PRESENTS THIS REPORT TO:

AES GENER

COCHRANE PLANT
UNITS 1 and 2

Cochrane, Chile

REDUCED MINIMUM LOAD BOILER TUNING
LOWER MNT TUNING
NOx REDUCTION

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ABSTRACT

AES GENER, Cochrane Units 1 and 2 are both IHI built, natural-circulation, water-cooled furnace, superheater, reheater and economizer.

The boiler pressure parts are manufactured both by IHI's Aioi-Works and by IHI's Indonesian-Works both having large experience in the construction of super critical steam generators, that run at and above 600 Deg C Superheated steam at or below super critical pressures.

Both units are coal fired, capable of burning bituminous, sub-bituminous or a mixture of both types of coal, either individually by mill or mixed in silos.

Coal pulverization is achieved by 5 IHI mills, the unit also is equipped with several overfire air ports and side air ports (OAP and SAP) that are installed above the top row of burners and branch air from the secondary air duct, that in turn is routed into the furnace by the OAP and SAP ports and controlled by air dampers, in order to achieve staged combustion to control NOx and CO.

Air balance between OAP and SAP is established by adjusting manual dampers based on our experience and tuning efforts and by observing actual combustion conditions. Air (OAP SAP) is supplied via the same secondary air ducts as the windbox, but a ramification is done before the secondary air enter the main burner windboxes.

NOx limit for both units is 200 mg/Nm3 and CO is 100 ppm per unit.

Primary air control is a standard hot/cold damper control and PA flow is controlled via a curve in the DCS that controls PA flow vs. feeder speed.

Coal flow is measured in Tons/hr and air flow is also measured in T/hr. For combustion control, the feeder speed is measured in percent of the feeder speed provided by 5 gravimetric feeders.

The control system is provided by an Emerson OVATION DCS.

1.1.2 Boiler Specification

1) General

- Type of Steam Generator	IHI SR Single Drum Natural Circulation, Reheat Type for Outdoor Service
- Main fuel	Pulverized coal
- Supplemental fuel	Fuel Oil No.2 Oil

- Steam / water condition (at BMCR)

- Evaporation	764,186 kg/hr
- Steam pressure at superheater outlet T.P.	162.9 bara
- Steam temperature at superheater outlet T.P.	566.8 deg.C
- Steam pressure at reheater outlet T.P.	40.74 bara
- Steam temperature at reheater outlet T.P.	565.6 deg.C

2) Draft System

- Air and Flue gas system	Balanced draft system
- Primary air system	Cold primary air fan system
- Number of trains	Two train

3) Furnace Size

- Furnace width	13.4 m
- Furnace depth	12.7 m
- Furnace height (knuckle~roof)	42.3 m

4) Burner Arrangement

- Burner arrangement	; Opposed firing system
- Number of Coal burners	; 3 /row x 3 rows (front wall) ; 3 /row x 2 rows (rear wall) ; Total 15 burner with 3 spares
- Type of Coal burners	; Intervene dual flow type
- Number of Ignitor	; 1 per each coal burner, 15 in total
- Type of Ignitor	; Air atomizing, direct ignition

1. INTRODUCTION

Unit 1 and 2 were during commissioning and all chains optimized for what were the operational conditions at the time.

At that time, the minimum load had been set by the plant and dispatch at 85 MWg.

After several meetings with Mr. Edinson Bascuñan and Mr. Hugo Marin we were requested to lower the minimum load on both units.

Having informed both about the procedures and the tuning needs, we confirmed this could be done but only with the help of a new logic specially designed and conceived for extremely low loads and with new curves specifically designed for safe operation at those new low loads.

This is because at these low loads, and since the units will operate at less than 30% MCR, the units must be operated differently, and new conditions created in automatic for this.

I briefly explained the results, experiences and observations obtained at other plants, at very low operating loads (MW), where we had achieved loads as low as around 15-20% MCR.

At those other plants I was quite successful in tuning for operation well below <30% MCR, and obtained rather good results, which allows them a lot more flexibility and span during low load demands by dispatch and improved NOx control and emissions, whilst lowering CO as well.

For this, and as has been done in other plants, I requested the help of the Plant I&C Manager, Mr. Nelson Salas, and the assistance of the highly qualified specialist, Mr. Javier Brizuela and Roberto Caldera.

This assistance was necessary so that they could assist me and work with the I&C of the plant implementing the necessary logic that I would design and to enter the new curves and configurations that we needed. The logic changes made to Unit 1 were exactly the same as those made to Unit 2, with minor variations to the PID values.

This was done at the same time that I was testing and making the new curves for the unit, all to be done at very low loads, and the help of Mr. Marco Castro was important in coordinating all the efforts and collecting boiler data for me.

The excellent level of professionalism of all Operators and test and laboratory staff was also very high.

2) EXECUTIVE SUMMARY

The work developped on Units 1 and 2 at Cochrane are based on the requirements established in the technical bases of this assignement.

The development was based on improving the performance of ancillary services, heat rate and production operations for a new technical minimum, indicated in the following points:

- Achieve a better response of the units for different load gradient values (MW/min).

  To achieve these objectives, the following activities were carried out:

  - Adjustment and tuning of boilers with changes in control philosophy
  - New optimized primary air curves
  - New optimized secondary air curves
  - Pressure optimizations and windbox operation
  - New burner damper curves
  - Changes to Mill Primary air curves.
  - New optimized Excess air control (O2)
  - Newly designed and optimized control logic for all loads and low loads. (*)

  (*) Further information and details about the logic changes can be found in points 1) to 7) in Annex I attached with this report.

- Adjustment of the operating parameters to define a new technical minimum value.

  The unit has a defined technical minimum of 85 MW, at lower loads the unit would exceed its regulatory NOX limit of (200 mg/Nm3). Adjustments made to operate at a new, lower technical minimum allowed the unit to operate at 60MW.

To achieve this, the following actions were carried out:

- Adjustments to low load mill curves
- Windbox damper settings and new curves for regulation
- Burner air register adjustments and curves
- Separate burner damper curves
- Main windbox inlet damper curves
- OAP/SAP damper curves
- OAP/SAP air distribution damper adjustments
- Adjustments to all windbox damper curves.

3) DEVELOPMENT

Until June 2022, the unit could only go down to 85MW as a minimum load and the plant wanted to reduce the MNT (minimum technical threshold) value. NOx emissions were one of the limiting reasons.

Tuning was eventually scheduled for Units 1 and 2, with Unit 1 tuning in May and Unit 2 in June 2022.

The plan was to tune up earlier, but various delays and setbacks upset the initial schedule and the tuning was only scheduled for May 2022 and June 2022 respectively.

A tuning plan was made (see below) and with this, I provided enough information for the plant to start preparing the necessary and various logic change permits required, plan unit loads with dispatch, etc.

As for the logic change details and drawings, since these are the property of the Plant, please refer to the internal report issued by Mr. Javier Brizuela and Mr. Roberto Caldera, on the changes in logic, although these changes and operating philosophy were defined by me and explained in detail later in this reports annex I attachment.

At the time, the plant's desired low load target was 65 MW gross, based on various emails and conversations, but I tried to go lower and actually achieved a much lower value of 60MWg.

In Unit 1 with mills A and C. In Unit 2 with mills A and B we achieved 60MW gross, maintaining good emission control.

It is possible with one mill operation to run the unit. However, this is a one mill operation and significant changes need to be made as well as more intensive testing.

Several emails and instructions were previously sent, of which the most important and relevant to the topic were the following:

a) Objective -If possible - Adjust the control system to operate below 65MW gross
b) Increase Windbox to furnace pressure at lower loads
c) Obtain this with a pair of mills
d) Lower NOx, especially at high and low loads
e) Lower CO

Since running a unit at this low load of >30% MCR, there is a risk of overheating the Reheater, the load reduction was gradual and started at 85MW gross, with slow decreases in load each time as we progressed into the tuning until we reached 60MW.

Once proven that the unit could in fact run under these conditions and at these lower loads, tuning proceeded, this time knowing it would not pose any risk to the equipment or personnel.

4) LOW LOAD TUNING PROGRAM

In order to achieve the requests of running at lower loads, I proposed a series of tests, with the unit running, that would allow modifications to the lower end of the boiler curves, and Mills, improve on these and improve operations in general, at the same time assuring the lowest NOx and CO emissions possible, increase Windbox pressure and assure decent flame geometry.

COCHRANE 1

UNIT 1 TUNING TESTING SCHEDULE

TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	21-abr	22-abr	23-abr	24-abr	25-abr	26-abr	27-abr	28-abr	29-abr	30-abr	01-may	02-may	03-may	04-may	05-may	06-may	07-may	08-may	09-may	10-may	11-may	12-may	13-may
	jueves	viernes	sábado	domingo	lunes	martes	miércoles	jueves	viernes	sábado	domingo	lunes	martes	miércoles	jueves	viernes	sábado	domingo	lunes	martes	miércoles	jueves	viernes
Unit 1																							
FULL TO MIN LOAD BOILER DATA COLLECTION																							
RAMP FROM FULL LOAD TO MINIMUM LOAD																							
MILL DATA COLLECTION																							
MILL TUNING																							
MILL 1																							
MILL 2																							
MILL 3																							
MILL 4																							
MILL 5																							
FINENESS TESTING																							
LAODING NEW MILL CURVES																							
TUNING WITH NORMAL COAL																							
FULL LOAD BOILER TUNING & DATA COLLECTION 100%									275 MW			275 MW											
FULL LOAD Burner adjustments 100%											275 MW	275 MW											
MEDIUM HIGH LOAD 75% (206 MW)													206 MW										
MEDIUM LOAD 50% (137,5 MW)														137,5 MW									
LOW LOAD 30% (85 MW)															85 MW								
NEW MIN TECH < 30% Load																< 85 MW							
MAKING NEW BOILER CURVES																							
CREATE NEW LOGIC (remote engineering station)																							
INSTALL NEW LOGIC																							
LOAD RAMP TEST IN AUTO FROM FULL LOAD TO MIN LOAD AND BACK																							
TUNING FOR PRIMARY FRECUENY CONTROL																							

COCHRANE 2

UNIT 2 TUNING TESTING SCHEDULE

TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	30-may	31-may	01-jun	02-jun	03-jun	04-jun	05-jun	06-jun	07-jun	08-jun	09-jun	10-jun	11-jun	12-jun	13-jun	14-jun	15-jun	16-jun	17-jun	18-jun	19-jun	20-jun	21-jun
	lunes	martes	miércoles	jueves	viernes	sábado	domingo	lunes	martes	miércoles	jueves	viernes	sábado	domingo	lunes	martes	miércoles	jueves	viernes	sábado	domingo	lunes	martes
Unit 2																							
FULL TO MIN LOAD BOILER DATA COLLECTION																							
RAMP FROM FULL LOAD TO MINIMUM LOAD																							
MILL DATA COLLECTION																							
MILL TUNING																							
MILL A																							
MILL B																							
MILL C																							
MILL D																							
MILL E																							
FINENESS TESTING																							
LAODING NEW MILL CURVES																							
TUNING WITH NORMAL COAL																							
FULL LOAD BOILER TUNING & DATA COLLECTION 100%								275 MW		275 MW													
FULL LOAD Burner adjustments 100%									275 MW	275 MW													
MEDIUM HIGH LOAD 75% (206 MW)											206 MW												
MEDIUM LOAD 50% (137,5 MW)												137,5 MW											
LOW LOAD 30% (85 MW)															85 MW	< 85 MW							
NEW MIN TECH < 30% Load																							
MAKING NEW BOILER CURVES																							
CREATE NEW LOGIC (remote engineering station)																							
INSTALL NEW LOGIC																							
LOAD RAMP TEST IN AUTO FROM FULL LOAD TO MIN LOAD AND BACK																							
TUNING FOR PRIMARY FRECUENY CONTROL (200 - 275 Mw)																							
TUNING FOR PRIMARY FRECUENY CONTROL (85 - 200 Mw)																							
HORA ENTRADA (CHILE)	23:00	20:00	20:00	20:00	20:00		20:00	20:00	20:00	20:00	20:00	23:00			8:00	8:00	8:00	8:00	20:00		20:00	20:00	

5) TESTING AND SETTING UP OF BOILERS

As is done with a normal boiler and combustion tuning, the tuning and data checks consisted of a series of moves to the various combustion components and changes to the firing controls would be made to assess the behavior of the unit and measure the emission results obtained with these lower loads.

These include but are not limited to moves to main burner air dampers, burner air registers, OAP/SAP dampers, mill primary air curves, excess air, etc.

Each day we would start at a higher load and slowly decrease load as we went. The next day, the staring load would be the lowest load achieved the previous day and so on.

Also each day we would lower load further, until the minimum load was achieved and we could not lower load anymore, due to constraints or obstacles that we could not transpose, such as NOx limits.

Tuning was done over a period of 13 days and a total of 107 tests were completed on Unit 1 and 118 tests on Unit 2. Ranging from full load down to 60MW.

We started by performing a full boiler check running from full load down to 85MW on day 1 on each unit.

