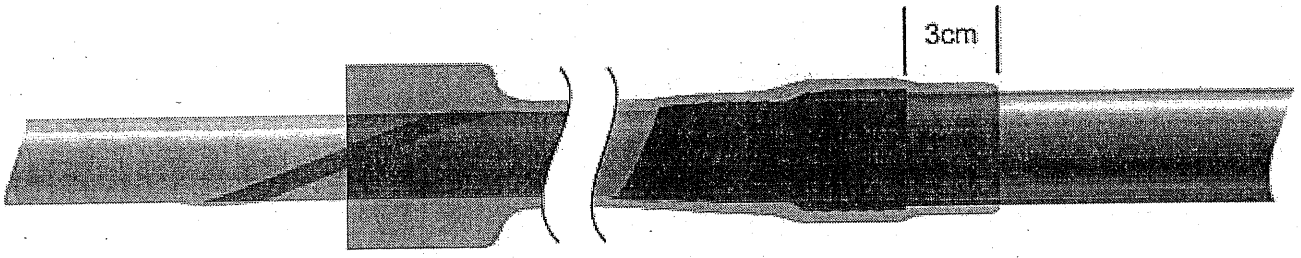


圖 33

14. 將第二個 600mm 之熱縮套管放進電纜上之位置，同樣地確保半導電之膠帶沒有受損，在之前的熱縮套管上重疊至少 3 公分，將熱縮套管之頂部末端約 7 公分熱縮到定位，以便在將塑膠桅桿底部轉接器固定回定位時熱縮套管與該轉接器之底座可在同一平面上。
繼續熱縮剩下的熱縮套管，確保其與熱縮套管之前面的部分至少重疊 3 公分(圖 34)，確保熱縮套管的剩餘部分整體外觀都能平順。備註：若有需要時，透過桅桿之部分與導索環饋送該電纜，將避雷針端子基座組件之塑膠桅桿底部轉接器重擺回到銅質連接器上，且確保 M6 之十字頭螺絲已被旋緊固妥。

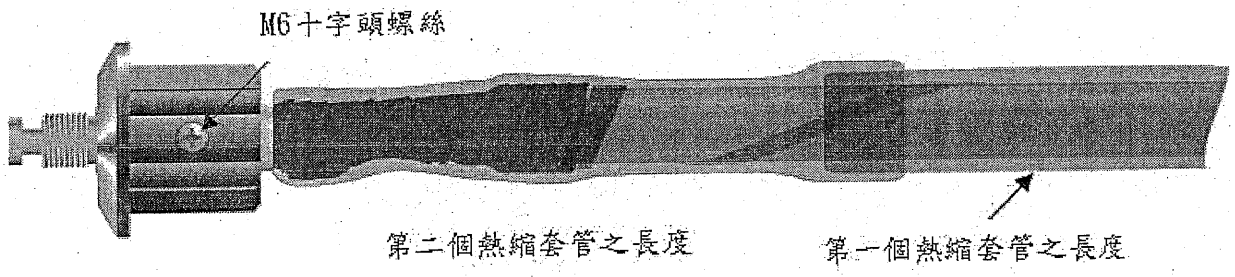


圖 34

15. 已採束紮耳狀片之 HVSC 現在已可以被連接到 Stormaster 避雷針端子上，將該端子旋緊到已完成之端子基座組件上，且用隨附供應之 M6 鎖到底 grub 螺絲加以固緊。

電壓遮蔽電纜HVSC之上部末端連接到Stormaster的避雷針端子

要安裝廠內已完成之頂部終端所需要之工具包括：

- 銳利的刀子。
- 中型的十字頭螺絲起子。

1. 首先將電纜及頂部終端處理好的末段部分之保護包裝移除，在此過程中要小心不要切到電纜或附屬的頂部終端。
2. 將(若有固緊者)桅桿底部轉接器固定在下方連接器的 M6 十字頭螺絲用十字頭螺絲起子將之移開，且保留好該螺絲與桅桿底部轉接器。
3. 將 HVSC 電纜饋送穿入 FRP 之支撐桅桿內。
4. 黑色塑膠桅桿底部轉接器將之滑回到下方銅質連接器上，孔洞對齊並將十字頭螺絲緊緊地鎖回到定位，現在將桅桿底部轉接器鎖入 Stormaster ESE 避雷針端子，且將端子底座之 M6 鎖到底 grub 螺絲旋緊以鎖住整個組件。

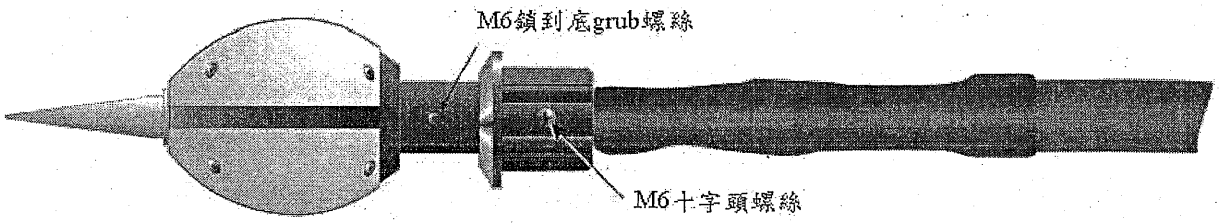


圖 35

標示

警告標示標籤有隨同 Stormaster ESE 避雷針端子提供，且須依據下列規定予以安裝：

- 人員可能在高電壓遮蔽電纜 HVSC 下導體鄰近處的場所。
- HVSC 下導體連接到接地系統之地點。
- 在支撐桅桿的基座。

本說明書的前首頁內有提供兩個警告標示標籤，另有兩個警告標示標籤在底部終端組件內，若需要更多標示標籤請與最鄰近之 LPI 供應商或經銷商連繫。

桅桿

被選作桅桿者須：

- 可將避雷針端子抬昇到超出建物 2 米(81 吋)以上(可接受之最小值)。
- 若採用 LPI 公司的 HVSC 時，在避雷針下方有用到 FRP 之桅桿部分須至少 2 米(81 吋)以上。
- 適合當地之氣候條件請向當地土木工程師尋求指引。
- 若有要求時需用導索穩固地附接到專用支撐點上。

桅桿組態之種類

要架設 Stormaster ESE 避雷針端子時通常有三種桅桿組態可供採用。

懸臂式

通常用於架設在高塔或工廠房間之側面牆因其不適合桅桿或基座時，參看 STA-02、STA-03、STA-05 之圖畫與圖 36。

- 桅桿整體高度的三分之一須固定在建物上，使其有適當之機械強度。
- 懸臂式桅桿可用導索以增加其強度，若有用到導索時可採導索環及/或直排耦合器上的小圓孔都可使用。

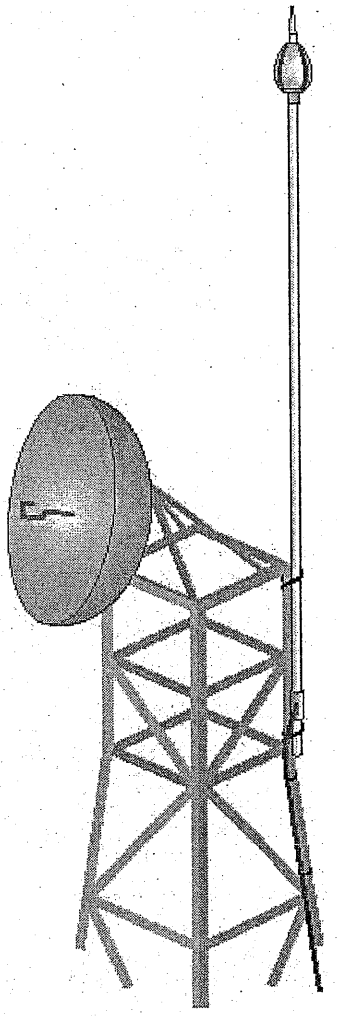


圖 36
懸臂式桅桿

有加導索固定者

當架設 Stormaster ESE 避雷針端子時，典型的導索之組態都會牽涉到下列情形，請參閱 STA-04 之圖畫與圖 37。

- 桅桿的兩個部分(鋁質桅桿與 FRP 桅桿)用直排耦合器耦合在一起，導索的固緊透過在直排耦合器上提供之小孔洞即可完成。
- 或可替代之方式，或可額外的作法，可提供導索環，安裝在桅桿的頸部介於 Stormaster ESE 避雷針端子與 FRP 的頂部之間，導索環有提供小孔洞以供導索之連接。

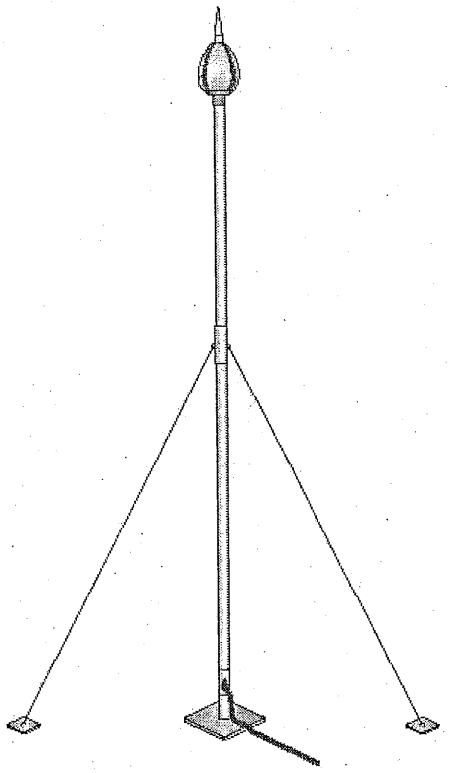


圖 37 有加導索固定者

自立式

自立式桅桿之組態，典型上用於需要靠絕緣來做保護之場合。舉例：Stormaster ESE 避雷針端子被安裝在距離燃料儲存槽五米以上，在安裝自立式桅桿之前須確保：

- 該自立式桅桿已有提供栓套管 spigot 使其可以讓 FRP 桅桿架設在外部或內部。
- 若架設在內部時下導體須可以從自立式桅桿的基座處穿出。
- 對桅桿的地基之需求有提供適當之資訊。

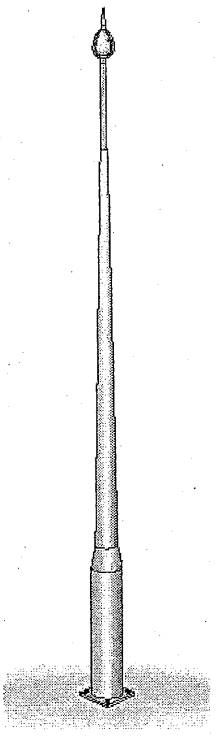


圖 38
自立式桅桿

桅桿之底座

LPI 公司供應之桅桿底座,有直接焊接到鋁質桅桿所需之長度上。

桅桿之耦合器與導索點

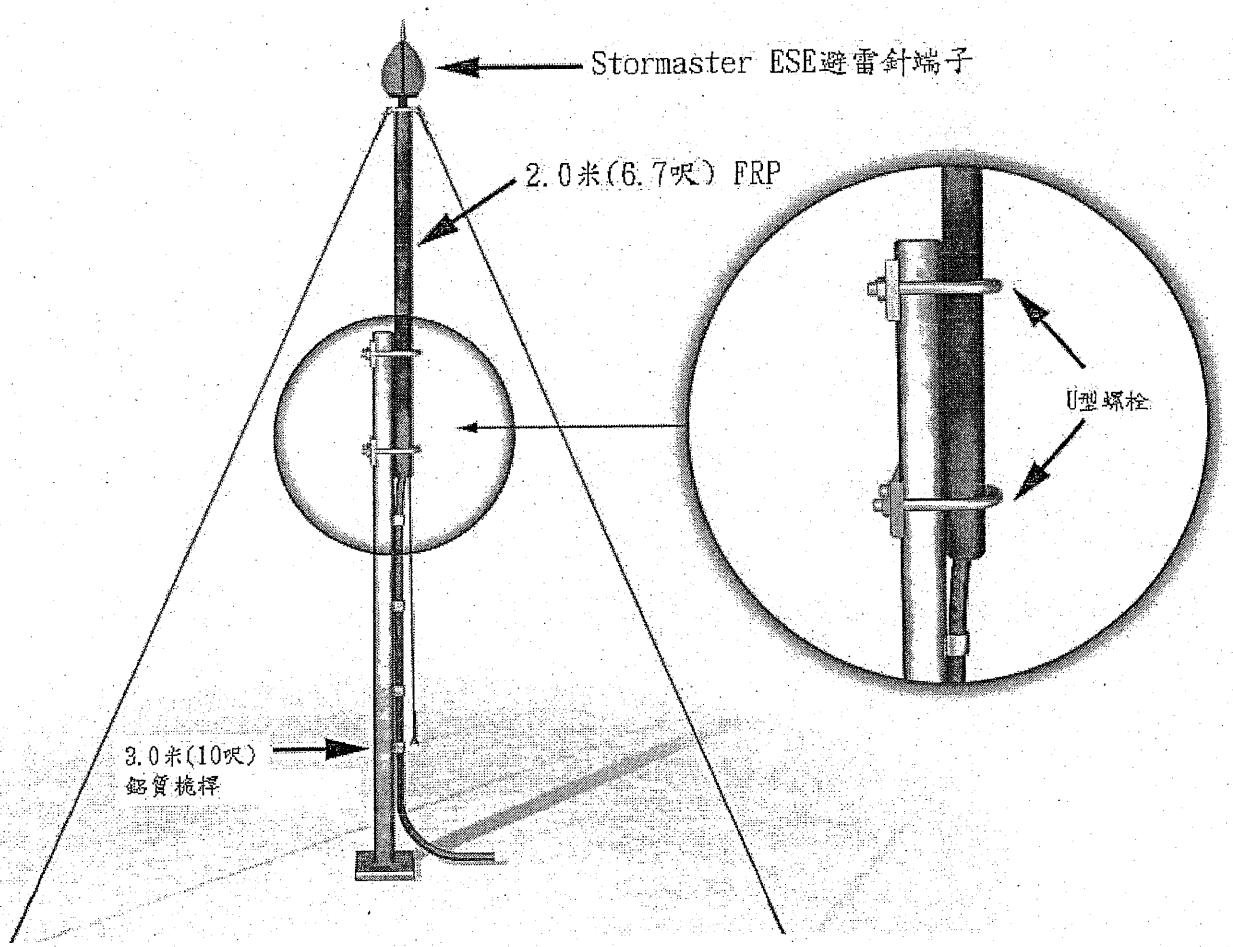
要耦合桅桿的兩部分有兩種方法：

1. U型螺栓套件採用兩個不銹鋼之U型螺栓，用來將兩個桅桿夾在一起(圖 39)。
2. 直排耦合器將桅桿之頂部與底部固定在一起，並為 HVSC 下導體提供導索點與穿出點。

U 型螺栓與直排耦合器的螺母必須鎖緊，但不能超過 55kg/cm (45in.lb)

有提供一個導索環可讓需要雙重導索之任兩片桅桿可以有導索點，此導索點位於避雷針端子之桅桿底部轉接器上，轉接器係介於 Stormaster ESE 避雷針端子與桅桿的頂端之間，參看圖 40。

圖 39



施加導索

LPI 公司有供應標準的 4 米(13 呎)與 7 米(22.75 呎)之導索套件組，係由輕量塑膠塗層之玻璃纖維、非導電電纜組成，LPI 公司之 GUYKIT-4M 與 GUYKIT-7M 都屬非導電導索套件組，設計用來在 FRP 桅桿之頂端部分採用導索環以安裝之，如圖 40 所示，當透過 LPI 公司直排耦合器來導索固定時，建議採用不銹鋼導索組件 GUYKIT-4M-SS、GUYKIT-7M-SS。

重要之建議：

- 導索之角度須自平面起算 60 度以上。
- 直排耦合器會將桅桿部分之頂部與底部耦合起來，並為 HVSC 下導體提供導索點與 HVSC 之穿出點。
- 每個導索末端至少須有 3 個導索夾把手 grip。
- 導索夾把手 grip 間隔至少 25mm (1 吋)。
- 導索夾把手 grip 之導向須正確一鞍架接在導索與(在導索尾側之)U 型螺栓之較長的一側。
- 拉緊的導索夾把手 grip 之扭力不可超過 60cN.m (5lbf.in)。
- 客製化之導索套件若有需求即可供應。

