

## ภาคผนวก ข-10

เอกสารข้อกำหนดข้อมูลจำเพาะของเครื่องจักรและอุปกรณ์ที่มีเสียงดัง



# Gulf MP Company Limited 12SPP Project

Applicable Projects: GNC  
Requisition No: FXGB001  
EPJ-GNC-002-M-121-209 [A]  
System description and control philosophy

## FOR APPROVAL

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## System design Philosophy and process description

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## DESCRIPTION OF EQUIPMENT

When reading this chapter please refer to:

- Piping and Instrument Diagram **EPJ-GNC-002-M-121-211** (364.SC.001 )
- Main layout drawings **EPJ-GNC-002-M-121-224** (364.OG.001 )
- Mechanical interface list **EPJ-GNC-002-M-121-241** (364TS-4-05 )
- Electrical interface list **EPJ-GNC-002-M-121-226** (364TS-4-06 )
- Data sheet **EPJ-GNC-002-M-121-212** (364TS-4-12 )

Main purpose of Gas Compressor Package (GCP) is to provide compressed gas to the consumers downstream of GCP keeping stable parameters of gas. In order to realize it GCP is equipped with all required and necessary systems accordingly contractual obligations and technical requirements for such kind of equipment and represents as a skid with mounted equipment GCP.

Model of functioning of GCP is following:

### Inlet gas line

Through the external connection point on skid edge gas comes into GCP inlet gas line.

Before to get into compressor gas goes through the inlet hand valve HV 100, pneumatically actuate valve SV131-2, filling valve SV169-2, inlet gas filter FS175, check valve RV108, thermo compensator EJ109 and inlet filter strainer FS110. Inlet gas line is also equipped by the visual pressure gauge PI103, transmitting pressure PIT105 and temperature TIT107 transmitters in order to control conditions of the gas in the line.

### Compressor

After inlet line, gas goes to the compressor K111 which is driven by the motor M112 and which are coupled by coupling C177. Coupling is covered in order not to hurt maintenance personal during the operation of GCP. Compressor is oil flooded screw compressor and it is equipped with following instruments:

- Slide position transmitter GI 168
- Vibration transmitter YIZ 111-13

Motor is equipped with the following instruments and auxiliaries:

- Temperature transmitters of winding TIA 112-5, TIA 112-6, TIA 112-7

Inside compressor gas is mixed with the oil, compresses and goes to outlet line.

### Outlet gas-oil line

Mixture of compressed gas and oil leaves compressor and goes to oil separator B200 via thermo compensator EJ117. Line between compressor and oil separator is equipped by the visual (pressure gauge PI115), and transmitting (pressure transmitter PIT124, temperature transmitter TIT116 and pressure transmitter PIT113-I, II, III and temperature transmitters TIT114-I, II, III) instruments to control mixture conditions. Oil separator represents as vessel where under the action of gravity most of the oil is separating from the mixture and remain in separator which also functions as oil tank. On the top part of oil separator integrated coalescing filter cartridges FSE 120-A going through which gas is filtering from the oil in vapour phase. Oil separator is equipped by the following instruments and auxiliaries:

- Visual oil level meter LI 202 and oil level transmitter LIA 210-1
- Differential pressure transmitter for controlling of the dirtiness of the coalescent cartridges PDIA 120-1
- Pressure safety valve PSV 138 connected with the vent line tracked to the skid edge
- Drain and filling line with hand valve HV 220

Separated in coalescent cartridges oil through the orifices FO120-3, goes to the inlet line of the GCP under the action of different pressure between inlet and outlet lines.

### Gas outlet line

Separated gas goes further to the gas cooler W119 which represented and shell-tube heat exchanger, where it is cooled by cooling water in order to keep required temperature of gas, measured by temperature transmitter TIT125. Then on the second stage of separation (gas filters FS 122 and FS121 which are represented as vertical vessel with integrated filter cartridges) remaining part of vaporized is separating from the gas and directing through the visual glasses FG 122-4 and FG 121-4 and check valves RV 122-5 and RV 121-5 to the inlet line of the GCP under the action of different pressure between inlet and outlet lines. In order to control conditions of filter cartridges, gas filter is equipped by differential pressure

transmitter PDIA 122-1 and PDIA 121-1. After filtration oil contamination is less than 0,5 ppm. After second stage of filtration gas goes through the check valve RV129, pneumatically actuated outlet valve SV130-2 and outlet hand valve HV 148 to the external connection point on the skid edge. In case of need to vent gas there is a branch pipe line with the hand valve HV 135-3 and pneumatically actuated vent valve SV135-2 which goes to the vent line from safety valve of the package. HV 135-3 is used for the maintenance purposes and normally closed in operations.

### Oil line

Oil separated in oil separator B200 under the action of outlet pressure goes to the oil heat exchanger W203. Cooled oil goes to oil filter FS 206 represented as two vertical 100% flow vessels with filter cartridges FSE 206 connected with each other by three way valve in order to let GCP continue operation with one dirtied filter. Level of dirtiness of the filter cartridge is controlled by differential pressure transmitter PDIA 206-1 connected to the common lines of the oil filter

After the filtration, the oil line goes to the oil pump P 214-2. In order to keep required pressure difference between outlet pressure of gas and oil mixture and oil pressure, an hydraulically actuated pressure control valve PCV 226 is installed on the oil system. Valve is bypassing oil overflow to the from the outlet line of the pump to the inlet line. In order to prevent unstable operation of the pump during the start of oil pump, oil system is equipped by the line with check valve RV 214-4 installed in order to pass oil to the outlet line of the pump. Oil goes to slide control regulation valve and to the chambers of compressor that require high pressure of the oil to be injected (bearings, mechanical seal etc.). Line between the fine filters and compressor is equipped with the following instruments:

- Oil pressure transmitters PIT 205

### Cooling line

In order to cool down oil in oil heat exchanger W 203 and gas in gas heat exchanger W119 there is a liquid cooling line implemented in the GCP. This is open loop line with the inlet and outlet external connections on the skid edge. Inlet cooling line is equipped by the hand shut off valve HV 418-2 and temperature gauge TI 401. Outlet cooling line after the oil heat exchanger W 203 is equipped by the temperature gauge TI 402

Outlet cooling line after the gas heat exchanger W 119 is equipped by the temperature gauge TI 403 and controlled by the control valve TCV440-2 that is regulating the flow of cooling water. After mixing of two cooling water outlet lines, the resulting line goes through hand valve HV418-1 to the skid edge. Cooling down the cooling media is in customer scope as well as cooling water pumping and control of cooling media temperature and/or pressure.

### Capacity regulation system

Regulation concept of the project is to keep stable given outlet pressure set point. In order to follow it there are two sub-systems implemented:

- Slide control valve is a hydraulic valve inside the compressor driven by the high pressure oil. This valve changes internal volume of the compression chamber that allows regulating capacity in range between 10 and 100%. Slide is operated by the slide control system FCV 270-1 and FCV 270-2 that consist of solenoid valves that regulate the flow of the oil to move compressor to load or unload direction.
- Pressure control pneumatic valves PCV 123 is connected to outlet line of the GCP with inlet line and provides bypass of the gas from outlet to inlet and regulation in range between 0 and 10% during the operation. However, PCV 123 valve is calculated and designed to provide regulation in full range of capacity (0...100%).

### Instrument air line

Most of the actuated valves of the GCP are instrument air actuated. Instrument air line connection point is situated on the skid edge. Further compressed instrument air goes through filter FS504 and pressure transmitters PIT501-I, II, III to the consumers. On each

line there are sets of solenoid valves (MV) that are actuated by the electricity and opening the air flow to the actuator of actuated technological valves.

### Enclosure systems

GCP is equipped by the Gas detection system with three gas sensors DAZ 307-1, DAZ 307-2, DAZ 307-3. Gas detectors are set for two set points – 10% LEL and 20% LEL. In case if any detector will recognize 10% LEL, alarm signal will be generated on PLC. In case if any detector will recognize 20% LEL, GCP will be automatically shutted down.

### Electrical connections and control panel

In order to organize normal operation of GCP, external electrical connections must be organized:

- Main motor power supply. Main motor must be connected with Medium Voltage Switch Gear (MVSG) by EPC Contractor's cable directly in motor junction box. Pass through the enclosure shall be made through the special Ex-proof cable rack foreseen in enclosure wall (in scope of Enerproject).
- 400 V auxiliary equipment power supply cables are connected by customer directly at the 400 volts terminals of each equipment's ( Lube oil pump, Ventilation Fan, Motor heater ) while the 400V MCC system is mounted in the PLC cubicle

Control cables are required for the connection of GCP with MVSG and supervision system:

- MVSG must be connected with control cubicle in order to let GCP PLC to interact with main motor and have possibility to proceed with stop sequence in correct way in case of emergency.
- Bus line between packages in order to provide auto start option for compressor un stand by in case of operating compressor will be shut down. Cable is in EPJ scope.
- Signals with supervision are required to have possibility for remote operation of GCP by hard-wire lines. Bus connections with supervision is also foreseen and made in order to let customer current information about working parameters, conditions and active alarm and emergency signals.

GCP is fully automatized and able to keep required operating conditions and follow foreseen operating sequences including start and stop without external intervention.

Measured values from field instruments could generate Alarm (AL) or Emergency (EM) signals on Programmable Logic Controller (PLC) of GCP in order to keep safety operation of the plant. Control cubicle is equipped with HMI for the local control of operation by the maintenance personnel.

Local panel is provided with followings devices:

- Start push button
- Stop push button
- Emergency stop push button
- Local / remote operation mode switch
- Emergency and alarm lights
- Buzzer

## DETAILED DESCRIPTIONS OF EQUIPMENT SYSTEMS

### Oil injected type screw compressor with slide control

Screw compressors K111 are oil injected dual rotor positive displacement machines with split casing. Rotors are dynamically balanced and standard foreseen from a balancing drum in order to reduce axial thrust. To prevent gas leakage stationary pressure-balanced mechanical seal are provided.

Main characteristic:

- High efficiency due to optimum rotor profile configuration
- High efficiency in a wide range thanks to a capacity control slide
- Long life and low maintenance requirements due to small number of rotating parts
- Low noise level and vibration free running thanks to low rotor speeds and oil injection

### Main drive motor

Main drive motor M112 is a self-ventilated medium-voltage three-phase asynchronous drive with a cylindrical shaft end and feather key way. The shaft with the end shield on both ends or with the inner bearing cap forms a flameproof shaft gap. The motor is suitable for continuous operation in ex-proof execution.

### Mechanical coupling

Power from main drive motor to compressor, will be transmitted by a mechanical coupling C177.

### Oil system

The lube oil system of the compressor package is a closed loop system. The main oil injection port feeds the rotors directly with smaller lines feeding various points on the machine for seals and bearings. Once the oil is injected it will pass through the compressor K111 where it combines with the gas. The gas / oil mixture is then discharged out of the compressor. Injected oil is removed from the gas downstream of the compressor by means

of an oil separator FS120/B200. The oil separator also acts as a reservoir for the lube oil, the oil flows from the bottom of the separator, through an oil cooler W203 and oil filters FS206 and then back to the compressor. Part of the oil is after the oil filter directed to the oil pump P214-2 which ensures proper oil supply to the compressor at all times and is required for the hydraulic device of the capacity control.

Main components:

- oil tank with oil gas separator FS120/B200
- oil cooler W203
- Duplex oil filter (FS206-I, II)
- 100% oil pump screw type with magnetic coupling P214-2

### Compressor gas line

The inlet gas line can be isolated by means of a hand ball valve HV100 from here the gas is fed through a standard installed strainer in order to remove large dirt particles.

Inlet line consists of:

- hand ball valve HV100
- actuated inlet valve SV131-2
- check valve RV108
- compressor inlet strainer FS110

The high pressure gas is fed through the oil separator and is then taken through a second stage coalescent filter and then taken off the skid for connection to the field piping.

Outlet consists of:

- oil/gas separator with integrated stages coalescent filter FS120/B200
- pressure relief valve PSV138
- 2<sup>nd</sup> stage coalescent filters FS121/FS122
- hand ball valve HV148

- check valve RV129
- actuated outlet valve SV130-2

### Cooling system water

Demineralized water for cooling is provided by the customer up to the connections flanges of the package. The cooling system includes two shell and tube heat exchangers built for efficient heat transfer, one for the oil W203, other is for gas W119. The heat exchangers consist of a series of tubes. Water flows through the tubes and the medium runs over the tubes in order to be cooled.

### Gas Detection

The gas detection system is designed to continuously monitor the explosive level of the atmosphere within the enclosure.

The operating personnel is warned of gas through acoustical and visual signals if the gas concentration in the enclosure increases above pre-selected levels, which are set as per lower explosive limit for warning and emergency shutdown.

Main components:

- 3 gas sensors DAZ307 installed inside the enclosure (2 above the compressor area, 1 around the ventilation outlet air flow area).
- Central analysis station with gas concentration display

### Base Frame

The compressor system and its auxiliaries are installed on a self-supporting base frame. The base frame is composed by two parts. The main frame, fully welded, acts as a tight retention basin which, in case of failure of the oil or water systems, can hold the liquids leak within the enclosure. The secondary frame, mounted on the main frame by means of spring pads, holds the compressor and the driving motor and avoid any vibration transmission to the main frame and therefore to the foundation.

- welded base frame with oil collecting shell
- spring pad mounted compressor frame

- lifting eyes at each corner

### Sound proof enclosure

The partial enclosure covering most noise-generating components is designed in order to allow easy maintenance on the main components and is built as a classified area.

#### Main characteristic:

- steel profile frame
- attenuated sound pressure level

Enclosure is provided with a removable roof located over the compressor, in order to permit an easy maintenance from the top.

### Vibration monitoring device

The system by mean of accelerometer sensors, monitor the vibration behaviour of the screw compressor and motor.

Main components:

- 1 (YIZ111-13) vibration sensor accelerometer type with embedded electronics mounted on casing
- vibration monitor device is in customer scope and is external. Vibration sensor shall be connected with Bently Nevada MMS.

### Control panel

GCP has included to the scope of supply control panel. Control panel control the operation of whole GCP and includes following functions:

- automatic and real-time (remote) control of the start-up, shutdown and ramping unit equipment up to the optimal operation mode and its maintenance;
- automatic control of the compressor capacity depending on the pressure in the outlet pipeline of the GCP
- remote start-up and stop;
- safety as technological and electrical components of the unit operation;



- issuing control commands to actuators and their execution for the transfer of the compression unit equipment in fault-free condition;
- continuous monitoring of main operating conditions and parameters;
- time synchronization between the system components;
- control and monitoring of the unit parameters from the local control panel and DCS;
- keep the liquid level in the filters, separators, oil separator within set-points;
- controlling the temperature, pressure and gas flow at the unit outlet;
- regulation of pressure, flow and temperature of the oil in the oil system;
- integration and output of information in the DCS by standard protocol
- indicating operating hours of main motor and lube oil pump motor
- indication of open/closed, running/stopped positions of equipment of compressor package.

## OPERATING CASES

### GCP start up and recirculation

Any GCP can be started individually at any time regardless the Turbine operation and related load condition. The unit simply remains in operation recirculating the Gas through the By-Pass line integrated on each skid.

### GT Start-up and Operation

The GCP can be started by operator in local or remote mode. This applies to all units.

### Stand-By Compressor

The remaining GCP, as long as it is selected to Remote mode switches automatically to Stand-by mode. Stand-by GCP will start automatically only in case of running compressor trips or any alarm will appear. Normal Start of the Stand-by unit is initiated by hardwire signals from DCS.

### GT Trip, load variation

If GT trips (even at full load), then none of the gas compressors need to be tripped, as the compressed gas is immediately by-passed through the by-pass line. The opening of the by-pass valve is triggered by the pressure increase driven by the sudden decrease of the Gas flow.

If GT tripped, then GCP will switch automatically to by-pass mode and remain ready to take load as soon as required by the GT re-start. By-pass mode does not require any signal. In case if pressure on outlet is high Compressor package will automatically move slide to the minimal position, in case if this would not be enough (i.e. zero flow) bypass valve will open automatically and compressor will bypass all the gas through itself.

## OPERATION MODES

The mode of operation can be selected by the operator as Remote/Local on the HMI panel for each Gas compressor.

### Local mode

In local mode of operation, gas compressor can be started individually via Local Start command. Also each gas compressor can be individually stopped using local Stop command.

### Remote mode

The remote mode of operation allows Remote start from DCS. Once the local selector is positioned to Remote, the gas compressor perform automatically a preparation sequence switching the unit to Stand-By mode where the compressor is pressurized at Gas inlet pressure and the lube oil Pump is set in operation if temperature is lower than set point or slide is not on minimum position. As soon as temperature will be heated to required set point or/and slide will reach minimum position, pump will be stopped automatically. In this mode, the operator can start or stop any gas compressor at any time.

## CONTROL PHILOSOPHY

### Concept

During operation the control is performed by the PLC of each compressor monitoring the Pressure at the outlet vs the specific pressure Set point set on GCP HMI.

Any turbine flow variation is followed by a corresponding pressure variation which is adjusted by the Slide Valve

### Ready to Start

Fuel gas compressor is in normal condition with all start permissives met.

When all the start permissives are satisfied, the system is now ready to start. By pressing the Start button on the Local Control Panel, or by Remote signal (mode have to be selected using the selector switch on the HMI [Local/ Remote mode selection for each compressor]).

### Start-up Sequence

Before the system can be started, a pre start sequence must comply with the first level check of start sequence. All conditions mentioned below must be achieved in order to start the fuel gas compressor

### Main equipment's initial position

Gas Inlet isolation valve ( SV131-2) is closed

Gas filling valve ( SV169-2) is closed

Gas outlet isolation valve (SV130-2) is closed

Recycle control valve ( PCV123) is opened

Compressor motor ( M112) is off position

Compressor ( K111) is off position with slide valve regulation at minimum load

### Gas Filling

Gas Inlet isolation bypass valve (SV169-2) is opened and gas filling the GCP until inlet pressure set point will be reached  
Gas outlet isolation valve (SV130-2) is opened  
Filling valve is maintained open until PIT105 pressure measurement reaches its Set Point

### System start up

Gas Inlet isolation valve (SV131-2) is opened  
Gas Compressor motor (M112) is started  
Gas Compressor (K111) is started  
Gas Inlet isolation bypass valve (SV169-2) is closed  
Motor M112 and Compressor K111 are started  
As soon as M112 reaches the nominal speed, the compressor slide control (figure 1) increases the load while the recycle control valves PCV123 is maintained open.  
The pressure set point is achieved and controlled by close loop pressure control of the slide.  
The gas stream, recirculating through the recycle control valve PCV123 is ready to supply the fuel gas to the Gas Turbine.

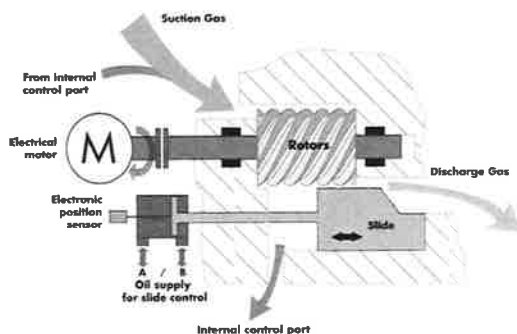


Figure 1

### Gas Turbine light-off

At Gas Turbine light-off, the gas flow demand initially decreases the pressure inside the GCP line, the by-pass line PCV123 is closed while the compressor slide controller increases the load in order to maintain the pressure set point.

### Gas Turbine operation

During the gas turbine operation, the compressor will be running and gas supply fuel gas to the Gas turbine. The recycle control valve PCV123 will be in closed position. Any Gas Turbine flow demand variation affects the GCP pressure which is monitored by the PLC acting at the slide.

### Gas Turbine-Stops

In case the customer needs to stop the Gas Turbine temporarily, the presence of the by-pass line helps to avoid the immediate shut-down of the FGC that can remain ready to supply gas at any time. The by-pass line is shown on P&ID and it is a line connecting the outlet line and inlet line with a pneumatically actuated valve PCV 123. This valve is needed when the compressor operates at low capacity – 0...10% of nominal flow. When capacity is low, the PLC automatically will open and regulate the position of the by-pass valve. In this case, part of the gas will be bypassed from outlet to inlet gas line that will reduce flow going to the customer even to 0% when needed. Gas outlet isolation valve SV130-2 remains open.

### By-Pass mode

As long as sufficient water cooling is provided, the unit can be operated unlimited in By-Pass configuration.

During start-up sequence (waiting for Gas Turbine start-up) or after a Gas Turbine stop (waiting for GT re-start).

Gas Inlet isolation valve (SV131-2) is opened  
Gas outlet isolation valve (SV130-2) is opened

Bypass automatic pressure control valve (PCV123) is opened  
Compressor motor (M112) is on  
Compressor (K111) is running with slide valve regulation at minimum load

During this mode gas flows through the by-pass valve PCV123 instead of going to the customer side. This allows compressor unit to operate with no-load and be ready for start working on load at any moment when turbine will be ready for gas consumption.

### Compressor Shutdown (STOP) Sequence

The shutdown sequence is activated once "Stop" signal is sent by Local Control Panel or REMOTE STOP unlatched only.

There are two shutdown scenarios:

1. Compressor shutdown sequence for normal mode.
2. Compressor protective trip shutdown.

### Compressor Shutdown Sequence for NORMAL Mode

When Stop-button is pushed, the following shutdown sequences are executed:

- Slide valve is forced to move to minimum position
- After slide reach minimum position or after 30 seconds after this command Main motor and pumps are stopped and vent valve and by-pass valve are opened.
- Enclosure fan will run till required temperature in enclosure is reached.

### Compressor protective trip shutdown

When Emergency Stop-button is pushed or PLC generated emergency activated, the following shutdown sequences are executed:

- Main motor and pumps are stopped immediately and vent valve and by-pass valve are opened.

### Status Indications & Compressor Alarms

All the analog and digital measurements of compressor package will be monitored in the HMI locating at the PLC panel. The GCP (Start up/shut down) and monitoring will be executed from the HMI. The signals that trip the compressor are listed in the related Document "BIC2-TD-CK0402 - PLC communication address list".

The different type of alarms such as low low, low, high, high high are configured in the PLC as per signal list Document. The alarms set points are indicated in the signal list. During the plant operation the alarms will appear in the HMI as per the priority of the alarm. Usually the alarms are configured in two types, one is advisory alarms i.e. low, high and second one is critical alarms these are distinct by different colour in HMI. Also the field signals such as transmitters are giving the alarm signals in HMI and the trip signals also initiated to start & stop the equipment's as per the plant "operation flow chart".

The alarms are initiated from field as described at below,

- 1) Alarm signals are generated by dry contact from field transmitter.
- 2) By comparing transmitter readings with given set point at the PLC. If reading is higher than the set point, and the system is checking for a high alarm, there will be a high alarm generated and vice versa for the low alarm. The set point will be keyed in by the operator at the HMI.

All the Gas compressor alarms will be shown in the HMI and the alarm summary page will be available in the HMI to see the history of the alarms. All the Gas compressor signals and alarms are sent to DCS through RS485 serial link Modbus communication for monitoring at control room. However each gas compressor remote start/stop and status signals are connected to DCS by hard wired.

## Mode of operation

Mode of operation	Command	Action
Local mode of GCP #1 selected in PLC HMI. (same action for local mode of GCP # 2)	Start GCP #1 from PLC HMI	Outlet gas valve open (SV 130-2) Filling valve open until filling pressure is reached (SV169-2). Inlet gas valve open (SV 131-2) Lube oil pump start (P 214-2) and lube oil pressure is checked. Main motor runs (M112). Compressor discharge pressure control is enabled.
	Stop GCP # 1 from PLC HMI	Main motor stops (M112). Gas discharge pressure control is disabled. Gas inlet (SV 131-2) and outlet (SV 130-2) valves close. Lube oil pump (P 214-2) stops after 10 seconds. Gas pressure is released via vent valve (SV 135-2) and the stop sequence ends after 5 minutes.
Remote mode of GCP # 1 selected in PLC HMI. (similar action for remote mode of GCP # 2)	Start GCP # 1 from DCS HMI	GCP # 1 is already in standby mode and filling sequence performed. Lube oil pump (P 214-2) start and lube oil pressure is checked. Main motor run (M112). Compressor discharge pressure control is enabled.
	Stop GCP # 1 from DCS HMI	Main motor stops (M112). Gas discharge pressure control is disabled. Gas inlet (SV 131-2) and outlet (SV 130-2) valves close. Lube oil pump (P 214-2) stops after 10 seconds. Gas pressure is released via vent valve (SV 135-2) and the stop sequence ends after 5 minutes.

Note : Failure of any of above will initiate an alarm in HMI

## CONTROLS OF AUXILIARIES

### Lube Oil system

As long as the compressor is in operation the lube oil Pump P214-2 is ON. This guarantee constant lube oil flow for following purposes:

- Compressor bare shaft BRG lubrication
- Compressor bare shaft rotor lubrication
- Gas cooling
- Hydraulic control of slide valve (positioning of the slide piston by means of a 4-20mA proportional valve)

### Lube oil Pump (P214-2)

Oil injection into the high pressure sections of compressor is achieved monitoring a minimum pressure difference between the high Gas pressure side and the lube oil.

### PCV226

is adjusted at commissioning at its final Set Point keeping set pressure difference between gas outlet pressure and oil pressure. The lube oil pressure is monitored by means of PIT205

### Cooling water system

Demineralized water flowing through the cooling water lines supplies the following equipment:

Gas Cooler W119 shell and tube heat exchanger

Oil Cooler W203 shell and tube heat exchanger :-

## Gas Detection System

### Gas detectors :

Gas detectors will be installed and used to monitor the explosive level of the atmosphere within the sound enclosure. Once the sensors detect the Gas level, it will give the alarm signal to Gas alarm control panel at CCR for further action by control room operator.

## Fire detection and fire fighting System

Compressor package is equipped with two fire detector sensors IS 318-2-I and IS318-2-II. In case if one detects fire compressor package alarm is activated (BUS signal, local light and horn HA318-3), in case of two detectors would detect fire, package would be shuttled down and fire fighting system with CO<sub>2</sub> would be activated.

## ***START/STOP & LOAD CHANGE FUNCTIONS FOR MULTI UNIT OPERATION***

Each GCP will be controlled automatically by respective local control panel to maintain the discharge gas pressure. Discharge gas pressure will be decided by the maximum required gas pressure among all running gas turbine corresponding to the gas turbine load demand.

One (1) gas compressor will be working for one (1) gas turbine. The stand-by compressor will start to operate if receive command from DCS except the case when running compressor trips or alarm is generated. In this case stand-by compressor will start operation.

