PART C.

Boiler Operation & Maintenance Manual

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Boiler Operation Manual

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Tab C.2.1

Design Data Sheet for Major Equipment

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1. Purpose and Scope

This operation manual is intended to familiarize Shuqaiq Steam Power Plant operating personnel with the Boiler and assist operating group in developing detailed operating instructions.

It is not intended to cover all possible variations in equipment and not to provide for specific operating problems which may arise. Should additional information be required, Hyundai Heavy Industries, Ltd. Or its field representatives should be contacted

It must be recognized that no amount of written instructions can replace intelligent thinking and reasoning on the part of the boiler operators, especially when coping with unforeseen operating conditions. It is the operator's responsibility to become thoroughly familiar not only with the immediate steam generating equipment but also with all pertinent control equipment. Satisfactory performance and safety depend on a great extent on proper functioning of controls and auxiliary equipment.

2. Design Data sheet for Major Equipment

Item No	Description	Particulars
1.	**General boiler details**	
1.1	Type of boiler	Mitsubishi Supercritical sliding Pressure Operation Once-Through Boiler (MO-SSRR)
1.2	Sub-critical or super-critical	Super-critical
1.3	Number of boilers	4
1.4	Manufacturer	MHPS and HHI
1.5	Pressure part design code	ASME

Item No	Description		Particulars
1.6	Maximum continuous rating	kg/s	615.0
1.7	Rated pressure at superheater outlet	barg	256.3
1.8	Rated temperature at superheater outlet	°C	540.0
1.9	Rated temperature of feed-water	°C	306.1
1.10	Rated reheater steam flow	kg/s	476.7
1.11	Rated pressure at reheater outlet	barg	47.3
1.12	Rated temperature at reheater outlet	°C	540.0
1.13	Rated pressure at reheater inlet	barg	49.8
1.14	Rated temperature at reheater inlet	°C	299.9
1.15	Main (overall) dimensions:		
1.15.1	Height	m	52.7
1.15.2	Width	m	16.6
1.15.3	Depth	m	14.3
2.	**Furnace**		
2.1	Type		Radiant
2.2	Mean furnace height	mm	52,713.8
2.3	Spiral furnace height	mm	24,140
2.4	Furnace width	mm	16,598.5
2.5	Furnace depth (front to rear walls)	mm	14,284.5

Item No	Description		Particulars		
2.6	Furnace volume	m^3	12,126		
2.7	Projected area of furnace	m^2	4,537		
2.8	Tube outside diameter	mm	31.8 / 38.1		
2.9	Tube thickness	mm	6.1 / 9.3, 8.0		
2.10	Tube corrosion allowance	mm	1.6		
2.11	Tube pitching	mm	44.5 / 59.33		
2.12	Tube material		SA-213T12 / SA-213T22		
2.13	Tube design temperature	°C	459 / 500		
2.14	Furnace exit gas temperature	°C	1245		
2.15	Lower header outside diameter and thickness	mm x mm	381 x 79		
2.16	Lower header corrosion allowance	mm	0		
2.17	Lower header material		SA-106C		
2.18	Upper header outside diameter and thickness	mm x mm	Rear	Front	Side
			711x129	323.8x67	273x55
2.19	Upper header corrosion allowance	mm	0		
	Upper header material		SA-335P12		
3.	**Water separator Header**				
3.1	Type of construction and quantity / boiler		WELDED / 2		

Item No	Description		Particulars
3.2	Design pressure	barg	299
3.3	Design temperature	°C	457
3.4	Material		SA-336F12
3.5	Internal diameter	mm	760.0
3.6	Thickness of shell	mm	128
3.7	Corrosion allowance	mm	3.2
3.8	Overall length	m	3.3
3.9	Finished weight	kg	16414 x 2
3.10	Separator volume:		
3.10.1	Full (for hydro test)	m3	3

Item No	Description		Water Separator Header	Superheater	Reheater
4.	**Safety valves**				
4.1	Manufacturer		DRESSER	DRESSER	DRESSER
4.2	Type		Spring	Spring/ERV	Spring
4.3	Capacity (each)	ton/h	344.3	154.4 / 118.8	189.2 in 189.2 out
4.4	Size	mm	DN80	DN65	DN150
4.5	Number		6	2/2	Inlet - 8 Outlet - 2
4.6	Lift	barg	328.2 322.6	321.2 283.0	65.9 64.0 62.0
4.7	Close	barg	315.1 309.7	308.4 277.3	63.3 61.4 59.5

Item No	Description		Particulars
5.	**Boiler recirculation pump**		
5.1	Manufacturer		Torishima
5.2	Type		Vertical wet motor
5.3	Number per boiler/capacity	N/%	1 / 100
5.4	Duty flow	kg/s	164.5
5.5	Absorbed power at pump shaft	kW	212.1
5.6	Motor rating	kW	320.0
5.7	Materials		
5.7.1	Casing		SA266 Gr.2
5.7.2	Impeller		SCSI-T2
5.7.3	Shaft		SUS420J2-HCrP
5.8	Method of cooling		Cooling Water
6.	**Screen tubes (convective evaporative heating surface)**		
6.1	Effective heating surface	m^2	450.5
6.2	Gas flow area	m^2	168.1
6.3	Steam/water mixture flow area	m^2	0.1
6.4	Tube outside diameter	mm	38.1
6.5	Tube thickness	mm	7.0,9.3
6.6	Corrosion allowance	mm	1.6
6.7	Tube material		SA-213T12
6.8	Tube pitch across gas flow	mm	178

Item No	Description		Particulars	
6.9	Tube pitch parallel to gas flow	mm	75	
6.10	Number of tubes in a single row		93	
6.11	Number of tubes in direction of gas flow		3	
6.12	Design metal temperature	°C	468,454	
6.13	Maximum gas velocity	m/s	20	
7.	**Superheater**			
7.1	**Superheater - first stage**		Primary	
7.1.1	Type		Panel Type	
7.1.2	Gas flow area	m^2	243	
7.1.3	Steam flow area	m^2	0.31	
7.1.4	Tube outside diameter	mm	50.8	
7.1.5	Tube thickness	mm	7.7,5.7,6.3	
7.1.6	Corrosion allowance	mm	1.6,10%(CASE 2328-2)	
7.1.7	Tube material		SA-213T12, CASE 2328-2 (High)	
7.1.8	Tube pitch across gas flow	mm	1780	
7.1.9	Tube pitch parallel to gas flow	mm	60.3	
7.1.10	Number of elements wide		8	
7.1.11	Number of parallel steam flows		40	
7.1.12	Number of tubes in direction of gas flow		80	
7.1.13	Metal Design temperature	°C	530	
7.1.14	Headers:		**Inlet**	**Outlet**
7.1.14.1	Outside diameter	mm	381	457

Item No	Description		Particulars	
7.1.14.2	Thickness	mm	84	87
7.1.14.3	Corrosion allowance	mm	0	0
7.1.14.4	Material		SA-335P12	SA-335P12
7.2	**Superheater – second stage**		Secondary	
7.2.1	Type		Platen Type	
7.2.2	Gas flow area	m^2	200	
7.2.3	Steam flow area	m^2	0.69	
7.2.4	Tube outside diameter	mm	45.0 / 50.8	
7.2.5	Tube thickness	mm	7.4, 5.6, 5.1 / 8.4, 5.7, 6.3	
7.2.6	Corrosion allowance	mm	1.6,10%(CASE 2328-2)	
7.2.7	Tube material		SA-213T12, CASE 2328-2 (High) / SA-213T12, CASE 2328-2 (High)	
7.2.8	Tube pitch across gas flow	mm	222.5	
7.2.9	Tube pitch parallel to gas flow	mm	54.5	
7.2.10	Number of elements wide		72	
7.2.11	Number of parallel steam flows		12	
7.2.12	Number of tubes in direction of gas flow		24	
7.2.13	Design metal temperature	°C	494, 527, 549 / 496, 544, 532	
7.2.14	Headers:		**Inlet**	**Outlet**
7.2.14.1	Outside diameter	mm	406.4	508
7.2.14.2	Thickness	mm	82	120
7.2.14.3	Corrosion allowance	mm	0	0

Item No	Description		Particulars	
7.2.14.4	Material		SA-335P12	SA-335P12
7.3	**Superheater – third stage**		Tertiary	
7.3.1	Type		Pendant	
7.3.2	Gas flow area	m^2	186	
7.3.3	Steam flow area	m^2	0.82	
7.3.4	Tube outside diameter	mm	45.0	
7.3.5	Tube thickness	mm	5.0, 5.6, 5.4	
7.3.6	Corrosion allowance	mm	10%	
7.3.7	Tube material		CASE 2328-2 (High)	
7.3.8	Tube pitch across gas flow	mm	222.5	
7.3.9	Tube pitch parallel to gas flow	mm	54.5	
7.3.10	Number of elements wide		72	
7.3.11	Number of parallel steam flows		14	
7.3.12	Number of tubes in direction of gas flow		28	
7.3.13	Design metal temperature	°C	543, 569, 587	
7.3.14	Headers:		**Inlet**	**Outlet**
7.3.14.1	Outside diameter	mm	508	508
7.3.14.2	Thickness	mm	108	88
7.3.14.3	Corrosion allowance	mm	0	0
7.3.14.4	Material		SA-335P12	SA-335P91

Item No	Description		Particulars	
8.	**Reheater**			
8.1	**Reheater - first stage**			
8.1.1	Type		Horizontal / Terminal	
8.1.2	Gas flow area	m^2	144 / 141	
8.1.3	Steam flow area	m^2	1.81	
8.1.4	Tube outside diameter	mm	50.8 / 63.5	
8.1.5	Tube thickness	mm	3.5 / 4.0, 6.1	
8.1.6	Corrosion allowance	mm	1.6,10%(CASE 2328-2)	
8.1.7	Tube material		SA-210C, SA-213T12, T22, case 2328-2(high)	
8.1.8	Tube pitch across gas flow	mm	111.25 / 222.5	
8.1.9	Tube pitch parallel to gas flow	mm	100 / 100	
8.1.10	Number of elements wide		148 / 74	
8.1.11	Number of parallel steam flows		6 / 12	
8.1.12	Number of tubes in direction of gas flow		29 / 12	
8.1.13	Design metal temperature	°C	554 / 359, 453, 550	
8.1.14	Headers:		**Inlet**	**Outlet**
	a. Outside diameter	mm	508	610
	b. Thickness	mm	33	33
	c. Corrosion allowance	mm	3.2	0
	d. Material		SA-106C	SA-335P12

Item No	Description		Particulars	
8.2	**Reheater - second stage**			
8.2.1	Type		Pendant	
8.2.2	Gas flow area	m^2	164	
8.2.3	Steam flow area	m^2	1.3	
8.2.4	Tube outside diameter	mm	50.8	
8.2.5	Tube thickness	mm	3.5	
8.2.6	Corrosion allowance	mm	10%(CASE 2328-2)	
8.2.7	Tube material		CASE 2328-2(high)	
8.2.8	Tube pitch across gas flow	mm	222.5	
8.2.9	Tube pitch parallel to gas flow	mm	90	
8.2.10	Number of elements wide		72	
8.2.11	Number of parallel steam flows		12	
8.2.12	Number of tubes in direction of gas flow		24	
8.2.13	Design metal temperature	°C	596	
8.2.14	Headers:		**Inlet**	**Outlet**
	a. Outside diameter	mm	610	660
	b. Thickness	mm	33	35
	c. Corrosion allowance	mm	1.6	1.6
	d. Material		SA-335 P12	SA-335P91
9.	**Economizer**			
9.1	Type		Bare Tube	

Item No	Description		Particulars	
9.2	Gas flow area	m^2	57	
9.3	Water flow area	m^2	0.573	
9.4	Tube outside diameter	mm	45	
9.5	Tube thickness	mm	7.1, 8.6	
9.6	Corrosion allowance	mm	1.6	
9.7	Tube material		SA-210C	
9.8	Tube pitch across gas flow	mm	222.5 / 85	
9.9	Tube pitch parallel to gas flow	mm	100 / 85	
9.10	Number of elements wide		74 Vertical / 194 Horizontal	
9.11	Number of parallel water flows		3/4	
9.12	Number of tubes in direction of gas flow		3 Vertical / 51 Horizontal	
9.13	Fouling factor – oil/gas firing		N/A	
9.14	Method of support		Stringer Tubes	
9.15	Material of supports		SA-210C	
9.16	Headers:		**Inlet**	**Outlet**
9.16.1	Outside diameter	mm	406.4	457
9.16.2	Thickness	mm	82	77
9.16.3	Corrosion allowance	mm	3.2	0
9.16.4	Material		SA-106C	SA-106C
10.	**Feeders and risers**			
10.1	Feeders:			

Item No	Description		Particulars	
10.1.1	Number		16	
10.1.2	Outside diameter	mm	168.3	
10.1.3	Thickness	mm	32	
10.1.4	Corrosion allowance	mm	1.6	
10.2	Risers:			
10.2.1	Number		4	
10.2.2	Outside diameter	mm	406.4	
10.2.3	Thickness	mm	67	
10.2.4	Corrosion allowance	mm	1.6	
11.	**Attemperators**		**Superheater 1RY / 2RY**	**Reheater emergency**
11.1	Nozzle diameter	mm	168.3 / 219.1	114.3
11.2	Sleeve diameter	mm	355.6 / 355.6	685.5
11.3	Sleeve length	mm	2600 / 2600	2600
11.4	Sleeve material		SA-335P12	SA-387-12-1
11.5	Water source		Eco. outlet	BFP Bleeding
11.6	Maximum design water flow rate	kg/h	116,223	37,800
12.	**Burners**			
12.1	Number of burners		24	
12.2	Manufacturer		MHPS	
12.3	Turn-down ratio of each burner			
12.3.1	HFO		5 : 1	

Item No	Description		Particulars
12.3.2	Distillate		5 : 1
12.4	Furnace excess air at full output	%	
12.4.1	HFO		5.0
12.4.2	Distillate		N/A
12.5	Maximum oil capacity of each burner	kg/h	7000
12.6	Oil pressure at burner at MCR	barg	21
12.7	Atomizing steam flow	kg/h	350 (Per Burner)
12.8	Atomizing steam pressure	barg	10.3
12.9	Method of cooling burners when not in use		Cooling air fan
12.10	Location of burners in furnace		Corner
12.11	Vertical pitch of burners	mm	2517.6
12.12	Life expectancy of burner tips in operating hours	hrs	Variable – Depends on Oil Properties
12.13	Life expectancy of burner swirler in operating hours	hrs	Variable-Depends on Oil Properties
12.14	Number of burners per level	No.	4
12.15	Number of burner levels	No.	6
12.16	Type of igniter		High Energy Ark (Direct Spark)
12.17	Manufacturer		HHI
12.18	Maximum distillate oil capacity per igniter	kg/h	N/A

Item No	Description		Particulars
12.19	Type of main flame viewing device		Scanners
12.20	Manufacturer		Fireye
12.21	Type of ignition flame viewing device		N/A(Ignition Single Only)
12.22	Manufacturer		N/A
13.	**Regenerative air heater**		
13.1	Type		Regenerative, Bi-sector, Vertical shaft
13.2	Heating surface (both sides of plates)	m^2	27,519
13.2.1	Hot end	m^2	12,953
13.2.2	Cold end	m^2	14,566
13.3	Diameter of rotor	mm	11,300
13.4	Depth of hot end heating surface	mm	863.6
13.5	Depth of cold end heating surface	mm	1067
13.6	Main drive:		
13.6.1	Type		Gearbox w/ electric AC motor
13.6.2	Speed	rpm	1.16
13.7	Method of lubrication		Oil
13.8	Number of sootblowers		2 per A/H
13.9	Type of water washing facility		Sodium Hydroxide + Hot water
13.10	Increase in excess air due to leakage at BMCR – oil/gas firing	%	5
13.11	Material of hot end elements		Carbon Steel

Item No	Description		Particulars
13.12	Material of cold end elements		Decarburized steel with enamel
13.13	Material of rotor		Corten or Similar
13.14	Material of casing		Carbon Steel
13.15	Life expectancy of cold end elements in operating hours	hrs	43,800
14.	**Steam air heater**		
14.1	Type		Fin Tube
14.2	Heating surface	m^2	4084.87
14.3	Tube diameter	mm	25.4
14.4	Tube thickness	mm	2.11
14.5	Corrosion allowance	mm	1.6
14.6	Tube material		Carbon Steel (A179)
14.7	Fin material		Aluminum
15.	**Sootblowers**		
15.1	Number of sootblowers	No.	42
15.2	Manufacturer		Bergemann
15.3	Total time required for automatic for one (1) cycle of sootblowing sequence including pipe heating and draining	min	173 (excl. warm-up)
15.4	Total steam consumption for the above	kg/cycle	15,913 (excl. condensate & drain losses)

	Section		Superheater	Reheater	Economizer	SCR	Air heater
15.5	Number	No.	12	10	12	8	2 per A/H
15.6	Type		Long Retractable	Long Retractable	Short Retractable	Rake Type	Retractable
15.7	Duration of cycle	min	5.51 / Unit	5.51 / Unit	2.62 / Unit	2.56 / Unit	58.5
15.8	Steam pressure before blower	barg	16.6 & 16.3	16.2 & 11.7	12.1	12.1	25
15.9	Steam pressure in lance	barg	11.2 & 10.8	10.6 & 7.5	7.0	5.6	13.8
15.10	Steam consumption for cycle	kg	516.4 / Unit	516.4 / Unit & 386.5 / Unit	239.0 / Unit	242.9 / Unit	4510
15.11	Maximum steam consumption rate	kg/h	5,868 / Unit	5,868 / Unit & 4362 / Unit	5,760 / Unit	5,760 / Unit	4630

Item No	Description		Particulars	
16.	**Forced draft fan**			
16.1	Manufacturer		Howden Axial Fan	
16.2	Type		Axial	
16.3	Number per boiler	No.	2	
16.4	Type of coupling		Flexible	
16.5	Method of control		Variable blade pitch	
16.6	Motor rating	kW	2,400 kW	
16.7	Maximum noise level at 1 m from fan	dB(A)	85 when insulated and lagged to vendors requirements	
16.8	Duty per fan:		**Boiler MCR**	**Fan design values**
16.8.1	Volume of air at fan inlet	Nm^3/s	233	280
16.8.2	Temperature of air at fan inlet	°C	40	55
16.8.3	Static pressure	mbar	42.3	42.9
16.8.4	Fan speed	rpm	1190	1190
16.8.5	Fan efficiency	%	88.3	85.5
16.8.6	Fan shaft power input	kW	1,316 kW	2,051 kW
16.9	Materials:			
16.9.1	Casing		EN10025-S235JRG2	
16.9.2	Impeller		EN10025-S355J2	
16.9.3	Shaft		EN10083-1-42CrMo4QT	
16.10	Bearing:			

Item No	Description		Particulars		
16.10.1	Type		Anti-friction		
16.10.2	Cooling method		Oil/ Water		
16.11	Hydraulic drive				
16.11.1	Manufacturer		Hyunbo		
16.11.2	Type		N/A		
16.11.3	Design code/standard		N/A		
16.11.4	Rated power	kW	N/A		
16.11.5	Rated Torque	Nm	N/A		
16.11.6	Slip at MCR conditions	%	N/A		
16.11.7	Range of slip	%	N/A		
16.11.8	Power loss at MCR conditions	kW	N/A		
16.12	Oil pumps:		Main	Auxiliary	Working oil
16.12.1	Type		Gear	Gear	ISO VG068
16.12.2	Number off x rating	N x %	2x100	2x100	
16.13	Oil filters:				
16.13.1	Number off x rating	N x %	2x100	2x100	
16.13.2	Type		Duplex	Duplex	
16.14	Oil coolers:		Lubrication		Working oil
16.14.1	Type		Water/Oil		
16.14.2	Number off x rating	N x %	2x100*		
16.14.3	Cooling fluid		Water		

Item No	Description		Particulars	
17.	**Induced draft fan**			
17.1	Manufacturer		Howden Axial Fan	
17.2	Type		Axial	
17.3	Number per boiler	No.	2	
17.4	Type of coupling		Flexible	
17.5	Method of control		Variable pitch	
17.6	Motor rating	kW	5800 kW	
17.7	Maximum noise level at 1 m from fan	dB(A)	85 when insulated and lagged to vendors requirements	
17.8	Duty per fan:		**Boiler MCR**	**Fan design values**
17.8.1	Volume of air at fan inlet	Nm^3/s	257.2	314.4
17.8.2	Temperature of air at fan inlet	°C	160	175
17.8.3	Static pressure	mbar	65.9	90.8
17.8.4	Fan speed	rpm	890	890
17.8.5	Fan efficiency	%	91.3	86.7
17.8.6	Fan shaft power input	kW	2916	5400
17.9	Materials:			
17.9.1	Casing		EN10025-S235JRG2	
17.9.2	Impeller		EN10025-S355J2	
17.9.3	Shaft		EN10083-1-42CrMo4	
17.10	Bearing:			

Item No	Description		Particulars		
17.10.1	Type		Antifriction		
17.10.2	Cooling method		Oil cooled		
17.11	Hydraulic drive:				
17.11.1	Manufacturer		Hyunbo		
17.11.2	Type/model reference		N/A		
17.11.3	Design code/standard		N/A		
17.11.4	Rated power	kW	N/A		
17.11.5	Rated Torque	Nm	N/A		
17.11.6	Slip at MCR conditions	%	N/A		
17.11.7	Range of slip	%	N/A		
17.11.8	Power loss at MCR conditions	kW	N/A		
17.12	Oil pumps:		Main	Auxiliary	Working oil
17.12.1	Type		Gear	Gear	ISO VG068
17.12.2	Number off x rating	N x %	2 x 100	2 x 100	
17.13	Oil filters:				
17.13.1	Number off x rating	N x %	2 x 100	2 x 100	
17.13.2	Type		Duplex	Duplex	
17.14	Oil coolers:		Lubrication		Working oil
17.14.1	Type		Plate		
17.14.2	Number off x rating	N x %	2x100*		
17.14.3	Cooling fluid		Water		

Item No	Description		Particulars	
18.	**Gas recirculation fan**			
18.1	Manufacturer		HOWDEN SPAIN	
18.2	Type		Centrifugal	
18.3	Number per boiler	No.	2	
18.4	Type of coupling		Flexible – RENOLD RD 5.5	
18.5	Method of control		Damper	
18.6	Motor rating	kW	1620	
18.7	Maximum noise level at 1 m from fan	dB(A)	85 when insulated and lagged to vendors requirements	
18.8	Duty per fan:		**Boiler MCR**	**Fan design values**
18.8.1	Volume of gas at fan inlet	Nm^3/s	67.5	137.8
18.8.2	Temperature of gas at fan inlet	°C	378	400
18.8.3	Static pressure	mbar	26.5	35.3
18.8.4	Fan speed	rpm	710	710
18.8.5	Fan efficiency	%	48.2	82.8
18.8.6	Fan shaft power input	kW	890	1460
18.9	Materials:			
18.9.1	Casing		S235 JR G2 (A570 GR 33)	
18.9.2	Impeller		S690QL (A514)	
18.9.3	Shaft		25 CrMo4 (4130)	
18.10	Bearing:		Renk	

Item No	Description		Particulars		
18.10.1	Type		Sleeve		
18.10.2	Cooling method		Oil cooled		
18.11	Hydraulic drive:		Lube unit		
18.11.1	Manufacturer		ATC OIL & GAS		
18.11.2	Type/model reference		N/A		
18.11.3	Design code/standard		N/A		
18.11.4	Rated power	kW	N/A		
18.11.5	Rated Torque	Nm	N/A		
18.11.6	Slip at MCR conditions	%	N/A		
18.11.7	Range of slip	%	N/A		
18.11.8	Power loss at MCR conditions	kW	N/A		
18.12	Oil pumps:		Main	Auxiliary	Working oil
18.12.1	Manufacturer		Marzocchi	Marzocchi	ISO VG068
18.12.2	Type		Gear type	Gear type	
18.12.3	Number off x rating	N x %	2 x 100	1 x 100	
18.13	Oil filters:		Duplex		
18.13.1	Number off x rating	N x %	1 x 100		
18.14	Oil coolers:		Lubrication		Working oil
18.14.1	Manufacturer		ALFA LAVAL		
18.14.2	Type		Welded plates		
18.14.3	Number off x rating	N x %	2 x 100		

Item No	Description		Particulars
19.	**Air and flue gas ducts**		
19.1	Materials:		
19.1.1	Flue gas ducts		Carbon steel & Low alloy steel
19.1.2	Air ducts		Carbon steel
19.2	Thickness (plate):		
19.2.1	Flue gas ducts	mm	6
19.2.2	Air ducts	mm	6
19.3	Damper type:		
19.3.1	Flue gas ducts		Motor operated shut-off & control
19.3.2	Air ducts		Motor operated shut-off
19.4	Insulation thickness:		
19.4.1	Flue gas ducts	mm	Refer to the approval document (Doc. No. : S-04-HBB-M-31-600-001)
19.4.2	Air ducts	mm	Refer to the approval document (Doc. No. : S-04-HBB-M-31-600-001)
19.5	Maximum velocity:		
19.5.1	Flue gas ducts	m/s	18
19.5.2	Air ducts	m/s	18 / 10
19.6	Design pressure:		
19.6.1	Flue gas ducts:		
19.6.1.1	Air heater outlet	mbar	-49.13

Item No	Description		Particulars
19.6.1.2	GR fan inlet	mbar	-17.36
19.6.2	Air ducts:		
19.6.2.1	FD fan outlet	mbar	42.85
20.	**Flash Tank**		
20.1	Design pressure	barg	8
20.2	Design temperature	°C	400
20.3	Size of flash tank	mm x mm	2,500 x 4,500
20.4	Capacity	m^3	26.2
20.5	Type of silencer		Vertical
21.	**Electrostatic precipitator**		
21.1	**Electrostatic precipitator general details**		
21.1.1	Number of zones with independent electrical supplies		12
21.1.2	Number of collecting plate electrodes		1800 [5 (CE/row) X 30 (CE rows/Bus Section) X 12 (Bus Sections/Boiler)]
21.1.3	Number of discharge wire electrodes		15660 [9 DE/CE X 5 (CE/row) X 29 (DE Rows/Bus Section) X 12 (Bus Sections/Boiler)]
21.1.4	Number of discharge wires per collecting plate		9 [3 Wires X 3 Levels]
21.1.5	Maximum draught loss at BMCR	mbar	3

Item No	Description		Particulars
21.1.6	Gas velocity at BMCR:		
21.1.6.1	Zone 1	m/s	1.2
21.1.6.2	Zone 2	m/s	1.2
21.1.6.3	Zone 3	m/s	1.2
21.1.7	Treatment time at BMCR:		
21.1.7.1	Zone 1	sec	10
21.1.7.2	Zone 2	sec	10
21.1.7.3	Zone 3	sec	10
21.2	**Electrostatic precipitator Electrodes**		
21.2.1	Collecting electrode type		Plate
21.2.2	Collecting electrode thickness	mm	1.25
21.2.3	Collecting electrode material		EN10130-FeP01Am
21.2.4	Collecting electrode width	mm	800
21.2.5	Collecting electrode length	mm	15000
21.2.6	Collecting electrode spacing	mm	400
21.2.7	Total collecting electrode projected area	m^2	41760
21.2.8	Discharge electrode type		Spiral
21.2.9	Discharge electrode cross-sectional area	m^2	Dia 2,75 mm
21.2.10	Discharge electrode length	mm	5000 (between fixings)
21.2.11	Discharge electrode material		904L

Item No	Description		Particulars
21.2.12	Total effective discharge electrode length	mm	15000
21.2.13	Distance between ties on supporting assembly	mm	270
21.3	**Electrostatic precipitator hoppers**		
21.3.1	Type		Pyramid
21.3.2	Angle of repose of hopper walls	^{o}	30
21.3.3	Capacity for zone 1	kg	24x61200
21.3.4	Capacity for zone 2	kg	24x61200
21.3.5	Capacity for zone 3	kg	24x61200
21.3.6	Volume for zone 1	m^3	24x68
21.3.7	Volume for zone 2	m^3	24x68
21.3.8	Volume for zone 3	m^3	24x68
21.4	**Electrostatic precipitator casings and supports**		
21.4.1	Material of supports		S355
21.4.2	Material of casings		S355
21.4.3	Material of hoppers		S355
21.4.4	Thickness of casing	mm	6.0
21.4.5	Thickness of hoppers	mm	6.0
21.4.6	Method of supporting casing		Steel support fixed

Item No	Description		Particulars
21.4.7	Type of expansion joints for casing to supports		Slide bearings, 1 fix point per casing
21.4.8	Type of expansion joints for casing to ducts		Fabric
21.4.9	Thickness of insulation for roof	mm	125
21.4.10	Thickness of insulation for walls	mm	125
21.4.11	Thickness of insulation for hoppers	mm	150
21.4.12	Method of ensuring uniform flue gas distribution in ESP (flow model etc)		Inlet screens with rappers.
21.5	**Electrostatic precipitator rapping gear**		
21.5.1	Collecting electrodes:		
21.5.1.1	Type		Tumbling hammer, staggered
21.5.1.2	Number	No.	1680
21.5.1.3	Plate area per rapper	m^2	2x60 (both sides)
21.5.1.4	Plates per rapper		5
21.5.1.5	Method of actuation		Tumbling
21.5.1.6	Type of drive		Electric motor geared
21.5.1.7	Frequency range	stroke/min	Adjustable
21.5.1.8	Power consumption	kW	0.37
21.5.2	Discharge electrodes:		
21.5.2.1	Type		Tumbling hammer
21.5.2.2	Number	No.	15660

Item No	Description		Particulars
21.5.2.3	Electrodes per rapper		93
21.5.2.4	Method of actuation		Tumbling hammer
21.5.2.5	Type of drive		Electric motor geared
21.5.2.6	Frequency range	stroke/min	Adjustable
21.5.2.7	Power consumption	kW	0.37
21.6	**Electrostatic precipitator electrical equipment**		
21.6.1	Type of transformer/rectifier		Conventional roof mounted ONAN
21.6.2	Number of transformer/rectifiers		12 per boiler
21.6.3	Type of control		Microprocessor based EPIC III
21.6.4	Peak voltage (no load) for each unit	kV	95
21.6.5	Mean voltage into precipitator for each unit	kV	~61
21.6.6	Arithmetic mean current for each unit	mA	1800
21.6.7	Effective rms current for each unit	mA	~2500
21.6.8	Collecting electrode current density per field	mA/m^2	0.517
21.6.9	Discharge electrode current density per field	mA/m^2	0.28
21.6.10	Number of earthing switches		24
21.6.11	Are ‘KEY’ interlocks provided for control cabinets?	yes/no	Yes

Item No	Description		Particulars
21.6.12	Are 'KEY' interlocks provided for T/R sets?	yes/no	Yes
21.6.13	Are 'KEY' interlocks provided for access doors?	yes/no	Yes
21.6.14	Total power consumption of T/R sets (continuous)	kW	1,050 per boiler
21.6.15	Total power consumption of rappers (intermittent)	kW	10 per boiler
21.6.16	Total power consumption of insulator heaters (intermittent)	kW	140 per boiler
21.6.17	Total power consumption of hopper heaters (intermittent)	kW	76 per boiler

3. References

3.1 Piping and Instrument Diagrams

Dwg. No.	Title
S-01-HA_-S-20-001-001	P&I DIAGRAM - BOILER WATER SYSTEM (1/4)
S-01-HA_-S-20-001-002	P&I DIAGRAM - BOILER WATER SYSTEM (2/4)
S-01-HA_-S-20-001-003	P&I DIAGRAM - BOILER WATER SYSTEM (3/4)
S-01-HA_-S-20-001-004	P&I DIAGRAM - BOILER WATER SYSTEM (4/4)
S-01-HA_-S-20-002-001	P&I DIAGRAM - BOILER WATER SYSTEM (1/2)
S-01-HA_-S-20-002-002	P&I DIAGRAM - BOILER WATER SYSTEM (2/2)

S-01-HA_-S-20-003-001	P&I DIAGRAM - BOILER REHEAT SYSTEM
S-01-HA_-S-20-004-001	P&I DIAGRAM - BOILER DRAIN SYSTEM
S-01-HC_-S-20-001-001	P&I DIAGRAM - BOILER SOOTBLOWING SYSTEM
S-01-HC_-S-20-001-002	P&I DIAGRAM - BOILER SEALING AIR SYSTEM (1/2)
S-01-HC_-S-20-001-003	P&I DIAGRAM - BOILER SEALING AIR SYSTEM (2/2)
S-01-HC_-S-20-002-001	P&I DIAGRAM - BOILER WATER WASHING SYSTEM
S-01-HH_-S-20-001-001	P&I DIAGRAM - BOILER BURNING SYSTEM (1/5)
S-01-HH_-S-20-001-002	P&I DIAGRAM - BOILER BURNING SYSTEM (2/5)
S-01-HH_-S-20-001-004	P&I DIAGRAM - BOILER BURNING SYSTEM (3/5)
S-01-HH_-S-20-001-005	P&I DIAGRAM - BOILER BURNING SYSTEM (4/5)
S-01-HH_-S-20-001-006	P&I DIAGRAM - BOILER BURNING SYSTEM (5/5)
S-01-HH_-S-20-001-007	P&I DIAGRAM - BOILER OILY WATER DRAIN SYSTEM
S-01-HL_-S-20-001-001	P&I DIAGRAM - BOILER COMBUSTION AIR SYSTEM (1/2)
S-01-HL_-S-20-001-002	P&I DIAGRAM - BOILER COMBUSTION AIR SYSTEM (2/2)
S-01-HL_-S-20-002-001	P&I DIAGRAM - BOILER STEAM AIR HEATER SYSTEM (1/2)
S-01-HL_-S-20-002-002	P&I DIAGRAM - BOILER STEAM AIR HEATER SYSTEM (2/2)
S-01-HN_-S-20-001-001	P&I DIAGRAM - BOILER FLUE GAS SYSTEM (1/2)
S-01-HN_-S-20-001-002	P&I DIAGRAM - BOILER FLUE GAS SYSTEM (2/2)
S-01-HN_-S-20-002-001	P&I DIAGRAM - BOILER INSTRUMENTATION
S-01-HS_-S-20-001-001	P&I DIAGRAM - FLUE GAS SELECTIVE CATALYTIC REDUCTION SYSTEM (1/2)
S-01-HS_-S-20-001-002	P&I DIAGRAM - FLUE GAS SELECTIVE CATALYTIC REDUCTION SYSTEM (2/2)
S-01-HS_-S-20-002-001	P&I DIAGRAM - UREA DISSOLVER SYSTEM (1/2)
S-03-HS_-S-20-002-002	P&I DIAGRAM - UREA DISSOLVER SYSTEM (2/2)

S-01-HS_-S-20-003-001	P&I DIAGRAM - UREA SUPPLY SYSTEM (1/3)
S-03-HS_-S-20-003-002	P&I DIAGRAM - UREA SUPPLY SYSTEM (2/3)
S-00-HS_-S-20-003-003	P&I DIAGRAM - UREA SUPPLY SYSTEM (3/3)
S-01-HX_-S-20-001-001	P&I DIAGRAM - BOILER COMPRESSED AIR SYSTEM (1/3)
S-01-HX_-S-20-001-002	P&I DIAGRAM - BOILER COMPRESSED AIR SYSTEM (2/3)
S-01-HX_-S-20-001-003	P&I DIAGRAM - BOILER COMPRESSED AIR SYSTEM (3/3)
S-01-HX_-S-20-002-001	P&I DIAGRAM - BOILER SERVICE WATER SYSTEM
S-01-LA_-S-20-001-001	P&I DIAGRAM – FEEDWATER SYSTEM (1/3) DEAERATOR
S-01-LA_-S-20-001-002	P&I DIAGRAM - FEED WATER SYSTEM (2/3) BFP
S-01-LA_-S-20-001-003	P&I DIAGRAM - FEED WATER SYSTEM (3/3) HP FEEDWATER HEATERS

3.2 PROCESS FLOW Diagrams

Dwg. No.	Title
S-01-MA_-S-12-001-001	MAIN AND REHEAT STEAM SYSTEM
S-01-HA_-S-12-001-001	BOILER AIR AND GAS SYSTEM

3.3 Heat balance diagrams

Doc. No.	Title
S-00-TA_-S-21-001-001	HEAT BALANCE DIAGRAM

3.4 DESIGN CRITERIA FOR BOILER

Doc. No.	Title
S-00-TA_-S-45-001-001	MECHANICAL DESIGN CRITERIA
S-00-TA_-S-45-002-001	DESIGN CRITERIA FOR BOILER

S-00-QH_-S-45-001-001 DESIGN CRITERIA FOR AUXILIARY BOILER

3.5 BOILER PERFORMANCE DATA

Doc. No.	Title
S-00-TA_-S-48-001-001	BOILER PERPORMANCE DATA

3.6 EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY

Doc. No.	Title
S-00-HA_-S-48-101-001	EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY

3.7 Control and Logic Diagrams

Doc. No.	Title
S-00-CAD-I-18-001-001	CONTROL LOGIC DIAGRAM FOR BMS & BPS
S-00-CUA-I-22-002-001	FUNCTIONAL CONTROL LOOP DIAGRAM FOR POWER BLOCK
S-00-CBA-I-22-003-001	FUNCTIONAL CONTROL LOGIC DIAGRAM FOR POWER BLOCK
S-00-CUA-I-22-005-001	APS CONTROL LOGIC DIAGRAM

Tab C.2.2

Boiler Control Concept

Table of Contents

The following paragraphs give a description of the overall boiler operating philosophy, details of special loops within the boiler control philosophy, and a brief description of the instruments installed, for a detailed overall description for boiler control.

1. Feed water Control

1.1 Related P&ID

S-01-LA_-S-20-001-002	P&ID for Feed Water System (2/3) (for Unit 1)
S-01-LA_-S-20-001-003	P&ID for Feed Water System (3/3) (for Unit 1)
S-01-HA_-S-20-001-001	P&ID for Boiler Water System (1/4)

1.2 Feed water master

The purpose of the feed water flow control is to control the total feed water flow to satisfy the current boiler input demand. The total feed water flow is measured by sum of the feed water discharge flow (FT-01LAB20CF001A/B/C) with temperature compensation and BCP recirculation flow (FT-01HAG10CF001A/B/C) with temperature compensation.

The feed water control scheme is based on two (2) motor driven boiler feed water pumps (01LAC11/12AP001 are duty, 01LAC13AP001 is standby) with feed water control valve (FCV-01LAB20AA551 (duty), FCV-01LAB20AA552 (standby), and FCV-01LAB20AA553 (30%TMCR)).

The feed water flow control system will control the boiler feed pump speed and flow control valve. The feedwater flow signal should be used as the primary signal to control the feed water control valves to keep the steam production at a corresponding firing level. The resultant change in differential pressure across the feed regulating station will provide the control input to modulate the frequency of the VSD (Variable Speed Drive), consequently to modulate speed of the boiler feed pumps to maintain a predetermined pressure differential across the feed water flow control valves.

The feedwater demand is generated from boiler demand and scaled in a function generator and then delayed. The delay is a critical value because it matches steam generation with feedwater supply. The scaled demand is corrected by adding the feed water flow BIR. The demand for feedwater is also compared in a maximum selector with the minimum flow setpoint. The maximum selector ensures that the feedwater demand is never below minimum flow through economizer.

Minimum feed water flow control

In once- through boiler, it is necessary to maintain the feed water flow rate at the minimum required flow rate in order to protect water wall tubes, and therefore, a minimum feed water flow rate setting logic is provided.

In addition, compensation (increasing) of the minimum feed water flow which is feed water flow plus total SH spray water flow during boiler wet mode operation is added.

The purpose of this function is to provide the compensation bias for feed water flow in order to secure the minimum feed water flow of the furnace pass which could invite the furnace overheat when the Superheater spray water flow rate is much increased because the superheater spray line (01HAC20BR001) is branched off from the boiler economizer outlet header.

Economizer steaming protection

In order to avoid economizer steaming phenomenon, plus bias is also added on the feed water flow demand to increase feed water flow.

If boiler pressure suddenly decreased due to load runback, rapid load down and so on, there is possibility of evaporation of economizer inside water because economizer water temperature becomes greater than saturated temperature of its water pressure.

Economizer steaming must be prevented since it causes unstable flow of water wall.

To prevent occasion of economizer steaming phenomenon, following measure will be taken if economizer outlet temperature (TE-01HAC11CT001A/B and TE-01HAC16CT001A/B) exceeded the

<Saturate temperature at Eco. outlet pressure minus 5°C>.

- 5% TMCR flow rate is added to the normal feed water flow demand : This is to decrease economizer outlet temperature
- Flue gas bypass by the economizer bypass dampers (FZ-01HNA10AA001/FZ-01HNA20AA001)

Cross limit function

Purpose of the cross-limited function is to give limit on feed water flow demand in order to ensure that the unbalance never exceed the regulated limits.

During steady and constant load operation of the boiler with automatic mode of feed water, fuel and air, each boiler input is responded in parallel with Boiler Input Demand (BID), and kept its balance to each other.

Under above steady situation, if mutual relation between feed water and fuel exceeded allowable limit due to some reason, corresponding feed water flow demand shall be forcibly operated to safety side, and feed water will be adjusted within allowable limit. This function is so called cross limit function.

Further unbalance of boiler input could be avoided if cross limit function is correctly activated. However, unbalance itself once occurred cannot be cancelled. Therefore operator should monitor boiler operating condition and take necessary action to cancel remaining unbalance of boiler input by their operation like load demand hold, changing the control mode from CC to BI and so on.

➢ Cross limit function between fuel and feed water

Following action shall be taken to avoid large discrepancy of feed water/fuel ratio since steam temperature of one through boiler would be determined thru feed water/fuel ratio.

a. Fuel flow to Feed water demand increasing cross limit: To avoid abnormal rise of steam temperature, feed water flow demand is to be increased.

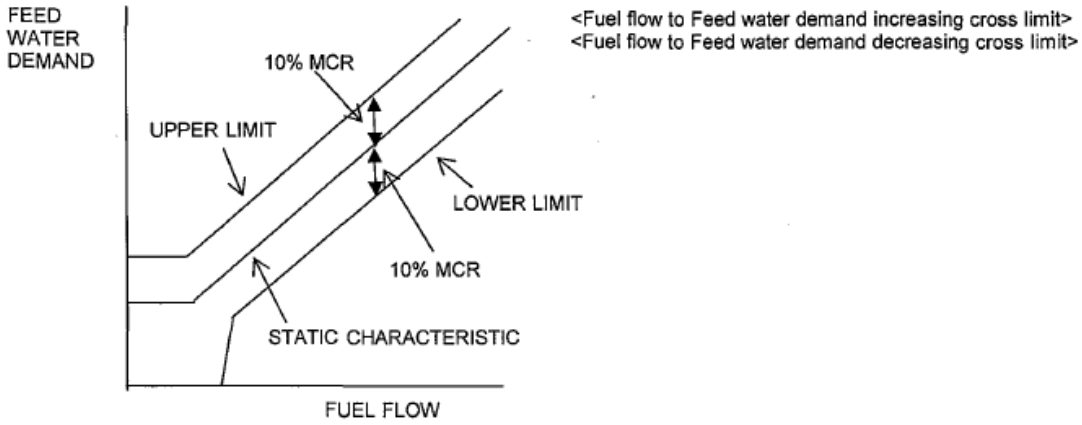
b. Fuel flow to Feed water demand decreasing cross limit: To avoid abnormal drop of steam temperature,

feed water flow demand is to be decreased.

- Set-point for allowable limit

Ten (10) % allowable upper and lower limit is usually given as shown below.

Five (5) % bias is also considered. This will allow transient unbalance due to over/under firing demand generated by 80iler Input Rate demand (8IR) during load changing.



2. Water Separator drain HEADER Control

2.1 Related P&ID

S-01-HA_-S-20-001-003 P&ID for Boiler Water System (3/4)

S-01-HA_-S-20-001-004 P&ID for Boiler Water System (4/4)

2.2 Water separator drain header level control

The purpose of water separator drain header (WSDH) level control is to maintain the WS drain header level below the regulated level by the boiler recirculation water flow control valve (BR, FCV-01HAG10AA551), WS drain header level control valves (WDC, LCV-01HAG21AA551 / LCV-01HAG22AA551) and the boiler recirculation pump (BCP) warming water discharge valve (LCV-

01HAG12AA551). WS drain will be generated during boiler clean-up operation and wet mode operation in principle.

2.3 Boiler recirculation (BR) water flow control

The purpose of the boiler recirculation water flow control is to achieve heat recovery by means of recirculation of generated drain during wet mode operation and to improve boiler efficiency.

Set point of the boiler recirculation water flow is given and generated by a function of the WS drain header level. If WS drain header level is reached at higher than preset level, and if BCP is started, BR flow PI control will be started so that BR flow is matched with WS drain header level. After that, when boiler steam flow becomes high and WS drain header level goes down, BR flow will also be decreased. Finally, BR valve will be closed, and BCP will be stopped. Namely, in Dry mode operation, BR flow will be zero.

When the boiler recirculation pump is stopped, the BR valve is forced to close.

2.4 WDC control

WDC valves (LCV-01HAG21AA551 / LCV-01HAG22AA551) are controlled as a function of the WS Drain header Level. The program functions are prepared for the individual WDC valves, so the two valves are used as a split range control. The functions are set as the WDC, LCV-01HAG22AA551 will be opened next to the WDC, LCV-01HAG21AA551.

In addition, the differential of the level is added to the WDC control to operate earlier in a case of rapid level change. WDC valves will be used as emergency back-up for BR valve (LCV-01HAG10AA551) during wet mode operation and for BCP warming water discharge valve (LCV-01HAG12AA551) during dry mode operation at low load.

The WDC valves will be forced to close when the WDC valve outlet valves (MOV-01LCM11AA801 / MOV-01LCM12AA801) are closed.

WDC outlet valves (MOV-01LCM11AA801 / MOV-01LCM12AA801) are forced closed at high load as follows;

- WDC outlet valve, MOV-01LCM11AA801 is closed when change over to dry operation.
- WDC outlet valve, MOV-01LCM12AA801 is closed when the water separator outlet pressure (PT-01HAH10CP001A/B/C) is higher than pre-set value (Initial value: 165barg).

2.5 BCP warming water discharge control

The BCP warming water discharge control valve (LCV-01HAG12AA551) is controlled as a function of the WS Drain header Level, too. This valve is opened only in the boiler Dry mode operation to discharge the level growth by the BCP warming water to the 2ry SH side. This valve is fully closed during wet mode operation.

During dry operation, the boiler circulation pump is stopped and boiler circulation is not carried out. However, once boiler circulation is started by switching between dry and wet operations, etc., a high temperature fluid flows in and causes the temperature to change (go up) suddenly, thereby having a bad effect on the piping and equipment on the downstream side.

In order to prevent this situation from happening, WS warming line (01HAC30BR001) from economizer outlet header is installed. However, because a phenomenon occurs in which the water level in the WS drain header is pushed up by warming water, the WS warming water discharge line (01HAG12BR001) is provided and control is done by in such a way that drain within the WS drain header is released to the SH spray line. Control is programmed control by the WS drain header level only during dry operation. In a state in which WS pressure (PI-01HAH10CP901) > 117 bara is reached, the BCP warming water discharge control valve (LCV-01HAG12AA551) is set to the specified opening (Initial value: 40%). During wet operation, the WS warming water discharge valve is completely closed.

2.6 BCP injection water control

During wet mode operation, injection water flow of 1-2 % MCR will be maintained by this control valve (FCV-01HAG11AA551) for sub cooling of the drain. During dry mode operation, this valve will be closed. However, warming line is kept by by-pass orifice (01HAG11BP001).

QUIPMENT		CONTROL METHOD		KIND OF CONTROL
No.	NAME	WET OPERATION	DRY OPERATION	
①	BCP	• BCP START AT WSDH PRESET LEVEL • BCP STOP AT WSDH LOW OR BOILER LOAD HIGH	• STOP	ON/OFF CONTROL
②	BR VALVE	• BCP RECIRCULATION FLOW CONTROL (FLOW SET IS GIVEN BY A WSDH LEVEL)	• CLOSE	FLOW CONTROL
③	BCP INJECTION WATER CONTROL VALVE	• INJECTION FLOW CONTROL (1~2% MCR) TO MAINTAIN SUB-COOLING OF DRAIN	• CLOSE WARMING LINE IS KEPT BY BY-PASS ORIFICE	FLOW CONTROL
④	BCP MINIMUM FLOW VALVE	• OPEN TO MAINTAIN MINIMUM WATER FLOW FROM BCP OUTLET TO WSDH DISCHARGE	• CLOSE	ON/OFF CONTROL
⑤	BCP WARMING LINE	----	• LINE WARMING BETWEEN BCP AND WSDH WHILE BCP IS STOPPED	----
⑥	WDC VALVE	• LEVEL CONTROL IN PROPORTION TO WSDH LEVEL	• EMERGENCY BACK-UP FOR WSDH LEVEL CONTROL AT LOW LOAD	LEVEL CONTROL
⑦	BCP WARMING WATER DISCHARGE VALVE	• CLOSE	• LEVEL CONTROL IN PROPORTION TO WSDH LEVEL PRODUCED BY WARMING WATER INJECTION	LEVEL CONTROL

<Abbreviation>

WDC : Water Separator Drain Header Control valve

BR : Boiler Recirculation Flow Control Valve

BCP : Boiler Circulation Pump

3. Fuel Control

3.1 Related P&ID

S-01-HH_-S-20-001-001 P&ID for Boiler Burning System (1/5) (D.O for Warm-up)

S-01-HH_-S-20-001-002 P&ID for Boiler Burning System (2/5) (Heavy Fuel Oil)

3.2 Fuel flow demand

Total Fuel flow control

The purpose of Fuel Flow control is to control the total fuel Flow to satisfy the current Boiler Input Demand.

Total fuel flow demand

The total fuel flow demand is made based on the Boiler Input Demand provided for different start-up mode. Water/Fuel ratio demand is added on total fuel flow demand. Cross-limited function and RH protection function is also considered.

The heat absorption condition of the boiler depends on kinds of fuel and burner elevations.

The actual heating value of the main fuel may vary, and the heat absorption condition of the boiler depends on kinds of fuel and burner elevations.

To compensate for this, the Water/Fuel ratio bias (WFR) demand is added to the total fuel flow demand. In addition, to improve the responsiveness of the boiler during a load changing, the Boiler Input Ratio demand (BIR-FF) is added as the feed forward signal.

