ภาคผนวก ข-8

ผลการตรวจสอบความถูกต้องของ CEMs

Analysis / Test Report

Client : Gulf NRV2 Co.,Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244525
Date Received : Nov 26, 2022
Date Reported : Dec 13, 2022
Report Number : 2283990-1

Sample Number 2244525-1
Sampled Date Nov 22, 2022
Sample Description Emission from Stationary Source
Location HRSG 21
Parameter NOx

Relative Accuracy Test Audit Report

Run No.	Date	Time		Raw Data at Actual O2		Corrected Value at 7% O2		Difference
		Start	Stop	CEMs (ppm)	RM (ppm)	CEMs (ppm)	RM (ppm)	
1*	22 Nov 22	13:30	13:50	22.36	26.24	47.64	56.30	8.66
2	22 Nov 22	13:51	14:11	22.44	23.86	47.97	51.53	3.56
3	22 Nov 22	14:12	14:32	23.55	25.96	50.25	55.47	5.23
4	22 Nov 22	14:33	14:53	19.50	22.33	42.40	48.83	6.43
5	22 Nov 22	14:54	15:14	19.89	22.72	43.40	49.92	6.52
6	22 Nov 22	15:15	15:35	19.48	22.26	42.67	49.08	6.41
7	22 Nov 22	15:36	15:56	19.35	22.23	42.56	48.99	6.43
8*	22 Nov 22	15:57	16:17	18.55	21.79	40.80	48.12	7.32
9*	22 Nov 22	16:18	16:38	18.66	21.51	40.85	47.58	6.73
10	22 Nov 22	16:39	16:59	18.34	20.98	40.12	46.39	6.27
11	22 Nov 22	17:00	17:20	18.41	20.89	40.25	46.08	5.84
12	22 Nov 22	17:21	17:41	18.88	21.36	41.25	47.02	5.77
	Average					43.43	49.26	5.83
	Confidence Coefficient (CC)							0.73
	Relative Accuracy (Compared with RM) (%)							13.32
	Relative Accuracy Criteria 1/ (Compared with RM)							≤ 20%

Reference Method : US EPA Method 7E

Remark: * Sample with * is a rejected data

1/ Relative Accuracy Criteria of NOx is refer to 40 CFR Part 60 Appendix B : Performance Specification Test 2 (PS-2)

RA Result is within Criteria

Technical Management
Wichan Choonharat
Manager
ทะเบียนเลขที่ ว-204-ค-6113

Approved by
Sarayuth Jittranont
Assistant General Manager
ทะเบียนเลขที่ ว-204-ค-4702

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ALS LABORATORY GROUP (THAILAND) CO., LTD. Part of the ALS Group

Analysis / Test Report

Client : Gulf NRV2 Co.,Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244525
Date Received : Nov 26, 2022
Date Reported : Dec 13, 2022
Report Number : 2283990-1

Sample Number 2244525-1
Sampled Date Nov 22, 2022
Sample Description Emission from Stationary Source
Location HRSG 21
Parameter SO2

Relative Accuracy Test Audit Report

Run No.	Date	Time		Raw Data at Actual O2		Corrected Value at 7% O2		Difference
		Start	Stop	CEMs (ppm)	RM (ppm)	CEMs (ppm)	RM (ppm)	
1*	22 Nov 22	13:30	13:50	0.03	0.14	0.07	0.29	0.22
2*	22 Nov 22	13:51	14:11	0.04	0.11	0.09	0.23	0.15
3*	22 Nov 22	14:12	14:32	0.05	0.10	0.10	0.21	0.11
4	22 Nov 22	14:33	14:53	0.04	0.07	0.10	0.14	0.05
5	22 Nov 22	14:54	15:14	0.04	0.05	0.09	0.11	0.03
6	22 Nov 22	15:15	15:35	0.05	0.04	0.12	0.09	-0.03
7	22 Nov 22	15:36	15:56	0.06	0.04	0.14	0.09	-0.05
8	22 Nov 22	15:57	16:17	0.05	0.04	0.10	0.08	-0.02
9	22 Nov 22	16:18	16:38	0.02	0.05	0.04	0.10	0.06
10	22 Nov 22	16:39	16:59	0.03	0.04	0.08	0.09	0.01
11	22 Nov 22	17:00	17:20	0.04	0.02	0.08	0.06	-0.02
12	22 Nov 22	17:21	17:41	0.03	0.03	0.08	0.08	0.00
	Average					0.09	0.09	0.00
	Confidence Coefficient (CC)							0.03
	Relative Accuracy (Compared with Emission Standard : 6 ppm) (%)							0.52
	Relative Accuracy Criteria 1/ (Compared with Emission Standard :6 ppm)							≤ 10%

Reference Method : US EPA Method 6C

Remark: * Sample with * is a rejected data

1/ Relative Accuracy Criteria of SO2 is refer to 40 CFR Part 60 Appendix B : Performance Specification Test 2 (PS-2) compared with Emission Standard 6 ppm at 7%O2

RA Result is within Criteria

Technical Management
Wichan Choonharat
Manager
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Approved by
Sarayuth Jittranont
Assistant General Manager
ทะเบียนเลขที่ ว-204-ค-4702

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Analysis / Test Report

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789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244525
Date Received : Nov 26, 2022
Date Reported : Dec 13, 2022
Report Number : 2283990-1

Sample Number	2244525-1
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Parameter	O2

Relative Accuracy Test Audit Report

Run No.	Date	Time		Raw Data at Actual		Difference
		Start	Stop	CEMs (%)	RM (%)	
1	22 Nov 22	13:30	13:50	14.38	14.42	0.05
2*	22 Nov 22	13:51	14:11	14.40	14.47	0.07
3	22 Nov 22	14:12	14:32	14.39	14.39	0.01
4	22 Nov 22	14:33	14:53	14.51	14.54	0.03
5	22 Nov 22	14:54	15:14	14.53	14.57	0.05
6	22 Nov 22	15:15	15:35	14.55	14.60	0.04
7	22 Nov 22	15:36	15:56	14.58	14.59	0.01
8	22 Nov 22	15:57	16:17	14.58	14.60	0.02
9*	22 Nov 22	16:18	16:38	14.55	14.61	0.06
10*	22 Nov 22	16:39	16:59	14.55	14.61	0.07
11	22 Nov 22	17:00	17:20	14.54	14.60	0.06
12	22 Nov 22	17:21	17:41	14.54	14.59	0.05
	Average			14.51	14.55	0.04
	Confidence Coefficient (CC)					-
	Relative Accuracy (Compared in Actual) (%)					0.04
	Relative Accuracy Criteria (%)					≤ 1%

Reference Method : US EPA Method 3A

Remark: * Sample with * is a rejected data

1/ Relative Accuracy Criteria of O2 is refer to 40 CFR Part 60 Appendix B : Performance Specification Test 3 (PS-3)

RA Result is within Criteria

Sampled By : Ussaree Namburee

Technical Management
Wichan Choonharat
Manager
ทะเบียนเลขที่ ว-204-ค-6113

Approved by
Sarayuth Jittranont
Assistant General Manager
ทะเบียนเลขที่ ว-204-ค-4702

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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received: Nov 26, 2022
Date Reported: Dec 14, 2022
Report Number: 2515742-1

Sample Number	2244527-1
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Parameter	Relative Response Audit

Relative Response Audit Test Report

No Sample	Date	Time		CEMS Values		RM Values	Allowable Range		Criterion
		Start	Stop	(%Opacity)	(mg/m³)	(mg/m³)	Minimum	Maximum	
1	22-Nov-22	13:30	14:18	0.25	0.37	0.11	-6.63	7.37	Pass
2	22-Nov-22	14:30	15:18	0.30	0.43	0.11	-6.57	7.43	Pass
3	22-Nov-22	15:30	16:18	0.24	0.35	0.22	-6.65	7.35	Pass
4	22-Nov-22	16:30	17:18	0.29	0.42	0.00	-6.58	7.42	Pass
5	22-Nov-22	17:30	18:18	0.30	0.44	0.23	-6.56	7.44	Pass

Remark: -Relative Response Audit is refer to 40 CFR Part 60 Appendix B : Performance Specification 11 : Specifications and Test Procedures for Particulate Matter Continuous Emission Monitoring Systems at Stationary Source (PS-11)
-Correlation Equation of Linear curve Y = 1.457X
-Emission limit 28 mg/m3 from Environmental Impact Assessment Report of Gulf NRV2 Co.,Ltd.

Technical Management
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Approved by
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Assistant General Manager
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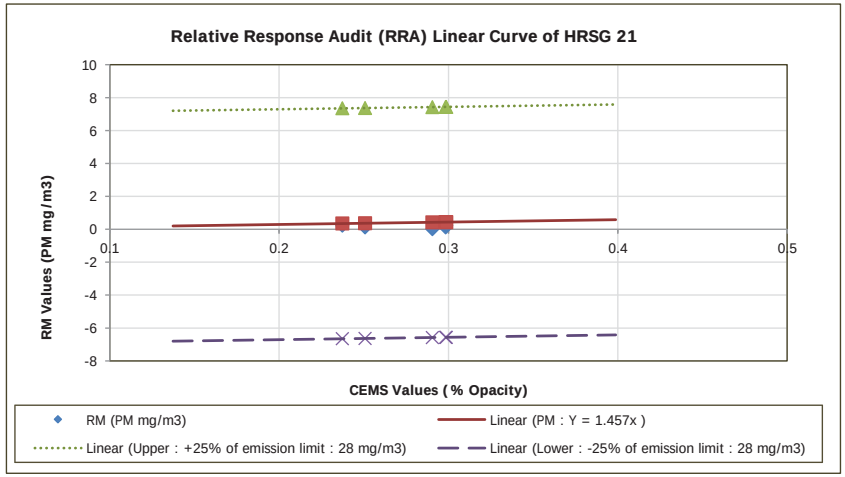
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received: Nov 26, 2022
Date Reported: Dec 14, 2022
Report Number: 2515742-1

Sample Number	2244527-1
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Parameter	Relative Response Audit



Sampled By : Atsawared Jorsaw

Technical Management
Wichan Choonharat
Manager
ทะเบียนเลขที่ ว-204-ค-6113

Approved by
Sarayuth Jittranont
Assistant General Manager
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Analysis / Test Report

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789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-2
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.4	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	116	°C	Gas Velocity	13.8	m/s
Type of Fuel	Natural Gas		Moisture	8.53	%	Flow Rate (Actual O2)	300557	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.4 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	01:30 PM - 02:18 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
Saranya Chalermthamrong
Scientist (4)
ทะเบียนเลขที่ ว-204-จ-4717

Approved by
Kanokkorn Anek
Senior Manager
ทะเบียนเลขที่ ว-204-ค-6111

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Analysis / Test Report

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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-2
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.4	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	116	°C	Gas Velocity	13.8	m/s
Type of Fuel	Natural Gas		Moisture	8.53	%	Flow Rate (Actual O2)	300557	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	01:30 PM - 02:18 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
Saranya Chalermthamrong
Scientist (4)
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Approved by
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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-3
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	115	°C	Gas Velocity	14.0	m/s
Type of Fuel	Natural Gas		Moisture	8.46	%	Flow Rate (Actual O2)	304385	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	02:30 PM - 03:18 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
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Approved by
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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-3
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	115	°C	Gas Velocity	14.0	m/s
Type of Fuel	Natural Gas		Moisture	8.46	%	Flow Rate (Actual O2)	304385	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	02:30 PM - 03:18 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
Saranya Chalermthamrong
Scientist (4)
ทะเบียนเลขที่ ว-204-จ-4717

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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-4
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	115	°C	Gas Velocity	13.8	m/s
Type of Fuel	Natural Gas		Moisture	8.52	%	Flow Rate (Actual O2)	300314	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	03:30 PM - 04:18 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
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Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-4
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	115	°C	Gas Velocity	13.8	m/s
Type of Fuel	Natural Gas		Moisture	8.52	%	Flow Rate (Actual O2)	300314	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	03:30 PM - 04:18 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
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Scientist (4)
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Approved by
Kanokkorn Anek
Senior Manager
ทะเบียนเลขที่ ว-204-ค-6111

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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-5
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	115	°C	Gas Velocity	13.8	m/s
Type of Fuel	Natural Gas		Moisture	9.03	%	Flow Rate (Actual O2)	299464	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	04:30 PM - 05:18 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-5
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	115	°C	Gas Velocity	13.8	m/s
Type of Fuel	Natural Gas		Moisture	9.03	%	Flow Rate (Actual O2)	299464	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	04:30 PM - 05:18 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-6
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	13.7	m/s
Type of Fuel	Natural Gas		Moisture	8.73	%	Flow Rate (Actual O2)	298742	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	05:30 PM - 06:18 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

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Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244527
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284011-1

Sample Number	2244527-6
Sampled Date	Nov 22, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 21
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	32.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	13.7	m/s
Type of Fuel	Natural Gas		Moisture	8.73	%	Flow Rate (Actual O2)	298742	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	05:30 PM - 06:18 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

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P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244526
Date Received : Nov 26, 2022
Date Reported : Dec 13, 2022
Report Number : 2283999-1

Sample Number	2244526-1
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Parameter	NOx

Relative Accuracy Test Audit Report

Run No.	Date	Time		Raw Data at Actual O2		Corrected Value at 7% O2		Difference
		Start	Stop	CEMs (ppm)	RM (ppm)	CEMs (ppm)	RM (ppm)	
1	23 Nov 22	11:10	11:30	15.41	17.37	35.65	37.66	2.00
2	23 Nov 22	11:31	11:51	14.72	17.25	34.26	37.47	3.21
3	23 Nov 22	11:52	12:12	13.14	15.28	30.64	33.52	2.89
4	23 Nov 22	12:13	12:33	15.36	17.87	35.46	38.81	3.35
5*	23 Nov 22	12:34	12:54	13.79	16.57	32.17	36.24	4.07
6	23 Nov 22	12:55	13:15	16.11	18.20	37.00	39.47	2.48
7	23 Nov 22	13:16	13:36	17.47	19.70	39.74	42.42	2.68
8	23 Nov 22	13:37	13:57	17.56	20.17	40.07	43.33	3.26
9	23 Nov 22	13:58	14:18	17.38	19.95	39.61	42.86	3.24
10	23 Nov 22	14:19	14:39	16.37	19.01	37.40	41.07	3.67
11*	23 Nov 22	14:40	15:00	16.81	19.62	38.42	42.26	3.84
12*	23 Nov 22	15:01	15:21	15.26	18.49	35.06	40.06	5.00
	Average					36.65	39.62	2.98
	Confidence Coefficient (CC)							0.40
	Relative Accuracy (Compared with RM) (%)							8.51
	Relative Accuracy Criteria 1/ (Compared with RM)							≤ 20%

Reference Method : US EPA Method 7E

Remark: * Sample with * is a rejected data

1/ Relative Accuracy Criteria of NOx is refer to 40 CFR Part 60 Appendix B : Performance Specification Test 2 (PS-2)

RA Result is within Criteria

Technical Management
Wichan Choonharat
Manager
ทะเบียนเลขที่ ว-204-ค-6113

Approved by
Sarayuth Jittranont
Assistant General Manager
ทะเบียนเลขที่ ว-204-ค-4702

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ALS LABORATORY GROUP (THAILAND) CO., LTD. Part of the ALS Group

Analysis / Test Report

Client : Gulf NRV2 Co.,Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244526
Date Received : Nov 26, 2022
Date Reported : Dec 13, 2022
Report Number : 2283999-1

Sample Number 2244526-1
Sampled Date Nov 23, 2022
Sample Description Emission from Stationary Source
Location HRSG 22
Parameter SO2

Relative Accuracy Test Audit Report

Run No.	Date	Time		Raw Data at Actual O2		Corrected Value at 7% O2		Difference
		Start	Stop	CEMs (ppm)	RM (ppm)	CEMs (ppm)	RM (ppm)	
1	23 Nov 22	11:10	11:30	0.00	0.07	0.00	0.14	0.14
2	23 Nov 22	11:31	11:51	0.00	0.07	0.00	0.14	0.14
3	23 Nov 22	11:52	12:12	0.00	0.08	0.01	0.17	0.17
4*	23 Nov 22	12:13	12:33	0.00	0.09	0.01	0.20	0.19
5	23 Nov 22	12:34	12:54	0.01	0.07	0.01	0.16	0.15
6	23 Nov 22	12:55	13:15	0.01	0.09	0.02	0.20	0.19
7*	23 Nov 22	13:16	13:36	0.01	0.11	0.02	0.23	0.21
8*	23 Nov 22	13:37	13:57	0.01	0.10	0.02	0.22	0.20
9	23 Nov 22	13:58	14:18	0.01	0.10	0.03	0.21	0.19
10	23 Nov 22	14:19	14:39	0.01	0.09	0.03	0.20	0.17
11	23 Nov 22	14:40	15:00	0.01	0.09	0.03	0.20	0.16
12	23 Nov 22	15:01	15:21	0.02	0.09	0.03	0.19	0.15
	Average					0.02	0.18	0.16
	Confidence Coefficient (CC)							0.01
	Relative Accuracy (Compared with Emission Standard : 6 ppm) (%)							2.93
	Relative Accuracy Criteria [1/] (Compared with Emission Standard :6 ppm)							≤ 10%

Reference Method : US EPA Method 6C

Remark: * Sample with * is a rejected data

[1/] Relative Accuracy Criteria of SO2 is refer to 40 CFR Part 60 Appendix B : Performance Specification Test 2 (PS-2) compared with Emission Standard 6 ppm at 7%O2

RA Result is within Criteria

Technical Management
Wichan Choonharat
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Approved by
Sarayuth Jittranont
Assistant General Manager
ทะเบียนเลขที่ ว-204-ค-4702

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Analysis / Test Report

Client : Gulf NRV2 Co.,Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244526
Date Received : Nov 26, 2022
Date Reported : Dec 13, 2022
Report Number : 2283999-1

Sample Number 2244526-1
Sampled Date Nov 23, 2022
Sample Description Emission from Stationary Source
Location HRSG 22
Parameter O2

Relative Accuracy Test Audit Report

Run No.	Date	Time		Raw Data at Actual		Difference
		Start	Stop	CEMs (%)	RM (%)	
1*	23 Nov 22	11:10	11:30	14.89	14.49	-0.40
2*	23 Nov 22	11:31	11:51	14.93	14.50	-0.43
3	23 Nov 22	11:52	12:12	14.94	14.56	-0.38
4	23 Nov 22	12:13	12:33	14.88	14.50	-0.38
5*	23 Nov 22	12:34	12:54	14.94	14.55	-0.39
6	23 Nov 22	12:55	13:15	14.85	14.49	-0.35
7	23 Nov 22	13:16	13:36	14.79	14.45	-0.34
8	23 Nov 22	13:37	13:57	14.81	14.43	-0.38
9	23 Nov 22	13:58	14:18	14.80	14.43	-0.37
10	23 Nov 22	14:19	14:39	14.82	14.47	-0.35
11	23 Nov 22	14:40	15:00	14.82	14.45	-0.37
12	23 Nov 22	15:01	15:21	14.85	14.48	-0.37
	Average			14.84	14.47	-0.37
	Confidence Coefficient (CC)					-
	Relative Accuracy (Compared in Actual) (%)					0.37
	Relative Accuracy Criteria (%)					≤ 1%

Reference Method : US EPA Method 3A

Remark: * Sample with * is a rejected data

[1/] Relative Accuracy Criteria of O2 is refer to 40 CFR Part 60 Appendix B : Performance Specification Test 3 (PS-3)

RA Result is within Criteria

Sampled By : Ussaree Namburee

Technical Management
Wichan Choonharat
Manager
ทะเบียนเลขที่ ว-204-ค-6113

Approved by
Sarayuth Jittranont
Assistant General Manager
ทะเบียนเลขที่ ว-204-ค-4702

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789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received: Nov 26, 2022
Date Reported: Dec 14, 2022
Report Number: 2515743-1

Sample Number	2244530-1
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Parameter	Relative Response Audit

Relative Response Audit Test Report

No Sample	Date	Time		CEMS Values		RM Values	Allowable Range		Criterion
		Start	Stop	(%Opacity)	(mg/m³)	(mg/m³)	Minimum	Maximum	
1	23-Nov-22	11:10	11:58	2.77	2.77	0.11	-4.23	9.77	Pass
2	23-Nov-22	12:10	12:58	2.50	2.51	0.00	-4.49	9.51	Pass
3	23-Nov-22	13:10	13:58	2.77	2.78	0.11	-4.22	9.78	Pass
4	23-Nov-22	14:10	14:58	2.75	2.75	0.22	-4.25	9.75	Pass
5	23-Nov-22	15:10	15:58	2.84	2.85	0.23	-4.15	9.85	Pass

Remark: -Relative Response Audit is refer to 40 CFR Part 60 Appendix B : Performance Specification 11 : Specifications and Test Procedures for Particulate Matter Continuous Emission Monitoring Systems at Stationary Source (PS-11)
-Correlation Equation of Linear curve Y = 1.0024X
-Emission limit 28 mg/m3 from Environmental Impact Assessment Report of Gulf NRV2 Co.,Ltd.

Technical Management
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Approved by
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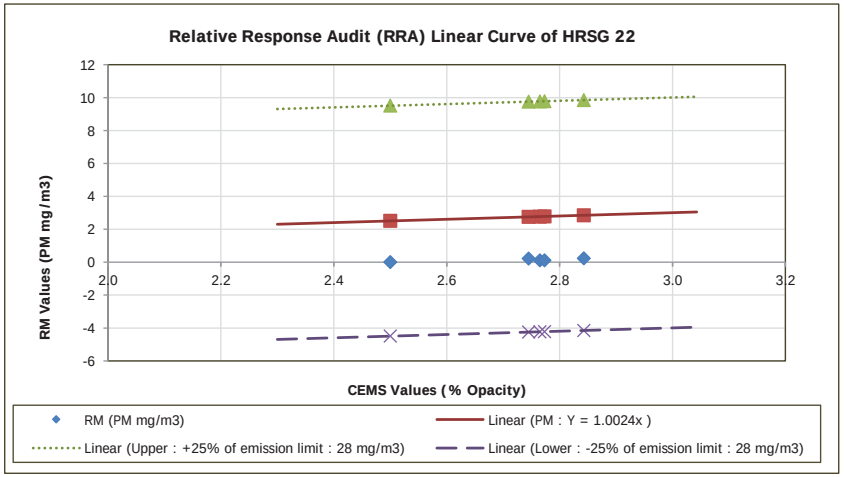
Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่ 4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received: Nov 26, 2022
Date Reported: Dec 14, 2022
Report Number: 2515743-1

Sample Number	2244530-1
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Parameter	Relative Response Audit



Sampled By : Atsawared Jorsaw

Technical Management
Wichan Choonharat
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Approved by
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11418-31/ EMAIL
S:\Reports\Stack_CEMs1.rpt

Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-2
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.3	m/s
Type of Fuel	Natural Gas		Moisture	8.85	%	Flow Rate (Actual O2)	311811	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	11:10 AM - 11:58 AM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
Saranya Chalermthamrong
Scientist (4)
ทะเบียนเลขที่ ว-204-จ-4717

Approved by
Kanokkorn Anek
Senior Manager
ทะเบียนเลขที่ ว-204-ค-6111

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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-2
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.3	m/s
Type of Fuel	Natural Gas		Moisture	8.85	%	Flow Rate (Actual O2)	311811	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	11:10 AM - 11:58 AM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
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Approved by
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11418-31/ EMAIL S:\Reports_Air Stack_O2_2GL.rpt (1:52PM)

Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-3
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.5	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	112	°C	Gas Velocity	14.3	m/s
Type of Fuel	Natural Gas		Moisture	8.70	%	Flow Rate (Actual O2)	314249	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.5 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	12:10 PM - 12:58 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

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Approved by
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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-3
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.5	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	112	°C	Gas Velocity	14.3	m/s
Type of Fuel	Natural Gas		Moisture	8.70	%	Flow Rate (Actual O2)	314249	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	12:10 PM - 12:58 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-4
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.4	m/s
Type of Fuel	Natural Gas		Moisture	8.55	%	Flow Rate (Actual O2)	313969	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	01:10 PM - 01:58 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

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Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-4
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.4	m/s
Type of Fuel	Natural Gas		Moisture	8.55	%	Flow Rate (Actual O2)	313969	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	01:10 PM - 01:58 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
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Approved by
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11418-31/ EMAIL S:\Reports_Air Stack_O2_2GL.rpt (1:52PM)

Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-5
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.4	m/s
Type of Fuel	Natural Gas		Moisture	8.83	%	Flow Rate (Actual O2)	314624	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	02:10 PM - 02:58 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
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ทะเบียนเลขที่ ว-204-จ-4717

Approved by
Kanokkorn Anek
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ทะเบียนเลขที่ ว-204-ค-6111

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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-5
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.7	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.4	m/s
Type of Fuel	Natural Gas		Moisture	8.83	%	Flow Rate (Actual O2)	314624	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	02:10 PM - 02:58 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
Saranya Chalermthamrong
Scientist (4)
ทะเบียนเลขที่ ว-204-จ-4717

Approved by
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Senior Manager
ทะเบียนเลขที่ ว-204-ค-6111

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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
789 Moo 6, T. Nongraveing, A. Muang, Nakhonratchasima Thailand 30000
P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-6
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.4	m/s
Type of Fuel	Natural Gas		Moisture	8.70	%	Flow Rate (Actual O2)	313711	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result at 7 %O_2	Result at 14.6 % O_2	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing										
Total Suspended Particulate	03:10 PM - 03:58 PM	mg/m3	-	0.5	<0.5	<0.5	28	60	US EPA, Method 5	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Technical Management
Saranya Chalermthamrong
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ทะเบียนเลขที่ ว-204-จ-4717

Approved by
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Senior Manager
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Analysis / Test Report

Client : Gulf NRV2 Co., Ltd.
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P/O : สัญญาเลขที่4600001547
Project Name : Monitoring EIA
Project Location : GNRV2

Lot ID: 2244530
Date Received : Nov 26, 2022
Date Reported : Dec 09, 2022
Report Number: 2284025-1

Sample Number	2244530-6
Sampled Date	Nov 23, 2022
Sample Description	Emission from Stationary Source
Location	HRSG 22
Date Analysis Commenced	Dec 01, 2022
Condition of Sample	Extracted into one filter paper placed in plastic petri dish

Stack Description

Ambient Pressure	743	mmHg	Diameter	3.35	m	Oxygen	14.6	%
Ambient Temperature	30.0	°C	Shape	Circle		Carbon Dioxide	3.6	%
Type of Process	Combustion		Stack Temperature	114	°C	Gas Velocity	14.4	m/s
Type of Fuel	Natural Gas		Moisture	8.70	%	Flow Rate (Actual O2)	313711	Nm3/hr

Analyte	Sampled Time	Unit	LOD	LOQ (LOR)	Result Emission Rate	Guideline (1)	Guideline (2)	Method	Testing Location
Air Testing									
Total Suspended Particulate	03:10 PM - 03:58 PM	g/s	-	-	<0.04	1.7	-	Calculated	Bangkok

Guideline :
Guideline (1) Environmental Impact Assessment Report of Gulf NRV2 Co., Ltd.
Guideline (2) Notification of the Ministry of Natural Resources and Environment, 2010 (B.E. 2553) on Emission Standard from New Power Plants.

Sampled By : Atsawared Jorsaw

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management
Saranya Chalermthamrong
Scientist (4)
ทะเบียนเลขที่ ว-204-จ-4717

Approved by
Kanokkorn Anek
Senior Manager
ทะเบียนเลขที่ ว-204-ค-6111

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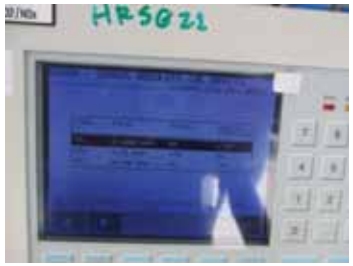
11418-31/ EMAIL S:\Reports_Air Stack_O2_2GL.rpt (1:52PM)

ภาพถ่ายการติดตามตรวจสอบ CEMs System Audit

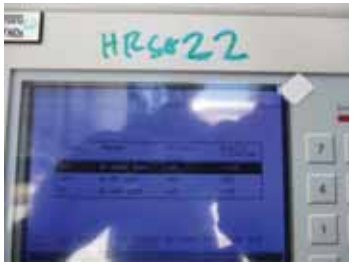
โรงไฟฟ้าหนองระเวียง 2 บริษัท กัลฟ์ เอ็นอาร์วี 2 จำกัด

วันที่ 12 ตุลาคม พ.ศ. 2565

HRSG 21

รูปถ่ายการตรวจสอบ CEMs System Audit	
	

HRSG 22

รูปถ่ายการตรวจสอบ CEMs System Audit	
	

ภาคผนวก ข-9

เอกสารการออกแบบระบบ Dry Low NOx Combustion

SPD	SYSTEM PACKAGE DESCRIPTION	007

DLE Gas Fuel System Description

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OVERVIEW

The purpose of the LM6000 DLE (Dry Low Emissions) fuel system is to reduce atmospheric emissions of the gas turbine engine. It does this by providing a combustion system design that is highly efficient at burning the air and fuel mixture. Traditional methods of reducing NOx emissions from combustion turbines (such as water and steam injection) are limited in some geographical areas, making DLE an attractive option for achieving increasingly stringent emissions requirements.

The DLE combustion system consists of three separate manifolds that supply fuel to the engine in successive stages. Each individual branch line to each manifold has its own metering valve. Operation of the DLE system is fully automatic as load is increased on the turbine. The controlling parameters for fuel delivery include combustion temperature and generator load.

The DLE system includes off-base support equipment such as shutoff valves, chromatograph (or Wobbe Index Meter), and package mounted equipment such as metering valves, manifolds and staging valves.

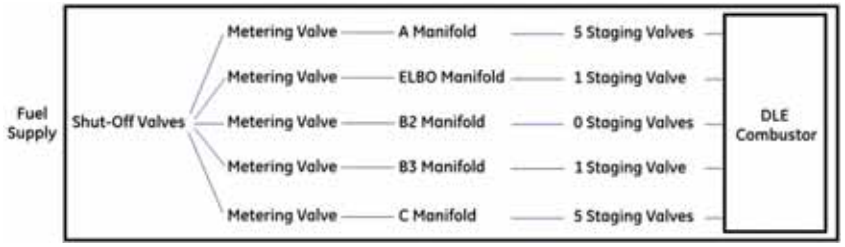


Figure 1 – DLE Fuel System Overview (PF1 Configuration shown)
*for illustration purposes only. Always refer to your site-specific drawings.

Emissions Basics

- *NOx Emissions*

  Nitrogen Oxides (NOx) emissions include NO and NO2. From gas turbines NOx is predominately NO. NOx emissions are due to thermal NOx from combustion and fuel bound nitrogen (FBN).

- *CO Emissions*

  Carbon Monoxide (CO) emissions are a measure of combustion completion. A higher value of CO indicates more incomplete combustion. CO is typically low due to the high combustion temperatures and the thermal efficiency of the unit.

MAIN TURBINE PACKAGE EQUIPMENT

The following is a description of the major components in the DLE gas fuel combustion system. The components can be located on the *DLE Gas Fuel System F&ID*, X-504245.

Strainer

Upon entering the main turbine package (fuel gas inlet connection # 10) the first component is a fuel gas strainer. The "Y" type strainer is designed to remove foreign particles from the gas fuel before it enters the downstream shut-off or metering valves.

Incoming Supply Pressure Transmitter

Following the Y strainer is a branch that supplies the fuel gas inlet supply pressure transmitter.

Pressure Transmitters

Another branch supplies fuel gas pressure to two pressure transmitters and a local gauge. One transmitter is set at 600 psig decreasing, and the other is set at 720 psig increasing.

Vents

Two branch lines are provided to aid in de-pressurizing the main line when necessary. The lines supply a set of 3-way vent valves.

Shut Off Valves

Gas flow is then routed through two shut off valves. The normally closed valves are operated by a 24 VDC pilot solenoid. Their purpose is to close during a shutdown (either normal or emergency) and prevent fuel flow to the turbine.

Temperature Sensors

A branch line provides fuel gas to a set of dual element RTD temperature sensors.

Branch Line Pressure Transmitters

As the incoming fuel gas branches into five individual lines (one to each manifold) there are individual pressure transmitters (and a set of redundant transmitters) that monitor the pressure in each branch.

Fuel Metering Valves

There are five fuel metering valves, one for each branch to each of the five manifolds. Each valve is designed to control the amount of fuel gas delivered to its respective manifold.

Manifolds

Gas fuel is metered to the on-engine fuel manifolds. The gas manifolds, one for each combustor ring, supply high pressure fuel to the pre-mixers via 90 flexible fuel hoses. The primary fuel supply to the pre-mixers uses 75 fuel hoses. The other 15 fuel hoses are used for the Enhanced Lean Blow-Out (ELBO) circuit integral with pre-mixers.

Acoustic Baffles

The acoustic baffles (sometimes referred to as elk horns) are installed on the Compressor Rear Frame pre-mixer pads. They are designed to attenuate or interfere with known negative combustor frequencies. Because of their individual designed structures, they are not interchangeable and should not be replaced or rearranged if an acoustic problem is encountered.

CAUTION
BECAUSE THE BAFFLE PIPES ARE HOLLOW THEY ARE EASILY DAMAGED. DO NOT USE THEM AS LADDERS DURING MAINTENANCE. THIS WARNING ALSO APPLIES TO STAGING VALVES.

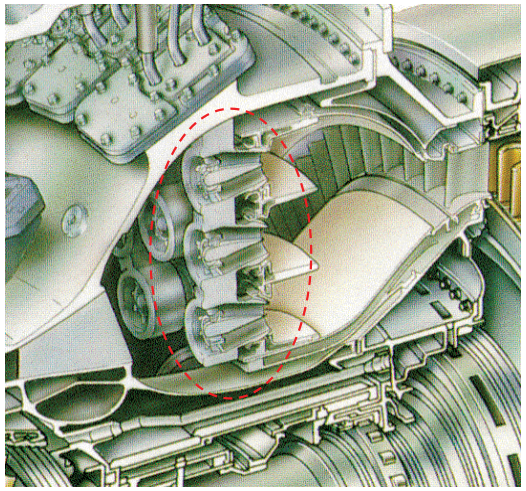
Staging Valves

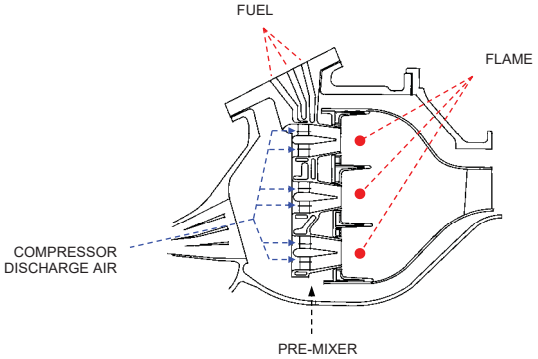
One of the key controlling parameters in a DLE gas turbine is combustor flame temperature. Flame temperature control is required to limit NOx emissions and control Hot Section component lives. To maintain flame temperature control in a narrow temperature range during all gas turbine operating conditions, it is necessary to "stage" the combustor (turn sections of the combustor on and off). The 12 fuel Staging Valves control fuel distribution to the combustor rings as scheduled by the electronic control unit. Five staging valves control the A or Outer Ring, five staging valves control the C or Inner Ring, and two staging valves controls increase flow to the B3 or Pilot Ring. The ELBO has one staging valve. The B2 has no staging valve. The B ring dome has fuel available to it at all operating conditions. The combustor modes go from B mode at core idle to ABC at full power. During B mode, no staging valves are open and fuel is only burning in the B ring pre-mixer cups. During ABC mode, all staging valves are open and supplying fuel to each pre-mixer cup. The staging valves are mounted on brackets attached to the gas manifolds.

Figure 2 – DLE Staging Valves

Pre-Mixers

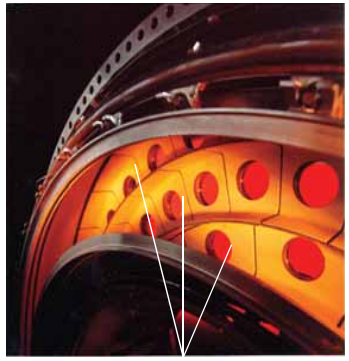
Prior to combustion, the air and fuel mixture is routed through a multi-nozzle assembly that provides efficient and uniform pre-mixing. The pre-mixer is a single piece, field replaceable assembly that provides a swirling effect to ensure maximum mixing of fuel and air. The design also has the added benefit of providing high velocity that helps prevent flashbacks. There are a total of 75 air/gas pre-mixers packaged in 30 removable modules. Half of the modules have two pre-mixers and the other half have three pre-mixers.



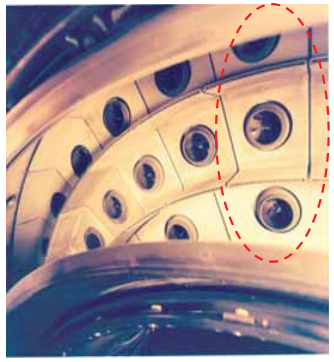


Combustor

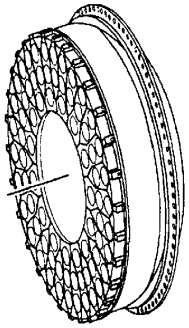
The tri-annular combustor is designed to deliver low emissions from start to full power. The combustor heat shields are made of single crystal Ni alloy and are impingement film cooled for low emissions at reduced power.



TRI-ANNULAR COMBUSTOR HEAT SHIELDS



PRE-MIXER ASSEMBLIES INSTALLED IN COMBUSTOR



OFF-BASE SUPPORT EQUIPMENT

The off-base support equipment consists of an external block and bleed arrangement, and a gas analysis skid.