# ภาคผนวก ข-11

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เอกสารการตรวจสอบ Silencer

# Applicable Equipment List for Near Field Noise Measurement

## Project: GNC

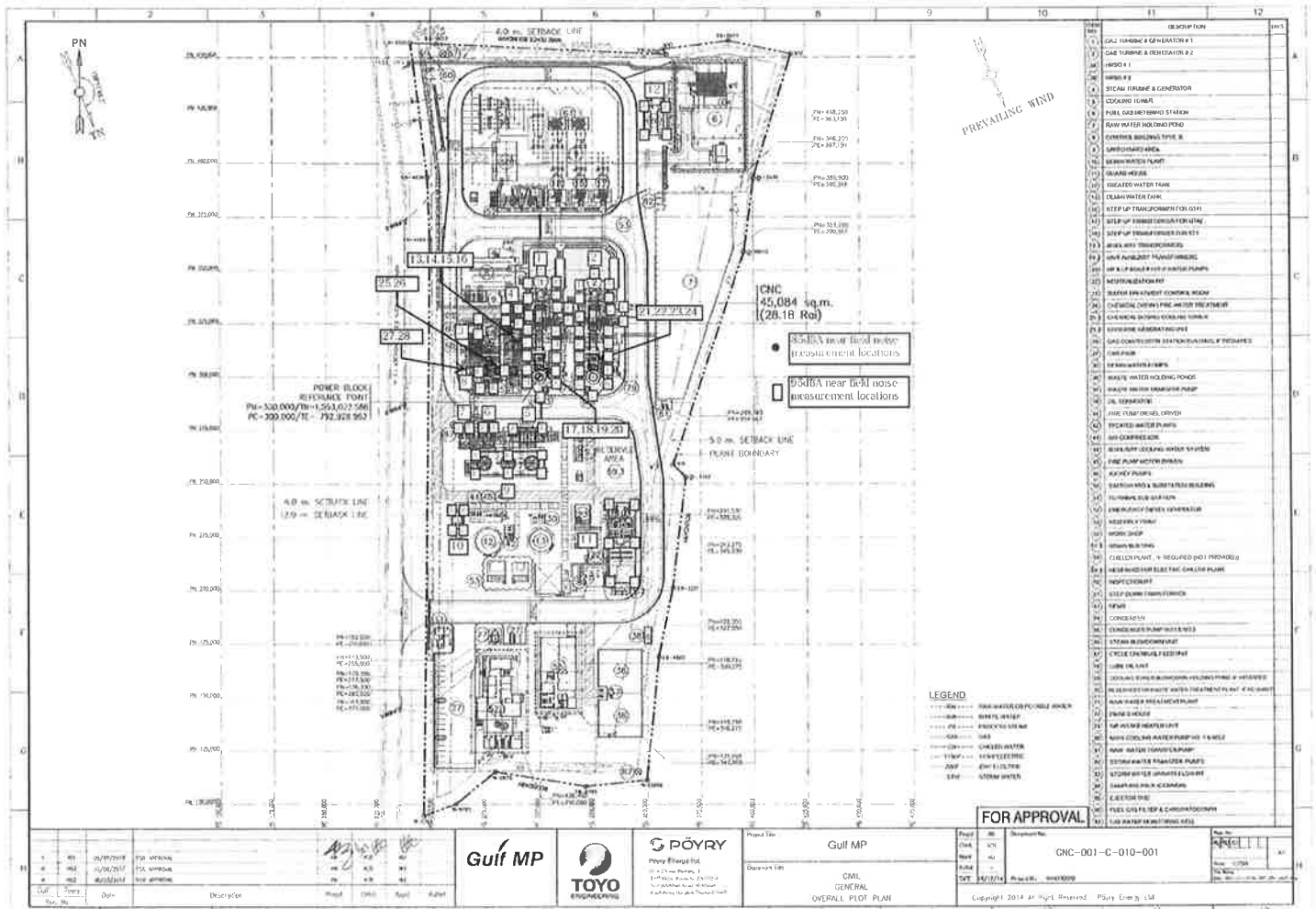
Rev. :

1

Date :

2018/1/28

Sr. #	KKS tag	Equipment	Type of test	Remarks
<b>For 85 dBA near field noise</b>				
1	11MB, 11HA	GTG11&HRSG11	85dBA	
2	12MB, 12HA	GTG12&HRSG12	85dBA	
3	10MA	STG	85dBA	
4	10LAC11AP001, 10LAC12AP001, 10LAC12AP001	BFW pumps	85dBA	
5	10PAC11AP001, 10PAC12AP001	MCW pumps	85dBA	
6	10PCC11AP001, 10PCC12AP001	ACW pumps	85dBA	
7	10PGC11AP001, 10PGC12AP001	CCW pumps	85dBA	
8	10LCB10AP001, 10LCB20AP001	Condensate pumps	85dBA	
9	10PAD91AN001, 10PAD92AN001, 10PAD93AN001	Cooling tower fans	85dBA	
10	10QEA	Air compressor package	85dBA	
11	10GC	Water treatment plant	85dBA	
12	10EKH	Fuel gas compressor package	85dBA	
<b>For 95 dBA near field noise</b>				
13	11LBH10BS001	HRSG11 HP start up vent silencer	95dBA	
14	11LBH65BS001	HRSG11 LP start up vent silencer	95dBA	
15	12LBH10BS001	HRSG12 HP start up vent silencer	95dBA	
16	12LBH65BS001	HRSG12 LP start up vent silencer	95dBA	
17	11LBA10BS201	HRSG11 HP superheater safety valve silencer	95dBA	
18	11LBA50BS201	HRSG11 LP superheater safety valve silencer	95dBA	
19	11HAD10BS201	HRSG11 HP drum safety valve silencer	95dBA	
20	11HAD50BS201	HRSG11 LP drum safety valve silencer	95dBA	
21	12LBA10BS201	HRSG12 HP superheater safety valve silencer	95dBA	
22	12LBA50BS201	HRSG12 LP superheater safety valve silencer	95dBA	
23	12HAD10BS201	HRSG12 HP drum safety valve silencer	95dBA	
24	12HAD50BS201	HRSG12 LP drum safety valve silencer	95dBA	
25	11MAN40AA001	HRSG 11 HP turbine bypass valve	95dBA	
26	11MAN10AA001	HRSG 11 LP turbine bypass valve	95dBA	
27	12MAN40AA001	HRSG 12 HP turbine bypass valve	95dBA	
28	12MAN10AA001	HRSG 12 LP turbine bypass valve	95dBA	





Near field noise (85dBA)  
(To follow)

Near field noise (95dBA)  
Start up vent silencers



Report No. : 2018-00090 / 001-6 (Page 1 of 6)

Issued date : February 8, 2018

CLIENT : TOYO ENGINEERING CORPORATION  
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Rajchathewi, Bangkok 10400  
Tel. 085-020-0134 Email : osamu.yamasaki@toyo-eng.com

### Analysis Report

SAMPLE DESIGNATED AS : Noise Level MEASUREMENT DATE : February 7, 2018  
MEASUREMENT LOCATION : HRSG11 HP&LP start up vent silencer, GNC MEASURED BY : Suriya Srithomee  
CALIBRATION DATA : Calibrator Model CR:515, Cerus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR-161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
7:58:19 - 7:58:29	81.5	8:03:19 - 8:03:29	70.8	8:08:19 - 8:08:29	74.0
7:58:29 - 7:58:39	70.3	8:03:29 - 8:03:39	74.3	8:08:29 - 8:08:39	73.8
7:58:39 - 7:58:49	70.1	8:03:39 - 8:03:49	74.2	8:08:39 - 8:08:49	73.0
7:58:49 - 7:58:59	70.1	8:03:49 - 8:03:59	72.4	8:08:49 - 8:08:59	72.8
7:58:59 - 7:59:09	70.0	8:03:59 - 8:04:09	72.9	8:08:59 - 8:09:09	73.6
7:59:09 - 7:59:19	70.0	8:04:09 - 8:04:19	75.1	8:09:09 - 8:09:19	73.7
7:59:19 - 7:59:29	70.8	8:04:19 - 8:04:29	72.9	8:09:19 - 8:09:29	73.0
7:59:29 - 7:59:39	70.2	8:04:29 - 8:04:39	73.4	8:09:29 - 8:09:39	72.8
7:59:39 - 7:59:49	71.5	8:04:39 - 8:04:49	73.3	8:09:39 - 8:09:49	74.0
7:59:49 - 7:59:59	70.2	8:04:49 - 8:04:59	74.2	8:09:49 - 8:09:59	73.5
7:59:59 - 8:00:09	70.0	8:04:59 - 8:05:09	73.7	8:09:59 - 8:10:09	74.1
8:00:09 - 8:00:19	69.9	8:05:09 - 8:05:19	73.6	8:10:09 - 8:10:19	73.8
8:00:19 - 8:00:29	69.8	8:05:19 - 8:05:29	73.4	8:10:19 - 8:10:29	73.8
8:00:29 - 8:00:39	69.8	8:05:29 - 8:05:39	73.4	8:10:29 - 8:10:39	74.2
8:00:39 - 8:00:49	70.2	8:05:39 - 8:05:49	73.0	8:10:39 - 8:10:49	74.1
8:00:49 - 8:00:59	71.3	8:05:49 - 8:05:59	72.5	8:10:49 - 8:10:59	74.3
8:00:59 - 8:01:09	70.6	8:05:59 - 8:06:09	72.8	8:10:59 - 8:11:09	75.0
8:01:09 - 8:01:19	72.6	8:06:09 - 8:06:19	73.3	8:11:09 - 8:11:19	74.3
8:01:19 - 8:01:29	70.6	8:06:19 - 8:06:29	73.7	8:11:19 - 8:11:29	74.9
8:01:29 - 8:01:39	70.6	8:06:29 - 8:06:39	73.7	8:11:29 - 8:11:39	72.5
8:01:39 - 8:01:49	70.7	8:06:39 - 8:06:49	74.4	8:11:39 - 8:11:49	72.9
8:01:49 - 8:01:59	71.3	8:06:49 - 8:06:59	73.9	8:11:49 - 8:11:59	73.6
8:01:59 - 8:02:09	70.4	8:06:59 - 8:07:09	73.0	8:11:59 - 8:12:09	73.2
8:02:09 - 8:02:19	70.4	8:07:09 - 8:07:19	73.5	8:12:09 - 8:12:19	76.2
8:02:19 - 8:02:29	70.3	8:07:19 - 8:07:29	73.7	8:12:19 - 8:12:29	77.3
8:02:29 - 8:02:39	70.4	8:07:29 - 8:07:39	74.3	8:12:29 - 8:12:39	77.2
8:02:39 - 8:02:49	70.6	8:07:39 - 8:07:49	73.3	8:12:39 - 8:12:49	77.3
8:02:49 - 8:02:59	70.6	8:07:49 - 8:07:59	73.2	8:12:49 - 8:12:59	77.3
8:02:59 - 8:03:09	70.6	8:07:59 - 8:08:09	72.7	8:12:59 - 8:13:09	77.5
8:03:09 - 8:03:19	70.5	8:08:09 - 8:08:19	73.1	8:13:09 - 8:13:19	77.4
Guaranteed Value* 95 dB(A)					



Report No. : 2018-00090 / 001-6 (Page 2 of 6)

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SOUND LEVEL METER NO. : Model CR-161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
8:13:19 - 8:13:29	77.4	8:18:19 - 8:18:29	77.3	8:23:19 - 8:23:29	84.8
8:13:29 - 8:13:39	77.3	8:18:29 - 8:18:39	77.3	8:23:29 - 8:23:39	84.6
8:13:39 - 8:13:49	77.3	8:18:39 - 8:18:49	76.9	8:23:39 - 8:23:49	84.8
8:13:49 - 8:13:59	77.3	8:18:49 - 8:18:59	77.1	8:23:49 - 8:23:59	84.9
8:13:59 - 8:14:09	77.4	8:18:59 - 8:19:09	77.6	8:23:59 - 8:24:09	85.1
8:14:09 - 8:14:19	77.4	8:19:09 - 8:19:19	78.1	8:24:09 - 8:24:19	85.4
8:14:19 - 8:14:29	77.4	8:19:19 - 8:19:29	78.8	8:24:19 - 8:24:29	85.4
8:14:29 - 8:14:39	77.4	8:19:29 - 8:19:39	79.4	8:24:29 - 8:24:39	85.2
8:14:39 - 8:14:49	77.4	8:19:39 - 8:19:49	80.2	8:24:39 - 8:24:49	85.2
8:14:49 - 8:14:59	77.4	8:19:49 - 8:19:59	80.6	8:24:49 - 8:24:59	85.4
8:14:59 - 8:15:09	77.4	8:19:59 - 8:20:09	81.2	8:24:59 - 8:25:09	85.4
8:15:09 - 8:15:19	77.5	8:20:09 - 8:20:19	81.7	8:25:09 - 8:25:19	85.7
8:15:19 - 8:15:29	77.4	8:20:19 - 8:20:29	82.1	8:25:19 - 8:25:29	86.0
8:15:29 - 8:15:39	77.5	8:20:29 - 8:20:39	82.3	8:25:29 - 8:25:39	86.1
8:15:39 - 8:15:49	77.5	8:20:39 - 8:20:49	82.6	8:25:39 - 8:25:49	86.3
8:15:49 - 8:15:59	77.5	8:20:49 - 8:20:59	82.9	8:25:49 - 8:25:59	86.3
8:15:59 - 8:16:09	77.5	8:20:59 - 8:21:09	83.4	8:25:59 - 8:26:09	86.5
8:16:09 - 8:16:19	77.5	8:21:09 - 8:21:19	83.8	8:26:09 - 8:26:19	86.5
8:16:19 - 8:16:29	77.5	8:21:19 - 8:21:29	84.0	8:26:19 - 8:26:29	86.4
8:16:29 - 8:16:39	77.6	8:21:29 - 8:21:39	84.0	8:26:29 - 8:26:39	86.5
8:16:39 - 8:16:49	77.4	8:21:39 - 8:21:49	84.1	8:26:39 - 8:26:49	86.3
8:16:49 - 8:16:59	77.4	8:21:49 - 8:21:59	84.1	8:26:49 - 8:26:59	86.5
8:16:59 - 8:17:09	77.5	8:21:59 - 8:22:09	84.0	8:26:59 - 8:27:09	86.6
8:17:09 - 8:17:19	77.4	8:22:09 - 8:22:19	84.1	8:27:09 - 8:27:19	86.3
8:17:19 - 8:17:29	77.4	8:22:19 - 8:22:29	84.4	8:27:19 - 8:27:29	86.1
8:17:29 - 8:17:39	77.5	8:22:29 - 8:22:39	84.4	8:27:29 - 8:27:39	86.2
8:17:39 - 8:17:49	77.5	8:22:39 - 8:22:49	84.3	8:27:39 - 8:27:49	86.3
8:17:49 - 8:17:59	77.4	8:22:49 - 8:22:59	84.4	8:27:49 - 8:27:59	86.4
8:17:59 - 8:18:09	77.6	8:22:59 - 8:23:09	84.6	8:27:59 - 8:28:09	86.4
8:18:09 - 8:18:19	77.5	8:23:09 - 8:23:19	84.7	8:28:09 - 8:28:19	86.3
Guaranteed Value* 95 dB(A)					

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Report No. : 2018-00090 / 001-6 (Page 3 of 6)

Issued date : February 8, 2018

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### Analysis Report

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Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
8:28:19	86.3	8:33:19	87.3	8:38:19	84.8
8:28:29	86.2	8:33:29	87.3	8:38:29	78.5
8:28:39	86.2	8:33:39	87.2	8:38:39	78.3
8:28:49	86.2	8:33:49	87.1	8:38:49	84.1
8:28:59	86.3	8:33:59	87.2	8:38:59	85.2
8:29:09	86.4	8:34:09	87.2	8:39:09	85.7
8:29:19	86.5	8:34:19	87.1	8:39:19	86.5
8:29:29	86.5	8:34:29	86.9	8:39:29	86.6
8:29:39	86.8	8:34:39	86.8	8:39:39	87.2
8:29:49	86.7	8:34:49	86.7	8:39:49	87.3
8:29:59	86.8	8:34:59	86.7	8:39:59	87.6
8:30:09	86.7	8:35:09	86.6	8:40:09	88.0
8:30:19	86.7	8:35:19	86.6	8:40:19	88.4
8:30:29	86.7	8:35:29	86.5	8:40:29	88.6
8:30:39	86.7	8:35:39	86.4	8:40:39	88.6
8:30:49	86.8	8:35:49	86.4	8:40:49	88.9
8:30:59	86.7	8:35:59	86.2	8:40:59	89.3
8:31:09	86.7	8:36:09	86.3	8:41:09	89.3
8:31:19	86.9	8:36:19	86.4	8:41:19	89.5
8:31:29	87.0	8:36:29	86.4	8:41:29	89.4
8:31:39	87.0	8:36:39	86.2	8:41:39	89.6
8:31:49	87.0	8:36:49	86.2	8:41:49	89.6
8:31:59	87.1	8:36:59	86.3	8:41:59	89.7
8:32:09	87.1	8:37:09	86.5	8:42:09	89.8
8:32:19	87.1	8:37:19	86.5	8:42:19	89.8
8:32:29	87.3	8:37:29	86.2	8:42:29	89.1
8:32:39	87.3	8:37:39	85.9	8:42:39	89.8
8:32:49	87.4	8:37:49	85.7	8:42:49	89.1
8:32:59	87.5	8:37:59	85.9	8:42:59	89.7
8:33:09	87.5	8:38:09	85.8	8:43:09	89.6
Guaranteed Value*		95	dB(A)		



Report No. : 2018-00090 / 001-6 (Page 4 of 6)

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SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
8:43:19	90.1	8:48:19	90.8	8:53:19	90.9
8:43:29	90.4	8:48:29	90.7	8:53:29	90.7
8:43:39	90.8	8:48:39	90.8	8:53:39	91.0
8:43:49	91.0	8:48:49	90.7	8:53:49	90.6
8:43:59	91.1	8:48:59	90.7	8:53:59	90.8
8:44:09	91.1	8:49:09	90.8	8:54:09	90.9
8:44:19	91.1	8:49:19	90.9	8:54:19	90.6
8:44:29	91.0	8:49:29	90.7	8:54:29	91.0
8:44:39	91.3	8:49:39	90.9	8:54:39	90.8
8:44:49	91.0	8:49:49	90.7	8:54:49	90.7
8:44:59	91.1	8:49:59	90.8	8:54:59	91.1
8:45:09	91.2	8:50:09	90.9	8:55:09	90.7
8:45:19	91.1	8:50:19	90.6	8:55:19	90.9
8:45:29	91.3	8:50:29	90.9	8:55:29	91.1
8:45:39	91.1	8:50:39	90.7	8:55:39	90.7
8:45:49	91.4	8:50:49	90.9	8:55:49	91.0
8:45:59	91.1	8:50:59	90.7	8:55:59	90.7
8:46:09	91.0	8:51:09	91.1	8:56:09	91.0
8:46:19	91.1	8:51:19	90.9	8:56:19	90.9
8:46:29	91.1	8:51:29	91.1	8:56:29	90.7
8:46:39	91.1	8:51:39	90.9	8:56:39	91.0
8:46:49	91.0	8:51:49	91.0	8:56:49	90.6
8:46:59	90.9	8:51:59	90.8	8:56:59	90.8
8:47:09	91.2	8:52:09	91.0	8:57:09	90.9
8:47:19	90.9	8:52:19	90.7	8:57:19	90.5
8:47:29	91.1	8:52:29	90.9	8:57:29	91.0
8:47:39	90.8	8:52:39	90.8	8:57:39	90.9
8:47:49	90.9	8:52:49	90.9	8:57:49	90.8
8:47:59	90.7	8:52:59	90.7	8:57:59	91.2
8:48:09	90.8	8:53:09	90.9	8:58:09	90.8
Guaranteed Value*		95	dB(A)		

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Report No. : 2018-00090 / 001-6 (Page 5 of 6)

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### Analysis Report

SAMPLE DESIGNATED AS : Noise Level MEASUREMENT DATE : February 7, 2018  
MEASUREMENT LOCATION : HRS111 HP&LP start up vent silencer, GNC MEASURED BY : Suriya Srithomee  
CALIBRATION DATA : Calibrator Model CR:515, Cernus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
8:58:19	91.0	9:03:19	91.0	9:08:19	89.4
8:58:29	91.2	9:03:29	90.7	9:08:29	89.5
8:58:39	90.9	9:03:39	90.8	9:08:39	89.1
8:58:49	91.2	9:03:49	90.9	9:08:49	88.7
8:58:59	90.9	9:03:59	90.8	9:08:59	88.7
8:59:09	90.7	9:04:09	88.5	9:09:09	88.0
8:59:19	91.0	9:04:19	88.5	9:09:19	88.2
8:59:29	90.8	9:04:29	87.6	9:09:29	88.0
8:59:39	90.9	9:04:39	86.9	9:09:39	87.4
8:59:49	91.0	9:04:49	86.5	9:09:49	88.0
8:59:59	90.6	9:04:59	86.1	9:09:59	87.0
9:00:09	90.9	9:05:09	85.6	9:10:09	86.8
9:00:19	90.8	9:05:19	85.2	9:10:19	87.2
9:00:29	90.7	9:05:29	82.2	9:10:29	85.9
9:00:39	91.0	9:05:39	85.0	9:10:39	86.3
9:00:49	90.7	9:05:49	86.1	9:10:49	86.3
9:00:59	90.9	9:05:59	86.0	9:10:59	84.9
9:01:09	91.0	9:06:09	86.6	9:11:09	85.9
9:01:19	90.7	9:06:19	87.2	9:11:19	83.8
9:01:29	91.0	9:06:29	87.6	9:11:29	83.9
9:01:39	90.8	9:06:39	87.6	9:11:39	83.8
9:01:49	90.7	9:06:49	87.7	9:11:49	83.8
9:01:59	91.0	9:06:59	87.7	9:11:59	83.9
9:02:09	90.6	9:07:09	87.0	9:12:09	83.8
9:02:19	90.7	9:07:19	88.4	9:12:19	83.9
9:02:29	90.9	9:07:29	89.4	9:12:29	83.9
9:02:39	90.6	9:07:39	90.2	9:12:39	80.7
9:02:49	90.9	9:07:49	89.7	9:12:49	83.7
9:02:59	90.7	9:07:59	90.3	9:12:59	82.5
9:03:09	90.7	9:08:09	90.1	9:13:09	78.8
Guaranteed Value* 95 dB(A)					



Report No. : 2018-00090 / 001-6 (Page 6 of 6)

Issued date : February 8, 2018

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### Analysis Report

SAMPLE DESIGNATED AS : Noise Level MEASUREMENT DATE : February 7, 2018  
MEASUREMENT LOCATION : HRS111 HP&LP start up vent silencer, GNC MEASURED BY : Suriya Srithomee  
CALIBRATION DATA : Calibrator Model CR:515, Cernus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
9:13:19	78.8	9:15:09	78.8	9:16:59	80.1
9:13:29	78.9	9:15:19	78.8	9:17:09	80.0
9:13:39	79.0	9:15:29	78.8	9:17:19	79.8
9:13:49	82.0	9:15:39	79.0	9:17:29	79.6
9:13:59	78.3	9:15:49	78.9	9:17:39	79.6
9:14:09	79.0	9:15:59	84.3	9:17:49	79.6
9:14:19	78.9	9:16:09	81.8	9:17:59	79.6
9:14:29	79.0	9:16:19	80.4	9:18:09	79.8
9:14:39	79.0	9:16:29	79.2	9:18:19	79.6
9:14:49	79.0	9:16:39	79.2		
9:14:59	78.8	9:16:49	79.8		
Guaranteed Value* 95 dB(A)					

Source : \* Guaranteed Value of GNC Power Plant.

*Siriporn Imwilaiwan*  
(Siriporn Imwilaiwan)  
Environmental Monitoring Manager



*Thepssan Yommana*  
(Thepssan Yommana)  
Technical Manager

TY/SS/AS/CJ

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Report No. : 2018-00090 / 001-7 (Page 1 of 5)

Issued date : February 8, 2018

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Rajchathewi, Bangkok 10400  
Tel. 085-020-0134  
Email : osamu.yamasaki@toyo-eng.com

### Analysis Report

SAMPLE DESIGNATED AS : Noise Level  
MEASUREMENT LOCATION : HRS12 HP&LP start up vent silencer, GNC  
CALIBRATION DATA : Calibrator Model CR:515, Cerus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

MEASUREMENT DATE : February 7, 2018  
MEASURED BY : Suriya Srithomee

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
9:46:05 - 9:46:15	78.5	9:51:05 - 9:51:15	78.5	9:56:05 - 9:56:15	78.7
9:46:15 - 9:46:25	78.7	9:51:15 - 9:51:25	78.7	9:56:15 - 9:56:25	78.8
9:46:25 - 9:46:35	78.7	9:51:25 - 9:51:35	78.5	9:56:25 - 9:56:35	78.8
9:46:35 - 9:46:45	78.8	9:51:35 - 9:51:45	78.5	9:56:35 - 9:56:45	78.4
9:46:45 - 9:46:55	78.7	9:51:45 - 9:51:55	78.6	9:56:45 - 9:56:55	78.5
9:46:55 - 9:47:05	78.6	9:51:55 - 9:52:05	78.6	9:56:55 - 9:57:05	78.7
9:47:05 - 9:47:15	78.4	9:52:05 - 9:52:15	78.7	9:57:05 - 9:57:15	78.8
9:47:15 - 9:47:25	78.6	9:52:15 - 9:52:25	78.6	9:57:15 - 9:57:25	78.8
9:47:25 - 9:47:35	78.7	9:52:25 - 9:52:35	78.4	9:57:25 - 9:57:35	78.8
9:47:35 - 9:47:45	78.7	9:52:35 - 9:52:45	78.3	9:57:35 - 9:57:45	78.9
9:47:45 - 9:47:55	78.7	9:52:45 - 9:52:55	78.5	9:57:45 - 9:57:55	78.8
9:47:55 - 9:48:05	78.8	9:52:55 - 9:53:05	78.5	9:57:55 - 9:58:05	78.7
9:48:05 - 9:48:15	78.6	9:53:05 - 9:53:15	78.5	9:58:05 - 9:58:15	78.7
9:48:15 - 9:48:25	78.6	9:53:15 - 9:53:25	78.5	9:58:15 - 9:58:25	78.8
9:48:25 - 9:48:35	78.6	9:53:25 - 9:53:35	78.5	9:58:25 - 9:58:35	79.0
9:48:35 - 9:48:45	78.5	9:53:35 - 9:53:45	78.6	9:58:35 - 9:58:45	78.9
9:48:45 - 9:48:55	78.7	9:53:45 - 9:53:55	78.6	9:58:45 - 9:58:55	78.9
9:48:55 - 9:49:05	78.7	9:53:55 - 9:54:05	78.5	9:58:55 - 9:59:05	79.0
9:49:05 - 9:49:15	78.8	9:54:05 - 9:54:15	78.5	9:59:05 - 9:59:15	79.1
9:49:15 - 9:49:25	79.0	9:54:15 - 9:54:25	78.6	9:59:15 - 9:59:25	79.0
9:49:25 - 9:49:35	78.6	9:54:25 - 9:54:35	78.6	9:59:25 - 9:59:35	79.1
9:49:35 - 9:49:45	78.5	9:54:35 - 9:54:45	78.7	9:59:35 - 9:59:45	79.3
9:49:45 - 9:49:55	78.4	9:54:45 - 9:54:55	78.7	9:59:45 - 9:59:55	79.4
9:49:55 - 9:50:05	78.4	9:54:55 - 9:55:05	78.8	9:59:55 - 10:00:05	79.3
9:50:05 - 9:50:15	78.4	9:55:05 - 9:55:15	78.7	10:00:05 - 10:00:15	79.1
9:50:15 - 9:50:25	78.6	9:55:15 - 9:55:25	78.4	10:00:15 - 10:00:25	79.0
9:50:25 - 9:50:35	78.6	9:55:25 - 9:55:35	78.4	10:00:25 - 10:00:35	78.9
9:50:35 - 9:50:45	78.6	9:55:35 - 9:55:45	78.4	10:00:35 - 10:00:45	78.9
9:50:45 - 9:50:55	78.7	9:55:45 - 9:55:55	78.5	10:00:45 - 10:00:55	78.8
9:50:55 - 9:51:05	78.6	9:55:55 - 9:56:05	78.6	10:00:55 - 10:01:05	78.8
Guaranteed Value*		95	dB(A)		



Report No. : 2018-00090 / 001-7 (Page 2 of 5)

Issued date : February 8, 2018

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Email : osamu.yamasaki@toyo-eng.com

### Analysis Report

SAMPLE DESIGNATED AS : Noise Level  
MEASUREMENT LOCATION : HRS12 HP&LP start up vent silencer, GNC  
CALIBRATION DATA : Calibrator Model CR:515, Cerus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