The tuning started at full load, followed by the half load tuning starting at 206 MWg, then 137 MWg, then the low load tuning starting at 85 MWg and ending at 60 MW G , having obtained a load reduction of 25 MWG from the original low load of 85MWg.

The first test run of the boiler was done in the AS FOUND state with the unit burning normal fuel at the minimum load the plant could support at the time. This was the multiple load test.

Following this, various boiler control parameters were tested and changed while observing how the unit would react. Based on those reactions, control change solutions were proposed and changed or modified accordingly. The data was provided from the trading desk through Excel by Mr. Marco Castro.

At the same time, Mr. Javier Brizuela and Mr. Roberto Caldera would be working in the DCS implementing the logic changes I had asked for, in order to allow operation at these low loads.

Control changes made during the test and evaluation sessions included:

- Different windbox damper positions affecting combustion
- New damper settings
- New OAP and SAP configuration
- New burner damper and register positions
- Mill tuning
- Excess air curve modifications
- Mill PA curve reduction at lower feeder speeds
- Other changes.

6) TEST DATA

Due to their size and the amount of data collected, the data sheets are attached with this report, in the form of Excel files, and will be sent with the email in where the report is sent.

Mr. Castro received a daily copy of this data sheet each day with the results obtained and loads achieved.

At same time, the normal unit's lower end of the curves was also improved and redesigned for operations at these lower loads.

During the tuning and testing, special attention was provided to the flame scanners and flame conditions and with each test the values noted in the test data sheet.

The Excel files with the technical sheets of the Boiler are:

- **Initial Boiler Load Ramp Data Test**
- **Full load test Mill C ON**
- **Full Load Test Mill C OFF**
- **Medium and low load testing**
- **Minimal Low Load Testing**
- **Load ramp tests**

7) TUNING IMPORTANT NOTES

The following important notes are important to mention in this report. They refer to observations and events that occurred during the tuning, that are worth noting.

Some of the issues were corrected or bypassed, others will remain and require future addressing

Below is a list of events. Some were corrected, others unfunded and others still need correction, but none interfere with achieving the low loads we were aiming for.

7.1) NOx at low loads was controlled with ammonia injection. After adjusting, the achievement reduced the ammonia injection to a minimum consumption at 60 MW

7.2) During tuning Mill airflow trip was at 42 ton/hr and was lowered to 35 ton/hr to avoid tripping mills once we lower the PA airflow to values as low as 10 Ton/hr. Later this was modified in the logic changes to a permanent value.

7.3) reduced the PA flow to a ratio that varies from 1.8 to 3.4 depending on the mill load.

7.4) Ignition points were observed and checked with each move.

7.5) tuned with all mill pairs.

7.6) limited the dropping of PA flow to 1.8 just for safety reasons. This gives us a large margin for instrument error and other unexpected effects inside the mills, such as roping, preferential coal paths etc.

8) CHANGES IN LOGIC AND OPERATION OF THE BOILER

The new logic was written, loaded and activated with tuning by Mr. Javier Brizuela and Mr. Roberto Caldera as we went along. The logical philosophy was provided by me.

The logic changes document both for Unit 1 and 2 can be found in Annex 1 at attached this report.

This logic was also populated with new curves accordingly (see below for new curves)

Logic loading was completed during tuning and logic for Windbox (auxiliary air set point), OAP and SAP and for operation below 85 MW gross were terminated. The new logic for very low load operation is as follows:

8.1 GENERAL LOW LOAD LOGIC: will switch to low load operation below 90 MWG and return to high load operation above 94 GMW. This is known as LOW LOAD logic and will be based on MW instead of relying on pressures and temperatures for combustion control, flame geometry and flame stability.

8.2 HHL burner sleeve damper logic: Below the low load setpoint and with 2 mills in service, the gates will now go from first stage pressure based windbox modulation to a MW based fixed position setting. The curves and data were provided by me and are as follows. This is valid for the operating condition of Mill "C", in service or out of service.

UNIT COCHRANE 1

BURNER SLEEVE DAMPERS HHL DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW / EXCESS AIR C MILL OFF

MAIN NORMAL OP >10.8			MAIN NORMAL OP >10.8 <90MW			START CURVE			T>60 + IGNITER			SHUTDOWN			EXCESS AIR C MILL OFF		
	coal T/h	%		coal T/h	%		coal T/h	%		coal T/h	%		F Oil P	%		BM dmd	% O2
1	0	28	1	0	32		0	28	1	0	15		0	50	1	0	10
2	15	28	2	15	32		20	33	2	30	15		20	50	2	30	8.5
3	18	28	3	20	34		27	50	3	100	15		40	50	3	37	8.23
4	20	33	4	25	40		30	52							4	54	4.6
5	27	50	5	30	44		35	55							5	81	3.45
6	30	52	6												6	107	3.5
7	35	55	7												7	150	3.5
8			8												8		
9			9												9		
10			10												10		
11			11												11		
12			12												12		

BURNER SLEEVE DAMPERS HHL DAMPERS C MILL ON - ABOVE AND BELLOW 90MW / EXCESS AIR C MILL ON

MAIN NORMAL OP >10.8			MAIN NORMAL OP >10.8 <90MW			START CURVE			T>60 + IGNITER			SHUTDOWN			1	0	10
	coal T/h	%		coal T/h	%		coal T/h	%		coal T/h	%		F Oil P	%	2	30	8.5
1	0	35	1	0	34		0	28	1	0	15		0	50	3	38	8
2	15	35	2	15	34		20	38	2	30	15		20	50	4	57	4.57
3	18	35	3	20	36		27	41	3	100	15		40	50	5	82	3.55
4	20	38	4	25	40		30	44							6	105	3.4
5	27	41	5	30	44		35	50							7	150	3.4
6	30	44	6												8		
7	35	50	7												9		
8			8												10		
9			9												11		
10			10												12		
11			11														
12			12														

UNIT COCHRANE 2

BURNER SLEEVE DAMPERS HHL DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW

MAIN NORMAL OP >10.8			MAIN NORMAL OP >10.8 <90MW			START CURVE			T>60 + IGNITER			SHUTDOWN		
	coal T/h	%		coal T/h	%		coal T/h	%		coal T/h	%		F Oil P	%
1	0	30	1	0	32		0	28	1	0	15		0	50
2	15	35	2	15	25		20	45	2	30	15		20	50
3	19	40	3	16	28		27	55	3	100	15		40	50
4	20	50	4	20	36		30	60						
5	27	60	5	30	45		35	60						
6	30	62	6											
7	35	62	7											
8			8											
9			9											
10			10											
11			11											
12			12											

EXCESS AIR C MILL OFF

	BM dmd	% O2
1	0	10
2	30	8.5
3	37	8.23
4	54	4.6
5	81	3.45
6	107	3.5
7	150	3.5
8		
9		
10		
11		
12		

BURNER SLEEVE DAMPERS HHL DAMPERS C MILL ON - ABOVE AND BELLOW 90MW

MAIN NORMAL OP >10.8			MAIN NORMAL OP >10.8 <90MW			START CURVE			T>60 + IGNITER			SHUTDOWN		
	coal T/h	%		coal T/h	%		coal T/h	%		coal T/h	%		F Oil P	%
1	0	40	1	0	34		0	28	1	0	15		0	50
2	15	40	2	15	34		20	45	2	30	15		20	50
3	18	40	3	20	36		27	48	3	100	15		40	50
4	20	45	4	25	40		30	50						
5	27	48	5	30	44		35	50						
6	30	50	6											
7	35	52	7											
8			8											
9			9											
10			10											
11			11											
12			12											

EXCESS AIR C MILL ON

	BM dmd	% O2
1	0	10
2	30	8.5
3	39	7.9
4	58	4.5
5	85	3.2
6	108	3.3
7	150	3.3
8		
9		
10		
11		
12		

8.3 Main windbox damper HLA Logic: Below the low load set point and with 2 mills in service, the main windbox dampers will now go from first stage pressure based windbox modulation to a fixed position setting based on MW.

The curves and data were provided by me and are as follows. This is valid for the operating condition of Mill “C”, in service or out of service.

UNIT COCHRANE 1

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW

PULV IN SERVICE			< 90MW			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	22	1	0	30	1	0	40	1	0	15
2	15	30	2	15	22	2	15	30	2	2	40	2	122.5	15
3	18	32	3	20	30	3	20	35	3	50	40	3	175	15
4	20	45	4	25	38	4	25	45	4	100	40	4	262.5	15
5	27	60	5	30	45	5	30	45	5	150	40	5	350	15
6	30	60	6			6	40	45	6	200	40	6	356.3	15
7	35	60	7			7	45	45	7	250	40	7	400	15
8	40	60	8			8	50	45	8	300	40	8		
9	50	60	9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

EXCESS AIR < 90MW

	MW	%
1	0	10
2	60	9.25
3	70	8.7
4	85	8.25
5	90	8
6	120	4.6
7		
8		
9		
10		
11		
12		
13		

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL ON - ABOVE AND BELLOW 90MW

PULV IN SERVICE			< 90MW			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	20	1	0	30	1	0	40	1	0	15
2	15	30	2	15	20	2	15	30	2	2	40	2	122.5	15
3	18	33	3	20	30	3	20	40	3	50	40	3	175	15
4	20	50	4	25	38	4	25	50	4	100	40	4	262.5	15
5	27	60	5	30	45	5	30	50	5	150	40	5	350	15
6	30	60	6			6	40	50	6	200	40	6	356.3	15
7	35	60	7			7	45	50	7	250	40	7	400	15
8	40	60	8			8	50	50	8	300	40	8		
9	50	60	9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

UNIT COCHRANE 2

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW

PULV IN SERVICE		
	coal T/h	%
1	0	30
2	15	30
3	19	32
4	20	40
5	27	50
6	30	55
7	35	55
8	40	60
9	50	60
10		
11		
12		

< 90MW		
	coal T/h	%
1	0	20
2	14	20
3	20	34
4	25	38
5	30	45
6		
7		
8		
9		
10		
11		
12		

DURING PURGE		
	MW	%
1	0	30
2	15	30
3	20	40
4	27	50
5	30	55
6	40	55
7	45	55
8	50	55
9		
10		
11		
12		

PULV OFF		
	MW	%
1	0	40
2	2	40
3	50	40
4	100	40
5	150	40
6	200	40
7	250	40
8	300	40
9		
10		
11		
12		

MILL OFF HHL OFF		
	MW	%
1	0	15
2	122.5	15
3	175	15
4	262.5	15
5	350	15
6	356.3	15
7	400	15
8		
9		
10		
11		
12		

EXCESS AIR < 90MW		
	MW	%
1	0	10
2	60	9
3	65	8.8
4	70	8.7
5	75	8.25
6	85	8
7	90	7.5
8	120	4.5
9		
10		
11		
12		
13		

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL ON - ABOVE AND BELLOW 90MW

PULV IN SERVICE		
	coal T/h	%
1	0	30
2	15	30
3	17	30
4	20	40
5	27	50
6	30	52
7	35	52
8	40	60
9	50	60
10		
11		
12		

< 90MW		
	coal T/h	%
1	0	20
2	15	20
3	20	32
4	25	40
5	30	45
6		
7		
8		
9		
10		
11		
12		

DURING PURGE		
	MW	%
1	0	30
2	15	30
3	20	40
4	25	50
5	30	50
6	40	50
7	45	50
8	50	50
9		
10		
11		
12		

PULV OFF		
	MW	%
1	0	40
2	2	40
3	50	40
4	100	40
5	150	40
6	200	40
7	250	40
8	300	40
9		
10		
11		
12		

MILL OFF HHL OFF		
	MW	%
1	0	15
2	122.5	15
3	175	15
4	262.5	15
5	350	15
6	356.3	15
7	400	15
8		
9		
10		
11		
12		

8.4 SAP logic OAP: Below the low load set point, the shock absorbers will now go from existing high load curves and work on low load curves provided by me as follows. The curves and data were provided by me and are as follows. This is valid for the operating condition of Mill "C", in service or out of service.

