出國報告（出國類別：其他）

桃園國際航空站
增設第一航廈 400Hz 設備工程
變頻器廠驗報告

服務機關：交通部民用航空局桃園國際航空站
姓名職稱：蔡幫工程司禹擎、余組員孟賢
派赴國家：丹麥
出國期間：99 年 07 月 20 日至 99 年 07 月 27 日
報告日期：99 年 9 月 23 日

目　次

圖目錄

表目錄

一、緣起

近年來，由於新型航機所配備的電子設備越來越複雜，加以旅客對於機上視聽娛樂系統之需求也越來越高，因此航機對於電力之需求也日益提高。爲了有效減少航機之重量，因此現有航機均採用頻率爲 400Hz 之電源，是故航機停靠機坪時所需之電源無法直接以市電供應之。桃園國際航空站現有航機停靠機坪時之電力供應方式共計三種：包含由航機啓動自身渦輪輔助動力系統(APU)提供電力、由地勤業者提供的電源供應車(多爲柴油引擎)供應電力或是利用懸掛於空橋下方之 400Hz 靜態式變頻器(以下稱 400Hz 變頻器)將航廈電力轉換爲航機適用之電力來供應。其中，前兩種方式均有造成空氣污染、產生過大噪音與源效率過低之問題。相較於使用航機之 APU， 使用 400Hz 變頻器可節能約 50%，而與地勤公司之電源車相比，400Hz 變頻器之使用可節省約 30%以上之能源成本，可謂施行節能減碳政策之極佳示範。另 400Hz 變頻器使用噪音低(小於 70dBA)以及無廢氣排放之問題，除了符合日趨嚴格的環保法規以外，對於改善機場整體背景噪音、降低空氣汙染與改善機坪工作人員之工作環境均有很大的助益。

桃園國際航空站第一航廈目前共計 18 座登機坪，如需滿足各機坪之航機地面用電需求，則須配置 18 部的 400Hz 變頻器。爲了服務航空公司之需求、增進機場之競爭力以及逐步汰除不敷使用需求之 400Hz 變頻器，本站將於 99 年 10 月中以「桃園國際航空站增設第一航廈 400Hz 設備工程」於第一航廈新設 14 組個別容量達 180kVA 之 400Hz 變頻器，本案由明德電機技師事務所規劃設計與監造，由超立科技有限公司承包，其 400Hz 變頻器則採丹麥 AXA POWER 公司製造之產品，本報告則詳細敘述本工程案派員至丹麥 AXA POWER 工廠進行 400Hz 變頻器廠驗之過程與結果。

二、目的

「桃園國際航空站增設第一航廈 400Hz 設備工程」(以下簡稱本案)共計訂購 14 組容量爲 180kVA 之 400Hz 變頻器，其中每一組各包含兩具容量各爲 90kVA 之變頻器，因此本案實際上是由 28 組容量爲 90kVA 之變頻器組成。與單機容量爲 180kVA 之機組相較，藉由前述雙機配置之模式，當單機發生故障時仍有一部機組可繼續提供服務，雖然於單機操作下無法供應大型航機之用電，但仍可持續服務小型航機，因此可減少空橋停用之困擾與營業損失。

本次廠驗之主要目地係執行履約督導之工作，確認工廠生產機組之規格與品質是否符合契約規範。整個廠驗過程從製造流程、品管程序與實機規格均依合約規範予以核對，並藉由裝備抽驗之方式實施細部規格與功能之現場測試。同時督導原廠對於本案承包廠商提供之設備使用與維護教育訓練，以確保未來保固期限內之維修工作順利。

三、廠驗行程

日期	星期	行　程　說　明
第一天 99 年 07 月 20 日	星期二	桃園國際機場出發 → 德國法蘭克福國際機場
第二天 99 年 07 月 21 日	星期三	德國法蘭克福國際機場→丹麥哥本哈根國際機場 哥本哈根機場火車→至丹麥 Odense 市。
第三天 99 年 07 月 22 日	星期四	至 AXA POWER 工廠 1．工廠會議室召開廠測說明會議。(由 AXA Power 公司專案經理 Mr. Christian Bak 主持) 2．討論 400Hz 主機測試之步驟及相關測試細節(由總工程師 Mr. Brain Hou Nielsen 主持。 3．抽驗機組 2 台，測試時間約 6 小時/台。 4．完成第 1 台機組特性測試。
第四天 99 年 07 月 23 日	星期五	AXA POWER 工廠 1．完成第 2 台機組特性測試。 2．AXA POWER 設備教育訓練課程-裝備介紹及操作。
第五天 99 年 07 月 24 日	星期六	1．AXA POWER 設備教育訓練課程-主要元件說明與故障排除。 2．工廠會議室召開主機廠測完成會議。(由 AXA Power 公司代表 Mr. Brain Hou Nielsen 主持)
第六天 99 年 07 月 25 日	星期日	1.參觀 AXA Power 工廠各產品設備及生產線(Mr. Christian Bak 主持)。 2.晚間搭火車由 Odense 市前往哥本哈根市。
第七天 99 年 07 月 26 日	星期一	1.丹麥哥本哈根國際機場→德國法蘭克福國際機場 2.德國法蘭克福國際機場→桃園國際機場
第八天 99 年 07 月 27 日	星期二	返抵台灣桃園國際機場

四、廠驗過程

4.1 AXA Power 公司簡介

AXA Power 工廠(圖 1)爲本次廠驗之地點，該公司位於丹麥南部的奧登斯 (Odense)市(圖 2)，該市爲丹麥第三大城市。AXA Power 公司成立於 1924 年，於 2000 年由美國 ITW 集團加以收購，該公司目前工廠廠房約 3000 平方米，員工人數爲 75 人，其 400Hz 變頻器年產能約 1000 台。以市場佔有率而言，該公司產品在歐洲市場之佔有率約爲 80%，而在其它地區則約爲 40%。其主要產品除了 400Hz 變頻器外，還有橋掛式機艙空調機(Pre-Conditioned Air unit, PCAIR)以及 28.5VDC 航空用電源機。本(2010)年度該公司承接主要專案爲印度德里新機場計 81 台 90KVA 的 400Hz 變頻器，本站 28 台 90KVA 的 400Hz 變頻器以及中東達卡機場 28 台橋掛式空調機。

圖 1 AXA Power 工廠外觀

圖 2 Odense 市地理位置

4.2　400Hz 變頻器廠測

4.2.1 廠測前說明會議

本次會議由 AXA Power 公司專案經理 Mr. Christen Bak 主持(圖 3)，除了介紹 400Hz 變頻器製造流程以外，對於主機零組件於各組裝工作站之組裝情形、各階段之檢測與設備校正、成品之塗裝、最終的運轉及功能測試等均有詳細的說明。會議中並由總工程師 Mr. Brain Hou Neilsen 說明本次 400Hz 變頻主機檢測之依據標準、檢測設備認證證書以及檢測流程等相關資料。

本章將依據以下項目進行整個廠驗流程之說明：

1.AXA Power Coil 90KVA 變頻機廠驗型號確認(共計 2 台)：

MODEL NO：3GVC-200/260-N 序號爲: 79526/1-25 及 79526/1-24(圖 4)。

2. AXA Power 相關 ISO 及 CE 認證書。

3.測試站流程說明。

4.測試站測試儀器校正認證書文件。

5. 400Hz 變頻器實機測試。

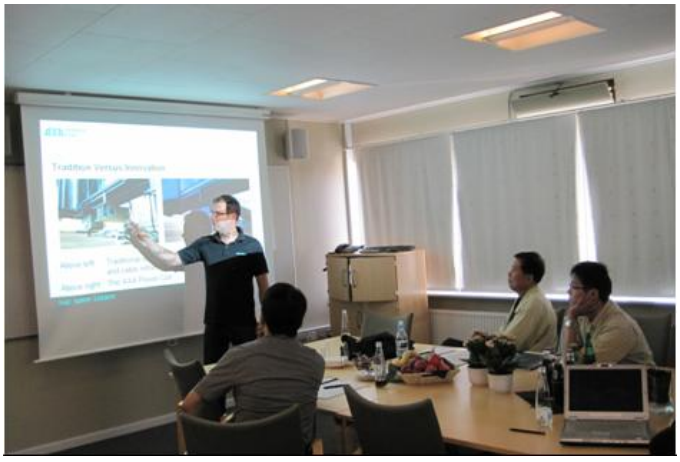


圖 3 廠驗前會議

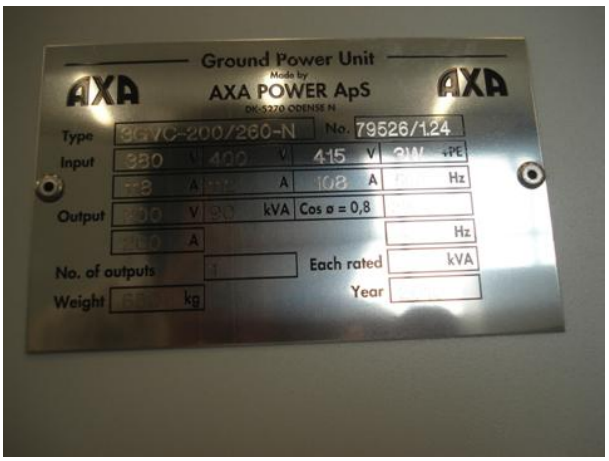


圖 4 抽驗 400Hz 設備，序號 79526/1-24

4.2.2 AXA Power 相關 ISO 及 CE 認證書

APPROACHABLE

ISOQAR

Certificate of Registration

This is to certify that the Quality Management System of:

AXA Power ApS

Smedebakken 31-33, Odense N, 5270, Denmark

has been approved by ISOQAR to the following standard:

ISO 9001: 2008

ISOQAR QUALITY ASSURED — UKAS QUALITY MANAGEMENT 026

Scope of Activities:

Research and Development, manufacturing, marketing and servicing of standard and customer specified equipment within power supplies and transformers.

Certificate Number: **4885QM8001**

Original Certificate Number: **4885/05**

Signed: (on behalf of ISOQAR)

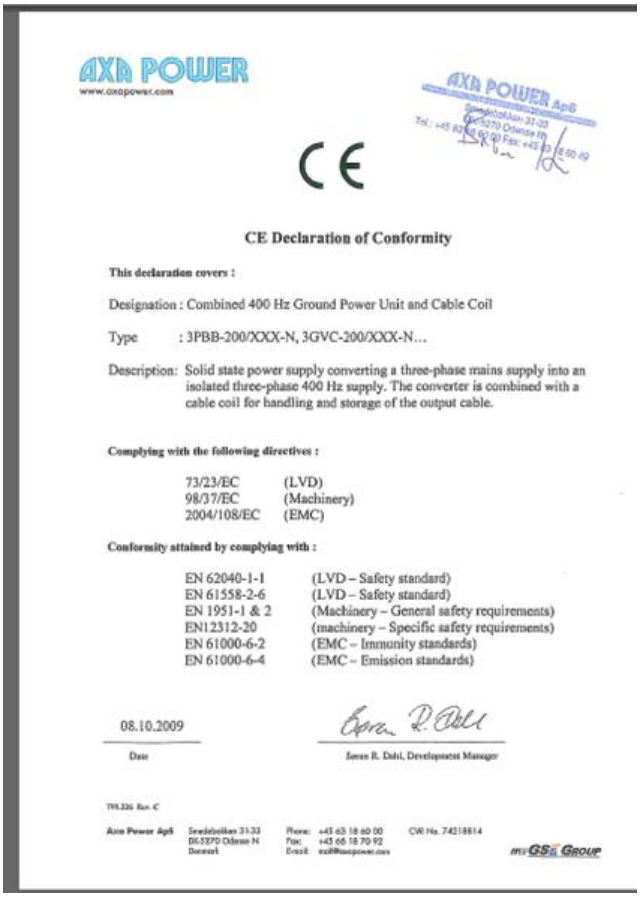
Initial Registration Date: **14 July 2005**

Expiry Date: **14 July 2011**

This certificate will remain current subject to the company maintaining its system to the required standard. This will be monitored regularly by ISOQAR. Further clarification regarding the scope of this certificate and the applicability of ISO 9001:2008 requirements may be obtained by consulting the organisation.

Tel +44 161 855 3999 — AXA POWER ApS Smedebakken 31-33 DK-5270 Odense N Tel.: +45 63 18 60 00 Fax: +45 63 18 70 92 — www.isoqar.com

圖 5 AXA ISO 認證書



AXA POWER

www.axapower.com

CE

AXA POWER ApS Smedebakken 31-33 DK-5270 Odense N Tel.: +45 63 18 60 00 Fax: +45 63 18 60 49

CE Declaration of Conformity

This declaration covers :

Designation : Combined 400 Hz Ground Power Unit and Cable Coil

Type : 3PBB-200/XXX-N, 3GVC-200/XXX-N...

Description: Solid state power supply converting a three-phase mains supply into an isolated three-phase 400 Hz supply. The converter is combined with a cable coil for handling and storage of the output cable.

Complying with the following directives :

73/23/EC	(LVD)
98/37/EC	(Machinery)
2004/108/EC	(EMC)

Conformity attained by complying with :

EN 62040-1-1	(LVD – Safety standard)
EN 61558-2-6	(LVD – Safety standard)
EN 1951-1 & 2	(Machinery – General safety requirements)
EN12312-20	(machinery – Specific safety requirements)
EN 61000-6-2	(EMC – Immunity standards)
EN 61000-6-4	(EMC – Emission standards)

08.10.2009

Date

Soren R. Dahl, Development Manager

TN326 Rev. C

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark — Phone: +45 63 18 60 00 Fax: +45 63 18 70 92 Email: ... — CVR No. 74218814

mGS Group

圖 6 AXA CE 認證書

4.2.3 測試流程說明

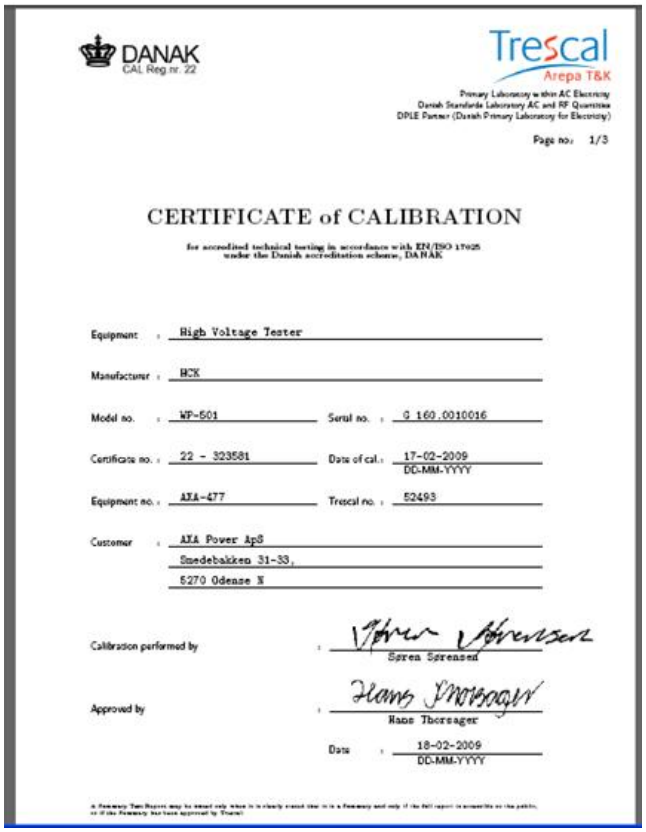
AXA Power 依據ISO核定製造測試程序 (Document no. 677005 rev. A)執行如表 1 之檢測，包含目視檢查、電氣強度測試、變頻器功能測試、其它額外之標準測試、溫昇測試以及最後調整測試，相關細部測試項目請參考附件 1 測試報告。

表 1 AXA POWER 測試程序表

1	Visual inspection.(目視檢查)
2	Electrical strength test.(電氣強度測試)
3	Functional test of converter.(變頻器功能測試)
4	Functional test of standard options, if any.(其它額外之標準測試)
5	Heat test. (溫昇測試)
6	Final adjustment and test.(最後調整及測試)

4.2.4 測試站測試儀器認證書

AXA POWER 於正式測試前，針對本次廠測之相關檢測儀器(表 2)均有出示校正報告書，其中主要的測試儀器爲高電壓測試儀(High Voltage Tester，廠牌：HCK，型號：WP-501)以及電力分析儀(Power Analyzer，廠牌：Voltech，型號：PM3000A)，其餘儀器校驗證明文件請參考附件 2。



DANAK CAL Reg.nr. 22

Trescal Arepa T&K

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

Page no.: 1/3

CERTIFICATE of CALIBRATION

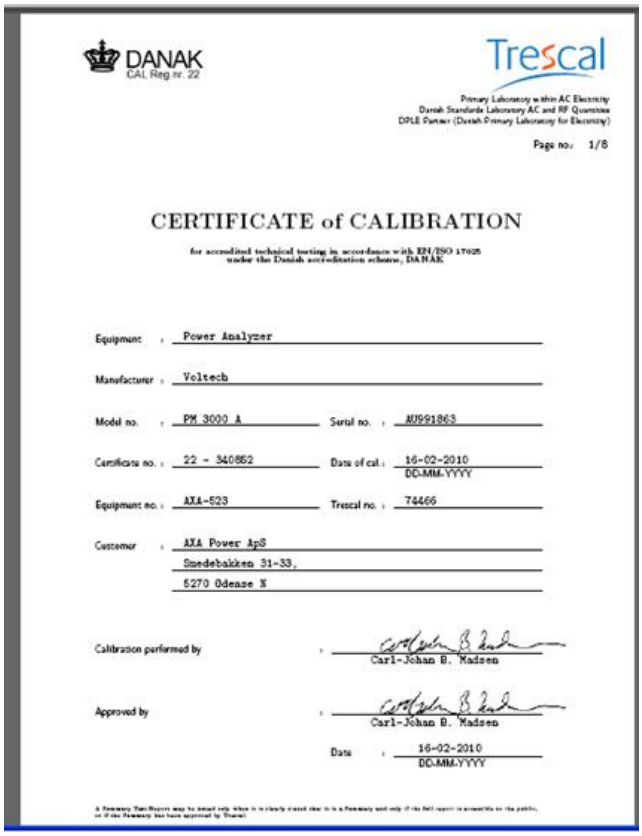
for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : High Voltage Tester
Manufacturer : HCK
Model no. : WP-501 Serial no. : G 160.0010016
Certificate no. : 22 - 323581 Date of cal. : 17-02-2009 DD-MM-YYYY
Equipment no. : AXA-477 Trescal no. : 52493
Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : Søren Sørensen
Approved by : Hans Thorsager
Date : 18-02-2009 DD-MM-YYYY

A Preliminary Test Report may be issued only when it is clearly stated that it is a Preliminary and only if the full report is unavailable or for the public, or if the Preliminary has been approved by Trescal

圖 7 高電壓測試儀器校正認證書



DANAK CAL Reg.nr. 22

Trescal

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

Page no.: 1/6

CERTIFICATE of CALIBRATION

for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : Power Analyzer
Manufacturer : Voltech
Model no. : PM 3000 A Serial no. : MU991863
Certificate no. : 22 - 340852 Date of cal. : 16-02-2010 DD-MM-YYYY
Equipment no. : AXA-523 Trescal no. : 74466
Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : Carl-Johan B. Madsen
Approved by : Carl-Johan B. Madsen
Date : 16-02-2010 DD-MM-YYYY