MEASUREMENT DATE : February 7, 2018  
MEASURED BY : Suriya Srithomee

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
10:01:05 - 10:01:15	78.9	10:06:05 - 10:06:15	84.8	10:11:05 - 10:11:15	87.7
10:01:15 - 10:01:25	79.1	10:06:15 - 10:06:25	83.1	10:11:15 - 10:11:25	85.2
10:01:25 - 10:01:35	79.1	10:06:25 - 10:06:35	85.6	10:11:25 - 10:11:35	87.8
10:01:35 - 10:01:45	79.1	10:06:35 - 10:06:45	85.6	10:11:35 - 10:11:45	88.1
10:01:45 - 10:01:55	78.9	10:06:45 - 10:06:55	85.8	10:11:45 - 10:11:55	87.9
10:01:55 - 10:02:05	77.7	10:06:55 - 10:07:05	84.7	10:11:55 - 10:12:05	88.1
10:02:05 - 10:02:15	77.8	10:07:05 - 10:07:15	84.5	10:12:05 - 10:12:15	87.4
10:02:15 - 10:02:25	78.1	10:07:15 - 10:07:25	85.2	10:12:15 - 10:12:25	86.9
10:02:25 - 10:02:35	78.5	10:07:25 - 10:07:35	86.2	10:12:25 - 10:12:35	88.2
10:02:35 - 10:02:45	79.3	10:07:35 - 10:07:45	85.5	10:12:35 - 10:12:45	88.1
10:02:45 - 10:02:55	80.2	10:07:45 - 10:07:55	84.8	10:12:45 - 10:12:55	88.4
10:02:55 - 10:03:05	80.4	10:07:55 - 10:08:05	84.1	10:12:55 - 10:13:05	88.8
10:03:05 - 10:03:15	80.8	10:08:05 - 10:08:15	83.6	10:13:05 - 10:13:15	88.9
10:03:15 - 10:03:25	81.2	10:08:15 - 10:08:25	85.9	10:13:15 - 10:13:25	88.7
10:03:25 - 10:03:35	81.3	10:08:25 - 10:08:35	86.4	10:13:25 - 10:13:35	86.9
10:03:35 - 10:03:45	81.5	10:08:35 - 10:08:45	85.7	10:13:35 - 10:13:45	88.4
10:03:45 - 10:03:55	79.9	10:08:45 - 10:08:55	87.1	10:13:45 - 10:13:55	87.3
10:03:55 - 10:04:05	78.8	10:08:55 - 10:09:05	87.2	10:13:55 - 10:14:05	86.7
10:04:05 - 10:04:15	80.0	10:09:05 - 10:09:15	85.9	10:14:05 - 10:14:15	87.0
10:04:15 - 10:04:25	81.0	10:09:15 - 10:09:25	86.8	10:14:15 - 10:14:25	89.1
10:04:25 - 10:04:35	81.4	10:09:25 - 10:09:35	87.5	10:14:25 - 10:14:35	88.8
10:04:35 - 10:04:45	82.2	10:09:35 - 10:09:45	87.7	10:14:35 - 10:14:45	86.4
10:04:45 - 10:04:55	82.7	10:09:45 - 10:09:55	88.0	10:14:45 - 10:14:55	89.2
10:04:55 - 10:05:05	82.2	10:09:55 - 10:10:05	88.0	10:14:55 - 10:15:05	88.8
10:05:05 - 10:05:15	82.9	10:10:05 - 10:10:15	87.7	10:15:05 - 10:15:15	89.5
10:05:15 - 10:05:25	82.7	10:10:15 - 10:10:25	87.6	10:15:15 - 10:15:25	88.8
10:05:25 - 10:05:35	85.2	10:10:25 - 10:10:35	87.7	10:15:25 - 10:15:35	87.7
10:05:35 - 10:05:45	85.5	10:10:35 - 10:10:45	87.9	10:15:35 - 10:15:45	88.0
10:05:45 - 10:05:55	84.7	10:10:45 - 10:10:55	87.9	10:15:45 - 10:15:55	88.2
10:05:55 - 10:06:05	84.5	10:10:55 - 10:11:05	86.2	10:15:55 - 10:16:05	88.3
Guaranteed Value*		95	dB(A)		

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Shenzhen SGS Auto

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**Report No. : 2018-00090 / 001-7 (Page 3 of 5)**

Issued date : February 8, 2018

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### Analysis Report

**SAMPLE DESIGNATED AS :** Noise Level  
**MEASUREMENT LOCATION :** HRS12 HP&LP start up vent silencer, GNC  
**CALIBRATION DATA :** Calibrator Model CR:515, Cerus Research plc. Serial No. 81969  
 Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
**SOUND LEVEL METER NO. :** Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
10:16:05 - 10:16:15	88.1	10:21:05 - 10:21:15	87.1	10:26:05 - 10:26:15	83.9
10:16:15 - 10:16:25	87.8	10:21:15 - 10:21:25	86.9	10:26:15 - 10:26:25	83.6
10:16:25 - 10:16:35	88.0	10:21:25 - 10:21:35	87.1	10:26:25 - 10:26:35	84.1
10:16:35 - 10:16:45	88.1	10:21:35 - 10:21:45	87.0	10:26:35 - 10:26:45	85.0
10:16:45 - 10:16:55	88.1	10:21:45 - 10:21:55	87.1	10:26:45 - 10:26:55	85.9
10:16:55 - 10:17:05	88.0	10:21:55 - 10:22:05	87.0	10:26:55 - 10:27:05	86.7
10:17:05 - 10:17:15	87.2	10:22:05 - 10:22:15	87.0	10:27:05 - 10:27:15	87.1
10:17:15 - 10:17:25	86.7	10:22:15 - 10:22:25	87.0	10:27:15 - 10:27:25	87.2
10:17:25 - 10:17:35	87.1	10:22:25 - 10:22:35	87.0	10:27:25 - 10:27:35	87.5
10:17:35 - 10:17:45	87.0	10:22:35 - 10:22:45	87.0	10:27:35 - 10:27:45	87.9
10:17:45 - 10:17:55	87.0	10:22:45 - 10:22:55	86.7	10:27:45 - 10:27:55	88.2
10:17:55 - 10:18:05	86.9	10:22:55 - 10:23:05	86.7	10:27:55 - 10:28:05	88.6
10:18:05 - 10:18:15	86.7	10:23:05 - 10:23:15	86.7	10:28:05 - 10:28:15	88.9
10:18:15 - 10:18:25	86.7	10:23:15 - 10:23:25	86.6	10:28:15 - 10:28:25	88.9
10:18:25 - 10:18:35	86.8	10:23:25 - 10:23:35	86.6	10:28:25 - 10:28:35	89.2
10:18:35 - 10:18:45	86.9	10:23:35 - 10:23:45	86.6	10:28:35 - 10:28:45	89.3
10:18:45 - 10:18:55	86.8	10:23:45 - 10:23:55	86.6	10:28:45 - 10:28:55	89.1
10:18:55 - 10:19:05	86.7	10:23:55 - 10:24:05	86.6	10:28:55 - 10:29:05	89.2
10:19:05 - 10:19:15	86.8	10:24:05 - 10:24:15	86.7	10:29:05 - 10:29:15	89.3
10:19:15 - 10:19:25	86.8	10:24:15 - 10:24:25	86.7	10:29:15 - 10:29:25	89.4
10:19:25 - 10:19:35	86.8	10:24:25 - 10:24:35	86.7	10:29:25 - 10:29:35	89.5
10:19:35 - 10:19:45	86.7	10:24:35 - 10:24:45	86.6	10:29:35 - 10:29:45	89.8
10:19:45 - 10:19:55	86.8	10:24:45 - 10:24:55	86.5	10:29:45 - 10:29:55	90.0
10:19:55 - 10:20:05	86.8	10:24:55 - 10:25:05	86.7	10:29:55 - 10:30:05	90.2
10:20:05 - 10:20:15	86.7	10:25:05 - 10:25:15	86.6	10:30:05 - 10:30:15	90.4
10:20:15 - 10:20:25	86.8	10:25:15 - 10:25:25	86.6	10:30:15 - 10:30:25	90.5
10:20:25 - 10:20:35	86.9	10:25:25 - 10:25:35	86.7	10:30:25 - 10:30:35	90.5
10:20:35 - 10:20:45	87.0	10:25:35 - 10:25:45	86.8	10:30:35 - 10:30:45	90.6
10:20:45 - 10:20:55	87.0	10:25:45 - 10:25:55	86.7	10:30:45 - 10:30:55	90.7
10:20:55 - 10:21:05	86.9	10:25:55 - 10:26:05	86.4	10:30:55 - 10:31:05	90.9
Guaranteed Value*		95	dB(A)		



**Report No. : 2018-00090 / 001-7 (Page 4 of 5)**

Issued date : February 8, 2018

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### Analysis Report

**SAMPLE DESIGNATED AS :** Noise Level  
**MEASUREMENT LOCATION :** HRS12 HP&LP start up vent silencer, GNC  
**CALIBRATION DATA :** Calibrator Model CR:515, Cerus Research plc. Serial No. 81969  
 Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
**SOUND LEVEL METER NO. :** Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
10:31:05 - 10:31:15	91.0	10:36:05 - 10:36:15	90.1	10:41:05 - 10:41:15	90.1
10:31:15 - 10:31:25	91.0	10:36:15 - 10:36:25	90.1	10:41:15 - 10:41:25	90.1
10:31:25 - 10:31:35	91.1	10:36:25 - 10:36:35	90.1	10:41:25 - 10:41:35	90.1
10:31:35 - 10:31:45	91.1	10:36:35 - 10:36:45	90.0	10:41:35 - 10:41:45	90.2
10:31:45 - 10:31:55	91.2	10:36:45 - 10:36:55	90.1	10:41:45 - 10:41:55	90.2
10:31:55 - 10:32:05	91.2	10:36:55 - 10:37:05	90.1	10:41:55 - 10:42:05	90.1
10:32:05 - 10:32:15	91.2	10:37:05 - 10:37:15	90.1	10:42:05 - 10:42:15	90.1
10:32:15 - 10:32:25	91.3	10:37:15 - 10:37:25	90.1	10:42:15 - 10:42:25	90.1
10:32:25 - 10:32:35	91.2	10:37:25 - 10:37:35	90.2	10:42:25 - 10:42:35	90.0
10:32:35 - 10:32:45	91.3	10:37:35 - 10:37:45	90.2	10:42:35 - 10:42:45	89.9
10:32:45 - 10:32:55	91.2	10:37:45 - 10:37:55	90.2	10:42:45 - 10:42:55	89.4
10:32:55 - 10:33:05	91.1	10:37:55 - 10:38:05	90.2	10:42:55 - 10:43:05	88.8
10:33:05 - 10:33:15	91.0	10:38:05 - 10:38:15	90.1	10:43:05 - 10:43:15	88.6
10:33:15 - 10:33:25	90.8	10:38:15 - 10:38:25	90.1	10:43:15 - 10:43:25	88.1
10:33:25 - 10:33:35	90.7	10:38:25 - 10:38:35	90.2	10:43:25 - 10:43:35	87.9
10:33:35 - 10:33:45	90.7	10:38:35 - 10:38:45	90.3	10:43:35 - 10:43:45	87.7
10:33:45 - 10:33:55	90.6	10:38:45 - 10:38:55	90.3	10:43:45 - 10:43:55	87.5
10:33:55 - 10:34:05	90.5	10:38:55 - 10:39:05	90.2	10:43:55 - 10:44:05	87.4
10:34:05 - 10:34:15	90.5	10:39:05 - 10:39:15	90.2	10:44:05 - 10:44:15	87.4
10:34:15 - 10:34:25	90.3	10:39:15 - 10:39:25	90.1	10:44:15 - 10:44:25	87.0
10:34:25 - 10:34:35	90.2	10:39:25 - 10:39:35	90.2	10:44:25 - 10:44:35	86.5
10:34:35 - 10:34:45	90.2	10:39:35 - 10:39:45	90.1	10:44:35 - 10:44:45	86.7
10:34:45 - 10:34:55	90.1	10:39:45 - 10:39:55	90.2	10:44:45 - 10:44:55	87.4
10:34:55 - 10:35:05	90.1	10:39:55 - 10:40:05	90.2	10:44:55 - 10:45:05	87.6
10:35:05 - 10:35:15	90.0	10:40:05 - 10:40:15	90.2	10:45:05 - 10:45:15	87.7
10:35:15 - 10:35:25	89.9	10:40:15 - 10:40:25	90.2	10:45:15 - 10:45:25	87.8
10:35:25 - 10:35:35	90.0	10:40:25 - 10:40:35	90.2	10:45:25 - 10:45:35	87.7
10:35:35 - 10:35:45	90.2	10:40:35 - 10:40:45	90.1	10:45:35 - 10:45:45	87.8
10:35:45 - 10:35:55	90.2	10:40:45 - 10:40:55	90.0	10:45:45 - 10:45:55	87.6
10:35:55 - 10:36:05	90.2	10:40:55 - 10:41:05	90.1	10:45:55 - 10:46:05	87.4
Guaranteed Value*		95	dB(A)		

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**Report No. : 2018-00090 / 001-7 (Page 5 of 5)**

Issued date : February 8, 2018

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 Tel. 085-020-0134 Email : osamu.yamasaki@toyo-eng.com

## Analysis Report

**SAMPLE DESIGNATED AS :** Noise Level **MEASUREMENT DATE :** February 7, 2018  
**MEASUREMENT LOCATION :** HRSG12 HP&LP start up vent silencer, GNC **MEASURED BY :** Suriya Srithomee  
**CALIBRATION DATA :** Calibrator Model CR:515, Cerus Research plc, Serial No. 81969  
 Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
**SOUND LEVEL METER NO. :** Model CR:161B, Serial No. G080136

Noise Level [dB(A)] : February 7, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
10:46:05 - 10:46:15	87.3	10:50:35 - 10:50:45	79.8	10:55:05 - 10:55:15	79.4
10:46:15 - 10:46:25	87.1	10:50:45 - 10:50:55	81.5	10:55:15 - 10:55:25	79.4
10:46:25 - 10:46:35	86.9	10:50:55 - 10:51:05	82.9	10:55:25 - 10:55:35	79.6
10:46:35 - 10:46:45	86.9	10:51:05 - 10:51:15	80.0	10:55:35 - 10:55:45	80.2
10:46:45 - 10:46:55	86.5	10:51:15 - 10:51:25	83.3	10:55:45 - 10:55:55	78.7
10:46:55 - 10:47:05	86.9	10:51:25 - 10:51:35	80.4	10:55:55 - 10:56:05	77.9
10:47:05 - 10:47:15	86.8	10:51:35 - 10:51:45	80.7	10:56:05 - 10:56:15	78.0
10:47:15 - 10:47:25	86.9	10:51:45 - 10:51:55	82.0	10:56:15 - 10:56:25	77.9
10:47:25 - 10:47:35	86.7	10:51:55 - 10:52:05	79.9	10:56:25 - 10:56:35	77.9
10:47:35 - 10:47:45	86.6	10:52:05 - 10:52:15	79.9	10:56:35 - 10:56:45	78.0
10:47:45 - 10:47:55	86.5	10:52:15 - 10:52:25	79.8	10:56:45 - 10:56:55	78.2
10:47:55 - 10:48:05	86.4	10:52:25 - 10:52:35	78.7	10:56:55 - 10:57:05	78.2
10:48:05 - 10:48:15	86.2	10:52:35 - 10:52:45	79.7	10:57:05 - 10:57:15	78.5
10:48:15 - 10:48:25	86.0	10:52:45 - 10:52:55	79.6	10:57:15 - 10:57:25	78.4
10:48:25 - 10:48:35	85.9	10:52:55 - 10:53:05	79.7	10:57:25 - 10:57:35	78.3
10:48:35 - 10:48:45	85.8	10:53:05 - 10:53:15	79.7	10:57:35 - 10:57:45	78.4
10:48:45 - 10:48:55	85.5	10:53:15 - 10:53:25	79.7	10:57:45 - 10:57:55	78.3
10:48:55 - 10:49:05	85.2	10:53:25 - 10:53:35	79.6	10:57:55 - 10:58:05	78.1
10:49:05 - 10:49:15	85.0	10:53:35 - 10:53:45	79.7	10:58:05 - 10:58:15	78.7
10:49:15 - 10:49:25	84.5	10:53:45 - 10:53:55	79.8	10:58:15 - 10:58:25	78.4
10:49:25 - 10:49:35	84.1	10:53:55 - 10:54:05	79.8	10:58:25 - 10:58:35	78.3
10:49:35 - 10:49:45	83.8	10:54:05 - 10:54:15	79.7	10:58:35 - 10:58:45	78.2
10:49:45 - 10:49:55	83.7	10:54:15 - 10:54:25	79.7	10:58:45 - 10:58:55	78.5
10:49:55 - 10:50:05	83.6	10:54:25 - 10:54:35	79.8	10:58:55 - 10:59:05	78.4
10:50:05 - 10:50:15	83.6	10:54:35 - 10:54:45	79.8	10:59:05 - 10:59:15	78.4
10:50:15 - 10:50:25	80.8	10:54:45 - 10:54:55	79.7	10:59:15 - 10:59:25	78.5
10:50:25 - 10:50:35	79.8	10:54:55 - 10:55:05	79.5	10:59:25 - 10:59:35	78.6
Guaranteed Value*		95	dB(A)		

Source : \* Guaranteed Value of GNC Power Plant.

*Siriporn*  
 (Siriporn Imwilaiwan)  
 Environmental Monitoring Manager



*Thapson*  
 (Thapson Yommana)  
 Technical Manager

TY/SS/AS/CJ

E 165737

Near field noise (95dBA)  
 Turbine bypass valves



Report No. : 2018-00090 / 001-2 (Page 1 of 1)

Issued date : February 7, 2018

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Rajchathewi, Bangkok 10400  
Tel. 085-020-0134

Email : osamu.yamasaki@toyo-eng.com

## Analysis Report

SAMPLE DESIGNATED AS : Noise Level  
MEASUREMENT LOCATION : HRSG11 HP turbine bypass valve, GNC  
CALIBRATION DATA : Calibrator Model CR:515, Cerrus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

MEASUREMENT DATE : February 6, 2018  
MEASURED BY : Suriya Srithomee

Noise Level [dB(A)] : February 6, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
14:28:05 - 14:28:15	92.5	14:32:05 - 14:32:15	91.7	14:36:05 - 14:36:15	91.9
14:28:15 - 14:28:25	92.1	14:32:15 - 14:32:25	91.8	14:36:15 - 14:36:25	91.8
14:28:25 - 14:28:35	91.8	14:32:25 - 14:32:35	91.8	14:36:25 - 14:36:35	92.0
14:28:35 - 14:28:45	92.0	14:32:35 - 14:32:45	92.0	14:36:35 - 14:36:45	91.7
14:28:45 - 14:28:55	91.8	14:32:45 - 14:32:55	91.9	14:36:45 - 14:36:55	91.9
14:28:55 - 14:29:05	91.9	14:32:55 - 14:33:05	91.9	14:36:55 - 14:37:05	91.8
14:29:05 - 14:29:15	91.9	14:33:05 - 14:33:15	91.6	14:37:05 - 14:37:15	91.7
14:29:15 - 14:29:25	91.8	14:33:15 - 14:33:25	91.8	14:37:15 - 14:37:25	91.6
14:29:25 - 14:29:35	91.8	14:33:25 - 14:33:35	91.8	14:37:25 - 14:37:35	91.6
14:29:35 - 14:29:45	91.7	14:33:35 - 14:33:45	91.8	14:37:35 - 14:37:45	91.6
14:29:45 - 14:29:55	91.9	14:33:45 - 14:33:55	91.7	14:37:45 - 14:37:55	91.5
14:29:55 - 14:30:05	91.8	14:33:55 - 14:34:05	91.7	14:37:55 - 14:38:05	91.5
14:30:05 - 14:30:15	91.8	14:34:05 - 14:34:15	91.9	14:38:05 - 14:38:15	91.6
14:30:15 - 14:30:25	91.7	14:34:15 - 14:34:25	91.9	14:38:15 - 14:38:25	91.7
14:30:25 - 14:30:35	91.8	14:34:25 - 14:34:35	91.9	14:38:25 - 14:38:35	91.6
14:30:35 - 14:30:45	91.7	14:34:35 - 14:34:45	91.7	14:38:35 - 14:38:45	91.9
14:30:45 - 14:30:55	91.5	14:34:45 - 14:34:55	91.9	14:38:45 - 14:38:55	91.8
14:30:55 - 14:31:05	91.6	14:34:55 - 14:35:05	91.8	14:38:55 - 14:39:05	92.2
14:31:05 - 14:31:15	91.6	14:35:05 - 14:35:15	91.8	14:39:05 - 14:39:15	92.2
14:31:15 - 14:31:25	91.6	14:35:15 - 14:35:25	91.7	14:39:15 - 14:39:25	92.3
14:31:25 - 14:31:35	91.6	14:35:25 - 14:35:35	91.7	14:39:25 - 14:39:35	92.2
14:31:35 - 14:31:45	91.6	14:35:35 - 14:35:45	91.7	14:39:35 - 14:39:45	92.2
14:31:45 - 14:31:55	91.6	14:35:45 - 14:35:55	91.8	14:39:45 - 14:39:55	92.3
14:31:55 - 14:32:05	91.6	14:35:55 - 14:36:05	91.7	14:39:55 - 14:40:05	92.2
Guaranteed Value*		95	dB(A)		

Source : \* Guaranteed Value of GNC Power Plant.

*Siriporn*  
(Siriporn Imwilaiwan)  
Environmental Monitoring Manager



*Thapson*  
(Thapson Yommana)  
Technical Manager

TY/SS/AS/CJ



Report No. : 2018-00090 / 001-3 (Page 1 of 1)

Issued date : February 7, 2018

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Tel. 085-020-0134

Email : osamu.yamasaki@toyo-eng.com

## Analysis Report

SAMPLE DESIGNATED AS : Noise Level  
MEASUREMENT LOCATION : HRSG11 LP turbine bypass valve, GNC  
CALIBRATION DATA : Calibrator Model CR:515, Cerrus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
SOUND LEVEL METER NO. : Model CR:161B, Serial No. G080136

MEASUREMENT DATE : February 6, 2018  
MEASURED BY : Suriya Srithomee

Noise Level [dB(A)] : February 6, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
14:40:05 - 14:40:15	92.1	14:41:15 - 14:41:25	92.2	14:42:25 - 14:42:35	92.0
14:40:15 - 14:40:25	92.2	14:41:25 - 14:41:35	92.1	14:42:35 - 14:42:45	92.1
14:40:25 - 14:40:35	92.1	14:41:35 - 14:41:45	91.9	14:42:45 - 14:42:55	92.0
14:40:35 - 14:40:45	92.2	14:41:45 - 14:41:55	91.9	14:42:55 - 14:43:05	92.0
14:40:45 - 14:40:55	92.1	14:41:55 - 14:42:05	91.8	14:43:05 - 14:43:15	91.9
14:40:55 - 14:41:05	92.2	14:42:05 - 14:42:15	92.0	14:43:15 - 14:43:25	91.9
14:41:05 - 14:41:15	92.1	14:42:15 - 14:42:25	92.0		
Guaranteed Value*		95	dB(A)		

Source : \* Guaranteed Value of GNC Power Plant.

*Siriporn*  
(Siriporn Imwilaiwan)  
Environmental Monitoring Manager



*Thapson*  
(Thapson Yommana)  
Technical Manager

TY/SS/AS/CJ

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**Report No. : 2018-00090 / 001-4 (Page 1 of 1)**

Issued date : February 7, 2018

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 Tel. 085-020-0134 Email : osamu.yamasaki@toyo-eng.com

### Analysis Report

**SAMPLE DESIGNATED AS :** Noise Level  
**MEASUREMENT LOCATION :** HRS12 HP turbine bypass valve, GNC  
**CALIBRATION DATA :** Calibrator Model CR:515, Cemus Research plc. Serial No. 81969  
 Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
**SOUND LEVEL METER NO. :** Model CR:161B, Serial No. G080136

**MEASUREMENT DATE :** February 6, 2018

**MEASURED BY :** Suriya Srithomee

Noise Level [dB(A)] : February 6, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
14:51:03 - 14:51:13	89.2	14:52:13 - 14:52:23	89.5	14:53:23 - 14:53:33	89.5
14:51:13 - 14:51:23	89.4	14:52:23 - 14:52:33	89.6	14:53:33 - 14:53:43	89.4
14:51:23 - 14:51:33	89.2	14:52:33 - 14:52:43	89.4	14:53:43 - 14:53:53	89.5
14:51:33 - 14:51:43	89.2	14:52:43 - 14:52:53	89.6	14:53:53 - 14:54:03	89.6
14:51:43 - 14:51:53	89.3	14:52:53 - 14:53:03	89.4	14:54:03 - 14:54:13	89.5
14:51:53 - 14:52:03	89.2	14:53:03 - 14:53:13	89.4	14:54:13 - 14:54:23	89.5
14:52:03 - 14:52:13	89.4	14:53:13 - 14:53:23	89.4	14:54:23 - 14:54:33	89.5
Guaranteed Value*		95		dB(A)	

Source : \* Guaranteed Value of GNC Power Plant.

*Siriporn*  
 (Siriporn Imwilaiwan)  
 Environmental Monitoring Manager



*Thapson*  
 (Thapson Yommana)  
 Technical Manager

TY/SS/AS/Cj



**Report No. : 2018-00090 / 001-5 (Page 1 of 1)**

Issued date : February 7, 2018

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 Tel. 085-020-0134 Email : osamu.yamasaki@toyo-eng.com

### Analysis Report

**SAMPLE DESIGNATED AS :** Noise Level  
**MEASUREMENT LOCATION :** HRS12 LP turbine bypass valve, GNC  
**CALIBRATION DATA :** Calibrator Model CR:515, Cemus Research plc. Serial No. 81969  
 Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.7 dB(A), Post Cal. : 93.7 dB(A)  
**SOUND LEVEL METER NO. :** Model CR:161B, Serial No. G080136

**MEASUREMENT DATE :** February 6, 2018

**MEASURED BY :** Suriya Srithomee

Noise Level [dB(A)] : February 6, 2018					
Time	Leq 10 sec	Time	Leq 10 sec	Time	Leq 10 sec
14:55:03 - 14:55:13	89.4	14:56:33 - 14:56:43	89.4	14:58:03 - 14:58:13	89.3
14:55:13 - 14:55:23	89.2	14:56:43 - 14:56:53	89.3	14:58:13 - 14:58:23	89.2
14:55:23 - 14:55:33	89.1	14:56:53 - 14:57:03	89.2	14:58:23 - 14:58:33	89.3
14:55:33 - 14:55:43	89.4	14:57:03 - 14:57:13	89.3	14:58:33 - 14:58:43	89.3
14:55:43 - 14:55:53	89.3	14:57:13 - 14:57:23	89.2	14:58:43 - 14:58:53	89.4
14:55:53 - 14:56:03	89.3	14:57:23 - 14:57:33	89.3	14:58:53 - 14:59:03	89.3
14:56:03 - 14:56:13	89.4	14:57:33 - 14:57:43	89.4	14:59:03 - 14:59:13	89.3
14:56:13 - 14:56:23	89.2	14:57:43 - 14:57:53	89.3		
14:56:23 - 14:56:33	89.4	14:57:53 - 14:58:03	89.3		
Guaranteed Value*		95		dB(A)	

Source : \* Guaranteed Value of GNC Power Plant.

