

RAPH SUPPORT BEARING FAILURE ANALYSIS REPORT-UNIT 1

Report /Failure analysis report / UNIT I-1/1/2018

Dt. 21.05.2018

Committee members:

- | | |
|--------------------------|---------|
| 1. Shri. V. Naganathan | DGM/O&C |
| 2. Shri. M. Somasundaram | CM/C&I |
| 3. Shri. K.R Jaya Kumar | CM/Elec |
| 4. Shri. K. Hari Sankar | EE/BM |

OCCURRENCE: Unit I RAPH A2 drive got failed 22:11 hrs on 01.05.2018 due to "Fluid coupling O-ring failure"

Load: 309 MW with Mills (B, C, E, G, H). and CMC mode.

OBSERVATIONS FROM ALARM PAGES:

22:41:26 Hrs : RAPH A1 On Command

22:41:30 Hrs : RAPH A2 Off command

22:45:43 Hrs : RAPH A2 On Command

22:45:50 Hrs : RAPH A1 off Command

ANALYSIS:

Unit was in service with a load of 309 MW. RAPH A with A2 drive was in service. Suddenly at 22.11 hrs flue gas outlet started increasing with decrease in mill outlet temperature, secondary air outlet, and primary air outlet in RAPH-1A. Rotor stoppage alarm not appeared in DCS. The deviation in the above parameter was noted by board operators and on local inspection it was found that RAPH A2 motor alone running with no transmission. RAPH A1 drive was started by 22:41 hrs and found no transmission as of fusible plug in fluid coupling failed. Support bearing and guide bearing temperature of RAPH 1A was maintained around 57.7°C and 50.6°C respectively. Since both drive got failed board operator decided to close the air and flue gas side dampers. But dampers could not be closed from DCS and flue gas inlet damper-2 was closed by electrical maintenance from local by 23:00hrs and flue gas inlet damper-1 was closed manually by 23:40hrs. RAPH was tried to rotate manually and observed it was not free to rotate. All the air dampers were closed from local parallelly. Since closing of flue gas dampers got delayed, it resulted in uneven expansion of modules. Later RAPH was allowed to cool. But even after cooling RAPH could not be rotated freely. It was decided to inspect the guide and support bearings. It was found guide bearing was normal & inner race of support bearing, flue gas side cold end circumferential seal of 24 nos got damaged. Then support bearing was replaced and RAPH-A was started after replacement of bearing on 11.05.2018 by 13:52 hrs.

CONCLUSION:

1. RAPH A2 drive fluid coupling drive got failed due to drive shaft O-ring failure. Due to that fluid coupling oil level got dropped resulted in transmission failure.

2. On reduction of RAPH rotor speed annunciation not came as it was in disabled condition. Since commissioning of RAPH A, the speed sensor got damaged twice in RAPH 1A alone. Frequent rotor stoppage was persisting due to misalignment of existing sensing plates hence it was kept in disabled condition. RAPH stoppage alarm appeared in SOE (Sequence of events page).

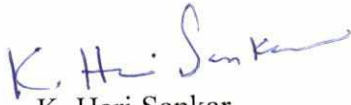
3. Board operator immediately after assessing the deviation in parameter at 22:20 hrs should have tried to start the reserve one, which might have saved the RAPH.


4. If all the air and flue gas dampers are closed immediately from DCS, the severity of the damage to RAPH could be minimised.


RECOMMENDATIONS:


<u>Sl.No</u>	<u>Recommendation</u>	<u>Scope</u>	<u>Remarks</u>
1.	RAPH rotor stoppage alarm should not be bypassed.	C&I	Immediate
2.	RAPH motor current reading should be made available at DCS.	C&I and EM	Current reading made ready at DCS on 13.05.2018.
3.	Board operator immediately after assessing the deviation in parameter at 22:20 hrs should have tried to start the reserve one, which might have saved the RAPH.	Operation	Frequent monitoring is advised.
4.	If RAPH motor failed and reserve motor could not be taken in to service immediately & on sensing the raise in flue gas temperature at RAPH outlet at 22:40 hrs. Rotor should not be rotated at local. Rather it should be allowed to cool for free rotation and to be checked at local.	Operation	To be followed.


5.	If RAPH flue gas outlet temperature crossing above 150 ° C flue temperature high annunciation may be provided for alerting board engineers.	C&I	To be implemented immediately.
6.	RAPH motor shall be changed once in a week after checking the oil level of reserve fluid coupling.	BM& Operation	To be followed.
7.	Periodical inspection of oil leak in fluid coupling to be ensured.	BM	To be followed.
8.	Periodical operation of all air and flue gas dampers from DCS by 10% inching operation to ensure the healthiness. It is to be done at partial load.	EM & Operation	To be followed.
9.	Lighting in the RAPH to be improved in bearing and drive area for the ease of inspection.	EM	To be implemented immediately.
10.	SOE display to kept regularly in one OWS monitor.	Operation	To be implemented immediately.