External Block and Bleed Valves

The external block and bleed valve arrangement is designed to provide a means for isolating and de-pressurizing the incoming gas supply line. Operation of these valves is to be controlled by GE logic.

Gas Analysis

The LM6000 DLE gas turbine requires accurate metering of the total mass flow rate of gas fuel. As part of the requirements to determine fuel metering valve demand position, the fuel system must include provisions for providing signals to the electronic control unit reflecting the following gas properties: specific gravity, ratio of specific heats, lower heating value, and compressibility. Rapid gas properties fluctuations will require more frequent updates. Improper properties can result in combustor flameout, acoustics, or reduced hot section life.

For proper DLE operation, the gas lower heating value (LHV) and specific gravity (SG) inputs to the fuel control must be within 1.0 percent of the actual values. If the properties of the particular site gas supply could change by more than this amount, gas analysis equipment must be supplied to ensure the fuel control is supplied with data of sufficient accuracy for proper operation.

The minimum temperature of the gas fuel supplied to the gas turbine shall be 50°F greater than the saturated vapor temperature of the gas supply pressure. The temperature of the gas fuel should not exceed 300°F at the gas manifold inlet. The use of unapproved fuels can cause severe damage to the engine.

When selecting and installing the gas analysis equipment, the total system response time should be considered. The total response time is defined as the time it takes for the gas sample to travel from the main supply line to the gas analysis equipment plus the time for the gas LHV and SG to be determined for input to the fuel control. To minimize the total system response time, it is necessary to minimize the mass of gas between the sampling point and the measurement device. The most important element in the design of the sampling pipe is location of the pressure regulator, which should be located as close as possible to the main gas supply line.

Gas Analysis Skid

The gas analysis skid is a complete, stand-alone skid that includes a gas fuel sampling system, an analyzer, a chromatograph, helium bottles and an enclosure. Or alternately, a Wobbe Index Meter may be used for gas analysis.

A Gas Chromatograph (or Wobbe Index Meter) is used to analyze the gas sample and determine the gas composition. The analysis will check for the presence of both hydrocarbons and non-hydrocarbons. Once gas composition is determined, the hydrocarbon and moisture dew point can then be calculated. If any parameters are exceeded, an alarm will be produced to make the Operator aware of the discrepancy.

The gas fuel moisture analyzer (hygrometer) operates on two separate electrical supplies of 120 VAC and 24 VDC. Its purpose is to detect moisture in the gas fuel supply.

References

X-504245 – *F&ID, DLE Gas Fuel System*
SPO-007 – *Fuel System Operation*
SPM-007 – *Fuel System Maintenance*
GEK 112743 – *LM6000-PF DLE Engine O&M Manual*
GEK 115699 – *LM6000-PH DLE Engine O&M Manual*

ภาคผนวก ข-10

เอกสารการใช้ก๊าซธรรมชาติเป็นเชื้อเพลิงเพียงชนิดเดียว

GUARANTEE On Peak
PROJECT: GULF NEW SPPS-CAT052900
LOCATION: THAILAND

KW AT GEN TERMS	47790
(KJ/KW-HR, LHV)	9136

Zhang, Meng
Performance Engineer
Date: 10/28/14

EMISSIONS ARE VALID FOR T2 WITHIN 41°F-140°F AND A GTG LOAD DOWN TO 66.5 % AS DEFINED IN STEADY STATE CONDITIONS FOR EMISSIONS GUARANTEE

NOX: 25 PPMVD AT 15% O2

CO: 690 PPMVD AT 7% O2

PM10: 30 mg/Nm3 AT 7% O2
dry condition 0 deg °C, 760 mmHg

EXHAUST ENERGY: 105606 BTU/S (REF 0°R)/111421 KJ/S (REF 0°K)
EXHAUST TEMP: 947.5 °F (508.6°C)

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 03/31/15

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LM6000PF+ DLE GAS TURBINE
FUEL:	20038Btu/lb / (46608 kJ/kg) LHV, GAS FUEL (#900-3838)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	SITE FUEL TEMPERATURE OF 130.0°F(54.5°C)
GENERATOR:	BDAX 72-340ERH (EffCurv#: 32743; CapCurve# : 34511)
GENERATOR OUTPUT	11kV, 50 Hz
POWER FACTOR:	0.8
AMBIENT TEMP:	89.6°F / (32.0°C)
AMBIENT RH:	78.0%
INLET CONDITIONING:	NONE
ALTITUDE:	89.2ft / (27.2m)
INLET FILTER LOSS:	5.00 inH_2O / (127.0 mmH_2O)
EXHAUST LOSS:	10.00 inH_2O / (254.0 mmH_2O)
NOX CONTROL:	DLE
SPRINT WATER FLOW:	NOT TO EXCEED 17 GPM
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE POWER & WATER SGTGPTM
NOX:	EPA METHOD 20
CO:	EPA METHOD 10
PM10:	EPA METHOD 5 / 202

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY
PREVIOUS GUARANTEES PRESENTED

GUARANTEE On Peak
PROJECT: GULF NEW SPPS-CAT052900
LOCATION: THAILAND

KW AT GEN TERMS	47790
(KJ/KW-HR, LHV)	9136

Zhang, Meng
Performance Engineer
Date: 10/28/14

NEAR FIELD NOISE:
85 DB(A) ARITHMETIC AVERAGE SOUND PRESSURE LEVEL (dB REF 20 MICROPASCALS, RMS) OF LOCATIONS AROUND THE PACKAGE (VERTICAL DISTANCE OF 5FT. (1.5M) ABOVE PACKAGE BASE AT A HORIZONTAL DISTANCE OF 3FT. (1M) FROM THE EXTERIOR PLANE OF EQUIPMENT AS TESTED IN A FREE-FIELD CONDITION OVER A HARD REFLECTING GROUND PLANE, OPERATING AT BASE LOAD)

EXHAUST ENERGY: 105606 BTU/S (REF 0°R)/111421 KJ/S (REF 0°K)
EXHAUST TEMP: 947.5 °F (508.6°C)

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 03/31/15

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LM6000PF+ DLE GAS TURBINE
FUEL:	20038Btu/lb / (46608 kJ/kg) LHV, GAS FUEL (#900-3838)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	SITE FUEL TEMPERATURE OF 130.0°F(54.5°C)
GENERATOR:	BDAX 72-340ERH (EffCurv#: 32743; CapCurve# : 34511)
GENERATOR OUTPUT	11kV, 50 Hz
POWER FACTOR:	0.8
AMBIENT TEMP:	89.6°F / (32.0°C)
AMBIENT RH:	78.0%
INLET CONDITIONING:	NONE
ALTITUDE:	89.2ft / (27.2m)
INLET FILTER LOSS:	5.00 inH_2O / (127.0 mmH_2O)
EXHAUST LOSS:	10.00 inH_2O / (254.0 mmH_2O)
NOX CONTROL:	DLE
SPRINT WATER FLOW:	NOT TO EXCEED 17 GPM
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE POWER & WATER SGTGPTM
NOX:	EPA METHOD 20
CO:	EPA METHOD 10
PM10:	EPA METHOD 5 / 202

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY
PREVIOUS GUARANTEES PRESENTED

ภาคผนวก ข-11

ขั้นตอนการควบคุมมลพิษจากปล่องระบายอากาศ

GULF

ใบขอดำเนินการเกี่ยวกับเอกสาร / Document Action Request, DAR

ถึง : DCC / ผู้อนุมัติ

จาก : Operation Department

ประเภท :
- [ ] คู่มือการจัดการ (MM)
- [ ] เอกสารสนับสนุน (SD)
- [ ] ฟอร์ม (FP, FW)
- [ ] ระเบียบปฏิบัติ (PD)
- [x] ขั้นตอนการทำงาน (WI)
- [ ] อื่นๆ .....

หัวเรื่อง :
- [ ] เอกสารใหม่
- [x] แก้ไขเอกสาร
- [ ] อื่นๆ
- [ ] ยกเลิกเอกสาร
- [ ] ขอสำเนาเพิ่ม

ชื่อเอกสาร HRSG Emission Control

รหัสเอกสาร : WI-OPT-08 การแก้ไข : 02

รายละเอียดในการแก้ไข

เพื่อให้สอดคล้องกับ One standard

สุริยา สีดำ
ร้องขอโดย
22 ธ.ค. 2565

ตรวจสอบโดย
DCC
22 ธ.ค. 2565

ส่วนงานเกี่ยวข้อง: [ ] MRT [ ] EHS [ ] GAD [x] OPT [ ] MTN

[✓] อนุมัติ
[ ] ไม่อนุมัติ : .....

ผู้อนุมัติ
22 ธ.ค. 2565

การรับเอกสารบน Central Drive

ที่	รับ	ส่วนงาน	วันที่
(1)		OPT	22 ธ.ค. 2565
(2)			
(3)			
(4)			
(5)			
(6)			
(7)			
(8)			

หมายเหตุ : ต้องนำเอกสารฉบับปัจจุบันที่ได้รับการอนุมัติประกาศใช้ ไปใช้เท่านั้น

FP-MRT-01-01 Rev.01

GULF	เลขที่เอกสาร (Document No.)	แก้ไขครั้งที่ (Revision)		
HRSG Emission Control	WI-OPT-08	02		
	วันที่บังคับใช้ (Date)	หน้า (Page)		
	25 Dec 2022	1	จาก (of)	5

วิธีปฏิบัติงาน

Work Instruction

เรื่อง

HRSG Emission Control

WI-OPT-08

ORIGINAL

ผู้จัดทำ	ผู้ทบทวน	ผู้อนุมัติ
ชื่อ นายสุริยา สีดำ	ชื่อ นายพรสวรรค์ จันทร์งาม	ชื่อ นายปณัย เจียมเจริญกุล
ตำแหน่ง วิศวกรควบคุมระบบเดินเครื่อง	ตำแหน่ง หัวหน้ากะ	ตำแหน่ง ผู้จัดการโรงไฟฟ้า
วันที่ 22 ธ.ค. 2565	วันที่ 22 ธ.ค. 2565	วันที่ 22 ธ.ค. 2565

"เอกสารนี้เป็นเอกสารใช้ภายในโรงไฟฟ้า SPP กลุ่มบริษัทกัลฟ์ฯ เท่านั้น
หากมีการพิมพ์เอกสาร จะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

ตารางบันทึกการแก้ไขเอกสาร

แก้ไขครั้งที่	ผู้แก้ไข	วันที่มีผลบังคับใช้	หน้าที่แก้ไข	จำนวนหน้ารวม	วัตถุประสงค์	รายละเอียดการเปลี่ยนแปลง
00	อัตติพร จันทรประทักษ์	18 May 2020	ทุกหน้า	4	ประกาศใช้ ครั้งที่ 1	เขียนขึ้นใหม่ทั้งหมด เพื่อใช้เป็นวิธีปฏิบัติงาน
01	อัตติพร จันทรประทักษ์	01 JAN 2021	ทุกหน้า	5	เพื่อรองรับ One standard	ทุกหน้า
02	สุริยา สีดำ	25 Dec 2022	5	5	ทบทวนและปรับปรุงเอกสาร	เพิ่มข้อกำหนดในการแก้ไขปรับปรุงเอกสาร

"เอกสารนี้เป็นเอกสารใช้ภายในโรงไฟฟ้า SPP กลุ่มบริษัทกัลฟ์ฯ เท่านั้น
หากมีการพิมพ์เอกสาร จะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

1. จุดประสงค์

- เพื่อเป็นแนวทางในการปฏิบัติงานในส่วนเดินเครื่องโรงไฟฟ้า ให้เป็นไปอย่างถูกต้องครบถ้วนและปลอดภัย ต่อบุคลากรและเครื่องจักร

2. ขอบเขต

- วิธีปฏิบัติงานนี้ ใช้ในโรงไฟฟ้า SPP กลุ่มบริษัทกัลฟ์ฯ เท่านั้น

3. คำจำกัดความ

- บริษัทฯ หมายถึง โรงไฟฟ้า SPP ในกลุ่มบริษัทกัลฟ์ฯ
- พนักงาน หมายถึง บุคลากรของโรงไฟฟ้า SPP ในกลุ่มบริษัทกัลฟ์ฯ

4. ผู้ปฏิบัติงาน

4.1 ผู้จัดการส่วนเดินเครื่อง รับผิดชอบควบคุมการปฏิบัติงาน ให้เป็นไปตามขั้นตอน
4.2 หัวหน้ากะเดินเครื่อง รับผิดชอบสั่งการและปฏิบัติงานให้เป็นไปตามขั้นตอน
4.3 วิศวกรควบคุมระบบเดินเครื่อง รับผิดชอบสั่งการและปฏิบัติงานให้เป็นไปตามขั้นตอน
4.4 วิศวกรเดินเครื่อง รับผิดชอบและปฏิบัติงานให้เป็นไปตามขั้นตอน
4.5 หน่วยงานซ่อมบำรุง รับผิดชอบควบคุม ตรวจสอบและแก้ไขความผิดปกติของอุปกรณ์ เครื่องจักร
4.6 วิศวกรซ่อมบำรุง รับผิดชอบตรวจสอบและแก้ไขความผิดปกติของอุปกรณ์ เครื่องจักร

5. ความถี่ในการปฏิบัติ

- จดบันทึกและตรวจสอบทุกครั้งที่เข้าปฏิบัติงานกะ ลงในแบบ Form FW-OPT-03-01 Daily Plant Log Sheet CCR

"เอกสารนี้เป็นเอกสารใช้ภายในโรงไฟฟ้า SPP กลุ่มบริษัทกัลฟ์ฯ เท่านั้น
หากมีการพิมพ์เอกสาร จะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

6. วิธีการปฏิบัติงาน

6.1 ตรวจสอบความถูกต้องของการทำงานระบบ CEMs (CEMs Audit) โดยใช้วิธีการตรวจสอบตามข้อกำหนด

6.1.1 System Audit เป็นการตรวจสอบความถูกต้องการทำงานของ CEMs ด้วยการประเมินความสามารถในเชิงคุณภาพ (Qualitative Evaluation) ในลักษณะการทบทวน (Review) และตรวจสอบเกี่ยวกับสถานภาพ (Status)การทำงานของ CEMs

6.1.2 Performance Audit เป็นการตรวจสอบความถูกต้องของการทำงานของ CEMs ด้วยการประเมินความสามารถการทำงานในเชิงปริมาณ (Quantitative Evaluation) ตรวจสอบความถูกต้องการตรวจวัด NOx, SO2, TSP และ O2 โดยวิธี Relative Accuracy Test Audit (RATA) ซึ่งใช้หลักการอ่านค่า NOx, SO2, TSP และ O2 จาก CEMs เปรียบเทียบกับค่าตรวจวัดจากการเก็บตัวอย่างอากาศจากปล่องโดยวิธีอ้างอิงมาตรฐานในเวลาเดียวกันจากนั้น นำค่าที่ได้มาคำนวณค่า Relative Accuracy และนำผลที่ได้ไปเปรียบเทียบกับเกณฑ์กำหนดการตรวจสอบความถูกต้อง

6.2 การตรวจสอบการส่งค่าออนไลน์ให้กรมโรงงานอุตสาหกรรม

6.2.1 ตรวจสอบค่าออนไลน์ในเว็บไซท์ https://poms.diw.go.th/

6.2.2 ตรวจสอบค่าในระบบ โดยค่าล่าสุดจะต้องไม่ช้าเกินกว่าเวลาปัจจุบันไม่เกิน 1 ชั่วโมง

6.3 แนวทางในการปฏิบัติกรณีค่าคุณภาพทางอากาศเกินที่กำหนดหรือไม่ Updateในระบบ Online

6.3.1 กรณีค่าคุณภาพอากาศเกินที่กำหนด

6.3.1.1 Shift Leader ทำการเพิ่ม หรือ ลดกำลังการผลิตของ GT

6.3.1.2 Shift Leader ออก Notification และแจ้งหน่วยงานซ่อมบำรุงเพื่อตรวจสอบอุปกรณ์เครื่องมือวัด

6.3.1.3 Shift Leader แจ้งหน่วยงาน EHS เพื่อแจ้งข้อมูลกับกรมโรงงานอุตสาหกรรม

6.3.2 กรณีค่าไม่ Updateในระบบ Online

6.3.2.1 เปิดโปรแกรม DBExport

6.3.2.2 ดูสถานะ Server ที่ใช้ส่งค่าให้กรมโรงงานอุตสาหกรรม ต้องเป็นสีเขียวแสดงว่าสถานะปกติ กรณีสถานะเป็นสีแดง แสดงว่า Server ของบริษัทใช้งานไม่ได้ ให้แจ้ง EHS และแจ้งทางหน่วยงานซ่อมบำรุง เพื่อตรวจสอบ

"เอกสารนี้เป็นเอกสารใช้ภายในโรงไฟฟ้า SPP กลุ่มบริษัทกัลฟ์ฯ เท่านั้น
หากมีการพิมพ์เอกสาร จะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

7. ข้อควรระวังด้านความปลอดภัยและสิ่งแวดล้อม

- ควบคุมค่า HRSG Emission Control ตามมาตรการที่ระบุใน EIA(Environmental Impact Assessment) กำหนด
- ปฏิบัติตาม ESMS Procedure

8. เอกสารอ้างอิง

- ตามประกาศ EIA ของแต่ละโรงไฟฟ้า
- AM-SPP-WI-OPT-08

9. บันทึก

FW-OPT-03-01 Daily Plant Log Sheet CCR

คณะผู้จัดทำ

1.	นาย สุทธิศักดิ์ หวังพัฒนศิริกุล	GNC Plant Manager
2.	นาย จรินทร์ จันทร์เพ็ญ	GTLC Plant Manager
3.	นาย สัญญา เพ็ญภักดิ์	GTLC Operation Manager
4.	นาย บรรหาร ภู่บุบผากาญจน	GBL Operation Manager
5.	นาย รุ่งชัย เธียรพิริยะ	GBP Operation Manager
6.	นาย พิสิษฐ์ นาคสุข	GNK2 Operation Manager
7.	นาย ชาญวิทย์ เจียมเกาะ	GNPM Operation Manager
8.	นาย นิทัศ วงศ์ศิลป์	GNNK Operation Manager
9.	นาย วิทยา วิเวกแว่ว	GNLL Operation Manager
10.	นาย ศุภฤกษ์ ตระการกุลชัย	GCRN Operation Manager
11.	นาย ศุภสิทธิ์ แดงอำ	GVTP Operation Manager
12.	นาย ณรงค์ศักดิ์ ศรีชมภู	GTS1&2 Operation Manager
13.	นาย พงษ์ศักดิ์ รำพรรณ์	GTS3&4 Operation Manager
14.	นาย นพดล เงินโสม	GNC Operation Manager
15.	นาย สุรเดช ปกรณ์	GKP1&2 Operation Manager
16.	นาย วศิน เพ็ชรเมือง	GNLL2 Operation Manager

"เอกสารนี้เป็นเอกสารใช้ภายในโรงไฟฟ้า SPP กลุ่มบริษัทกัลฟ์ฯ เท่านั้น
หากมีการพิมพ์เอกสาร จะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

ภาคผนวก ข-12

เอกสารรับรองบุคลากรด้านสิ่งแวดล้อม

ที่ อก ๐๓๑๓/ ๘๙๙๗

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๑ กรกฎาคม ๒๕๖๕

เรื่อง หนังสือรับแจ้งการมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน

เรียน ผู้รับใบอนุญาตประกอบกิจการโรงงาน บริษัท กัลฟ์ เอ็นอาร์วี ๒ จำกัด

อ้างถึง คำขอเลขที่ ๐๗๗๘ ลงรับวันที่ ๑ กรกฎาคม ๒๕๖๕

ตามคำขอที่อ้างถึง ท่านแจ้งการเปลี่ยนแปลงบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ของ บริษัท กัลฟ์ เอ็นอาร์วี ๒ จำกัด (โรงไฟฟ้าหนองระเวียง ๒) ทะเบียนโรงงานเลขที่ ๔๐๓๐๐๐๐๔๒๒๕๕๙๑ (๓-๘๘(๒)-๔๒/๕๙ นม) ประกอบกิจการผลิตพลังงานไฟฟ้าจากก๊าซธรรมชาติ ขนาดกำลังการผลิต ๑๓๒.๒๕ เมกะวัตต์ ตั้งอยู่ ณ เลขที่ ๗๘๙ หมู่ที่ ๖ ตำบลหนองระเวียง อำเภอเมืองนครราชสีมา จังหวัดนครราชสีมา โทรศัพท์ ๐ ๔๔๓๗ ๕๙๙๐

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว รับแจ้งการเปลี่ยนแปลงบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน และให้ท่านยื่นคำขอแจ้งการมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงานครั้งต่อไป ภายในวันที่ ๘ พฤษภาคม ๒๕๖๘ โดยมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ดังนี้

ผู้จัดการสิ่งแวดล้อม			นายวิเชียร นามสนธ์		
ลำดับ	ผู้ควบคุมระบบบำบัด	เลขทะเบียน	มลพิษน้ำ	มลพิษอากาศ	มลพิษกากอุตสาหกรรม
๑	นายศรัญยู สมศิริตระกูล	๐๒๐-๕๖-๐๐๑๓๔		✓	

ลำดับ	ผู้ปฏิบัติงานประจำระบบบำบัด	มลพิษน้ำ	มลพิษอากาศ	มลพิษกากอุตสาหกรรม
๑	นายสุริยา สีดำ		✓	
๒	นายอรรฆย์ ลาน้ำเที่ยง		✓	
๓	นายณัฏฐนนท์ ประสิทธิสาร		✓	

หมายเหตุ ๑. การแจ้งการมี/ยกเลิก/เพิ่มเติม/เปลี่ยนแปลง บุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ต้องส่งหนังสือฉบับนี้ด้วย
๒. ยกเลิกหนังสือรับแจ้งการมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ที่ อก ๐๓๑๓/๒๗๖๐ ลงวันที่ ๓ มีนาคม ๒๕๖๕

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(นายวโรศักดิ์ สันติวราคม)
วิศวกรชำนาญการพิเศษ รักษาราชการแทน
ผู้อำนวยการกองส่งเสริมเทคโนโลยีสิ่งแวดล้อมโรงงาน
ปฏิบัติราชการแทน อธิบดีกรมโรงงานอุตสาหกรรม

กองส่งเสริมเทคโนโลยีสิ่งแวดล้อมโรงงาน
กลุ่มกำกับบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน
โทรศัพท์ ๐ ๒๔๓๐ ๖๓๑๕ ต่อ ๒๔๐๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๕ ต่อ ๒๔๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

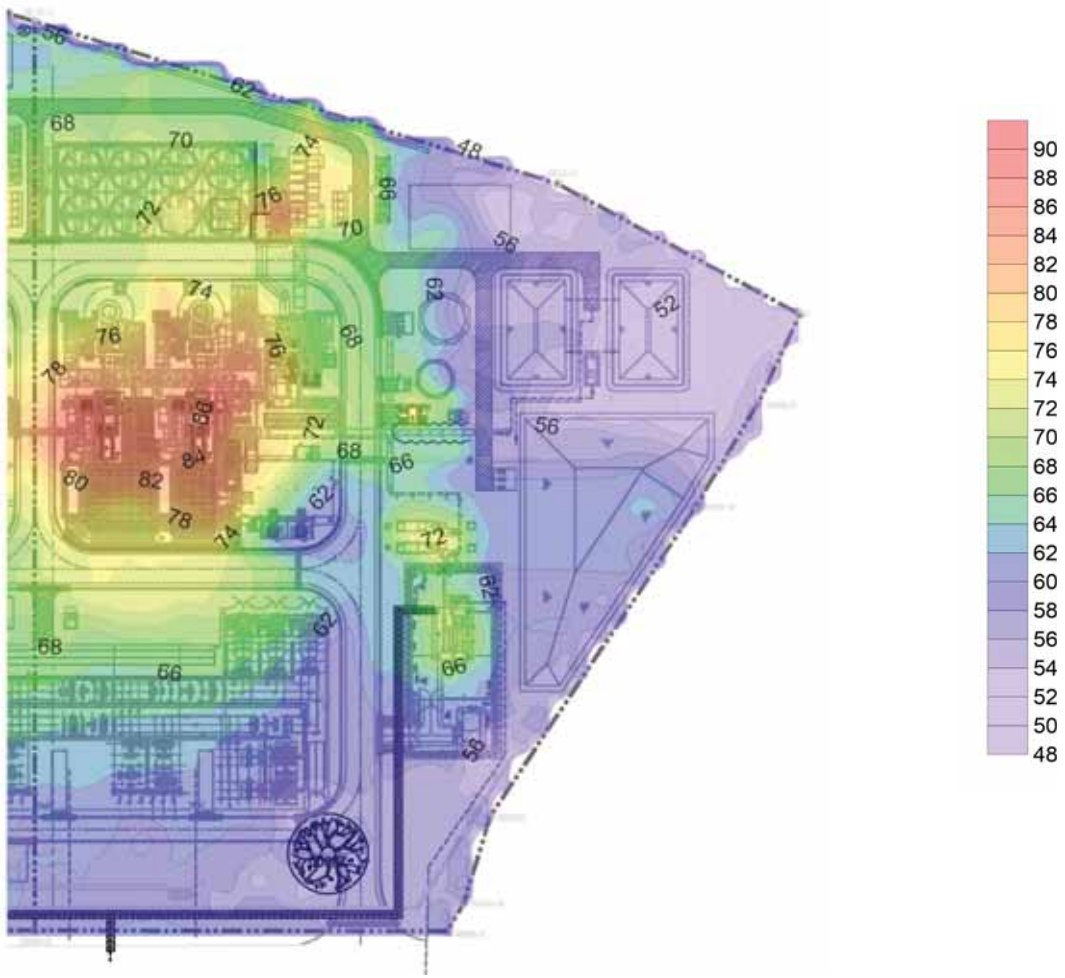
ภาคผนวก ข-13

แผนผังเส้นเสียง (Noise Contour)

Noise Contour Map

Gulf NRV2 Co., Ltd.

Reference Number: 2295772
Measurement Date: September 6, 2022



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ภาคผนวก ข-14

เอกสารข้อมูลจำเพาะของเครื่องจักรและอุปกรณ์ที่มีเสียงดัง

GUARANTEE On Peak
PROJECT: GULF NEW SPPS-CAT052900
LOCATION: THAILAND

KW AT GEN TERMS 47790

(KJ/KW-HR, LHV) 9136

Zhang, Meng
Performance Engineer
Date: 10/28/14

EMISSIONS ARE VALID FOR T2 WITHIN 41°F-140°F AND A GTG LOAD DOWN TO 66.5 % AS DEFINED IN STEADY STATE CONDITIONS FOR EMISSIONS GUARANTEE

NOX: 25 PPMVD AT 15% O2

CO: 690 PPMVD AT 7% O2

PM10: 30 mg/Nm3 AT 7% O2
dry condition 0 deg °C, 760 mmHg

EXHAUST ENERGY: 105606 BTU/S (REF 0°R)/111421 KJ/S (REF 0°K)
EXHAUST TEMP: 947.5 °F (508.6°C)

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 03/31/15

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LM6000PF+ DLE GAS TURBINE
FUEL:	20038Btu/lb / (46608 kJ/kg) LHV, GAS FUEL (#900-3838)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	SITE FUEL TEMPERATURE OF 130.0°F(54.5°C)
GENERATOR:	BDAX 72-340ERH (EffCurv#: 32743; CapCurve# : 34511)
GENERATOR OUTPUT	11kV, 50 Hz
POWER FACTOR:	0.8
AMBIENT TEMP:	89.6°F / (32.0°C)
AMBIENT RH:	78.0%
INLET CONDITIONING:	NONE
ALTITUDE:	89.2ft / (27.2m)
INLET FILTER LOSS:	5.00 inH_2O / (127.0 mmH_2O)
EXHAUST LOSS:	10.00 inH_2O / (254.0 mmH_2O)
NOX CONTROL:	DLE
SPRINT WATER FLOW:	NOT TO EXCEED 17 GPM
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE POWER & WATER SGTGPTM
NOX:	EPA METHOD 20
CO:	EPA METHOD 10
PM10:	EPA METHOD 5 / 202

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

GE POWER & WATER

GUARANTEE On Peak
PROJECT: GULF NEW SPPS-CAT052900
LOCATION: THAILAND

KW AT GEN TERMS 47790

(KJ/KW-HR, LHV) 9136

Zhang, Meng
Performance Engineer
Date: 10/28/14

NEAR FIELD NOISE:
85 DB(A) ARITHMETIC AVERAGE SOUND PRESSURE LEVEL (dB REF 20 MICROPASCALS, RMS) OF LOCATIONS AROUND THE PACKAGE (VERTICAL DISTANCE OF 5FT. (1.5M) ABOVE PACKAGE BASE AT A HORIZONTAL DISTANCE OF 3FT. (1M) FROM THE EXTERIOR PLANE OF EQUIPMENT AS TESTED IN A FREE-FIELD CONDITION OVER A HARD REFLECTING GROUND PLANE, OPERATING AT BASE LOAD)

EXHAUST ENERGY: 105606 BTU/S (REF 0°R)/111421 KJ/S (REF 0°K)
EXHAUST TEMP: 947.5 °F (508.6°C)

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 03/31/15

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LM6000PF+ DLE GAS TURBINE
FUEL:	20038Btu/lb / (46608 kJ/kg) LHV, GAS FUEL (#900-3838)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	SITE FUEL TEMPERATURE OF 130.0°F(54.5°C)
GENERATOR:	BDAX 72-340ERH (EffCurv#: 32743; CapCurve# : 34511)
GENERATOR OUTPUT	11kV, 50 Hz
POWER FACTOR:	0.8
AMBIENT TEMP:	89.6°F / (32.0°C)
AMBIENT RH:	78.0%
INLET CONDITIONING:	NONE
ALTITUDE:	89.2ft / (27.2m)
INLET FILTER LOSS:	5.00 inH_2O / (127.0 mmH_2O)
EXHAUST LOSS:	10.00 inH_2O / (254.0 mmH_2O)
NOX CONTROL:	DLE
SPRINT WATER FLOW:	NOT TO EXCEED 17 GPM
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE POWER & WATER SGTGPTM
NOX:	EPA METHOD 20
CO:	EPA METHOD 10
PM10:	EPA METHOD 5 / 202

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

Performance

Group-5b: One(1) plant with GE LM 6000 PF+ Gas Turbines
Net Electric output - 120MW

ALSTOM	Title: Guarantee of Steam Turbine/Generator						
	Date: 2014-11-19	Register No.: -	Doc. type: CD	Language: EN	Revision: -	Page: 1/7	Doc. No.: 2BSS140291

1. Subject of guarantee

These guarantees refer to Steam Turbine/Generator (STG) as defined in the scope section of this proposal:

- STG Gross Electrical Power Output
- STG Gross Heat Rate
- Process Steam Parameters
- Auxiliary Power Consumption
- Noise level

2. STG gross electrical power output

The Supplier guarantees that STG gross electrical power output, at the generator terminals will not be less than:

P_{EL} = 31869 kW
in operating point "Peak – Max Process Steam Flow"- GLF_5B_1121, sheet 1 of 4,

P_{EL} = 26860 kW
in operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4.

The above guaranteed value of gross electrical power output is given under conditions stated in paragraph 7 and are valid with the operating conditions defined at paragraph 8 and taking into account test tolerance equal to test uncertainty.

3. STG gross heat rate

The Supplier guarantees that STG heat rate (excitation losses taken into account) will not be higher than:

HR = 11928 kJ/kWh
in operating point "Peak – Max Process Steam Flow"- GLF_5B_1121, sheet 1 of 4,

HR = 11379 kJ/kWh
in operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4.

The above guaranteed values for gross STG heat rate are given under conditions stated in paragraph 7 and are valid with the operating conditions defined at paragraph 8 and taking into account test tolerance equal to test uncertainty.

The value of heat rate will be determined as follows:

HR = 3600 * (LS"Q" + SS."Q" – FW"Q" – PE."Q") / (GTerminals."P_EL")

Where:

LS"Q" – [Live steam mass flow at inlet to the turbine] * [Live steam enthalpy at inlet to the turbine]

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SS"Q" – [Second steam mass flow at inlet to the turbine] * [Second steam enthalpy at inlet to the turbine]

FW"Q" – [Condensate mass flow after GSC] * [Feed water enthalpy after GSC]

PE."Q" – [Process steam extraction mass flow after pressure and temperature adjustment] * [Process steam enthalpy after pressure and temperature adjustment]

GTerminals."P_EL" – electric power output at generator terminals

4. Process Steam Parameters

The Supplier guarantees that Process Steam downstream of Temperature and Pressure Control System would have the following parameters:

Process Extraction		Case 1	Case 2
Steam Mass Flow	[kg/s]	2.778	2.778
Steam Pressure	[bar a]	17	17
Steam Temperature	[degC]	212	212

- Case 1 – operating point "Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 1 of 4
- Case 2 – operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4

The above guaranteed values are given under conditions stated in paragraph 7 and are valid with the operating conditions defined at paragraph 8 and taking into account test tolerance equal to test uncertainty.

5. Auxiliary Electric Power Consumption

The Supplier guarantees that the electrical power consumption of the equipment delivered by Alstom will be not more than the value given below:

$$\sum P_{EL_AUX} \leq 30 \text{ kW}$$

The guaranteed value refers to operation in normal, continuous operating conditions of the steam turbine and in particular in guaranteed operational case "Peak – Max Process Steam Flow". Only mandatory equipment shall be operated during the auxiliary power consumption measurement. List of equipment (in Alstom scope) considered mandatory for operation of the STG in normal conditions:

- Control oil pump
- Oil Mist Eliminator Fan
- Turbine control cubicles

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- Turbine actuators panel
- Generator cubicles
- Gland Steam Condenser Fan
- Control Oil Cooler Unit

6. STG noise level

The Supplier guarantees the following sound pressure levels of the equipment.

1) The A-weighted surface sound pressure level averaged over the measurement surface according to ISO 3746 at a distance of 1 m from the equipment of Alstom's scope of supply or its acoustical enclosure and 1.5 m above ground level or personnel platforms, which need to be accessed during normal operation, will not exceed 85 dB(A).

   Exclusions

   Excluded from the noise level guarantee are operation modes such as:

   - Steam turbine bypass operation - with exception related to the bypass valves only as per clause 2);
   - Start up and shut down of the plant;
   - Construction, erection and commissioning;
   - Drain valves in operation;
   - Safety valves in operation;
   - Equipment failures and unit trip.

2) The A-weighted surface sound pressure level averaged over the measurement surface according to ISO 3746 at a distance of 1 m from the turbine bypass valves of Alstom's scope of supply and 1.5 m above ground level or personnel platforms, which need to be accessed during normal operation, with only one bypass in operation at a time will not exceed 95 dB(A).

Measurement uncertainty, correction for background, environmental noise and for noise from equipment outside Alstom's scope of supply shall be considered.

During the measurements, the plant shall be after successful erection and commissioning and should be in steady operating conditions.

The noise test shall be conducted by the Purchaser as per the relevant noise test procedure which shall be submitted to the Purchaser in a later stage.

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7. Guarantee conditions

The Supplier guarantees the STG gross electrical power output and gross heat rate as per paragraphs 2 and 3 under the following conditions:

7.1. The test of the guaranteed values will be performed according to ASME PTC6s and Technical Conditions for Performance Tests (paragraph 10), by the Institution accepted by both parties and at the presence and participation of the Supplier's representatives.

7.2. The performance test will be performed not later than three months after the turbine is first put into initial operation (commissioning) under load. Ageing according to ASME PTC 6 Report -1985 (edition 1986) or Bench Mark tests (which will commence as soon as possible after first steam admission when the conditions are stable and will confirm real degradation), whatever is higher will be applied before comparison with the guarantees. The Supplier reserves the rights to receive performance test report as soon as it is worked out.

7.3. During the performance tests, the turbine will be operating according to basic thermal diagram without any additional extractions or feed of steam and / or water.

7.4. For performance comparison purposes the guarantee conditions given in Table 1, paragraph 8 "Guarantee operation conditions", will be taken as reference.

7.5. Flow measurements will be performed with the flow meters that conform to ASME PTC6s test accuracy.

7.6. Steam quality has to be ensured according to Alstom Steam Purity Requirements HTGD 90486V0001G (attached to the technical offer). Steam quality test results will be recorded and handed over to ALSTOM for checking. Additionally steam cleanness checking during boiler and steam lines blowing out is required for supervision and approval of ALSTOM inspectors before turbine initial start-up. During performance test no deposits on blading system are allowed.

7.7. All measuring instruments shall be examined just before and after the acceptance test to check their condition and that they are of the correct size and comply in other respects with the appropriate Standards. The equipment applied during the test shall possess valid certificates of calibration. The measurements are to be taken in such a range so the guaranteed values could be estimated with proper accuracy.

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7.8. The institution performing the performance tests should assess actual test uncertainty for gross electric power output and gross heat rate. Test tolerances equal to test uncertainties will apply to the measured and corrected values of gross electric power output and heat rate before comparison with the guarantee value given in paragraphs 2 and 3 of this document.

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8. Guarantee operation conditions

During the guarantee tests the following conditions of operation are to be maintained as in the table given below.