A Preliminary Test Report may be issued only when it is clearly stated that it is a Preliminary and only if the full report is unavailable or for the public, or if the Preliminary has been approved by Trescal

圖 8 電力分析儀校正認證書

表 2 測試儀器用途說明表

AXA Power 工廠品管測試儀器及用途說明					
項次	工廠編號	儀器英文名稱	儀器中文名稱	用途說明	備考
1	AXA-477	High Voltage Tester	高電壓測試儀	量測機組耐高電壓使用	
2	AXA-523	Power Analyzer	電力分析儀	用於比對GPU輸出或輸入之波型/相角/功率	
3	AXA-553	Multimeter	多功能三用電錶	可與於量測電壓/頻率/電流/電阻等	
4	AXA-570	Insulation Tester	絕緣測試器	用於量測線路或迴路之絕緣值	
5	AXA-599	Power Analyzer	電力分析儀	用於比對GPU輸出或輸入之波型/相角/功率	

4.2.5 400Hz 變頻器實機測試

整個實機測試作業程序及結果如下：

1. 現場清點本案裝備數量：28 台 AXA Power 90KVA GPU(圖 9)。
2. 核對設備型號規格爲 Power Coil MODEL NO：3GVC-200/260-N 與送審規格相符，並登記抽驗兩台之序號。
3. 依表 1 檢驗程序 1 進行目視檢查(Visual inspection)，外觀檢查良好且 400Hz 變頻器電源輸出線長度爲 26M，均符合契約規定。
4. 確認手冊及線路圖等附件已配置於正確位置、核對銘牌序號以及輸出功率無誤、核對各次組件及電路板皆已單獨執行測試，同時前述電路零件皆已由品管人員核對接線及零件標示之正確性並且加以簽署(圖 10)。

圖 9 現場清點機台數量

圖 10 核對電路板是否已執行品管測試

5. 依表 1 檢驗流程 2 進行電氣強度測試(Electrical strength test)，以高電壓測試儀(圖 11)進行變頻器箱體輸出/輸入端高電壓(2kV)短路測試，該測試時間設定爲 1 分鐘(圖 12)。另進行輸入/輸出端與介面模組短路測試(500VDC)，其測試時間同樣爲 1 分鐘。由於安全考量，除原廠工程師外其於參加廠測人員需於隔離柵欄外以策安全。
6. 依表 1 檢驗流程 3 進行變頻器功能測試(Functional test of converter)，其測試內容及結果如下：
    (1) 將介面模組上之指撥開關 SW1 調撥至預設位置，並確認控制晶片內軟體版本正確。
    (2) 確認介面模組控制電壓爲 27-29VDC，並核對控制面盤電壓是否有誤差(圖 13)。
    (3) 設定額定負載並量測瞬入電流(inrush current)(圖 14)。

圖 11 高電壓測試器，儀器編號: AXA 477 (WP-501)

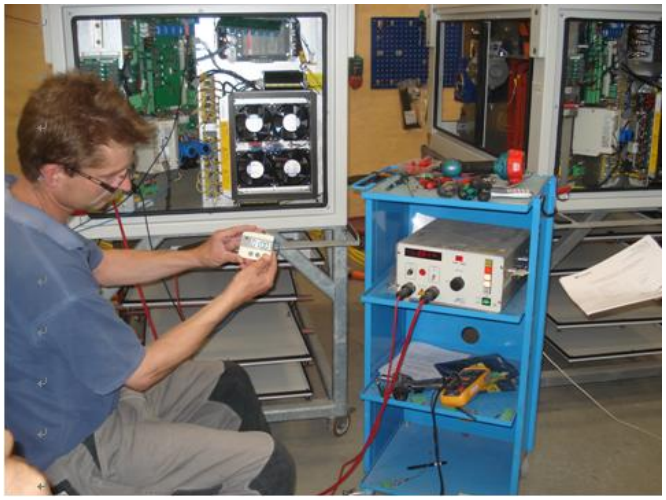


圖 12 設定高電壓測試儀於 2KV，並設定測試時間爲 1 分鐘

圖 13 核對控制面盤電壓是否有誤差

圖 14 利用電力分析儀量測瞬入電流

圖 15 低電壓跳脫保護功能測試

圖 16 過電壓跳脫保護功能測試

(4) 設定輸入電壓爲 360V，並檢查設備於標稱電壓範圍內 400VAC +/-15%可運作。

(5) 測試變頻器低電壓跳脫保護功能(圖 14)以及過電壓跳脫保護功能(圖 16)。

(6) 開啓電纜線捲線器馬達，並確認其增/減速率爲 1m/1.5 Sec，同時以飛機端插頭上之壓置開關試行控制捲線器，確認飛機端插頭上壓置開關及 LED 顯示燈功能正常，並確認捲線器收放時間及極限開關運作正常(圖 17、18)。

(7) 另爲確保變頻器與航機間之連動機制正常，進行 28VDC 飛機連鎖功能之測試，確認 28VDC 燈號顯示正常且控制盤之顯示亦無誤，並試行輸電測試連鎖動作。

(8) 確認飛機端插頭 90%開關功能正常。此項功能在於確認插頭至少需 90%插入飛機電源接口處(內置彈簧機構，可偵測接頭插入深度)，否則變頻器不予送電以確保安全。

(9) 確認變頻器於接頭端之相序正確(圖 19)。

圖 17 利用飛機端插頭壓置開關控制捲線器

圖 18 確認捲線器收放時間及極限開關是否正常

圖 19 以相序儀檢查變頻器接頭相序

圖 20 確認輸出端電壓爲 115V +/- 0.5%

(10) 於額定負載下調整輸出端電壓至 115V +/- 0.5%，其程序爲先行核對變頻機輸出電壓，使用電表比對並確認電壓後，再至控制面板微調輸出電壓至可接受範圍(圖 20)。

(11) 確認 400Hz 設備輸出端之頻率爲 400Hz +/- 0.4 Hz，電壓爲 115V +/- 0.5%。

(12) 確認 400Hz 設備於超負載(125-150%)操作時(圖 21)，於 60 秒內會自動進行跳脫保護。

(13) 確認輸出過電壓跳脫保護設定於 100V/128V。

(14) 使用 Plug & Play 裝置進行三相電壓自動補償，並確認自動補償後之電壓合於規範。

(15) 確認機械結構如電纜捲盤，軸承，齒輪機構及 400Hz 負載線導引組件功能正常。確認捲線器導槽無變形以及減速齒輪機及輸出線安裝正確(圖 22)。

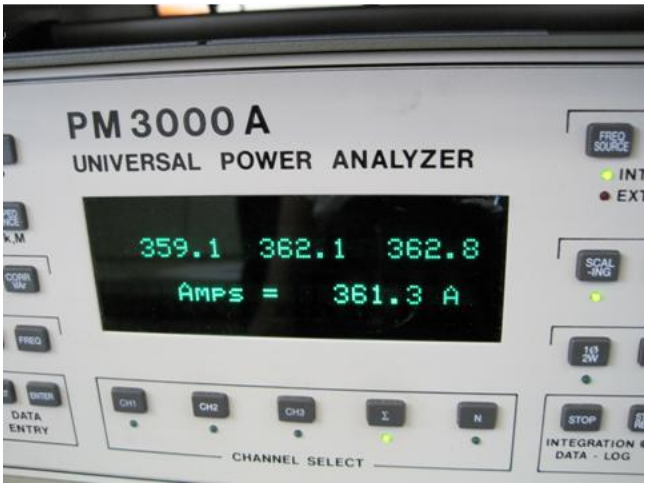


圖 21 設定超負載 150%負載電流 361Amps

圖 22 確認捲線器運轉平順

7. 依表 1 檢驗流程 4 進行其它額外之標準測試(Functional test of standard options)，其測試內容及結果如下：
    (1) 確認遠端主控盤功能正常。
    (2) 模擬中性接地保護發生故障之狀況，並同時確認 NCR 中性接地保護功能運作正常(圖 23)。
    (3) 確認 400Hz 變頻器與空橋連鎖功能正常(圖 24)，該功能可用以防止當 400Hz 變頻器仍處於向航機送電之狀態時，空橋因人為疏忽之操作而導致變頻器纜線遭拉扯斷線。
    (4) 確認 GPU 具備 RS485 及乙太網路擴充之功能(本案由於未配附上列功能，現場人員儘指出擴充槽位置以利未來昇級時可直接購買 PCB 板昇級)。
    (5) 本案監造單位指定抽查 250%超負載保護測試(圖 25)，測試結果符合契約規定(圖 26)。

圖 23 模擬中性接地保護故障

圖 24 以一手動開關模擬空橋連鎖訊號

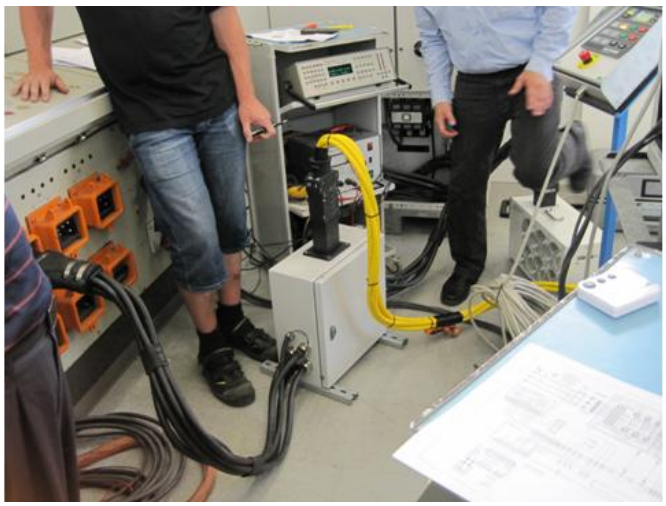


圖 25 AXA 串接兩組負載機進行 250%超載測試

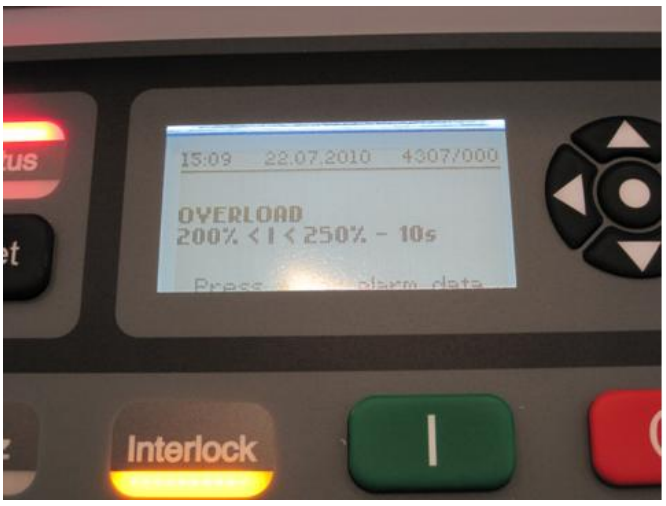


圖 26 確認 250%過負載功能正常

8. 依表 4 檢驗流程進行溫昇測試(Heat Test)，此項測試亦爲變頻器之可靠度測試。本測試藉由變頻器於額定負載下連續兩小時運轉後，檢查變頻器主要區段之溫度是否有過高或異常之現象，經測試結果，機體內部溫度均在標準範圍內(圖 27)。
9. 依表 4 檢驗流程進行最後調整及設定(Final adjustment and test)以及核對最後測試結果(圖 28)。
10. 除了上述表定之測試，本案監造單位代表依契約規範提出箱體防水 IP 等級認證、EMC 認證及測試程序，AXA POWER 提出相關報告如附件 3、4，另有關總諧波之計算則如附件 5。

圖 27 溫昇測試後機體內部溫度

圖 28 核對所有測試結果

4.3 檢測說明及結果紀錄

4.3.1 出廠檢測報告

相關檢測報告細部內容與數值可參閱附件 1 之測試報告，其相關數值經比對契約

規範，均符合契約規定，同時經本站代表、承包商代表、監造單位與 AXA POWER 代表簽署認同測試結果之書面聲明(圖 29)，並准許該變頻機辦理船運事宜。

AXA POWER
www.axapower.com

Factory Test Conclusion

The FAT has been witnessed – Reference document 678001 rev C. - accepted and the representative for customer acknowledges the design and the performance of the system. The signature below signifies satisfactory completion of the design and tests and approves the equipment for shipment to the costumer site.

Test subjects: One fully test have been performed on unit with serial number 79526/1.25 and a partial test – with supplementary tests – have been performed on unit with serial number 79526/1.24.

23-07-2010

Signed by:

Yu-Meng-Hsien - TIA

Tsai-Yu-Ching - TIA

Lin-Tung-Chou - Wiselec

Tsou, Hsin-Tung - Wiselec

Chen, Kuan-Hung - IEEC

Brian Hou Nielsen – AXA Power

Christian Bak – AXA Power

AXA POWER ApS
Smedeholm 31-33
DK-5270 Odense N
Tel.: +45 63 18 60 00 Fax: +45 63 18 60 92

Axa Power ApS Smedeholm 31-33 DK-5270 Odense N Denmark Phone +45 63 18 60 00 Fax +45 66 18 70 92 CVR No. 74218834

GSE GROUP

圖 29 測試結果認同聲明書

4.4 現場生產線及品管作業參觀

4.4.1 生產流程簡介

除了實機之測試，本次廠驗亦藉由參觀工廠之生產線來了解 AXA POWER 之品管作業。工廠生產線之參訪由 AXA Power 公司專案經理 Mr. Christian Bak 帶領參觀並詳細介紹 400Hz 變頻機之製造流程(圖 30~圖 37)，參訪內容包含：零組件組裝工作站、各階段的檢測、調整校正、完成後的塗裝、最終的運轉及功能測試、產品出廠前的包裝，以及該公司之教育訓練中心。該公司的廠區非常清潔，動線規劃人車分道，標線亦標示的十分清楚，不同的工作區域其地面以不同之顏色區分，非屬作業人員不得任意進入。該公司採用與豐田汽車相同之品管過站流程，對於外廠訂製之零件在上線組裝前均先經過入廠檢驗，同時測試品管人員必需簽署合格標簽並建立批號記錄，以利瑕疵或故障零件之後續追蹤。經由參觀了解，AXA POWER 公司之生產流程採取一貫化之作業，各個生產站區皆有極細之分工以及查核程序，因此其生產品質亦有一定之水準。此外，其工作安全作業執行極爲嚴格，值得國內工廠參考改善的空間極多。

AXA Power 公司目前主要產品爲 28.5VDC 直流電源供應機，此項設備係使用於小型定翼機或直昇機飛行前之檢查或做爲充電機使用。第二產品線爲 400Hz 靜態式變頻器，AXA 目前主力在於生產新款的 2300 系列，惟舊款 2200 系列仍保留生產，2300 系列相較於舊款式而言其體積更爲輕巧，不僅採用模組化之設計，同時亦採用新一代之 PCB 技術來達成高可靠度低維修度的設計。AXA Power 第三種主要產品爲橋掛式空調機(PCAIR)，該公司今年已取得中東卡達國際機場新設空橋空調器之計畫。該空調器目前生產規格爲 120 及 75 噸兩種，值得一提的是，該公司之空調機爲全球唯一採用壓縮機組模組化維修之設計，如機體中有任何一組壓縮機損壞，維修人員可於一小時內完成壓縮機之拆解維修，而該公司宣稱該空調機進行年度定期保養時，拆解所有壓縮機及清潔內部只需兩小時。與航站現有空調機之保養與維修時程相較之下，其產品設備之維護優點十分值得航站未來採購類似產品之參考。

圖 30 工廠參觀-生產流程進度管制表說明

圖 31 工廠參觀-28VDC GPU 產品線製程說明

圖 32 工廠參觀-Power Coil 生產線

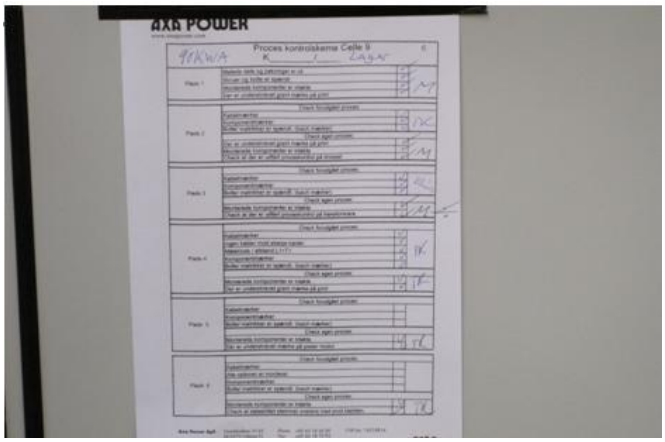


圖 33 工廠參觀-品管檢驗表

圖 34 工廠參觀-Power Coil 生產組裝區

圖 35 工廠參觀-橋掛空調器(PCAIR)生產線

圖 36 工廠參觀-負載機控制台(變頻機測試用)

圖 37 工廠參觀-測試結果討論會

4.4.2 AXA Power 90kVA GPU 教育訓練

AXA Power 特別針對本案進行爲期一天半之 400Hz GPU 安裝及使用訓練，課程內容包含 Power Coil 變頻機於其它國家之安裝工程實例、安裝固定架型式之建議(圖 38)、細部零組件功能說明以及實機操作及故障排除演練(圖 39)。

AXA Power 公司說明顧客端可以使用線上教學進行更進一步的訓練，待本案機組安裝完成後，該公司將派遣工程師來台協助運轉調試(Commissioning)，同時會在台灣舉辦使用及維修講習。

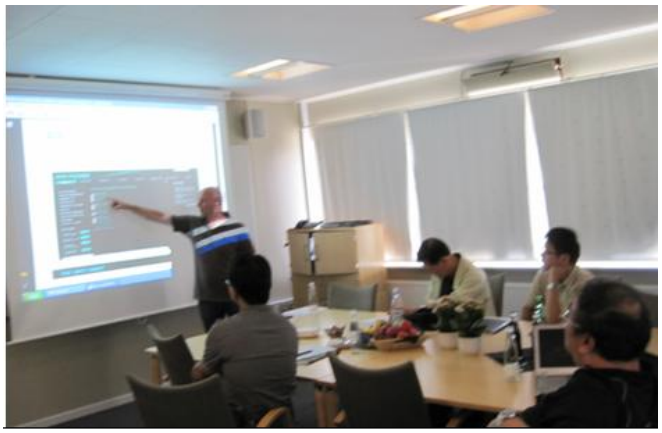


圖 38 教育訓練-GPU 橋掛安裝說明

圖 39 教育訓練-實際故障排除課程

4.5 機場應用實例參訪

本次出國主要之目的係執行第一航廈 400Hz 變頻器廠驗，以確保本工程使用之設備於進場安裝前之品質與規格是否符合規定，在整個廠驗行程中須過境德國法蘭克福、丹麥哥本哈根國際機場，在候機及轉機過程時，亦留意各機場之設計與相關設施之建置，以下爲前述機場之參訪心得：

