出國報告（出國類別：國外承攬）

關島 CABRAS 電廠#1 機
汽機大修 PART II 報告

服務機關：台 灣 電 力 公 司 電 力 修 護 處
姓名職稱：黃 奕 凱 工 程 專 員
派赴國家：美 國 關 島
出國期間：106 年 09 月 08 日 ~ 106 年 09 月 16 日
報告日期：106 年 10 月 31 日

出國報告審核表

出國報告名稱：關島 CABRAS 電廠 #1 機汽機大修 PART II 報告		
出國人姓名 （2 人以上，以 1 人為代表）	職稱	服務單位
黃奕凱	電機工程專員	電力修護處
出國類別	☐考察 ☐進修 ☐研究 ☐實習 ■其他 關島 CABRAS 電廠 #1 機汽機大修	
出國期間： 106 年 9 月 8 日 至 106 年 9 月 16 日		報告繳交日期： 106 年 10 月 31 日

出國人員自我檢核	計畫主辦機關審核	審　　核　　項　　目
■	☐	1.依限繳交出國報告
■	☐	2.格式完整（本文必須具備「目的」、「過程」、「心得及建議事項」）
■	☐	3.無抄襲相關資料
■	☐	4.內容充實完備
☐	☐	5.建議具參考價值
☐	☐	6.送本機關參考或研辦
☐	☐	7.送上級機關參考
☐	☐	8.退回補正，原因：
☐	☐	（1）不符原核定出國計畫
☐	☐	（2）以外文撰寫或僅以所蒐集外文資料為內容
☐	☐	（3）內容空洞簡略或未涵蓋規定要項
☐	☐	（4）抄襲相關資料之全部或部分內容
☐	☐	（5）引用相關資料未註明資料來源
☐	☐	（6）電子檔案未依格式辦理
☐	☐	9.本報告除上傳至出國報告資訊網外，將採行之公開發表：
☐	☐	（1）辦理本機關出國報告座談會（說明會），與同仁進行知識分享。
☐	☐	（2）於本機關業務會報提出報告
☐	☐	（3）其他＿＿＿＿＿＿
☐	☐	10.其他處理意見及方式：

出國人簽章（2 人以上，得以 1 人為代表）	計畫主辦機關審核人	一級單位主管簽章	機關首長或其授權人員簽章

說明：

一、各機關可依需要自行增列審核項目內容，出國報告審核完畢本表請自行保存。

二、審核作業應儘速完成，以不影響出國人員上傳出國報告至「公務出國報告資訊網」為原則。

列印 匯出

提 要 表

系統識別號：	C10603654
相關專案：	無
計畫名稱：	執行關島CABRAS#1機汽機大修工作
報告名稱：	CABRAS電廠 #1機汽機大修 PART II報告
計畫主辦機關：	台灣電力股份有限公司
出國人員：	姓名 / 服務機關 / 服務單位 / 職稱 / 官職等 / E-MAIL 信箱 黃奕凱等8人 / 台灣電力股份有限公司 / 電力修護處 / 電機工程專員 / 薦任(派) / 聯絡人 u477582@taipower.com.tw
前往地區：	關島
參訪機關：	CABRAS電廠
出國類別：	其他
實際使用經費：	年度 / 經費種類 / 來源機關 / 金額
出國計畫預算：	年度 / 經費種類 / 來源機關 / 金額 106年度 / 本機關 / 台灣電力股份有限公司 / 568,192元
出國期間：	民國106年09月08日 至 民國106年09月16日
報告日期：	民國106年10月31日
關鍵詞：	CABRAS，大修
報告書頁數：	57頁
報告內容摘要：	關島CABRAS電廠#1機汽機大修第二階段預定工期9天，自2017年9月8日至16日。主要工作內容為優化汽機軸承振動值、推力軸承變位量及輕油點火器進退控制系統之改善。 初始試運轉時，#2軸承易發生油漩現象，因此在230度的位置施以平衡配重，增加約280克的配重塊，不僅降低了低載時的油漩現象，並使各軸承振動值更加良好。推力軸承變位量則是在turning gear時即有偏高的情況，推測是待測面之差異性導致軸位變位量偏高，因此在Mark V系統設定補償值後即顯示正常。新的輕油點火器進退控制系統使得值班人員能夠透過人機介面控制點火裝置並更加容易排除故障情況。此外，汽機頭手動復歸手把機構附件因內部活塞阻滯致行程不足，無法自然觸發復歸開關，與廠方說明如何手動輔助復歸後，即可順利起機運轉。發電量於9月16日早上9點達到49.4MW。
報告建議事項：	
電子全文檔：	C10603654_01.pdf
出國報告審核表：	
限閱與否：	否

專責人員姓名：	
專責人員電話：	

列印 匯出

目錄

關島 CABRAS 電廠 #1 機汽機大修 PART II 報告

一、前言：

關島 CABRAS 電廠#1 機汽機大修第二階段預定工期 9 天，自 2017 年 9 月 8 日至 16 日。主要工作內容為優化汽機軸承振動值、推力軸承變位量及輕油點火器進退控制系統之改善。

初始試運轉時，#2 軸承易發生油漩現象，因此在 230 度的位置施以平衡配重，增加約 280 克的配重塊，不僅降低了低載時的油漩現象，並使各軸承振動值更加良好。推力軸承變位量則是在 turning gear 時即有偏高的情況，推測是待測面之差異性導致軸位變位量偏高，因此在 Mark V 系統設定補償值後即顯示正常。新的輕油點火器進退控制系統使得值班人員能夠透過人機介面控制點火裝置並更加容易排除故障情況。

此外，汽機頭手動復歸手把機構附件因內部活塞阻滯致行程不足，無法自然觸發復歸開關，與廠方說明如何手動輔助復歸後，即可順利起機運轉。發電量於 9 月 16 日早上 09:04 達到 49.4MW。

大修工期

預定工期：106/09/08~106/09/16

實際工期：106/09/08~106/09/16

大修人力配置表

黃奕凱	電機工程專員
江朝賢	裝配高級技術專員
李鶯墻	電機設備裝修高級技術專員
林宏建	起重技術員
王國廷	振動研究發展課 課長
鍾浩元	振動分析專員
王明山	台中發電廠 儀資三課 課長
蔡建興	協和發電廠 控制儀器課 課長

大修工作日誌

9/8　3/4 載時，振動值最高至 4.1miles

9/9　17:30 於 LP-GE 側第一次配重完成，但因點火系統異常無法起機，
改善輕油槍控制迴路及測試汽機復歸裝置至 23:50。

9/10　11:00 處理汽機無法復歸的問題並教育值班人員如何手動輔助復歸，預計下午再次啟動。

21:45 rolling

22:20 #2 軸承出現油漩現象，振動值高至 4.79mils。

22:54 重油槍點不起來，無法加載， #2 軸承振動降至 2.9mils 左右。

9/11　07:56 負載 10MW，振動值最高至 3.2mils，預計持續升載至 40MW 觀察。

10:24 負載 15MW，振動值最高至 3.0mils，值班人員表示爐水含矽量過高，擔心破管，所以緩慢升載。

14:02 CWP B 台故障，無法滿載。

15:18 負載 41.5MW，振動值最高至 2.9mils。

16:24 負載 50.5MW，振動值最高至 3.1mils。
與廠長報告後，廠方表示先觀察滿載後情況。

9/12　10:58 負載 54.0MW，振動值最高至 3.1mils。

12:07 負載 55.0MW，振動值最高至 3.1mils。

14:10 負載 44.3MW，振動值最高至 3.4mils。
廠方表示待 9/13 與 GPA(關島電力局)開會討論是否需要重新配重。

9/13　10:00 GPA(關島電力局)開會決議重新配重，預計 9/14 00:00 停機交予我司。

9/14　11:53 CWP B 台漏水處理和鍋爐換管。

13:00 完成 LP-GE 側第二次配重。280g @230 度位置。

9/15　06:23 在 0.5 倍頻時發生油漩現象，振動過大，後因值班人員操作問題跳機。另輔機設備疑似有燒損情況，停機巡查。

16:05 負載 2.0MW，振動值最高至 5.01mils，發生油漩現象，升載至 6.0MW 後即消失。

19:17 負載 16.1MW，振動值最高至 2.6mils。

9/16　09:04 負載 49.4MW，振動值最高至 2.7mils，符合 GPA(關島電力局)期望值。

09:15 工具裝櫃。

11:30 搭機返台。

二、檢修項目：

(1) 優化汽機軸承振動值

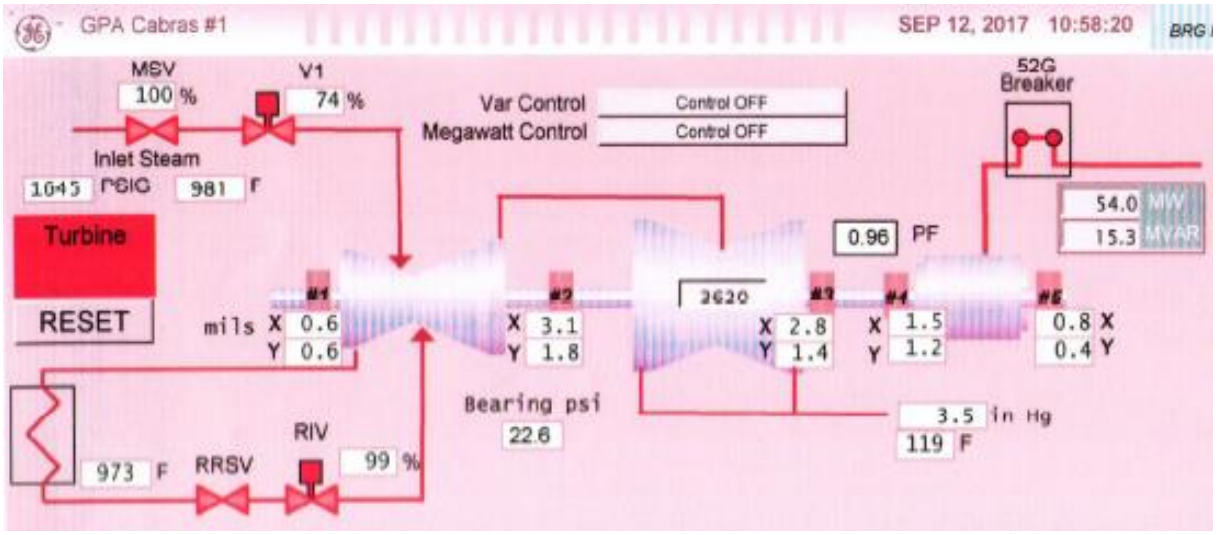
(2) 汽機軸位變位量過高情形探究

(3) 輕油點火器進退控制系統之改善

三、檢修內容：

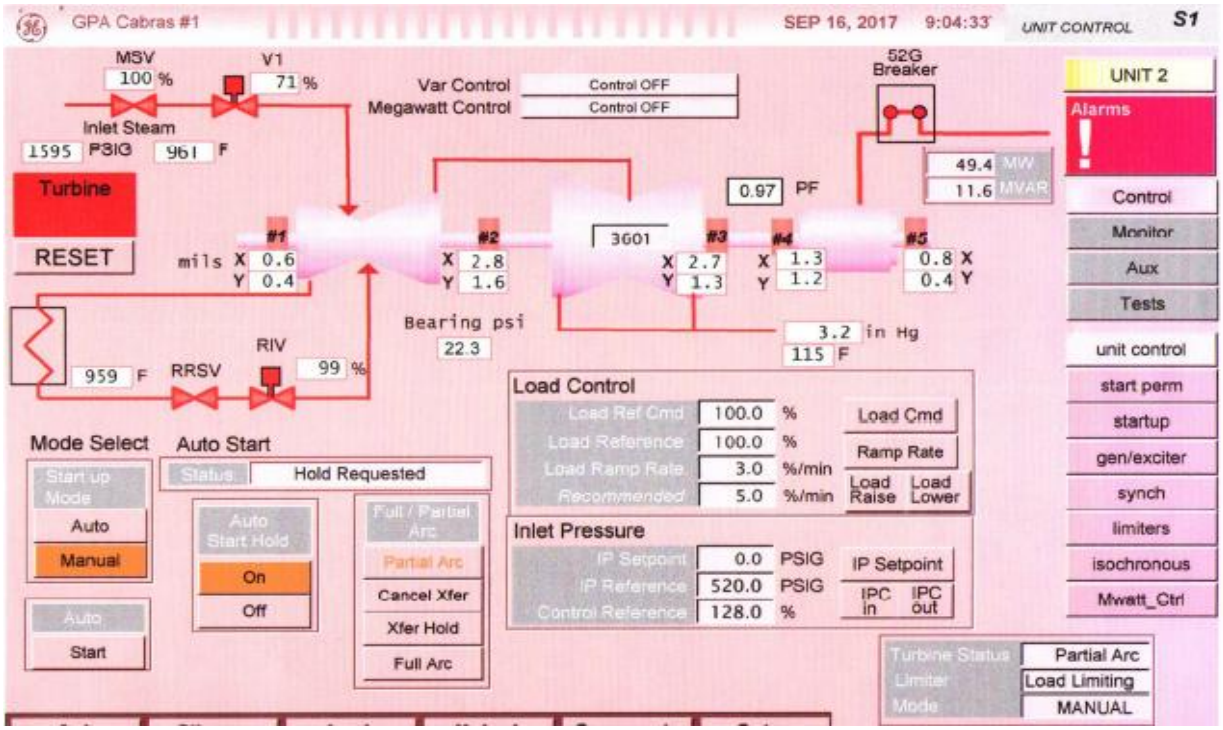
(1) 2017/09/09 於 240°~250°處增加 336 克(6 塊)配重塊。

穩定升載後，各軸承之振動數值如下圖所示：



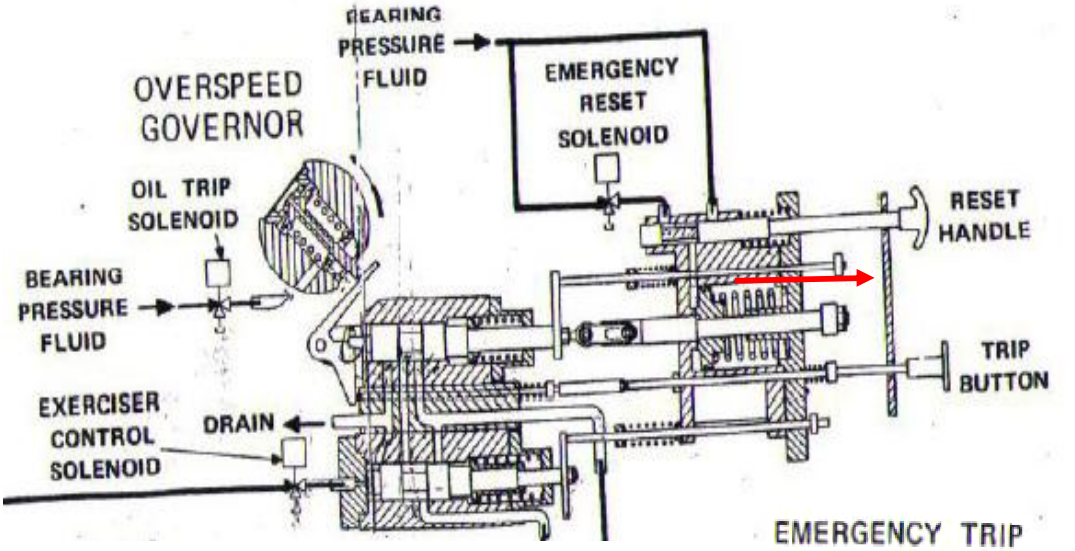
2017/09/14 於 230°處減少 56 克(1 塊)配重塊。

穩定升載後，各軸承之振動數值如下圖所示：



(2) 軸位顯示因待測面之差異性，turning gear 時即約有 8 mils 之變化，導致汽機運轉時，顯示之數值偏高，趨近警報值，台中電廠王課長明山於 Mark V 系統裡做補償修正後即顯示正常。

(3) 汽機頭 OVERSPEED GOVERNOR/(ETD)EXERCISER 復歸手把(Reset Handle)機構附件，因內部活塞阻滯致行程不足，無法自然觸發 reset limit switch，需靠外力幫助才能定位(如下圖紅線標示)，已建議廠方於下次大修時更新該機構或請值班人員每次復歸時至現場手動操作。



另請詳閱附件報告:

附件一 振動檢測報告(電力修護處王國廷課長)----------第 1 頁至第 12 頁

附件二 汽機控制系統檢測報告(台中電廠王明山課長)----------第 13 頁至第 19 頁

附件三 點火器進退控制系統改善報告(協和電廠蔡建興課長)---第 20 頁至第 51 頁

四、檢討及建議事項：

無

附件一

台電電力修護處振動研測隊振動檢測報告

委託單位	台灣機電工程服務社
試驗名稱	大修後振動檢測
設備名稱	關島電力局 GPA Cabras #1汽輪發電機
檢測人員	鍾浩元、王國廷
試驗日期	106年 08 月 25 日 至 09 月 01日、09 月 08 日 至 106 年 09 月 16日

（一）檢測結果：

單位：mil/deg.

程序 \ 測試位置			#1 BRG (X)	#1 BRG (Y)	#2 BRG (X)	#2 BRG (Y)	#3 BRG (X)	#3 BRG (Y)	#4 BRG (X)	#4 BRG (Y)	#5 BRG (X)	#5 BRG (Y)
處置前	3600rpm NOLOAD	In	0.2/114	0.2/218	1.1/142	1.6/264	2.8/220	2/309	0.4/15	0.3/101	0.6/44	0.3/138
		out	0.7	0.6	1.6	1.8	2.9	2	0.9	0.8	1	0.8
	10MW	In	0.2/126	0.2/229	1/189	1.7/300	3.1/122	2.3/311	0.3/94	0.1/~	0.5/31	0.2/114
		out	0.7	0.6	1.4	2	3.2	2.4	0.9	0.7	0.9	0.7
	15MW	In	0.1/~	0.2/216	1/180	1.1/307	3.3/225	2.5/311	0.6/98	0.2/284	0.5/38	0.3/103
		out	0.7	0.6	1.4	2.1	3.5	2.6	1.1	1.1	1	0.9
	25MW	In	0.2/131	0.2/236	0.8/184	1.5/305	3.5/229	2.7/313	0.7/150	0.2/285	0.6/48	0.3/108
		out	0.7	0.6	1.3	2	3.6	2.6	1.1	0.9	0.9	0.9
	42MW	out					4.1					
處置後	升速臨界	In	0.55/257	0.58/335	2.5/12	1.53/73	2.1/290	1.3/342	1.4/46	0.7/130	1.3/307	1/62
		rpm	2060	2080	2440	2260	1720	1480	1240	860	1920	1960
	3600rpm NOLOAD	In	0.04/~	0.1/~	2.3/83	2.2/194	1.6/235	0.9/338	0.8/22	0.5/117	0.7/9	0.5/117
	10MW	In	0.1/~	0.1/~	2.4/105	2.1/223	1.6/237	0.9/312	0.7/41	0.3/128	0.6/26	0.3/113
		out	0.5	0.6	2.8	2.5	1.7	0.9	1.2	0.7	1	0.7
	15MW	In	0.2/297	0.1/~	2.2/113	1.9/232	1.9/242	1.1/312	0.6/51	0.2/107	0.5/29	0.3/120
		out	0.5	0.4	2.7	2.2	2.1	1.2	1.1	0.6	0.8	0.6
	50MW	out	0.6	0.4	2.7	1.6	2.6	1.3	1.3	1.2	0.6	0.4
配重情形			**LP(GE側):+280g@230°**									
接受標準			ALARM: **4 mil** **TRIP: 9 mil**									

（二）試驗前狀況：

此為大修後振動檢測。

（三）原因分析：

1.質量不平衡。

2.#2BRG於定速時易發生油漩現象。

（四）處理對策：

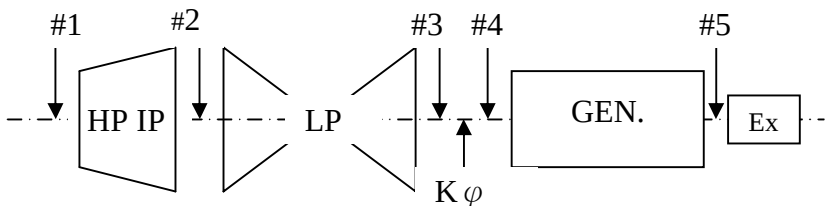
平衡配重:

LP(GE):+280g@230°

（五）建議事項：

請持續監測各軸承振變化情形。

（六）設備概述：



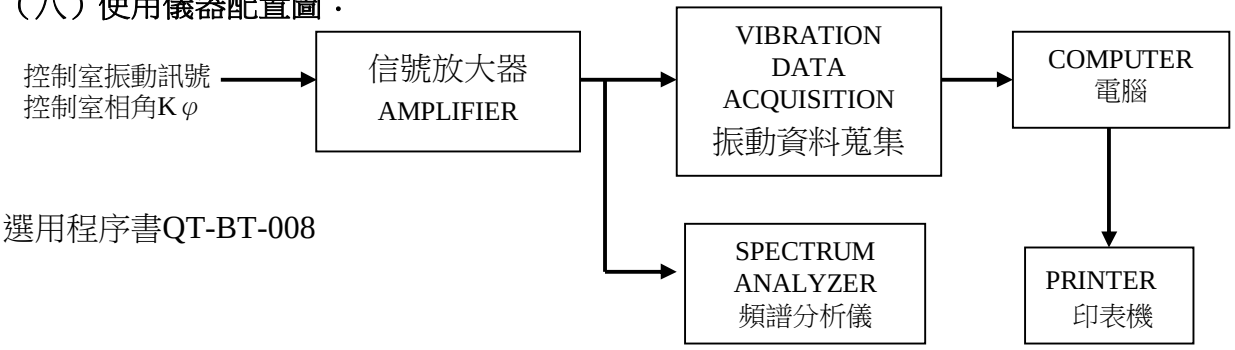
容　　量：66MW
轉　　速：3600rpm
傳動方式：.蒸汽
轉向（TG）：Turb->.Gen CCW
軸承型式：Sleeve
振動拾訊位置: X-45R ; Y-45L
相角拾訊位置:90R