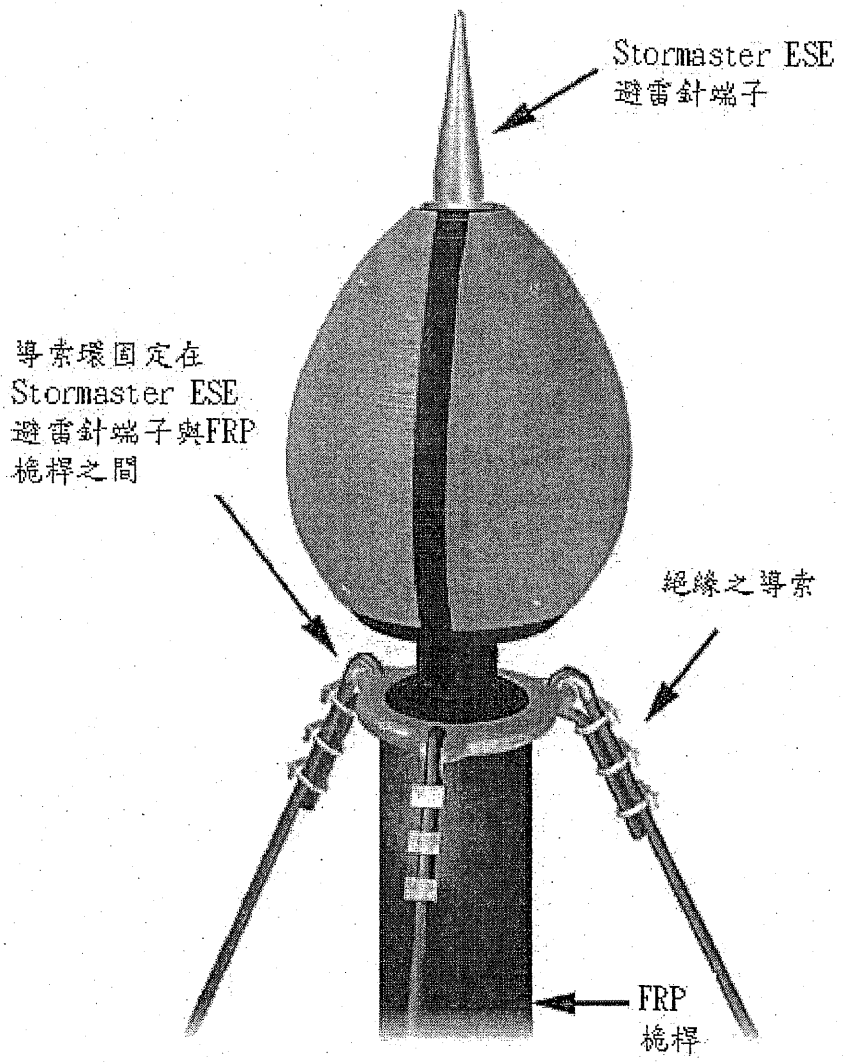


圖 40

將桅桿抬昇到定位之準備工作

隨著高電壓遮蔽電纜 HVSC 之頂部終端處理已完成且 FRP 桅桿已定位安裝好，現在就是完成架設安排的完成時機，以讓桅桿能被抬昇並穩妥地架設到定位。

- 若採用所建議之依據(第六、七、八、九頁上)STA-01、STA-02、STA-03 與 STA-04 之圖畫的安裝方法，將直排耦合器固定在底部的桅桿材料上。
- 若有需求時將 HVSC 下導體穿過直排耦合器之側邊穿入點，且穿過 FRP 桅桿，參照第四十二頁上之圖 42。
- 若有需求時將頂部終端處理饋送穿過導索環。
- 小心將 Stormaster ESE 避雷針端子的桅桿轉接器固定入 FRP 之頂部。
- 可能會需要將 HVSC 下導體穿過 FRP 支撐桅桿後，有鬆弛的部分拉回使 Stormaster ESE 避雷針端子可以緊密固定，此作業須小心地完成，避免損害到頂部之終端處理。
- 將 FRP 支撐桅桿穩妥地固定入直排耦合器內，且將耦合器拉緊使 FRP 桅桿與底部桅桿材料都能穩固在定位上，拉緊的力量不得超過 55kg/cm (45lb/in)。
- 若須安裝導索套件時導索必須穩妥地固定在直排耦合器上及或導索環上的小孔洞，請參閱標題為施加導索之圖文，內有更多資訊。

抬昇桅桿

當抬昇桅桿時須確保：

- 拉到直排耦合器及/或導索環之導索已適當地固緊。
- 導索沒有被扭曲、彎繞或受損。
- 在較低之導索的固錨點當桅桿被抬昇時導索可以很容易地固緊。

在導索之基座固錨點，建議採用(套筒螺母、螺絲扣 turnbuckle)或裝配鎖緊 rigging 螺絲。

諸如導電性不銹鋼等其他施加導索之方法，只有在 FRP 部份之下方為鋁質桅桿或直排耦合器才可採用。

任何東西高度超過 6 米(20 呎)者或危險區域或高區域，建議採用吊車(或其他適當之設備)。

- 在吊掛時要讓桅桿保持直立以免桅桿受損，這點非常重要。
- Stormaster ESE 避雷針端子絕對不可用做吊掛點。
- 在吊昇桅桿時要確保吊掛處或繩索不會損害到 Stormaster ESE 避雷針端子，如圖 41。

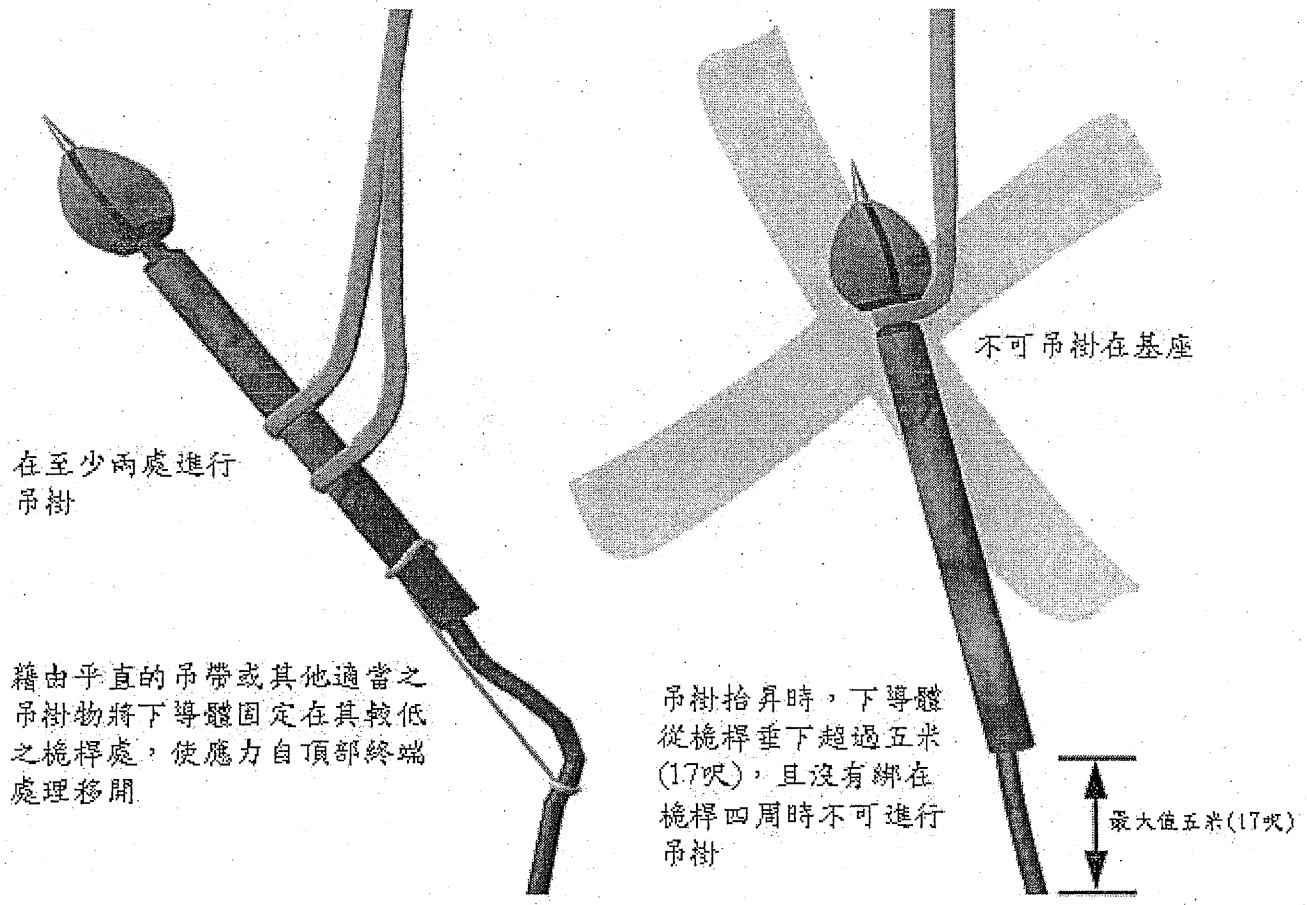


圖 41

- 當進行吊掛桅桿時 HVSC 下導體必須綁在桅桿四周，使 HVSC 下導體終端處理到 Stormaster ESE 避雷針端子上面的應力得以移除。
- 當進行吊掛時須保護在桅桿基座之 HVSC 下導體維持最小彎曲半徑在 500mm (20 吋)，且確保其不會被拉扯在粗糙或尖銳之表面上。

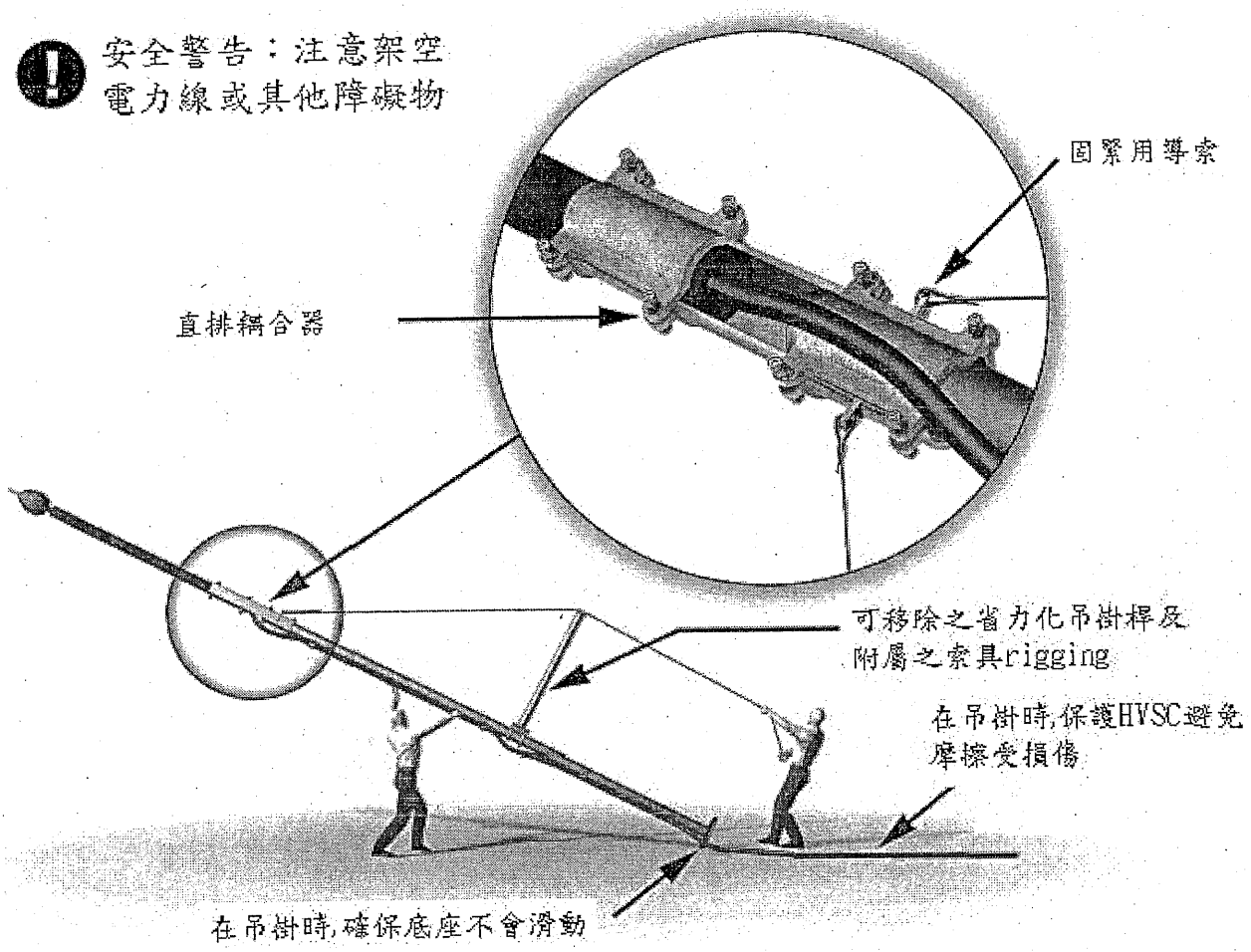


圖 42

雷擊計數器 LSR 1

雷擊計數器 LSR 1 安裝的位置須沿著下導體之長度做檢驗時很容易觸手可及的地方，通常安裝在大約離地面 1.5 米或可在接地坑箱內於 HVSC 較低的終端處理點。

當安裝雷擊計數器 LSR 1 時須考量下列事項：

- 雷擊計數器 LSR 1 必須架設在容易因偷竊、破壞公物或附近作業而受損之區域之外。
- 雷擊計數器 LSR 1 可被裝在保全箱內，但顯示器須保持可被看到，以便查核已記錄到的雷擊。

圖43
雷擊計數器LSR 1安裝
在HVSC下導體上

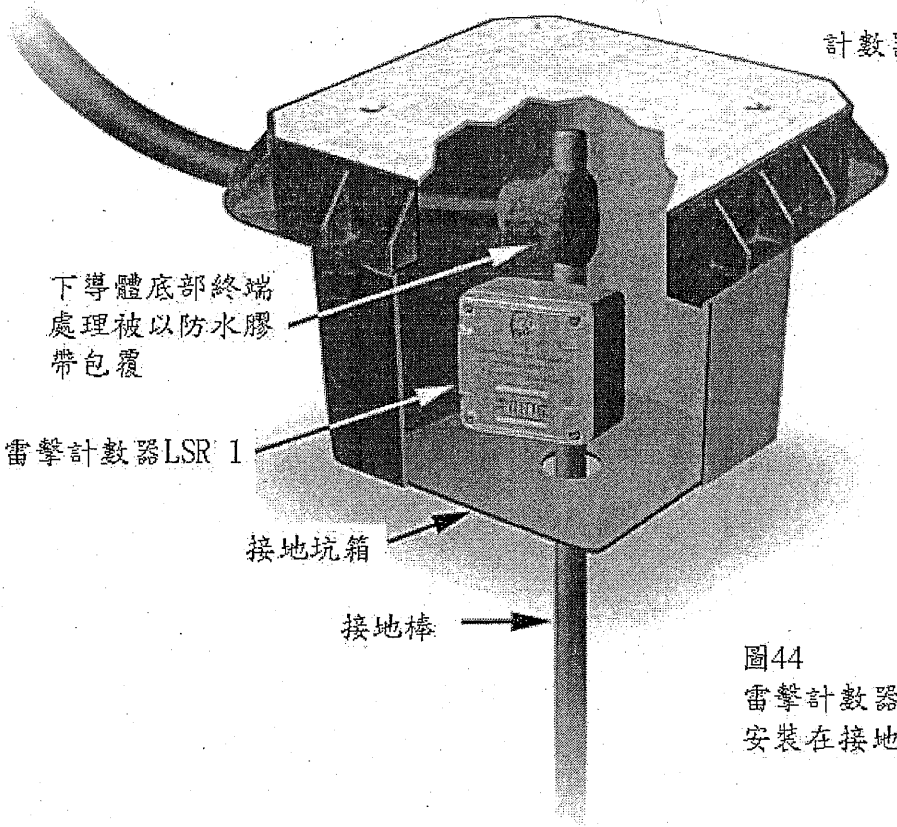


圖44
雷擊計數器LSR 1被
安裝在接地棒上

驗證

LPI 公司 Stormaster ESE 之安裝的驗證必須由經授權的 LPI 代表人員來執行。

符合性證書與保證書註冊登記單隨附在安裝說明書，本證書須於成功地對安裝進行檢查及驗證後完整地填妥。

要檢查工藝品質與建議之安裝說明是否已符合須檢核下列事項。

驗證查檢表(檢視清單)：

- 桅桿及任何附屬之支架及鎖緊連接件已被用於安裝者均為正確。
- 導索、固錨定位點鎖緊連接件。
- HVSC 下導體之佈線配置固定、耐候防風雨。
- HVSC 下導體之底部終端處理。
- 接地系統。
- 標示。

操作與維護

LPI 公司 Stormaster ESE 雷擊防護系統設計用來對存在於趨近中的雷暴內之電場上升能作出回應，Stormaster ESE 避雷針端子只有在雷暴活動期間才會有所動作。

- 該系統動作時不需要外部電源供應或標準動作時亦不需要備用零件。
- 要讓 LPI 公司 Stormaster ESE 雷擊防護系統能在最佳水準下動作，需要定期檢查下列情形下。

須進行維護檢查：

- 已知有雷打到避雷端子。
- 每隔 12 個月。
- 建物有變動更改時。

標準維護檢查中須執行之查核：

- Stormaster ESE 系統有受到任何損傷？
- 自上次維護查核後受保護之建物已有修繕？
- 查核避雷針針尖有無過度凹損。
- 檢查全部的鎖到底 rigging(螺絲)、桅桿支架、鞍架、導線固定器是否穩固緊實。
- 確保在避雷針針尖及環繞其間的鑲板條邊緣，兩者之間的空氣間隙內確保其沒有累積灰塵或其他物質。
- 若採用傳統式下導體，查核全部的下導體是否穩妥地固緊且未受損。
- 查核 LPI 公司 HVSC 是否受損，下導體不可被非經授權人員(或機械)接觸碰到。
- 全部的警告標示都還在定位。
- 查核雷擊計數器 LSR 1 是否穩妥地安裝並記錄下雷擊次數。

測試 Stormaster 避雷針端子

LPI 公司製造並供應避雷針端子電弧跳火測試器，適用於測試 Stormaster ESE 系列產品之端子，進一步之細節請與當地經銷商洽詢。

雷擊接地之測試與 HVSC 下導體之測試

下列步驟完成後採用第 47 頁之表格以記錄其結果之。

1. 從底部終端處理移除防水膠帶。
2. 將 HVSC 下導體從雷擊接地處斷接。
3. 將建物接地搭接之纜線與接地系統斷接。
4. 量測雷擊接地系統之接地電阻，並記錄在第 47 頁提供之表格內標題為接地電阻讀值之第三欄。
5. 量測建物之接地電阻並記錄在第四欄。

6. 重新將建物接地搭接纜線連接到雷擊接地並量測之，且將接地電阻讀值記錄在第五欄。
7. 採三用電表以量測 HVSC 下導體之內側與外側導線之間的電氣接續性，量測值須超過一萬歐姆。
8. 將 HVSC 底部終端處理再重新連接到雷擊接地，並採防水膠帶將終端處理重新密封以確保其具防水性。
9. 前述測試發現的任何問題向當地 LPI 經銷商報告，以尋求進一步之建議諮詢。