*Siriporn*  
 (Siriporn Imwilaiwan)  
 Environmental Monitoring Manager



*Thapson*  
 (Thapson Yommana)  
 Technical Manager

TY/SS/AS/Cj

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Model of CR:161B

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Model of CR:161B

Near field noise (95dBA)  
HRSG safety valve silencers

Measured Noise Data by 3rd party, SGS



Report No. : 2018-00090 / 001-1 (Page 1 of 1)

Issued date : February 6, 2018

CLIENT : TOYO ENGINEERING CORPORATION  
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Rajchathewi, Bangkok 10400  
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Email : osamu.yamasaki@toyo-eng.com

## Analysis Report

SAMPLE DESIGNATED AS : Noise Level  
MEASUREMENT LOCATION : HRSG Safety Valve, GNC  
CALIBRATION DATA : Calibrator Model CR:515, Cirrus Research plc. Serial No. 81969  
Calibration Value Reference : 94.0 dB(A), Pre Cal. : 93.9 dB(A), Post Cal. : 94.0 dB(A)  
SOUND LEVEL METER NO. : Model NL-21, Serial No. 00596472

MEASUREMENT DATE : February 6, 2018  
MEASURED BY : Suriya Srithomee

Equipment	Steam Pressure	Date	Time	Noise Level [dB(A)]
				Leq 2 sec
HRSG11 HP superheater safety valve silencer	62.7 barG	06/02/2018	13:40	91.4
HRSG11 HP drum safety valve silencer	65.1 barG	06/02/2018	13:27	88.8
HRSG11 LP superheater safety valve silencer	6.6 barG	06/02/2018	13:46	84.6
HRSG11 LP drum safety valve silencer	6.97 barG	06/02/2018	13:47	86.1
HRSG12 HP superheater safety valve silencer	62.7 barG	06/02/2018	14:05	85.6
HRSG12 HP drum safety valve silencer	65.2 barG	06/02/2018	14:01	88.5
HRSG12 LP superheater safety valve silencer	6.7 barG	06/02/2018	14:07	87.9
HRSG12 LP drum safety valve silencer	7.0 barG	06/02/2018	14:10	85.5
Guaranteed Value*				95

Source : \* Guaranteed Value of GNC Power Plant.

  
(Siriporn Imwailaiwan)  
Environmental Monitoring Manager



  
(Thepsan Yommana)  
Technical Manager

TY/SS/AS/CJ

Test Results Corrected by Toyo

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Model Form SET 6/11/14

**Test Results:**  
The below table summarize test results of HRS safety valve silencers noise. Noise were measured by 3rd party SGS at the indicated test pressure.  
Measured noise reported by 3rd party SGS were corrected by applying correction factor in order to take into account influence of test pressure incorporating Owner's comment.

**Correction method:**

The attachment 3 shows the correction curves which were created based on the noise calculation sheets of PSVs (see Attachment 1) and PSV silencers (see Attachment 2) in order to estimate the noise at PSV noise test at lower operating pressure than SPV popping pressure. Basis of the correction curves are as below;

- (1) Power level of noise at PSV outlet (PWL) is function of set pressure (Ps) and is varied corresponding to variation of Ps. PWL can be calculated according to the equation 1) - 7) in the PSV noise calculation sheet and weighting correction using Table-A provided by Fukui as shown in the Attachment 1.
- (2) PWL at test condition can be estimated by entering operation pressure at test into Ps in the equations in the Attachment-1.
- (3) The PWL can be converted to sound pressure level (SPL) by the equation 9) in the Attachment-1.
- (4) This noise from PSV (= PWL) is reduced by the silencers as Attachment 2. The silencer is sized to achieve guarantee noise level of not exceeding 95dBA at 1m from silencer at design point (PSV popping at set pressure). The Attachment 2 also shows that silencer outlet noise is governed by the silencer inlet noise (= PSV outlet noise) and effect of flow noise is negligible. Therefore the sound pressure level (SPL) at 1 m from silencer outlet at test condition can be estimated by subtracting difference of PSV outlet noise between the one at PSV set pressure and test pressure from design noise level of 95 dBA at silencer outlet as shown in the Attachment 3
- (5) Correction curves are created by plotting estimated noise at various test pressure (x axis) and expected noise at each test pressure (y axis).

Based on the proposed correction curves, the noise test results will be judged as successful when measured noise [dBA] does not exceed expected noise [dBA] at test pressure.

	PSV set	Test date (See SGS Report)	Noise		Test Results	Noise correction curve equation
			Measured	Corrected		
	barg	yyyy/mm/dd	dBA	dBA	Criteria <=95dBA	
HRS G11						
HP drum	70.67	2018/2/6	88.8	90.7	Pass	$y = 5.92583E+00 \ln(x) + 6.97769E+01$
HP S/H	67.55	2018/2/6	91.4	92.8	Pass	$y = 4.30871E+00 \ln(x) + 7.68143E+01$
LP drum	67.55	2018/2/6	86.1	87.4	Pass	$y = 4.87262E+00 \ln(x) + 8.46530E+01$
LP S/H	7.4	2018/2/6	84.6	85.5	Pass	$y = 3.65039E+00 \ln(x) + 8.76884E+01$
HRS G12						
HP drum	70.67	2018/2/6	88.5	90.4	Pass	$y = 5.92583E+00 \ln(x) + 6.97769E+01$
HP S/H	67.55	2018/2/6	85.6	86.9	Pass	$y = 4.30871E+00 \ln(x) + 7.68143E+01$
LP drum	8.27	2018/2/6	85.5	86.8	Pass	$y = 4.87262E+00 \ln(x) + 8.46530E+01$
LP S/H	7.4	2018/2/6	87.9	88.7	Pass	$y = 3.65039E+00 \ln(x) + 8.76884E+01$

Noise Calculation Sheet			
PLANT		Gulf SPP3 B	
P.O. No.		150200-010	
JOB No.		150200	
騒音計算書 (ISO4216-9 Annex F)			
1 Item No.	アイテム番号		
2 Tag No.	弁番号		11/12HAD10AA401
3 Fukui Use 1	福井 使用欄 1		15L-032A-C/0
4 Fukui Use 2	福井 使用欄 2		20150 2250,2257,2264-1-2
5 FUKUI Style	型式番号		SL631-M2(T)
6 Size	サイズ		2.1/2*K*6
7 Throat Diameter	のど部の径	dt	40.6 mm
8 Orifice Area	吹出し面積	A <sub>1</sub>	12.946 cm <sup>2</sup>
9 Outlet Diameter	出口の径	do	150 mm
10 Outlet Area	出口面積	A <sub>2</sub>	176.714 cm <sup>2</sup>
11 Fluid	流体名		STEAM
12 Mol. Wt.	分子量	M	18
13 Specific Heat Ratio	比熱比	k	1.25
14 Relieving Temp.	吹出温度	T	289.4 °C
			562.4 K
16 Set Pressure	設定圧力	Ps	70.67 barG
			7.067 MPaG
18 Allowable Over Press.	許容超過圧力	A <sub>G</sub>	3 %
19 Atmos. Press.	大気圧	Pa	0.101 MPaA
20 Gas Constant	ガス定数	R	8.314 J / (mol・K)
21 Relieving Pressure from (2)	吹出し量決定圧力 (2)式より	P <sub>0</sub>	7.38001 MPaA
22 Ratio Volume at Throat from (3)	のど部の比容積 (3)式より	V <sub>1</sub>	0.0352 m <sup>3</sup> /kg
23 Pressure at Outlet from (4)	出口圧力 (4)式より	P <sub>2</sub>	0.3 MPaA
24 Ratio Volume at Outlet from (5)	出口部比容積 (5)式より	V <sub>2</sub>	0.4563 m <sup>3</sup> /kg
25 Speed at Throat from (6)	のど部流体速度 (6)式より	U	570 m/s
26 Power Level at Valve from (1)	音響出力*1 (1)式より	PWL <sub>1</sub>	144 dB
27 Center Frequency from (7)	中心周波数(7)式より	f	760 Hz
28 Surface Density	二次側配管材の面密度 *2	m	55.7 kg/m <sup>2</sup>
29 Power Level from Table (A)	音響出力 (A)表より	PWL	142 dBA
30 Sound Pressure Level from (9)	音圧レベル (9)式より	SPL	135 dBA
31			
32	$PWL_1 = 20 \log \frac{dt}{1000} - 10 \log y_1 + 80 \log U - 53$	(1)	$U = \sqrt{\frac{1000 \times RT}{M}}$
33	$P_0 = P_s \left( 1 + \frac{A_c}{100} \right) + P_s$	(2)	$f = \frac{0.2U}{do} \times 1000$
34	$v_1 = \frac{RT}{1000 \times MP_0}$	(3)	$TL = 18 \log (m \times f) - 44$
35	$P_2 = \left( \frac{2}{k+1} \right)^{\frac{k}{k-1}} \frac{A_1}{A_2} P_0$	(4)	
36	$v_2 = \left( \frac{P_0}{P_2} \right)^{\frac{1}{k}} v_1$	(5)	$SPL = PWL - 10 \log (2\pi r^2)$
37			(9)
38			r = 1m (from Outlet)
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
51	(A)		
52	Octave band / オクターブバンド	Hz	63 125 250 500 1000 2000 4000 8000 OA
53	PWL <sub>1</sub>	dB	134 134 135 135 136 135 134 132 144
54	A Weighting / A特性補正	dB	-26 -16 -9 -3 0 1 1 -1 -
55	Transmission Loss / 透過損失 TL(8)	dB	0 0 0 0 0 0 0 0 -
56	PWL	dBA	108 118 126 132 136 136 135 131 142
57			
58			
59			
60			

\*1: Power level generated from valve outlet to outlet pipe internal / 安全弁から二次側配管内に発生する音響出力  
\*2: Calculation is outlet pipe Sch40 (Steel Pipe) basis / 二次側配管サイズはSch40(鋼管)とする。

Noise Calculation Sheet 騒音計算書 (ISO4216-9 Annex F)				PLANT Gulf SPP3 B P.O. No. 150200-010 JOB No. 150200
GENERAL 全項		1 Item No. アイテム番号 2 Tag No. 弁番号 11/12LBA10AA401 3 Fukui Use 1 福井 使用欄 1 15L-032A-C/0 4 Fukui Use 2 福井 使用欄 2 20150 2251,2258,2265-1-2 5 FUKUI Style 型式番号 SL651-C2-M2(T) 6 Size サイズ 2*H*3		
DIMENSIONS 寸法		7 Throat Diameter のど部の径 $d_t$ 26.6 mm 8 Orifice Area 吹出し面積 $A_1$ 5.557 cm <sup>2</sup> 9 Outlet Diameter 出口の径 $d_o$ 80 mm 10 Outlet Area 出口面積 $A_2$ 50.265 cm <sup>2</sup>		
CONDITIONS 仕様		11 Fluid 流体名 STEAM 12 Mol. Wt. 分子量 M 18 13 Specific Heat Ratio 比熱比 k 1.28 14 Relieving Temp. 吹出温度 T 472 °C 15 745 K 16 Set Pressure 設定圧力 $P_s$ 67.55 barG 17 6.755 MPaG 18 Allowable Over Press. 許容超過圧力 $A_c$ 3 % 19 Atmos. Press. 大気圧 $P_a$ 0.101 MPaA 20 Gas Constant ガス定数 R 8.314 J / (mol·K) 21 Relieving Pressure from (2) 吹出し量決定圧力 (2)式より $P_0$ 7.05865 MPaA 22 Ratio Volume at Throat from (3) のど部の比容積 (3)式より $V_1$ 0.04875 m <sup>3</sup> /kg 23 Pressure at Outlet from (4) 出口圧力 (4)式より $P_2$ 0.4287 MPaA 24 Ratio Volume at Outlet from (5) 出口部比容積 (5)式より $V_2$ 0.4349 m <sup>3</sup> /kg 25 Speed at Throat from (6) のど部流体速度 (6)式より U 664 m/s 26 Power Level at Valve from (1) 音響出力*1 (1)式より $PWL_1$ 145 dB 27 Center Frequency from (7) 中心周波数(7)式より f 1660 Hz 28 Surface Density 二次側配管材の面密度 *2 m 43.2 kg/m <sup>2</sup> 29 Power Level from Table (A) 音響出力 (A)表より $PWL$ 144 dBA 30 Sound Pressure Level from (9) 音圧レベル (9)式より $SPL$ 137 dBA		
CALCULATION 計算式		31 $PWL_1 = 20 \log \frac{d_t}{1000} - 10 \log v_1 + 80 \log U - 53$ (1) $U = \sqrt{\frac{1000 \kappa R T}{M}}$ (6) 32 $P_0 = P_s \left( 1 + \frac{A_c}{100} \right) + P_a$ (2) $f = \frac{0.2U}{d_o} \times 1000$ (7) 33 $v_1 = \frac{RT}{1000 \times MP_0}$ (3) $TL = 18 \log (m \times f) - 44$ (8) 34 $P_2 = \left( \frac{2}{\kappa + 1} \right)^{\frac{\kappa}{\kappa - 1}} \frac{A_1}{A_2} P_0$ (4) 35 $v_2 = \left( \frac{P_0}{P_2} \right)^{\frac{1}{\kappa}} v_1$ (5) $SPL = PWL - 10 \log (2 \pi r^2)$ (9) 36 $r = 1m$ (from Outlet)		
REMARKS 記号		*1: Power level generated from valve outlet to outlet pipe internal / 安全弁から二次側配管内に発生する音響出力 *2: Calculation is outlet pipe Sch40 (Steel Pipe) basis / 二次側配管サイズはSch40(鋼管)とする。 (A) Octave band / オクターブバンド 37 Hz 63 125 250 500 1000 2000 4000 8000 OA 38 $PWL_1$ dB 134 135 135 136 136 137 136 135 145 39 A Weighting / A特性補正 dB -26 -16 -9 -3 0 1 1 -1 - 40 Transmission Loss / 透過損失 TL(8) dB 0 0 0 0 0 0 0 0 0 41 $PWL$ dBA 108 119 126 133 136 138 137 134 144		

Noise Calculation Sheet 騒音計算書 (ISO4216-9 Annex F)				PLANT Gulf SPP3 B P.O. No. 150200-010 JOB No. 150200
GENERAL 全項		1 Item No. アイテム番号 2 Tag No. 弁番号 11/12HAD50AA401 3 Fukui Use 1 福井 使用欄 1 15L-032A-C/0 4 Fukui Use 2 福井 使用欄 2 20150 2253,2260,2267-1-2 5 FUKUI Style 型式番号 SL231(T) 6 Size サイズ 4*P*6		
DIMENSIONS 寸法		7 Throat Diameter のど部の径 $d_t$ 75.7 mm 8 Orifice Area 吹出し面積 $A_1$ 45.007 cm <sup>2</sup> 9 Outlet Diameter 出口の径 $d_o$ 150 mm 10 Outlet Area 出口面積 $A_2$ 176.714 cm <sup>2</sup>		
CONDITIONS 仕様		11 Fluid 流体名 STEAM 12 Mol. Wt. 分子量 M 18 13 Specific Heat Ratio 比熱比 k 1.29 14 Relieving Temp. 吹出温度 T 177.8 °C 15 450.8 K 16 Set Pressure 設定圧力 $P_s$ 8.27 barG 17 0.827 MPaG 18 Allowable Over Press. 許容超過圧力 $A_c$ 3 % 19 Atmos. Press. 大気圧 $P_a$ 0.101 MPaA 20 Gas Constant ガス定数 R 8.314 J / (mol·K) 21 Relieving Pressure from (2) 吹出し量決定圧力 (2)式より $P_0$ 0.95281 MPaA 22 Ratio Volume at Throat from (3) のど部の比容積 (3)式より $V_1$ 0.21853 m <sup>3</sup> /kg 23 Pressure at Outlet from (4) 出口圧力 (4)式より $P_2$ 0.1329 MPaA 24 Ratio Volume at Outlet from (5) 出口部比容積 (5)式より $V_2$ 1.0062 m <sup>3</sup> /kg 25 Speed at Throat from (6) のど部流体速度 (6)式より U 518 m/s 26 Power Level at Valve from (1) 音響出力*1 (1)式より $PWL_1$ 142 dB 27 Center Frequency from (7) 中心周波数(7)式より f 691 Hz 28 Surface Density 二次側配管材の面密度 *2 m 55.7 kg/m <sup>2</sup> 29 Power Level from Table (A) 音響出力 (A)表より $PWL$ 140 dBA 30 Sound Pressure Level from (9) 音圧レベル (9)式より $SPL$ 133 dBA		
CALCULATION 計算式		31 $PWL_1 = 20 \log \frac{d_t}{1000} - 10 \log v_1 + 80 \log U - 53$ (1) $U = \sqrt{\frac{1000 \kappa R T}{M}}$ (6) 32 $P_0 = P_s \left( 1 + \frac{A_c}{100} \right) + P_a$ (2) $f = \frac{0.2U}{d_o} \times 1000$ (7) 33 $v_1 = \frac{RT}{1000 \times MP_0}$ (3) $TL = 18 \log (m \times f) - 44$ (8) 34 $P_2 = \left( \frac{2}{\kappa + 1} \right)^{\frac{\kappa}{\kappa - 1}} \frac{A_1}{A_2} P_0$ (4) 35 $v_2 = \left( \frac{P_0}{P_2} \right)^{\frac{1}{\kappa}} v_1$ (5) $SPL = PWL - 10 \log (2 \pi r^2)$ (9) 36 $r = 1m$ (from Outlet)		
REMARKS 記号		*1: Power level generated from valve outlet to outlet pipe internal / 安全弁から二次側配管内に発生する音響出力 *2: Calculation is outlet pipe Sch40 (Steel Pipe) basis / 二次側配管サイズはSch40(鋼管)とする。 (A) Octave band / オクターブバンド 37 Hz 63 125 250 500 1000 2000 4000 8000 OA 38 $PWL_1$ dB 133 134 134 135 134 133 131 130 142 39 A Weighting / A特性補正 dB -26 -16 -9 -3 0 1 1 -1 - 40 Transmission Loss / 透過損失 TL(8) dB 0 0 0 0 0 0 0 0 0 41 $PWL$ dBA 107 118 125 132 134 134 132 129 140		

Noise Calculation Sheet  
騒音計算書 (ISO4216-9 Annex F)

PLANT Gulf SPP3 B  
P.O. No. 150200-010  
JOB No. 150200

1	Item No.	アイテム番号	
2	Tag No.	弁番号	11/12LBA50AA401
3	Fukui Use 1	福井 使用欄 1	15L-032A-C/O
4	Fukui Use 2	福井 使用欄 2	2015O 2254.2261.2268-1-2
5	FUKUI Style	型式番号	SL231(T)
6	Size	サイズ	3*K*4
7	Throat Diameter	のど部の径	dt 40.6 mm
8	Orifice Area	吹出し面積	A <sub>1</sub> 12.946 cm <sup>2</sup>
9	Outlet Diameter	出口の径	do 100 mm
10	Outlet Area	出口面積	A <sub>2</sub> 78.54 cm <sup>2</sup>
11	Fluid	流体名	STEAM
12	Mol. Wt.	分子量	M 18
13	Specific Heat Ratio	比熱比	k 1.3
14	Relieving Temp.	吹出温度	T 253 °C 526 K
15	Set Pressure	設定圧力	Ps 7.4 barG 0.74 MPaG
16	Allowable Over Press.	許容超過圧力	Ac 3 %
17	Atmos. Press.	大気圧	Pa 0.101 MPaA
18	Gas Constant	ガス定数	R 8.314 J / (mol·K)
19	Relieving Pressure from (2)	吹出し量決定圧力 (2)式より	P <sub>0</sub> 0.8632 MPaA
20	Ratio Volume at Throat from (3)	のど部の比容積 (3)式より	V <sub>1</sub> 0.28146 m <sup>3</sup> /kg
21	Pressure at Outlet from (4)	出口圧力 (4)式より	P <sub>2</sub> 0.0776 MPaA
22	Ratio Volume at Outlet from (5)	出口部比容積 (5)式より	V <sub>2</sub> 1.7957 m <sup>3</sup> /kg
23	Speed at Throat from (6)	のど部流体速度 (6)式より	U 562 m/s
24	Power Level at Valve from (1)	音響出力*1 (1)式より	PWL <sub>1</sub> 137 dB
25	Center Frequency from (7)	中心周波数 (7)式より	f 1124 Hz
26	Surface Density	二次側配管材の面密度 *2	m 47.1 kg/m <sup>2</sup>
27	Power Level from Table (A)	音響出力 (A)表より	PWL 135 dBA
28	Sound Pressure Level from (9)	音圧レベル (9)式より	SPL 128 dBA

$$PWL_1 = 20 \log \frac{dt}{1000} - 10 \log v_1 + 80 \log U - 53 \quad (1)$$
$$P_0 = P_s \left( 1 + \frac{Ac}{100} \right) + P_a \quad (2)$$
$$v_1 = \frac{RT}{1000 \times MP_0} \quad (3)$$
$$P_2 = \left( \frac{2}{\kappa + 1} \right)^{\frac{\kappa}{\kappa - 1}} \frac{A_1}{A_2} P_0 \quad (4)$$
$$v_2 = \left( \frac{P_0}{P_2} \right)^{\frac{1}{\kappa}} v_1 \quad (5)$$

$$U = \sqrt{\frac{1000 \kappa RT}{M}} \quad (6)$$
$$f = \frac{0.2U}{do} \times 1000 \quad (7)$$
$$TL = 18 \log (m \times f) - 44 \quad (8)$$
$$SPL = PWL - 10 \log (2 \pi r^2) \quad (9)$$

$$r = 1 \text{ m (from Outlet)}$$

\*1: Power level generated from valve outlet to outlet pipe internal / 安全弁から二次側配管内に発生する音響出力  
\*2: Calculation is outlet pipe Sch40 (Steel Pipe) basis / 二次側配管サイズはSch40(鋼管)とする。

51	Octave band / オクターブバンド	Hz	63	125	250	500	1000	2000	4000	8000	OA
52	PWL <sub>1</sub>	dB	127	127	128	128	129	128	127	125	137
53	A Weighting / A特性補正	dB	-26	-16	-9	-3	0	1	1	-1	-
54	Transmission Loss/透過損失 TL(8)	dB	0	0	0	0	0	0	0	0	-
55	PWL	dBA	101	111	119	125	129	129	128	124	135

REMARKS  
57  
58  
59  
60

Attachment 2

Aarding Thermal Acoustics USA, Inc.  
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Ventura, CA 93003  
www.ata-bv.com | info@ata-bv.com

Page 1 of 1

Transmittal

ATA Project	P15419	Transmittal No.	011215_DS	Date	01Dec15
Prepared by	Mike Barrett			Distribution	Function
To	Nooter Eriksen	PO 150200-020	Gulf SPP3 B		
Attention	Rachel Holmes	Fax			
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Zip code		City			

Document or drawing No.	Rev.	Description	Status code	format
P15419-65-1010	1	Data Sheets 11/12HAD10BS201	1	.pdf
P15419-65-1020	1	Data Sheets 11/12LBA10BS201	1	.pdf
P15419-65-1030	1	Data Sheets 10LAA30BS201	1	.pdf
P15419-65-1040	1	Data Sheets 11/12HAD50BS201	1	.pdf
P15419-65-1050	1	Data Sheets 11/12LBA50BS201	1	.pdf
P15419-65-1060	1	Data Sheets 11/12LCQ70BS201	1	.pdf
P15419-65-1070	1	Data Sheets 11/12LBH10BS001	1	.pdf
P15419-65-1080	1	Data Sheets 11/12LBH65BS001	1	.pdf

Status code

1 For approval	4 For information	7 final
2 For production	5 As requested	
3 For construction	6 revision	

Remarks

When receiving revised drawings, all previous versions of these drawings are expired. Please make sure that the previous versions of these drawings are marked obsolete or destroyed  
Return a completed and signed copy of this transmittal to Aarding Thermal Acoustics USA by e-mail or fax

Received on.	Ref.	Signature
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ATA-FO-6.044-rev0

株式会社 福井製作所

## Attachment 2

### NOISE CALCULATION STEAM VENT SILENCER

Date:	25/Nov/15
Project:	P15419 - Gulf SPP3 B - NE-PO: 150200-020
Item:	1 - 11 / 12HAD10BS201
Revision:	1

Freq.Hz	31	63	125	250	500	1000	2000	4000	8000	dBA
Lw core 1 inlet	117	120	124	129	136	141	145	147	147	152
Diffuser Element 1	0	8	16	21	28	34	37	33	30	
Lw core 1 silenced	117	112	108	108	108	107	108	114	117	119
	0	0	0	0	0	0	0	0	0	7
Lw core 2 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Lw core 3 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Total Silenced Cores	117	112	108	108	108	107	108	114	117	119 **
Casing (=Dir 90°)	2	2	3	5	6	8	9	10	11	
Splitter Package	0	0	0	0	0	0	0	0	0	
Total Lw no flow noise	115	110	105	103	102	99	99	104	106	109
Flow noise*	70	70	70	70	66	61	56	52	47	67
Lw ir	115	110	105	103	102	99	99	104	106	109
Lw - Lp @ 1 m	15	15	15	15	15	15	15	15	15	
Expected Lp @ 1 m / 90°	99	94	89	87	86	83	83	88	90	94

ø Casing	49.7 [Inch]	1,262 [mm]
Flow	107,855 [lb/hr]	48,922 [kg/hr]
Temp	549 [°F]	287 [°C]
Lw max*		151.7 [dB]
Lw core1		151.7 [dB]
		0.0 [dB]
		[dB]

\*\*Core with the highest reduction

Velocity casing	68 [ft/s]	20.67 [m/s]
Open area casing	4.10 [ft²]	1.25 [m²]
Temp in casing	322 [°F]	147 [°C]
Flow Noise*		75 [dB]

\*In case of combined Flows

Required Lp @ 1 m / 90° 95.0 dBA

"These acoustic calculations are based on actual venting noise of the silencer discharge with no inclusion of silencer upstream pipe radiated noise or any and all other noise sources within the measurement vicinity that may increase our acoustic prediction results due to measurement locations."



## Attachment 2

### NOISE CALCULATION STEAM VENT SILENCER

Date:	25/Nov/15
Project:	P15419 - Gulf SPP3 B - NE-PO: 150200-020
Item:	4 - 11 / 12HAD50BS201
Revision:	1

Freq.Hz	31	63	125	250	500	1000	2000	4000	8000	dBA
Lw core 1 Inlet	106	109	113	118	125	130	134	136	136	141
Diffuser Element 1	0	8	14	20	28	32	31	27	22	
Lw core 1 silenced	106	103	99	98	97	98	103	109	114	115
	0	0	0	0	0	0	0	0	0	7
Lw core 2 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Lw core 3 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Total Silenced Cores	106	103	99	98	97	98	103	109	114	115 **
Casing (=Dir 90°)	2	2	3	5	6	8	9	10	11	
Splitter Package	0	0	0	0	0	0	0	0	0	
Total Lw no flow noise	104	101	96	93	91	90	94	99	103	105
Flow noise*	61	61	61	60	55	51	46	41	37	57
Lw ir	104	101	96	93	91	90	94	99	103	105
Lw - Lp @ 1 m	14	14	14	14	14	14	14	14	14	
Expected Lp @ 1 m / 90°	90	87	82	79	77	76	80	85	89	90

ø Casing	38.2 [Inch]	970 [mm]
Flow	48,404 [lb/hr]	21,956 [kg/hr]
Temp	350 [°F]	177 [°C]
Lw max*		141.0 [dB]
Lw core1		141.0 [dB]
		0.0 [dB]
		[dB]

\*\*Core with the highest reduction

Velocity casing	52 [ft/s]	15.78 [m/s]
Open area casing	2.42 [ft²]	0.74 [m²]
Temp in casing	326 [°F]	149 [°C]
Flow Noise*		66 [dB]

\*In case of combined Flows

Required Lp @ 1 m / 90° 95.0 dBA

"These acoustic calculations are based on actual venting noise of the silencer discharge with no inclusion of silencer upstream pipe radiated noise or any and all other noise sources within the measurement vicinity that may increase our acoustic prediction results due to measurement locations."