（七）拾訊器靈敏度記錄：

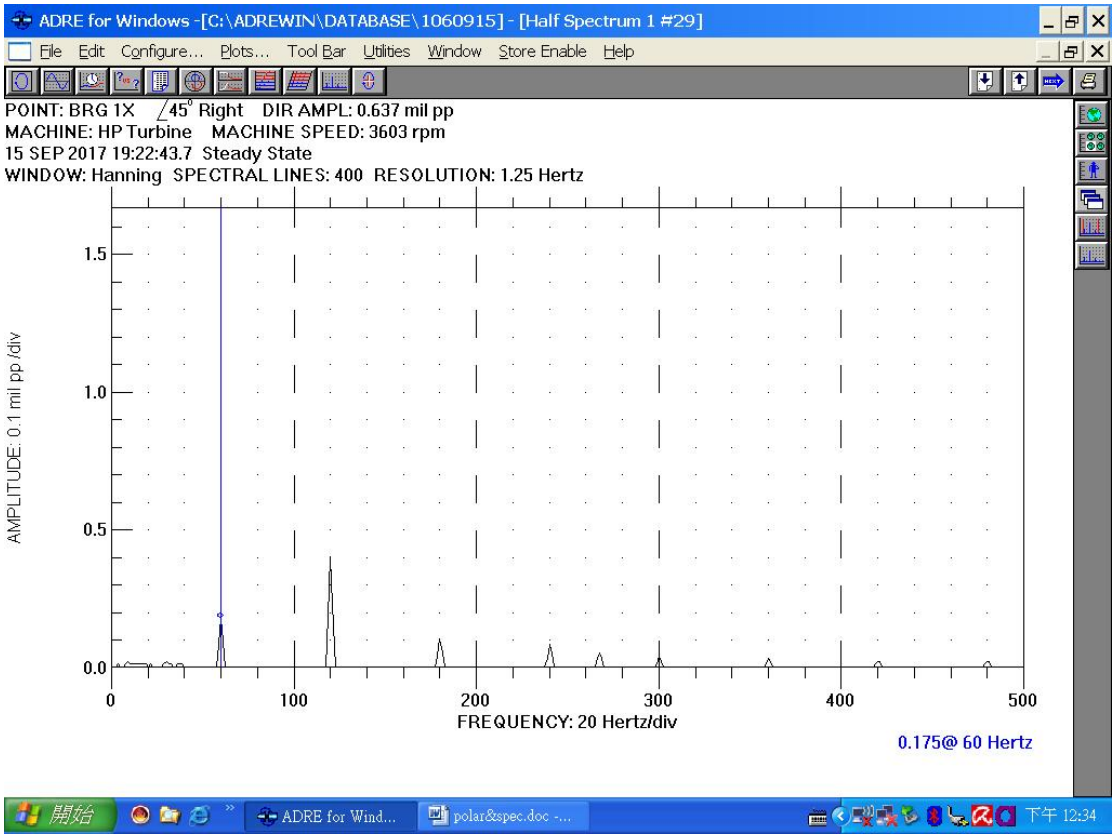
單位：mv/mils

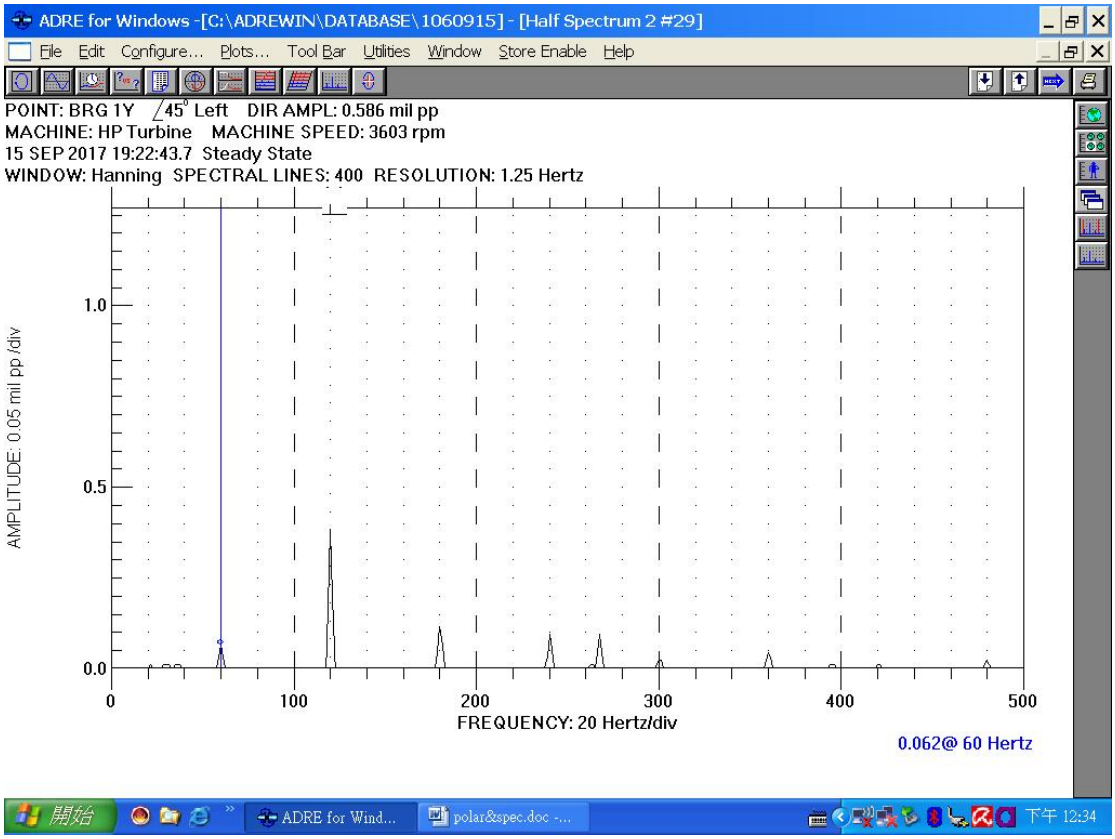
拾訊器靈敏度 / 振動值	標準值						
1 mil	200						

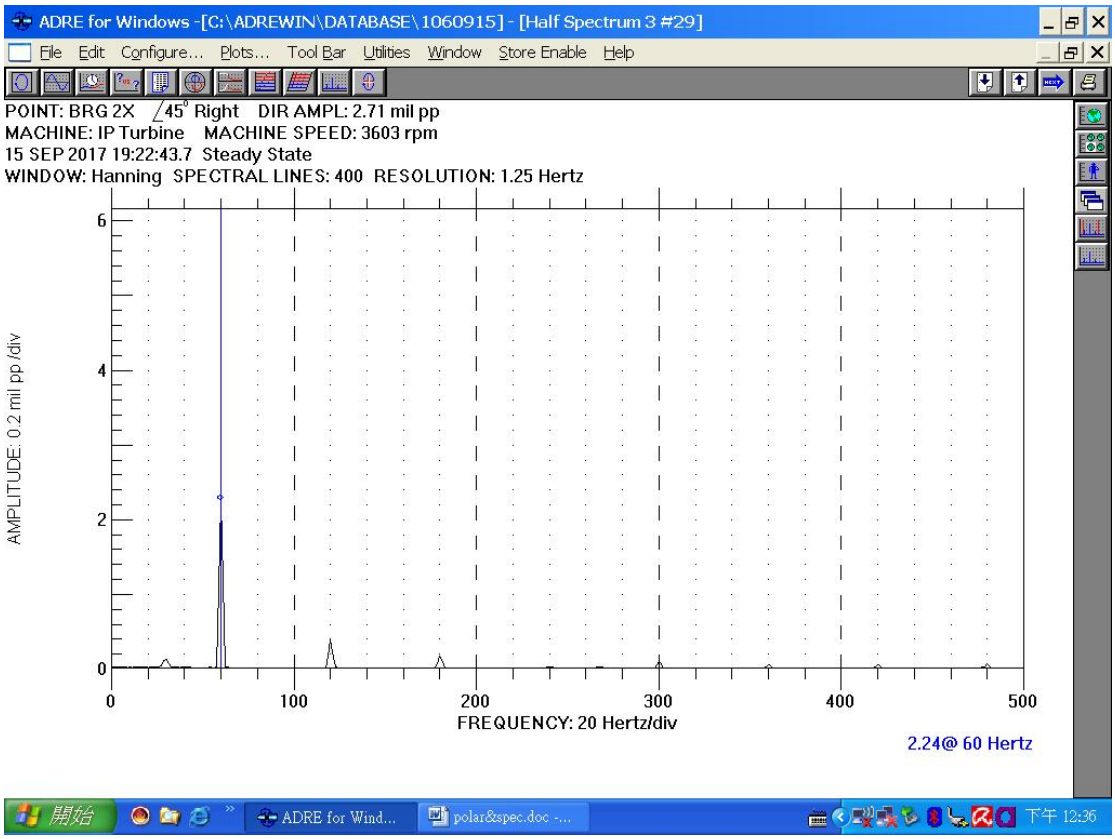
（八）使用儀器配置圖：

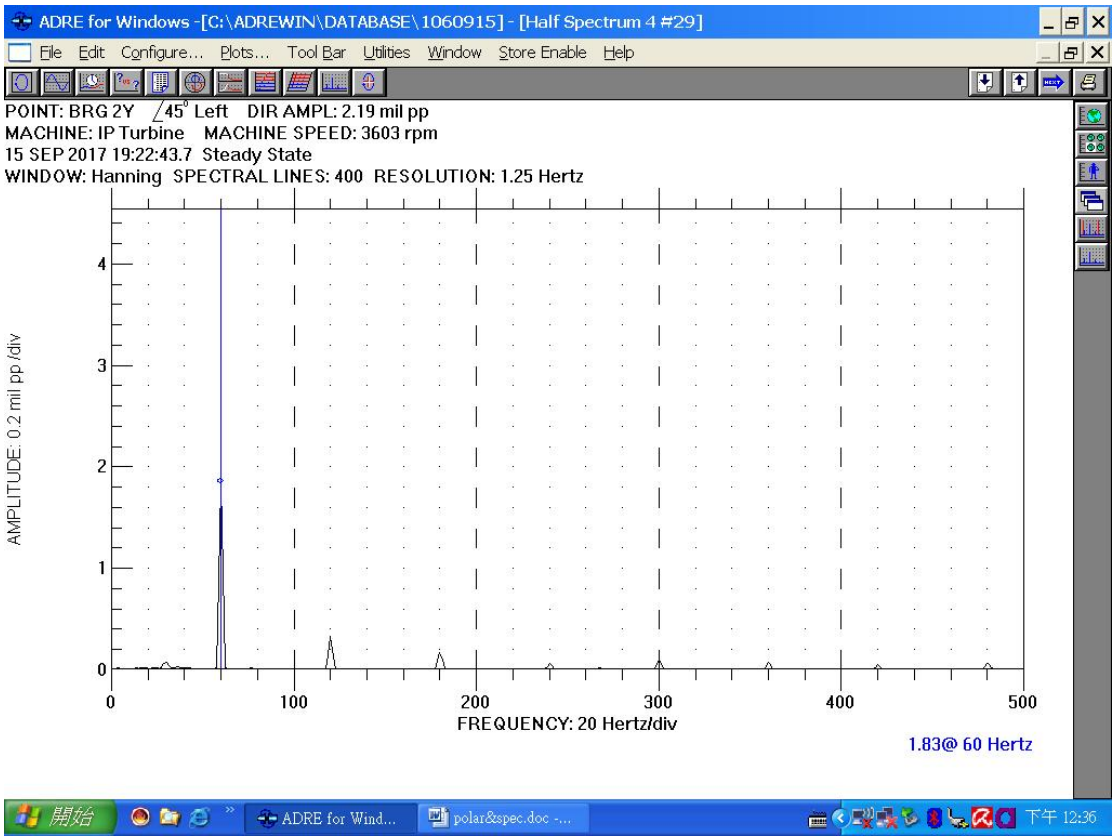


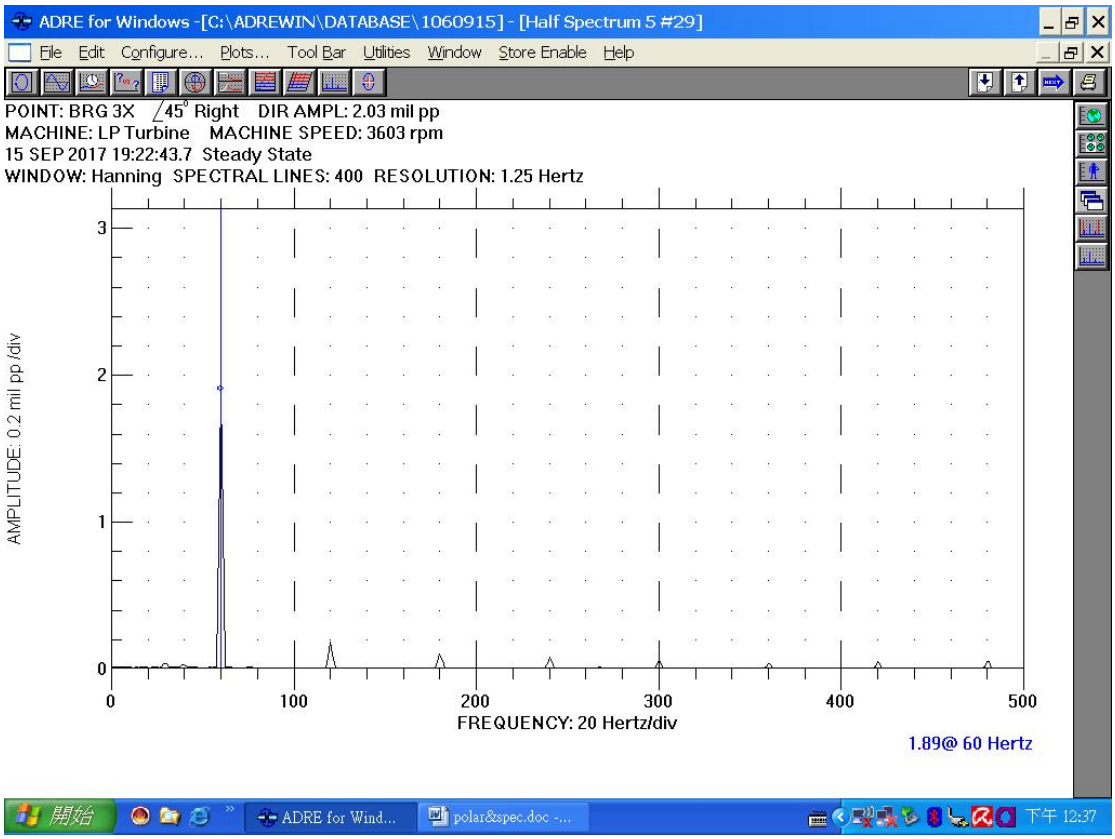
選用程序書QT-BT-008

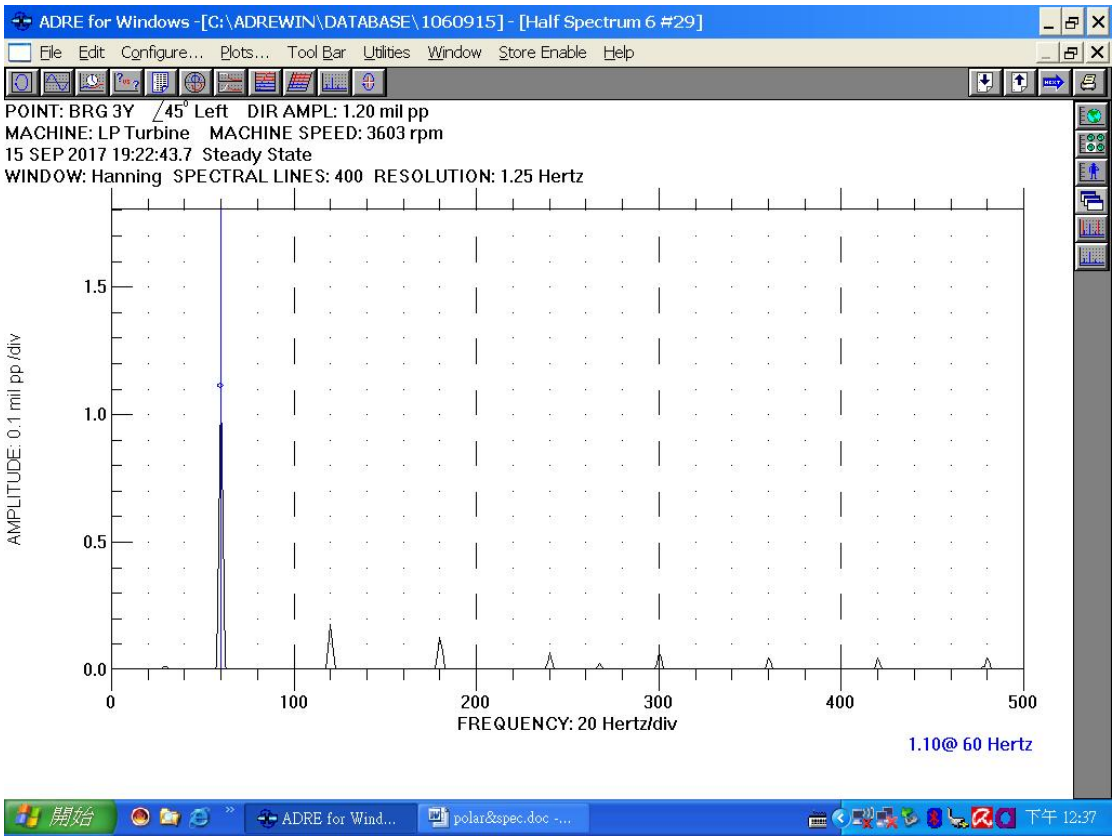

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 1 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 1X ∠45° Right DIR AMPL: 0.637 mil pp
MACHINE: HP Turbine MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.1 mil pp /div
1.5
1.0
0.5
0.0
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
0.175@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:34

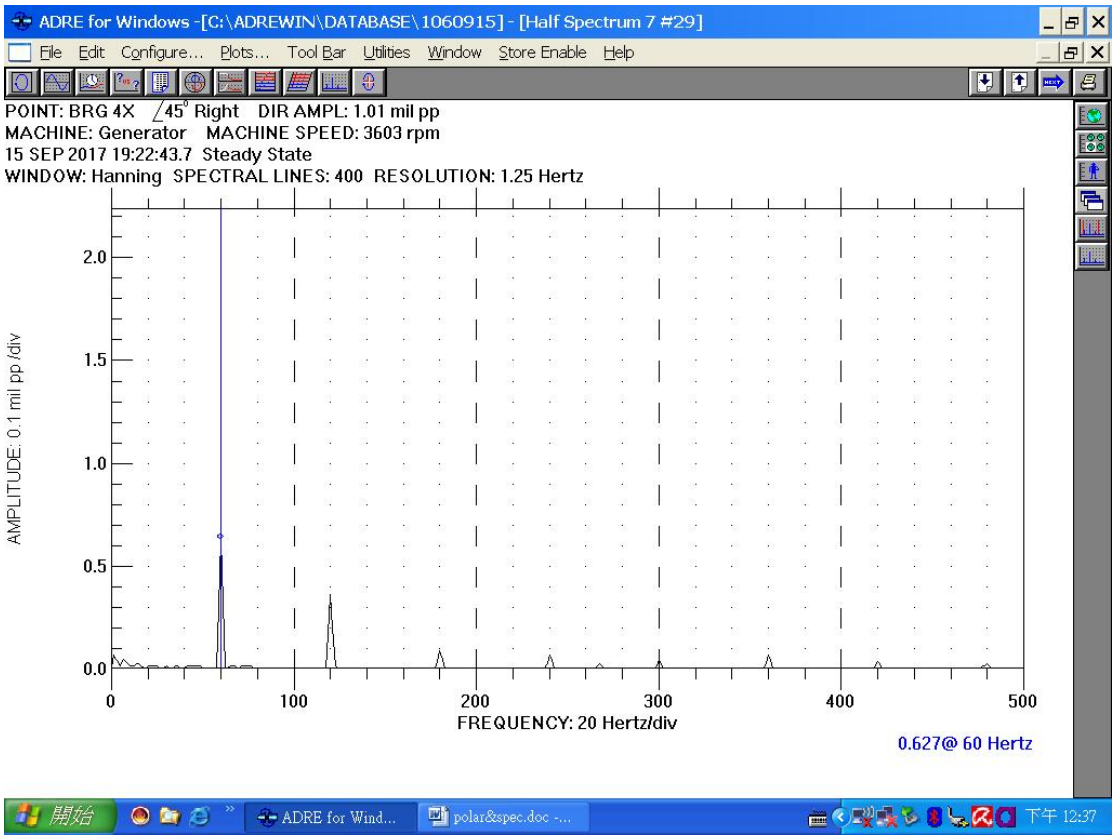

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 2 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 1Y ∠45° Left DIR AMPL: 0.586 mil pp
MACHINE: HP Turbine MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.05 mil pp /div
1.0
0.5
0.0
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
0.062@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:34

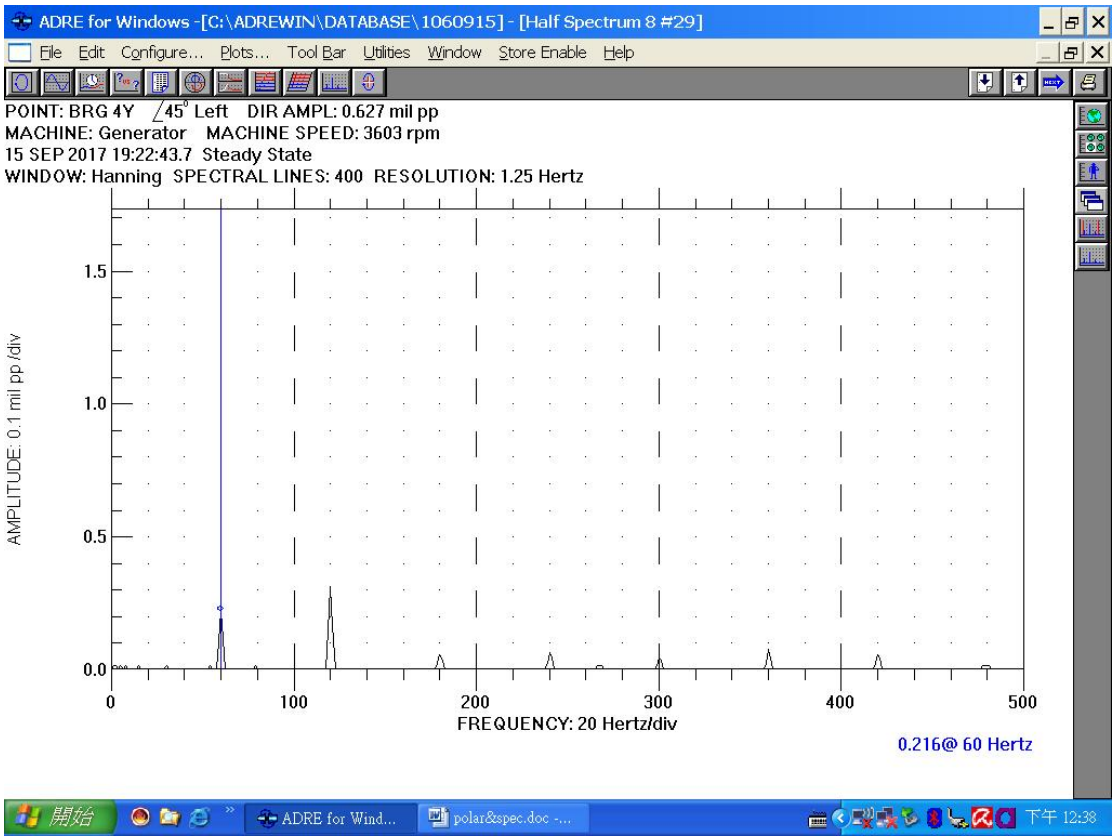

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 3 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 2X ∠45° Right DIR AMPL: 2.71 mil pp
MACHINE: IP Turbine MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.2 mil pp /div
FREQUENCY: 20 Hertz/div
2.24@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:36