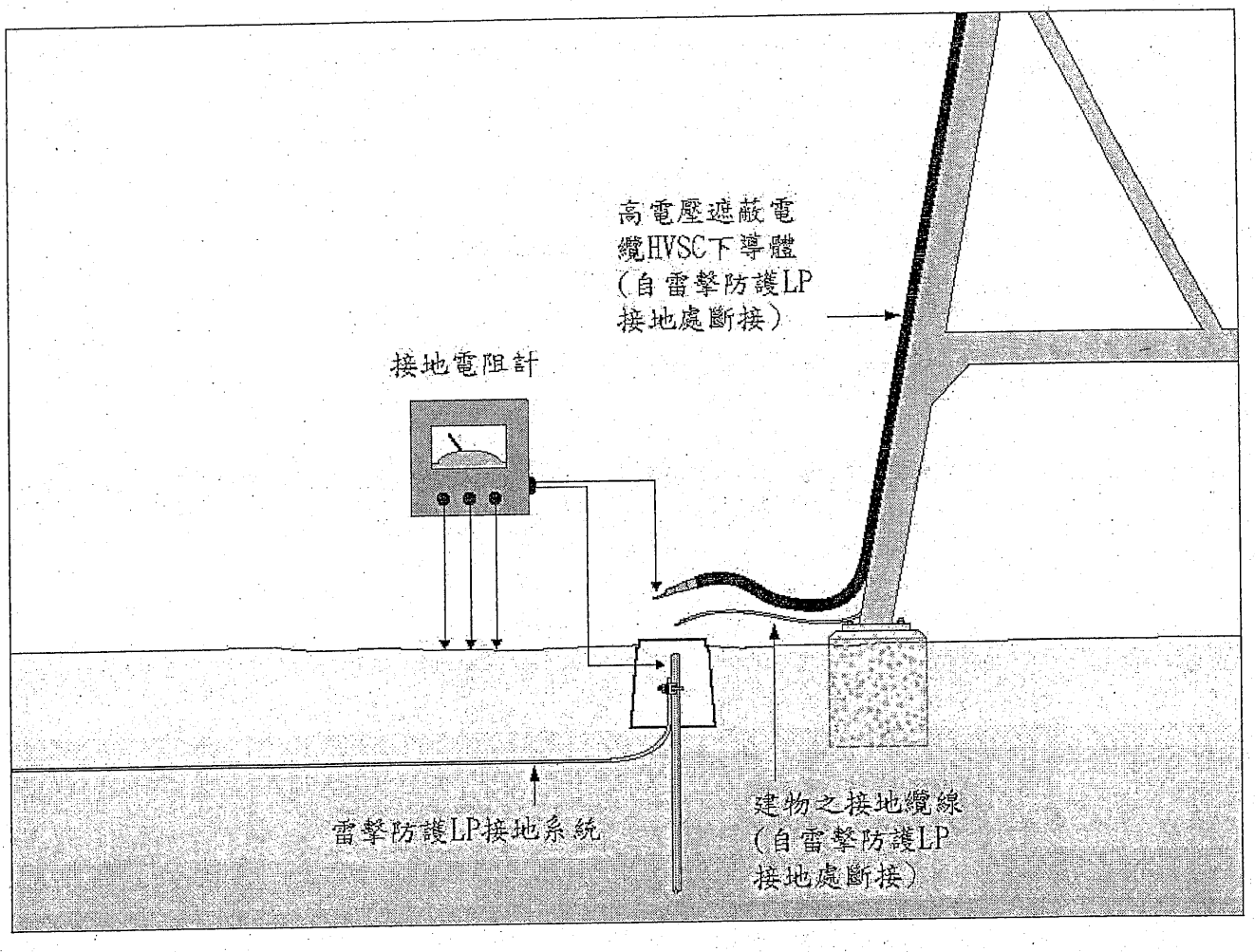


圖 45

檢驗日	檢驗者	接地電阻讀值#1	接地電阻讀值#2	接地電阻讀值#3	雷擊計數器LSR讀值	意見

安裝紀事 notes

後頁內側
(空白)

國際避雷 LPI 股份有限公司

統一編號:ABN 11 099 190 897

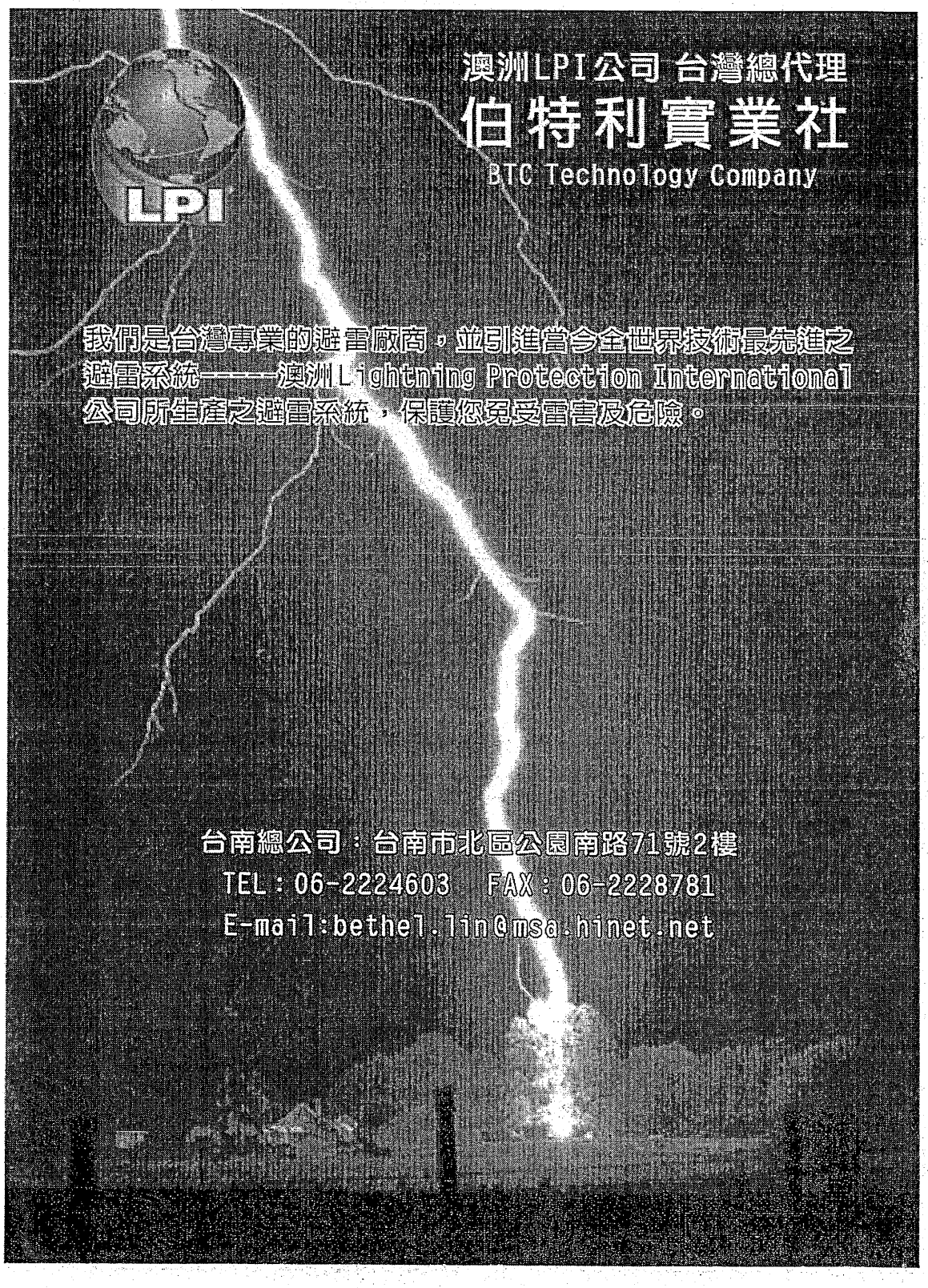
澳洲 7051 塔斯馬尼亞 京仕頓 郵政信箱 379

電話：+61 3 62271955

傳真：+61 3 62291900

電子郵箱：info@lpi.com.au

網址：www.lpi.com.au


澳洲LPI公司 台灣總代理
伯特利實業社
BTC Technology Company
LPI
我們是台灣專業的避雷廠商，並引進當今全世界技術最先進之
避雷系統-----澳洲Lightning Protection International
公司所生產之避雷系統，保護您免受雷害及危險。
台南總公司：台南市北區公園南路71號2樓
TEL：06-2224603 FAX：06-2228781
E-mail:bethel.lin@msa.hinet.net

業主：

避雷系統使用地點：

施工日期：

若您想了解最有效之避雷，請與我們聯絡。

伯特利實業社

操作手冊及保養維護說明書

當雷電靠近時LPI STORMASTER ESE 避雷系統是完全自動控制及操作。本系統無需供應任何電源或額外的基本操作。
為使LPI STORMASTER ESE 避雷系統處於最佳動作及保護狀態必須定期檢查其外表及相關連接之結構。

下列情形必須確實施作維護保養---

- 每次雷擊後須檢查及確認
- 每十二個月至少檢查一次
- 每當移動或改變相關連結之結構時

確實執行以下維護保養項目---

- LPI STORMASTER ESE 避雷系統是否有任何的損壞
- 在做最後一項維護保養或更動時，須確認建築物是否已被保護
- 檢查尖端是否過度熔損或變形
- 檢查所有束具零件、支撐架固定、底座及導線固定均牢固無鬆動
- 若使用傳統式下導線，檢查所有導線是否完整連結並且無損壞
- 檢查避雷同軸電纜(HVSC)是否損壞，非專業維護人員不可輕易接近此導線
- 確認所有警告標籤標語仍在明顯處
- 檢查雷擊計數器(LSR1)是否安裝正確，並記錄雷擊計數次數
- 確實測量並記錄接地電阻值，需＜10Ω為OK

LPI STOMASTER ESE 避雷系統並不是絕對可以在所有的環境條件下發揮完整的效能，例如在結冰或下雪或高溫煙囪上或排放可燃物或污染物之廢氣煙囪上。對於上列特殊環境場所之業主，建議您與LPI授權代理商連絡。

LPI台灣總代理
伯特利實業社
台南市公園南路71號2樓
TEL：06-2224603 FAX：06-2228781

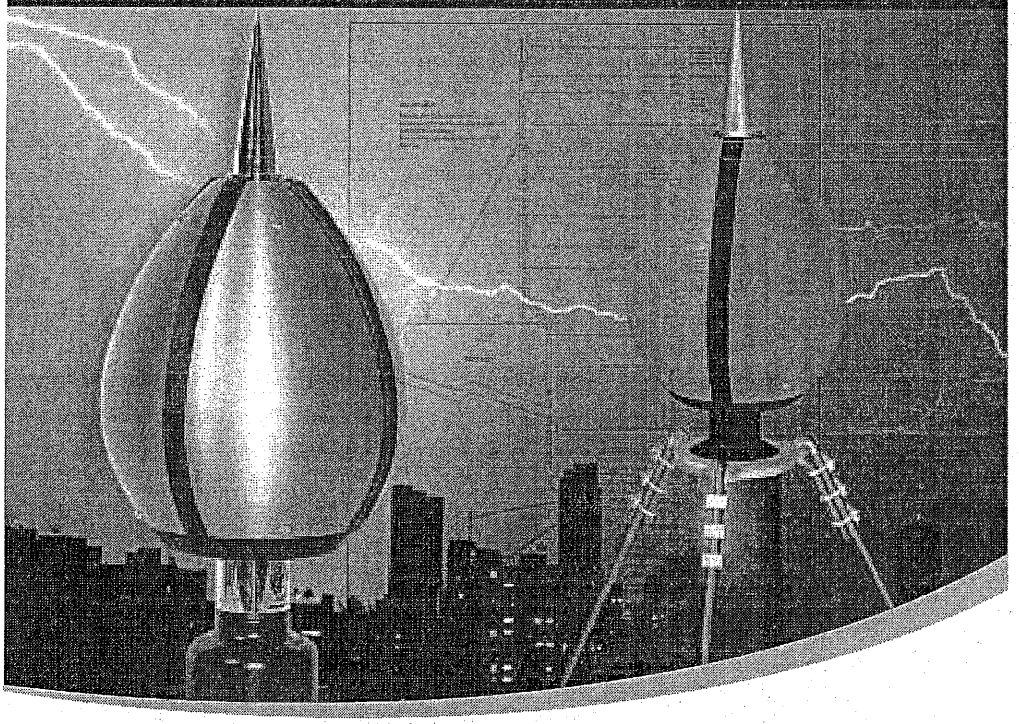
保養維護記錄表：

檢查避雷系統

維護日期	雷擊次數	接地電阻值	列出是否損壞	維護人員簽名	業主簽名

Stormaster ESE

INSTALLATION MANUAL



LIGHTNING PROTECTION INTERNATIONAL PTY LTD
www.lpi.com.au
ABN 11 099 190 897

STORMASTER ESE INSTALLATION MANUAL

As a result of continuing research and product development in the area of lightning and lightning protection, LPI reserves the right to alter any detail contained within at any time without notice.

Prior to installation of the Stormaster ESE system, installers should check with LPI or an authorised distributor to confirm they have the most recent version of the Stormaster ESE Installation manual.

It should be noted that 100% (100 percent) protection level for direct lightning strikes is not possible and cannot be provided due to the lightning discharge process being a natural atmospheric event.

Stormaster ESE Lightning Protection System

System Owner: _____

Date Installed: _____

Installation Contractor: _____

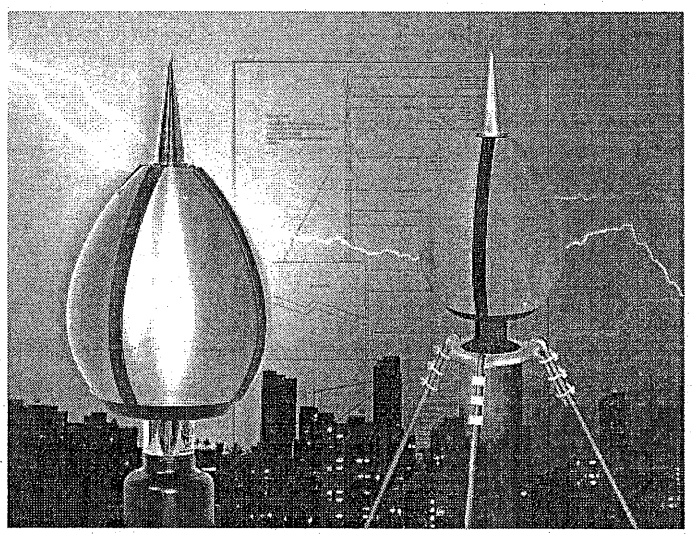
Supplied by: _____

Location of Installation: _____

Lightning Protection International Pty Ltd
ABN 11 099 190 897

PO Box 379 Kingston, Tasmania, Australia 7051
Phone: +61 3 62271955
Fax: +61 3 62291900
Email: info@lpi.com.au
Web: www.lpi.com.au

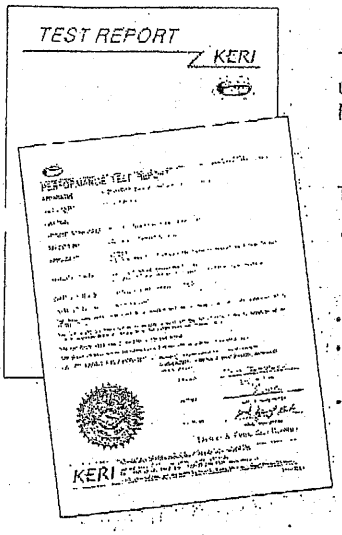
Stormaster ESE
INSTALLATION MANUAL



Lightning Protection International Pty Ltd

Contents

PROTECTION RADIUS (M) - (Rp)										
h = height of Stormaster terminal above area to be protected (m)	2	4	5	6	10	15	20	30	45	60
Protection Level 1										
Stormaster 15	13	26	32	32	34	35	35			
Stormaster 30	19	38	48	48	49	49	50			
Protection Level 2										
Stormaster 15	15	30	37	38	40	42	44	45		
Stormaster 30	22	44	55	55	57	58	59	60		
Protection Level 3										
Stormaster 15	18	36	45	46	49	52	55	58	60	
Stormaster 30	25	50	63	64	66	69	71	73	75	
Protection Level 4										
Stormaster 15	20	41	51	52	56	60	63	69	73	75
Stormaster 30	28	57	71	72	75	78	81	85	89	90



Protection Performance

The protection radius (Rp) of a Stormaster ESE terminal is calculated using the following formula as defined by the French National Standard NF C 17-102 (September 2011).

$R_P(h)=\sqrt{2rh-h^2+\Delta(2r+\Delta)}$ for $h \geq 5m$ where:

The following key parameters determine the calculation of RP.

- ΔT as established during the test.
  Stormaster-ESE-15 = ΔT (μs) 15
  Stormaster-ESE-30 = ΔT (μs) 30
- $\Delta=\Delta T*10^6$
- h=actual height of Stormaster terminal above the area to be protected (m).
- r(in m) depends on the selected level of protection, protection levels are speciáed in annex B of the standard NF C 17-102.
  r = 20m for protection level 1
  r = 30m for protection level 2
  r = 45m for protection level 3
  r = 60m for protection level 4

P.~1

Warranty

LPI's Stormaster ESE terminals are guaranteed against defects in materials and workmanship for a period of 5 years from the original sales date when it was purchased from LPI or one of its authorised distributors.

The warranty is limited to the ex factory cost of replacement of equipment providing it has been installed and or certified by LPI or its distributor. All other costs such as freight, re-installation, loss of profit, insurance premiums are not included.

Responsibility for other direct or indirect damages or death is also specifically excluded from the warranty.

The range of Stormaster ESE terminals (or to our knowledge any other lightning protection system) cannot provide 100% protection and therefore it is not inferred.

As confirmation of the above paragraph we refer to French Standard NF C 17-102.

Lightning Protection

Comments on the French Standard NF C 17-102.

We refer to the section in the standard titled "foreward" where it states the following:

"As in the case with anything related to the natural elements, a lightning protection system designed and installed in accordance with the standard, cannot guarantee absolute protection to structures, persons or objects: however , applying this standard will significantly reduce the risk of protected structures being damaged by lightning."

The LPI Stormaster ESE Terminal should only be installed during storm free periods.