Case 1 – operating point "Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 1 of 4

Case 2 – operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4

Table 1

Item	Guarantee operation condition			
1	**Load Case**		**Case 1**	**Case 2**
2	**All Control Valves Fully Open**			
3	**Live Steam at STG inlet**			
3.1	Mass Flow	[kg/s]	30.489	27.516
3.2	Pressure	[bar a]	60.000	54.023
3.3	Temperature	[degC]	469.8	470.0
4	**Second Steam Admission**			
4.1	Mass Flow	[kg/s]	6.522	1.983
4.2	Pressure	[bar a]	6.000	4.492
4.3	Temperature	[degC]	239.8	242.9
5	**Process Extraction**			
5.1	Steam Mass Flow after Attemperation and Pressure Control	[kg/s]	2.778	2.778
5.2	Steam Pressure after Attemperation and Pressure Control	[bar a]	17.0	17.0
5.3	Steam Temperature after Attemperation and Pressure Control	[degC]	212.0	212.0
5.4	Enthalpy of Cooling Water to LP Process Steam Attemperation	[kJ/kg]	228.7	205.4
5.5	Total pressure drop (flow resistance) on the line: from the active turbine extraction nozzle to the point downstream of the Temperature and Pressure Control System with all valves on this line fully open (no additional throttling) not larger than:	[%]	5.02 *)	5.15 *)
6	**ST Exhaust Pressure**			
6.1	Pressure at Steam Turbine Exhaust	[bar a]	0.149	0.113
7	**Feed water**			
7.1	Feed water Enthalpy after Gland Steam Condenser	[kJ/kg]	230.5	207.7
8	**Generator**			
8.1	Voltage	[kV]	11	11
8.2	Cos Φ	[-]	0.85	0.85
8.3	Generator cooling water temperature	[degC]	36.4	36.4

*) - If the flow resistance is lower than specified in this Table 1 then throttling operation of the extraction pressure control valve in this line is necessary in order to adjust the extraction steam pressure to the value quoted in Item 5.2 of Table 1.

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9. Correction method of deviations from test performance conditions of operation

If any deviations of the reference conditions from their nominal values given in Table 1, will be stated during the performance tests, STG gross electrical power output will be converted to guarantee conditions using correction curves or by heat balances supplied by Alstom.

10. Regulations and instructions obligatory during measurements

In case of any doubts concerning method of performance test execution or test results processing, the procedures included in the test standard will be applied.

During performance tests following regulations will be applied:

10.1. GENERAL REGULATIONS.

10.1.1. ASME Steam Table for Industrial Use Based on IAPWS-97.

10.1.2. Performance Test Code 6 on steam turbines- ASME PTC 6s

10.1.3. Guidance for evaluation of measurement uncertainty in performance tests of steam turbines - ASME PTC 6 Report - 1985 (edition 1986)

10.2. DETAILED INSTRUCTIONS AND DIAGRAMS.

10.2.1. Correction Curves: [1])

10.2.2. Technical Conditions for Performance Tests. [1])

[1]) Supplier will supply these documents as per document schedule

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The approval or deemed approval of drawings and documents by Owner shall not relieve Contractor/Suppliers of any of its obligations or liabilities under the Construction/Supply Contract.

POYRY ENERGY LTD.
Document Submission Approval

APPROVED Approved without exception	AP X
APPROVED WITH COMMENTS Approved subject to incorporation of comments	AWC
NOT APPROVED Insufficient information/detail Resubmit for Approval	NAP
REJECTED Complete redesign required	REJ

Note. Approval or does not relieve Vendor/Sub-Contractor of any obligations covered under contract

Engineer: Andrew Lattimore

Discipline:

Date: 08-Dec-2016

THERMAL DOCUMENTATION

Purchaser: TEC Project Services Corporation

Owner: Gulf MP Company Limited

Project Name: (GNC) Gulf SPP3

N/E Project Number: 150200

N/E Project Manager: Nathan Morton/ David Godfrey

The following Nooter/Eriksen and/or sub-supplier documents are included with this cover sheet:

Rev. No.	No. Of Sheets	Document Description	Rev Date
B	13	Revision: See Thermal Performance Metric Data Sheets	12-Oct-2016

NOOTER/ERIKSEN

(Internal Use Only)

Project: Gulf SPP 3	Job No.-Code-Sheet	Release Date	OM	FE
N/E Drawing No.	150200-TD-TRK001	17-Oct-2016		

Document Number for Applicable Project:

NE-GNC-002-M-032-018	NE-GRNV1-002-M-032-018	NE-GNRV2-002-M-032-018

Cc: Nathan Morton

Original Document Returned To Project Manager: Landon Relph

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NOOTER/ERIKSEN — **CASE 1 - Group 3b - Peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service
End User: Gulf Energy Development Company Limited
Plant Site: Thailand
Plant Name: LM6000 sites
Turbine: 6x LM6000 PF+
Proposal No: 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	470,880	-	470,880	470,880	470,880	470,880	470,880	403,847
3	Gas Δ P	mm WC	16.5	-	17.6	85.0	2.0	45.0	38.0	39.6
4	Inlet Temperature	°C	507.0	-	506.4	449.1	290.2	286.2	231.7	175.7
5	Outlet Temperature	°C	506.4	-	449.1	290.2	286.2	231.7	175.7	118.3
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	8,700/-	23,600/-	600/-	7,900/-	8,000/-	7,000/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	54,887	54,887	54,887	11,692	54,887	11,692	54,887
11	Inlet Pressure	Bar(a)	-	(7) 61.80	66.29	66.29	6.83	71.11	6.83	(1) 75.43 B
12	Outlet Pressure	Bar(a)	-	61.80	61.80	66.29	6.36	66.29	6.83	71.11
13	Fluid Δ P	Bar	-	-	3.11	-	0.09	3.08	-	4.33
14	Valve/Piping Δ P	Bar	-	-	(6) 1.38 B	-	0.38	1.73	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 0	-	-	-	(3) -1,936	-
16	Add./Extract Temp.	°C	-	-	282.2	-	-	-	164.0	-
17	Outlet Temperature	°C	-	471.9	471.9	282.2	242.0	279.9	164.0	169.6
18	Inlet Temperature	°C	-	471.9	282.2	279.9	164.0	169.6	155.2	62.2
19	Heat Absorbed	KW	-	-	8,800	23,500	600	7,800	8,000	6,900
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	67,033	-	-	-	-	470,880		
24	Gas Δ P	mm WC	39.6	-	-	-	-	5.8		
25	Inlet Temperature	°C	175.7	-	-	-	-	115.8		
26	Outlet Temperature	°C	101.1	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	1,500/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	13,627	72	68,515	66,650	66,650	-		
32	Inlet Pressure	Bar(a)	(1) 19.18	1.35	2.07	2.03	(5) 2.03 B	-		
33	Outlet Pressure	Bar(a)	6.83	1.35	1.33	1.35	2.03	-		
34	Fluid Δ P	Bar	9.95	-	0.74	0.67	-	-		
35	Valve/Piping Δ P	Bar	2.40	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	155.2	108.3	61.7	93.0	45.0	-		
39	Inlet Temperature	°C	61.9	108.3	108.3	45.0	45.0	-		
40	Heat Absorbed	KW	1,500	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 249.5 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol): N2 = 71.96 , O2 = 12.78 , CO2 = 3.38 , H2O = 11.02 , Ar = 0.86 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
B	5/11/2015	Revision to notes	LAR	DLS
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JOB DATA SHEET N/E FORM TD.005 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: AM01 | REVISION: B
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NOOTER/ERIKSEN — **CASE 2 - Group 3b - Off-peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service
End User: Gulf Energy Development Company Limited
Plant Site: Thailand
Plant Name: LM6000 sites
Turbine: 6x LM6000 PF+
Proposal No: 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	344,520	-	344,520	344,520	344,520	344,520	344,520	296,352
3	Gas Δ P	mm WC	9.5	-	10.8	47.9	1.1	24.6	20.4	21.3
4	Inlet Temperature	°C	558.0	-	557.1	486.9	280.4	276.8	206.4	158.8
5	Outlet Temperature	°C	557.1	-	486.9	280.4	276.8	206.4	158.8	98.1
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	7,900/-	22,400/-	400/-	7,400/-	4,900/-	5,400/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	49,535	39,874	49,535	6,680	49,535	6,680	49,535
11	Inlet Pressure	Bar(a)	-	(7) 55.43	58.38	58.38	4.92	62.17	4.92	(1) 65.68 B
12	Outlet Pressure	Bar(a)	-	55.43	55.43	58.38	4.70	58.38	4.92	62.17
13	Fluid Δ P	Bar	-	-	2.05	-	0.05	2.42	-	3.51
14	Valve/Piping Δ P	Bar	-	-	(6) 0.90 B	-	0.17	1.37	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 9,661	-	-	-	(3) -1,642	-
16	Add./Extract Temp.	°C	-	-	273.8	-	-	-	151.2	-
17	Outlet Temperature	°C	-	472.0	472.0	273.8	244.2	267.0	151.2	150.1
18	Inlet Temperature	°C	-	472.0	273.8	267.0	151.2	150.1	149.0	58.3
19	Heat Absorbed	KW	-	-	7,900	22,200	400	7,300	4,900	5,300
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	48,168	-	-	-	-	344,520		
24	Gas Δ P	mm WC	21.3	-	-	-	-	0.1		
25	Inlet Temperature	°C	158.8	-	-	-	-	97.9		
26	Outlet Temperature	°C	96.4	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	900/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	8,321	58	57,857	56,272	56,272	-		
32	Inlet Pressure	Bar(a)	(1) 9.57	1.35	2.07	1.92	(5) 1.92 B	-		
33	Outlet Pressure	Bar(a)	4.92	1.35	1.44	1.35	1.92	-		
34	Fluid Δ P	Bar	3.76	-	0.62	0.57	-	-		
35	Valve/Piping Δ P	Bar	0.89	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	149.0	108.3	57.8	93.0	41.0	-		
39	Inlet Temperature	°C	57.9	108.3	108.3	41.0	41.0	-		
40	Heat Absorbed	KW	900	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 135.8 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 72.88 , O2 = 13.21 , CO2 = 3.29 , H2O = 9.76 , Ar = 0.87 , SO2 = 0.00

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NOOTER/ERIKSEN — **CASE 3 - Group 4b - Peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service
End User: Gulf Energy Development Company Limited
Plant Site: Thailand
Plant Name: LM6000 sites
Turbine: 6x LM6000 PF+
Proposal No: 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	470,880	-	470,880	470,880	470,880	470,880	470,880	403,866
3	Gas Δ P	mm WC	16.5	-	17.6	85.0	2.0	45.0	38.0	39.7
4	Inlet Temperature	°C	507.0	-	506.4	449.1	290.2	286.2	231.8	175.7
5	Outlet Temperature	°C	506.4	-	449.1	290.2	286.2	231.8	175.7	119.3
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	8,700/-	23,600/-	600/-	7,900/-	8,000/-	6,800/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	54,888	54,888	54,888	11,708	54,888	11,708	54,888
11	Inlet Pressure	Bar(a)	-	(7) 61.80	66.29	66.29	6.83	71.11	6.83	(1) 75.44 B
12	Outlet Pressure	Bar(a)	-	61.80	61.80	66.29	6.36	66.29	6.83	71.11
13	Fluid Δ P	Bar	-	-	3.11	-	0.09	3.08	-	4.33
14	Valve/Piping Δ P	Bar	-	-	(6) 1.38 B	-	0.38	1.73	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 0	-	-	-	(3) -1,936	-
16	Add./Extract Temp.	°C	-	-	282.2	-	-	-	164.0	-
17	Outlet Temperature	°C	-	471.9	471.9	282.2	242.0	279.9	164.0	169.8
18	Inlet Temperature	°C	-	471.9	282.2	279.9	164.0	169.8	155.5	64.2
19	Heat Absorbed	KW	-	-	8,800	23,500	600	7,800	8,000	6,800
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	67,014	-	-	-	-	470,880		
24	Gas Δ P	mm WC	39.7	-	-	-	-	5.7		
25	Inlet Temperature	°C	175.7	-	-	-	-	116.8		
26	Outlet Temperature	°C	102.3	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	1,500/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	13,644	72	68,531	66,667	66,667	-		
32	Inlet Pressure	Bar(a)	(1) 19.21	1.35	2.07	2.03	(5) 2.03 B	-		
33	Outlet Pressure	Bar(a)	6.83	1.35	1.33	1.35	2.03	-		
34	Fluid Δ P	Bar	9.97	-	0.74	0.67	-	-		
35	Valve/Piping Δ P	Bar	2.40	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	155.5	108.3	63.7	93.0	47.0	-		
39	Inlet Temperature	°C	63.8	108.3	108.3	47.0	47.0	-		
40	Heat Absorbed	KW	1,500	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 249.5 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 71.96 , O2 = 12.78 , CO2 = 3.38 , H2O = 11.02 , Ar = 0.86 , SO2 = 0.00

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NOOTER/ERIKSEN **CASE 4 - Group 4b - Off-peak Condition** **THERMAL PERFORMANCE**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	344,520	-	344,520	344,520	344,520	344,520	344,520	296,355
3	Gas Δ P	mm WC	9.5	-	10.8	48.0	1.1	24.7	20.5	21.3
4	Inlet Temperature	°C	558.0	-	557.1	486.9	280.8	277.2	207.0	159.5
5	Outlet Temperature	°C	557.1	-	486.9	280.8	277.2	207.0	159.5	99.0
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	7,900/-	22,300/-	400/-	7,400/-	4,900/-	5,300/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	49,525	39,859	49,525	6,669	49,525	6,669	49,525
11	Inlet Pressure	Bar(a)	-	(7) 55.85	58.77	58.77	5.01	62.57	5.01	(1) 66.08 B
12	Outlet Pressure	Bar(a)	-	55.85	55.85	58.77	4.80	58.77	5.01	62.57
13	Fluid Δ P	Bar	-	-	2.03	-	0.04	2.42	-	3.51
14	Valve/Piping Δ P	Bar	-	-	(6) 0.89 B	-	0.17	1.37	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 9,666	-	-	-	(3) -1,641	-
16	Add./Extract Temp.	°C	-	-	274.2	-	-	-	151.9	-
17	Outlet Temperature	°C	-	472.0	472.0	274.2	244.7	267.4	151.9	150.9
18	Inlet Temperature	°C	-	472.0	274.2	267.4	151.9	150.9	149.7	59.3
19	Heat Absorbed	KW	-	-	7,900	22,200	400	7,300	4,900	5,300
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	48,165	-	-	-	-	344,520		
24	Gas Δ P	mm WC	21.3	-	-	-	-	0.1		
25	Inlet Temperature	°C	159.5	-	-	-	-	98.8		
26	Outlet Temperature	°C	97.4	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	900/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	8,309	58	57,834	56,251	56,251	-		
32	Inlet Pressure	Bar(a)	(1) 9.65	1.35	2.07	1.92	(5) 1.92 B	-		
33	Outlet Pressure	Bar(a)	5.01	1.35	1.44	1.35	1.92	-		
34	Fluid Δ P	Bar	3.75	-	0.62	0.57	-	-		
35	Valve/Piping Δ P	Bar	0.89	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	149.7	108.3	58.8	93.0	42.0	-		
39	Inlet Temperature	°C	58.9	108.3	108.3	42.0	42.0	-		
40	Heat Absorbed	KW	900	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 135.9 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 72.88 , O2 = 13.21 , CO2 = 3.29 , H2O = 9.76 , Ar = 0.87 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
B	5/11/2015	Revision to notes	LAR	DLS
A	2/18/2015	INITIAL RELEASE	LAR	DLS

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REV. 7 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOOTER/ERIKSEN **CASE 5 - Group 5b - Peak Condition** **THERMAL PERFORMANCE**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	470,880	-	470,880	470,880	470,880	470,880	470,880	403,914
3	Gas Δ P	mm WC	16.5	-	17.6	85.0	2.0	45.1	38.0	39.8
4	Inlet Temperature	°C	507.0	-	506.4	449.1	290.2	286.2	231.9	175.7
5	Outlet Temperature	°C	506.4	-	449.1	290.2	286.2	231.9	175.7	121.7
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	8,700/-	23,600/-	600/-	7,900/-	8,000/-	6,600/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	54,888	54,888	54,888	11,748	54,888	11,748	54,888
11	Inlet Pressure	Bar(a)	-	(7) 61.80	66.29	66.29	6.84	71.11	6.84	(1) 75.44 B
12	Outlet Pressure	Bar(a)	-	61.80	61.80	66.29	6.36	66.29	6.84	71.11
13	Fluid Δ P	Bar	-	-	3.11	-	0.10	3.08	-	4.33
14	Valve/Piping Δ P	Bar	-	-	(6) 1.38 B	-	0.38	1.73	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 0	-	-	-	(3) -1,938	-
16	Add./Extract Temp.	°C	-	-	282.2	-	-	-	164.0	-
17	Outlet Temperature	°C	-	471.9	471.9	282.2	241.9	279.9	164.0	170.0
18	Inlet Temperature	°C	-	471.9	282.2	279.9	164.0	170.0	156.2	69.1
19	Heat Absorbed	KW	-	-	8,800	23,500	600	7,800	8,000	6,500
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	66,966	-	-	-	-	470,880		
24	Gas Δ P	mm WC	39.8	-	-	-	-	5.6		
25	Inlet Temperature	°C	175.7	-	-	-	-	119.4		
26	Outlet Temperature	°C	105.3	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	1,400/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	13,686	72	68,574	66,708	66,708	-		
32	Inlet Pressure	Bar(a)	(1) 19.30	1.35	2.07	2.03	(5) 2.03 B	-		
33	Outlet Pressure	Bar(a)	6.84	1.35	1.33	1.35	2.03	-		
34	Fluid Δ P	Bar	10.05	-	0.74	0.67	-	-		
35	Valve/Piping Δ P	Bar	2.42	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	156.2	108.3	68.5	93.0	52.0	-		
39	Inlet Temperature	°C	68.7	108.3	108.3	52.0	52.0	-		
40	Heat Absorbed	KW	1,400	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 249.5 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 71.96 , O2 = 12.78 , CO2 = 3.38 , H2O = 11.02 , Ar = 0.86 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
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NE NOOTER/ERIKSEN — **CASE 6 - Group 5b - Off-peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service — **Plant Site:** Thailand — **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited — **Plant Name:** LM6000 sites — **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	344,520	-	344,520	344,520	344,520	344,520	344,520	296,346
3	Gas Δ P	mm WC	9.5	-	10.8	48.0	1.1	24.7	20.5	21.4
4	Inlet Temperature	°C	558.0	-	557.1	486.9	280.8	277.3	207.2	159.5
5	Outlet Temperature	°C	557.1	-	486.9	280.8	277.3	207.2	159.5	102.0
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	7,900/-	22,300/-	400/-	7,300/-	4,900/-	5,100/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	49,529	39,863	49,529	6,612	49,529	6,612	49,529
11	Inlet Pressure	Bar(a)	-	(7) 55.85	58.77	58.78	5.01	62.57	5.01	(1) 66.08 B
12	Outlet Pressure	Bar(a)	-	55.85	55.85	58.77	4.80	58.78	5.01	62.57
13	Fluid Δ P	Bar	-	-	2.03	-	0.04	2.43	-	3.51
14	Valve/Piping Δ P	Bar	-	-	(6) 0.89 B	-	0.17	1.37	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 9,666	-	-	-	(3) -1,743	-
16	Add./Extract Temp.	°C	-	-	274.2	-	-	-	151.9	-
17	Outlet Temperature	°C	-	472.0	472.0	274.2	245.0	267.4	151.9	151.3
18	Inlet Temperature	°C	-	472.0	274.2	267.4	151.9	151.3	150.1	64.2
19	Heat Absorbed	KW	-	-	7,900	22,200	400	7,300	4,900	5,100
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	48,174	-	-	-	-	344,520		
24	Gas Δ P	mm WC	21.4	-	-	-	-	-0.1		
25	Inlet Temperature	°C	159.5	-	-	-	-	101.7		
26	Outlet Temperature	°C	100.2	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	900/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	8,353	58	57,882	56,198	56,198	-		
32	Inlet Pressure	Bar(a)	(1) 9.70	1.35	2.07	1.92	(5) 1.92 B	-		
33	Outlet Pressure	Bar(a)	5.01	1.35	1.44	1.35	1.92	-		
34	Fluid Δ P	Bar	3.79	-	0.62	0.57	-	-		
35	Valve/Piping Δ P	Bar	0.90	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	150.1	108.3	63.8	92.0	46.0	-		
39	Inlet Temperature	°C	63.8	108.3	108.3	46.0	46.0	-		
40	Heat Absorbed	KW	800	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 135.8 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 72.88 , O2 = 13.21 , CO2 = 3.29 , H2O = 9.76 , Ar = 0.87 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
B	5/11/2015	Revision to notes	LAR	DLS
A	2/18/2015	INITIAL RELEASE	LAR	DLS

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REV. 7 (APPROVED BY: RKG) Date: 4/27/05 OP-101 — HRU Version: 3.1

NE NOOTER/ERIKSEN — **HEATING SURFACE**

Purchaser: TEC Project Service — **Plant Site:** Thailand — **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited — **Plant Name:** LM6000 sites — **Proposal No:** 240405

	Coil		Units (M)	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1	LPECON
2	Area	(31,862)	sq.m.	2,599	8,988	393	6,908	5,483	6,446	1,045
3	MAWP		Bar(a)	(1) 71.68	71.68	9.28	75.47	9.28	80.30	57.00 C
4	Expansion Temperature		°C	573.0	335.0	283.0	296.0	260.0	260.0	260.0
5	Layout/Arrangement			Staggered	Staggered	Staggered	Staggered	Staggered	Staggered	Staggered
6	Tube OD		mm	44.45	38.10	50.80	31.75	38.10	31.75	31.75
7	Effective Fin Length		m.	12.42	12.42	12.42	12.42	12.42	12.42	12.42
8	No. Transverse Sections			27	41	23	42	41	37	6
9	No. of Flow Circuits			27	-	23	21	-	18.5	3
10	Transverse Spacing		mm	111.645	73.981	130.648	72.241	73.981	70.580	70.580
11	No. Longitudinal Rows			6	15	1	13	9	14	14
12	Longitudinal Spacing		mm	120.650	76.200	304.800	76.200	92.075	76.200	76.200
13	No. of Bare Rows			0	0	0	0	0	0	0
14	No. of Finned Rows			6	15	1	13	9	14	14
15	Inlet Top or Bottom			Top	Bottom	Bottom	Top	Bottom	Top	Top
16	Module Number			1	1	2	2	3	3	3
17	Transverse Bundles			1	1	1	1	1	1	1
18	**Design Temp :**	Row 1	°C	573.0						
19		Row 2	°C	562.0						
20		Row 3	°C	544.0						
21		Row 4	°C	519.0						
22		Row 5	°C	480.0						
23		Row 6	°C							
24		All\Remaining Rows	°C	424.0	335.0	283.0	296.0	260.0	260.0	260.0
25	**Minimum Wall :**	Row 1	mm	4.400						
26		Row 2	mm	3.900						
27		Row 3	mm	4.000						
28		Row 4	mm	3.000						
29		Row 5	mm							
30		Row 6	mm							
31		All\Remaining Rows	mm	2.700	2.700	2.700	2.700	2.700	2.700	2.700
32	**Tube Material :**	Row 1		SA-213 T22						
33		Row 2		SA-213 T22						
34		Row 3		SA-213 T11						
35		Row 4		SA-213 T11						
36		Row 5		SA-213 T11						
37		Row 6								
38		All\Remaining Rows		SA-178 A	SA-178 A	SA-178 A	SA-178 A	SA-213 T11	SA-178 A	SA-178 A
39	**Fin Density :**	Row 1	fins/m.							
40		Row 2	fins/m.							
41		Row 3	fins/m.							
42		Row 4	fins/m.							
43		Row 5	fins/m.							
44		Row 6	fins/m.							
45		All\Remaining Rows	fins/m.	255.91	265.75	236.22	270.67	270.67	265.75	265.75
46	**Fin Height :**	Row 1	mm							
47		Row 2	mm							
48		Row 3	mm							
49		Row 4	mm							
50		Row 5	mm							
51		Row 6	mm							
52		All\Remaining Rows	mm	12.7	12.7	12.7	12.7	12.7	12.7	12.7
53	**Fin Thickness :**	Row 1	mm							
54		Row 2	mm							
55		Row 3	mm							
56		Row 4	mm							
57		Row 5	mm							
58		Row 6	mm							
59		All\Remaining Rows	mm	1.0	1.0	1.0	1.0	1.0	1.0	1.0
60	**Fin Segment :**	Row 1	mm	4.501						
61		Row 2	mm	4.501						
62		Row 3	mm	4.501						
63		Row 4	mm	4.501						
64		Row 5	mm	4.501						
65		Row 6	mm							
66		All\Remaining Rows	mm	3.969	3.969	3.969	3.969	3.969	3.969	3.969
67	**Fin Material :**	Row 1		409SS						
68		Row 2		409SS						
69		Row 3		409SS						
70		Row 4		409SS						
71		Row 5		409SS						
72		Row 6								
73		All\Remaining Rows		CS	CS	CS	CS	CS	CS	CS

NO.	DATE	REVISION	BY	CHK
C	9/16/2015	LPECON MAWP	LAR	DLS
B	5/11/2015	Ambient air pressure note	LAR	DLS

JOB DATA SHEET N/E FORM TD.006 Page 1 of 1 — JOB No: 150200 — CODE: TD — SHEET: BM01 — REVISION: C
REV. 7 (APPROVED BY: RKG) Date: 4/27/05 OP-101 — HRU Version: 3.1

NOOTER/ERIKSEN **MECHANICAL**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1	LPECON
2	**INLET HEADERS**									
3	Header #1: Diameter	mm	-	200.0 B	200.0	200.0	250.0 B	200.0	250.0 B	250.0 B
4	Number		-	1	5	1	1	3	1	1
5	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
6	Number		-	-	-	-	-	-	-	-
7	Minimum ID at End of Header	mm	-	131.6	-	204.5	103.4	-	97.5	39.1
8	Minimum ID at Center of Header	mm	-	93.0	-	144.5	72.9	-	69.1	27.7
9	Material		-	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B
10	Design Temperature	°C	-	305.0	291.0	183.0	187.0	183.0	175.0 C	175.0 C
11	Header Location (Top or Bottom)		-	Top	Bottom	Bottom	Top	Bottom	Top	Top
12	**OUTLET HEADERS**									
13	Header #1: Diameter	mm	-	200.0 B	200.0	200.0	250.0 B	250.0	250.0 B	250.0 B
14	Number		-	1	5	1	1	3	1	1
15	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
16	Number		-	-	-	-	-	-	-	-
17	Minimum ID at End of Header	mm	-	118.9	-	215.4	173.0	-	98.8	69.9
18	Minimum ID at Center of Header	mm	-	84.1	-	152.4	122.4	-	39.4	27.9
19	Material		-	SA-335P22	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B
20	Design Temperature	°C	-	567.0	291.0	268.0	297.0	183.0	187.0	187.0
21	Header Location (Top or Bottom)		-	Top	Top	Top	Top	Top	Top	Top
22	**INTERMEDIATE HEADERS**									
23	Header #1: Diameter	mm	-	100.0	-	-	100.0	-	65.0	65.0
24	Number		-	3	-	-	1	-	14	14
25	Header #2: Diameter	mm	-	-	-	-	65.0	-	-	-
26	Number		-	-	-	-	11	-	-	-
27	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
28	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
29	Orifice Quantity		-	-	-	-	21	-	-	-
30	Orifice Diameter	mm	-	-	-	-	12.7	-	-	-
31	Header #1: Material		-	SA-335P22	-	-	SA-106C B	-	SA-106C B	SA-106C B
32	Design Temperature	°C	-	552.0	-	-	297.0	-	187.0	187.0
33	Header #2: Material		-	SA-335P11	-	-	SA-106C B	-	-	-
34	Design Temperature	°C	-	494.0	-	-	297.0	-	-	-
35	Header #3: Material		-	SA-106C B	-	-	-	-	-	-
36	Design Temperature	°C	-	372.0	-	-	-	-	-	-
37	Header #4: Material		-	-	-	-	-	-	-	-
38	Design Temperature	°C	-	-	-	-	-	-	-	-
39	Remaining: Material		-	-	-	-	-	-	-	-
40	Design Temperature	°C	-	-	-	-	-	-	-	-
41	**CASING & INSULATION**									
42	Average Casing Temperature	°C	(1) 60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
43	Casing Design Pressure (Max)	mm WC	(3) 508.0 B	508.0	508.0	508.0	508.0	508.0	508.0	508.0
44	Casing Design Pressure (Min)	mm WC	0	0	0	0	0	0	0	0
45	Casing Thickness	mm	6.4 B	6.4	6.4	6.4	6.4	6.4	6.4	6.4
46	Hot Insulation (Hot)	mm	139.7	139.7	139.7	50.8	50.8	50.8	50.8	50.8
47	Cold Insulation (Cold)	mm	-	-	-	-	-	-	-	-
48	Gas Path Design Temperature	°C	626.0	626.0	552.0	346.0	342.0	288.0	232.0	232.0
49	Liner Material		(2) 409 SS	409 SS	409 SS	409 SS	409 SS	409 SS	409 SS	409 SS
50	Liner Thickness (Wall)	Gauge	12	16	16	16	16	16	16	16
51	Liner Thickness (Roof)	Gauge	12	16	16	16	16	16	16	16
52	Liner Thickness (Floor)	Gauge	12	16	16	16	16	16	16	16
53	**BAFFLES & SUPPORTS**									
54	Number of Acoustic Baffles		-	0	1	0	1	1	1	1
55	Tubes Between Acoustic Baffles		-	29	26	39	32	33	34	34
56	Min. Number of Vibration Supports		-	2	3	2	2	2	2	2
57	Max. Span Between Center Supp	m.	-	4.44	3.79	4.44	4.70	4.27	4.90	4.90

NO.	DATE	REVISION	BY	CHK
C	9/16/2015	HPECON1 & LPECON Inlet Header Design Temp.	LAR	DLS
B	5/11/2015	General revision	LAR	LAR

JOB DATA SHEET N/E FORM TD.007 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: CM01 | REVISION: C
REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOOTER/ERIKSEN **MECHANICAL**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Stack							
2	**INLET HEADERS**									
3	Header #1: Diameter	mm	-	-	-	-	-	-	-	-
4	Number		-	-	-	-	-	-	-	-
5	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
6	Number		-	-	-	-	-	-	-	-
7	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
8	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
9	Material		-	-	-	-	-	-	-	-
10	Design Temperature	°C	-	-	-	-	-	-	-	-
11	Header Location (Top or Bottom)		-	-	-	-	-	-	-	-
12	**OUTLET HEADERS**									
13	Header #1: Diameter	mm	-	-	-	-	-	-	-	-
14	Number		-	-	-	-	-	-	-	-
15	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
16	Number		-	-	-	-	-	-	-	-
17	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
18	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
19	Material		-	-	-	-	-	-	-	-
20	Design Temperature	°C	-	-	-	-	-	-	-	-
21	Header Location (Top or Bottom)		-	-	-	-	-	-	-	-
22	**INTERMEDIATE HEADERS**									
23	Header #1: Diameter	mm	-	-	-	-	-	-	-	-
24	Number		-	-	-	-	-	-	-	-
25	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
26	Number		-	-	-	-	-	-	-	-
27	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
28	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
29	Orifice Quantity		-	-	-	-	-	-	-	-
30	Orifice Diameter	mm	-	-	-	-	-	-	-	-
31	Header #1: Material		-	-	-	-	-	-	-	-
32	Design Temperature	°C	-	-	-	-	-	-	-	-
33	Header #2: Material		-	-	-	-	-	-	-	-
34	Design Temperature	°C	-	-	-	-	-	-	-	-
35	Header #3: Material		-	-	-	-	-	-	-	-
36	Design Temperature	°C	-	-	-	-	-	-	-	-
37	Header #4: Material		-	-	-	-	-	-	-	-
38	Design Temperature	°C	-	-	-	-	-	-	-	-
39	Remaining: Material		-	-	-	-	-	-	-	-
40	Design Temperature	°C	-	-	-	-	-	-	-	-
41	**CASING & INSULATION**									
42	Average Casing Temperature	°C	-	-	-	-	-	-	-	-
43	Casing Design Pressure (Max)	mm WC	50.8	-	-	-	-	-	-	-
44	Casing Design Pressure (Min)	mm WC	0	-	-	-	-	-	-	-
45	Casing Thickness	mm	6.4	-	-	-	-	-	-	-
46	Hot Insulation (Hot)	mm	-	-	-	-	-	-	-	-
47	Cold Insulation (Cold)	mm	-	-	-	-	-	-	-	-
48	Gas Path Design Temperature	°C	130.0	-	-	-	-	-	-	-
49	Liner Material		-	-	-	-	-	-	-	-
50	Liner Thickness (Wall)	Gauge	-	-	-	-	-	-	-	-
51	Liner Thickness (Roof)	Gauge	-	-	-	-	-	-	-	-
52	Liner Thickness (Floor)	Gauge	-	-	-	-	-	-	-	-
53	**BAFFLES & SUPPORTS**									
54	Number of Acoustic Baffles		-	-	-	-	-	-	-	-
55	Tubes Between Acoustic Baffles		-	-	-	-	-	-	-	-
56	Min. Number of Vibration Supports		-	-	-	-	-	-	-	-
57	Max. Span Between Center Supp	m.	-	-	-	-	-	-	-	-

Exhaust Stack: 3.5 m. Diameter x 40 m. Tall.