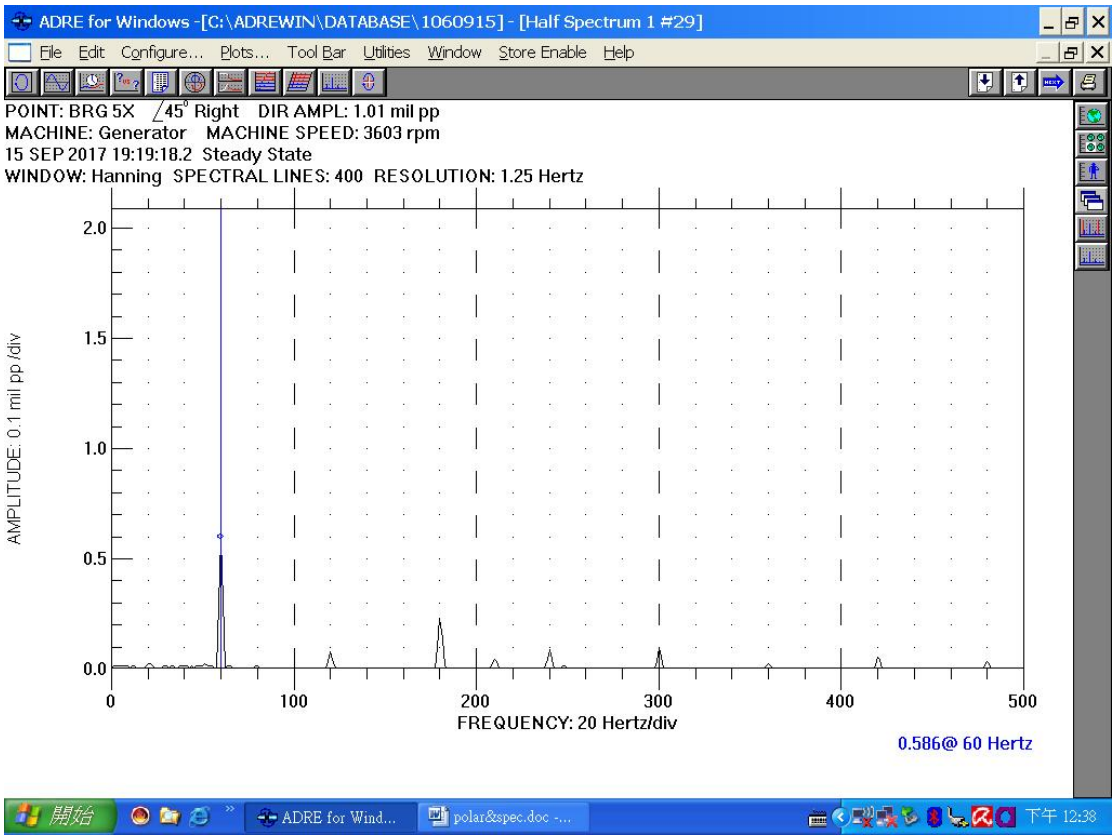

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 4 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 2Y ∠45° Left DIR AMPL: 2.19 mil pp
MACHINE: IP Turbine MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.2 mil pp /div
FREQUENCY: 20 Hertz/div
1.83@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:36

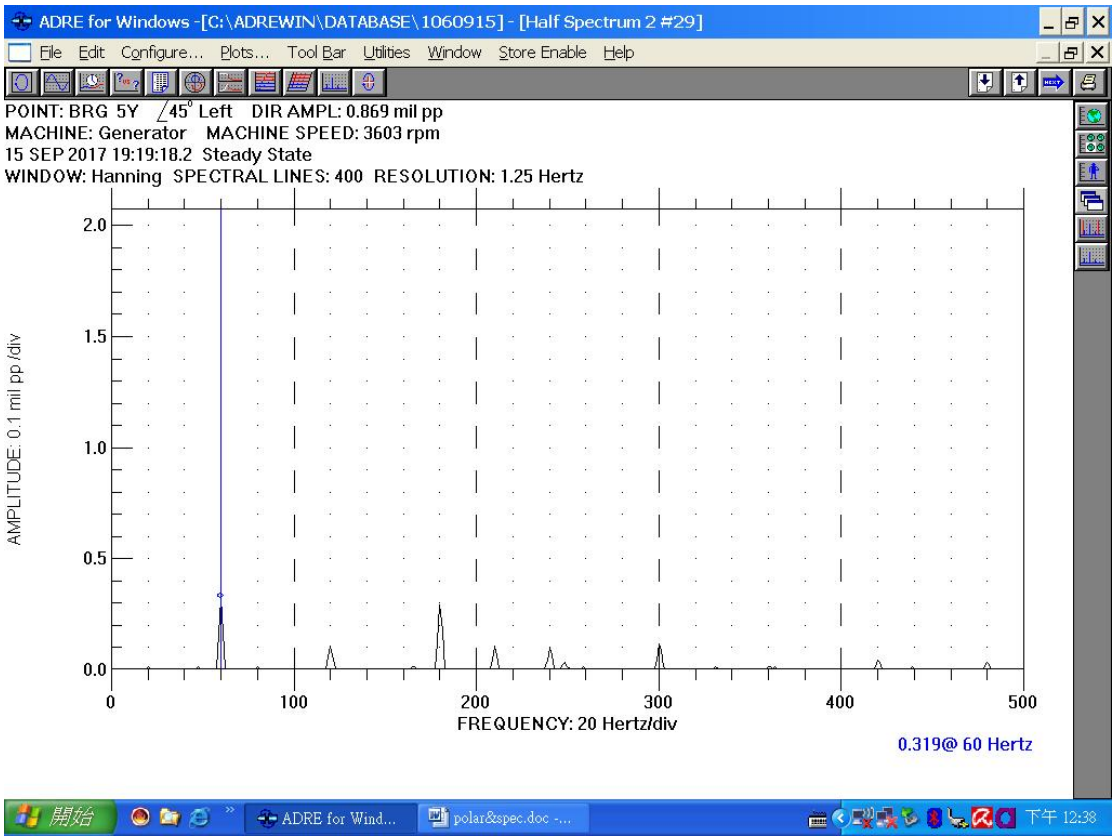

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 5 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 3X ∠45° Right DIR AMPL: 2.03 mil pp
MACHINE: LP Turbine MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.2 mil pp/div
0
1
2
3
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
1.89@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:37

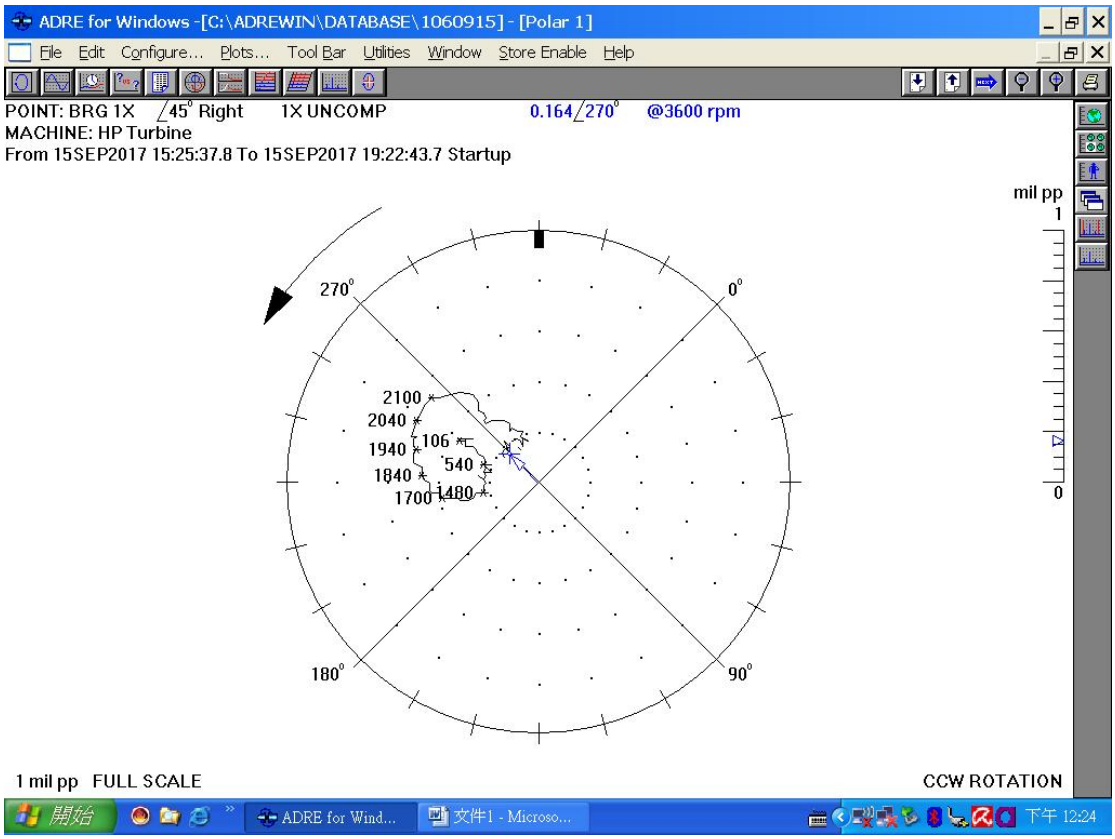

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 6 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 3Y ∠45° Left DIR AMPL: 1.20 mil pp
MACHINE: LP Turbine MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.1 mil pp/div
0.0
0.5
1.0
1.5
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
1.10@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:37

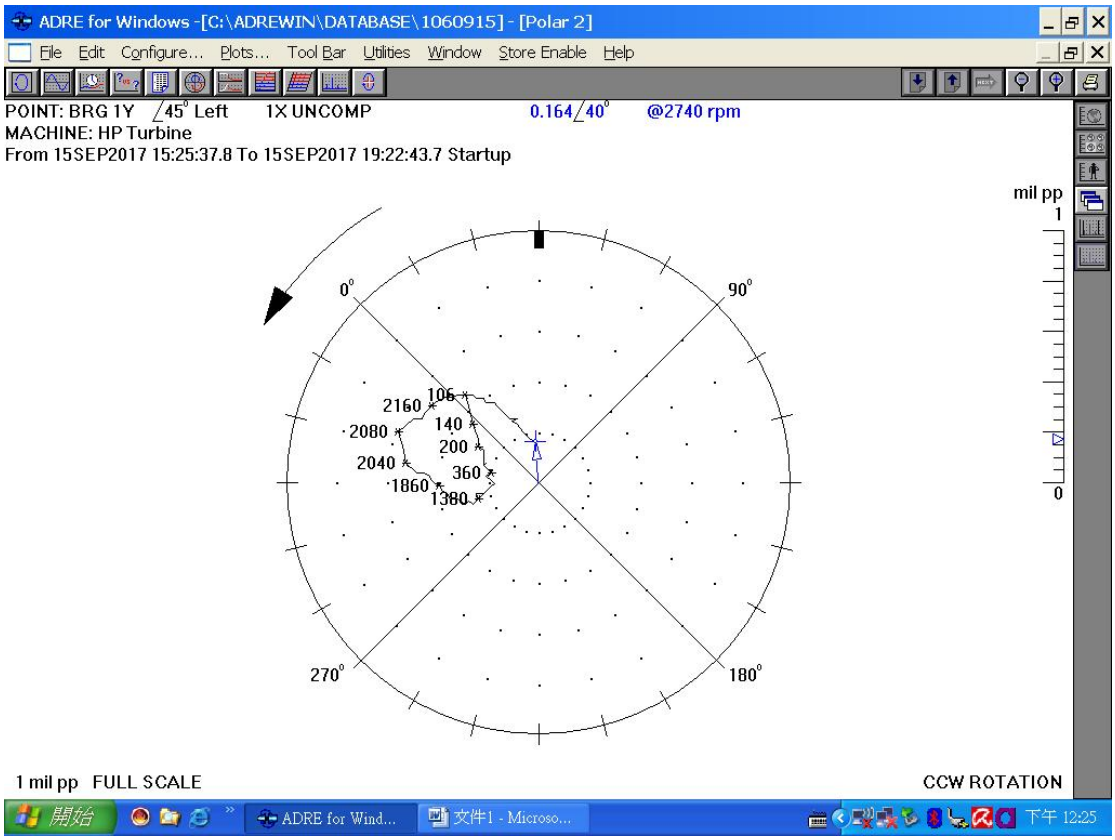

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 7 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 4X ∠45° Right DIR AMPL: 1.01 mil pp
MACHINE: Generator MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.1 mil pp /div
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
0.627@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:37

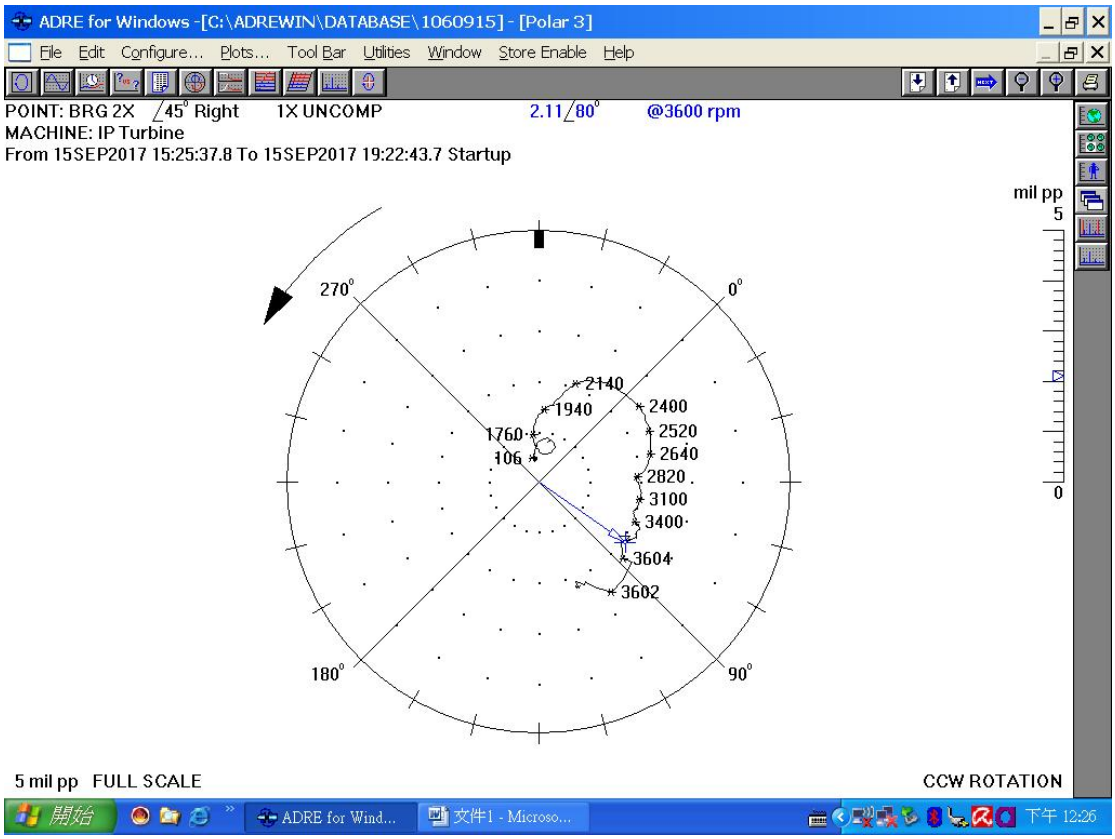

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 8 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 4Y ∠45° Left DIR AMPL: 0.627 mil pp
MACHINE: Generator MACHINE SPEED: 3603 rpm
15 SEP 2017 19:22:43.7 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.1 mil pp /div
1.5
1.0
0.5
0.0
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
0.216@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:38

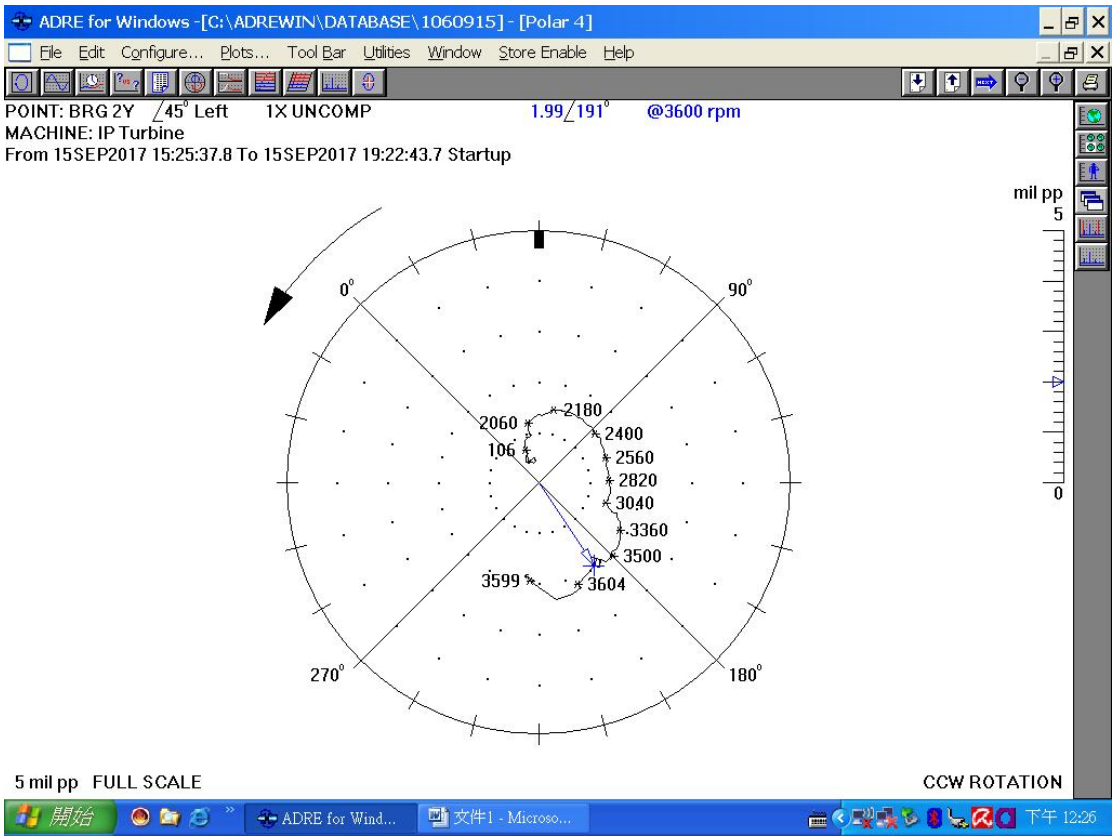

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 1 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 5X ∠45° Right DIR AMPL: 1.01 mil pp
MACHINE: Generator MACHINE SPEED: 3603 rpm
15 SEP 2017 19:19:18.2 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.1 mil pp /div
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
0.586@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:38

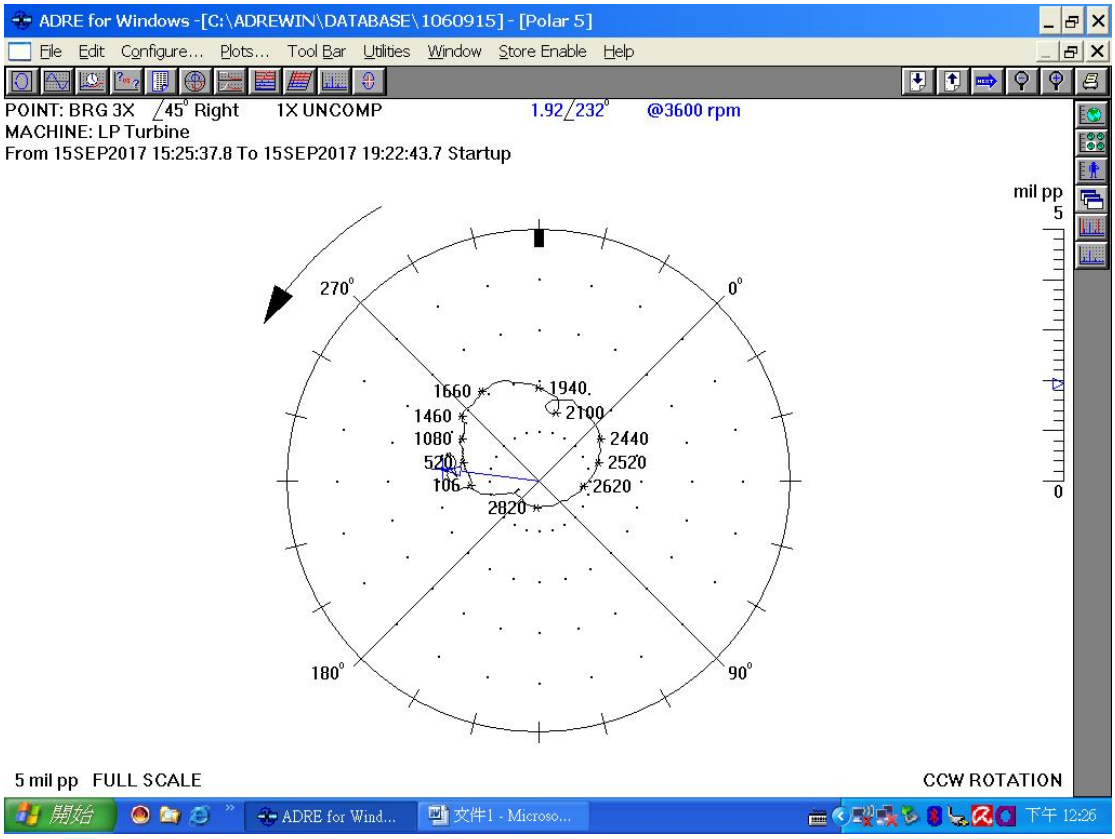

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Half Spectrum 2 #29]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 5Y ∠45° Left DIR AMPL: 0.869 mil pp
MACHINE: Generator MACHINE SPEED: 3603 rpm
15 SEP 2017 19:19:18.2 Steady State
WINDOW: Hanning SPECTRAL LINES: 400 RESOLUTION: 1.25 Hertz
AMPLITUDE: 0.1 mil pp /div
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
500
FREQUENCY: 20 Hertz/div
0.319@ 60 Hertz
開始
ADRE for Wind...
polar&spec.doc -...
下午 12:38