Cross-limit

Purpose of the cross-limited function is to give some limit on fuel flow demand in order to ensure that

the unbalance never exceed the regulated limits.

During steady and constant load operation of the boiler with automatic mode of feed water, fuel and air, each boiler input is responded in parallel with Boiler Input Demand (BID), and kept its balance to each other.

Under above steady situation, if mutual relation between feed water and fuel or air and fuel exceeded allowable limit due to some reason, corresponding fuel flow demand shall be forcibly operated to safety side, and fuel will be adjusted within allowable limit. This function is so called cross limit function.

Cross limit function between feed water and fuel & between fuel and air;

- Following action shall be taken to avoid large discrepancy of feed water/fuel ratio since steam temperature of one through boiler would be determined through feed water/fuel ratio.

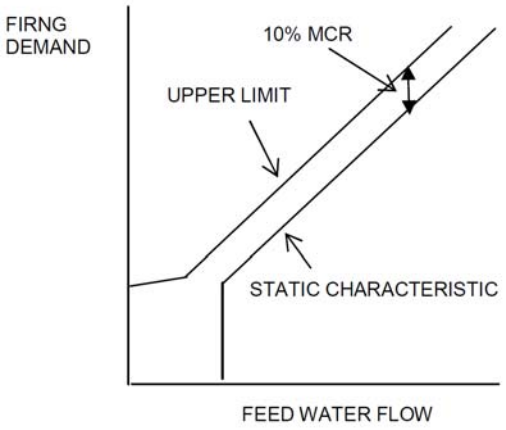
  Feed water flow to Firing demand decreasing cross limit: To avoid abnormal rise of steam temperature, firing demand (fuel and air) is to be decreased.

- Following action shall be taken to avoid incomplete combustion due to lack of O2 (excess air ratio low).

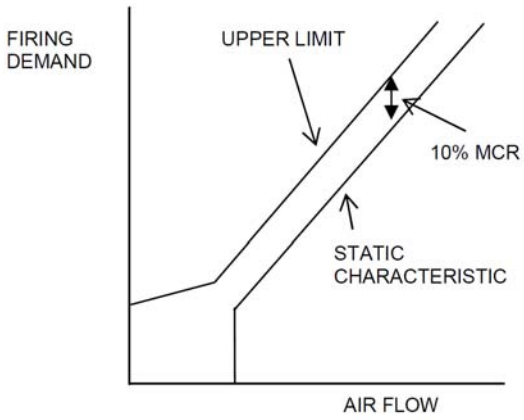
  Air flow to Fuel demand decreasing cross limit: To avoid lack of O2, fuel flow demand is to be decreased.

Ten (10) % allowable upper and lower limit is usually given as shown below.

Five (5) % bias is also considered for feed water flow / fuel flow demand cross limit. This will allow transient unbalance due to over/under firing demand generated by Boiler Input Rate demand (BIR) during load changing. However, for air flow / fuel flow demand cross limit, upper and lower limit cannot be expanded to protect combustion condition.



<Feed water flow to Firing demand decreasing cross limit>



<Air flow to Fuel demand decreasing cross limit>

RH protection function

Upper limitation is provided so that the fuel flow demand becomes lower than limited value when steam entering into the RH is not established.

3.3 Water/Fuel ratio demand

The Water/Fuel Ratio (WFR) demand is generated by the following method.

When the boiler is in WET mode, the main steam pressure is controlled by the fuel flow (same as Drum type boiler). Therefore in this case, the WFR demand is adjusted to control the main steam pressure.

When the boiler is in DRY mode, the WFR demand controls the 2ry SH outlet steam temperature.

Upper and/or lower limitation to the Water/Fuel ratio control demand is given since allowable operation width is different at low load range and high load range.

Water separator header inlet temperature compensation circuits for WFR demand signal is also considered.

Purpose of WFR forced decrease function is to decrease the Feed Water/Fuel Flow ratio when the following main process of boiler exceeds a restriction value, in order to protect boiler tube;

- Water separator header inlet temperature (TWSI) Super heat rate High

(Saturation temperature calculated based on the water separator equalizing pipe pressure (PI-01HAH10CP901))

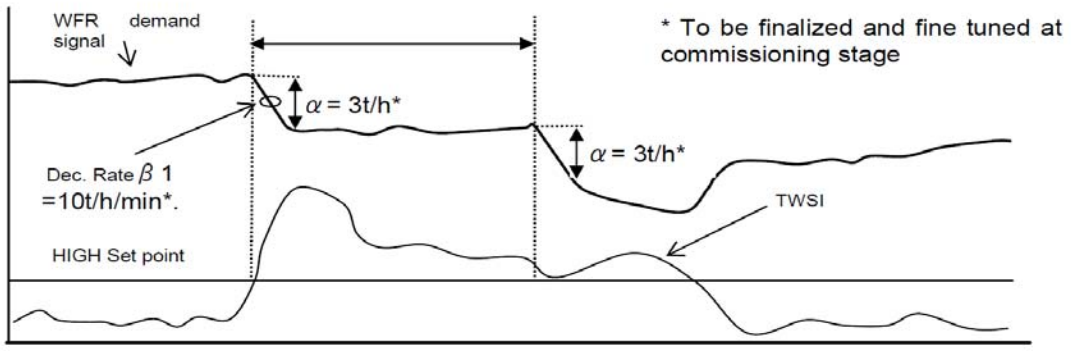
- TWSO High
- 1ry superheater outlet temperature (T1SHO) High

Actually, it is to reduce fuel flow.

Function provided;

- TWSI Super heat rate High.

If TWSI Super heat rate high detects, - α t/h reduction with β1 decreasing rate will be carried out from present WFR demand signal. If TWSI Super heat rate high condition still continued after some minutes, then further - α t/h reduction with β1 decreasing rate will be carried out. This reduction will be continued until TWSI Super heat rate high condition is reset.

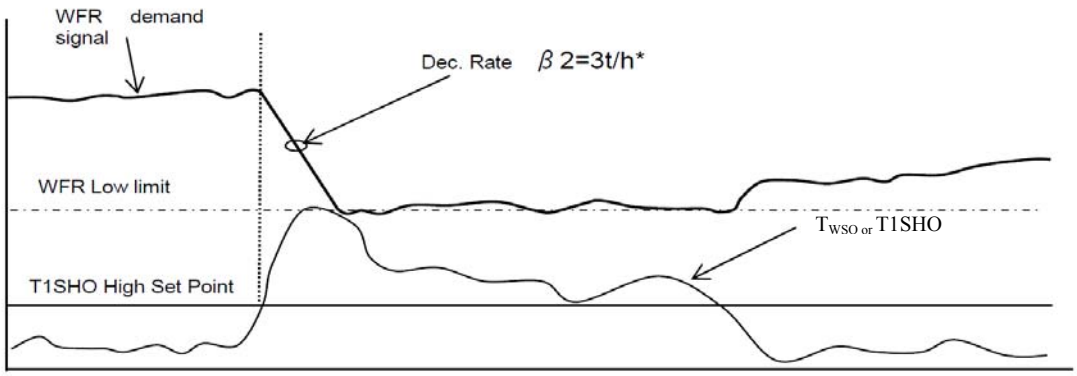


- TWSO High.

When TWSO high detects, WFR demand is decreased from present value to WFR low limit with decreasing rate β2.

- T1SHO High.

Similar to the function of TWSO High.



3.4 Heavy oil control

The heavy oil is controlled by Heavy oil flow control valve (FCV-01HHF10AA551), and the heavy oil flow demand is given as "Fuel Flow Demand –Distillate Oil Flow".

The heavy oil header pressure (PT-01HHF10CP001A/B) override function is used for keeping heavy oil header pressure within stable combustion level to avoid unstable continuous operation and boiler trip. This is so-called "Heavy oil minimum pressure control".

There are following preset opening position in Heavy oil flow control valve;

- Initial firing position

- Leak test position

- Shut down position

- FCB position

HFO header pressure control mode is also prepared for boiler initial light off in consideration of boiler stable operation. (Flow control will be difficult under the condition that HFO flow value is small.)

3.5 Distillate oil control

The distillate oil is controlled by Distillate oil pressure control valve (PCV-01HHJ10AA551) as pressure (PT-01HHJ10CP001) control mode. During boiler start-up, pressure set value is prepared in each start-

up mode (Clod / Warm / Hot / Very hot).

There are following preset opening position in Distillate oil pressure control valve;

- Initial firing position

- Leak test position

- Shut down position

The distillate oil is distributed to the burners at the elevation – 1 around four (4) corners described in the section 2.2.11. When the burner is required to start, the burner is permitted to ignite over the permissible range of distillate oil pressure at the distillate oil common header pipe.

4. Burner Control

4.1 Related P&ID

01-HH_-S-20-001-001 P&ID for Boiler Burning System (1/5) (D.O for Warm-up)

01-HH_-S-20-001-002 P&ID for Boiler Burning System (2/5) (Heavy Fuel Oil)

01-HH_-S-20-001-004 P&ID for Boiler Burning System (3/5) (Burner Unit)

01-HH_-S-20-001-005 P&ID for Boiler Burning System (4/5) (Ignitor Unit)

01-HH_-S-20-001-006 P&ID for Boiler Burning System (5/5) (Burner Detail)

01-HL_-S-20-001-002 Boiler Combustion Air System (2/2)

4.2 Fire circle concept

In the corner firing boilers, burners are located at four corners of the furnace.

The flames from burners are directed to an imaginary circle at the center of the furnace, and these flames together produce a vortex of fire assisting each other to stabilize the combustion in the furnace. We call this vortex a “fire circle”.

This combustion looks like a huge flame when viewed from a side of the furnace. In this condition, the furnace is considered one huge burner, with each burner serving merely as a fuel feeding device.

It is remarkable feature of the corner firing system that the fire circle makes very stable combustion in the furnace.

Therefore the flame monitoring and protection system concentrates its attention on the condition of this huge fire circle rather than on the condition of each burner flame.

4.3 Burner Control

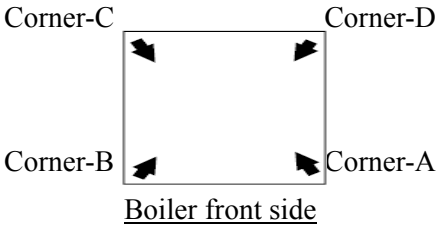
In the corner firing boilers, controlling actions such as ignition and shutdown of burners, operation of air dampers attached to the burners are as a rule performed for respective elevations separately from a viewpoint of maintaining the fire vortex in the furnace.

The ignition sequence for burners is started by depressing a corresponding button on the operator station when the conditions for ignition are established, or by the command from load program in BMS.

The shutdown sequence for the same is started by depressing a corresponding button on the operator station or by command from load program in BMS.

The ignition and shut down sequences are shown on the Table 5.4.3.1“Burner Ignition and Shut down Sequence”.

Table 5.4.3.1 Burner Ignition and Shut down Sequence

<table>
<tr><th>Item</th><th>Guideline</th></tr>
<tr><td>1) Simultaneous on / off burner number</td><td>The one stage is ignition or shut down as pair of burners which is located at opposite side each other (refer to the sketch of pair of burners as below).
 

Pair of burners : A, C burners / B, D burners</td></tr>
<tr><td>2) Ignition / Shut down sequence for each elevation</td><td><table>
<tr><th></th><th>Ignition</th><th>Shutdown</th></tr>
<tr><td>Elev.-6</td><td>6</td><td>1</td></tr>
<tr><td>Elev.-5</td><td>5</td><td>5</td></tr>
<tr><td>Elev.-4</td><td>4</td><td>6</td></tr>
<tr><td>Eelv.-3</td><td>3</td><td>4</td></tr>
<tr><td>Elev.-2</td><td>1</td><td>3</td></tr>
<tr><td>Elev.-1</td><td>2</td><td>2</td></tr>
</table></td></tr>
</table>

3) Burner operation sequence per boiler load

	Start-up	20%	30%	50%	75%	100%
Elev.-6	-	-				Used (HFO)
Elev.-5	-					Used (HFO)
Elev.-4	-				Used (HFO)	Used (HFO)
Elev.-3	-	-	-	Used (HFO)	Used (HFO)	Used (HFO)
Elev.-2	-	Used (HFO)	Used (HFO)	Used (HFO)	Used (HFO)	Used (HFO)
Elev.-1	Used* (DFO)	Used* (DFO)	Used (HFO)	Used (HFO)	Used (HFO)	Used (HFO)

Note)

* : DFO burner capacity of Elev.-1 is up to 17% TMCR

(Note)

Ignition/shutoff sequence as above shall be decided during commissioning considering the boiler characteristics, such as the fluid temperature at furnace outlet, ECO outlet, boiler outlet and so on.

Each burner is provided with air dampers, which are adjusted to match the firing conditions of the burner.

When they are on the control mode, the damper opening is analogously controlled to be proportional to the burner load program (a ratio of fuel oil pressure to design maximum pressure through the burner), furnace-vertical duct difference pressure and fuel oil pressure at common header line as shown as Table 5.4.3.2“Air Damper Control” and Table 5.4.3.3 “Control Philosophy of Air Damper”.

The oil burner load program is a function that ensures the correct number of burners are brought into service or taken out of service to meet the requirement of oil header pressure.

The oil header pressure demand is used as index for determining the required number of burners to be operated.

Table 5.4.3.2 Air Damper Control

Item	Guideline	Remarks
CONC damper	• Unused stage: Minimum opening (10% for initial setting) • Used stage: Program in function to the fuel oil pressure(DO : PT-01HHN10CP001 / HFO/HCO : PT-01HHF10CP001A/B) at header pipe	• The minimum opening shall be adjusted to the load program after commissioning. • CONC damper of each corner shall be controlled separately for direct ignition.
WEAK damper	• Unused stage: (a) < 30%MCR: the furnace-vertical duct difference pressure (PDT-01HAD10CP051A/B/C/D) constant (b) > 30%MCR: Minimum opening (10% for initial setting) • Used stage: Program in function to the fuel oil pressure (DO : PT-01HHN10CP001 / HFO/HCO : PT-01HHF10CP001A/B) at header pipe	• The minimum opening shall be adjusted to the load program after commissioning. • WEAK damper of each corner shall be controlled separately for direct ignition.

SGR damper	• Unused stage: Minimum opening (10% for initial setting) • Used stage: Program in function to the fuel oil pressure(DO : PT-01HHN10CP001 / HFO/HCO : PT-01HHF10CP001A/B) at header pipe	• The minimum opening shall be adjusted to the load program after commissioning. • SGR damper of each corner shall be controlled separately for direct ignition.

Table 5.4.3.3 Control Philosophy of Air Damper

		MFT and/or Both fans	MFT & Banking mode	Furnace Purge	→ Synch roniza tion	Initial load	→ 20%T wet	20%T →30%T change over (we	30%T dry min. Load increase	100%T	30%T dry min. Load	30%T →20%T change over (dry	10%T → Shut down
Burner		-	-	-	DFO	DFO → HFO	HFO	HFO	HFO	HFO	HFO	HFO	Shut Off
OFA		Open				Close				Load Program			
6-OIL	CONC	Open	Close	Min.	Min.	Min.	Min.	Min.	Min.	Prog, for P_{HFO}	Prog, for P_{HFO}	Min.	Min.
	WEAK	Open	Close	ΔP control	ΔP control	ΔP control	ΔP control	ΔP control	ΔP control	Prog, for P_{HFO}	Prog, for P_{HFO}	ΔP control	ΔP control
	SGR	Open	Close	Min.	Min.	Min.	Min.	Min.	Min.	Load Prog.	Load Prog.	Min.	Min.
5-OIL	CONC	Open	Close	Min.	Min.	Min.	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Min.
	WEAK	Open	Close	ΔP control	ΔP control	ΔP control	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	ΔP control
	SGR	Open	Close	Min.	Min.	Min.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Min.
4-OIL	CONC	Open	Close	Min.	Min.	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}
	WEAK	Open	Close	ΔP control	ΔP control	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}	Prog, for P_{HFO}
	SGR	Open	Close	Min.	Min.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Load Prog.	Load Prog.
3-OIL	CONC	Open	Close	Min.	Min.	Min.	Min.	Min.	Min.	Prog, for P_{HFO}	Min.	Min.	Min.
	WEAK	Open	Close	ΔP control	ΔP control	ΔP control	ΔP control	ΔP control	ΔP control	Prog, for P_{HFO}	ΔP control	ΔP control	ΔP control
	SGR	Open	Close	Min.	Min.	Min.	Min.	Min.	Min.	Load Prog.	Min.	Min.	Min.
2-OIL	CONC	Open	Close	Min.	Min.	Min.	Min.	Min.	Min.	Prog, for P_{HFO}	Min.	Min.	Min.
	WEAK	Open	Close	ΔP control	ΔP control	ΔP control	ΔP control	ΔP control	ΔP control	Prog, for P_{HFO}	ΔP control	ΔP control	ΔP control
	SGR	Open	Close	Min.	Min.	Min.	Min.	Min.	Min.	Load Prog.	Min.	Min.	Min.
1-OIL	CONC	Open	Close	Min.	Prog, for P_{DO}	Prog, for P_{DO}	Min.	Min.	Min.	Prog, for P_{HFO}	Min.	Min.	Min.
	WEAK	Open	Close	ΔP control	Prog, for P_{DO}	Prog, for P_{DO}	ΔP control	ΔP control	ΔP control	Prog, for P_{HFO}	ΔP control	ΔP control	ΔP control
	SGR	Open	Close	Min.	Load Prog.	Load Prog.	Min.	Min.	Min.	Load Prog.	Min.	Min.	Min.
LGR		Open	Close	Open	Load Program								

(NOTE)
All of dampers shall be decided during commissioning considering the boiler characteristics.
Legend

Min	: Minimum opening (10% for initial setting)
ΔP control	: Furnace-vertical duct difference pressure constant
Prog. for P_{HFO}	: Program in function to HFO pressure at the HFO common header Also, the PHFO is replaced with P_{HCO} in case of HCO firing instead of HFO.
Prog. for P_{DO}	: Program in function to DO pressure at the DO common header
Load Prog.	: Load Program

5. Air Flow Control

5.1 Related P&ID

01-HL_-S-20-001-001 Boiler Combustion Air System (1/2)

01-HN_-S-20-001-001 Boiler Flue Gas System (1/2)

5.2 Air fuel ratio control (O2 control)

This control is intended to indirectly control the amount of air required for combustion by controlling the economizer outlet gas O2 concentration so that an optimum excess air ratio will be reached.

Economizer outlet gas O2 signal

Three O2 measurements (AT-01HNA10CQ001A/B/C and AT-01HNA20CQ001A/B/C) are installed on right and left side gas duct respectively. Measured average O2 at each gas duct are compared and lower value is selected to maintain stable combustion.

Set value of economizer outlet gas O2

The O2 demand signal is derived as function of firing rate demand (FRD), with bias signal by an operator setting.

Economizer outlet gas O2 alarm

If the Economizer outlet exhaust gas O2 reaches a value equal to or below the specified value, an alarm for low economizer outlet exhaust gas O2 is sent to the operation station. While if the high range is used, alarm for low excess air ratio are excluded.

Air fuel ratio control (O2 control)

O2 is controlled, in the automatic mode, by a P + I controller that receives an error signal from the comparison of O2 demand and measured O2.

As for the air fuel ratio, the air flow demand is for a minimum air flow rate when the firing rate demand (FRD) is at 30% MCR or less, and therefore, the air fuel ratio control is on standby mode for automatic operation (The air fuel ratio signal is 1.0.). In addition, when any FDF is stopped, a shift is also made to standby mode for automatic operation.

When both FDF control mode are changed to “Manual” during normal operation, O2 control is also changed to “Manual”, and O2 control is tracked with actual air fuel ratio.

Integral (I) action of O2 control is interrupted during load change in order to avoid unstable operation, i.e. O2 control is not available during load change due to late response time of O2 analyzer.

During a load change, O2 deviations continue to come out and response time of O2 analyzer is late. If integral action is left active, integral output will go too far, and after the load change is completed, it takes long time to return to the original normal balance point. During a load change, therefore, integral output is put on hold by setting the O2 integral input at 0%, and then, after the load change is completed, integral action is effectively utilized again.

5.3 Air flow demand

Air flow demand (AFD) is calculated as a function of firing rate demand (FRD) and Boiler Input Ratio (BIR-Air) and corrected to insure complete combustion by monitoring for flue gas oxygen. The AFD is cross-limited with total fuel flow to prevent fuel rich condition in the furnace. Limitation of minimum air flow (Including the air flow during start-up of unit / during forced cooling of boiler / during furnace purge) is also provided.

5.4 FDF blade pitch control

The air flow is controlled by modulating the pitch position of the moving blade installed at the FDF inlet through the control drive (FCD-01HLB10AA001/ FCD-01HLB20AA001). In the automatic mode, FDF blade pitch are controlled by a proportional-integral controller that receives an error signal from the comparison of an air flow demand and an actual total measured air flow. In order to compensate load imbalance between FDF-A (01HLB10AN001) and FDF-B (01HLB20AN001), the FDF bias station is provided for arbitrary adjustments. The FDF blade demand is fed through a direction block interlock which blocks demand change. The direction block interlock prevents the FDF demand increase when the Surging block function detects an impending FDF Surging condition.

5.5 Overfire air (OFA) control

Overfire Air Port supplying air control damper will be controlled in proportion to boiler load up to 75%TMCR, and maintain the position for higher load. Below than 30%TMCR, OFA control damper will be fixed as minimum opening position.

6. Furnace draft control

6.1 Related P&ID

S-01-HN_-S-20-001-002 Boiler Flue Gas System (2/2)

S-01-HN_-S-20-002-001 Boiler Instrumentation

6.2 General

This unit is an oil fired boiler and controlled by the induced draft fan (IDF, 01HNC10AN001 / 01HNC20AN001) moving blade pitch to maintain the furnace draft at a constant negative pressure value through the control drive (FCD-01HNC10AA001/ FCD-01HNC20AA001) .

Furnace pressure (PT-01HAD10CP052A/B/C) signals have large ripples, and therefore, time lag on the measured signal and a function generator to give some dead band on the deviation are provided. In

addition, compensations are provided based on the number of IDFs to be operated to optimize the proportional-integral gains and enhance the follow-up property of the furnace pressure control.

In order to compensate load imbalance between IDF-A and IDF-B, IDF bias station for arbitrary adjustments are provided. And the boiler load goes down a runback up to 40% TMCR when one between IDFs or FDFs or RAHs is tripped.

In addition, the following functions are also provided to enhance the controllability.

1) Feed forward signals from FDF moving blade position

There is a correlation between IDF moving blade position and FDF moving blade position. The FDF moving blade position is used as the feed forward signal to improve response during a load change.

2) Correction of IDF opening during MFT

In the event of a Master Fuel Trip (MFT), sudden variations in the amount of gas in a furnace are anticipated, and thus, furnace pressure goes down suddenly. In order to prevent this, the IDF blade demands are forced to minimum position by the Furnace Pressure control high-limits. This is so called furnace implosion protection.

3) Override action of furnace draft control

In the event of a large furnace draft excursion, appropriate overrides are automatically taken.

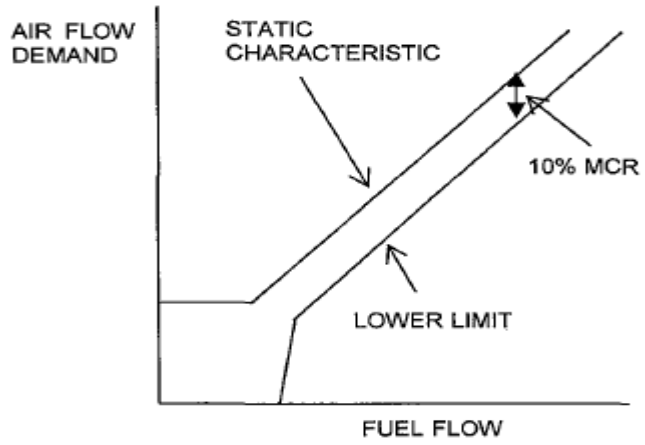
4) Direction block interlock

The IDF blade demand is fed through a direction block interlock which blocks demand change which could cause furnace pressure extremes. The direction block interlock also prevents the IDF demand increase when the Surging block function detects an impending IDF Surging condition.

5) Cross limit function between fuel and air

Following action shall be taken to avoid incomplete combustion due to lack of O2 (excess air ratio low)

Fuel flow to Air demand increasing cross limit: To avoid lack of O2, air flow demand is to be increased. Ten (10) % allowable upper and lower limit is usually given as shown below.



<Fuel flow to Air demand increasing cross limit>

6) Stall protection

Stall phenomenon for IDF and FDF is protected by stall warning system. At actual flow, the fan stall pressure is calculated and then calculated stall pressure is compared to the actual pressure. If the actual pressure is larger than stall warning pressure, fan will reduce blade pitch. If it is larger than stall trip pressure, fan will shut off.

7. Main Steam Temperature Control

7.1 Related P&ID

S-01-HA_-S-20-001-001	P&ID for Boiler Water System (1/4)
S-01-HA_-S-20-001-003	P&ID for Boiler Water System (3/4)
S-01-HA_-S-20-002-001	P&ID for Boiler Steam System (1/2)
S-01-HA_-S-20-002-002	P&ID for Boiler Steam System (2/2)

7.2 General

Accurate and stable control of the Main Steam Temperature is important to maximize the efficiency of the steam cycle.

7.3 1ry de-superheater spray control

The 1ry de-superheater spray control uses PID controller to adjust the 2ry SH outlet temperature (TE-01HAH21CT001A/B/C and TE-01HAH26CT001A/B/C). The set point is programmed based on load demand, and is compared with measured 2ry SH outlet temperature. Feed forward demand programmed by load demand is also added in order to achieve the planned 1ry spray water flow based on boiler static performance.

The primary stage attemperation control will also adjust spray control valves so that pre-determined temperature difference between inlet and outlet of the primary stage attemperator could be kept during steady state operation.

A steam saturation protection function is incorporated to prevent the 1ry SH spray control valves (TCV-01HAC41AA551 / TCV-01HAC43AA551) from driving the 1ry de-superheater outlet temperature (TE-01HAH11CT003A/B & TE-01HAH16CT003A/B) below the steam saturation point by the spray water block valve (MOV-01HAC40AA801).

Provision to maintain minimum opening of 1ry SH spray control valves (TCV-01HAC41AA551 / TCV-01HAC43AA551)is considered to avoid thermal stress of the 1ry de-superheater (01HAH11AH101 / 01HAH16AH101) due to repetition of opening/closing of 1ry SH spray control valve. Set point of minimum opening will be made based on load demand, and to be finalized during commissioning stage.

While a master Fuel Trip condition or Steam block condition or Boiler load low condition (fuel flow demand low), the 1ry SH spray control valves are forced to close to limit possibility of the thermal influence at the downstream of the 1ry de-superheater.

7.4 2ry de-superheater spray control

The main steam temperature (TE-01LBA11CT001A/B/C and TE-01LBA12CT001A/B/C) control uses Cascade control (upstream controller adjusts the Final SH inlet temperature set point which is downstream controller set point.).

The set point is programmed based on load demand, and is compared with measured Final SH outlet temperature (main steam temperature). Feed forward demand programmed by load demand is also added in order to achieve the planned 2ry spray water flow based on boiler static performance.

The 2ry de-superheater spray control will also adjust the 2ry SH spray control valves (TCV-01HAC51AA551 / TCV-01HAC53AA551) so that pre-determined temperature difference between inlet and outlet of the 2ry de-superheater (01HAH21AH101 / 01HAH26AH101) could be kept during steady state operation.

A steam saturation protection function is incorporated to prevent the 2ry SH spray control valves (TCV-01HAC51AA551 / TCV-01HAC53AA551) from driving the 2ry de-superheater outlet temperature (TE-01HAH21CT002A/B & TE-01HAH26CT002A/B) below the Steam Saturation point.

In order to enhance the controllability during a load change, boiler input rate (BIR) demand for secondary spray flow control is provided.

Provision to maintain minimum opening of 2ry SH spray control valves (TCV-01HAC51AA551 / TCV-01HAC53AA551) is considered to avoid thermal stress of the 2ry de-superheater (01HAH21AH101 / 01HAH26AH101) due to repetition of opening/closing of 2ry SH spray control valve. Set point of minimum opening will be made based on load demand, and to be finalized during commissioning stage.

While a master Fuel Trip condition or Steam block condition or Boiler load low condition (fuel flow demand low), the 2ry SH spray control valves are forced to close to limit possibility of the thermal influence at the downstream of the 2ry de-superheater.

8. Reheat Steam Temperature Control

8.1 Related P&ID

S-01-HA_-S-20-003-001 P&ID for Boiler Reheat System

8.2 General

Accurate and stable control of the Hot Reheat Steam Temperature is important to maximize the efficiency of the steam cycle.

The A line and the B line shall be controlled separately by each corresponding drive.

8.3 Gas recirculation fan damper control

The set point of the hot reheat steam temperature is programmed by the load demand with some restriction by change rate limiter. The set point bias function is also provided for operator manipulation.

The reheater outlet temperature is measured, and compared with set point.

The difference between the measured value and the set point, i.e. the error signal, is fed to a PI controller through process gain compensation loop. Feed forward signal programmed by the load demand is added on output signal from a PI controller.

The recirculation gas flow demand from the PI controller is fed to the Gas recirculation fan suction damper actuator drives (FCD-01HNF10AA002 for GR Fan-A, FCD-01HNF20AA002 for GR Fan-B) to control the recirculation gas flow for the GR fan. Finally the discharged recirculation gas from gas recirculation fan is distributed to the 4 LGRs (Lower Gas Recirculation) located at the below lowest level burner on the four (4) corners of boiler furnace bottom side. Each LGR has two (2) dampers and these dampers has modulating operation to have even recirculation gas flow to the four (4) LGRs

8.4 Reheater spray control

Being installed on the upstream of the 2ry reheater (between 1ry RH and 2ry RH), the RH de-superheater(01HAJ11AH101 / 01HAJ16AH101) controls the reheater outlet steam temperature (TE-01LBB11CT001A/B/C &TE-01LBB12CT001A/B/C) by adjusting the RH spray control valve (TCV-01LAF51AA551 / TCV-01LAF53AA551) to change the amount of spray water.

The Reheat Steam Temperature controller maintains the RH Steam Temperature to an operator adjustable set point by primary modulating flue gas recirculation and secondary, by controlling the Reheater spray control valves (TCV-01LAF51AA551 / TCV-01LAF53AA551).

Therefore, during normal operation, the RH spray control valve is kept complete closing, and it is used for emergency purposes in case where the boiler outlet reheat steam temperature goes up abnormally.

A steam saturation protection function is incorporated to prevent the RH spray control valves from driving the RH de-superheater outlet temperature (TE-01HAJ11CT002A/B & TE-01HAJ16CT002A/B) below the steam saturation point by the spray water block valve (MOV-01LAF50AA801).

While a Master Fuel Trip condition or Steam Block condition or Boiler load low condition (fuel flow demand low), the RH spray control valves are forced to close to limit possibility of the thermal influence at the downstream of the RH de-superheater.

9. Steam Airheater Control

9.1 Related P&ID

S-01-HL_-S-20-001-001	P&ID for Boiler Combustion Air System (1/2)
S-01-HL_-S-20-002-001	P&ID for Steam Air Heater System (1/2)
S-01-HL_-S-20-002-002	P&ID for Steam Air Heater System (2/2)
S-01-HN_-S-20-001-001	P&ID for Boiler Flue Gas System (1/2)

9.2 Steam air heater (SAH) temperature control

SAH temperature (TE-01HLC10CT001A/B/C and TE-01HLC20CT001A/B/C) is controlled by modulating the Auxiliary steam flow into SAH. Steam input to SAH-A (01HLC10AC001) and SAH-B (01HLC20AC001) is modulated by temperature control valve (TCV-01LBG31AA551 / TCV-01LBG32AA551) at the inlet of respective SAH.

SAH is used to keep the regenerative air heater metal temperature above the acid dew point at the gas exhaust side and thus avoid regenerative air heater corrosion. Therefore, average of regenerative air heater inlet air temperature (TE-01HLC10CT001A/B/C and TE-01HLC20CT001A/B/C) and regenerative air heater outlet gas temperature (TE-01HNA10CT003A/B and 01HNA20CT003A/B) is considered for SAH temperature control.

The set value of SAH temperature is constant. However, operator will have the provision to vary the temperature set value of both SAH individually using set value.

When SAH steam is provided, SAH TCVs (TCV-01LBG31AA551 / TCV-01LBG32AA551) will open up to initial opening position to prevent Temperature (Process variable) overshoot. SAH TCV starts controlling temperature when any of the following conditions is established:

- Deviation between the temperature set Value and Actual Process Value is within some specified range.
- SAH TCV remains at initial opening position for specified period of time.

9.3 SAH drain tank level control

SAH drain tank level is controlled by SAH drain tank level control valve (LCV-01LCN15AA551/LCV-01LCN25AA551) located at downstream of SAH Drain Tank. Set value of drain tank level is constant. However, operator will have the provision to vary the Level set value of both SAH individually using set value bias loop plate.

Condensate of the SAH drain tank flows to the deaerator to recover by the SAH drain pump. But, if measured quality of condensate by the conductivity analyzer is not met, this condensate will be drained

to the flash tank.

Flash steam in the SAH drain tank is vented to aux. steam inlet line of the SAH though vent line.

SAH drain tank level control valves will be fully closed (0 % open) if respective SAH drain pumps stop, as there will not be any water flow through the valve when pump stops. Each SAH drain pump has the minimum flow line connected to the SAH drain tank.

Tab C.2.3

Boiler Startup and Shutdown Procedure

Table of Contents

1 General

This document outlines the required actions in order to bring the Boiler and its associated auxiliary equipments in service for Shuqaiq Steam Power Plant.

1.1 Tag numbers

The described Tag numbers in this document are only for Boiler #11.

Tag numbers for Boilers #12, #13, and #14 are the same as Tag numbers for Boiler #11 except the following prefix:

Boiler #11	: 11 mentioned in this document as typical
Boiler #12	: replace with 12
Boiler #13	: replace with 13
Boiler #14	: replace with 14

1.2 Abbreviations

APC	Auto Plant Control
Approx.	Approximate
APS	Auto Plant Start-up
BCP	Boiler Circulation Pump
BFP	Boiler Feedwater Pump
BMS	Burner Management System
BOP	Balance of Plant
BR valve	Boiler Recirculation valve
CW	Cooling Water
CWT	Combine Water Treatment
DCS	Distributed Control System
ESP	Electrostatic Precipitator

FCV	Flow Control Valve
FDF	Forced Draft Fan
FGD	Flue Gas Desulphurization
GM	Gas Mixture
GRF	Gas Recirculation Fan
HP	High Pressure
HTR	Heater
IDF	Induced Draft Fan
LCV	Level Control Valve
LGR	Low Gas Recirculation
LP	Low Pressure
MOV	Motor Operated Valve
MFT	Master Fuel Trip
NWL	Normal Water Level
OFA	Over Firing Air
PB	Push Button
PCV	Pressure Control Valve
RAH	Regenerative Air Heater
SAH	Steam Air Heater
SAT	Saturated condition
SCR	Selective Catalytic Reduction
SDS	Sensor Driver System
Seq.	Sequence
SGR	Side Gas Recirculation
SH	Superheater
TB	Turbine Bypass
TCV	Temperature Control Valve
VSD	Variable Speed Driver
WDC	Water Separator Header Drain Control
WS	Water Separator Header
WSDH	Water Separator Drain Header

2 Boiler start-up procedure

2.1 Cold Start-up

2.3.1 Preparation for cold start-up

(1) Before starting unit, following condition should be established.

1) Power supply should be turned on.

- All auxiliary equipment required to be in operation
- Automatic plant control system
- Burner management system (BMS)
- All pneumatic shut-off valves and Motor operated valves (MOV)
- RAH SDS (Sensor Drive System)
- RAH Fire Detector & Rotation Detector System
- HP & LP TB valves oil units (High pressure & low pressure turbine bypass valves oil unit)

2) All monitoring instruments and supervisory equipment is in service

3) Line up of all systems should be completed.

For example,

- Feedwater system lined up and in service.
- Put the burner atomizing steam into service.
- Put the atomizing air for warming oil in to service.
- Line-up of warming oil line and it is ready for service operation
- All low temperature reheat steam pipe drain valves and high temperature reheat steam pipe drain valves are opened

(2) The following system should be taken in service at least (and other system should be taken in-

service if required);

- Deaerator ready for service.
- Feedwater storage tank at normal water level.
- Boiler feed pump sets and auxiliaries with VSD system ready for service.
- Condensate system lined up and ready for service.
- Gland steam condenser ready for service.
- Condenser air removal system ready for service.
- Instrument air system
- Make-up water system in service.
- Circulation water system
- Service air system
- Service water system
- Closed Cooling water system (CCW system)
- Sampling system in service.
- Chemical dosing system available for service.
- Auxiliary boiler and aux. Steam system
- Seal water supply

(3) Boiler inspection

1) Confirm there is no person inside the boiler.

2) Close all the manholes of the boiler and the ducts.

3) Retract all soot blowers and the furnace temperature probe.

4) Confirm the repair works have been completed if it was done.

2.3.2 Boiler filling-up

(1) Confirm that the following condition is satisfied;

1) BCP water filling is completed.

2) If blind plate is installed in the purge water line, spool should be installed before starting BCP water filling sequence.

3) SH spray shut-off valves

- MOV-01HAC40AA801 CLOSED : AUTO
- MOV-01HAC50AA801 CLOSED : AUTO

4) RH spray shut-off valve

- MOV-01LAF50AA801 CLOSED : AUTO

5) BCP warming discharge isolating and bypass valves

- MOV-01HAG12AA801 CLOSED : AUTO
- MOV-01HAG12AA802 CLOSED : AUTO

6) Chemical dosing pump running

(2) Line up & equipment condition

1) Condensate make-up water pump (A),(B), and (C)

- 00GHC31AP001 : AUTO
- 00GHC32AP001 : AUTO
- 00GHC33AP001 : AUTO

2) Condensate make-up water pump pressure control valve

- PCV-00GHC40AA551 : AUTO

3) Condensate make-up water pump (A),(B),and(C) isolating valve

- MOV-00GHC31AA801 : AUTO
- MOV-00GHC32AA801 : AUTO
- MOV-00GHC33AA801 : AUTO

4) Boiler / Deaerator filling pump (A),and (B)

- 00GHC61AP001 : AUTO
- 00GHC62AP001 : AUTO

5) Boiler / Deaerator filling pump pressure control valve

- PCV-00GHC70AA551 : AUTO

6) Boiler / Deaerator filling pump (A),and(B) isolating valve

- MOV-00GHC61AA801 : AUTO
- MOV-00GHC62AA801 : AUTO

7) BCP Injection control valve

- FCV-01HAG11AA551 : AUTO

8) BCP warming discharge control valve

- LCV-01HAG12AA551 : AUTO

9) WDC outlet MOV to condenser –A /B and CW discharge seal weir

- MOV-01LCM11AA801 : AUTO
- MOV-01LCM21AA801 : AUTO
- MOV-01LCL20AA801 : AUTO

10) WDC Valve

- LCV-01HAG21AA551 : AUTO
- LCV-01HAG22AA551 : AUTO

11) BCP Inlet MOV

- MOV-01HAG10AA801 : AUTO

12) BCP Outlet MOV

- MOV-01HAG10AA802 : AUTO

13) BR Valve

- FCV-01HAG10AA551 : AUTO

14) BCP Min. Flow Valve

- MOV-01HAG13AA801 : AUTO / OPEN

15) Manual valve position

- Economizer drain valve, 01LAB30AA401 / 402 : Lock Closed
- Furnace water wall inlet drain valve,
- 01HAC11AA401 / 402, 01HAC16AA401 / 402 : Lock Closed
- Economizer outlet vent valve, 01HAC20AA501 / 502 : OPEN
- Front wall outlet vent valve, 01HAD10AA501 / 502 : OPEN
- Side wall outlet vent valve, 01HAD10AA503 / 504 : OPEN
- 2ry pass outlet vent valve, 01HAD20AA501 / 502 /503 / 504 : OPEN
- WS outlet vent valve, 01HAH10AA501 / 502 : OPEN

16) 2ry pass inlet pipe drain MOV

- MOV-01HAD16AA801 : AUTO
- MOV-01HAD16AA802 : AUTO

17) 2ry pass bypass MOV

- MOV-01HAD12AA801 : AUTO
- MOV-01HAD17AA801 : AUTO

(3) Boiler water filling start-up seq.

1) Condensate make-up water pump isolating valve shall be opened.

- MOV-00GHC31AA801 : OPEN
- MOV-00GHC32AA801 : OPEN
- MOV-00GHC33AA801 : OPEN

2) Boiler / Deaerator filling pump isolating valve shall be opened.

- MOV-00GHC61AA801 : OPEN
- MOV-00GHC62AA801 : OPEN

3) Boiler filling water shall be provided to the boiler.

- Filling water flow : Approx. 150 t/h
- Expected water filling up time : Approx. 2 hour

4) When WSDH level becomes more than pre-set value (Initial value: 10m, control system judges that level is established.

5) After WSDH level is established, WSDH level shall be controlled by WDC Valve, LCV-01HAG21AA551 and LCV-01HAG22AA551.

6) After completion of water filling, following vent valves shall be CLOSED.

- Economizer outlet vent valve, 01HAC20AA501 / 502
- Front wall outlet vent valve, 01HAD10AA501 / 502
- Side wall outlet vent valve, 01HAD10AA503 / 504
- 2ry pass outlet vent valve, 01HAD20AA501 / 502 /503 / 504
- W/S outlet vent valve, 01HAH10AA501 / 502

2.3.3 Boiler cold clean-up blow

(1) Following mode shall be selected before use of APS;

1) APS mode of BMS

2) APC-APS mode

3) APS mode selection : AUTO

4) APS : IN

5) APS mode : SU(Start-up)

6) Start-up mode

(2) Confirm that the following conditions are satisfied:

1) Boiler filling-up is completed.

2) Pre-Boiler Clean up (Condensate water line, LP feed water line & HP feed water line) is completed.

3) Close vent valves and drain valves attached to a boiler.

4) BCP, 01HAG10AP001 : STOP

5) BR valve, FCV-01HAG10AA551 : AUTO

6) BFP A or B or C, 01LAC11AP001 / 01LAC12AP001 : RUNNING

(3) Operation procedure of STEP-1.

1) WDC outlet MOV condensers A and B

- MOV-01LCM11AA801 : AUTO (CLOSED)

- MOV-01LCM21AA801 : AUTO (CLOSED)

2) WDC outlet MOV to CW discharge seal weir

- MOV-01LCL20AA801 : AUTO (OPEN)

3) Open BCP inlet valve, MOV-01HAG10AA801.

4) Check BCP outlet valve, MOV-01HAG10AA802 is closed.

5) BCP injection valve will start to control injection water flow.

6) Check BR valve, FCV-01HAG10AA551 is closed.

7) Start a blow while controlling water level of Water separator drain header (WSDH) controlled by WDC valves, LCV-01HAG21AA551 / LCV-01HAG22AA551.

- Total feed water flow : 475 t/h(20% of BMCR)
- Boiler circulation flow : 0 t/h

  * BCP can be operated according to the BFP discharge flow.

8) When the water quality at the Water separator drain header (WSDH) outlet satisfies the following condition, go to the boiler circulation sequence.

- Fe < 0.5 ppm

2.3.4 Boiler cold clean-up circulation

(1) Operation procedure.

1) Open WDC outlet valves to condenser, MOV-01LCM11AA801 / 01LCM21AA801.

2) Close WDC outlet valve to CW discharge seal weir, MOV-01LCL20AA801.

3) Boiler water is return to condenser and recirculation is started.

4) Maintain feedwater flow rate at 25%BMCR.

5) Start the BCP sub-cooling water flow control valve, FCV-01HAG11AA551

6) Open the BCP minimum flow valve, MOV- 11HAG13AA801.

7) Open the BCP outlet valve, MOV-01HAG10AA802.

8) BCP start permission

- WSDH level > 4m
- BR valve, FCV-01HAG10AA551 : AUTO (<15%)
- BCP motor cooling water flow, FIS-01PGB36CF101 : ≥ 15m3/h.
- BCP Heat barrier temperature, TE-01HAG10CT012A/B/C :< 60°C
  - High Trip ≥ 65℃
  - High ANN. ≥ 60℃

9) Start BCP.

10) BR valve, LCV-01HAG10AA551 controls boiler circulation flow at approx. 20 % BMCR flow to the Economizer inlet. : 465 t/h

- Total feedwater flow at Economizer inlet : 581 t/h (25% BMCR)

- Economizer inlet feedwater flow rate shall be kept to approx. 25% BMCR, balance (i.e. approx. 5%BMCR: 116 t/h) will be supplied by BFP through WDC valves.
- WDC valves, LCV-01HAG21AA551 / LCV-01HAG22AA551 control the WSDH level.

(2) When the water qualities at the Water separator drain header (WSDH) outlet satisfies the following condition, the boiler cold clean-up circulation is completed.

- Fe < 0.3 ppm

2.3.5 Preparation for boiler light-off

(1) Preparation for Feedwater System

1) Re-confirm that the following is established.

- BFP outlet flow control valve Start Sequence : AUTO
- VSD Start Sequence : AUTO
- BR valve Start Sequence : AUTO
- BFP -A or B or C will be taken in-service.

2) Confirm that the total feedwater flow (BFP discharge flow, FT-01LAB20CF001A/B/C + BCP circulation flow, FT-01HAG10CF001A/B/C) is controlled at 581 t/h (=25%BMCR)

3) Confirm that BCP is running and the boiler circulation flow (FT-01HAG10CF001A/B/C) is controlled at 465 t/h by BR valve.

(2) Preparation for combustion air and flue gas draft system

1) Confirm that the manhole of boiler each section and all observation port has been closed.

2) Make sure that the draft transmitters (PT-01HAD10CP052A/B/C and PT-01HAD10CP053A/B/C) of each section have been checked out and are available for service.

3) When Air & Gas path start, Urea system will start for Hydrolyzer filling and heating (It will take about 2 hours)

4) Confirm that ESP is ready for start up.

* For ESP service, ESP inlet temperature should be satisfied.

5) Confirm that RAH is ready for start up.

6) Confirm that FGD is ready for start up.

7) FGD by-pass damper or FGD inlet & outlet damper must be open.

8) Confirm that the following “Start Sequence" and equipment should be placed into ’‘auto' position.

- Air & Gas system start up sequence
- Furnace purge sequence
- All air & gas system dampers
  - FDF outlet dampers (FZ-01HLB10/20AA002)
  - SAH inlet dampers (FZ-01HLB10/20AA003)
  - RAH inlet air dampers (FZ-01HLC10/20AA001)
  - RAH outlet air dampers (FZ-01HLD10/20AA001)
  - RAH air bypass dampers(FZ-01HLC10/20AA002)
  - IDF outlet dampers (FZ-01HNA10/20AA008)
  - Economizer outlet dampers (FZ-01HNA10/20AA002)
  - SCR inlet dampers (FZ-01HNA10/20AA003)
  - Economizer bypass dampers (FZ-01HNA10/20AA001)
  - SCR bypass dampers (FZ-01HNA10/20AA004)
  - RAH inlet gas dampers (FZ-01HNA10/20AA005)
  - RAH gas bypass dampers(11HNA/1020AA006)
  - IDF inlet dampers (FZ-01HNA10/20AA007)
  - GRF outlet dampers (FZ-01HNF10/20AA003)
- A,B-IDF moving blades (UZ-01HNC10/20AA009) Start Sequence
- A,B-FDF moving blades (FCD-01HNB10/20AA001) Start Sequence
- A,B-GRF moving dampers (FCD-01HNF10/20AA002) Start Sequence
- A,B-GM Dampers (FZ-01HNF30AA001/002) Start Sequence

- All wind box dampers Start Sequence
- A,B-AH Main Motor & Aux. Motor
- A,B-IDF (11HNC10/20AN001)
- A,B-IDF control oil pumps (No.1 & No.2)
- A,B-IDF seal air fans (No.1 & No.2)
- A,B-FDF (11HLB10/20AN001)
- A,B-FDF control oil pumps (No.1 & No.2)
- A,B-GRF (11HNF10/20AN001)
- A,B-GRF Lub. Oil Pump (No.1 & No.2)
- A,B-GRF Turning Gear
- Cooling air fan (11HHQ10AN001/002)

  * Main Motor of RAH, which drives RAH by direct coupling，should be used in normal operation.

(3) Preparation of Fuel System

1) Following “Start Sequence" and equipment should be put into "Auto"

- Warm up Oil Supply System
  - Warm up oil start up sequence
  - Warm up oil leak test
  - Shut-off valve of warm up burner (XV-01HJF10AA851/852)
  - Pressure control valve of warm up burner (PCV-01HJF10AA551)
  - Warm up burner atomizing air pressure control valve (PCV-01HJN10AA551)
- Fuel Oil Supply System
  - Fuel oil start-up sequence
  - Fuel oil leak test

- Fuel oil supply pump
- Shut-off valve of fuel oil burner header (XV-01HHF10AA851/852)
- Leak check valve of fuel oil burner header (XV-01HHF10AA853)
- Fuel oil flow control valve (FCV-01HHF10AA551/552)
- Fuel oil strainer (11HHF10AR001/002) isolation MOV-01HHF10AA801/802/803/804)
- Warm up MOV-01HHF10AA805
- Recirculation MOV-01HHF10AA806
- Fuel oil burner atomizing steam pressure control valve (PCV-01HHM10AA551)

• Water Fuel Ratio : AUTO

2) Recommendation

• After shutdown period, the local position indication of moving blade for each fan shall be confirmed as in the same position of the control room demand prior to 'Air & Gas system start up' to make sure moving blade is working smoothly.

(4) Preparation for TB (Turbine By-pass) System

Following condition should be established.

• HP & LP TB System oil unit has been taken in service and they should be placed into Auto.
• Line up of HP & LP TB spray system is completed
• HP & LP TB valves : AUTO
• HP-TB spray shut-off valve : AUTO
• HP-TB spray control valves : AUTO
• LP-TB spray control valves : AUTO
• LP-TB inlet shut-off valves : AUTO

(5) Preparation for steam line

- 3ry Super heater outlet header drain valve, MOV-01HAH30AA801/802 : AUTO
- Main steam drain valve : AUTO
- Reheat steam line drain valve : AUTO (Open)

(6) Start up of sequence 'Boiler Light-off preparation on APS.

1) Press 'button of 'Boiler Light-off preparation' on APS.