K. Hari Sankar
EE/BM


K.R. Jaya Kumar
CM/Electrical


M. Somasundaram
CM/C&I


V. Naganathan
DGM/O&C

Submitted to CEO/MTOL

DGM/O&C


28/5/18

UNIT 1

4/5/18 22:11:48

RAPHIA

STOPPED

Event Summary

(Manual Stop)

Start Time: Tuesday 01/May/2018 22:00 End Time: Tuesday 01/May/2018 22:30

2519

Time	A T...	Tag Name	Event Text	Description
01/May/18 22:11:06	A PA	CEPCFlowL...	Alarm Digital Value = True 1B14CRE35_s	CEP-C Flow Low
01/May/18 22:11:06	A PA	1MAV51AA0...	MCC Disturbed 1ATRS2_P	Motor Optd Bi-Direction Valve
01/May/18 22:11:07	C PA	1MAV51AA0...	MCC Disturbed 1ATRS2_P	Motor Optd Bi-Direction Valve
01/May/18 22:11:07	SQ	1HHA41CE1...	Digital_State Old=FALSE New=TRUE 101...	DISC SCAN NO FLAME GH
01/May/18 22:11:08	A PA	1LAB10AA501	MCC/Actuator Disturbed 1B15CRE38_s	Motor Optd Bi-Direction Valve
01/May/18 22:11:08	C PA	1LAB10AA501	MCC/Actuator Disturbed 1B15CRE38_s	Motor Optd Bi-Direction Valve
01/May/18 22:11:08	SQ	1HHA30CE1...	Digital_State Old=NO FLAME New=FALSE...	FB SCANNER CD
01/May/18 22:11:08	SQ	1HHA30CE1...	Digital_State Old=FALSE New=FLAME 1...	FB SCANNER CD
01/May/18 22:11:08	SQ	1HHA30CE1...	Alarm Clear Value = N True 1B14CRE35_s	CEP-C Flow Low
01/May/18 22:11:10	C PA	CEPCFlowL...	Low PV Deviation 1B16CRE40_P	DISC SCAN NO FLAME AB
01/May/18 22:11:11	A PA	1HPH5A_H...	Digital_State Old=FALSE New=TRUE 101...	DISC SCAN NO FLAME GH
01/May/18 22:11:11	SQ	1HHA13CE1...	Digital_State Old=FALSE New=TRUE 101...	DISC SCAN NO FLAME GH
01/May/18 22:11:11	SQ	1HHA41CE1...	Low PV Deviation 1B16CRE40_P	Motor Optd Bi-Direction Valve
01/May/18 22:11:12	C PA	1HPH5A_H...	MCC/Actuator Disturbed 1B15CRE38_s	Motor Optd Bi-Direction Valve
01/May/18 22:11:12	C PA	1LAB10AA501	OpCmd1 Old= 12.00 New= 12.00 1B09C...	CEP-C Flow Low
01/May/18 22:11:12	EA	1UNIT_LOA...	Alarm Digital Value = True 1B14CRE35_s	CEP-C Flow Low
01/May/18 22:11:12	A PA	CEPCFlowL...	Digital_State Old=N YES New=YES 1B03...	APH-A ROTOR STPG
01/May/18 22:11:12	SQ	1HLD01CS2...	Digital_State Old=FLAME New=FALSE 1...	FB SCANNER CD
01/May/18 22:11:12	SQ	1HHA30CE1...	Digital_State Old=FALSE New=NO FLAM...	FB SCANNER CD
01/May/18 22:11:12	SQ	1HHA30CE1...	MCC/Actuator Disturbed 1B15CRE38_s	Motor Optd Bi-Direction Valve
01/May/18 22:11:13	A PA	1LAB10AA501	Digital_State Old=NO FLAME New=FALSE...	FB SCANNER CD
01/May/18 22:11:13	SQ	1HHA30CE1...		
01/May/18 22:11:13	SQ	1HHA30CE1...		

MAIN LAST

SG TG

BOP ELEC

GEN TDBRP

PR DEV -0.61

H2 PR 3.27

FUR PRS -10.2

TOT COAL 236.8

TOT AIR 1603.3

SA FLOW 1002.7

O2 3.59

PA HDR 814.4

DRUM PR 186.3

MS PRESS 166.2

HRH PR 41.25

MS TEMP 523.7

HRH TEMP 544.6

SH SPRAY 0.0

COND PR 0.1502

HWL LVL -29.48

DEA LVL 148.3

DRUM LVL 7.3

MS FLOW 1487.6

FW FLOW 1503.1

COND FLOW 1250.3

IA PRESS 6.9279

MOT LVL -54.99

CF LVL -146.0

MFT APRDS MILL A MILL B MILL C TDBFP A TDBFP B EHTC CMC 1HLD01CS201_XG49

FLAME SADC MILL D MILL E MILL F TP TDBFP A TDBFP B HPBP VACCUM APH-A ROTOR STPG

INTENSITY CLCS MILL G MILL H WALL B TURB. PCAL LPBP PW SYS /B-CLCS/C-Burner/1B-Controll/Modd/DRV/B-