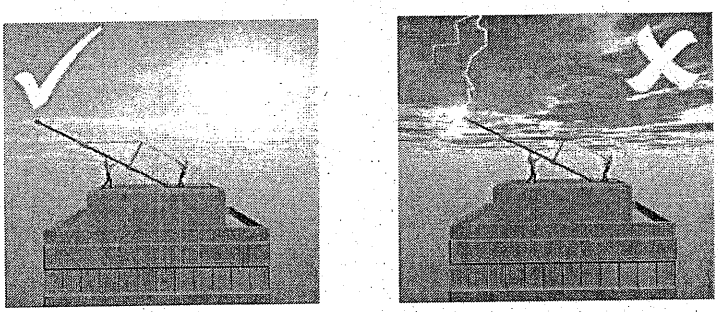


Figure 1.

General Safety Guidelines

- Ensure safe working environments and practices to local codes.
- Use of personal protective equipment during installation.
- Use mechanical methods of raising and installing masts over 6m.
- Cordon off area below installation point.
- Check for overhead powerlines or any other obstructions before lifting or raising.
- Ensure enough man power to safely conduct all aspects of installation.
- The installation must conform to all relevant local standards and regulations.

Recommended Installation Method

To assist in the installation of the Stormaster ESE terminal and accessories, refer to drawings STA-01, STA-02, STA-03, STA-04, STA-05, STA-06 and HVS-1 as illustrated on pages 6 to 12.

1. Installation of the lightning earth.
2. Installation of the HVSC Downconductor.
3. Lower termination of the HVSC Downconductor and connection to the lightning earth.
4. Upper termination of the HVSC Downconductor and connection to the Stormaster ESE terminal.
5. Preparation and raising of the mast into position.

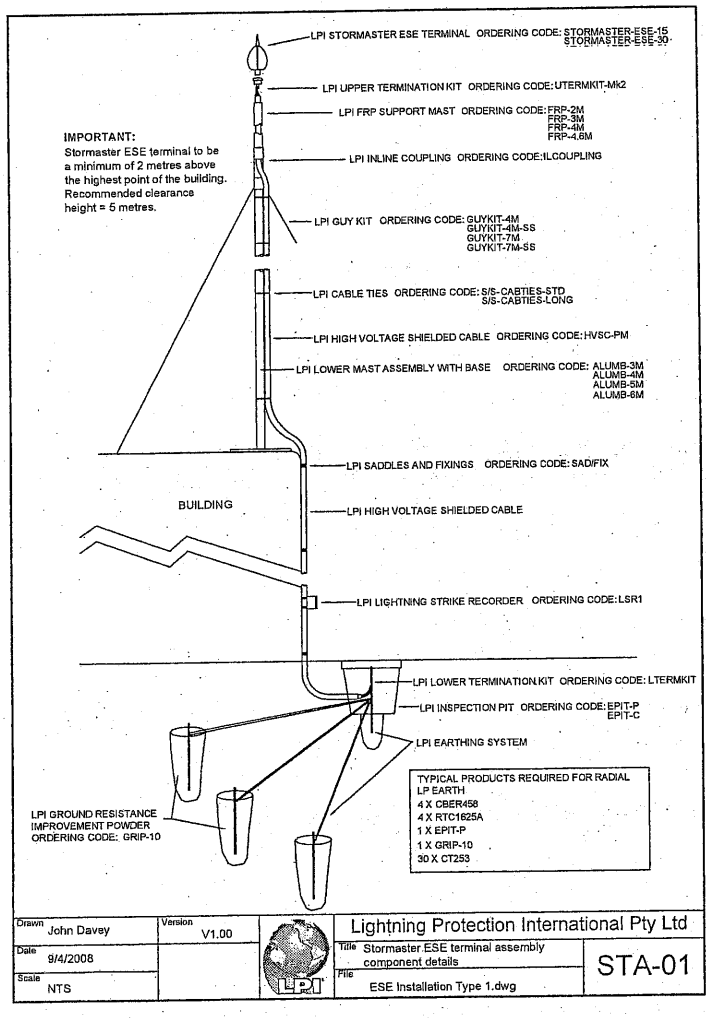


Figure 2.

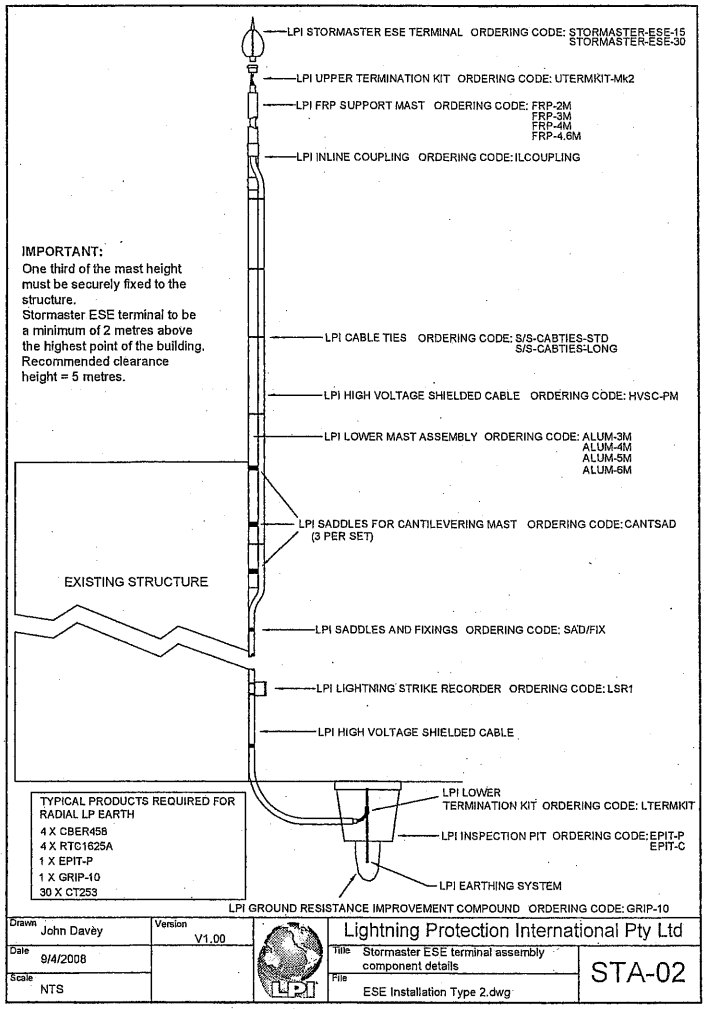

LPI STORMASTER ESE TERMINAL ORDERING CODE: STORMASTER-ESE-15 STORMASTER-ESE-30
LPI UPPER TERMINATION KIT ORDERING CODE: UTERMKIT-Mk2
LPI FRP SUPPORT MAST ORDERING CODE: FRP-2M FRP-3M FRP-4M FRP-4.6M
LPI INLINE COUPLING ORDERING CODE: ILCOUPLING
IMPORTANT:
One third of the mast height must be securely fixed to the structure.
Stormaster ESE terminal to be a minimum of 2 metres above the highest point of the building.
Recommended clearance height = 5 metres.
LPI CABLE TIES ORDERING CODE: S/S-CABTIES-STD S/S-CABTIES-LONG
LPI HIGH VOLTAGE SHIELDED CABLE ORDERING CODE: HVSC-PM
LPI LOWER MAST ASSEMBLY ORDERING CODE: ALUM-3M ALUM-4M ALUM-5M ALUM-6M
LPI SADDLES FOR CANTILEVERING MAST ORDERING CODE: CANTSAD (3 PER SET)
EXISTING STRUCTURE
LPI SADDLES AND FIXINGS ORDERING CODE: SAD/FIX
LPI LIGHTNING STRIKE RECORDER ORDERING CODE: LSR1
LPI HIGH VOLTAGE SHIELDED CABLE
TYPICAL PRODUCTS REQUIRED FOR RADIAL LP EARTH
4 X CBER458
4 X RTC1625A
1 X EPIT-P
1 X GRIP-10
30 X CT253
LPI LOWER TERMINATION KIT ORDERING CODE: LTERMKIT
LPI INSPECTION PIT ORDERING CODE: EPIT-P EPIT-C
LPI EARTHING SYSTEM
LPI GROUND RESISTANCE IMPROVEMENT COMPOUND ORDERING CODE: GRIP-10
Drawn John Davey
Version V1.00
Date 9/4/2008
Scale NTS
Lightning Protection International Pty Ltd
Title Stormaster ESE terminal assembly component details
File ESE Installation Type 2.dwg
STA-02

Figure 3.

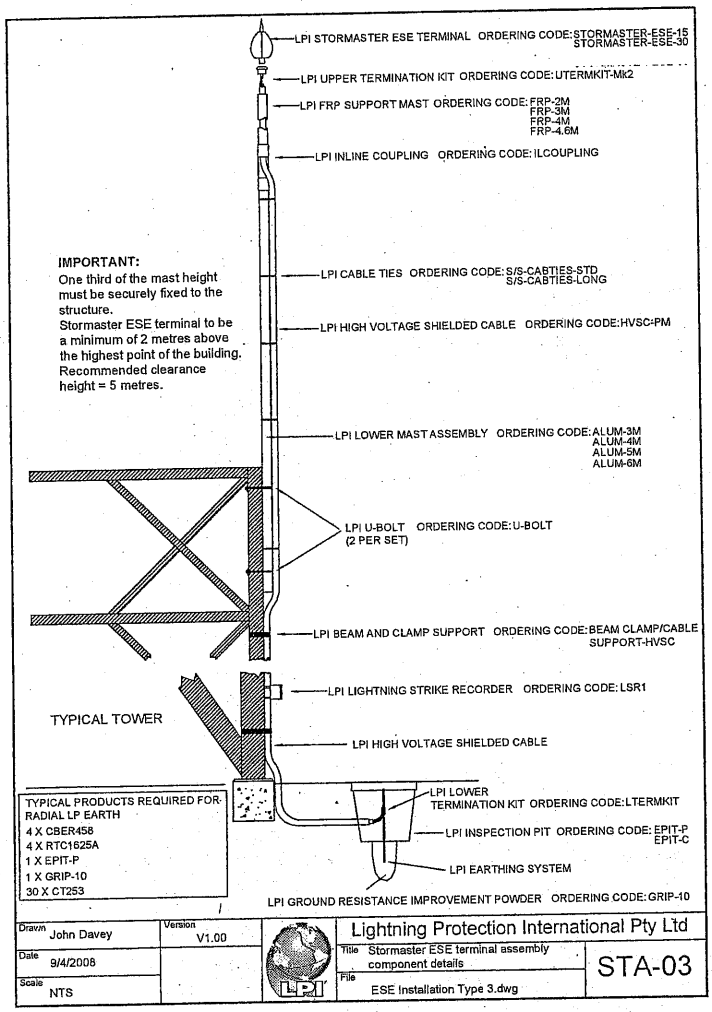


Figure 4.

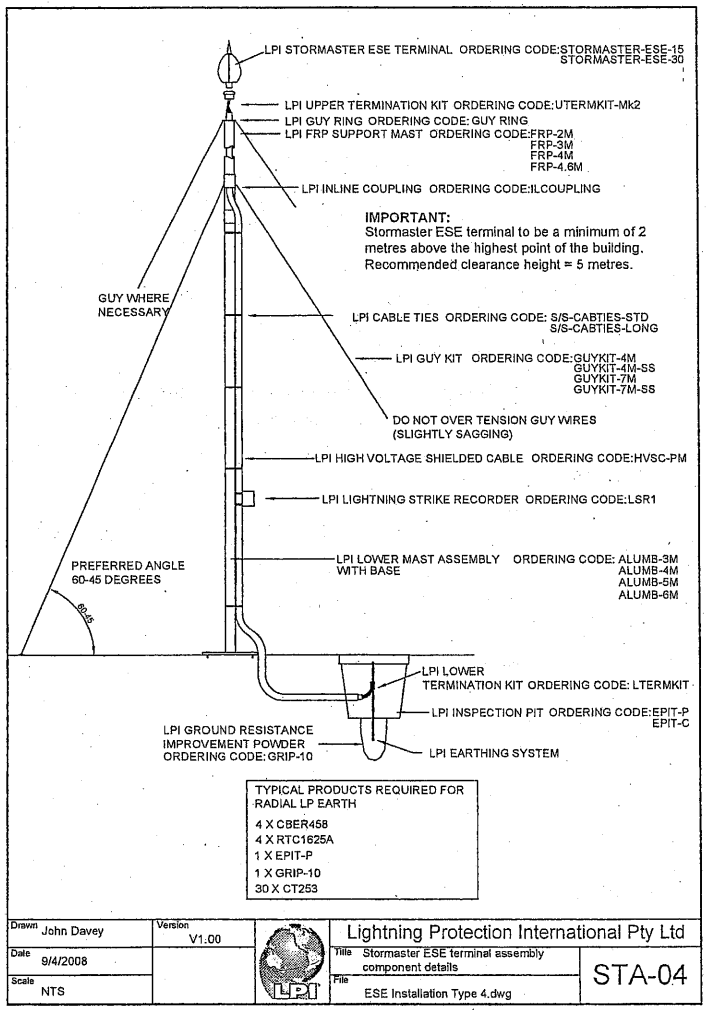

LPI STORMASTER ESE TERMINAL ORDERING CODE:STORMASTER-ESE-15
STORMASTER-ESE-30
LPI UPPER TERMINATION KIT ORDERING CODE:UTERMKIT-Mk2
LPI GUY RING ORDERING CODE: GUY RING
LPI FRP SUPPORT MAST ORDERING CODE:FRP-2M
FRP-3M
FRP-4M
FRP-4.6M
LPI INLINE COUPLING ORDERING CODE:ILCOUPLING
IMPORTANT:
Stormaster ESE terminal to be a minimum of 2 metres above the highest point of the building.
Recommended clearance height = 5 metres.
GUY WHERE NECESSARY
LPI CABLE TIES ORDERING CODE: S/S-CABTIES-STD
S/S-CABTIES-LONG
LPI GUY KIT ORDERING CODE:GUYKIT-4M
GUYKIT-4M-SS
GUYKIT-7M
GUYKIT-7M-SS
DO NOT OVER TENSION GUY WIRES (SLIGHTLY SAGGING)
LPI HIGH VOLTAGE SHIELDED CABLE ORDERING CODE:HVSC-PM
LPI LIGHTNING STRIKE RECORDER ORDERING CODE:LSR1
PREFERRED ANGLE 60-45 DEGREES
60-45
LPI LOWER MAST ASSEMBLY WITH BASE ORDERING CODE: ALUMB-3M
ALUMB-4M
ALUMB-5M
ALUMB-6M
LPI LOWER TERMINATION KIT ORDERING CODE: LTERMKIT
LPI INSPECTION PIT ORDERING CODE:EPIT-P
EPIT-C
LPI GROUND RESISTANCE IMPROVEMENT POWDER ORDERING CODE: GRIP-10
LPI EARTHING SYSTEM
TYPICAL PRODUCTS REQUIRED FOR RADIAL LP EARTH
4 X CBER458
4 X RTC1625A
1 X EPIT-P
1 X GRIP-10
30 X CT253
Drawn John Davey
Version V1.00
Date 9/4/2008
Scale NTS
Lightning Protection International Pty Ltd
Title Stormaster ESE terminal assembly component details
File ESE Installation Type 4.dwg
STA-04

Figure 5.

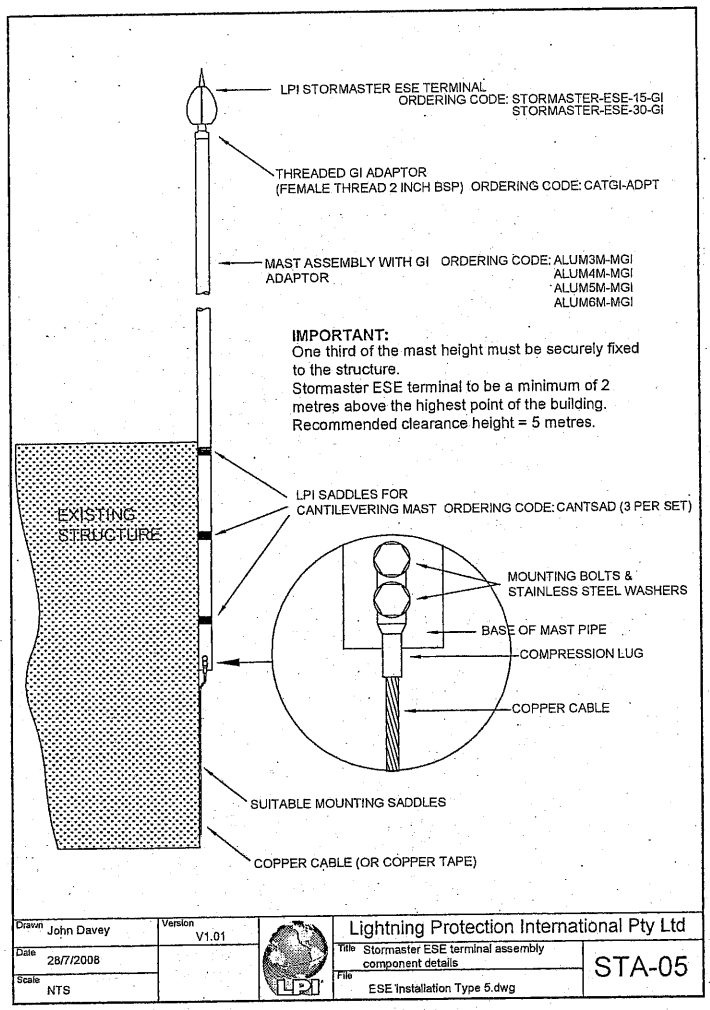


Figure 6.