1. 丹麥哥本哈根機場之航機起降極爲忙碌，航廈設施甚爲新穎，不過其航廈之設計並不大(圖 40)，航空公司報到櫃台遠不如桃園機場多，且報到區引道面積狹窄，故易導致旅客報到速度緩慢，另外且其航廈部分區域之地圖導引標示不甚明確，容易誤導旅客走錯地方。不過哥本哈根機場在規劃上仍有其優點，例如結合火車捷運及巴士車站於航廈內，因此其轉乘大眾運輸可於 10 分鐘以內步行抵達。
2. 德國法蘭克福國際機場，由於位於轉運樞紐，旅客運量及飛機起降非常繁忙，機場內往來各航站必需使用輕軌捷運系統，旅客運輸十分方便，不過如同哥本哈根機場之缺點，其路標指示亦有改善空間。
3. 法蘭克福機場也是採用 AXA Power 生產之靜態式變頻器，不過在航廈空橋處其設置方式並非採用橋掛式，而是於空橋附近空地設置直立式變頻器，其管線採用預埋式(圖 41)，因此其安裝線路非常簡潔。

圖 40 機場參訪-丹麥哥本哈根機場

圖 41 機場參訪-法蘭克福機場 400Hz 之電纜採預埋式

五、心得與建議事項

本廠測目的在於 400Hz 變頻器出廠前，確認變頻器主機之機型尺寸、規格以及性能等符合契約規範之要求。本次廠驗在施工廠商超立科技有限公司以及規劃設計監造單位明德電機技師事務所安排下，會同本站人員依據契約規定事項順利完成相關檢測作業，設備檢測結果亦由監造單位代表確認符合規範規定。該批變頻器完成檢測後即依預訂進度時程辦理後續運輸作業，運送至現場進行安裝與測試。

廠驗行程中除了針對本工程之設備辦理相關之檢測外，亦有機會參觀製造廠商 AXA POWER 公司變頻器之製作流程，經由該公司專案經理 Mr. Christen Bak 先生引領解說，實地了解主機生產及品質管制流程，所有的程序步驟，自零件逐一組裝及專業的分工檢測，均在嚴格的控管下完成。此外，本次廠驗亦參觀丹麥哥本哈根機場以及德國法蘭克福機場，對於兩機場之相關設施配置方式亦收穫不少。

以下則針對本次廠驗過程之收穫，提供幾點建議：

(一)現有桃園國際航空站已建置之 400Hz 設備容量均屬於 120kVA，惟該容量並不適用於如波音 747 這類型的大型客機，因此如依現有航站之配置，則無法免除對於地勤業者所提供的電源供應車之依賴。因此，建議航站將來進行 400Hz 設備之新增或汰換時，可考量本案所建置之 180kVA 之容量。

(二)本案建置 180kVA 之 400Hz 變頻器，係採雙機(各 90kVA)併聯之形式，如單機故障，則仍有另外一台機組可持續提供 90kVA 之電源服務予航機。與現有航站設置單台 120kVA 之設備相較之下，其可用率必然大幅提高。因此，建議航站未來之機組配置亦可採本案之方式。

(三)本案所採用之變頻器，其電纜線配備有自動放/捲線器並收納於捲線箱中，與現有航站之配置採用空橋外吊掛式相比，不但可延長電纜線之壽命，同時亦大幅減少操作人員將電纜線銜接於航機時之負擔，減少職業傷害(電纜線十分笨重)並增加作業之速度。

(四)德國法蘭克福機場也是採用 AXA Power 公司生產之靜態式變頻器，不過在航廈空橋處其設置方式並非採用本案之橋掛式，而是於空橋附近空地設置直立式變頻器，其管線則採用預埋式埋入地面裡，因此空橋下方之線路與配置非常簡潔，不但減少空橋本體之荷重負荷，其下方淨空之空間亦減少車輛碰撞事故之發生。此種配置方式的另一個好處，可減少電纜線橫跨機坪或垂置地面所造成之交通阻礙。未來如第三航廈建置時，可考慮採用此一配置方式，以增進機坪作業空間。

六、附件

附件 1：測試報告(原文)
附件 2：儀器校驗證明文件
附件 3：設備 IP 等級證明文件
附件 4：設備 EMC 檢測證明文件
附件 5：總諧波之計算證明

AXA POWER
www.axapower.com

Acceptance Test Certificate for 60 - 90 kVA
AXA2300 Power Coil Units

Converter Data:

Type:	36VC-200/260-N	Serial no.:	79526/1.25
Input voltage:	400V	Output voltage:	200V
Input current:	112A	Output current:	260A
Input frequency:	70Hz	Output frequency:	50Hz
Document no. 677005 rev B:		Output power:	90kVA

Inspections and tests performed:

		Signature:
1	Visual inspection.	
2	Electrical strength test.	BHN
3	Functional test of converter.	
4	Functional test of standard options, if any.	
5	Heat test.	
6	Final adjustment and test.	

Approval:

AXA hereby confirms that the above equipment has been tested and complies with the acceptance requirements of the test procedure.

Date:

AXA POWER ApS
Smedebakken 31-33
DK-5270 Odense N
Tel.: +45 63 18 60 00 Fax: +45 63 18 60 49

Remarks, external approval etc:

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark Phone +45 63 18 60 00 Fax: +45 66 18 70 92 E-mail: mail@axapower.com CVR No. 74218814

23

Visual inspection:

	Serial no.:	Accept. level	Value:	Instr. no.:	Pass:
1	Verify presence of manual and diagram.	——	——	——	√
2	Verify correctness of the rating plate.	——	——	——	√
3	Check specified labeling according to parts list.	——	——	——	√
4	Check that sub-component testing has been performed (PCBs, magnetics & paint quality).	——	——	——	√
5	Check that components, wires and cables are numbered according to the diagram(s).	——	——	——	√
6	Check bolt/screw connections by looking at the leaf springs.	——	——	——	√

Electric strength test:

	Preparations prior to the electrical strength tests: • The processor module is dismounted. • The frequency converter G1 is disconnected. • The RFI connections to frame are removed. • On the interface module the output voltage X8, interlock. & I/O-terminals X11-15 are disconnected. • The power modules are shorted (one side is sufficient).	Accept. level	Value:	Instr. no.:	Pass:
1	Output terminals are shorted to frame and 2.0 kV is applied between input terminals and frame for 1 minute.	——	——	AXA477	BKN
2	Input terminals are shorted to frame and 2.0 kV is applied between output terminals and frame for 1 minute.	——	——	AXA477	BKN
3	I/O-terminals on the interface module are shorted and 500 VDC is applied between the terminals and frame for 1 min.	——	——	AX4570	BKN

Axa Power ApS Snedsbolten 31-33 DK-5270 Odense N Denmark Phone: +45 63 18 60 00 Fax: +45 66 18 70 92 Email: mail@axapower.com CVR No. 74218814

Functional test:

	If nothing else is stated, functional tests are performed at nominal input voltage, nominal output voltage and no load.	Accept. level	Value:	Instr. no.:	Pass:
1	Preset the DIP-switch (SW1) on the interface module to the present hardware configuration.	978.001	—	—	√
2	Check/note software version of D4. MASTER Check/note software version of D24. DSP Check/note software version of the display PCB.	077020 077020 077020	Rev. A Rev. A Rev. A	— — —	√
3	Check control voltage at interface module.	27-29 VDC	28,0V	AXA 553	√
4	Verify correct function of the neutral voltage supervision, with a 9 V battery.	7.5 ± 1.5 V	—	—	√
5	Verify function of fans – Set value = 01 ⇒ max. speed.	—	—	—	√
6	The current trip function is tested by means of the current stop box, AXA no. 382 or equivalent. Verify that the GPU trips due to short circuit when one of the output phases is connected to neutral.	—	—	—	√
7	Check and note inrush current (peak-value/1.414).	< In	58,6A	AXA 594	√
8	Verify acceptable input voltage range to ± 15% of nominal.	± 8 V	—	AXA 553	√
9	The DIP switches on the frequency converter G1 are set up as follows: I / AI / U 50 Hz 1 — 60 Hz, Nom. freq. Off 2 — On, Silent P&F 3 — CT, Load 5 4 — 10, Jog Hz Fault 5 — Run, Relay Off 6 — On, AI offset Off 7 — On, Auto reset Off 8 — On, Hi Frequency	—	—	—	√
10	The potentiometers on the frequency converter G1 are set up as follows: Motor I nom.: 150 % Acc./Dec.: 1.5 sec. High frequency: Nom.	—	—	—	√
11	Verify function of push buttons/LEDs located on the aircraft connector.	—	—	—	√
12	Verify function of interlock system at aircraft connector.	—	—	—	√

Axa Power ApS Smedeholmen 31-33 DK-2730 Herlev Denmark Phone +45 63 18 60 00 Fax +45 66 18 70 92 E-mail mail@axapower.com CVR No. 74218014

Functional test: *(continued)*

			Accept. level	Value:	Instr. no.:	Pass:
13	Verify correct function of the 90% switch. If activated the converter can be started but coiling must be inhibited.		——	——	——	√
14	Verify phase sequence A-B-C at the aircraft connector.		——	——	——	√
15	Adjust the output voltage at nominal load.	V_{AN} V_{BN} V_{CN}	115.0 V ± 0.5 %	115,0 115,0 115,0	AXA 599	√
16	Adjust the DC-voltage at nominal load.	V_{DC1} (+ to N) V_{DC2} (N to -)	± 1 %	276 V 276 V	AXA 599	√
17	Adjust the active power at nominal load. Verify that the output current shown in the display equals the actual output current. Verify that the output apparent power shown in the display equals the actual output power.	IAVG (actual) IAVG (disp.) SAVG (actual) SAVG (disp.)	± 3 % ± 3 %	247,3 A 248 A 85,4 kVA 85,8 kVA	AXA 599	√
18	Verify phase displacement at nominal load.	Angle_BN Angle_CN	-120 ± 1° -240 ± 1°	-120,2 -240,2	AXA 599	√
19	Verify output voltage DF at nominal load.	DF_AN DF_BN DF_CN	< 2 %	0,9 % 1,0 % 1,1 %	AXA 599	√
20	Verify output frequency.		400 ± 0.4 Hz	399,9 Hz	AXA 599	√
21	Verify disengagement time at 125-150% load.		60 ± 1 sec.	——	AXA 599	√
22	Verify output voltage trips at 100 V / 128 V.		± 2 V	——	AXA 599	√
23	Verify correct function of "manual" voltage compensation facility. Set value(s) = 2 V / 100 A		± 0.2 V /100 A	2,2 / 260	AXA 599	√

Functional test: *(continued)*

		Accept. level	Value:	Instr. no.:	Pass:
24	Enabled Plug'n'Play compensation & verify correct function by comparing the plug voltage at no load and nominal load.	± 1 V			√
25	Verify smooth mechanical running of the cable drum including bearings, worm gear, and cable guide system.	—	—	—	√
26	Verify correct mechanical adjustment and electrical function of cable coil limit switches (slow coiling at < 4 m cable out).	—	—	—	√
27	If the unit is equipped with non standard software verify the function of the remote control/indication including any added standard options.	—	—	—	N/A

Functional test of options (if included):

		Accept. level	Value:	Instr. no.:	Pass:
1	Verify correct function of remote control box.	—	—	—	√
2	Activate the NCR-supervision and verify correct function.	—	—	—	√
3	Activate GPU enable and verify correct function.	—	—	—	√
4	Verify correct function of the RS485 serial interface (A18), by connecting the 'AXA Service Tool' software via an USB to RS485 adaptor to the DATA+, DATA- terminals.	—	—	—	N/A
5	Verify correct function of the Modbus TCP/IP interface (A19), by connecting the 'Modscan' software via the Ethernet port on the NetBiter RTU-TCP Gateway (A19).	—	—	—	N/A

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark Phone +45 63 18 60 00 Fax +45 66 18 70 92 Email: mail@axapower.com CVR No. 74218814

AXA POWER
www.axapower.com

Heat Tests:

		Accept. level	Value:	Instr. no.:	Pass:
1	The 60-90 kVA unit is tested at nominal load for 2 hours, with the fan control by-passed (fan speed high).				
	Actual load [kVA]:	——	90kVA		
	Final temperatures measured at the end of the test (acceptance levels are related to Tamb ≈ 20 °C):				
	Ambient temperature.	——	27°C	——	
	Inverter module (via display readings).	< 55 °C	47-50°C	——	
	Output transf. (outer part of winding via thermal strip).	< 132 °C	104°C	——	

Final Adjustments / Tests:

		Accept. level	Value:	Instr. no.:	Pass:
1	Activate 'Default Setup' in the setup menu.	——	——	——	
2	- Set voltage compensation to Plug'n'Play.	——	——	——	
	- Set up real time clock to actual time.	——	——	——	
	- Set display language acc. to specification: ENG	——	——	——	
	- Verify presence of silicone on rubber weather slips.	——	——	——	
	- Verify presence of fittings (filters, mounting devices etc.).	——	——	——	
	- Verify presence of 'GPU Setup' label in control box.	——	——	——	
	- Fill in the 'GPU Setup' labels with the appropriate data.	——	——	——	
	- Fill in the 'DIP-setting' label with the present setup.	——	——	——	
	- Fill in the component registration form 799.360	——	——	——	
3	For all GPU's to the UK market disable the setup access by setting the DIP switch SW2:4 to OFF on the display module.	——	——	——	NA

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark Phone: +45 63 18 60 00 Fax: +45 66 18 70 92 E-mail: mail@axapower.com CVR No. 74218814

AXA POWER
www.axapower.com

Acceptance Test Certificate for 60 - 90 kVA AXA2300 Power Coil Units

Converter Data:

Type:	36VC-200/260-1V	Serial no.:	79526/1.24
Input voltage:	400V	Output voltage:	200V
Input current:	117A	Output current:	260A
Input frequency:	50Hz	Output frequency:	400Hz
Document no. 677005 rev B:		Output power:	90kVA

Inspections and tests performed:

		Signature:
1	Visual inspection.	
2	Electrical strength test.	
3	Functional test of converter.	
4	Functional test of standard options, if any.	
5	Heat test.	
6	Final adjustment and test.	

Approval:

AXA hereby confirms that the above equipment has been tested and complies with the acceptance requirements of the test procedure.

27/7 - 2010
Date:

Signature:

AXA POWER ApS
Smedebakken 31-33
DK-5270 Odense N
Tel.: +45 63 18 60 00 Fax: +45 63 18 60 49

Remarks, external approval etc:

Additional test:
overload with 154 %
Over load with 245 %
η = 94.4 % (Pinput = 80.2 kW AND Pout = 75.7 kW) - Instrument AXA 549 AXA 523

AXA POWER
www.axapower.com

Visual inspection:

	Serial no.:	Accept. level	Value:	Instr. no.:	Pass:
1	Verify presence of manual and diagram.	———	———	———	
2	Verify correctness of the rating plate.	———	———	———	
3	Check specified labeling according to parts list.	———	———	———	
4	Check that sub-component testing has been performed (PCBs, magnetics & paint quality).	———	———	———	
5	Check that components, wires and cables are numbered according to the diagram(s).	———	———	———	
6	Check bolt/screw connections by looking at the leaf springs.	———	———	———	

Electric strength test:

	Preparations prior to the electrical strength tests: • The processor module is dismounted. • The frequency converter G1 is disconnected. • The RFI connections to frame are removed. • On the interface module the output voltage X8, interlock. & I/O-terminals X11-15 are disconnected. • The power modules are shorted (one side is sufficient).	Accept. level	Value:	Instr. no.:	Pass:
1	Output terminals are shorted to frame and 2.0 kV is applied between input terminals and frame for 1 minute.	———	———		
2	Input terminals are shorted to frame and 2.0 kV is applied between output terminals and frame for 1 minute.	———	———		
3	I/O-terminals on the interface module are shorted and 500 VDC is applied between the terminals and frame for 1 min.	———	———		

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark Phone +45 63 18 60 00 Fax +45 66 18 70 92 Email mail@axapower.com CVR No. 74218814

Functional test:

	If nothing else is stated, functional tests are performed at nominal input voltage, nominal output voltage and no load.	Accept. level	Value:	Instr. no.:	Pass:
1	Preset the DIP-switch (SW1) on the interface module to the present hardware configuration.	978.001	——	——	
2	Check/note software version of D4. MASTER Check/note software version of D24. DSP Check/note software version of the display PCB.	077 20 077 20 077 20	Rev. A Rev. A Rev. A	—— —— ——	✓
3	Check control voltage at interface module.	27-29 VDC			
4	Verify correct function of the neutral voltage supervision, with a 9 V battery.	7.5 ± 1.5 V	——	——	
5	Verify function of fans – Set value = 01 ⇒ max. speed.	——	——	——	
6	The current trip function is tested by means of the current step box, AXA no. 382 or equivalent. Verify that the GPU trips due to short circuit when one of the output phases is connected to neutral.	——	——	——	
7	Check and note inrush current (peak-value/1.414).	< In			
8	Verify acceptable input voltage range to ± 15% of nominal.	± 8 V	——		
9	The DIP switches on the frequency converter G1 are set up as follows: I / AI / U 50 Hz 1 — 60 Hz, Nom. freq. Off 2 — On, Silent P&F 3 — CT, Load 5 4 — 10, Jog Hz Fault 5 — Run, Relay Off 6 — On, AI offset Off 7 — On, Auto reset Off 8 — On, Hi Frequency	——	——	——	
10	The potentiometers on the frequency converter G1 are set up as follows: Motor I nom.: 150 % Acc./Dec.: 1.5 sec. High frequency: Nom.	——	——	——	
11	Verify function of push buttons/LEDs located on the aircraft connector.	——	——	——	✓
12	Verify function of interlock system at aircraft connector.	——	——	——	✓

Functional test: *(continued)*

			Accept. level	Value:	Instr. no.:	Pass:
13	Verify correct function of the 90% switch. If activated the converter can be started but coiling must be inhibited.		——	——	——	
14	Verify phase sequence A-B-C at the aircraft connector.		——	——	——	
15	Adjust the output voltage at nominal load.	V_{AN} V_{BN} V_{CN}	115.0 V ± 0.5 %			
16	Adjust the DC-voltage at nominal load.	V_{DC1} (+ to N) V_{DC2} (N to -)	± 1 %			
17	Adjust the active power at nominal load. Verify that the output current shown in the display equals the actual output current. Verify that the output apparent power shown in the display equals the actual output power.	IAVG (actual) IAVG (disp.) SAVG (actual) SAVG (disp.)	± 3 % ± 3 %			
18	Verify phase displacement at nominal load.	Angle_BN Angle_CN	-120 ± 1° -240 ± 1°	-120.1° -239.9°	AXA 599	✓
19	Verify output voltage DF at nominal load.	DF_AN DF_BN DF_CN	< 2 %	0,9 % 1,0 % 1,0 %	AXA 599	✓
20	Verify output frequency.		400 ± 0.4 Hz	399.9	AXA 599	✓
21	Verify disengagement time at 125-150% load.		60 ± 1 sec.	——	AXA 599	✓
22	Verify output voltage trips at 100 V / 128 V.		± 2 V	——	AXA	✓
23	Verify correct function of "manual" voltage compensation facility. Set value(s) = 2 V / 100 A		± 0.2 V /100 A			%

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark Phone: +45 63 19 60 00 Fax: +45 66 19 70 92 E-mail: ma@axapower.com CVR No. 74218014