BOILER CONTROL CLCS MILL G MILL H WALL B TURB. PCAL LPBP PW SYS "EventsSummary/EventsSummary/5OE_MIN"

SILENCE TAG Print HW Cond

ACK SOE Almsum

RESET ALARM TRND

17:41:56

26May18

2994RPM

474MW

9

AIR HEATERS

AH-A
SEQUENCE

AH-B
SEQUENCE

TEMP FDF IDF PAF SA PA

AH-A MTR-1 AH-A MTR-2

24 A

0 A

ROTOR N STOPPED

AH-B MTR-1AH-B MTR-2

22 A

0 A

ROTOR N STOPPED

Event Retrieval Properties

Event Summary

(Completed)

Start Time: Tuesday 01/May/2018 22:00 End Time: Tuesday 01/May/2018 23:59

Time Ty... TagName Event Text

01/May/18 22:41:25	EA	1HLD01AE001	OpCmd Old=State 1 New=State 2 1B03CRE07_p By 161.48
01/May/18 22:41:26.450	SQ	1HLD01AE001_XB01	Digital_State Old=FALSE New=FdbkOn 1B03CRE07_p
01/May/18 22:41:29	EA	1HLD01AE002	OpCmd Old=State 2 New=State 1 1B03CRE07_p By 161.48
01/May/18 22:41:30.432	SQ	1HLD01AE002_XB02	Digital_State Old=FALSE New=FdbkOff 1B03CRE07_p
01/May/18 22:44:01	EA	1HLD01AE002	OpCmd Old=State 1 New=Reset 1B03CRE07_p By 161.48
01/May/18 22:45:43	EA	1HLD01AE002	OpCmd Old=Reset New=State 2 1B03CRE07_p By 161.48
01/May/18 22:45:43.918	SQ	1HLD01AE002_XB01	Digital_State Old=FALSE New=FdbkOn 1B03CRE07_p
01/May/18 22:45:49	EA	1HLD01AE001	OpCmd Old=State 2 New=State 1 1B03CRE07_p By 161.48
01/May/18 22:45:50.410	SQ	1HLD01AE001_XB02	Digital_State Old=FALSE New=FdbkOff 1B03CRE07_p
01/May/18 23:04:58	EA	1HLD01AE001	OpCmd Old=State 1 New=State 2 1B03CRE07_p By 161.40
01/May/18 23:04:58.310	SQ	1HLD01AE001_XB01	Digital_State Old=FALSE New=FdbkOn 1B03CRE07_p
01/May/18 23:05:02	EA	1HLD01AE002	OpCmd Old=State 2 New=State 1 1B03CRE07_p By 161.40
01/May/18 23:05:03.296	SQ	1HLD01AE002_XB02	Digital_State Old=FALSE New=FdbkOff 1B03CRE07_p
01/May/18 23:06:30	EA	1HLD01AE002	OpCmd Old=State 1 New=State 2 1B03CRE07_p By 161.6
01/May/18 23:06:31.846	SQ	1HLD01AE002_XB01	Digital_State Old=FALSE New=FdbkOn 1B03CRE07_p
01/May/18 23:06:35	EA	1HLD01AE001	OpCmd Old=State 2 New=State 1 1B03CRE07_p By 161.6
01/May/18 23:06:36.292	SQ	1HLD01AE001_XB02	Digital_State Old=FALSE New=FdbkOff 1B03CRE07_p
01/May/18 23:28:02	EA	1HLD01AE002	OpCmd Old=State 2 New=State 1 1B03CRE07_p By 161.6
01/May/18 23:28:03.195	SQ	1HLD01AE002_XB02	Digital_State Old=FALSE New=FdbkOff 1B03CRE07_p
01/May/18 23:28:21	EA	1HLD01AE002	OpCmd Old=State 1 New=State 2 1B03CRE07_p By 161.6
01/May/18 23:28:22.211	SQ	1HLD01AE002_XB01	Digital_State Old=FALSE New=FdbkOn 1B03CRE07_p

MFT	APRDS	MILL A	MILL B	MILL C	TDBFP A	TDBFP B	EHTC	CMC	1HLD01AE002_XB01	SILENCE	TAG	Print	HW Cond
FLAME INTENSITY	SADC	MILL D	MILL E	MILL F	TRIP	LUB OIL	HPBP	VACUUM	AH-A MAIN ELEC MTR-2	ACK	SOE	AlarmSum	10.5
BOILER CONTROL	CLCS	MILL G	MILL H	WALL B	TURB. PROT	PCAL	LPBP	PW SYS	"EventSummaryEventsSummarySOE.MN"	RESET	ALARM	TRND	8.0