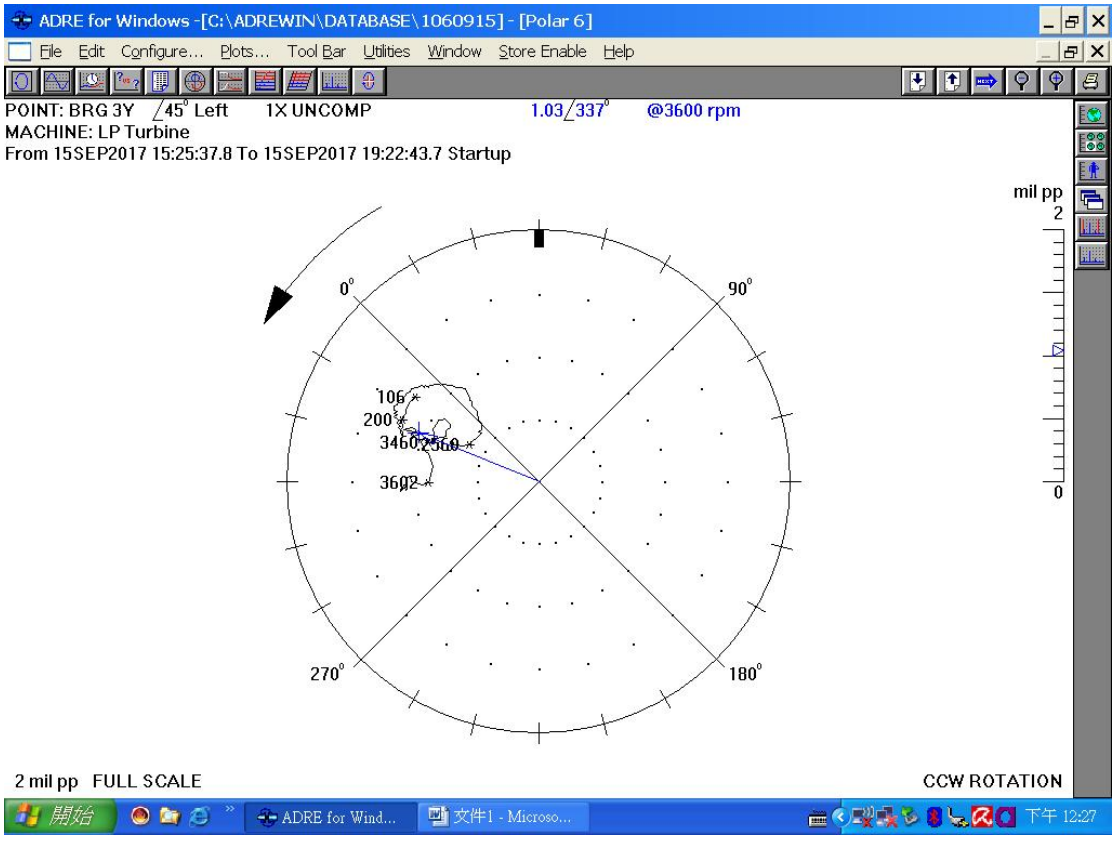

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 1]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 1X ∠45° Right 1X UNCOMP 0.164∠270° @3600 rpm
MACHINE: HP Turbine
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
1
0
270°
0°
180°
90°
2100
2040
1940
1840
1700
106
540
1480
1 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:24

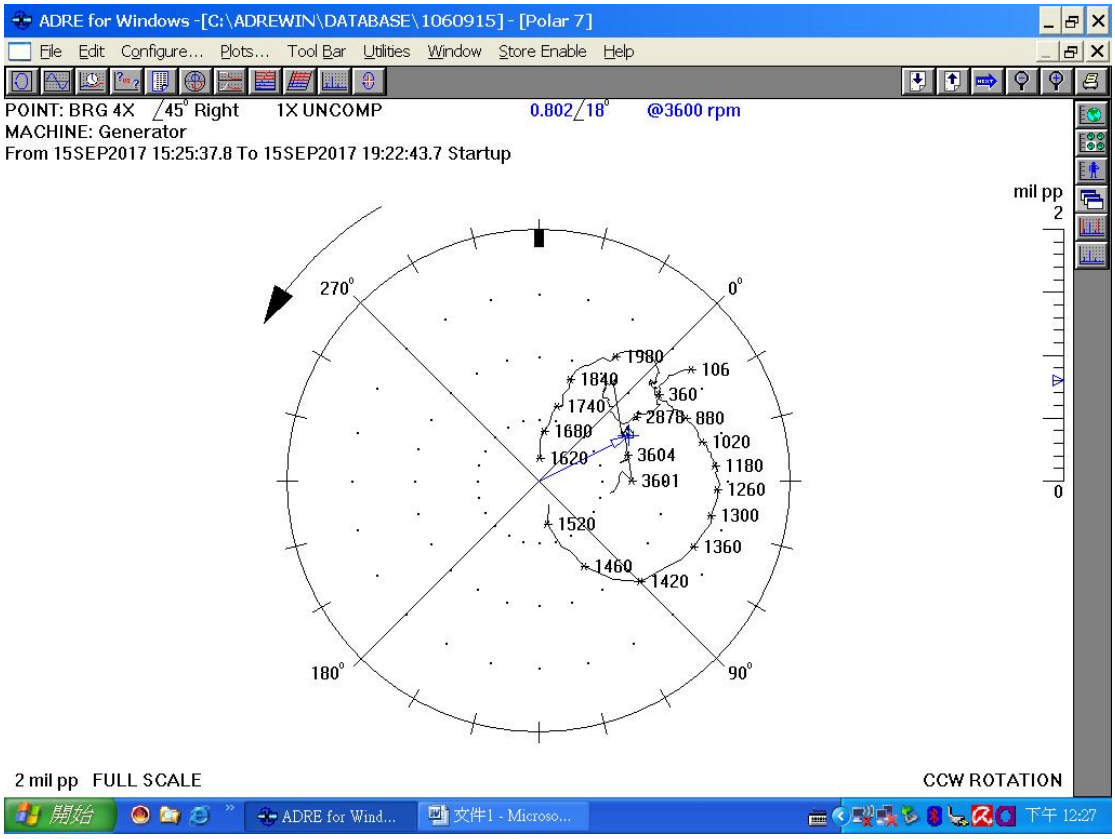

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 2]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 1Y ∠45° Left 1X UNCOMP 0.164∠40° @2740 rpm
MACHINE: HP Turbine
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
1
0
0°
90°
270°
180°
2160
2080
2040
1860
1380
106
140
200
360
1 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:25

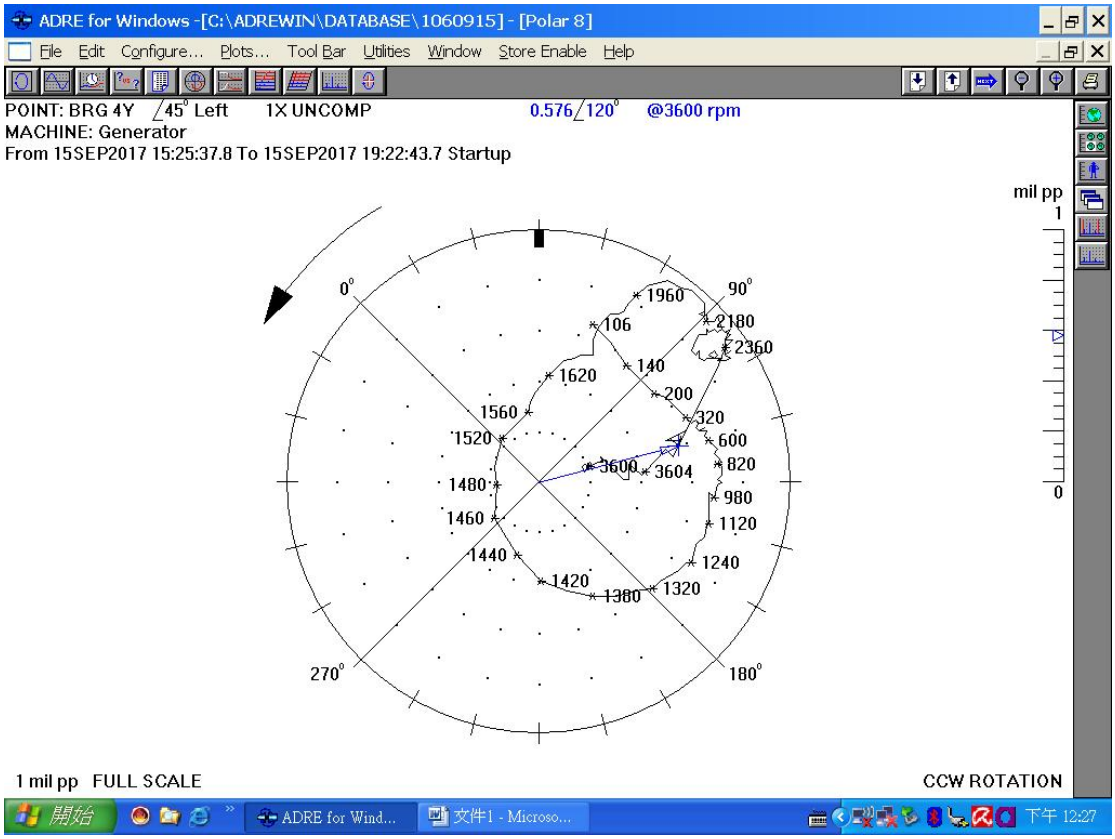

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 3]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 2X ∠45° Right 1X UNCOMP 2.11∠80° @3600 rpm
MACHINE: IP Turbine
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
5
0
270°
0°
180°
90°
2140
1940
2400
1760
2520
106
2640
2820
3100
3400
3604
3602
5 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:26

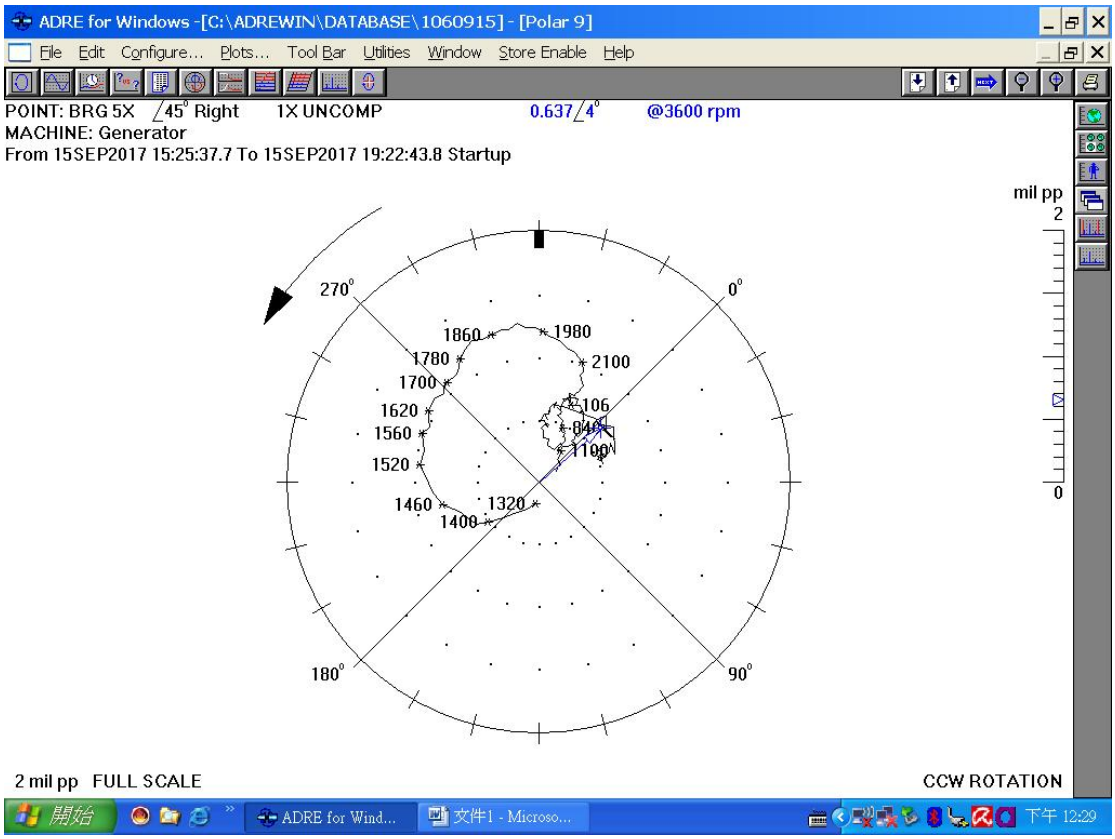

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 4]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 2Y ∠45° Left 1X UNCOMP 1.99∠191° @3600 rpm
MACHINE: IP Turbine
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
5
0
0°
90°
270°
180°
2180
2060
2400
106
2560
2820
3040
3360
3500
3599
3604
5 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:26

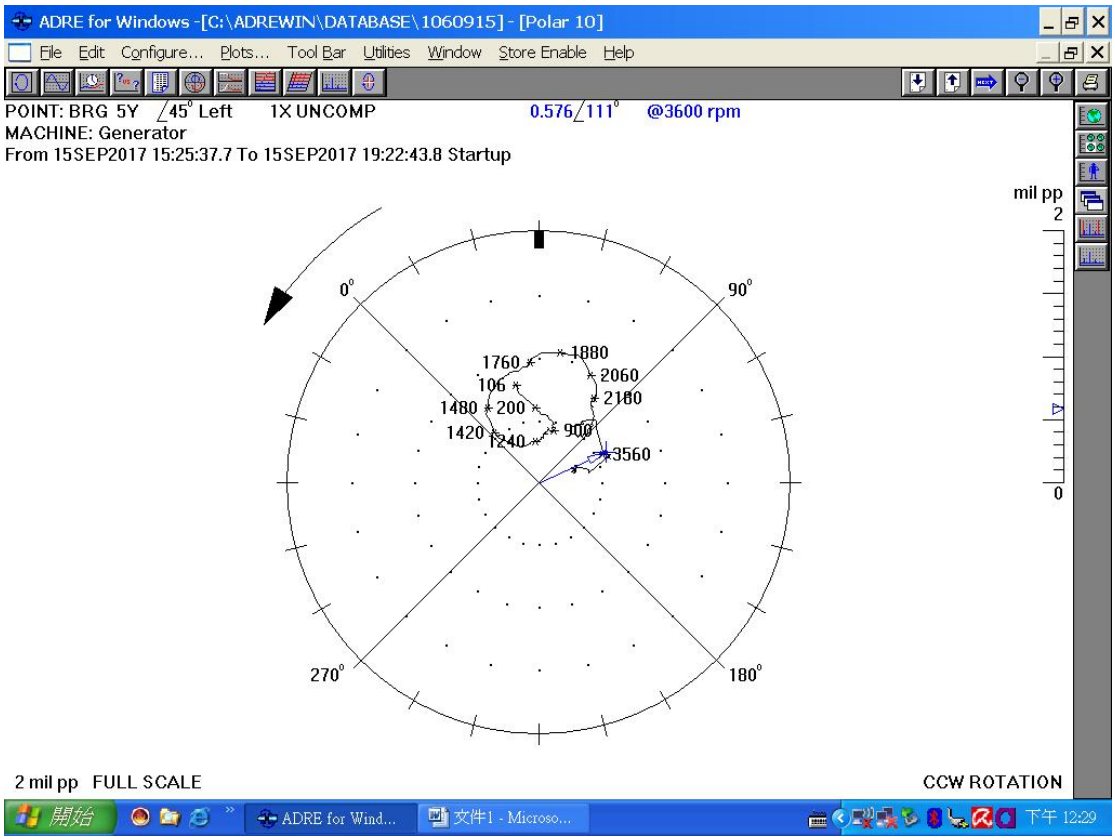

ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 5]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 3X ∠45° Right 1X UNCOMP 1.92∠232° @3600 rpm
MACHINE: LP Turbine
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
5
0
270°
0°
180°
90°
1660
1940
1460
2100
1080
2440
520
2520
106
2620
2820
5 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:26


ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 6]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 3Y ∠45° Left 1X UNCOMP 1.03∠337° @3600 rpm
MACHINE: LP Turbine
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
2
0
0°
90°
270°
180°
106
200
3460
2560
3602
2 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:27


ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 7]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 4X ∠45° Right 1X UNCOMP 0.802∠18° @3600 rpm
MACHINE: Generator
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
2
0
270°
0°
180°
90°
1980
1840
1740
1680
1620
1520
1460
1420
1360
1300
1260
1180
1020
880
2878
360
106
3604
3601
2 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:27


ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 8]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 4Y ∠45° Left 1X UNCOMP 0.576∠120° @3600 rpm
MACHINE: Generator
From 15SEP2017 15:25:37.8 To 15SEP2017 19:22:43.7 Startup
mil pp
1
0
0°
90°
270°
180°
1960
2180
2360
106
140
200
320
600
820
980
1120
1240
1320
1380
1420
1440
1460
1480
1520
1560
1620
3600
3604
1 mil pp FULL SCALE
CCW ROTATION
開始
ADRE for Wind...
文件1 - Microso...
下午 12:27


ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 9]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 5X ∠45° Right 1X UNCOMP 0.637∠4° @3600 rpm
MACHINE: Generator
From 15SEP2017 15:25:37.7 To 15SEP2017 19:22:43.8 Startup
mil pp
2
0
270°
0°
180°
90°
1860
1980
1780
2100
1700
1620
106
1560
1520
1460
1320
1400
2 mil pp FULL SCALE
CCW ROTATION


ADRE for Windows -[C:\ADREWIN\DATABASE\1060915] - [Polar 10]
File Edit Configure... Plots... Tool Bar Utilities Window Store Enable Help
POINT: BRG 5Y ∠45° Left 1X UNCOMP 0.576∠111° @3600 rpm
MACHINE: Generator
From 15SEP2017 15:25:37.7 To 15SEP2017 19:22:43.8 Startup
mil pp
2
0
0°
90°
270°
180°
1760
1880
2060
106
2160
1480
200
1420
900
1240
3560
2 mil pp FULL SCALE
CCW ROTATION

附件二

TURBINE CONTROL SYSTEM INSPECT REPORT
For Guam Power Authority Cabras Power Station Unit 1

1. The Sell Expansion Calibration

The original scale is -10~+10VDC corresponding to 0~1” sell expansion on BNC 3300 monitor. To conform to the LVTD 24765-02-00 specification, the range of the LVTD needs to be scaled to the voltage of -4.395~4.395VDC corresponding to 0~1” sell expansion. The cold position was set in the -4.395VDC and the MK5 I/O configuration parameters and control constants were changed. (refer to the following figure)

點名	LVDT Voltage (V)	OLD Min CDB Value	OLD Max CDB Value	New Min CDB Value	New Max CDB Value	Card Def. Location	IO ITEM
SED1	-4.395	0.00	1299.00	500.00	1637.00	TCQA-14/21	SIGNAL 3
SED2	-4.395	0.00	1299.00	500.00	1637.00	TCQA-14/21	SIGNAL 4

2. The Rotor Differential Expansion Calibration

The Cold Position for probe A and B means the gap voltage of the probe was set at -11.8Vdc. According to the BNC 3300 document, the reduction of gap voltage of the Probe A is defined as Rotor Long which is opposite to Mark V. It is necessary to pay more attention when maintaining the rotor differential expansion with Mark V system. To conform to the probe specification, the probe sensitivity in MK5 I/O configuration should be changed from 0.0194 V/mil to 0.02 V/mil.

Control Constants were modified as following:

KDE1_TRANS1 :150mils changed to 200mils

K39DE1_RANGE :1248mils changed to 1180mils

K39DE1_OFF :-617mils changed to -590mils

3. The Shaft Position Calibration

According to the BNC 3300 document, the Active Direction means the rotor moves toward to the generator side. The definition of Zero Position is that the rotor pushes toward to the generator end and adjusts the gap voltage of the probe at -10.0VDC. In Mark V, the Zero Position is the rotor in the center

of the floating range. To conform to the Zero Position definition in BNC 3300, the Mark V has to adjust alarm and trip setting. Since the unit 1 has total gap 16mils, the active and inactive alarm and trip setting should be offset +-8 mils.