NO.	DATE	REVISION	BY	CHK
C	9/16/2015	HPECON1 & LPECON Inlet Header Design Temp.	LAR	DLS
B	5/11/2015	General revision	LAR	LAR

JOB DATA SHEET N/E FORM TD.007 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: CM02 | REVISION: C
REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOOTERERIKSEN **PIPING**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

Line No	Description	Qty	Pipe Size (mm)	Pipe Schedule / Min Nom Thk (mm)	Material (SA-)	Design Pressure (Bar(a))	Design Temperature (°C)	Insulation Thickness (mm)	ANSI Class
HP-09 C	Main HP Steam Outlet - 5 Dia D/S Mix Point or 2 Dia D/S Last Nozzle B	1	150	S-40	SA-335P11	(6) 69.13 B	481.0	90	900
HP-09 C	Main HP Steam Outlet	1	150	S-160	SA-335P22	69.13	567.0	115	2500
HP-09 C	HPSHTR Outlet	2	150	S-160	SA-335P22	69.13	567.0	115	2500
HP-07 C	HPSHTR Inlet	2	150	S-40	SA-106B	71.68	291.0 B	50	600
HP-07 C	HP Drum Manifold	1	200	S-80 D	SA-106C D	71.68	291.0 B	65	600
HP-07 C	HP Drum Outlets	2	150	S-40	SA-106B	71.68	291.0 B	50	600
HP-08 C	HP Steam Bypass - Cold Side	1	80	S-40	SA-106B	71.68	291.0 B	50	600
HP-08 C	HP Steam Bypass - Hot Side	1	80	S-160	SA-335P22	71.68	567.0	100	2500
HP-06 C	(5) HP Panel 1 Riser	2	200	S-40	SA-106B	71.68	291.0	65	600
HP-06 C	HP Panel 2 Riser	2	150	S-40	SA-106B	71.68	291.0	50	600
HP-06 C	HP Panel 3 Riser	2	100	S-40	SA-106B	71.68	291.0	50	600
HP-06 C	HP Panel 4 Riser	2	100	S-40	SA-106B	71.68	291.0	50	600
HP-06 C	HP Panel 5 Riser	2	150 B	S-40	SA-106B	71.68	291.0	50	600
HP-04,05 C	HP Main DC	2	150	S-40	SA-106B	71.68	291.0	50	600
	HP Longitudinal Tee	1	250	S-80 B	SA-106C B	71.68	291.0		600
	HP Panel 1 DC Stub (o=6.250" [158.8 mm]) B	1	200	S-120 B	SA-106C B	71.68	291.0		600
	HP Panel 2 DC Stub (o=4.375" [111.1 mm])	1	150	S-40	SA-106C B	71.68	291.0		600
	HP Panel 3 DC Stub (o=3.250" [82.6 mm])	1	100	S-40	SA-106C B	71.68	291.0		600
	HP Panel 4 DC Stub (o=2.375" [60.3 mm])	1	100	S-40	SA-106C B	71.68	291.0		600
	HP Panel 5 DC Stub (o=1.750" [44.5 mm])	1	100	S-40	SA-106C B	71.68	291.0		600
HP-108 C	HP to LP Cascading Blowdown - HP Side B	1 B	40 B	S-80 B	SA-106B B	71.68 B	291.0 B	50 B	600 B
HP-108 C	HP to LP Cascading Blowdown - LP Side B	1 B	100 B	S-40 B	SA-106B B	42.38 B	254.4 B	40 B	300 B
HP-03 C	HPECON2 to HP Drum	1	100	S-40	SA-106B	75.47	297.0	50	600
HP-02 C	HPECON1 to HPECON2	1	100	S-40	SA-106B	80.30	187.0	40	600
HP-01 C	Last Valve to HPECON1 Inlet	1	100	S-40	SA-106B	95.81	175.0 C	25	900 C
HP-01 C	(3) HP FW TP to Last Valve	1	100	S-80	SA-106B	138.91	175.0 C	25	1500 C
LP-09,30,31 C	(4) Boiler Feed Pump Recirc - Last Valve to DA Drum	1	80	S-40	SA-106B	9.63	175.0	25	150
	HPSHTR DRAINS - First Header - Inside Casing	1	40	S-160	SA-335P22	87.19	570.0		2500
HP-103 C	HPSHTR DRAINS - First Header - Outside Casing	1	40	S-80	SA-335P22	87.19	552.0	90	2500
	HPSHTR DRAINS - Second Header - Inside Casing	1	40	S-80	SA-335P22 C	87.19	537.0		2500
HP-102 C	HPSHTR DRAINS - Second Header - Outside Casing	1	40	S-80	SA-335P22 C	87.19	494.0	75	1500
	HPSHTR DRAINS - Third Header - Inside Casing	1	40	S-80	SA-335P11	87.19	537.0		2500
HP-101 C	HPSHTR DRAINS - Third Header - Outside Casing	1	40	S-80	SA-106B	87.19	372.0	65	900
	Deleted B	B	B	B	B	B	B	B	B

NO.	DATE	REVISION	BY	CHK
D	5/11/2016	HP Drum Manifold Material, Thickness & HX Cold Side Bypass Quantity	LAR	DLS
C	9/16/2015	General Revision	LAR	DLS

JOB DATA SHEET N/E FORM TD.009 Page 1 of 2 | JOB No: 150200 | CODE: TD | SHEET: DM01 | REVISION: D

REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 HRU Version: 3.1

NOOTERERIKSEN **PIPING**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

Line No	Description	Qty	Pipe Size (mm)	Pipe Schedule / Min Nom Thk (mm)	Material (SA-)	Design Pressure (Bar(a))	Design Temperature (°C)	Insulation Thickness (mm)	ANSI Class
LP-16 C	LPSHTR Outlet to Terminal	1	200	S-40	SA-106B	9.28	268.0	50	150
LP-15 C	Manifold to LPSHTR Inlet C	1	200	S-40	SA-106B	9.28	183.0	40	150
LP-15 C	LP Drum to Manifold C	2 C	150 C	S-40 C	SA-106B C	9.28 C	183.0 C	40 C	150 C
LP-14 C	LP Panel 1 Riser	2	200	S-40	SA-106B	9.28	183.0	40	150
LP-14 C	LP Panel 2 Riser	2	150	S-40	SA-106B	9.28	183.0	40	150
LP-14 C	LP Panel 3 Riser	2	100	S-40	SA-106B	9.28	183.0	40	150
LP-13 C	LP Main DC	1	200	S-40	SA-106B	9.28	183.0	40	150
	LP Panel 1 DC Stub (o=3.750" [95.3 mm])	1	150	S-40	SA-106C B	9.28	183.0		150
	(2) LP Panel 2 DC Stub (o=2.875" [73.0 mm])	1	200	S-80 B	SA-106C B	9.28	183.0		150
	LP Panel 3 DC Stub (o=2.125" [54.0 mm])	1	100	S-40	SA-106C B	9.28	183.0		150
LP-12 C	Last valve to LP Drum	1	50	S-80	SA-106B	11.35	187.0	25	150
LP-12 C	LPECON Outlet to Last Valve	1	50	S-80	SA-106B	57.00 C	187.0	25	600 C
LP-11 C	LPECON Inlet	1	50	S-80	SA-106B	57.00 C	175.0 C	25	600 C
LP-07 C	(7) LP to DA Pegging Steam - To CV Outlet	1	80	S-40	SA-106B	9.28	183.0	25	150
LP-07 C	LP to DA Pegging Steam - CV Outlet to Last Valve B	1 B	150 B	S-40 B	SA-106B B	9.28 B	183.0 B	40 B	150 B
LP-08 C	(4) LP to DA Pegging Steam - Terminal to DA	1	250 C	S-40	SA-106B	9.28	183.0	40	150
LP-05 C	(4) HX Hot Side Outlet to BFP	1	200 C	S-40	SA-106B	(1) 19.97	175.0	25	300
LP-04 C	(4) DA Storage Tank to HX Hot Side Inlet	1	200 C	S-40	SA-106B	(1) 19.97	175.0	25	300
LP-37 C	(4) Process Return Condensate to HX Cold Side Outlet C	1 C	100 C	S-40 C	SA-106B C	19.97 C	130.0 C	25 C	300 C
LP-02 C	(4) HX Cold Side Outlet to DA	1	150	S-40	SA-106B	(1) 19.97	130.0	25	300
LP-01 C	(4) Cond In to HX Cold Side Inlet	1	150	S-40	SA-106B	(1) 19.97	69.0	25	300
LP-06 C	(4) HX Hot Side Bypass	1	200 C	S-40	SA-106B	(1) 19.97	175.0	25	300
LP-03,28 C	(4) HX Cold Side Bypass	2 D	150	S-40	SA-106B	(1) 19.97	130.0	25	300

NO.	DATE	REVISION	BY	CHK
D	5/11/2016	HP Drum Manifold Material, Thickness & HX Cold Side Bypass Quantity	LAR	DLS
C	9/16/2015	General Revision	LAR	DLS

JOB DATA SHEET N/E FORM TD.009 Page 2 of 2 | JOB No: 150200 | CODE: TD | SHEET: DM02 | REVISION: D

REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 HRU Version: 3.1

STEAM DRUM

Purchaser: TEC Project Service | **Plant Site:** Thailand | **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited | **Plant Name:** LM6000 sites | **Proposal No:** 240405

	Pressure Level	Units (M)		HP Drum		LP Drum		
1	Pressure Level	Units (M)		HP Drum		LP Drum	D	
2	**DESIGN CONDITIONS**							
3	Steam Capacity	kg./hr.		54,888		13,776 C	(1) D	
4	MAWP (As Indicated and Full Vac)	Bar(a)	(2)	71.68 B		9.28	D	
5	Design Temperature	°C		291.0		183.0	D	
6	**STEAM DRUM**							
7	Diameter	mm		1,219.2		1,219.2	D	
8	Length	m.		5.64		4.42	D	
9	Material			SA 516Gr70		SA 516Gr70	D	
10	Insulation Thickness	mm		63.5		38.1	D	
11	NWL (From Centerline)	mm		-50.8		-50.8	D	
12	Water Levels (From NWL)							
13	HHWL	mm		203.2		203.2	D	
14	HWL	mm		101.6		101.6	D	
15	LWL	mm		-101.6		-101.6	D	
16	LLWL	mm		-330.2		-330.2	D	
17	**PRIMARY SEPARATOR**							
18	Design:							
19	Flow	kg./hr.		49,237		13,776 C		
20	Pressure	Bar(a)		56.91		6.80 C		
21	Arrangement			Single		Single		
22	Baffle Length x Min. Baffle Gap	m. x mm	3.07 X	69.9	3.07 X	63.5		
23	**SECONDARY SEPARATOR**							
24	Design (Preliminary)							
25	Flow	kg./hr.		54,888		13,776 C		
26	Pressure	Bar(a)		66.29		6.80 C		
27	Type			Chevron		Chevron		
28	Number of Sections			1		1		
29	Vane Length x Housing Length	mm x mm	266.7 X	2,451.1	279.4 C X	1,860.6 C		
30	Mesh Pad Width x Thickness	mm x mm	165.1 X	76.2	177.8 C X	76.2		
31	Manifold (Yes/No)			Yes		Yes		
32	**MISCELLANEOUS**							
33	FW Orifices Qty x Diameter	# x mm	3 X	38.1	3 X	15.9		
34	Inlet Spray header (Yes/No)			No		No	D	

NO.	DATE	REVISION	BY	CHK
D	10/12/2016	Removed DA Storage Tank	LAR	DLS
C	9/16/2015	General Revision	LAR	DLS

JOB DATA SHEET N/E FORM TD.010 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: EM01 | REVISION: D
REV. 10 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOTES

Purchaser: TEC Project Service | **Plant Site:** Thailand | **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited | **Plant Name:** LM6000 sites | **Proposal No:** 240405

Thermal Datasheet

Case 1 Group 3b - Peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 2 Group 3b - Off-peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 3 Group 4b - Peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 4 Group 4b - Off-peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 5 Group 5b - Peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 6 Group 5b - Off-peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Heating Surface Datasheet

(1) Reference ambient pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Mechanical Datasheet

(1) Average casing temperature based on 32 deg C ambient with 0 m/s wind speed.
(2) Inlet configuration based on CT as a Type I - Benign.
(3) A one diameter spool piece to be included in the inlet duct with a Type II design classification (60 in. WC casing design pressure and minimum 0.5 in. thick casing for floor and sidewalls and minimum 0.25 in. thick roof casing). The remainder of the inlet duct, excluding the spool piece, to be designed as Type I (20 in. WC casing design pressure and minimum 0.25 in. thick casing).

Steam Drum Datasheet

(1) Deleted.
(2) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Piping Datasheet

(1) Customer to verify condensate dead head pressure.
(2) Panels 1 and 3 stubs branch off of Panel 2 stub.
(3) Customer to verify HP BFP shut off pressure.
(4) Line size based on one common line per two HRSGs (one common line per plant site).
(5) HP Panel 1 Riser is DN200 S-120 inside the casing and DN200 S-40 outside the casing.
(6) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.
(7) Pegging steam line to be connected downstream of LP drum outlets (from manifold).

NO.	DATE	REVISION	BY	CHK
E	10/12/2016	Removed DA Storage Tank Note	LAR	DLS
D	9/16/2015	Pegging Steam Location	LAR	DLS

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REV. 2 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

Performance

Group-5b: One(1) plant with GE LM 6000 PF+ Gas Turbines
Net Electric output - 120MW

ALSTOM	Title: Guarantee of Steam Turbine/Generator						
	Date: 2014-11-19	Register No.: -	Doc. type: CD	Language: EN	Revision: -	Page: 1/7	Doc. No.: 2BSS140291

1. Subject of guarantee

These guarantees refer to Steam Turbine/Generator (STG) as defined in the scope section of this proposal:

- STG Gross Electrical Power Output
- STG Gross Heat Rate
- Process Steam Parameters
- Auxiliary Power Consumption
- Noise level

2. STG gross electrical power output

The Supplier guarantees that STG gross electrical power output, at the generator terminals will not be less than:

P_{EL} = 31869 kW
in operating point "Peak – Max Process Steam Flow"- GLF_5B_1121, sheet 1 of 4,

P_{EL} = 26860 kW
in operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4.

The above guaranteed value of gross electrical power output is given under conditions stated in paragraph 7 and are valid with the operating conditions defined at paragraph 8 and taking into account test tolerance equal to test uncertainty.

3. STG gross heat rate

The Supplier guarantees that STG heat rate (excitation losses taken into account) will not be higher than:

HR = 11928 kJ/kWh
in operating point "Peak – Max Process Steam Flow"- GLF_5B_1121, sheet 1 of 4,

HR = 11379 kJ/kWh
in operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4.

The above guaranteed values for gross STG heat rate are given under conditions stated in paragraph 7 and are valid with the operating conditions defined at paragraph 8 and taking into account test tolerance equal to test uncertainty.

The value of heat rate will be determined as follows:

HR = 3600 * (LS"Q" + SS."Q" – FW"Q" – PE."Q") / (GTerminals."P_EL")

Where:

LS"Q" – [Live steam mass flow at inlet to the turbine] * [Live steam enthalpy at inlet to the turbine]

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SS"Q" – [Second steam mass flow at inlet to the turbine] * [Second steam enthalpy at inlet to the turbine]

FW"Q" – [Condensate mass flow after GSC] * [Feed water enthalpy after GSC]

PE."Q" – [Process steam extraction mass flow after pressure and temperature adjustment] * [Process steam enthalpy after pressure and temperature adjustment]

GTerminals."P_EL" – electric power output at generator terminals

4. Process Steam Parameters

The Supplier guarantees that Process Steam downstream of Temperature and Pressure Control System would have the following parameters:

Process Extraction		Case 1	Case 2
Steam Mass Flow	[kg/s]	2.778	2.778
Steam Pressure	[bar a]	17	17
Steam Temperature	[degC]	212	212

- Case 1 – operating point "Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 1 of 4
- Case 2 – operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4

The above guaranteed values are given under conditions stated in paragraph 7 and are valid with the operating conditions defined at paragraph 8 and taking into account test tolerance equal to test uncertainty.

5. Auxiliary Electric Power Consumption

The Supplier guarantees that the electrical power consumption of the equipment delivered by Alstom will be not more than the value given below:

$$\sum P_{EL_AUX} \leq 30 \text{ kW}$$

The guaranteed value refers to operation in normal, continuous operating conditions of the steam turbine and in particular in guaranteed operational case "Peak – Max Process Steam Flow". Only mandatory equipment shall be operated during the auxiliary power consumption measurement. List of equipment (in Alstom scope) considered mandatory for operation of the STG in normal conditions:

- Control oil pump
- Oil Mist Eliminator Fan
- Turbine control cubicles

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- Turbine actuators panel
- Generator cubicles
- Gland Steam Condenser Fan
- Control Oil Cooler Unit

6. STG noise level

The Supplier guarantees the following sound pressure levels of the equipment.

1) The A-weighted surface sound pressure level averaged over the measurement surface according to ISO 3746 at a distance of 1 m from the equipment of Alstom's scope of supply or its acoustical enclosure and 1.5 m above ground level or personnel platforms, which need to be accessed during normal operation, will not exceed 85 dB(A).

   Exclusions

   Excluded from the noise level guarantee are operation modes such as:

   - Steam turbine bypass operation - with exception related to the bypass valves only as per clause 2);
   - Start up and shut down of the plant;
   - Construction, erection and commissioning;
   - Drain valves in operation;
   - Safety valves in operation;
   - Equipment failures and unit trip.

2) The A-weighted surface sound pressure level averaged over the measurement surface according to ISO 3746 at a distance of 1 m from the turbine bypass valves of Alstom's scope of supply and 1.5 m above ground level or personnel platforms, which need to be accessed during normal operation, with only one bypass in operation at a time will not exceed 95 dB(A).

Measurement uncertainty, correction for background, environmental noise and for noise from equipment outside Alstom's scope of supply shall be considered.

During the measurements, the plant shall be after successful erection and commissioning and should be in steady operating conditions.

The noise test shall be conducted by the Purchaser as per the relevant noise test procedure which shall be submitted to the Purchaser in a later stage.

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7. Guarantee conditions

The Supplier guarantees the STG gross electrical power output and gross heat rate as per paragraphs 2 and 3 under the following conditions:

7.1. The test of the guaranteed values will be performed according to ASME PTC6s and Technical Conditions for Performance Tests (paragraph 10), by the Institution accepted by both parties and at the presence and participation of the Supplier's representatives.

7.2. The performance test will be performed not later than three months after the turbine is first put into initial operation (commissioning) under load. Ageing according to ASME PTC 6 Report -1985 (edition 1986) or Bench Mark tests (which will commence as soon as possible after first steam admission when the conditions are stable and will confirm real degradation), whatever is higher will be applied before comparison with the guarantees. The Supplier reserves the rights to receive performance test report as soon as it is worked out.

7.3. During the performance tests, the turbine will be operating according to basic thermal diagram without any additional extractions or feed of steam and / or water.

7.4. For performance comparison purposes the guarantee conditions given in Table 1, paragraph 8 "Guarantee operation conditions", will be taken as reference.

7.5. Flow measurements will be performed with the flow meters that conform to ASME PTC6s test accuracy.

7.6. Steam quality has to be ensured according to Alstom Steam Purity Requirements HTGD 90486V0001G (attached to the technical offer). Steam quality test results will be recorded and handed over to ALSTOM for checking. Additionally steam cleanness checking during boiler and steam lines blowing out is required for supervision and approval of ALSTOM inspectors before turbine initial start-up. During performance test no deposits on blading system are allowed.

7.7. All measuring instruments shall be examined just before and after the acceptance test to check their condition and that they are of the correct size and comply in other respects with the appropriate Standards. The equipment applied during the test shall possess valid certificates of calibration. The measurements are to be taken in such a range so the guaranteed values could be estimated with proper accuracy.

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7.8. The institution performing the performance tests should assess actual test uncertainty for gross electric power output and gross heat rate. Test tolerances equal to test uncertainties will apply to the measured and corrected values of gross electric power output and heat rate before comparison with the guarantee value given in paragraphs 2 and 3 of this document.

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8. Guarantee operation conditions

During the guarantee tests the following conditions of operation are to be maintained as in the table given below.

Case 1 – operating point "Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 1 of 4

Case 2 – operating point "Off-Peak – Max Process Steam Flow" - GLF_5B_1121, sheet 3 of 4

Table 1

Item	Guarantee operation condition			
1	**Load Case**		**Case 1**	**Case 2**
2	**All Control Valves Fully Open**			
3	**Live Steam at STG inlet**			
3.1	Mass Flow	[kg/s]	30.489	27.516
3.2	Pressure	[bar a]	60.000	54.023
3.3	Temperature	[degC]	469.8	470.0
4	**Second Steam Admission**			
4.1	Mass Flow	[kg/s]	6.522	1.983
4.2	Pressure	[bar a]	6.000	4.492
4.3	Temperature	[degC]	239.8	242.9
5	**Process Extraction**			
5.1	Steam Mass Flow after Attemperation and Pressure Control	[kg/s]	2.778	2.778
5.2	Steam Pressure after Attemperation and Pressure Control	[bar a]	17.0	17.0
5.3	Steam Temperature after Attemperation and Pressure Control	[degC]	212.0	212.0
5.4	Enthalpy of Cooling Water to LP Process Steam Attemperation	[kJ/kg]	228.7	205.4
5.5	Total pressure drop (flow resistance) on the line: from the active turbine extraction nozzle to the point downstream of the Temperature and Pressure Control System with all valves on this line fully open (no additional throttling) not larger than:	[%]	5.02 *)	5.15 *)
6	**ST Exhaust Pressure**			
6.1	Pressure at Steam Turbine Exhaust	[bar a]	0.149	0.113
7	**Feed water**			
7.1	Feed water Enthalpy after Gland Steam Condenser	[kJ/kg]	230.5	207.7
8	**Generator**			
8.1	Voltage	[kV]	11	11
8.2	Cos Φ	[-]	0.85	0.85
8.3	Generator cooling water temperature	[degC]	36.4	36.4

*) - If the flow resistance is lower than specified in this Table 1 then throttling operation of the extraction pressure control valve in this line is necessary in order to adjust the extraction steam pressure to the value quoted in Item 5.2 of Table 1.

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9. Correction method of deviations from test performance conditions of operation

If any deviations of the reference conditions from their nominal values given in Table 1, will be stated during the performance tests, STG gross electrical power output will be converted to guarantee conditions using correction curves or by heat balances supplied by Alstom.

10. Regulations and instructions obligatory during measurements

In case of any doubts concerning method of performance test execution or test results processing, the procedures included in the test standard will be applied.

During performance tests following regulations will be applied:

10.1. GENERAL REGULATIONS.

10.1.1. ASME Steam Table for Industrial Use Based on IAPWS-97.

10.1.2. Performance Test Code 6 on steam turbines- ASME PTC 6s

10.1.3. Guidance for evaluation of measurement uncertainty in performance tests of steam turbines - ASME PTC 6 Report - 1985 (edition 1986)

10.2. DETAILED INSTRUCTIONS AND DIAGRAMS.

10.2.1. Correction Curves: [1])

10.2.2. Technical Conditions for Performance Tests. [1])

[1]) Supplier will supply these documents as per document schedule

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POYRY ENERGY LTD.
Document Submission Approval

APPROVED Approved without exception	AP X
APPROVED WITH COMMENTS Approved subject to incorporation of comments	AWC
NOT APPROVED Insufficient information/detail Resubmit for Approval	NAP
REJECTED Complete redesign required	REJ

Note. Approval or does not relieve Vendor/Sub-Contractor of any obligations covered under contract

Engineer: Andrew Lattimore

Discipline:

Date: 08-Dec-2016

THERMAL DOCUMENTATION

Purchaser: TEC Project Services Corporation

Owner: Gulf MP Company Limited

Project Name: (GNC) Gulf SPP3

N/E Project Number: 150200

N/E Project Manager: Nathan Morton/ David Godfrey

The following Nooter/Eriksen and/or sub-supplier documents are included with this cover sheet:

Rev. No.	No. Of Sheets	Document Description	Rev Date
B	13	Revision: See Thermal Performance Metric Data Sheets	12-Oct-2016

NOOTER/ERIKSEN

(Internal Use Only)

Project: Gulf SPP 3	Job No.-Code-Sheet	Release Date	OM	FE
N/E Drawing No.	150200-TD-TRK001	17-Oct-2016		

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NE-GNC-002-M-032-018	NE-GRNV1-002-M-032-018	NE-GNRV2-002-M-032-018

Cc: Nathan Morton

Original Document Returned To Project Manager: Landon Relph

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NOOTER/ERIKSEN — **CASE 1 - Group 3b - Peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service
End User: Gulf Energy Development Company Limited
Plant Site: Thailand
Plant Name: LM6000 sites
Turbine: 6x LM6000 PF+
Proposal No: 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	470,880	-	470,880	470,880	470,880	470,880	470,880	403,847
3	Gas Δ P	mm WC	16.5	-	17.6	85.0	2.0	45.0	38.0	39.6
4	Inlet Temperature	°C	507.0	-	506.4	449.1	290.2	286.2	231.7	175.7
5	Outlet Temperature	°C	506.4	-	449.1	290.2	286.2	231.7	175.7	118.3
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	8,700/-	23,600/-	600/-	7,900/-	8,000/-	7,000/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	54,887	54,887	54,887	11,692	54,887	11,692	54,887
11	Inlet Pressure	Bar(a)	-	(7) 61.80	66.29	66.29	6.83	71.11	6.83	(1) 75.43 B
12	Outlet Pressure	Bar(a)	-	61.80	61.80	66.29	6.36	66.29	6.83	71.11
13	Fluid Δ P	Bar	-	-	3.11	-	0.09	3.08	-	4.33
14	Valve/Piping Δ P	Bar	-	-	(6) 1.38 B	-	0.38	1.73	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 0	-	-	-	(3) -1,936	-
16	Add./Extract Temp.	°C	-	-	282.2	-	-	-	164.0	-
17	Outlet Temperature	°C	-	471.9	471.9	282.2	242.0	279.9	164.0	169.6
18	Inlet Temperature	°C	-	471.9	282.2	279.9	164.0	169.6	155.2	62.2
19	Heat Absorbed	KW	-	-	8,800	23,500	600	7,800	8,000	6,900
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	67,033	-	-	-	-	470,880		
24	Gas Δ P	mm WC	39.6	-	-	-	-	5.8		
25	Inlet Temperature	°C	175.7	-	-	-	-	115.8		
26	Outlet Temperature	°C	101.1	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	1,500/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	13,627	72	68,515	66,650	66,650	-		
32	Inlet Pressure	Bar(a)	(1) 19.18	1.35	2.07	2.03	(5) 2.03 B	-		
33	Outlet Pressure	Bar(a)	6.83	1.35	1.33	1.35	2.03	-		
34	Fluid Δ P	Bar	9.95	-	0.74	0.67	-	-		
35	Valve/Piping Δ P	Bar	2.40	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	155.2	108.3	61.7	93.0	45.0	-		
39	Inlet Temperature	°C	61.9	108.3	108.3	45.0	45.0	-		
40	Heat Absorbed	KW	1,500	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 249.5 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol): N2 = 71.96 , O2 = 12.78 , CO2 = 3.38 , H2O = 11.02 , Ar = 0.86 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
B	5/11/2015	Revision to notes	LAR	DLS
A	2/18/2015	INITIAL RELEASE	LAR	DLS

JOB DATA SHEET N/E FORM TD.005 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: AM01 | REVISION: B
REV. 7 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOOTER/ERIKSEN — **CASE 2 - Group 3b - Off-peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service
End User: Gulf Energy Development Company Limited
Plant Site: Thailand
Plant Name: LM6000 sites
Turbine: 6x LM6000 PF+
Proposal No: 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	344,520	-	344,520	344,520	344,520	344,520	344,520	296,352
3	Gas Δ P	mm WC	9.5	-	10.8	47.9	1.1	24.6	20.4	21.3
4	Inlet Temperature	°C	558.0	-	557.1	486.9	280.4	276.8	206.4	158.8
5	Outlet Temperature	°C	557.1	-	486.9	280.4	276.8	206.4	158.8	98.1
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	7,900/-	22,400/-	400/-	7,400/-	4,900/-	5,400/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	49,535	39,874	49,535	6,680	49,535	6,680	49,535
11	Inlet Pressure	Bar(a)	-	(7) 55.43	58.38	58.38	4.92	62.17	4.92	(1) 65.68 B
12	Outlet Pressure	Bar(a)	-	55.43	55.43	58.38	4.70	58.38	4.92	62.17
13	Fluid Δ P	Bar	-	-	2.05	-	0.05	2.42	-	3.51
14	Valve/Piping Δ P	Bar	-	-	(6) 0.90 B	-	0.17	1.37	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 9,661	-	-	-	(3) -1,642	-
16	Add./Extract Temp.	°C	-	-	273.8	-	-	-	151.2	-
17	Outlet Temperature	°C	-	472.0	472.0	273.8	244.2	267.0	151.2	150.1
18	Inlet Temperature	°C	-	472.0	273.8	267.0	151.2	150.1	149.0	58.3
19	Heat Absorbed	KW	-	-	7,900	22,200	400	7,300	4,900	5,300
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	48,168	-	-	-	-	344,520		
24	Gas Δ P	mm WC	21.3	-	-	-	-	0.1		
25	Inlet Temperature	°C	158.8	-	-	-	-	97.9		
26	Outlet Temperature	°C	96.4	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	900/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	8,321	58	57,857	56,272	56,272	-		
32	Inlet Pressure	Bar(a)	(1) 9.57	1.35	2.07	1.92	(5) 1.92 B	-		
33	Outlet Pressure	Bar(a)	4.92	1.35	1.44	1.35	1.92	-		
34	Fluid Δ P	Bar	3.76	-	0.62	0.57	-	-		
35	Valve/Piping Δ P	Bar	0.89	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	149.0	108.3	57.8	93.0	41.0	-		
39	Inlet Temperature	°C	57.9	108.3	108.3	41.0	41.0	-		
40	Heat Absorbed	KW	900	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 135.8 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 72.88 , O2 = 13.21 , CO2 = 3.29 , H2O = 9.76 , Ar = 0.87 , SO2 = 0.00

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NOOTER/ERIKSEN — **CASE 3 - Group 4b - Peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service
End User: Gulf Energy Development Company Limited
Plant Site: Thailand
Plant Name: LM6000 sites
Turbine: 6x LM6000 PF+
Proposal No: 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	470,880	-	470,880	470,880	470,880	470,880	470,880	403,866
3	Gas Δ P	mm WC	16.5	-	17.6	85.0	2.0	45.0	38.0	39.7
4	Inlet Temperature	°C	507.0	-	506.4	449.1	290.2	286.2	231.8	175.7
5	Outlet Temperature	°C	506.4	-	449.1	290.2	286.2	231.8	175.7	119.3
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	8,700/-	23,600/-	600/-	7,900/-	8,000/-	6,800/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	54,888	54,888	54,888	11,708	54,888	11,708	54,888
11	Inlet Pressure	Bar(a)	-	(7) 61.80	66.29	66.29	6.83	71.11	6.83	(1) 75.44 B
12	Outlet Pressure	Bar(a)	-	61.80	61.80	66.29	6.36	66.29	6.83	71.11
13	Fluid Δ P	Bar	-	-	3.11	-	0.09	3.08	-	4.33
14	Valve/Piping Δ P	Bar	-	-	(6) 1.38 B	-	0.38	1.73	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 0	-	-	-	(3) -1,936	-
16	Add./Extract Temp.	°C	-	-	282.2	-	-	-	164.0	-
17	Outlet Temperature	°C	-	471.9	471.9	282.2	242.0	279.9	164.0	169.8
18	Inlet Temperature	°C	-	471.9	282.2	279.9	164.0	169.8	155.5	64.2
19	Heat Absorbed	KW	-	-	8,800	23,500	600	7,800	8,000	6,800
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	67,014	-	-	-	-	470,880		
24	Gas Δ P	mm WC	39.7	-	-	-	-	5.7		
25	Inlet Temperature	°C	175.7	-	-	-	-	116.8		
26	Outlet Temperature	°C	102.3	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	1,500/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	13,644	72	68,531	66,667	66,667	-		
32	Inlet Pressure	Bar(a)	(1) 19.21	1.35	2.07	2.03	(5) 2.03 B	-		
33	Outlet Pressure	Bar(a)	6.83	1.35	1.33	1.35	2.03	-		
34	Fluid Δ P	Bar	9.97	-	0.74	0.67	-	-		
35	Valve/Piping Δ P	Bar	2.40	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	155.5	108.3	63.7	93.0	47.0	-		
39	Inlet Temperature	°C	63.8	108.3	108.3	47.0	47.0	-		
40	Heat Absorbed	KW	1,500	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 249.5 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 71.96 , O2 = 12.78 , CO2 = 3.38 , H2O = 11.02 , Ar = 0.86 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
B	5/11/2015	Revision to Notes	LAR	DLS
A	2/18/2015	INITIAL RELEASE	LAR	DLS

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NOOTER/ERIKSEN **CASE 4 - Group 4b - Off-peak Condition** **THERMAL PERFORMANCE**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	344,520	-	344,520	344,520	344,520	344,520	344,520	296,355
3	Gas Δ P	mm WC	9.5	-	10.8	48.0	1.1	24.7	20.5	21.3
4	Inlet Temperature	°C	558.0	-	557.1	486.9	280.8	277.2	207.0	159.5
5	Outlet Temperature	°C	557.1	-	486.9	280.8	277.2	207.0	159.5	99.0
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	7,900/-	22,300/-	400/-	7,400/-	4,900/-	5,300/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	49,525	39,859	49,525	6,669	49,525	6,669	49,525
11	Inlet Pressure	Bar(a)	-	(7) 55.85	58.77	58.77	5.01	62.57	5.01	(1) 66.08 B
12	Outlet Pressure	Bar(a)	-	55.85	55.85	58.77	4.80	58.77	5.01	62.57
13	Fluid Δ P	Bar	-	-	2.03	-	0.04	2.42	-	3.51
14	Valve/Piping Δ P	Bar	-	-	(6) 0.89 B	-	0.17	1.37	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 9,666	-	-	-	(3) -1,641	-
16	Add./Extract Temp.	°C	-	-	274.2	-	-	-	151.9	-
17	Outlet Temperature	°C	-	472.0	472.0	274.2	244.7	267.4	151.9	150.9
18	Inlet Temperature	°C	-	472.0	274.2	267.4	151.9	150.9	149.7	59.3
19	Heat Absorbed	KW	-	-	7,900	22,200	400	7,300	4,900	5,300
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	48,165	-	-	-	-	344,520		
24	Gas Δ P	mm WC	21.3	-	-	-	-	0.1		
25	Inlet Temperature	°C	159.5	-	-	-	-	98.8		
26	Outlet Temperature	°C	97.4	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	900/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	8,309	58	57,834	56,251	56,251	-		
32	Inlet Pressure	Bar(a)	(1) 9.65	1.35	2.07	1.92	(5) 1.92 B	-		
33	Outlet Pressure	Bar(a)	5.01	1.35	1.44	1.35	1.92	-		
34	Fluid Δ P	Bar	3.75	-	0.62	0.57	-	-		
35	Valve/Piping Δ P	Bar	0.89	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	149.7	108.3	58.8	93.0	42.0	-		
39	Inlet Temperature	°C	58.9	108.3	108.3	42.0	42.0	-		
40	Heat Absorbed	KW	900	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 135.9 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 72.88 , O2 = 13.21 , CO2 = 3.29 , H2O = 9.76 , Ar = 0.87 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
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NOOTER/ERIKSEN **CASE 5 - Group 5b - Peak Condition** **THERMAL PERFORMANCE**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	470,880	-	470,880	470,880	470,880	470,880	470,880	403,914
3	Gas Δ P	mm WC	16.5	-	17.6	85.0	2.0	45.1	38.0	39.8
4	Inlet Temperature	°C	507.0	-	506.4	449.1	290.2	286.2	231.9	175.7
5	Outlet Temperature	°C	506.4	-	449.1	290.2	286.2	231.9	175.7	121.7
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	8,700/-	23,600/-	600/-	7,900/-	8,000/-	6,600/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	54,888	54,888	54,888	11,748	54,888	11,748	54,888
11	Inlet Pressure	Bar(a)	-	(7) 61.80	66.29	66.29	6.84	71.11	6.84	(1) 75.44 B
12	Outlet Pressure	Bar(a)	-	61.80	61.80	66.29	6.36	66.29	6.84	71.11
13	Fluid Δ P	Bar	-	-	3.11	-	0.10	3.08	-	4.33
14	Valve/Piping Δ P	Bar	-	-	(6) 1.38 B	-	0.38	1.73	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 0	-	-	-	(3) -1,938	-
16	Add./Extract Temp.	°C	-	-	282.2	-	-	-	164.0	-
17	Outlet Temperature	°C	-	471.9	471.9	282.2	241.9	279.9	164.0	170.0
18	Inlet Temperature	°C	-	471.9	282.2	279.9	164.0	170.0	156.2	69.1
19	Heat Absorbed	KW	-	-	8,800	23,500	600	7,800	8,000	6,500
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	66,966	-	-	-	-	470,880		
24	Gas Δ P	mm WC	39.8	-	-	-	-	5.6		
25	Inlet Temperature	°C	175.7	-	-	-	-	119.4		
26	Outlet Temperature	°C	105.3	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	1,400/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	13,686	72	68,574	66,708	66,708	-		
32	Inlet Pressure	Bar(a)	(1) 19.30	1.35	2.07	2.03	(5) 2.03 B	-		
33	Outlet Pressure	Bar(a)	6.84	1.35	1.33	1.35	2.03	-		
34	Fluid Δ P	Bar	10.05	-	0.74	0.67	-	-		
35	Valve/Piping Δ P	Bar	2.42	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	156.2	108.3	68.5	93.0	52.0	-		
39	Inlet Temperature	°C	68.7	108.3	108.3	52.0	52.0	-		
40	Heat Absorbed	KW	1,400	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 249.5 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 71.96 , O2 = 12.78 , CO2 = 3.38 , H2O = 11.02 , Ar = 0.86 , SO2 = 0.00

NO.	DATE	REVISION	BY	CHK
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NE NOOTER/ERIKSEN — **CASE 6 - Group 5b - Off-peak Condition** — **THERMAL PERFORMANCE**

Purchaser: TEC Project Service — **Plant Site:** Thailand — **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited — **Plant Name:** LM6000 sites — **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HP Steam Out	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1
2	**GAS** Flow	kg./hr.	344,520	-	344,520	344,520	344,520	344,520	344,520	296,346
3	Gas Δ P	mm WC	9.5	-	10.8	48.0	1.1	24.7	20.5	21.4
4	Inlet Temperature	°C	558.0	-	557.1	486.9	280.8	277.3	207.2	159.5
5	Outlet Temperature	°C	557.1	-	486.9	280.8	277.3	207.2	159.5	102.0
6	Efficiency	%	-	-	99.50	99.50	99.50	99.50	99.50	99.50
7	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
8	Heat Rej./Rad.	KW	-/100	-	7,900/-	22,300/-	400/-	7,300/-	4,900/-	5,100/-
9	Flow Arrangement		-	-	Counter	Cross	Cross	Counter	Cross	Counter
10	**FLUID** Flow	kg./hr.	-	49,529	39,863	49,529	6,612	49,529	6,612	49,529
11	Inlet Pressure	Bar(a)	-	(7) 55.85	58.77	58.78	5.01	62.57	5.01	(1) 66.08 B
12	Outlet Pressure	Bar(a)	-	55.85	55.85	58.77	4.80	58.78	5.01	62.57
13	Fluid Δ P	Bar	-	-	2.03	-	0.04	2.43	-	3.51
14	Valve/Piping Δ P	Bar	-	-	(6) 0.89 B	-	0.17	1.37	-	-
15	Add./Extract Flow	kg./hr.	-	-	(4) 9,666	-	-	-	(3) -1,743	-
16	Add./Extract Temp.	°C	-	-	274.2	-	-	-	151.9	-
17	Outlet Temperature	°C	-	472.0	472.0	274.2	245.0	267.4	151.9	151.3
18	Inlet Temperature	°C	-	472.0	274.2	267.4	151.9	151.3	150.1	64.2
19	Heat Absorbed	KW	-	-	7,900	22,200	400	7,300	4,900	5,100
20	Fouling Factor	hr.-sq.m.-K/kJ.	-	-	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
21	Blowdown	%	-	-	-	-	-	-	-	-
22	Coil	Units (M)	LPECON	DA Terminal	HX Hot Side	HX Cold Side	Cond In	Stack		
23	**GAS** Flow	kg./hr.	48,174	-	-	-	-	344,520		
24	Gas Δ P	mm WC	21.4	-	-	-	-	-0.1		
25	Inlet Temperature	°C	159.5	-	-	-	-	101.7		
26	Outlet Temperature	°C	100.2	-	-	-	-	-		
27	Efficiency	%	99.50	-	-	-	-	-		
28	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	-	-	-	-		
29	Heat Rej./Rad.	KW	900/-	-	-	-	-	-		
30	Flow Arrangement		Counter	-	-	-	-	-		
31	**FLUID** Flow	kg./hr.	8,353	58	57,882	56,198	56,198	-		
32	Inlet Pressure	Bar(a)	(1) 9.70	1.35	2.07	1.92	(5) 1.92 B	-		
33	Outlet Pressure	Bar(a)	5.01	1.35	1.44	1.35	1.92	-		
34	Fluid Δ P	Bar	3.79	-	0.62	0.57	-	-		
35	Valve/Piping Δ P	Bar	0.90	-	-	-	-	-		
36	Add./Extract Flow	kg./hr.	-	-	-	-	-	-		
37	Add./Extract Temp.	°C	-	-	-	-	-	-		
38	Outlet Temperature	°C	150.1	108.3	63.8	92.0	46.0	-		
39	Inlet Temperature	°C	63.8	108.3	108.3	46.0	46.0	-		
40	Heat Absorbed	KW	800	-	-	-	-	-		
41	Fouling Factor	hr.-sq.m.-K/kJ.	0.00006	-	0	0	-	-		
42	Blowdown	%	-	-	-	-	-	-		

Notes: * Total TEG Pressure Loss of 135.8 mm WC for the HRSG scope of supply including Inlet Duct, Stack
** Gas Turbine (% vol) : N2 = 72.88 , O2 = 13.21 , CO2 = 3.29 , H2O = 9.76 , Ar = 0.87 , SO2 = 0.00

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NE NOOTER/ERIKSEN — **HEATING SURFACE**