AXA POWER
www.axapower.com

Functional test: *(continued)*

			Accept. level	Value:	Instr. no.:	Pass:
	24	Enabled Plug'n'Play compensation & verify correct function by comparing the plug voltage at no load and nominal load.	± 1 V	114.9 V 114.9 V 114.8 V	AXA	√
	25	Verify smooth mechanical running of the cable drum including bearings, worm gear, and cable guide system.	—	—	—	√
	26	Verify correct mechanical adjustment and electrical function of cable coil limit switches (slow coiling at < 4 m cable out).	—	—	—	√
	27	If the unit is equipped with non standard software verify the function of the remote control/indication including any added standard options.	—	—	—	

Functional test of options (if included):

			Accept. level	Value:	Instr. no.:	Pass:
	1	Verify correct function of remote control box.	—	—	—	√
	2	Activate the NCR-supervision and verify correct function.	—	—	—	√
	3	Activate GPU enable and verify correct function.	—	—	—	√
	4	Verify correct function of the RS485 serial interface (A18), by connecting the 'AXA Service Tool' software via an USB to RS485 adaptor to the DATA+, DATA- terminals.	—	—	—	
	5	Verify correct function of the Modbus TCP/IP interface (A19), by connecting the 'Modscan' software via the Ethernet port on the NetBiter RTU-TCP Gateway (A19).	—	—	—	

Axa Power ApS Smedeholm 31-33 DK-5270 Odense N Denmark Phone: +45 63 19 60 00 Fax: +45 66 18 70 92 E-mail: mail@axapower.com CVR No. 74218814

Heat Tests:

		Accept. level	Value:	Instr. no.:	Pass:
1	The 60-90 kVA unit is tested at nominal load for 2 hours, with the fan control by-passed (fan speed high).				
	Actual load [kVA]:	____			
	Final temperatures measured at the end of the test (acceptance levels are related to Tamb = 20 °C):				
	Ambient temperature.	____		____	
	Inverter module (via display readings).	< 55 °C		____	
	Output transf. (outer part of winding via thermal strip).	< 132 °C		____	

Final Adjustments / Tests:

		Accept. level	Value:	Instr. no.:	Pass:
1	Activate 'Default Setup' in the setup menu.	____	____	____	
2	- Set voltage compensation to Plug'n'Play.	____	____	____	
	- Set up real time clock to actual time.	____	____	____	
	- Set display language acc. to specification: _____	____	____	____	
	- Verify presence of silicone on rubber weather slips.	____	____	____	
	- Verify presence of fittings (filters, mounting devices etc.).	____	____	____	
	- Verify presence of 'GPU Setup' label in control box.	____	____	____	
	- Fill in the 'GPU Setup' labels with the appropriate data.	____	____	____	
	- Fill in the 'DIP-setting' label with the present setup.	____	____	____	
	- Fill in the component registration form 799.360	____	____	____	
3	For all GPU's to the UK market disable the setup access by setting the DIP switch SW2:4 to OFF on the display module.	____	____	____	

Axa Power ApS Smedebakken 31-33 DK-5270 Odense N Denmark Phone: +45 63 15 60 00 Fax: +45 66 18 70 92 E-mail: mail@axapower.com CVR No. 74218814

DANAK
CAL Reg.nr. 22

Trescal
Arepa T&K

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

CERTIFICATE of CALIBRATION

for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : High Voltage Tester

Manufacturer : HCK

Model no. : WP-501 Serial no. : G 160.0010016

Certificate no. : 22 - 323581 Date of cal.: 17-02-2009 (DD-MM-YYYY)

Equipment no. : AXA-477 Trescal no. : 52493

Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : Søren Sørensen

Approved by : Hans Thorsager

Date : 18-02-2009 (DD-MM-YYYY)

Trescal A/S
Mads Clausens Vej 12
Postboks 126, DK-8600 Silkeborg

Tel.: +45 87 20 69 69, Fax +45 86 81 26 54
E-mail: dkcalib@trescal.com
CVR-nr. DK 15009535, Bank: 7170 107278-8

Environmental conditions : 23°C±2.5°C, 45% relative humidity ±20% R.H.

Uncertainty : The uncertainty is based on an estimated confidence probability of 95% (k=2), and includes the uncertainties from the reference equipment and the unit under test according to EA-4/02.

Procedure:

The instrument has been calibrated according to AREPA procedure number 6196 .

The calibration has been carried out under the environmental conditions as stated above.

Equipment:

Reference equipment is listed on page 3.

Results:

AC Voltage (50 Hz).

Note:	Range:	Setting:	Reading:	Error:	Uncert.:	Spec.:
	6 kV	0.04 kV	0.045 kV	5 V	±11V	90V
	6 kV	2.00 kV	2.010 kV	10 V	±13V	90V
	6 kV	4.00 kV	4.002 kV	2 V	±18V	90V
	6 kV	6.00 kV	5.993 kV	-7 V	±24V	90V

AC Trip Current (50 Hz).

Note:	Range:	Setting:	Reading:	Error:	Uncert.:	Spec.:
	100 mA	50 mA	57.14 mA	7.14mA	±860µA	N/A

REFERENCE EQUIPMENT USED FOR CALIBRATION

Trescal Id:	Reference Equipment:	Cal.due:	Traceability:
400921	Fluke, Multimeter, 87 IV	jul-2009	DFM-NPL-PTB
400229	Fluke, Multimeter, 8062 A	jun-2009	DFM-NPL-PTB
400970	Fluke, High Voltage Probe, 80K-6	oct-2009	SP-DFM-PTB

Any potential notes do not form part of the certificate, but serve only as notes for the customer.

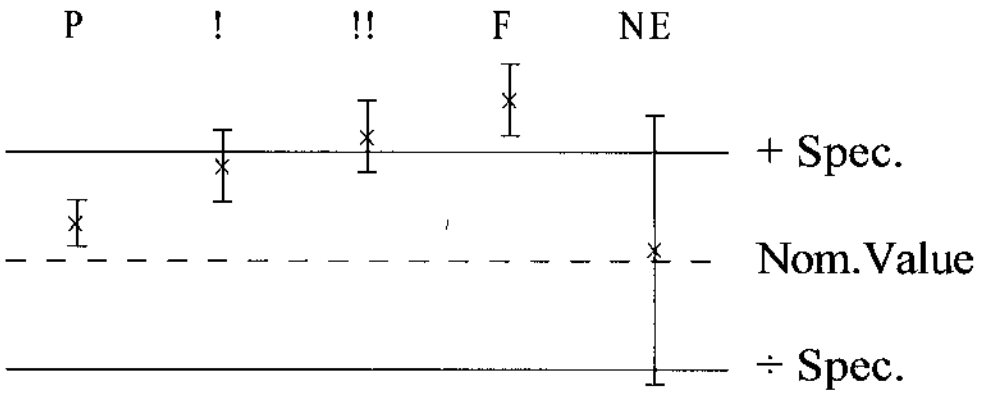
APPENDIX

CERTIFICATE OF COMPLIANCE:

Equipment	: High Voltage Tester	Date of Cal.	: 17-02-2009 DD-MM-YYYY
Manufacturer	: HCK	Cert. no..	: 22 - 323581
Model no.	: WP-501	Instrument no.	: AXA-477
Serial no.	: G 160.0010016	Trescal no.	: 52493

OWNERS SIGN.: _____ **DATE:** _____

All measured values are (The measured value is) within the stated requirements for compliance, according to the explanation below, with the given specifications.



For instruments, that have a specification, the measured values are evaluated as follows:

Passed (not marked):	**All (All other) measurement results are within the specification when added the measurement uncertainty: Compliance.**
!):	**The measurement result is within the specification, but it is outside when added the measurement uncertainty: Compliance cannot be decided.**
!!):	**The measurement result is outside the specification, but it is inside when added the measurement uncertainty: Compliance cannot be decided.**
Failed (F):	**The measurement result added the measurement uncertainty is outside the specification : No Compliance.**
Evaluation not possible (NE):	**The measured value is inside (outside) the specification, but the uncertainty is larger than or equal to the specification. Therefore a statement about compliance is not possible.**

A confidence level of 95% is used for calculation of measurement uncertainty.

DANAK
CAL Reg.nr. 22

Trescal

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

CERTIFICATE of CALIBRATION

for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : Power Analyzer

Manufacturer : Voltech

Model no. : PM 3000 A Serial no. : AU991863

Certificate no. : 22 - 340852 Date of cal.: 16-02-2010 (DD-MM-YYYY)

Equipment no. : AXA-523 Trescal no. : 74466

Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : Carl-Johan B. Madsen

Approved by : Carl-Johan B. Madsen

Date : 16-02-2010 (DD-MM-YYYY)

Trescal A/S
Mads Clausens Vej 12
Postboks 126, DK-8600 Silkeborg

Tel.: +45 87 20 69 69, Fax +45 86 81 26 54
E-mail: dkcalib@trescal.com
CVR-nr. DK 15009535, Bank: 7170 107278-8

Environmental conditions : 23°C±2.5°C, 45% relative humidity ±20% R.H.

Uncertainty : The uncertainty is based on an estimated confidence probability of 95% (k=2), and includes the uncertainties from the reference equipment and the unit under test according to EA-4/02.

Procedure::

This instrumentet has been calibrated in accordance with Trescal procedure number 3386

The instrument has been calibrated under the environmental conditions as stated above.

Equipment:

Reference equipment is listed on page 8.

Results:

AC Voltage Test - Channel 1.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.5 Vp	198.00 mV	60 Hz	197.82 mV	-180µV	±97µV	0.05% + 20.3mV
	0.5 Vp	198.00 mV	1 kHz	197.75 mV	-250µV	±97µV	0.12% + 20.3mV
	0.5 Vp	198.00 mV	50 kHz	199.76 mV	1.76mV	±280µV	1.1% + 20.3mV
	1 Vp	350.0 mV	60 Hz	350.5 mV	500µV	±240µV	0.05% + 20.5mV
	1 Vp	350.0 mV	1 kHz	350.7 mV	700µV	±240µV	0.12% + 20.5mV
	1 Vp	350.0 mV	50 kHz	350.9 mV	900µV	±660µV	1.1% + 20.5mV
	2 Vp	700.0 mV	60 Hz	699.6 mV	-400µV	±300µV	0.05% + 21mV
	2 Vp	700.0 mV	1 kHz	699.7 mV	-300µV	±300µV	0.12% + 21mV
	2 Vp	700.0 mV	50 kHz	698.6 mV	-1.4mV	±1.1mV	1.1% + 21mV
	5 Vp	1.7000 V	60 Hz	1.6987 V	-1.3mV	±500µV	0.05% + 22.5mV
	5 Vp	1.7000 V	1 kHz	1.6984 V	-1.6mV	±500µV	0.12% + 22.5mV
	5 Vp	1.7000 V	50 kHz	1.6957 V	-4.3mV	±2.2mV	1.1% + 22.5mV
	10 Vp	3.500 V	60 Hz	3.496 V	-4mV	±2.6mV	0.05% + 25mV
	10 Vp	3.500 V	1 kHz	3.496 V	-4mV	±2.6mV	0.12% + 25mV
	10 Vp	3.500 V	50 kHz	3.490 V	-10mV	±9.4mV	1.1% + 25mV
	20 Vp	7.000 V	60 Hz	6.995 V	-5mV	±3.4mV	0.05% + 30mV
	20 Vp	7.000 V	1 kHz	6.992 V	-8mV	±3.4mV	0.12% + 30mV
	20 Vp	7.000 V	50 kHz	6.975 V	-25mV	±15mV	1.1% + 30mV
	50 Vp	17.000 V	60 Hz	16.979 V	-21mV	±6.2mV	0.05% + 45mV
	50 Vp	17.000 V	1 kHz	16.983 V	-17mV	±6.2mV	0.12% + 45mV
	50 Vp	17.000 V	50 kHz	16.948 V	-52mV	±30mV	1.1% + 45mV
	100 Vp	35.00 V	60 Hz	34.97 V	-30mV	±28mV	0.05% + 70mV
	100 Vp	35.00 V	1 kHz	34.95 V	-50mV	±28mV	0.12% + 70mV
	100 Vp	35.00 V	20 kHz	34.97 V	-30mV	±55mV	0.5% + 70mV
	200 Vp	70.00 V	60 Hz	69.92 V	-80mV	±39mV	0.05% + 120mV
	200 Vp	70.00 V	1 kHz	69.93 V	-70mV	±39mV	0.12% + 120mV
	200 Vp	70.00 V	20 kHz	69.92 V	-80mV	±78mV	0.5% + 120mV
	500 Vp	170.00 V	60 Hz	169.79 V	-210mV	±75mV	0.05% + 270mV
	500 Vp	170.00 V	1 kHz	169.75 V	-250mV	±75mV	0.12% + 270mV
	1000 Vp	350.0 V	60 Hz	350.0 V	0 V	±290mV	0.05% + 520mV
	1000 Vp	350.0 V	1 kHz	349.5 V	-500mV	±290mV	0.12% + 520mV
	2000 Vp	700.0 V	60 Hz	699.8 V	-200mV	±400mV	0.05% + 1020mV
	2000 Vp	700.0 V	1 kHz	699.7 V	-300mV	±400mV	0.12% + 1020mV

AC Voltage Test - Channel 2.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.5 Vp	198.00 mV	60 Hz	198.00 mV	0mV	±97µV	0.05% + 20.3mV
	0.5 Vp	198.00 mV	1 kHz	197.92 mV	-80µV	±97µV	0.12% + 20.3mV
	0.5 Vp	198.00 mV	50 kHz	199.90 mV	1.9mV	±280µV	1.1% + 20.3mV
	1 Vp	350.0 mV	60 Hz	351.0 mV	1mV	±240µV	0.05% + 20.5mV
	1 Vp	350.0 mV	1 kHz	350.8 mV	800µV	±240µV	0.12% + 20.5mV
	1 Vp	350.0 mV	50 kHz	351.5 mV	1.5mV	±660µV	1.1% + 20.5mV
	2 Vp	700.0 mV	60 Hz	699.9 mV	-100µV	±300µV	0.05% + 21mV
	2 Vp	700.0 mV	1 kHz	699.8 mV	-200µV	±300µV	0.12% + 21mV
	2 Vp	700.0 mV	50 kHz	699.6 mV	-400µV	±1.1mV	1.1% + 21mV
	5 Vp	1.7000 V	60 Hz	1.6996 V	-400µV	±500µV	0.05% + 22.5mV
	5 Vp	1.7000 V	1 kHz	1.6992 V	-800µV	±500µV	0.12% + 22.5mV
	5 Vp	1.7000 V	50 kHz	1.6988 V	-1.2mV	±2.2mV	1.1% + 22.5mV
	10 Vp	3.500 V	60 Hz	3.497 V	-3mV	±2.6mV	0.05% + 25mV
	10 Vp	3.500 V	1 kHz	3.497 V	-3mV	±2.6mV	0.12% + 25mV
	10 Vp	3.500 V	50 kHz	3.496 V	-4mV	±9.4mV	1.1% + 25mV
	20 Vp	7.000 V	60 Hz	6.998 V	-2mV	±3.4mV	0.05% + 30mV
	20 Vp	7.000 V	1 kHz	6.993 V	-7mV	±3.4mV	0.12% + 30mV
	20 Vp	7.000 V	50 kHz	6.989 V	-11mV	±15mV	1.1% + 30mV
	50 Vp	17.000 V	60 Hz	16.992 V	-8mV	±6.2mV	0.05% + 45mV
	50 Vp	17.000 V	1 kHz	16.992 V	-8mV	±6.2mV	0.12% + 45mV
	50 Vp	17.000 V	50 kHz	16.982 V	-18mV	±30mV	1.1% + 45mV
	100 Vp	35.00 V	60 Hz	34.98 V	-20mV	±28mV	0.05% + 70mV
	100 Vp	35.00 V	1 kHz	34.96 V	-40mV	±28mV	0.12% + 70mV
	100 Vp	35.00 V	20 kHz	35.01 V	10mV	±55mV	0.5% + 70mV
	200 Vp	70.00 V	60 Hz	69.95 V	-50mV	±39mV	0.05% + 120mV
	200 Vp	70.00 V	1 kHz	69.97 V	-30mV	±39mV	0.12% + 120mV
	200 Vp	70.00 V	20 kHz	69.96 V	-40mV	±78mV	0.5% + 120mV
	500 Vp	170.00 V	60 Hz	169.80 V	-200mV	±75mV	0.05% + 270mV
	500 Vp	170.00 V	1 kHz	169.77 V	-230mV	±75mV	0.12% + 270mV
	1000 Vp	350.0 V	60 Hz	349.8 V	-200mV	±290mV	0.05% + 520mV
	1000 Vp	350.0 V	1 kHz	349.5 V	-500mV	±290mV	0.12% + 520mV
	2000 Vp	700.0 V	60 Hz	700.0 V	0 V	±400mV	0.05% + 1020mV
	2000 Vp	700.0 V	1 kHz	699.4 V	-600mV	±400mV	0.12% + 1020mV

AC Voltage Test - Channel 3.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.5 Vp	198.00 mV	60 Hz	197.90 mV	-100µV	±97µV	0.05% + 20.3mV
	0.5 Vp	198.00 mV	1 kHz	197.92 mV	-80µV	±97µV	0.12% + 20.3mV
	0.5 Vp	198.00 mV	50 kHz	200.4 mV	2.4mV	±350µV	1.1% + 20.3mV
	1 Vp	350.0 mV	60 Hz	350.1 mV	100µV	±240µV	0.05% + 20.5mV
	1 Vp	350.0 mV	1 kHz	350.6 mV	600µV	±240µV	0.12% + 20.5mV
	1 Vp	350.0 mV	50 kHz	351.6 mV	1.6mV	±660µV	1.1% + 20.5mV
	2 Vp	700.0 mV	60 Hz	699.9 mV	-100µV	±300µV	0.05% + 21mV
	2 Vp	700.0 mV	1 kHz	699.7 mV	-300µV	±300µV	0.12% + 21mV
	2 Vp	700.0 mV	50 kHz	700.4 mV	400µV	±1.1mV	1.1% + 21mV
	5 Vp	1.7000 V	60 Hz	1.6995 V	-500µV	±500µV	0.05% + 22.5mV
	5 Vp	1.7000 V	1 kHz	1.6990 V	-1mV	±500µV	0.12% + 22.5mV
	5 Vp	1.7000 V	50 kHz	1.7016 V	1.6mV	±2.2mV	1.1% + 22.5mV
	10 Vp	3.500 V	60 Hz	3.498 V	-2mV	±2.6mV	0.05% + 25mV
	10 Vp	3.500 V	1 kHz	3.497 V	-3mV	±2.6mV	0.12% + 25mV
	10 Vp	3.500 V	50 kHz	3.499 V	-1mV	±9.4mV	1.1% + 25mV
	20 Vp	7.000 V	60 Hz	6.995 V	-5mV	±3.4mV	0.05% + 30mV
	20 Vp	7.000 V	1 kHz	6.993 V	-7mV	±3.4mV	0.12% + 30mV
	20 Vp	7.000 V	50 kHz	6.996 V	-4mV	±15mV	1.1% + 30mV
	50 Vp	17.000 V	60 Hz	16.986 V	-14mV	±6.2mV	0.05% + 45mV
	50 Vp	17.000 V	1 kHz	16.990 V	-10mV	±6.2mV	0.12% + 45mV
	50 Vp	17.000 V	50 kHz	16.992 V	-8mV	±30mV	1.1% + 45mV
	100 Vp	35.00 V	60 Hz	34.97 V	-30mV	±28mV	0.05% + 70mV
	100 Vp	35.00 V	1 kHz	34.95 V	-50mV	±28mV	0.12% + 70mV
	100 Vp	35.00 V	20 kHz	35.00 V	0 V	±55mV	0.5% + 70mV
	200 Vp	70.00 V	60 Hz	69.90 V	-100mV	±39mV	0.05% + 120mV
	200 Vp	70.00 V	1 kHz	69.93 V	-70mV	±39mV	0.12% + 120mV
	200 Vp	70.00 V	20 kHz	69.94 V	-60mV	±78mV	0.5% + 120mV
	500 Vp	170.00 V	60 Hz	169.80 V	-200mV	±75mV	0.05% + 270mV
	500 Vp	170.00 V	1 kHz	169.80 V	-200mV	±75mV	0.12% + 270mV
	1000 Vp	350.0 V	60 Hz	349.8 V	-200mV	±290mV	0.05% + 520mV
	1000 Vp	350.0 V	1 kHz	349.5 V	-500mV	±290mV	0.12% + 520mV
	2000 Vp	700.0 V	60 Hz	699.8 V	-200mV	±400mV	0.05% + 1020mV
	2000 Vp	700.0 V	1 kHz	699.5 V	-500mV	±400mV	0.12% + 1020mV