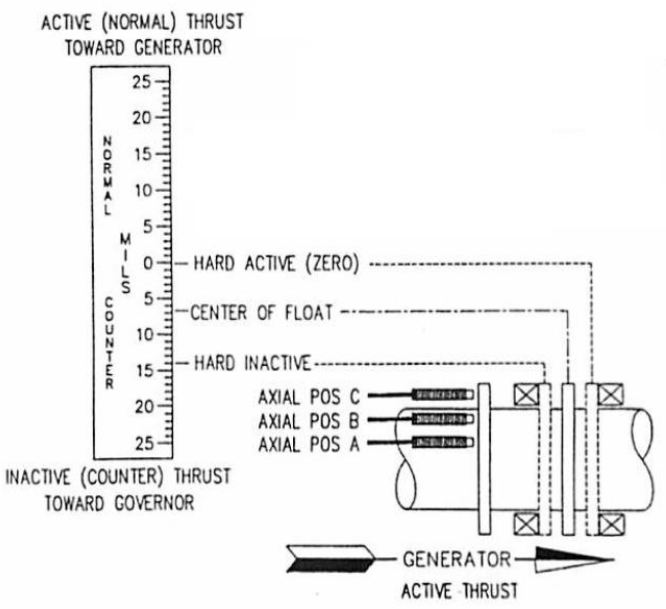
Control Constants were modified as following:

K39AAA 15.0mils changed to 7.0mils

K39AAT 20.0mils changed to 12.0mils

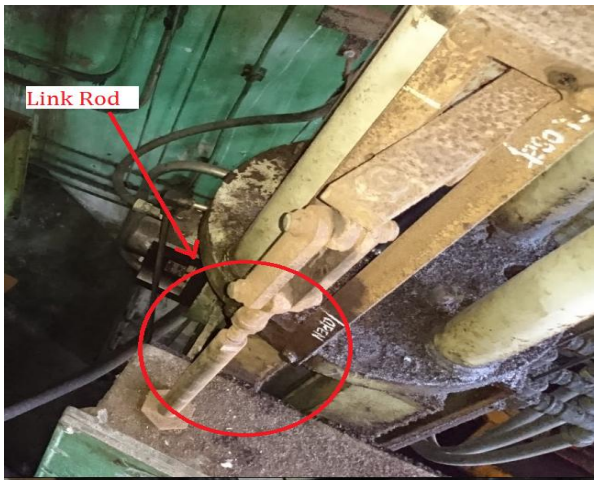
K39AIA -15.0mils changed to -23.0mils

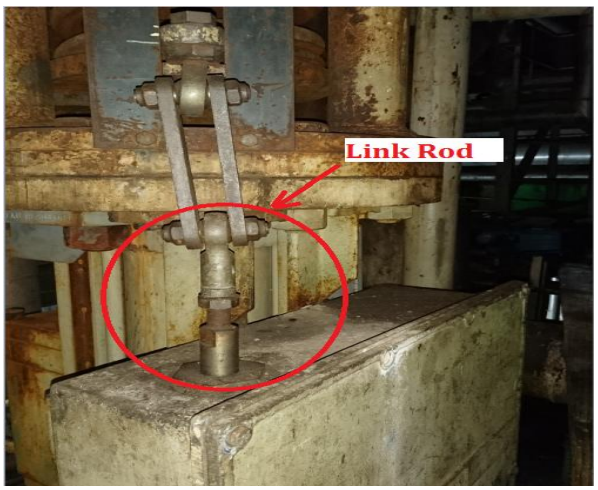
K39AIT -20.0mils changed to -28.0mils



4. Test and adjust the MSV / RSV / RIV limit switches

The MSV / RSV / RIV close limit switches, labeled CSB-1 / CSB-2 / CSB-3, which used for the unit safety protection. When the MSV fully closed and either RSV nor RIV fully closed, it will trip both boiler and generator. The close limit switch must be verified and adjust carefully when the link rod, connect valve to switch box(refer to the figure), was disconnected and connected for the valve maintenance. The Mark V valve calibration function used to force valve open and close to verify the safety protection.





5. V1 Valve Calibration

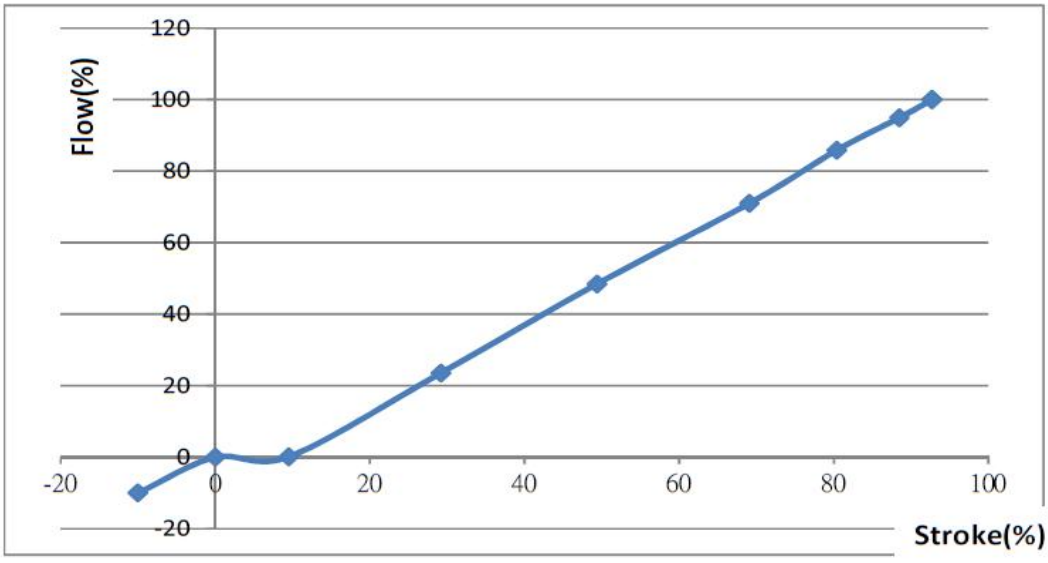
Control Valve V1

Position Calibration

LVDT編號	OPEN/CLOSE	回授電壓(Vrms)		
		R	S	T
LVDT#1	Full Open	5.50	5.52	5.51
LVDT#2	Full Open	5.61	5.61	5.63
LVDT#16	Full Open	5.55	5.55	5.53
LVDT#1	Full Close	1.32	1.32	1.33
LVDT#2	Full Close	1.31	1.31	1.32
LVDT#16	Full Close	1.37	1.37	1.35

Mark V Control Constant

Index	KV1U_TRO	KV1L_FLO
0	-10	-10
1	0	0
2	9.5	0.1
3	29.2	23.56
4	49.4	48.46
5	69.1	71.02
6	80.4	85.87
7	88.5	94.94
8	92.71	100
9	92.71	100



6. MSV Valve Calibration

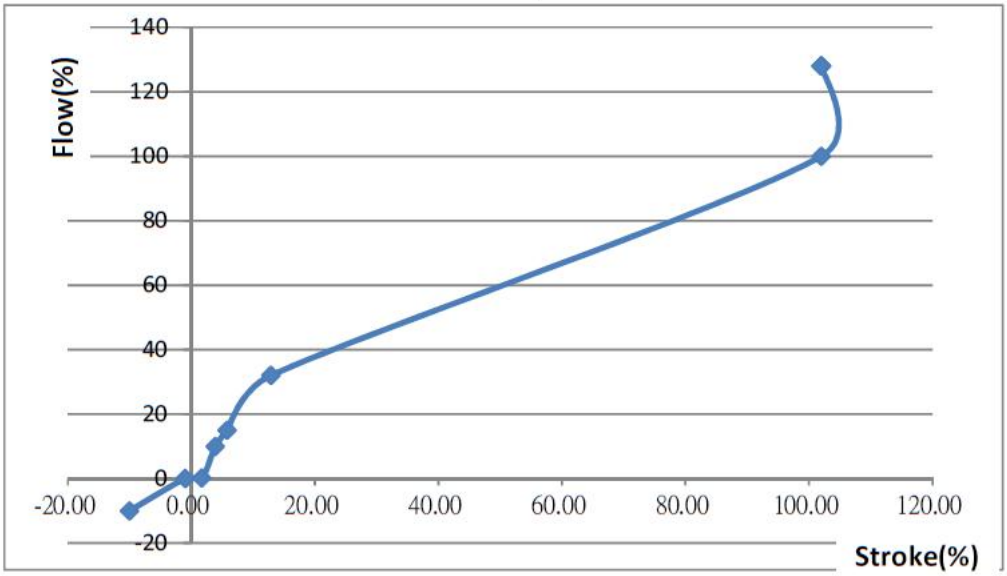
Control Valve MSV

Position Calibration

LVDT編號	OPEN/CLOSE	回授電壓(Vrms)		
		R	S	T
LVDT#3	Full Open	4.89	4.90	4.90
LVDT#4	Full Open	4.85	4.85	4.85
LVDT#15	Full Open	4.77	4.77	4.78
LVDT#3	Full Close	1.33	1.34	1.34
LVDT#4	Full Close	1.36	1.37	1.36
LVDT#15	Full Close	1.33	1.34	1.34

Mark V Control Constant

Index	KMSV_TRO	KMSV_FLO
0	-10.00	-10
1	-1.00	0
2	1.70	0.2
3	3.90	10
4	5.80	15
5	12.90	32
6	102.00	100
7	102.00	128
8	102.00	128
9	102.00	128



7. RIV Valve Calibration

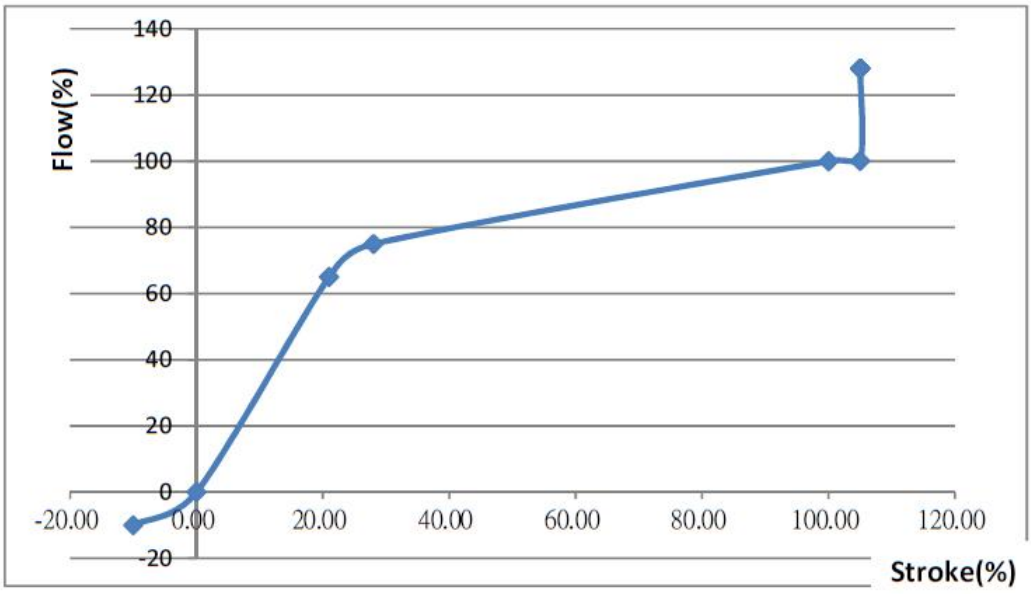
Control Valve RIV

Position Calibration

LVDT編號	OPEN/CLOSE	回授電壓(Vrms)		
		R	S	T
LVDT#5	Full Open	1.59	1.57	1.57
LVDT#6	Full Open	1.67	1.66	1.60
LVDT#14	Full Open	1.59	1.60	1.59
LVDT#5	Full Close	5.68	5.68	5.68
LVDT#6	Full Close	5.74	5.74	5.73
LVDT#14	Full Close	5.75	5.76	5.75

Mark V Control Constant

Index	KMSV_TRO	KMSV_FLO
0	-10.00	-10
1	0.00	0
2	21.00	65
3	28.00	75
4	100.00	100
5	105.00	100.1
6	105.00	128
7	105.00	128
8	105.00	128
9	105.00	128



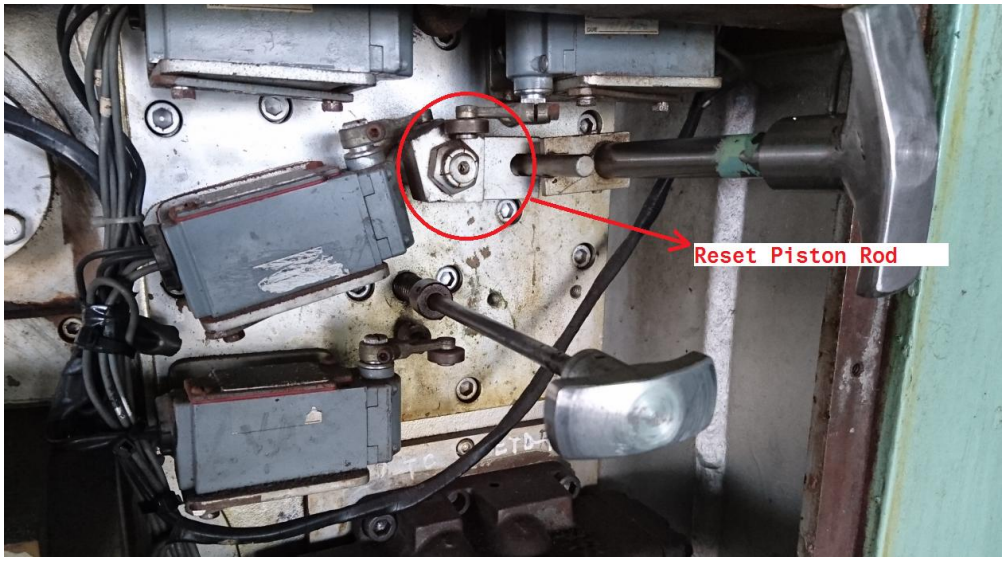
8. Primary Overspeed Test (POST)

Before conducting the simulated Primary Overspeed test, the control constant KTNHOS was changed form 110% to 25%, equates to 900 rpm. The unit increased speed slowly. When it reached 900 rpm, the unit tripped as intended. After finished the simulated POST, the control constant KTNHOS was changed form 25% to 110%.

9. Recommendation Summary

(1) Normally, the shaft position varies from -2~ 0 mils when the turning gear is running, but this unit's shaft position varies from -5 to 2 mils periodically. The possible reasons as the following:
1.The material of the probe detecting target is not uniform or not AISI 4140 Steel.
2.The surface of the probe detecting target is not smooth.
The shaft cold position cannot be adjusted accurately. When the turbine started, the shaft position increased gradually and reached its maximum at 8 mils, at the load 50MW. According to the BNC 3300 document, when the rotor position against the thrust bearing of the generator side, the position value should be zero. All the alarm and trip setpoints were settled on the basis of the zero position. The position value 8 mils should be reduced to ZERO to conform to the definition. Finally, it is expedient to modify the Mark V I/O config parameters to eliminate the offset. On the next outage opportunity, the gap between probe and target should be measured and compared to the standard gap-voltage of the probe. When finished the cold position setting, the rotor should be pushed back to turbine side, and to confirm the shaft position indicating negative floating gap, about -14~16mils, at Mark V display (inactive direction). If the inactive shaft position is not correct, the cold position should be adjusted again.

(2) When the unit finished the mechanical overspeed test, the turbine cannot be reset. It is still not working to pull the manual reset handle in the front standard. The turbine tripped once and again when the manual reset handle return to original position. It seems that the reset mechanism has problem. The reset piston stocked and could not hold the trip trigger at reset position. Finally, the reset piston rod (refer to the following figure)was pulled manually ,and then the turbine reset successfully. On the next outage opportunity, the turbine trip and reset mechanism should be disassembled, inspected and washing the sludge out.



(3) The RIV test solenoid needs to be replaced. This solenoid wasn't working and the RIV cannot be tested.

(4) Servo valve null Bias Current check

The servo valve output current from each Mark V control processor should be approximately -0.2 ± 0.133 mA. When viewing on the auto calibrate display, the servo current will be displayed in percent, where 1.0% equals 0.1 mA on a control panel. In the Mark V turbine control panel, the error between a servo-valve output's regulator feedback and its reference is converted into servo current. When the feedback of a regulator is equal to the reference the error is zero, so zero error would mean zero current. Some amount of current must be added to the output when the regulator error is zero to provide sufficient current to overcome the fail-safe spring to keep the device in position to maintain a steady flow of steam. In the Mark V, null bias current is a fixed value of current, defined in the I/O Configurator, that is added to the output to overcome fail-safe spring tension. The MSV servo-valve null position has shifted to open-side position. The servo-valve output current must keep some amount of positive current to overcome the unbalanced null position. This cause the MSV valve position feedback is a little greater than the reference. So, the MSV valve position feedback always does not match the command. The badly unbalanced null position represent that the servo valve internal mechanism wears badly or be contaminated by sludge. Although the unbalanced null position does not affect the valve control significantly, it had better to replace new one in next overhaul time.

附件三

CABRAS unit 1
Burner Front Modification Report

TAIWAN POWER COMPANY HSIE HO POWER PLANT
Instrument and control section
Tsai Chien-Hsing

List of figures

1.Introduction

According hard to light off burners in CABRAS unit 1, GPA permitted to start burner front modification plan that had proposed to discuss in 2014. The benefit of burner front modification plan is

A. Successfully light off the first burner in 5 minutes after boiler purge.
B. Catch the flame of Igniter and main burner actually.
C. Replace old igniter pad with easy maintenance pneumatic actuator drive valve.
D. Replace MONO Block valve with 3 easy maintenance pneumatic actuator drive valve, saving cooling and purge steam.
E. Improve main gun purge sequence to make sure waist oil into boiler will burned exactly.

Whole plan period started from 2/8/17 to 30/8/17. Remove OLD devices and install new equipment, welding pipe, cabling and wiring, logic modification and testing. All work done on 23/8/17 and verification all functions on 24/8/17~14/9/17. New burner front equipment provide more safety and reliability functions than before.

2. Scope of project

The scope of burner front modification replaces some equipment and devices at burner, not include the Igniter gun and main burner devices. Those equipment and devices are modified as follows.

2.1 Igniter Local Control Package

Dismantle, remove the existing Igniter Local Control Package and renovate to PLC control package and solenoid valves panel with new valve rack

2.2 Heating box

Install a space heating box for protecting Igniter probe tips from moisture at long time outage.

2.3 Igniter Probe tips

Dismantle, remove the existing Igniter Probe tips and replace them with a new one.

2.4 Igniter Cylinders

Dismantle, remove the existing Igniter Cylinders and replace them with a new one equipped with a proximity switch.

2.5 Main Burner Mono Block Valve

Dismantle, remove the existing Main Burner Mono Block Valve and renovate mono block valve to be pneumatic actuated. Limit switch is integrated in the actuator, easy for maintenance. Valves are controlled via DCS.

2.6 IGNITER flame detectors

Dismantle, remove the existing 4 IGNITER flame detectors with amplifier model per each unit and replace them with 4 IGNITER intelligent integrated flame detectors with internal flame relay model.

2.7 Main flame detectors

Dismantle, remove the existing 4 main flame detectors with amplifier model per each unit and replace them with 4 main intelligent flame detectors with the internal flame relay model.

3 Burner front modification

3.1 Igniter Local Control Package

3.1.1 Dismantle, remove the existing Igniter Local Control Package

Old Igniter Local Control Package include the control panel, solenoid valve, oil valve and purge valve. The control sequence of old Igniter Control Package uses electric circuit and timer relay, but the NEW Igniter Control Package uses PLC (Programmable Logic Controller) to control the Igniter sequence.

3.1.2 new valves and new control panel

The oil valve and purge valve of the Igniter system is too old to find repair kits, and hard to prevent valve leakage. But the new oil valve and purge valve did not have this weakness. Using the pneumatic actuator to drive oil and purge valve could have quick response and the limit switch of the actuator could feedback right position to the control system.