SECUR...
CONTROL

16:01:31
17May1

30077
491

MAIN
SG

BOP
GEN

Select
Print

PR DEV
H2 PR

FUR PRS
TOT COAL

TOT AIR
SA FLOW

O2
PA HDR

DRUM PR
MS PRESS

HRH PR
MS TEMP

HRH TEMP
SH SPRAY

COND PR
HML LVL

DEA LVL
DRUM LVL

MS FLOW
FW FLOW

COND FLOW
IA PRESS

MOT LVL
CF LVL

2/5/2018

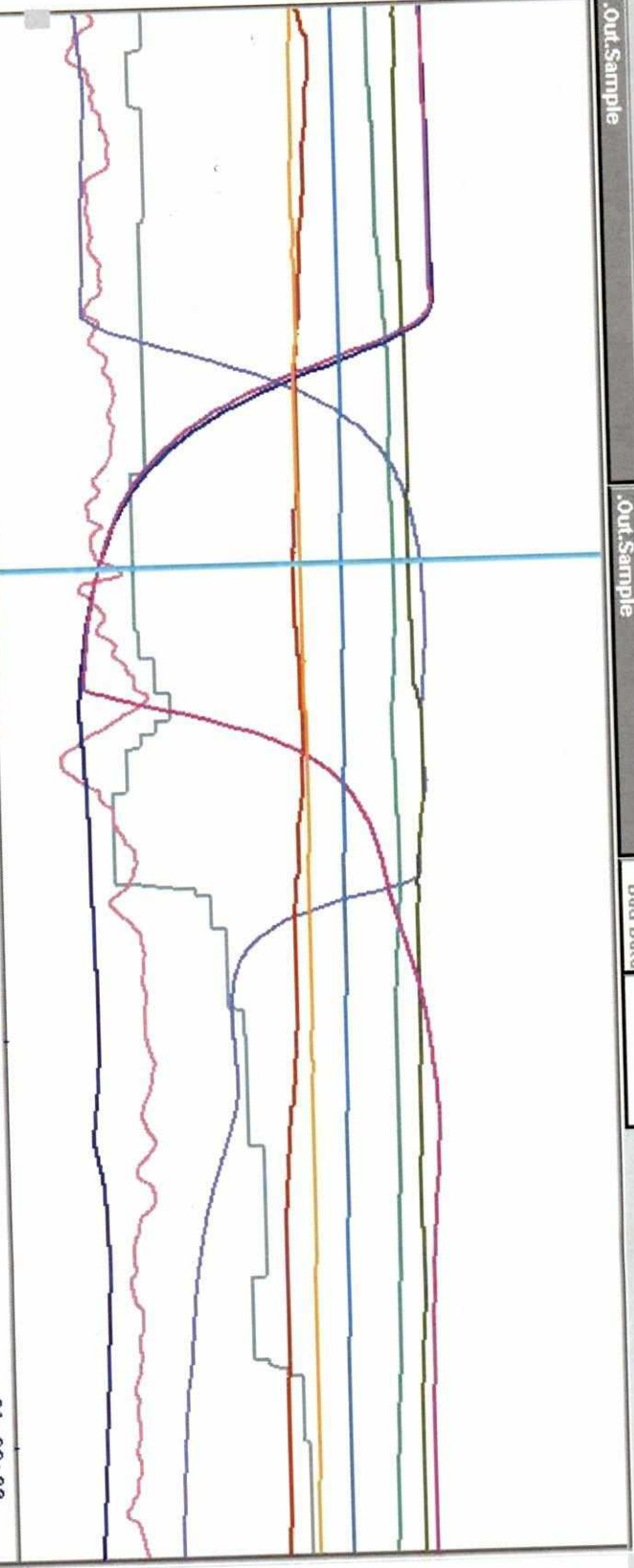
RAPH # 1A

Dynamic 8 Point Trend

.Out Sample

.Out Sample

Bad Data



22:00:00
01May2018

01May2018

23:00:00
01May2018

01May2018

00:00:00
02May2018

02May2018

01:00:00
02May2018

02May2018

21.00
16.80
12.60
8.40
4.20
0.00

01May2018 22:51:00

1HLD01CT102_XQ02.Out.Sample	50.4682
1HFE40CT001_XQ03.Out.Sample	68.4559
1HLA50CT001_XQ03.Out.Sample	68.5880
1HNA10CT001_XQ03.Out.Sample	329.4709
1HNA10CQ001_XQ01.Out.Sample	4.2044

1HLD01CT101_XQ02.Out.Sample	57.4057
1HFE20CT001_XQ02.Out.Sample	41.0446
1HLA30CT001_XQ02.Out.Sample	34.8004
1HNA30CT001_XQ02.Out.Sample	275.8822
1HNA30CQ001_XQ01.Out.Sample	4.7875