AC Current Test - Channel 1.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.1 Ap	35.00 mA	60 Hz	34.98 mA	-20µA	±53µA	0.05% + 1.05mA
	0.1 Ap	35.00 mA	1 kHz	34.97 mA	-30µA	±53µA	0.14% + 1.05mA
	0.2 Ap	70.00 mA	60 Hz	70.07 mA	70µA	±77µA	0.05% + 1.1mA
	0.2 Ap	70.00 mA	1 kHz	69.97 mA	-30µA	±77µA	0.14% + 1.1mA
	0.5 Ap	170.00 mA	60 Hz	170.08 mA	80µA	±150µA	0.05% + 1.25mA
	0.5 Ap	170.00 mA	1 kHz	170.20 mA	200µA	±150µA	0.14% + 1.25mA
	1 Ap	350.0 mA	60 Hz	350.3 mA	300µA	±560µA	0.05% + 1.5mA
	1 Ap	350.0 mA	1 kHz	350.3 mA	300µA	±560µA	0.14% + 1.5mA
	2 Ap	700.0 mA	60 Hz	700.2 mA	200µA	±820µA	0.05% + 2mA
	2 Ap	700.0 mA	1 kHz	699.8 mA	-200µA	±820µA	0.14% + 2mA
	5 Ap	1.7000 A	60 Hz	1.6995 A	-500µA	±1.6mA	0.05% + 3.5mA
	5 Ap	1.7000 A	1 kHz	1.7002 A	200µA	±1.6mA	0.14% + 3.5mA
	10 Ap	3.500 A	60 Hz	3.497 A	-3mA	±3.6mA	0.05% + 6mA
	10 Ap	3.500 A	1 kHz	3.502 A	2mA	±3.6mA	0.14% + 6mA
	20 Ap	7.000 A	60 Hz	7.001 A	1mA	±6.1mA	0.05% + 11mA
	20 Ap	7.000 A	1 kHz	7.000 A	0 A	±6.1mA	0.14% + 11mA
	50 Ap	17.000 A	60 Hz	16.988 A	-12mA	±21mA	0.05% + 26mA
	50 Ap	17.000 A	1 kHz	17.002 A	2mA	±21mA	0.14% + 26mA
	Ext.	1.0000 V	60 Hz	79.84 A	-160mA	±28mA	N/A
	Ext.	1.0000 V	1 kHz	79.98 A	-20mA	±28mA	N/A

AC Current Test - Channel 2.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.1 Ap	35.00 mA	60 Hz	35.03 mA	30µA	±53µA	0.05% + 1.05mA
	0.1 Ap	35.00 mA	1 kHz	35.01 mA	10µA	±53µA	0.14% + 1.05mA
	0.2 Ap	70.00 mA	60 Hz	70.05 mA	50µA	±77µA	0.05% + 1.1mA
	0.2 Ap	70.00 mA	1 kHz	70.03 mA	30µA	±77µA	0.14% + 1.1mA
	0.5 Ap	170.00 mA	60 Hz	170.16 mA	160µA	±150µA	0.05% + 1.25mA
	0.5 Ap	170.00 mA	1 kHz	170.30 mA	300µA	±150µA	0.14% + 1.25mA
	1 Ap	350.0 mA	60 Hz	350.7 mA	700µA	±560µA	0.05% + 1.5mA
	1 Ap	350.0 mA	1 kHz	350.6 mA	600µA	±560µA	0.14% + 1.5mA
	2 Ap	700.0 mA	60 Hz	700.3 mA	300µA	±820µA	0.05% + 2mA
	2 Ap	700.0 mA	1 kHz	700.4 mA	400µA	±820µA	0.14% + 2mA
	5 Ap	1.7000 A	60 Hz	1.7001 A	100µA	±1.6mA	0.05% + 3.5mA
	5 Ap	1.7000 A	1 kHz	1.7018 A	1.8mA	±1.6mA	0.14% + 3.5mA
	10 Ap	3.500 A	60 Hz	3.501 A	1mA	±3.6mA	0.05% + 6mA
	10 Ap	3.500 A	1 kHz	3.504 A	4mA	±3.6mA	0.14% + 6mA
	20 Ap	7.000 A	60 Hz	7.004 A	4mA	±6.1mA	0.05% + 11mA
	20 Ap	7.000 A	1 kHz	7.006 A	6mA	±6.1mA	0.14% + 11mA
	50 Ap	17.000 A	60 Hz	17.007 A	7mA	±21mA	0.05% + 26mA
	50 Ap	17.000 A	1 kHz	17.005 A	5mA	±21mA	0.14% + 26mA
	Ext.	1.0000 V	60 Hz	79.99 A	-10mA	±28mA	N/A
	Ext.	1.0000 V	1 kHz	79.98 A	-20mA	±28mA	N/A

AC Current Test - Channel 3.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.1 Ap	35.00 mA	60 Hz	35.01 mA	10µA	±53µA	0.05% + 1.05mA
	0.1 Ap	35.00 mA	1 kHz	34.98 mA	-20µA	±53µA	0.14% + 1.05mA
	0.2 Ap	70.00 mA	60 Hz	70.03 mA	30µA	±77µA	0.05% + 1.1mA
	0.2 Ap	70.00 mA	1 kHz	69.99 mA	-10µA	±77µA	0.14% + 1.1mA
	0.5 Ap	170.00 mA	60 Hz	170.19 mA	190µA	±150µA	0.05% + 1.25mA
	0.5 Ap	170.00 mA	1 kHz	170.16 mA	160µA	±150µA	0.14% + 1.25mA
	1 Ap	350.0 mA	60 Hz	350.4 mA	400µA	±560µA	0.05% + 1.5mA
	1 Ap	350.0 mA	1 kHz	350.3 mA	300µA	±560µA	0.14% + 1.5mA
	2 Ap	700.0 mA	60 Hz	699.3 mA	-700µA	±820µA	0.05% + 2mA
	2 Ap	700.0 mA	1 kHz	699.8 mA	-200µA	±820µA	0.14% + 2mA
	5 Ap	1.7000 A	60 Hz	1.7005 A	500µA	±1.6mA	0.05% + 3.5mA
	5 Ap	1.7000 A	1 kHz	1.7006 A	600µA	±1.6mA	0.14% + 3.5mA
	10 Ap	3.500 A	60 Hz	3.498 A	-2mA	±3.6mA	0.05% + 6mA
	10 Ap	3.500 A	1 kHz	3.501 A	1mA	±3.6mA	0.14% + 6mA
	20 Ap	7.000 A	60 Hz	6.997 A	-3mA	±6.1mA	0.05% + 11mA
	20 Ap	7.000 A	1 kHz	7.001 A	1mA	±6.1mA	0.14% + 11mA
	50 Ap	17.000 A	60 Hz	16.992 A	-8mA	±21mA	0.05% + 26mA
	50 Ap	17.000 A	1 kHz	16.985 A	-15mA	±21mA	0.14% + 26mA
	Ext.	1.0000 V	60 Hz	80.04 A	40mA	±28mA	N/A
	Ext.	1.0000 V	1 kHz	80.04 A	40mA	±28mA	N/A

AC Power Test (60 Hz, cos ϕ = 1.00) - Channel 1.

Note:	Range:	Input:	Nom.value:	Reading:	Error:	Uncert.:	Spec.:
	5 Vp/2 Ap	1.7 V/0.7 A	1.1900 W	1.1873 W	-2.7mW	±1.4mW	20.4mW
	200 Vp/5 Ap	70 V/1.7 A	119.00 W	118.81 W	-190mW	±130mW	570mW
	1000 Vp/5 Ap	350 V/1.7 A	595.0 W	594.1 W	-900mW	±670mW	2.7W

AC Power Test (60 Hz, cos ϕ = 1.00) - Channel 2.

Note:	Range:	Input:	Nom.value:	Reading:	Error:	Uncert.:	Spec.:
	5 Vp/2 Ap	1.7 V/0.7 A	1.1900 W	1.1891 W	-900µW	±1.4mW	20.4mW
	200 Vp/5 Ap	70 V/1.7 A	119.00 W	118.92 W	-80mW	±130mW	570mW
	1000 Vp/5 Ap	350 V/1.7 A	595.0 W	594.6 W	-400mW	±670mW	2.7W

AC Power Test (60 Hz, cos ϕ = 1.00) - Channel 3.

Note:	Range:	Input:	Nom.value:	Reading:	Error:	Uncert.:	Spec.:
	5 Vp/2 Ap	1.7 V/0.7 A	1.1900 W	1.1880 W	-2mW	±1.4mW	20.4mW
	200 Vp/5 Ap	70 V/1.7 A	119.00 W	118.79 W	-210mW	±130mW	570mW
	1000 Vp/5 Ap	350 V/1.7 A	595.0 W	593.9 W	-1.1 W	±670mW	2.7W

Frequency Test.

Note:	Input:	Reading:	Error:	Uncert.:	Spec.:
	1.0000 kHz	999.9 Hz	-100mHz	±120mHz	0.1%
	10.000 kHz	10.001 kHz	1Hz	±1.2Hz	0.1%
	20.00 kHz	20.00 kHz	0kHz	±7Hz	0.1%

Distortion, total V-distortion.

Note:	Frequency:	Input:	Reading:	Error:	Uncert.:	Spec.:
	50 Hz	10.000 %d	10.02 %d	0.02%d	±0.034%d	N/A
	60 Hz	10.000 %d	10.00 %d	0%d	±0.034%d	N/A
	120 Hz	10.000 %d	10.02 %d	0.02%d	±0.034%d	N/A
	240 Hz	10.000 %d	9.997 %d	-0.003%d	±0.016%d	N/A
	400 Hz	1.000 %d	1.023 %d	0.023%d	±0.0051%d	N/A
	400 Hz	5.000 %d	5.029 %d	0.029%d	±0.0099%d	N/A
	400 Hz	10.000 %d	10.02 %d	0.02%d	±0.034%d	N/A
	400 Hz	20.000 %d	20.05 %d	0.05%d	±0.042%d	N/A
	400 Hz	30.000 %d	30.03 %d	0.03%d	+0.051%d	N/A

Distortion, total V-distortion.

Note:	Frequency:	Harm.:	Input:	Reading:	Error:	Uncert.:	Spec.:
	400 Hz	2	5.000 %d	5.009 %d	0.009%d	±0.0099%d	N/A
	400 Hz	3	4.000 %d	4.011 %d	0.011%d	±0.019%d	N/A
	400 Hz	4	3.000 %d	3.008 %d	0.008%d	±0.0095%d	N/A
	400 Hz	5	2.000 %d	2.005 %d	0.005%d	±0.0077%d	N/A
	400 Hz	6	1.000 %d	1.004 %d	0.004%d	±0.0061%d	N/A
	400 Hz	7	0.750 %d	0.751 %d	0.001%d	±0.0058%d	N/A
	400 Hz	8	0.500 %d	0.493 %d	-0.007%d	±0.0054%d	N/A
	400 Hz	9	0.300 %d	0.289 %d	-0.011%d	±0.0051%d	N/A

REFERENCE EQUIPMENT USED FOR CALIBRATION

Trescal Id:	Reference Equipment:	Cal.due:	Traceability:
400771	Fluke, Calibrator, 5520 A	feb-2011	DFM-NPL-PTB
400470	Fluke, Calibrator, 5500 A	oct-2010	DFM-NPL-PTB

Any potential notes do not form part of the certificate, but serve only as notes for the customer.

DANAK (Danish Accreditation)

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" and in DS/EN ISO/IEC 15189 "Medical Laboratories - Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the stadards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- that the laboratory and its personnel are free from any commercial, financial and other pressures, which might influence their impartiality.
- that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained.
- that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform.
- that the laboratory has at its disposal personnel with technical competence and practical experience in performing the sevices that it is accredited to perform.
- that the laboratory has procedures for traceability and uncertainty calculations.
- that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods.
- that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request.
- that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination.
- that the laboratory is subject to surveillance by DANAK on a regular basis.
- that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

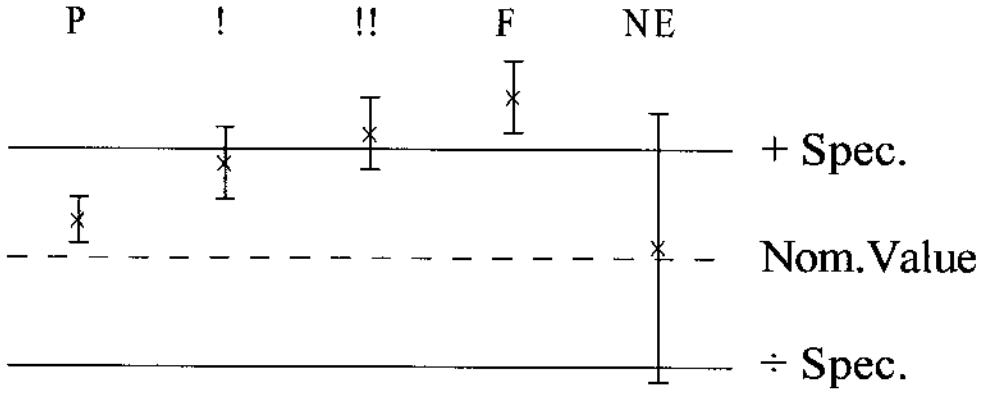
APPENDIX

CERTIFICATE OF COMPLIANCE:

Equipment	: Power Analyzer	Date of Cal.	: 16-02-2010 DD-MM-YYYY
Manufacturer	: Voltech	Cert. no..	: 22 - 340852
Model no.	: PM 3000 A	Instrument no.	: AXA-523
Serial no.	: AU991863	Trescal no.	: 74466

OWNERS SIGN.: _____ **DATE:** _____

All measured values are (The measured value is) within the stated requirements for compliance, according to the explanation below, with the given specifications.



For instruments, that have a specification, the measured values are evaluated as follows:

Passed (not marked):	**All (All other) measurement results are within the specification when added the measurement uncertainty: Compliance.**
!):	**The measurement result is within the specification, but it is outside when added the measurement uncertainty: Compliance cannot be decided.**
!!):	**The measurement result is outside the specification, but it is inside when added the measurement uncertainty: Compliance cannot be decided.**
Failed (F):	**The measurement result added the measurement uncertainty is outside the specification : No Compliance.**
Evaluation not possible (NE):	**The measured value is inside (outside) the specification, but the uncertainty is larger than or equal to the specification. Therefore a statement about compliance is not possible.**

A confidence level of 95% is used for calculation of measurement uncertainty.

DANAK
CAL Reg.nr. 22

Trescal
Arepa T&K

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

CERTIFICATE of CALIBRATION

for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : Multimeter

Manufacturer : Fluke

Model no. : 189 Serial no. : 91900315

Certificate no. : 22 - 317412 Date of cal.: 21-10-2008 (DD-MM-YYYY)

Equipment no. : AXA-553 AREPA no. : 111911

Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : John Salomonsen

Approved by : Carl-Johan B. Madsen

Date : 21-10-2008 (DD-MM-YYYY)

A Summary Test Report may be issued only when it is clearly stated that it is a Summary and only if the full report is accessible to the public, or if the Summary has been approved by AREPA.

AREPA Test & Kalibrering A/S
Mads Clausens Vej 12
Postboks 126, DK-8600 Silkeborg

Tel.: +45 87 20 69 69, Fax +45 86 81 26 54
E-mail: dkcalib@trescal.com
CVR-nr. DK 15009535, Bank: 7170 107278-8

Environmental conditions : 23°C±2.5°C, 45% relative humidity ±20% R.H.

Uncertainty : The uncertainty is based on an estimated confidence probability of 95% (k=2), and includes the uncertainties from the reference equipment and the unit under test according to EA-4/02.

Procedure:

The instrument has been calibrated according to Arepa procedure number 7906 .

The calibration has been carried out under the environmental conditions as stated above.

Equipment:

Reference equipment is listed on page 6.

Results:

Check.

Note:	Text:	Check:
	Testing the Display	Passed.
	Backlight Test	Passed.
	Current Terminal Sensing Test	Passed.
	Keypad Test	Passed.

Temperature, Type K (ITS 90) (Reference 23 °C, Offset -9.8 °C).

Note:	Input:	Reading:	Error:	Uncert.:	Spec.:
	0.0 °C	0.1 °C	0.1°C	±0.2°C	1% + 1°C
	-10.0 °C	-9.8 °C	0.2°C	±0.2°C	1% + 1°C
	350.0 °C	350.3 °C	0.3°C	±0.4°C	1% + 1°C

Testing AC Voltage.

Note:	Step:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	1	5 V	0.2500 V	100 kHz	0.2466 V	-3.4mV	±200µV	8% + 4mV
	2	5 V	5.0000 V	20 kHz	4.9883 V	-11.7mV	±1.5mV	1.5% + 4mV
	3	5 V	5.0000 V	100 kHz	4.9552 V	-44.8mV	±4.9mV	8% + 4mV
	4	50 V	50.000 V	700 Hz	49.977 V	-23mV	±9.4mV	0.4% + 40mV
	5	50 V	50.000 V	20 kHz	50.287 V	287mV	±15mV	1.5% + 40mV
	6	50 V	50.000 V	100 kHz	50.875 V	875mV	±120mV	8% + 40mV
	7	500 V	500.00 V	65 Hz	499.30 V	-700mV	±130mV	0.4% + 400mV
	8	1000 V	500.0 V	65 Hz	499.2 V	-800mV	±150mV	0.4% + 4 V
	9	50 mV	2.500 mV	100 kHz	2.294 mV	-206µV	±17µV	15% + 40µV
	10	50 mV	50.000 mV	20 kHz	48.206 mV	-1.794mV	±14µV	5.5% + 40µV
	11	50 mV	50.000 mV	100 kHz	46.111 mV	-3.889mV	±57µV	15% + 40µV
	12	500 mV	500.00 mV	10 kHz	482.34 mV	-17.66mV	±81µV	5% + 400µV
	13	5000 mV	3000.0 mV	20 kHz	2991.0 mV	-9mV	±500µV	1.5% + 4mV
	14	5000 mV	3000.0 mV	100 kHz	3062.8 mV	62.8mV	±1.8mV	8% + 4mV

Testing Frequency (1 V).