UNIT COCHRANE 1

SAP AND OAP DAMPERS MILL C OFF

	FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT	
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	50	2	30	50	2	30	50	2	30	50
3	37	50	3	37	50	3	37	50	3	37	50
4	42	50	4	42	50	4	42	50	4	42	50
5	58	60	5	58	60	5	58	60	5	58	60
6	75	90	6	75	90	6	75	90	6	75	90
7	100	90	7	100	90	7	100	90	7	100	90
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

ALL SAP AND OAP <90 MILL C OFF		
	MW	%
1	0	0
2	50	45
3	60	50
4	75	50
5	80	60
6	90	60
7	120	60
8		
9		
10		
11		

SAP AND OAP DAMPERS MILL C ON

	FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT	
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	50	2	30	50	2	30	50	2	30	50
3	38	50	3	38	50	3	38	50	3	38	50
4	42	50	4	42	50	4	42	50	4	42	50
5	57	65	5	57	65	5	57	65	5	57	65
6	75	80	6	75	80	6	75	80	6	75	80
7	100	85	7	100	85	7	100	85	7	100	85
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

ALL SAP AND OAP <90 MILL C ON		
	MW	%
1	0	0
2	50	45
3	60	50
4	65	60
5	80	60
6	90	60
7	120	60
8		
9		
10		
11		

UNIT COCHRANE 2

SAP AND OAP DAMPERS MILL C OFF											
FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	55	2	30	55	2	30	55	2	30	55
3	38	60	3	38	60	3	38	60	3	38	60
4	46	65	4	46	65	4	46	65	4	46	65
5	60	70	5	60	70	5	60	70	5	60	70
6	78	80	6	78	80	6	78	80	6	78	80
7	100	85	7	100	85	7	100	85	7	100	85
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

ALL SAP AND OAP <90 MILL C OFF		
	MW	%
1	0	0
2	50	52
3	60	65
4	70	65
5	85	60
6	90	60
7	120	60
8		
9		
10		
11		

SAP AND OAP DAMPERS MILL C ON											
FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	55	2	30	55	2	30	55	2	30	55
3	38	60	3	38	60	3	38	60	3	38	60
4	45	70	4	45	70	4	45	70	4	45	70
5	60	75	5	60	75	5	60	75	5	60	75
6	75	80	6	75	80	6	75	80	6	75	80
7	100	85	7	100	85	7	100	85	7	100	85
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

ALL SAP AND OAP <90 MILL C ON		
	MW	%
1	0	0
2	50	52
3	60	65
4	70	65
5	85	60
6	90	60
7	120	60
8		
9		
10		
11		

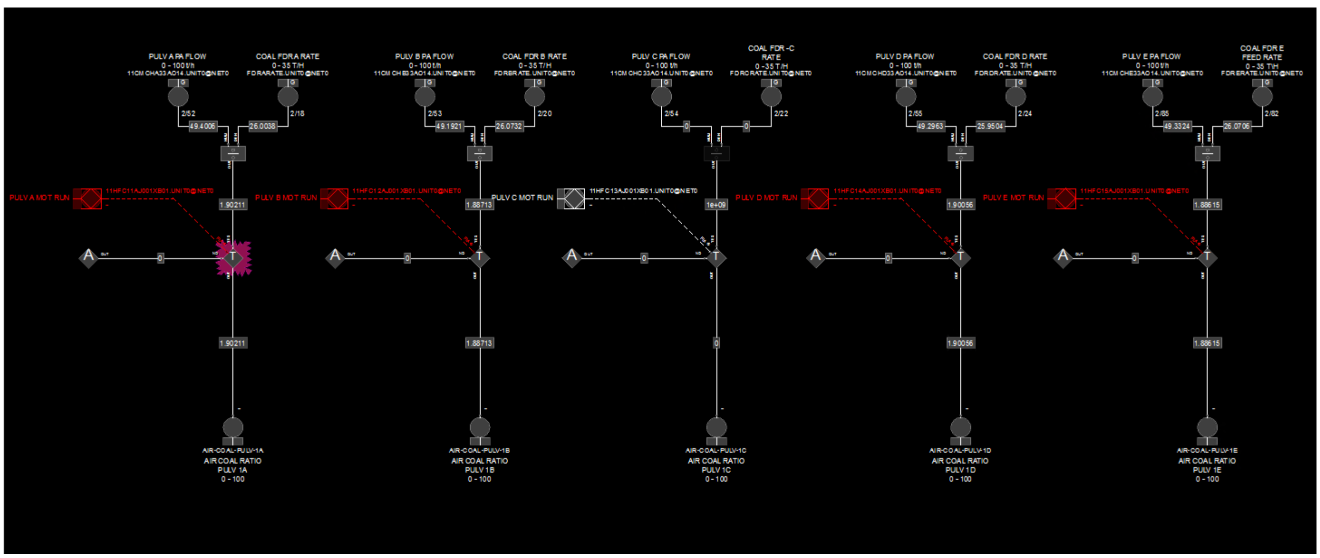
AES GENER July 2022
UNIT 1 and 2 Reduced Minimum Load Tuning

ANEX 1 LOGIC CHANGES

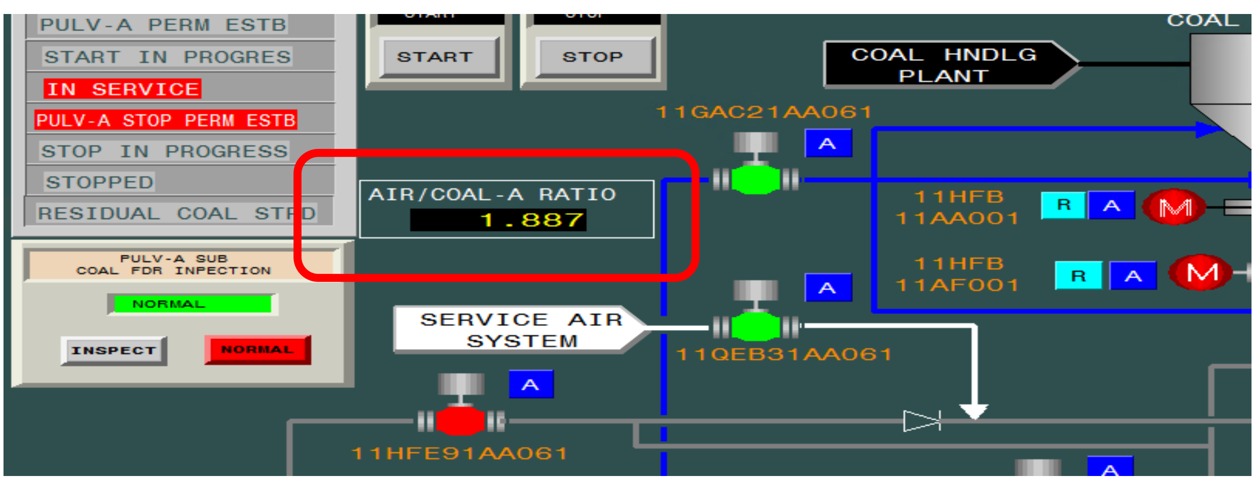
By: Alex Kossack
PTS - WY

COCHRANE UNIT 1 LOGIC CHANGES and OTHER REQUESTS
LOGIC CHANGES

1) Install in Ovation a MILL FUEL/AIR ratio window on all mill pages **DONE 26 APRIL**



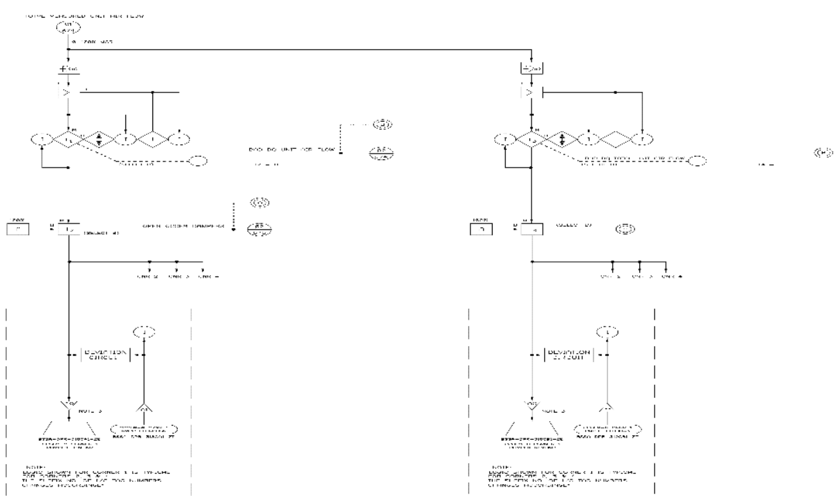
FEEDER A, B, C, D, E (DROP 2 TASK 4 SHEET 121).

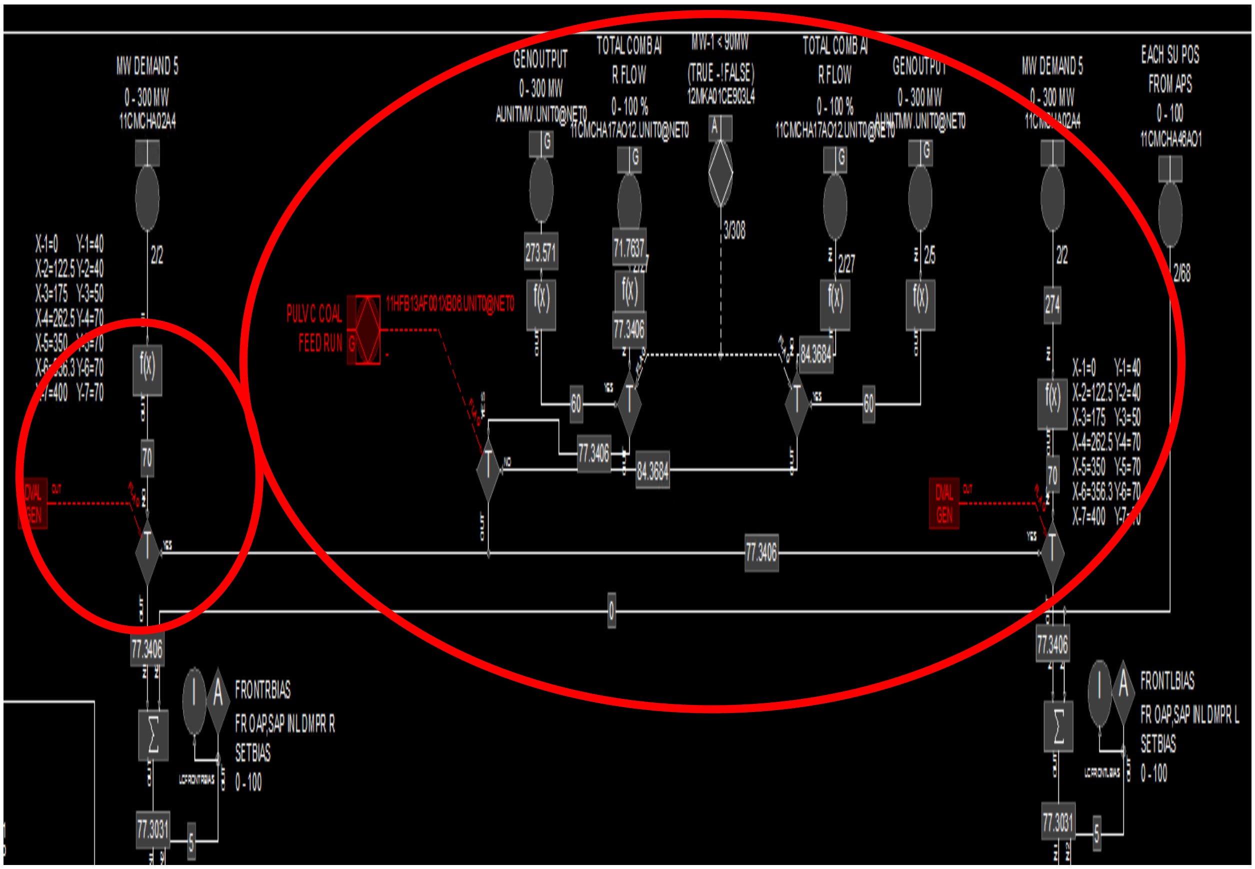


2) Install the following curves in all Mills **DONE 29 APRIL**

COCHRANE 1 MILL PRIMARY AIR CURVES														
NEW CURVES FOR DCS APRIL 2022 TUNING														
A PRIMARY AIR			B PRIMARY AIR			C PRIMARY AIR			D PRIMARY AIR			E PRIMARY AIR		
	X	Y		X	Y		X	Y		X	Y		X	Y
	Feeder Speed	Air		Feeder Speed	Air		Feeder Speed	Air		Feeder Speed	Air		Feeder Speed	Air
	T/hr	T/hr		T/hr	T/hr		T/hr	T/hr		T/hr	T/hr		T/hr	T/hr
1	0	41	1	0	41	1	0	41	1	0	41	1	0	41
2	10	41	2	10	41	2	10	41	2	10	41	2	10	41
3	16	41	3	16	41	3	16	41	3	16	41	3	16	41
4	25	48.5	4	25	48.5	4	25	48.5	4	25	48.5	4	25	48.5
5	40	60	5	40	60	5	40	60	5	40	60	5	40	60
6			6			6			6			6		
7			7			7			7			7		
8			8			8			8			8		
9			9			9			9			9		
10			10			10			10			10		

3) OAP AND SAP main control – change OAP and SAP master control from load to Total Airflow percentage. A sample logic for this is below. **DONE 29 APRIL**





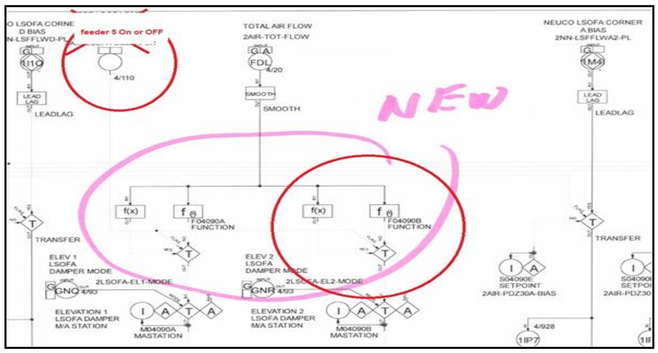
FRONT OAP/SAP DAMPER (DROP 2 TASK 4 SHEET 69)