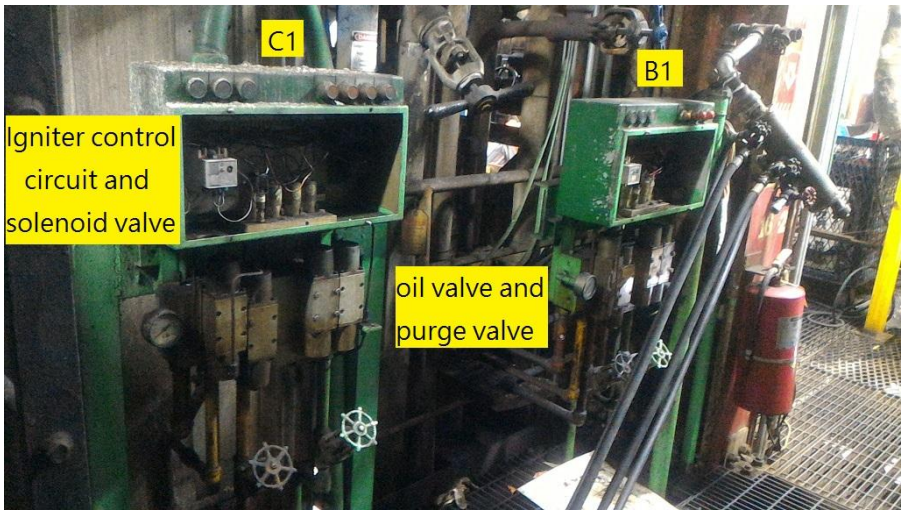


FIGURE 1. OLD IGNITER LOCAL CONTROL PACKAGE (B1 & C1)

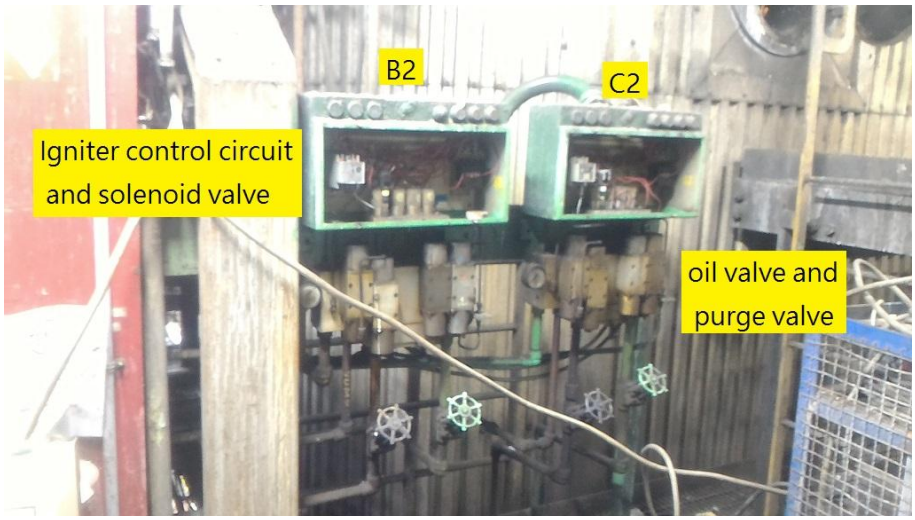


FIGURE 2. OLD IGNITER LOCAL CONTROL PACKAGE (B2 & C2)

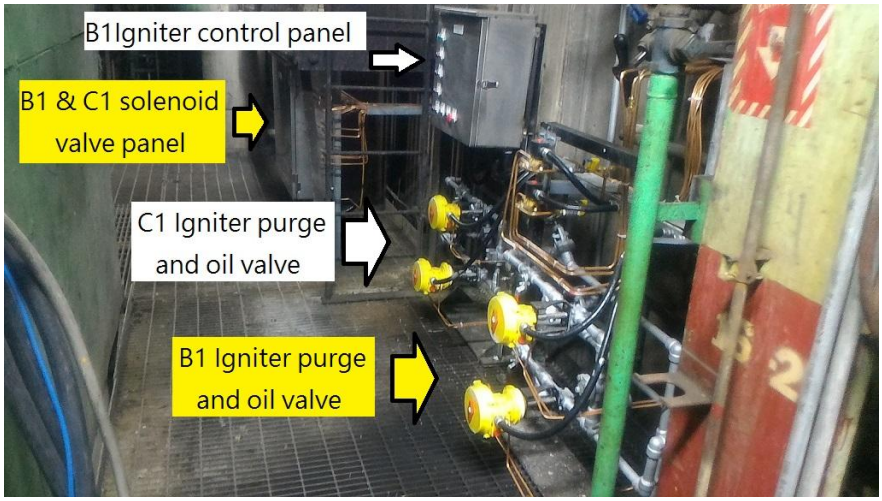


FIGURE 3. NEW IGNITER LOCAL CONTROL PACKAGE (B1 & C1)

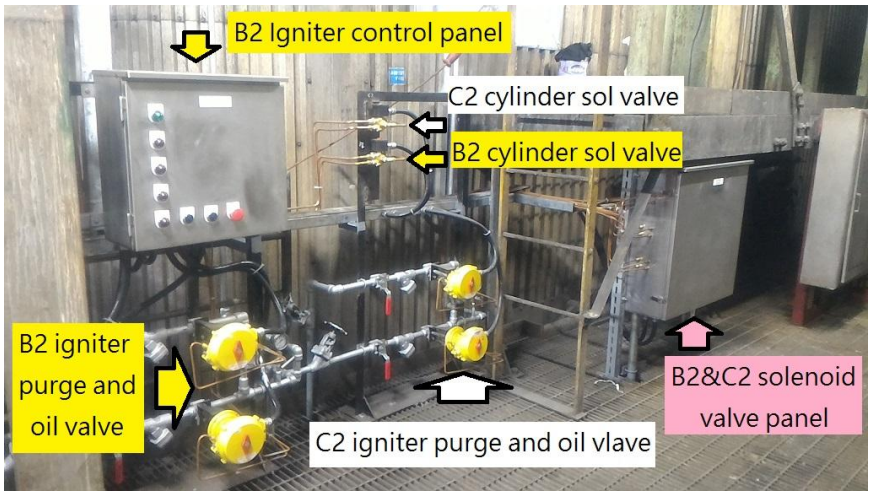


FIGURE 4. NEW IGNITER LOCAL CONTROL PACKAGE (B2 & C2)

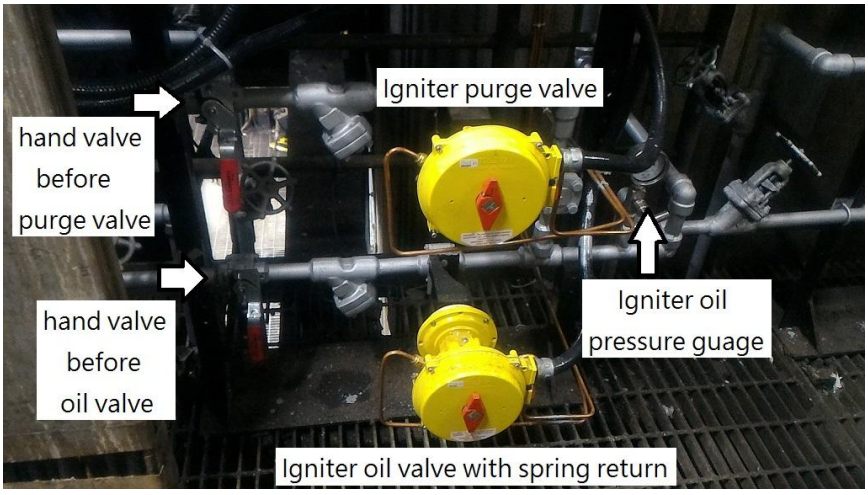


FIGURE 5. LOCATION OF IGNITER PURGE AND OIL VALVE

We relocate the igniter control panel for real use and nearby the Igniter which control by the control panel. Igniter control panel of B1 & B2 are located at the same place, but C1 & C2 are located nearby C1 & C2 burners. (figure 6 & 7)

New Igniter control wiring schematic is quite simple and easy to maintain.

FIGURE 6. C1 IGNITER CONTROL PANEL

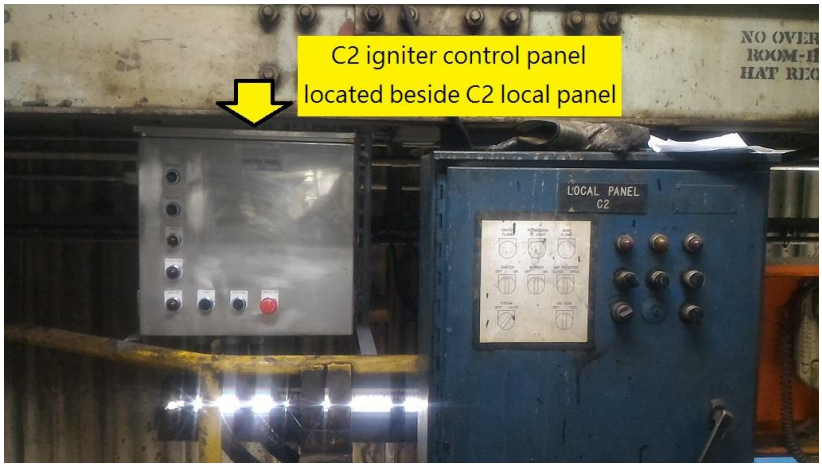


FIGURE 7. C2 IGNITER CONTROL PANEL

3.1.3 PLC control sequence

There is a PLC (Programmable Logic Controller) to control the Igniter sequence. NEW PLC control sequence is 100% follow the OLD Igniter sequence.

There is a Allen-Brandley Micro logix 1400 PLC in the igniter control panel(Figure 8), all control sequence hade programmed into ladder logic and download to the PLC.

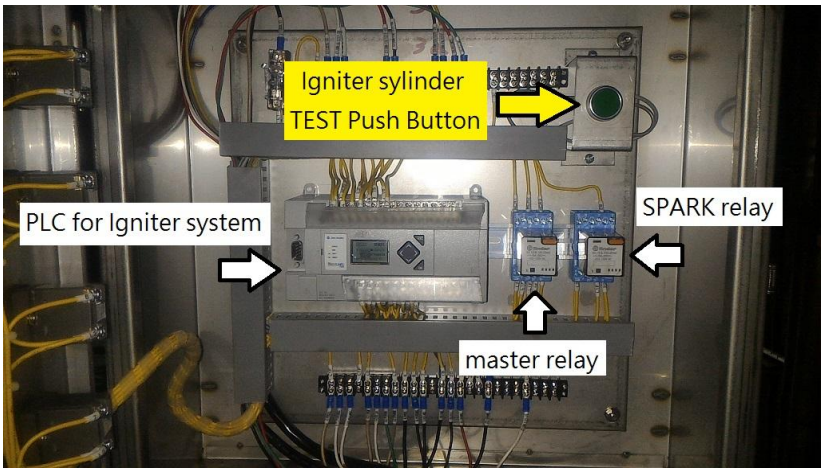


FIGURE 8. PLC INSIDE IGNITER CONTROL PANEL

New igniter control panels have START,STOP and Emergency STOP push buttons on the panel that could let operators operate the Igniter in the field, and have 5 indicator light to show the status of the Igniter system. These indicator lights will help operators more understanding the sequence of the Igniter system.(Figure 9) The following description are the functions of the indicator lights and push buttons.

INDICATOR LIGHTS:

SYSTEM ENABLED: Light ON when Igniter system permissive to operate.

IGNITER INSERTED: Light ON when Igniter fully inserted.

PURGING: Light ON when purge valve opened.

OIL VALVE OPEN: Light ON when oil valve opened.

SPARK ON: Light ON when SPARK PACKAGE in operate.

PUSH BUTTONS:

START P.B.: press to START igniter, momentary type N.O. contact.

STOP & PURGE P.B.: press to STOP igniter and get into purge sequence, momentary type N.C. contact.

EMERGENCY STOP P.B.: press to STOP igniter and FORCE retract igniter immediately, maintained type N.C. contact.

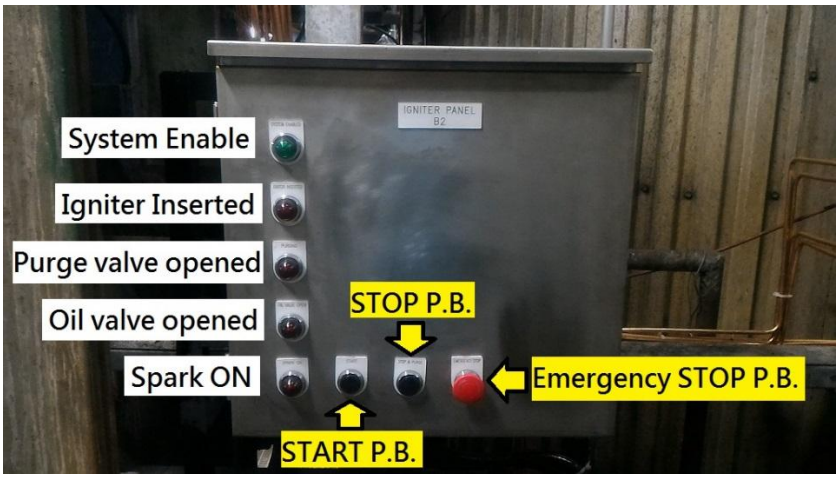


FIGURE 9. INDICATOR LIGHT AND PUSH BOTTOM OF IGNITER CONTROL PANEL

3.1.4 Igniter cylinder test function

There is a Igniter cylinder TEST push button(reference to figure 8) inside the igniter control panel could let the operator to test the Igniter cylinder and whole the igniter travel. This push button force to energize the igniter extend solenoid valve to push the igniter extend to the fully extend position. If the igniter extended to the fully extend position, the “Igniter Inserted” indicator light on the panel will light.

3.2 Heating box

This project has to install a space heating box for protecting Igniter probe tips from moisture at long time outage. For the experience, when the unit is in outage period, the temperature will cool and make moisture inside the igniter probe rods and tips. If we did not remove the moisture, the igniter probe tip can’t get good spark to light off the igniter. Put the igniter probe tips into a heating box to keep it stay dry and prevent moisture.
Igniter probe Supply power is 220VAC and temperature setting range is from 20℃~80℃(68℉ ~ 176℉).The box is shown in Figure 10.

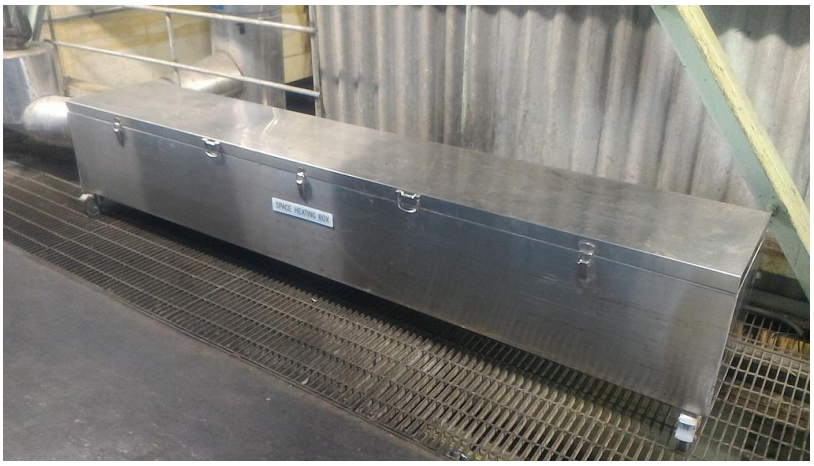


FIGURE 10. HEATING BOX

3.3 Igniter Probe tips

3.3.1 Dismantle, remove the existing Igniter Probe tips

The OLD igniter Probe tips and power unit did not provide strong SPARK to light off the Igniter, and electric leakage on the connector and shell that could cause light off failure of the igniter.

This project is to remove the existing Igniter probe package and replace new one. The new igniter probe package includes igniter probe tips and power unit. Both of them should be replaced for a new one.

FIGURE 11. OLD IGNITER PROBE TIP IN ELECTRODE SLEEVE

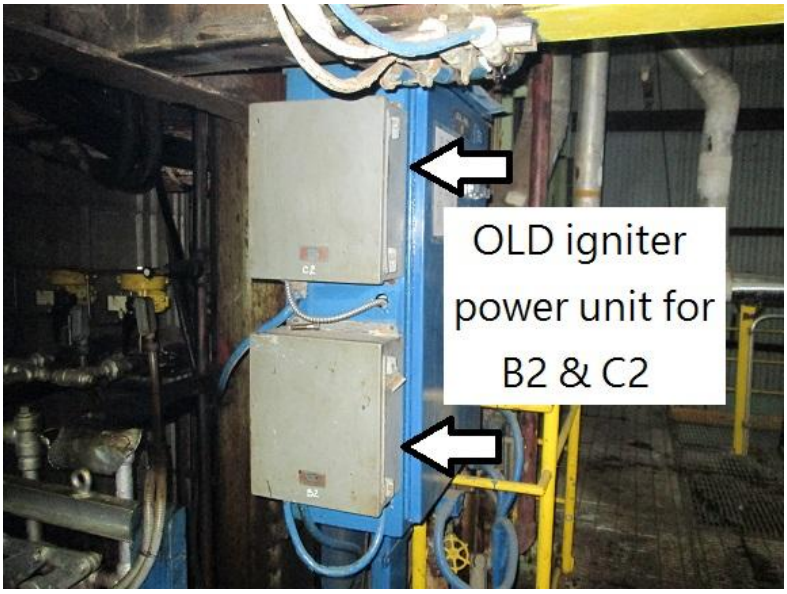


FIGURE 12. OLD IGNITER POWER UNIT IN B2 & C2

3.3.2 New Igniter probe and power unit

New Igniter probe tips and power units are provider from Porney called "High Energy Spark Igniter (HESI)". The length of spark rod tip is 96 inch, connecting cable is 20 feet.

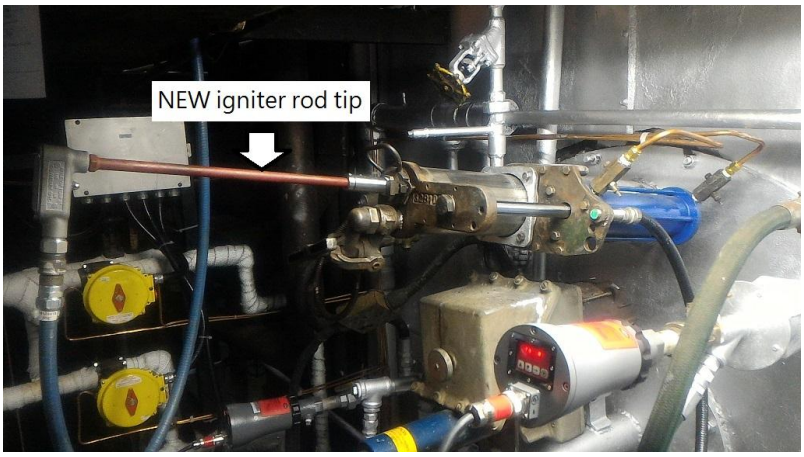


FIGURE 13. NEW IGNITER ROD TIP IN B1

FIGURE 14. NEW IGNITER POWER UNIT IN B2 & C2

3.3.3 Improve of Igniter probe.

3.3.3.1 Depth adjustment function

The OLD spark rod had different way to install on igniter sleeve and all can't adjust the depth insert to the boiler. That may cause the spark is not in the right position to light off the igniter, and make the igniter hard to light off.

There is a new way to adjust the depth of igniter rod and easy to do it. The design is shown in figure 16.

The original design of the depth of igniter rod tip is 8 inch, and we adjust the depth of the spark rod tip match the original design.

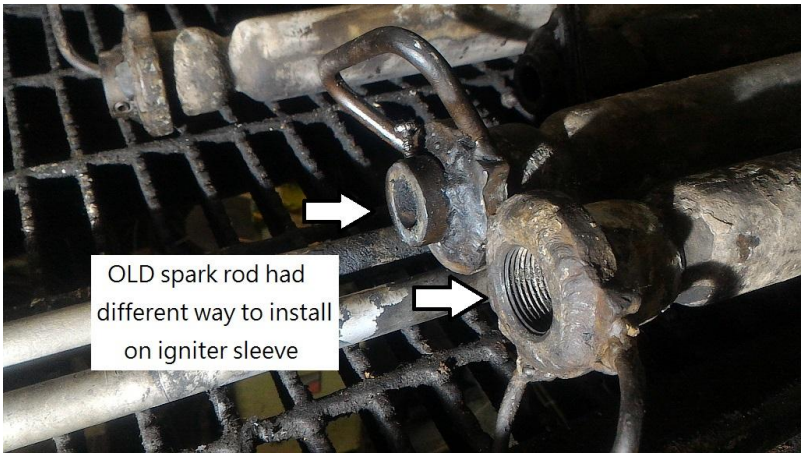


FIGURE 15. IGNITER SLEEVE FOR SPARK ROD (BEFORE)

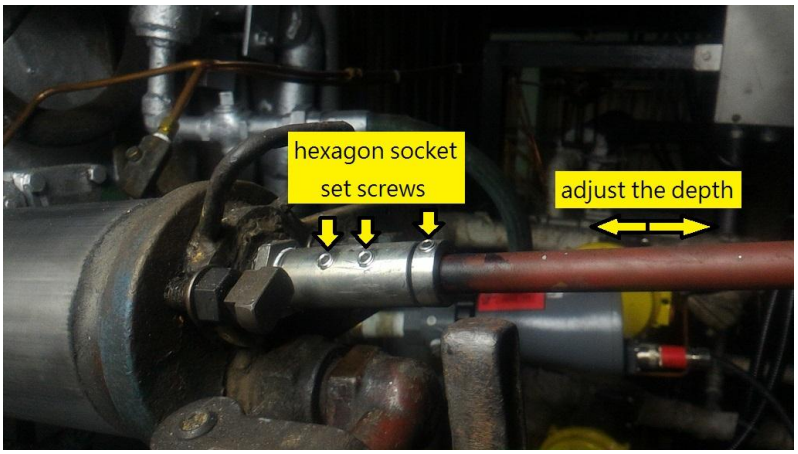


FIGURE 16. IGNITER SLEEVE FOR SPARK ROD (AFTER)

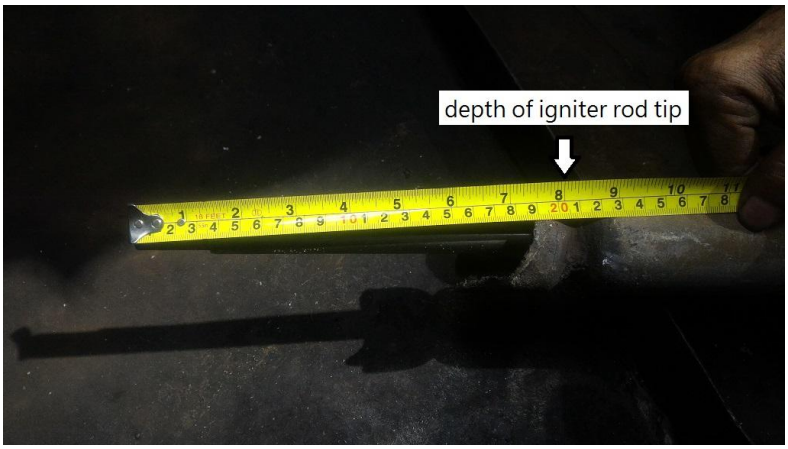


FIGURE 17. DEPTH OF SPARK ROD (8 INCH)

3.3.3.2 Spark indicator window

When the spark rod tip is inserted to the boiler and start spark, no one knows does it work or not. The only way to know is listen to the sound of the spark when it ignition, but it is hard to listen to the sound in the field. The new igniter power unit provide a window to see the light of the discharge tube when it ignition. That is easy to know the spark rod tip is working or not.

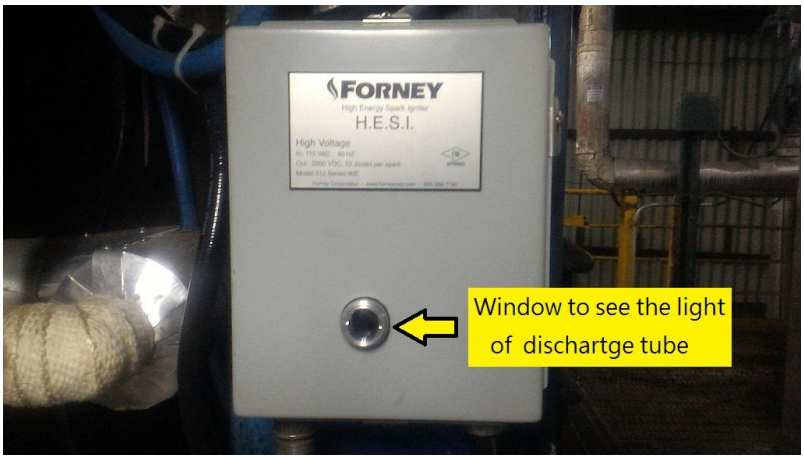


FIGURE 18. WINDOW OF IGNITER POWER UNIT

3.4 Igniter Cylinders

Dismantle, remove the existing Igniter Cylinders and replace them with a new one equipped with a proximity switch.

Old pneumatic igniter cylinder is a very old and no piston seal type of cylinder. New igniter cylinder has seal between piston and cylinder to prevent air leakage and keep the cylinder working well.