Note:	Step:	Range:	Input:		Reading:	Error:	Uncert.:		Spec.:
	15	50 kHz	20.000 kHz		20.000 kHz	0kHz	±700mHz	0.005% +	1Hz

Testing Duty Cycle (Input: 2.2 Vpp).

Note:	Step:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	16	3 V	30.00 %dc	500 Hz	30.03 %dc	0.03%dc	±1%dc	8.18%dc

Testing DC Voltage.

Note:	Step:	Range:	Input:	Reading:	Error:	Uncert.:		Spec.:
	17	5 V	0.0000 V	0.0000 V	0 V	±70µV	0.025% +	1mV
	18	5 V	5.0000 V	4.9988 V	-1.2mV	±90µV	0.025% +	1mV
	19	5 V	-5.0000 V	-4.9989 V	1.1mV	±90µV	0.025% +	1mV
	20	50 V	-50.000 V	-49.988 V	12mV	±1.1mV	0.03% +	3mV
	21	500 V	-500.00 V	-499.88 V	120mV	±11mV	0.1% +	20mV
	22	1000 V	-500.0 V	-499.9 V	100mV	±70mV	0.1% +	200mV
	24	50 mV	0.000 mV	0.006 mV	6µV	±1000nV	0.1% +	20µV
	25	50 mV	50.000 mV	49.997 mV	-3µV	±1.7µV	0.1% +	20µV
	26	50 mV	-50.000 mV	-49.977 mV	23µV	±1.7µV	0.1% +	20µV
	27	500 mV	0.00 mV	0.00 mV	0mV	±7µV	0.03% +	20µV
	28	500 mV	500.00 mV	499.89 mV	-110µV	±22µV	0.03% +	20µV
	29	5000 mV	2000.0 mV	1999.5 mV	-500µV	±70µV	0.025% +	500µV
	30	5000 mV	-3000.0 mV	-2999.3 mV	700µV	±70µV	0.025% +	500µV

Testing AC & DC.

Note:	Step:	Range:	Input:		Reading:	Error:	Uncert.:		Spec.:
	23	50 V	50.000 V	20 kHz	50.294 V	294mV	±15mV	2% +	40mV
	31	5000 mV	1000.0 mV	20 kHz	996.4 mV	-3.6mV	±200µV	2% +	4mV

Testing Resistance (#) Relative mode).

Note:	Step:	Range:	Input:	Reading:	Error:	Uncert.:	Spec.:
#)	32	500 Ω	0.00 Ω	0.00 Ω	0 Ω	±7mΩ	0.05% + 100mΩ
#)	33	500 Ω	500.00 Ω	499.96 Ω	-40mΩ	±15mΩ	0.05% + 100mΩ
	34	5 kΩ	5.0000 kΩ	4.9997 kΩ	-300mΩ	±150mΩ	0.05% + 200mΩ
	35	50 kΩ	50.000 kΩ	49.996 kΩ	-4 Ω	±1.5Ω	0.05% + 2 Ω
	36	500 kΩ	500.00 kΩ	499.95 kΩ	-50 Ω	±16Ω	0.05% + 20 Ω
	37	5 MΩ	5.0000 MΩ	4.9993 MΩ	-700 Ω	±590Ω	0.15% + 400 Ω
	38	50 MΩ	30.000 MΩ	29.992 MΩ	-8kΩ	±7.5kΩ	1% + 4kΩ
	39	500 MΩ	100.0 MΩ	100.2 MΩ	200kΩ	±80kΩ	10% + 200kΩ
	40	50 nS	0.00 nS	0.01 nS	10pS	±8pS	1% + 100pS
	41	50 nS	10.00 nS	10.05 nS	50pS	±8pS	1% + 100pS

Capacitance.

Note:	Step:	Range:	Input:	Reading:	Error:	Uncert.:	Spec.:
	42	1 nF	Open	0.066 nF		±2pF	< 0.07nF
	43	100 nF	100.0 nF	100.2 nF	200pF	±290pF	1% + 500pF
	44	10 μF	5.00 μF	5.01 μF	10nF	±20nF	1% + 50nF

Diode (Input: 1 kΩ).

Note:	Step:	Range:	Nom.Value:	Reading:	Error:	Uncert.:	Spec.:
	45	3.1 V	1.0000 V	0.9985 V	-1.5mV	±70μV	10%

Testing Current.

Note:	Step:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	46	50 mA	2.500 mA	1 kHz	2.501 mA	1µA	±2.2µA	0.75% + 20µA
	47	500 mA	329.00 mA	10 kHz	330.66 mA	1.66mA	±600µA	1.5% + 100µA
	48	500 µA	500.00 µA	1 kHz	499.91 µA	-90nA	±520nA	0.75% + 200nA
	49	5000 µA	1500.0 µA	1 kHz	1499.9 µA	-100nA	±2.1µA	0.75% + 500nA
	50	50 mA	Open		-0.004 mA	-4µA	±1µA	0.15% + 10µA
	51	50 mA	50.000 mA		50.004 mA	4µA	±5.7µA	0.15% + 10µA
	52	50 mA	-50.000 mA		-50.006 mA	-6µA	±5.7µA	0.15% + 10µA
	53	500 mA	-329.00 mA		-329.02 mA	-20µA	±29µA	0.15% + 20µA
	54	500 µA	500.00 µA		499.91 µA	-90nA	±65nA	0.25% + 200nA
	55	500 µA	-500.00 µA		-499.74 µA	260nA	±65nA	0.25% + 200nA
	56	5000 µA	-5000.0 µA		-4998.9 µA	1.1µA	±570nA	0.25% + 200nA
	57	500 µA	Open		0.08 µA	80nA	±10nA	0.25% + 200nA
	58	5 A	0.2500 A	1 kHz	0.2501 A	100µA	±120µA	1.5% + 2mA
	59	5 A	0.2500 A	20 kHz	0.2597 A	9.7mA	±950µA	6% + 4mA
	60	5 A	Open		-0.0004 A	-400µA	±100µA	0.5% + 1mA
	61	5 A	5.0000 A		4.9993 A	-700µA	±2.3mA	0.5% + 1mA
	62	5 A	-5.0000 A		-4.9995 A	500µA	⊥2.3mA	0.5% + 1mA
	63	10 A	-6.000 A		-5.999 A	1mA	±2.8mA	0.5% + 2mA
	64	10 A	6.000 A	1 kHz	5.995 A	-5mA	+6.4mA	1.5% + 5mA

REFERENCE EQUIPMENT USED FOR CALIBRATION

AREPA Id:	Reference Equipment:	Cal.due:	Traceability:
400050	Fluke, Calibrator, 5700 A	feb-2009	DFM-NPL-PTB
400488	Fluke, Calibrator, 5500 A	sep-2009	DFM-NPL-PTB
400567	Fluke, Transconductance Amplifier, 5220 A	nov-2008	DFM-NPL-PTB
400221	Datron, Transconductance Amplifier, 4600	feb-2009	DFM-NPL-PTB
400264	Danbridge, Decade Capacitance Box, DK 4 S	jun-2009	NPL
401020	Hewlett Packard, GPS Time & Frequency Reference Receiver,	Selfcal.	USNO
401308	AREPA Test & Kalibrering, Thermocouple, Type K	aug-2009	DTI-DFM-NPL

Any potential notes do not form part of the certificate, but serve only as notes for the customer.

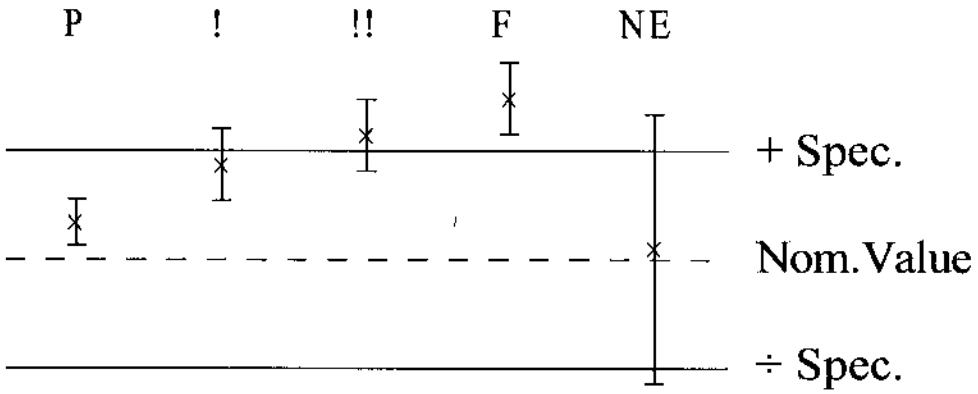
APPENDIX

CERTIFICATE OF COMPLIANCE:

Equipment	: Multimeter	Date of Cal.	: 21-10-2008 DD-MM-YYYY
Manufacturer	: Fluke	Cert. no..	: 22 - 317412
Model no.	: 189	Instrument no.	: AXA-553
Serial no.	: 91900315	AREPA no.	: 111911

OWNERS SIGN.: _____ **DATE:** _____

All measured values are (The measured value is) within the stated requirements for compliance, according to the explanation below, with the given specifications.



For instruments, that have a specification, the measured values are evaluated as follows:

Passed (not marked):	**All (All other) measurement results are within the specification when added the measurement uncertainty: Compliance.**
!):	**The measurement result is within the specification, but it is outside when added the measurement uncertainty: Compliance cannot be decided.**
!!):	**The measurement result is outside the specification, but it is inside when added the measurement uncertainty: Compliance cannot be decided.**
Failed (F):	**The measurement result added the measurement uncertainty is outside the specification : No Compliance.**
Evaluation not possible (NE):	**The measured value is inside (outside) the specification, but the uncertainty is larger than or equal to the specification. Therefore a statement about compliance is not possible.**

A confidence level of 95% is used for calculation of measurement uncertainty.

DANAK
CAL Reg.nr. 22

Trescal
Arepa T&K

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

CERTIFICATE of CALIBRATION

for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : Insulation Tester

Manufacturer : Fluke

Model no. : 1507 Serial no. : 94520013

Certificate no. : 22 - 337148 Date of cal.: 25-11-2009
DD-MM-YYYY

Equipment no. : AXA-570 Trescal no. : 123673

Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : Anette Nygaard Bust
Anette Nygaard Bust

Approved by : Carl-Johan B. Madsen
Carl-Johan B. Madsen

Date : 26-11-2009
DD-MM-YYYY

Trescal A/S
Mads Clausens Vej 12
Postboks 126, DK-8600 Silkeborg

Tel.: +45 87 20 69 69, Fax +45 86 81 26 54
E-mail: dkcalib@trescal.com
CVR-nr. DK 15009535, Bank: 7170 107278-8

Environmental conditions : 23°C±2.5°C, 45% relative humidity ±20% R.H.

Uncertainty : The uncertainty is based on an estimated confidence probability of 95% (k=2), and includes the uncertainties from the reference equipment and the unit under test according to EA-4/02.

Procedure:

The instrument has been calibrated according to Arepa procedure number 10987 .

The calibration has been carried out under the environmental conditions as stated above.

Equipment:

Reference equipment is listed on page 4.

Results:

Voltage.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	600 V	3.0 V		3.0 V	0 V	±60mV	2% + 300mV
	600 V	8.0 V		8.0 V	0 V	±70mV	2% + 300mV
	600 V	50.0 V		50.1 V	100mV	±70mV	2% + 300mV
	600 V	100.0 V		100.1 V	100mV	±70mV	2% + 300mV
	600 V	250.0 V		249.8 V	-200mV	±70mV	2% + 300mV
	600 V	500.0 V		500.0 V	0 V	±70mV	2% + 300mV
	600 V	120.0 V	60 Hz	120.1 V	100mV	±70mV	2% + 300mV
	600 V	230.0 V	50 Hz	230.1 V	100mV	±70mV	2% + 300mV
	600 V	600.0 V	400 Hz	600.6 V	600mV	±70mV	2% + 300mV

Voltage.

Note:	Text:	Check:
	8.0 V 400 Hz	Passed.

Insulation Resistance.

Note:	Range:	Input:	Reading:	Error:	Uncert.:	Spec.:
	1000 V	10.0 GΩ	9.7 GΩ	-300MΩ	±70MΩ	10% + 0.3GΩ
	1000 V	1.0 GΩ	999 MΩ	-1MΩ	±5.9MΩ	1.5% + 5MΩ
	1000 V	1.0 MΩ	1.0 MΩ	0MΩ	±60kΩ	1.5% + 500kΩ
	1000 V	50.0 MΩ	49.7 MΩ	-300kΩ	±70kΩ	1.5% + 500kΩ
	1000 V	60.0 MΩ	60.3 MΩ	300kΩ	±70kΩ	1.5% + 500kΩ
	500 V	0.50 MΩ	0.50 MΩ	0MΩ	±6kΩ	1.5% + 50kΩ
	250 V	0.25 MΩ	0.25 MΩ	0MΩ	±6kΩ	1.5% + 50kΩ
	100 V	0.10 MΩ	0.10 MΩ	0MΩ	±6kΩ	3% + 50kΩ
	50 V	0.05 MΩ	0.05 MΩ	0MΩ	±6kΩ	3% + 50kΩ

Source Voltage "R" Nominel.

Note:	Range:	Load:	Measured:	Uncert.:	Spec.:
	1000 V	1 MΩ	1040.9 V	±3.8V	0 - 20%
	500 V	500 kΩ	519.5 V	±2V	0 - 20%
	250 V	250 kΩ	269.9 V	±980mV	0 - 20%
	100 V	100 kΩ	106.8 V	±410mV	0 - 20%
	50 V	50 kΩ	51.95 V	±200mV	0 - 20%

Source Voltage Open circuit (10 MΩ).

Note:	Range:	Measured:	Uncert.:	Spec.:
	1000 V	1048.9 V	±1.1V	0 - 20%
	500 V	525.9 V	±600mV	0 - 20%
	250 V	275.6 V	±260mV	0 - 20%
	100 V	110.6 V	±150mV	0 - 20%
	50 V	55.3 V	±120mV	0 - 20%

Ohm Function.

Note:	Range:	Input:	Reading:	Error:	Uncert.:	Spec.:
	20 Ω	2.00 Ω	2.00 Ω	0 Ω	±14mΩ	1.5% + 30mΩ
	2000 Ω	810 Ω	807 Ω	-3 Ω	±700mΩ	1.5% + 3 Ω
	2000 Ω	990 Ω	991 Ω	1 Ω	±700mΩ	1.5% + 3 Ω
	20 kΩ	18.00 kΩ	18.00 kΩ	0kΩ	±7Ω	1.5% + 30 Ω

Open circuit Voltage.

Note:	Measured:	Uncert.:	Spec.:
	5.477 V	±4.1mV	4 - 8V

REFERENCE EQUIPMENT USED FOR CALIBRATION

Trescal Id:	Reference Equipment:	Cal.due:	Traceability:
400507	Hewlett Packard / Agilent, Multimeter, 34401 A	sep-2010	DFM-NPL-PTB
401355	Danbridge, Decade Resistance Box, DR6/BCDEFG	nov-2009	DFM-NPL-PTB
400482	Arepa T & K, Res. High Tester, Res. 7		
400531	AREPA Test & Kalibrering, Resistance Box for Meggers,	dec-2009	DFM-NPL
400029	Welwyn, Standard Resistor, T 44, 10 Gohm	aug-2010	NPL
400028	Welwyn, Standard Resistor, T 44, 1 Gohm	aug-2010	NPL
401566	Fluke, Multimeter, 8060 A	nov-2010	DFM-NPL-PTB

Any potential notes do not form part of the certificate, but serve only as notes for the customer.

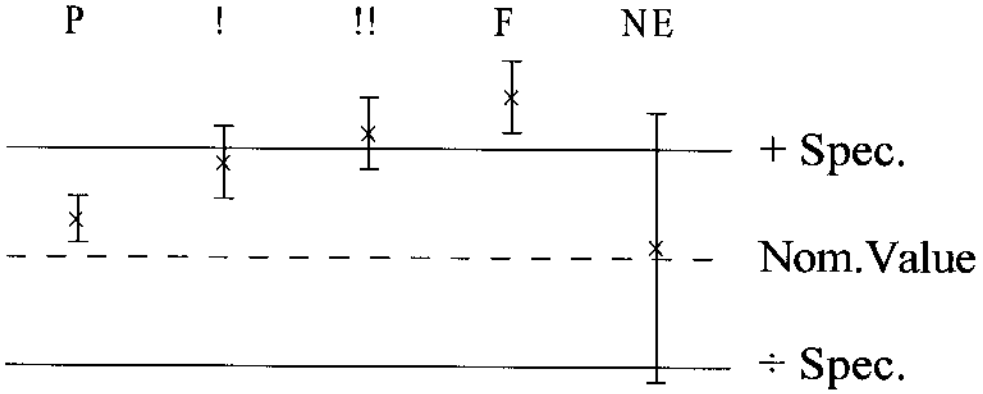
APPENDIX

CERTIFICATE OF COMPLIANCE:

Equipment	: Insulation Tester	Date of Cal.	: 25-11-2009 DD-MM-YYYY
Manufacturer	: Fluke	Cert. no..	: 22 - 337148
Model no.	: 1507	Instrument no.	: AXA-570
Serial no.	: 94520013	Trescal no.	: 123673

OWNERS SIGN.: _____ **DATE:** _____

All measured values are (The measured value is) within the stated requirements for compliance, according to the explanation below, with the given specifications.



For instruments, that have a specification, the measured values are evaluated as follows:

Passed (not marked):	**All (All other) measurement results are within the specification when added the measurement uncertainty: Compliance.**
!):	**The measurement result is within the specification, but it is outside when added the measurement uncertainty: Compliance cannot be decided.**
!!):	**The measurement result is outside the specification, but it is inside when added the measurement uncertainty: Compliance cannot be decided.**
Failed (F):	**The measurement result added the measurement uncertainty is outside the specification : No Compliance.**
Evaluation not possible (NE):	**The measured value is inside (outside) the specification, but the uncertainty is larger than or equal to the specification. Therefore a statement about compliance is not possible.**

A confidence level of 95% is used for calculation of measurement uncertainty.

DANAK
CAL Reg.nr. 22

Trescal
Arepa T&K

Primary Laboratory within AC Electricity
Danish Standards Laboratory AC and RF Quantities
DPLE Partner (Danish Primary Laboratory for Electricity)

CERTIFICATE of CALIBRATION

for accredited technical testing in accordance with EN/ISO 17025 under the Danish accreditation scheme, DANAK

Equipment : Power Analyzer

Manufacturer : Voltech

Model no. : PM 3000 A Serial no. : AU157/1183

Certificate no. : 22 - 334966 Date of cal.: 21-10-2009 (DD-MM-YYYY)

Equipment no. : AXA-599 Trescal no. : 173032

Customer : AXA Power ApS
Smedebakken 31-33,
5270 Odense N

Calibration performed by : Carl-Johan B. Madsen

Approved by : Carl-Johan B. Madsen

Date : 21-10-2009 (DD-MM-YYYY)

A Summary Test Report may be issued only when it is clearly stated that it is a Summary and only if the full report is accessible to the public, or if the Summary has been approved by Trescal.

Trescal A/S
Mads Clausens Vej 12
Postboks 126, DK-8600 Silkeborg

Tel.: +45 87 20 69 69, Fax +45 86 81 26 54
E-mail: dkcalib@trescal.com
CVR-nr. DK 15009535, Bank: 7170 107278-8

Environmental conditions : 23 °C±2.5 °C, 45% relative humidity ±20% R.H.