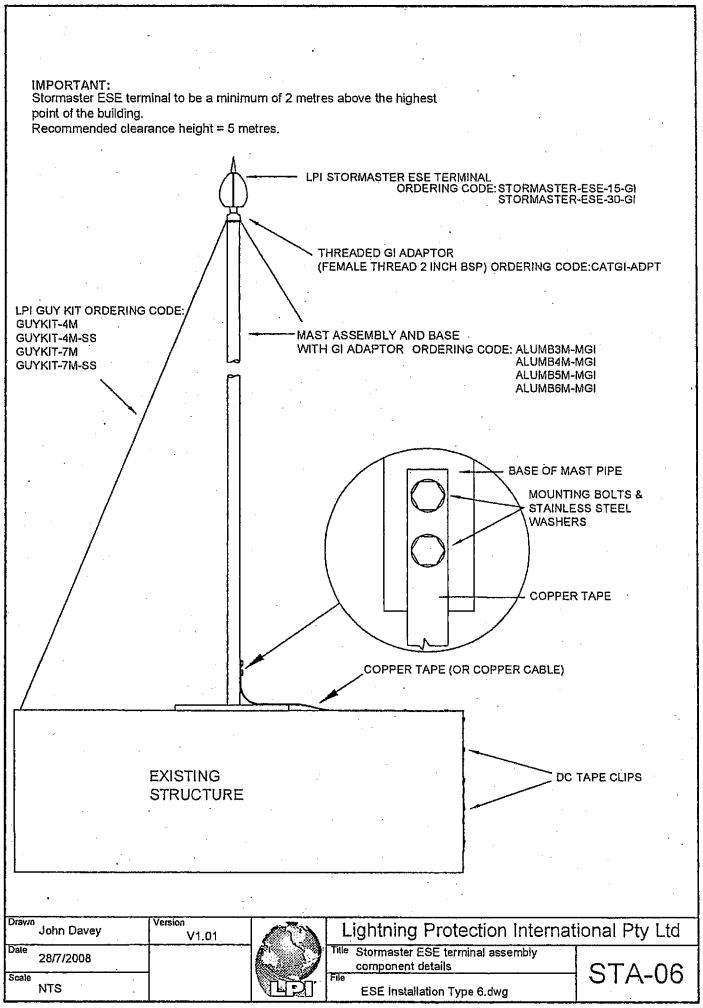

IMPORTANT:
Stormaster ESE terminal to be a minimum of 2 metres above the highest point of the building.
Recommended clearance height = 5 metres.
LPI STORMASTER ESE TERMINAL
ORDERING CODE: STORMASTER-ESE-15-GI
STORMASTER-ESE-30-GI
THREADED GI ADAPTOR
(FEMALE THREAD 2 INCH BSP) ORDERING CODE:CATGI-ADPT
LPI GUY KIT ORDERING CODE:
GUYKIT-4M
GUYKIT-4M-SS
GUYKIT-7M
GUYKIT-7M-SS
MAST ASSEMBLY AND BASE
WITH GI ADAPTOR ORDERING CODE: ALUMB3M-MGI
ALUMB4M-MGI
ALUMB5M-MGI
ALUMB6M-MGI
BASE OF MAST PIPE
MOUNTING BOLTS & STAINLESS STEEL WASHERS
COPPER TAPE
COPPER TAPE (OR COPPER CABLE)
EXISTING STRUCTURE
DC TAPE CLIPS
Drawn John Davey
Version V1.01
Date 28/7/2008
Scale NTS
Lightning Protection International Pty Ltd
Title Stormaster ESE terminal assembly component details
File ESE Installation Type 6.dwg
STA-06

Figure 7.

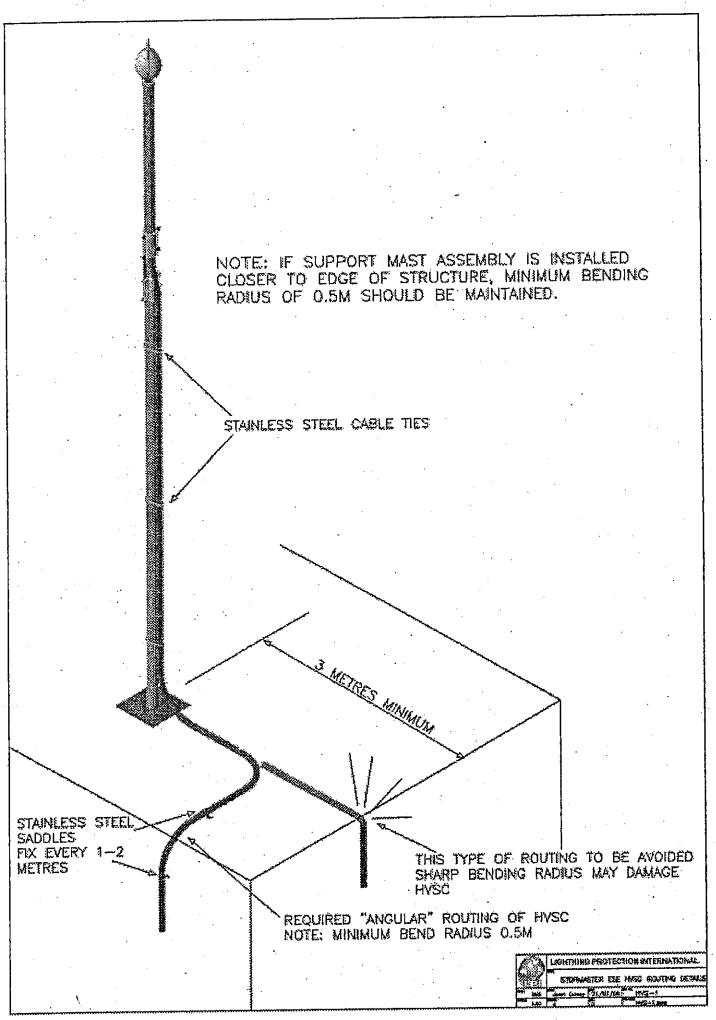


Figure 8.

Checking Lightning Protection Components Supplied

The LPI Stormaster ESE components received should be checked against the "Bill of materials" for loss during shipping and for damage.

Check the following:

Terminal(s)

- Terminals have not been dented or damaged in any way during transit.
- Instructions, warning labels, warranty, test certificate and relevant mast base components are supplied

Downconductor(s)

- The HVSC cable drum (if supplied) is not damaged.
- The correct HVSC length(s) have been supplied.
- No obvious damage to the HVSC cable.
- If a factory completed upper termination is supplied, check to see that the termination is not damaged and confirm inside or outside termination(s).
- Order of lengths and quantities of HVSC (if multiple lengths on one drum), will be shown on the side of the Cable Drum(s).

LPI Stormaster ESE Installation

All site and safety requirements must be followed during the installation of the LPI Stormaster ESE.

The correct order of installation is as follows:

1. Installation of the lightning earth.
2. Installation of the HVSC downconductor.
3. Lower termination of the HVSC downconductor and connection to the lightning earth.

4. Upper termination the HVSC downconductor and connection to the Stormaster ESE terminal.
5. Preparation and raising of the mast into position.

LPI Stormaster ESE should only be installed during storm-free periods.

If the Stormaster ESE terminal needs to be raised prior to connection to the lightning earth or immediate connection is not possible then connect the lower end of the downconductor to structural steel reinforcing or other suitable earth point.

Installation of the Lightning Earth

Before installation of the lightning protection earth, consult site drawings of underground services so that these are not damaged during installation of the earthing system.

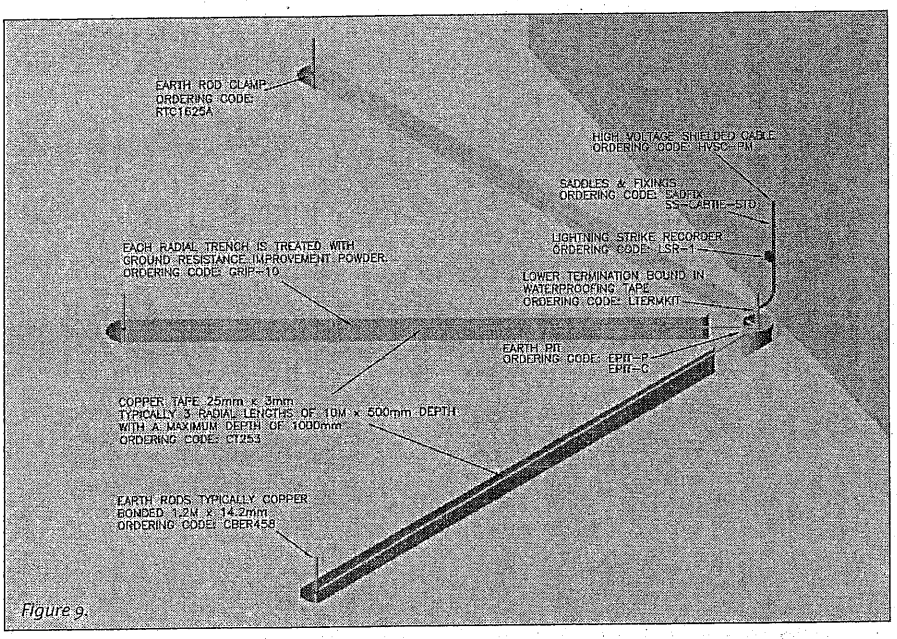


Figure 9.

Earth DC resistance (typically <10 ohms) and impedance (typically <30 ohms) is required for successful operation of LPI Stormaster ESE.

LPI recommends the installation of a radial lightning earth as shown in figure 9.

- Recommended to install a 3 x 10 metre length radial trench.
- Each radial should consist of a trench (Approx: 500mm Deep x 200mm wide x 10m length).
- An earth rod should be driven at the end of each trench.
- All rods should be interconnected through the use of 25mm x 3mm copper tape. The use of earth rod clamps to fix the tape to rods is recommended.
- Use waterproofing mastic on all mechanical connections.
- The application of earth enhancing compounds such as LPI RESLO and GRIP assists to reduce soil resistivity to the recommended level of less than 10 ohms.
- An earth pit should be installed where the end of the downconductor terminates to the lightning earth as shown in figure 9. This gives an access point for disconnection and future testing.
- Do not lower terminate (connect) the downconductor to the earthing system at this point in time.

Note: If due to space constraints it is not possible to install a radial earth as recommended, consult with LPI or an authorised distributor for further advice.

When using earth rods:

- Use driving heads to prevent mushrooming on top of rod.
- Use driving heads when using coupled rods.
- Use a post or picket driver.

Recommendations for bonding the earthing system components are listed below:

- The use of the EXOWELD exothermic welding process is a safe and efficient way of providing a permanent connection between conductors. EXOWELD connections will not corrode or rust with age.
- DO NOT use aluminium lugs or couplings.

Ground Resistance Lowering Compounds

- Ground resistance lowering compounds (such as LPI RESLO and GRIP) are supplied when the existing soil mass has a high resistivity.
- Using the compounds can lower earth resistance/impedance.
- Compounds will require water and a mixing container.
- Follow all installation and safety instructions as supplied with products when applying the compounds.

Bonding The Lightning Earth

Where separate earths exist eg. Structure, Power, Communications and Lightning Protection, they need to be bonded to form an equipotential ground plane. This will stop ground loops and potential differences arising under transient conditions.

Before bonding of these earths takes place, make sure proper authorisation is gained.

Bonding cable must be 70mm² (2/0 AWG) minimum depending on local standards. It may be necessary to use a Transient Earth Clamp (TEC 100) which bonds all earths to the same potential under transient conditions.

For further information, it is advisable that local applicable standards are used, ie. IEC 61024-1, BS 6551, AS1768-2007, NFPA 780, C22.1-98 and NEC.

Labelling

It is the responsibility of the customer/installer to label earth pits or earthing systems to local requirements.

Installation of the HVSC Downconductor

If installing LPI HVSC, the HVSC downconductors(s) may have had the upper terminations completed at a pre-specified end of the cable by the LPI factory before being shipped.

When removing HVSC downconductor packaging, do not use a knife or cut in any way as this can damage the outer layer of termination.

LPI's HVSC has an outer layer which is approximately 2mm (1/16in.) thick. Be careful not to damage this layer.

Hauling the HVSC Downconductor

Place the HVSC downconductor cable drum close to where it is to be installed.

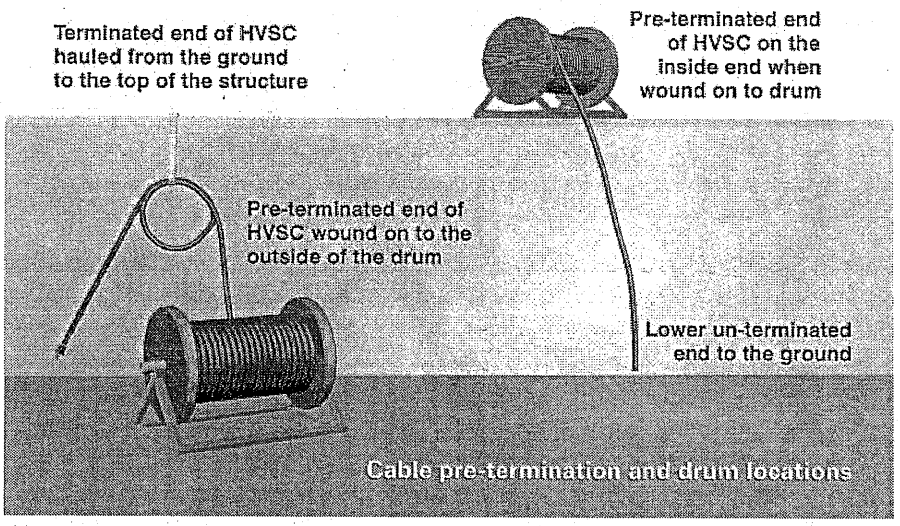


Figure 10.

- Make sure that the cable drum is in a servicable condition.
- Check that the correct length of HVSC downconductor has been supplied. The length of HVSC will be marked on the drum.
- If the HVSC downconductor has been upper terminated on the outside of the drum, then the HVSC downconductor will need to be hauled up the structure with the drum staying on the ground.
- If the HVSC downconductor has been upper terminated on the inside of the drum, then the drum has to be taken to the top or near the top of the structure, then the HVSC downconductor can be hauled downwards from the drum to the ground.

- Any lifting slings or ropes must be securely attached.
- DO NOT haul the HVSC downconductor from the termination, see Figure 11.
- Protect the HVSC downconductor at all times when it is being moved.

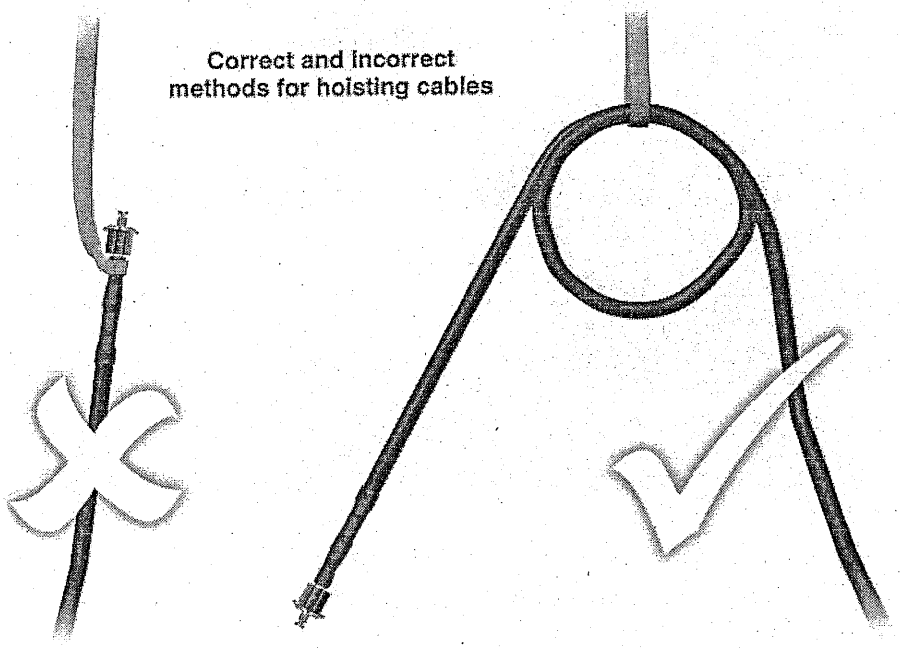


Figure 11.

HVSC Downconductor clearance holes

Before running the HVSC downconductor through any clearance holes, ensure that:

- A minimum hole diameter of 60mm (2 3/8") is used.

- Enough protection is provided so that the HVSC downconductor is not damaged during or after installation.
- A waterproofing sealant or sealing gland should be used if the hole needs to be weatherproof.

Routing

The routing of the HVSC downconductor needs to follow these guidelines:

- The route of the HVSC downconductor should be as set out in the original design. Ensure no structural changes such as new antenna or mast installations, air conditioning towers or ducting has been installed.
- DO NOT double the HVSC downconductor back against itself after changes of direction, ie. 180°.
- The HVSC downconductor may be installed internally or externally on the structure.
- The HVSC downconductor should be installed as close (flush) as possible to the structure.
- Minimise the number of bends and use the most direct route to ground.
- Minimise strain on the HVSC downconductor.
- Ensure minimum bend radius maintained ›500mm (20in.).
- Parallel routing with other services – Minimum separation = 2m. See Figure 12 on page 20.
- If the HVSC downconductor has to cross other services make sure it crosses at right angles using a conduit that extends at least 1m past either side of the existing service.
- The lower end of the HVSC downconductor must terminate close to the initial injection point of the lightning earth.
- Be sure to allow for enough slack in the HVSC at the top end for connection to the Stormaster ESE Terminal and the raising of the mast.
- If it is necessary to isolate the HVSC downconductor from the structure, run the cable in an insulating conduit with a minimum wall thickness of 3mm (1/8in.). The maximum

length isolated from the structure should be 2.5m (9ft). The entire length of the HVSC downconductor cannot be run in insulated conduit.

- HVSC downconductor should be protected from damage at the lower end by installing a "Top Hat" surface mount cover of no more than 2m from ground level.

The HVSC downconductor must be checked by an LPI representative if it is damaged during installation to see if the damage will affect performance.