Purchaser: TEC Project Service — **Plant Site:** Thailand — **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited — **Plant Name:** LM6000 sites — **Proposal No:** 240405

	Coil		Units (M)	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1	LPECON
2	Area	(31,862)	sq.m.	2,599	8,988	393	6,908	5,483	6,446	1,045
3	MAWP		Bar(a)	(1) 71.68	71.68	9.28	75.47	9.28	80.30	57.00 C
4	Expansion Temperature		°C	573.0	335.0	283.0	296.0	260.0	260.0	260.0
5	Layout/Arrangement			Staggered	Staggered	Staggered	Staggered	Staggered	Staggered	Staggered
6	Tube OD		mm	44.45	38.10	50.80	31.75	38.10	31.75	31.75
7	Effective Fin Length		m.	12.42	12.42	12.42	12.42	12.42	12.42	12.42
8	No. Transverse Sections			27	41	23	42	41	37	6
9	No. of Flow Circuits			27	-	23	21	-	18.5	3
10	Transverse Spacing		mm	111.645	73.981	130.648	72.241	73.981	70.580	70.580
11	No. Longitudinal Rows			6	15	1	13	9	14	14
12	Longitudinal Spacing		mm	120.650	76.200	304.800	76.200	92.075	76.200	76.200
13	No. of Bare Rows			0	0	0	0	0	0	0
14	No. of Finned Rows			6	15	1	13	9	14	14
15	Inlet Top or Bottom			Top	Bottom	Bottom	Top	Bottom	Top	Top
16	Module Number			1	1	2	2	3	3	3
17	Transverse Bundles			1	1	1	1	1	1	1
18	**Design Temp :**	Row 1	°C	573.0						
19		Row 2	°C	562.0						
20		Row 3	°C	544.0						
21		Row 4	°C	519.0						
22		Row 5	°C	480.0						
23		Row 6	°C							
24		All\Remaining Rows	°C	424.0	335.0	283.0	296.0	260.0	260.0	260.0
25	**Minimum Wall :**	Row 1	mm	4.400						
26		Row 2	mm	3.900						
27		Row 3	mm	4.000						
28		Row 4	mm	3.000						
29		Row 5	mm							
30		Row 6	mm							
31		All\Remaining Rows	mm	2.700	2.700	2.700	2.700	2.700	2.700	2.700
32	**Tube Material :**	Row 1		SA-213 T22						
33		Row 2		SA-213 T22						
34		Row 3		SA-213 T11						
35		Row 4		SA-213 T11						
36		Row 5		SA-213 T11						
37		Row 6								
38		All\Remaining Rows		SA-178 A	SA-178 A	SA-178 A	SA-178 A	SA-213 T11	SA-178 A	SA-178 A
39	**Fin Density :**	Row 1	fins/m.							
40		Row 2	fins/m.							
41		Row 3	fins/m.							
42		Row 4	fins/m.							
43		Row 5	fins/m.							
44		Row 6	fins/m.							
45		All\Remaining Rows	fins/m.	255.91	265.75	236.22	270.67	270.67	265.75	265.75
46	**Fin Height :**	Row 1	mm							
47		Row 2	mm							
48		Row 3	mm							
49		Row 4	mm							
50		Row 5	mm							
51		Row 6	mm							
52		All\Remaining Rows	mm	12.7	12.7	12.7	12.7	12.7	12.7	12.7
53	**Fin Thickness :**	Row 1	mm							
54		Row 2	mm							
55		Row 3	mm							
56		Row 4	mm							
57		Row 5	mm							
58		Row 6	mm							
59		All\Remaining Rows	mm	1.0	1.0	1.0	1.0	1.0	1.0	1.0
60	**Fin Segment :**	Row 1	mm	4.501						
61		Row 2	mm	4.501						
62		Row 3	mm	4.501						
63		Row 4	mm	4.501						
64		Row 5	mm	4.501						
65		Row 6	mm							
66		All\Remaining Rows	mm	3.969	3.969	3.969	3.969	3.969	3.969	3.969
67	**Fin Material :**	Row 1		409SS						
68		Row 2		409SS						
69		Row 3		409SS						
70		Row 4		409SS						
71		Row 5		409SS						
72		Row 6								
73		All\Remaining Rows		CS	CS	CS	CS	CS	CS	CS

NO.	DATE	REVISION	BY	CHK
C	9/16/2015	LPECON MAWP	LAR	DLS
B	5/11/2015	Ambient air pressure note	LAR	DLS

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REV. 7 (APPROVED BY: RKG) Date: 4/27/05 OP-101 — HRU Version: 3.1

NOOTER/ERIKSEN **MECHANICAL**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Inlet Duct	HPSHTR	HPEVAP	LPSHTR	HPECON2	LPEVAP	HPECON1	LPECON
2	**INLET HEADERS**									
3	Header #1: Diameter	mm	-	200.0 B	200.0	200.0	250.0 B	200.0	250.0 B	250.0 B
4	Number		-	1	5	1	1	3	1	1
5	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
6	Number		-	-	-	-	-	-	-	-
7	Minimum ID at End of Header	mm	-	131.6	-	204.5	103.4	-	97.5	39.1
8	Minimum ID at Center of Header	mm	-	93.0	-	144.5	72.9	-	69.1	27.7
9	Material		-	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B
10	Design Temperature	°C	-	305.0	291.0	183.0	187.0	183.0	175.0 C	175.0 C
11	Header Location (Top or Bottom)		-	Top	Bottom	Bottom	Top	Bottom	Top	Top
12	**OUTLET HEADERS**									
13	Header #1: Diameter	mm	-	200.0 B	200.0	200.0	250.0 B	250.0	250.0 B	250.0 B
14	Number		-	1	5	1	1	3	1	1
15	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
16	Number		-	-	-	-	-	-	-	-
17	Minimum ID at End of Header	mm	-	118.9	-	215.4	173.0	-	98.8	69.9
18	Minimum ID at Center of Header	mm	-	84.1	-	152.4	122.4	-	39.4	27.9
19	Material		-	SA-335P22	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B	SA-106C B
20	Design Temperature	°C	-	567.0	291.0	268.0	297.0	183.0	187.0	187.0
21	Header Location (Top or Bottom)		-	Top	Top	Top	Top	Top	Top	Top
22	**INTERMEDIATE HEADERS**									
23	Header #1: Diameter	mm	-	100.0	-	-	100.0	-	65.0	65.0
24	Number		-	3	-	-	1	-	14	14
25	Header #2: Diameter	mm	-	-	-	-	65.0	-	-	-
26	Number		-	-	-	-	11	-	-	-
27	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
28	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
29	Orifice Quantity		-	-	-	-	21	-	-	-
30	Orifice Diameter	mm	-	-	-	-	12.7	-	-	-
31	Header #1: Material		-	SA-335P22	-	-	SA-106C B	-	SA-106C B	SA-106C B
32	Design Temperature	°C	-	552.0	-	-	297.0	-	187.0	187.0
33	Header #2: Material		-	SA-335P11	-	-	SA-106C B	-	-	-
34	Design Temperature	°C	-	494.0	-	-	297.0	-	-	-
35	Header #3: Material		-	SA-106C B	-	-	-	-	-	-
36	Design Temperature	°C	-	372.0	-	-	-	-	-	-
37	Header #4: Material		-	-	-	-	-	-	-	-
38	Design Temperature	°C	-	-	-	-	-	-	-	-
39	Remaining: Material		-	-	-	-	-	-	-	-
40	Design Temperature	°C	-	-	-	-	-	-	-	-
41	**CASING & INSULATION**									
42	Average Casing Temperature	°C	(1) 60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
43	Casing Design Pressure (Max)	mm WC	(3) 508.0 B	508.0	508.0	508.0	508.0	508.0	508.0	508.0
44	Casing Design Pressure (Min)	mm WC	0	0	0	0	0	0	0	0
45	Casing Thickness	mm	6.4 B	6.4	6.4	6.4	6.4	6.4	6.4	6.4
46	Hot Insulation (Hot)	mm	139.7	139.7	139.7	50.8	50.8	50.8	50.8	50.8
47	Cold Insulation (Cold)	mm	-	-	-	-	-	-	-	-
48	Gas Path Design Temperature	°C	626.0	626.0	552.0	346.0	342.0	288.0	232.0	232.0
49	Liner Material		(2) 409 SS	409 SS	409 SS	409 SS	409 SS	409 SS	409 SS	409 SS
50	Liner Thickness (Wall)	Gauge	12	16	16	16	16	16	16	16
51	Liner Thickness (Roof)	Gauge	12	16	16	16	16	16	16	16
52	Liner Thickness (Floor)	Gauge	12	16	16	16	16	16	16	16
53	**BAFFLES & SUPPORTS**									
54	Number of Acoustic Baffles		-	0	1	0	1	1	1	1
55	Tubes Between Acoustic Baffles		-	29	26	39	32	33	34	34
56	Min. Number of Vibration Supports		-	2	3	2	2	2	2	2
57	Max. Span Between Center Supp	m.	-	4.44	3.79	4.44	4.70	4.27	4.90	4.90

NO.	DATE	REVISION	BY	CHK
C	9/16/2015	HPECON1 & LPECON Inlet Header Design Temp.	LAR	DLS
B	5/11/2015	General revision	LAR	LAR

JOB DATA SHEET N/E FORM TD.007 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: CM01 | REVISION: C
REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOOTER/ERIKSEN **MECHANICAL**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

	Coil	Units (M)	Stack							
2	**INLET HEADERS**									
3	Header #1: Diameter	mm	-	-	-	-	-	-	-	-
4	Number		-	-	-	-	-	-	-	-
5	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
6	Number		-	-	-	-	-	-	-	-
7	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
8	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
9	Material		-	-	-	-	-	-	-	-
10	Design Temperature	°C	-	-	-	-	-	-	-	-
11	Header Location (Top or Bottom)		-	-	-	-	-	-	-	-
12	**OUTLET HEADERS**									
13	Header #1: Diameter	mm	-	-	-	-	-	-	-	-
14	Number		-	-	-	-	-	-	-	-
15	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
16	Number		-	-	-	-	-	-	-	-
17	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
18	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
19	Material		-	-	-	-	-	-	-	-
20	Design Temperature	°C	-	-	-	-	-	-	-	-
21	Header Location (Top or Bottom)		-	-	-	-	-	-	-	-
22	**INTERMEDIATE HEADERS**									
23	Header #1: Diameter	mm	-	-	-	-	-	-	-	-
24	Number		-	-	-	-	-	-	-	-
25	Header #2: Diameter	mm	-	-	-	-	-	-	-	-
26	Number		-	-	-	-	-	-	-	-
27	Minimum ID at End of Header	mm	-	-	-	-	-	-	-	-
28	Minimum ID at Center of Header	mm	-	-	-	-	-	-	-	-
29	Orifice Quantity		-	-	-	-	-	-	-	-
30	Orifice Diameter	mm	-	-	-	-	-	-	-	-
31	Header #1: Material		-	-	-	-	-	-	-	-
32	Design Temperature	°C	-	-	-	-	-	-	-	-
33	Header #2: Material		-	-	-	-	-	-	-	-
34	Design Temperature	°C	-	-	-	-	-	-	-	-
35	Header #3: Material		-	-	-	-	-	-	-	-
36	Design Temperature	°C	-	-	-	-	-	-	-	-
37	Header #4: Material		-	-	-	-	-	-	-	-
38	Design Temperature	°C	-	-	-	-	-	-	-	-
39	Remaining: Material		-	-	-	-	-	-	-	-
40	Design Temperature	°C	-	-	-	-	-	-	-	-
41	**CASING & INSULATION**									
42	Average Casing Temperature	°C	-	-	-	-	-	-	-	-
43	Casing Design Pressure (Max)	mm WC	50.8	-	-	-	-	-	-	-
44	Casing Design Pressure (Min)	mm WC	0	-	-	-	-	-	-	-
45	Casing Thickness	mm	6.4	-	-	-	-	-	-	-
46	Hot Insulation (Hot)	mm	-	-	-	-	-	-	-	-
47	Cold Insulation (Cold)	mm	-	-	-	-	-	-	-	-
48	Gas Path Design Temperature	°C	130.0	-	-	-	-	-	-	-
49	Liner Material		-	-	-	-	-	-	-	-
50	Liner Thickness (Wall)	Gauge	-	-	-	-	-	-	-	-
51	Liner Thickness (Roof)	Gauge	-	-	-	-	-	-	-	-
52	Liner Thickness (Floor)	Gauge	-	-	-	-	-	-	-	-
53	**BAFFLES & SUPPORTS**									
54	Number of Acoustic Baffles		-	-	-	-	-	-	-	-
55	Tubes Between Acoustic Baffles		-	-	-	-	-	-	-	-
56	Min. Number of Vibration Supports		-	-	-	-	-	-	-	-
57	Max. Span Between Center Supp	m.	-	-	-	-	-	-	-	-

Exhaust Stack: 3.5 m. Diameter x 40 m. Tall.

NO.	DATE	REVISION	BY	CHK
C	9/16/2015	HPECON1 & LPECON Inlet Header Design Temp.	LAR	DLS
B	5/11/2015	General revision	LAR	LAR

JOB DATA SHEET N/E FORM TD.007 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: CM02 | REVISION: C
REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOOTERERIKSEN **PIPING**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

Line No	Description	Qty	Pipe Size (mm)	Pipe Schedule / Min Nom Thk (mm)	Material (SA-)	Design Pressure (Bar(a))	Design Temperature (°C)	Insulation Thickness (mm)	ANSI Class
HP-09 C	Main HP Steam Outlet - 5 Dia D/S Mix Point or 2 Dia D/S Last Nozzle B	1	150	S-40	SA-335P11	(6) 69.13 B	481.0	90	900
HP-09 C	Main HP Steam Outlet	1	150	S-160	SA-335P22	69.13	567.0	115	2500
HP-09 C	HPSHTR Outlet	2	150	S-160	SA-335P22	69.13	567.0	115	2500
HP-07 C	HPSHTR Inlet	2	150	S-40	SA-106B	71.68	291.0 B	50	600
HP-07 C	HP Drum Manifold	1	200	S-80 D	SA-106C D	71.68	291.0 B	65	600
HP-07 C	HP Drum Outlets	2	150	S-40	SA-106B	71.68	291.0 B	50	600
HP-08 C	HP Steam Bypass - Cold Side	1	80	S-40	SA-106B	71.68	291.0 B	50	600
HP-08 C	HP Steam Bypass - Hot Side	1	80	S-160	SA-335P22	71.68	567.0	100	2500
HP-06 C	(5) HP Panel 1 Riser	2	200	S-40	SA-106B	71.68	291.0	65	600
HP-06 C	HP Panel 2 Riser	2	150	S-40	SA-106B	71.68	291.0	50	600
HP-06 C	HP Panel 3 Riser	2	100	S-40	SA-106B	71.68	291.0	50	600
HP-06 C	HP Panel 4 Riser	2	100	S-40	SA-106B	71.68	291.0	50	600
HP-06 C	HP Panel 5 Riser	2	150 B	S-40	SA-106B	71.68	291.0	50	600
HP-04,05 C	HP Main DC	2	150	S-40	SA-106B	71.68	291.0	50	600
	HP Longitudinal Tee	1	250	S-80 B	SA-106C B	71.68	291.0		600
	HP Panel 1 DC Stub (o=6.250" [158.8 mm]) B	1	200	S-120 B	SA-106C B	71.68	291.0		600
	HP Panel 2 DC Stub (o=4.375" [111.1 mm])	1	150	S-40	SA-106C B	71.68	291.0		600
	HP Panel 3 DC Stub (o=3.250" [82.6 mm])	1	100	S-40	SA-106C B	71.68	291.0		600
	HP Panel 4 DC Stub (o=2.375" [60.3 mm])	1	100	S-40	SA-106C B	71.68	291.0		600
	HP Panel 5 DC Stub (o=1.750" [44.5 mm])	1	100	S-40	SA-106C B	71.68	291.0		600
HP-108 C	HP to LP Cascading Blowdown - HP Side B	1 B	40 B	S-80 B	SA-106B B	71.68 B	291.0 B	50 B	600 B
HP-108 C	HP to LP Cascading Blowdown - LP Side B	1 B	100 B	S-40 B	SA-106B B	42.38 B	254.4 B	40 B	300 B
HP-03 C	HPECON2 to HP Drum	1	100	S-40	SA-106B	75.47	297.0	50	600
HP-02 C	HPECON1 to HPECON2	1	100	S-40	SA-106B	80.30	187.0	40	600
HP-01 C	Last Valve to HPECON1 Inlet	1	100	S-40	SA-106B	95.81	175.0 C	25	900 C
HP-01 C	(3) HP FW TP to Last Valve	1	100	S-80	SA-106B	138.91	175.0 C	25	1500 C
LP-09,30,31 C	(4) Boiler Feed Pump Recirc - Last Valve to DA Drum	1	80	S-40	SA-106B	9.63	175.0	25	150
	HPSHTR DRAINS - First Header - Inside Casing	1	40	S-160	SA-335P22	87.19	570.0		2500
HP-103 C	HPSHTR DRAINS - First Header - Outside Casing	1	40	S-80	SA-335P22	87.19	552.0	90	2500
	HPSHTR DRAINS - Second Header - Inside Casing	1	40	S-80	SA-335P22 C	87.19	537.0		2500
HP-102 C	HPSHTR DRAINS - Second Header - Outside Casing	1	40	S-80	SA-335P22 C	87.19	494.0	75	1500
	HPSHTR DRAINS - Third Header - Inside Casing	1	40	S-80	SA-335P11	87.19	537.0		2500
HP-101 C	HPSHTR DRAINS - Third Header - Outside Casing	1	40	S-80	SA-106B	87.19	372.0	65	900
	Deleted B	B	B	B	B	B	B	B	B

NO.	DATE	REVISION	BY	CHK
D	5/11/2016	HP Drum Manifold Material, Thickness & HX Cold Side Bypass Quantity	LAR	DLS
C	9/16/2015	General Revision	LAR	DLS

JOB DATA SHEET N/E FORM TD.009 Page 1 of 2 | JOB No: 150200 | CODE: TD | SHEET: DM01 | REVISION: D

REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 HRU Version: 3.1

NOOTERERIKSEN **PIPING**

Purchaser: TEC Project Service **Plant Site:** Thailand **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited **Plant Name:** LM6000 sites **Proposal No:** 240405

Line No	Description	Qty	Pipe Size (mm)	Pipe Schedule / Min Nom Thk (mm)	Material (SA-)	Design Pressure (Bar(a))	Design Temperature (°C)	Insulation Thickness (mm)	ANSI Class
LP-16 C	LPSHTR Outlet to Terminal	1	200	S-40	SA-106B	9.28	268.0	50	150
LP-15 C	Manifold to LPSHTR Inlet C	1	200	S-40	SA-106B	9.28	183.0	40	150
LP-15 C	LP Drum to Manifold C	2 C	150 C	S-40 C	SA-106B C	9.28 C	183.0 C	40 C	150 C
LP-14 C	LP Panel 1 Riser	2	200	S-40	SA-106B	9.28	183.0	40	150
LP-14 C	LP Panel 2 Riser	2	150	S-40	SA-106B	9.28	183.0	40	150
LP-14 C	LP Panel 3 Riser	2	100	S-40	SA-106B	9.28	183.0	40	150
LP-13 C	LP Main DC	1	200	S-40	SA-106B	9.28	183.0	40	150
	LP Panel 1 DC Stub (o=3.750" [95.3 mm])	1	150	S-40	SA-106C B	9.28	183.0		150
	(2) LP Panel 2 DC Stub (o=2.875" [73.0 mm])	1	200	S-80 B	SA-106C B	9.28	183.0		150
	LP Panel 3 DC Stub (o=2.125" [54.0 mm])	1	100	S-40	SA-106C B	9.28	183.0		150
LP-12 C	Last valve to LP Drum	1	50	S-80	SA-106B	11.35	187.0	25	150
LP-12 C	LPECON Outlet to Last Valve	1	50	S-80	SA-106B	57.00 C	187.0	25	600 C
LP-11 C	LPECON Inlet	1	50	S-80	SA-106B	57.00 C	175.0 C	25	600 C
LP-07 C	(7) LP to DA Pegging Steam - To CV Outlet	1	80	S-40	SA-106B	9.28	183.0	25	150
LP-07 C	LP to DA Pegging Steam - CV Outlet to Last Valve B	1 B	150 B	S-40 B	SA-106B B	9.28 B	183.0 B	40 B	150 B
LP-08 C	(4) LP to DA Pegging Steam - Terminal to DA	1	250 C	S-40	SA-106B	9.28	183.0	40	150
LP-05 C	(4) HX Hot Side Outlet to BFP	1	200 C	S-40	SA-106B	(1) 19.97	175.0	25	300
LP-04 C	(4) DA Storage Tank to HX Hot Side Inlet	1	200 C	S-40	SA-106B	(1) 19.97	175.0	25	300
LP-37 C	(4) Process Return Condensate to HX Cold Side Outlet C	1 C	100 C	S-40 C	SA-106B C	19.97 C	130.0 C	25 C	300 C
LP-02 C	(4) HX Cold Side Outlet to DA	1	150	S-40	SA-106B	(1) 19.97	130.0	25	300
LP-01 C	(4) Cond In to HX Cold Side Inlet	1	150	S-40	SA-106B	(1) 19.97	69.0	25	300
LP-06 C	(4) HX Hot Side Bypass	1	200 C	S-40	SA-106B	(1) 19.97	175.0	25	300
LP-03,28 C	(4) HX Cold Side Bypass	2 D	150	S-40	SA-106B	(1) 19.97	130.0	25	300

NO.	DATE	REVISION	BY	CHK
D	5/11/2016	HP Drum Manifold Material, Thickness & HX Cold Side Bypass Quantity	LAR	DLS
C	9/16/2015	General Revision	LAR	DLS

JOB DATA SHEET N/E FORM TD.009 Page 2 of 2 | JOB No: 150200 | CODE: TD | SHEET: DM02 | REVISION: D

REV. 9 (APPROVED BY: RKG) Date: 4/27/05 OP-101 HRU Version: 3.1

STEAM DRUM

Purchaser: TEC Project Service | **Plant Site:** Thailand | **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited | **Plant Name:** LM6000 sites | **Proposal No:** 240405

	Pressure Level	Units (M)		HP Drum		LP Drum		
1	Pressure Level	Units (M)		HP Drum		LP Drum	D	
2	**DESIGN CONDITIONS**							
3	Steam Capacity	kg./hr.		54,888		13,776 C	(1) D	
4	MAWP (As Indicated and Full Vac)	Bar(a)	(2)	71.68 B		9.28	D	
5	Design Temperature	°C		291.0		183.0	D	
6	**STEAM DRUM**							
7	Diameter	mm		1,219.2		1,219.2	D	
8	Length	m.		5.64		4.42	D	
9	Material			SA 516Gr70		SA 516Gr70	D	
10	Insulation Thickness	mm		63.5		38.1	D	
11	NWL (From Centerline)	mm		-50.8		-50.8	D	
12	Water Levels (From NWL)							
13	HHWL	mm		203.2		203.2	D	
14	HWL	mm		101.6		101.6	D	
15	LWL	mm		-101.6		-101.6	D	
16	LLWL	mm		-330.2		-330.2	D	
17	**PRIMARY SEPARATOR**							
18	Design:							
19	Flow	kg./hr.		49,237		13,776 C		
20	Pressure	Bar(a)		56.91		6.80 C		
21	Arrangement			Single		Single		
22	Baffle Length x Min. Baffle Gap	m. x mm	3.07 X	69.9	3.07 X	63.5		
23	**SECONDARY SEPARATOR**							
24	Design (Preliminary)							
25	Flow	kg./hr.		54,888		13,776 C		
26	Pressure	Bar(a)		66.29		6.80 C		
27	Type			Chevron		Chevron		
28	Number of Sections			1		1		
29	Vane Length x Housing Length	mm x mm	266.7 X	2,451.1	279.4 C X	1,860.6 C		
30	Mesh Pad Width x Thickness	mm x mm	165.1 X	76.2	177.8 C X	76.2		
31	Manifold (Yes/No)			Yes		Yes		
32	**MISCELLANEOUS**							
33	FW Orifices Qty x Diameter	# x mm	3 X	38.1	3 X	15.9		
34	Inlet Spray header (Yes/No)			No		No	D	

NO.	DATE	REVISION	BY	CHK
D	10/12/2016	Removed DA Storage Tank	LAR	DLS
C	9/16/2015	General Revision	LAR	DLS

JOB DATA SHEET N/E FORM TD.010 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: EM01 | REVISION: D
REV. 10 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

NOTES

Purchaser: TEC Project Service | **Plant Site:** Thailand | **Turbine:** 6x LM6000 PF+
End User: Gulf Energy Development Company Limited | **Plant Name:** LM6000 sites | **Proposal No:** 240405

Thermal Datasheet

Case 1 Group 3b - Peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 2 Group 3b - Off-peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 3 Group 4b - Peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 4 Group 4b - Off-peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 5 Group 5b - Peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Case 6 Group 5b - Off-peak Condition

(1) Inlet pressure does not include static head to grade or level control valve losses.
(3) Steam flow sent to common external DA.
(4) Steam bypass flow to control the final HP temperature. Flowrate is taken from HP Drum outlet.
(5) Inlet pressure does not include valve or instrumentation losses upstream of common external heat exchanger nor account for elevation difference to deaerator.
(6) Valve/Piping Pressure Drop shown assumes the HP steam stop valve provided by Toyo in N/E's piping matches the pipe size.
(7) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Heating Surface Datasheet

(1) Reference ambient pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Mechanical Datasheet

(1) Average casing temperature based on 32 deg C ambient with 0 m/s wind speed.
(2) Inlet configuration based on CT as a Type I - Benign.
(3) A one diameter spool piece to be included in the inlet duct with a Type II design classification (60 in. WC casing design pressure and minimum 0.5 in. thick casing for floor and sidewalls and minimum 0.25 in. thick roof casing). The remainder of the inlet duct, excluding the spool piece, to be designed as Type I (20 in. WC casing design pressure and minimum 0.25 in. thick casing).

Steam Drum Datasheet

(1) Deleted.
(2) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.

Piping Datasheet

(1) Customer to verify condensate dead head pressure.
(2) Panels 1 and 3 stubs branch off of Panel 2 stub.
(3) Customer to verify HP BFP shut off pressure.
(4) Line size based on one common line per two HRSGs (one common line per plant site).
(5) HP Panel 1 Riser is DN200 S-120 inside the casing and DN200 S-40 outside the casing.
(6) Reference ambient air pressure is 1.01 bar (1,010 mbar) per Appendix 1 of the technical specification.
(7) Pegging steam line to be connected downstream of LP drum outlets (from manifold).

NO.	DATE	REVISION	BY	CHK
E	10/12/2016	Removed DA Storage Tank Note	LAR	DLS
D	9/16/2015	Pegging Steam Location	LAR	DLS

JOB DATA SHEET N/E FORM TD.018 Page 1 of 1 | JOB No: 150200 | CODE: TD | SHEET: FM01 | REVISION: E
REV. 2 (APPROVED BY: RKG) Date: 4/27/05 OP-101 | HRU Version: 3.1

ภาคผนวก ข-15

เอกสารการออกแบบใบพัดของหน่วยหล่อเย็น

Gulf MP Company Limited

12SPP Project

Applicable Projects : GNRV1

SPXDC Work No: LXEC001

Document No: SPX-GNRV1-002-M-090-204

Document Title : Thermal Datasheet Client Version

Final, Approved For Construction

POYRY ENERGY LTD. Document Submission Approval	
APPROVED Approved without exception	AP X
APPROVED WITH COMMENTS Approved subject to Incorporation of comments	AWC
NOT APPROVED Insufficient information/detail Resubmit for Approval	NAP
REJECTED Complete redesign required	REJ
Note. Approval or does not relieve Vendor/Sub-Contractor of any obligations covered under contract	
Engineer:	Karan Kanponpai
Discipline:	Mechanical
Date:	2 Oct 2018

System No.	Equipment No.
090	

REV	DATE ISSUED	ISSUE PURPOSE	PREPARE	CHECKED	APPROVED	AUTHORIZED
0	21/09/2018	IFC	BARONE	CABY	CABY	FOURMENTIN
B	27/09/2017	Last revision	BARONE	CABY	CABY	FOURMENTIN

SPXDC doc no: DSH0002_0

BEM no: D0274379_0

Revision History

Rev.B: **Last revision**

Rev.0: **IFC**

SPX Dry Cooling Belgium

AIR COOLED STEAM CONDENSER (ACC)

Rev.

Client	Toyo	Document Reference	
Location	12SPP		WB1-101-000496_DSH0002_RB
Document	**ACC TECHNICAL DATA SHEET**	Project Nr	WB1-101-000496

THERMAL DESIGN DATA

	CASE1	CASE3(Design)		
Total Steam Flow:	124.384	97.128	t / h	
Turbine Exhaust Pressure:	149.0	113.3	mbar	
Turbine Exhaust Temperature:	53.8	48.3	°C	
Turbine Exhaust Enthalpy:	2333.4	2315.0	kJ / kg	
Turbine Exhaust Steam Dryness:	88.81	88.51	%	
Duty:	72.8	57.0	MW	

Face Velocity:	1.91	m / s	B
Total Air Flow:	4640	kg / s	B
Atmospheric Pressure:	988.74	mbar	B
Air Inlet Temperature	32.0	°C	B
Relative Humidity:	78.0	%	
Min. / Max. Ambient Temperature:	12.8 / 40.0	°C	
Top ACC Wind Velocity (max.):	5.0	m / s	
Performance Test Code:	ASME PTC 30.1		

GEOMETRIC DATA

Number of Modules / Model:	8 / A - FRAME		
Nr of Streets x Modules per Street:	2 x 4		
Area between Columns (W x L):	24.52 x 52.18	m	
Overall Plot Area (W x L):	27.32 x 55.38	m	
Fan Deck Level:	10.5	m	
Top Manifold Height (from GL -200):	23.3	m	
Top Windwalls Height (from GL -200):	20.8	m	
Fin Surface Area:	274927	m²	
Bundle Arrang. in Street:→ 18 Prim 6 Sec 24 Prim			

DUCTING

Steam Duct Diameter:	2.60	m
Riser Diameter:	2.00	m
Manifold Diameter:	2.00 > 1.70 > 1.50 > 1.20	m
Steam/Condensate Header Diameter:	0.500	m
Nr of Isolating Valves on Risers:	NONE	

FINNING

Material:	Aluminium Brazed to Tube	
Type:	Corrugated	
FPI / FPM:	11 / 433.1	
Length x Height:	200 x 19	mm

MECHANICAL DESIGN DATA

Design Pressure:	0.9 bar(g)+FV		B
Design Temperature:	120	°C	

MODULES

Nr Primary / Mixed Modules:	6 / 2		
Ground Width x Length:	12.260 x 13.045	m	

BUNDLES

Tube Type:	Single Row Condenser (SRC)		B
Nr of Tube Rows:	1		
Nr of Bundles per Module:	12		
Nr of Tubes per Bundles:	38		
Nr of Prim. / Sec. Bundles:	84 / 12		
Dimensions Prim. Bundles:	10.650 x 2.174	m	
Dimensions Sec. Bundles:	9.850 x 2.174	m	
Tube Pitch:	57.2	mm	
Bundle Slope:	60	°	

BARE TUBE

Material:	Welded CS + Aluminium Coating		
External Dimensions:	219 x 19	mm	
Wall Thickness:	1.4	mm	
Tube Length: Prim. / Sec.:	10.65 / 9.65	m	
DEAERATING DOME	YES		

MECHANICAL EQUIPMENTS

FAN Type: Axial

Manufacturer & Model:	COFIMCO 50F		
Draft Type:	Forced		
Air Flow per Fan (Prim.):	524.1	m³ / s	
Static Pressure:	65.7	Pa	
Diameter:	36 ft / 10.973	m	
Blade Material / Nr:	FRP / 6		
Blade Angle:	~13.2	°	
Speed:	~29.3 m / s / ~51	RPM	
Inlet Shape:	Elliptic		
Fan Screen:	YES		

SPEED REDUCER Type: Parallel Shaft Gear Box

Manufacturer & Model:	PVPDX2U-ACC-UDN-20S		
Reduction Ratio:	19.458 / 1		
AGMA Factor on Abs. / Nom. Motor Pwr:	2 (min) / 2 (min)		
Vibration Transmitter:	YES		

ELECTRIC MOTOR Type: Squirrel Cage

Manufacturer & Model:	WEG W22 315SM		B
Nominal Power:	75	kW	
Nominal Speed:	1000	RPM	B
Phase / Voltage:	3 / 400	V	B
Frequency:	50	Hz	
Control Mode:	2-speed motor		
Guaranteed Consumed Power:	495	kWe	
(at Motor Terminals)	@32.0°C with 8 Fans at Full Speed		

NOISE

Sound Pressure Level @ 1m from ACC: 70 dB(A)		
Sound Pressure Level @ power plant fence(*): 55 dB(A)		B
Noise Generated by Duct Excluded for Turbine Operation		B
Noise Generated by Duct Excluded for Bypass Operation		
(*) for one ACC only		B
Gravel under ACC:	YES (by client)	
Acoustic Insulation of Steam Duc	YES	

Revision	-	A	B	C	D	E	F	G	H
Date	9-May-17	14-Jul-17	25-Sep-17						
Issued	CBR	MCO	CBR						
Approved (Therm.)	CDE	CDE	ICA						
Approved (Techn.)	SNA	SNA	SNA						
Released (PM)	SFO	SFO	SFO						
Status	PRE	PRE	CFC						

BEM Nr D0274379

Gulf MP Company Limited

12SPP Project

Applicable Projects : GNRV1

SPXDC Work No: AXEC001

Document No: SPX-GNRV1-002-M-090-205

Document Title : Fan Datasheet

For Approval

POYRY ENERGY LTD. Document Submission Approval	
APPROVED Approved without exception	AP
APPROVED WITH COMMENTS Approved subject to Incorporation of comments	AWC X
NOT APPROVED Insufficient information/detail Resubmit for Approval	NAP
REJECTED Complete redesign required	REJ
Note. Approval or does not relieve Vendor/Sub-Contractor of any obligations covered under contract	
Engineer:	Karan Kanponpai
Discipline:	Mechanical
Date:	7 Jul 2017

System No.	Equipment No.
090	

REV	DATE ISSUED	ISSUE PURPOSE	PREPARE	CHECKED	APPROVED	AUTHORIZED
E						
D						
C						
B						
A	21/06/2017	First Issue	BARONE	DELEPLANQUE	DELEPLANQUE	FOURMENTIN

SPXDC doc no: DSH3210_A

BEM no: D0274441_A

SPX Dry Cooling Belgium

AIR COOLED STEAM CONDENSER (ACC)

Client	TOYO	BEM Nr	D0274441
Location	12SPP (Thailand)	Doc Ref	WB1-101-000496_DSH3210_RA
Document	**AXIAL FLOW FAN DATA SHEET**	Project Nr	WB1-101-000496

Pos	Rev						
		GENERAL DATA					
1		MANUFACTURER	LATER		CLIENT ' S REFERENCE	-	
2		MANUFACTURER ' S REF.	*		QUANTITY PER CONDENSER		8
3		MODEL NR.	*				
4		DRAWING NR.	*				
5							
		SITE DATA / SERVICE CONDITIONS					
6		LOCATION	12SPP (Thailand)		DESIGN AMBIENT TEMPERATURE	°C	32.0
7		INSTALLATION	OUTDOOR		DESIGN AIR DENSITY	kg / m³	1.113
8		AREA CLASSIFICATION	NON HAZARDOUS		RELATIVE HUMIDITY	%	0 to 100
9		ALTITUDE ASL	m	200	MIN./MAX. CONTINUOUS OPERATING TEMPERATURE	°C	12.8 / 40
10		BAROMETRIC PRESSURE	mbar	989			
11		ATMOSPHERE TYPE	Forested Area, Humid				
		PROCESS OPERATING DESIGN DATA					
		DRIVER ELECTRIC MOTOR			**SPEED REDUCING UNIT**		
12		TYPE	SQUIRREL CAGE / INDUCTION TYPE		TYPE	PARALLEL SHAFT GEARBOX	
13		CONTROL		2-speed	GEARBOX INSTALLED ABOVE THE FAN		
14		NOMINAL ROTATION SPEED	RPM	1000 / 750			
15		INSTALLED MOTOR POWER PER FAN	kW	75			
16		STARTING METHOD	DIRECT ON LINE	NR OF STARTS / HOUR MIN. 3			
		AXIAL FLOW FAN DATA					
17		AIR QUANTITY PER FAN	m3 / s	526.8			
18		STATIC PRESSURE AT DESIGN AIR DENSITY	Pa	66.1			
19							
20		VOLUME MARGIN	%	14 (min)	at fixed resistive circuit (API)		
21		PRESSURE MARGIN	%	30 (min)	at fixed resistive circuit (API)		
22		TIP CLEARANCE RATIO 2 S / Dfan	-	0.007	= 2 x tip clearance distance / fan diameter		
23		FAN DIAMETER	mm / ft	36 / 10973	FAN INLET SHAPE	ELLIPTIC	
24		NUMBER OF BLADES	-	* (min. 6)	BLADE MATERIAL	FRP	
25		BLADE ANGLE	°	~ *	INSTALLATION TYPE	FORCED	
26		DESIGN FAN SPEED	RPM	~ *	FAN POSITION	HORIZONTAL	
27		DESIGN FAN TIP SPEED	m / s	~ * (max. 50)	FLOW DIRECTION	UPWARDS	
28		ABSORBED POWER PER FAN AT DESIGN AIR DENSITY	kW	~	ROTATION DIRECTION	CW FACING AIR FLOW	
29							
		NOISE DATA					
30		**The Actual Site Operating Conditions for which GUARANTEED Noise Levels are Valid are listed here above (Pos. 6 to 11 & 17 to 22)**					
31		SOUND POWER LEVEL LwA	dB(A)	< 90			
32		Required noise level is sound power level of one fan for Actual Site Operating Conditions					
33							
		MECHANICAL DATA					
34		FAN MOMENT OF INERTIA (J = Mr2)	kg.m2	*			
35		FAN THRUST AT DES. T.°C (EXCL.WEIGHT)	N	*			
36		WEIGHT (incl.HUB & COUPLING FLANGE)	kg	*			
37		CONTINOUS UNBALANCE FORCE	N	*	(AT DESIGN SPEED)		
38		RADIAL ROTATING UNBALANCE FORCE	N	*	(AT DESIGN SPEED & IN CASE OF DAMAGED FAN BLADE)		
39		VIBRATION CLASS / CODE	ISO 10816 - 1				
40		BALANCING CLASS / CODE	ISO 1940 / 1	(G = 6.3 mm/sec)			
		FAN ACCESSORIES					
41		SHAFT COUPLING	YES Required		FAN HUB	YES Required	
42		DESIGN CODE	*		MATERIAL	*	
43		TYPE	*		DIAMETER mm	*	
44		MATERIAL	*		HARDWARE /BOLTS / NUTS	YES Required	
45		GEARBOX SHAFT DIAMETER	Refer to gearbox DWG		MATERIAL	Geomet 8.8 (blade fastening)	
46		KEYWAY / KEY DESIGN CODE	DIN6885 part 1			Hot dip galvanized for other bolts / nuts	
47		ASSEMBLY TOLERANCE (coupling / gearbox shaft)	ISO 286 part 2 N7/m6		INCLINOMETER (DIGITAL - LENGTH 600 mm)	NOT Required	
48		RETAINING PLATES	GEARBOX SUPPLIER		TORQUE WRENCH	NOT Required	
49		+BOLT,WASHER,SPRINGWASHER	GEARBOX SUPPLIER		FAN PITCH ADJUSTEMENT	MANUAL	
50							
		PREPARATION FOR SHIPMENT & STORAGE / DELIVERY					
51		PAINTING SYSTEM (HUB)	MANUFACTURER STANDARD / CLIENT SPECIFICATION				
52		SURFACE PREPARATION	SHOTBLASTING TO GRADE SA 2 1/2				
53			PRODUCT NAME	COLOUR CODE	NR OF LAYERS	DRY FILM THICKNESS	
54		PRIMER	*	*	*	*	
55		INTERMEDIATE COAT	*	*	*	*	
56		FINAL COAT	*	*	*	*	
57		TOTAL DRY FILM THICKNESS				µm	*
58		PROTECTION FOR 12 MONTHS OUTSIDE STORAGE OF MACHINED / UNPAINTED PARTS / INTERNALS				YES Required	
59		PACKING	MANUFACTURER STANDARD / SEAWORTHY PACKING / CLIENT SPECIFICATION				
60		MARKING	MANUFACTURER STANDARD / CLIENT SPECIFICATION				
61		DELIVERY	REFER TO PURCHASE ORDER				
62							
63							

Revision	A	B	C	D	E
Date	02-Jun-17				
Issued	CBR				
Approved	CDE				
Released	SFO				
Status	PRE				

ภาคผนวก ข-16

เอกสารการตรวจสอบ (Silencer)

GULF NRV2 CO.,LTD.