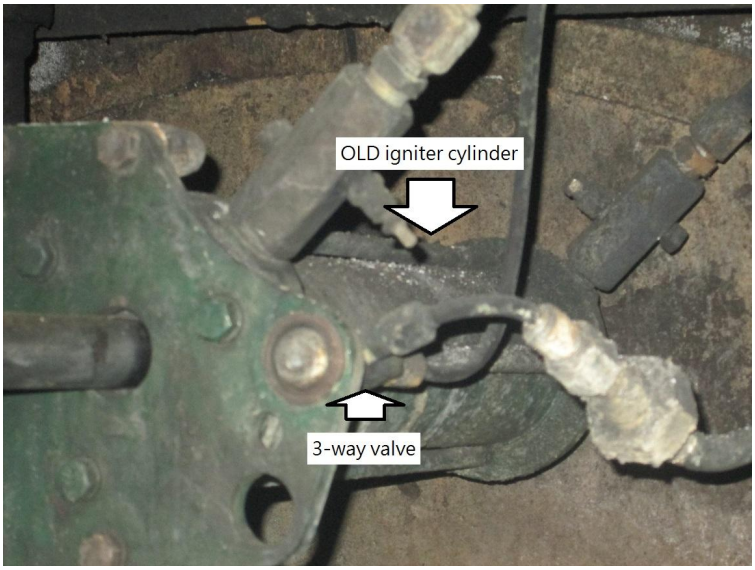


FIGURE 19. OLD IGNITER CYLINDER

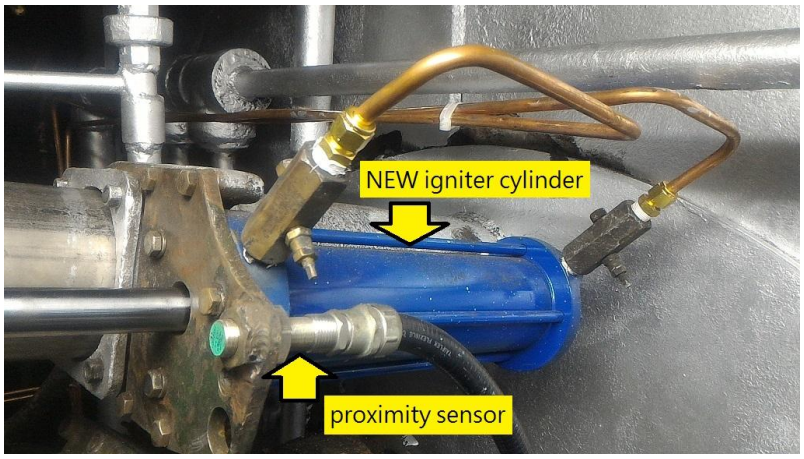


FIGURE 20. NEW IGNITER CYLINDER

Here also replace the old 3-way valve to proximity sensor. The function of the 3-way valve is let igniter control system know the igniter gun is really extend to the fully extended position. The proximity sensor has the same function as the 3-way valve in the new PLC control system.

3.5 Main Burner Mono Block Valve

3.5.1 Dismantle, remove the Main Burner Mono Block Valve

The existing Main Burner Mono Block Valve is the key equipment for supplying fuel and atomizing media to main burner. Mono Block Valve composed of 1 motor, 1 limit switch, 2 2-way valve and 1 3-way valve. The pipe connection and valve position drawing shows in figure 21 & 22.

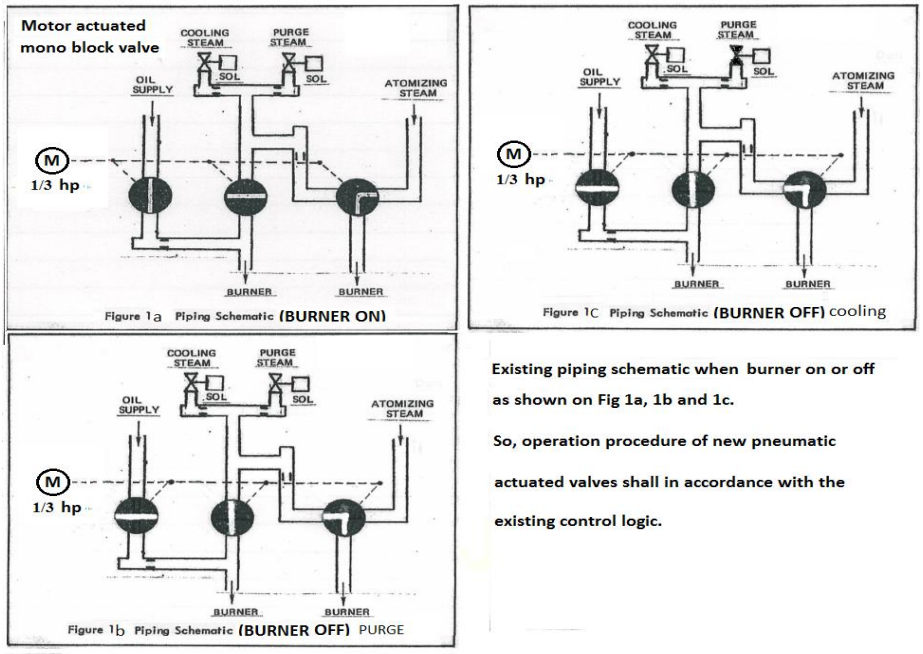


FIGURE 21. CONNCTION & VALVE POSITION DRAWING OF MONO BLOCK VALVE

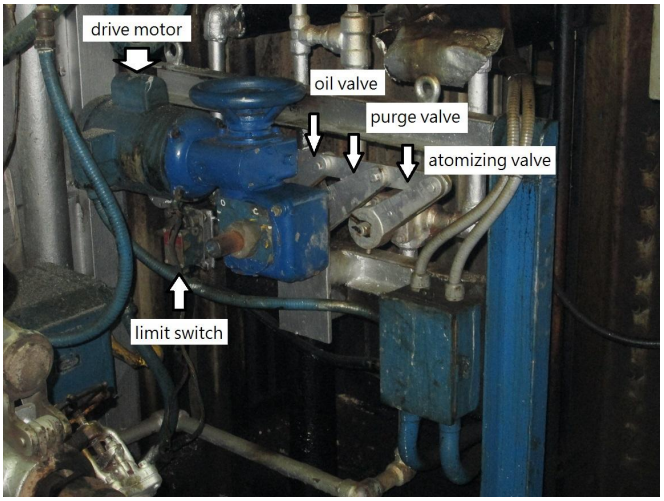


FIGURE 22. MONO BLOCK VALVE

Mono block valve is use a 1/3 motor to drive oil, purge and atomizing valves at the same time , and the motor stop command is come from the limit switch when the drive arm touch the limit switch. All the three valves have the same stroke, if one valve did not match the right position, that valve will leakage. If the limit switch did not adjust well, the motor will over travel and stop due to the motor overload. That will cause the main burner light off failure.

3.5.2 renovate mono block valve to be pneumatic actuated

This project is to renovate mono block valve to be pneumatic actuated.

The advantages of pneumatic actuated valves are:

A. Fast action and response of the valve.
B. Control the valve one by one to prevent leakage.
C. Two limit switches for open and close position can get the position accurately.
D. Simple and easy to maintain.

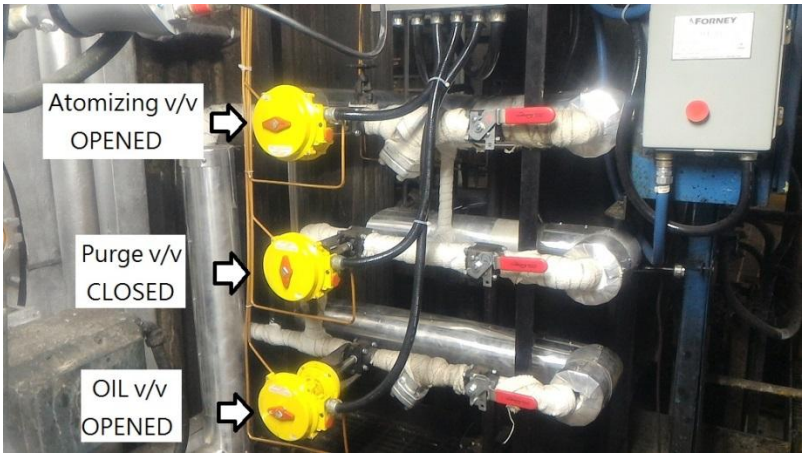


FIGURE 23. NEW PNUMATIC ACTUATED VALVE IN OPERATION

The pneumatic actuated valve needs a solenoid valve to change the direction of the air inlet path to the actuator and drive the valve open or close. There are two solenoid valve panels located beside the burner front, each panel has 12 solenoid valves for 2 burners (B1&C1 or B2&C2). Those solenoid valves are driving the following valves.

A. Main burner Atomizing valve.
B. Main burner PURGE valve.
C. Main burner OIL valve.
D. Main burner cooling valve.
E. Igniter PURGE valve
F. Igniter OIL valve

The location of the solenoid valves are match valves in burner front physically. Both solenoid valve panel have same layout for the solenoid and have tags beside the solenoid valve to know which it drive. (Figure 24) Every solenoid valve has 1 LED indicator to indicate when the coil energized. There is a RED manual push button on the solenoid valve, when pressed the manual push button that will force the solenoid valve into energize function immediately and drive the pneumatic driven valve open. (Figure 25)

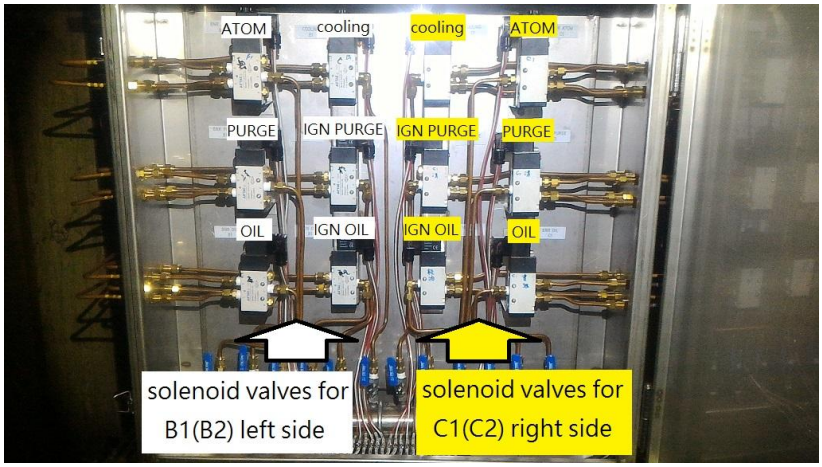


FIGURE 24. SOLENOID VALVE PANEL LAYOUT

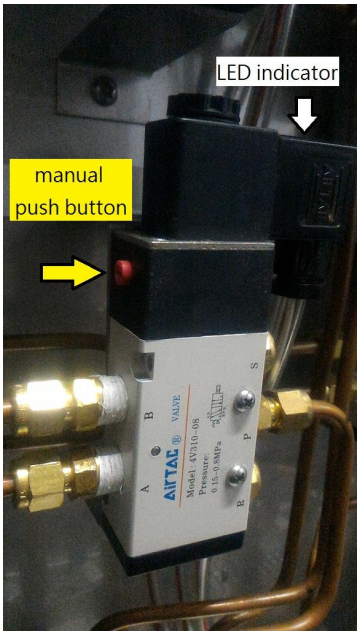


FIGURE 25. SOLENOID VALVE

3.5.3 DCS logic modification

After replaced main burner mono block valve with pneumatic actuated valve, DCS should modify the burner control logic to fit the equipment in burner front. Every burner had added 6 digital input points, 2 analog input points and 2 digital output points.

The DCS logic modification includes not only mono block valve, but also the igniter remote control. The igniter remote control is the part of the burner control logic. All the function of the burner is the same as before, and get a little improve of purging sequence.

It will automatically light off the igniter and open the purge valve into the purging sequence when the burner tripped. It should manually press the

“BURNER OFF” to start purging sequence before. It is more convenience than before.

There is one common logic block had modified, that is:

1BMS_2:B0053CA: remove “ANY BURNER UNSUCCESSFUL MAIN FLAME CHECK” signal, that doesn’t use after change the new flame scanner.

There are 3 logic blocks in every burner have been modified. They are:

1BMS_2:BB104CA: modify the IGNITER control sequence and output “IGNITER START” and “IGNITER STOP” signal to remote control the igniter.

1BMS_2:BB109CA: modify the MONO block valve sequence to pneumatic actuated atomizing valve and OIL valve. Change “OIL VALVE CLOSING” signal to “ATOMIZING VALVE OPENING” signal.

1BMS_2:BB110CA: modify “IGNITER LOAD” signal to “IGNITER EMERGENCY STOP COMMAND” signal to emergency stop the igniter and retract the igniter immediately.

3.5.4 Control graphics modification

There are more controlled signals feedback from burner front before renovate mono block valve to be pneumatic actuated. The advantage is operator can get more information from burner front and handle all well. Here are the control graphics before and after modification.(figure 26 & 27). We only have 8 signals from burner front before, that are Igniter & main FLAME signals, air register OPEN or CLOSE position signals, Impeller EXTEND position signal & burner COUPLED signal. Right now we have 14 signals from burner front, the new added signals are:

Igniter EXTEND: Igniter gun in extend position.

Igniter OIL valve OPEN: Igniter oil valve in fully open position.

Atomizing valve OPEN: atomizing valve in fully open position.

PURGE valve OPEN / CLOSE: purge valve in fully open or close position.

Cooling valve OPEN: cooling valve in fully open position.

Those signals provide all information of burner front to the operator to handle the burner.

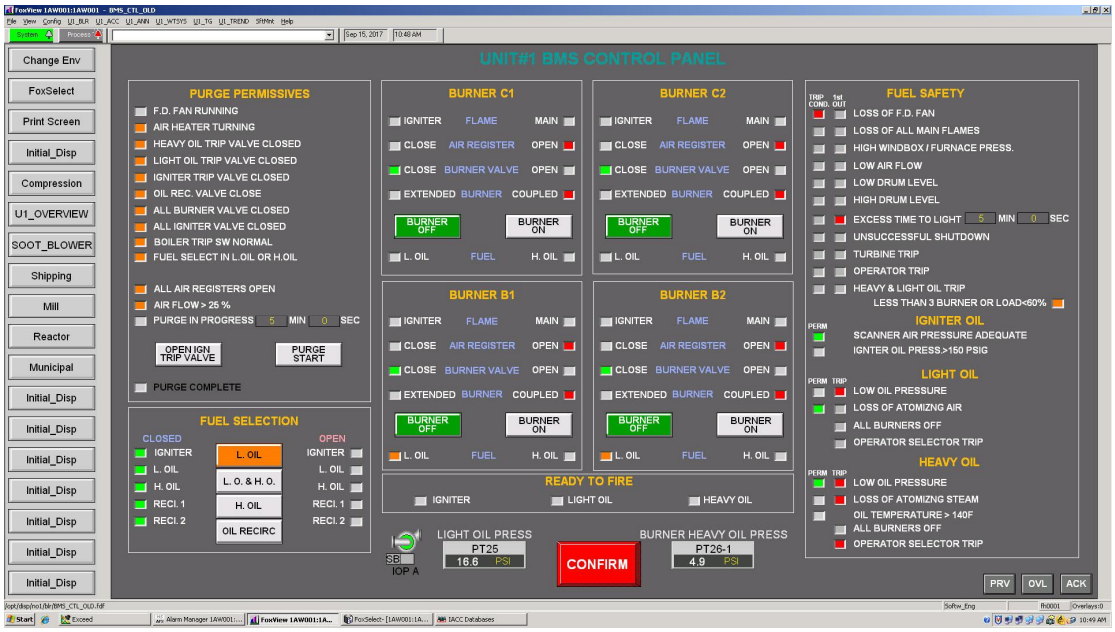


FIGURE 26.CONTROL GRAPHIC BEFORE MODIFICATION

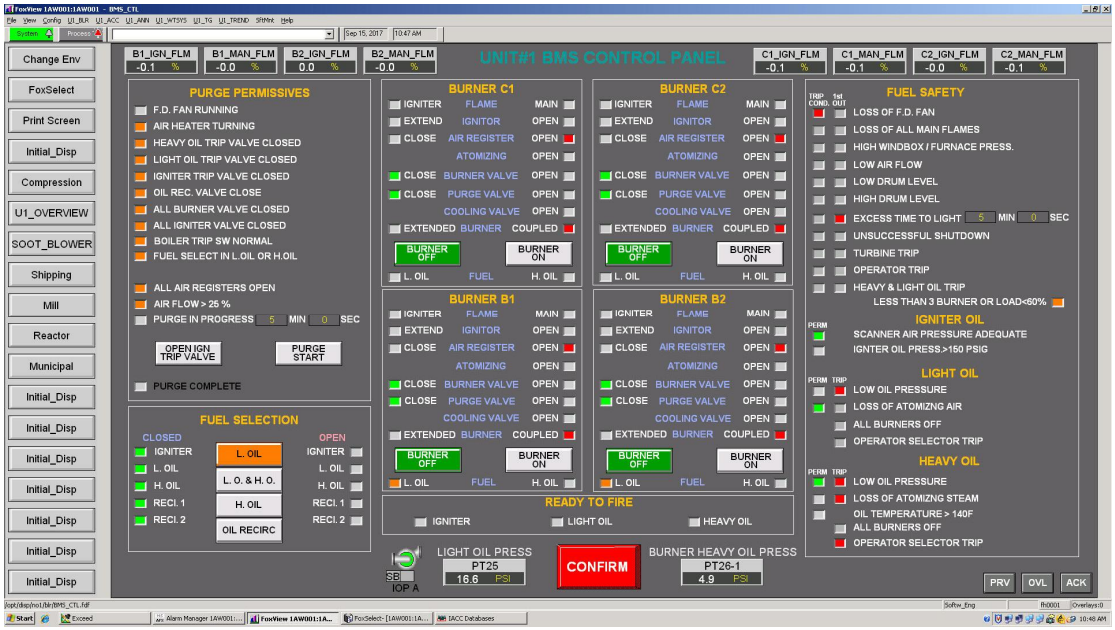


FIGURE 27.CONTROL GRAPHIC AFTER MODIFICATION

3.6 IGNITER & Main flame detectors

3.6.1 Old igniter and main flame detectors

There are 8 flame detectors in burner front to detect the flame of 4 igniters and 4 main burners. The old igniter and main flame detectors are old, out of phase and hard to find spare parts to maintain. Most flame detectors in burner front are in poor condition.

The old flame detectors are amplifier type, flame detector in burner front to detector the flame of the burner and send signal to the amplifier module in the electric room, the amplifier module analyze the signal and determine the

flame is ON or OFF, if the flame detector detect the flame, the amplifier module send a **FLAME ON** signal to **BMS**(Burner Management System).

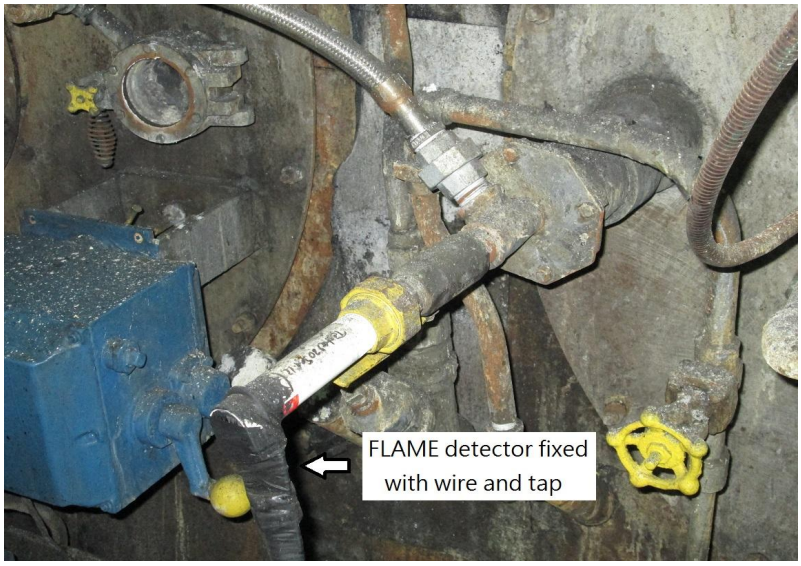


FIGURE 28.FLAME DETECTOR BEFORE MODIFICATION

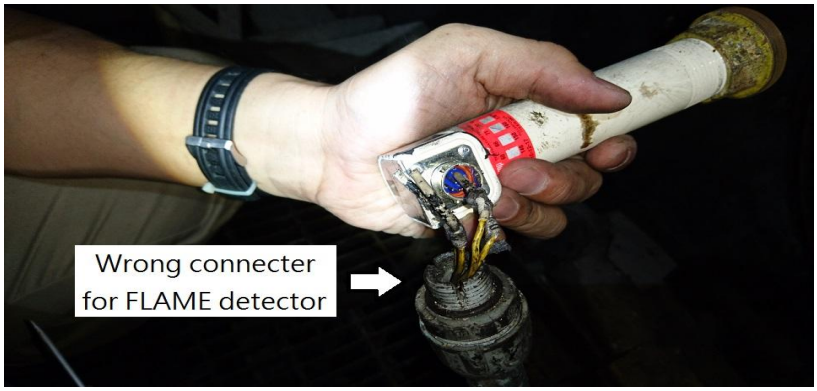


FIGURE 29.WRONG CABLE CONNECTER FOR FALEM DETECTOR

FIGURE 30.AMPLIFIER FOR FALEM DETECTOR

3.6.2 NEW igniter and main flame detectors

This project needs to replace the old flame detectors with NEW intelligent integrated flame detectors with internal flame relay model. The new intelligent integrated flame detectors are made by FIREYE type is 95IRS2. 95IRS2 have 21 choices of flame flicker frequency, adjustable sensor gain, adjustable flame relay ON/OFF thresholds, 4-20mA analog signal strength output, fault relay and 4 selectable programmable files to store setting. And we could remote communication via Fireye software in laptop. All settings could be set via keypad on the 95IRS2 scanner.