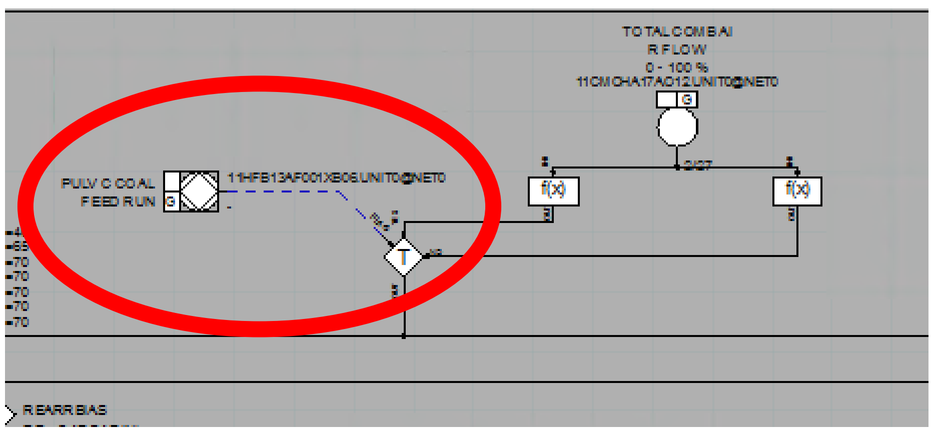
- 11HLA36AA071
- 11HLA76AA071

FRONT OAP/SAP DAMPER (DROP 2 TASK 4 SHEET 69-1)

- 11HLA37AA071
- 11HLA77AA071

4) Create 2 (Fx) for OAP and SAP one for Mill C ON and one for mill C OFF, with a transfer block activated by feeder C proven (see red below). **DONE 29 APRIL**

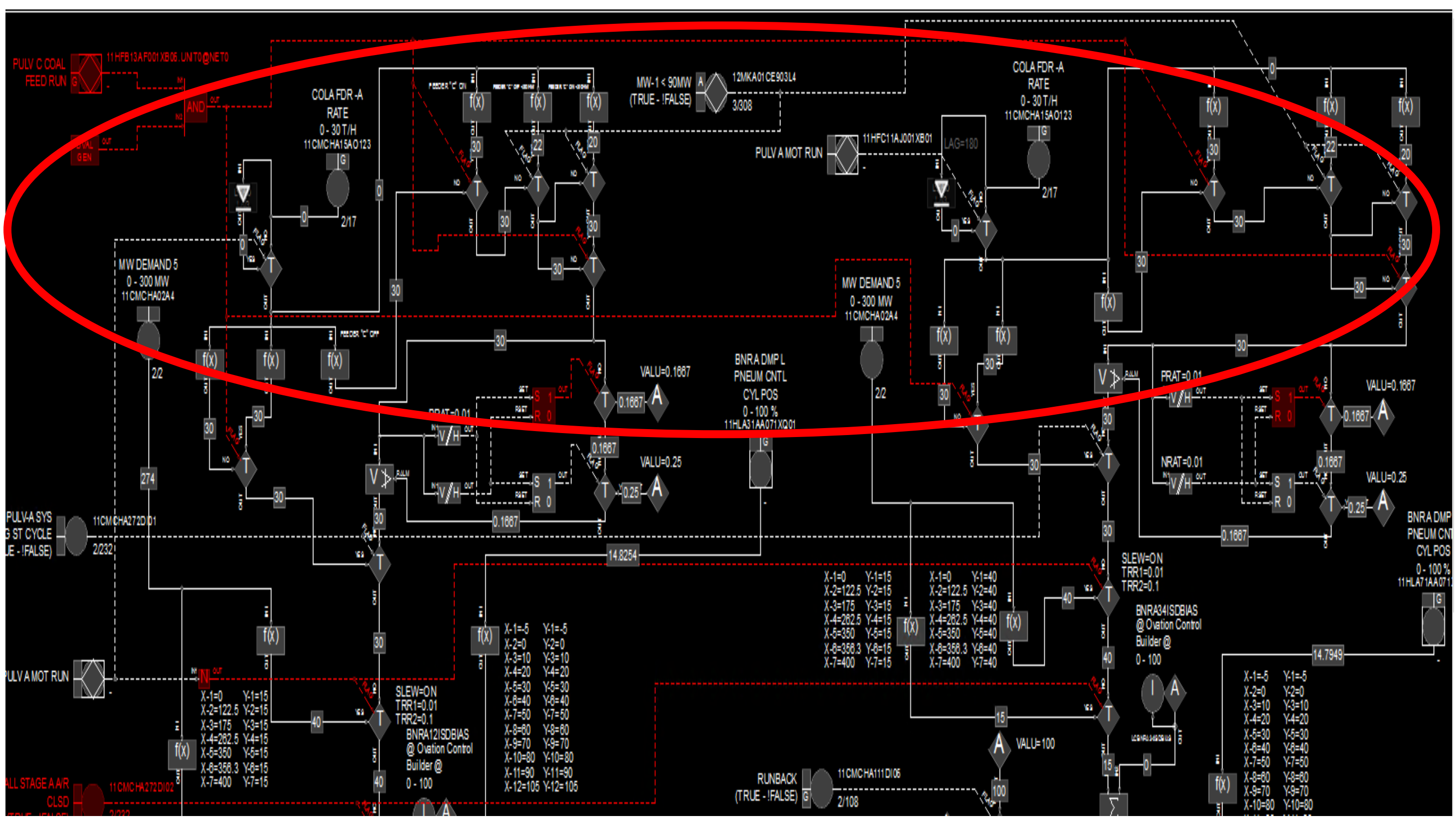




5) Create 2 (Fx) for all HLA and all HHL, one for Mill C ON and one for mill C OFF, with a transfer block activated by feeder C proven. Same logic as OFS, (see red above), but with different indexes. Using the current indexes MW for HLA and Coal Flow for HHL **DONE 02 MAY**

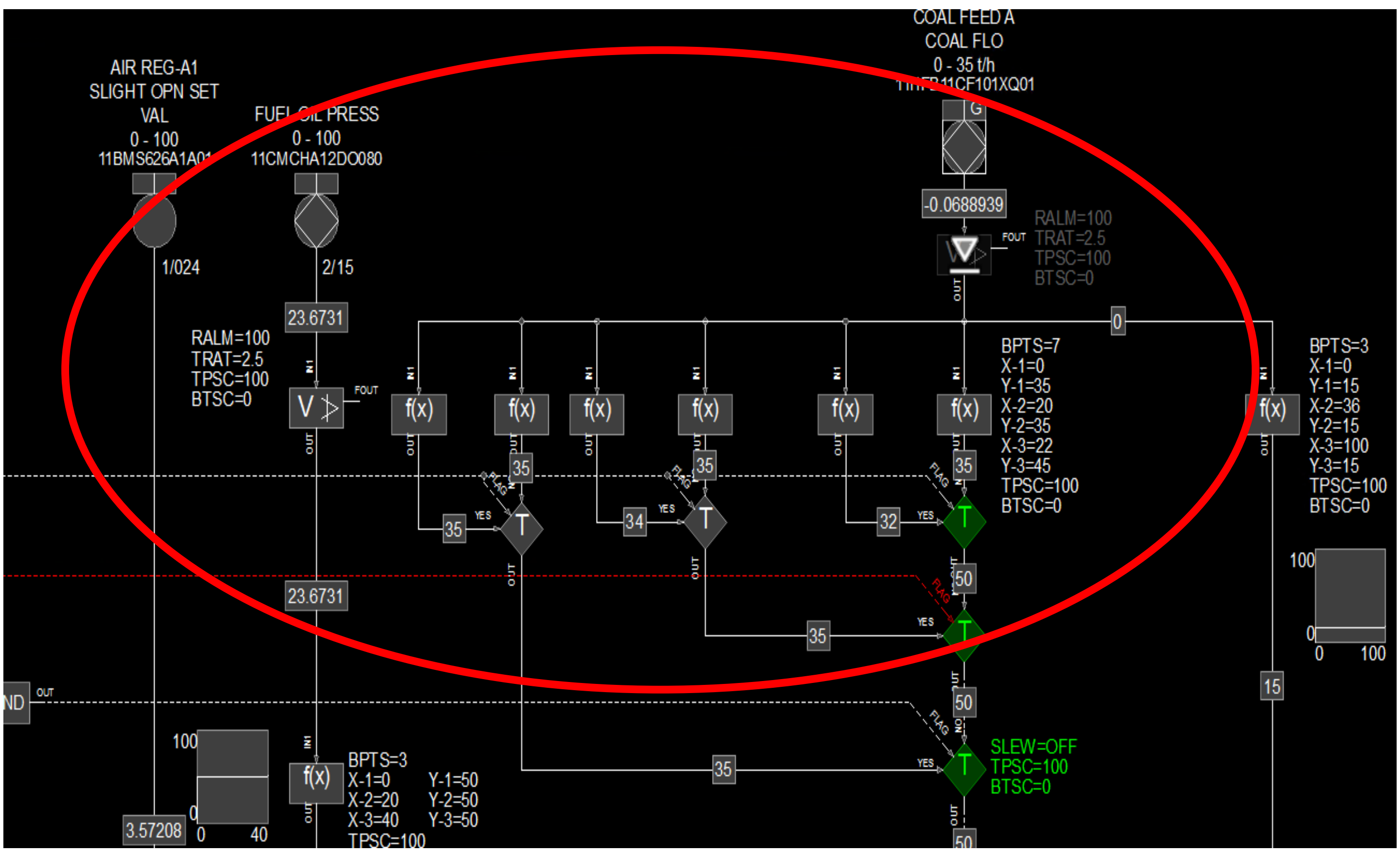
MAIN WINDBOX DAMPERS

- **11HLA31AA071 (LEFT) / 11HLA71AA071 (RIGHT) BURNER "A" (DROP 2 TASK 4 SHEET 64).**
- **11HLA32AA071 (LEFT) / 11HLA72AA071 (RIGHT) BURNER "B" (DROP 2 TASK 4 SHEET 65).**
- **11HLA33AA071 (LEFT) / 11HLA73AA071 (RIGHT) BURNER "C" (DROP 2 TASK 4 SHEET 66).**
- **11HLA34AA071 (LEFT) / 11HLA74AA071 (RIGHT) BURNER "D" (DROP 2 TASK 4 SHEET 67).**
- **11HLA35AA071 (LEFT) / 11HLA75AA071 (RIGHT) BURNER "E" (DROP 2 TASK 4 SHEET 99).**