## Attachment 2

NOISE CALCULATION STEAM VENT SILENCER										
*****										
Date:	25/Nov/15									
Project:	P15419 - Gulf SPP3 B - NE-PO: 150200-020									
Item:	2 - 11 / 12LBA10BS201									
Revision:	1									
Freq.Hz	31	63	125	250	500	1000	2000	4000	8000	dBA
*****										
Lw core 1 Inlet	115	118	122	127	134	139	143	145	145	150
Diffuser Element 1	0	5	16	21	28	34	37	33	30	
Lw core 1 silenced	115	110	106	106	106	105	106	112	115	117
	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Lw core 2 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Lw core 3 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Total Silenced Cores	115	110	106	106	106	105	106	112	115	117 **
Casing (=Dir 90°)	2	2	3	5	6	8	9	10	11	
Splitter Package	0	0	0	0	0	0	0	0	0	
Total Lw no flow noise	113	108	103	101	100	97	97	102	104	107
Flow noise*	51	51	51	47	42	38	33	28	24	44
Lw Ir	113	108	103	101	100	97	97	102	104	107
Lw - Lp @ 1 m	15	15	15	15	15	15	15	15	15	
Expected Lp @ 1 m / 90°	97	92	87	85	84	81	81	86	88	92
Required Lp @ 1 m / 90°										95.0 dBA

σ Casing	49.7 [Inch]	1,262 [mm]
Flow	35,617 [lb/hr]	16,156 [kg/hr]
Temp	882 [°F]	472 [°C]
Lw max*		149.7 [dB]
Lw core1		149.7 [dB]
		0.0 [dB]
		[dB]
**Core with the highest reduction		
Velocity casing	38 [ft/s]	11.54 [m/s]
Open area casing	4.10 [ft²]	1.25 [m²]
Temp in casing	835 [°F]	432 [°C]
Flow Noise*		56 [dB]

\*In case of combined Flows

"These acoustic calculations are based on actual venting noise of the silencer discharge with no inclusion of silencer upstream pipe radiated noise or any and all other noise sources within the measurement vicinity that may increase our acoustic prediction results due to measurement locations."



## Attachment 2

NOISE CALCULATION STEAM VENT SILENCER										
*****										
Date:	25/Nov/15									
Project:	P15419 - Gulf SPP3 B - NE-PO: 150200-020									
Item:	5 - 11 / 12LBA50BS201									
Revision:	1									
Freq.Hz	31	63	125	250	500	1000	2000	4000	8000	dBA
*****										
Lw core 1 Inlet	99	102	106	111	118	123	127	129	129	134
Diffuser Element 1	0	8	13	18	27	29	28	25	21	
Lw core 1 silenced	99	94	93	93	91	94	99	104	108	110
	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Lw core 2 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Lw core 3 silenced	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	7
Total Silenced Cores	99	94	93	93	91	94	99	104	108	110 **
Casing (=Dir 90°)	2	2	3	5	6	8	9	10	11	
Splitter Package	0	0	0	0	0	0	0	0	0	
Total Lw no flow noise	97	92	90	88	85	86	90	94	97	100
Flow noise*	30	30	25	20	16	11	6	2	-3	18
Lw Ir	97	92	90	88	85	86	90	94	97	100
Lw - Lp @ 1 m	14	14	14	14	14	14	14	14	14	
Expected Lp @ 1 m / 90°	83	78	76	74	71	72	76	80	83	85
Required Lp @ 1 m / 90°										95.0 dBA

σ Casing	38.2 [Inch]	970 [mm]
Flow	11,947 [lb/hr]	5,419 [kg/hr]
Temp	487 [°F]	253 [°C]
Lw max*		134.1 [dB]
Lw core1		134.1 [dB]
		0.0 [dB]
		[dB]
**Core with the highest reduction		
Velocity casing	16 [ft/s]	4.76 [m/s]
Open area casing	2.42 [ft²]	0.74 [m²]
Temp in casing	490 [°F]	240 [°C]
Flow Noise*		35 [dB]

\*In case of combined Flows

"These acoustic calculations are based on actual venting noise of the silencer discharge with no inclusion of silencer upstream pipe radiated noise or any and all other noise sources within the measurement vicinity that may increase our acoustic prediction results due to measurement locations."





## HRSG PSV Silencer Noise Test for GNC, GNRV1 and GNRV2 (LM6000 sites)

		GNC		Noise		Noise correction curve equation
PSV sat	Test date	Test Pms	Measured		Corrected	
			freq	dB		
HRSG11					Criteria <=95dB(A)	
HP G11	70.67	60.0	90.9	$y = 5.92583E + 00(x) + 6.97769E + 01$		
HP S14	67.95	60.0	90.5	$y = 4.30871E + 00(x) + 5.1943E + 01$		
HP G12	8.27	7.0	90.8	$y = 4.87762E + 00(x) + 5.46535E + 01$		
HP S14	7.4	8.0	90.7	$y = 3.65035E + 00(x) + 8.76834E + 01$		
HRSG12						
HP G12	70.67	60.0	90.9	$y = 5.92583E + 00(x) + 6.97769E + 01$		
HP S14	67.95	60.0	90.5	$y = 4.30871E + 00(x) + 5.1943E + 01$		
HP G11	8.27	7.0	90.8	$y = 4.87762E + 00(x) + 5.46535E + 01$		
HP S14	7.4	8.0	90.7	$y = 3.65035E + 00(x) + 8.76834E + 01$		

**By Fekral**

Original message from Fukur (Japanese)

- [illegible]

English translation

- 1) Calculate center frequency per equation 17 on the PSV noise calculation sheet and obtain A weighting correction from the table B below
- 2) In case  $FS=80\text{dB}$ , center frequency is 761 Hz. Therefore use A weighting correction for  $710\text{Hz} < f < 1400\text{Hz}$  as per table B
- 3)  $10 \log(10^4/P1/P10) + 10^4(P3/P10) + 10^4(P4/P10) + 10^4(P5/P10) + 10^4(P7/P10) + 10^4(P8/P10)$  ----- (Equation 1)
- 4) Determine all of P1 to be overall PWL1 per equation 1 above and overall PWL1 per PSV noise calculation sheet
- 5) In case  $FS=80\text{dB}$ , center frequency is 1000Hz. Therefore A weighting correction at P5 is zero. The other P1 can be automatically calculated from the above table B.
- 6) Adjust figure of P5 manually in order for overall PWL1 per noise calculation sheet equals to overall PWL1 per equation 1.
- 7) Obtain  $PWL = PWL1 + A \text{ weighting} + \text{Transmission loss}$
- 8) By entering PWL for each frequency in the above equation 1, Overall PWL (after corrections)

TABLE 9

Center Frequency	40	80	125	250	500	1000	2000	4000	8000
40 Hz	F	---	---	1.2	-1.2	-2.4	-3.6	-4.8	-6
80 Hz	F	---	---	-0.6	0	-1.2	-2.4	-3.6	-4.8
125 Hz	F	---	---	-1.2	-0.6	0	-1.2	-2.4	-3.6
250 Hz	F	---	---	-1.8	-1.2	-0.6	0	-1.2	-2.4
500 Hz	F	---	---	-1.8	-1.2	-0.6	0	-1.2	-2.4
1000 Hz	F	---	---	-2.4	-1.8	-1.2	-0.6	0	-1.2
2000 Hz	F	---	---	-3.6	-2.4	-1.8	-1.2	-0.6	0
4000 Hz	F	---	---	-4.2	-3.6	-3	-2.4	-1.8	-1.2
8000 Hz	F	---	---	---	---	---	---	---	---
Octave band	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
PWL, 1 dB	P1	P2	P3	P4	P5	P6	P7	P8	PWL, 1

Date: 20-Feb-18  
Rev: 0

### HRSG PSV Silencer Noise Test

Name		HP DCM PSV						
		11/27/2014 10:04:01						
Description	Unit	Design	Case 1	Case 2	Case 3	Case 4	Case 5	
Throat diameter	in	40.6	40.6	40.6	40.6	40.6	40.6	
Orifice area	in <sup>2</sup>	12.946	12.946	12.946	12.946	12.946	12.946	
Outlet diameter	in	150	150	150	150	150	150	
Outlet area	in <sup>2</sup>	176.714	176.714	176.714	176.714	176.714	176.714	
Max. WT		18	18	18	18	18	18	
Specific heat ratio		1.25	1.25	1.25	1.25	1.25	1.25	
Relieving temp.	in deg. C	289.4	284.9	280.9	276.7	272.3	267.7	
Relieving temp.	K	562.4	557.0	553.9	549.7	545.3	541.1	
Set pressure	PS	76.87	80	84	80	86	86	
Set pressure	PS	MPaG	7.067	6.8	6.4	6.0	5.8	
Allowable over press.	Ac	%	3	3	3	3	3	
Atmos. Press	PS	MPaA	0.101	0.101	0.101	0.101	0.101	
Case constant	deg. C/mol K	8.314	8.314	8.314	8.314	8.314	8.314	
Relieving pressure at throat (1)	PO	MPaG	7.380010	7.105000	6.690000	6.281000	5.869000	
Pressure at throat from (2)	V1	m.kPa	0.035196	0.036267	0.036223	0.035422	0.034313	
Pressure at outlet from (1)	P2	MPaG	0.3000	0.2868	0.2741	0.2653	0.2386	
Pressure at outlet from (2)	V2	m.kPa	0.4563	0.4701	0.4959	0.5240	0.5563	
Pressure at outlet from (3)	P3	MPa	569	567	565	563	548	
Center Frequency from (1)	F1	Hz	767	754	751	744	741	
Power level at PSV from (1)	PSWL	dB	143.04	142.8	142.4	142.0	141.6	
Power level from table (A)	PSWL	dBa	141.0	140.8	140.4	140.0	139.6	
Sound pressure level from (9)	Δ SPL	dB	133.0	132.8	132.4	132.0	131.6	
Δ SPL - Case 1	Δ SPL	dBa	0	-0.19	-0.59	-0.89	-1.39	
At Silencer								
Design = 95dBa	SPL	dBa	95	94.81	94.41	94.01	93.61	
Other case = 95dBa - Δ SPL								

Table A

Parameter	Hz	63	125	250	500	1000	2000	4000	8000 1/3A
Octave band	Hz								
PWL1	dB	133	134	134	135	135.3	134	133	132
A weighting	dB	-26	-18	-9	-3	0	1	1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0
PWL	dB	107	116	125	132	135.3	135	134	131

Port	dB range									
Optical band	Hz	63	125	250	500	1000	2000	4000	8000	16k
PWL1	dB	132.80013	133.49013	134.09013	134.7	135.29013	134.99013	132.80013	131.69013	142.8
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	106.89013	117.49013	125.09013	131.69013	135.29013	135.09013	133.89013	130.69013	149.8

Pin	64 berg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	QA
PWL1	dB	132.400	133.0913	133.68013	134.25913	<u>134.80013</u>	133.69013	132.40013	131.29013	142.4
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dB	106.400	117.0913	124.68013	131.25913	134.80013	134.69013	133.49013	130.29013	145.4

60 barg		125	250	500	1000	2000	4000	8000	16000
Octave band	Hz	(3)							
PWL1	dB	132.00(1)	132.68(1)	133.29(1)	133.85(1)	<b>134.48(1)</b>	133.29(1)	132.00(1)	130.80(1)
A weighting	dB	-26	-18	-9	-3	0	1	1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0
PWL	dB	106.00(1)	114.68(1)	124.29(1)	130.85(1)	134.48(1)	133.29(1)	132.00(1)	129.80(1)

Plan	56 barg									
	Hz	63	125	250	500	1000	2000	4000	8000	OA
Octave band										
PWL1	dB	131.6901	132.29013	132.89013	133.49013	<u>134.09013</u>	133.89013	133.69013	133.4901	141.6
A weighting	dB	-25	-16	-9	-3	0	1	1	1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dB	105.69011	116.29013	123.89013	130.49013	134.09013	133.89013	133.69013	133.4901	139.6

Psy	52 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
SWEL	dB	131.290	131.890(1)	132.490(1)	133.090(1)	<u>133.690(1)</u>	132.490(1)	131.290(1)	130.090(1)	141.2
A weighting	dB	-26	-16	0	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
SWEL	dBA	105.290	115.890(1)	132.490(1)	130.090(1)	133.690(1)	133.490(1)	132.290(1)	129.090(1)	139.7

# Attachment 3

## HRSG PSV Silencer Noise Test

Name		HP SH PSV						
Tag	1112LBA10AA01							
Description	Unit	Design	Case 1	Case 2	Case 3	Case 4	Case 5	
Throat diameter	in	26.6	26.6	26.6	26.6	26.6	26.6	
Orifice area	A1 cm <sup>2</sup>	5.557	5.557	5.557	5.557	5.557	5.557	
Outlet diameter	in	80	80	80	80	80	80	
Outlet area	A2 cm <sup>2</sup>	50.295	50.295	50.295	50.295	50.295	50.295	
Mol. Wt.	M	18	18	18	18	18	18	
Specific heat ratio	k	1.28	1.28	1.28	1.28	1.28	1.28	
Relieving temp.	1 deg C	472	472	472	472	472	472	
Relieving temp.	2 °K	745	745	745	745	745	745	
Set pressure	Ps barg	67.55	65	61	57	54	50	
Set pressure	Ps MPaG	6.755	6.5	6.1	5.7	5.4	5	
Allowable over press.	Ac %	3	3	3	3	3	3	
Atmos. Press.	Pa MPaA	0.101	0.101	0.101	0.101	0.101	0.101	
Gas constant	R J/mol K	8.314	8.314	8.314	8.314	8.314	8.314	
Relieving pressure from (2)	PO MPaA	7.058550	6.796000	6.384000	5.972000	5.560000	5.250000	
Ratio volume at throat from (3)	V1 m <sup>3</sup> /kg	0.048750	0.050634	0.053902	0.057620	0.060764	0.065532	
Pressure at outlet from (4)	P2 MPaA	0.4287	0.4128	0.3877	0.3627	0.3439	0.3185	
Ratio volume at outlet from (5)	V2 m <sup>3</sup> /kg	0.4348	0.4517	0.4809	0.5141	0.5421	0.5848	
Speed at throat from (6)	U m/s	663.7	663.7	663.7	663.7	663.7	663.7	
Center frequency from (7)	f Hz	1659	1659	1659	1659	1659	1659	
Power level at PSV from (1)	PWL dBA	144.9	144.7	144.4	144.1	143.9	143.6	
Power level from table (A)	PWL dBA	143.4	143.2	142.9	142.6	142.4	142.1	
Sound pressure level from (8)	SPL dBA	135.4	135.2	134.9	134.6	134.4	134.1	
Δ SPL (Design - Case)	dBA	0	-0.20	-0.50	-0.80	-1.00	-1.30	
At Silencer								
Design = 95dBA	PWL dBA	95	94.80	94.50	94.20	94.00	93.70	
Other case = 95dBA - Δ SPL								

Table A

P <sub>W</sub>	67.55 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	134.3406	134.9406	135.5406	136.1406	136.7406	137.3406	137.9406	138.5406	144.9
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	108.3406	118.8406	126.5406	133.1406	136.7406	138.3406	137.9406	137.5406	143.4

P <sub>W</sub>	65 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	134.1406	134.7406	135.3406	135.9406	136.5406	137.1406	137.7406	138.3406	144.7
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	108.1406	118.6406	126.3406	132.9406	136.5406	138.1406	137.7406	137.3406	143.2

P <sub>W</sub>	61 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	133.8406	134.4406	135.0406	135.6406	136.2406	136.8406	137.4406	138.0406	144.4
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	107.8406	118.4406	126.0406	132.6406	136.2406	137.8406	137.4406	137.0406	143.9

P <sub>W</sub>	57 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	133.5406	134.1406	134.7406	135.3406	135.9406	136.5406	137.1406	137.7406	144.1
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	107.5406	118.1406	125.7406	132.3406	135.9406	137.5406	137.1406	136.7406	143.6

P <sub>W</sub>	54 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	133.3406	133.9406	134.5406	135.1406	135.7406	136.3406	136.9406	137.5406	143.9
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	107.3406	117.9406	125.5406	132.1406	135.7406	137.3406	136.9406	136.5406	143.4

P <sub>W</sub>	50 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	133.0406	133.6406	134.2406	134.8406	135.4406	136.0406	136.6406	137.2406	143.6
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	107.0406	117.6406	125.2406	131.8406	135.4406	137.0406	136.6406	136.2406	143.1

# Attachment 3

## HRSG PSV Silencer Noise Test

Name		LP drum PSV						
Tag	1112HAD00AA01							
Description	Unit	Design	Case 1	Case 2	Case 3	Case 4	Case 5	
Throat diameter	in	75.7	75.7	75.7	75.7	75.7	75.7	
Orifice area	cm <sup>2</sup>	45.007	45.007	45.007	45.007	45.007	45.007	
Outlet diameter	in	150	150	150	150	150	150	
Outlet area	cm <sup>2</sup>	176.714	176.714	176.714	176.714	176.714	176.714	
Mol. Wt.	M	18	18	18	18	18	18	
Specific heat ratio	k	1.29	1.29	1.29	1.29	1.29	1.29	
Relieving temp.	deg C	177.8	174.0	171.0	167.8	164.4	160.8	
Relieving temp.	K	450.8	446.952	443.959	440.8262	437.449	433.6302	
Set pressure	Pa barg	8.27	7.7	7.1	6.5	5.9	5.3	
Set pressure	Pa MPaG	0.827	0.77	0.71	0.65	0.59	0.53	
Allowable over press.	Pa %	3	3	3	3	3	3	
Atmos. Press.	Pa MPaA	0.101	0.101	0.101	0.101	0.101	0.101	
Gas constant	R J/mol K	8.314	8.314	8.314	8.314	8.314	8.314	
Relieving pressure from (2)	Pa MPaA	0.952810	0.894100	0.832300	0.770500	0.708700	0.646900	
Ratio volume at throat from (3)	U m <sup>3</sup> /kg	0.218532	0.230911	0.246398	0.264261	0.285103	0.309750	
Pressure at outlet from (4)	Pa MPaA	0.1229	0.1247	0.1181	0.1074	0.0983	0.0902	
Ratio volume at outlet from (5)	V2 m <sup>3</sup> /kg	1.0064	1.0634	1.1347	1.2169	1.3129	1.4254	
Speed at throat from (6)	U m/s	519.3	516.1	514.3	512.5	510.5	508.4	
Center Frequency from (7)	f Hz	681	688	686	683	681	678	
Power level at PSV from (1)	PWL1 dBA	141.7	141.3	140.9	140.5	140.0	139.5	
Power level from table (A)	PWL dBA	139.0	138.6	138.2	137.8	137.3	136.8	
Sound pressure level from (8)	SPL dBA	131.1	130.7	130.3	129.9	129.4	128.9	
Δ SPL (Design - Case)	dBA	0	-0.40	-0.90	-1.20	-1.70	-2.20	
At Silencer								
Design = 95dBA	PWL dBA	85	84.60	84.10	83.80	83.30	82.80	
Other case = 95dBA - Δ SPL								

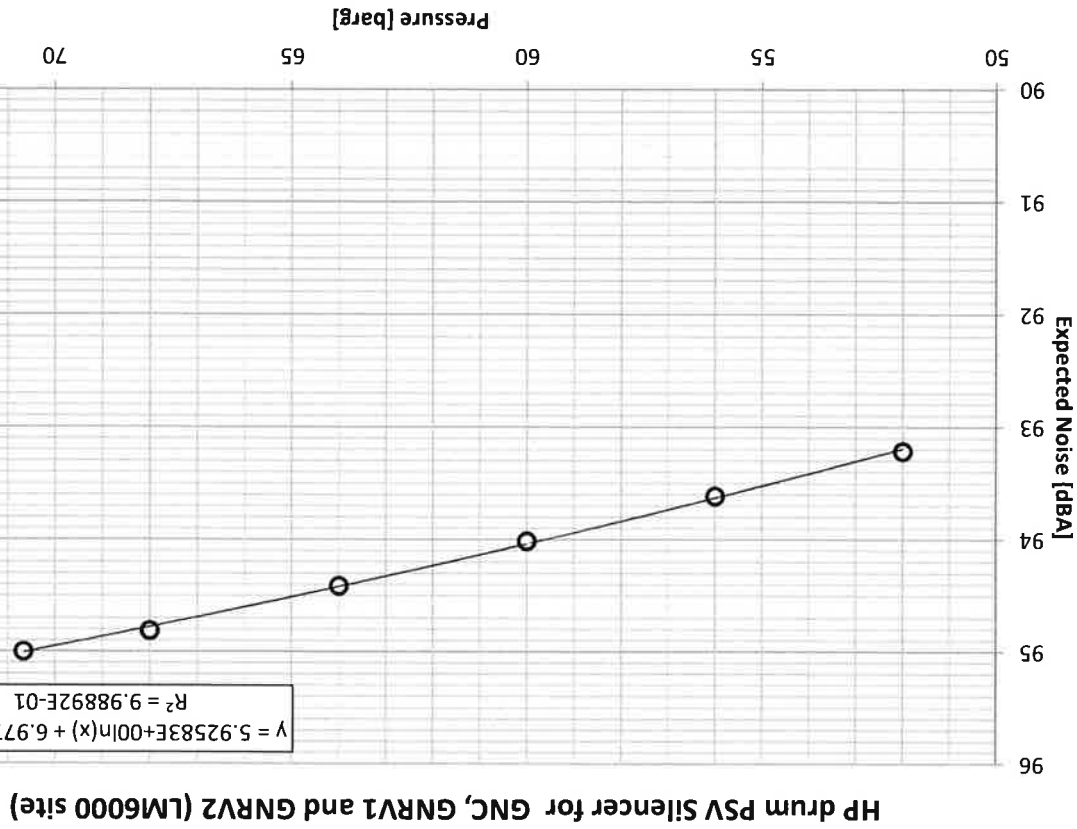
Table A

P <sub>W</sub>	8.27 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	132.5826	133.1826	133.7826	134.3826	134.9826	135.5826	136.1826	136.7826	141.7
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	106.5826	117.1826	124.7826	131.3826	133.9826	136.5826	138.1826	139.7826	139.0

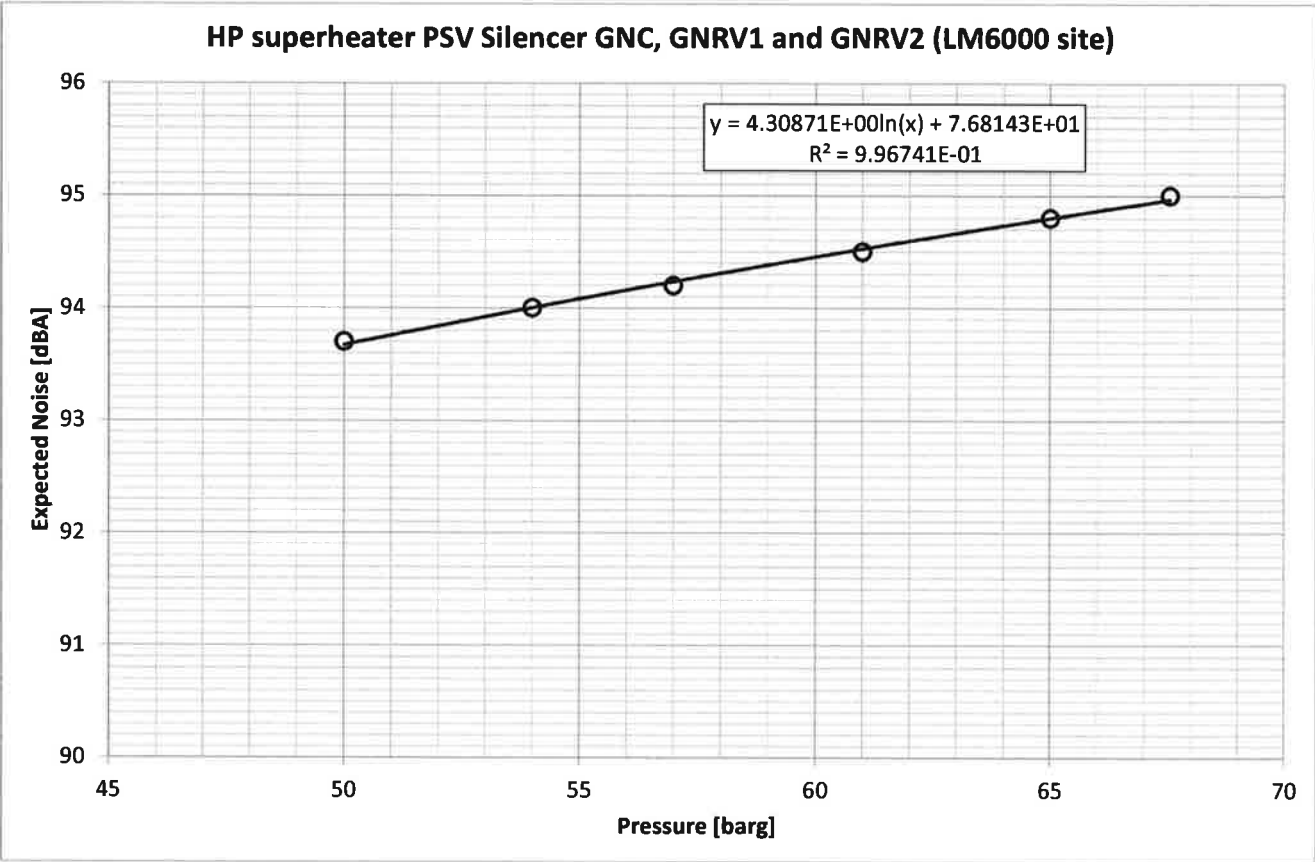
P <sub>W</sub>	7.7 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	132.1826	132.7826	133.3826	133.9826	134.5826	135.1826	135.7826	136.3826	141.3
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0	0
PWL	dBA	106.1826	116.7826	124.3826	130.9826	133.5826	136.1826	137.7826	139.3826	138.6

P <sub>W</sub>	7.1 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	131.7826	132.3826	132.9826	133.5826	134.1826	134.7826	135.3826	135.9826	140.9
A weighting	dB	-26	-16	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	105.7826	116.3826	123.9826	130.5826	132	132.1826	130.9826	127.7826	136.2