1HNA30CQ001_XQ01	Bad Data
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1HNA30CQ001_XQ01	Bad Data
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1HNA30CQ001_XQ01	Bad Data
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MFT	APRDS	MILL A	MILL B	MILL C	TDBFP A	TDBFP B	EHTC	CMC	1HNA30CQ001_XQ01
FLAME INTENSITY	SADC	MILL D	MILL E	MILL F	TP INDITTS	LUB OIL	HPBP	VACCUM	AH-A FG O/L O2 ANALY
BOILER CONTROL	CLCS	MILL G	MILL H	WALL B	TURB. PROTN	PCAL	LPBP	PW SYS	trends:OT12Ptmn dp1=1HLD01CT102_XQ02.

ACK	SOE	Alm Sum	15.0
RESET	ALARM	TEND	11.2

Clear A	Sele	8-P	Tre	12-F	Tre
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Clear A	Sele	8-P	Tre	12-F	Tre
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AH-A Guide Brg
PA o/L Temp
SA o/L Temp
FG o/L Temp
Eco o/L O2

AH-A SLP & Temp
PAF-A o/L Temp
SA o/L Temp
FG o/L Temp
Eco o/L O2

4/5/2018

RAPH # 1B

Dynamic 8 Point Trend

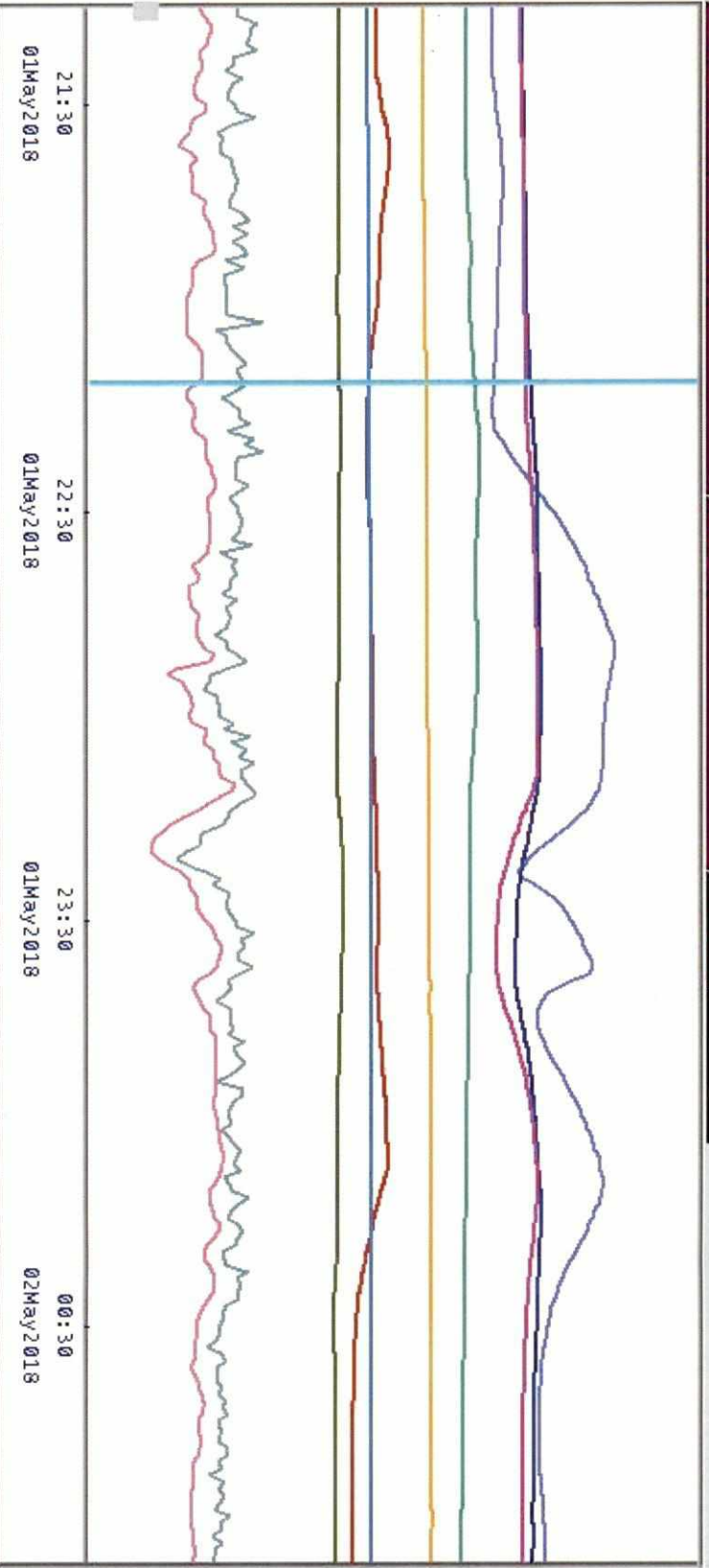
1HFE45CT001_XQ03.Out.Sample

TC FIELD

286.2326 °C

15:27:4

15May2018



01May2018 22:11:00													
<div></div>													
1HL002CT102_XQ02.Out.Sample	55.5565	1HL002CT101_XQ02.Out.Sample	46.2572	1HL002CT101_XQ02.Out.Sample	46.2572	1HL002CT101_XQ02.Out.Sample	46.2572	1HL002CT101_XQ02.Out.Sample	46.2572	1HL002CT101_XQ02.Out.Sample	46.2572	1HL002CT101_XQ02.Out.Sample	46.2572