The NEW 95IRS2 flame detector in burner front shows in figure 21

FIGURE 30.AMPLIFIER FOR FALEM DETECTOR

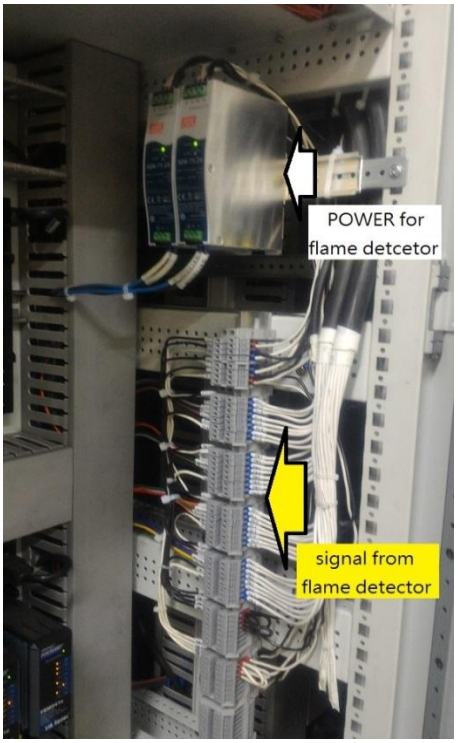


FIGURE 31.POWER AND TERMINAL OF FLAME DETECTOR IN ELECTRIC ROOM

We can use the push button on the flame detector to change the settings, the display and push button shows in figure 31.

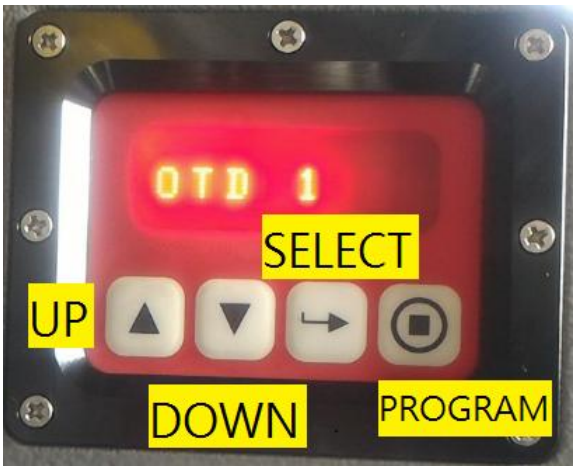


FIGURE 32.DISPLAY AND PUSH BUTTON ON 95IRS2

For ease of operation, 95IRS2 flame detector contains three menus (or loops) accessed via the keypad and viewed on the scanner's display. The menus are:

STATUS MENU: The Status menu is the default display, and appears as soon as power is applied. Use the UP and DOWN buttons to scroll through the menu and view the current operating status. No operating parameters can be changed from the Status menu. To change any setting, you must enter a four digit password then enter the Edit, or AutoTune menus (figure 33) . The parameters in status menu are descripted in figure 34.

EDIT MENU: The Edit Menu contains all the user-selected setting for the 95IRS2 scanner. The Edit menu is entered from the Status menu after first entering a four-digit password. In the Edit menu, the user is allowed to change the setting to optimize the scanner performance (figure 35) . The parameters in edit menu are descript in figure 36.

AUTOTUNE MENU: From the AutoTune menu, the user views the flame signal intensity and physically aims the scanner for optimum signal. The user then commands the InSight scanner to analyze the flame ON and OFF (background radiation) conditions, and automatically select the optimum

setting. As with the Edit menu, the AutoTune menu is entered from the Status menu after first entering a four-digit password (figure 37). The parameters in AutoTune menu are descripted in figure 38.

For more information of 95IRS2 flame detector, please refers manual for detail.

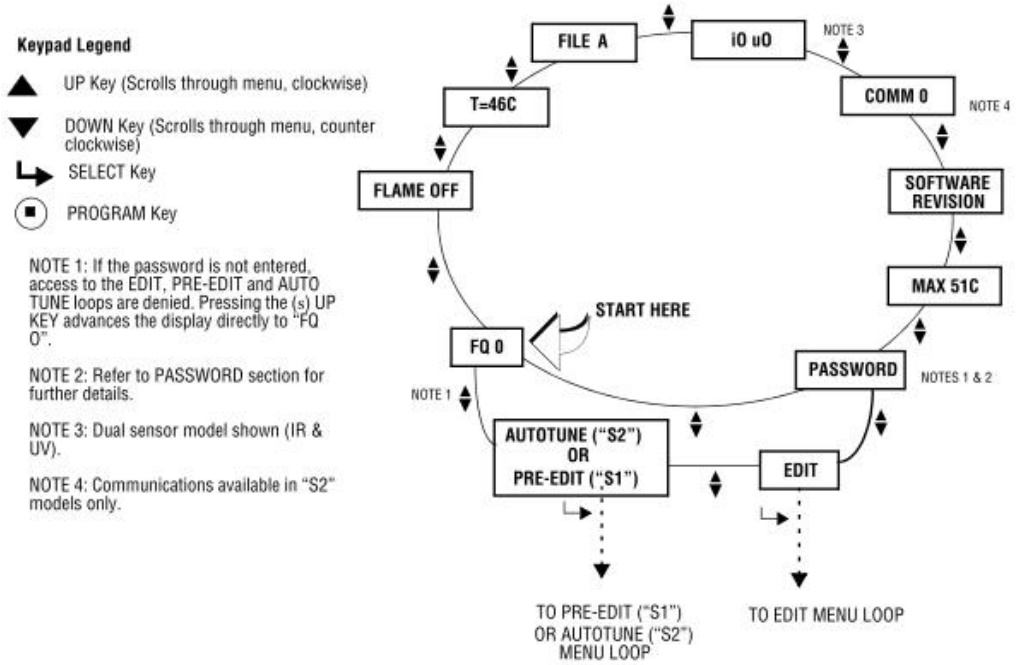


FIGURE 33.STATUS MENU OF 95IRS2

TEXT DISPLAYED	DESCRIPTION	POSSIBLE VALUES
FQ 0	Flame Quality (scanner output)	0-100
FLAME OFF	Flame Relay status	ON, OFF
T= 46C	Present Scanner temperature	+32°F to 212°F (0°C to 100°C)
File A	Scanner file in operation	A,B,C,D
i 0 u 0	Signal strength, IR and UV (dual sensor models)	0-999
COMM 0	Communication address ("S2" models only)	0-127
FIREYE INSIGHT 95XXXX VX.X	Scanner part number and software revision	
MAX XXX°C (XXX°F)	Scanner Temperature, exposure (stored) maximum	-40° F to 185°F (-40°C to 85° C)
PASSWORD	A Password is required to enter the EDIT, PRE-EDIT or AutoTune menus. See PASSWORD section.	0000-9999

FIGURE 34.PARAMETERS OF STATUS MENU

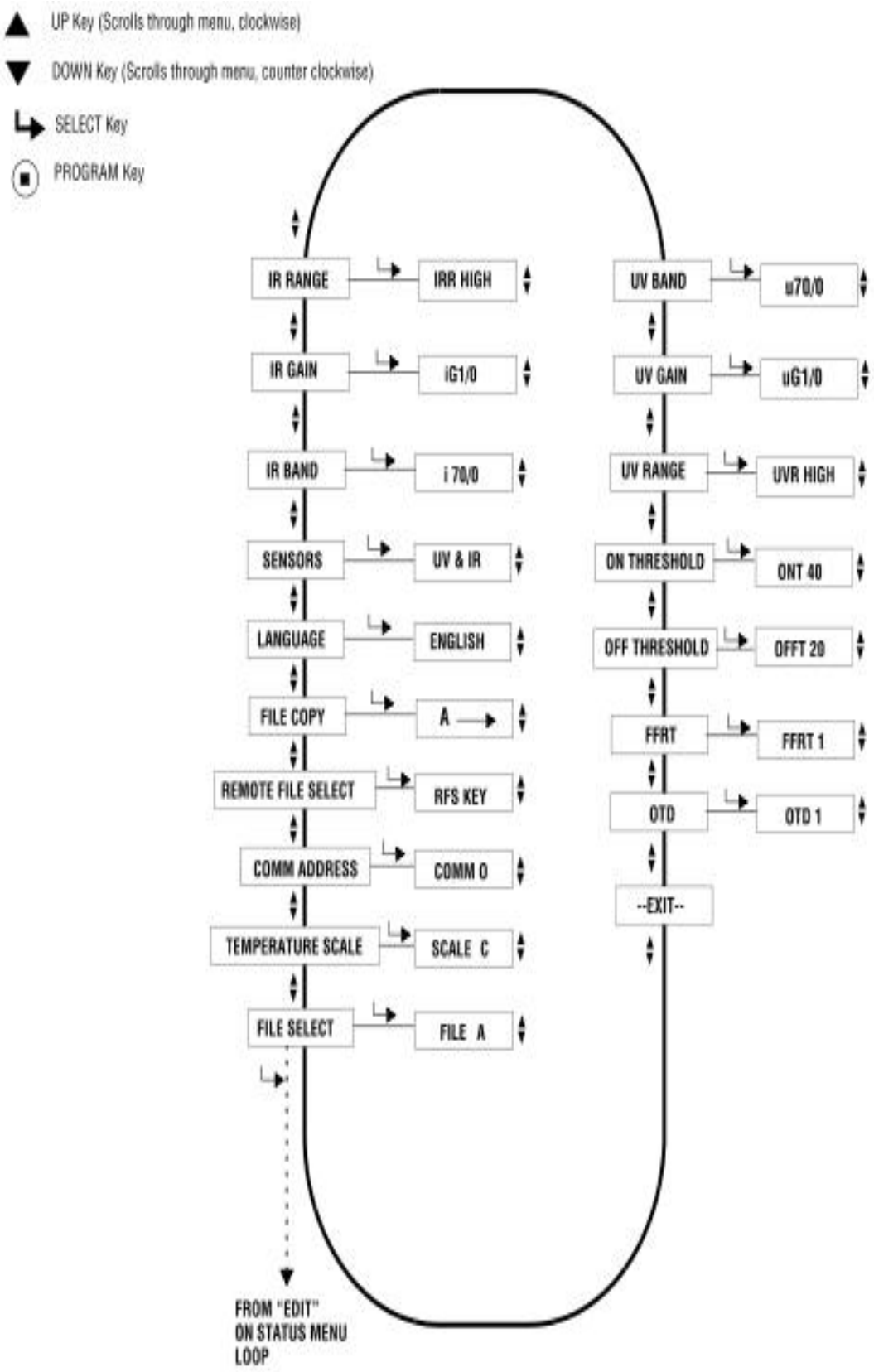


FIGURE 35.EDIT MENU OF 95IRS2

TEXT DISPLAYED	DEPRESS 'SELECT' KEY, TEXT DISPLAYED	POSSIBLE VALUES (UP/DOWN KEYS)
File Select	FILE A	"S1" models: A.B "S2" models: A.B, C, D
Temperature Scale	Scale C	C, F
Comm address ("S2" only)	COMM 0	0-127
Remote File Select	RFS KEY	"S1" models: KEY, LINE "S2" models: KEY, LINE, COMM* *(Comm not available in "E" models)
File Copy	A-> (See File Copy Section)	
Language	English	English
Sensors (Dual Sensor Models Only)	UV + IR	UV + IR, IR Only, UV Only
IR Band	i70/ 0 (IR Frequency selected/Signal strength)	"S1" Models: 23, 70, 117 "S2" Models: 23, 31, 39, 46, 54, 62, 70, 78, 85, 93, 101, 109, 117, 125, 132, 140, 148, 156, 164, 171, 179 Hz
IR Gain	iG1 / 0 (IR Gain selected/ Signal strength)	1 - 31
IR Range	IRR HIGH	HIGH, LOW
UV Band	u70/ 0 (UV Frequency selected/Signal strength)	"S1" Models: 23, 70, 117 "S2" Models: 23, 31, 39, 46, 54, 62, 70, 78, 85, 93, 101, 109, 117, 125, 132, 140, 148, 156, 164, 171, 179 Hz
UV Gain	uG1 / 0 (UV Gain selected/ Signal strength)	1 - 31
UV Range	UVR HIGH	HIGH, LOW
On Threshold	ONT 40	5 - 100
Off Threshold	OFFT 20	0 - 95
FFRT	FFRT 1	1, 2, 3, 4, 5, 6 seconds
OTD	OTD 1	1, 2, 3, 4, 5, 6 seconds
--EXIT--	Edit (Returns you to STATUS loop)	

FIGURE 36.PARAMETERS OF EDIT MENU

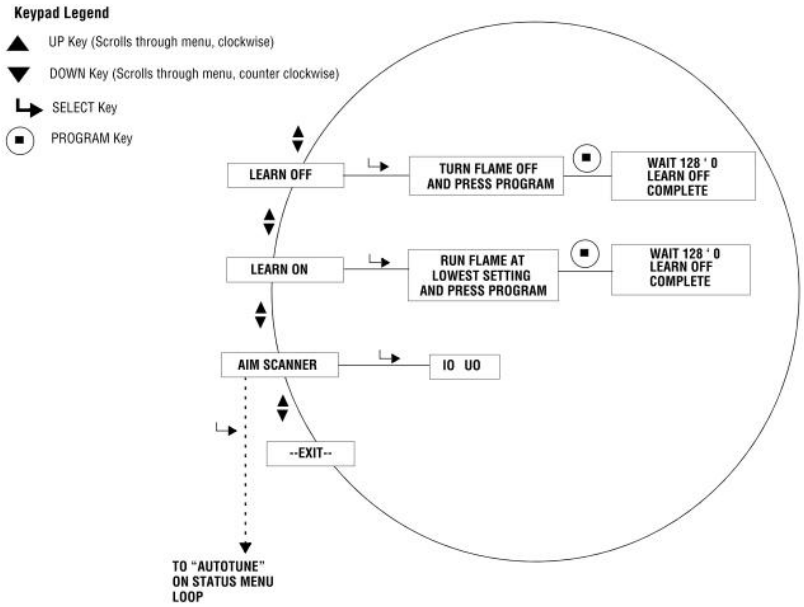


FIGURE 37.AUTOTUNE MENU OF 95IRS2

TEXT DISPLAYED	DEPRESS "SELECT" KEY TEXT DISPLAYED	DEPRESS "PROGRAM" KEY TEXT DISPLAYED
Aim Scanner	I 0 U 0 (Possible Values 0-60)	
Learn On	Run Flame at Lowest setting and press PROGRAM	WAIT 128 – 0 (Counts down to 0 within 20 seconds, then displays "Learn ON complete")
LearnOff (only displayed if Learn ON had been performed)	Turn Flame OFF and press PROGRAM	WAIT 128 – 0 (Counts down to 0 within 20 seconds, then displays "Learn OFF complete")
--Exit--	AutoTune (Returns you to STATUS loop)	

FIGURE 38 PARAMETERS OF .AUTOTUNE MENU

Flame Detector setting of CABRAS unit #1

BURNER	Address	Description	File Select	Temp scale	IR Band	IR GAIN	IR RANGE	ON threshold	OFF Threshold	FFRT	OTD
B1 IGN	1	B1I	A	scale F	i31	iG17	HIGH	30	15	4	1
B1 MAN	2	B1M	A	scale F	i70	iG23	LOW	30	15	4	1
B2 IGN	3	B2I	A	scale F	i31	iG17	HIGH	30	15	4	1
B2 MAN	4	B2M	A	scale F	i70	iG23	LOW	30	15	4	1
C1 IGN	5	C1I	A	scale F	i31	iG17	HIGH	30	15	4	1
C1 MAN	6	C1M	A	scale F	i70	iG23	LOW	30	15	4	1
C2 IGN	7	C2I	A	scale F	i31	iG17	HIGH	30	15	4	1
C2 MAN	8	C2M	A	scale F	i70	iG23	LOW	30	15	4	1

FIGURE 39 95IRS2 PARAMETER SETTINGS OF CABRAS UNIT #1

3.6.3 Communication software of flame detector

This project provides software FS950W that can communicate with 95IRS2 flame detectors. All flame detectors in CABRAS UNIT #1 had assigned an address that could communication with the software via the laptop (figure 39). This software has following capabilities:

A. Communicate with up to 128 flame detectors via RS485.
B. Display flame signature configuration.
C. Create flame signal bar graphs.
D. Review real time flame signal trend log.
E. Review fast Fourier Transform of flame signal spectrum.
F. Review time readout of flame signal, and flame signature configuration files.
G. Review/program scanner setting remotely.

The communication wiring of flame detectors is shown in figure 40. Most new IBM compatible PC did not have RS485 port, there is a RS485 to USB converter used for communicating with 95IRS2 flame detectors.

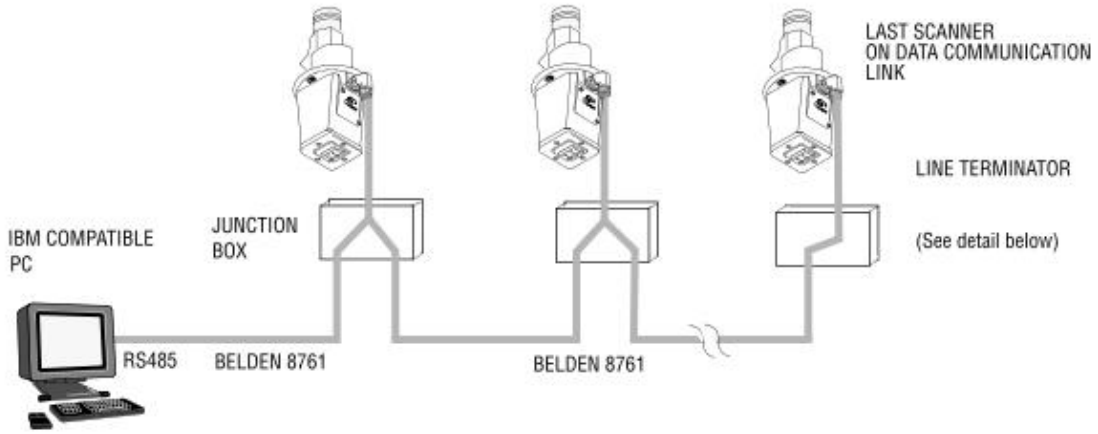


FIGURE 40 COMMUNICATION WIRING OF 95IRS2 FLAME DETECTORS

The “CABRAS UNIT” database had created in FS950W, and there are 8 flame detectors in the database. We shall click the “CONNECT” pushbutton on the toolbar to connect the flame detectors in the burner front, the function of the toolbar shows in figure 41. The useful tools are “SCANNER CONFIGURATION”, GRAPHS” and “KEYPAD”.

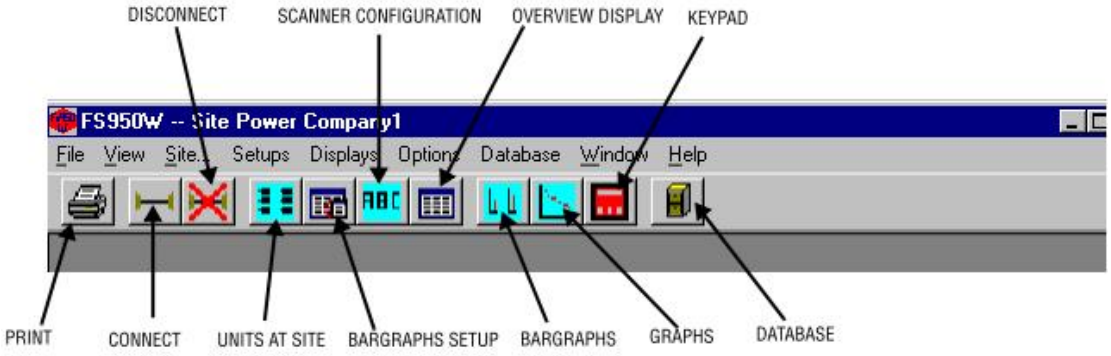


FIGURE 41 THE FUNCTION OF THE TOOLBAR

SCANNER CONFIGURATION: Scanner configuration shows the contents of the memory files of the current flame detector which you connect and can save the contents to file. This will help user to set the parameters when change or replace a NEW flame detector. The 95IRS2 flame detector have 4 memory files, all flame detectors use “file A “in CABRAS unit 1.

GRAPHS: The Graph Window allows the user to view the scanner information as an FFT Graph, a Trend graph, or a Time Series

Graph. User can see the fire strength and Frequency V.s Amplitude graph to check the flame condition in the boiler.

KEYPAD: The “Keypad” Screen (figure 42) duplicates the action of the detector keypad display in the field. User can set all setting in front the laptop and don’t need go to the burner front.

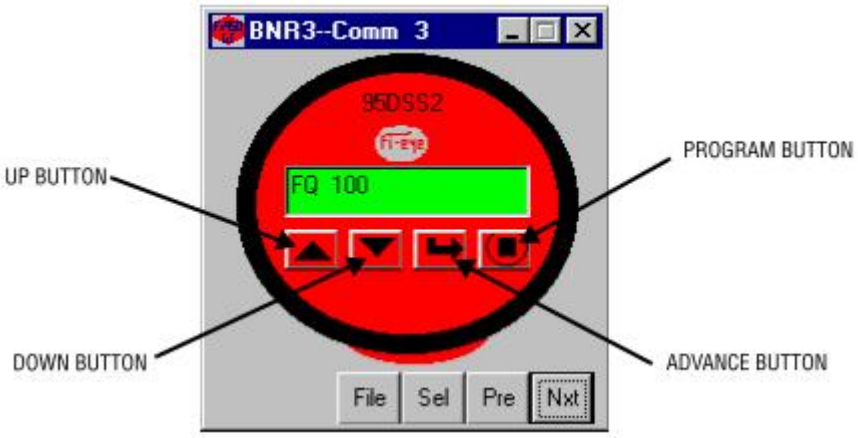


FIGURE 42 THE KEYPAD SCREEN

4 Conclusion

Burner front modification plan is a big change in the burner front. Replace the old devices with new type and easy maintain devices will help operators and maintenance person easy to find where the problem is and easy to fix it. Such as the MONOblock valve, a motor actuate to open or close 3 valves(oil, purge and atomizing valve) and no open or close indicate of the MONOblock valve, no one knows all the three valve are in the fully closed position or not. But the new pneumatic actuate valve is a ball valve and have a indicator to see the valve is in open or close position. If the indicator is horizontal the valve is in open position, if the indicator is vertical the valve is in close position. That is much easy to see and understand the situation of the valves.

All in all the burner front modification have following advantages:

A. Easy to find out root cause if IGNITER package problem occurred
B. It is a better way to protect igniter probe tips from moisture at long time outage with a space heating box.
C. Renovate mono block valve to be pneumatic actuated. Limit switch is integrated in the actuator, easy for operation and maintenance.
D. New intelligent integrated flame detectors have good sensitivity.

E. HMI PC for behaving monitoring of intelligent flame detector, in order to get good accuracy of intelligent flame detector.
F. More reliable operation of Burner System.

A successful modification in burner front is not only all devices in burner front, but also the experience from the operator. All recommendation can make the function in burner front better and better, and more easily to maintain and operate.