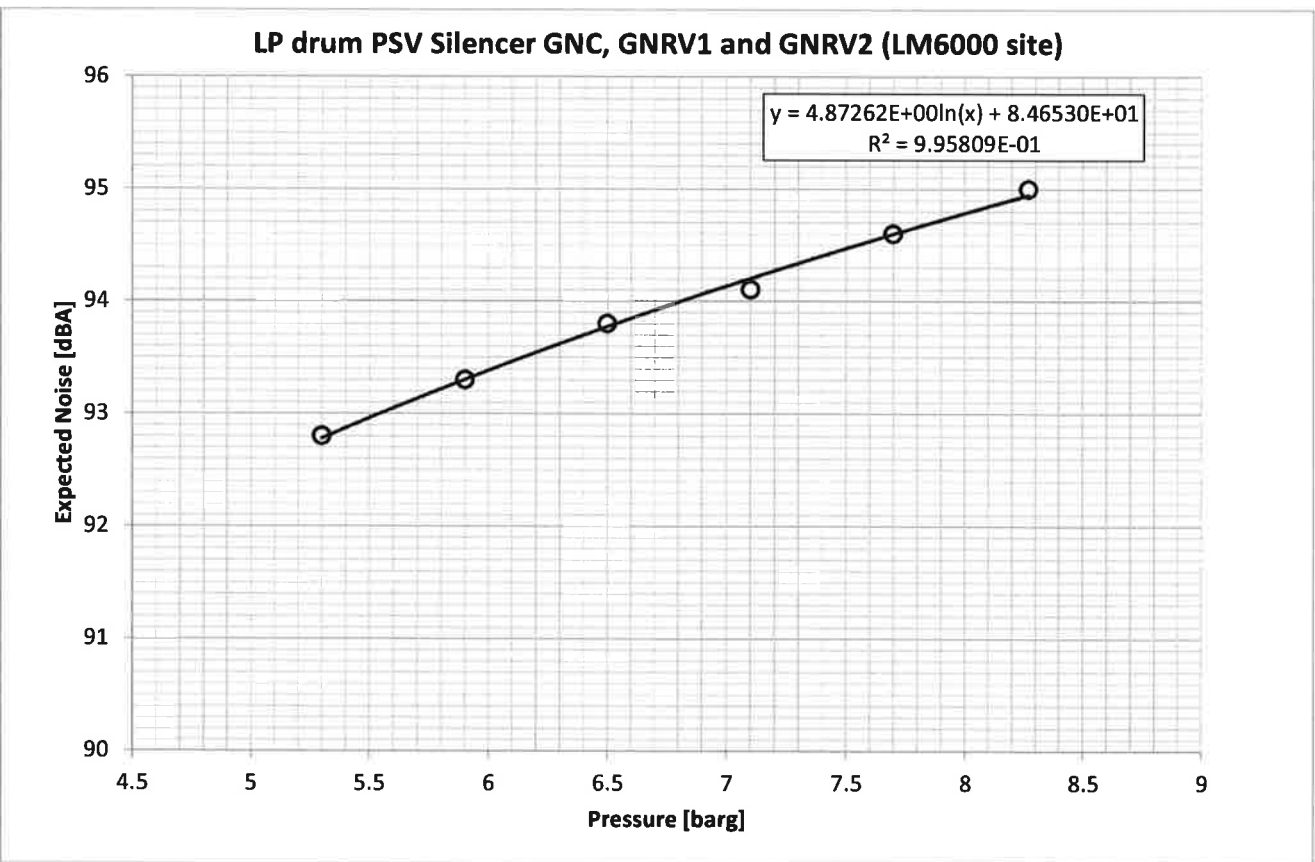
## Attachment 3

Name  
LP S/H PSVName  
LP S/H PSV

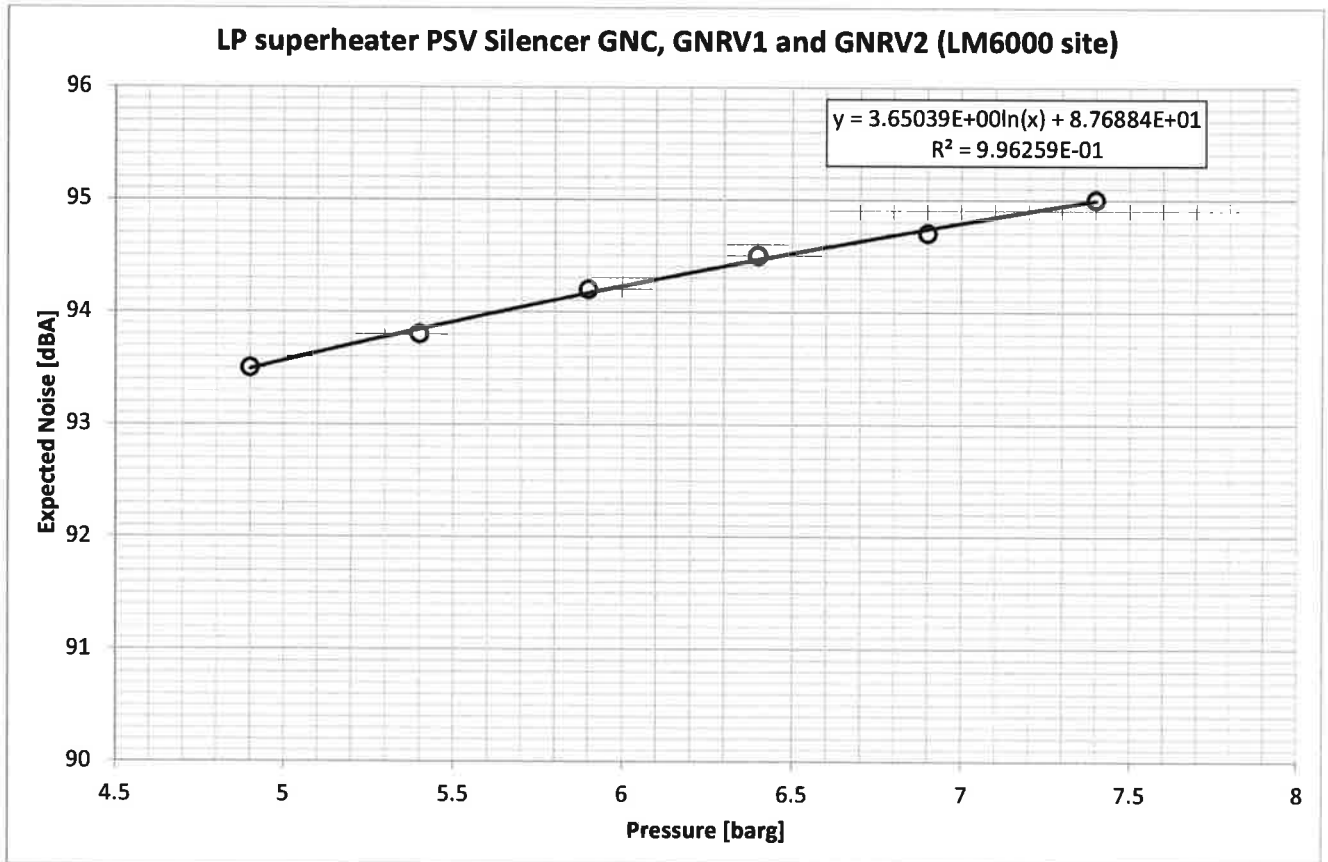
Attachment 3



Attachment 3



# Attachment 3



# ภาคผนวก ข-12

ผังแสดงชั้นระดับเสียง (Noise Contour)



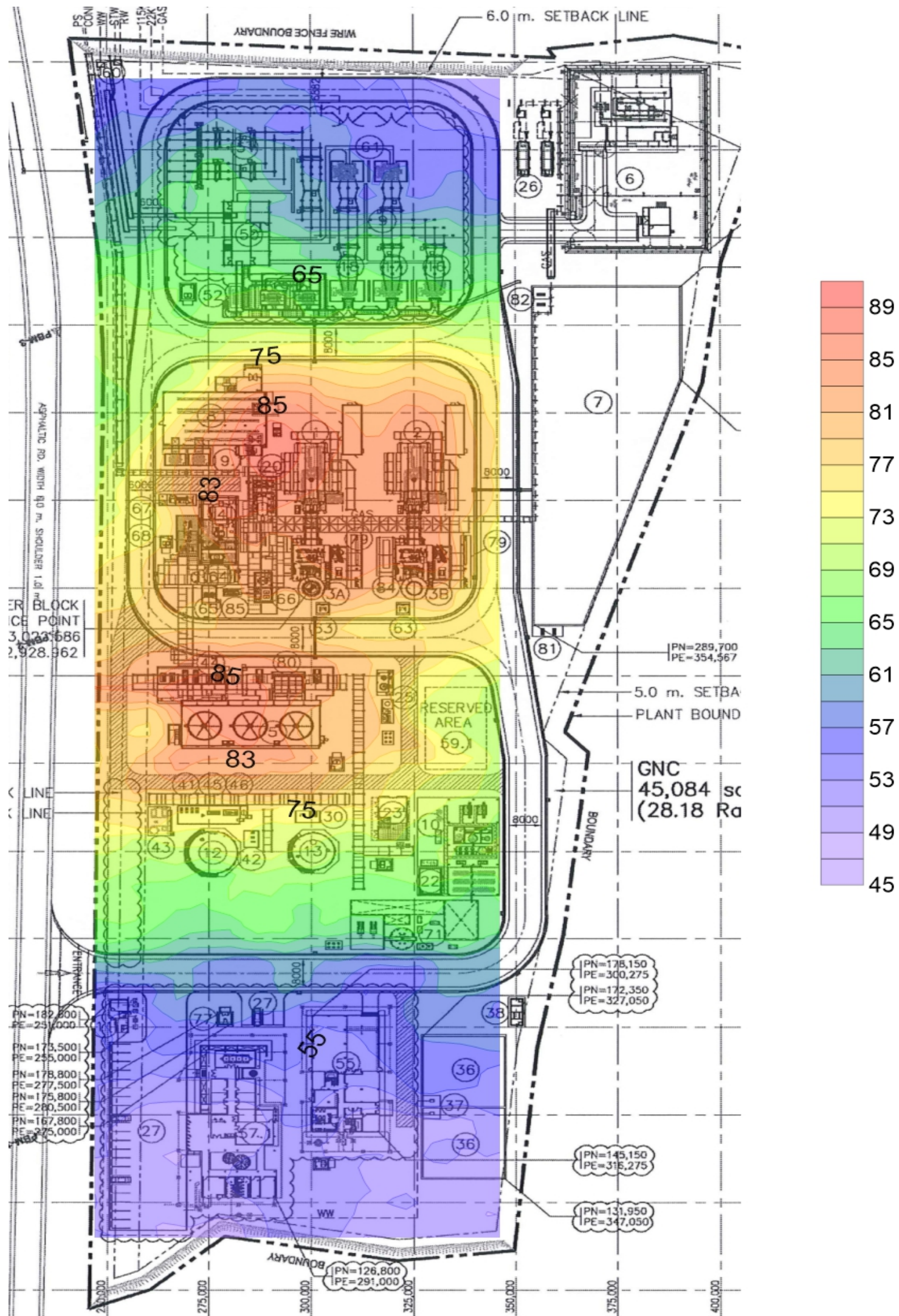


# Noise Contour Map

Gulf NC Co., Ltd.

Reference Number : 20133772-1

Measurement Date : Jul 22, 2021



## ภาคผนวก ข-13

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ผลการติดตามตรวจสอบคุณภาพน้ำทิ้ง แบบต่อเนื่อง  
(Online Monitoring) บริเวณจุดระบายน้ำทิ้งของโครงการ



Time	DCMABCF001HQ2L.PV WASTE WATER OUTLET FLOW	DCMABCF001HQ2L.PV WASTE WATER TEMP DEG C	DCMABCF001HQ2L.PV WASTE WATER PH	DCMABCF001HQ2L.PV WASTE WATER CONDUCTIVITY µS/cm	DCMABCF001HQ2L.PV WASTE WATER D.O. mg/L	DCMABCF001HQ2L.PV Raw water water TNR
08.A.22.00:00:00	51.54	32.72	7.38	1.402.40	5.62	184.05
08.A.22.01:00:00	51.26	32.72	7.38	1.398.80	5.62	184.05
08.A.22.02:00:00	52.96	32.52	7.31	1.386.80	5.52	183.57
08.A.22.03:00:00	53.40	32.42	7.30	1.379.00	5.55	184.88
08.A.22.04:00:00	53.86	32.46	7.28	1.371.30	5.45	183.11
08.A.22.05:00:00	53.96	32.22	7.29	1.363.39	5.50	180.83
08.A.22.06:00:00	54.34	32.02	7.28	1.355.40	5.49	180.29
08.A.22.07:00:00	54.17	32.02	7.28	1.360.63	5.44	181.26
08.A.22.08:00:00	54.12	31.92	7.28	1.361.22	5.37	180.22
08.A.22.09:00:00	54.34	31.92	7.28	1.361.81	5.38	182.01
08.A.22.10:00:00	54.86	32.23	7.42	1.362.44	5.56	182.43
08.A.22.11:00:00	54.57	32.08	7.40	1.363.05	5.78	183.52
08.A.22.12:00:00	54.11	32.18	7.41	1.363.14	5.61	182.58
08.A.22.13:00:00	54.13	32.74	7.38	1.364.26	4.19	186.21
08.A.22.14:00:00	53.85	32.65	7.38	1.363.33	4.19	183.43
08.A.22.15:00:00	53.94	32.43	7.18	1.362.14	4.28	182.74
08.A.22.16:00:00	53.81	32.43	7.18	1.360.96	4.28	180.35
08.A.22.17:00:00	53.93	32.45	7.18	1.359.81	4.21	180.35
08.A.22.18:00:00	53.63	32.43	7.11	1.358.64	4.26	181.35
08.A.22.19:00:00	53.53	32.43	7.13	1.357.46	4.28	182.38
08.A.22.20:00:00	53.64	32.58	7.12	1.356.28	4.22	182.23
08.A.22.21:00:00	53.01	32.09	7.12	1.355.12	4.28	184.40
08.A.22.22:00:00	52.91	32.45	7.08	1.357.47	4.21	182.86
08.A.22.23:00:00	45.29	32.38	7.28	1.036.40	5.86	189.19
08.A.22.24:00:00	45.31	32.38	7.12	1.035.76	5.62	189.21
08.A.22.25:00:00	48.55	32.25	7.14	1.035.10	5.35	190.74
08.A.22.26:00:00	47.99	32.19	7.12	1.033.34	5.22	187.35
08.A.22.27:00:00	48.46	32.03	7.12	1.031.34	5.03	187.35
08.A.22.28:00:00	49.04	32.05	7.07	1.030.33	4.93	189.85
08.A.22.29:00:00	49.04	32.05	7.07	1.030.33	4.93	189.85
08.A.22.30:00:00	50.28	31.98	7.03	1.027.52	4.75	190.25
08.A.22.31:00:00	50.30	32.00	7.00	1.026.11	4.66	187.30
08.A.22.32:00:00	50.45	32.00	6.98	1.024.10	4.64	187.30
08.A.22.33:00:00	50.4	32.00	6.98	1.023.42	4.78	187.30
08.A.22.34:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.35:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.36:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.37:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.38:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.39:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.40:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.41:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.42:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.43:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.44:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.45:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.46:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.47:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.48:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.49:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.50:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.51:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.52:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.53:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.54:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.55:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.56:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.57:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.58:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.59:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30
08.A.22.60:00:00	50.4	32.00	6.98	1.024.10	4.66	187.30

Time	DCMABCF001HQ2L.PV WASTE WATER OUTLET FLOW	DCMABCF001HQ2L.PV WASTE WATER TEMP DEG C	DCMABCF001HQ2L.PV WASTE WATER PH	DCMABCF001HQ2L.PV WASTE WATER CONDUCTIVITY µS/cm	DCMABCF001HQ2L.PV WASTE WATER D.O. mg/L	DCMABCF001HQ2L.PV Raw water water TNR
08.A.22.18:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.19:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.20:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.21:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.22:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.23:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.24:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.25:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.26:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.27:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.28:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.29:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.30:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.31:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.32:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.33:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.34:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.35:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.36:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.37:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.38:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.39:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.40:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.41:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.42:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.43:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.44:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.45:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.46:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.47:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.48:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.49:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.50:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.51:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.52:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.53:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.54:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.55:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.56:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.57:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.58:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.59:00:00	0.08	37.47	6.89	983.65	0.04	0.04
08.A.22.60:00:00	0.08	37.47	6.89	983.65	0.04	0.04

Time	DCMABCF001HQ2L.PV WASTE WATER FLOW	DCMABCF001HQ2L.PV WASTE WATER TEMP	DCMABCF001HQ2L.PV WASTE WATER PH	DCMABCF001HQ2L.PV WASTE WATER CONDUCTIVITY	DCMABCF001HQ2L.PV WASTE WATER D.O.	DCMABCF001HQ2L.PV Raw water inlet flow
	TON	DEG C	PH	µS/cm	mg/L	TON
08.A.22.12:00:00	0.05045893	31.44457127	7.30491498	950.523134	11.0578812	88.1872928
08.A.22.13:00:00	0.05045893	31.44457127	7.30491498	950.523134	11.0578812	88.1872928
08.A.22.14:00:00	0.05045893	31.44457127	7.30491498	950.523134	11.0578812	88.1872928
08.A.22.15:00:00	0.05045893	31.44457127	7.30491498	950.523134	11.0578812	88.1872928
08.A.22.16:00:00	0.05045893	31.44457127	7.30491498	950.523134	11.0578812	88.1872928
08.A.22.17:00:00	0.047268923	31.05959427	7.031434	968.76229	10.8327604	88.1276204
08.A.22.18:00:00	0.047113129	31.08411325	7.041348	968.447843	10.817468	87.7788482
08.A.22.19:00:00	0.041193777	30.7112089	6.9820278	968.74668	10.7784862	87.11788482
08.A.22.20:00:00	0.03858484	30.4854848	6.9405078	968.827488	10.7488488	86.5184888
08.A.22.21:00:00	0.03654078	29.49584708	6.8748488	968.948488	10.7184888	85.8184888
08.A.22.22:00:00	0.03395732	28.0484882	6.74085318	969.963886	10.55011248	83.3788884
08.A.22.23:00:00	0.03204838	27.0204888	6.65485318	970.979288	10.38171248	80.9384888
08.A.22.24:00:00	0.04804472	31.08411325	7.041348	968.447843	10.817468	87.7788482
08.A.22.25:00:00	0.04810527	31.121174	7.0972318	968.32863	10.8300378	87.9388488
08.A.22.26:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.27:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.28:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.29:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.30:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.31:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.32:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.33:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.34:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.35:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.36:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.37:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.38:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.39:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.40:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.41:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.42:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.43:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.44:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.45:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.46:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.47:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.48:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.49:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.50:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.51:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.52:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.53:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.54:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.55:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.56:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.57:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.58:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.59:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.60:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.61:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.62:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.63:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.64:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.65:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.66:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.67:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.68:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.69:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.70:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.71:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.72:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.73:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.74:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.75:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.76:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.77:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.78:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.79:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.80:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.81:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.82:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.83:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.84:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.85:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.86:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.87:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.88:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.89:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.90:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.91:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.92:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.93:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.94:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.95:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.96:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.97:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.98:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.22.99:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488
08.A.23.00:00:00	0.04810527	31.121174	7.13092518	968.32863	10.8300378	87.9388488















Time	WASTE WATER FLOW	WASTE WATER TEMP	WASTE WATER PH	WASTE WATER CONDUCTIVITY	WASTE WATER D.O.	New water inlet flow
Time	Flow	TEMP	PH	uS/cm	mg/L	Flow
12.00.00.00	0.04214077	37.0381668	7.24070597	997.151140	89.281268	15.031876
12.00.01.00	0.04215171	37.0378009	7.23770521	997.151140	89.281268	15.031876
12.00.02.00	0.04216265	37.0374350	7.23470458	997.151140	89.281268	15.031876
12.00.03.00	0.04217359	37.0370691	7.23170395	997.151140	89.281268	15.031876
12.00.04.00	0.04218453	37.0367032	7.22870332	997.151140	89.281268	15.031876
12.00.05.00	0.04219547	37.0363373	7.22570269	997.151140	89.281268	15.031876
12.00.06.00	0.04220641	37.0359714	7.22270206	997.151140	89.281268	15.031876
12.00.07.00	0.04221735	37.0356055	7.21970143	997.151140	89.281268	15.031876
12.00.08.00	0.04222829	37.0352396	7.21670080	997.151140	89.281268	15.031876
12.00.09.00	0.04223923	37.0348737	7.21370017	997.151140	89.281268	15.031876
12.00.10.00	0.04225017	37.0345078	7.21070054	997.151140	89.281268	15.031876
12.00.11.00	0.04226111	37.0341419	7.20770091	997.151140	89.281268	15.031876
12.00.12.00	0.04227205	37.0337760	7.20470128	997.151140	89.281268	15.031876
12.00.13.00	0.04228299	37.0334101	7.20170165	997.151140	89.281268	15.031876
12.00.14.00	0.04229393	37.0330442	7.19870202	997.151140	89.281268	15.031876
12.00.15.00	0.04230487	37.0326783	7.19570239	997.151140	89.281268	15.031876
12.00.16.00	0.04231581	37.0323124	7.19270276	997.151140	89.281268	15.031876
12.00.17.00	0.04232675	37.0319465	7.18970313	997.151140	89.281268	15.031876
12.00.18.00	0.04233769	37.0315806	7.18670350	997.151140	89.281268	15.031876
12.00.19.00	0.04234863	37.0312147	7.18370387	997.151140	89.281268	15.031876
12.00.20.00	0.04235957	37.0308488	7.18070424	997.151140	89.281268	15.031876
12.00.21.00	0.04237051	37.0304829	7.17770461	997.151140	89.281268	15.031876
12.00.22.00	0.04238145	37.0301170	7.17470498	997.151140	89.281268	15.031876
12.00.23.00	0.04239239	37.0297511	7.17170535	997.151140	89.281268	15.031876
12.00.24.00	0.04240333	37.0293852	7.16870572	997.151140	89.281268	15.031876
12.00.25.00	0.04241427	37.0290193	7.16570609	997.151140	89.281268	15.031876
12.00.26.00	0.04242521	37.0286534	7.16270646	997.151140	89.281268	15.031876
12.00.27.00	0.04243615	37.0282875	7.15970683	997.151140	89.281268	15.031876
12.00.28.00	0.04244709	37.0279216	7.15670720	997.151140	89.281268	15.031876
12.00.29.00	0.04245803	37.0275557	7.15370757	997.151140	89.281268	15.031876
12.00.30.00	0.04246897	37.0271898	7.15070794	997.151140	89.281268	15.031876
12.00.31.00	0.04247991	37.0268239	7.14770831	997.151140	89.281268	15.031876
12.00.32.00	0.04249085	37.0264580	7.14470868	997.151140	89.281268	15.031876
12.00.33.00	0.04250179	37.0260921	7.14170905	997.151140	89.281268	15.031876
12.00.34.00	0.04251273	37.0257262	7.13870942	997.151140	89.281268	15.031876
12.00.35.00	0.04252367	37.0253603	7.13570979	997.151140	89.281268	15.031876
12.00.36.00	0.04253461	37.0249944	7.13271016	997.151140	89.281268	15.031876
12.00.37.00	0.04254555	37.0246285	7.12971053	997.151140	89.281268	15.031876
12.00.38.00	0.04255649	37.0242626	7.12671090	997.151140	89.281268	15.031876
12.00.39.00	0.04256743	37.0238967	7.12371127	997.151140	89.281268	15.031876
12.00.40.00	0.04257837	37.0235308	7.12071164	997.151140	89.281268	15.031876
12.00.41.00	0.04258931	37.0231649	7.11771201	997.151140	89.281268	15.031876
12.00.42.00	0.04260025	37.0227990	7.11471238	997.151140	89.281268	15.031876
12.00.43.00	0.04261119	37.0224331	7.11171275	997.151140	89.281268	15.031876
12.00.44.00	0.04262213	37.0220672	7.10871312	997.151140	89.281268	15.031876
12.00.45.00	0.04263307	37.0217013	7.10571349	997.151140	89.281268	15.031876
12.00.46.00	0.04264401	37.0213354	7.10271386	997.151140	89.281268	15.031876
12.00.47.00	0.04265495	37.0209695	7.09971423	997.151140	89.281268	15.031876
12.00.48.00	0.04266589	37.0206036	7.09671460	997.151140	89.281268	15.031876
12.00.49.00	0.04267683	37.0202377	7.09371497	997.151140	89.281268	15.031876
12.00.50.00	0.04268777	37.0198718	7.09071534	997.151140	89.281268	15.031876
12.00.51.00	0.04269871	37.0195059	7.08771571	997.151140	89.281268	15.031876
12.00.52.00	0.04270965	37.0191400	7.08471608	997.151140	89.281268	15.031876
12.00.53.00	0.04272059	37.0187741	7.08171645	997.151140	89.281268	15.031876
12.00.54.00	0.04273153	37.0184082	7.07871682	997.151140	89.281268	15.031876
12.00.55.00	0.04274247	37.0180423	7.07571719	997.151140	89.281268	15.031876
12.00.56.00	0.04275341	37.0176764	7.07271756	997.151140	89.281268	15.031876
12.00.57.00	0.04276435	37.0173105	7.06971793	997.151140	89.281268	15.031876
12.00.58.00	0.04277529	37.0169446	7.06671830	997.151140	89.281268	15.031876
12.00.59.00	0.04278623	37.0165787	7.06371867	997.151140	89.281268	15.031876
12.01.00.00	0.04279717	37.0162128	7.06071904	997.151140	89.281268	15.031876
12.01.01.00	0.04280811	37.0158469	7.05771941	997.151140	89.281268	15.031876
12.01.02.00	0.04281905	37.0154810	7.05471978	997.151140	89.281268	15.031876
12.01.03.00	0.04283000	37.0151151	7.05172015	997.151140	89.281268	15.031876
12.01.04.00	0.04284094	37.0147492	7.04872052	997.151140	89.281268	15.031876
12.01.05.00	0.04285188	37.0143833	7.04572089	997.151140	89.281268	15.031876
12.01.06.00	0.04286282	37.0140174	7.04272126	997.151140	89.281268	15.031876
12.01.07.00	0.04287376	37.0136515	7.03972163	997.151140	89.281268	15.031876
12.01.08.00	0.04288470	37.0132856	7.03672200	997.151140	89.281268	15.031876
12.01.09.00	0.04289564	37.0129197	7.03372237	997.151140	89.281268	15.031876
12.01.10.00	0.04290658	37.0125538	7.03072274	997.151140	89.281268	15.031876
12.01.11.00	0.04291752	37.0121879	7.02772311	997.151140	89.281268	15.031876
12.01.12.00	0.04292846	37.0118220	7.02472348	997.151140	89.281268	15.031876
12.01.13.00	0.04293940	37.0114561	7.02172385	997.151140	89.281268	15.031876
12.01.14.00	0.04295034	37.0110902	7.01872422	997.151140	89.281268	15.031876
12.01.15.00	0.04296128	37.0107243	7.01572459	997.151140	89.281268	15.031876
12.01.16.00	0.04297222	37.0103584	7.01272496	997.151140	89.281268	15.031876
12.01.17.00	0.04298316	37.0100000	7.00972533	997.151140	89.281268	15.031876
12.01.18.00	0.04299410	37.0096341	7.00672570	997.151140	89.281268	15.031876
12.01.19.00	0.04300504	37.0092682	7.00372607	997.151140	89.281268	15.031876
12.01.20.00	0.04301598	37.0089023	7.00072644	997.151140	89.281268	15.031876
12.01.21.00	0.04302692	37.0085364	6.99772681	997.151140	89.281268	15.031876
12.01.22.00	0.04303786	37.0081705	6.99472718	997.151140	89.281268	15.031876
12.01.23.00	0.04304880	37.0078046	6.99172755	997.151140	89.281268	15.031876
12.01.24.00	0.04305974	37.0074387	6.98872792	997.151140	89.281268	15.031876
12.01.25.00	0.04307068	37.0070728	6.98572829	997.151140	89.281268	15.031876
12.01.26.00	0.04308162	37.0067069	6.98272866	997.151140	89.281268	15.031876
12.01.27.00	0.04309256	37.0063410	6.97972903	997.151140	89.281268	15.031876
12.01.28.00	0.04310350	37.0059751	6.97672940	997.151140	89.281268	15.031876
12.01.29.00	0.04311444	37.0056092	6.97372977	997.151140	89.281268	15.031876
12.01.30.00	0.04312538	37.0052433	6.97073014	997.151140	89.281268	15.031876
12.01.31.00	0.04313632	37.0048774	6.96773051	997.151140	89.281268	15.031876
12.01.32.00	0.04314726	37.0045115	6.96473088	997.151140	89.281268	15.031876
12.01.33.00	0.04315820	37.0041456	6.96173125	997.151140	89.281268	15.031876
12.01.34.00	0.04316914	37.0037797	6.95873162	997.151140	89.281268	15.031876
12.01.35.00	0.04318008	37.0034138	6.95573199	997.151140	89.281268	15.031876
12.01.36.00	0.04319102	37.0030479	6.95273236	997.151140	89.281268	15.031876
12.01.37.00	0.04320196	37.0026820	6.94973273	997.151140	89.281268	15.031876
12.01.38.00	0.04321290	37.0023161	6.94673310	997.151140	89.281268	15.031876
12.01.39.00	0.04322384	37.0019502	6.94373347	997.151140	89.281268	15.031876
12.01.40.00	0.04323478	37.0015843	6.94073384	997.151140	89.281268	15.031876
12.01.41.00	0.04324572	37.0012184	6.93773421	997.151140	89.281268	15.031876
12.01.42.00	0.04325666	37.0008525	6.93473458	997.151140	89.281268	15.031876
12.01.43.00	0.04326760	37.0004866	6.93173495	997.151140	89.281268	15.031876
12.01.44.00	0.04327854	37.0001207	6.92873532	997.151140	89.281268	15.031876
12.01.45.00	0.04328948	36.9997548	6.92573569	997.151140	89.281268	15.031876
12.01.46.00	0.04330042	36.9993889	6.92273606	997.151140	89.281268	15.031876
12.01.47.00	0.04331136	36.9990230	6.91973643	997.151140	89.281268	15.031876
12.01.48.00	0.04332230	36.9986571	6.91673680	997.151140	89.281268	15.031876
12.01.49.00	0.04333324	36.9982912	6.91373717	997.151140	89.281268	15.031876
12.01.50.00	0.04334418	36.9979253	6.91073754	997.151140	89.281268	15.031876
12.01.51.00	0.04335512	36.9975594	6.90773791	997.151140	89.281268	15.031876
12.01.52.00	0.0					