(Refer to flow chart on next page.)

2) After starting first IDF, furnace draft will drop to -50 mmH2O approx.

If furnace draft drops to less than -400 mmH2O, IDF will be tripped. If open signal of more than 80% of all burner wind box dampers, including LGR, does not come on control system, IDF start will not be permitted.

3) After first FDF is started, air flow shall be controlled at 813 T/H

4) After one side of Air & Gas system is completely started up and air flow is higher than 30% of total air flow, Distillate oil pump will be started by warm up burner start up sequence and discharge pressure will be controlled at 30 bar.

5) Heavy fuel oil pump will be started after five minutes from starting second FDF.

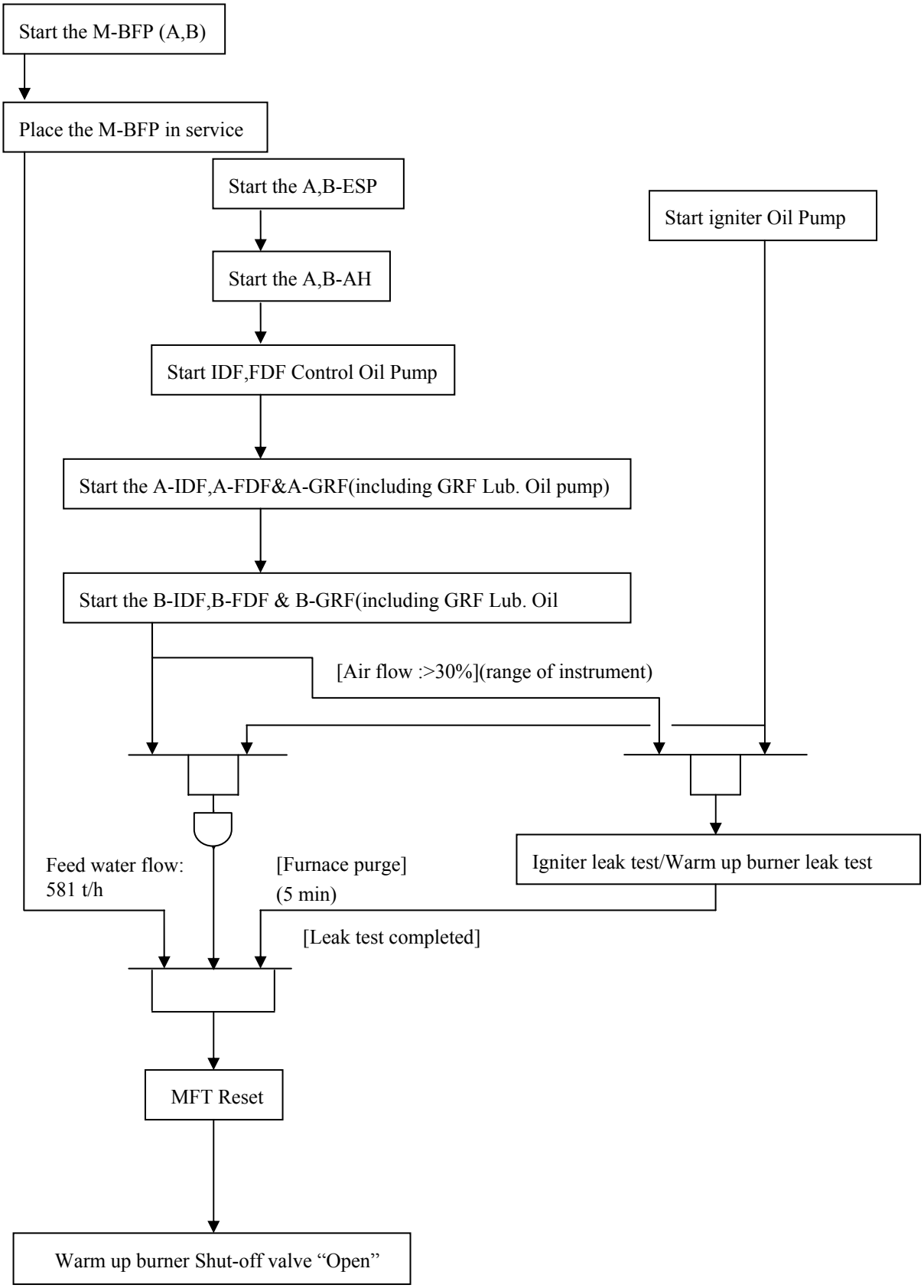
6) Furnace draft will drop to -150 mmH2O approx. just after starting second IDF.

7) After starting both FDF, Air flow shall be controlled at 813 T/H of total air flow. Furnace draft shall be controlled at -10 mmH2O by IDF moving blade.

8) After Air & Gas system is started up, furnace purge will be started.

9) When warm up oil leak test and furnace purge is successfully completed, MFT will be reset and shut-off valve (warm up oil) will open.

10) Heavy fuel oil shut-off valve will open when fuel oil leak test is successfully completed.


Start the M-BFP (A,B)
Place the M-BFP in service
Start the A,B-ESP
Start igniter Oil Pump
Start the A,B-AH
Start IDF,FDF Control Oil Pump
Start the A-IDF,A-FDF&A-GRF(including GRF Lub. Oil pump)
Start the B-IDF,B-FDF & B-GRF(including GRF Lub. Oil
[Air flow :>30%](range of instrument)
Feed water flow:
581 t/h
[Furnace purge]
(5 min)
Igniter leak test/Warm up burner leak test
[Leak test completed]
MFT Reset
Warm up burner Shut-off valve “Open”

2.3.6 Light off and pressure rising

(1) Light off preparation

1) Start up mode shall be selected automatically judging from the following condition when APC-APS mode is "Auto"

- Boiler water separator inlet temperature, TE-HAD21/22/26/27CT001

2) BMS shall be put in "APS" mode

3) Confirm that the following light off permission is satisfied.

- Warm up oil burner light off permission
  - Igniter light off permission completed.
  - Distillate oil shut-off valve, 11HJF10AA851/852 : OPEN
  - Atomizing air / steam press., PSLL-01HJN10CP101A/B/C : NORMAL
  - Light oil header press., PSLL-01HJF10CP101A/B/C : NORMAL

CAUTION

OFA & Windbox differential pressure control Start Sequence MUST be placed into "Auto" to avoid unstable combustion.

(2) Light off

1) Warm up oil flow control valve (PCV-01HJF10AA551) will open to light off position (32%) automatically.

2) Press "Light off' on APS.

3) The first warm up burner (B-1) at elevation -1 shall be taken in service after its igniter is

sparking.

4) The warm up control valve will change to light off pressure control.

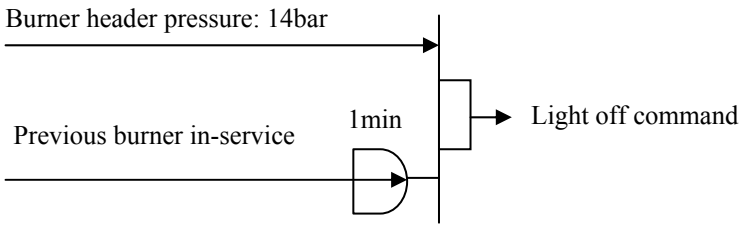
5) The next warm-up burner (D-1) at elevation-1 shall be in service after 30 sec. from B-1 burner in service.

6) The warm control valve will change to flow control after 1 burner valves opened.

7) The warm up control valve will be increased gradually to hot clean-up flow rate for each mode.

8) When burner pressure is increased to 14 bar and 1 minute has passed since previous burner in-service, additional burner will be taken in-service. 4 burners of elevation -1 will be taken in-service as per following sequence.

- Burner light off level : 14 bar



- Check firing condition (flame length , flame brightness) through the TV camera at the control room or observation port at local.
- Confirm the burner damper position and differential pressure between wind box and burner is normal.

Damper	In service burner	Out of service burner
OFA	Opening VS. Load	Min. opening (20%)

CONC	Opening VS. Oil pressure	Min. opening (10%)
WEAK	Opening VS. Oil pressure	• Min. opening (10%) @ 30%TMCR~ • ΔP (7 mbar) control @ ~ 30% TMCR
SGR	Opening VS. Oil pressure	Min. opening (10%)
LGR	Opening VS. Load	Min. opening (70%)

(3) Hot clean-up

When water wall outlet temperature (TE-01HAD21/22/25/27CT001) reaches 140^{O}C, 1 pair burners will be shut-down and hot clean-up will be started as follows.

1) Warm up oil flow will be changed the set point as per water wall outlet temperature to keep 120~170 ^{O}C.

2) Two Burner will be in-service for Hot clean-up

3) BR valve, LCV-01HAG10AA551 controls boiler circulation flow at approx. 20 % BMCR flow to the Economizer inlet. : 465 t/h

- Total feedwater flow : 581 t/h (25% BMCR)
- Economizer inlet feedwater flow rate shall be kept to approx. 25% BMCR, balance (i.e. approx. 5%BMCR: 116 t/h) will be supplied by BFP through WDC valves.
- WDC valves, LCV-01HAG21AA551 / LCV-01HAG22AA551 control the WSDH level.

4) Turbine bypass valves are to be kept as closed position.

5) When the water quality at water separator drain header outlet satisfies the following condition, boiler hot clean-up is completed.

- Fe < 0.1 mg/l
- SiO2 < 0.03 mg/l

6) Press water quality confirmation button.

(4) Pressure rising and temperature rising

After the completion hot clean up, pressure rise shall be carried out as follows.

1) Boiler re-circulation flow shall be maintained as 465t/h.

2) Fuel flow shall be increased to Pre-set value (Value: 22 t/h) when hot clean up finished.

3) Additional one pair burners will be taken in service with the increment of burner pressure.

4) HP-TB valve inlet shut-off valves(HV-11/12/13/14LBA11/12AA851) will open when the control valve is opened more than 2%

5) HP-TB valve when open to minimum position and warming of reheat line will be started, when any burner light-off is performed

6) Confirm that LP HTR and HP HTR drains, which are connected to the condenser, are open.

7) When hot reheat line pressure gets 2 barg, LP-TB valves will open to minimum position.

8) When HTR pressure gets 12 barg, LP-TB valves will start to control the pressure at 12 barg.

9) SAH and SAH drain pump start Sequence.

① When following condition is established, SAH drain recovery to the deaerator can be started.

- Deaerator is in-service condition
- Water quality is satisfied the criteria for recovery

② Select [Deaerator] case before starting the recovery.

- Case 1 [SAH to Deaerator]

· SAH drain MOV-01LCN15/25AA802 will open.

· SAH drain MOV-01LCN16/26AA802 will close.

- Case 2 [SAH to Boiler Flash tank]

· SAH drain MOV-01LCN16/26AA802 will open.

· SAH drain MOV-01LCN15/25AA802 will close.

10) When main steam pressure reaches 85 bara, HP-TB valves will start to control the main steam pressure at 85 bara. At the same time, pressure rise is completed.

Note) Furnace outlet gas temperature < 540 ^{O}C, before HP bypass and LP bypass operation

(5) Fuel change over from Distillate oil to Heavy fuel oil

Before charging over to Heavy fuel oil, FGD and SAH should be taken in service according to manufacturer's operation procedure. Heavy fuel oil up to heavy fuel oil shut-off valve leakage test also should be finished before this step.

1) Confirm that the lineup of Heavy fuel oil systems and warming is complete.

- Judgment of warming completion
  - Temperature of burner return line, TE-HHF10CT003 > 65 ^{O}C

2) Confirm that the following Heavy fuel oil light off permission condition is satisfied.

- Heavy fuel oil header shut-off valve, XV-01HHF10AA851 / 852 : OPEN
- Heavy fuel oil header press., 11HHF10CP102A/B/C : NORMAL > 9.0 bar
- Heavy fuel oil header temp., 11HHF10CT101 : NORMAL > 110 ^{O}C
- Atomizing steam pressure, 11HHM10CP101A/B/C : NORMAL > 8.0 bar

3) APS send the command on warm up oil / Heavy fuel oil change over.

4) One pair of Heavy fuel oil burners at “elevation – 2” will be lighted off for the time interval 15 seconds between two burners which are controlled simultaneously as one pair.

5) Warm up oil flow will be reduced automatically to keep the same total fuel flow.

6) When one pair of Heavy fuel oil is taken in service total fuel flow is controlled by Heavy fuel oil control valve, FCV-01HHF10AA551.

7) When one pair of Heavy fuel oil burners are established, one pair of warm up burners will be shutdown

8) After one pair of Warm up burners is shutdown, warm up burner header pressure will be decreased automatically by closing pressure control valve.

9) When all warm up burners are shutdown, warm up burner shut-off valve will be closed. (After burner purge will be carried out for 6 min, changeover will be finished.)

10) When four (4) Heavy fuel oil burners are taken in service, burner re-circulation valve, MOV- 01HHF10AA805 will start to close gradually.

11) Check Heavy fuel oil burner firing condition (flame length, flame brightness) by the TV camera at the control room.

- Wind box damper opening position is shown as below.
  (Under turbine no-load operation)

Damper	In service burner	Out of service burner
OFA	Opening VS. Load	Min. opening (20%)
CONC	Opening VS. Oil pressure	Min. opening (10%)
WEAK	Opening VS. Oil pressure	• Min. opening (10%) @ 30%TMCR~ • ΔP (7 mbar) control @ ~ 30% TMCR
SGR	Opening VS. Oil pressure	Min. opening (10%)
LGR	Opening VS. Load	Min. opening (70%)

2.3.7 Turbine start

Start the turbine according to the turbine start up procedure when the minimum permissible turbine inlet steam temperature and pressure is satisfied.

(Refer to turbine manufacturer's instructions.)

2.3.8 Synchronization (0~5%TMCR)

(1) Synchronization

1) Confirm that steam turbine, generator and power network are ready for synchronization. Follow steam turbine and generator start up procedure.

2) Following valves should be placed into AUTO.

- 1ry De-superheater spray control valves
  - TCV-01HAC41AA551
  - TCV-01HAC43AA551
- 1ry De-superheater spray shut-off MOV-01HAC40AA801
- 2ry De-superheater spray control valves
  - TCV-01HAC51AA551
  - TCV-01HAC53AA551
- 2ry De-superheater spray shut-off MOV-01HAC50AA801
- RH De-superheater spray control valves
  - TCV-01LAF51AA551
  - TCV-01LAF53AA551

- RH De-superheater spray main shut-off MOV-01LAF50AA801

3) During the Turbine Speed-up, LP Heater will be in-service.(Turbine RPM at 2000)

4) APS send the command on 'Synchronization' after turbine start.

5) After synchronizing, main steam drain pipe will close.

6) Initial Load will be followed according to the Turbine start up procedure

2.3.9 Load up-1 (5% TMCR→20% TMCR)

(1) Start the load-up to 20% TMCR.

1) APS send the command on 'Load up-1'.

2) Load variation rate will be set to 1.5% TMCR/min.

3) Unit load will be increased to BID-140MW. Burner will be taken in-service with increment of fuel flow.

4) When the load reaches 70MW, HP Heaters will be in-service.

5) HP/LP Bypass valve will be closed at this stage.

6) After HP Bypass close, Turbine IPC mode will be ON

2.3.10 Load up-2 (20% TMCR → 35% TMCR)

(1) Preparation

1) Following valves should be placed into 'Auto'

- Aux. steam supply isolation MOV-01LCB16/17AA801 from cold reheater.
- Aux. steam pressure control valve, PCV-01LCB16/17AA551 from cold reheater.

(2) Load up-2

APS send the command on 'Load up-2'.

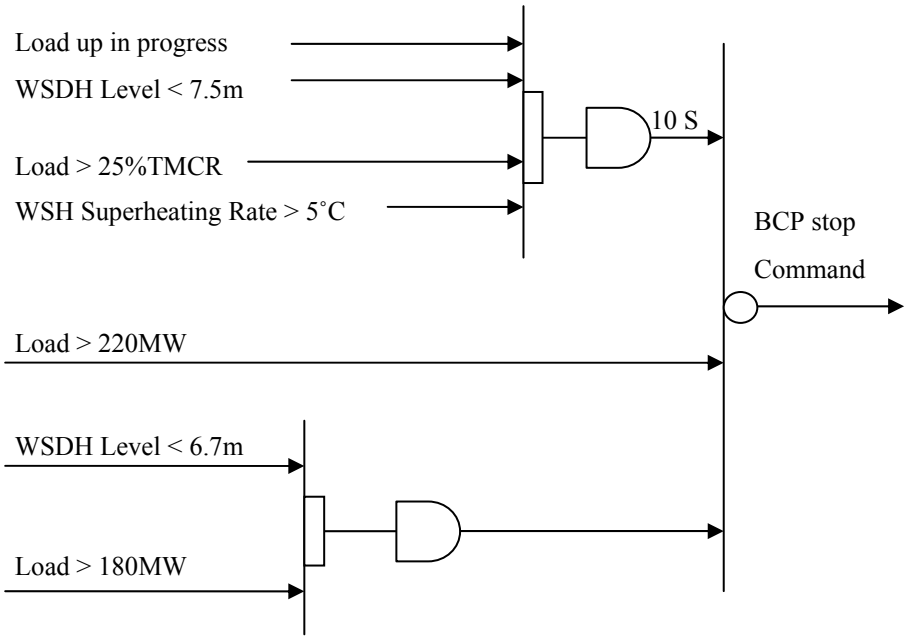
1) Load variation rate will be set to 1.5 %/min.

2) Load up will be started with BI operation (Set : BID-250MW)

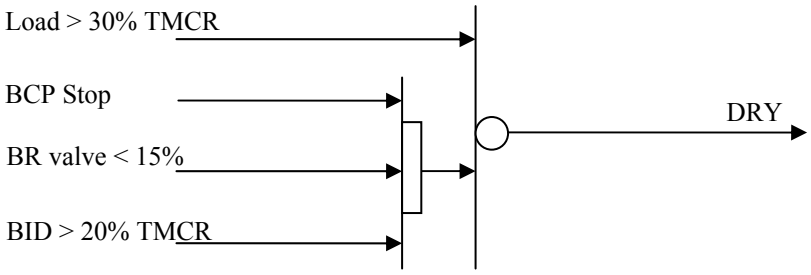
(3) Wet/Dry Change-over

When the following conditions is established the BCP will be stopped, then boiler control mode will be changed from [WET] mode to [DRY] mode.

1) BCP stop command

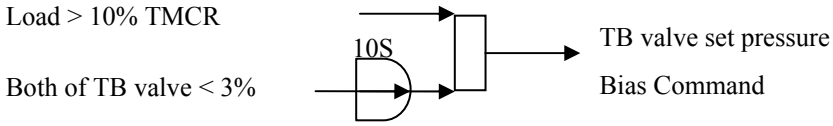


2) [DRY] mode command.



3) When the following conditions is established, pressure set point of TB valve goes Up to

30 bar over main steam pressure set point of boiler master.



4) A-WDC valve outlet MOV-01LCM11AA801 will close after changing over to dry mode.

5) BCP warming line discharge control valve, LCV-01HAG12AA551 & MOV-01HAG12AA801 will open after changing over to dry mode.

2.3.11 Load-up-3 (35% of TMCR → 100% of TMCR)

(1) Load up-3

1) Mode will be changed from BI to CC before the load up

3) Load variation rate will be set to 1.5 %/min.

(2) When water separator (WS) pressure reaches 165 bar, B-WDC valve, LCV-01HAG21AA551 and B-WDC outlet MOV-01LCM21AA801 will close.

(3) Set the target load as per load dispatch center demand.

2.2 Warm, hot and very hot start-up

2.2.1 Preparation

(1) Confirm that the all [APC s/s] place into “AUTO"

Refer to section 2.3.2 (2), 2.3.5 (2)(3)(4)(5) of cold start up procedure. Valve status of section 2.3.2 (2) (whether valve is open or not) is not applicable for this section.

(2) Confirm that ‘lock out’ of all auxiliary equipment is released.

(3) The following auxiliary equipment should be running during boiler hot banking.

1) AH

2) GRF turning motor

3) Cooling fan.

4) Control oil & Lub. Oil pumps of IDF & FDF, Lub. oil pump of GRF

5) IDF seal air fans

(4) Unit Start up

1) Select the following item.

- Start-up mode
- Aux. steam selection
- (Another operating boiler or auxiliary boiler)

2) When the start-up after condenser vacuum break or warm start-up, following LP clean up procedure will be carried out.

- Confirm LP clean up termination sequence is Auto.
- After confirmation of water quality of LP- clean up circulation, boiler can be started up. Press “Water quality confirmation PB".

(5) Start up of sequence of 'Boiler Light-off Preparation'

1) Air & Gas system will be started.

2) M-BFP will be taken in-service 5 minutes after starting both FDF.

⇨ Feed water flow will be increased to 450 t/h.

3) Furnace purge, warm-up oil leak test and will be carried out. (Please refer to cold start up procedure.)

4) Heavy fuel oil pump will be started

5) When the following condition is satisfied, BCP will be started.

- WS drain header level > 7.5 m
- Feed water flow shall be controlled at 593 t/h (25% BMCR)
- Boiler water re-circulation flow shall be controlled at 465 t/h, and feed water flow is more than 25% BMCR.

6) When warm up oil leak test & furnace purge is successfully completed, MFT will be reset and warm up oil shut-off valve will open.

7) When MFT is reset, start-up mode shall be determined and recommended by APS.

2.2.2 Light-off

(1) Light off and pressure rise

1) Basic operation procedure is the same as the one of cold start up mode.

2) Refer to section 2.3.6 (1),(2),(4) of cold start up procedure.

3) When BMS is APS mode, following burners will be taken in-service.

- Oil start up : Elevation-1 burner will be lighted-off

4) Fuel flow will be increased to following flow according to judgment of start-up mode in

APC.

Note) Final oil flow set point & increasing rate will be decided during the commissioning stage.

5) When the following conditions is satisfied, HP-TB valve will open to minimum position automatically. Refer to section 6-4)-(4) of cold start up procedure.

- 6 minute passes after lighted off.
- Main Steam pressure goes up to 2 barg higher pressure from initial burner light-off.
- Main Steam pressure is more than 10 bar.

6) When the main steam pressure reaches 85 barg, HP-TB valve will start to control main steam pressure at 85 barg.

7) When re-heat line pressure reaches 2 barg, LP-TB valve will open minimum position. When re-heat line pressure reaches 12 barg, LP-TB valve will start to control re-heat line pressure at 12 barg.

8) The next steps are same as the steps from the 7) Turbine start of cold start-up procedure.

3 Boiler shut down

3.1 Normal shut down

3.1.1 Preparation for unit shut down

(1) Confirm unit is operated under the following condition

1) APS mode of BMS : ON

2) APC-APS mode : ON

3) APS mode selection :AUTO

4) APS : IN

5) APS :SD(Shutdown)

6) Shut-down mode

7) Aux. steam selection

(Another operating boiler or auxiliary boiler)

8) All “Start Sequence” :AUTO

9) Refer to section 2.3.2(2), 2.3.5(2) (3) (4) (5), 2.3.11(1) of cold start-up.

10) BMS---“auto”

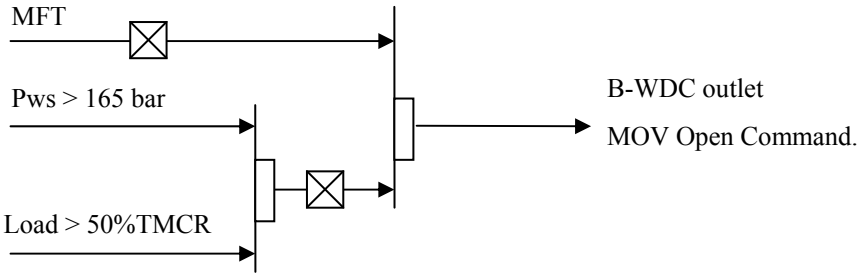
3.1.2 Load down (100% load (TMCR) → 20% load or certain load → 20% load)

(1) Load down-1 (Load down to 50%)

1) Load variation rate will be set to (-) 1.5%/min.

2) Load will start to go down to 50%.

(2) B-WDC outlet MOV-01LCM21AA801 will open when W.S. steam pressure becomes less than 165 bar.



(3) Load down to 35%

Load variation rate will be set to (-)1.0%/min. from unit load 50%TMCR. Target load will be set to 35 %TMCR. The operation mode will be changed from CC to BI after 30 minutes from the load is 250MW

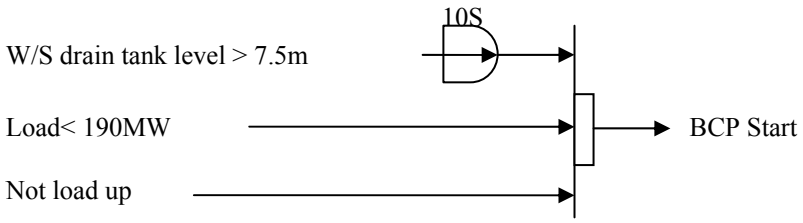
(4) Load down to 20% (Minimum load)

Target load will be set to 20%TMCR and load variation rate will be set to (-)0.5%/min.

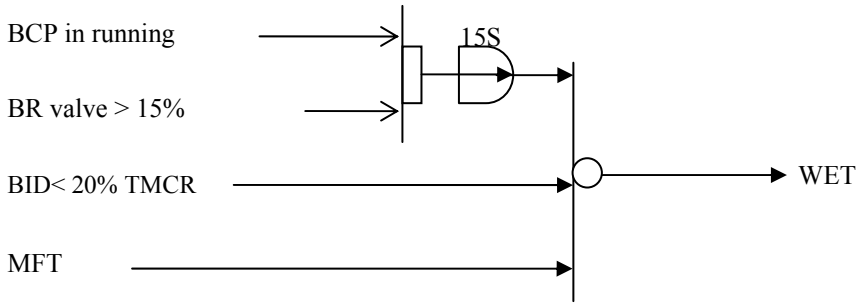
(5) Dry/Wet change-over

When the following condition is satisfied, BCP will be started, then unit operation mode will be changed-over from “dry” to “wet”.

1) BCP start command



2) Dry/Wet change-over permissive conditions



3.1.3 Load down-2 (20% of TMCR → 5% of TMCR)

(1) Preparation for load down

The feed water flow rate from the both BFPs shall be more than 590t/h.

If auxiliary steam is not able to be supplied by another operating main boiler, start auxiliary boiler and pressurize it to prepare for change over of auxiliary steam supply.

(2) Load down

Select 'Load down-2' on APS

1) Lower load limit will be set to 0 %TMCR.

2) Load variation rate will be set to (-)0.5%/min.

3) Load target will be set 5% TMCR.

(3) HP, LP Heater out of service.

HP, LP healer will be out of service when the turbine trip.

(4) BMS manual mode

When number of in-service burner is four, automatic start-up & shutdown function of BMS

is not available any more. However, burner will be shutdown automatically if 'APS mode of BMS' is selected and 'Boiler shut down' sequence of APS is started.

3.1.4 Line off (De- synchronization)

(1) Line off (De- synchronization)

(Follow the generator manufacturer's procedure)

Select 'line off' button on APS.

(2) Turbine trip

Turbine will be tripped.

Refer to turbine operation procedure.

(3) Boiler operation

After de- synchronization, boiler should be operated as follows.

1) HP-TB valves will open to maintain main steam pressure at 108 bar. LP-TB valves will open as well to maintain reheat steam pressure at 7 bar.

2) Re-heat line drain valves, which are connected to condenser, will open. -Superheat and reheater spray control valves and spray shut-off MOV will close.

3) Boiler operation mode will be changed over to BI mode (Boiler Input mode)

3.1.5 Boiler Shutdown

(1) Boiler Shutdown

APS send the command on 'Boiler Shutdown'

1) Fuel flow set will be decreased to 10t/h with the rate of 3t/min. When following condition is established, one pair of burners will be shutdown.

- Burner header pressure 9 bar [oil firing]

2) After shutdown of one pair of burners, fuel flow control valve will go to close gradually. When burner pressure reaches the following value, remaining burners will be shutdown.

- Burner header pressure 9 bar [oil firing]

3) After burner gun purge completed, MFT is set.

4) After MFT is set, Air & gas System should be operated for 5 minutes for post-furnace-purge.

5) When MFT is set, BFP will be stopped. Shut-off valve of fuel oil burner header should be closed automatically. After post purge completed, GRF, FDF and IDF will be stopped. After GRF are stopped, GRF turning gear will be started.

6) Fuel oil re-circulation valve should be opened after shut-off valve for fuel oil header closed and maintain for a couple of minutes to relief oil pressure on Boiler fuel oil ring header.

7) After closed the fuel oil re-circulation valve, first return MOV will be opened to maintain the recirculation of HFO

8) If boiler banking mode selected, Air & gas system will be operated in boiler banking.

9) ESP & SAH will trip when the Draft system shutdown.

(2) Operating of drain valves

1) Following valve shall be closed position.

- Main steam drain MOV
- Super heater outlet drain MOV

2) Following valves should be open.

- Reheat line drain valves, which are connected to condenser.

(3) Fuel oil pump stop

1) Fuel oil pump will be stopped

2) Fuel oil heater heating steam pressure control valve and temperature control valve will close.

3.1.6 Unit Shutdown

(1) Feed Water System

1) BCP will be stopped.

(2) Air & Gas System

1) "Air & gas system shutdown sequence" should be Auto to avoid excessive furnace draft fluctuation.

2) Air & Gas System will be shut down one side by one side.

3) Following condition should be established.

• IDF	STOP
• FDF	STOP
• GRF	STOP
• GRF Turning Gear	RUNNING
• IDF Seal Air Fan	RUNNING
• AH	RUNNING
• Cooling fan	RUNNING
• IDF control and Lub. Oil pump	RUNNING
• FDF control and Lub. Oil pump	RUNNING

- GRF Lub. Oil pump RUNNING
- FDF outlet damper CLOSED
- AH inlet gas damper CLOSED
- IDF outlet gas damper CLOSED
- GRF outlet damper CLOSED
- Windbox damper (conc. Week, SGR) CLOSED

3.2 Forced Cooling Shut-down

3.2.1 Forced Cooling Shutdown of Boiler

Press 'Forced Cooling Shutdown' button of APS.

1) Fuel flow set will be decreased to 10t/h with the rate of 3t/min. When following condition is established, one pair of burners will be shutdown.

- Burner header pressure 9 bar [oil firing]

2) After shutdown of one pair of burners and burner gun purge completed, fuel flow control valve will go to close gradually. When burner pressure reaches the following value, remaining burners will be shutdown.

- Burner header pressure 9 bar [oil firing]

3) After shutdown of all burners, MFT is set.

4) When MFT is set, BFP will stopped. Shut-off valve of fuel oil burner header should be closed automatically. Compare to normal shut down, BFP will be started to boiler cooling.

5) When following condition is satisfied, Equipment will be tripped.

Water wall outlet temperature	< 90 ^{O}C
Economizer outlet water temperature	<100 ^{O}C
RAH outlet gas temperature	<100 ^{O}C

6) Equipment stop procedure will be followed same as normal shutdown procedure.

Tab C.2.4

Interlocks and Protection

Table of Contents

3.17 Boiler / Steam turbine emergency trip pushbutton

3.18 Total air flow low low

3.19 All fuel loss

3.20 Boiler major control system serious trouble

1 General

This section provides the guideline for the boiler protection interlock. The objects of this section are the items within the scope of the boiler. The items included in the auxiliary equipment or plant system are not concerned in this section.

1.1 Two out of three protection

The thermal power plant has a substantial number of potential plant major equipment trips. To achieve the high level of plant reliability, it is necessary to avoid trips due to single sensor or wiring faults. To achieve acceptable results, two out of three protective logic is provided for critical protection. Two out of three protective logic requires three (3) process devices with three input cards to the process control system. This logic initiates the trip if any two of the three inputs activate a trip stage. Failure of one device will not initiate a trip.

1.2 Median value selection

The control, alarming and protective tripping input value are determined from the median selection of the three transmitter inputs. If the transmitter would fail, it is identified by the control system and its value is not counted in the median determination. This will typically be very high or low value depending upon the application. While the median selection block continues to select the median value, it is effectively based on the two remaining transmitters. The median selected output is utilized for the control, alarm and trip function. By the careful selection of the substitute value, at least two of the three transmitter values are required to be in the trip state or failed before a protective plant trip is initiated.

1.3 Unit protection system

The unit protection system is incorporated within the plant DCS. It is to monitor the operating status of the boiler, steam turbine/generator and auxiliary system and to initiate a master fuel trip (MFT) and/or steam turbine trip on the occurrence of any conditions under which continued operation of the unit shall be hazardous to plant personnel or damaging to equipment. The unit protection system interfaces with

the following systems,

1) Burner management system (including Boiler protection function)
2) Steam turbine/generator control system
3) Auxiliary control system related with plant trip

For the each systems detail description and specification, please refer to the each system's P&ID and System description.

2 Boiler Protection

2.1 Function

Boiler protection system shall be provided to assure safe operation of the Boiler. When serious accident or trouble of the boiler occurs, all the fuel input to the boiler shall be cut off immediately. This function is so called Master Fuel Trip (herein after MFT).

2.2 Master fuel trip

Master fuel trip command is initiated by any one of the following conditions being present

1) Reheater protection
2) Turbine trip (in case of Bypass valve not operating)
3) All flame loss
4) Unstable fuel supply
5) Both Forced draft fan stop
6) Both Induced draft fan stop
7) All Boiler feed water pump stop
8) Feed water flow low low (When boiler is being fired)
9) Main steam pressure high high
10) Furnace draft high high
11) Furnace draft low low

12) Water separator drain header level high high
13) Main steam temperature high high
14) Reheat steam temperature high high
15) Instrument air pressure low low
16) Cold reheat steam temp high high/ condenser pressure high high/ condenser level high high & Turbine trip
    (* No. 16) is related with steam turbine trip only)
17) Boiler/ Steam turbine emergency trip pushbutton
18) Total air flow low low
19) All fuel loss
20) Boiler major control system serious trouble.

3 Master fuel trip condition detail

3.1 Reheater protection

Mater fuel trip is initiated to protect the reheater against burning in the case that excessive boiler heat input is charged longer than specified time in the state that the steam flow in the reheater line is blocked.

If the following condition is established, reheater protection will be activated.

Steam block condition and total fuel flow more than specified rate of BMCR (Boiler maximum continuous rating) for more than specified seconds.

3.2 Turbine trip (in case of Bypass valve not operating)

In the event of a turbine trip and the failure of the bypass valve opening, a master fuel trip will be initiated to prevent steam pressure from exceeding piping design limits. The tripping of the boiler will allow from a minimum of wear and tear on the boiler vent and safety valves that will need to be operated for an extended period to allow the boiler to cool. If HP an LP turbine bypass valves can be operated in time, the boiler will continue to fire and a mater fuel trip will not be initiated.

3.3 All flame loss

In boiler, adjacent burners on each burner elevation of the furnace support the combustion of each other. During normal operation, the operation is performed by each elevation (4 corners). Whether combustion is stable or not is judged by each elevation. When the safe combustion is not maintained in all elevations, master fuel trip is initiated.

If the burners on all of elevations are not operated, continued operation of the boiler is determined to be inappropriate.

3.4 Unstable fuel supply

In case of heavy fuel oil or atomizing steam pressure is dropped below the limit of burner safe operation , master fuel trip will be initiated judging the unstable combustion.

Also in case of distillate oil or atomizing air / steam pressure is dropped below the limit of burner safe operation, master fuel trip will be initiated judging the unstable combustion.

3.5 Both Forced draft fan stop

Generally in case of critical auxiliary equipment failure, it is not possible to continue the boiler operation. Especially the stopping of both forced draft fans need to stop of combustion and block of the fuel charge immediately. Since it means the impossibility of continuous operation of boiler, master fuel trip is initiated.

3.6 Both Induced draft fan stop

Generally in case of serious auxiliary equipment failure, it is not possible to continue the boiler operation. Especially the stoppage of both induced draft fans cause the accumulation of unburned fuel in the furnace or furnace explosion. Therefore master fuel trip is initiated.

3.7 All Boiler feed water pump stop

In once-through boiler the stopping of feed water during operation means boiler output is stopped, namely the impossibility of continuous operation. The master fuel trip due to stoppage of all boiler feed water pump is to prevent overheating and damage to water wall tubes caused by extreme unbalance of

water/fuel ratio.

3.8 Feed water flow low low

It is provided to prevent the damage to water wall. The low flow condition generally will initiate a timer to allow for corrective actions prior to the initiation of the master fuel trip. An excessively low flow or no flow indication will result in an instantaneous master fuel trip to prevent overheating and damage to the boiler water wall tubes.

3.9 Main steam pressure high high

When high pressure alarm for main steam line is initiated, it will be provided to alert the operator. The operator is required to take immediate action to restore the unit condition to the normal state.

If main steam pressure at boiler outlet continues to be higher than set point for some time period, the master fuel trip is initiated to prevent the over-pressurization of the boiler pressure part.

3.10 Furnace draft high high

When furnace draft pressure is high high, master fuel trip is initiated to minimize the damage due to abnormal combustion such as furnace explosion. The causes of furnace pressure abnormal rise are as follows,

- Explosion combustion attributable to abnormally high fuel/air ratio
- Closure of the combustion gas exhaust system such as erroneous closing of airheater inlet/outlet damper

In the event of exceeding the furnace design pressure, furnace wall and flue gas duct may be deformed abnormally. Therefore master fuel trip is provided to cut the fuel charge into the furnace immediately to ensure the safety of boiler.

The forced draft (FD) fans are also tripped if furnace draft pressure is beyond pressure set point.

3.11 Furnace draft low low

When furnace draft pressure is low low, master fuel trip is initiated to minimize the damage due to

abnormally low furnace pressure. The main cause of abrupt and abnormal drop of furnace pressure is the malfunction of furnace draft control system. Also abnormal combustion may result with the abnormal furnace pressure drop. In the event of exceeding furnace strength design pressure, furnace wall and flue gas duct may be deformed abnormally.

3.12 Water separator drain header level high high

The water separator drain header level high high trip is installed to prevent any water to turbine through the superheater header and steam tubes. This could result in steam line of superheater damage. Therefore a high level alarm and a high high level trip are provided to prevent it.

3.13 Main steam temperature high high

A high temperature alarm for main steam line will be provided to alert the operator to take corrective action. The operator is required to take immediate action to restore the unit condition to the normal state either by reducing his firing rate or utilizing desuperheater. If the corrective actions are not sufficient, a master fuel trip will be intiated to prevent the over heat of the superheater section

3.14 Reheat steam temperature high high

A high temperature alarm for reheat steam line will be provided to alert the operator to take corrective action. The operator is required to take immediate action to restore the unit condition to the normal state either by reducing his firing rate or utilizing desuperheater. If the corrective actions are not sufficient, a master fuel trip will be intiated to prevent the over heat of the reheater section

3.15 Instrument air pressure low low

When instrument air pressure reaches a low low level, a master fuel trip is initiated to prevent a major misoperation due to the lack of control air.

3.16 Cold reheat steam temp high high/ condenser pressure high high/ condenser level high high

When one of follow condition is occured, steam turbine trip command is initiated.

- Cold reheat steam temp high high

: The high high temperature protection is required to prevent the possibility of steam turbine damage due to overheating.

- Condenser pressure high high

: The high high pressure protection is required to minimize the possibility of last stage bucket fatigue damage and bucket or exhaust hood damage due to overheating.

- Condenser hotwell level high high

: The protection is required to assure that water does not reach the steam turbine last stage buckets while in operation. This could result in steam turbine equipment damage.

3.17 Boiler/ Steam turbine emergency trip pushbutton

These pushbuttons are for an emergency trip of the plant by the operator for the prevention of an incident that could result in a fatality or significant equipment damage and usually for an incident that would not have an inherent trip device built in.

3.18 Total air flow low low

The minimum total air flow to the furnace is set at 25% MCR. Boiler trip is initiated when the total air flow is below the specified setting to ensure enough air is provided to completely burn all of the fuel and prevent the accumulation of uncombusted fuel inside the furnace.

3.19 All fuel loss

When any burner valve is once opened and then all the burner valves are closed regardless of the plant condition, MFT is initiated to require the furnace purging of the charged fuel and leak test before burner re-firing.

3.20 Boiler major control system serious trouble

In order to continue safe and stable boiler operation, it is fundamental that the major control system functions normally. If any abnormal case occurs that the major control system is not manually operated continuously, MFT is initiated.

Tab C.2.5

Emergency Operation

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1 General

It is quite normal to come across some emergency conditions during boiler plant operation. There are some cases which warrant an emergency shutdown of the plant. The cause of an emergency can be internal or external. Some of the most common emergency conditions that arise in a power plant are：

1.1 Internal Causes

1) Actuation of Master Fuel Trip
2) Tube Leakage
3) Loss of Feedwater
4) Sea Water Leakage into Condenser
5) Desuperheater Trouble
6) Furnace Explosion

MFT is a protective function, which is initiated due to various malfunctions in the plant system, which warrants a shutdown. Reasons for MFT are detailed in section C.2.4 Interlocks and Protections.

Items 2 to 6 are associated with Boiler Pressure Parts, Main and Reheat Steam System and are described in this manual.

1) Blackout
2) Earthquake
3) Fire in Plant

All items under this category are of general nature and are described in this manual.

1.2 Judgment and Shutdown Pattern

There are two kinds of emergency shutdown patterns. One is automatic shutdown and the other is

manual shutdown.

The automatic shutdown is designed for protection of the equipment or system of the Boiler. If some problem occurs on the equipment and it exceeds operational limit, the protection systems stops the equipment. The largest protection systems are BIR (Boiler Interlock System) and TIR (Turbine Interlock System)

BIR is generally called MFT (Master fuel Trip). Exactly saying, BIR generate MFT signal and transfer it to APC System, Sequence Logics, etc.

If some dangerous conditions for example, Feed water flow low, is detected during normal operation and that condition is continued, the boiler may be damaged seriously. To protect the boiler, BIR actuate MFT and all fuel input is shut off immediately. As long as the boiler is shutdown by MFT, the boiler is not damaged and can be restarted after removal of cause of the trouble.

As a case for manual shutdown, if fire occurs for example at the boiler burner area and it is spreading quickly, (the fire is out of BIR scope and boiler continues in operation) the boiler must be shutdown and all fuel system are also to be shutdown by manual MFT actuation from CCR to avoid more severe danger /damage and then fire fighting must be started.

For this example, manual push button is provided in the BIR system. In an emergency, a responsible person such as “Shift Charge Engineer” must decide whether or not to make manual trip or not by checking seriousness of trouble.

The responsible person must decide whether or not evacuation of personnel to the safe area from the power house is necessary. The operators and maintainers must follow with the order given by responsible person.

2 Emergency Shutdown-Internal Cause

2.1 Master Fuel Trip (MFT)

The MFT is the most important protective function of the boiler. The MFT is provided to protects the boiler itself from overpressure caused by steam rejection of steam turbine and protected from overheat caused by unbalance of fuel input against feed water flow. It also protects the boiler from explosion by unstable firing condition by detecting several items concerning fuel and combustion air.

When MFT is actuated, the following occurs.

1) All BFPs are stopped
2) All burner valves and emergency shut off valve are closed. Oil pump is kept running.
3) Main steam turbine is tripped by MFT.
4) SH and RH desuperheater spray water valves are closed.
5) FDF, RAH, IDF are kept running at 30 % air flow.
6) Condenser system is operated keeping vacuum in condenser shell.

If MFT actuates, the operator must take following action:

1) The operator must check that operating equipments are running steady and plant area is safe for persons for action to next step.
2) The operator must investigate the cause of the trip and report to the responsible persons.
3) For investigation of trip cause, use the event recorder and trend recorder of DCS.
4) The responsible person must decide to restart or shutdown of the plant as soon as possible.

2.2 Tube Leakage

1) Steam leaking from the boiler tube may damage the adjacent tubes or pressure part assemblies via steam cutting. When a tube leak is found, the boiler must be shutdown immediately and repair work must be done after forced cooling of the unit. The following conditions indicate that a significant proportion of tube leak has occurred:

   • Increase of feed water flow rate or make up water flow rate

   • Drop in the economizer outlet flue gas temperature

• Existence of loud sounds resulting from steam leaking

• Existence of water leakage from casing or furnace bottom

• Fluctuation of furnace draft

• Increase of white smoke from chimney

• Increase of IDF blade pitch position.

2) Check the damaged portion for the conditions mentioned above. Observation port must not be unnecessarily opened.
3) In case that WS level can be maintained with effective feed water control and firing condition is stable, perform normal shutdown.
4) In case that WS level cannot be maintained with feed water control ineffective and firing condition is unstable, all fuel input and feed water system must be shutdown or cutoff.
5) After furnace purge, forced cooling will be performed.
6) When WS inlet temperature and ECO outlet flue gas temperature reach required temperature levels, air and gas draft system could be shutdown.
7) The draft system equipment must be de-energized and/or isolated.
8) The boiler may be drained, if necessary in order to perform the repair works.
9) The furnace and boiler must be properly cooled before personnel enter into the boiler for either inspection or repair activities. O2 concentration in the furnace, secondary pass and working space must be more than 21 %.

2.3 Loss of Feedwater

When the feed water stops, stop supplying the fuel completely by actuating MFT.

2.4 Sea Water Leakage into Condenser

The condenser tube does not leak a large amount of water, and the leak is normally found by checking the water analysis data on the feed water and/or condensate water.

The salinity matter in the sea water deposits on internal surface of the boiler tube. The deposit increases the pressure drop of the boiler system and also it causes corrosion on inside surface of the boiler tubes. Therefore, it is very important to keep water quality as specified and always check for abnormal indication. If it becomes clear that the leakage of sea water occurred, quick decision must be done for shutting down of the boiler to reduce the influence of salty water in the main cycle.

If salty water entry to boiler is suspected and confirmed by water analysis, then it is recommended to stop the unit and then do water washing of the boiler pressure parts including the SH and RH DeSH spray water lines. Boiler to be restarted after ensuring water quality has reached back to the normal standard values.

2.5 Desuperheater Trouble

Desuperheater (DSH) for SH and RH are important equipment to control steam temperature during boiler operation.

In a case that one of the desuperheater control valves leak or malfunction, this may cause a much lower steam temperature due to excessive spray injection or it may be a too high steam temperature due to shorter spray injection, downstream of the desuperheater.

Water injection to SH/RH heating surface due to excessive spray injection may lead to temperature imbalance among tube panels and deformation of tube panels.

Higher metal temperatures of SH/RH, due to shorter spray injection, may lead to overheat or consumption of tube life.

As a countermeasure, the input demand and feedback signal of desuperheater control valve are monitored continuously by DCS. When the deviation exceeds the preset value alarm and changeover from auto mode to manual mode are executed.

In case of desuperheater control valve leak, gland packing should be tightened additionally. If required, the gland packing may be replaced in accordance with the vendor manual.

If it becomes clear that trouble in the desuperheater line have occurred, a quick decision must be made for shutting down the boiler.

2.6 Furnace Explosion

In general, furnace explosion may be caused by any one of the following conditions.

1) Ignition is imperfect or unburned fuel is in furnace without ignition.
2) The mixed ratio of unburned fuel and air is within an explosive limit
3) There is a sufficient heating source in furnace that raises the temperature of mixed gas above their ignition point.

Furnace explosion can be avoided during boiler operation by means of paying attention to the following items:

1) Inlet valves of unused burner to be fully closed and properly seated so that possible leakage of fuel into furnace is eliminated.
2) Combustion conditions should be constantly monitored so that in the event of an unexpected flameout, fuel to the boiler can be quickly shut off
3) In case of flameout, airflow rate must be maintained and a furnace purge must be completed prior to re-ignition
4) In case that fuel ignition is not proven within a few seconds, the fuel supply should be cut off and a furnace purge initiated prior to attempting a re-ignition sequence.

The Boiler should be immediately shutdown following a furnace explosion, after cutting off fuel. Boiler shall be cooled by running FD/ID fans following forced cooling procedure. Inspection shall be carried out after temperatures are down for the safe entry of personnel and repairs done. All areas of the boiler shall be checked for possible damages caused by the explosion.

3 Emergency Shutdown-External Cause

3.1 Blackout

Black out of the plant occurs due to grid fault and all running generators trip. This means all power supplies to the plant are lost completely.

Three (3) emergency diesel generators (EDG) of 8.7MW are connected directly to the 13.8kV Emergency switchgear. The EDG Switchgear will be constantly energized from Common Station Switchgear and will allow the Emergency Diesel Gen sets to be pre-warmed and pre-lubricated and the starting air bottle to be pressurized constantly. In the event of blackout, two of three sets of emergency generator will be started automatically through programmable sequence to provide power to the essential loads for both unit and common electrical loads in case of overall main power has failed.

The bus tie circuit breakers of the 13.8kV emergency SWGR will be normally closed condition. One of the emergency generator will energize the 13.8kV emergency SWGR bus with dead bus condition first and another emergency generator will engaged by the synchronizing function to the 13.8kV emergency SWGR bus.

After the EDG output voltage reaches more than 90% of nominal value, the outgoing circuit breaker of the EDG will be closed to the emergency switchgear sequentially The EDG will feed power supply to essential loads connected to the switchgears in power plant area through the 13.8kV emergency swithchgears.

When blackout occurs, DC EOP starts automatically since it is always connected to 220V battery system. The battery system is always supplying AC power to control system through inverter to avoid any influences of normal AC current around the power plant and additionally supplies DC power to following DC motors during an emergency.

- Emergency oil pump for main turbine

- Emergency oil pump for BFPT
- Emergency seal oil pump for generator
- Furnace TV camera & Flame detector cooling air fan
- Vacuum breaker valve

The batteries are continuously charged when the battery system is in service by battery charger even getting AC power from emergency diesel generator during black out.

The EOP supplies lubricating oil to the turbine bearings, until the TOP is started after EDG starts feeding the essential power.

The EDG starts automatically detecting low voltage of the system and supplies power to following equipment：

- BCP cooling water pump
- PAF lubrication oil pump
- FDF control oil pump
- AH motor
- AH lubrication oil pump
- AH sector plate drive motor
- IDF seal oil pump
- IDF seal air fan
- IDF control oil pump

- Main turbine turning gear
- Jacking oil pump
- Main oil tank vapor extractor fan
- Loop seal vapor extractor fan
- Seal oil pump
- Vacuum pump
- BFPT turning gear
- Boiler elevator
- Power for HVAC
- Essential light
- Inverter for battery charger

During power loss, control system is kept ready for next action and large rotating equipment have suitable lubrication by DC operated motor or AC motor, which get power from DC battery system or EDG.