Uncertainty : The uncertainty is based on an estimated confidence probability of 95% (k=2), and includes the uncertainties from the reference equipment and the unit under test according to EA-4/02.

Procedure::

This instrumentet has been calibrated in accordance with AREPA procedure number 3386 .

The instrument has been calibrated under the environmental conditions as stated above.

Equipment:

Reference equipment is listed on page 8.

Results:

AC Voltage Test - Channel 1.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.5 Vp	198.00 mV	60 Hz	197.84 mV	-160µV	±97µV	0.05%+20.3mV
	0.5 Vp	198.00 mV	1 kHz	197.85 mV	-150µV	±97µV	0.12%+20.3mV
	0.5 Vp	198.00 mV	50 kHz	200.9 mV	2.9mV	±350µV	1.1%+20.3mV
	1 Vp	350.0 mV	60 Hz	350.3 mV	300µV	±240µV	0.05%+20.5mV
	1 Vp	350.0 mV	1 kHz	350.2 mV	200µV	±240µV	0.12%+20.5mV
	1 Vp	350.0 mV	50 kHz	352.5 mV	2.5mV	±660µV	1.1%+20.5mV
	2 Vp	700.0 mV	60 Hz	700.1 mV	100µV	±300µV	0.05%+ 21mV
	2 Vp	700.0 mV	1 kHz	700.1 mV	100µV	±300µV	0.12%+ 21mV
	2 Vp	700.0 mV	50 kHz	701.6 mV	1.6mV	±1.1mV	1.1%+ 21mV
	5 Vp	1.7000 V	60 Hz	1.6995 V	-500µV	±500µV	0.05%+22.5mV
	5 Vp	1.7000 V	1 kHz	1.6994 V	-600µV	±500µV	0.12%+22.5mV
	5 Vp	1.7000 V	50 kHz	1.7026 V	2.6mV	±2.2mV	1.1%+22.5mV
	10 Vp	3.500 V	60 Hz	3.497 V	-3mV	±2.6mV	0.05%+ 25mV
	10 Vp	3.500 V	1 kHz	3.497 V	-3mV	±2.6mV	0.12%+ 25mV
	10 Vp	3.500 V	50 kHz	3.500 V	0 V	±9.4mV	1.1%+ 25mV
	20 Vp	7.000 V	60 Hz	7.008 V	8mV	±3.4mV	0.05%+ 30mV
	20 Vp	7.000 V	1 kHz	7.008 V	8mV	±3.4mV	0.12%+ 30mV
	20 Vp	7.000 V	50 kHz	7.011 V	11mV	±15mV	1.1%+ 30mV
	50 Vp	17.000 V	60 Hz	16.995 V	-5mV	±6.2mV	0.05%+ 45mV
	50 Vp	17.000 V	1 kHz	16.997 V	-3mV	±6.2mV	0.12%+ 45mV
	50 Vp	17.000 V	50 kHz	17.009 V	9mV	±30mV	1.1%+ 45mV
	100 Vp	35.00 V	60 Hz	35.03 V	30mV	±28mV	0.05%+ 70mV
	100 Vp	35.00 V	1 kHz	35.03 V	30mV	±28mV	0.12%+ 70mV
	100 Vp	35.00 V	20 kHz	35.01 V	10mV	±55mV	0.5%+ 70mV
	200 Vp	70.00 V	60 Hz	69.98 V	-20mV	±39mV	0.05%+ 120mV
	200 Vp	70.00 V	1 kHz	69.99 V	-10mV	±39mV	0.12%+ 120mV
	200 Vp	70.00 V	20 kHz	70.02 V	20mV	±78mV	0.5%+ 120mV
	500 Vp	170.00 V	60 Hz	170.07 V	70mV	±75mV	0.05%+ 270mV
	500 Vp	170.00 V	1 kHz	170.07 V	70mV	±75mV	0.12%+ 270mV
	1000 Vp	350.0 V	60 Hz	350.1 V	100mV	±290mV	0.05%+ 520mV
	1000 Vp	350.0 V	1 kHz	350.1 V	100mV	±290mV	0.12%+ 520mV
	2000 Vp	700.0 V	60 Hz	699.9 V	-100mV	±400mV	0.05%+1020mV
	2000 Vp	700.0 V	1 kHz	700.2 V	200mV	±400mV	0.12%+1020mV

AC Voltage Test - Channel 2.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.5 Vp	198.00 mV	60 Hz	198.03 mV	30µV	±97µV	0.05% + 20.3mV
	0.5 Vp	198.00 mV	1 kHz	198.04 mV	40µV	±97µV	0.12% + 20.3mV
	0.5 Vp	198.00 mV	50 kHz	200.5 mV	2.5mV	±350µV	1.1% + 20.3mV
	1 Vp	350.0 mV	60 Hz	350.2 mV	200µV	±240µV	0.05% + 20.5mV
	1 Vp	350.0 mV	1 kHz	350.1 mV	100µV	±240µV	0.12% + 20.5mV
	1 Vp	350.0 mV	50 kHz	351.4 mV	1.4mV	±660µV	1.1% + 20.5mV
	2 Vp	700.0 mV	60 Hz	700.0 mV	0mV	±300µV	0.05% + 21mV
	2 Vp	700.0 mV	1 kHz	699.9 mV	-100µV	±300µV	0.12% + 21mV
	2 Vp	700.0 mV	50 kHz	699.1 mV	-900µV	±1.1mV	1.1% + 21mV
	5 Vp	1.7000 V	60 Hz	1.6986 V	-1.4mV	±500µV	0.05% + 22.5mV
	5 Vp	1.7000 V	1 kHz	1.6985 V	-1.5mV	±500µV	0.12% + 22.5mV
	5 Vp	1.7000 V	50 kHz	1.6960 V	-4mV	±2.2mV	1.1% + 22.5mV
	10 Vp	3.500 V	60 Hz	3.495 V	-5mV	±2.6mV	0.05% + 25mV
	10 Vp	3.500 V	1 kHz	3.495 V	-5mV	±2.6mV	0.12% + 25mV
	10 Vp	3.500 V	50 kHz	3.488 V	-12mV	±9.4mV	1.1% + 25mV
	20 Vp	7.000 V	60 Hz	6.993 V	-7mV	±3.4mV	0.05% + 30mV
	20 Vp	7.000 V	1 kHz	6.993 V	-7mV	±3.4mV	0.12% + 30mV
	20 Vp	7.000 V	50 kHz	6.976 V	-24mV	±15mV	1.1% + 30mV
	50 Vp	17.000 V	60 Hz	16.992 V	-8mV	±6.2mV	0.05% + 45mV
	50 Vp	17.000 V	1 kHz	16.993 V	-7mV	±6.2mV	0.12% + 45mV
	50 Vp	17.000 V	50 kHz	16.954 V	-46mV	±30mV	1.1% + 45mV
	100 Vp	35.00 V	60 Hz	34.97 V	-30mV	±28mV	0.05% + 70mV
	100 Vp	35.00 V	1 kHz	34.97 V	-30mV	±28mV	0.12% + 70mV
	100 Vp	35.00 V	20 kHz	35.00 V	0 V	±55mV	0.5% + 70mV
	200 Vp	70.00 V	60 Hz	69.96 V	-40mV	±39mV	0.05% + 120mV
	200 Vp	70.00 V	1 kHz	69.97 V	-30mV	±39mV	0.12% + 120mV
	200 Vp	70.00 V	20 kHz	69.96 V	-40mV	±78mV	0.5% + 120mV
	500 Vp	170.00 V	60 Hz	169.80 V	-200mV	±75mV	0.05% + 270mV
	500 Vp	170.00 V	1 kHz	169.82 V	-180mV	±75mV	0.12% + 270mV
	1000 Vp	350.0 V	60 Hz	349.7 V	-300mV	±290mV	0.05% + 520mV
	1000 Vp	350.0 V	1 kHz	349.8 V	-200mV	±290mV	0.12% + 520mV
	2000 Vp	700.0 V	60 Hz	699.5 V	-500mV	±400mV	0.05% + 1020mV
	2000 Vp	700.0 V	1 kHz	699.5 V	-500mV	±400mV	0.12% + 1020mV

AC Voltage Test - Channel 3.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.5 Vp	198.00 mV	60 Hz	198.13 mV	130µV	±97µV	0.05% + 20.3mV
	0.5 Vp	198.00 mV	1 kHz	198.13 mV	130µV	±97µV	0.12% + 20.3mV
	0.5 Vp	198.00 mV	50 kHz	201.3 mV	3.3mV	±350µV	1.1% + 20.3mV
	1 Vp	350.0 mV	60 Hz	350.4 mV	400µV	±240µV	0.05% + 20.5mV
	1 Vp	350.0 mV	1 kHz	350.3 mV	300µV	±240µV	0.12% + 20.5mV
	1 Vp	350.0 mV	50 kHz	352.9 mV	2.9mV	±660µV	1.1% + 20.5mV
	2 Vp	700.0 mV	60 Hz	700.6 mV	600µV	±300µV	0.05% + 21mV
	2 Vp	700.0 mV	1 kHz	700.5 mV	500µV	±300µV	0.12% + 21mV
	2 Vp	700.0 mV	50 kHz	702.1 mV	2.1mV	±1.1mV	1.1% + 21mV
	5 Vp	1.7000 V	60 Hz	1.7011 V	1.1mV	±500µV	0.05% + 22.5mV
	5 Vp	1.7000 V	1 kHz	1.7010 V	1mV	±500µV	0.12% + 22.5mV
	5 Vp	1.7000 V	50 kHz	1.7044 V	4.4mV	±2.2mV	1.1% + 22.5mV
	10 Vp	3.500 V	60 Hz	3.503 V	3mV	±2.6mV	0.05% + 25mV
	10 Vp	3.500 V	1 kHz	3.503 V	3mV	±2.6mV	0.12% + 25mV
	10 Vp	3.500 V	50 kHz	3.507 V	7mV	±9.4mV	1.1% + 25mV
	20 Vp	7.000 V	60 Hz	7.005 V	5mV	±3.4mV	0.05% + 30mV
	20 Vp	7.000 V	1 kHz	7.004 V	4mV	±3.4mV	0.12% + 30mV
	20 Vp	7.000 V	50 kHz	7.011 V	11mV	±15mV	1.1% + 30mV
	50 Vp	17.000 V	60 Hz	17.003 V	3mV	±6.2mV	0.05% + 45mV
	50 Vp	17.000 V	1 kHz	17.002 V	2mV	±6.2mV	0.12% + 45mV
	50 Vp	17.000 V	50 kHz	17.023 V	23mV	±30mV	1.1% + 45mV
	100 Vp	35.00 V	60 Hz	35.01 V	10mV	±28mV	0.05% + 70mV
	100 Vp	35.00 V	1 kHz	35.01 V	10mV	±28mV	0.12% + 70mV
	100 Vp	35.00 V	20 kHz	35.12 V	120mV	±55mV	0.5% + 70mV
	200 Vp	70.00 V	60 Hz	70.01 V	10mV	±39mV	0.05% + 120mV
	200 Vp	70.00 V	1 kHz	70.02 V	20mV	±39mV	0.12% + 120mV
	200 Vp	70.00 V	20 kHz	70.05 V	50mV	±78mV	0.5% + 120mV
	500 Vp	170.00 V	60 Hz	170.07 V	70mV	±75mV	0.05% + 270mV
	500 Vp	170.00 V	1 kHz	170.06 V	60mV	±75mV	0.12% + 270mV
	1000 Vp	350.0 V	60 Hz	350.1 V	100mV	±290mV	0.05% + 520mV
	1000 Vp	350.0 V	1 kHz	350.2 V	200mV	±290mV	0.12% + 520mV
	2000 Vp	700.0 V	60 Hz	700.2 V	200mV	±400mV	0.05% + 1020mV
	2000 Vp	700.0 V	1 kHz	700.2 V	200mV	±400mV	0.12% + 1020mV

AC Current Test - Channel 1.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.1 Ap	35.00 mA	60 Hz	35.01 mA	10µA	±53µA	0.05% + 1.05mA
	0.1 Ap	35.00 mA	1 kHz	35.01 mA	10µA	±53µA	0.14% + 1.05mA
	0.2 Ap	70.00 mA	60 Hz	70.02 mA	20µA	±77µA	0.05% + 1.1mA
	0.2 Ap	70.00 mA	1 kHz	70.01 mA	10µA	±77µA	0.14% + 1.1mA
	0.5 Ap	170.00 mA	60 Hz	170.00 mA	0mA	±150µA	0.05% + 1.25mA
	0.5 Ap	170.00 mA	1 kHz	169.99 mA	-10µA	±150µA	0.14% + 1.25mA
	1 Ap	350.0 mA	60 Hz	350.0 mA	0mA	±560µA	0.05% + 1.5mA
	1 Ap	350.0 mA	1 kHz	349.9 mA	-100µA	±560µA	0.14% + 1.5mA
	2 Ap	700.0 mA	60 Hz	700.0 mA	0mA	±820µA	0.05% + 2mA
	2 Ap	700.0 mA	1 kHz	699.8 mA	-200µA	±820µA	0.14% + 2mA
	5 Ap	1.7000 A	60 Hz	1.7001 A	100µA	±1.6mA	0.05% + 3.5mA
	5 Ap	1.7000 A	1 kHz	1.6998 A	-200µA	±1.6mA	0.14% + 3.5mA
	10 Ap	3.500 A	60 Hz	3.500 A	0 A	±3.6mA	0.05% + 6mA
	10 Ap	3.500 A	1 kHz	3.499 A	-1mA	±3.6mA	0.14% + 6mA
	20 Ap	7.000 A	60 Hz	7.000 A	0 A	±6.1mA	0.05% + 11mA
	20 Ap	7.000 A	1 kHz	6.998 A	-2mA	±6.1mA	0.14% + 11mA
	50 Ap	17.000 A	60 Hz	16.996 A	-4mA	±21mA	0.05% + 26mA
	50 Ap	17.000 A	1 kHz	16.982 A	-18mA	±21mA	0.14% + 26mA
	Ext.	1.0000 V	60 Hz	80.01 A	10mA	±28mA	N/A
	Ext.	1.0000 V	1 kHz	80.03 A	30mA	±28mA	N/A

AC Current Test - Channel 2.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.1 Ap	35.00 mA	60 Hz	35.01 mA	10µA	±53µA	0.05% + 1.05mA
	0.1 Ap	35.00 mA	1 kHz	35.02 mA	20µA	±53µA	0.14% + 1.05mA
	0.2 Ap	70.00 mA	60 Hz	70.01 mA	10µA	±77µA	0.05% + 1.1mA
	0.2 Ap	70.00 mA	1 kHz	70.00 mA	0mA	±77µA	0.14% + 1.1mA
	0.5 Ap	170.00 mA	60 Hz	169.99 mA	-10µA	±150µA	0.05% + 1.25mA
	0.5 Ap	170.00 mA	1 kHz	169.98 mA	-20µA	±150µA	0.14% + 1.25mA
	1 Ap	350.0 mA	60 Hz	349.9 mA	-100µA	±560µA	0.05% + 1.5mA
	1 Ap	350.0 mA	1 kHz	349.9 mA	-100µA	±560µA	0.14% + 1.5mA
	2 Ap	700.0 mA	60 Hz	699.9 mA	-100µA	±820µA	0.05% + 2mA
	2 Ap	700.0 mA	1 kHz	699.8 mA	-200µA	±820µA	0.14% + 2mA
	5 Ap	1.7000 A	60 Hz	1.7001 A	100µA	±1.6mA	0.05% + 3.5mA
	5 Ap	1.7000 A	1 kHz	1.6995 A	-500µA	±1.6mA	0.14% + 3.5mA
	10 Ap	3.500 A	60 Hz	3.499 A	-1mA	±3.6mA	0.05% + 6mA
	10 Ap	3.500 A	1 kHz	3.498 A	-2mA	±3.6mA	0.14% + 6mA
	20 Ap	7.000 A	60 Hz	6.998 A	-2mA	±6.1mA	0.05% + 11mA
	20 Ap	7.000 A	1 kHz	6.998 A	-2mA	±6.1mA	0.14% + 11mA
	50 Ap	17.000 A	60 Hz	16.991 A	-9mA	±21mA	0.05% + 26mA
	50 Ap	17.000 A	1 kHz	16.980 A	-20mA	±21mA	0.14% + 26mA
	Ext.	1.0000 V	60 Hz	79.86 A	-140mA	±28mA	N/A
	Ext.	1.0000 V	1 kHz	80.01 A	10mA	±28mA	N/A

AC Current Test - Channel 3.

Note:	Range:	Input:		Reading:	Error:	Uncert.:	Spec.:
	0.1 Ap	35.00 mA	60 Hz	35.01 mA	10μA	±53μA	0.05% + 1.05mA
	0.1 Ap	35.00 mA	1 kHz	35.02 mA	20μA	±53μA	0.14% + 1.05mA
	0.2 Ap	70.00 mA	60 Hz	70.01 mA	10μA	±77μA	0.05% + 1.1mA
	0.2 Ap	70.00 mA	1 kHz	70.01 mA	10μA	±77μA	0.14% + 1.1mA
	0.5 Ap	170.00 mA	60 Hz	169.99 mA	-10μA	±150μA	0.05% + 1.25mA
	0.5 Ap	170.00 mA	1 kHz	169.99 mA	-10μA	±150μA	0.14% + 1.25mA
	1 Ap	350.0 mA	60 Hz	350.0 mA	0mA	±560μA	0.05% + 1.5mA
	1 Ap	350.0 mA	1 kHz	349.9 mA	-100μA	±560μA	0.14% + 1.5mA
	2 Ap	700.0 mA	60 Hz	700.0 mA	0mA	±820μA	0.05% + 2mA
	2 Ap	700.0 mA	1 kHz	699.8 mA	-200μA	±820μA	0.14% + 2mA
	5 Ap	1.7000 A	60 Hz	1.7000 A	0 A	±1.6mA	0.05% + 3.5mA
	5 Ap	1.7000 A	1 kHz	1.6996 A	-400μA	±1.6mA	0.14% + 3.5mA
	10 Ap	3.500 A	60 Hz	3.499 A	-1mA	±3.6mA	0.05% + 6mA
	10 Ap	3.500 A	1 kHz	3.499 A	-1mA	±3.6mA	0.14% + 6mA
	20 Ap	7.000 A	60 Hz	6.999 A	-1mA	±6.1mA	0.05% + 11mA
	20 Ap	7.000 A	1 kHz	6.999 A	-1mA	±6.1mA	0.14% + 11mA
	50 Ap	17.000 A	60 Hz	16.992 A	-8mA	±21mA	0.05% + 26mA
	50 Ap	17.000 A	1 kHz	16.983 A	-17mA	±21mA	0.14% + 26mA
	Ext.	1.0000 V	60 Hz	79.99 A	-10mA	±28mA	N/A
	Ext.	1.0000 V	1 kHz	80.00 A	0 A	±28mA	N/A

AC Power Test (60 Hz, cos ϕ = 1.00) - Channel 1.

Note:	Range:	Input:	Nom.value:	Reading:	Error:	Uncert.:	Spec.:
	5 Vp/2 Ap	1.7 V/0.7 A	1.1900 W	1.1898 W	-200μW	±1.4mW	20.4mW
	200 Vp/5 Ap	70 V/1.7 A	119.00 W	118.99 W	-10mW	±130mW	570mW
	1000 Vp/5 Ap	350 V/1.7 A	595.0 W	595.3 W	300mW	±670mW	2.7W

AC Power Test (60 Hz, cos ϕ = 1.00) - Channel 2.