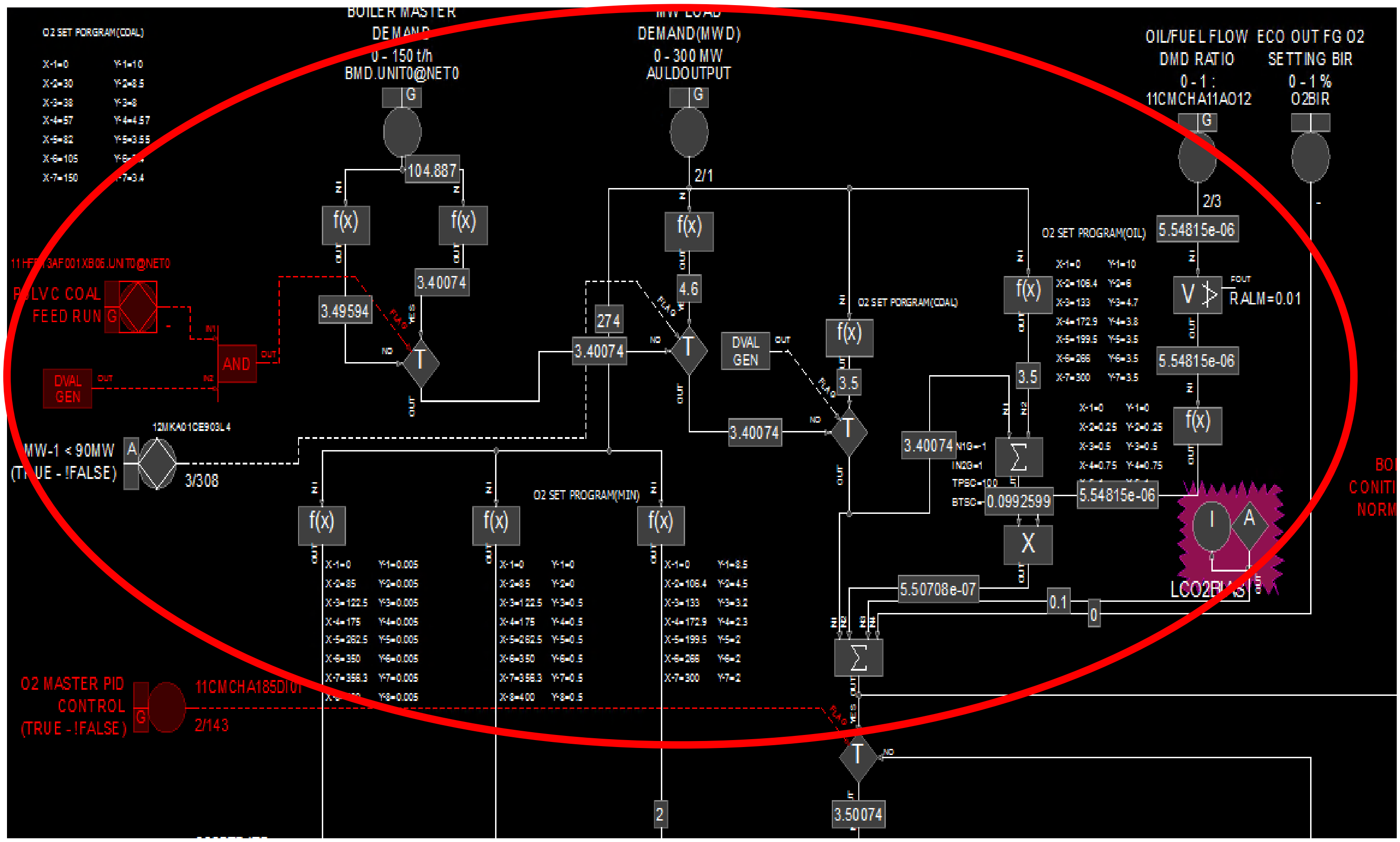
AIR REGISTER CONTROL

- **11HHL11AM001 BURNER SLEEVE DAMPERS "A1" (DROP 1 TASK 4 SHEET 010).**
- **11HHL12AM001 BURNER SLEEVE DAMPERS "A2" (DROP 1 TASK 4 SHEET 011).**
- **11HHL13AM001 BURNER SLEEVE DAMPERS "A3" (DROP 1 TASK 4 SHEET 012).**
- **11HHL21AM001 BURNER SLEEVE DAMPERS "B1" (DROP 1 TASK 4 SHEET 013).**
- **11HHL22AM001 BURNER SLEEVE DAMPERS "B2" (DROP 1 TASK 4 SHEET 017).**
- **11HHL23AM001 BURNER SLEEVE DAMPERS "B3" (DROP 1 TASK 4 SHEET 021).**
- **11HHL31AM001 BURNER SLEEVE DAMPERS "C1" (DROP 1 TASK 4 SHEET 014).**
- **11HHL32AM001 BURNER SLEEVE DAMPERS "C2" (DROP 1 TASK 4 SHEET 018).**
- **11HHL33AM001 BURNER SLEEVE DAMPERS "C3" (DROP 1 TASK 4 SHEET 022).**
- **11HHL41AM001 BURNER SLEEVE DAMPERS "D1" (DROP 1 TASK 4 SHEET 015).**
- **11HHL42AM001 BURNER SLEEVE DAMPERS "D2" (DROP 1 TASK 4 SHEET 019).**
- **11HHL43AM001 BURNER SLEEVE DAMPERS "D3" (DROP 1 TASK 4 SHEET 023).**
- **11HHL51AM001 BURNER SLEEVE DAMPERS "E1" (DROP 1 TASK 4 SHEET 016).**
- **11HHL52AM001 BURNER SLEEVE DAMPERS "E2" (DROP 1 TASK 4 SHEET 020).**
- **11HHL53AM001 BURNER SLEEVE DAMPERS "E3" (DROP 1 TASK 4 SHEET 035).**



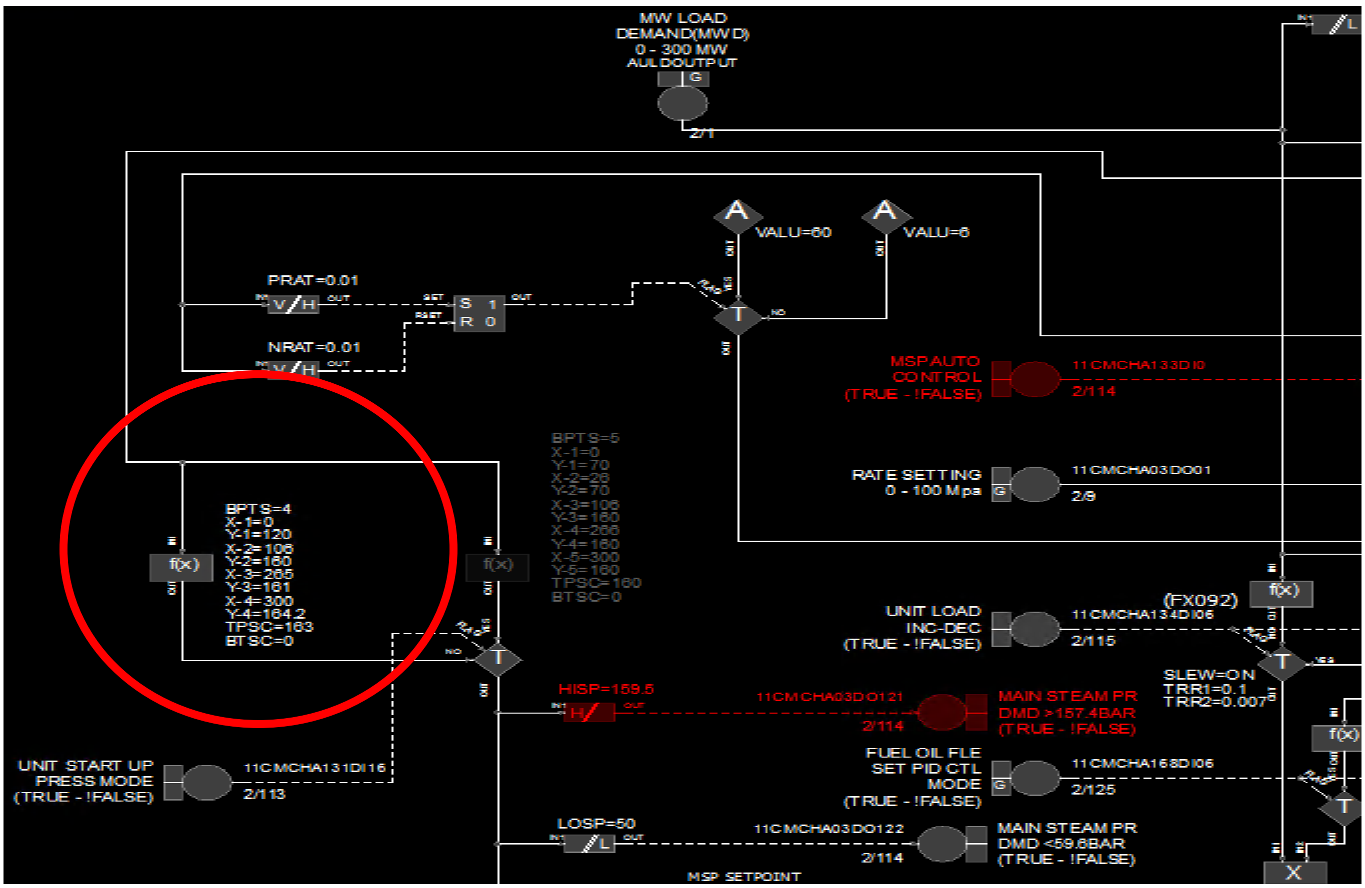
6) **EXCESS AIRE**

- **AIR FLOW CONTROL (DROP 2 TASK 4 SHEET 25).**



7) **SLIDING PRESSURE**

- **BOILER MASTER CONTROL (DROP 2 TASK 4 SHEET 7).**



OLD CURVES

AES GENER - COCHRANE UNIT 1
CURVES LOADED IN DCS

UNIT 1 CURVES AS FOUND DO NOT USE

BURNER SLEEVE DAMPERS HHL DAMPERS / **EXCESS AIR**

	MAIN NORMAL OP >10.8			START CURVE			T>60 + IGNITER			SHUTDOWN			EXCESS AIR	
	coal T/h	%		coal T/h	%		coal T/h	%		F Oil P	%		MW	% O2
1	0	35	1	0	35	1	0	15		0	50		0	10
2	20	35	2	20	35	2	30	15		20	50		106.4	6
3	22	45	3	22	45	3	100	15		40	50		133	4.7
4	30	45	4	30	45	4							172.9	3.8
5	35	45	5	35	45	5							199.5	3.5
6			6			6							266	3.5
7			7			7							300	3.5
8			8			8								
9			9			9								
10			10			10								
11			11			11								
12			12			12								

MAIN WINDBOX DAMPERS HLA DAMPERS

	PULV IN SERVICE			DURING PURGE			PULV OFF			MILL OFF HHL OFF	
	coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	40	1	0	40	1	0	15
2	15	30	2	2	40	2	2	40	2	122.5	15
3	20	35	3	50	40	3	50	40	3	175	15
4	25	40	4	100	40	4	100	40	4	262.5	15
5	30	45	5	150	40	5	150	40	5	350	15
6	40	45	6	200	40	6	200	40	6	356.3	15
7	45	45	7	250	40	7	250	40	7	400	15
8	50	45	8	300	40	8	300	40	8		
9			9			9			9		
10			10			10			10		
11			11			11			11		
12			12			12			12		

SAP AND OAP DAMPERS

	FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT	
	MW	%		MW	%		MW	%		MW	%
1	0	40	1	0	40	1	0	40	1	0	40
2	122.5	40	2	122.5	40	2	122.5	40	2	122.5	40
3	175	50	3	175	50	3	175	50	3	175	50
4	262.5	70	4	262.5	70	4	262.5	70	4	262.5	70
5	350	70	5	350	70	5	350	70	5	350	70
6	356.3	70	6	356.3	70	6	356.3	70	6	356.3	70
7	400	70	7	400	70	7	400	70	7	400	70
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		
12			12			12			12		

NEW CURVES

AES GENER - COCHRANE UNIT 1
CURVES LOADED IN DCS

UNIT 1 NEW CURVES AFTER BOILER TUNING 9-MAY 2022 Alex and Javier Brizuela

BURNER SLEEVE DAMPERS HHL DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW / **EXCESS AIR C MILL OFF**

	MAIN NORMAL OP >10.8			MAIN NORMAL OP >10.8 <90MW		START CURVE			T>60 + IGNITER		SHUTDOWN			EXCESS AIR C MILL OFF	
	coal T/h	%		coal T/h	%	coal T/h	%		coal T/h	%	F Oil P	%		BM dmd	% O2
1	0	28	1	0	32	0	28	1	0	15	0	50	1	0	10
2	15	28	2	15	32	20	33	2	30	15	20	50	2	30	8.5
3	18	28	3	20	34	27	50	3	100	15	40	50	3	37	8.23
4	20	33	4	25	40	30	52						4	54	4.6
5	27	50	5	30	44	35	55						5	81	3.45
6	30	52	6										6	107	3.5
7	35	55	7										7	150	3.5
8			8										8		
9			9										9		
10			10										10		
11			11										11		
12			12										12		

BURNER SLEEVE DAMPERS HHL DAMPERS C MILL ON - ABOVE AND BELLOW 90MW

	MAIN NORMAL OP >10.8			MAIN NORMAL OP >10.8 <90MW		START CURVE			T>60 + IGNITER		SHUTDOWN	
	coal T/h	%		coal T/h	%	coal T/h	%		coal T/h	%	F Oil P	%
1	0	35	1	0	34	0	28	1	0	15	0	50
2	15	35	2	15	34	20	38	2	30	15	20	50
3	18	35	3	20	36	27	41	3	100	15	40	50
4	20	38	4	25	40	30	44					
5	27	41	5	30	44	35	50					
6	30	44	6									
7	35	50	7									
8			8									

EXCESS AIR C MILL ON

1	0	10
2	30	8.5
3	38	8
4	57	4.57
5	82	3.55
6	105	3.4
7	150	3.4
8		
9		
10		

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW														
PULV IN SERVICE			< 90MW			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	22	1	0	30	1	0	40	1	0	15
2	15	30	2	15	22	2	15	30	2	2	40	2	122.5	15
3	18	32	3	20	30	3	20	35	3	50	40	3	175	15
4	20	45	4	25	38	4	25	45	4	100	40	4	262.5	15
5	27	60	5	30	45	5	30	45	5	150	40	5	350	15
6	30	60	6			6	40	45	6	200	40	6	356.3	15
7	35	60	7			7	45	45	7	250	40	7	400	15
8	40	60	8			8	50	45	8	300	40	8		
9	50	60	9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

EXCESS AIR < 90MW		
	MW	%
1	0	10
2	60	9.25
3	70	8.7
4	85	8.25
5	90	8
6	120	4.6
7		
8		
9		
10		
11		
12		
13		

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL ON - ABOVE AND BELLOW 90MW														
PULV IN SERVICE			< 90MW			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	20	1	0	30	1	0	40	1	0	15
2	15	30	2	15	20	2	15	30	2	2	40	2	122.5	15
3	18	33	3	20	30	3	20	40	3	50	40	3	175	15
4	20	50	4	25	38	4	25	50	4	100	40	4	262.5	15
5	27	60	5	30	45	5	30	50	5	150	40	5	350	15
6	30	60	6			6	40	50	6	200	40	6	356.3	15
7	35	60	7			7	45	50	7	250	40	7	400	15
8	40	60	8			8	50	50	8	300	40	8		
9	50	60	9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