Inspection Sheet for PM HRSG

Equipment HRSG **KKS** 11HA, 12HA
Manufacturer NOOTER ERIKSEN

			Work supervisor	Pattanapong
Work Order No.				-
Work Permit No.				-
Date				20-12-22
Interval				6 Monthly
ITEM	**Description**			
	6 Monthly			
1	11HAD10BS201	HP DRUM SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
2	11HAD50BS201	LP STEAM DRUM SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
3	11LBA10BS201	HP STEAM OUTLET SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
4	11LBH10BS001	HP STEAM OUTLET STARTUP VENT SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
5	11LBH65BS001	LP STEAM OUTLET STARTUP VENT SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
6	11LCQ70BS201	ATM BLOWOFF TANK SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
7	12HAD10BS201	HP DRUM SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
8	12HAD50BS201	LP STEAM DRUM SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
9	12LBA10BS201	HP STEAM OUTLET SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
10	12LBH10BS001	HP STEAM OUTLET STARTUP VENT SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
11	12LBH65BS001	LP STEAM OUTLET STARTUP VENT SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
12	12LCQ70BS201	ATM BLOWOFF TANK SILENCER	Check damage of silencer	No damage
			Check damage of inlet pipe	No damage
			Check fixation	Normal
13	11HAD10BB001	HP DRUM	Check leak of tank and manhole	Not Leak
			Check damage of nozzle/flange	No damage
			Check operation pressure	57.1096853
			Check operation temperature	269.0945406
14	11HAD50BB001	LP DRUM	Check leak of tank and manhole	Not Leak
			Check damage of nozzle/flange	No damage
			Check operation pressure	5.353097169
			Check operation temperature	159.8638568
15	12HAD10BB001	HP DRUM	Check leak of tank and manhole	Not Leak
			Check damage of nozzle/flange	No damage
			Check operation pressure	56.96987038
			Check operation temperature	273.1506209
16	12HAD50BB001	LP DRUM	Check leak of tank and manhole	Not Leak
			Check damage of nozzle/flange	No damage
			Check operation pressure	5.344547055
			Check operation temperature	159.3908428
17	Check insulation damage overall HRSG		Check silicone	No damage
			Check screw	No damage
			Check jacket	No damage
18	Check crack or damage overall HRSG		Check crack	No damage
19	Check leak overall HRSG		Check leak	Not Leak
	Yearly			
20	Thermo scan checking		Temp. Surface < 60 C	Checked
21	Safety valve testing		Set presrure ASME Sec.1	Tested
22	Hydro static testing (If required)		ASME Sec.1	Tested

Note

ภาคผนวก ข-17

คู่มือการบำรุงรักษาเครื่องมือและอุปกรณ์

GULF ใบขอดำเนินการเกี่ยวกับเอกสาร / Document Action Request, DAR

ถึง : DCC / ผู้อนุมัติ

จาก : MTN Department

ประเภท :
- [ ] คู่มือการจัดการ (MM)
- [ ] เอกสารสนับสนุน (SD)
- [ ] ฟอร์ม (FP, FW)
- [x] ระเบียบปฏิบัติ (PD)
- [ ] ขั้นตอนการทำงาน (WI)
- [ ] อื่นๆ .....

หัวเรื่อง :
- [ ] เอกสารใหม่
- [x] แก้ไขเอกสาร
- [ ] อื่นๆ
- [ ] ยกเลิกเอกสาร
- [ ] ขอสำเนาเพิ่ม

ชื่อเอกสาร : การบำรุงรักษาเชิงป้องกันและแก้ไข

รหัสเอกสาร : PD-MTN-01 การแก้ไข : 02

รายละเอียดในการแก้ไข

[หน้า 3 ข้อ 4 แก้ไข PD-HRA-03 ระเบียบปฏิบัติเรื่องการจัดซื้อ คัดเลือกและประเมินผู้ขาย เป็น PD-GAD-03 การจัดซื้อ คัดเลือกประเมินผู้ให้บริการภายนอก, EHS-P-018 ระเบียบเรื่อง Hazardous Work Permit เป็น ESMS-Sa-P-01 Permit-to-Work System, EHS-P-019 ระเบียบเรื่อง Lock out tag out เป็น ESMS-Sa-P-02 Lock out/Tag out] , [หน้า 4 ข้อ 1 แก้ไขและเพิ่มเติม จาก NN-CCC-NN-CC-NNN เป็น 211X-CG-NN-CCC-NN-CC-NNN 211X = Power Plant, 2111 – Gulf GNRV1, 2112 – Gulf GNRV2, CG = Cogeneration Power Plant] , [หน้า 6 แก้ไขจาก บันทึกการ PM ตามรอบสัญญาของผู้รับเหมา จัดเก็บไว้ที่ M:\O-Departments\11-MTN\05-MTN Report\06 Contactors Report\ เป็น บันทึก Report การทำงานของผู้รับเหมา จัดเก็บไว้ที่ Drive "\GULF NRV1 & NRV2 - Documents\Maintenance\00 Report\06 Contactors Report"] , [หน้า 6 ข้อ 3 แก้ไขจาก PD-HRA-03 เป็น PD-GAD-03]

ร้องขอโดย
15 / 06 / 22

ตรวจสอบโดย
DCC
15 / 06 / 22

ส่วนงานเกี่ยวข้อง: [ ] MRT [ ] EHS [ ] GAD [ ] OPT [x] MTN

- [x] อนุมัติ
- [ ] ไม่อนุมัติ : .....

ผู้อนุมัติ
15 / 6 / 22

การรับเอกสารบน Central Drive

ที่	รับ	ส่วนงาน	วันที่
(1)		MTN	15-6-22
(2)			
(3)			
(4)			
(5)			
(6)			
(7)			
(8)			

หมายเหตุ : ต้องนำเอกสารฉบับปัจจุบันที่ได้รับการอนุมัติประกาศใช้ ไปใช้เท่านั้น

ระเบียบปฏิบัติ

เรื่อง

"การบำรุงรักษาเชิงป้องกันและแก้ไข"

"PREVENTIVE AND CORRECTIVE MAINTENANCE"

PD-MTN-01

ORIGINAL

ผู้จัดทำ	ผู้ทบทวน	ผู้อนุมัติ
Roongsak S.		/ Chanidapa
ชื่อ นายเริงศักดิ์ สีนวลแล	ชื่อ นายวิเชียร นามสนธ์	ชื่อ นายวิเชียร นามสนธ์
ตำแหน่ง หัวหน้างานไฟฟ้า	ตำแหน่ง ผู้จัดการบำรุงรักษา	/ นางสาวชนิดาภา พันธไชย
		ตำแหน่ง QMR / EMR
วันที่ 15/06/22	วันที่ 15-6-22	วันที่ 15-6-22

"เอกสารนี้เป็นเอกสารใช้ภายในหน่วยงานของบริษัท กัลฟ์ เอ็นอาร์วี1 จำกัด และ บริษัท กัลฟ์ เอ็นอาร์วี2 จำกัด เท่านั้น"

"หากมีการพิมพ์เอกสารจะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

สถานะ การปรับปรุงแก้ไข

แก้ไขครั้งที่	วันที่เริ่มใช้	หน้าที่แก้ไข	รายละเอียด	เอกสารอ้างอิง	ผู้อนุมัติ
00	05 May 2020	ทุกหน้า	ขึ้นทะเบียนเอกสารใหม่	-	QMR / EMR
01	14 July 2021	4, 5	- แก้ไข แผนผังกระบวนการ - แก้ไขที่จัดเก็บ บันทึกการ PM ตามรอบสัญญาของผู้รับเหมา	-	QMR / EMR
02	15 June 2022	3, 4, 6	หน้า 3 ข้อ 4 แก้ไขดังนี้ - PD-HRA-03 ระเบียบปฏิบัติเรื่องการจัดซื้อ คัดเลือกและประเมินผู้ขาย เป็น PD-GAD-03 การจัดซื้อ คัดเลือกประเมินผู้ให้บริการภายนอก - EHS-P-018 ระเบียบเรื่อง Hazardous Work Permit เป็น ESMS-Sa-P-01 Permit-to-Work System - EHS-P-019 ระเบียบเรื่อง Lock out tag out เป็น ESMS-Sa-P-02 Lock out/Tag out หน้า 4 ข้อ 1 แก้ไขและเพิ่มเติม จาก NN-CCC-NN-CC-NNN เป็น 211X-CG-NN-CCC-NN-CC-NNN 211X = Power Plant 2111 – Gulf GNRV1 2112 – Gulf GNRV2 CG = Cogeneration Power Plant หน้า 6 แก้ไขจาก บันทึกการ PM ตามรอบสัญญาของผู้รับเหมา จัดเก็บไว้ที่ M:\O-Departments\11-MTN\05-MTN Report\06 Contactors Report\ เป็น บันทึก Report การทำงานของผู้รับเหมา จัดเก็บไว้ที่ Online Drive \GULF NRV1 & NRV2 - Documents\Maintenance\00 Report\06 Contactors Report หน้า 6 ข้อ 3 แก้ไขจาก PD-HRA-03 เป็น PD-GAD-03		

"เอกสารนี้เป็นเอกสารใช้ภายในหน่วยงานของบริษัท กัลฟ์ เอ็นอาร์วี1 จำกัด และ บริษัท กัลฟ์ เอ็นอาร์วี2 จำกัด เท่านั้น"
"หากมีการพิมพ์เอกสารจะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

1. วัตถุประสงค์

เพื่อกำหนดวิธีการ และขั้นตอนในการซ่อม และบำรุงรักษาเครื่องจักร อุปกรณ์ไฟฟ้า ในกระบวนการเพื่อให้มั่นใจได้ว่า เครื่องจักร อุปกรณ์ไฟฟ้า ที่มีผลกระทบต่อคุณภาพของผลิตภัณฑ์ และสิ่งแวดล้อม กระบวนการได้รับการซ่อม และบำรุงรักษาให้มีสภาพพร้อมใช้งานเสมอ

2. ขอบเขต

ระเบียบปฏิบัตินี้ครอบคลุมถึงกิจกรรมซ่อม การบำรุงรักษาตามระยะเวลา สำหรับเครื่องจักร อุปกรณ์ไฟฟ้า

3. คำจำกัดความ

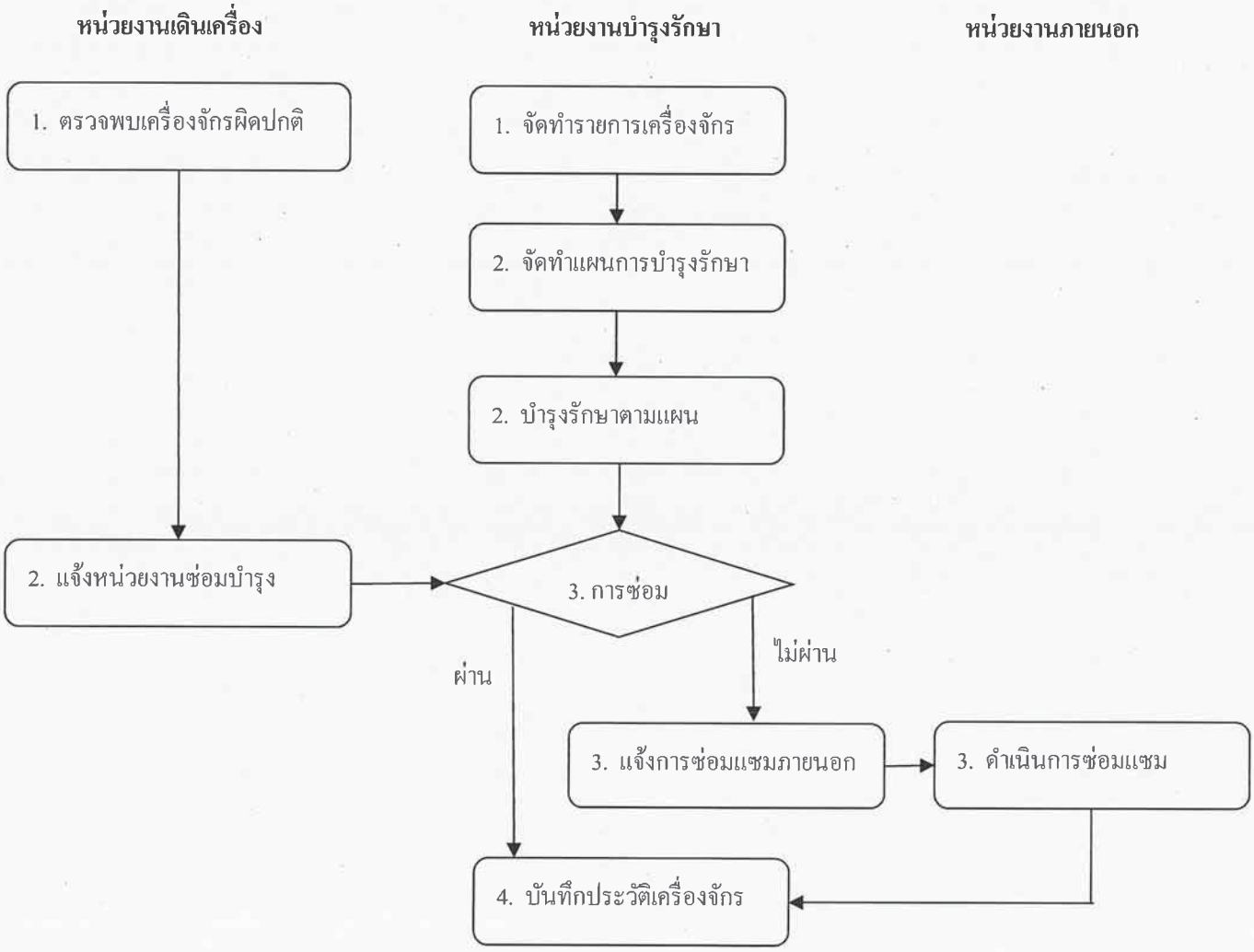
- การซ่อม หมายถึง การซ่อมเครื่องจักร อุปกรณ์ไฟฟ้า ซึ่งเสียหายเพื่อให้สามารถใช้งานได้
- การบำรุงรักษา หมายถึง การบำรุงรักษาตามระยะเวลา
- เครื่องจักร หมายถึง เครื่องจักรในกระบวนการผลิตกระแสไฟฟ้า อุปกรณ์ไฟฟ้าในสำนักงาน อุปกรณ์ฉุกเฉิน

4. เอกสารอ้างอิง

- PD-MTN-03 ระเบียบปฏิบัติเรื่องการบริหารคลังพัสดุ
- PD-GAD-03 การจัดซื้อ คัดเลือกประเมินผู้ให้บริการภายนอก
- ESMS-Sa-P-01 Permit-to-Work System
- ESMS-Sa-P-02 Lock out/Tag out

"เอกสารนี้เป็นเอกสารใช้ภายในหน่วยงานของบริษัท กัลฟ์ เอ็นอาร์วี1 จำกัด และ บริษัท กัลฟ์ เอ็นอาร์วี2 จำกัด เท่านั้น"
"หากมีการพิมพ์เอกสารจะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

5. แผนผังกระบวนการ



"เอกสารนี้เป็นเอกสารใช้ภายในหน่วยงานของบริษัท กัลฟ์ เอ็นอาร์วี1 จำกัด และ บริษัท กัลฟ์ เอ็นอาร์วี2 จำกัด เท่านั้น"

"หากมีการพิมพ์เอกสารจะถือว่าเอกสารนั้นเป็นเอกสารไม่ควบคุม"

6. ขั้นตอนปฏิบัติการ

รายละเอียด	ผู้รับผิดชอบ	เอกสารที่เกี่ยวข้อง
1. การชี้บ่ง และจัดทำรายการเครื่องจักร ● กำหนดหมายเลขเฉพาะของเครื่องจักรดังนี้ (อ้างอิง SAP) 211X-CG-NN-CCC-NN-CC-NNN 211X = Power Plant 2111 – Gulf GNRV1 2112 – Gulf GNRV2 CG = Cogeneration Power Plant NN = Block 10 – Water Plant 10 - BOP STG 11 – GTG HRSG 11 12 – GTG HRSG 12 CCC = Main System / System / Sub System NN = Line CC = Equipment (Set) NNN = Equipment Running No. ● ติดป้ายชี้บ่งบนเครื่องจักรแสดงหมายเลขเครื่องจักรให้ชัดเจน ● จัดทำบัญชีรายชื่อเครื่องจักรในระบบ SAP	พนักงาน ส่วนงาน บำรุงรักษา	ทะเบียนรายชื่อ เครื่องจักร ใน SAP System
2. การบำรุงรักษาตามแผน ● พนักงานส่วนงานบำรุงรักษา กำหนดระยะเวลาการบำรุงรักษาโดยอ้างอิงตามคู่มือเครื่องจักร โดยระบุในระบบ SAP ● จัดทำบันทึกการซ่อมบำรุง โดยอ้างอิงตามระยะเวลาที่กำหนด - รายเดือน - รายปี ● พนักงานส่วนงานบำรุงรักษา เปิด Work Order พร้อมทั้ง Work Permit ในระบบ SAP เพื่อดำเนินการบำรุงรักษาตามแผน ● พนักงานส่วนงานบำรุงรักษา นำ Work Permit ไปขออนุญาตการบำรุงรักษาที่หัวหน้ากะ เพื่อเริ่มการบำรุงรักษาเครื่องจักร ● ในกรณีที่เครื่องจักรบางรายการไม่สามารถบำรุงรักษาตามระยะเวลาที่กำหนดได้ ให้ทำการบำรุงรักษาในช่วงเวลาหยุดเดินเครื่องจักรประจำปี	พนักงาน ส่วนงาน บำรุงรักษา	ทะเบียนรายชื่อ เครื่องจักร ใน SAP System PM Work Order ใน SAP System Work Permit ใน SAP System / เอกสารในระบบ ESMS

รายละเอียด	ผู้รับผิดชอบ	เอกสารที่เกี่ยวข้อง
• บันทึก Report การทำงานของผู้รับเหมา จัดเก็บไว้ที่ Online Drive \Maintenance\00 Report\06 Contactors Report		
3. การซ่อมเครื่องจักรและอุปกรณ์ไฟฟ้า • กรณีเครื่องจักรและอุปกรณ์ไฟฟ้าเสีย ผู้เกี่ยวข้องแจ้งซ่อมบำรุงโดยใช้แบบฟอร์ม Notification ในระบบ SAP • พนักงานส่วนงานบำรุงรักษา ตรวจสอบการแจ้งซ่อมในระบบ SAP แล้วทำการเปิด Work Order พร้อมทั้ง Work Permit เพื่อดำเนินการซ่อมบำรุง • พนักงานส่วนงานบำรุงรักษา นำ Work Permit ไปขออนุญาตการซ่อมบำรุงที่หัวหน้ากะ เพื่อเริ่มการซ่อมแซมเครื่องจักร • ในกรณีที่ต้องทำการเบิกอะไหล่ ให้ปฏิบัติตามระเบียบปฏิบัติเรื่องการบริหารคลังพัสดุ • กรณีที่ไม่สามารถซ่อมเองได้ ให้ทำการแจ้งเจ้าหน้าที่จัดซื้อเพื่อดำเนินการจัดจ้างผู้ซ่อมจากภายนอกตามรายละเอียดที่ระบุไว้ในระเบียบปฏิบัติ เรื่องการจัดซื้อ คัดเลือกและประเมินผู้ขาย • กรณีที่สามารถซ่อมได้ ให้ดำเนินการซ่อม และทดสอบเครื่องจักรจนใช้ได้ บันทึกการซ่อมใน Notification ในระบบ SAP	ผู้แจ้งซ่อม / พนักงานส่วนงานบำรุงรักษา/ เจ้าหน้าที่ฝ่ายจัดซื้อ	CM Work Order ใน SAP System ระเบียบปฏิบัติเรื่องการบริหารคลังพัสดุ PD-MTN-03 ระเบียบปฏิบัติเรื่องการจัดซื้อ คัดเลือกและประเมินผู้ขาย PD-GAD-03
4. การจัดทำประวัติเครื่องจักร • พนักงานส่วนงานบำรุงรักษา จัดทำประวัติเครื่องจักรในระบบ SAP • กรณีที่มีการเปลี่ยนอะไหล่ หรือดำเนินการแก้ไข รวมถึงการซ่อมบำรุงรักษา ให้บันทึกการแก้ไขเครื่องจักรในประวัติเครื่องจักรทุกครั้ง	พนักงานส่วนงานบำรุงรักษา	ทะเบียนรายชื่อเครื่องจักร ใน SAP System

7. บันทึก

ไม่มี

"เอกสารนี้เป็นเอกสารใช้ภายในหน่วยงานของบริษัท กัลฟ์ เอ็นอาร์วี1 จำกัด และ บริษัท กัลฟ์ เอ็นอาร์วี2 จำกัด เท่านั้น"

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ภาคผนวก ข-18

เอกสารแสดงชนิดและจำนวนอุปกรณ์ความปลอดภัย

Prod. ID	Product	Product Detail	Supplier	Category	Stock	Unit
2021110035	Electrical gloves	Electrical gloves	ผลธัญญะ	Safety Equipment	2	ชิ้น
2021110026	Full Body harness	เข็มขัดรัดตัวชนิดเต็มตัว	ผลธัญญะ	Safety Equipment	16	ชุด
2021110053	Tape Barricade	เทปกันพื้นที่ขาวแดง	ผลธัญญะ	Safety Equipment	6	ชิ้น
2021110027	Rain Cloth	เสื้อกันฝน	ผลธัญญะ	Safety Equipment	16	ชุด
2021110055	Life Jacket	เสื้อชูชีพ สำหรับเก็บไว้ที่ฝั่งบ่อเก็บน้ำ	ผลธัญญะ	Safety Equipment	28	ชุด
2021110020	Pancake filter	แผ่นกรองฟูมจากงานเชื่อม	ผลธัญญะ	Safety Equipment	10	คู่ (Pairs)
2021110039	Oil Spill Absorbent (100 Pad/Box)	แผ่นซับน้ำมัน	ผลธัญญะ	Safety Equipment	900	ชิ้น
2021110041	Chemical Spill Absorbent (100 Pad/Box)	แผ่นซับสารเคมี	ผลธัญญะ	Safety Equipment	700	ชิ้น
2021110010	SAFETY GLASSES COVER GLASSES	แว่นครอบแว่นสายตา	ผลธัญญะ	Safety Equipment	30	ชิ้น
2021110011	Goggle for chemical handling	แว่นครอบตากันสารเคมี	ผลธัญญะ	Safety Equipment	20	ชิ้น
2021110009	Safety Glassess Clear lense	แว่นตานิรภัย เลนส์ใส	ผลธัญญะ	Safety Equipment	31	ชิ้น
2021110008	Safety Glassess I/O lense	แว่นตานิรภัย เลนส์ชา	ผลธัญญะ	Safety Equipment	112	ชิ้น
2021110007	Safety Glassess Black lense	แว่นตานิรภัย เลนส์ดำ	ผลธัญญะ	Safety Equipment	52	ชิ้น
2021110048	Traffic cone	กรวยจราจร	ผลธัญญะ	Safety Equipment	4	ชิ้น
2021110006	Face shield	กระบังหน้า	ผลธัญญะ	Safety Equipment	0	ชิ้น
2021110056	PADLOCK	กุญแจล้อค	ผลธัญญะ	Safety Equipment	0	ชิ้น
2021110025	Cover all suit	ชุดกันฝุ่นกันสารเคมี(สีขาว)	ผลธัญญะ	Safety Equipment	243	ชุด
2021110024	Chemical Suit Type C	ชุดป้องกันสารเคมี Type C	ผลธัญญะ	Safety Equipment	19	ชุด
2021110018	Cartridge fillter for respirator (Organic acid)	ตลับกรองป้องกันสารเคมีชนิดไอกรด	ผลธัญญะ	Safety Equipment	0	คู่ (Pairs)
2021110019	Cartridge fillter for respirator (Mercury /Chlorine)	ตลับกรองป้องกันสารเคมีชนิดปรอทและคลอรีน	ผลธัญญะ	Safety Equipment	0	คู่ (Pairs)
2021110016	Cartridge fillter for respirator (Multi pursose)	ตลับกรองป้องกันสารเคมีชนิดรวม	ผลธัญญะ	Safety Equipment	31	คู่ (Pairs)
2021110017	Cartridge fillter for respirator (Organic vapor)	ตลับกรองป้องกันสารเคมีชนิดสารอินทรีย์	ผลธัญญะ	Safety Equipment	0	คู่ (Pairs)
2021110044	Fire Extinguisher (Carbon Dioxide)	ถังดับเพลิง (CO2)	ผลธัญญะ	Safety Equipment	1	ชิ้น

2021110043	Fire Extinguisher (Dry Chemical)	ถังดับเพลิง (ผงเคมีแห้ง)	ผลธัญญะ	Safety Equipment	3	ชิ้น
2021110031	Cut resistance gloves	ถุงมือกันบาด	ผลธัญญะ	Safety Equipment	111	คู่ (Pairs)
2021110028	Laboratory rubber gloves	ถุงมือกันสารเคมีในห้องปฏิบัติการ	ผลธัญญะ	Safety Equipment	1800	คู่ (Pairs)
2021110029	Nitrile Gloves	ถุงมือกันสารเคมีไนไตร์	ผลธัญญะ	Safety Equipment	12	คู่ (Pairs)
2021110030	Neoprene Gloves	ถุงมือกันสารเคมีนิวโอฟีน	ผลธัญญะ	Safety Equipment	0	ชิ้น
2022030022	Cut resistance gloves SIZE M SYNOS	ถุงมือผ้ากันบาด	ผลธัญญะ	Safety Equipment	17	คู่ (Pairs)
2021110032	Leather gloves	ถุงมือหนัง	ผลธัญญะ	Safety Equipment	38	คู่ (Pairs)
2021110033	Leather gloves Heat Resistance 250 ๐C	ถุงมือหนังกันความร้อน 250 ๐C	ผลธัญญะ	Safety Equipment	8	คู่ (Pairs)
2021110034	Leather gloves Heat Resistance 500 ๐C	ถุงมือหนังกันความร้อน 500 ๐C	ผลธัญญะ	Safety Equipment	2	คู่ (Pairs)
2021110051	Wind sock (30*150 cm)	ถุงลมบอกทิศทาง (30*150 ซม)	ผลธัญญะ	Safety Equipment	4	ชิ้น
2021110050	Wind sock (50*150 cm)	ถุงลมบอกทิศทาง (50*150 ซม)	ผลธัญญะ	Safety Equipment	12	ชิ้น
2021110049	Wind sock (80*200 cm)	ถุงลมบอกทิศทาง (80*200 ซม)	ผลธัญญะ	Safety Equipment	6	ชิ้น
2021110040	Oil Spill Absorbent (Boom)	ท่อนซับน้ำมัน	ผลธัญญะ	Safety Equipment	14	กล่อง
2021110042	Chemical Spill Absorbent (Boom)	ท่อนซับสารเคมี	ผลธัญญะ	Safety Equipment	18	กล่อง
2021110014	Ear muff	ที่ครอบหู	ผลธัญญะ	Safety Equipment	27	คู่ (Pairs)
2021110054	Flag Barricade	ธงกั้นพื้นที่ขาวแดง	ผลธัญญะ	Safety Equipment	4	ชิ้น
2021110013	Ear plug (Foam)	ปลั๊กอุดหูชนิดโฟม	ผลธัญญะ	Safety Equipment	2400	คู่ (Pairs)
2021110012	Ear plug (Silicone)	ปลั๊กอุดหูชนิดซิลิโคน	ผลธัญญะ	Safety Equipment	315	คู่ (Pairs)
2021110023	Aporn	ผ้ากันเปื้อนล้างพื้นหน่วยผลิตน้ำ	ผลธัญญะ	Safety Equipment	0	ชิ้น
2021110045	Fire Extinguisher cover	ผ้าคลุมถังดับเพลิง	ผลธัญญะ	Safety Equipment	2	ชิ้น
2021110005	Head Cover	ผ้าคลุมศรีษะแบบตัวหนอน	ผลธัญญะ	Safety Equipment	96	ชิ้น
2021110036	Safety Shoes	รองเท้านิรภัย	ผลธัญญะ	Safety Equipment	10	คู่ (Pairs)
2021110038	Electrical Boots	รองเท้าบู๊ตกันไฟฟ้า	ผลธัญญะ	Safety Equipment	2	คู่ (Pairs)
2021110037	Chemical Boots	รองเท้าบู๊ตกันสารเคมี	ผลธัญญะ	Safety Equipment	0	คู่ (Pairs)

2021110003	Helmet Harness	รองในหมวก	ผลธัญญะ	Safety Equipment	0	ชิ้น
2021110047	Fire Hose (1.5 inch)	สายฉีดน้ำดับเพลิง 1.5 นิ้ว	ผลธัญญะ	Safety Equipment	31	ชิ้น
2021110046	Fire Hose (2.5 inch)	สายฉีดน้ำดับเพลิง 2.5 นิ้ว	ผลธัญญะ	Safety Equipment	52	ชิ้น
2021110004	Chin Strap	สายรัดคาง	ผลธัญญะ	Safety Equipment	0	ชิ้น
2021110021	Dust Mask (12 ea/.box) N95	หน้ากากป้องกันฝุ่น N95	ผลธัญญะ	Safety Equipment	48	ชิ้น
2021110022	Dust Mask with Carbon Filter (10 ea/box)	หน้ากากป้องกันฝุ่น ชนิด P1	ผลธัญญะ	Safety Equipment	142	ชิ้น
2021110015	Half Mask for chemical resistant	หน้ากากป้องกันสารเคมี	ผลธัญญะ	Safety Equipment	12	ชิ้น
2021110001	Safety Helmet	หมวกนิรภัยสีขาว	ผลธัญญะ	Safety Equipment	52	ชิ้น
2021110002	Safety Helmet	หมวกนิรภัยสีขาว	ผลธัญญะ	Safety Equipment	79	ชิ้น
2021110052	Life buoy	ห่วงชูชีพ สำหรับเก็บไว้ที่ฝั่งบ่อเก็บน้ำ	ผลธัญญะ	Safety Equipment	40	ชิ้น

ภาคผนวก ข-19

เอกสารอบรมด้านอาชีวอนามัย และความปลอดภัย (Safety Induction)

SAFETY INDUCTION

Induction prior start work

October 2022

GNRV1-2

โรงไฟฟ้าหนองระเวียง1 และ โรงไฟฟ้าหนองระเวียง2

SAFETY INDUCTION

SHE Induction Training

After the work / project is awarded and prior to the start of work, the Contractor and applicable company representatives shall participate in an SHE Induction Training (at least 7 days prior to commencing work for planned outage), which includes:

- A review of GULF and site specific SHE requirements, site specific hazards, abnormal operating conditions, emergency response, restricted areas, security, potential hazards that may be encountered, evacuation procedures, assembly areas, safety systems and contractor access and parking requirements at the worksite. The Contractors is encouraged to ask questions during the induction process.
- The induction is required annually or when changes occur. The Contractors shall ensure that everyone that works on site receives this induction training. The Contractors require to complete after induction session. A copy of the complete checklist and training record form shall be kept by site SHE.