The power supply system must be re-energized after check for restart preparation. DC motor operated pumps must be stopped after normal service pumps are in service. The EDG must be put in stand–by condition after the power plant is energized by normal power.

The unit can be started after all systems are ready for hot start.

3.2 Earthquake

Boiler proper is hanged from boiler structure and horizontal force made by the earthquake is transferred to the structure through boiler stoppers.

Swing of the boiler is stopped by the stopper that is installed on buckstay at 3 elevations.

For strong earthquake, the boiler stoppers may be broken to avoid damage on the boiler structure by excess force. After the earthquake, the boiler stopper must be inspected for deformation and clearance between stopper and buckstay.

The rotating equipments are on a common foundation and therefore, rotor and bearings swing together. This means no troubles if the earthquake is mild.

As the piping is supported by separate structure, the possibilities of the damages by earthquake are considerably high. Operators must check the damages of piping as soon as possible after the earth quake.

Inspection of boiler pressure parts is recommended, considering the structural integrity of the steam cooled spacer and girdling tubes.

3.3 Fire in the Plant

All operators and maintainers must know the position and route of safety exit of power house and auxiliary buildings.

All persons in the power plant must follow with shift charge engineer’s direction in emergency case.

All operators must know the procedure concerning the equipment to be stopped and equipment to be kept running such as lubrication oil pump of main turbine.

4 Restart after Emergency shutdown

4.1 Decision of Restart

Make sure the following before restarting the system

1) Cause of the emergency shutdown is solved completely.
2) Visual inspections performed and no damages or abnormal situations found.
3) Power system is available to receive and supply power to auxiliaries for restart.
4) All the plant systems are ready for restart from DCS.

4.2 Restart

Restart after short time outage is called “hot start”. Very hot start requires high temperature steam because turbine metal temperature is still high. To get high temperature steam for turbine start, followings are important points.

1) Early stage of boiler start, steam temperature at boiler SH outlet is not high as that of turbine metal and main steam pipe. If low temperature steam flow through main steam pipe, pipe metal temperature drops and heat and time are required for heating it again due to huge heat volume of thick pipe. It is therefore important to prevent to cool down of main steam pipe during steam temperature at boiler outlet is lower than main steam pipe.
2) On the other hand, to get higher steam temperature at boiler outlet, higher fuel input is necessary and high fuel input generates more steam in the boiler. It becomes necessary to release the steam to out of boiler system to control steam pressure at desired value. To release the steam, SH drain lines are fully used during SH outlet steam temperature is low. However, since the reheaters have no flow of steam during the boiler parameter raising, the fuel firing rate shall be restricted to maintain furnace flue gas outlet temperature <550 ºC.
3) After SH outlet steam temperature reaches desired temperature (by 3ry SH outlet header drain valve operation), the steam in the boiler could be discharged to condenser through main steam drain and turbine bypass system. The steam pressure and steam temperature could be controlled following normal procedure, taking care of the RH metal temperature.
4) Careful observation for any steaming in ECO shall be done.

5) Water wall metal temperature is also observed to avoid excessive temperature difference.

5 Loss of AC Power

Loss of AC power to different equipment is another type of emergency condition in the power plant. The action to be taken by the operator under such conditions is identified and briefed in the following paragraphs for the various equipments in the Boiler Pressure Parts, Main Steam and Reheat Steam System.

5.1 BCP

The BCP is operated during low load operation in the wet mode including start up and shutdown. The provision of BCP enhances the heat recovery during startup. During normal operation, BCP is OFF.

In case of loss of AC power to BCP during normal operation of plant under dry mode, there is no immediate effect on the system.

However, if the loss of AC is during startup or shutdown with BCP in service, then the effect shall be as follows;

Feedwater flow through furnace has to be maintained at a minimum flow of 25% Load in a supercritical boiler during startup or shutdown.

If loss of AC to BCP is during startup, boiler is tripped by actuating MFT, on low feed water flow to protect the boiler. However, boiler can be restarted, after selecting BCP outmode in APS. There will be delay in achieving steam parameters for turbine startup, since heat is lost in condenser by dumping water through WDC valves (Normally the heat picked up is retained in the system because of BCP re-circulating the water back to economizer inlet).

If loss of AC to BCP is during shutdown, then boiler is tripped by actuating MFT, on low feed water

flow to protect the boiler.

5.2 Motor Operated Valves

All motor operated valves are provided with hand wheel for manual operation, in case of emergency. During normal operation of the plant, the motor operated valves are either open or closed. Hence, in case of loss of AC power, if the valve is to be opened or closed, the operator can get it done through local operator manually.

6 Operation under Fault Conditions

During the plant operation, it is quite normal to come across some fault conditions due to equipment malfunction or high deviation of operating parameters from normal operating range. Where ever standby equipment is provided, they come into service automatically on tripping of any in-service equipment. This has been built in the control system philosophy and the fault condition is annunciated at DCS. However, when other fault conditions occur, they are brought into the operating personnel's attention by audible and visual alarms. The operating personnel are to respond under such circumstances to correct the situation.

Some of the most common process fault conditions in Boiler Pressure Parts, Main & Reheat Steam System and the possible operator responses to the alarm/annunciation are described hereunder.

6.1 List of Fault conditions

1) Feed water Flow Low
2) Economizer Outlet Feedwater Temperature High
3) Furnace Outlet Fluid Temperature High
4) Boiler Outlet Main Steam Pressure High

5) Main Steam Temperature High
6) RH Steam Temperature High
7) 1ry/2ry/3ry SH Metal Temperature High
8) 1ry/2ry RH Metal Temperature High
9) BCP Cavity Temperature High/High-High
10) BCP Motor Cooler Secondary Cooling Water Return Flow Low
11) WS DT Level High/Low

6.2 Description of Response under Fault conditions

The fault conditions are alarmed in the DCS and the operator is expected to respond and take action to correct the situation, so that the plant and equipment are not damaged and there is no harm to the personnel working nearby.

Each fault condition is described in the response table as follows:

• Alarm title, Initiating device and Set point are indicated and then the possible causes of such a fault condition are detailed from the past experience.

• The consequence of the fault condition, if left unattended, is indicated and the possible immediate action to safeguard/limit the damage is described.

• The follow up action subsequent to the above response is listed so that the plant/equipment under fault conditions is rectified and either brought back to service or kept as standby.

ALARAM RESPONSE

Alarm Title	:	1. FEEDWATER FLOW LOW / LOW-LOW
Initiating Device	:	Flow Transmitter 01/02/03/04HAG10CF001A/B/C Flow Transmitter 01/02/03/04LAB20CF001A/B/C
Set Point	:	< 495Ton/hr / < 410 Ton/hr

Possible Cause(s) of Alarm :

1. BCP trip (during wet mode operation).
2. Malfunction of feedwater flow controller.
3. Possible BFP trip.
4. Malfunction of BR valve (during wet mode operation).
5. Malfunction of flow transmitter.
6. Leakage by damage of upstream equipment.

Consequences :

1. Furnace water wall tube overheating and possible tube failure.
2. Possible MFT actuation, if flow goes down to < 410 Ton/hr.

Immediate Action :

1. Verify the feedwater flow at flow transmitter indicator at local.
2. Take the control of feedwater controller to manual mode and increase feedwater flow.
3. Reduce fuel firing rate.

Follow Up Action :

1. Notify supervisor.
2. Check and rectify the auto functioning of feedwater controller.
3. Check the auto functioning of BR valve.
4. Calibrate the flow transmitter, if necessary.
5. Check the leakage of upstream equipment.
6. If MFT actuates, restart the boiler following normal operation procedure.

ALARAM RESPONSE

Alarm Title : 2. ECONOMIZER OUTLET FEEDWATER TEMPERATURE HIGH

Initiating Device : Temperature Elements 01/02/03/04HAC11/16CT001A/B

Set Point : Variable set point (Saturation temperature – 5°C)

Possible Cause(s) of Alarm :

1. Higher air flow （Excess air high） than normal.
2. Higher flue gas temperature at economizer inlet, than normal.
3. Economizer steaming due to sudden decrease in boiler pressure.
4. Higher BCP recirculation flow during wet mode operation.
5. Malfunction of temperature elements.

Consequences :

1. Economizer tube and furnace water wall tube overheating.
2. Possible tube failure, if the situation is allowed to continue for long.

Immediate Action :

1. Increase feedwater flow from BFP and reduce BCP recirculation flow.
2. Reduce air flow, if economizer inlet O2 content is higher than normal.
3. Reduce unit load/fuel firing rate.

Follow Up Action :

1. Notify supervisor.
2. Closely watch the furnace wall outlet temperature.
3. Shutdown the unit, if economizer tube leakage is confirmed.
4. Calibrate the temperature elements, if necessary.

ALARAM RESPONSE

Alarm Title : 3. FURNACE OUTLET FLUID TEMPERATURE HIGH

Initiating Device : Temperature Elements 01/02/03/04HAD21/22/26/27CT001

Set Point : Variable set point (Saturation temperature + 15°C)

Possible Cause(s) of Alarm :

1. Feedwater flow low.
2. Water/Fuel ratio control malfunction.
3. Low excess air operation.
4. Malfunction of temperature elements.
5. Malfunction of 1ry and 2ry SH outlet DeSH spray water CV.

Consequences :

1. Furnace water wall tube overheating.
2. Possible tube failure, if the situation is allowed to continue for long.

Immediate Action :

1. Increase feedwater flow from BFP and reduce BCP recirculation flow, if under wet mode operation.
2. Increase air flow, if economizer inlet O2 content is lower than normal.
3. Reduce unit load/fuel firing rate.

Follow Up Action :

1. Notify supervisor.
2. Check for burner tilt stuck up and rectify for auto operation.
3. Check and rectify water/fuel ratio auto function.
4. Calibrate the temperature elements, if necessary.
5. Check and rectify the 1ry and 2ry SH DeSH spray water CV control.

ALARAM RESPONSE

Alarm Title : 4. MAIN STEAM PRESSURE HIGH/HIGH-HIGH

Initiating Device : Pressure Transmitter 01/02/03/04LBA11/12CP001A/B/C

Set Point : >267 barg / > 299 barg

Possible Cause(s) of Alarm :

1. Rapid load reduction due to load fluctuation.
2. Malfunction of Water/Fuel Ratio Controller.
3. Failure of Turbine Bypass backup control.
4. Malfunction of pressure transmitters.
5. Malfunction of feedwater flow control.

Consequences :

1. Possible main steam line ERV operation, if pressure increases further to 283 barg.
2. Possible MFT actuation if pressure increases to 299 barg.
3. Possible damage to pressure parts, if over pressure operation is continued for long periods.

Immediate Action :

1. Verify the main steam pressure.
2. Open turbine bypass valve, after taking control to manual mode, if pressure is increasing continuously.
3. Put boiler master into manual mode and reduce boiler input demand manually.
4. If pressure continues to increase, after confirming that ERV is opened and safety valve stopper is removed, open the main steam line ERV.

Follow Up Action :

1. Notify the shift supervisor.
2. Check and rectify turbine bypass backup control.
3. Check and rectify the functioning of feedwater control.
4. Calibrate the pressure transmitters, if necessary.
5. If MFT actuates, restart the boiler following normal operation procedure.

ALARAM RESPONSE

Alarm Title : 5. MAIN STEAM TEMPERATURE HIGH / HIGH-HIGH

Initiating Device : Temperature Elements 01/02/03/04LAB11/12CT501A/B/C

Set Point : >550°C / >600 °C

Possible Cause(s) of Alarm :

1. Higher fuel input due to Water Fuel Ratio Control malfunction.
2. Malfunction of 1ry and /or 2ry SH outlet DeSH spray water CV.
3. High excess air operation.
4. Malfunction of the temperature elements.

Consequences :

1. Possible damage to 3rySH tubes and headers due to overheating.
2. Possible damage to turbine internals.
3. Possible MFT actuation if temperature increases to 600 °C

Immediate Action :

1. Verify the 2ry & 3ry SH metal temperatures.
2. Verify the steam temperature before and after 2ry DeSH.
3. Put the 2ry SH outlet DeSH spray water CV into manual mode and increase the spray water.
4. Reduce excess air to normal value, if necessary after taking control to Manual mode.

Follow Up Action :

1. Notify the shift supervisor.
2. Check and rectify the 2rySH outlet DeSH spray control valve auto operation.
3. Check and calibrate /replace the temperature element, if necessary.
4. If MFT actuates, restart the boiler following normal operation procedure.

ALARAM RESPONSE

Alarm Title : 6. RH STEAM TEMPERATURE HIGH / HIGH-HIGH

Initiating Device : Temperature Elements 01/02/03/04LBB11/12CT001A/B/C

Set Point : >550^{o}C / >600 ^{o}C

Possible Cause(s) of Alarm :

1. Higher fuel input due to Boiler Master malfunction.
2. Malfunction of gas distribution damper control and burner tilt control.
3. Emergency backup RH DeSH spray control valve malfunction.
4. Malfunction of the temperature elements.

Consequences :

1. Possible damage to RH tubes and headers due to overheating.
2. Possible damage to IP turbine internals.
3. Possible MFT actuation if temperature increases to 600 ^{o}C

Immediate Action :

1. Verify the 1ry & 2ry RH metal temperatures.
2. Verify the steam temperature before and after 2ry DeSH.
3. Put the RH DeSH spray water CV into manual mode and increase the spray water.
4. Reduce the GR fan flow, after taking control to manual mode.

Follow Up Action :

1. Notify the shift supervisor.
2. Check and rectify the RH DESH spray control valve operation.
3. Check and rectify the gas distribution damper control auto function.
4. Check and rectify the function of burner tilt control.
5. Check and calibrate/ replace the temperature element, if necessary.

ALARAM RESPONSE

Alarm Title : 7. SH METAL TEMPERATURE HIGH / HIGH-HIGH

Initiating Device : Various metal temperature thermocouples in the 1ry /2ry /3ry SH tubes

Set Point : Variable set point depending on operating pressure.

Possible Cause(s) of Alarm :

1. Higher fuel input due to Water/Fuel Ratio Control malfunction.
2. Malfunction of DeSH spray water CV.
3. Malfunction of the temperature elements.

Consequences :

1. Possible damage to SH tubes and headers due to overheating.
2. Possible increase in main steam temperature and each stage SH outlet temperature and increase in spray water flow.

Immediate Action :

1. Verify the SH tube metal temperature in other tubes..
2. Reduce load and check for the reducing tendency in the SH metal temperature.
3. Verify the DeSH inlet and outlet steam temperature.
4. Put the DeSH spray water CV into manual mode and increase the spray water

Follow Up Action :

1. Notify the shift supervisor.
2. Check and rectify the DeSH spray control valve auto operation.
3. Check and calibrate / replace the temperature element, if necessary.

ALARAM RESPONSE

Alarm Title : 8. RH METAL TEMPERATURE HIGH / HIGH-HIGH

Initiating Device : Various metal temperature thermocouples in the 1ry /2ry SH tubes

Set Point : Variable set point depending on operating pressure.

Possible Cause(s) of Alarm :

1. Higher fuel input due to Water/Fuel Ratio Control malfunction.
2. Reduced cold reheat steam flow, due to higher extraction steam from HP turbine.
3. Failure of emergency backup RH DeSH spray water control.
4. Malfunction of the temperature elements.

Consequences :

1. Possible damage to RH tubes and headers due to overheating.
2. Increase in RH steam temperature to turbine and associated problems

Immediate Action :

1. Verify the RH tube metal temperature in other tubes..
2. Verify the RH inlet and outlet steam temperature.
3. Put the DeSH spray water CV into manual mode and increase the spray water.

Follow Up Action :

1. Notify the shift supervisor.
2. Check and rectify the auto functioning of RH DeSH spray control valve.
3. Check and replace the temperature element, if necessary.
4. Check and rectify the auto operation of burner tilt control..

ALARAM RESPONSE

Alarm Title : 9. BCP CAVITY TEMPERATURE HIGH/HIGH-HIGH

Initiating Device : Temperature Elements 01/02/03/04HAG10CT012A/B/C

Set Point : >60 °C / >65 °C

Possible Cause(s) of Alarm :

1. Low cooling water flow through BCP heat barrier.
2. Possible higher cooling water inlet temperature.
3. Failure of emergency cooling water backup, when normal CCCW supply not available.
4. Malfunction of temperature elements.

Consequences :

1. Possible damage to motor windings, if temperature goes up further
2. BCP trips, if cavity temperature goes higher to >65°C.

Immediate Action :

1. Verify the CCCW supply temperature.
2. Verify the heat barrier cooling water flow through sight glass.
3. Monitor the motor cooling water temperature in the local indicator.
4. Inject purge water manually, if necessary.

Follow Up Action :

1. Notify the shift supervisor.
2. Continue injection of the purge water manually.
3. Supply emergency cooling water by opening the air operated ON/OFF valves, if CCCW supply fails.
4. Calibrate the temperature elements, if necessary.

ALARAM RESPONSE

Alarm Title	:	10.BCP MOTOR COOLER SECONDARY COOLING WATER RETURN FLOW LOW
Initiating Device	:	Flow Switch 01/02/03/04PGB36CF101
Set Point	:	<70% of water flow

Possible Cause(s) of Alarm :

1. Inadvertent closure of isolation valve in CCCW supply / return lines.
2. Possible cooling water supply failure.
3. Malfunction of flow switch.

Consequences :

1. Increase in BCP motor winding temperature, and possible damage to motor windings.
2. Possible BCP trip, if motor windings temperature goes High-High.

Immediate Action :

1. Verify the CCCW flow at the flow sight in return line.
2. Check for any increase in the circulating motor cooling water temperature, at local indicator after cooler, from the normal value.
3. Check the CCCW return cooling water temperature at the local indicator.
4. Open the CCCW supply/return line isolation valves, if found closed.

Follow Up Action :

1. Notify shift supervisor.
2. Establish normal values for CCCW return water flow.
3. Perform calibration of the flow switch, if necessary.

Tab C.2.6

Boiler Preservation Procedure

Table of Contents

1 General

1.1 Introduction

The document describes the basic procedure of boiler preservation.

In this procedure, the preservation procedures of auxiliary equipment such as Fan or AH and some instruments are not mentioned. The preservation procedure for these items should follow the each manufacture O & M manual from vendor.

2 Procedure

2.1 Boiler General

As for the boiler preservation after unit shut down completion, operator should decide by referring to the below table according to the unit shut down period. The preservation condition should be changed as per each water treatment operation (AVT or CWT)

Treatment of boiler preservation (AVT)

<table>
<tr><td rowspan="2">ITEM</td><td colspan="2">1~3days</td><td rowspan="2">4~7days</td><td rowspan="2">8~30days</td><td rowspan="2">Over 30days</td></tr>
<tr><td>~32hours</td><td>~72hours</td></tr>
<tr><td>Boiler</td><td colspan="2">Hot banking</td><td>Wet lay up by the N2H4 water more than 50ppm concentration*2</td><td>Wet lay up by the N2H4 water more than 50ppm x kept weeks concentration*2</td><td>Wet lay up by the N2H4 water more than 500ppm concentration*2</td></tr>
<tr><td>SH&MS pipe</td><td rowspan="2">Close all valves</td><td colspan="4">Sealed by pressurized N2 (more than 0.3bar)*1</td></tr>
<tr><td>RH&RS pipe</td><td colspan="4">Dry Lay up or Sealed by pressurized N2 (more than 0.3bar)*1</td></tr>
</table>

* 1 During boiler preservation period, check the pressure of N_2 gas every day.

*2 Concentration of N_2H_4 is only for deaerated water. If it is not, wet lay up by N_2H_4 water more than 500ppm concentration.

Treatment of boiler preservation (CWT)

<table>
<tr><td rowspan="2">ITEM</td><td colspan="2">1~3days *1</td><td rowspan="2">4~7days *2</td><td rowspan="2">8~30days *2</td><td rowspan="2">Over 30days *2</td></tr>
<tr><td>~32hours</td><td>~72hours</td></tr>
<tr><td>Boiler</td><td colspan="2">Hot banking</td><td>Dry lay up or Layup with AVT water and N2 sealing</td><td>Dry lay up or Sealed by pressurized N2 (more than 0.3bar)*4</td><td>Dry lay up or Sealed by pressurized N2 (more than 0.3bar)*4</td></tr>
<tr><td>SH&MS pipe</td><td rowspan="2">Close all valves</td><td colspan="4">Sealed by pressurized N2 (more than 0.3bar)*4</td></tr>
<tr><td>RH&RS pipe</td><td colspan="4">Dry Lay up or Sealed by pressurized N2 (more than 0.3bar)*4</td></tr>
</table>

*1 The unit shall be shutdown under CWT condition for 1-3 days preservation.

*2 The unit shall be changed over to AVT operation before 2 hours of shut down for over 4 days preservation (without N2H4 injections).

*3 In case of emergency shutdown or unit trip, and the unit can not be started in 32 hours, the boiler water has to be drained out by opening all drain valves including manual drain valves because the boiler tube inside become under corrosive atmosphere.

*4 During boiler preservation period, check the pressure of N2 gas every day.

*5 If vacuum condition of condenser is maintained, the preservation procedure must be the same as the one in 32 hours preservation.

*6 When the unit is shutdown under AVT condition without N2H4, the unit has to be started up under same condition (AVT without N2H4) and changed over to CWT operation after the water quality criteria is satisfied.

2.2 Detailed Boiler Preservation Procedure

Previous requirements and general condition before preservation start

1) Boiler is MFT condition.
2) Boiler forced cooling is in progress.
3) Condenser vacuum pressure is kept.
4) The chemical injection system and boiler feed water system is available.
5) The required instruments are properly installed and functional.
6) Flush pipe drain pit pump is put into service.

7) Neutralization pit is available.
8) Nitrogen cylinder is prepared, (if require)

Detailed Boiler Preservation Operation (Dry lay up)

1) After completion of boiler MFT, each drain valve for SH and RH is opened to decrease the pressure. The timing of open each valve is depended on the boiler remaining pressure.
   In case of N2 seal, N2 injection starts (N2 pressure set; 0.3~0.6 bar) when boiler pressure reaches 10 bar. Open SH and MS drain valves one by one for about 10 minutes to remove the remaining drain.

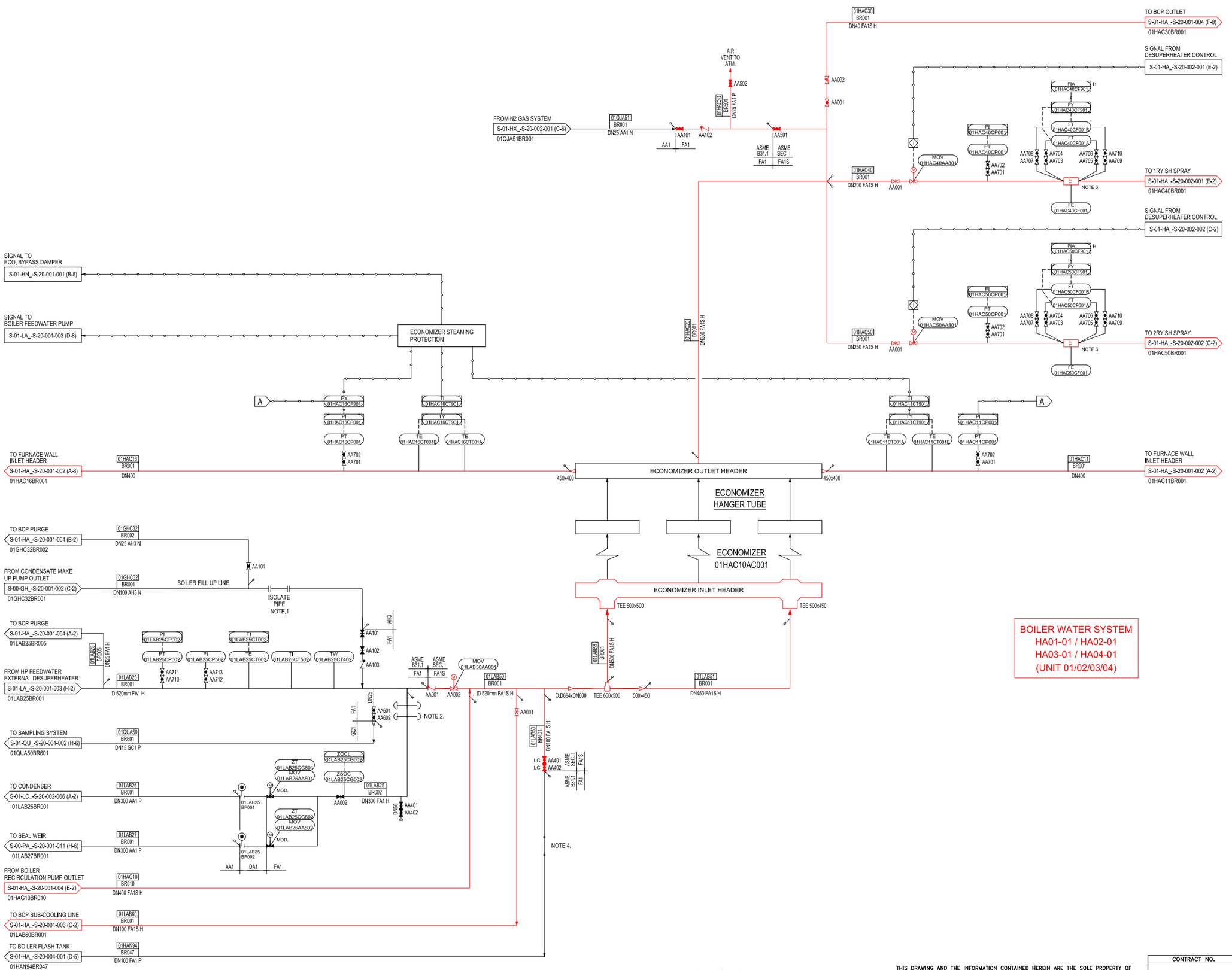
2) Confirm boiler water wall outlet temperature is less than 93°C.
3) Confirm M-BFP is stopped. Then open the all boiler blow valve to empty out the boiler water.
   In case of N2 seal, drain out boiler water with N2 injection and vent valves kept close position.
4) Confirm all boiler water has been emptied out.
   In case of N2 seal, close all drain valve and keep N2 pressure 0.3~0.6 bar in the boiler.

Detailed Boiler Preservation Operation (Wet lay up)

1) After completion of boiler MFT, start boiler forced cooling down sequence.
   In case of N2 seal, N2 injection starts (N2 pressure set; 0.3~0.6kg/cm2) when boiler pressure reaches 10kg/cm2. Open SH and MS drain valves one by one for about 10 minutes to remove the remaining drain.
   Prepare the chemical dosing system for N2H4 injection.
   Generally, N2H4 water filling from pre-boiler system with M-BFP. Start N2H4 injection when T –wwo < 200℃.
2) Preservation will be completed when the N2H4 concentration of feed water at WS drain reach to target value.
3) Stop M-BFP, and vacuum break if required.
   In case of N2 seal, close all drain valve and keep N2 pressure 0.3~0.6kglcm2 in the boiler.

Tab C.2.7

Sub-System P&I Diagram



GENERAL NOTES

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NOTES

1. ISOLATE PIPE SHALL BE REMOVED DURING NORMAL OPERATION.
2. WATER FLUSHING CONNECTION Q'TY : DN125 x 4EA.
3. FLOW COMPENSATION USING PT-01HAC11/16CP001, TE-01HAC11/16CT001A/B
4. SPOOL FOR CHEMICAL CLEANING TO BE WELDED AFTER CHEMICAL CLEANING

AS BUILT

BOILER WATER SYSTEM
HA01-01 / HA02-01
HA03-01 / HA04-01
(UNIT 01/02/03/04)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
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"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (1/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-001	01 OF 01	2X

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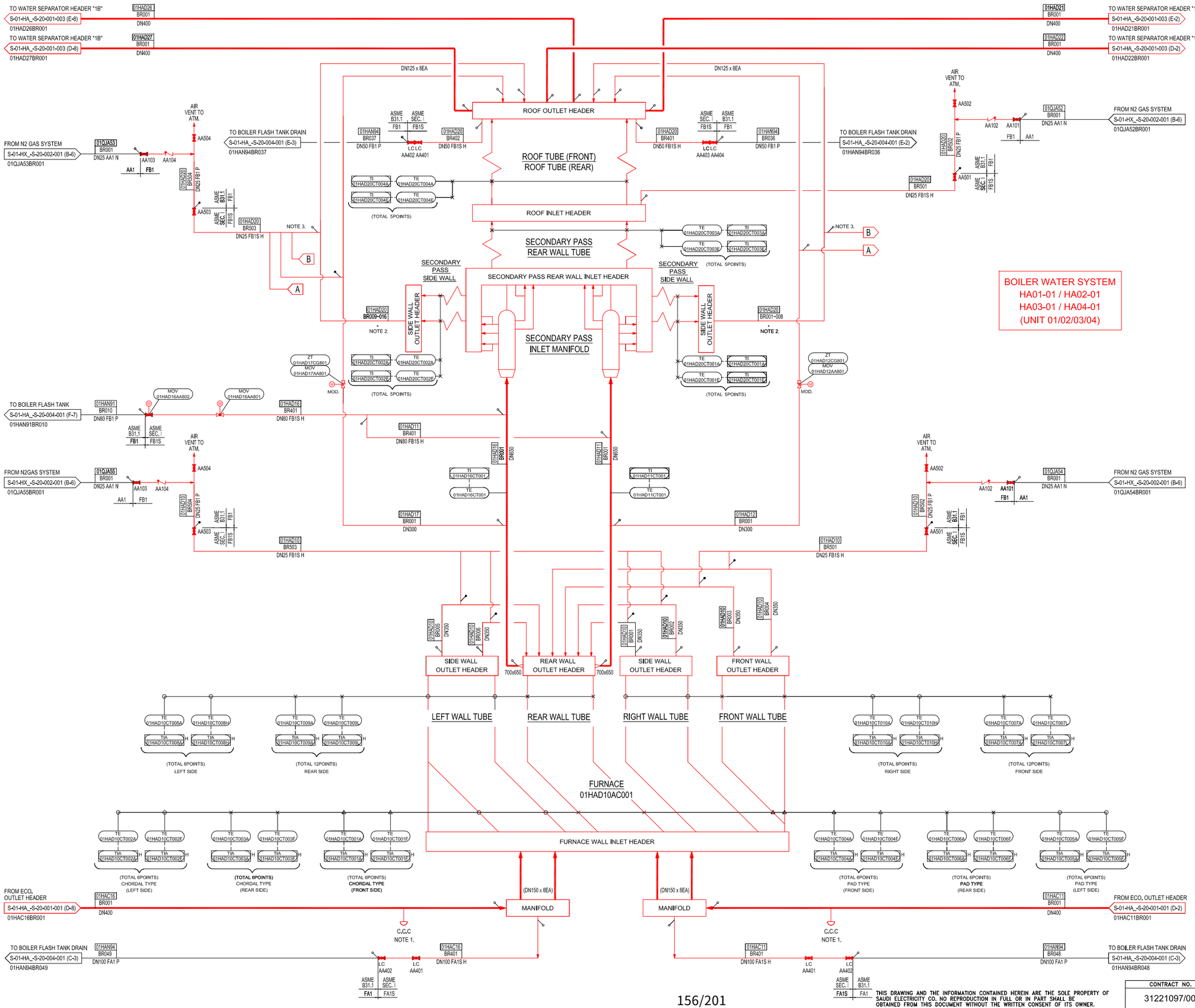

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NOTES

1. C.C.C : CHEMICAL CLEANING CONNECTION Q'TY : DN125 x 2EA.
2. CONNECTING PIPE : DN125 x 8EA FOR EACH SIDE (TAG NO. 01HAD20BR001-BR016)
3. EACH VENT (16 POINT) SHALL BE CONNECTED TO COMMON VENT PIPE.

AS BUILT

REFERENCE DRAWINGS

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BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00944
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (2/4)

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CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-002	01 OF 01	1X

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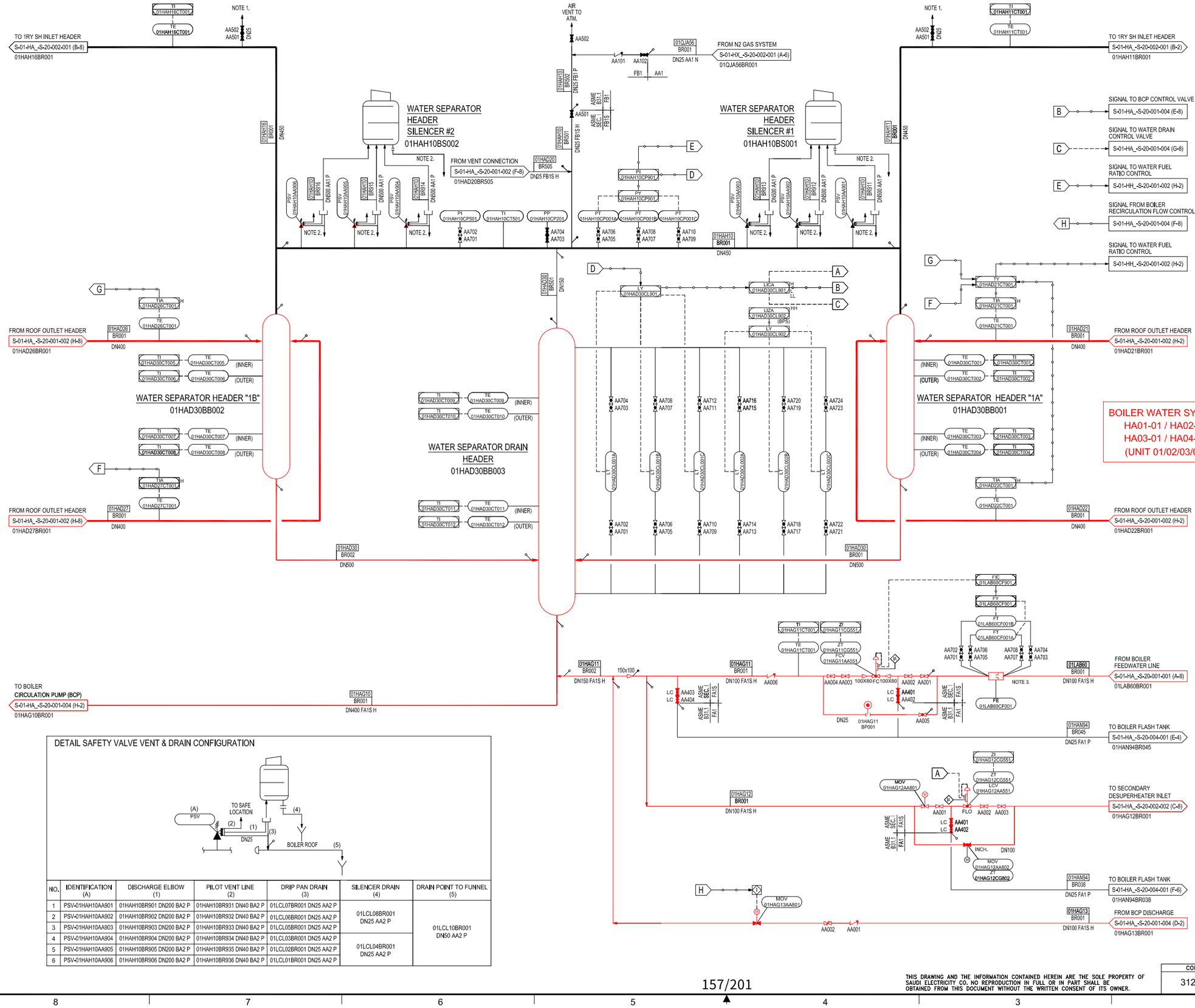

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION

NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01HAH10AA901	01HAH10BR901 DN200 BA2 P	01HAH10BR931 DN40 BA2 P	01LCL07BR001 DN25 AA2 P	01LCL08BR001 DN25 AA2 P	01LCL10BR001 DN50 AA2 P
2	PSV-01HAH10AA902	01HAH10BR902 DN200 BA2 P	01HAH10BR932 DN40 BA2 P	01LCL06BR001 DN25 AA2 P		
3	PSV-01HAH10AA903	01HAH10BR903 DN200 BA2 P	01HAH10BR933 DN40 BA2 P	01LCL05BR001 DN25 AA2 P		
4	PSV-01HAH10AA904	01HAH10BR904 DN200 BA2 P	01HAH10BR934 DN40 BA2 P	01LCL03BR001 DN25 AA2 P	01LCL04BR001 DN25 AA2 P	
5	PSV-01HAH10AA905	01HAH10BR905 DN200 BA2 P	01HAH10BR935 DN40 BA2 P	01LCL02BR001 DN25 AA2 P		
6	PSV-01HAH10AA906	01HAH10BR906 DN200 BA2 P	01HAH10BR936 DN40 BA2 P	01LCL01BR001 DN25 AA2 P		

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NOTES

1. THIS VENT SHALL BE USED FOR HYDROSTATIC TEST ONLY.
2. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN
3. FLOW COMPENSATION USING PT-01LAB25CP002, TE-01LAB25CT002

AS BUILT

REFERENCE DRAWINGS

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SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (3/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-003	01 OF 01	3X

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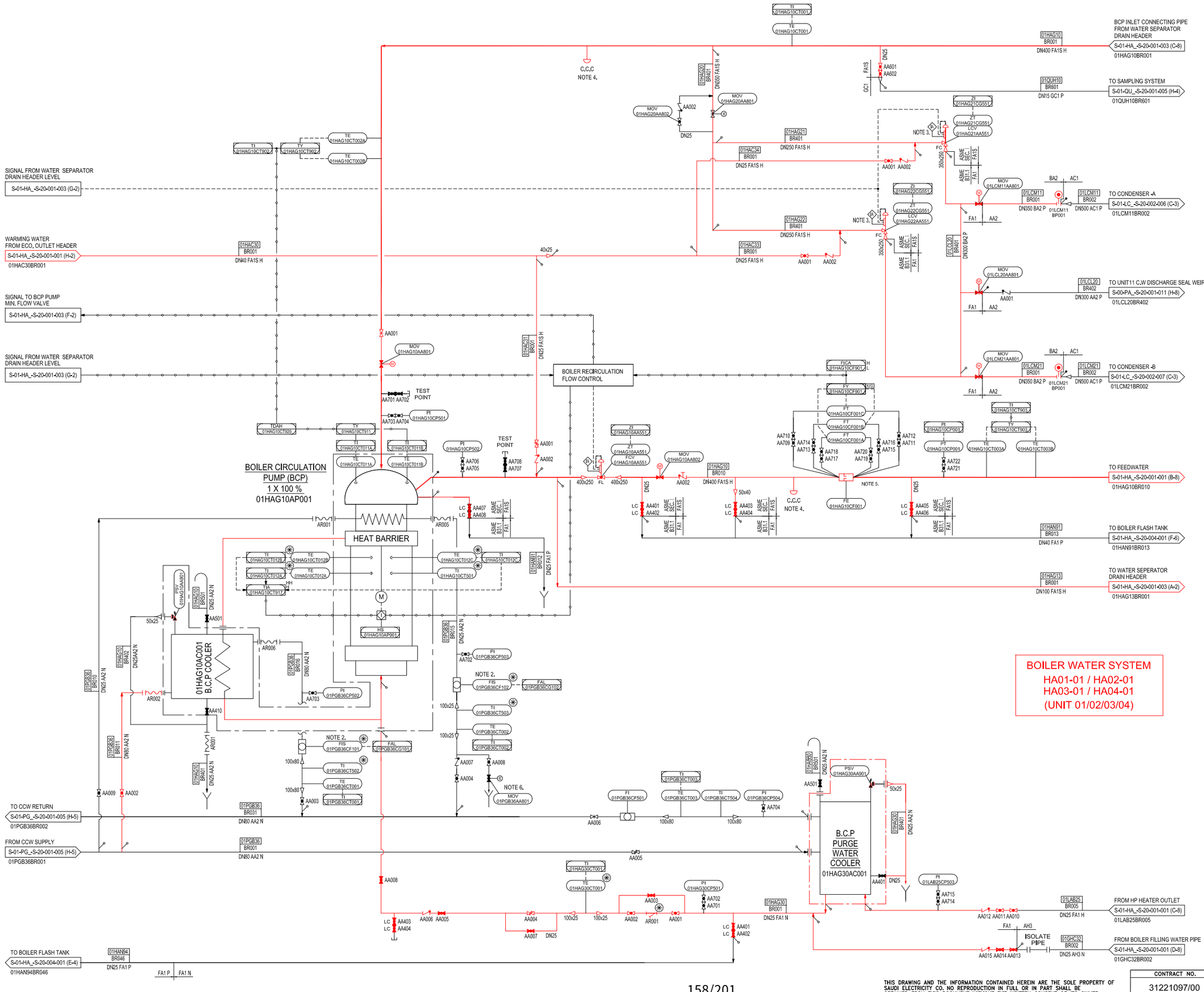

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NOTES

1. [ ] : SUPPLIED BY VENDOR
   ⊛ : LOOSE PARTS SUPPLIED BY VENDOR
2. FIS : FLOW SIGHT GLASS WITH SWITCH.
3. FOR LCV - 01HAG21/22AA551 AND DOWNSTREAM PIPING AND INSTRUMENTS SHALL BE INSTALLED AT CONDENSER INLET.
4. C.C.C : CHEMICAL CLEANING CONNECTION Q'TY : DN125 x 4EA.
5. FLOW COMPENSATION USING PT-01HAG10CP001, TE-01HAG10CT003A/B
6. UPS POWER. MOV SHALL BE OPEN AT CCCW PUMP AND EMERGENCY CCCW PUMP BOTH TRIP.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
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BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
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"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
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4	08.FEB.2017	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR BOILER WATER SYSTEM (4/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-004	01 OF 01	4X

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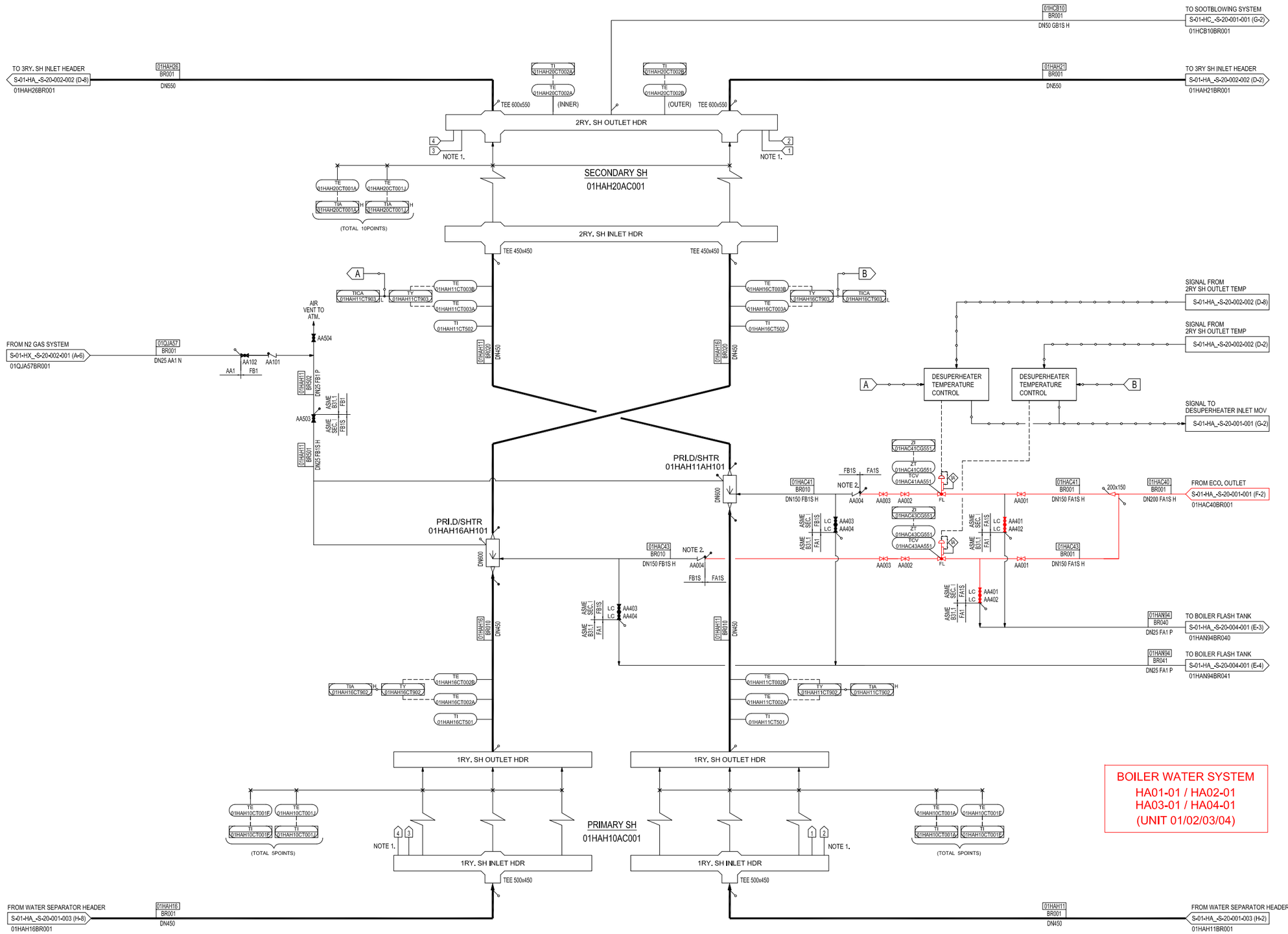

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8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS. AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. TUBE CONNECT 1&3 : GIRDLING TUBE
   TUBE CONNECT 2&4 : SPACER TUBE
2. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER

AS BUILT

BOILER WATER SYSTEM
HA01-01 / HA02-01
HA03-01 / HA04-01
(UNIT 01/02/03/04)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
0X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER STEAM SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-002-001	01 OF 01	0X

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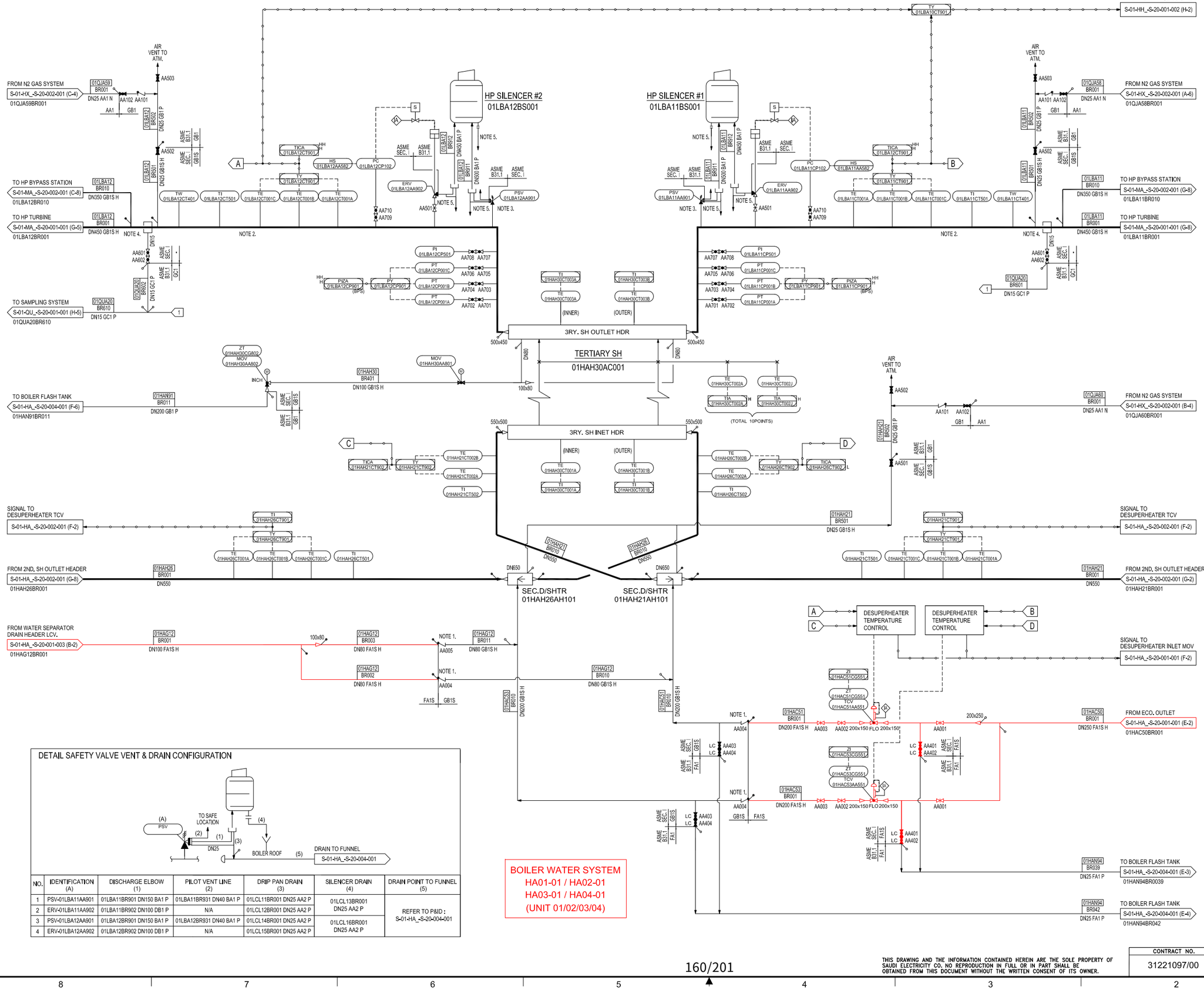
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
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NOTES

1. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER
2. THE MAIN STEAM PIPE SHALL BE PROVIDED WITH CREEP PIPS.
3. ALL SAFETY VALVES SHALL HAVE WELDED INLETS AND FLANGED OUTLET.
4. THE SAMPLING NOZZLE SHALL BE PROVIDED TO BE SUITABLE FOR ISOKINETIC SAMPLING.
5. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN

AS BUILT

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION

NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01LBA11AA901	01LBA11BR901 DN150 BA1 P	01LBA11BR931 DN40 BA1 P	01LCL11BR001 DN25 AA2 P	01LCL13BR001 DN25 AA2 P	REFER TO P&ID : S-01-HA_-S-20-004-001
2	ERV-01LBA11AA902	01LBA11BR902 DN100 DB1 P	N/A	01LCL12BR001 DN25 AA2 P		
3	PSV-01LBA12AA901	01LBA12BR901 DN150 BA1 P	01LBA12BR931 DN40 BA1 P	01LCL14BR001 DN25 AA2 P	01LCL16BR001 DN25 AA2 P	
4	ERV-01LBA12AA902	01LBA12BR902 DN100 DB1 P	N/A	01LCL15BR001 DN25 AA2 P		