SAP AND OAP DAMPERS MILL C OFF											
FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	50	2	30	50	2	30	50	2	30	50
3	37	50	3	37	50	3	37	50	3	37	50
4	42	50	4	42	50	4	42	50	4	42	50
5	58	60	5	58	60	5	58	60	5	58	60
6	75	90	6	75	90	6	75	90	6	75	90
7	100	90	7	100	90	7	100	90	7	100	90
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

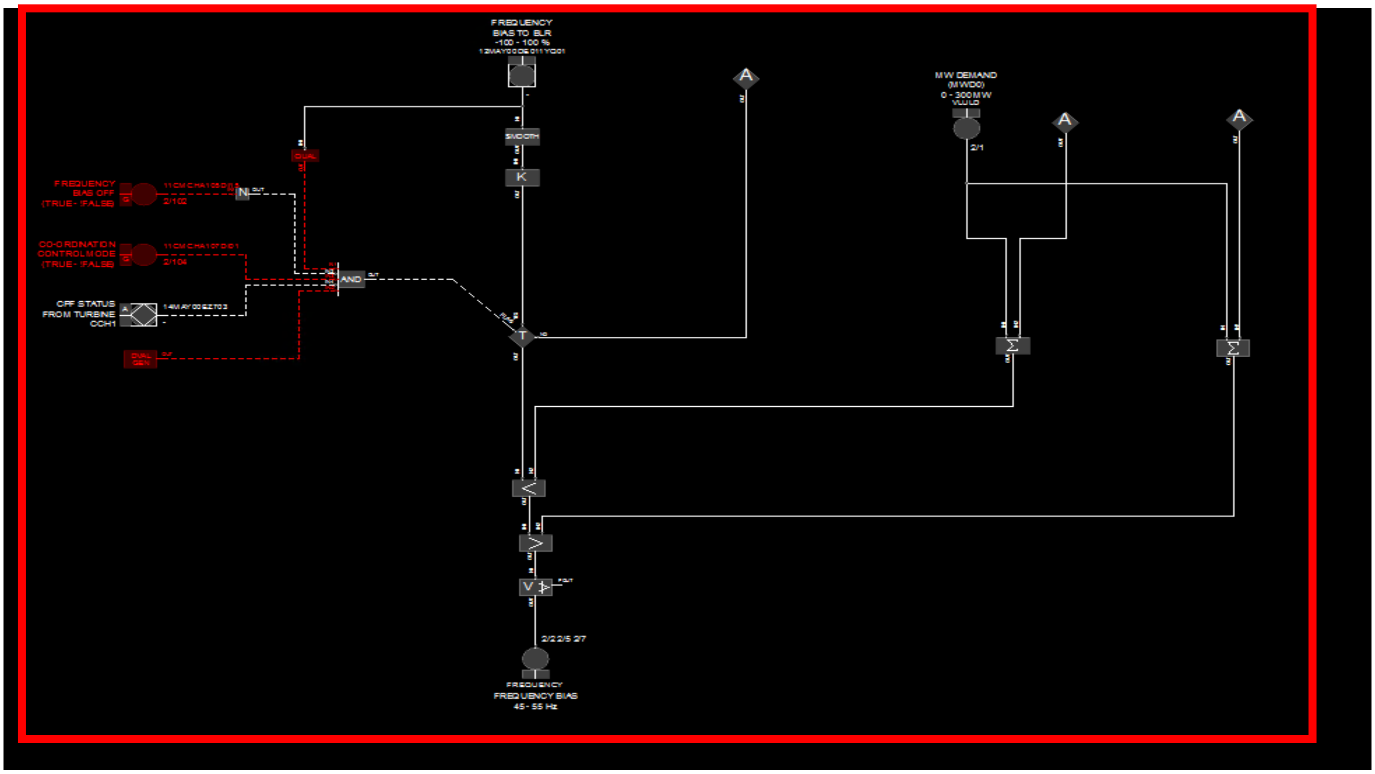
ALL SAP AND OAP <90 MILL C OFF		
	MW	%
1	0	0
2	50	45
3	60	50
4	75	50
5	80	60
6	90	60
7	120	60
8		
9		
10		
11		

SAP AND OAP DAMPERS MILL C ON											
FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	50	2	30	50	2	30	50	2	30	50
3	38	50	3	38	50	3	38	50	3	38	50
4	42	50	4	42	50	4	42	50	4	42	50
5	57	65	5	57	65	5	57	65	5	57	65
6	75	80	6	75	80	6	75	80	6	75	80
7	100	85	7	100	85	7	100	85	7	100	85
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

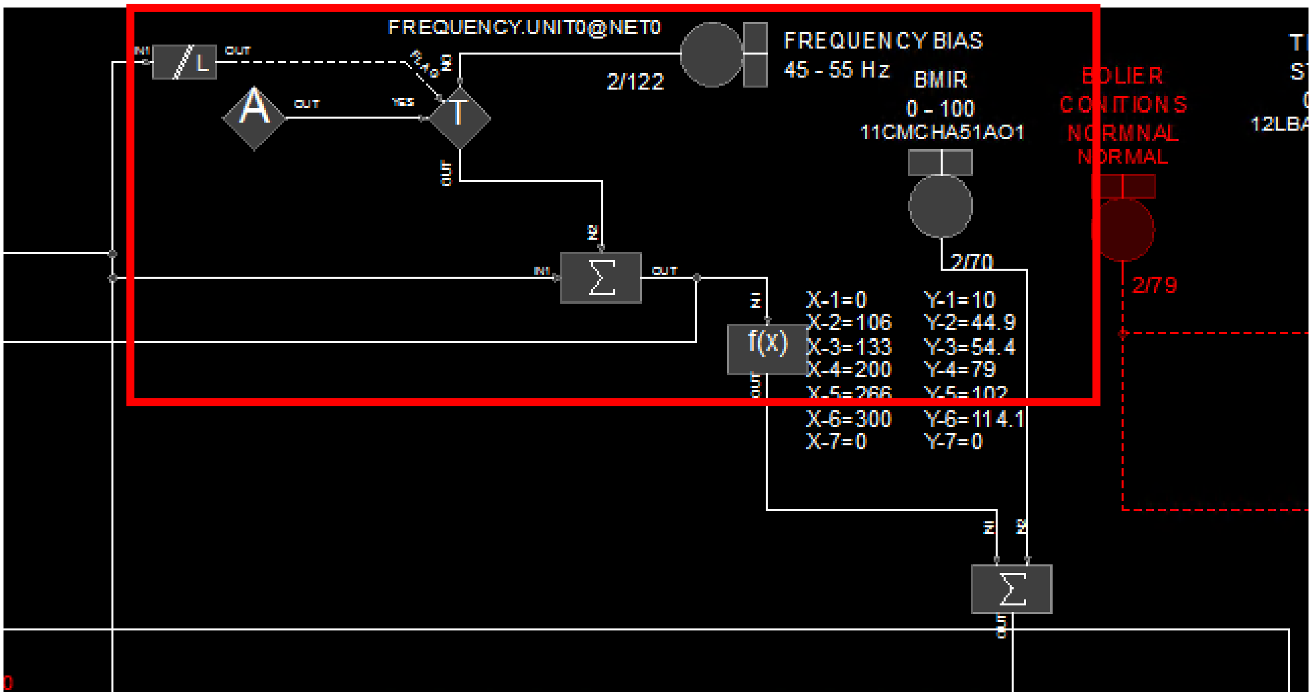
ALL SAP AND OAP <90 MILL C ON		
	MW	%
1	0	0
2	50	45
3	60	50
4	65	60
5	80	60
6	90	60
7	120	60
8		
9		
10		
11		

<u>FRECUENCY CORRECTION</u>

- **(DROP 2 TASK 4 SHEET 122).**



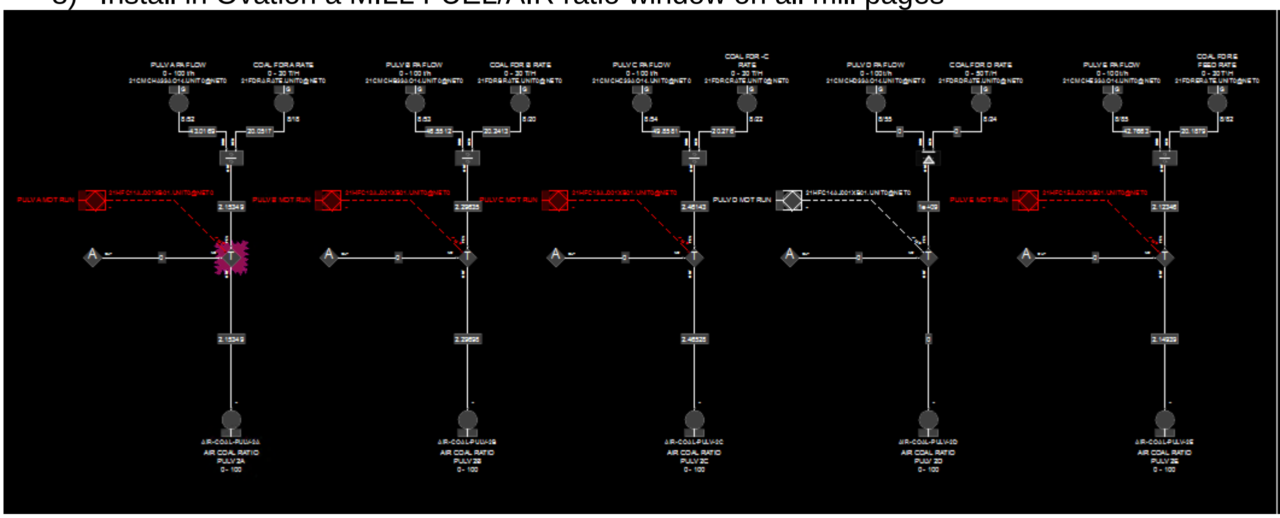
- **BOILER MASTER CONTROL (DROP 2 TASK 4 SHEET 7).**



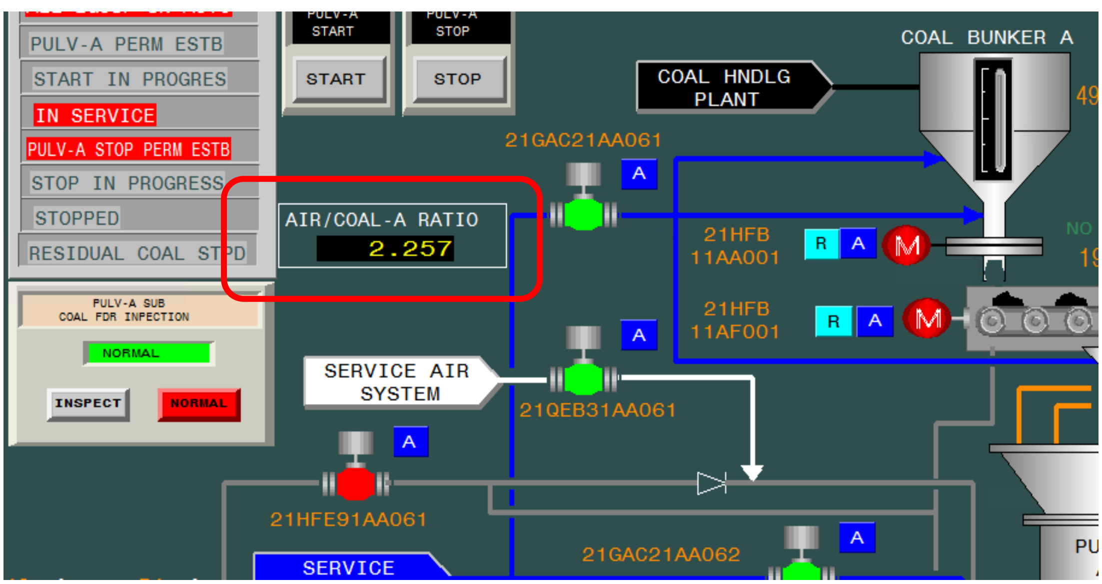
By: Alex Kossack
PTS - WY

COCHRANE UNIT 2 LOGIC CHANGES and OTHER REQUESTS
LOGIC CHANGES

8) Install in Ovation a MILL FUEL/AIR ratio window on all mill pages



FEEDER A, B, C, D, E (DROP 8 TASK 4 SHEET 121).