13.m. 22 17 20.00	0.00979126	31.8068090	7.28725262	1263.73905	131.488040
13.m. 22 18 00.00	0.02299776	30.7931404	7.3368766	1267.73705	131.468820
13.m. 22 18 30.00	0.03766527	30.7156512	7.38651104	1270.73505	131.450040
13.m. 22 19 00.00	0.05000776	31.7864503	7.40800920	1285.71304	130.945578
13.m. 22 20 00.00	0.06494400	31.7490400	7.50434000	1315.52200	130.899768
13.m. 22 21 00.00	0.08191100	31.7120000	7.58481411	1331.52200	130.852141
13.m. 22 22 00.00	0.10130800	31.6750000	7.65511200	1347.52200	130.804514
13.m. 22 23 00.00	0.12319200	31.6380000	7.71600000	1363.52200	130.756887
13.m. 22 24 00.00	0.14751200	31.5910000	7.76800000	1379.52200	130.709260
13.m. 22 25 00.00	0.17436800	31.5440000	7.81100000	1395.52200	130.661633
13.m. 22 26 00.00	0.20376000	31.4970000	7.84500000	1411.52200	130.614006
13.m. 22 27 00.00	0.23579200	31.4500000	7.87900000	1427.52200	130.566379
13.m. 22 28 00.00	0.27046400	31.4030000	7.91300000	1443.52200	130.518752
13.m. 22 29 00.00	0.30777600	31.3560000	7.94700000	1459.52200	130.471125
13.m. 22 30 00.00	0.34782400	31.3090000	7.98100000	1475.52200	130.423498
13.m. 22 31 00.00	0.39060800	31.2620000	8.01500000	1491.52200	130.375871
13.m. 22 32 00.00	0.43612800	31.2150000	8.04900000	1507.52200	130.328244
13.m. 22 33 00.00	0.48438400	31.1680000	8.08300000	1523.52200	130.280617
13.m. 22 34 00.00	0.53537600	31.1210000	8.11700000	1539.52200	130.232990
13.m. 22 35 00.00	0.58910400	31.0740000	8.15100000	1555.52200	130.185363
13.m. 22 36 00.00	0.64556800	31.0270000	8.18500000	1571.52200	130.137736
13.m. 22 37 00.00	0.70476800	30.9800000	8.21900000	1587.52200	130.090109
13.m. 22 38 00.00	0.76670400	30.9330000	8.25300000	1603.52200	130.042482
13.m. 22 39 00.00	0.83137600	30.8860000	8.28700000	1619.52200	130.000000
13.m. 22 40 00.00	0.89979200	30.8390000	8.32100000	1635.52200	129.957517
13.m. 22 41 00.00	0.97195200	30.7920000	8.35500000	1651.52200	129.915034
13.m. 22 42 00.00	1.04785600	30.7450000	8.38900000	1667.52200	129.872551
13.m. 22 43 00.00	1.12750400	30.6980000	8.42300000	1683.52200	129.830068
13.m. 22 44 00.00	1.21090400	30.6510000	8.45700000	1699.52200	129.787585
13.m. 22 45 00.00	1.29805600	30.6040000	8.49100000	1715.52200	129.745102
13.m. 22 46 00.00	1.38996800	30.5570000	8.52500000	1731.52200	129.702619
13.m. 22 47 00.00	1.48664000	30.5100000	8.55900000	1747.52200	129.660136
13.m. 22 48 00.00	1.58808000	30.4630000	8.59300000	1763.52200	129.617653
13.m. 22 49 00.00	1.69428800	30.4160000	8.62700000	1779.52200	129.575170
13.m. 22 50 00.00	1.80526400	30.3690000	8.66100000	1795.52200	129.532687
13.m. 22 51 00.00	1.92100800	30.3220000	8.69500000	1811.52200	129.490204
13.m. 22 52 00.00	2.04151200	30.2750000	8.72900000	1827.52200	129.447721
13.m. 22 53 00.00	2.16677600	30.2280000	8.76300000	1843.52200	129.405238
13.m. 22 54 00.00	2.29679200	30.1810000	8.79700000	1859.52200	129.362755
13.m. 22 55 00.00	2.43155200	30.1340000	8.83100000	1875.52200	129.320272
13.m. 22 56 00.00	2.57196800	30.0870000	8.86500000	1891.52200	129.277789
13.m. 22 57 00.00	2.71803200	30.0400000	8.89900000	1907.52200	129.235306
13.m. 22 58 00.00	2.86974400	29.9930000	8.93300000	1923.52200	129.192823
13.m. 22 59 00.00	3.02710400	29.9460000	8.96700000	1939.52200	129.150340
13.m. 23 00 00.00	3.19011200	29.8990000	9.00100000	1955.52200	129.107857
13.m. 23 01 00.00	3.35877600	29.8520000	9.03500000	1971.52200	129.065374
13.m. 23 02 00.00	3.53409600	29.8050000	9.06900000	1987.52200	129.022891
13.m. 23 03 00.00	3.71607200	29.7580000	9.10300000	2003.52200	128.980408
13.m. 23 04 00.00	3.90470400	29.7110000	9.13700000	2019.52200	128.937925
13.m. 23 05 00.00	4.09998400	29.6640000	9.17100000	2035.52200	128.895442
13.m. 23 06 00.00	4.30191200	29.6170000	9.20500000	2051.52200	128.852959
13.m. 23 07 00.00	4.51048800	29.5700000	9.23900000	2067.52200	128.810476
13.m. 23 08 00.00	4.72571200	29.5230000	9.27300000	2083.52200	128.767993
13.m. 23 09 00.00	4.94758400	29.4760000	9.30700000	2099.52200	128.725510
13.m. 23 10 00.00	5.17609600	29.4290000	9.34100000	2115.52200	128.683027
13.m. 23 11 00.00	5.41225600	29.3820000	9.37500000	2131.52200	128.640544
13.m. 23 12 00.00	5.65606400	29.3350000	9.40900000	2147.52200	128.598061
13.m. 23 13 00.00	5.90752800	29.2880000	9.44300000	2163.52200	128.555578
13.m. 23 14 00.00	6.16664800	29.2410000	9.47700000	2179.52200	128.513095
13.m. 23 15 00.00	6.43342400	29.1940000	9.51100000	2195.52200	128.470612
13.m. 23 16 00.00	6.70785600	29.1470000	9.54500000	2211.52200	128.428129
13.m. 23 17 00.00	6.98993600	29.1000000	9.57900000	2227.52200	128.385646
13.m. 23 18 00.00	7.27966400	29.0530000	9.61300000	2243.52200	128.343163
13.m. 23 19 00.00	7.57694400	29.0060000	9.64700000	2259.52200	128.300680
13.m. 23 20 00.00	7.88177600	28.9590000	9.68100000	2275.52200	128.258197
13.m. 23 21 00.00	8.19416000	28.9120000	9.71500000	2291.52200	128.215714
13.m. 23 22 00.00	8.51409600	28.8650000	9.74900000	2307.52200	128.173231
13.m. 23 23 00.00	8.84158400	28.8180000	9.78300000	2323.52200	128.130748
13.m. 23 24 00.00	9.17662400	28.7710000	9.81700000	2339.52200	128.088265
13.m. 23 25 00.00	9.51921600	28.7240000	9.85100000	2355.52200	128.045782
13.m. 23 26 00.00	9.86936000	28.6770000	9.88500000	2371.52200	128.003299
13.m. 23 27 00.00	10.22705600	28.6300000	9.91900000	2387.52200	127.960816
13.m. 23 28 00.00	10.59230400	28.5830000	9.95300000	2403.52200	127.918333
13.m. 23 29 00.00	10.96510400	28.5360000	9.98700000	2419.52200	127.875850
13.m. 23 30 00.00	11.34545600	28.4890000	10.02100000	2435.52200	127.833367
13.m. 23 31 00.00	11.73336000	28.4420000	10.05500000	2451.52200	127.790884
13.m. 23 32 00.00	12.12881600	28.3950000	10.08900000	2467.52200	127.748401
13.m. 23 33 00.00	12.53182400	28.3480000	10.12300000	2483.52200	127.705918
13.m. 23 34 00.00	12.94238400	28.3010000	10.15700000	2499.52200	127.663435
13.m. 23 35 00.00	13.36050400	28.2540000	10.19100000	2515.52200	127.620952
13.m. 23 36 00.00	13.78617600	28.2070000	10.22500000	2531.52200	127.578469
13.m. 23 37 00.00	14.21940800	28.1600000	10.25900000	2547.52200	127.535986
13.m. 23 38 00.00	14.66019200	28.1130000	10.29300000	2563.52200	127.493503
13.m. 23 39 00.00	15.10852800	28.0660000	10.32700000	2579.52200	127.451020
13.m. 23 40 00.00	15.56441600	28.0190000	10.36100000	2595.52200	127.408537
13.m. 23 41 00.00	16.02785600	27.9720000	10.39500000	2611.52200	127.366054
13.m. 23 42 00.00	16.49884800	27.9250000	10.42900000	2627.52200	127.323571
13.m. 23 43 00.00	16.97739200	27.8780000	10.46300000	2643.52200	127.281088
13.m. 23 44 00.00	17.46348800	27.8310000	10.49700000	2659.52200	127.238605
13.m. 23 45 00.00	17.95713600	27.7840000	10.53100000	2675.52200	127.196122
13.m. 23 46 00.00	18.45832800	27.7370000	10.56500000	2691.52200	127.153639
13.m. 23 47 00.00	18.96707200	27.6900000	10.59900000	2707.52200	127.111156
13.m. 23 48 00.00	19.48336000	27.6430000	10.63300000	2723.52200	127.068673
13.m. 23 49 00.00	20.00719200	27.5960000	10.66700000	2739.52200	127.026190
13.m. 23 50 00.00	20.53857600	27.5490000	10.70100000	2755.52200	126.983707
13.m. 23 51 00.00	21.07751200	27.5020000	10.73500000	2771.52200	126.941224
13.m. 23 52 00.00	21.62400000	27.4550000	10.76900000	2787.52200	126.898741
13.m. 23 53 00.00	22.17804800	27.4080000	10.80300000	2803.52200	126.856258
13.m. 23 54 00.00	22.73966400	27.3610000	10.83700000	2819.52200	126.813775
13.m. 23 55 00.00	23.30788800	27.3140000	10.87100000	2835.52200	126.771292
13.m. 23 56 00.00	23.88272000	27.2670000	10.90500000	2851.52200	126.728809
13.m. 23 57 00.00	24.46416000	27.2200000	10.93900000	2867.52200	126.686326
13.m. 23 58 00.00	25.05220800	27.1730000	10.97300000	2883.52200	126.643843
13.m. 23 59 00.00	25.64686400	27.1260000	11.00700000	2899.52200	126.601360
13.m. 24 00 00.00	26.24812800	27.0790000	11.04100000	2915.52200	126.558877
13.m. 24 01 00.00	26.85600000	27.0320000	11.07500000	2931.52200	126.516394
13.m. 24 02 00.00	27.47048000	26.9850000	11.10900000	2947.52200	126.473911
13.m. 24 03 00.00	28.09156800	26.9380000	11.14300000	2963.52200	126.431428
13.m. 24 04 00.00	28.71926400	26.8910000	11.17700000	2979.52200	126.388945
13.m. 24 05 00.00	29.35356800	26.8440000	11.21100000	2995.52200	126.346462
13.m. 24 06 00.00	29.99448000	26.7970000	11.24500000	3011.52200	126.303979
13.m. 24 07 00.00	30.64199200	26.7500000	11.27900000	3027.52200	126.261496
13.m. 24 08 00.00	31.29600000	26.7030000	11.31300000	3043.52200	126.219013
13.m. 24 09 00.00	31.95651200	26.6560000	11.34700000	3059.52200	126.176530
13.m. 24 10 00.00	32.62352000	26.6090000	11.38100000	3075.52200	126.134047
13.m. 24 11 00.00	33.29703200	26.5620000	11.41500000	3091.52200	126.091564
13.m. 24 12 00.00	33.97704800	26.5150000	11.44900000	3107.52200	126.049081
13.m. 24 13 00.00	34.66356800	26.4680000	11.48300000	3123.52200	126.006598
13.m. 24 14 00.00	35.35659200	26.4210000	11.51700000	3139.52200	125.964115
13.m. 24 15 00.00	36.05612800	26.3740000	11.55100000	3155.52200	125.921632
13.m. 24 16 00.00	36.76217600	26.3270000	11.58500000	3171.52200	125.879149
13.m. 24 17 00.00	37.47473600				

Daily Time	DOMESTIC/COMMERCIAL PW			DOMESTIC/COMMERCIAL PW			DOMESTIC/COMMERCIAL PW			DOMESTIC/COMMERCIAL PW			DOMESTIC/COMMERCIAL PW		
	WASTE WATER OUTFLET TIME	WASTE WATER TEMP	WASTE WATER PH	WASTE WATER CONDUCTIVITY	WASTE WATER DO	WASTE WATER TDS	Raw water Inlet Flow	Raw water Inlet Temp	Raw water Inlet PH	Raw water Inlet Conductivity	Raw water Inlet DO	Raw water Inlet TDS	Raw water Inlet Temp	Raw water Inlet PH	Raw water Inlet Conductivity
01.00.00	52.82	31.53	7.66	1.078.38	8.53	109.18									
01.00.10	53.21	31.48	7.64	1.078.31	8.61	110.01									
01.00.20	53.17	31.43	7.62	1.078.12	8.62	108.80									
01.00.30	54.42	31.38	7.58	1.078.23	8.79	109.74									
01.00.40	54.74	31.36	7.55	1.078.23	8.84	110.95									
01.00.50	0.07	31.13	7.54	1.078.24	8.39	111.52									
01.01.00	0.07	29.83	7.40	1.078.11	8.75	114.87									
01.01.10	0.04	28.64	7.36	1.078.21	8.12	115.71									
01.01.20	0.04	28.15	7.32	1.078.28	7.97	116.86									
01.01.30	0.05	30.01	7.38	1.078.18	8.36	105.87									
01.01.40	0.05	34.61	7.34	1.078.34	5.51	116.11									
01.01.50	0.05	38.61	7.31	1.078.11	7.11	109.41									
01.02.00	0.04	38.61	7.11	1.078.13		104.55									
01.02.10	0.04	38.61	7.10	1.078.13		103.20									
01.02.20	0.04	38.61	7.10	1.078.14		103.62									
01.02.30	0.05	37.34	7.10	1.078.11		110.36									
01.02.40	0.05	37.34	7.10	1.078.14		106.10									
01.02.50	0.04	34.22	7.09	1.078.27		108.20									
01.03.00	0.04	32.16	7.10	1.078.24		101.20									
01.03.10	0.04	30.46	7.13	1.078.32		98.20									
01.03.20	0.04	32.03	7.06	1.078.33	7.61	97.50									
01.03.30	0.04	31.99	7.07	1.078.34	8.15	97.25									
01.03.40	0.04	31.84	7.06	1.078.34	8.53	91.57									
01.03.50	0.04	31.76	7.05	1.078.33	8.70	91.50									
01.04.00	0.04	31.57	7.08	1.078.32	8.64	99.69									
01.04.10	0.04	31.44	7.07	1.078.33	8.62	97.77									
01.04.20	0.04	31.31	7.05	1.078.31	8.65	97.25									
01.04.30	0.04	30.59	7.08	1.078.30	8.09	100.85									
01.04.40	0.04	29.12	7.01	1.078.29	7.61	101.38									
01.04.50	0.13	28.55	7.40	1.078.27	7.45	101.27									
01.05.00	0.04	27.46	7.37	1.078.25	7.46	103.74									
01.05.10	0.04	27.01	7.34	1.078.23	6.96	106.05									
01.05.20	0.04	27.26	7.31	1.078.21	6.48	110.40									
01.05.30	0.04	27.02	7.28	1.078.19	6.55	110.17									
01.05.40	0.04	26.63	7.10	1.078.14		109.79									
01.05.50	0.04	26.36	7.07	1.078.13		109.10									
01.06.00	0.04	25.78	7.10	1.078.10		110.50									
01.06.10	0.03	25.18	7.10	1.078.12		110.45									
01.06.20	0.03	24.93	7.10	1.078.13		110.10									
01.06.30	0.03	24.51	7.11	1.078.20		110.13									
01.06.40	0.03	24.48	7.11	1.078.15		109.81									
01.06.50	0.03	25.78	7.11	1.078.28		110.17									
01.07.00	0.03	27.62	7.11	1.078.13		101.81									
01.07.10	0.03	29.82	7.11	1.078.14		111.84									
01.07.20	0.03	30.02	7.11	1.078.42		110.00									
01.07.30	0.03	30.12	7.11	1.078.41		109.12									
01.07.40	0.03	30.77	7.11	1.078.17		112.70									
01.07.50	0.03	31.21	7.12	1.078.24		110.70									
01.08.00	0.03	31.12	7.12	1.078.29		110.20									
01.08.10	0.03	30.76	7.12	1.078.16		101.80									
01.08.20	0.03	30.76	7.12	1.078.13		101.70									
01.08.30	0.03	30.44	7.13	1.078.11		105.14									
01.08.40	0.03	30.94	7.82	1.078.10	8.58	101.13									
01.08.50	0.04	30.71	8.26	1.078.10	8.95	100.61									
01.09.00	0.03	30.44	7.87	1.078.09	8.02	106.50									
01.09.10	0.03	30.12	7.86	1.078.08	8.02	105.69									
01.09.20	0.03	29.82	7.77	1.078.09	8.02	111.52									
01.09.30	0.03	29.83	7.73	1.078.08	8.48	101.06									
01.09.40	0.03	29.78	7.69	1.078.08	8.48	100.30									
01.09.50	0.03	29.64	7.66	1.078.07	8.46	100.52									
01.10.00	0.03	29.54	7.65	1.078.07	8.70	110.57									
01.10.10	0.07	29.65	7.57	1.078.06	8.42	106.78									
01.10.20	0.06	29.34	7.50	1.078.06	8.14	101.10									
01.10.30	0.06	28.25	7.41	1.078.05	7.65	101.24									
01.10.40	0.06	28.82	7.39	1.078.05	7.25	112.09									
01.10.50	0.06	31.01	7.34	1.078.04	6.84	109.40									
01.11.00	0.04	31.33	7.19	1.078.04	6.80	104.42									
01.11.10	0.03	31.58	7.15	1.078.08		106.74									
01.11.20	0.03	30.34	7.16	1.078.17		101.11									
01.11.30	0.03	31.00	7.09	1.078.11		104.46									
01.11.40	0.03	30.85	7.10	1.078.08		109.12									
01.11.50	0.04	31.08	7.10	1.078.05		114.43									
01.12.00	0.04	34.44	7.11	1.078.04		111.22									
01.12.10	0.04	32.47	7.12	1.078.08		101.47									
01.12.20	0.05	30.76	7.11	1.078.17		97.90									
01.12.30	0.04	30.43	7.00	1.078.13	8.18	99.88									
01.12.40	0.05	30.12	8.02	1.078.09	8.10	101.50									
01.12.50	0.04	30.18	8.02	1.078.27	8.67	106.00									
01.13.00	0.04	30.23	7.86	1.078.24	8.17	107.24									
01.13.10	0.04	30.12	7.89	1.078.21	8.47	103.81									
01.13.20	0.11	29.68	7.64	1.078.18	7.86	107.80									
01.13.30	0.04	28.67	7.41	1.078.16	7.46	104.03									
01.13.40	0.04	28.14	7.36	1.078.28	6.97	107.20									
01.13.50	0.04	27.42	7.17	1.078.22	6.87	111.94									
01.14.00	0.04	26.86	7.38	1.078.27	6.96	107.46									
01.14.10	0.05	26.53	7.40	1.078.38	6.53	116.79									
01.14.20	0.04	26.74	7.31	1.078.11	6.13	110.62									
01.14.30	0.03	26.19	7.24	1.078.34	5.11	106.60									
01.14.40	0.03	30.11	7.17	1.078.19	4.48	99.54									

01.14.50	01.00.00	48.23	29.88	7.78	1.078.15	8.58	124.51
01.15.00	01.00.10	50.37	29.83	7.72	1.078.19	8.47	103.88
01.15.10	01.00.20	49.10	29.51	7.66	1.078.17	8.47	114.95
01.15.20	01.00.30	51.88	29.55	7.60	1.078.11	8.75	104.00
01.15.30	01.00.40	52.28	29.19	7.54	1.078.15	8.66	111.10
01.15.40	01.00.50	0.06	28.86	7.49	1.078.11	8.79	100.70
01.15.50	01.01.00	0.04	28.48	7.44	1.078.09	7.82	99.13
01.16.00	01.01.10	0.04	27.75	7.41	1.078.06	7.42	103.40
01.16.10	01.01.20	0.05	28.12	7.39	1.078.04	7.04	110.99
01.16.20	01.01.30	0.05	32.14	7.36	1.078.04	5.41	104.17
01.16.30	01.01.40	0.05	38.44	7.31	1.078.05	4.03	100.24
01.16.40	01.01.50	0.04		7.29	1.078.08		99.10
01.16.50	01.02.00	0.04	32.14	7.36	1.078.05		100.60
01.17.00	01.02.10	0.04		7.15	1.078.13		100.00
01.17.10	01.02.20	0.05	32.14	7.36	1.078.11		100.40
01.17.20	01.02.30	0.05	38.77	7.34	1.078.14		110.11
01.17.30	01.02.40	0.05	36.48	7.13	1.078.21		106.01
01.17.40	01.02.50	0.05	31.43	7.13	1.078.15		103.17
01.17.50	01.03.00	0.04	31.72	7.12	1.078.25		98.20
01.18.00	01.03.10	0.04	30.02	7.17	1.078.30		106.10
01.18.10	01.03.20	0.04	29.84	7.68	1.078.17	8.30	105.45

## ภาคผนวก ข-14

ผลการตรวจวัดอุณหภูมิของน้ำทิ้งที่ผ่านหอหล่อเย็น  
ก่อนระบายลงสู่ระบบที่รวบรวมน้ำเสีย








GULF		Daily Plant Log Sheet CCR										Plant: <u>GNC</u>	
												Date: <u>20/12/22</u>	
TAG NO	DESCRIPTION	UNIT	Max	Min	Time						Incase of abnormal, Please issue Notic.		
					01:00	05:00	09:00	13:00	17:00	21:00			
GR-1005 Deaerator and Storage Section													
10LAA30CT004XQ01	FW STORAGE TANK TEMP	°C	110	90			103.76				102.23		
10LAA30CP001XQ01	DEAERATOR PRESS	bar	0.5	0			0.07				0.03		
10LAA30CL900XQ01	DEAERATOR STORAGE LVL	mm	100	-100			-43.8				-33.9		
10LAA30CT003XQ01	CPH OUTLET WATER TEMP	°C	80	55			77.30				68.01		
10LAB25CP001XQ01	BFW HP COMMON DISC PRESS	bar	149	91			96.03				98.90		
10LAB17CP001XQ01	BFW LP COMMON DISC PRESS	bar	50	32			33.12				33.82		
10LCA32CF001XQ01	CONDENSATE FLOW TO DE-AER	T/HR	100	0			63.8				114.9		
10LCA32CT001XQ01	TEMP CONDENSATE TO DE-AER	°C	65	40			39.62				43.75		
10LCA32CP001XQ01	P CONDENSATE TO DEAER	bar	4	1.5			1.84				2.20		
GR-1006 Cooling Water / Main And Auxiliary													
10PAD91AN001XQ03	CT FAN 1 Ampere	A	135	0			133.4				132.0		
10PAD91CY302XQ01	CT FAN 1 VIB	mm/s	5	0			1.90				2.10		
10PAD92AN001XQ03	CT FAN 2 Ampere	A	135	0			5/0				118.2		
10PAD92CY302XQ01	CT FAN 2 VIB	mm/s	5	0			5/0				1.02		
10PAD93AN001XQ03	CT FAN 3 Ampere	A	135	0			118.4				116.2		
10PAD93CY302XQ01	CT FAN 3 VIB	mm/s	5	0			1.93				2.14		
10PAB40CT001XQ01	MCW Return Temp at Condenser	°C	45	0			33.06				28.06		
10PAB40CT002XQ01	MCW RETURN TEMP AT BASIN	°C	45	0			32.99				32.99		
10PAB10CL900XQ01	CT BASIN LEVEL	mm	3300	3000			5192				3185		
10PAB11CL001HL01	DL MCWP#1 STOPLOCK	mm	50	-200			-61				-61		
10PAB12CL001HL01	DL MCWP#2 STOPLOCK	mm	50	-200			-174				-184		
10PAC11AP001XQ03	MCW PUMP 1 Ampere	A	30	0			22.10				22.20		
10PAC12AP001XQ03	MCW PUMP 2 Ampere	A	30	0			22.01				21.22		
10PAB35CT001XQ01	MCW SUPPLY TEMP	°C	37	0			28.12				28.88		
10PAB35CP001XQ01	MCW SUPPLY PRESS	bar	2	0.5			0.908				0.900		
10PAB35CQ001XQ01	MCW PH	pH	8	6.8			7.59				7.21		
10PAB35CQ002XQ01	MCW Conductivity	us/cm	1600	0			989				920		
10PAB31CF001XQ01	CW BLOWDOWN FLOW	T/HR	25	0			18.14				22.30		
GR-1007 Close Cooling Water System & Aux Cooling Water System													
10PGC11AP001XQ03	CCW PMP 1 Amperes	A	215	0			1				1		
10PGC11CT001XQ01	CCW PMP 1 TEMP Phase 1	°C	90	0			5/0				5/0		
10PGC11CT002XQ01	CCW PMP 1 TEMP Phase 2	°C	90	0			1				7/0		
10PGC11CT003XQ01	CCW PMP 1 TEMP Phase 3	°C	90	0			1				1		
10PGC12AP001XQ03	CCW PMP 2 Amperes	A	215	0			206.3				202.6		
10PGC12CT001XQ01	CCW PMP 2 TEMP Phase 1	°C	90	0			49.7				53.0		
10PGC12CT002XQ01	CCW PMP 2 TEMP Phase 2	°C	90	0			50.6				50.2		
10PGC12CT003XQ01	CCW PMP 2 TEMP Phase 3	°C	90	0			49.5				53.1		
10PGA11CP010XQ01	PRESS AFTER CCW PUMPS	bar	4.5	2.5			3.07				3.02		
10PGB90CT001XQ01	CCW TEMP AFTER HEAT EXCH	°C	37	0			29.088				29.835		
10PGB70CT001XQ01	CCW TEMP BEFORE HEAT EXCH	°C	40	0			31.002				35.651		
10PCB40CT001XQ01	ACW Return Temp	°C	40	0			28.86				28.82		
10PCB11CP001XQ01	DP ACW PUMP 1 STRAINER	bar	0.35	0			0.299				0.292		
10PCC11AP001XQ03	ACW PUMP 1 Ampere	A	150	0			142.9				139.8		
10PCB12CP001XQ01	DP ACW PUMP 2 STRAINER	bar	0.35	0			5/0				5/0		
10PCC12AP001XQ03	ACW PUMP 2 Ampere	A	150	0			5/0				5/0		
10PCB30CP001XQ01	PRESS AFTER AUX CW PUMPS	bar	4	2.3			2.75				2.22		
10PGB08CL001XQ01	CCW EXPANSION TANK LEVEL	%	95	50			77.4				83.3		
GNC GR-1009 WATER TREATMENT SYS (1/2) UF													
10GBB40CP001XQ01	UF Feed Pressure	bar.	3	2			2.018	2.336					
10GBB50CPF001	UF#1 Flow	m3/H	60	0			54.0	54.8					
10GBB50CP001	UF#1 Diff pressure	bar.	0.5	0			0.140	0.145					
10GBB51CP001	UF#1 Outlet pressure	bar.	1.5	1			1.256	1.239					
10GBB60CPF001	UF#2 Flow	m3/H	60	0							5/0		
10GBB60CP001	UF#2 Diff pressure	bar.	0.5	0									
10GBB61CP001	UF#2 Outlet pressure	bar.	1.5	1									
10GBB70CPF001	UF#3 Flow	m3/H	60	0			5/0	5/0					
10GBB70CP001	UF#3 Diff pressure	bar.	0.5	0									
10GBB71CP001	UF#3 Outlet pressure	bar.	1.5	1									