BOILER WATER SYSTEM
HA01-01 / HA02-01
HA03-01 / HA04-01
(UNIT 01/02/03/04)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER STEAM SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-002-002	01 OF 01	3X

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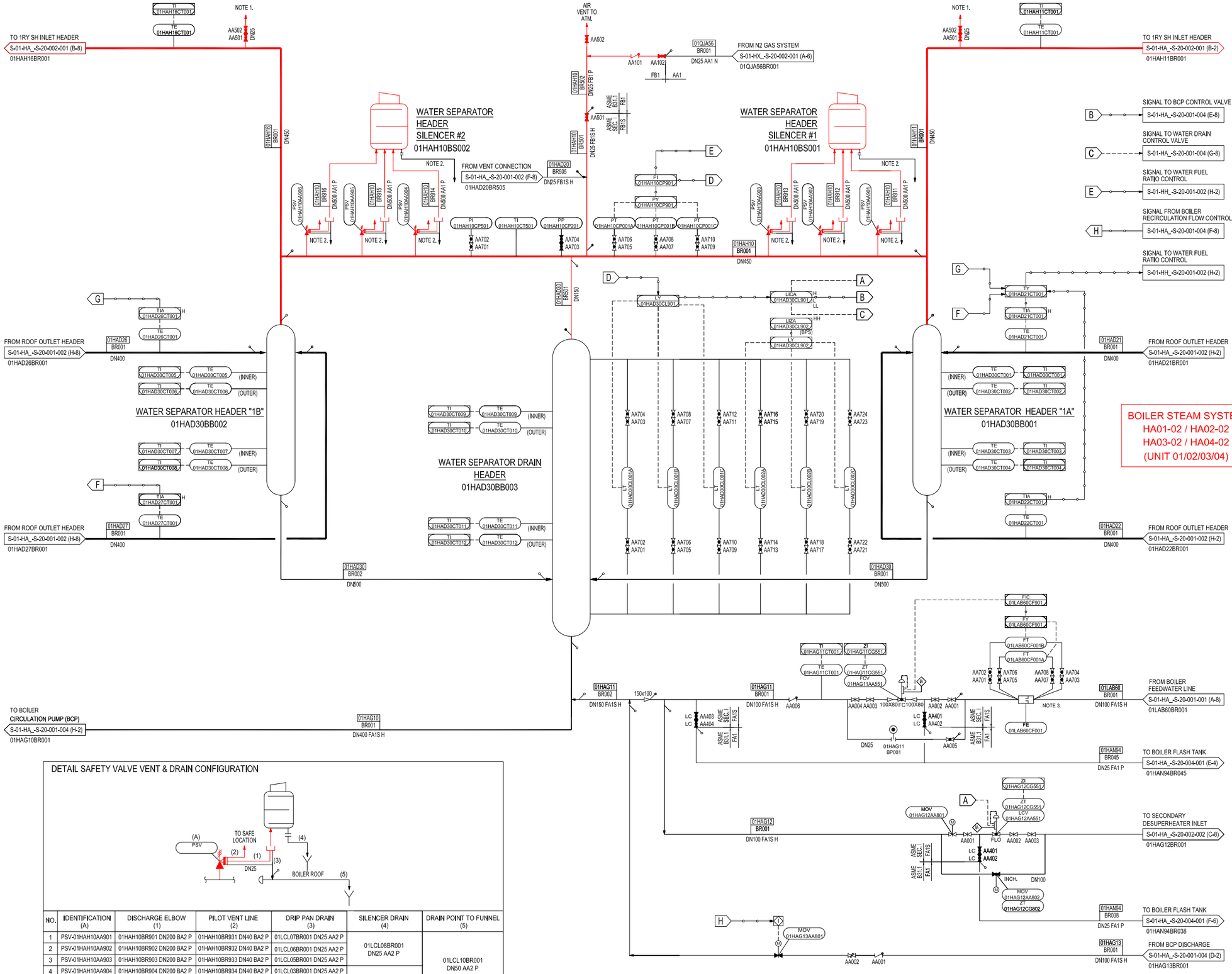

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION

NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01HAH10AA901	01HAH10BR901 DN200 BA2 P	01HAH10BR931 DN40 BA2 P	01LCL07BR001 DN25 AA2 P	01LCL08BR001 DN25 AA2 P	01LCL10BR001 DN50 AA2 P
2	PSV-01HAH10AA902	01HAH10BR902 DN200 BA2 P	01HAH10BR932 DN40 BA2 P	01LCL06BR001 DN25 AA2 P		
3	PSV-01HAH10AA903	01HAH10BR903 DN200 BA2 P	01HAH10BR933 DN40 BA2 P	01LCL05BR001 DN25 AA2 P		
4	PSV-01HAH10AA904	01HAH10BR904 DN200 BA2 P	01HAH10BR934 DN40 BA2 P	01LCL03BR001 DN25 AA2 P	01LCL04BR001 DN25 AA2 P	
5	PSV-01HAH10AA905	01HAH10BR905 DN200 BA2 P	01HAH10BR935 DN40 BA2 P	01LCL02BR001 DN25 AA2 P		
6	PSV-01HAH10AA906	01HAH10BR906 DN200 BA2 P	01HAH10BR936 DN40 BA2 P	01LCL01BR001 DN25 AA2 P		

GENERAL NOTES

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NOTES

1. THIS VENT SHALL BE USED FOR HYDROSTATIC TEST ONLY.
2. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN
3. FLOW COMPENSATION USING PT-01LAB25CP002, TE-01LAB25CT002

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	31.AUG.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (3/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-003	01 OF 01	3X

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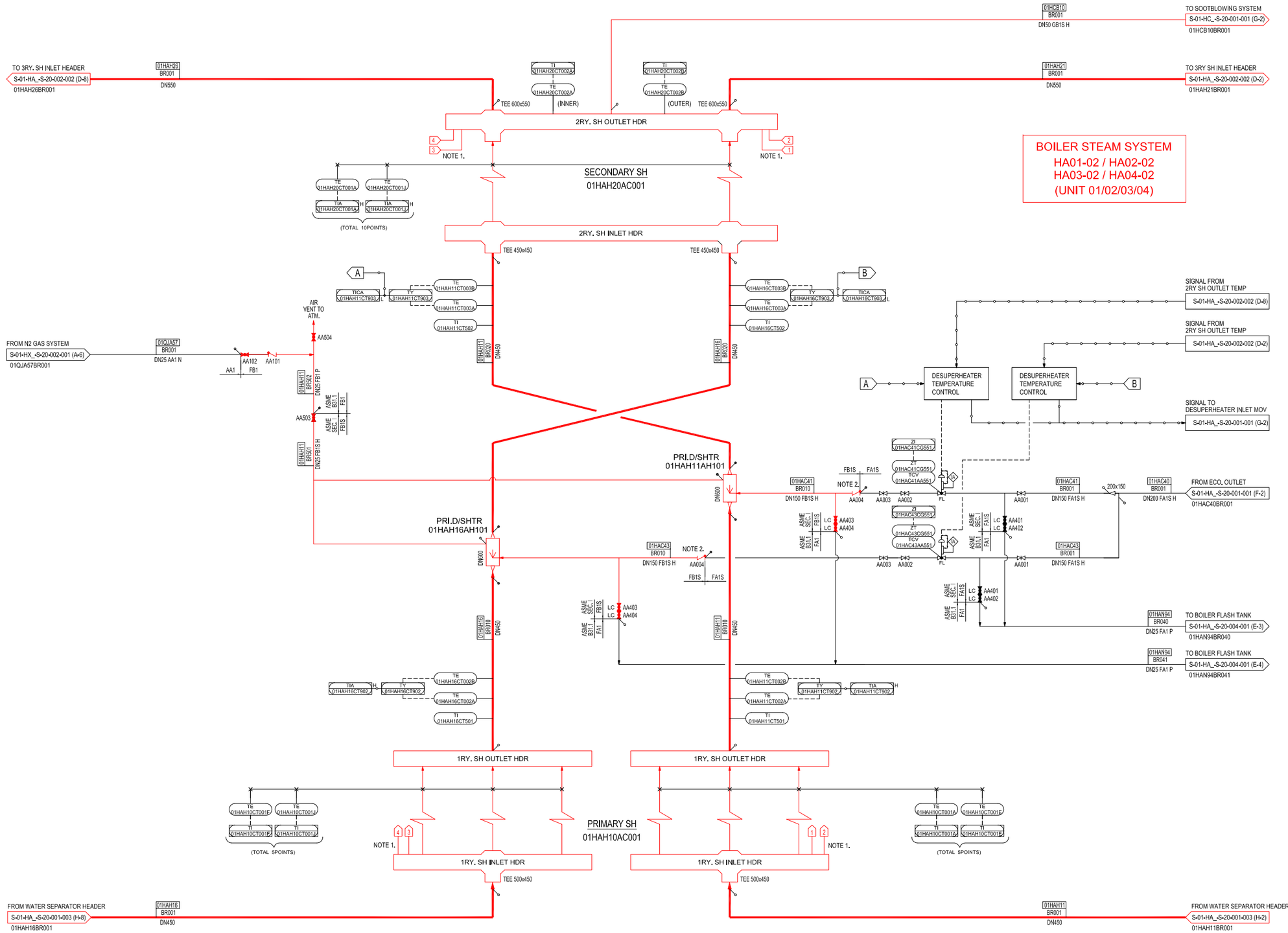

GENERAL NOTES

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NOTES

1. TUBE CONNECT 1&3 : GIRDLING TUBE
   TUBE CONNECT 2&4 : SPACER TUBE
2. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
0X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
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SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER STEAM SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-002-001	01 OF 01	0X

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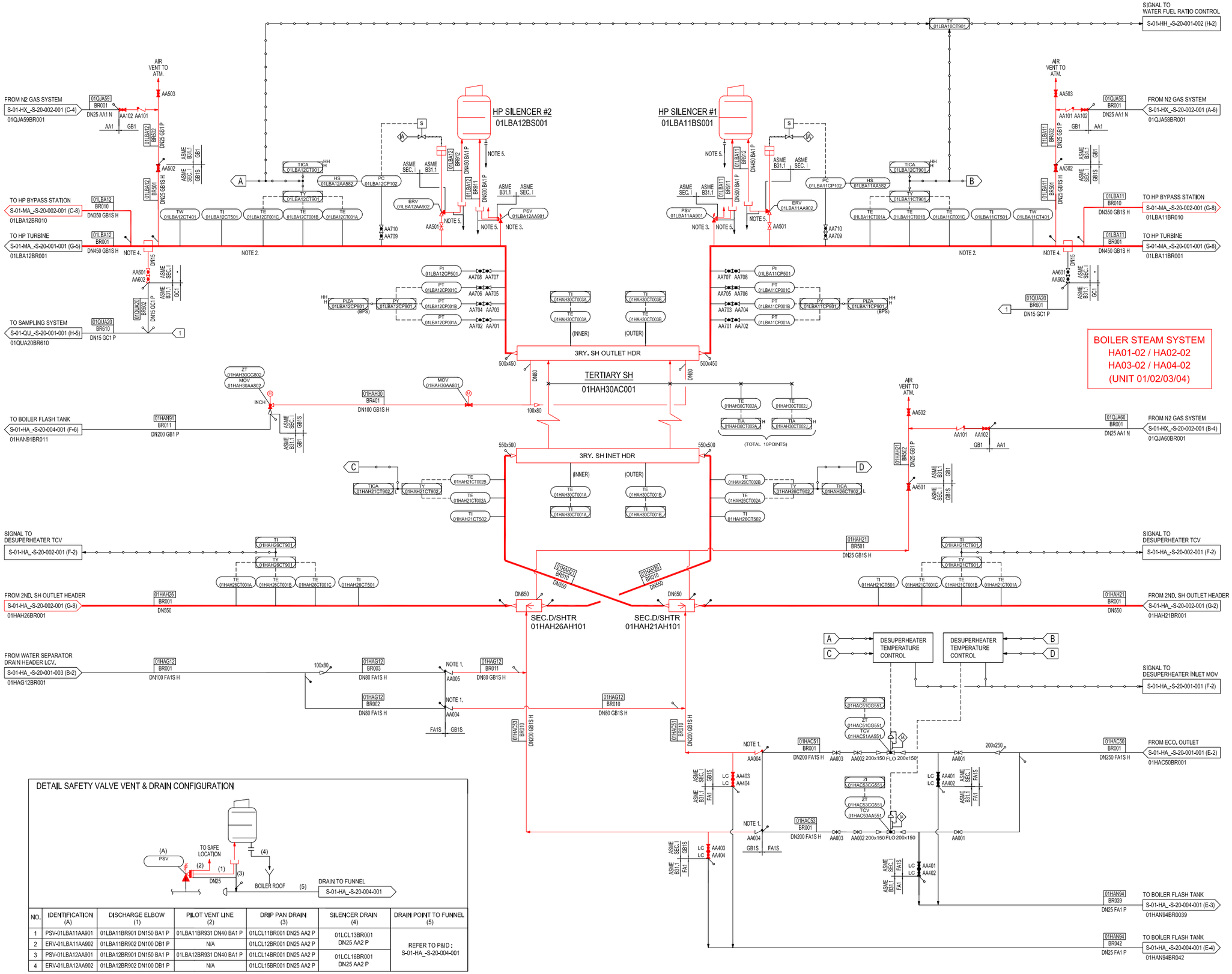

GENERAL NOTES

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5. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN

AS BUILT

REFERENCE DRAWINGS

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BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
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"	"
"	"

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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER STEAM SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-002-002	01 OF 01	3X

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION

NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
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2	ERV-01LBA11AA902	01LBA11BR902 DN100 DB1 P	N/A	01LCL12BR001 DN25 AA2 P		
3	PSV-01LBA12AA901	01LBA12BR901 DN150 BA1 P	01LBA12BR931 DN40 BA1 P	01LCL14BR001 DN25 AA2 P	01LCL16BR001 DN25 AA2 P	
4	ERV-01LBA12AA902	01LBA12BR902 DN100 DB1 P	N/A	01LCL15BR001 DN25 AA2 P		

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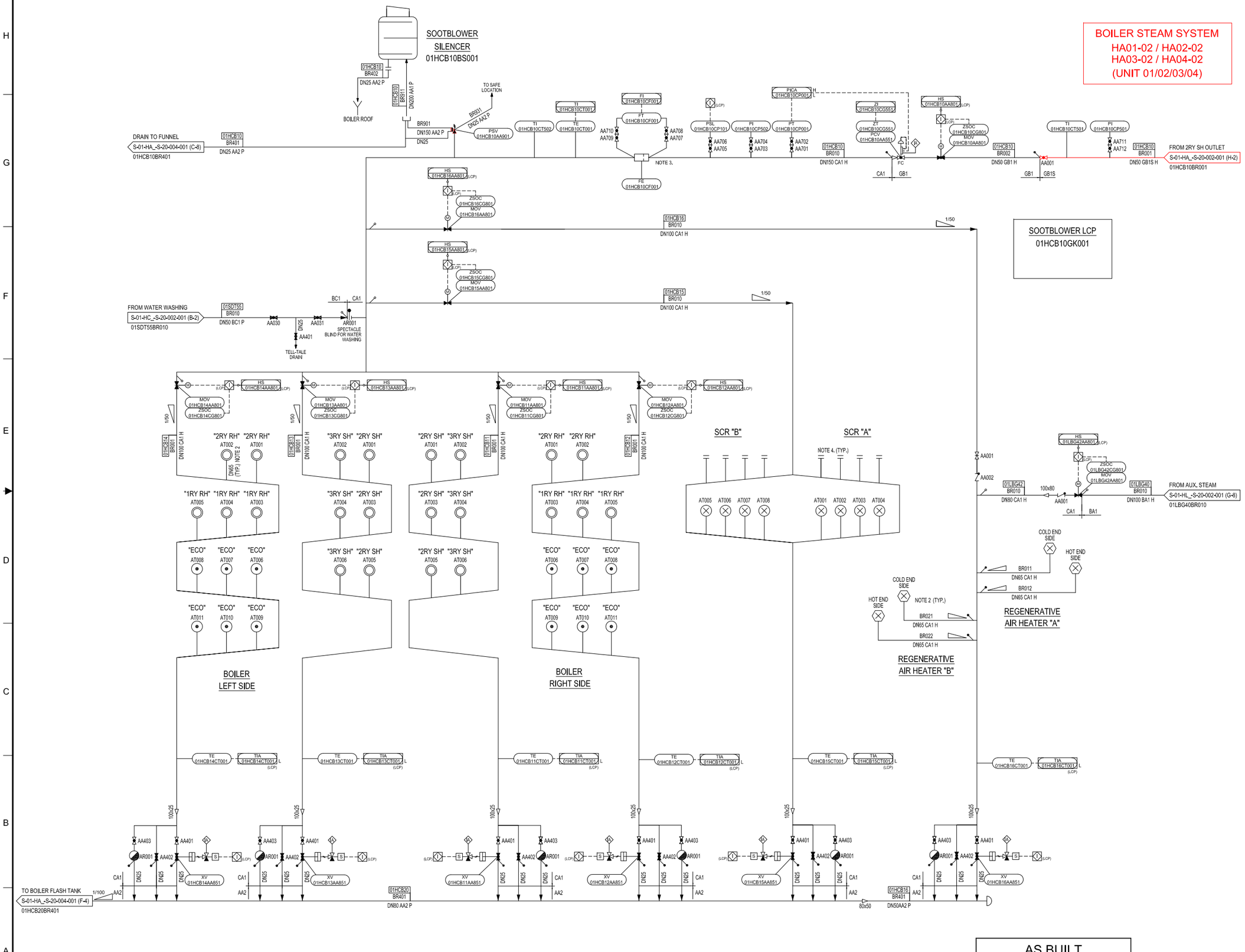

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1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. SOOTBLOWER SYMBOL LEGEND
   - ◎ : LONG RETRACTABLE TYPE
   - ⊙ : SHORT RETRACTABLE TYPE
   - ⊗ : RAKE TYPE
   - ⊗ : AIR HEATER SOOT BLOWER
2. SOOTBLOWER NOZZLE CONNECTION, DN80(TYP.)
3. FLOW COMPENSATION USING PT-01HCB10CP001, TE-01HCB10CT001
4. FOR FUTURE SOOTBLOWER

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT: SHUQAIQ STEAM POWER PLANT

OWNER: الشركة السعودية للكهرباء Saudi Electricity Company

ENGINEER: PÖYRY

CONTRACTOR: HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR: N/A

VENDOR INTERNAL DWG NO.: N/A

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. THE CONTRACTOR HHI CONFIRMS FULLY COMPLIANCE WITH THE OE'S COMMENTS. NO OTHER CHANGES HAD BEEN MADE ON THE DRAWING. THE CONTRACTOR MAY SUBMIT THE DRAWING AS "FOR CONSTRUCTION"

APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE: P&ID FOR BOILER SOOTBLOWING SYSTEM

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-001	01 OF 01	2X

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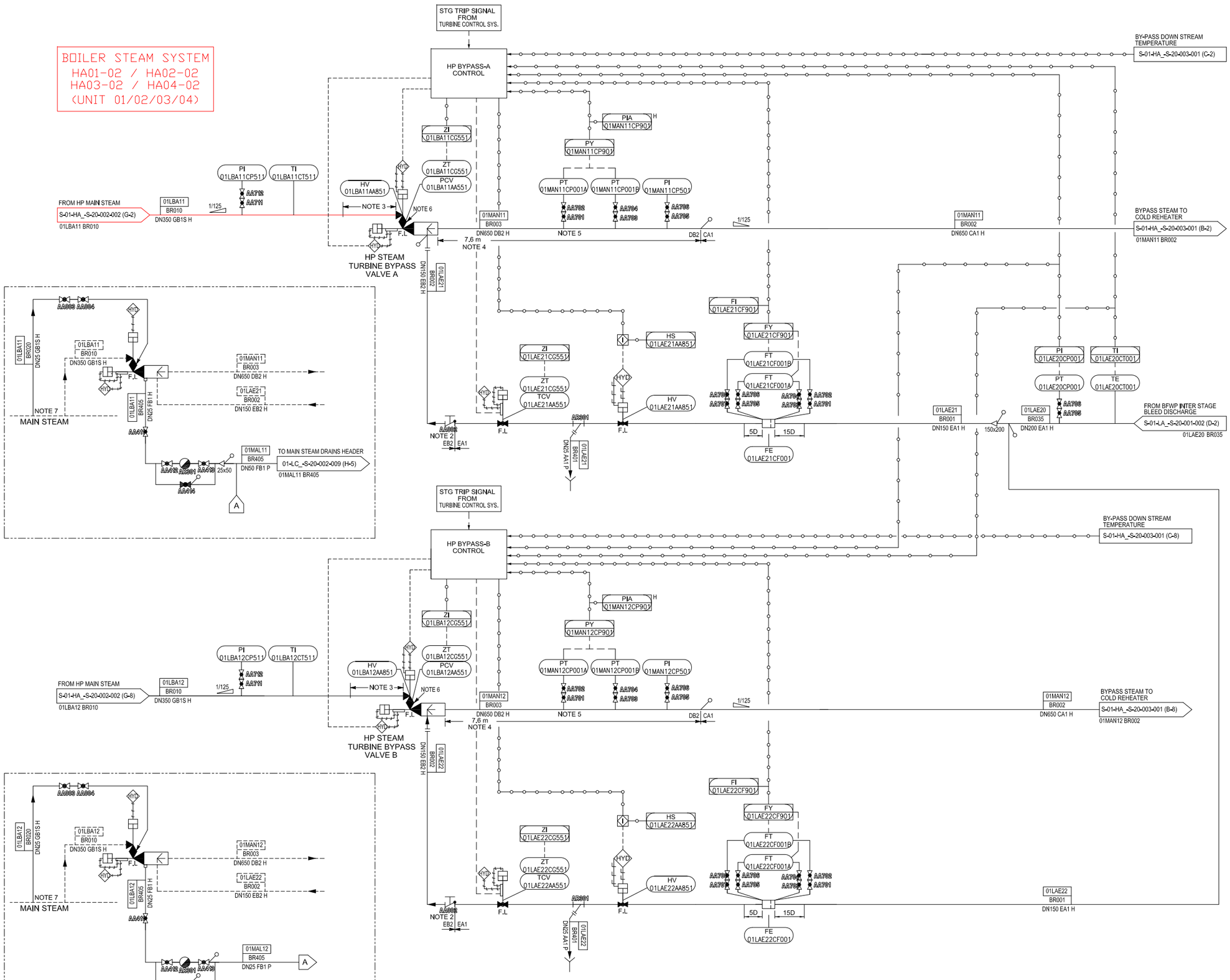
A1(594x841)

BOILER STEAM SYSTEM
HA01-02 / HA02-02
HA03-02 / HA04-02
(UNIT 01/02/03/04)



HP BYPASS SYSTEM

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.

NOTES

1. CAPACITY : MINIMUM (2 X 50%) VWO.
2. THE CHECK VALVE TO BE EQUIPPED WITH HANDWHEEL AND TO BE INSTALLED HORIZONTALLY.
3. MINIMUM STRAIGHT LENGTH : 5D
4. DISTANCE TO FIRST BEND MINIMUM STRAIGHT LENGTH 7.6 METER, DESIGN TEMP. : 550°C
5. MINIMUM DISTANCE TO FIRST PRESSURE SENSOR : 5D
6. FIELD WELDING POINT
7. HP BYPASS WARM UP TAKE-OFF TO BE LOCATED AT LEAST 5D UPSTREAM OF HP BYPASS TAKE-OFF.

FOR CONSTRUCTION

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
SYSTEM DESCRIPTION FOR MAIN & REHEAT STEAM SYS.	S-00-MA_-S-45-102-001
PFD - MAIN & REHEAT STEAM SYSTEM	S-01-MA_-S-12-001-001

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1	06.JAN.2015	REVISED AS MARKED	I.J.LEE	S.W.KIM	J.K.SEO
0	13.MAY.2014	ISSUED FOR CONSTRUCTION	I.J.LEE	H.H.KIM	J.K.SEO
B	21.MAR.2014	REVISED AS MARKED	I.J.LEE	H.H.KIM	J.K.SEO
A	25.OCT.2013	ISSUED FOR APPROVAL	H.H.KIM	J.K.SEO	H.S.BAEK

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HH-T-00835
REV. NO. B
DATE : 17.APR.2014 STATUS : 1

DRAWING TITLE
P & ID FOR
HP STEAM BYPASS SYSTEM
(FOR UNIT 1)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	NONE	S-01-MA_-S-20-002-001 (Old No: S-1T-MA_-S-20-002-001)	01 OF 01	1

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A1(841x594)

BOILER REHEAT SYSTEM
HA01-03 / HA02-03
HA03-03 / HA04-03
(UNIT 01/02/03/04)

RH START UP SILENCER #2 01LBB12BS002
HOT RH SILENCER #2 01LBB12BS001
HOT RH SILENCER #1 01LBB11BS001
RH START UP SILENCER #1 01LBB11BS002
SECONDARY RH 01HAJ20AC001
PRIMARY RH 01HAJ10AC001
COLD RH SILENCER #2 01LBC12BS001
COLD RH SILENCER #1 01LBC11BS001

2RY RH OUTLET HDR
2RY RH INLET HDR
1RY RH OUTLET HDR
1RY RH INLET HDR

SIGNAL TO G.R FAN CONTROL S-01-HL_-S-20-001-002 (B-4)

FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (A-4) 01QJA65BR001
FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (A-4) 01QJA64BR001
TO IP TURBINE S-01-MA_-S-20-001-001 (E-5) 01LBB12BR001
TO IP TURBINE S-01-MA_-S-20-001-001 (E-8) 01LBB11BR001
TO SAMPLING SYSTEM S-01-QU_-S-20-001-001 (H-4) 01QUA30BR610
FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (B-4) 01QJA63BR001
FROM BOILER FEED WATER PUMP BLEEDING S-01-LA_-S-20-001-002 (E-2) 01LAF10BR035
TO HP BYPASS HYDRAULIC CONTROL PANEL S-01-MA_-S-20-002-001 (D-3)
FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (B-4) 01QJA62BR001
FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (B-4) 01QJA61BR001
TO HP BYPASS HYDRAULIC CONTROL PANEL S-01-MA_-S-20-002-001 (H-2)
FROM HP BYPASS STATION S-01-MA_-S-20-002-001 (C-3) 01MAN12BR002
FROM HP BYPASS STATION S-01-MA_-S-20-002-001 (G-3) 01MAN11BR002
FROM HP TURBINE S-01-MA_-S-20-001-001 (C-5) 01LBC12BR002
FROM HP TURBINE S-01-MA_-S-20-001-001 (C-8) 01LBC11BR002
TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-4) 01HAN94BR044
TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-4) 01HAN94BR043
TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-3) 01MAL32BR411
TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-3) 01MAL31BR411

RH DESUPERHEATER TEMPERATURE CONTROL
RH DESUPERHEATER TEMPERATURE CONTROL

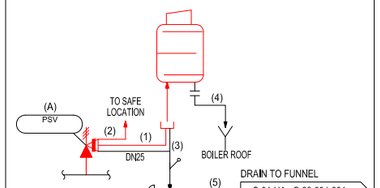
RH.D/SHTR 01HAJ16AH101
RH.D/SHTR 01HAJ11AH101

(TOTAL 10POINTS)
(TOTAL 10POINTS)

AIR VENT TO ATM.
AIR VENT TO ATM.

COLD REHEAT

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION



NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01LBC11AA901	01LBC11BR901 DN250 BA2 P	01LBC11BR931 DN65 BA2 P	01LCL31BR001 DN25 AA2 P	01LCL39BR001 DN25 AA2 P	REFER TO P&ID : S-01-HA_-S-20-004-001
2	PSV-01LBC11AA902	01LBC11BR902 DN250 BA2 P	01LBC11BR932 DN65 BA2 P	01LCL32BR001 DN25 AA2 P		
3	PSV-01LBC11AA903	01LBC11BR903 DN250 BA2 P	01LBC11BR933 DN65 BA2 P	01LCL33BR001 DN25 AA2 P		
4	PSV-01LBC11AA904	01LBC11BR904 DN250 BA2 P	01LBC11BR934 DN65 BA2 P	01LCL34BR001 DN25 AA2 P		
5	PSV-01LBC12AA901	01LBC12BR901 DN250 BA2 P	01LBC12BR931 DN65 BA2 P	01LCL38BR001 DN25 AA2 P	01LCL40BR001 DN25 AA2 P	
6	PSV-01LBC12AA902	01LBC12BR902 DN250 BA2 P	01LBC12BR932 DN65 BA2 P	01LCL37BR001 DN25 AA2 P		
7	PSV-01LBC12AA903	01LBC12BR903 DN250 BA2 P	01LBC12BR933 DN65 BA2 P	01LCL36BR001 DN25 AA2 P		
8	PSV-01LBC12AA904	01LBC12BR904 DN250 BA2 P	01LBC12BR934 DN65 BA2 P	01LCL35BR001 DN25 AA2 P		
9	PSV-01LBB11AA901	01LBB11BR901 DN250 BB1 P	01LBB11BR931 DN65 BB1 P	01LCL21BR001 DN25 AA2 P	01LCL22BR001 DN25 AA2 P	
10	PSV-01LBB12AA901	01LBB12BR901 DN250 BB1 P	01LBB12BR931 DN65 BB1 P	01LCL24BR001 DN25 AA2 P	01LCL25BR001 DN25 AA2 P	

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS. AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER
2. THE REHEATER MAIN STEAM PIPE SHALL BE PROVIDED WITH CREEP PIPS.
3. ALL SAFETY VALVES SHALL HAVE WELDED INLETS AND FLANGED OUTLET.
4. THE SAMPLING NOZZLE SHALL BE PROVIDED TO BE SUITABLE FOR ISOKINETIC SAMPLING.
5. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN
6. FLOW COMPENSATION USING PT-01LAF10CP001, TE-01LAF50CT001
7. SPOOL FOR LINE FLUSHING TO BE WELDED AFTER LINE FLUSHING
8. PARALLEL SLIDE GATE VALVE.

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00944
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR BOILER REHEAT SYSTEM

AS BUILT

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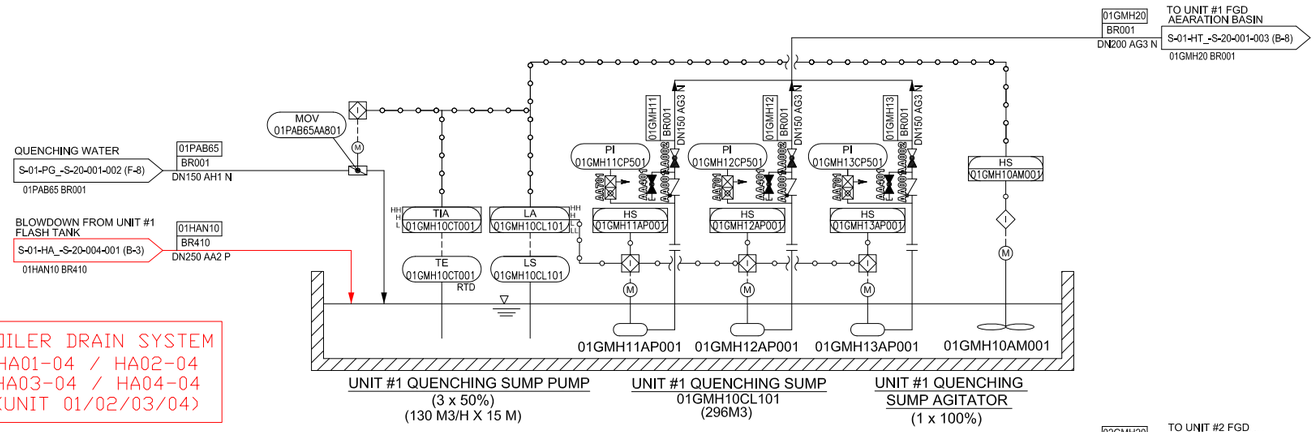
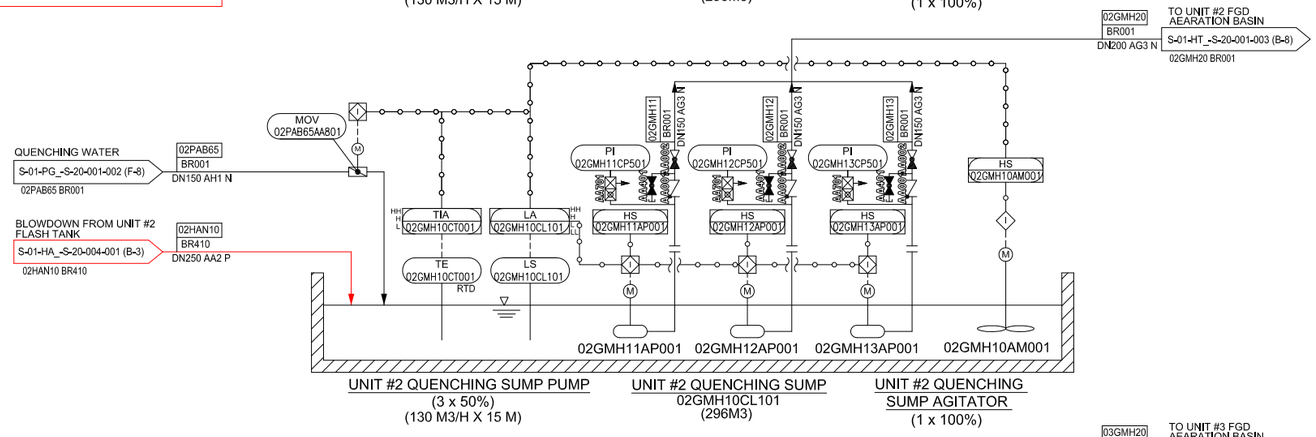
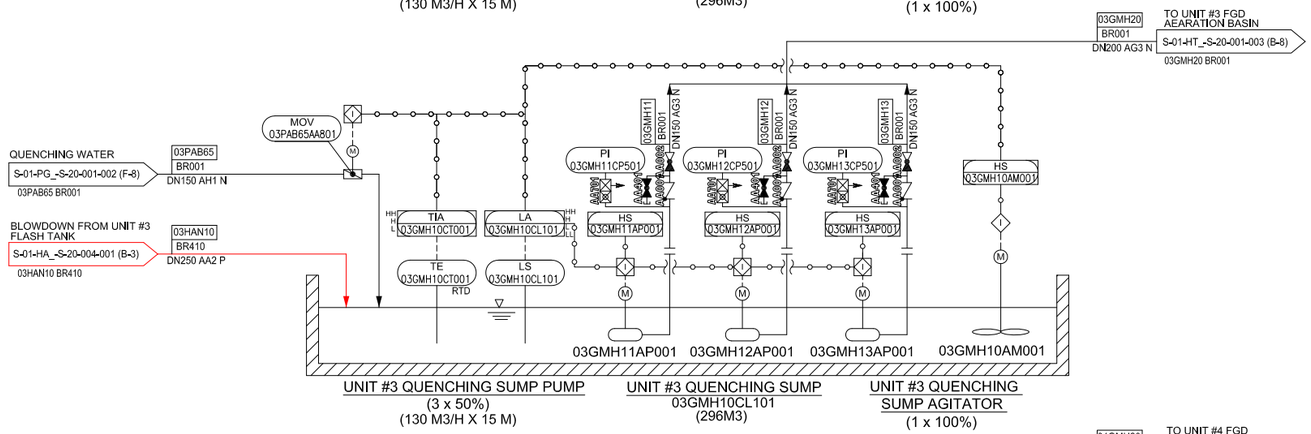
CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-003-001	01 OF 01	3X

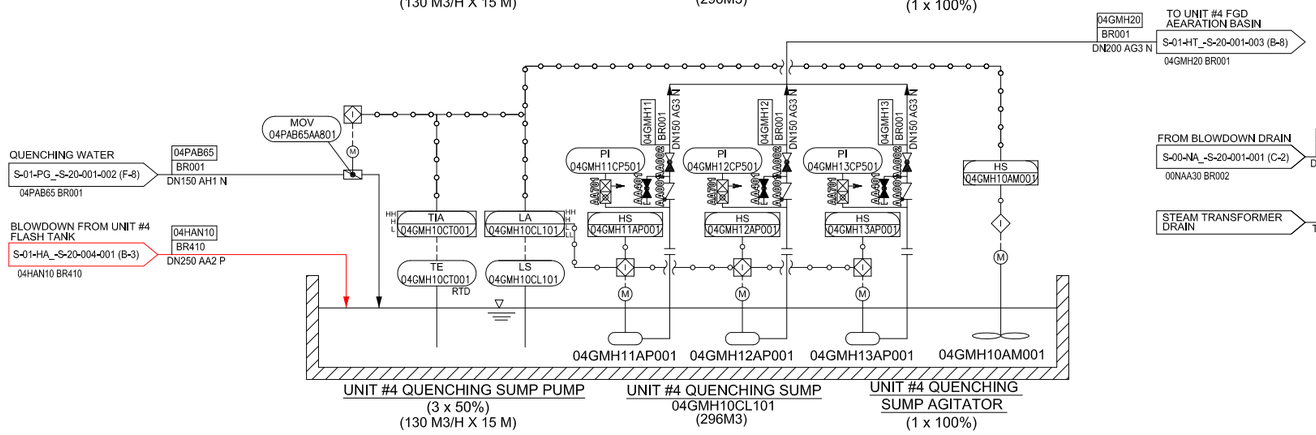
A1(594x841)

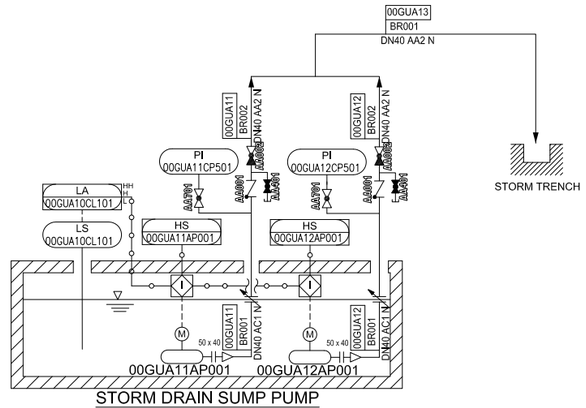
BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)





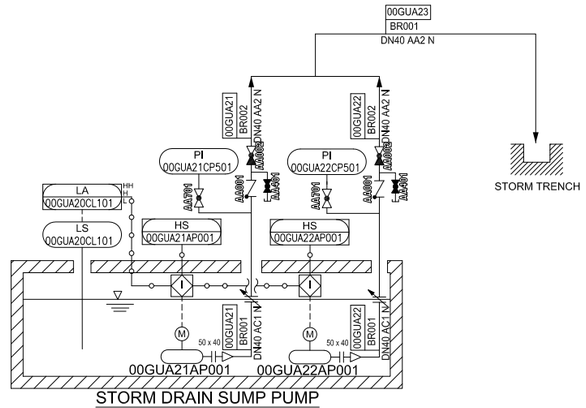






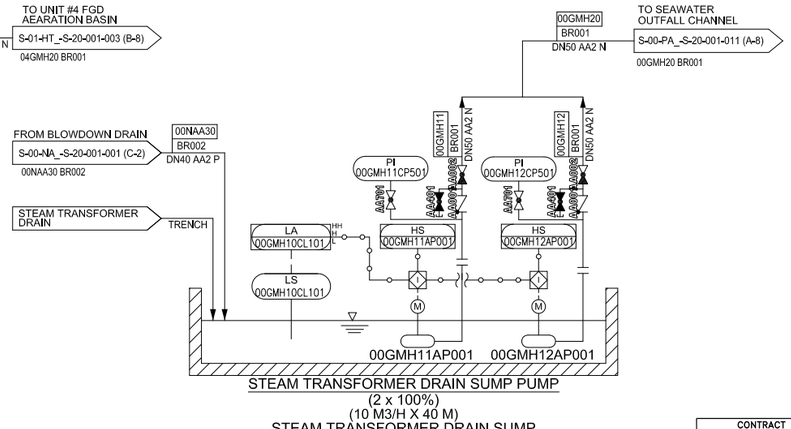
STORM DRAIN SUMP PUMP
FOR HFO/HCO OPEN TRENCH #1
(2 x 100%)
(10 M3/H X 10 M)

STORM DRAIN SUMP
FOR HFO/HCO OPEN TRENCH #1
00GUA11BB001
(10M3)



STORM DRAIN SUMP PUMP
FOR HFO/HCO OPEN TRENCH #2
(2 x 100%)
(10 M3/H X 10 M)

STORM DRAIN SUMP
FOR HFO/HCO OPEN TRENCH #2
00GUA21BB001
(10M3)



STEAM TRANSFORMER DRAIN SUMP PUMP
(2 x 100%)
(10 M3/H X 40 M)
STEAM TRANSFORMER DRAIN SUMP
00GMH10BB001
(12M3)

GENERAL NOTES

1. THIS IS COMMON FOR THE PLANT.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. THE DEFINITION OF ABBREVIATION IN P&ID FOR CLEAN DRAIN COLLECTION SYSTEM IS AS FOLLOWING.

ABBREVIATION	DEFINITION
FGD	FLUE GAS DESULPHURIZATION
CPP	CONDENSATE POLISHING PLANT
CEP	CONDENSATE EXTRACTION PUMP
CCCW	CLOSED CIRCUIT COOLING WATER
SW	SEAWATER
CCB	CENTRAL CONTROL BUILDING

NOTES

FOR CONSTRUCTION

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
EQUIPMENT SIZING REPORT FOR WASTE WATER TREATMENT SYSTEM	S-00-GN_-S-48-117-001 (Old No. : S-10-GN_-S-48-117-001)
SYSTEM DESCRIPTION FOR WASTE WATER TREATMENT SYSTEM	S-00-GN_-S-45-118-001 (Old No. : S-10-GN_-S-45-118-001)

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2	09.DEC.2015	ISSUED FOR CONSTRUCTION	R.PARK	Y.K.OH	S.W.KIM
1	12.MAR.2015	ISSUED FOR CONSTRUCTION	R.PARK	S.W.KIM	J.K.SEO
0	03.JUL.2014	ISSUED FOR CONSTURCTION	H.J.KIM	S.W.KIM	J.K.SEO
B	23.MAY.2014	ISSUED FOR APPROVAL	H.J.KIM	S.W.KIM	J.K.SEO
A	25.OCT.2013	ISSUED FOR APPROVAL	C.H.KIM	S.W.KIM	H.S.BAEK

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01837
REV. NO. B
DATE : 19.JUN.2014 STATUS : 2

DRAWING TITLE
P & ID FOR
CLEAN DRAIN COLLECTION SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	NONE	S-00-GM_-S-20-004-001 (Old No. : S-10-GM_-S-20-001-001)	01 OF 01	2

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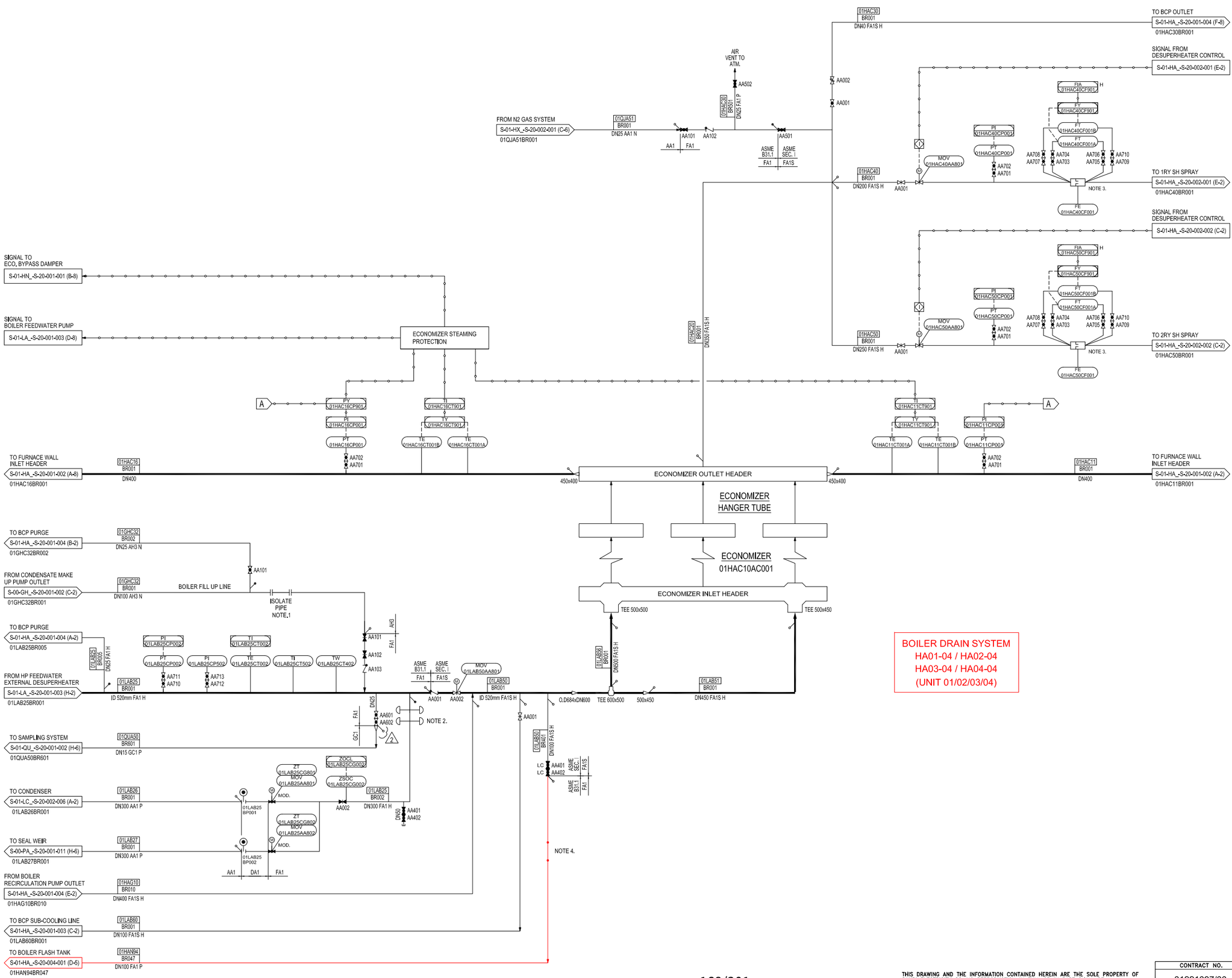
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. ISOLATE PIPE SHALL BE REMOVED DURING NORMAL OPERATION.
2. WATER FLUSHING CONNECTION Q'TY : DN125 x 4EA.
3. FLOW COMPENSATION USING PT-01HAC11/16CP001, TE-01HAC11/16CT001A/B
4. SPOOL FOR CHEMICAL CLEANING TO BE WELDED AFTER CHEMICAL CLEANING

AS BUILT

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR	VENDOR INTERNAL DWG NO.
N/A	N/A

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. THE CONTRACTOR HHI CONFIRMS FULLY COMPLIANCE WITH THE OE'S COMMENTS. NO OTHER CHANGES HAD BEEN MADE ON THE DRAWING. THE CONTRACTOR MAY SUBMIT THE DRAWING AS "FOR CONSTRUCTION"

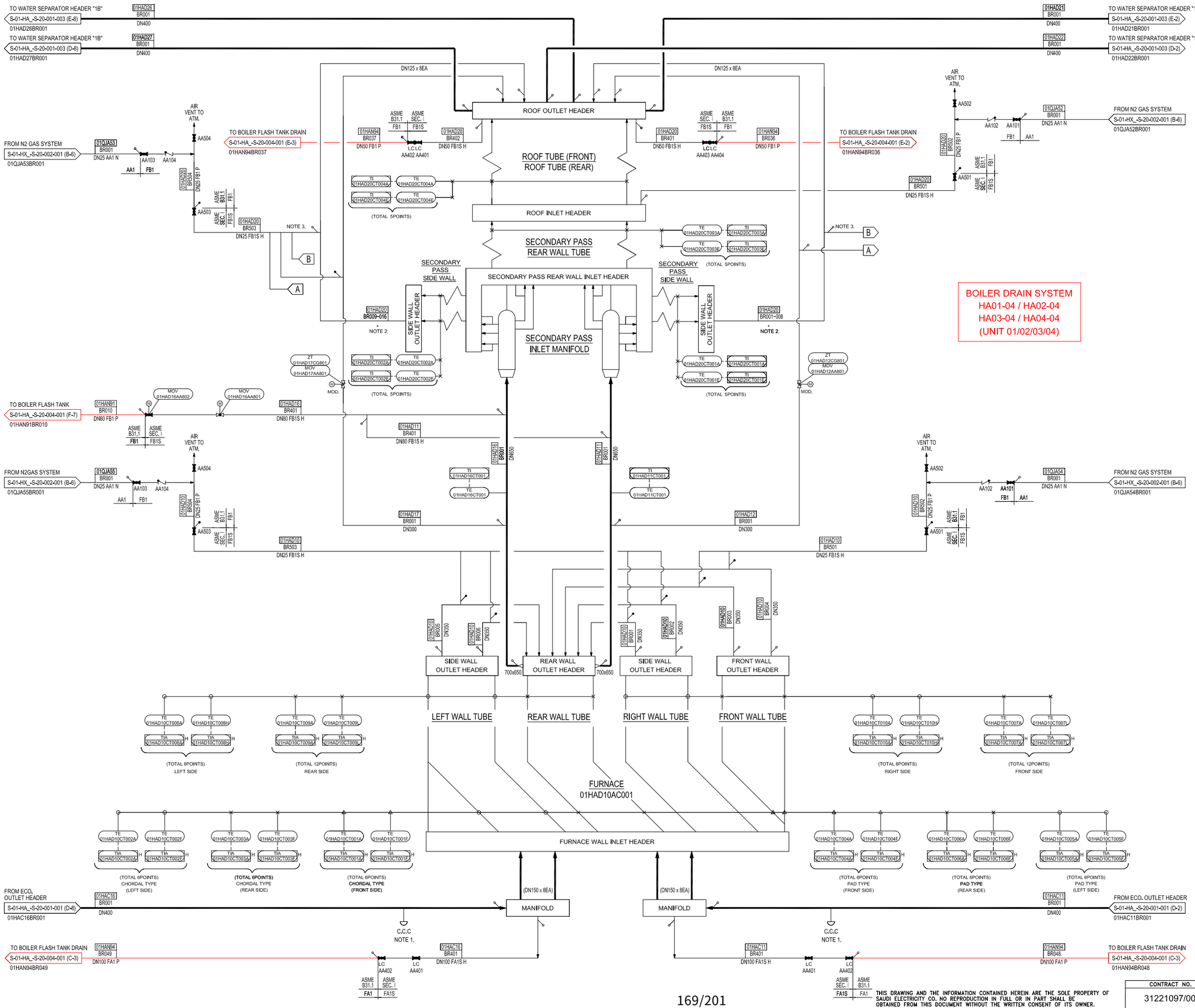
APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (1/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-001	01 OF 01	2X

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE THE SOLE PROPERTY OF SAUDI ELECTRICITY CO. NO REPRODUCTION IN FULL OR IN PART SHALL BE OBTAINED FROM THIS DOCUMENT WITHOUT THE WRITTEN CONSENT OF ITS OWNER.