9) Install the following curves in all Mills

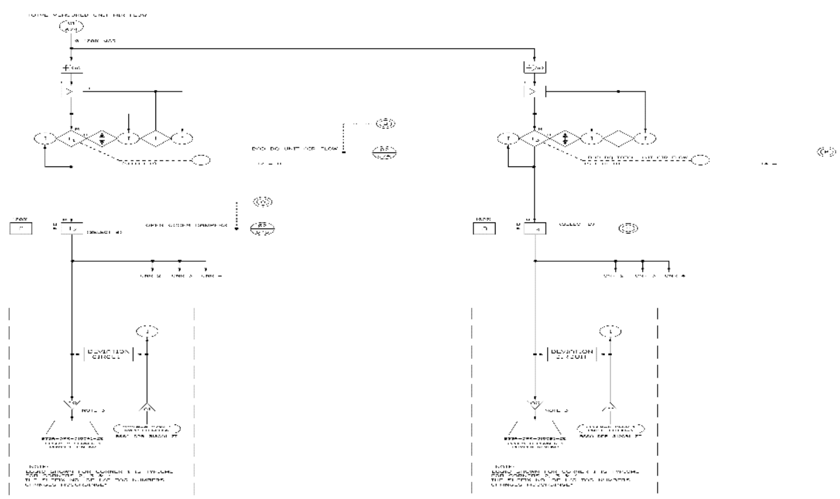
NUEVAS CURVAS DE AIRE PRIMARIO DE PULVERIZADORES

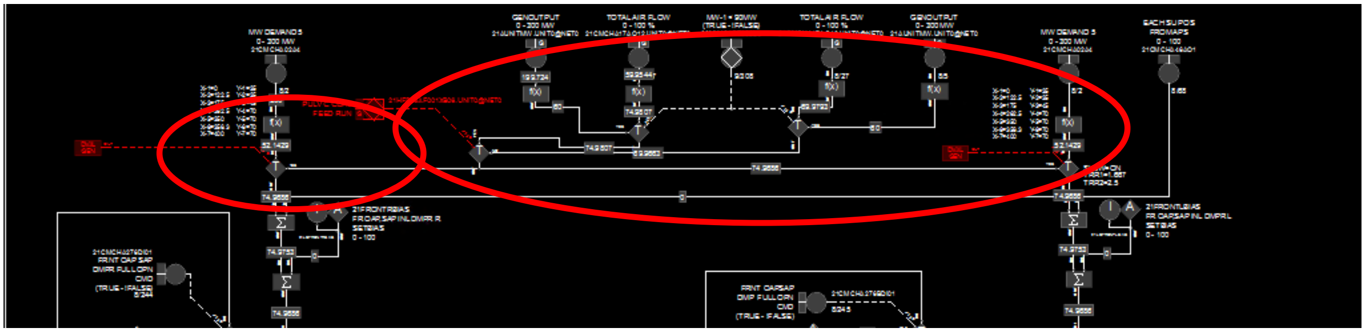
COCHRANE 2 MILL PRIMARY AIR CURVES

NEW CURVES FOR DCS JUNE 2022 TUNING

A PRIMARY AIR			B PRIMARY AIR			C PRIMARY AIR			D PRIMARY AIR			E PRIMARY AIR		
	X	Y		X	Y		X	Y		X	Y		X	Y
	Feeder Speed	Air		Feeder Speed	Air		Feeder Speed	Air		Feeder Speed	Air		Feeder Speed	Air
	T/hr	T/hr		T/hr	T/hr		T/hr	T/hr		T/hr	T/hr		T/hr	T/hr
1	0	40	1	0	40	1	0	40	1	0	40	1	0	40
2	10	40	2	10	40	2	10	40	2	10	40	2	10	40
3	16	40	3	16	40	3	16	40	3	16	40	3	16	40
4	25	48	4	25	48	4	25	48	4	25	48	4	25	48
5	40	59	5	40	59	5	40	59	5	40	59	5	40	59
6			6			6			6			6		
7			7			7			7			7		
8			8			8			8			8		
9			9			9			9			9		
10			10			10			10			10		

10) OAP AND SAP main control – change OAP and SAP master control from load to Total Airflow percentage. A sample logic for this is below.





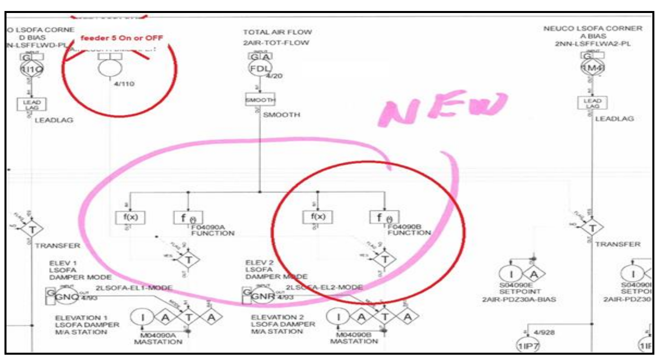
FRONT OAP/SAP DAMPER (DROP 8 TASK 4 SHEET 69)

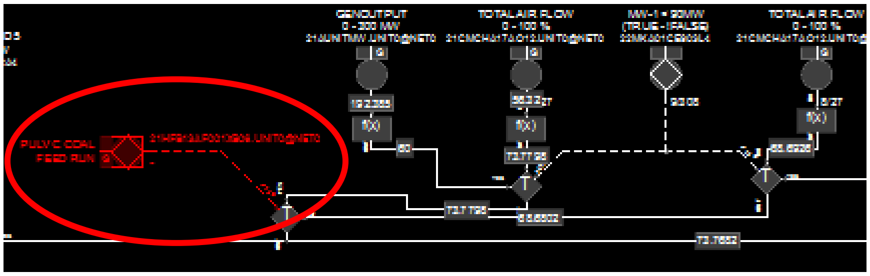
- 21HLA36AA071
- 21HLA76AA071

FRONT OAP/SAP DAMPER (DROP 8 TASK 4 SHEET 69-1)

- 21HLA37AA071
- 21HLA77AA071

11) Create 2 (Fx) for OAP and SAP one for Mill C ON and one for mill C OFF, with a transfer block activated by feeder C proven (see red below).

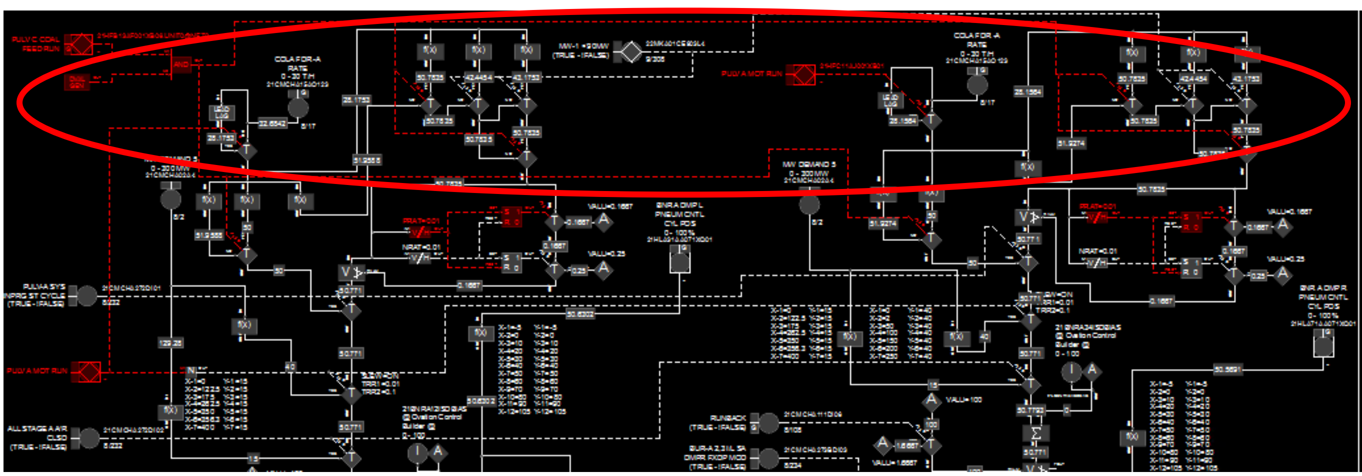




12) Create 2 (Fx) for all HLA and all HHL, one for Mill C ON and one for mill C OFF, with a transfer block activated by feeder C proven. Same logic as OFS, (see red above), but with different indexes. Using the current indexes MW for HLA and Coal Flow for HHL

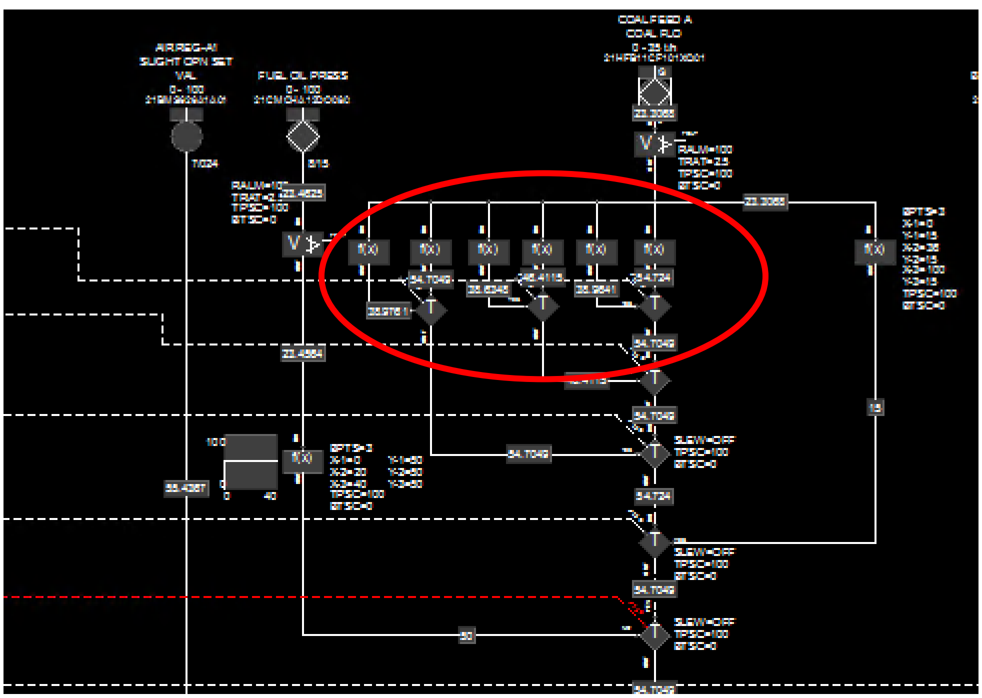
MAIN WINDBOX DAMPERS

- **21HLA31AA071 (LEFT) /21HLA71AA071 (RIGHT) BURNER "A" (DROP 8 TASK 4 SHEET 64).**
- **21HLA32AA071 (LEFT) / 21HLA72AA071 (RIGHT) BURNER "B" (DROP 8 TASK 4 SHEET 65).**
- **21HLA33AA071 (LEFT) / 21HLA73AA071 (RIGHT) BURNER "C" (DROP 8 TASK 4 SHEET 66).**
- **21HLA34AA071 (LEFT) / 21HLA74AA071 (RIGHT) BURNER "D" (DROP 8 TASK 4 SHEET 67).**
- **21HLA35AA071 (LEFT) / 21HLA75AA071 (RIGHT) BURNER "E" (DROP 8 TASK 4 SHEET 99).**