1HFE45CT001_XQ03.Out.Sample	286.2326	1HFE25CT001_XQ02.Out.Sample	41.3224	1HFE25CT001_XQ02.Out.Sample	41.3224	1HFE25CT001_XQ02.Out.Sample	41.3224	1HFE25CT001_XQ02.Out.Sample	41.3224	1HFE25CT001_XQ02.Out.Sample	41.3224	1HFE25CT001_XQ02.Out.Sample	41.3224
1HLA60CT001_XQ03.Out.Sample	291.5110	1HLA40CT001_XQ02.Out.Sample	46.2225	1HLA40CT001_XQ02.Out.Sample	46.2225	1HLA40CT001_XQ02.Out.Sample	46.2225	1HLA40CT001_XQ02.Out.Sample	46.2225	1HLA40CT001_XQ02.Out.Sample	46.2225	1HLA40CT001_XQ02.Out.Sample	46.2225
1HMA20CT001_XQ03.Out.Sample	318.2789	1HMA40CT001_XQ02.Out.Sample	133.5672	1HMA40CT001_XQ02.Out.Sample	133.5672	1HMA40CT001_XQ02.Out.Sample	133.5672	1HMA40CT001_XQ02.Out.Sample	133.5672	1HMA40CT001_XQ02.Out.Sample	133.5672	1HMA40CT001_XQ02.Out.Sample	133.5672
1HMA20CQ001_XQ01.Out.Sample	3.7064	1HMA40CQ001_XQ01.Out.Sample	5.4090	1HMA40CQ001_XQ01.Out.Sample	5.4090	1HMA40CQ001_XQ01.Out.Sample	5.4090	1HMA40CQ001_XQ01.Out.Sample	5.4090	1HMA40CQ001_XQ01.Out.Sample	5.4090	1HMA40CQ001_XQ01.Out.Sample	5.4090
.Out.Sample	Bad Data	.Out.Sample	Bad Data	.Out.Sample	Bad Data	.Out.Sample	Bad Data	.Out.Sample	Bad Data	.Out.Sample	Bad Data	.Out.Sample	Bad Data
MFT	APRDS	MILL A	MILL B	MILL C	TDBFP A	TDBFP B	EHTC	CMC	1DrumLevelActual	Click to select a new tagname.			
FLAME INTENSITY	SADC	MILL D	MILL E	MILL F	TP INDITTS	LUB OIL	HPBP	VACCUM	Drum Level Actual(Average)	ACK	SOE	AlmsSum	AlmsSum
BOILER CONTROL	CLCS	MILL G	MILL H	WALL B	TURB. PROTN	PCAL	LPBP	PW SYS	trendSID12Pft.mn dp1=1HL001CT102_XQ02.	RESET	ALARM	TEND	10.9