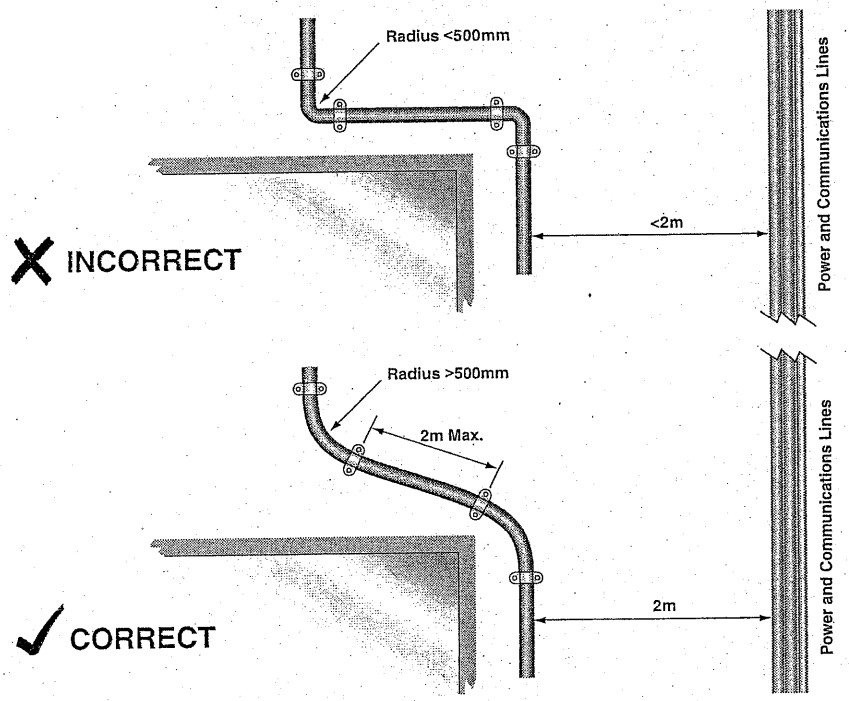


Figure 12.

Fixing the HVSC Downconductor

Using non LPI saddles can damage the downconductor outer sheath.

- The HVSC downconductor should be fixed to the structure every 2m for the entire length of the run. (Use LPI supplied or recommended saddles, fixing and cable ties).
- For masonry walls or roofs, use the LPI saddles provided. These can be used with masonry anchors, suitable fastenings for wood, fibreglass and metallic surfaces or self tapping screws.
- The most direct path to ground is recommended, avoid sharp bends (see HVS-1 on page 12).
- Use cable ties when fixing to round sections, such as pipes, tower legs, masts, etc.
- If the HVSC downconductor is to be routed above a false ceiling, ensure that it is fixed to the underside of the concrete floor slab.
- Do not use explosive fastening methods on LPI saddles or HVSC downconductors.

Installation of Conventional Downconductors

In some installations the use of copper tape or insulated stranded copper cable may be installed as the downconductor. In such cases it may be necessary to install multiple downconductors in compliance with local standards and/or international standards. (NFC 17-102, AS1768-2007, BS6651, IEC 62305). See the following dot points for further information.

The Stormaster ESE Terminal provides a bolt for the lug connection to the lower finial connector of the mast butt adaptor. All conventional downconductors should be lugged and fixed to the terminal as per figure 13 on page 22.

The following are recommendations and points that should be considered when installing conventional downconductors.

- Downconductors should be installed at each external corner of the building and additional downconductors installed at spacing not exceeding 20m.
- The most direct path to ground is recommended, avoid sharp bends.
- Downconductors should be installed around the outside walls of the structure. It is not recommended to install downconductors internally to the structure.

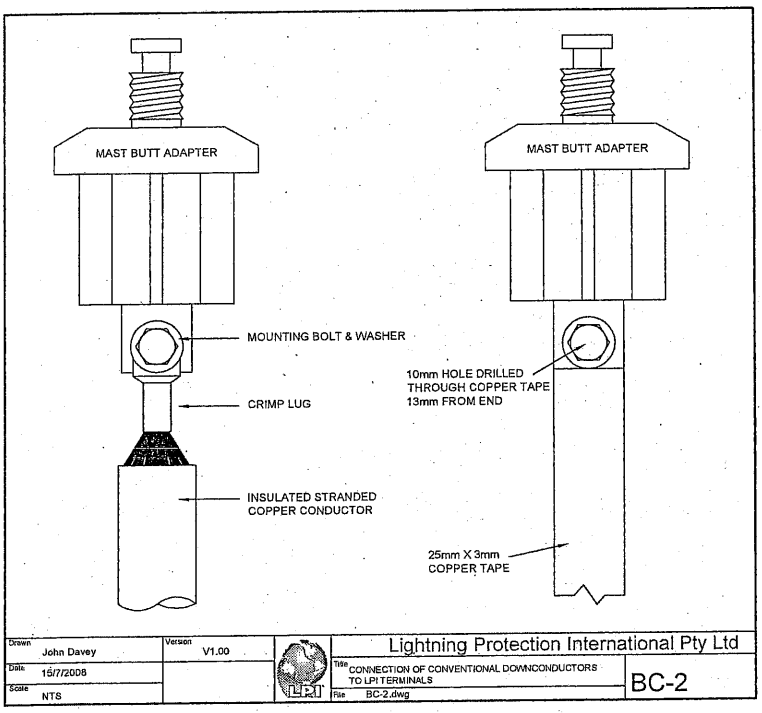


Figure 13.

- It is not recommended to locate downconductors in areas where personnel are liable to congregate.
- Any extended metal running vertically through the structure should be bonded to the lightning downconductor at the top and bottom of the structure.
- Each downconductor should be connected to the earthing system.
- Where practical, all structural steel and metallic reinforcement in the structure should be bonded to the downconductor system at recommended intervals as per international standards.

- The use of copper conductors are recommended and should have a cross sectional area of not less than 35mm². In addition, the use of PVC copper, bare aluminium and stainless steel as downconductors is permitted in compliance to most international standards.
- Recommended copper conductor size is 25mm x 3mm.
- The copper should be of a grade normally used for commercial electrical work.
- Suitable fasteners should be installed to adequately secure all downconductors.
- Downconductors should be fastened at spacings not exceeding 1.0m on horizontal runs and not exceeding 2m on vertical runs.

Installation of Stormaster GI Terminal to threaded pipe

LPI offers within its range of Stormaster terminals a GI version which is designed for a threaded connection to a 2 inch BSP GI pipe. Please refer to drawings STA-05 and STA-06 on pages 10 and 11 along with figure 14 for further details.

The Stormaster GI terminal is supplied with a threaded coupler (female thread) fixed to the terminal and designed for connection to a 2 inch pipe (Male thread).

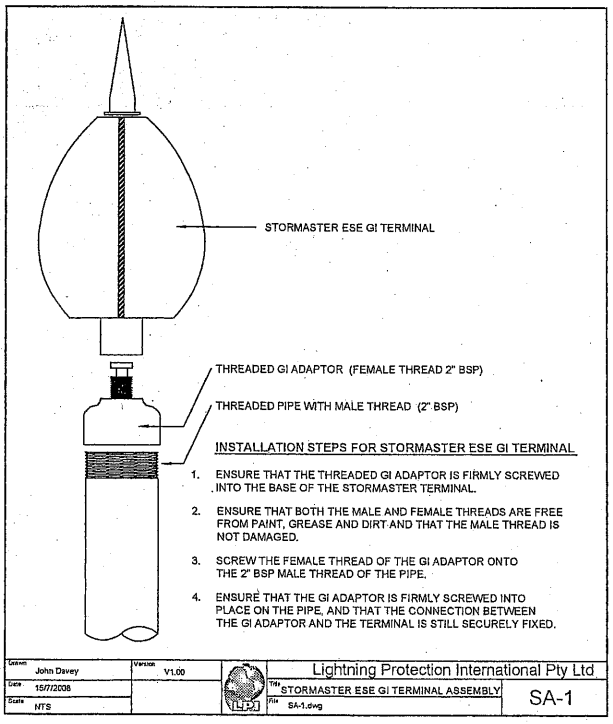


Figure 14.

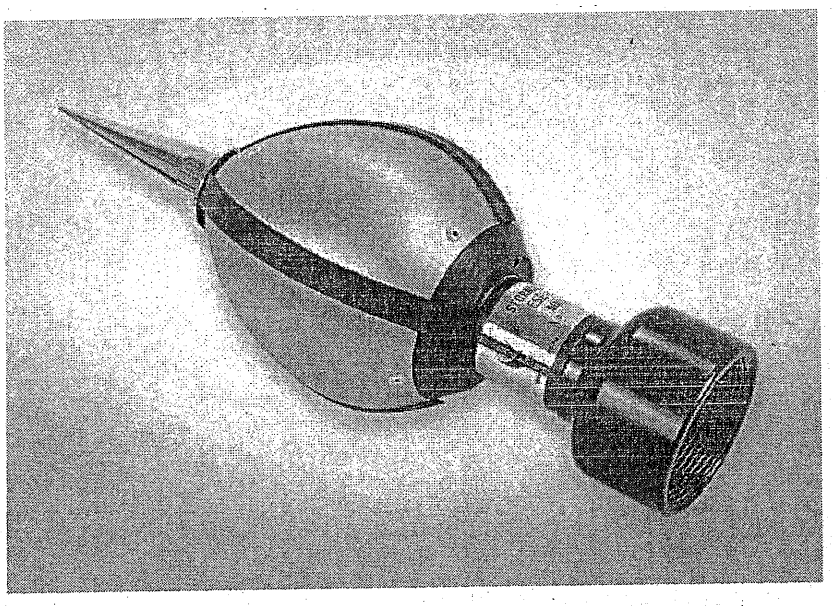


Figure 15.

- Following installation of the Stormaster GI terminal to the threaded pipe as per drawing STA-05 and figure 14 it will be necessary to connect the metallic pipe to a conventional downconductor in order to convey the lightning energy to the earthing system.
- Ideally the connection between the metallic pipe and the conventional downconductor should be completed by lugging or exothermically welding (LPI EXOWELD) the down-conductor at a practical point somewhere along the length of the pipe.
- Particular care should be taken to ensure that compatible metals are used when connecting the downconductor to the metallic pipe.
- For installation details of the conventional downconductor please review instructions and comments as detailed under the heading Installation of Conventional Downconductors on page 21.

Termination of the HVSC Lower End

Tools required for the completion of the HVSC Lower Termination include:

- Compression or Mechanical Crimping Tool (for 95mm² crimping lug).
- Sharp Knife.
- 2 x screwdrivers (used as friction cutting tool handles).
- Shifting Spanner.
- Tape Measure (cm).

Lower Termination Kit Consists of

1 x Roll Waterproofing Tape.

1 x 95mm Crimp Lug.

2 x Warning Stickers.

1 x Earth Clamp.

1 x Insulation Friction Cutting Tool.

The following steps outline the termination of the lower end of the High Voltage Shielded Cable to the lightning earth.

The inner screen copper conductors and the outer screen copper conductors should be connected to the earthing system.

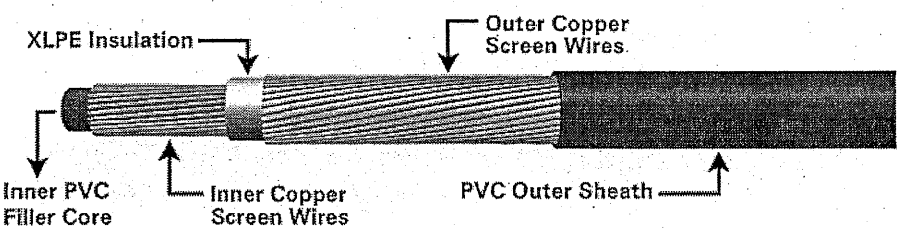


Figure 16.

1. Remove the outer sheath for a length of 15cm from the lower end of the HVSC by cutting radially around HVSC cable with the supplied insulation friction cutting tool. (This is less likely to damage individual copper conductors than by cutting radially with a knife). The lengthwise cut can be completed with a knife.
2. Remove the clear binder tape (2nd layer) for a length of 15cm from the end of the HVSC, this will expose the outer screen copper conductors as shown in Figure 17.

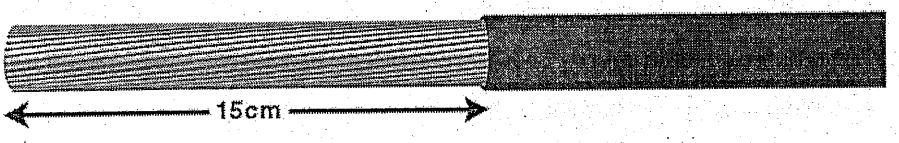


Figure 17.

3. Bend outer screen conductors back without damaging them. For a length of 5cm from the end of the HVSC, remove XLPE insulation (4th layer) and inner binding tape (5th layer) to expose inner screen copper conductors. Be sure not to remove outer screen conductors in this step. It is recommended to use the insulation friction cutting tool in this step.
4. Bend inner screen conductors back without damaging them. For a length of 5cm from the end of the HVSC, remove the inner PVC filler core under the inner screen copper conductor leaving the inner screen copper conductor in place.

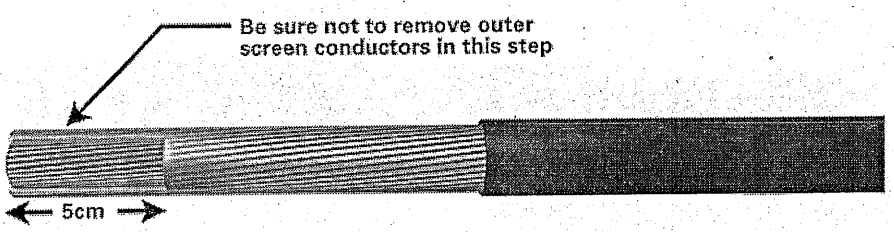


Figure 18.

5. Bunch together both inner and outer screen conductors. If connecting directly to the earth system as per figure 21, the bunched conductors should be connected to the earth rod clamp and the clamp tightened holding the conductors firmly in place. To avoid oxidisation of this connection, seal it using the waterproofing tape as provided in the kit.

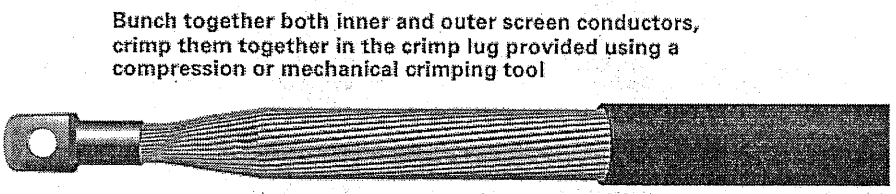


Figure 19.

6. If terminating the lower end of the HVSC to a bus bar, bunch together both inner and outer screen conductors, crimp them together in the 95m² crimp lug provided using a compression or mechanical crimping tool and connect the bus bar as per Figure 20.

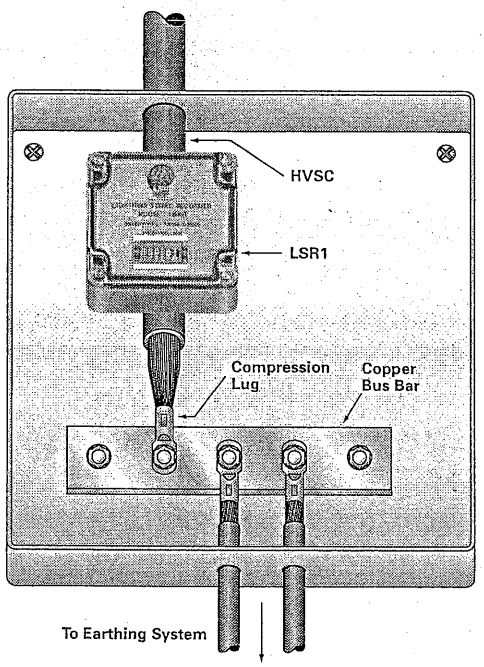


Figure 20.

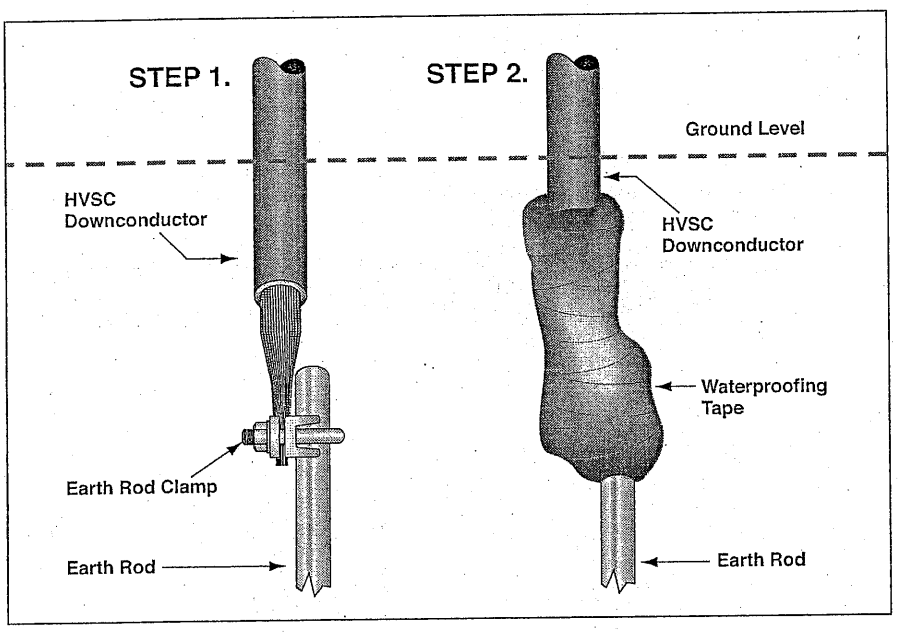


Figure 21.

Lower Termination of Conventional Downconductor to the Lightning Earth

- If installing stranded copper cable as a downconductor then the lower end should be connected to the lightning earth through the use of an earth rod clamp and then wrapped with waterproofing tape to avoid oxidisation.
- If installing copper tape (25mm x 3mm) as a downconductor then the lower end should be directly connected to the lightning earth through the use of a suitable earth rod clamp and then wrapped with waterproofing tape to avoid oxidisation.

Termination of the HVSC Upper End

Tools and parts required for the completion of the HVSC Upper Termination include:

- Compression or mechanical crimping tool (for 50mm² crimp lug).
- Sharp knife.
- Phillips Head Screwdriver.
- Shifting spanner (or 14mm spanner/socket).
- 2 x screwdrivers (used as friction cutting tool handles).
- Heat gun or Gas Torch (LPG).
- Tape measure (cm).
- Marker or pen.
- Combination Pliers/Cutters.
- Terminal Base Assembly (supplied with the Stormaster Terminal).