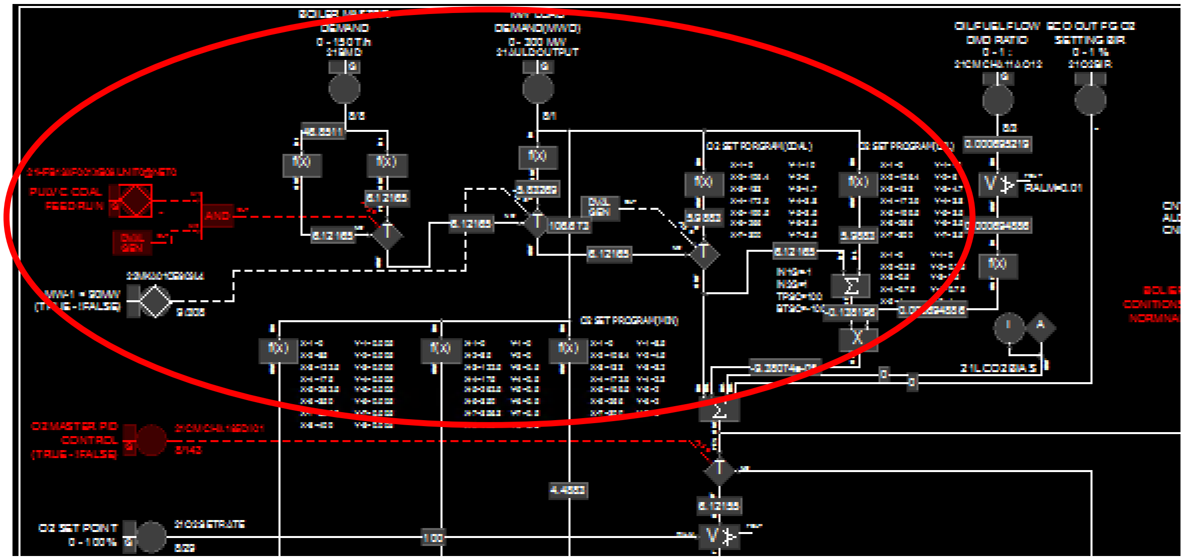
<u>AIR REGISTER CONTROL</u>

- **21HHL11AM001 BURNER SLEEVE DAMPERS "A1" (DROP 7 TASK 4 SHEET 010).**
- **21HHL12AM001 BURNER SLEEVE DAMPERS "A2" (DROP 7 TASK 4 SHEET 011).**
- **21HHL13AM001 BURNER SLEEVE DAMPERS "A3" (DROP 7 TASK 4 SHEET 012).**
- **21HHL21AM001 BURNER SLEEVE DAMPERS "B1" (DROP 7 TASK 4 SHEET 013).**
- **21HHL22AM001 BURNER SLEEVE DAMPERS "B2" (DROP 7 TASK 4 SHEET 017).**
- **21HHL23AM001 BURNER SLEEVE DAMPERS "B3" (DROP 7 TASK 4 SHEET 021).**
- **21HHL31AM001 BURNER SLEEVE DAMPERS "C1" (DROP 7 TASK 4 SHEET 014).**
- **21HHL32AM001 BURNER SLEEVE DAMPERS "C2" (DROP 7 TASK 4 SHEET 018).**
- **21HHL33AM001 BURNER SLEEVE DAMPERS "C3" (DROP 7 TASK 4 SHEET 022).**
- **21HHL41AM001 BURNER SLEEVE DAMPERS "D1" (DROP 7 TASK 4 SHEET 015).**
- **21HHL42AM001 BURNER SLEEVE DAMPERS "D2" (DROP 7 TASK 4 SHEET 019).**
- **21HHL43AM001 BURNER SLEEVE DAMPERS "D3" (DROP 7 TASK 4 SHEET 023).**
- **21HHL51AM001 BURNER SLEEVE DAMPERS "E1" (DROP 7 TASK 4 SHEET 016).**
- **21HHL52AM001 BURNER SLEEVE DAMPERS "E2" (DROP 7 TASK 4 SHEET 020).**
- **21HHL53AM001 BURNER SLEEVE DAMPERS "E3" (DROP 7 TASK 4 SHEET 035).**



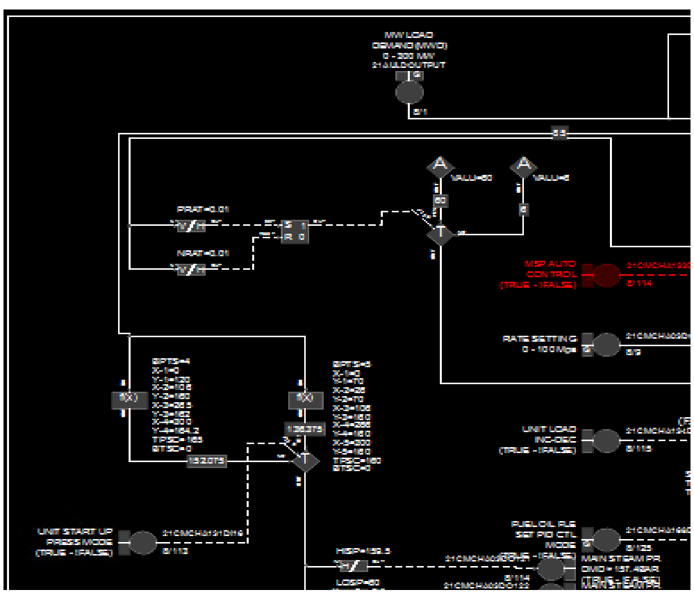
13) **EXCESS AIRE**

- **AIR FLOW CONTROL (DROP 8 TASK 4 SHEET 25).**



14) **SLIDING PRESSURE**

- **BOILER MASTER CONTROL (DROP 8 TASK 4 SHEET 7).**



OLD CURVES

UNIT 2 CURVES AS FOUND DO NOT USE

BURNER SLEEVE DAMPERS HHL DAMPERS

MAIN NORMAL OP >10.8			START CURVE			T>60 + IGNITER			SHUTDOWN		
	coal T/h	%		coal T/h	%		coal T/h	%		F Oil P	%
1	0	35	1	0	35	1	0	15		0	50
2	20	35	2	20	35	2	30	15		20	50
3	22	45	3	22	45	3	100	15		40	50
4	30	45	4	30	45	4					
5	35	45	5	35	45	5					
6			6			6					
7			7			7					
8			8			8					
9			9			9					
10			10			10					
11			11			11					
12			12			12					

EXCESS AIR

	MW	% O2
	0	10
	106.4	6
	133	4.7
	172.9	3.8
	199.5	3.5
	266	3.5
	300	3.5

MAIN WINDBOX DAMPERS HLA DAMPERS

PULV IN SERVICE			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	30	1	0	40	1	0	15
2	15	30	2	15	30	2	2	40	2	122.5	15
3	20	35	3	20	35	3	50	40	3	175	15
4	25	40	4	25	40	4	100	40	4	262.5	15
5	30	45	5	30	45	5	150	40	5	350	15
6	40	45	6	40	45	6	200	40	6	356.3	15
7	45	45	7	45	45	7	250	40	7	400	15
8	50	45	8	50	45	8	300	40	8		
9			9			9			9		
10			10			10			10		
11			11			11			11		
12			12			12			12		

SAP AND OAP DAMPERS

FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	MW	%		MW	%		MW	%		MW	%
1	0	40	1	0	40	1	0	40	1	0	40
2	122.5	40	2	122.5	40	2	122.5	40	2	122.5	40
3	175	50	3	175	50	3	175	50	3	175	50
4	262.5	70	4	262.5	70	4	262.5	70	4	262.5	70
5	350	70	5	350	70	5	350	70	5	350	70
6	356.3	70	6	356.3	70	6	356.3	70	6	356.3	70
7	400	70	7	400	70	7	400	70	7	400	70
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		
12			12			12			12		

NEW CURVES

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL OFF - ABOVE AND BELLOW 90MW

PULV IN SERVICE			< 90MW			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	20	1	0	30	1	0	40	1	0	15
2	15	30	2	14	20	2	15	30	2	2	40	2	122.5	15
3	19	32	3	20	34	3	20	40	3	50	40	3	175	15
4	20	40	4	25	38	4	27	50	4	100	40	4	262.5	15
5	27	50	5	30	45	5	30	55	5	150	40	5	350	15
6	30	55	6			6	40	55	6	200	40	6	356.3	15
7	35	55	7			7	45	55	7	250	40	7	400	15
8	40	60	8			8	50	55	8	300	40	8		
9	50	60	9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

EXCESS AIR < 90MW

	MW	%
1	0	10
2	60	9
3	65	8.8
4	70	8.7
5	75	8.25
6	85	8
7	90	7.5
8	120	4.5
9		
10		
11		
12		
13		

MAIN WINDBOX DAMPERS HLA DAMPERS C MILL ON - ABOVE AND BELLOW 90MW

PULV IN SERVICE			< 90MW			DURING PURGE			PULV OFF			MILL OFF HHL OFF		
	coal T/h	%		coal T/h	%		MW	%		MW	%		MW	%
1	0	30	1	0	20	1	0	30	1	0	40	1	0	15
2	15	30	2	15	20	2	15	30	2	2	40	2	122.5	15
3	17	30	3	20	32	3	20	40	3	50	40	3	175	15
4	20	40	4	25	40	4	25	50	4	100	40	4	262.5	15
5	27	50	5	30	45	5	30	50	5	150	40	5	350	15
6	30	52	6			6	40	50	6	200	40	6	356.3	15
7	35	52	7			7	45	50	7	250	40	7	400	15
8	40	60	8			8	50	50	8	300	40	8		
9	50	60	9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

SAP AND OAP DAMPERS MILL C OFF

FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	55	2	30	55	2	30	55	2	30	55
3	38	60	3	38	60	3	38	60	3	38	60
4	46	65	4	46	65	4	46	65	4	46	65
5	60	70	5	60	70	5	60	70	5	60	70
6	78	80	6	78	80	6	78	80	6	78	80
7	100	85	7	100	85	7	100	85	7	100	85
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

ALL SAP AND OAP <90 MILL C OFF

	MW	%
1	0	0
2	50	52
3	60	65
4	70	65
5	85	60
6	90	60
7	120	60
8		
9		
10		
11		

SAP AND OAP DAMPERS MILL C ON

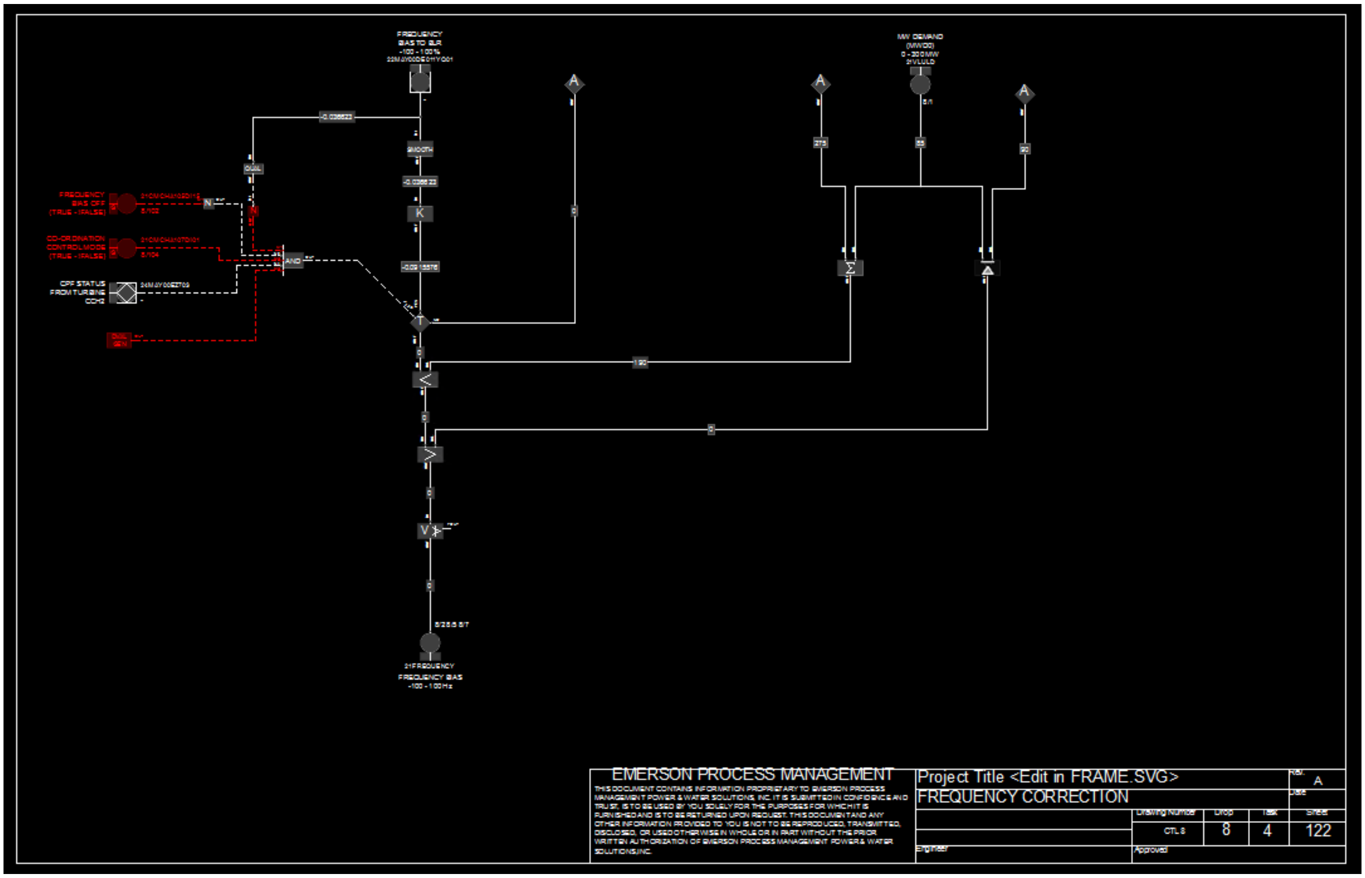
FRONT LEFT			FRONT RIGHT			REAR LEFT			REAR RIGHT		
	Airflow %	%		Airflow %	%		Airflow %	%		Airflow %	%
1	0	0	1	0	0	1	0	0	1	0	0
2	30	55	2	30	55	2	30	55	2	30	55
3	38	60	3	38	60	3	38	60	3	38	60
4	45	70	4	45	70	4	45	70	4	45	70
5	60	75	5	60	75	5	60	75	5	60	75
6	75	80	6	75	80	6	75	80	6	75	80
7	100	85	7	100	85	7	100	85	7	100	85
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		

ALL SAP AND OAP <90 MILL C ON

	MW	%
1	0	0
2	50	52
3	60	65
4	70	65
5	85	60
6	90	60
7	120	60
8		
9		
10		
11		

FRECUENCY CORRECTION

- **(DROP 8 TASK 4 SHEET 122).**



- **BOILER MASTER CONTROL (DROP 8 TASK 4 SHEET 7).**