A1(594x841)



BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. C.C.C : CHEMICAL CLEANING CONNECTION Q'TY : DN125 x 2EA.
2. CONNECTING PIPE : DN125 x 8EA FOR EACH SIDE (TAG NO. 01HAD20BR001-BR016)
3. EACH VENT (16 POINT) SHALL BE CONNECTED TO COMMON VENT PIPE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
1	31.AUG.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00944
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (2/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-002	01 OF 01	1X

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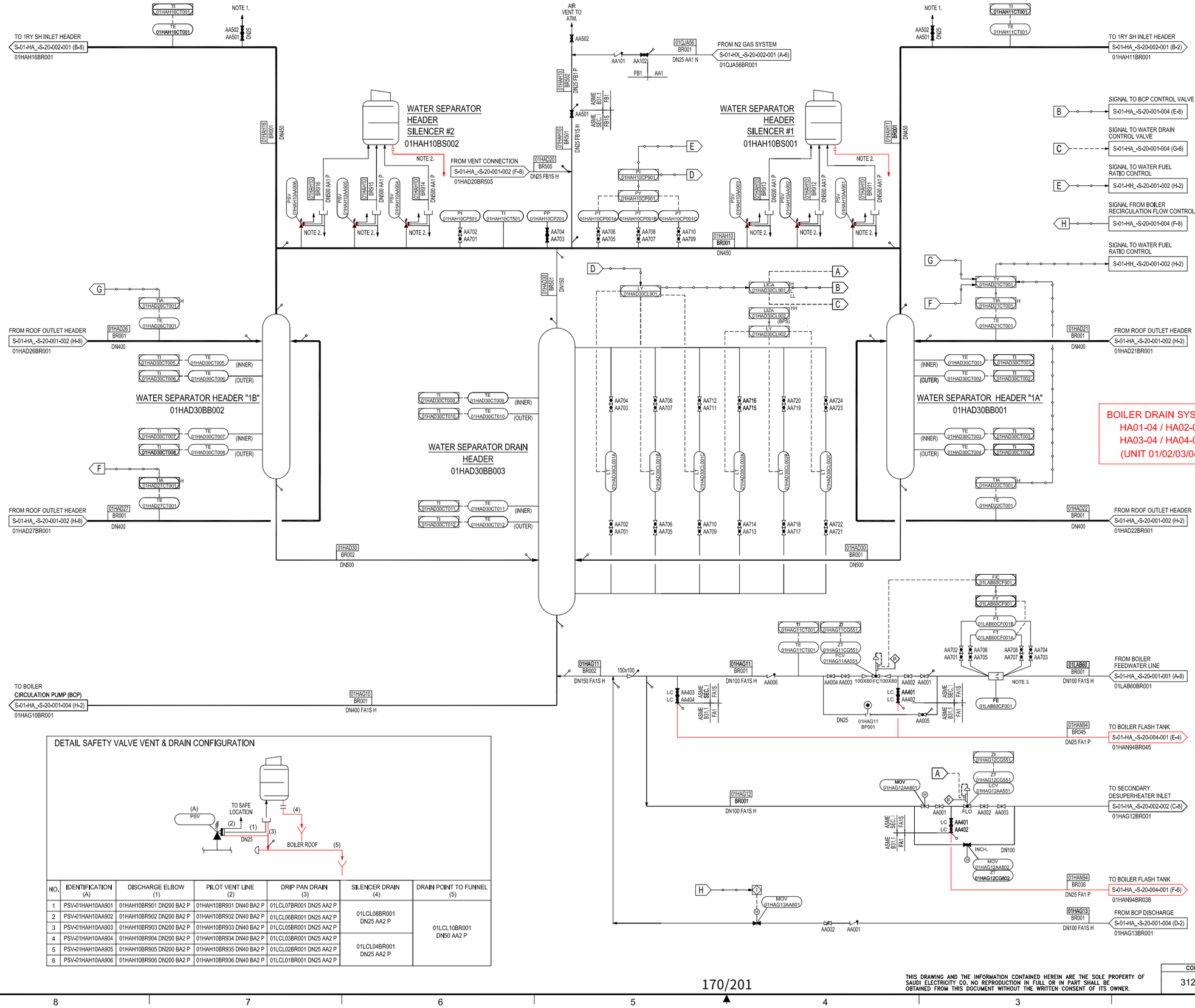

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
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8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. THIS VENT SHALL BE USED FOR HYDROSTATIC TEST ONLY.
2. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN
3. FLOW COMPENSATION USING PT-01LAB25CP002, TE-01LAB25CT002

AS BUILT

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION

NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01HAH10AA901	01HAH10BR901 DN200 BA2 P	01HAH10BR931 DN40 BA2 P	01LCL07BR001 DN25 AA2 P	01LCL08BR001 DN25 AA2 P	01LCL10BR001 DN50 AA2 P
2	PSV-01HAH10AA902	01HAH10BR902 DN200 BA2 P	01HAH10BR932 DN40 BA2 P	01LCL06BR001 DN25 AA2 P		
3	PSV-01HAH10AA903	01HAH10BR903 DN200 BA2 P	01HAH10BR933 DN40 BA2 P	01LCL05BR001 DN25 AA2 P		
4	PSV-01HAH10AA904	01HAH10BR904 DN200 BA2 P	01HAH10BR934 DN40 BA2 P	01LCL03BR001 DN25 AA2 P	01LCL04BR001 DN25 AA2 P	
5	PSV-01HAH10AA905	01HAH10BR905 DN200 BA2 P	01HAH10BR935 DN40 BA2 P	01LCL02BR001 DN25 AA2 P		
6	PSV-01HAH10AA906	01HAH10BR906 DN200 BA2 P	01HAH10BR936 DN40 BA2 P	01LCL01BR001 DN25 AA2 P		

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	31.AUG.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (3/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-003	01 OF 01	3X

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE THE SOLE PROPERTY OF SAUDI ELECTRICITY CO. NO REPRODUCTION IN FULL OR IN PART SHALL BE OBTAINED FROM THIS DOCUMENT WITHOUT THE WRITTEN CONSENT OF ITS OWNER.

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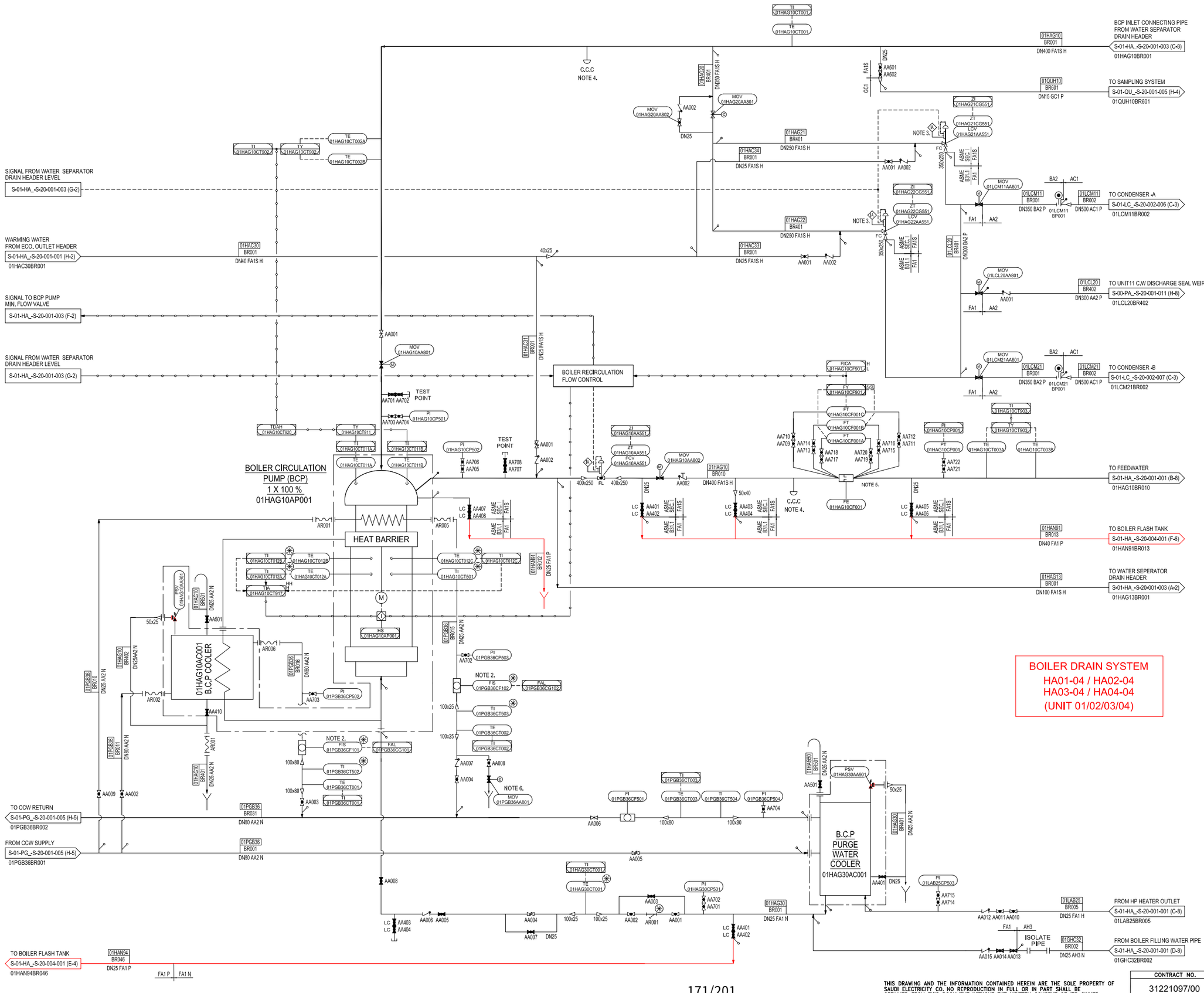

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
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9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. [ ] : SUPPLIED BY VENDOR
   ⊛ : LOOSE PARTS SUPPLIED BY VENDOR
2. FIS : FLOW SIGHT GLASS WITH SWITCH.
3. FOR LCV - 01HAG21/22AA551 AND DOWNSTREAM PIPING AND INSTRUMENTS SHALL BE INSTALLED AT CONDENSER INLET.
4. C.C.C : CHEMICAL CLEANING CONNECTION Q'TY : DN125 x 4EA.
5. FLOW COMPENSATION USING PT-01HAG10CP001, TE-01HAG10CT003A/B
6. UPS POWER. MOV SHALL BE OPEN AT CCCW PUMP AND EMERGENCY CCCW PUMP BOTH TRIP.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
4X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
4	08.FEB.2017	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
3	24.DEC.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER SYSTEM (4/4)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-001-004	01 OF 01	4X

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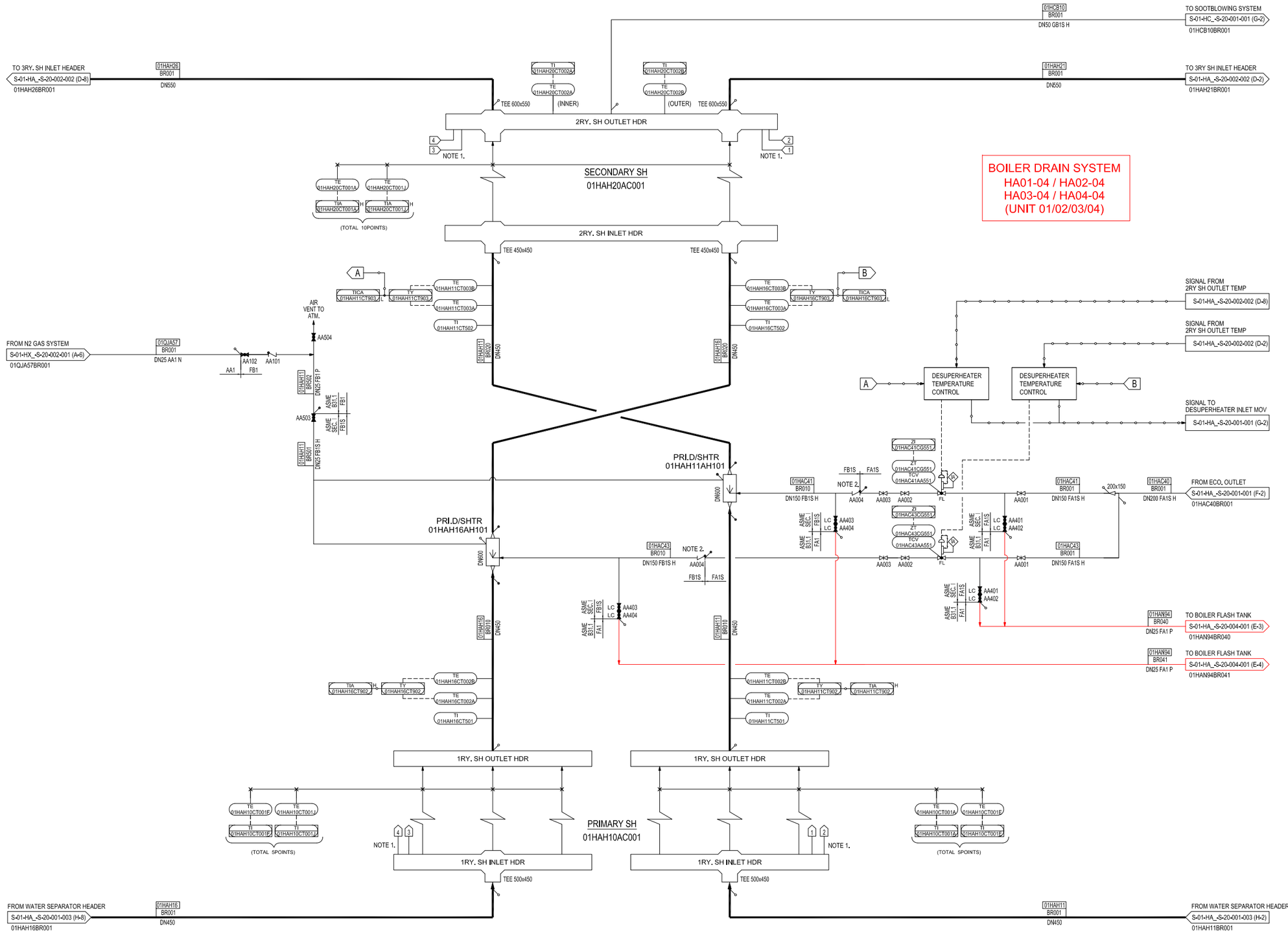

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
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9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. TUBE CONNECT 1&3 : GIRDLING TUBE
   TUBE CONNECT 2&4 : SPACER TUBE
2. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
0X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER STEAM SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-002-001	01 OF 01	0X

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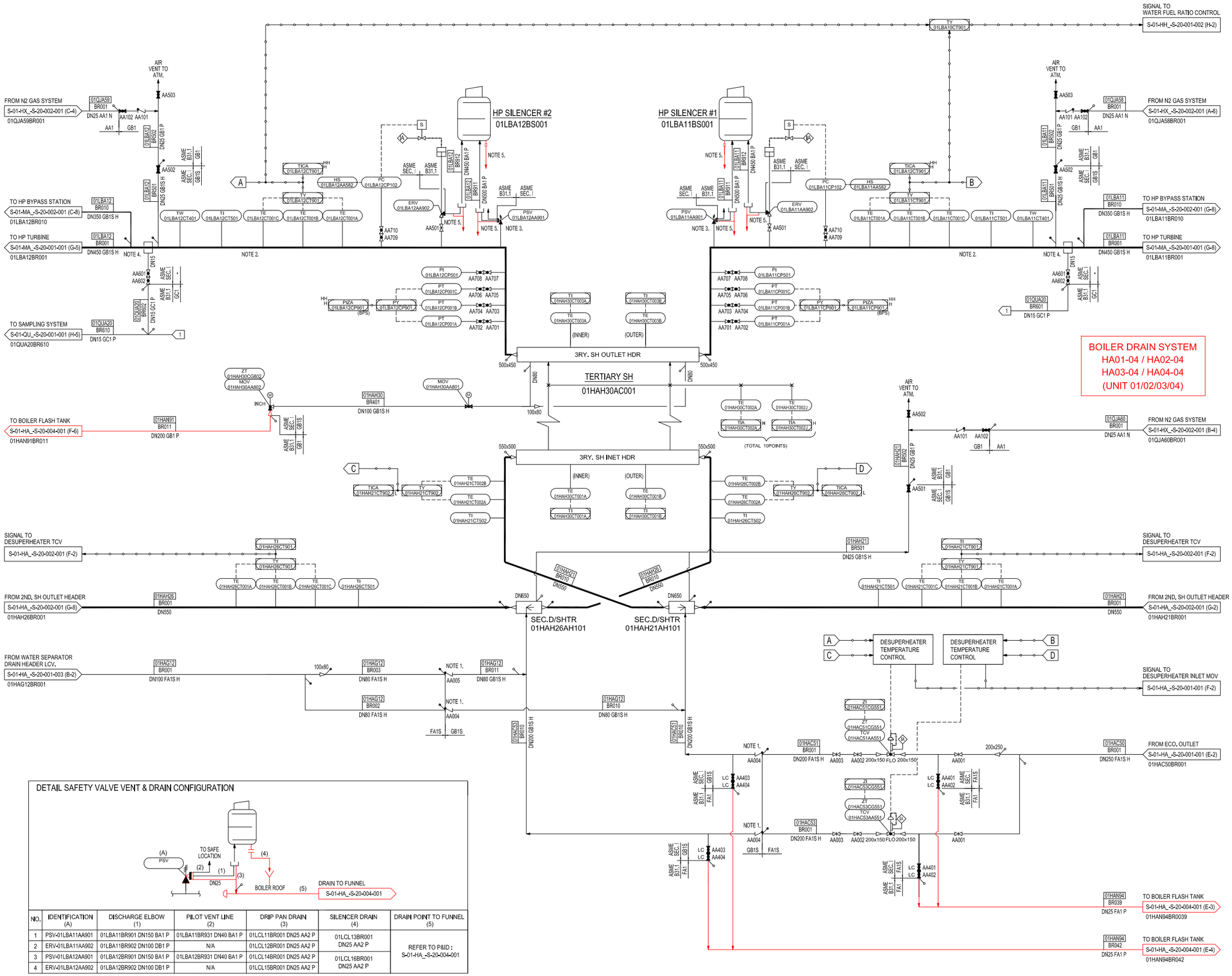

NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01LBA11AA901	01LBA11BR901 DN150 BA1 P	01LBA11BR931 DN40 BA1 P	01LCL11BR001 DN25 AA2 P	01LCL13BR001 DN25 AA2 P	REFER TO P&ID : S-01-HA_-S-20-004-001
2	ERV-01LBA11AA902	01LBA11BR902 DN100 DB1 P	N/A	01LCL12BR001 DN25 AA2 P		
3	PSV-01LBA12AA901	01LBA12BR901 DN150 BA1 P	01LBA12BR931 DN40 BA1 P	01LCL14BR001 DN25 AA2 P	01LCL16BR001 DN25 AA2 P	
4	ERV-01LBA12AA902	01LBA12BR902 DN100 DB1 P	N/A	01LCL15BR001 DN25 AA2 P		

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS. AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER
2. THE MAIN STEAM PIPE SHALL BE PROVIDED WITH CREEP PIPS.
3. ALL SAFETY VALVES SHALL HAVE WELDED INLETS AND FLANGED OUTLET.
4. THE SAMPLING NOZZLE SHALL BE PROVIDED TO BE SUITABLE FOR ISOKINETIC SAMPLING.
5. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT: SHUQAIQ STEAM POWER PLANT

OWNER: الشركة السعودية للكهرباء Saudi Electricity Company

ENGINEER: PÖYRY

CONTRACTOR: HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR: N/A

VENDOR INTERNAL DWG NO.: N/A

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. THE CONTRACTOR HHI CONFIRMS FULLY COMPLIANCE WITH THE OE'S COMMENTS. NO OTHER CHANGES HAD BEEN MADE ON THE DRAWING. THE CONTRACTOR MAY SUBMIT THE DRAWING AS "FOR CONSTRUCTION"

APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE: P&ID FOR BOILER STEAM SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-002-002	01 OF 01	3X

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE THE SOLE PROPERTY OF SAUDI ELECTRICITY CO. NO REPRODUCTION IN FULL OR IN PART SHALL BE OBTAINED FROM THIS DOCUMENT WITHOUT THE WRITTEN CONSENT OF ITS OWNER.

A1(594x841)

RH START UP SILENCER #2 01LBB12BS002

HOT RH SILENCER #2 01LBB12BS001

HOT RH SILENCER #1 01LBB11BS001

RH START UP SILENCER #1 01LBB11BS002

SIGNAL TO G.R FAN CONTROL

S-01-HL_-S-20-001-002 (B-4)

FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (A-4) 01QJA65BR001

FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (A-4) 01QJA64BR001

TO IP TURBINE S-01-MA_-S-20-001-001 (E-5) 01LBB12BR001

TO IP TURBINE S-01-MA_-S-20-001-001 (E-8) 01LBB11BR001

2RY RH OUTLET HDR

SECONDARY RH 01HAJ20AC001

2RY RH INLET HDR

(TOTAL 10POINTS)

RH DESUPERHEATER TEMPERATURE CONTROL

RH DESUPERHEATER TEMPERATURE CONTROL

TO SAMPLING SYSTEM S-01-QU_-S-20-001-001 (H-4) 01QUA30BR610

FROM BOILER FEED WATER PUMP BLEEDING S-01-LA_-S-20-001-002 (E-2) 01LAF10BR035

RH.D/SHTR 01HAJ16AH101

RH.D/SHTR 01HAJ11AH101

AIR VENT TO ATM.

FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (B-4) 01QJA63BR001

TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-4) 01HAN94BR044

TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-4) 01HAN94BR043

PRIMARY RH 01HAJ10AC001

FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (B-4) 01QJA62BR001

FROM N2 GAS SYSTEM S-01-HX_-S-20-002-001 (B-4) 01QJA61BR001

TO HP BYPASS HYDRAULIC CONTROL PANEL S-01-MA_-S-20-002-001 (D-3)

TO HP BYPASS HYDRAULIC CONTROL PANEL S-01-MA_-S-20-002-001 (H-2)

COLD RH SILENCER #2 01LBC12BS001

COLD RH SILENCER #1 01LBC11BS001

1RY RH INLET HDR

1RY RH OUTLET HDR

FROM HP BYPASS STATION S-01-MA_-S-20-002-001 (C-3) 01MAN12BR002

FROM HP TURBINE S-01-MA_-S-20-001-001 (C-5) 01LBC12BR002

FROM HP BYPASS STATION S-01-MA_-S-20-002-001 (G-3) 01MAN11BR002

FROM HP TURBINE S-01-MA_-S-20-001-001 (C-8) 01LBC11BR002

COLD REHEAT

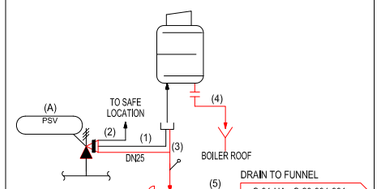
TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-3) 01MAL32BR411

TO BOILER FLASH TANK S-01-HA_-S-20-004-001 (F-3) 01MAL31BR411

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

AS BUILT

DETAIL SAFETY VALVE VENT & DRAIN CONFIGURATION



NO.	IDENTIFICATION (A)	DISCHARGE ELBOW (1)	PILOT VENT LINE (2)	DRIP PAN DRAIN (3)	SILENCER DRAIN (4)	DRAIN POINT TO FUNNEL (5)
1	PSV-01LBC11AA901	01LBC11BR901 DN250 BA2 P	01LBC11BR931 DN65 BA2 P	01LCL31BR001 DN25 AA2 P	01LCL39BR001 DN25 AA2 P	REFER TO P&ID : S-01-HA_-S-20-004-001
2	PSV-01LBC11AA902	01LBC11BR902 DN250 BA2 P	01LBC11BR932 DN65 BA2 P	01LCL32BR001 DN25 AA2 P		
3	PSV-01LBC11AA903	01LBC11BR903 DN250 BA2 P	01LBC11BR933 DN65 BA2 P	01LCL33BR001 DN25 AA2 P		
4	PSV-01LBC11AA904	01LBC11BR904 DN250 BA2 P	01LBC11BR934 DN65 BA2 P	01LCL34BR001 DN25 AA2 P		
5	PSV-01LBC12AA901	01LBC12BR901 DN250 BA2 P	01LBC12BR931 DN65 BA2 P	01LCL38BR001 DN25 AA2 P	01LCL40BR001 DN25 AA2 P	
6	PSV-01LBC12AA902	01LBC12BR902 DN250 BA2 P	01LBC12BR932 DN65 BA2 P	01LCL37BR001 DN25 AA2 P		
7	PSV-01LBC12AA903	01LBC12BR903 DN250 BA2 P	01LBC12BR933 DN65 BA2 P	01LCL36BR001 DN25 AA2 P		
8	PSV-01LBC12AA904	01LBC12BR904 DN250 BA2 P	01LBC12BR934 DN65 BA2 P	01LCL35BR001 DN25 AA2 P		
9	PSV-01LBB11AA901	01LBB11BR901 DN250 BB1 P	01LBB11BR931 DN65 BB1 P	01LCL21BR001 DN25 AA2 P	01LCL22BR001 DN25 AA2 P	
10	PSV-01LBB12AA901	01LBB12BR901 DN250 BB1 P	01LBB12BR931 DN65 BB1 P	01LCL24BR001 DN25 AA2 P	01LCL25BR001 DN25 AA2 P	

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS. AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. THE CHECK VALVE SHALL BE INSTALLED AS CLOSE AS TO THE DESUPERHEATER
2. THE REHEATER MAIN STEAM PIPE SHALL BE PROVIDED WITH CREEP PIPS.
3. ALL SAFETY VALVES SHALL HAVE WELDED INLETS AND FLANGED OUTLET.
4. THE SAMPLING NOZZLE SHALL BE PROVIDED TO BE SUITABLE FOR ISOKINETIC SAMPLING.
5. REFER TO DETAIL CONFIGURATION FOR SAFETY VALVE VENT AND DRAIN
6. FLOW COMPENSATION USING PT-01LAF10CP001, TE-01LAF50CT001
7. SPOOL FOR LINE FLUSHING TO BE WELDED AFTER LINE FLUSHING
8. PARALLEL SLIDE GATE VALVE.

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT: SHUQAIQ STEAM POWER PLANT

OWNER: الشركة السعودية للكهرباء Saudi Electricity Company

ENGINEER: POYRY

CONTRACTOR: HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR: N/A

VENDOR INTERNAL DWG NO.: N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00944
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE: P&ID FOR BOILER REHEAT SYSTEM

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-003-001	01 OF 01	3X

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A1(594x841)

VENT TO ATM.

BOILER FLASH TANK SILENCER
01HAN10BS001

01HAN10 BR402 DN25 AA2 P

BOILER ROOF

01HAN10 BR510 DN1050 BA2 P NOTE 2.

01HAN10 BR520 DN50 AA2 P

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

BOILER FLASH TANK
01HAN10BB001
NOTE 1.

FROM SECONDARY PASS INLET MANIFOLD
S-01-HA_-S-20-001-002 (E-8)
01HAN91BR010
01HAN91 BR010 DN80 FB1 P

FROM BCP DISCHARGE LINE DRAIN
S-01-HA_-S-20-001-004 (D-2)
01HAN91BR013
01HAN91 BR013 DN40 FA1 P

FROM WATER SEPARATOR DRAIN HEADER LCV
S-01-HA_-S-20-001-003 (A-2)
01HAN94BR038
01HAN94 BR038 DN25 FA1 P

FROM 3RY SH OUTLET HEADER DRAIN
S-01-HA_-S-20-002-002 (E-8)
01HAN91BR011
01HAN91 BR011 DN200 GB1 P

01HAN81 BR001 DN150 DA1 P — 1/100 — DN50

HIGH PRESSURE DRAIN HEADER

FROM SOOTBLOWER DRAIN
S-01-HC_-S-20-001-001 (A-8)
01HCB26BR401
01HCB26 BR401 DN80 AA2 P

FROM SAH-A DRAIN
S-01-HL_-S-20-002-001 (B-8)
01LCN16BR402
01LCN16 BR402 DN80 BA1 P

FROM SAH-B DRAIN
S-01-HL_-S-20-002-002 (B-8)
01LCN26BR402
01LCN26 BR402 DN80 BA1 P

FROM RH SPRAY LINE DRAIN
S-01-HA_-S-20-003-001 (D-8)
01HAN94BR044
01HAN94 BR044 DN25 EA1 P

FROM RH SPRAY LINE DRAIN
S-01-HA_-S-20-003-001 (D-8)
01HAN94BR043
01HAN94 BR043 DN25 EA1 P

FROM COLD RH INLET DRAIN
S-01-HA_-S-20-003-001 (A-8)
01MAL32BR411
01MAL32 BR411 DN50 CA1 P

FROM COLD RH INLET DRAIN
S-01-HA_-S-20-003-001 (A-2)
01MAL31BR411
01MAL31 BR411 DN50 CA1 P

1/100 — DN50 — 01HAN82 BR001 DN200 BA1 P

MEDIUM PRESSURE DRAIN HEADER

FROM ATOMIZING STEAM CONDENSATE
S-01-HH_-S-20-001-002 (B-8)
01HAN93BR402
01HAN93 BR402 DN25 AA2 P

FROM ATOMIZING STEAM CONDENSATE
S-01-HH_-S-20-001-005 (B-5)
01HAN93BR404
01HAN93 BR404 DN25 AA2 P

FROM ATOMIZING STEAM CONDENSATE
S-01-HH_-S-20-001-005 (B-2)
01HAN93BR406
01HAN93 BR406 DN25 AA2 P

01HAN83 BR001 DN150 AA2 P — 1/100 — DN25

CONDENSATE DRAIN HEADER

FROM FEEDWATER DRAIN
S-01-HA_-S-20-001-001 (A-8)
01HAN94BR047
01HAN94 BR047 DN100 FA1 P

FROM BCP PUMP PURGE WATER DRAIN
S-01-HA_-S-20-001-004 (A-8)
01HAN94BR046
01HAN94 BR046 DN25 FA1 P

FROM WATER SEPARATOR DRAIN HEADER
S-01-HA_-S-20-001-003 (C-2)
01HAN94BR045
01HAN94 BR045 DN25 FA1 P

FROM ATEMPERATOR DRAIN
S-01-HA_-S-20-002-002 (A-2)
01HAN94BR042
01HAN94 BR042 DN25 FA1 P

FROM ATEMPERATOR DRAIN
S-01-HA_-S-20-002-001 (C-2)
01HAN94BR041
01HAN94 BR041 DN25 FA1 P

FROM ATEMPERATOR DRAIN
S-01-HA_-S-20-002-001 (D-2)
01HAN94BR040
01HAN94 BR040 DN25 FA1 P

FROM ATEMPERATOR DRAIN
S-01-HA_-S-20-002-002 (A-2)
01HAN94BR039
01HAN94 BR039 DN25 FA1 P

FROM UREA SKID CONDENSATE RETURN
S-01-HS_-S-20-003-003 (B-8)
01HSU10BR420
01HSU10 BR420 DN50 AA2 P

FROM ROOF OUTLET HEADER (LEFT)
S-01-HA_-S-20-001-002 (G-7)
01HAN94BR037
01HAN94 BR037 DN50 FB1 P

FROM ROOF OUTLET HEADER (RIGHT)
S-01-HA_-S-20-001-002 (G-4)
01HAN94BR036
01HAN94 BR036 DN50 FB1 P

1/100 — DN25 — 01HAN84 BR001 DN350 DA1 P

WATER DRAIN HEADER

TI 01HAN10CT501

PI 01HAN10CP501

AA701

AA401

01HAN10 BR401 DN50 AA2 P

FROM FURNACE WALL INLET HEADER
S-01-HA_-S-20-001-002 (A-8)
01HAN94BR049
01HAN94 BR049 DN100 FA1 P

FROM FURNACE WALL INLET HEADER
S-01-HA_-S-20-001-002 (A-2)
01HAN94BR048
01HAN94 BR048 DN100 FA1 P

01HAN10 BR410 DN250 AA2 P — 1/125 — TO QUENCHING SUMP
S-00-GM_-S-20-004-001 (G-8)
01HAN10BR410

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
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8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. THE DESIGN PRESSURE OF THE TANK SHALL BE 8 BARG. THE TANK SHALL HAVE RENEWABLE BAFFLE PLATES AT TANK INSIDE AROUND BOILER DRAIN HEADER NOZZLES.
2. HEAT RESISTANT PAINTING SHALL BE APPLIED TO THE OUTSIDE SURFACE OF VENT PIPE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01377
REV. NO. B
DATE : 26.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER DRAIN SYSTEM

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HA_-S-20-004-001	01 OF 01	3X

A1(594x841)

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FROM PSV — S-01-HC_-S-20-001-001 (G-7) — 01HCB10BR401 — 01HCB10 BR401 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL21BR001 — 01LCL21 BR001 DN25 AA2 P
FROM ERV — S-01-HA_-S-20-002-002 (A-7) — 01LCL12BR001 — 01LCL12 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-002-002 (A-7) — 01LCL11BR001 — 01LCL11 BR001 DN25 AA2 P
01LCL50 BR020 DN50 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL31BR001 — 01LCL31 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL32BR001 — 01LCL32 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL33BR001 — 01LCL33 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL34BR001 — 01LCL34 BR001 DN25 AA2 P
01LCL50 BR030 DN50 AA2 P
01LCL50 BR010 DN50 AA2 P

BOILER RIGHT SIDE

FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL24BR001 — 01LCL24 BR001 DN25 AA2 P
FROM ERV — S-01-HA_-S-20-002-002 (A-7) — 01LCL13BR001 — 01LCL13 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-002-002 (A-7) — 01LCL14BR001 — 01LCL14 BR001 DN25 AA2 P
01LCL55 BR020 DN50 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL38BR001 — 01LCL38 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL37BR001 — 01LCL37 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL36BR001 — 01LCL36 BR001 DN25 AA2 P
FROM PSV — S-01-HA_-S-20-003-001 (D-3) — 01LCL35BR001 — 01LCL35 BR001 DN25 AA2 P
01LCL55 BR030 DN50 AA2 P
01LCL55 BR010 DN50 AA2 P

BOILER LEFT SIDE

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

SOOTBLOWER SILENCER
01HCB10BS001

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. SOOTBLOWER SYMBOL LEGEND
   - ◎ : LONG RETRACTABLE TYPE
   - ⊙ : SHORT RETRACTABLE TYPE
   - ⊗ : RAKE TYPE
   - ⊗ : AIR HEATER SOOT BLOWER
2. SOOTBLOWER NOZZLE CONNECTION, DN80(TYP.)
3. FLOW COMPENSATION USING PT-01HCB10CP001, TE-01HCB10CT001
4. FOR FUTURE SOOTBLOWER

SOOTBLOWER LCP
01HCB10GK001

BOILER LEFT SIDE

BOILER RIGHT SIDE

SCR "B"

SCR "A"

REGENERATIVE AIR HEATER "B"

REGENERATIVE AIR HEATER "A"

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER SOOTBLOWING SYSTEM

AS BUILT

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-001	01 OF 01	2X

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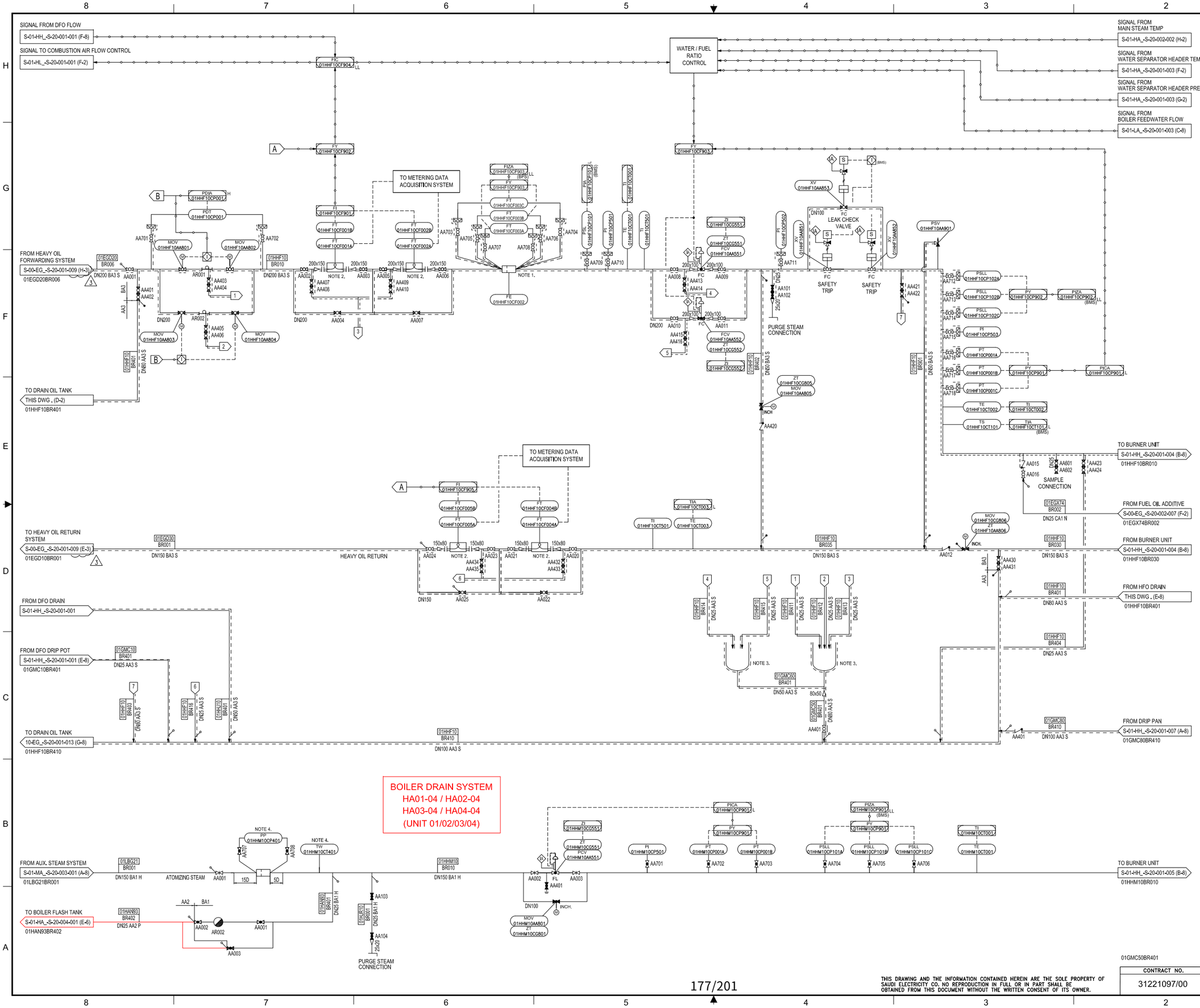
A1(594x841)



GENERAL NOTES

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NOTES

1. FLOW COMPENSATION USING TE-01HHF10CT001
2. THE RATING OF FLANGE FOR CORIOLIS MASS METER IS ASME CLASS 600.
3. DRIP POT : DN350 x L400mm
4. PP AND TW WILL BE USED FOR PROVISION OF PERFORMANCE TEST. THE FLOW ORIFICE SHALL BE CALIBRATED AS PER ASME PTC 19.5.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
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2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT: SHUQAIQ STEAM POWER PLANT

OWNER: الشركة السعودية للكهرباء Saudi Electricity Company

ENGINEER: PÖYRY

CONTRACTOR: HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR: N/A — VENDOR INTERNAL DWG NO.: N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01376
REV. NO. C
DATE : 26.MAY.2014 STATUS : 1

DRAWING TITLE: P&ID FOR BOILER BURNING SYSTEM(2/5) (HEAVY FUEL OIL)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HH_-S-20-001-002	01 OF 01	3X

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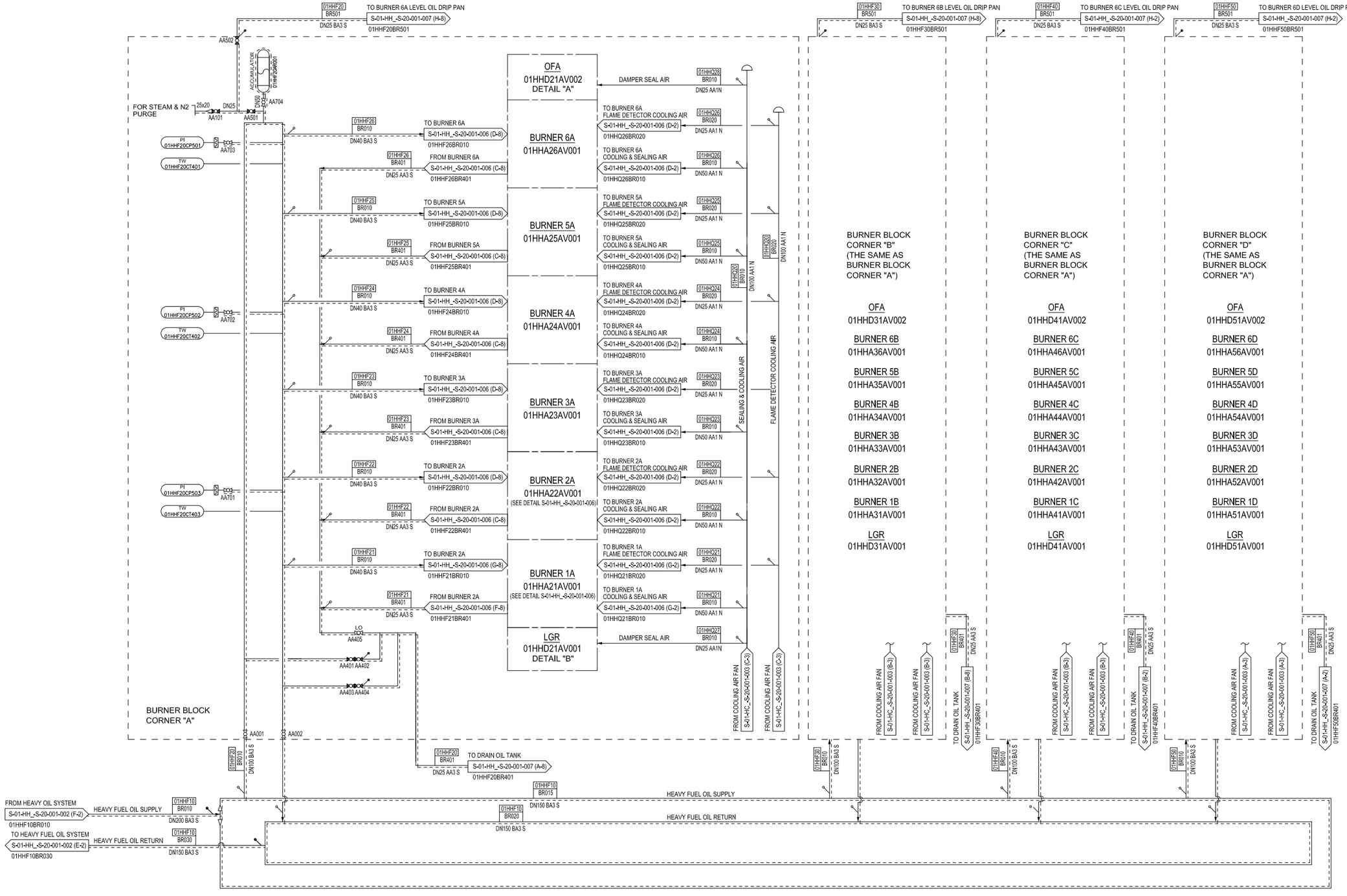
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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NOTES

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AS BUILT

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DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
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BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
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"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	31.AUG.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	15.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00878
REV. NO. B
DATE : 24.APR.2014 STATUS : 2

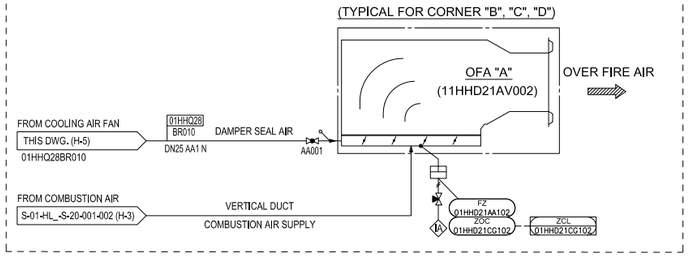
DRAWING TITLE
P&ID FOR
BOILER BURNING SYSTEM(3/5)
(BURNER UNIT)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HH_-S-20-001-004	01 OF 01	3X

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

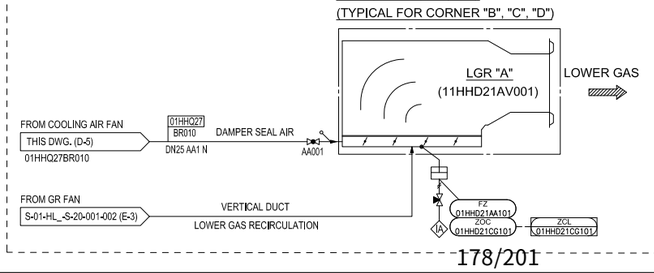
DETAIL "A"

OVER FIRE AIR PORT DETAIL CONFIGURATION (OFA)
(TYPICAL FOR CORNER "B", "C", "D")



DETAIL "B"

LOWER GAS RECIRCULATION PORT DETAIL CONFIGURATION (LGR)
(TYPICAL FOR CORNER "B", "C", "D")



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A1(594x841)

BURNER BLOCK
CORNER "A"

OFA
01HHD21AV002

BURNER 6A
01HHA26AV001

BURNER 5A
01HHA25AV001

BURNER 4A
01HHA24AV001

BURNER 3A
01HHA23AV001

BURNER 2A
01HHA22AV001
(SEE DETAIL S-01-HH_-S-20-001-006)

BURNER 1A
01HHA21AV001
(SEE DETAIL S-01-HH_-S-20-001-006)

LGR
01HHD21AV001

01HHM26 BR010 → TO BURNER 6A: S-01-HH_-S-20-001-006 (D-8) → 01HHM26BR010; DN25 BA1 H; 25x65

01HHM25 BR010 → TO BURNER 5A: S-01-HH_-S-20-001-006 (D-8) → 01HHM25BR010; DN25 BA1 H

01HHM24 BR010 → TO BURNER 4A: S-01-HH_-S-20-001-006 (D-8) → 01HHM24BR010; DN25 BA1 H

01HHM23 BR010 → TO BURNER 3A: S-01-HH_-S-20-001-006 (D-8) → 01HHM23BR010; DN25 BA1 H

01HHM22 BR010 → TO BURNER 2A: S-01-HH_-S-20-001-006 (D-8) → 01HHM22BR010; DN25 BA1 H

WARM-UP OIL: S-01-HH_-S-20-001-006 (F-8) → 01HHJ21BR010

01HHM21 BR010 → TO BURNER 1A: S-01-HH_-S-20-001-006 (H-8) → 01HHM21BR010; DN25 BA1 H

WARM-UP ATOMIZING AIR: S-01-HH_-S-20-001-006 (H-8) → 01HHN21BR010

BURNER BLOCK
CORNER "B"
(THE SAME AS
BURNER BLOCK
CORNER "A")

OFA
01HHD31AV002

BURNER 6B
01HHA36AV001

BURNER 5B
01HHA35AV001

BURNER 4B
01HHA34AV001

BURNER 3B
01HHA33AV001

BURNER 2B
01HHA32AV001

BURNER 1B
01HHA31AV001

LGR
01HHD31AV001

BURNER BLOCK
CORNER "C"
(THE SAME AS
BURNER BLOCK
CORNER "A")

OFA
01HHD41AV002

BURNER 6C
01HHA46AV001

BURNER 5C
01HHA45AV001

BURNER 4C
01HHA44AV001

BURNER 3C
01HHA43AV001

BURNER 2C
01HHA42AV001

BURNER 1C
01HHA41AV001

LGR
01HHD41AV001

BURNER BLOCK
CORNER "D"
(THE SAME AS
BURNER BLOCK
CORNER "A")

OFA
01HHD51AV002

BURNER 6D
01HHA56AV001

BURNER 5D
01HHA55AV001

BURNER 4D
01HHA54AV001

BURNER 3D
01HHA53AV001

BURNER 2D
01HHA52AV001

BURNER 1D
01HHA51AV001

LGR
01HHD51AV001

BOILER DRAIN SYSTEM
HA01-04 / HA02-04
HA03-04 / HA04-04
(UNIT 01/02/03/04)

01HHJ21 BR010 DN40 BA3 N
01HHK21 BR010 DN25 AA4 N
01HHX20 BR010 DN65 BA1 H
01HHJ31 BR010 DN40 BA3 N
01HHK31 BR010 DN25 AA4 N
01HHX30 BR010 DN65 BA1 H
01HHJ41 BR010 DN40 BA3 N
01HHK41 BR010 DN25 AA4 N
01HHX40 BR010 DN65 BA1 H
01HHJ51 BR010 DN40 BA3 N
01HHK51 BR010 DN25 AA4 N
01HHX50 BR010 DN65 BA1 H

01HHJ10 BR015 DN100 BA3 N — WARM-UP OIL
01HHN10 BR015 DN50 AA4 N — WARM-UP ATOMIZING AIR
01HHM10 BR020 DN100 BA1 H — ATOMIZING STEAM