PH-B Guide Brg
PA o/L Pump
SA o/L Pump
FG, FL Pump
Eco o/L or

Dynamic Trend

Pen-1 Pen-2 Pen-3 Pen-4 Pen-5 Pen-6 Pen-7 Pen-8 Pen-9 Pen-10 Pen-11 Pen-12

Clear All Pen Selection

8-Point Trend

12-Point Trend

DRUM LVL

MS FLOW

FW FLOW

COND FLOW

MOT LVL

CF LVL

1/5/2018

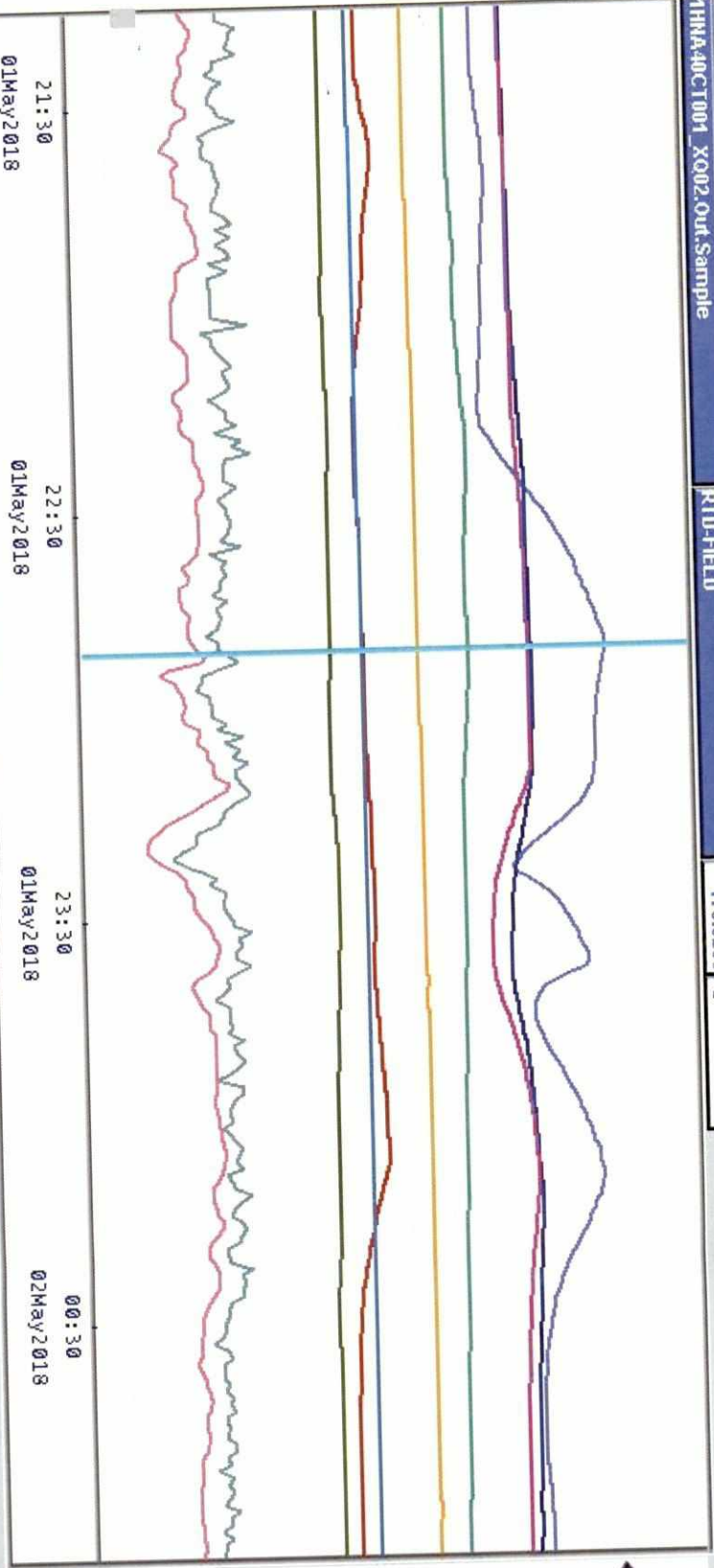
RAPH # 1B

Dynamic 8 Point Trend

1HNA40CT001_XQ02.Out.Sample

RTD-FIELD

173.3265 °C



01May2018 22:51:00		Bad Data	
1HL002CT102_XQ02.Out.Sample	55.8007	1HL002CT101_XQ02.Out.Sample	46.5355
1HFE45CT001_XQ03.Out.Sample	295.6702	1HFE25CT001_XQ02.Out.Sample	41.2529
1HLA60CT001_XQ03.Out.Sample	297.7477	1HLA40CT001_XQ02.Out.Sample	46.6746
1HNA20CT001_XQ03.Out.Sample	319.5531	1HNA40CT001_XQ02.Out.Sample	173.3265
1HNA20CQ001_XQ01.Out.Sample	4.3479	1HNA40CQ001_XQ01.Out.Sample	5.1804
.Out.Sample		Bad Data	
MFT	APRDS	MILL A	MILL B
FLAME INTENSITY	SADC	MILL D	MILL E
BOILER CONTROL	CLCS	MILL G	MILL H
		WALL B	
		TP INDICTR	LUB OIL
		TURB. PROTN	PCAL
			LPBP
			PW SYS
			CMC
			1DrumLevelActual
			Drum Level Actual(Average)
			trendst012P1.mn dp1=1HL001CT102_XQ02.
			RESET
			ALARM
			TRND
			Print
			HW Cond
			14.8
			11.1
			CF LVL
			MOT LV
			IA PRES
			COND FL
			FW FLOW
			MS FLOW
			DRUM LV