Note:	Range:	Input:	Nom.value:	Reading:	Error:	Uncert.:	Spec.:
	5 Vp/2 Ap	1.7 V/0.7 A	1.1900 W	1.1891 W	-900μW	±1.4mW	20.4mW
	200 Vp/5 Ap	70 V/1.7 A	119.00 W	118.94 W	-60mW	±130mW	570mW
	1000 Vp/5 Ap	350 V/1.7 A	595.0 W	594.5 W	-500mW	±670mW	2.7W

AC Power Test (60 Hz, cos ϕ = 1.00) - Channel 3.

Note:	Range:	Input:	Nom.value:	Reading:	Error:	Uncert.:	Spec.:
	5 Vp/2 Ap	1.7 V/0.7 A	1.1900 W	1.1910 W	1mW	±1.4mW	20.4mW
	200 Vp/5 Ap	70 V/1.7 A	119.00 W	119.02 W	20mW	±130mW	570mW
	1000 Vp/5 Ap	350 V/1.7 A	595.0 W	595.3 W	300mW	±670mW	2.7W

Frequency Test.

Note:	Input:	Reading:	Error:	Uncert.:	Spec.:
	1.0000 kHz	999.9 Hz	-100mHz	±120mHz	0.1%
	10.000 kHz	10.000 kHz	0kHz	±1.2Hz	0.1%
	20.00 kHz	20.00 kHz	0kHz	±7Hz	0.1%

Distortion, total V-distortion.

Note:	Frequency:	Input:	Reading:	Error:	Uncert.:	Spec.:
	50 Hz	10.000 %d	10.02 %d	0.02%d	±0.034%d	N/A
	60 Hz	10.000 %d	10.04 %d	0.04%d	±0.034%d	N/A
	120 Hz	10.000 %d	10.01 %d	0.01%d	±0.034%d	N/A
	240 Hz	10.000 %d	9.991 %d	-0.009%d	±0.016%d	N/A
	400 Hz	1.000 %d	1.015 %d	0.015%d	±0.0051%d	N/A
	400 Hz	5.000 %d	5.007 %d	0.007%d	±0.0099%d	N/A
	400 Hz	10.000 %d	10.01 %d	0.01%d	±0.034%d	N/A
	400 Hz	20.000 %d	19.96 %d	-0.04%d	±0.042%d	N/A
	400 Hz	30.000 %d	30.02 %d	0.02%d	±0.051%d	N/A

Distortion, total V-distortion.

Note:	Frequency:	Harm.:	Input:	Reading:	Error:	Uncert.:	Spec.:
	400 Hz	2	5.000 %d	4.996 %d	-0.004%d	±0.0099%d	N/A
	400 Hz	3	4.000 %d	3.990 %d	-0.01%d	±0.019%d	N/A
	400 Hz	4	3.000 %d	3.010 %d	0.01%d	±0.0095%d	N/A
	400 Hz	5	2.000 %d	2.016 %d	0.016%d	±0.0077%d	N/A
	400 Hz	6	1.000 %d	1.002 %d	0.002%d	±0.0061%d	N/A
	400 Hz	7	0.750 %d	0.751 %d	0.001%d	±0.0058%d	N/A
	400 Hz	8	0.500 %d	0.503 %d	0.003%d	±0.0054%d	N/A
	400 Hz	9	0.300 %d	0.294 %d	-0.006%d	⊥0.0051%d	N/A

REFERENCE EQUIPMENT USED FOR CALIBRATION

Trescal Id:	Reference Equipment:	Cal.due:	Traceability:
401691	Fluke, Calibrator, 5520 A	dec-2009	DFM-NPL-PTB
400503	Fluke, Calibrator, 5700 A w/Wideband	oct-2009	DFM-NPL-PTB

Any potential notes do not form part of the certificate, but serve only as notes for the customer.

DANAK (Danish Accreditation)

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" and in DS/EN ISO/IEC 15189 "Medical Laboratories - Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- that the laboratory and its personnel are free from any commercial, financial and other pressures, which might influence their impartiality.
- that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained.
- that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform.
- that the laboratory has at its disposal personnel with technical competence and practical experience in performing the sevices that it is accredited to perform.
- that the laboratory has procedures for traceability and uncertainty calculations.
- that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods.
- that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request.
- that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination.
- that the laboratory is subject to surveillance by DANAK on a regular basis.
- that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

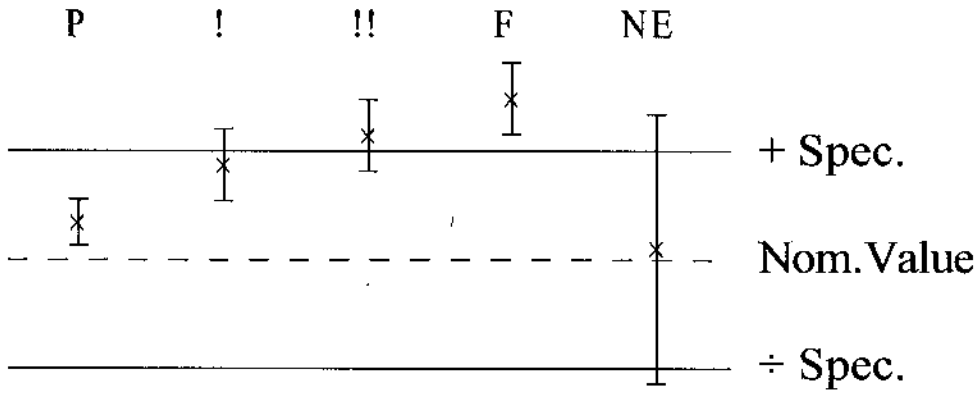
APPENDIX

CERTIFICATE OF COMPLIANCE:

Equipment	: Power Analyzer	Date of Cal.	: 21-10-2009 DD-MM-YYYY
Manufacturer	: Voltech	Cert. no..	: 22 - 334966
Model no.	: PM 3000 A	Instrument no.	: AXA-599
Serial no.	: AU157/1183	Trescal no.	: 173032

OWNERS SIGN.: _____ **DATE:** _____

All measured values are (The measured value is) within the stated requirements for compliance, according to the explanation below, with the given specifications.



For instruments, that have a specification, the measured values are evaluated as follows:

Passed (not marked):	**All (All other) measurement results are within the specification when added the measurement uncertainty: Compliance.**
!):	**The measurement result is within the specification, but it is outside when added the measurement uncertainty: Compliance cannot be decided.**
!!):	**The measurement result is outside the specification, but it is inside when added the measurement uncertainty: Compliance cannot be decided.**
Failed (F):	**The measurement result added the measurement uncertainty is outside the specification : No Compliance.**
Evaluation not possible (NE):	**The measured value is inside (outside) the specification, but the uncertainty is larger than or equal to the specification. Therefore a statement about compliance is not possible.**

A confidence level of 95% is used for calculation of measurement uncertainty.

Cert. No.: FRC-09-04081
Job Id.: 22010100-1

DET NORSKE VERITAS

SURVEY REPORT

Manufacturer: AXA Power Aps, Odense, Denmark

Item: AXA Power Coil, 90 kVA Solid-state GPU and cable coil in one single unit.

Type: 3PBB-200/260-N.

The above mentioned unit has been inspected in relation to Environmental Protection Class IP.

The Cabinet can be split in three sections:
1) Electronic Zone: IP 55.
2) Magnetic/Ventilated Zone: IP 54.
3) Cable Zone: All Components installed as minimum IP 55.

Odense, Denmark 2009-04-22

Leif Rasmussen
Surveyor

AXA POWER ApS
Smedebakken 31-33
DK-5270 Odense N
Tel.: +45 63 18 60 00 Fax: +45 63 18 60 49

AXA POWER
www.axapower.com

AXA POWER ApS
Smedebakken 31-33
DK-5270 Odense N
Tel.: +45 63 18 60 00 Fax: +45 63 18 60 49

CE

CE Declaration of Conformity

This declaration covers :

Designation : Combined 400 Hz Ground Power Unit and Cable Coil

Type : 3PBB-200/XXX-N, 3GVC-200/XXX-N...

Description: Solid state power supply converting a three-phase mains supply into an isolated three-phase 400 Hz supply. The converter is combined with a cable coil for handling and storage of the output cable.

Complying with the following directives :

73/23/EC	(LVD)
98/37/EC	(Machinery)
2004/108/EC	(EMC)

Conformity attained by complying with :

EN 62040-1-1	(LVD – Safety standard)
EN 61558-2-6	(LVD – Safety standard)
EN 1951-1 & 2	(Machinery – General safety requirements)
EN12312-20	(machinery – Specific safety requirements)
EN 61000-6-2	(EMC – Immunity standards)
EN 61000-6-4	(EMC – Emission standards)

08.10.2009

Date

Søren R. Dahl

Søren R. Dahl, Development Manager

799.326 Rev. C

```
**************************************************
VOLTECH PM3000CE  Serial 1032  Version v2.22
11 Aug 10      05:12
RMS DC COUPLED
******************  CHANNEL 1  ******************
Watts        +21.33kW
Watts.f      +21.33kW
VA            29.82kVA
VA.f          29.79kVA
Vrms         115.11 V
Vrms.f       115.09 V
Arms          259.1 A
Arms.f        258.9 A
PF            0.715
cos phi      -0.715
VH01         115.09 V          000.0 deg
******************  CHANNEL 2  ******************
Watts        +21.78kW
Watts.f      +21.78kW
VA            29.63kVA
VA.f          29.60kVA
Vrms         115.19 V
Vrms.f       115.18 V
Arms          257.3 A
Arms.f        257.0 A
PF            0.735
cos phi      -0.735
VH01         115.18 V         -120.3 deg
******************  CHANNEL 3  ******************
Watts        +22.12kW
Watts.f      +22.11kW
VA            30.32kVA
VA.f          30.29kVA
Vrms         115.05 V
Vrms.f       115.03 V
Arms          263.5 A
Arms.f        263.3 A
PF            0.729
cos phi      -0.730
VH01         115.03 V         -240.2 deg
******************  SUM 1+2+3  ******************
Watts        +65.23kW
Watts.f      +65.22kW
VA            89.77kVA
VA.f          89.68kVA
Vrms         199.39 V
Vrms.f       199.36 V
Arms          259.9 A
Arms.f        259.7 A
PF            0.726
cos phi      -0.727
*************** VOLTAGE HARMONICS ***************
V dc         +4.165mV
V dc        +18.910mV
V dc        -12.734mV
VH02          470.6mV        0.408 %       -004.7 deg
VH02         110.73mV        0.096 %       -307.9 deg
VH02         143.99mV        0.125 %       -116.5 deg
VH03          399.0mV        0.346 %       -154.2 deg
VH03          399.3mV        0.346 %       -148.9 deg
VH03          395.7mV        0.344 %       -152.6 deg
VH04          449.3mV        0.390 %       -073.8 deg
VH04          344.4mV        0.299 %       -112.9 deg
VH04         17.319mV        0.015 %       -099.4 deg
```

VH05	661.0mV	0.574 %	-356.6 deg
VH05	530.4mV	0.460 %	-200.6 deg
VH05	390.7mV	0.339 %	-063.7 deg
VH06	64.00mV	0.055 %	-175.9 deg
VH06	57.92mV	0.050 %	-039.2 deg
VH06	89.33mV	0.077 %	-335.6 deg
VH07	1.2134 V	1.054 %	-189.8 deg
VH07	1.3529 V	1.175 %	-311.1 deg
VH07	1.2867 V	1.119 %	-071.4 deg
VH08	23.56mV	0.020 %	-229.6 deg
VH08	57.72mV	0.050 %	-064.4 deg
VH08	54.03mV	0.046 %	-274.9 deg
VH09	160.00mV	0.139 %	-083.0 deg
VH09	127.30mV	0.110 %	-100.1 deg
VH09	129.06mV	0.112 %	-073.7 deg
VH10	26.37mV	0.022 %	-305.2 deg
VH10	38.42mV	0.033 %	-054.4 deg
VH10	6.265mV	0.005 %	-132.8 deg
VH11	57.17mV	0.049 %	-211.7 deg
VH11	80.91mV	0.070 %	-075.7 deg
VH11	58.18mV	0.050 %	-344.8 deg
VH12	7.816mV	0.006 %	-353.0 deg
VH12	16.204mV	0.014 %	-024.1 deg
VH12	7.758mV	0.006 %	000.0 deg
VH13	77.27mV	0.067 %	-249.7 deg
VH13	82.30mV	0.071 %	-018.3 deg
VH13	75.87mV	0.065 %	-130.3 deg
VH14	39.96mV	0.034 %	-036.5 deg
VH14	25.36mV	0.022 %	-243.6 deg
VH14	33.11mV	0.028 %	-171.4 deg
VH15	21.08mV	0.018 %	-070.9 deg
VH15	17.924mV	0.015 %	-093.2 deg
VH15	13.248mV	0.011 %	-072.3 deg
VH16	27.59mV	0.023 %	-191.9 deg
VH16	19.743mV	0.017 %	-299.4 deg
VH16	27.38mV	0.023 %	-072.7 deg
VH17	27.87mV	0.024 %	-321.6 deg
VH17	35.47mV	0.030 %	-187.6 deg
VH17	25.70mV	0.022 %	-085.0 deg
VH18	749.6uV	0.000 %	-135.0 deg
VH18	15.337mV	0.013 %	-174.8 deg
VH18	12.058mV	0.010 %	-247.4 deg
VH19	5.940mV	0.005 %	-269.5 deg
VH19	13.025mV	0.011 %	-065.2 deg
VH19	8.621mV	0.007 %	-221.8 deg
VH20	4.286mV	0.003 %	-251.6 deg
VH20	3.669mV	0.003 %	-126.4 deg
VH20	2.925mV	0.002 %	-353.4 deg
VH21	21.83mV	0.018 %	-308.7 deg
VH21	32.30mV	0.028 %	-289.8 deg
VH21	31.48mV	0.027 %	-308.7 deg
VH22	1.1945mV	0.001 %	-191.8 deg
VH22	7.267mV	0.006 %	-135.3 deg
VH22	14.347mV	0.012 %	-327.1 deg
VH23	52.42mV	0.045 %	-040.6 deg
VH23	52.16mV	0.045 %	-295.6 deg
VH23	48.50mV	0.042 %	-161.2 deg
VH24	4.644mV	0.004 %	-029.8 deg
VH24	3.031mV	0.002 %	-153.0 deg
VH24	3.319mV	0.002 %	-140.4 deg
VH25	24.69mV	0.021 %	-056.3 deg
VH25	32.73mV	0.028 %	-181.2 deg
VH25	22.50mV	0.019 %	-281.5 deg
VH26	1.9856mV	0.001 %	-031.7 deg

VH26	3.001mV	0.002 %	-286.3 deg
VH26	4.453mV	0.003 %	-069.7 deg
VH27	301.2mV	0.261 %	-251.3 deg
VH27	387.1mV	0.336 %	-255.6 deg
VH27	520.0mV	0.452 %	-257.2 deg
VH28	6.236mV	0.005 %	-226.6 deg
VH28	3.814mV	0.003 %	-053.6 deg
VH28	3.011mV	0.002 %	-098.7 deg
VH29	816.9mV	0.709 %	-244.9 deg
VH29	1.0495 V	0.911 %	-127.3 deg
VH29	854.0mV	0.742 %	-006.8 deg
VH30	906.0uV	0.000 %	-042.7 deg
VH30	4.415mV	0.003 %	-223.1 deg
VH30	2.997mV	0.002 %	-232.0 deg
VH31	534.9mV	0.464 %	-049.8 deg
VH31	725.7mV	0.630 %	-173.9 deg
VH31	566.9mV	0.492 %	-293.9 deg
VH32	1.1410mV	0.000 %	-254.1 deg
VH32	1.6301mV	0.001 %	-097.3 deg
VH32	3.988mV	0.003 %	-023.2 deg
VH33	227.4mV	0.197 %	-033.2 deg
VH33	323.6mV	0.281 %	-042.0 deg
VH33	501.6mV	0.436 %	-045.1 deg
VH34	2.992mV	0.002 %	-048.6 deg
VH34	4.481mV	0.003 %	-171.1 deg
VH34	2.931mV	0.002 %	-140.2 deg
VH35	45.74mV	0.039 %	-033.6 deg
VH35	68.40mV	0.059 %	-279.7 deg
VH35	49.49mV	0.043 %	-146.7 deg
VH36	2.481mV	0.002 %	-114.9 deg
VH36	2.115mV	0.001 %	-068.8 deg
VH36	1.1153mV	0.000 %	-032.9 deg
VH37	7.811mV	0.006 %	-141.7 deg
VH37	12.211mV	0.010 %	-282.1 deg
VH37	6.016mV	0.005 %	-033.2 deg
VH38	1.6746mV	0.001 %	-168.3 deg
VH38	2.408mV	0.002 %	-020.5 deg
VH38	3.428mV	0.002 %	-153.4 deg
VH39	6.585mV	0.005 %	-150.8 deg
VH39	10.628mV	0.009 %	-167.2 deg
VH39	20.80mV	0.018 %	-169.1 deg
VH40	2.364mV	0.002 %	-130.0 deg
VH40	904.0uV	0.000 %	-104.9 deg
VH40	1.0583mV	0.000 %	-183.2 deg
VH41	1.5563mV	0.001 %	-223.4 deg
VH41	3.874mV	0.003 %	-066.6 deg
VH41	1.7646mV	0.001 %	-331.7 deg
VH42	2.689mV	0.002 %	-277.8 deg
VH42	2.148mV	0.001 %	-231.9 deg
VH42	7.388mV	0.006 %	-278.5 deg
VH43	2.121mV	0.001 %	-008.4 deg
VH43	3.460mV	0.003 %	-109.7 deg
VH43	939.2uV	0.000 %	-352.4 deg
VH44	1.6371mV	0.001 %	-177.8 deg
VH44	2.695mV	0.002 %	-162.4 deg
VH44	2.151mV	0.001 %	-042.6 deg
VH45	2.277mV	0.001 %	-068.5 deg
VH45	6.490mV	0.005 %	-115.1 deg
VH45	9.527mV	0.008 %	-104.1 deg
VH46	1.6282mV	0.001 %	-130.1 deg
VH46	1.7720mV	0.001 %	-186.3 deg
VH46	2.275mV	0.001 %	-196.9 deg
VH47	2.492mV	0.002 %	-186.2 deg
VH47	5.022mV	0.004 %	-111.8 deg

VH47	1.7734mV	0.001 %	-008.7 deg
VH48	2.467mV	0.002 %	-356.8 deg
VH48	4.692mV	0.004 %	-109.5 deg
VH48	2.035mV	0.001 %	-061.7 deg
VH49	1.1909mV	0.001 %	-176.6 deg
VH49	3.061mV	0.002 %	-001.3 deg
VH49	2.327mV	0.002 %	-125.1 deg
VH50	2.520mV	0.002 %	-304.6 deg
VH50	1.0693mV	0.000 %	-183.8 deg
VH50	5.039mV	0.004 %	-146.1 deg
V thd	1.657 %		
V thd	1.808 %		
V thd	1.651 %		

****