SAFETY INDUCTION

- **ผู้รับเหมา** หมายถึง บุคคลภายนอกที่เข้ามาปฏิบัติงานเป็นระยะเวลาหนึ่ง เพื่อซ่อมแซมหรือติดตั้งเครื่องจักร รวมไปถึง การก่อสร้างภายในบริษัทฯ
- **ผู้มาติดต่องาน** หมายถึง บุคคลภายนอกที่เข้ามาติดต่องาน ส่งของ เสนองาน ประชุม เป็นระยะเวลาหนึ่ง ในแต่ละวันเท่านั้น
- **บัตรผ่านการอบรมด้านสิ่งแวดล้อมและความปลอดภัย** หมายถึง บัตรที่เจ้าหน้าที่เจ้าหน้าที่ความปลอดภัย ออกให้เพื่อแสดงว่าพนักงานผู้รับเหมาผ่านการอบรมด้านสิ่งแวดล้อม อาชีวอนามัยและความปลอดภัย

Refer : PD-ESH-09 OUTSOURCE CONTROL

SAFETY INDUCTION

1. การขออนุญาตเข้าปฏิบัติงานในพื้นที่ของบริษัทฯ

1.1 สำหรับผู้รับเหมา

- **สำหรับบุคคลที่ยังไม่เคยผ่านการอบรม** บริษัทต้นสังกัดของผู้รับเหมาส่งรายชื่อผู้รับเหมาที่จะขอเข้าทำงานและขอเข้าอบรมด้านสิ่งแวดล้อม อาชีวอนามัยและความปลอดภัยก่อนปฏิบัติงาน โดยติดต่อประสานงานผ่านเจ้าของงาน (พนักงานโรงไฟฟ้า) โดยมีเอกสารประกอบการขอเข้าทำงานและขอเข้าฝึกอบรมที่ต้องเตรียม ได้แก่ สำเนาบัตรประจำตัวประชาชน และสำหรับผู้เหมาขนส่งสารเคมีต้องเตรียมเอกสารเพิ่มเติม ได้แก่ สำเนาใบอนุญาตขับขี่รถขนส่งสารเคมี และเอกสารหลักฐานอื่นใดตามที่กฎหมายกำหนด
- สำหรับบุคคลที่ผ่านการอบรมแล้วและบัตรยังไม่หมดอายุ ให้บริษัทต้นสังกัดทำการแจ้งชื่อขอเข้าทำงานล่วงหน้า และนำบัตรผ่านการอบรมมาแสดงที่หน้าป้อม รปภ. ทุกครั้งเมื่อเข้ามาปฏิบัติงาน
- ผู้รับเหมาทำการแลกบัตรผ่านเข้า-ออกโรงไฟฟ้า โดยยึดระเบียบปฏิบัติตาม Plant security
- กรณีที่มีการประกาศจากหน่วยงานราชการให้เป็นภาวะโรคระบาด ให้ปฏิบัติตาม ESMS-ES-P03-WI-01 เรื่อง Access control for CVID-19 Pandemic Prevention

Refer : PD-ESH-09 OUTSOURCE CONTROL

SAFETY INDUCTION

1.2 สำหรับผู้มาติดต่องานทั่วไป

- ผู้มาติดต่องานทั่วไปก่อนเข้ามาในพื้นที่ต้องทำการติดต่อประสานงานผู้ต้องการเข้าพบล่วงหน้า และแจ้งชื่อที่ป้อม รปภ. ว่ามาพบพนักงานท่านใด เพื่อให้ รปภ. ทำการโทรแจ้งผู้ที่ขอเข้าพบให้ทราบ และทำเรื่องแลกบัตรผ่านเข้า-ออกโรงไฟฟ้า โดยยึดระเบียบปฏิบัติตาม Plant security ทั้งนี้ผู้มาติดต่องานทั่วไป ไม่ต้องผ่านการอบรมด้านสิ่งแวดล้อมและความปลอดภัยก่อนเข้าพื้นที่แต่ต้องได้รับทราบข้อมูลข่าวสารด้านการจัดการสิ่งแวดล้อมและความปลอดภัยตามระเบียบปฏิบัติ การสื่อสารทุกครั้ง

Refer : PD-ESH-09 OUTSOURCE CONTROL

SAFETY INDUCTION

2. การฝึกอบรมความปลอดภัยก่อนการปฏิบัติงาน

- ผู้รับเหมาทั่วไปและผู้รับเหมาขนส่งสารเคมี เข้ารับการอบรมที่ห้องประชุมโรงไฟฟ้า
- เจ้าหน้าที่ความปลอดภัย/หัวหน้าส่วนงาน ทำการอบรมแก่ผู้รับเหมาก่อนเข้าปฏิบัติงานภายในบริษัทฯ และเก็บบันทึกการอบรมไว้
- ผู้รับเหมาต้องผ่านการทำแบบทดสอบด้านสิ่งแวดล้อมและความปลอดภัย โดยผ่านเกณฑ์ 80%
- ผู้รับเหมาที่ผ่านการฝึกอบรมด้านสิ่งแวดล้อมและความปลอดภัย จะมีหลักฐานเพื่อแสดงการอบรม เช่น สติ๊กเกอร์ บัตร บันทึก เป็นต้น โดยมีอายุ 1 ปี นับจากวันที่ผ่านการอบรม
- ในกรณีผู้รับเหมาที่ทำงาน Outage ให้จัดทำบัตรผ่านการอบรม
- เมื่อบัตรหมดอายุต้องผ่านการอบรมด้านสิ่งแวดล้อมและความปลอดภัย ใหม่ จึงจะสามารถเข้าทำงานภายในพื้นที่โรงไฟฟ้าได้

Refer : PD-ESH-09 OUTSOURCE CONTROL

SAFETY INDUCTION

Recordkeeping and review

FP-EHS-09-01 ใบลงทะเบียนและประเมินผลการฝึกอบรมด้านสิ่งแวดล้อมและความปลอดภัยของผู้รับเหมา

FP-EHS-09-02 บัตรผ่านการอบรมด้านสิ่งแวดล้อมและความปลอดภัย

Refer : PD-ESH-09 OUTSOURCE CONTROL

SAFETY INDUCTION

- เจ้าหน้าที่ความปลอดภัย/หัวหน้าส่วนงาน ทำการอบรมแก่ผู้รับเหมาก่อนเข้าปฏิบัติงานภายในบริษัทฯ และเก็บบันทึกการอบรมไว้ โดยมีหัวข้อดังต่อไปนี้

- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
- ผังองค์กร
- สถานที่ในโรงไฟฟ้า
- การเข้า-ออกโรงไฟฟ้า
- การนำของ เข้า-ออกโรงไฟฟ้า
- การขออนุญาต เข้าทำงาน
- อุปกรณ์ป้องกันภัยส่วนบุคคล
- ป้ายเตือนความปลอดภัย
- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม

1. มุ่งมั่นที่จะบรรลุและปฏิบัติตามกฎหมายด้านสิ่งแวดล้อม ความปลอดภัย และสังคม อย่างเคร่งครัด พร้อมทั้งนำข้อกำหนด ของลูกค้า และข้อกำหนดอื่นๆที่เกี่ยวข้องมาปรับใช้เป็นมาตรฐานในการดำเนินการ
2. จะดำเนินธุรกิจอย่างมีแนวทางความรับผิดชอบต่อสิ่งแวดล้อม รวมถึงความมุ่งมั่นในการปกป้องสิ่งแวดล้อม ความปลอดภัยและการจัดการด้านสังคมโดยมีเป้าหมายคือลดการปลดปล่อยก๊าซเรือนกระจกของทั้งองค์กรตลอดจนวัฏจักรการผลิตของผลิตภัณฑ์ สร้างสมดุลระหว่างผลประโยชน์และผู้มีส่วนได้ส่วนเสียขององค์กร ทำให้เกิดการพัฒนาธุรกิจอย่างยั่งยืน
3. มุ่งมั่นในการป้องกันการได้รับบาดเจ็บและ เจ็บป่วย อันตรายจากการทำงาน และโรคที่เกิดจากการทำงาน รวมถึงการดูแลสภาพจิตใจของพนักงาน พร้อมทั้งมีการปรับปรุงสภาพแวดล้อมในการทำงานให้น่าอยู่น่าทำงาน และเกิดความปลอดภัยสูงสุดในขณะทำงาน

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม

4. จัดให้มีการสื่อสารทั้งภายในและภายนอกองค์กร โดยให้พนักงานทุกระดับ ชุมชนรอบข้าง และผู้มีส่วนได้ส่วนเสีย ให้มีความเข้าใจในระบบการจัดการด้านคุณภาพ ด้านสิ่งแวดล้อม และความปลอดภัย พร้อมทั้งให้คำปรึกษา ข้อแนะนำ รวมถึงการส่งเสริมและสนับสนุนกิจกรรมทั้งภายในและภายนอกองค์กร โดยให้พนักงานทุกระดับมีส่วนร่วมในการจัดกิจกรรม เพื่อเสริมสร้างความสัมพันธ์ที่ดีระหว่างองค์กรกับผู้ทำงาน, ตัวแทนผู้ทำงานและผู้มีส่วนได้ส่วนเสีย และยินดีเปิดเผยรายงานผลการดำเนินงานสู่สาธารณะ

5. ให้การสนับสนุนทรัพยากรอย่างเหมาะสม ทั้งในเรื่องบุคลากร เทคโนโลยีสารสนเทศ เวลา งบประมาณและให้ความสำคัญกับการพัฒนาทรัพยากรมนุษย์ พร้อมทั้งปลูกฝังและเสริมสร้างวัฒนธรรมและพฤติกรรมที่ดีด้านสิ่งแวดล้อม ความปลอดภัยและการจัดการด้านสังคม เน้นการมีส่วนร่วมจากระดับผู้บริหารไปจนถึงพนักงานทุกๆระดับ

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม

6. มุ่งเน้นการมีส่วนร่วมในการบริหารจัดการ และปรับปรุงประสิทธิภาพในการดำเนินงานด้านสิ่งแวดล้อม ความปลอดภัยและการจัดการด้านสังคมร่วมกับผู้รับเหมาหลัก ผู้ผลิต และผู้ค้าทางธุรกิจ เพื่อสร้างความพึงพอใจของลูกค้า และพัฒนาด้านคุณภาพ ด้านสิ่งแวดล้อม และด้านอาชีวอนามัยและความปลอดภัยอย่างต่อเนื่อง

7. ทบทวนแผนการดำเนินงานด้านคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม เป็นประจำทุกปี เพื่อพัฒนาระบบการจัดการอย่างต่อเนื่องและมีประสิทธิภาพ

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Organization & Contact Point

Plant Manager
Panai Cheamcharoenkul
Tel. 089-936-9546

Operation Manager

Outage / Maintenance Manager
Wichian Namson
Tel. 089-936-9546

General Administration
- GA Manager: Papimon Chartphehon, Tel. 084-2655369
- GA Officer: Anya Khemasa-ard, Tel. 087-244-8101
- GA Officer: Patcharin Ploenaksorn, Tel. 092-795-9929

SH&E
- SH&E Manager: Chanidapa Punthachal, Tel. 086-257-8988
- SH&E Officer: Annop Tantadprasert, Tel. 089-231-4702

Part withdrawal
- Warehouse: Amnart Muttapato, Tel. 086-971-9847
- Warehouse: Detsak Iasra, Tel. 083-282-5195

QA Supporting Team
- QC Advisor: Jirawut Veraporthep, Tel.087-767-9781
- QC Advisor: Chuttana Prongnol, Tel. 085-920-9958

Operation
- Shift Leader: Arik Lanamthieng, Tel. 083-362-4325
- Shift Leader: Noparat Pengarl, Tel. 088-505-0007
- Shift Leader: Pornawan Channgam, Tel. 086-625-3045
- Shift Leader: Sirawut Sombatrattananan, Tel. 091-764-9333
- Shift Leader: Yuttana Chaykla, Tel. 084-227-3283
- Chemist: Angsana Panomwech, Tel. 089-616-5191

Mechanical Leader: Kritsanapong Boonmun, Tel. 083-794-0025
- Mechanical Inspector
  - Mechanical Engineer: Chirawut Kaewnaphan, Tel. 086-201-1993
  - Mechanical Engineer: Pattanapong Prayoonchan, Tel. 098-241-1142
  - Mechanical Engineer: Kittikhun Nanwong, Tel. 083-371-2292

Electrical Leader: Roengsak Seenuanlae, Tel. 089-148-1210
- Electrical Inspector
  - Electrical Engineer: Kasidz Thuannok, Tel. 061-924-7895
  - Electrical Engineer: Narudom Chuthong, Tel. 081-892-5489
  - Electrical Engineer: Worapot Saelee, Tel. 095-552-0325

C&I Leader: Sumet Bunpok, Tel. 096-825-9937
- C&I Inspector
  - C&I Engineer: Prapath Suktam, Tel. 083-116-9777
  - C&I Engineer: Tanakorn Sepacok, Tel. 087-241-8957
  - C&I Engineer: Rangsiwut Sritasan, Tel. 0989614497

SAFETY INDUCTION

GULF

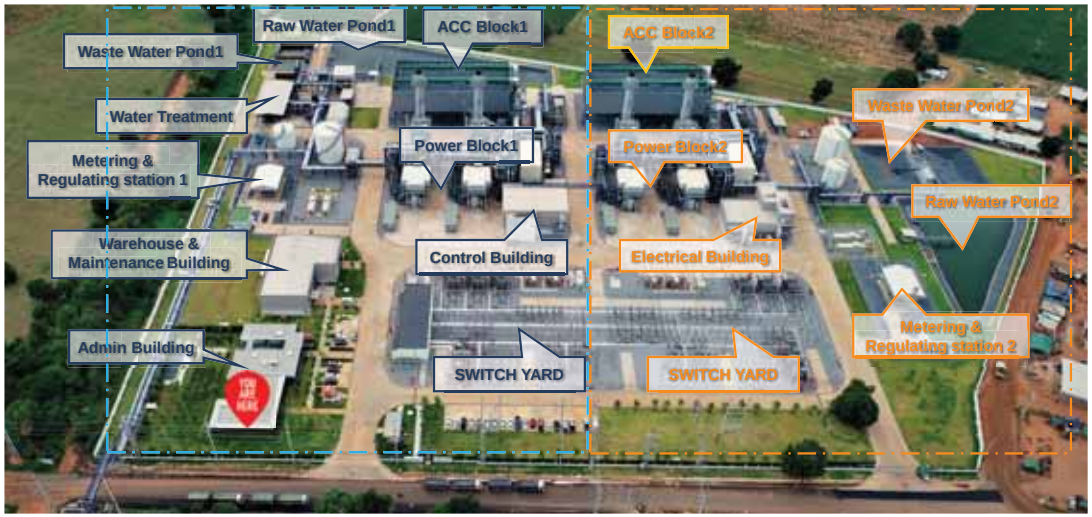
- เจ้าหน้าที่ความปลอดภัย/หัวหน้าส่วนงาน ทำการอบรมแก่ผู้รับเหมาก่อนเข้าปฏิบัติงานภายในบริษัทฯ และเก็บบันทึกการอบรมไว้ โดยมีหัวข้อดังต่อไปนี้

- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
- ผังองค์กร
- สถานที่ในโรงไฟฟ้า
- การเข้า-ออกโรงไฟฟ้า
- การนำของ เข้า-ออกโรงไฟฟ้า
- การขออนุญาต เข้าทำงาน
- อุปกรณ์ป้องกันภัยส่วนบุคคล
- ป้ายเตือนความปลอดภัย
- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

Power Plant Overview ภาพรวมภายในโรงไฟฟ้า

GULF

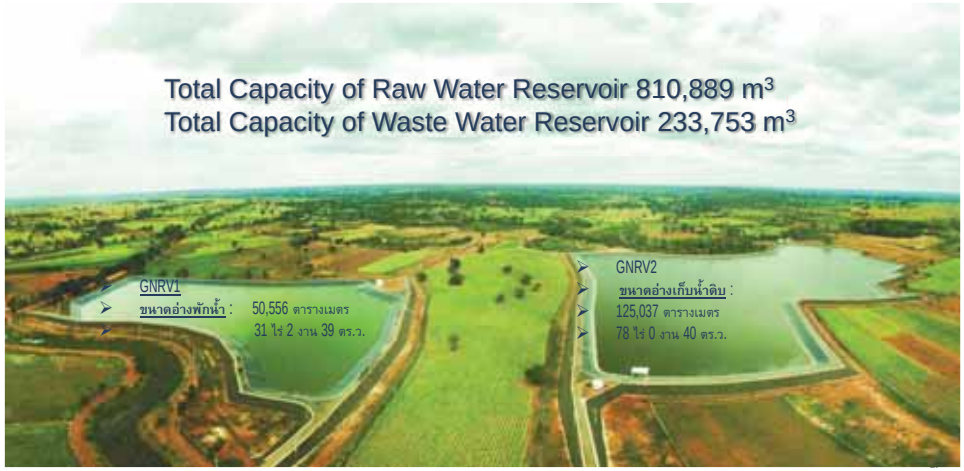


GNRV1 & GNRV2 Location

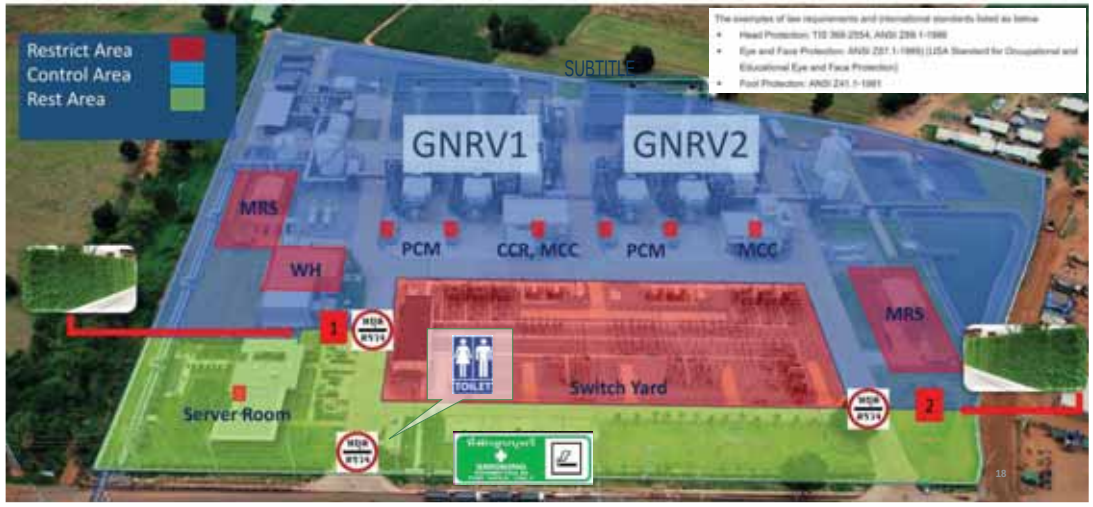
GULF

อ่างเก็บน้ำดิบ และอ่างพักน้ำ
- ❑ ต.ท่าจะหลุง, อ.เมืองนครราชสีมา, จ. นครราชสีมา(อ่างพักน้ำ) เนื้อที่ 147 ไร่ 1 งาน 56 ตารางวา
- ❑ ต.ด่านเกวียน, อ.เมืองนครราชสีมา, จ. นครราชสีมา(อ่างเก็บน้ำ) เนื้อที่พื้นที่ 136 ไร่ 1 งาน 42 ตารางวา

Water Reservoir & Waste Water Reservoir



POWER PLANT AREA



พื้นที่สูบบุหรี่

General Requirements

Smoking is prohibited generally throughout the site. Only those areas specially marked as smoking areas "SMOKING AREA" may be used. The site SH&E will inform the Contractors and describe during site SH&E induction training where these are located.

The smoking area is provided at behind the guard house.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

ห้องน้ำ

General Requirements

Contractor can use the sanitary facilities located in the guard house.

Keep the area clean and be respectful of the next person who will use these facilities.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

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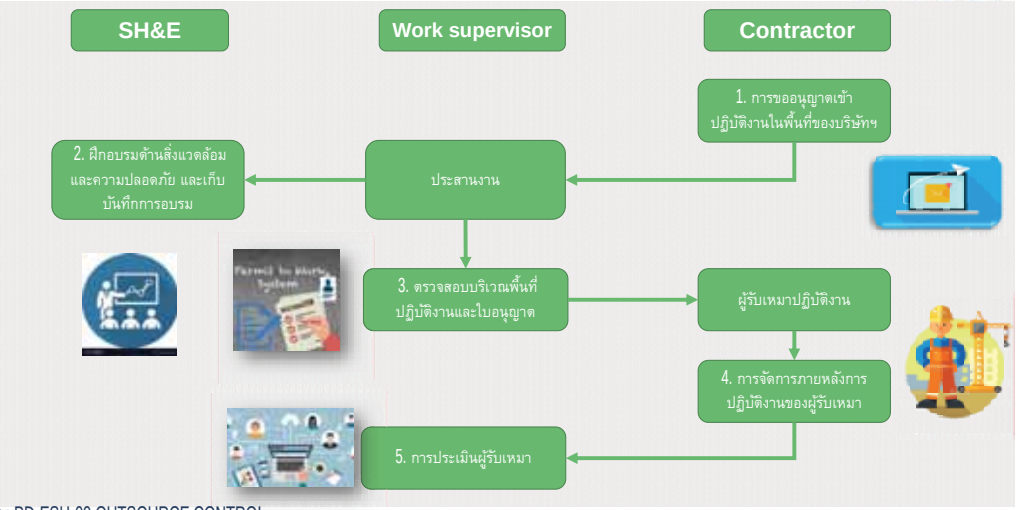
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

การเข้า-ออกโรงไฟฟ้า



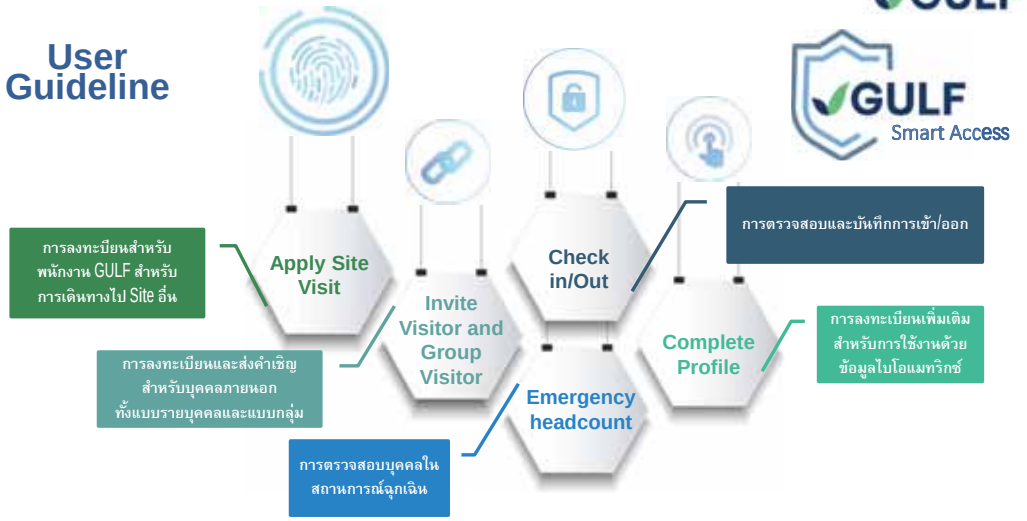
Refer : PD-ESH-09 OUTSOURCE CONTROL

การเข้า-ออกโรงไฟฟ้า

1. การขออนุญาตเข้าปฏิบัติงานในพื้นที่ของบริษัทฯ

- ใบอนุญาตผ่านเข้าออกประตูโรงไฟฟ้า
- บันทึกการเข้าออก (สำหรับผู้รับเหมา) ESMS-Sa-P-07 (เอกสารแนบ 8)
- แบบสอบถามข้อมูลสำหรับผู้มาติดต่อเพื่อป้องกันโรคระบาด ESMS-ES-P03-WI-01 (เอกสารแนบA1)

การเข้า-ออกโรงไฟฟ้า



วิธีบันทึกการเข้า/ออก สำหรับ พนักงานกัลฟ์

ขั้นตอนและกระบวนการ (3) -Check-In / Check-Out

การเข้า-ออกโรงไฟฟ้า

Site premises are not be accessed by the Contractor without prior authorization.

- Only designated roads, gates, and doors should be used for entry or exit.
- The Contractor's employees shall park in the areas designated by the work location.
- When entering and exiting site premises, vehicles and belongings are subject to screening. The Contractors may be required to present valid government photo identification (e.g., Identification Card, Drivers License and Passport) to security and sign in and out of the premises.
- Contractor's ID badge will be issued by security.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การเข้า-ออกโรงไฟฟ้า

Site premises are not be accessed by the Contractor without prior authorization.

- Bringing tools and equipment into site premises, the Contractor shall complete Material Gate Pass Form and have inventory list Then all will be locked or stored at control area.
- Identify and list of all necessary tools and equipment which detailed in condition, date and inspector for submitting to GULF in advance. Form as ATTACHMENT_2_Material list for contractor form of ESMS-Sa-P-07 Plant security.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การเข้า-ออกโรงไฟฟ้า

Gate entry control The following procedure applies to all personnel and will be enforced by the gate security guard.

- The security guards at the main gate shall check the employee ID card of all Gulf group's employees, visitors, vendor, and suppliers as well as employee of contractor.
- Person who enters to Gulf groups shall wear proper dress, short pan, slipper is not allowed.
- Visitors, vendors, suppliers need to complete the gate pass permit as mention in item
- After complete all gate pass requirement, security guard shall informs Gulf group's relevant person and get permission.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การเข้า-ออกโรงไฟฟ้า

Gate entry control The following procedure applies to all personnel and will be enforced by the gate security guard.

- The visitor gate pass form shall be kept at least 90 days.
- Only work-related tools, equipment and materials are allowed to entry the power plant area.
  - Contractor have to submit the tools, equipment and materials list to Work Supervisor (in advance).
  - Work Supervisor will check and inspect those tools, equipment and materials before entering the power plant area.
  - Entered contractor's tools, equipment and materials have to be locked and stored in designated area

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การเข้า-ออกโรงไฟฟ้า

Entering to production related area

- Power Plant shall Indicated and categorized the production-related area into;
  - 1.) Control area
  - 2.) Restrict area
  - 3.) Work preparation area for contractor
  - 4.) Lay down area for contractor
  - 5.) Rest area for contractor.
- Clearly separate the area in with appropriate equipment e.g. physical barricade(fence, gate with lock, Chain with lock, hard barricade, soft barricade, etc.) to control the area access.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การเข้า-ออกโรงไฟฟ้า

Entering to production related area

- All production related area accessing have to be controlled strictly.
- Contractor's tools, equipment and materials must be locked and stored in designated area indicated. Work supervisor must ensure that only tools and equipment indicated in PTW and JSA is allowed to use and contractor shall make a requisition for tools and equipment using to Work supervisor to unlock.
- Information Board* shall be displayed and updated by Work Supervisor at Restricted area access point during planned outage. Security personnel shall be assigned to monitor the restricted area entry.

* Information board is a displayed board which using to communicate the detail of work, responsible person and personnel that allowed to access the area.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การเข้า-ออกโรงไฟฟ้า

Entering to production related area

- The camera, or any electronic device that can take photograph is not allow to bring in production area unless get permission from plant manager or designee.
- All require PPE to be worn or carry when entry to Gulf group's production area.
- No Visitors/Vendors/Suppliers are allowed to present in production area without Gulf group's representative.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

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- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

การนำของ เข้า-ออกโรงไฟฟ้า

Material Gate Pass Control. (Incoming control.)

- When carry in material to Gulf group's area for any purpose such as for construction work, maintenance, the owner shall record all incoming material in material gate pass form and obtain the signature from Gulf group's work sponsor.
- The list shall indicate detail enough such as type, number, quantity etc.
- The security guard shall inspect the material gate pass form and verify all equipment indicated in the list.
- One copy of the material gate pass shall be kept at security guard for reference.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

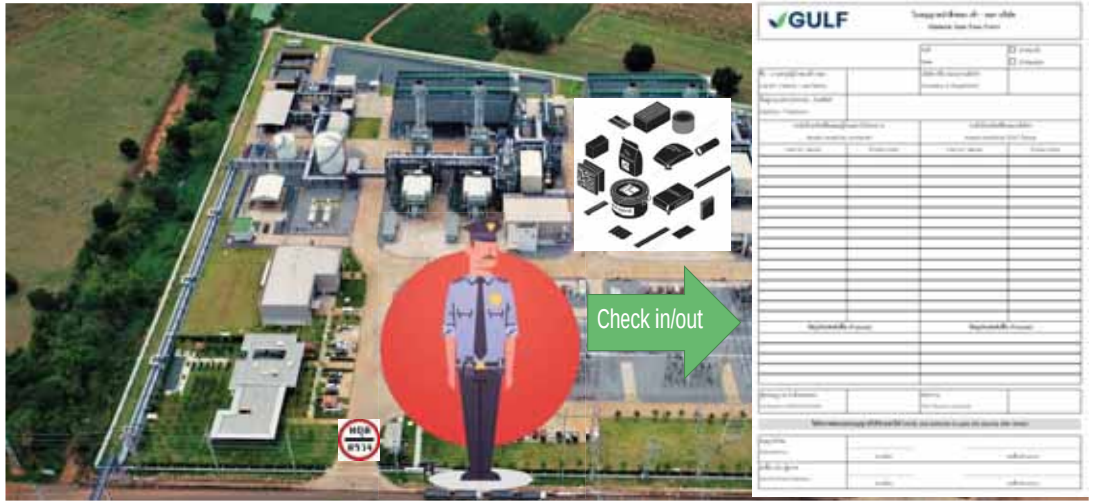
การนำของ เข้า-ออกโรงไฟฟ้า

Material Gate Pass Control. (Outgoing control.)

- Prior to carry out the construction, tool for maintenance material, the contractor or requester shall complete the material gate pass form. In case of incoming form is submitted, the incoming material gate pass shall be attached.
- The contractor, requester, shall obtain the approval from work sponsor and area relevant manager prior to ship the material. Shipment of to the truck shall under monitoring of Gulf group's work sponsor.
- Prior to leave Gulf group's area, security guard shall inspect and verify the completion of material gate pass form.
- In case any doubt, the security guard shall consult with Gulf group's work sponsor.
- The material gate pass shall be then distributed to
- (a) Original shall be kept along with person who need to carry material
- (b) 2nd copy shall be kept at security guard
- ~~(c) 3rd copy shall be return to the approval authority person.~~

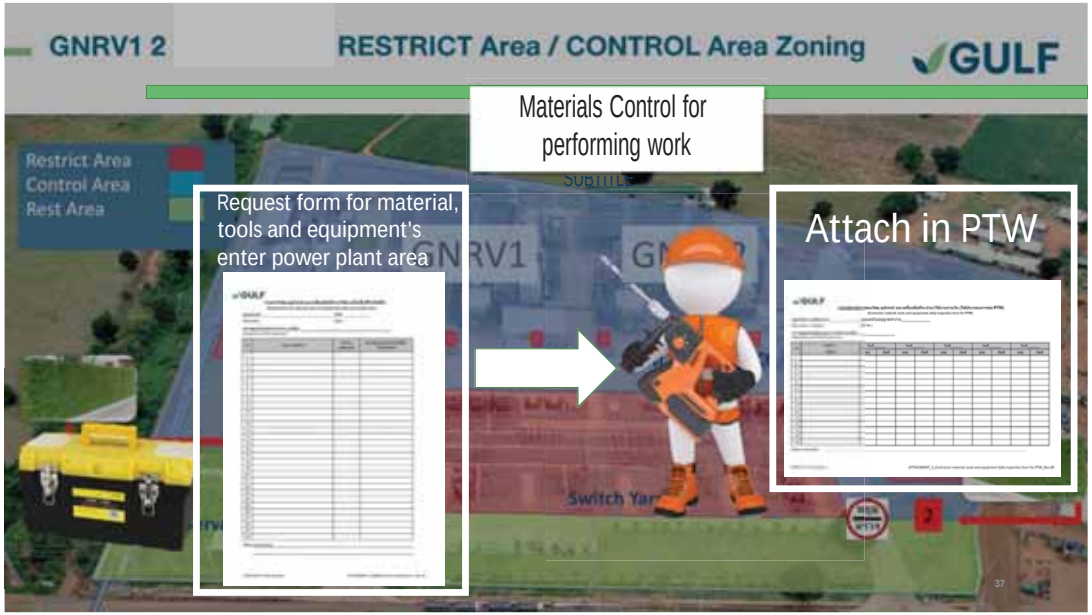
Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การนำของ เข้า-ออกโรงไฟฟ้า



GNRV1 2 RESTRICT Area / CONTROL Area Zoning

GULF



การนำของ เข้า-ออกโรงไฟฟ้า

GULF

Contractor Parking

- Vehicles may be driven onto site or the company's premises only for short periods for the purpose of loading and unloading.
- Parking in front of fire hydrants or emergency equipment is not allowed. Contractors shall park only in designated contractor parking areas.
- If the contractor needs to use special vehicles or equipment in order to carry out the work, he must ask the work supervisor or security to allocate appropriate parking areas
- If parked in violation of the rules, vehicles may be towed away police man at the owner's expense.
- All vehicle need to entry to Gulf group's area need to be registered.
- Vehicle of visitors/vendors/suppliers who need to entry to Gulf group's for specific purpose need to get a temporary vehicle entry permit. To do so the vehicles require stopping at outside and preceding all security requirements.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การนำของ เข้า-ออกโรงไฟฟ้า

GULF

Contractor Parking

- The vehicle will then receive temporary vehicle entry permit card. The card shall be posted on vehicle at all time while they are in plant area.
- Security guard shall conduct an inspection and ensure no safety concerned and no environmental related issue may generate from the vehicle.
- Parking of vehicle is allowed only at parking area or designed Area.
- For emergency response purpose, parking on other area where obstruct to fire fighting facilities is strictly prohibited.

Note; the visitors/vendors/suppliers not allow transporting the vehicle while they entering pass through the security guard and within Gulf group's area.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

PARKING AREA

GULF

SAFETY INDUCTION

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- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

PD-ESH-09 OUTSOURCE CONTROL

Safety Induction

Purpose

เพื่อใช้เป็นระเบียบในการควบคุมบุคคลภายนอกซึ่งได้แก่ผู้รับเหมา (Subcontractor) และผู้มาติดต่องาน (Visitor) เพื่อป้องกันการเกิดอันตราย การเจ็บป่วยซึ่งอาจจะเกิดขึ้นภายในบริเวณพื้นที่ปฏิบัติงานตลอดจนทรัพย์สิน สภาพแวดล้อม ของบริษัทฯ

Refer : PD-ESH-09 OUTSOURCE CONTROL

Safety Induction

Scope

- ระเบียบปฏิบัตินี้ครอบคลุมที่เข้ามาในบริเวณพื้นที่ของบริษัท ฯ

GNRV1 2 : RESTRICT Area / CONTROL Area Zoning

GULF

การขออนุญาต เข้าทำงาน

GULF

การปฏิบัติงานของผู้รับเหมา

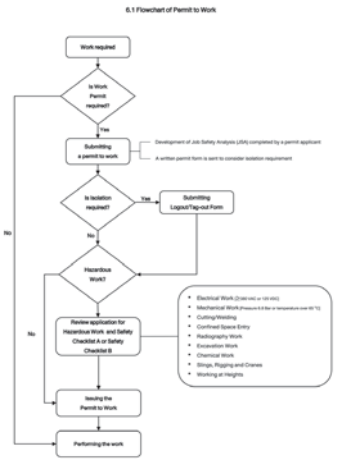
- เจ้าของงาน(พนักงานโรงไฟฟ้า) ทำการขออนุญาตเปิด work permit ให้ผู้รับเหมาก่อนเริ่มปฏิบัติ โดยปฏิบัติตามระเบียบปฏิบัติ Permit to Work System โดยไม่อนุญาตให้ผู้รับเหมาเปิด-ปิด work permit เองโดยเด็ดขาด
- เจ้าของงาน (พนักงานโรงไฟฟ้า) ตรวจสอบบริเวณพื้นที่ปฏิบัติงานของผู้รับเหมาก่อนการปฏิบัติงานอีกครั้งภายหลังขออนุญาตเปิด work permit
- ผู้รับเหมาปฏิบัติงานได้ตามปกติ โดย Work permit ต้องแสดงไว้ที่หน้างานตลอดเวลาขณะปฏิบัติงาน เมื่อปฏิบัติงานแล้วแสร็จ เจ้าของงาน (พนักงานโรงไฟฟ้า) ทำการขออนุญาตปิด Work permit

Refer : PD-ESH-09 OUTSOURCE CONTROL

การขออนุญาต เข้าทำงาน

GULF

5.7 Permit to Work System



Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Attachment-6: Flowchart of Permit to Work System and Hazardous Work Permit

การขออนุญาต เข้าทำงาน

GULF

Risk Assessment and Job Safety Analysis (JSA)

- Prior to commence of any works, the risk assessment shall be conducted and Job Safety Analysis (JAS) form shall be completed. The detailed Job Safety Analysis (JSA) shall identify the hazards associated with the tasks and activities assesses the level of risks, and identify appropriate control measures.
- Where a Risk Assessment and Job Safety Analysis (JSA) are not considered to be acceptable, the Contractor will be notified and appropriate modifications made to the Risk Assessment and Job Safety Analysis (JSA).

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Risk Assessment and Job Safety Analysis (JSA)

แบบฟอร์มการวิเคราะห์งานเพื่อความปลอดภัย (Job Safety Analysis)

Date/ วันที่ : ..... หมายเลข JSA No. ME-20-01

Job/ ชื่องาน : การบำรุงรักษาอุปกรณ์ไฟฟ้า

Work Location/ Equipment No./ อุปกรณ์/ พื้นที่ทำงาน : All Plant

Prepared by/ ผู้จัดทำ/ แผนก/ ฝ่าย : MTN/ ME Approved by/ อนุมัติโดย : .....