FROM WARM-UP OIL: S-01-HH_-S-20-001-001 (F-2) → 01HHJ10BR010 — WARM-UP OIL — 01HHJ10 BR010 DN100 BA3 N
FROM SERVICE AIR SYSTEM: S-01-HH_-S-20-001-001 (D-2) → 01HHN10BR010 — WARM-UP ATOMIZING AIR — 01HHN10 BR010 DN50 AA4 N
FROM AUX. STEAM SYSTEM: S-01-HH_-S-20-001-002 (B-2) → 01HHM10BR010 — ATOMIZING STEAM — 01HHM10 BR010 DN150 BA1 H

150x100
150x100

01HAN93 BR403 DN25 BA1 H — AA004 — AR004 — AA005 — BA1 — AA2 — 01HAN93 BR404 DN25 AA2 P — TO BOILER FLASH TANK: S-01-HA_-S-20-004-001 (E-6) → 01HAN93BR404
AA006

01HAN93 BR405 DN25 BA1 H (3) — AA007 — AR006 — AA008 — BA1 — AA2 — 01HAN93 BR406 DN25 AA2 P — TO BOILER FLASH TANK: S-01-HA_-S-20-004-001 (E-6) → 01HAN93BR406
AA009

GENERAL NOTES

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NOTES
-

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00837
REV. NO. B
DATE : 17.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER BURNING SYSTEM(4/5)
(IGNITOR UNIT)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HH_-S-20-001-005	01 OF 01	3X

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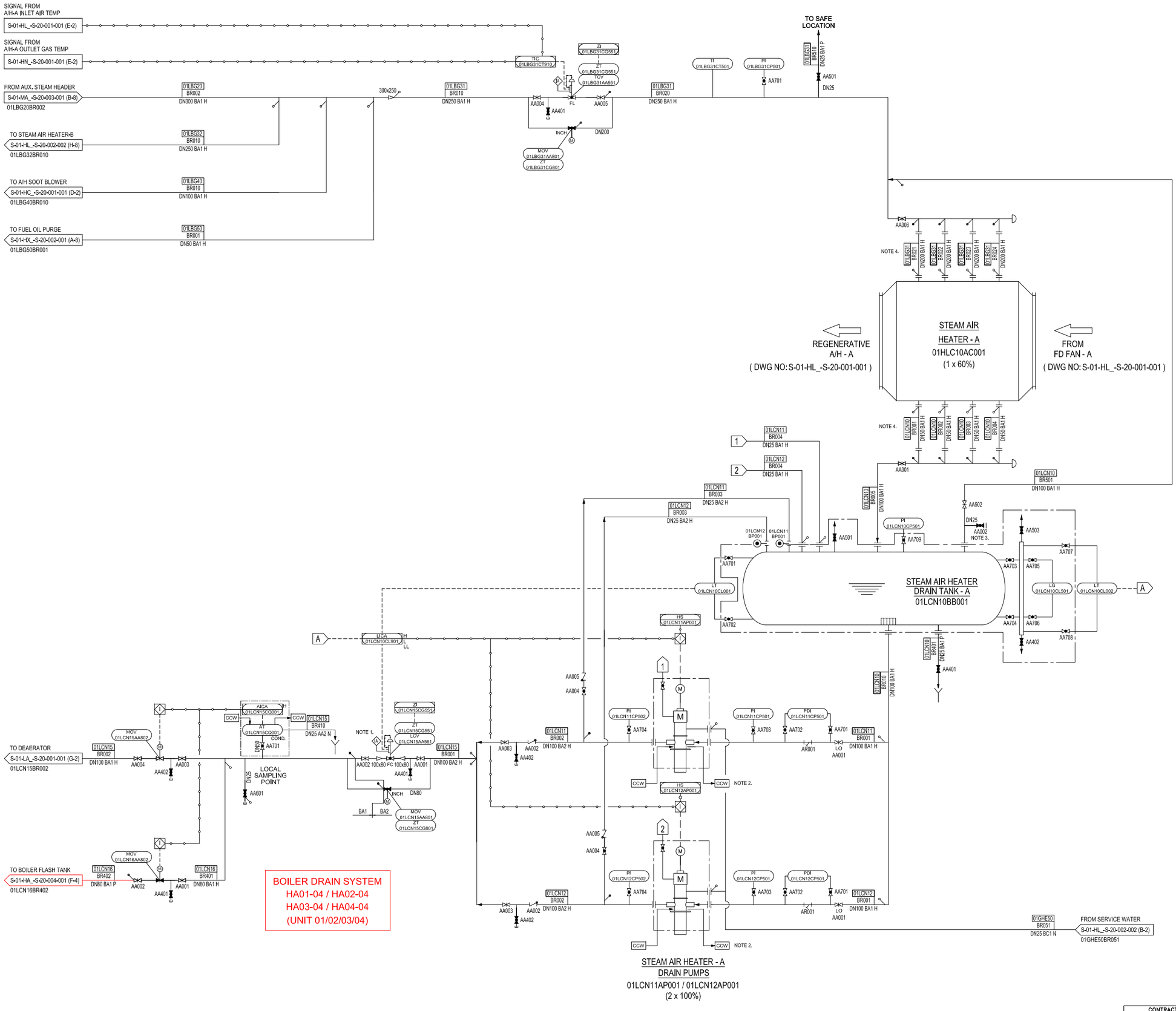
A1(594x841)



GENERAL NOTES

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9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. CONTROL VALVE STATION SHALL BE LOCATED NEAR THE BOILER FLASH TANK AREA.
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION
3. FOR INITIAL FILLING ONLY.
4. REMOVABLE PIECE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
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BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
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"	"
"	"

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0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER STEAM AIR HEATER SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-002-001	01 OF 01	2X

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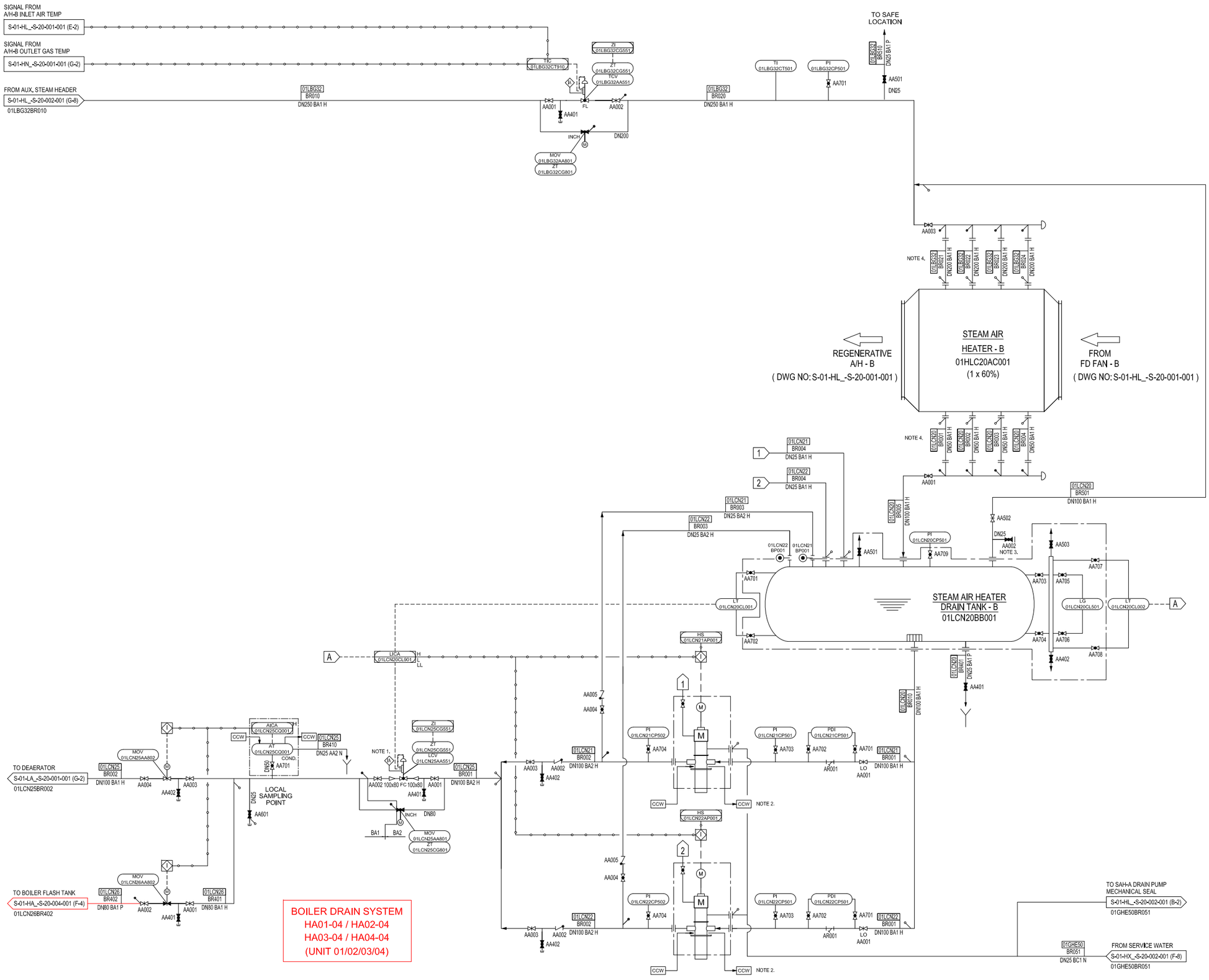
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
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7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. CONTROL VALVE STATION SHALL BE LOCATED NEAR THE BOILER FLASH TANK AREA.
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION
3. FOR INITIAL FILLING ONLY.
4. REMOVABLE PIECE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
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A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER STEAM AIR HEATER SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-002-002	01 OF 01	2X

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A1(594x841)

SOOTBLOWER SILENCER
01HCB10BS001

01HCB10 BR402 DN25 AA2 P
BOILER ROOF
01HCB10 BR911 DN200 AA1 P
TO SAFE LOCATION
BR901 DN25 AA2 P
PSV 01HCB10AA901
BR901 DN150 AA2 P DN25

DRAIN TO FUNNEL
S-01-HA_-S-20-004-001 (C-8)
01HCB10BR401
01HCB10 BR401 DN25 AA2 P

TI 01HCB10CT502
TI 01HCB10CT001
TE 01HCB10CT001
FI 01HCB10CF001
FT 01HCB10CF001
AA710 AA709
AA708 AA707
NOTE 3.
FE 01HCB10CF001
(LCP) PSL 01HCB10CP101
AA706 AA705
PI 01HCB10CP502
AA704 AA703
PT 01HCB10CP001
AA702 AA701
PICA 01HCB10CP001 H
ZI 01HCB10CG551
ZT 01HCB10CG551
PCV 01HCB10AA551
FC
CA1 GB1
HS 01HCB10AA801 (LCP)
ZSOC 01HCB10CG801
MOV 01HCB10AA801
01HCB10 BR002 DN50 GB1 H
AA001
GB1 GB1S
TI 01HCB10CT501
PI 01HCB10CP501
AA711 AA712
01HCB10 BR001 DN50 GB1S H
FROM 2RY SH OUTLET
S-01-HA_-S-20-002-001 (H-2)
01HCB10BR001

HS 01HCB16AA801 (LCP)
ZSOC 01HCB16CG801
MOV 01HCB16AA801
01HCB16 BR010 DN100 CA1 H
1/50

HS 01HCB15AA801 (LCP)
ZSOC 01HCB15CG801
MOV 01HCB15AA801
01HCB15 BR010 DN100 CA1 H
1/50

FROM WATER WASHING
S-01-HC_-S-20-002-001 (B-2)
01SDT55BR010
01SDT55 BR010 DN50 BC1 P
AA030
DN25 AA031
BC1 CA1
AR001 SPECTACLE BLIND FOR WATER WASHING
AA401 TELL-TALE DRAIN

SOOTBLOWER LCP
01HCB10GK001

BOILER SOOTBLOWING SYSTEM
HA01-05 / HA02-05
HA03-05 / HA04-05
(UNIT 01/02/03/04)

HS 01HCB14AA801 (LCP)
MOV 01HCB14AA801
ZSOC 01HCB14CG801
01HCB14 BR001 DN100 CA1 H
"2RY RH" AT002 "2RY RH" AT001
DN65 (TYP.) NOTE 2
"1RY RH" AT005 "1RY RH" AT004 "1RY RH" AT003
"ECO" AT008 "ECO" AT007 "ECO" AT006
"ECO" AT011 "ECO" AT010 "ECO" AT009
BOILER LEFT SIDE

HS 01HCB13AA801 (LCP)
MOV 01HCB13AA801
ZSOC 01HCB13CG801
01HCB13 BR001 DN100 CA1 H
"3RY SH" AT002 "2RY SH" AT001
"3RY SH" AT004 "2RY SH" AT003
"3RY SH" AT006 "2RY SH" AT005

HS 01HCB11AA801 (LCP)
MOV 01HCB11AA801
ZSOC 01HCB11CG801
01HCB11 BR001 DN100 CA1 H
"2RY SH" AT001 "3RY SH" AT002
"2RY SH" AT003 "3RY SH" AT004
"2RY SH" AT005 "3RY SH" AT006

HS 01HCB12AA801 (LCP)
MOV 01HCB12AA801
ZSOC 01HCB12CG801
01HCB12 BR001 DN100 CA1 H
"2RY RH" AT001 "2RY RH" AT002
"1RY RH" AT003 "1RY RH" AT004 "1RY RH" AT005
"ECO" AT006 "ECO" AT007 "ECO" AT008
"ECO" AT009 "ECO" AT010 "ECO" AT011
BOILER RIGHT SIDE

SCR "B"
SCR "A"
NOTE 4. (TYP.)
AT005 AT006 AT007 AT008
AT001 AT002 AT003 AT004

HS 01LBG42AA801 (LCP)
ZSOC 01LBG42CG801
MOV 01LBG42AA801
AA001
AA002
01LBG42 BR010 DN80 CA1 H
100x80
AA001
CA1 BA1
01LBG40 BR010 DN100 BA1 H
FROM AUX. STEAM
S-01-HL_-S-20-002-001 (G-8)
01LBG40BR010

COLD END SIDE
HOT END SIDE
BR011 DN65 CA1 H
BR012 DN65 CA1 H
REGENERATIVE AIR HEATER "A"
COLD END SIDE
HOT END SIDE
NOTE 2 (TYP.)
BR021 DN65 CA1 H
BR022 DN65 CA1 H
REGENERATIVE AIR HEATER "B"

TE 01HCB14CT001
TIA 01HCB14CT001 L (LCP)
TE 01HCB13CT001
TIA 01HCB13CT001 L (LCP)
TE 01HCB11CT001
TIA 01HCB11CT001 L (LCP)
TE 01HCB12CT001
TIA 01HCB12CT001 L (LCP)
TE 01HCB15CT001
TIA 01HCB15CT001 L (LCP)
TE 01HCB16CT001
TIA 01HCB16CT001 L (LCP)

100x25
AA403 AA401 AA402 AR001
XV 01HCB14AA851
XV 01HCB13AA851
XV 01HCB11AA851
XV 01HCB12AA851
XV 01HCB15AA851
XV 01HCB16AA851
CA1 DN25 DN25 DN25 CA1 AA2

TO BOILER FLASH TANK
S-01-HA_-S-20-004-001 (F-4)
1/100 AA2
01HCB20BR401
01HCB20 BR401 DN80 AA2 P
60x50
01HCB16 BR401 DN50AA2 P

AS BUILT

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
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9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. SOOTBLOWER SYMBOL LEGEND
   - ◎ : LONG RETRACTABLE TYPE
   - ⊙ : SHORT RETRACTABLE TYPE
   - ⊗ : RAKE TYPE
   - ⊗ : AIR HEATER SOOT BLOWER
2. SOOTBLOWER NOZZLE CONNECTION, DN80(TYP.)
3. FLOW COMPENSATION USING PT-01HCB10CP001, TE-01HCB10CT001
4. FOR FUTURE SOOTBLOWER

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER SOOTBLOWING SYSTEM

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-001	01 OF 01	2X

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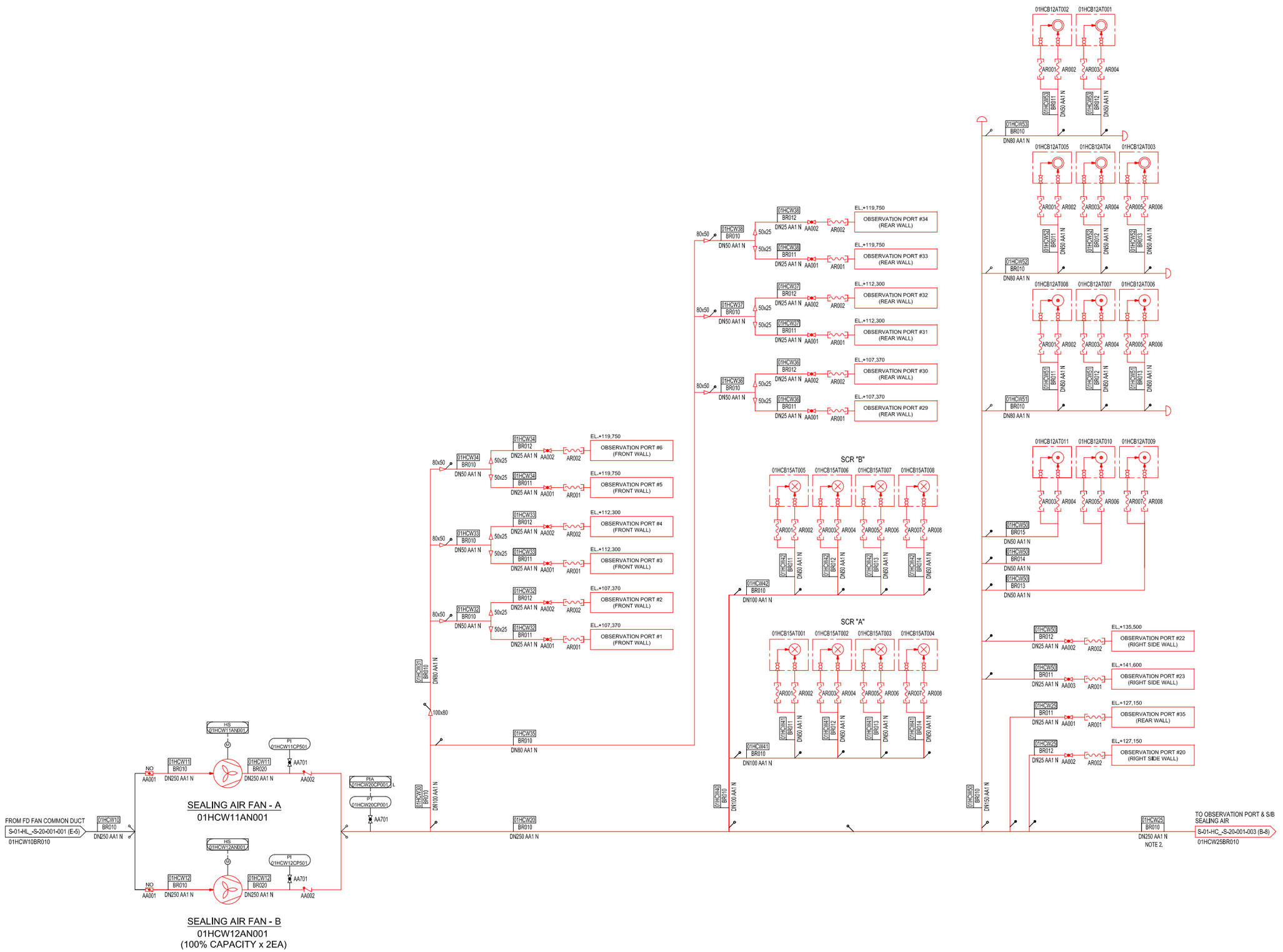
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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NOTES

1. SOOTBLOWER SYMBOL LEGEND
   - ◯ : LONG RETRACTABLE TYPE
   - ⊙ : SHORT RETRACTABLE TYPE
   - ⊗ : RAKE TYPE
2. SEALING AIR RING HEADER.
3. [ ] : SUPPLIED BY VENDOR

BOILER SEALING SYSTEM
HA01-06 / HA02-06
HA03-06 / HA04-06
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
3	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
C	15.MAY.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
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CONTRACTOR
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SUBCONTRACTOR
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VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01376
REV. NO. C
DATE : 26.MAY.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER SEALING AIR SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-002	01 OF 01	3X

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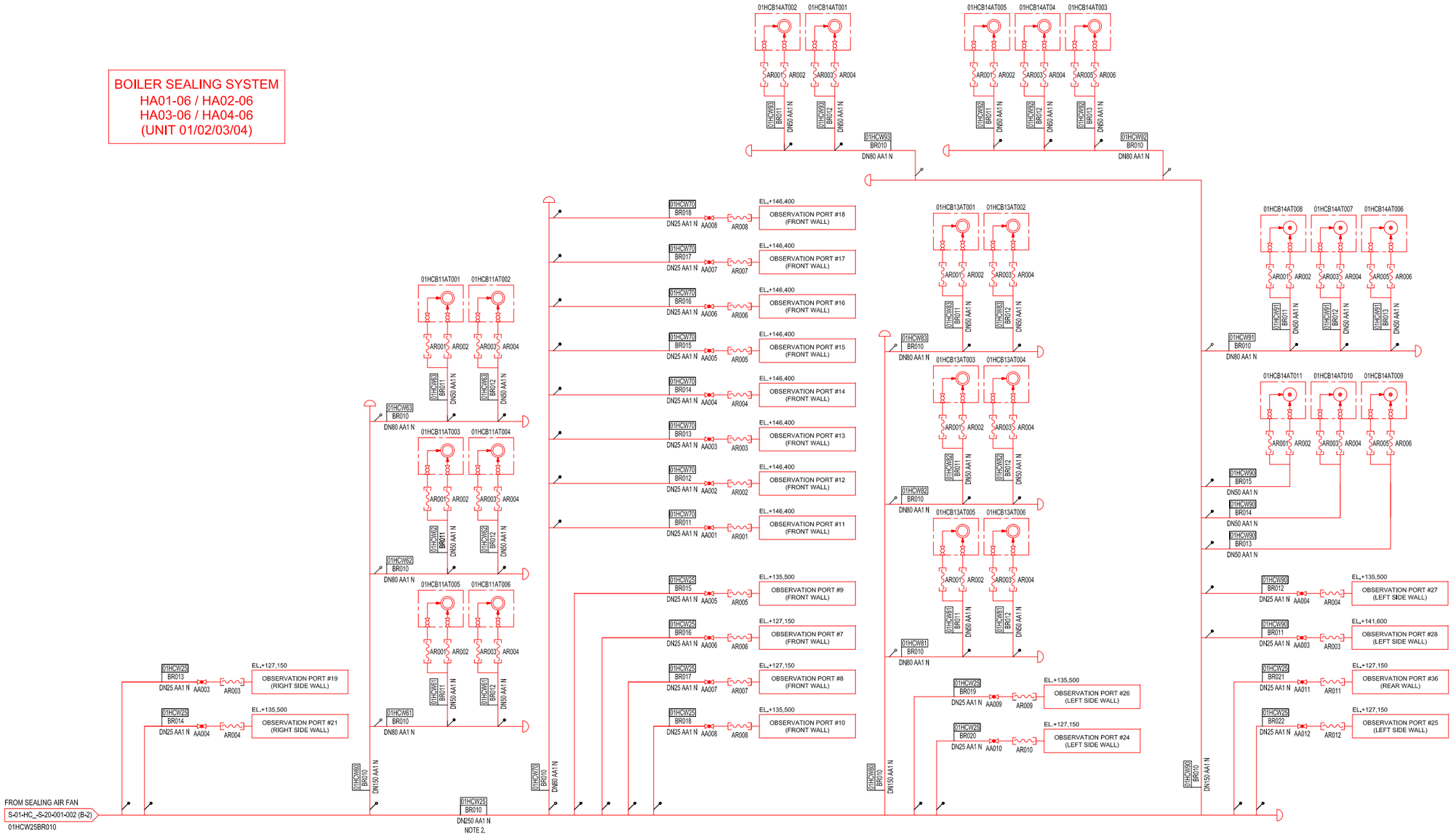
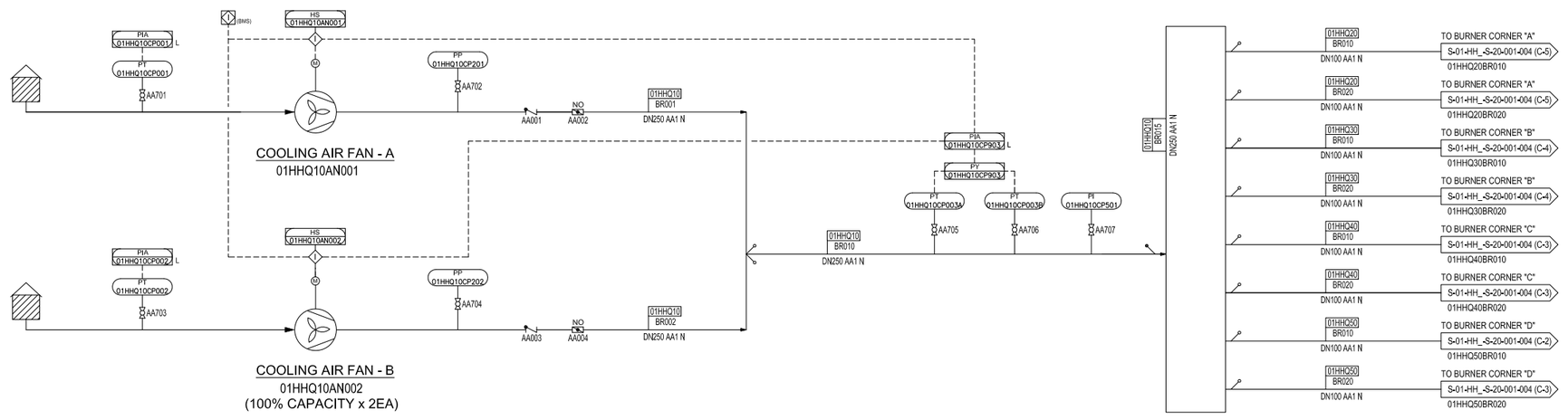
A1(594x841)

BOILER SEALING SYSTEM
HA01-06 / HA02-06
HA03-06 / HA04-06
(UNIT 01/02/03/04)





GENERAL NOTES

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NOTES

1. SOOTBLOWER SYMBOL LEGEND
   ◎ : LONG RETRACTABLE TYPE
   ⊙ : SHORT RETRACTABLE TYPE
   ⊗ : RAKE TYPE
2. SEALING AIR RING HEADER.
3. [ ] : SUPPLIED BY VENDOR

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
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SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
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A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
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VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01376
REV. NO. C
DATE : 26.MAY.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER SEALING AIR SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-003	01 OF 01	2X

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A1(594x841)

SOOTBLOWER SILENCER
01HCB10BS001

BOILER WATER WASHING SYSTEM
HA01-07 / HA02-07
HA03-07 / HA04-07
(UNIT 01/02/03/04)

SOOTBLOWER LCP
01HCB10GK001

SCR "B"

SCR "A"

BOILER LEFT SIDE

BOILER RIGHT SIDE

REGENERATIVE AIR HEATER "A"

REGENERATIVE AIR HEATER "B"

GENERAL NOTES

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7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. SOOTBLOWER SYMBOL LEGEND
   - ◎ : LONG RETRACTABLE TYPE
   - ⊙ : SHORT RETRACTABLE TYPE
   - ⊗ : RAKE TYPE
   - ⊗ : AIR HEATER SOOT BLOWER
2. SOOTBLOWER NOZZLE CONNECTION, DN80(TYP.)
3. FLOW COMPENSATION USING PT-01HCB10CP001, TE-01HCB10CT001
4. FOR FUTURE SOOTBLOWER

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT: SHUQAIQ STEAM POWER PLANT

OWNER: الشركة السعودية للكهرباء Saudi Electricity Company

ENGINEER: PÖYRY

CONTRACTOR: HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR: N/A

VENDOR INTERNAL DWG NO.: N/A

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. THE CONTRACTOR H/E CONFIRMS FULLY COMPLIANCE WITH THE OE'S COMMENTS. NO OTHER CHANGES HAD BEEN MADE ON THE DRAWING. THE CONTRACTOR MAY SUBMIT THE DRAWING AS "FOR CONSTRUCTION"

APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE: P&ID FOR BOILER SOOTBLOWING SYSTEM

AS BUILT

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-001	01 OF 01	2X

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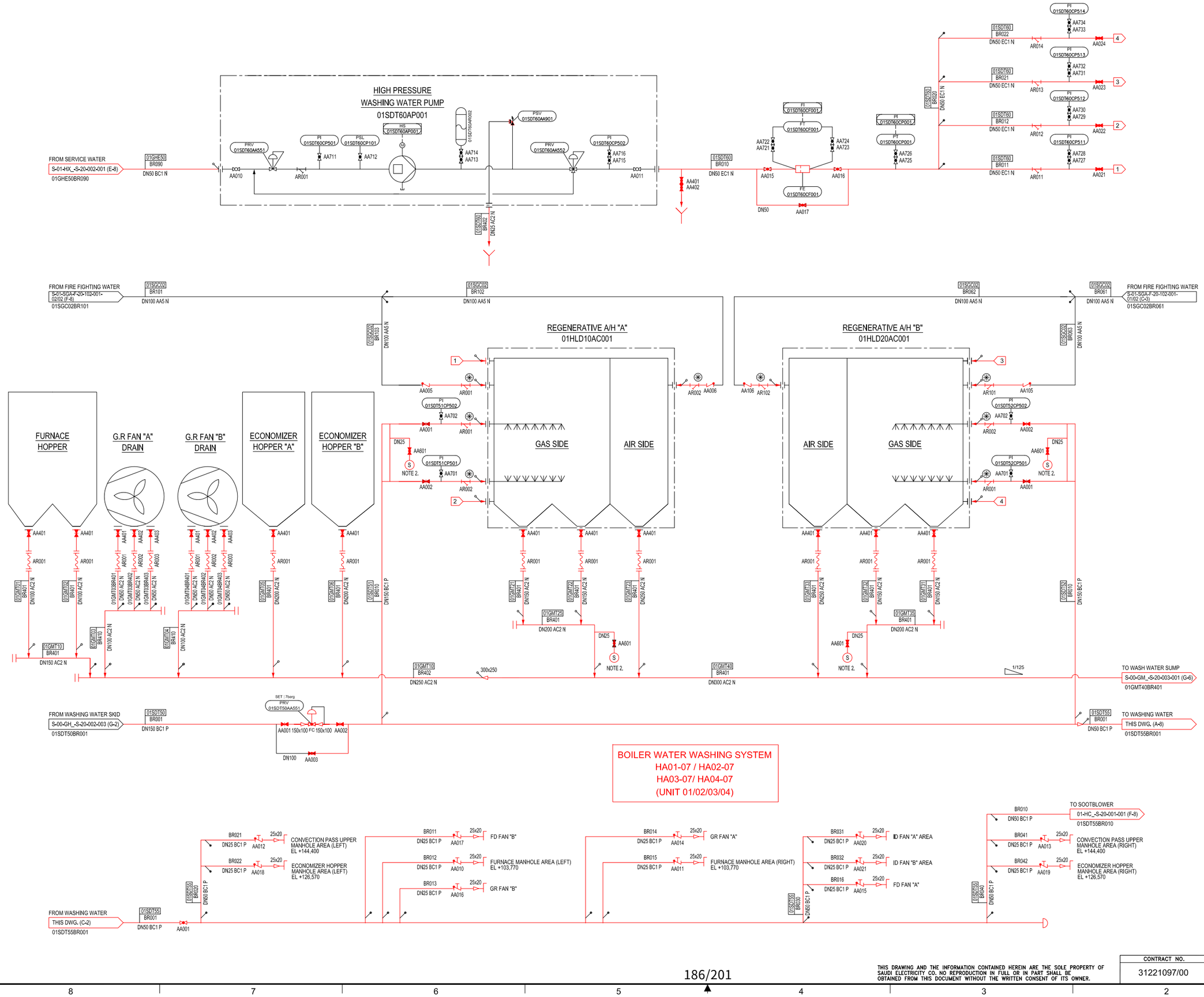
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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NOTES

1. (✳) : LOOSE PART SUPPLIED BY VENDOR
2. (S) : GRAB SAMPLE POINT

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00944
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER WATER WASHING SYSTEM

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-002-001	01 OF 01	3X

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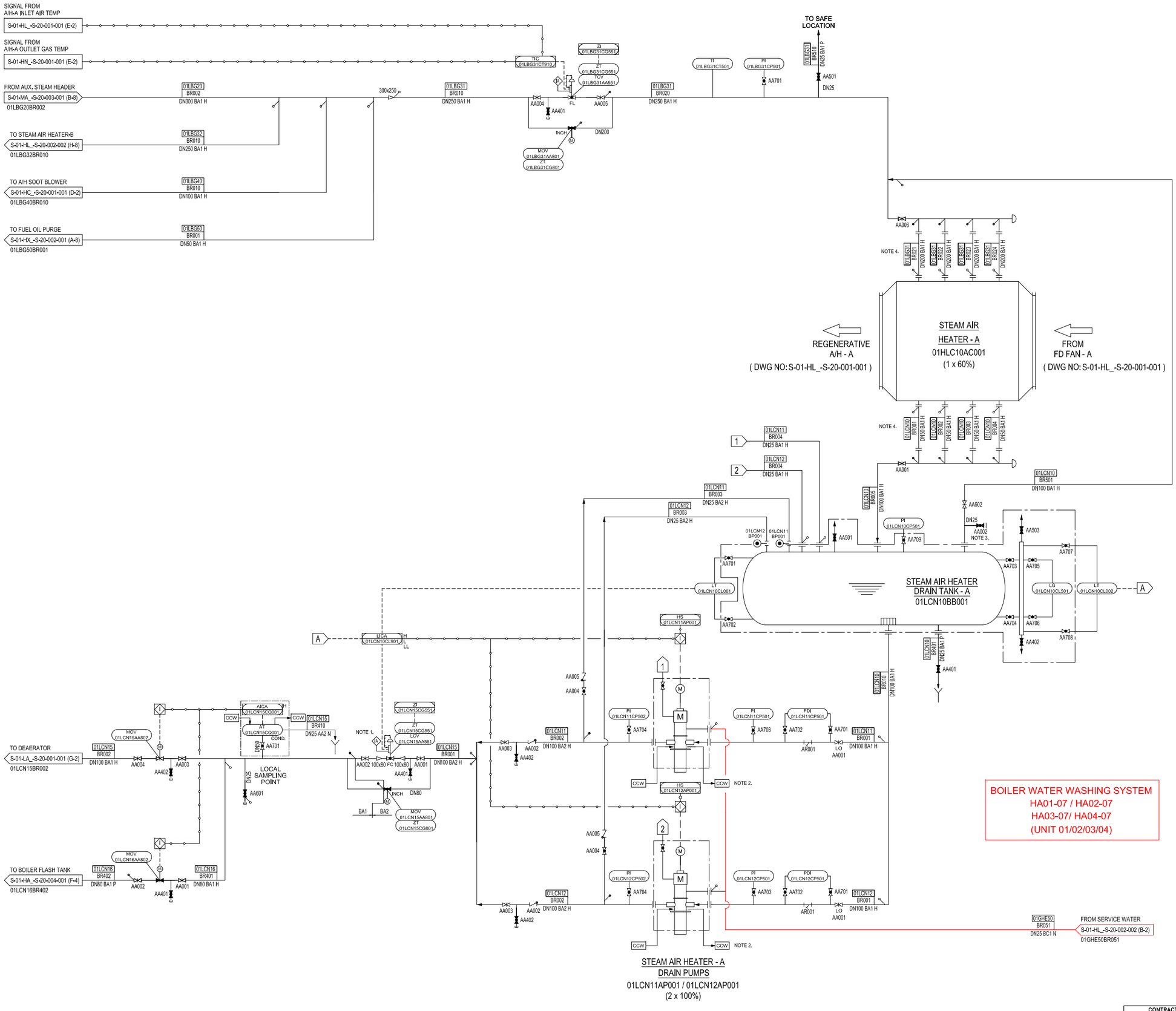
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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NOTES

1. CONTROL VALVE STATION SHALL BE LOCATED NEAR THE BOILER FLASH TANK AREA.
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION
3. FOR INITIAL FILLING ONLY.
4. REMOVABLE PIECE.

AS BUILT

BOILER WATER WASHING SYSTEM
HA01-07 / HA02-07
HA03-07/ HA04-07
(UNIT 01/02/03/04)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
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1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER STEAM AIR HEATER SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-002-001	01 OF 01	2X

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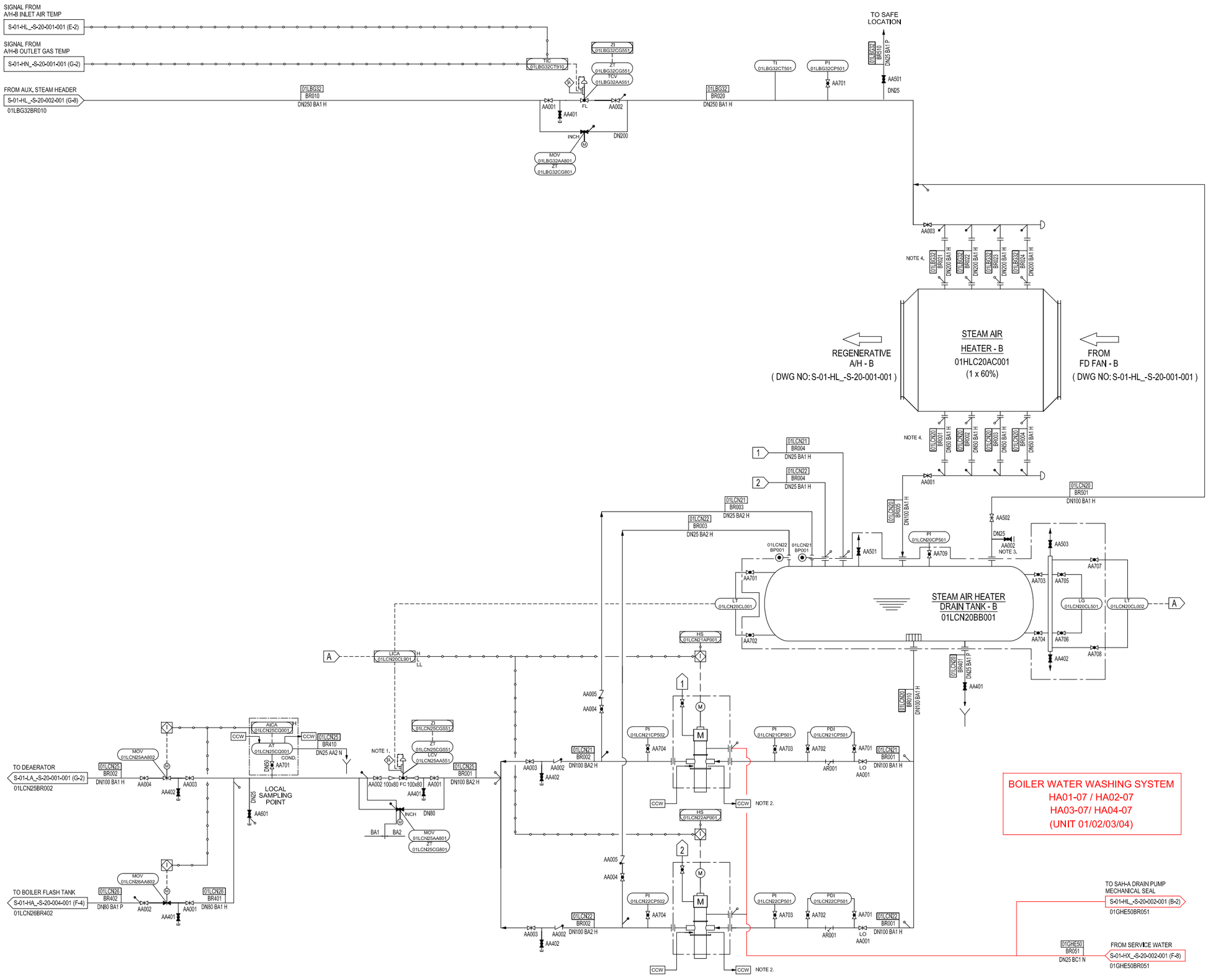
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
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NOTES

1. CONTROL VALVE STATION SHALL BE LOCATED NEAR THE BOILER FLASH TANK AREA.
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION
3. FOR INITIAL FILLING ONLY.
4. REMOVABLE PIECE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER STEAM AIR HEATER SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-002-002	01 OF 01	2X

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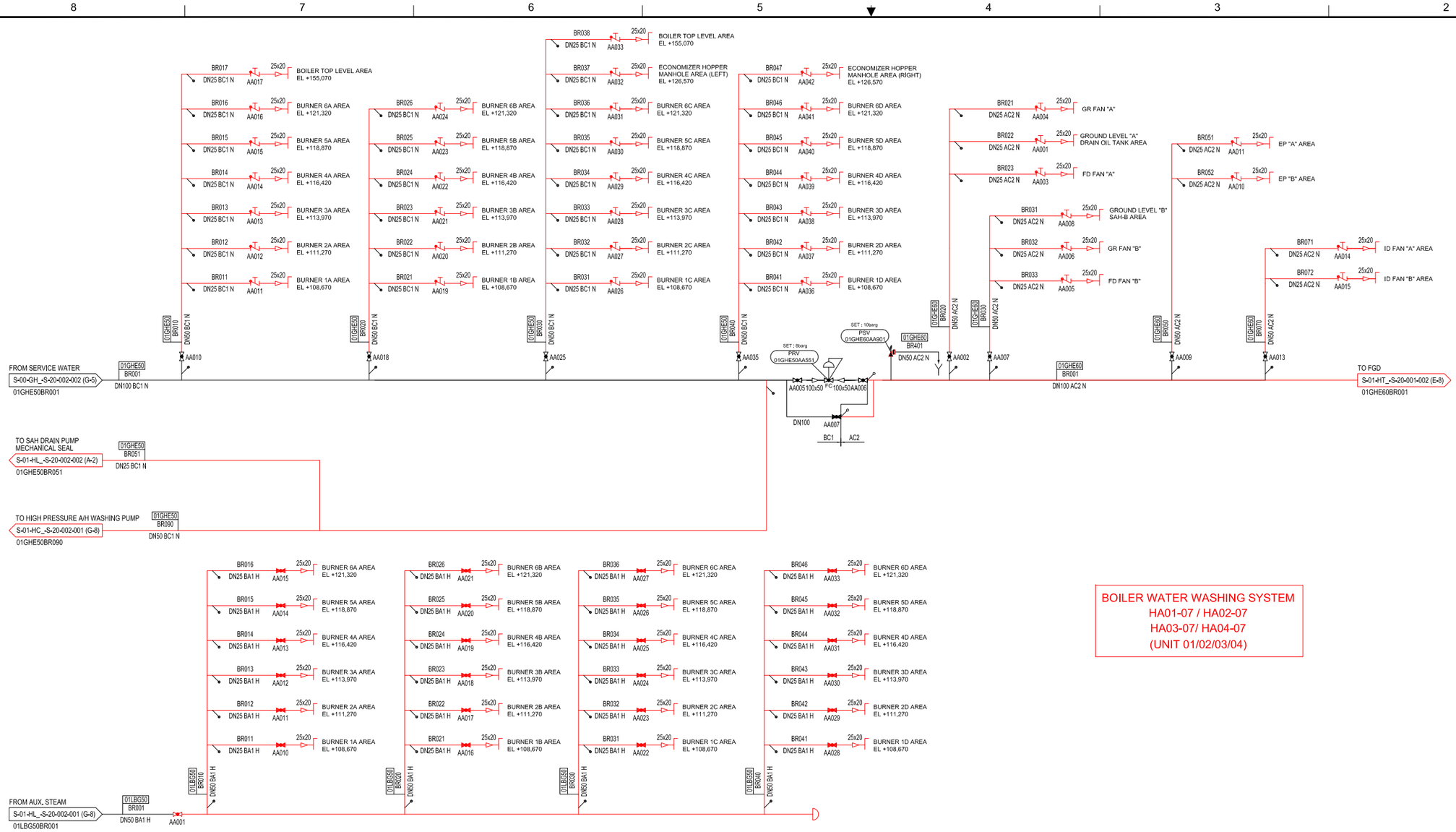
A1(594x841)



BOILER WATER WASHING SYSTEM
HA01-07 / HA02-07
HA03-07/ HA04-07
(UNIT 01/02/03/04)

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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NOTES

1. DELETED
2. DELETED

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
3X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER UTILITY SYSTEM

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HX_-S-20-002-001	01 OF 01	3X

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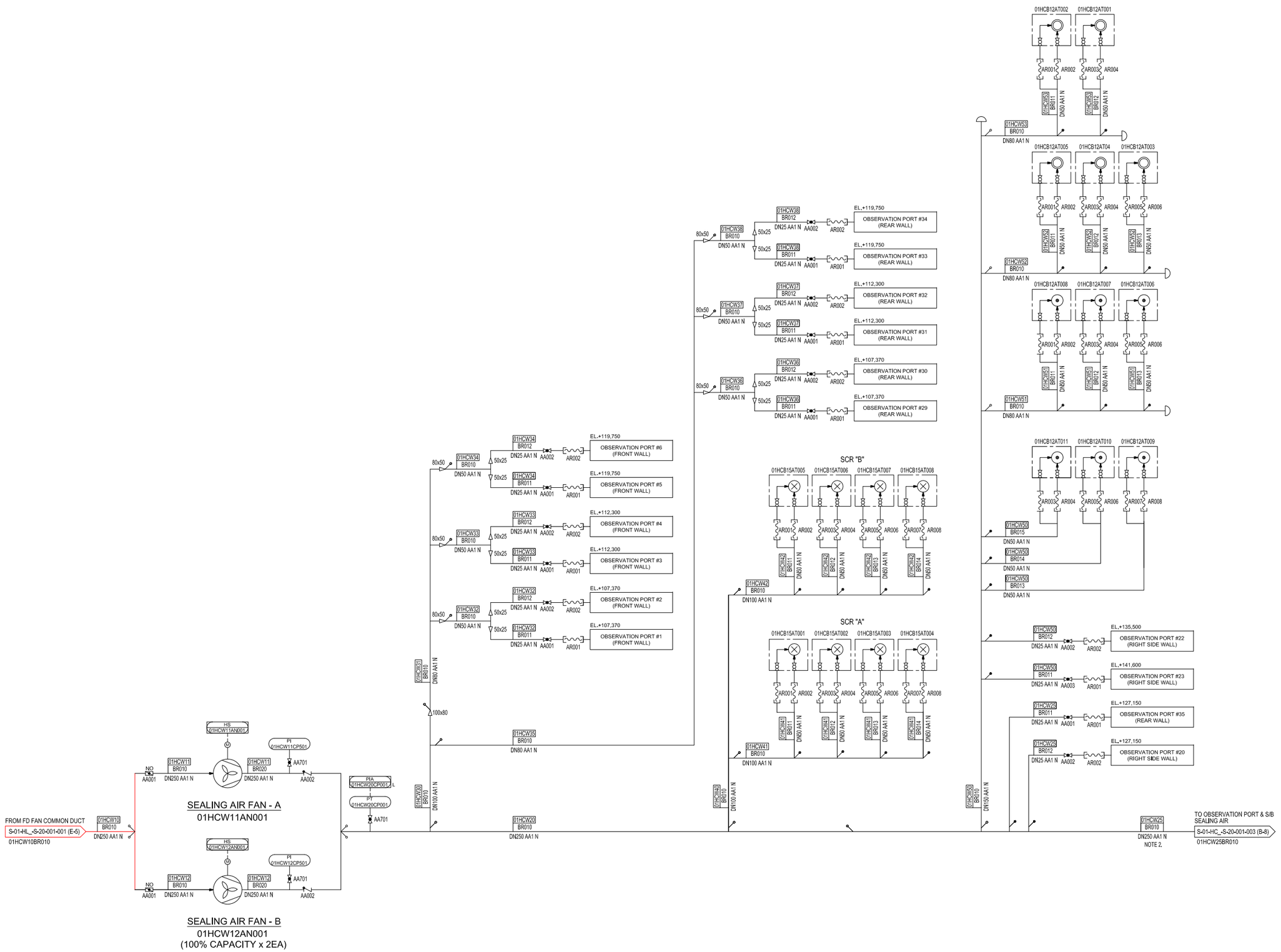

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NOTES

1. SOOTBLOWER SYMBOL LEGEND
   - ◯ : LONG RETRACTABLE TYPE
   - ⊙ : SHORT RETRACTABLE TYPE
   - ⊗ : RAKE TYPE
2. SEALING AIR RING HEADER.
3. ┌┄┄┐ : SUPPLIED BY VENDOR

BOILER COMBUSTION AIR SYSTEM
HA01-08 / HA02-08
HA03-08 / HA04-08
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

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0	2.JUN.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
C	15.MAY.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
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VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-01376
REV. NO. C
DATE : 26.MAY.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER SEALING AIR SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HC_-S-20-001-002	01 OF 01	3X

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A1(594x841)

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING.
   VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.