Upper Termination Kit consists of:

- Instructions.
- 1 x roll of Semi-Conductive Tape.
- 1 x 50mm² Crimp Lug.
- 1.5 x Heatshrink Tubes (1 x 1200 & 1 x 600mm lengths).
- Insulation Friction Cutting Tool.
- Insulation Tape (1 x roll).

Upper Termination Instructions For UTERMKIT-Mk2 (Heatshrink)

The diagram on the following page (Figure 22) shows the different layers of the HVSC cable and indicates their names as referred to in the following instructions:

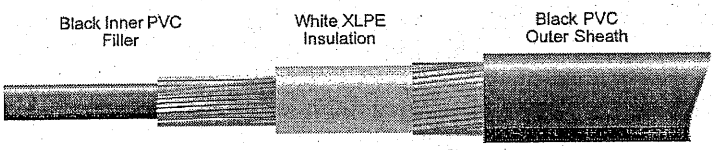


Figure 22.

1. First, remove the Black PVC Outer Sheath for a length of 165cm by cutting radially round the HVSC cable with the supplied insulation friction cutting tool (this is less likely to damage individual copper conductors than by cutting with a knife). The lengthwise cut can be completed with a knife, but take great care not to score the White XLPE Insulation. Also remove the clear plastic lining over the copper.
2. Measure and mark the outer copper screen wires at 3 cm above the end of the Black PVC Outer Sheath. (Figure 23) With the cutters, carefully cut and remove the wires, again without damaging the White XLPE Insulation below.

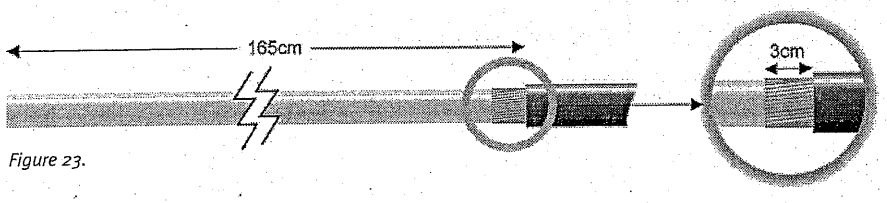


Figure 23.

3. Using the insulation friction cutting tool, remove the White XLPE Insulation to expose the Inner Copper Conductors for a length of 5cm from the top end of the HVSC (Fig 24). Also remove the clear plastic lining over the copper conductors.
4. Remove the Black Inner PVC Filler core under the Inner Copper Conductors by folding back the Inner Copper Conductors to expose the Filler core, then cut and remove with a knife. Return the Inner Copper Conductors to their original position. (Figure 24)

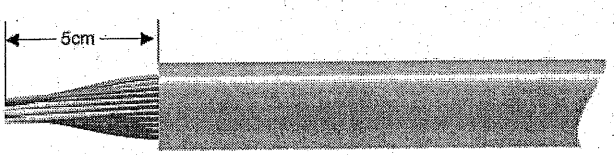


Figure 24.

5. Straighten the cable back to the Black PVC Outer Sheath as much as possible then crimp the Inner Copper Conductors into the supplied 50mm² crimp lug using a suitable compression or mechanical crimping tool. (Figure 25)

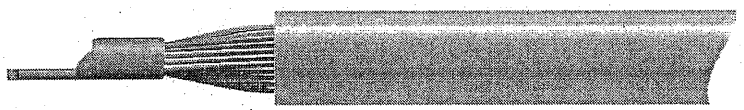


Figure 25.

6. Connect the crimp lug to the Stormaster Terminal Base Assembly using the bolt and washers as supplied with the assembly. Ensure the connection is aligned correctly and tightly secured using a 14mm spanner, socket or shifting spanner. (Figure 26)

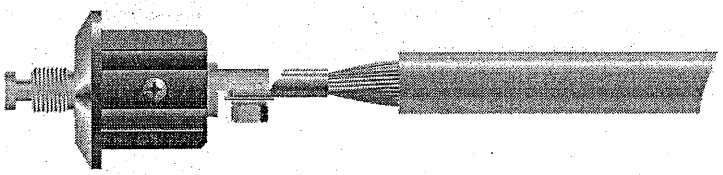


Figure 26.

7. Use a marker or pen to mark 30cm intervals on the White XLPE Insulation between the end of the Outer Copper Screen Wires and the Crimp - this will act as a guide to wrapping the semi-conductive tape towards the Crimp in a coarse spiral. (Figure 27)

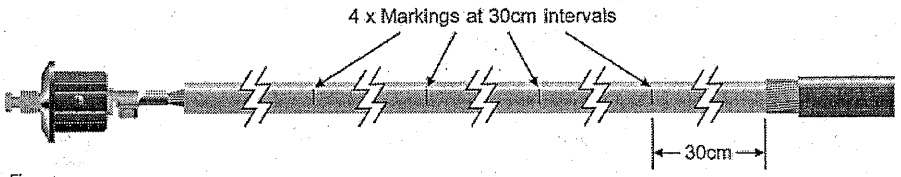


Figure 27.

8. Using the Semi-Conductive Tape provided, starting 2cm in front of the end of the Outer Copper Screen Wires (or 5cm in front of the Black PVC Outer Sheath), stretch and wrap the tape back over the wires and 3cm over the Black PVC with 50% overlap, securing the Outer Copper Screen Wires in place. This should use approx 50cm of the tape. (Figure 28)

Note: DO NOT cut the tape at this stage.

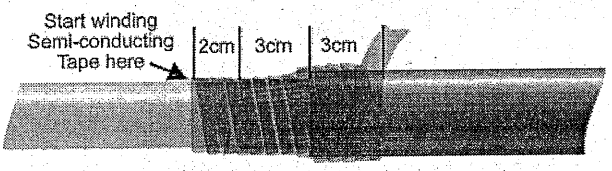


Figure 28.

9. Over wrap back towards the Crimp end of the cable, again stretching the tape and with 50% overlap, leaving 5cm covering the Outer Copper Screen Wires and White XLPE Insulation and 3cm covering the Black PVC Outer Sheath. This should use approx another 50cm of the tape. Again, do not cut the tape. (Figure 29)

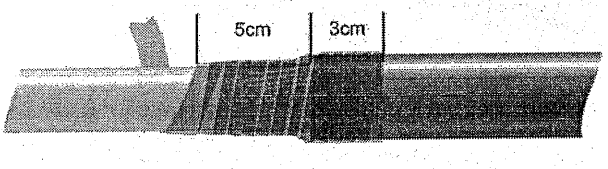


Figure 29.

10. Using the 30cm markings as a guide, continue to wrap the tape around the White XLPE Insulation in a coarse spiral, (5 Turns from the outer-Copper screen wires to crimp), with only slight tension, ensuring that the tape is not too loose. Note: The spiral needs to be applied with even pitch to achieve best performance. (Figure 30)

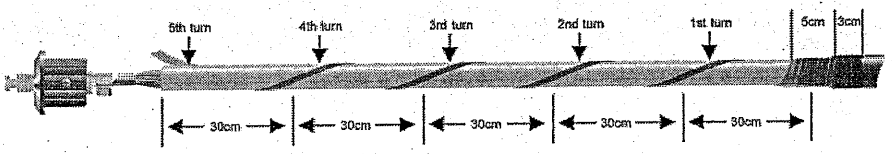


Figure 30.

11. Once the tape has reached the crimp, start to stretch the remaining tape and using 50% overlap, cover the last 3cm of the White XLPE Insulation, over the brass lower connector and up to the black plastic section of the Terminal Base Assembly in multiple layers, completely covering the crimp and achieving as smooth and level a surface as possible, removing all sharp edges. (Figure 31)

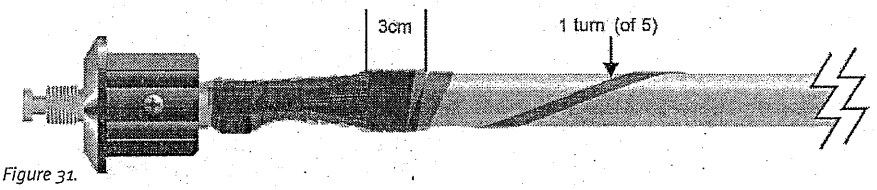


Figure 31.

12. Using the supplied Insulation Tape (or 50mm packing tape), cover the coarse spiral section of the Semi-Conductive Tape to ensure that it stays in place during the application of the Heatshrink tubes. Do this first by covering the left half of the tape, then using a second length to cover the right half of the tape for the full length of the spiral. (Figure 32)

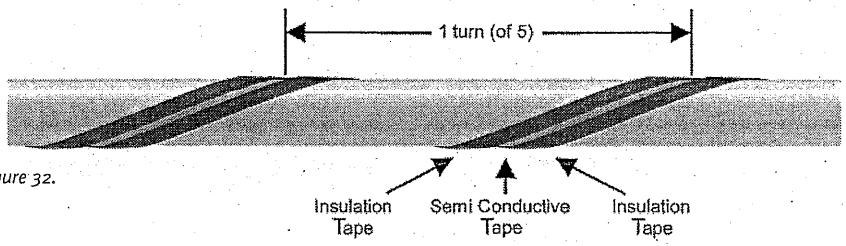


Figure 32.

13. Remove the plastic Mast Butt Adaptor section of the Terminal Base Assembly by unscrewing the M6 Phillips head screw on the side. Again, straighten the cable as much as possible and carefully slip the first 1.2m length of Heatshrink over the cable ensuring that the Semi-Conducting Tape is not effected, until the end of the Heatshrink tube covers and overlaps the Semi-Conductive Tape (over the Black PVC Outer Sheath) by 3cm. (Figure 33) Using a Gas torch or heat gun, shrink the lower end into the correct position and gradually work up towards the top of the Heatshrink.

Note: Ensure that the Heat gun or Gas torch is not pointed in the same area for too long as this will burn the Heatshrink, also be careful around the ends of the tube as too much heat will damage the Black PVC Outer Sheath, Semi-Conductive Tape and White XLPE Insulation.

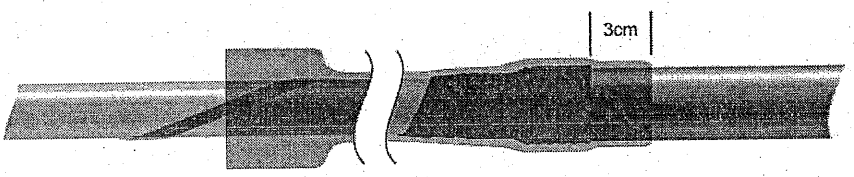


Figure 33.

14. Place the 2nd 600mm Heatshrink tube into place over the cable, again ensuring that the Semi-Conductive tape is not damaged, overlapping the previous Heatshrink tube by at least 3cm. Shrink about 7cm of the upper end of the Heatshrink into place so that it will sit flush with the base of the Plastic Mast Butt Adaptor when fitted back into place.

    Shrink the rest of the Heatshrink, ensuring that it overlaps the previous piece of Heatshrink by at Least 3cm. (Figure 34) Ensure the rest of the Heatshrink has a smooth overall finish. Note; If required, feed the cable through the mast sections & guying ring. Replace the plastic Mast Butt Adaptor section of the Terminal Base Assembly back onto the brass connector and ensure that the M6 Phillips Head screw is tight and secure.

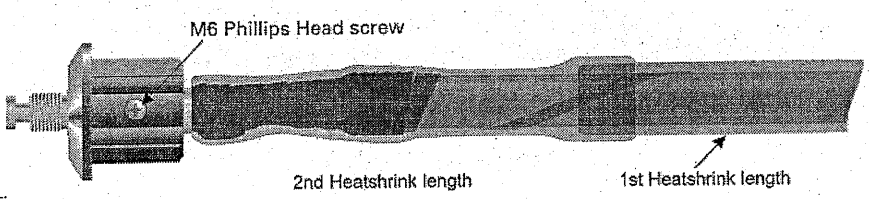


Figure 34.

15. The lugged HVSC is now ready to be connected to the base of the Stormaster terminal. Screw the terminal onto the completed Terminal Base Assembly and secure with the supplied M6 locking grub screw.

Connection of Factory Pre-Terminated HVSC (Upper End) to Stormaster ESE Terminal

Tools required for the installation of the factory completed upper termination include:

- Sharp Knife.
- Medium size Phillips head screw driver.

1. Firstly remove the protective packaging from the cable and upper terminated end section taking care not to cut cable or associated upper termination parts in the process.
2. Using a Phillips Head screwdriver, remove the M6 Phillips Head screw holding the mast butt adaptor (if fitted) to the lower connector and retain both screw and mast butt adaptor.
3. Feed the HVSC cable through the FRP support mast.
4. Slide the black plastic mast butt adaptor back onto the brass lower connector, line up holes and screw the Phillips Head screw into position tightly. Now screw the mast butt adaptor into the Stormaster ESE terminal and tighten the M6 Grub screw at the base of the terminal to lock the assembly.

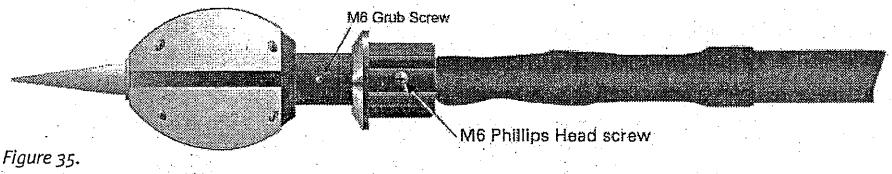


Figure 35.

Labelling

Warning Labels are supplied with all Stormaster ESE terminals and should be installed as per the following.

- In locations where personnel may be in close proximity to the HVSC Downconductor.
- Where the HVSC downconductor connects to the earthing system.
- At the base of the support mast.

There are 2 Warning Labels supplied in the front cover of this manual and also 2 supplied in the lower termination kit. If more labels are required, contact your nearest LPI supplier or Distributor.

The mast chosen for the application must:

- Raise the terminal to a height of at least 2 metres (81 in.) higher than the structure. (Minimum accepted).
- Have an FRP mast section of at least 2 metres (81 in.) used below the air terminal if using LPI HVSC.
- Be suitable for local weather conditions. Seek guidance from a local civil engineer.
- Be guyed and securely attached to the dedicated mounting points (if required).

Types of Mast Configurations

When mounting a Stormaster ESE terminal, there are generally three types of mast configurations that can be used.

Cantilevered

Typically used for mounting to a tower or the side wall of a plant room when a mast and base are not suitable. See drawings STA-02, STA-03, STA-05 and Figure 36.

- 1/3 of the overall mast height must be fixed to the structure for adequate mechanical strength.
- Cantilevered masts can be guyed for additional strength. If guying, the use of a guy ring and/or the eyelets provided on the inline coupling can be utilized.

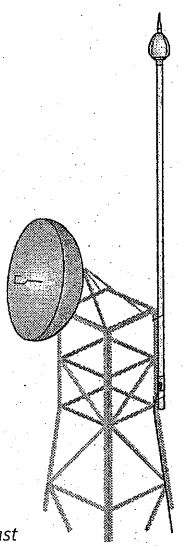


Figure 36.
Cantilevered Mast

Guyed

When mounting a Stormaster ESE terminal, a typical guyed configuration would involve the following. See drawing STA-04 and Figure 37.

- Two sections of mast (Aluminium mast & FRP mast) coupled together with an inline coupling. Securing of guy wires is completed at the eyelets as provided on the inline coupling.
- Alternatively or in addition, a guy ring can be supplied which is installed at the neck of the mast in between the Stormaster terminal and the top section of the FRP. The guy ring provides eyelets for connection of the guy wires.

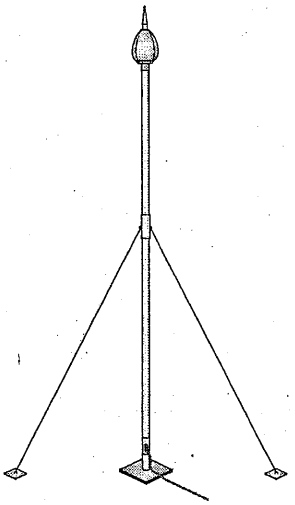


Figure 37. Guyed Mast

Freestanding

A freestanding mast configuration is typically used in situations where protection by isolation is required. For example a Stormaster ESE terminal is installed 5 metres or more away from a fuel storage tank.

Prior to installing the freestanding mast, ensure that:

- A spigot has been supplied with the freestanding mast which allows for external or internal mounting of the FRP mast.
- The downconductor can exit through the base of the freestanding mast if run internally.
- Adequate information is provided for mast foundation requirements.

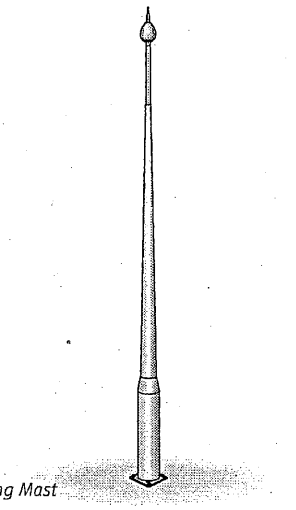


Figure 38. Freestanding Mast

Mast Bases

LPI supplies a mast base welded directly onto the required length of aluminium mast.