PH o/l Pump
SA o/l Pump
FG o/l Pump
Etc o/l o2

PH o/l Pump
SA o/l Pump
FG o/l Pump
Etc o/l o2

Dynamic Trend

Pen-1

Pen-2

Pen-3

Pen-4

Pen-5

Pen-6

Pen-7

Pen-8

Pen-9

Pen-10

Pen-11

Pen-12

Clear All Pen Selection

8-Point Trend

12-Point Trend

15May18 15:28:04

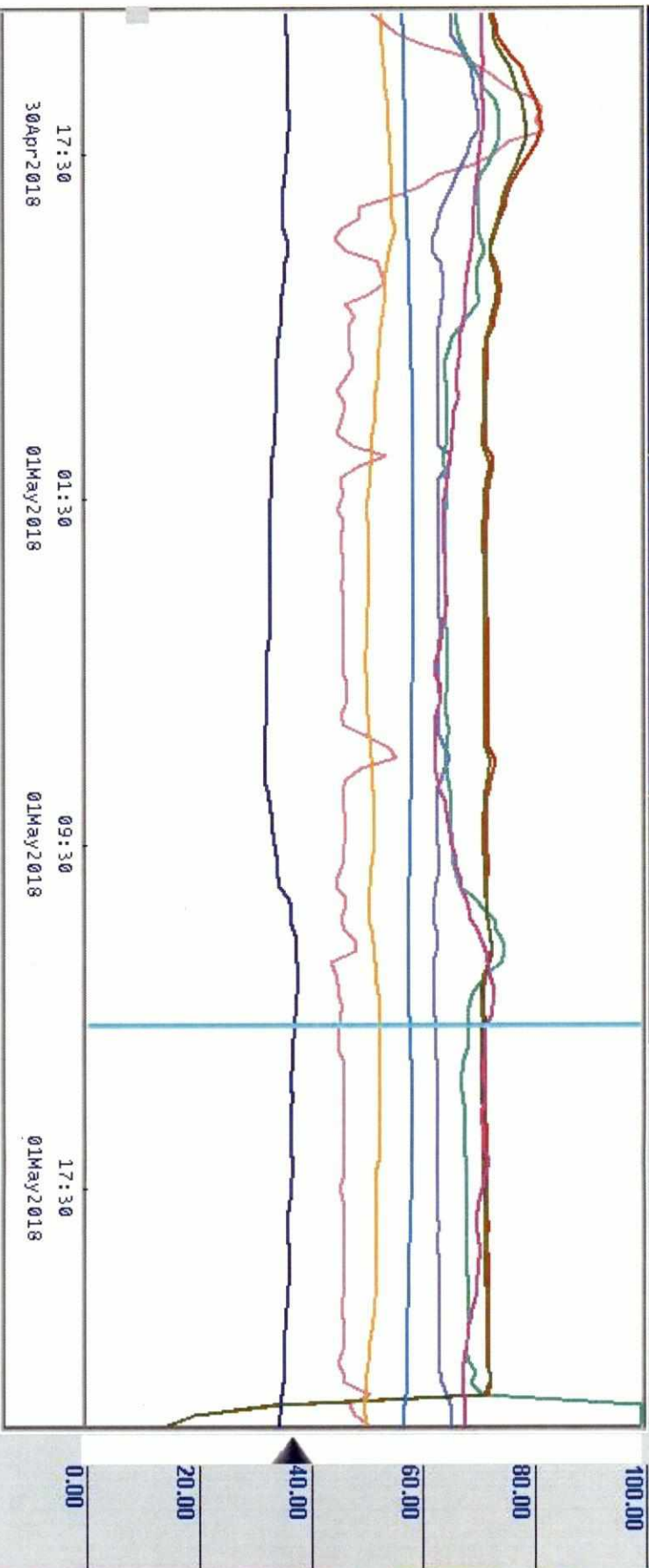
TrendCon...

Dynamic 8 Point Trend

1HL A30CT001_X002.Out.Sample

AH-A SA IL TMP

37.4700 °C



01May2018 13:45:00

AH-A GUIDE BRG TMP	52.9765
PAF-A OIL TMP	43.3372
AH-A SA IL TMP	37.4700
AH-A FG OIL TMP	137.8931
ACTUAL LOAD	274.8401
.Out.Sample	Bad Data

AH-A SUPP BRG TMP	58.4179
AH-A PA OIL TMP	286.5919
AH-A SA OIL TMP	288.2326
AH-A FG IL TMP	315.8614
.Out.Sample	Bad Data
.Out.Sample	Bad Data

MFT	APRDS	MILL A	MILL B	MILL C	TDBFP A	TDBFP B	EHTC	CMC	1HNA30CT001_X002
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FLAME INTENSITY	SADC	MILL D	MILL E	MILL F	TP INDITS	LUB OIL	HPBP	VACCUM	AH-A FG OIL TMP
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BOILER CONTROL	CLCS	MILL G	MILL H	WALL B	TURB. PROT	PCAL	LPBP	PW SYS	trends0T12Pt.mn dp1=1HLD01CT102_X002.
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ACK	RESET	ALARM	TREND	HW Cond	11.5	7.9
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