NOTES

1. FLOW COMPENSATION USING TE-01HLB10CT001A/B/C, TE-01HLB20CT001A/B/C
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION.
3. STALL ALARM

BOILER COMBUSTION AIR SYSTEM
HA01-08 / HA02-08
HA03-08 / HA04-08
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
FD FAN - P&ID	S-04-HLB-M-20-V001-001
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT: SHUQAIQ STEAM POWER PLANT

OWNER: الشركة السعودية للكهرباء Saudi Electricity Company

ENGINEER: PÖYRY

CONTRACTOR: HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR: N/A

VENDOR INTERNAL DWG NO.: N/A

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. THE CONTRACTOR HHI CONFIRMS FULLY COMPLIANCE WITH THE OE'S COMMENTS. NO OTHER CHANGES HAD BEEN MADE ON THE DRAWING. THE CONTRACTOR MAY SUBMIT THE DRAWING AS "FOR CONSTRUCTION"

APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE: P&ID FOR BOILER COMBUSTION AIR SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-001-001	01 OF 01	2X

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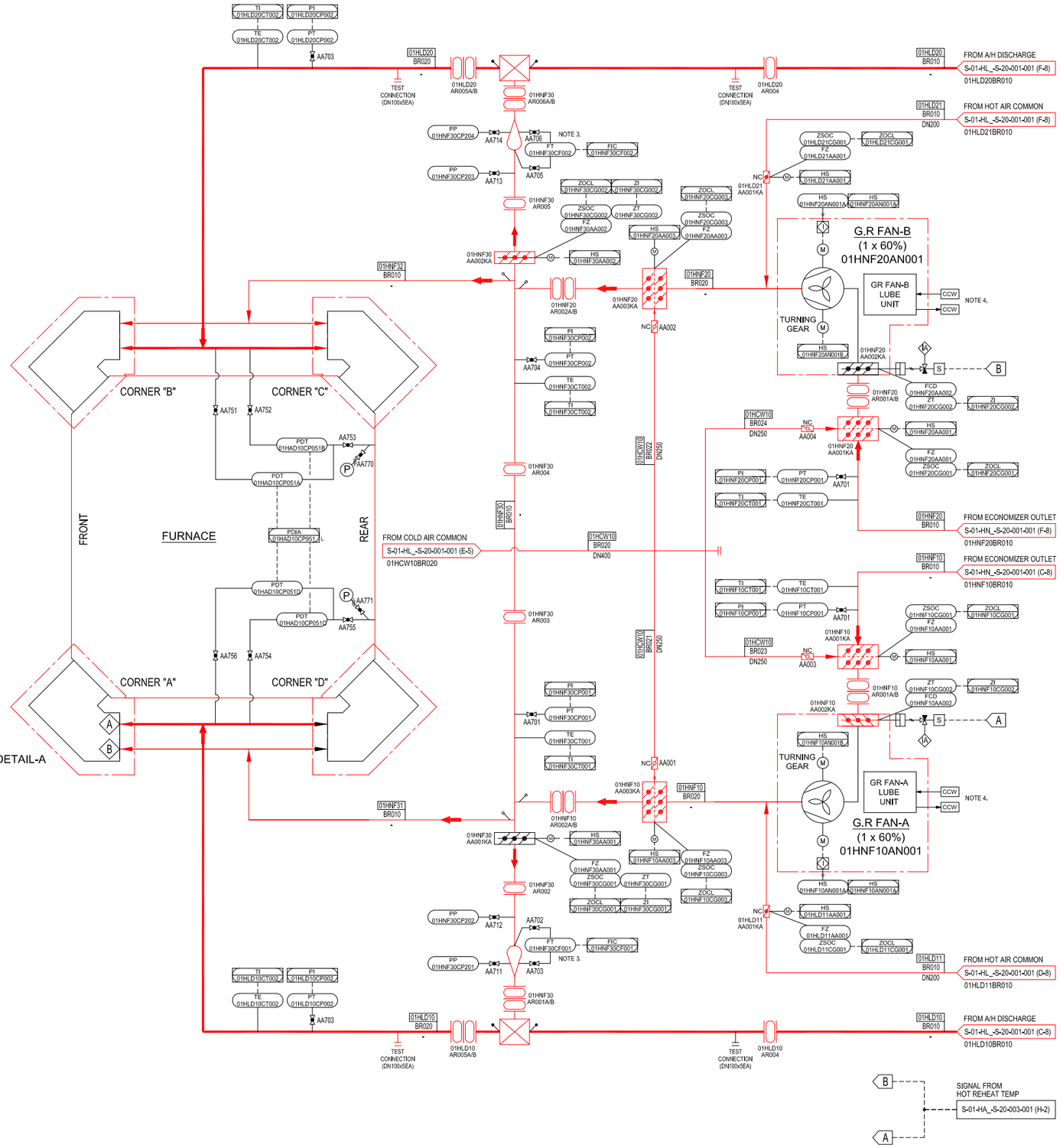
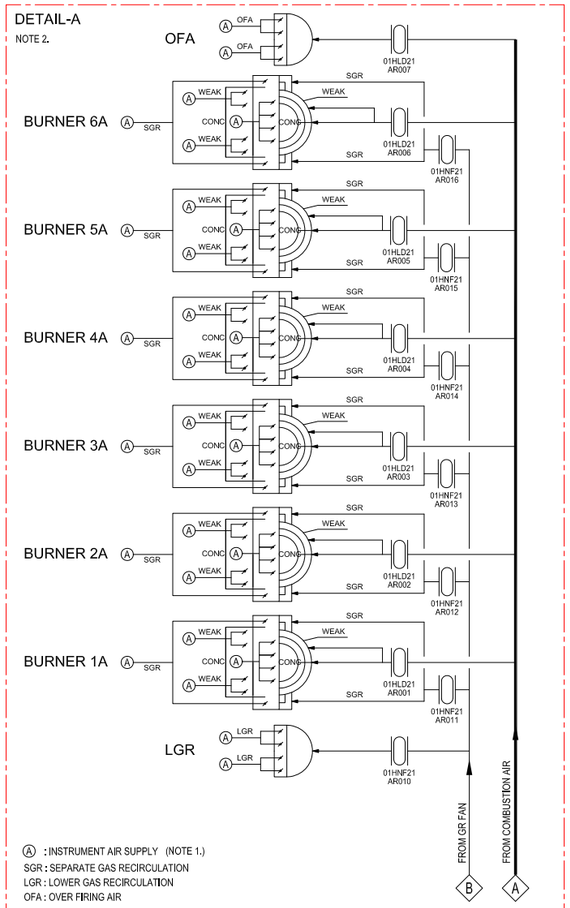
A1(594x841)





BURNER DAMPER TAG NUMBERS

NO.	LOCATION	ITEM	CORNER "A"	CORNER "B"	CORNER "C"	CORNER "D"
1	OFA		FZ - 01HHD21AA102A FZ - 01HHD21AA102B	FZ - 01HHD31AA102A FZ - 01HHD31AA102B	FZ - 01HHD41AA102A FZ - 01HHD41AA102B	FZ - 01HHD51AA102A FZ - 01HHD51AA102B
2	BURNER ELEVATION-6	CONC	FZ - 01HHA26AA101	FZ - 01HHA36AA101	FZ - 01HHA46AA101	FZ - 01HHA56AA101
		WEAK	FZ - 01HHA26AA102A FZ - 01HHA26AA102B	FZ - 01HHA36AA102A FZ - 01HHA36AA102B	FZ - 01HHA46AA102A FZ - 01HHA46AA102B	FZ - 01HHA56AA102A FZ - 01HHA56AA102B
		SGR	FZ - 01HHA26AA103	FZ - 01HHA36AA103	FZ - 01HHA46AA103	FZ - 01HHA56AA103
3	BURNER ELEVATION-5	CONC	FZ - 01HHA25AA101	FZ - 01HHA35AA101	FZ - 01HHA45AA101	FZ - 01HHA55AA101
		WEAK	FZ - 01HHA25AA102A FZ - 01HHA25AA102B	FZ - 01HHA35AA102A FZ - 01HHA35AA102B	FZ - 01HHA45AA102A FZ - 01HHA45AA102B	FZ - 01HHA55AA102A FZ - 01HHA55AA102B
		SGR	FZ - 01HHA25AA103	FZ - 01HHA35AA103	FZ - 01HHA45AA103	FZ - 01HHA55AA103
4	BURNER ELEVATION-4	CONC	FZ - 01HHA24AA101	FZ - 01HHA34AA101	FZ - 01HHA44AA101	FZ - 01HHA54AA101
		WEAK	FZ - 01HHA24AA102A FZ - 01HHA24AA102B	FZ - 01HHA34AA102A FZ - 01HHA34AA102B	FZ - 01HHA44AA102A FZ - 01HHA44AA102B	FZ - 01HHA54AA102A FZ - 01HHA54AA102B
		SGR	FZ - 01HHA24AA103	FZ - 01HHA34AA103	FZ - 01HHA44AA103	FZ - 01HHA54AA103
5	BURNER ELEVATION-3	CONC	FZ - 01HHA23AA101	FZ - 01HHA33AA101	FZ - 01HHA43AA101	FZ - 01HHA53AA101
		WEAK	FZ - 01HHA23AA102A FZ - 01HHA23AA102B	FZ - 01HHA33AA102A FZ - 01HHA33AA102B	FZ - 01HHA43AA102A FZ - 01HHA43AA102B	FZ - 01HHA53AA102A FZ - 01HHA53AA102B
		SGR	FZ - 01HHA23AA103	FZ - 01HHA33AA103	FZ - 01HHA43AA103	FZ - 01HHA53AA103
6	BURNER ELEVATION-2	CONC	FZ - 01HHA22AA101	FZ - 01HHA32AA101	FZ - 01HHA42AA101	FZ - 01HHA52AA101
		WEAK	FZ - 01HHA22AA102A FZ - 01HHA22AA102B	FZ - 01HHA32AA102A FZ - 01HHA32AA102B	FZ - 01HHA42AA102A FZ - 01HHA42AA102B	FZ - 01HHA52AA102A FZ - 01HHA52AA102B
		SGR	FZ - 01HHA22AA103	FZ - 01HHA32AA103	FZ - 01HHA42AA103	FZ - 01HHA52AA103
7	BURNER ELEVATION-1	CONC	FZ - 01HHA21AA101	FZ - 01HHA31AA101	FZ - 01HHA41AA101	FZ - 01HHA51AA101
		WEAK	FZ - 01HHA21AA102A FZ - 01HHA21AA102B	FZ - 01HHA31AA102A FZ - 01HHA31AA102B	FZ - 01HHA41AA102A FZ - 01HHA41AA102B	FZ - 01HHA51AA102A FZ - 01HHA51AA102B
		SGR	FZ - 01HHA21AA103	FZ - 01HHA31AA103	FZ - 01HHA41AA103	FZ - 01HHA51AA103
8	LGR		FZ - 01HHD21AA101A FZ - 01HHD21AA101B	FZ - 01HHD31AA101A FZ - 01HHD31AA101B	FZ - 01HHD41AA101A FZ - 01HHD41AA101B	FZ - 01HHD51AA101A FZ - 01HHD51AA101B

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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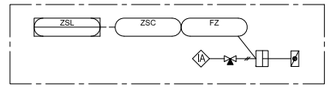
NOTES

1. Ⓐ : MODULATING DAMPER ACTUATOR DETAIL
   REFER TO P&ID NO. S-01-HX_-S-20-001-002



2. THE DETAIL-A SHOWS CORNER "A" WHICH IS TYPICAL FOR OTHER CORNERS "B", "C", AND "D" EXCEPT TAG NO.
3. FLOW COMPENSATION USING PT-01HNF30CP001/002, TE-01HNF30CT001/002
4. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION.
5. Ⓟ: PURGE AIR CONNECTION
   REFER TO 01-HN_-S-20-002-001

BOILER COMBUSTION AIR SYSTEM
HA01-08 / HA02-08
HA03-08 / HA04-08
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
GR FAN - P&ID	S-04-HLB-M-20-V001-001
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
1	31.AUG.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER COMBUSTION AIR SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-001-002	01 OF 01	1X

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A1(594x841)

SIGNAL TO SCR-A CONTROL (AMMONIA)
S-01-HS_-S-20-001-001 (C-8)
FIC 01HNA10CF901
SIGNAL TO SCR-B CONTROL (AMMONIA)
S-01-HS_-S-20-001-001 (B-8)
FIC 01HNA20CF901
SIGNAL TO F.D FAN
S-01-HL_-S-20-001-001 (F-2)
COMBUSTION AIR CONTROL (O2)
SIGNAL FROM ECO. STEAMING PROTECTION
S-01-HA_-S-20-001-001 (F-8)
ECONOMIZER BYPASS DUCT
TO GR FAN SUCTION
S-01-HL_-S-20-001-002 (E-4)
01HNF20BR010
ECONOMIZER OUTLET
FURNACE
S.C.R-B
01HSD20BT001
(DWG NO. S-01-HS_-S-20-001-001)
SCR BYPASS DUCT
A/H BYPASS DUCT
REGENERATIVE AIR HEATER-B
01HLD20AC001
(1 x 60%)
AIR SIDE
FLUE GAS SIDE
SIGNAL TO SAH-B CONTROL
S-01-HL_-S-20-002-002 (H-8)
TO ELETROSTATIC PRECIPITATOR-8
S-01-HN_-S-20-001-002 (F-8)
01HNA20BR030
SIGNAL TO SAH-A CONTROL
S-01-HL_-S-20-002-001 (H-8)
S.C.R-A
01HSD10BT001
(DWG NO. S-01-HS_-S-20-001-001)
FLUE GAS SIDE
AIR SIDE
REGENERATIVE AIR HEATER-A
01HLD10AC001
(1 x 60%)
TO ELETROSTATIC PRECIPITATOR-A
S-01-HN_-S-20-001-002 (D-8)
01HNA10BR030
TO GR FAN SUCTION
S-01-HL_-S-20-001-002 (E-4)
01HNF10BR010
ECONOMIZER BYPASS DUCT

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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6. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING.
   VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.

NOTES

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BOILER COMBUSTION AIR SYSTEM
HA01-08 / HA02-08
HA03-08 / HA04-08
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
REGENERATIVE AIR HEATER - P&ID	S-04-HLD-M-20-V001-001
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER FLUE GAS SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HN_-S-20-001-001	01 OF 01	1X

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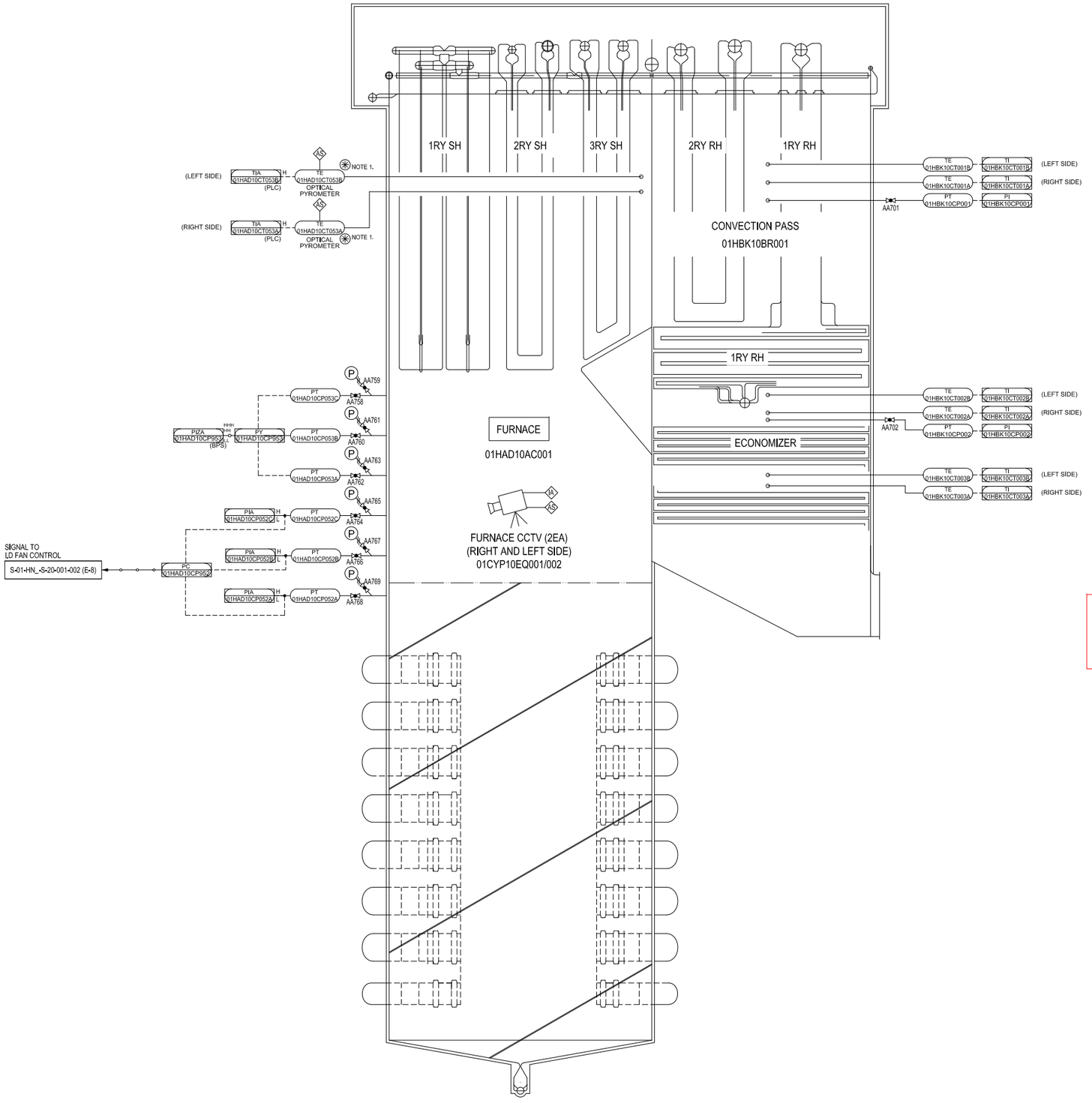
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
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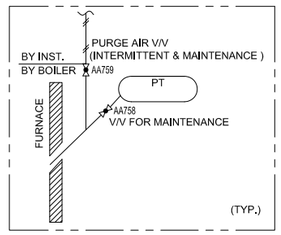
NOTES

1. (✳) : SUPPLIED BY VENDOR.
2. (P): INSTRUMENT PURGE SCHEMATIC FOR FURNACE.



AS BUILT

BOILER COMBUSTION AIR SYSTEM
HA01-08 / HA02-08
HA03-08 / HA04-08
(UNIT 01/02/03/04)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	31.AUG.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
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A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00945
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER INSTRUMENTATION

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HN_-S-20-002-001	01 OF 01	2X

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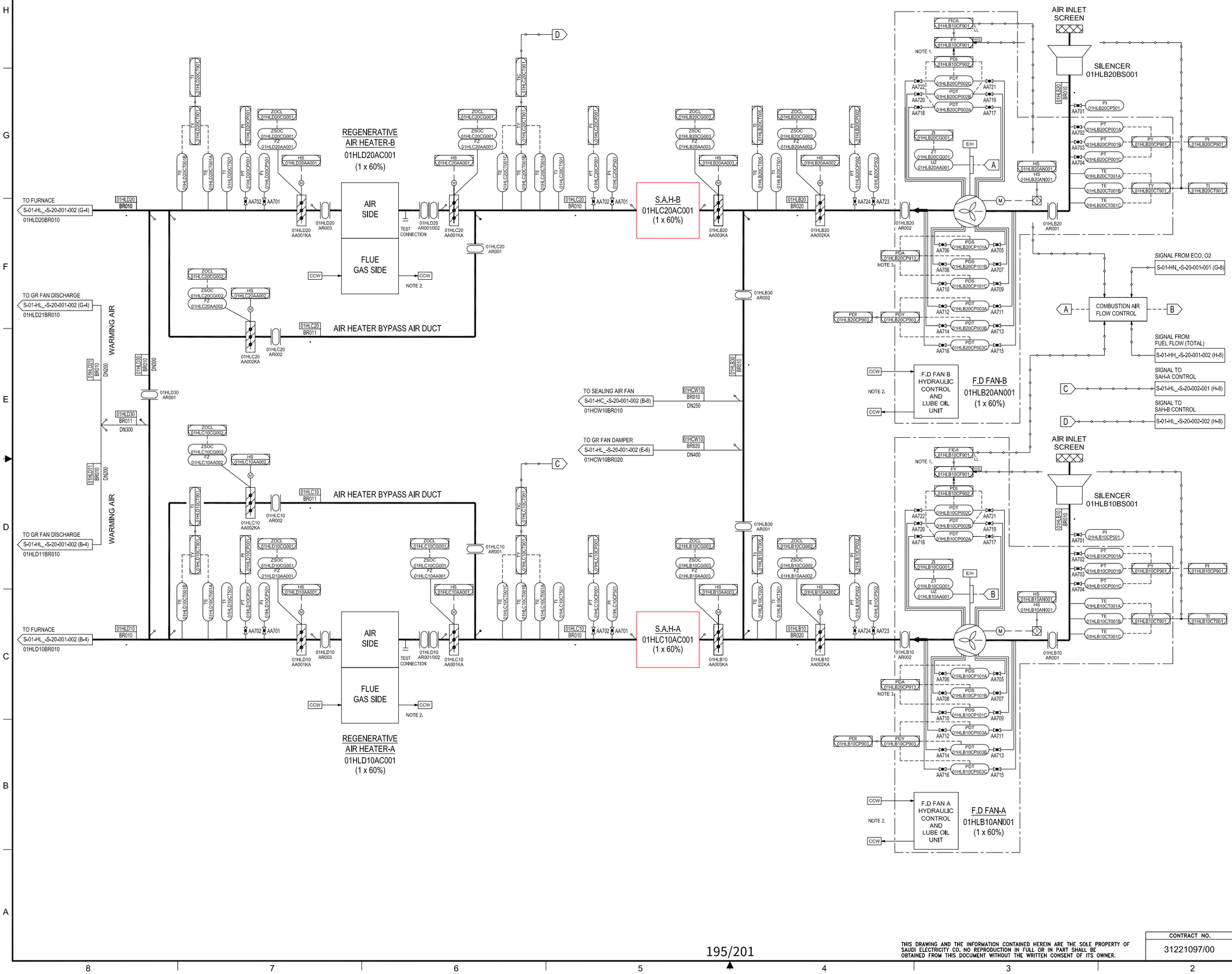
A1(594x841)



GENERAL NOTES

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NOTES

1. FLOW COMPENSATION USING TE-01HLB10CT001A/B/C, TE-01HLB20CT001A/B/C
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION.
3. STALL ALARM

BOILER STEAM AIR HEATER SYSTEM
HS01-09 / HS02-09
HS03-09 / HS04-09
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
FD FAN - P&ID	S-04-HLB-M-20-V001-001
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REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	12.SEP.2014	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER COMBUSTION AIR SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-001-001	01 OF 01	2X

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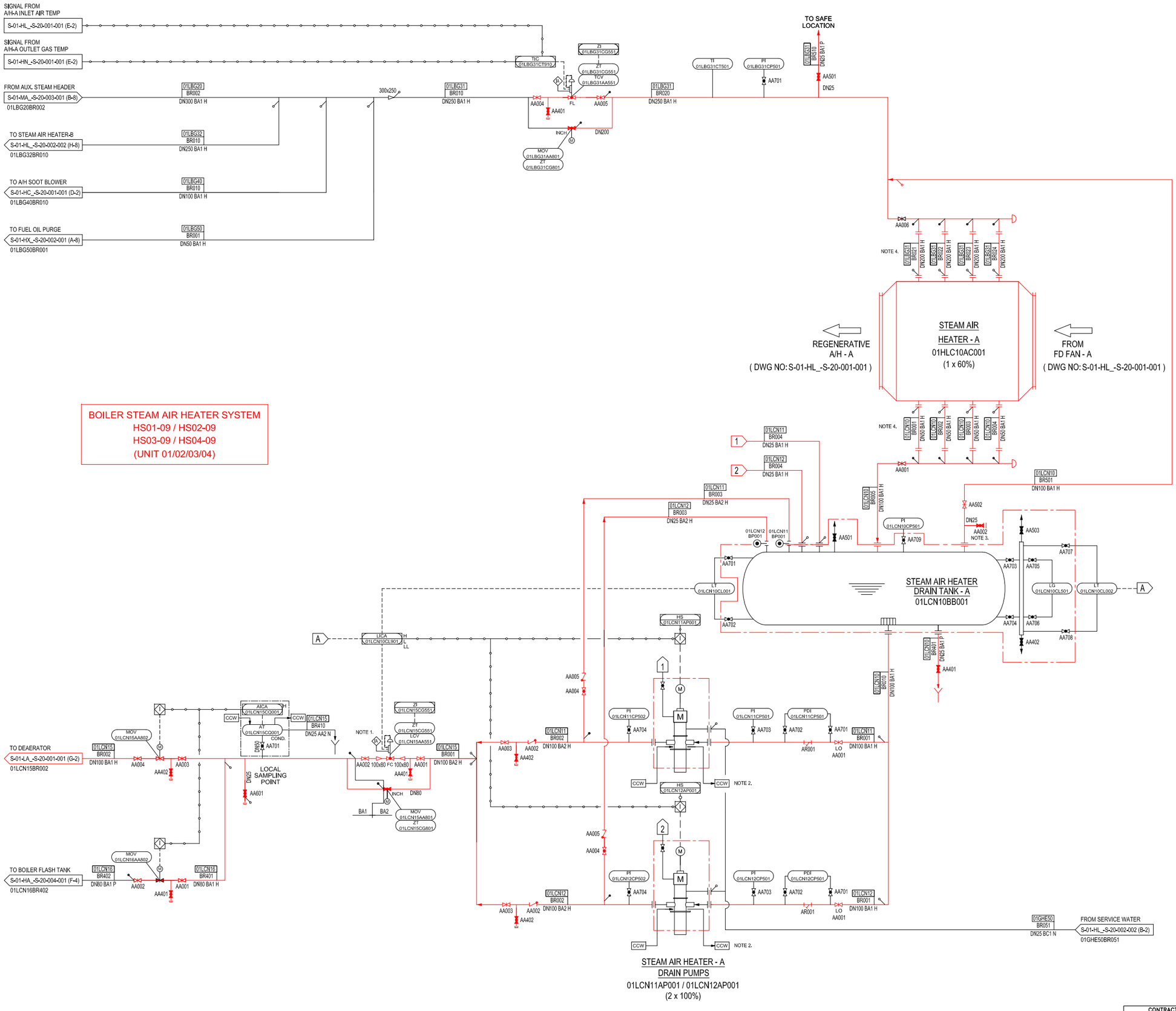
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
6. ALL BOTTOM HEADERS AND PIPING LOW POINTS SHALL BE DRAINABLE WITH DRAIN VALVES. ALL TOP HEADERS AND PIPING HIGH POINTS SHALL BE VENTED WITH VENT VALVES.
7. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING. VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.
8. DOUBLE ISOLATION VALVES SHALL BE PROVIDED FOR ALL STEAM AND FEED WATER DRAINS, AND THE DOUBLE ISOLATION VALVES SHALL BE LOCATED AS CLOSE AS TAPPING POINT. BOTH VALVES SHALL BE OF THE GLOBE TYPE.
9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. CONTROL VALVE STATION SHALL BE LOCATED NEAR THE BOILER FLASH TANK AREA.
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION
3. FOR INITIAL FILLING ONLY.
4. REMOVABLE PIECE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER STEAM AIR HEATER SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-002-001	01 OF 01	2X

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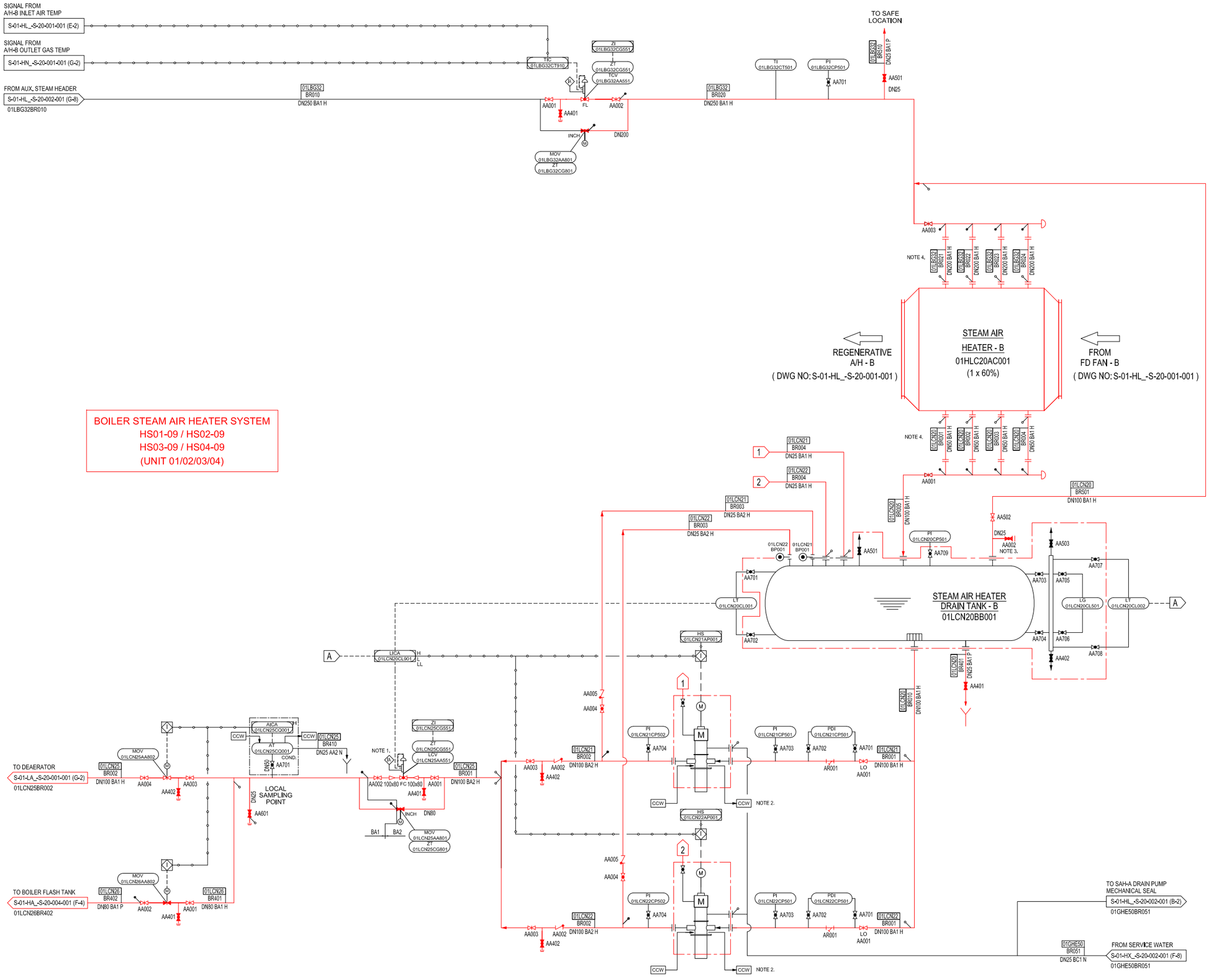
A1(594x841)



BOILER STEAM AIR HEATER SYSTEM
HS01-09 / HS02-09
HS03-09 / HS04-09
(UNIT 01/02/03/04)

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
5. LINE NUMBER OF PIPE WITHIN BOILER BOUNDARY INDICATES SIZE ONLY WITHOUT MATERIAL SPECIFICATION.
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9. DOUBLE ROOT VALVES SHALL BE PROVIDED FOR ALL TAPPINGS, ie INSTRUMENTS, DRAINS, VENTS, ON SYSTEMS HAVING DESIGN PRESSURE 40 BARG OR HIGHER.

NOTES

1. CONTROL VALVE STATION SHALL BE LOCATED NEAR THE BOILER FLASH TANK AREA.
2. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION
3. FOR INITIAL FILLING ONLY.
4. REMOVABLE PIECE.

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
"	"
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
2X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
2	12.JUN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00838
REV. NO. B
DATE : 21.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER STEAM AIR HEATER SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HL_-S-20-002-002	01 OF 01	2X

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A1(594x841)

GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
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3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.
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6. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING.
   VENTS, DRAINS, 3 OR 5 VALVE MANIFOLDS ARE PROVIDED AS NORMALLY REQUIRED BUT NOT SHOWN.

NOTES

-

BOILER STEAM AIR HEATER SYSTEM
HS01-09 / HS02-09
HS03-09 / HS04-09
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
REGENERATIVE AIR HEATER - P&ID	S-04-HLD-M-20-V001-001
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER FLUE GAS SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HN_-S-20-001-001	01 OF 01	1X

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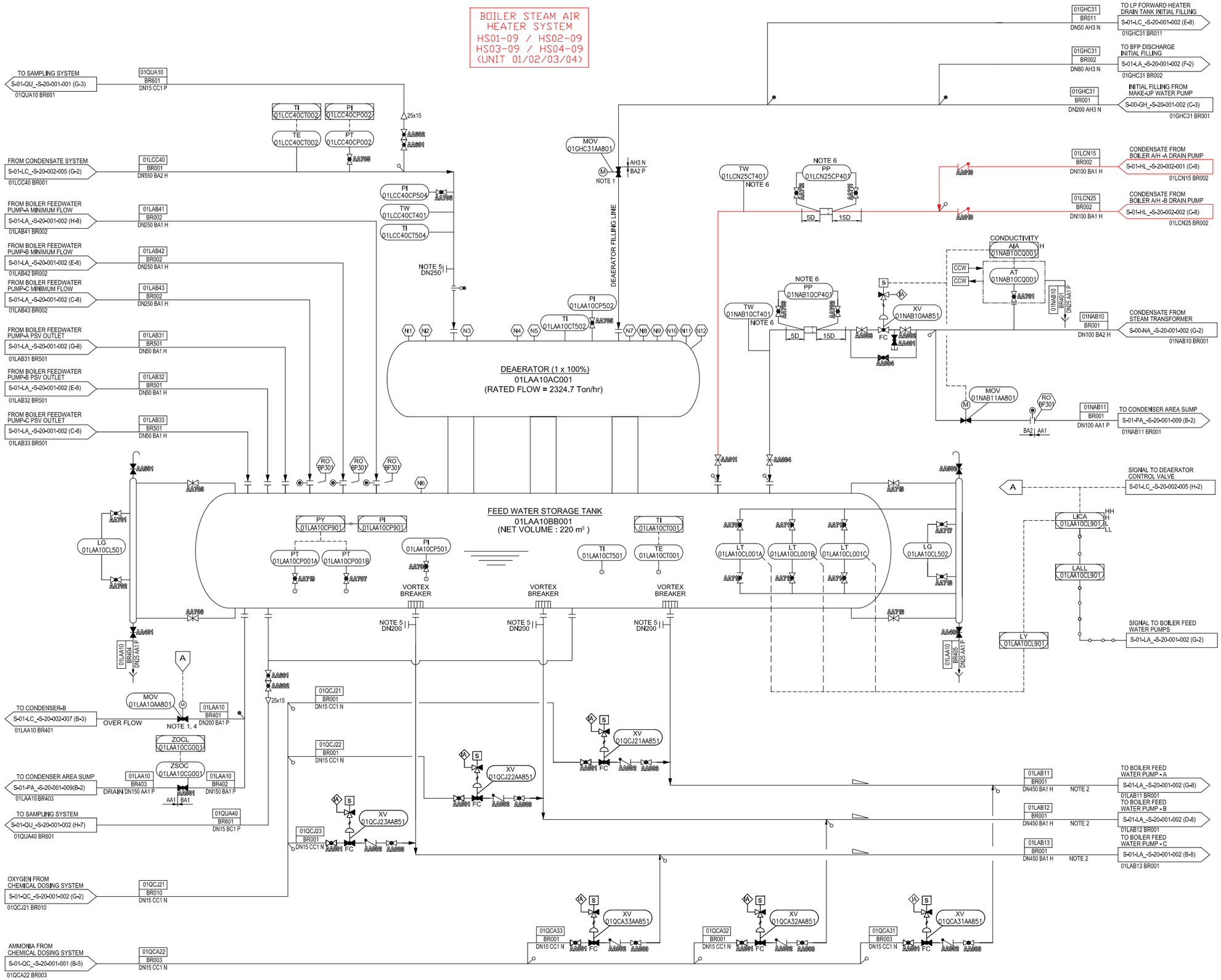
A1(594x841)

BOILER STEAM AIR HEATER SYSTEM
HS01-09 / HS02-09
HS03-09 / HS04-09
(UNIT 01/02/03/04)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
4. ALL MOTOR TAGS TO READ "EQUIPMENT TAG NO." PLUS THE POSTFIX "-M", UNLESS NOTED.

NOTES

1. MODULATING TYPE MOV.
2. HORIZONTAL RUN SLOPE OF PUMP SUCTION PIPE : MIN 1/4 (15 DEGREES)
3. BFP TRIP AT LEVEL LOW-LOW FEEDWATER STORAGE TANK.
4. MOV OPEN AT STORAGE TANK LEVEL HIGH-HIGH AND CLOSE AT TANK LEVEL HIGH.
5. FLUSHING AND CLEANING CONNECTION.
6. PP AND TW WILL BE USED FOR PROVISION OF PERFORMANCE TEST. THE FLOW ORIFICE SHALL BE CALIBRATED AS PER ASME PTC 19.5.

NOZZLE NO.	LINE SIZE	DESCRIPTION	P&ID NO.
N1	DN800	HEATING STEAM	S-01-LB_-S-20-001-001
N2	DN500	CASCADE DRAIN	S-01-LC_-S-20-001-001
N3	DN50	START-UP VENT	S-01-LB_-S-20-002-001
N4	DN300	PSV	S-01-LB_-S-20-002-001
N5	DN300	PSV	S-01-LB_-S-20-002-001
N6	DN400	START-UP STEAM	S-01-LB_-S-20-001-001
N7	DN50	VENT	S-01-LB_-S-20-001-001
N8	DN50	VENT	S-01-LB_-S-20-001-001
N9	DN50	VENT	S-01-LB_-S-20-001-001
N10	DN50	VENT	S-01-LB_-S-20-001-001
N11	DN50	VENT	S-01-LB_-S-20-001-001
N12	DN50	VENT	S-01-LB_-S-20-001-001

FOR CONSTRUCTION

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
EQUIPMENT SIZING REPORT FOR FEED WATER SYS.	S-00-LA-S-48-105-001
SYSTEM DESCRIPTION FOR FEED WATER SYSTEM	S-00-LA-S-45-105-001
PFD-FEED WATER SYSTEM	S-00-LA-S-12-001-001
PFD-CONDENSATE SYSTEM	S-00-LA-S-12-002-001

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1	17.JAN.2015	REVISED AS MARKED	I.J.LEE	S.W.KIM	J.K.SEO
0	20.MAY.2014	ISSUED FOR CONSTRUCTION	I.J.LEE	H.H.KIM	J.K.SEO
B	13.MAR.2014	REVISED AS MARKED	I.J.LEE	H.H.KIM	J.K.SEO
A	25.OCT.2013	ISSUED FOR APPROVAL	H.H.KIM	J.K.SEO	H.S.BAEK

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.

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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00833
REV. NO. B
DATE : 29.APR.2014 STATUS : 2

DRAWING TITLE
P & ID FOR
FEED WATER SYSTEM (1/3) (FOR UNIT 01)
- DEAERATOR

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	NONE	S-01-LA_-S-20-001-001 (Old No: S-T1-LA_-S-20-001-001)	01 OF 01	1

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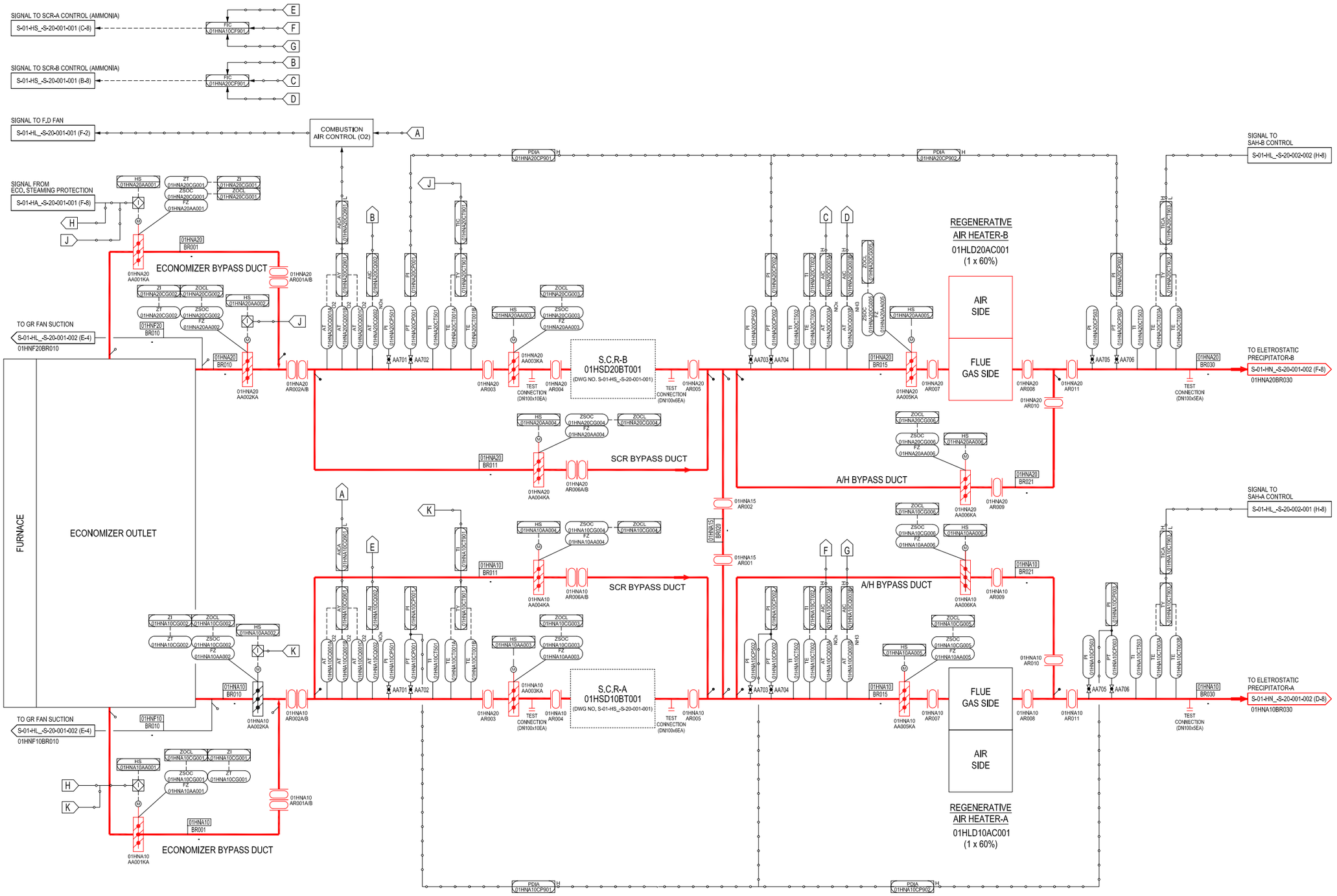
A1(594x841)



GENERAL NOTES

1. THIS IS TYPICAL FOR UNIT 01, 02, 03 & 04.
2. REFER TO P&IDs-SYMBOL & LEGEND. DWG. NO. : S-00-TA_-S-20-002-001, 002, 003 & 004.
3. FUNCTION PREFIX NUMBER OF MANUAL VALVE TO READ SAME PREFIX NUMBER OF LINE NUMBER, UNLESS NOTED.
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6. ONLY INSTRUMENT ROOT VALVES ARE SHOWN ON THIS DRAWING.
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NOTES

-

BOILER FLUE GAS SYSTEM
HA01-10 / HA02-10
HA03-10 / HA04-10
(UNIT 01/02/03/04)

AS BUILT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
REGENERATIVE AIR HEATER - P&ID	S-04-HLD-M-20-V001-001
"	"
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
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PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
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VENDOR INTERNAL DWG NO.
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APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00943
REV. NO. B
DATE : 04.MAY.2014 STATUS : 2

DRAWING TITLE
P&ID FOR
BOILER FLUE GAS SYSTEM (1/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HN_-S-20-001-001	01 OF 01	1X

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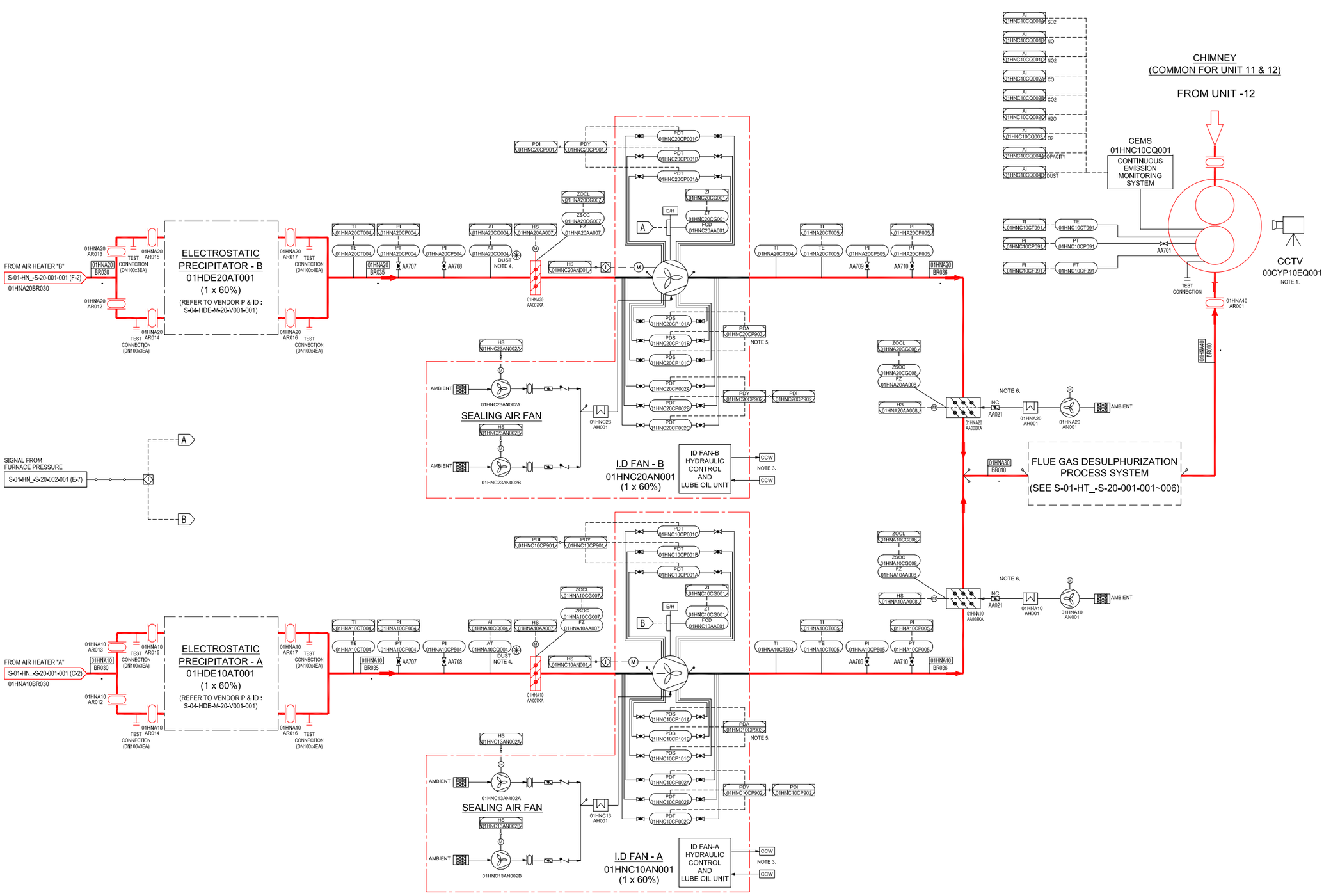

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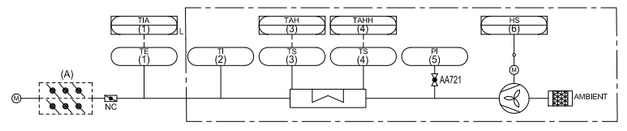
NOTES

1. CCTV FOR CHIMNEY : COMMON FOR UNIT 11 AND 12.
2. [ ] : SUPPLIED BY VENDOR.
3. REFER TO P&ID NO. S-01-PG_-S-20-001-003 FOR COOLING WATER CONNECTION.
4. ⊛ : SUPPLIED BY EP VENDOR
5. STALL ALARM
6. REFER TO DETAIL CONFIGURATION FOR DAMPER SEAL AIR HEATER

BOILER FLUE GAS SYSTEM
HA01-10 / HA02-10
HA03-10 / HA04-10
(UNIT 01/02/03/04)

AS BUILT

DETAIL CONFIGURATION FOR DAMPER SEAL AIR HEATER



	DAMPER INDENTIFICATION (A)	TE (1)	TI (2)	TS (3)	TS (4)	PI (5)	HS (6)
FLUE GAS TRAIN "A"	01HNA10AA008KA	01HNA10CT006	01HNA10CT521	01HNA10CT101	01HNA10CT102	01HNA10CP521	01HNA10AN001
FULE GAS TRAIN "B"	01HNA20AA008KA	01HNA20CT006	01HNA20CT521	01HNA20CT101	01HNA20CT102	01HNA20CP521	01HNA20AN001

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DESIGN CRITERIA FOR BOILER	S-00-TA_-S-45-002-001
SYSTEM DESCRIPTION FOR BOILER SYSTEM	S-00-HA_-S-45-101-001
EQUIPMENT SIZING REPORT FOR BOILER AUXILIARY EQUIPMENT	S-00-HA_-S-48-101-001
BOILER PERFORMANCE DATA	S-00-TA_-S-48-001-001
ESP - P&ID	S-04-HDE-M-20-V001-001
ID FAN - P&ID	S-04-HNC-M-20-V001-001
"	"
"	"

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
1X	11.JAN.2018	AS BUILT	M.H.LEE	Y.S.LEE	K.M.LEE
1	13.JAN.2015	REVISED AS MARKED	M.H.LEE	Y.S.LEE	K.M.LEE
0	14.MAY.2014	ISSUED FOR CONSTRUCTION	M.H.LEE	Y.S.LEE	K.M.LEE
B	21.MAR.2014	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE
A	25.OCT.2013	ISSUED FOR APPROVAL	M.H.LEE	Y.S.LEE	K.M.LEE

PROJECT
SHUQAIQ STEAM POWER PLANT

OWNER
الشركة السعودية للكهرباء
Saudi Electricity Company

ENGINEER
PÖYRY

CONTRACTOR
HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBCONTRACTOR
N/A

VENDOR INTERNAL DWG NO.
N/A

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. THE CONTRACTOR HHI CONFIRMS FULLY COMPLIANCE WITH THE OE'S COMMENTS. NO OTHER CHANGES HAD BEEN MADE ON THE DRAWING. THE CONTRACTOR MAY SUBMIT THE DRAWING AS "FOR CONSTRUCTION"

APPROVAL/CERTIFICATION INFORMATION
DOC. NO. POY-HHI-T-00837
REV. NO. B
DATE : 17.APR.2014 STATUS : 1

DRAWING TITLE
P&ID FOR
BOILER FLUE GAS SYSTEM (2/2)

CONTRACT NO.	SCALE	DRAWING NO.	SHEET NO.	REV.
31221097/00	1:1	S-01-HN_-S-20-001-002	01 OF 01	1X

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