Mast Couplings and Guying Points

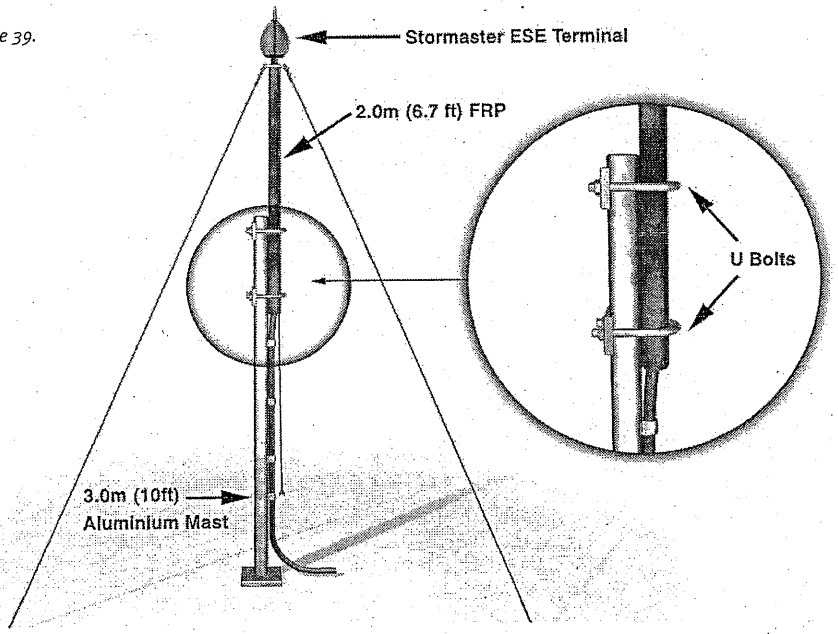
There are two methods of coupling two sections of mast:

1. The U-Bolt set uses two stainless steel U-Bolts to clamp the two masts together. (Figure 39)
2. The inline coupling fixes the upper and lower mast sections together and provides guying points and an exit point for the HVSC downconductor.

U-Bolts and Inline Couplings nuts must be tightened to no more than 55kg/cm (45in.lb).

A Guying Ring is supplied for guy points for any two piece masts that require double guying. This fits on the terminals mast butt adaptor between the Stormaster ESE terminal and the top of the mast. See Figure 40

Figure 39.



Guying

LPI offers a standard 4m (13 ft) and 7m (22.75 ft) guy kit made up of light weight plastic coated fibreglass, non-conductive cable. The LPI GUYKIT-4M and GUYKIT-7M are both non-conductive guying kits. They are designed to be installed with the use of a Guy Ring at the top section of the FRP Mast as illustrated in figure 40. When guying from the LPI Inline Coupling, the use of stainless steel guy wire kits (GUYKIT-4M-SS, GUYKIT-7M-SS) is recommended.

Important Recommendations:

- The guying angle must be no greater than 60° from horizontal.
- The inline coupling couples the upper and lower mast sections and provides guying points and an exit point for the HVSC downconductor.
- Minimum of 3 guying grips per guy end.
- Guying grips spaced at a minimum of 25mm (1 in.).
- Grips are correctly orientated –saddle on the longer length side of the guy and U-bolt over the tail side of the guy.
- Tighten grips to no more than 60cN.m (51bf.in) of torque.
- Customised guy kits can be supplied upon request.

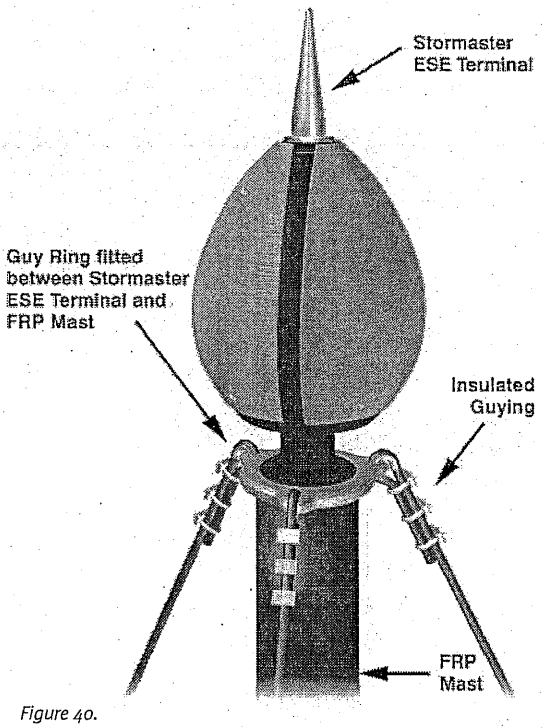


Figure 40.

Preparation for raising the Mast into position

With the upper termination of the HVSC completed and the FRP mast in position it is now time to finalise the mounting arrangement so that the mast can be raised and secured into position.

- If using the recommended installation methods as per drawings STA-01, STA-02, STA-03 and STA-04 (on pages 6, 7, 8 and 9) fit the inline coupling to the lower mast material.
- If required, fit the HVSC downconductor through the side entry of the inline coupling and through the FRP mast. Refer to Figure 42 on page 42.
- Feed the Upper Termination through the guying ring if required.
- Carefully fit the mast adaptor of the Stormaster terminal into the top of the FRP.
- It may be necessary to pull back any slack of HVSC downconductor through the FRP support mast to achieve a tight fit for the Stormaster terminal. This should be completed carefully so as to not damage the upper termination.
- Fix the FRP support mast firmly into the inline coupling and tighten the coupling so that the FRP mast and lower mast material are secured firmly into position with no more than 55kg/cm (45in/lb).
- If a guy kit is to be installed, the guys should be securely fixed to the eyelets as provided on the inline coupling and or the guy ring. See text and graphics as detailed under the heading Guying for more information.

Raising of the Mast

When raising the mast, ensure:

- Guys to inline coupling and/or guy ring are properly secured.
- Guys are not twisted, kinked or damaged.
- Guys are able to be easily secured at the lower guy anchoring points when the mast has been raised.

Turnbuckles or Rigging Screws are recommended at the base anchor points of the guys.

Other guying methods such as conductive stainless steel can be used only on aluminium masts or inline couplings below an FRP section.

Using a crane is recommended (or other suitable equipment) for anything over 6 metres (20ft.) in height, or for hazardous areas or high areas.

- It is very important to keep the mast straight during the lift to avoid damaging the mast.
- The Stormaster ESE terminal must NOT be used as a slinging point.
- When lifting the mast, ensure that the slings or ropes cannot damage the Stormaster ESE terminal, see Figure 41.

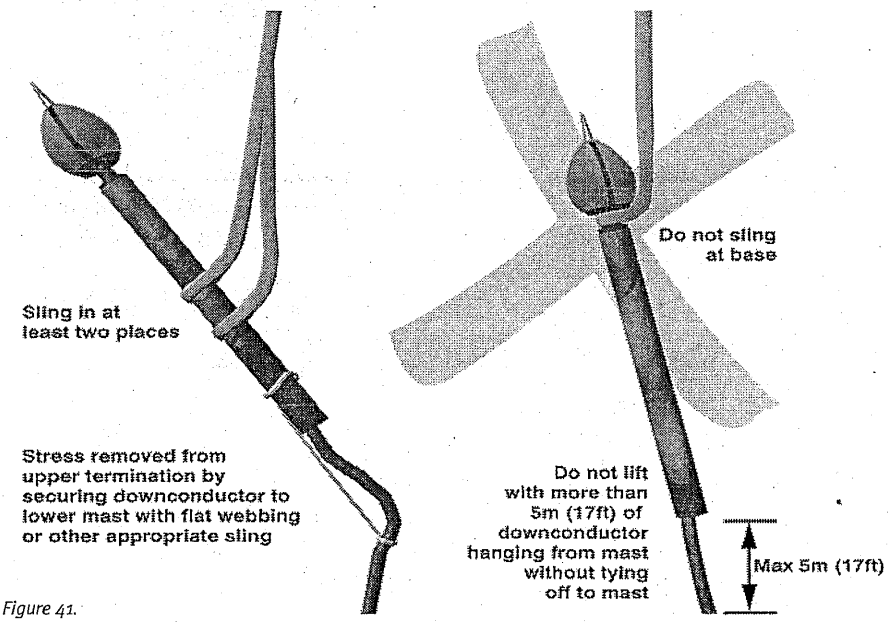


Figure 41.

- When lifting the mast, the HVSC downconductor must be tied off to the mast to remove any strain on the HVSC downconductor termination to the Stormaster ESE terminal.
- Protect the HVSC downconductor at the base of the mast when lifting, maintain a minimum bending radius of 500mm (20 in.) and ensure it does not drag over rough or sharp surfaces.

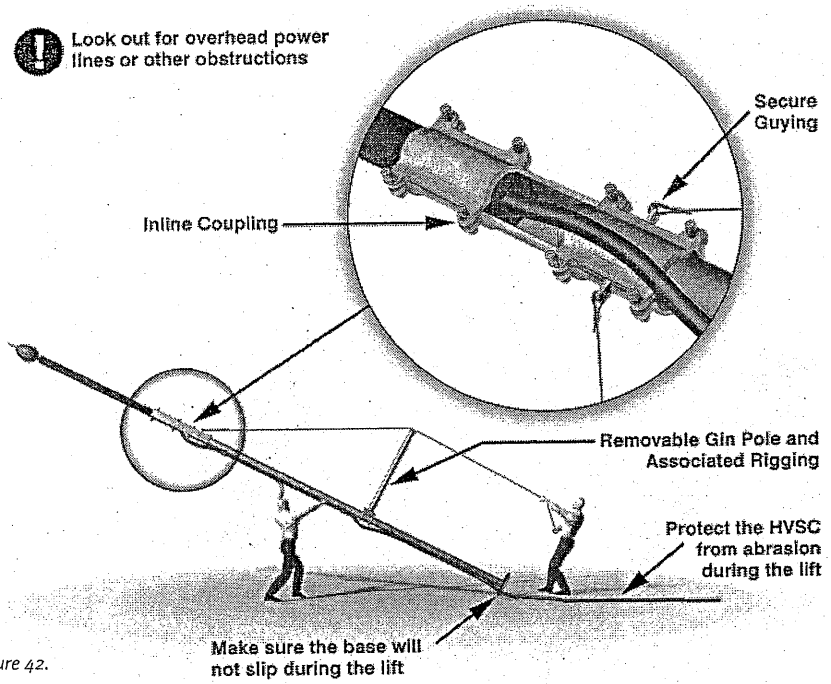


Figure 42.

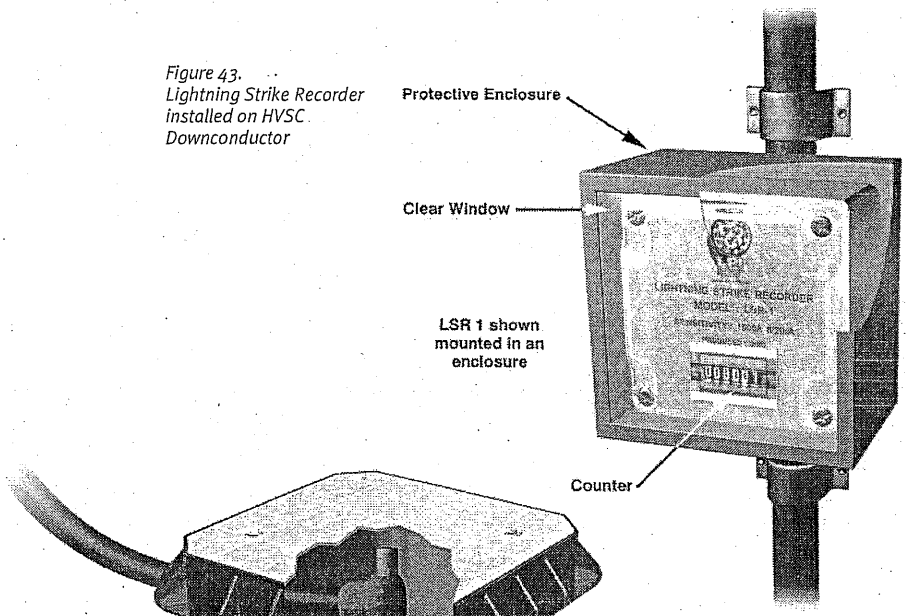
Lightning Strike Recorder (LSR1)

The Lightning Strike Recorder (LSR1) should be installed at a position along the downconductor length where it can be accessed easily for inspection. Typically the LSR1 should be installed approximately 1.5m from ground level or alternatively within the earth pit at the lower termination point of the HVSC.

When installing the LSR1 the following should be considered:

- The LSR1 should be mounted away from areas where damage may occur due to theft, vandalism or nearby operations.
- The LSR1 can be enclosed in a security enclosure but the display should be kept visible to allow for the checking of recorded strikes.

Figure 43.
Lightning Strike Recorder installed on HVSC Downconductor



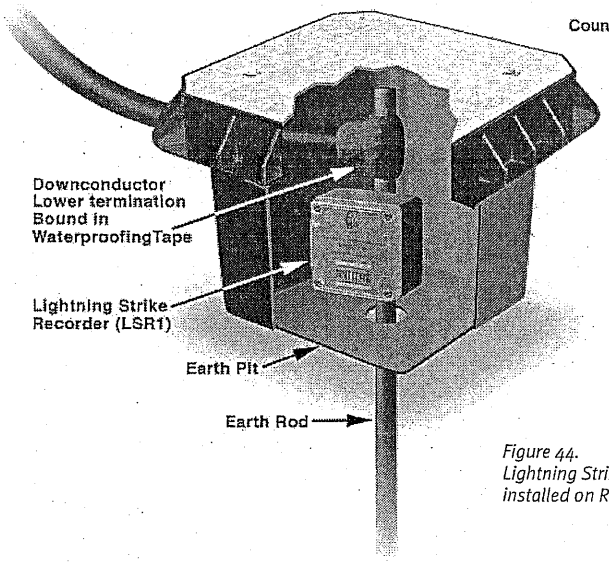


Figure 44.
Lightning Strike Recorder installed on Rod.

Certification

The certification of the LPI Stormaster ESE installation should be performed by an authorised LPI representative.

A certificate of compliance and warranty registration is provided with the installation manual. This certificate should be completed in full following the successful inspection and certification of the installation.

The following should be checked for quality of workmanship and compliance to recommended installation instructions.

Certification checklist

- Correct mast and any associated brackets and fastenings have been used for installation.
- Guying, anchor points and fastenings.
- HVSC Downconductor routing, fixing and weatherproofing.
- Lower termination of HVSC Downconductor.
- Earthing System.
- Labelling.

Operation and Maintenance

The LPI Stormaster ESE Lightning Protection System is designed to react to the rise in electric field which is present in approaching thunder storms. The Stormaster ESE Terminal becomes active only during storm activity.

- The system operates without the need for external power supply or spare parts for standard operation.
- To keep the LPI Stormaster ESE Lightning Protection System operating at optimum levels it needs to be regularly checked.

Maintenance checks must be done:

- After each known lightning strike to the terminal.
- Once every twelve months.
- If changes have been made to the structure.

Checks to be conducted in standard maintenance inspection:

- Is there any damage to Stormaster ESE system?
- Has the structure to be protected been modified since the last maintenance check?
- Check finial tip for excessive pitting.
- Check all rigging, mast mounts, saddles and conductor fixings are secure and tight.
- Ensure that no dirt or other matter is sitting in the air gap between the finial tip and the surrounding panel edges.
- If conventional downconductors are used, check that all conductors are securely fixed and not damaged.
- Check for damage to the LPI HVSC. The downconductor should not be able to be accessed by non authorised people or machinery.
- All warning labels must still be in place.
- Check LSR1 for secure installation and record number of strikes.

Testing the Stormaster Terminal

LPI manufactures and supplies a terminal spark-over tester suitable for testing the Stormaster ESE range of terminals. Contact your local distributor for further details.

Testing the Lightning Earth and the HVSC Downconductor

Use the table on page 47 to record the results following completion of the following steps.

1. Remove the waterproofing tape from the lower termination.
2. Disconnect the HVSC downconductor from the lightning earth.
3. Disconnect the structure earth bonding cable from the earth system.
4. Measure the earth resistance of the lightning earth system and record in column 3 under the heading Earth Resistance Readings in the table provided on page 47.
5. Measure the earth resistance of the structure and record in column 4.

6. Reconnect the structure earth bonding cable to the lightning earth and measure and record in column 5 the earth resistance reading.
7. Use a multimeter to measure the continuity between the inner and outer conductors of the HVSC downconductor. The measurement should exceed 10,000 ohms.
8. Reconnect the HVSC lower termination to the lightning earth and re-seal the termination using waterproofing tape to ensure that it is waterproof.
9. Report any problems arising from the above tests to your local LPI distributor for further advice.

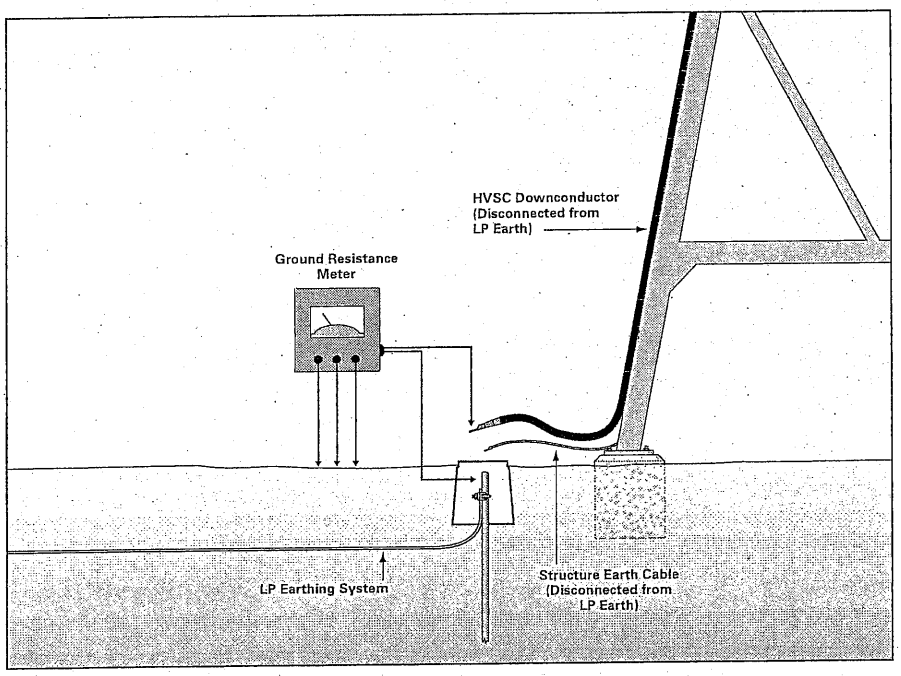


Figure 45.

Date of Inspection	Inspected by:	Earth Resistance Reading #1	Earth Resistance Reading #2	Earth Resistance Reading #3	LSR Reading	Comments

Installation Notes

Inside Back Cover
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