Item No. ขั้นตอนที่	Step of Work ขั้นตอนการทำงาน	Potential Hazards อันตรายที่อาจเกิดขึ้น	Risk ระดับความรุนแรง	Control Measures มาตรการควบคุม ป้องกัน	Residual Risk ความรุนแรงหลังจากทำการควบคุมป้องกันแล้ว
1	ตรวจสอบสภาพทั่วไปของมอเตอร์ไฟฟ้าด้วยสายตา, การสั่นสะเทือนการฟังเสียง	1.ถังเกรายจากเพลาวัสดุกระเด็นเข้าตา	ต่อบุคคล =สูง	1. สวมใส่อุปกรณ์ PPE พื้นฐาน 2. รักษาระยะห่างจากมอเตอร์ไฟฟ้าขณะปฏิบัติงาน	ต่อบุคคล =เล็กน้อย
		2. ได้รับเสียงดังเกินกว่าค่ามาตรฐาน	ต่อบุคคล =ปานกลาง	1. สวมใส่อุปกรณ์ป้องกันเสียง Ear Plug, Ear Muff ที่ได้มาตรฐานตลอดเวลาขณะทำงาน	ต่อบุคคล =เล็กน้อย
		3. ถูกไฟฟ้าช็อตขณะวัดแรงดันหรือกระแสไฟฟ้า	ต่อบุคคล =สูง	1.สวมใส่อุปกรณ์ PPE พื้นฐาน ,หลีกเลี่ยงการสวมใส่เครื่องประดับที่มีส่วนที่เป็นโลหะขณะปฏิบัติงาน 2. ใช้อุปกรณ์ตรวจสอบไฟว์ก่อนการสัมผัสทุกครั้ง 3. เชื่อมต่อและส่วนต่างๆของร่างกายไม่มีความชื้น	ต่อบุคคล =เล็กน้อย

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

- GULF has site-specific Permit to Work procedures, work permit requirements and hazardous work permits. Hazardous Work means the following:
  - Working at a height above 1.8-metres
  - Working in a confined space
  - Working with electrical high voltage
  - Working with hot work activities as defined by site's policy
  - Working with radiography
  - Working with lifting equipment such as mobile crane
  - Working with chemicals that are classified as hazardous substances by site
  - Working with excavation to a depth greater than 10 centimeters
  - Working with scaffold erection and dismantling

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

SAFETY CHECKLIST.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

- These site specific requirements and the requirements in this manual shall be met, with the most stringent requirements taking precedence. These requirements shall be defined during pre-job meetings.
- The Contractors are required to obtain a work permit from a site representative (site Work Supervisor) prior to the start of work. The permits shall identify work to be completed, additional permits that may be required, potential hazards and safety measures to be followed. All work permits can be written up to five days, but shall be updated each day if work is ongoing. The work permits that are not reviewed within one day of the last update or work is not continuous shall be terminated and the new one shall be required.
- The Contractors shall not operate any site valves, equipment, fire suppression systems or alarm systems unless specifically outlined in the work permit or at the direct approval and / or presence of a site representative.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

- The work permits shall be posted at the work site area until job completion.
- Sounding of the Emergency Alarm in your area, except for testing purpose, immediately voids all work permits. They will have to be initiated or re-issued after the "ALL CLEAR" is sounded.
- The site Work Supervisor and site Shift Leader will identify any permits that the Contractors may need for scope of work. Work permit forms shall provide for the Contractors by site Work Supervisor.
- All necessary tools and equipment will be daily inspected and attached with permit to work as form ATTACHMENT_3_Contractor material, tools and equipment daily inspection form for PTW of ESMS-Sa-P-07 Plant security

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

- All work permits shall be produced in triplicate and the work permit copies shall be distributed as follows:
- Work supervisor page (Green) and any copies of Job Safety Analysis (JSA) and copies of associated certificates shall remain with the Work Supervisor.
- A board, or similar, shall be used to display copies (Yellow) of the active of Work Permits and shall remain in the permit issuing area.
- Shift Leader copy (White) shall be remained in control room.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

- PERMIT EXTIONSION

Where work continues over more than on shift, the permit to work shall be revalidated and extended. The permit will be extended if

- Conditions remain unchanged and it is safe to do the work
- The Shift Leader and Work Supervisor confirm that conditions are safe and the permit restrictions continue to be met

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

General Work Permit Form

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Permit to Work System

Hazardous Work Permit Form

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Control of Hazardous Energy (Lock out / Tag out; LOTO)

- It is the policy of GULF to protect all employees and contractors who are engaged in servicing, maintenance, inspection, construction and / or similar activities on equipment. This is accomplished by ensuring the control of hazardous energy sources, by means of Lock out / Tag out procedures, to prevent energization, start-up, release, or stored energy that could cause injury to workers.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

Control of Hazardous Energy (Lock out / Tag out; LOTO)

- Before starting work on any equipment, all energy sources to the equipment shall be isolated, locked, tagged, and tested.
- All contractors shall comply with the GULF Lock Out / Tag Out (LOTO) Procedures to protect employees and contractors from unexpected startup or energy release.
- All Lock Out / Tag Out shall be coordinated with site before working in an area of hazardous or stored energy.
- The Contractors shall follow applicable Job Safety Analysis (JSA), Lock Out / Tag Out (LOTO) procedures and / and Permit to Work requirements before performing work.
- The Contractors shall review and understand the GULF's Lock Out / Tag Out procedures and adhere to all warnings including:
  - Unauthorized removal of Lock Out / Tag Out devices is prohibited;
  - Unauthorized operation or servicing of equipment is prohibited.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

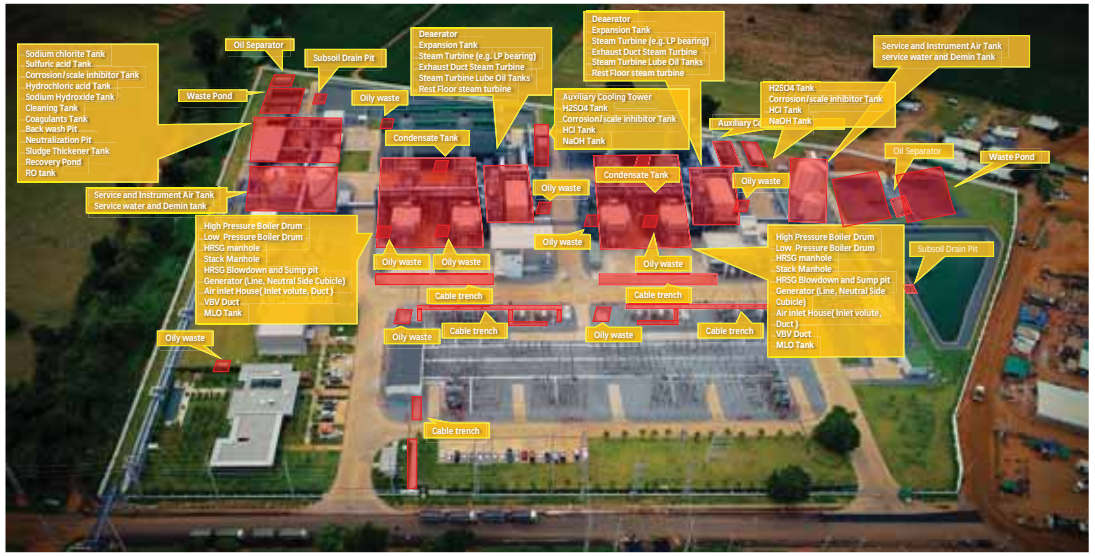
GULF

Confined Space Entry

- The contractor shall establish and maintain a Confined Space Entry Program to enter confined space.
- The contractors performing any confined space tasks shall be qualified and physically fit. Certification of "Confined Space Entry" and "Medical Certificate" (it is valid only 6 months from date of issue) shall be submitted to site SH&E prior to work.
- All confined spaces encountered during the course of the work shall be evaluated for hazards before entry is allowed. A confined space entry permit is required and safe work practices applicable to the type of confined space shall be enforced. The copy of permit should be clearly displayed at the work.
- Atmospheric monitoring shall be performed to detect hazardous atmospheric conditions in confined spaces prior to entry and continuously monitored by site Local Operators for Oxygen and LEL (flammability). Additional monitoring such as H2S, SO2 and CO may be required. Such monitoring shall be documented and be made available upon request.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

GNRV1 & GNRV2 Confined Space Layout



GNRV1 & GNRV2 Confined Space Layout

การขออนุญาต เข้าทำงาน

GULF

Confined Space Entry

- These confined spaces shall be properly ventilated prior to or during entry. One person shall stand guard outside the confined space whenever another person enters it and shall be appropriately trained and ready to implement emergency procedures without putting themselves at risk in order to help that person if necessary. During a confined space entry, a mechanical means to extract a worker from the space shall be available and in use in the event of an emergency arises.
- Where hot work is to be carried out in the confined spaces, local exhaust ventilation shall be provided. A dry chemical power portable fire extinguisher shall be placed at the entrance to the confined space before any hot work is performing or power tools are used. When possible, explosion-proof tools shall be used.
- The contractors entering the confined space shall be provided with a means of communicating to person(s) outside the confined space.
- No entry shall be allowed into confined space that has an atmosphere that is immediately dangerous to life or health.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Cutting / Welding or Hot Work

Hot work includes grinding, welding, thermal or oxygen cutting or heating, or any other heat of spark producing task (e.g. use of metal blades on a brush cutter).

- A Hot Work Permit is required for any hot work. The permit shall be display at any points of hot work areas. During work performing, flammable vapour levels are measured at or below 10% of the Lower Explosive Limit (LEL). If any level of Lower Explosive Limit (LEL) is detected, stop work, locate the source and take action to assure that conditions will not exceed 10% of the Lower Explosive Limit (LEL). Continuous monitoring shall be required.
- A Fire Watch is required. The primary function of the Fire Watch is to observe conditions in the immediate and adjacent area to assure that hot work is performed safely. The Fire Watch is expected to be able to immediately extinguish a small fire should one occur.
- As a minimum, a 6A20B fire extinguisher shall be immediately available. The Contractors are required to provide their own approval fire extinguisher(s).

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Cutting / Welding or Hot Work

Hot work includes grinding, welding, thermal or oxygen cutting or heating, or any other

heat of spark producing task (e.g. use of metal blades on a brush cutter).

- Hot work shall have an exclusion zone, where all flammable material is cleared, covered, wetted or otherwise protected. Cover wall, ceiling, piping or vessel surfaces with a fire resistant and heat insulating material to prevent ignition and accumulation of heat. Secure, isolate, and vent pressurized vessels, piping and equipment as needed before beginning hot work.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Mobile Crane, HIAB Truck Crane / Sling, Rigging

- The mobile crane operator (Contractor's employee) is generally responsible for the safety of the operation as soon as the load is lifted clear of the ground. Whenever there is reasonable cause to believe that the lift may be dangerous or unsafe, the operator shall refuse to proceed until the concern has been reported to their supervisor or site work supervisor, any hazard has been corrected, and safe conditions have been confirmed.
- A certification of crane operator for an operator controlling or driving mobile crane is required and it shall be submitted to site SH&E on the first day of working and prior to work. This certification shall be properly kept in place. A certification of crane operator for an operator controlling overhead crane is also required if overhead crane is needed for contractors.
- Signalers shall be competent and capable of directing the crane and load to ensure safe, efficient operation. Knowledge of the hand signals for hoisting is necessary, as it is for operators.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Mobile Crane, HIAB Truck Crane / Sling, Rigging

- Crane inspection report for mobile crane (known as Por-Chor 2) shall be provided and submitted to site SH&E on the day of working along with a lifting plan / procedure.
- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on all cranes. Instructions shall be visible to the operator of the equipment
- Flagman, standby personnel or other means of warning shall be used prior to making a lift and at any time the load is moving.
- Taglines are required for control suspended loads. No work will be allowed under a suspended loaded.
- Cranes operated on any GULF's power plant site roads shall follow site traffic rules and shall require an escort if the load or boom could interfere with the operator's vision.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

GULF

Mobile Crane, HIAB Truck Crane / Sling, Rigging

- Area within the swing radius of the rear superstructure of the cranes shall be barricaded or a flagman shall be posed to protect personnel and equipment in the area.
- Each day before being used, contractor's crane operator shall inspect the sling, fastenings and attachments for damage and defects by contractor's crane operator. Additional inspections shall be performed during sling use as often as necessary to assure that safety of the operation.
- Replacement is recommended if kinking, broken wire, crushing, or any damage resulting in distortion of the rope structure is found.
- See An Example of Appropriate Crane Condition as ATTACHMENT-03

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

GULF

Mobile Crane, HIAB Truck Crane / Sling, Rigging

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

GULF

Mobile Crane, HIAB Truck Crane / Sling, Rigging

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การขออนุญาต เข้าทำงาน

GULF

Mobile Crane, HIAB Truck Crane / Sling, Rigging

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Scaffolding and Ladder Safety

- All scaffolding shall be constructed in accordance with Ministerial Regulation, Ministry of Labour, on the prescribing of standard for administration and management of occupational safety, health and working environment in relation to construction works B.E. 2021. See An Example of Appropriate Scaffolding Condition as ATTACHEMENT-04.
- A designed calculation for scaffolding erection shall be done by a competent qualified person prior to scaffold erected. A competent qualified persons one who by possession of a license for professional practice as mentioned in the Engineering Act B.E. 1999. See ATTACHMENT-05 for An Example of Design Calculation for Scaffolding Erection.
- The Contractors and their employees require to wear full body harness and tie-off whenever over 6 feet or 1.85 meters or above the working surface and the platform is not protected by handrails. Always, being tied of when working on anything other than an approved structure or platform. Visually inspect your safety harness and lanyard prior to each use. If damaged or defect are reserved, the system shall be tagged and removed.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Scaffolding and Ladder Safety

- Scaffolds shall not obstruct block valves, fire extinguishers, safety eyewashes and emergency showers.
- All tags will be of a solid GREEN or RED colour with black lettering.
- All identification tags will have the front information displayed and shall be completed for
  - Date erected / tagged
  - Inspected By: Name (print or signature)
  - Detail

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Scaffolding and Ladder Safety

- It is common practice to use the following colour schemes:
- GREEN - tags will be hung on scaffolds or ladders that have been inspected and are safe for use. A green "SAFE FOR USE" tag(s) should be attached to the scaffolds or ladders at each access point after the initial inspection is complete
- RED - "DANGER - UNSAFE FOR USE" (tag(s), this colour tag indicates the scaffold or ladder is unfit for use
- See ATTACHMENT-06 for An Example of Scaffolding Inspection Tags

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Scaffolding and Ladder Safety

- A designed calculation for scaffolding erection must be done by a competent qualified person prior to scaffold erected. A competent qualified person means one who by possession of a license for professional practice

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Scaffolding and Ladder Safety

- A designed calculation for scaffolding erection must be done by a competent qualified person prior to scaffold erected. A competent qualified person means one who by possession of a license for professional practice

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Scaffolding and Ladder Safety

- It is common practice to use the following colour schemes:

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Compressed Gas Cylinder

- Cylinder valve shall be in accordance with the industrial product standard of cylinder valve. If the industrial standard has not been established, it then shall be followed in the international standard such as CGA, BS, DIN, JIS, etc.
- Valve connections shall be in accordance with the industrial product standard of cylinder valve connections. If the industrial standard has not been established, it then shall be allowed the international standard such as CGA, etc.
- Cylinder in use shall have valid hydrostatic test stamps (within the last five(5) years) as per Ministerial Regulation regarding industrial gas on storage, transportation and fill-up B.E. 2549 and TIS 358-2551
- The oxygen, acetylene and oxygen-fuel system regulators have flashback arrestors installed. The flashback arrestors are installed at least at the regular end and the torch end.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Chemical Management

Chemical substances have the potential risk to cause considerable health and environmental problems. The Contractors shall manage and handle such substances in a proper manner to eliminate these problems and hazards.

- All chemicals used in the course of the work shall be included in the risk assessment and Job Safety Analysis (JSA)
- The Contractor is responsible for ensuring that all users are properly trained in the safe use and disposal of any hazardous material or chemical involved in or related to the work
- Chemicals and other hazardous materials shall be properly labelled with the name of the chemical or material and its environmental, safety, and / or health hazards
- Appropriate PPE shall be used when handling chemicals

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Chemical Management

Chemical substances have the potential risk to cause considerable health and environmental problems. The Contractors shall manage and handle such substances in a proper manner to eliminate these problems and hazards.

- Chemicals and other hazardous materials shall be properly stored according to the manufacturer's recommendations and any applicable laws or regulations
- Except for materials intended to be left as part of a deliverable, chemicals and other hazardous materials shall be removed from site upon completion of the work activities
- SDS's shall be readily available to site SH&E and the individuals working on the site for any hazardous materials and chemicals as applicable, and provided upon request

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Site Radiography Safety Procedure

- The Contractor shall ensure the safe conduct of their work, and comply with all applicable regulatory requirements and workers shall follow the radiation protection program established by their employer, in accordance with regulatory requirements.
- All site radiography works shall be evaluated for hazards before work is allowed. A radiography permit is required and shall be documented.
- Site radiography shall be done in an area where specific protection measures and safety provisions are in place.
- The boundary of the controlled area has to be demarcated; when reasonably practicable, this is done by physical means. This may include using existing structures such as walls, using temporary barriers, or condoning the area with tape.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Site Radiography Safety Procedure

- Warning notices and warning signals; notices shall be displayed at the controlled area boundary at suitable positons, radiation symbol, warning and appropriate instructions. Visible or audible signals or both shall be used where a radiographic source is exposed.
- Before the start of radiographic work, the area shall be cleared of all people except for authorized personnel. The boundary should be clearly visible and well lit and continuously patrolled to ensure that unauthorized people do not enter the controlled area.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

General Requirements

Documentations, training and qualifications;

- The Contractor shall provide acceptable proof of qualifications, safety training or certifications, for all such employees to the site SH&E upon request (For planned outage, to be submit at least 7 days prior to commencing work). For example - certifications / license as required for electricians, confined space entry, documentation of physician check-up report regarding confined space entry, Por-Chor 2 (U2. 2) and Safety Data Sheet (SDS)

- The Contractors shall hold a safety briefing (daily Tool Box safety meeting)

covering the precautions to take for that day's work

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Tools and Equipment

All equipment brought into site shall be inspected and safe working operating condition. All guards and safety devices shall be in place and shall meet all applicable GULF and manufacturer standards, and relevant legal requirements.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Electrical Safety

- GULF requires the Contractor to maintain proper handling and operation of electrical equipment.
- The Contractor shall develop and follow its own Electrical Safety procedures for ensuring that any requirements applicable to the type of job being done are addressed in accordance with applicable SHE laws and regulations (e.g. training, certificates, etc.)
- Portable Power Tools and Extension Cords, all extension cords and portable electric tools, except double-insulated or battery-powered tools, shall have a three-wire grounded cord and plug. Tools likely to be used in wet and conductive locations need not to be grounded if the supplied voltage is fewer than 50 volts or if the tools are double insulated (29 CFR 1910.304 and 1926.302)
- Extension cords shall not be damaged, taped, or repaired.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Electrical Safety

- Inspection, all portable equipment will be inspected before first use, before it is returned to service following repairs and before it is used after any incident, which can be reasonably suspected to have caused damage then marked with the appropriate inspection tag. See ATTACHMENT - 7 for An Example of Portable Electrical Inspection Tag. Before each day's use, the user (contractor's employees) for signs of damage should visually inspect each cord set, electrical tool and piece of electrical equipment. Equipment found to be damaged or defective shall not be used until repaired, inspected, and tested. These daily-use inspections typically do not have to be documented. Typically, battery-powered tools are exempt from the inspection and testing requirements.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Site Safety Inspections / Corrective Actions / Post Job Evaluations

- Site Safety Inspections; the site safety inspection shall be conducted to satisfy GULF that the contractor is complying with legislative requirements, requirements of this document and other risk documentation (e.g. measures described in JSA for specific tasks). Inspections will be conducted to identify and correct any observed, potentially unsafe, or environmentally unacceptable conditions. The inspection shall be at least daily and be made available to site SH&E on request.
- Corrective Actions; the Contractor is required to take corrective actions on observed hazards or potentially hazardous conditions when such hazards are identified though Site Safety Inspections.
- Post Job Evaluation, the site SH&E will evaluate the Contractor's SHE performance upon work completion. The Contractor shall collaborate with and contribute to post job evaluations as required and the evaluation results will be used in assessing the Contractor for future works.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

- เจ้าหน้าที่ความปลอดภัย/หัวหน้าส่วนงาน ทำการอบรมแก่ผู้รับเหมาก่อนเข้าปฏิบัติงานภายในบริษัทฯ และเก็บบันทึกการอบรมไว้ โดยมีหัวข้อดังต่อไปนี้

- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
- ผังองค์กร
- สถานที่ในโรงไฟฟ้า
- การเข้า-ออกโรงไฟฟ้า
- การนำของ เข้า-ออกโรงไฟฟ้า
- การขออนุญาต เข้าทำงาน
- อุปกรณ์ป้องกันภัยส่วนบุคคล
- ป้ายเตือนความปลอดภัย
- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

อุปกรณ์ป้องกันภัยส่วนบุคคล

Contractor shall supplying all safety and personal protective equipment (PPE) required completing the scope of the contracted work. Equipment supplied by the contractor must meet or exceed all Gulf requirements.

Minimum PPE requirement include

Safety Helmet

Safety Glasses

Safety Shoes.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

อุปกรณ์ป้องกันภัยส่วนบุคคล

Personal Protective Equipment (PPE)

- The Contractor is responsible for ensuring that PPE identified during the generic risk assessment or Job Safety Analysis (JSA) is available to and worn by their employees who will be perform the work. Contractor's employees shall be appropriately trained in the proper use, maintenance and storage of PPE.
- Contractor's employees shall dress appropriately for the work being performed. Loose clothing, long hair, and any kind of accessories, such as chains, watchbands, rings, and earrings shall not be worn when working near equipment with moving or rotating parts. Metal jewelry shall not be worn while working on live exposed electrical components.
- Adequate eye protection (e.g., safety glasses with attached side shields; chemical googles, welding glasses) shall be worn whenever the potential for eye injury exists (e.g., flying objects, use of power tools, potential for chemical splashing, working on or near exposed energized components) or when specified as a requirement at the site. Wearing sunglasses is prohibited.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

อุปกรณ์ป้องกันภัยส่วนบุคคล

Personal Protective Equipment (PPE)

- Appropriate footwear shall consist of, at a minimum; safety shoes shall be worn at all times. Sneakers or sandals are prohibited.
- Hard hats shall be worn whenever there is a danger of being struck by falling objects, striking the head on a hard or sharp surface. Allowance are acceptable for specific tasks such as welding and grinding. No hat shall be worn under the hard hats (unless welders with welder caps). Nothing shall be stored between hard hat suspension system and hat shell that would affect the performance of the hard hat.
- Additional PPE such as gloves, chemical apron, earplugs or earmuffs will be required for certain tasks and shall be noted on the permits issued to the contractor performing the work. Always wear the PPE listed on the permit for the work you are performing. See An Example of Personal Protective Equipment (PPE) as ATTACHMENT-01.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

- เจ้าหน้าที่ความปลอดภัย/หัวหน้าส่วนงาน ทำการอบรมแก่ผู้รับเหมาก่อนเข้าปฏิบัติงานภายในบริษัทฯ และเก็บบันทึกการอบรมไว้ โดยมีหัวข้อดังต่อไปนี้

- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
- ผังองค์กร
- สถานที่ในโรงไฟฟ้า
- การเข้า-ออกโรงไฟฟ้า
- การนำของ เข้า-ออกโรงไฟฟ้า
- การขออนุญาต เข้าทำงาน
- อุปกรณ์ป้องกันภัยส่วนบุคคล
- ป้ายเตือนความปลอดภัย
- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

ป้ายเตือนความปลอดภัย

- Contractor means any company or person contracted to perform short or long-term work for company, including, but not limited to, contractor's employees, its subcontractors and its third party inspectors and consultants. For clarity purposes, a contractor is not an employee of company.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

ป้ายเตือนความปลอดภัย

ป้ายห้าม Prohibition Signs

ป้ายบังคับ Mandatory Signs

ป้ายเตือน Warning Signs

ป้ายป้องกันอัคคีภัย Fire Prevention Signs

ป้ายภาวะปลอดภัย Safety Condition

ป้ายจราจร Traffic Signs

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

- เจ้าหน้าที่ความปลอดภัย/หัวหน้าส่วนงาน ทำการอบรมแก่ผู้รับเหมาก่อนเข้าปฏิบัติงานภายในบริษัทฯ และเก็บบันทึกการอบรมไว้ โดยมีหัวข้อดังต่อไปนี้

- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
- ผังองค์กร
- สถานที่ในโรงไฟฟ้า
- การเข้า-ออกโรงไฟฟ้า
- การนำของ เข้า-ออกโรงไฟฟ้า
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- อุปกรณ์ป้องกันภัยส่วนบุคคล
- ป้ายเตือนความปลอดภัย
- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

การตอบสนองเหตุฉุกเฉิน

Emergency Reponses

Reporting Emergencies

- Contractors are required to report all emergencies to site SH&E by using company telephone, mobile phone or Radio Chanel. Give your name, location, type of emergency you have. Wait for the information to be repeated back to you and confirmed before hanging up unless it is unsafe to do so. You may also report an emergency to your GULF Work Supervisor or any site personnel.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การตอบสนองเหตุฉุกเฉิน

Emergency Reponses

Contractor Response and Assembly Point

- When the evacuation alarm sounds, all contractors should stop all works and go to your assigned Assembly Point, and report to your Head Count Checker. Contractors who are working in the impacted area should leave the area if possible. If you cannot travel safely, report to your supervisor.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การตอบสนองเหตุฉุกเฉิน

Emergency Reponses

Return to work after an emergency

- When the evacuation alarm sounds, all contractors should stop all works and go to your assigned Assembly Point, and report to your Head Count Checker.
- Work may not commence until site Operations has re-issued your permit or updated the old one.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การตอบสนองเหตุฉุกเฉิน

SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

GULF

5.Requirements for all jobs

5.1 General Requirements

5.1.7 First Aid Kit Provision

- The Contractors shall provide necessary first aid kits for their employees.
- Any major medical emergency shall be immediately reported and activated the site SH&E to respond.
- Any outside emergency assistance will be coordinated through the site SHE. This assured that the right persons are notified and in place when ambulances or emergency equipment arrives.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

GULF

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- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
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- การตอบสนองเหตุฉุกเฉิน
- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

การจัดการสารเคมี

GULF

- Chemical substances have the potential risk to cause considerable health and environmental problems. The Contractors shall manage and handle such substances in a proper manner to eliminate these problems and hazards.
- Chemicals and other hazardous materials shall be properly stored according to the manufacturer's recommendations and any applicable laws or regulations
- Except for materials intended to be left as part of a deliverable, chemicals and other hazardous materials shall be removed from site upon completion of the work activities
- SDS's shall be readily available to site SH&E and the individuals working on the site for any hazardous materials and chemicals as applicable, and provided upon request

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

GULF

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- นโยบายด้านการจัดการคุณภาพ สิ่งแวดล้อม ความปลอดภัยและสังคม
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- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

การจัดการขยะ

GULF

General Requirements

Housekeeping

- Job site housekeeping is the Contractor's responsibility and the job site shall be as clean and orderly as possible while working is being performed.
- At the completion of the work, the job site shall be left in an acceptable condition. The site SH&E will make a final inspection to determine the adequacy of the final cleanup.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การจัดการขยะ

GULF

Environmental Requirements

- The Contractors will comply with all applicable laws, rules, regulation, and standards, including GULF Environmental Policy. Additionally, the Contractor will:
- Immediately notify site SH&E of any spill, releases or other environmental incidents and take all reasonable steps to prevent and clean up any release or spills.
- Waste generated, as a result of work activities, shall be managed in compliance with applicable regulatory provisions. The contractors shall estimate the type and quantities of wastes (both hazardous and non-hazardous) prior to work commencing to ensure that the proper collecting storage and transportation are provided
- All waste material, hazardous or non-hazardous, shall be segregated and placed into proper containers. Waste shall not be mixed with different types of waste. Properly label, accumulate and dispose of all waste materials generated from activities in accordance with site guidance. The Contractor shall coordinate all disposal activities with the site SHE.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การจัดการขยะ

GULF

Environmental Requirements

- The Contractors will comply with all applicable laws, rules, regulation, and standards, including GULF Environmental Policy. Additionally, the Contractor will:
- Provide and maintain adequate secondary containment for all hazardous chemicals, oil and process solutions that could damage the environment.
- Tarps, covers, or hatches shall be kept closed on all containers when not in the process of being filled.
- All tanks for liquid storage that are brought on to site shall be provided with secondary containment that is large enough to contain the contents of the tank.
- The containment shall be inspected for evidence or leakage. If it is found to be free of such substances, it shall be drained to the ground. At all other times, containment drains shall be kept closed. Tanks shall not be placed near storm or process water drainage systems.
- See ATTACHMENT-02 for An Example of Waste Management.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

การจัดการขยะ

GULF

การจัดการภายหลังการปฏิบัติงานของผู้รับเหมา

- เมื่อสิ้นสุดการปฏิบัติงาน ผู้รับเหมาจะต้องจัดเก็บ ทำความสะอาดบริเวณ พื้นที่ปฏิบัติงานให้เรียบร้อย เพื่อให้มั่นใจว่าไม่มีขยะจากการปฏิบัติงานทิ้ง ไว้ภายในบริษัทฯ รวมทั้งเพื่อความปลอดภัยและป้องกันการเกิดอัคคีภัย

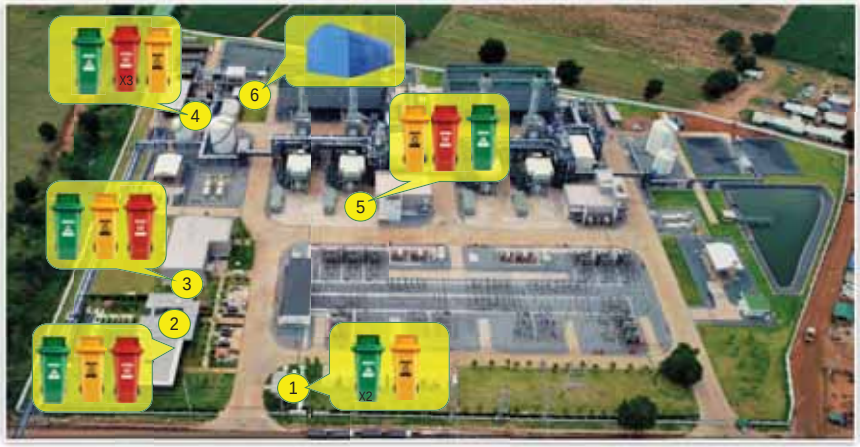
Refer : PD-ESH-09 OUTSOURCE CONTROL

แผนผังสถานที่เก็บขยะโรงไฟฟ้าหนองระเวียง 1 และโรงไฟฟ้าหนองระเวียง 2

24 June 2021

GULF

Waste Container and Waste House Location



จุดที่ 1
ถังขยะสีเขียว 2 ถัง
ถังขยะสีเหลือง 1 ถัง

จุดที่ 2
ถังขยะสีเขียว 1 ถัง
ถังขยะสีเหลือง 1 ถัง
ถังขยะสีแดง 1 ถัง

จุดที่ 3
ถังขยะสีเขียว 1 ถัง
ถังขยะสีเหลือง 1 ถัง
ถังขยะสีแดง 1 ถัง

จุดที่ 4
ถังขยะสีเขียว 1 ถัง
ถังขยะสีเหลือง 1 ถัง
ถังขยะสีแดง 3 ถัง

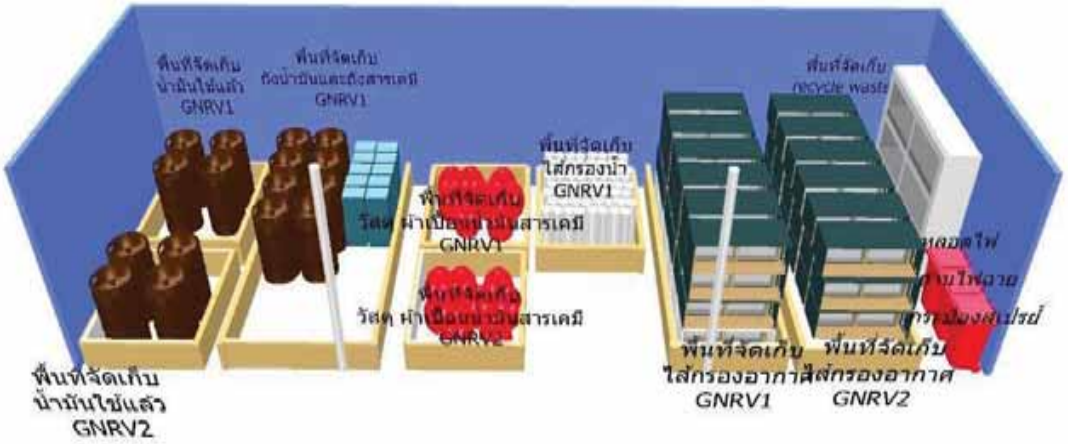
จุดที่ 5
ถังขยะสีเขียว 1 ถัง
ถังขยะสีเหลือง 1 ถัง
ถังขยะสีแดง 1 ถัง

จุดที่ 6
จุดรวบรวมของเสีย

SD-SHE-01 Rev.01

การจัดการขยะ

GULF



Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

SAFETY INDUCTION

GULF

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- การขออนุญาต เข้าทำงาน
- อุปกรณ์ป้องกันภัยส่วนบุคคล
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- การจัดการสารเคมี
- การจัดการขยะ
- กฎจราจร
- อื่น ๆ

Refer : PD-ESH-09 OUTSOURCE CONTROL

Other

GULF

Requester which can be any person working for power plant such as Operations, Maintenance, General Administration or Major Maintenance shall responsible for

- Providing scope of work and submitting the SHE Manual for Contractors along with Purchase Requisition (PR)
- Ensuring that all contractors and / or sub-contractors comply with all requirements mentioned in this procedure.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

A copy of SHE Manual for Contractors as ATTACHMENT-1 will be provided and sent to contractors by Procurement Department along with the Purchase Order (PO).

Penalties for non-compliance with safety regulations as ESMS-ES-P-21_SHE Minimum Requirements for contractor.

The 1 st warning: Verbal warning and let your supervisor know immediately.

The 2 nd warning: Warning in a written statement to the contractor company.

The 3 rd warning: Terminate contractor.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

This manual sets out GULF expectations in areas of Safety, Health and Environment, (SH&E)of all contractors of Gulf and provides guidance in how these expectations can be met.

To align with the GULF SHE Policy, Gulf requires that its contractors:

- Comply with all applicable SHE laws, regulations and other standards
- Comply with other SHE requirements contained in this manual

Contractors are responsible for the health and safety of their employees and its subcontractors (where applicable), and for the safe and environmentally acceptable performance of their work.

Contractors shall ensure that SHE *hazard and risks are properly identified, assessed, controlled and evaluated prior to any work begins.*

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

Scope The requirements outlined in this document apply to all GULF contractors and can be used as a guidance document for other works / services including, but not limited to, equipment installation or de-installation, repair, and regular or planned outage activities.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

- As note above in section 1, the requirements set forth in this manual are the minimum expectations of GULF and shall take all reasonable actions to prevent personal injuries and environmental incidents associated with the work to be performed.
- The Contractors shall comply with all applicable laws, regulations. Failure to do so will result in removal from site property.
- The Contractors are responsible for ensuring that personal Protective Equipment (PPE) identified during generic risk assessment is available to and worn by employees who will perform the work. Their employees shall be appropriately trained in the proper use, maintenance and storage of PPE.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

Type of work required safety representative

Safety officer at all levels required certificate of appointment from contractor.

- Determine by quantity of employee/worker (required by laws)

- 2 - 19 persons: Safety officer at Supervisory level
- 20 - 49 persons: Safety Officer at Technical Level
- 50 - 99 persons: Safety Officer at High Technical Level
- >100 person: Safety Officer at Professional Level

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

The Contractors shall have an safety representative present on the job at all times when work is physically being performed. This safety representative can be a supervisor who is knowledgeable about Safety and Environment policies and procedures. The safety representative shall;

- Have the authority to stop work
- Responsible for administering the contractor's SHE program
- Participate with daily routine safety inspection and site SH&E
- Supply a daily SHE report to site SH&E, detailing any SHE related items, including SHE statistics, near misses, environmental releases, details on Toolbox Talk and actions that have been taken due to daily safety inspection
- Safety representative shall responsibility for safety inspection only, not the other work responsibility at the same time.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

Type of work required safety representative

Safety officer at all levels required certificate of appointment from contractor.

- Hazardous work eg. Hot Work, High Voltage, Chemical Cleaning, Work at High, Radiation, Excavation work

a) Safety Officer at Supervisory Level or Safety Officer at Technical Level or Safety Officer at High Technical Level or Safety Officer at Professional Level

b) Fire watchman in case of hot work (trained in fire watchman course)

c) Welding work: Submit welder name with work experience and welding certificate to GULF in advance.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

Type of work required safety representative

Safety officer at all levels required certificate of appointment from contractor.

- Confined Space (All confined space works)

a) Safety Officer at Supervisory Level or Safety Officer at Technical Level or Safety Officer at High Technical Level or Safety Officer at Professional Level

b) Fire watchman in case of hot work which trained in Fire watch course.

c) Supervisors in confined space working (appointment and certificate)

d) Operators in confined space working (appointment and certificate)

e) Assistant in confined space working (appointment and certificate)

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

General Requirements

Contractor Duties and Responsibilities with Subcontractors

Contractor shall provide direct supervision of its subcontractors. Contractor shall submit the required subcontractor documentation or evaluation documentation before subcontractors commence work on any power plant site.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

Contractor SHE Reporting

- Incident / Accident Reporting

The Contractor shall notify the site SH&E or site Work Supervisor of all SHE incidents and injuries immediately with the initial written report to be submitted by shift end. Initial reports will include, at minimum:

- Location of Incident
- Name of persons involved
- Equipment involved
- Time / date of incident
- Nature of incident: injury, illness, near miss, property damage
- Brief description of incident
- Where injured (body part)

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

Contractor SHE Reporting

Daily Performance Reporting

The Contractor shall commit to providing site SH&E with daily regular performance of SHE reports. The Contractor shall submit within working day of daily SHE statistic, details on Toolbox talk conducted (topic and number of participation) and corrective actions related to site SH&E inspection taken.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

- It is GULF's expectation that contractor's SHE performance remains satisfactory throughout the duration of work being completed for Gulf. If at any time contractor's status becomes unsatisfactory, contractor must work with the GULF wok supervisor or site SH&E to develop a plan for correcting deficiencies and timeliness for completion. If contractor does not address or correct any such deficiencies within the applicable timeline for completion, then GULF (any power plant site) may discontinue working with contractor and/or terminate its contract or agreement with contractor.

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

- If contractor requires, requests or allows it employees to perform unsafe action or work in or around unsafe condition or violates environmental permits or regulations, GULF may immediately remove contractor or any of it individual employees from any GULF power plant site. For example, immediate and permanent removal may occur if any of the following activities are observed:
- Disrespect for the safety program
- Falsifying documents or information
- Violates any law, safety or environmental rules, regulations or procedures
- Possesses weapons such as firearms (or knives not typically used in conjunction with normal work tasks)
- Failure to comply with company drug and alcohol policies

Refer : SHE MINIMUM REQUIREMENTS FOR CONTRACTORS

Other

การประเมินผู้รับเหมา

- เจ้าของงาน (พนักงานโรงไฟฟ้า)ทำการประเมินผลการปฏิบัติงานของผู้รับเหมาโดยอ้างอิงการดำเนินการตามระเบียบปฏิบัติ การจัดซื้อ คัดเลือกประเมินผู้ให้บริการภายนอก
- ในกรณีที่ผู้รับเหมาปฏิบัติงานเป็นระยะเวลานานให้ทำการประเมิน ผู้รับเหมาทุก 1 ปี

Refer : PD-ESH-09 OUTSOURCE CONTROL

SAFETY INDUCTION

ESMS-Sa-P-07_Plant security

ESMS-Sa-P-01_Permit to Work System

ESMS-ES-P03-WI-01_Access control for COVID-19 Pandemic Prevention

ESMS-ES-P-04_SHE Criteria for Supplier or Contractor Screening Evaluation and Selection

ESMS-ES-P-21_SHE Minimum Requirements for Contractor

ESMS-ES-P-23_Supplier or Contractor EHS Performance Evaluation Procedure

PD-EHS-06_การสื่อสาร

OTHER

Awards and Recognition

GULF

Thank You

Registration & Quiz
https://forms.office.com/Pages/ResponsePage.aspx?id=GDCb049oDU2fzow8sRacIYrnaRC2gH5Kn2dWCfTQ0MBURTJYREpaWkdRM0owWEpUOFZEUVk1S0Y1Qi4u