# ภาคผนวก ข-15

ระบบท่อระบายน้ำทิ้งลงสู่แหล่งน้ำสาธารณะ

No.	Location Picture	Description	STATUS		Ab-Normal Please Detail
			Cover weld lock	No water leak	
1		STA.0+225 Waste/Storm pipe vent valve Suan-pom conjunction	Flange connection not damage <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
2		STA.0+300 Air box vent valve Suan-Pom conjunction 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
3		STA. 0+942 Air box vent valve cross of Prachinburi Provincial of Skill Development Center 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
4		STA. 1+012 Air box vent valve cross of Prachinburi Provincial of Skill Development Center 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
5		STA. 1+195 Air box vent valve entrance Public water pond 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
6		STA. 1+265 Air box vent valve entrance Public water pond	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
7		STA. 1+671 Air box vent valve gate entrance SAHAPAT	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
8		STA. 1+729 Air box vent valve gate entrance SAHAPAT 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	





No.	Location Picture	Description	STATUS		Ab-Normal Please Detail
			Cover weld lock	No water leak	
9		STA. 2+500 Air box vent valve public road to PTT 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10		STA. 2+750 Air box vent valve 33highway front of FIX pub	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
11		STA. 3+050 Air box vent valve 33highway front of Sra-doo school	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
12		STA. 3+450 Air box vent valve 33highway @HOME condominium	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
13		STA. 3+625 Air box vent valve 33highway front of deserted building 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
14		STA. 3+900 Air box vent valve 33highway .....Cross of Perd-Jai prok grill 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
15		STA. 4+300 Air box vent valve Nong-eian entrance road	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Cover loss
16		STA. 4+655 Air box vent valve public forest 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	





## Waste / Storm water discharge pipeline monthly inspections

11/10/65

No.	Location Picture	Description	STATUS		Ab-Normal Please Detail
			Cover weld lock	No water leak	
17		STA. 5+005 Air box vent valve Nong-eian learning center	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
18		STA. 5+395 Air box vent valve Junction road Tod-yai-som 	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
19		Waste Discharge (Tod-Yai-Som)	Discharge pipe align <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Rip Rap not collapse <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

Record By :

Date :

*gargaw*  
11/10/65

Approved By :

Date :

*gargaw*  
11/10/65

# ภาคผนวก ข-16

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เอกสารการตรวจสอบการทำงานของถังแยกน้ำ-น้ำมัน (Oil Separator)



# Oily pit\_Sump and status drain valve spill containment

05/10/2022

Item	KKS	Oily Pit	Panel select	P1 / Auto / P2	Panel	Float switch,	Liquid level OK	Pump Current (2.1-2.3 Amp)	
			(Auto)	Selector	(No Alarm)	align. OK	(min1 < X > max1)	P1	P2
1	10GQA60GH001	Switch yard area	✓	AUTO	✓	✓	✓	—	—
2	10GQC10GH001	Control building area	✓	AUTO	✓	✓	✓	—	—
3	10GQB50GH001	STG & Condenser area	✓	AUTO	✓	✓	✓	—	—
4	11GQA70GH001	GT11 Power block area	✓	AUTO	✓	✓	✓	—	—
5	12GQA70GH001	GT12 Power block area	✓	AUTO	✓	✓	✓	—	—
6	10GQB14GH001	Cooling Tower area	✓	AUTO	✓	✓	✓	—	—
7	10GQB41GH001	WTP Utility area	✓	AUTO	✓	✓	✓	—	—
8	10GQC70GH001	Admin Building area	✓	AUTO	✓	✓	✓	—	—
9	10GQB90B001	Oily Water Separator	No Oil contaminate (OK or Not) = OK					Test on week 2nd of Month	

Item	KKS	Drain pump pit	Breaker On	Water not flood	Remark
1	10BLA17GQ001	22kV Cable Trench (swyd area)	✓	✓	
2	10BLA16GQ002	Pipe Trench Gas Metering	✓	✓	
3	10BLA14GQ001	Cable Trench SWYD (10BAT01)	✓	✓	
4	10BLA14GQ002	Cable Trench GT (GT11 PCM)	✓	✓	
5	10BLA15GQ002	Cable Trench (CCR cable area)	✓	✓	
6	10BLA16GQ001	Cable Trench (ST turbine area)	✓	✓	
7	10BLA15GQ001	Cable Trench (Aux Tr. area)	✓	✓	

Item	KKS	Drain valves pit	Status Open	Remark
1	10GQA60AA201	22kV Step down trans no.1	✓	
2	10GQA60AA202	22kV Step down trans no.2	✓	
3	10GQA60AA204	GTG11 Step up transformer	✓	
4	10GQA60AA203	GTG12 Step up transformer	✓	
5	10GQA60AA205	STG Step up transformer	✓	
6	10GQA60AA207	6.6kV Unit Auxiliary trans no.1	✓	
7	10GQA60AA208	6.6kV Unit Auxiliary trans no.2	✓	
8	10GQA60AA209	Emergency diesel generator	✓	
9	10GQA50AA201	STG lube oil containment	✓	
10	10GQA50AA202	400 VAC Auxiliary trans no.1	✓	
11	10GQA50AA203	400 VAC Auxiliary trans no.2	✓	
12	10GQA50AA204	Boiler Feed water pump area	✓	
13	10GQA50AA205	Consensate pump station	✓	
14	11GQA70AA206	GTG11 LO aux. skid	✓	
15	11GQA70AA203	GTG11 Inlet air heating pump	✓	
16	12GQA70AA206	GTG12 LO aux. skid	✓	
17	12GQA70AA203	GTG12 Inlet air heating pump	✓	
18	10GQB14AA201	Main cooling pump station	✓	
19	10GQB14AA202	AUX., CCW and Heat exchanger	✓	
20	10GQB42AA201	Air compressor station	✓	
21	10GQB42AA202	Diesel oil tank	✓	
22	10GQB42AA203	Fire water pump station	✓	
23	10GQB42AA204	Ro feed water pump station	✓	
24	10GQB42AA205	Demin and regen water pump	✓	

Remark : / = OK = Equipment Status is really True x = No = Equipment status is really false.

Record by : [Signature]  
Date : 05/10/2022


Approved by : [Signature]  
Date : 05/10/2022

# ภาคผนวก ข-17

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เอกสารตรวจสอบสภาพท่อน้ำและซ่อมแซมท่อน้ำ



			IUs STEAM STATION WEEKLY INSPECTIONS									
			03/10/65									
Item	Description		Saha Seire		Okamoto		Thai Takeda		A-Tech		Thai Gunze	
		Unit/Time	Range	11:36	Range	11:29	Range	11:25	Range	11:19	Range	11:08
1	STEAM METER PANEL (Normal)	OK	Normal	✓	Normal	✓	Normal	✓	Normal	✓	Normal	✓
2	Steam mass flow	Ton/hr	< 5	0.54	< 3	0.20	< 5	1.53	< 8	1.42	< 3	1.0
3	Pressure (SV/PV, green/red)	Barg	5-8	5.7/6.0	5-8	6/6	5-8	5.0/5.0	5-8	5.6/5.6	5-8	6.2/6.2
4	Control Valve (CM/FB, yellow/red)	%	-	90/19	-	46.8/47.8	-	42.9/42.8	-	27.2/42.0	-	43.5/43.5
5	Cooling fan	OK	RUN	✓	RUN	✓	RUN	✓	RUN	✓	RUN	✓
6	10NAA01GW Power Sply (voltage)	Volt	220-240	232	220-240	233	220-240	226	220-240	224	220-240	225
7	Flow Meter (CB on)	OK	ON	✓	ON	✓	ON	✓	ON	✓	ON	✓
8	Lighting (CB on)	OK	ON	✓	ON	✓	ON	✓	ON	✓	ON	✓
9	Press inlet gauge	Barg	8 - 12	10	8 - 12	10	8 - 12	10	8 - 12	10	8 - 12	10
10	Temp inlet gauge	°C	160 - 200	185	160 - 200	175	160 - 200	180	160 - 200	180	160 - 200	180
11	Press outlet gauge	Barg	5.0 - 7.0	6.8	6	6.2	4.0 - 8.0	5.0	6.5 - 8.0	6.0	5.0 - 8.0	6.4
12	Temp outlet gauge	°C	160 - 200	165	175 - 178	170	≥ Sat temp.	160	165 - 220	160	≥ Sat temp.	165
13	Instrument Air Supply (Reg. press)	Barg	4-6	4.0	4-6	4.6	4-6	4.6	4-6	4.0	4-6	4.3
14	Instrument Air (Aut trap drain)	OK	No water	✓	No water	✓	No water	✓	No water	✓	No water	✓
15	Outlet Valve bypass Flow meter	OK	Closed /Lock	✓	Closed /Lock	✓	Closed /Lock	✓	Closed /Lock	✓	Closed /Lock	✓
16	Steam station supply	OK	No leak	✓	No leak	✓	No leak	✓	No leak	✓	No leak	✓
17	Steam pipeline branch to steam station (Trap drain normal)	OK	No leak	✓	No leak	✓	No leak	✓	No leak	✓	No leak	✓
Remark: CBI tighten packing steam CV steam supply at Thai Gunze.												
Record By : <u>Seawang S</u> Date : <u>03/10/65</u>												
Approved By : <u>[Signature]</u> Date : <u>03/10/65</u>												

# ภาคผนวก ข-18

แผนการใช้น้ำของโรงไฟฟ้า

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	A	B	C	D	E	F	G	H	I
41			Steam Turbine Power Output	MW	< 30	28.03			
42			Condenser cooling water inlet temp.	°C	< 33.7	33.88			
43			Condenser cooling water outlet temp.	°C	< 43.6	40.80			
44			Condenser cooling water diff temp	°C	< 9.9	9.24			
45			Condenser vacuum pressure	bar(a)	0.093-0.103	0.087			
46			Condensate water temperature	°C	42.80	42.97			
47			Condenser cleanliness factor	TTD	< 3	2.17			
48									
49			PRODUCTION AND CONSUMPTION						
50									
51			ITEM	UNIT	TARGET	ACTUAL			
52			Fuel Consumption						
53			Fuel Gas (PTT Metering)	MMSCF	< 19.55	11.90			
54			Total Fuel Gas Consumption (Plant Metering)	MMBTU	N/A	11,925.36			
55			Fuel Stock						
56			Fuel Oil for Diesel Generator	%	> 60	74.8			
57			Fuel Oil for Fire Pump	%	> 67	75.0			
58			Water Consumption						
59			Raw Water Supply	m <sup>3</sup>	< 3928.70	1,679.85			
60			Demin Water Supply	m <sup>3</sup>	< 252.7	142.60			
61			Cooling Tower Make up	m <sup>3</sup>	< 2800	1,509.92			
62			Cooling Tower Blowdown	m <sup>3</sup>	< 700	391.84			
63			Cooling Tower Evaporation Loss	m <sup>3</sup>	2,100	1,118.08			
64			Waste Water Discharge	m <sup>3</sup>	<800	396.70			
65									
66			SAFETY DEVICE FUNCTION TEST						
67									
68			ITEM	RESULT					
69									
70									
71									

# ภาคผนวก ข-19

เอกสารบันทึกชนิด ปริมาณ และการส่งกำจัดกากของเสีย



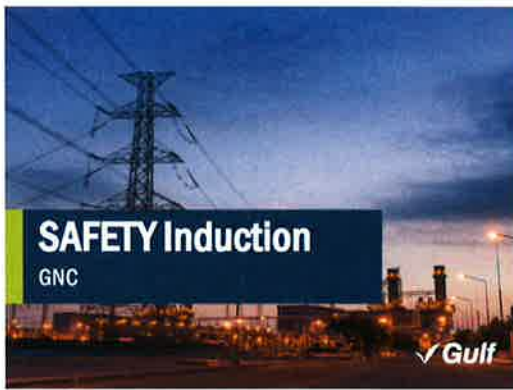
● Waste Management (status, quantity of waste disposed)

- Disposal method of industrial waste:
  - Landfill 0 kg. (code 071-073)
  - Incineration 0 kg. (code 074-076)
- Hazardous wastes to waste disposal total: 0 kg
- Non-Hazardous wastes to waste disposal: 0 kg
- General waste disposal total: 520.8 kg. (Disposal by high tech industrial estate).

No.	Waste List	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum 2022
1	Hazardous and non-Hazardous Waste	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	น้ำมันใช้แล้ว	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	วัสดุปนเปื้อนน้ำมัน	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	วัสดุปนเปื้อนสารเคมี	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	หลอดไฟฟลูออเรสเซนต์ใช้แล้ว	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	ภาชนะปนเปื้อน	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	กระป๋องสเปรย์	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	ไส้กรองน้ำ	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	ฉนวนกันความร้อน	Kg.	0	0	0	0	0	0	0	0	0	0	0	0	0
	ไส้กรองอากาศ	Kg.	0	0	0	0	0	0	0	0	5000	0	0	0	5000
2	General Waste (Disposal by Hitech)	Kg.	520.8	520.8	520.8	520.8	520.8	520.8	520.8	487.2	520.8	520.8	520.8	520.8	6216

## ภาคผนวก ข-20

เอกสารอบรมด้านความปลอดภัยให้แก่พนักงานและผู้รับเหมา



## GNC Plant Overview

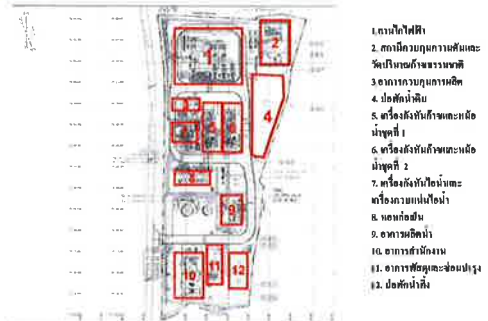


- ที่ตั้งโรงไฟฟ้า : เนื้อที่ 29,15 ไร่ ตำบล นนทรี อำเภอ กบินทร์บุรี จังหวัดปราจีนบุรี
- ประเภท : โรงไฟฟ้าพลังความร้อนร่วม
- ขนาดกำลังการผลิต : 120 เมกกะวัตต์
- เชื้อเพลิงที่ใช้ : ก๊าซธรรมชาติ
- แหล่งน้ำใช้ : น้ำดิบจากสวนอุตสาหกรรมเครือสหพัฒน์ กบินทร์บุรี
- EIA : ผ่านการเห็นชอบวันที่ 8 ธันวาคม 2558
- วันเริ่มต้นซื้อขายไฟฟ้าเชิงพาณิชย์(COD) : 1 มีนาคม 2561

## GNC Plant Over View



## GNC Plant Over view



## GNC Organization chart



## ความหมายของความปลอดภัย



### ความปลอดภัยในการทำงาน หมายถึงอะไร

- สภาพและปัจจัยที่มีหรืออาจมีผลต่อสุขภาพและความปลอดภัยของผู้ปฏิบัติงาน ลูกจ้าง หรือคนอื่นๆ (รวมถึงคนงานชั่วคราวและคนงานผู้รับเหมา) ผู้เยี่ยมชม หรือบุคคลอื่นๆ ในสถานที่ทำงาน **Conditions and factors that may affect to the health and safety of workers, employees or other workers. (Including temporary workers and contractors), visitors or other persons. In the workplace**

## หัวข้อการฝึกอบรม



- 72 ชั่วโมง (Safety Induction and Safety Training)
- พื้นฐานความปลอดภัย Basic Safety
- แผนผังโรงงานและพื้นที่ Site layout and Restricted area
- โครงสร้างการบริหารงาน Organization Chart
- อุปกรณ์ป้องกันตัวส่วนบุคคล PPE requirement
- การเข้า-ออกโรงไฟฟ้า Access control
- การจราจร Traffic control
- การแจ้งขอเข้า-ออกโรงไฟฟ้า Material gate Pass control
- การขออนุญาต เข้าทำงาน Work permit and J (COC)
- การวิเคราะห์ความปลอดภัยของงาน Job safety analysis
- แผนฉุกเฉิน Emergency plan (for contractor)
- การจัดการขยะและการรักษาความสะอาด House keeping
- สัญลักษณ์ความปลอดภัย Safety Sign

## ความหมายของความปลอดภัย



### อุบัติเหตุ (Incident)

หมายถึง เหตุการณ์ที่ไม่พึงประสงค์เมื่อเกิดขึ้นแล้ว ฝ่อก่ให้เกิดเหตุการณ์เกือบเกิดอุบัติเหตุ  
Events are unwanted when it occurs, Causes of almost any accident or near miss.

### เหตุการณ์เกือบเกิดอุบัติเหตุ (Near Miss)

หมายถึง เหตุการณ์ที่ไม่พึงประสงค์ เมื่อเกิดขึ้นแล้วมีแนวโน้มที่จะก่อให้เกิดอุบัติเหตุ  
Events are unwanted when it occurs, Tend to causes any accident

### อุบัติเหตุ (Accident)

หมายถึง เหตุการณ์ที่ไม่พึงประสงค์ที่ก่อให้เกิดการบาดเจ็บได้คาดคิดไว้ล่วงหน้า  
จึงเมื่อเกิดขึ้น ย่อมมีผลกระทบต่อการทำงานและผลผลิตต้องทำให้ทรัพย์สินเสียหายหรือทำให้คน  
ได้รับบาดเจ็บหรือพิการหรือถึงขั้นเสียชีวิตได้  
Events are unwanted when it occurs When it happens Impact on work productivity / cause  
property damage or cause injury, or disability or serious death.

## สาเหตุของการเกิดอุบัติเหตุ



### สาเหตุจากการกระทำที่ไม่ปลอดภัย (Unsafe Acts) ได้แก่

- การทำงานไม่ถูกวิธี หรือ ไม่ถูกขั้นตอน Work with wrong method/Procedure
- การมีทัศนคติที่ไม่ถูกต้อง เช่น อุบัติเหตุเป็นเรื่องของเคราะห์กรรม แก้ไขป้องกันไม่ได้ Wrong attitude in safety such as accident is a fate can't protect
- ความไม่เอาใจใส่ในการทำงาน Lack of attention to work
- ความประมาท หลังเลอ หลอหลอ Cholesterol
- การมีนิสัยชอบเสี่ยง I have a habit of risk
- การไม่ปฏิบัติตามกฎระเบียบของความปลอดภัยในการทำงาน Non-compliance with safety regulations
- การทำงานโดยไม่ใช้อุปกรณ์ป้องกันอันตรายส่วนบุคคล (Personal Protective Equipment) เป็นต้น Working without PPE

## ความสูญเสียจากอุบัติเหตุ



- ภัยที่มองเห็น
  - ✗ ค่ารักษาพยาบาล Medical fee
  - ✗ ค่าประกันภัย
  - ✗ ค่าเสียหาย Claim fee
  - ✗ ค่าทำขวัญ ทักขณ
- ภัยที่มองไม่เห็น
  - ✗ การสูญเสียเวลาทำงานของพนักงาน Loss-time
  - ✗ ค่าใช้จ่ายในการซ่อมแซม Maintenance cost
  - ✗ เสียความน่าเชื่อถือขององค์กร
  - ✗ เกิดผลกระทบระยะยาวต่อสุขภาพจิต
  - ✗ เสียค่าใช้จ่ายในการฟ้องร้องคดีความ
  - ✗ เสียชื่อเสียงและสถานะของโรงงาน disreputable

## สาเหตุของการเกิดอุบัติเหตุ



### สาเหตุจากสภาพการณ์ที่ไม่ปลอดภัย (Unsafe Conditions) ได้แก่

- ส่วนที่เป็นอันตราย (ส่วนที่เคลื่อนไหว) ของเครื่องจักรไม่มีเครื่องกั้นหรืออุปกรณ์ป้องกันอันตราย Machine Equipment or moving part without Guard
- การวางผังโรงงานที่ไม่ถูกต้อง Improper design
- ความไม่พร้อมของเครื่องมือและอุปกรณ์ในการจัดเก็บวัสดุสิ่งของ Improper Housekeeping
- พื้นโรงงานขรุขระ เปื้อนหลุมบ่อ Working area is rough
- สภาพแวดล้อมในการทำงานไม่ปลอดภัยหรือไม่ถูกสุขอนามัย เช่น แสงสว่างไม่เพียงพอ เสียงดังเกินควร ความร้อนสูง ฝุ่นละออง ไรฝุ่นของสารเคมีที่เป็นพิษ เป็นต้น
- เครื่องจักรกล เครื่องมือ หรืออุปกรณ์ชำรุดบกพร่อง จากการใช้มากเกินไปหรือบำรุงรักษาไม่เหมาะสม Machine Equipment damage/lack of maintenance
- ระบบไฟฟ้าหรืออุปกรณ์ไฟฟ้าชำรุดบกพร่อง เป็นต้น Electrical equipment damage

## อุปกรณ์ป้องกันอันตรายส่วนบุคคล PPE

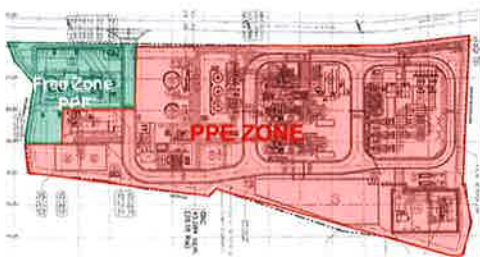


- อุปกรณ์ป้องกันอันตรายส่วนบุคคล Personal Protective Equipment (PPE) : สิ่งใดสิ่งหนึ่งหรือหลายสิ่งรวมกัน ที่สวมใส่ลงบนอวัยวะส่วนใดส่วนหนึ่งหรือหลายส่วนรวมกันของร่างกาย เพื่อป้องกันอันตรายให้แก่ตัวคนนั้น ไม่ต้องประสบอันตราย หรือลดความรุนแรง จากอันตรายที่เกิดขึ้น ในระหว่างที่ปฏิบัติงาน One or more things. Are worn on part of body or organs to prevent or reduce from the dangers during the works

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## PPE Free Zone / PPE Zone



## การเข้า-ออกโรงไฟฟ้า Access control.



- ผู้ขอเข้าเยี่ยมชมผู้ที่ยกบัตร โรงไฟฟ้า จะเครื่องล็อกและมอบที่ถือของลงจากทางเข้าโรงไฟฟ้า จึงเจ้าหน้าที่รักษาความปลอดภัยเป็นผู้ดำเนินการจัดเตรียมบัตร visitors/contractor ซึ่งผู้ขอเข้าเยี่ยมชมผู้ที่ยกบัตร จะเครื่องล็อกไว้กับที่เก็บไว้ที่จุดของล็อกออกทางเข้าโรงไฟฟ้า และเจ้าหน้าที่รักษาความปลอดภัย จะแจกบัตรให้กลับคืนกับบัตร visitors/contractor ของโรงไฟฟ้า
- All Visitor must report to main gate house where they are issued with a visitors/contractor pass card which must be worn at all times whenever the power station. Contractors working inside the plant will also be issued with a visitors/contractor pass card together with their company ID's which is to be worn at all time inside the power plant.

## PPE Free Zone / PPE Zone



- โรงไฟฟ้าบนที่ราบลุ่มให้เป็นพื้นที่ปลอดภัยสำหรับคนนิรภัย โรงไฟฟ้า นิรภัย เมื่อเข้ามายังบริเวณโรงไฟฟ้าจะเครื่องความปลอดภัยออกจากรายใน ภายในอาคาร หรือเดินจากทางเข้าอาคารบริหาร หรือทางเดิน ผู้ดูแลบำรุงรักษา GNC is a restricted area. Hard hats, Safety Foot wear, Safety glasses must be worn at all time when on site. Only exceptions are within the office block or when walking directly to or from Administration Building, Work shop Building, Via the designated route.

## ตัวอย่างบัตรผู้รับเหมา



កង្កែបចរាចរ **Traffic control**

- การจอดรถ ให้ออกบริเวณที่กำหนด ที่ขึ้นนอกโรงไฟฟ้า ซึ่งจะข้าม  
กำแพงการเข้ารอบเขตที่ดินหลัก ไม่เกิน 20 km/h และ ในบริเวณ  
ถนนในพื้นที่ขั้วสายหลัก และ ไม่เกิน 10 km/h 115 KV ภายในโรงไฟฟ้า  
หรือแปลง
- Vehicle speed limit at site is 20 km/h on main road (from the gate to  
Work shop), 10 km/h on service road and 10 km/h within 115 kv  
switchyard, transformer

### Parking area



การนำของ เข้า-ออกโรงไฟฟ้า  
Material gate Pass.

1. วัสดุ อุปกรณ์ ที่ใช้กับงาน มีผู้จำหน่ายมา เช่น กระจก ไม้ ไม้ไผ่ และสิ่งของใช้ติดงาน ซึ่งก่อนการนำของเข้าใกล้รถคัน จะต้องมีการกรอกใบสารเข้างานเข้า - ออกโดยขอ: สักงานรถโดยสาร และ เติมน้ำมันให้รถคัน
2. All tool and material that come in / out of power plant must be follow up material gate pass procedure and contractor full fill detail as defined in material gate pass form
3. ให้หน่วยงาน เช่น ฝ่ายเทคนิค หรือ ผู้รับผิดชอบงาน ไปขอรับทราบและขอใบติดใบเข้าออกก่อน
4. Owner work supervisor: Store - MINT mgr. inspect and signed in material gate pass form.
5. วัสดุ สารจากสถานการรถคัน อุปกรณ์ และ วัสดุที่ใช้ได้รวมอยู่ใต้งานของรถคันตามใบเข้าออก เช่น กระจก ใบประตู หน้ารถคัน สวิตซ์ และ ใบไม้เข้างานเข้า - ออกก่อนเข้าเข้าไปในเขตโครงการ
6. Security inspect in detail between list and actual / authorize person signed- If all correct security signed in form and send form collect at PMS manager.

ใบนำของ เข้า-ออกโรงไฟฟ้า **Material gate pass**

[illegible]

ใบขออนุญาตนำสิ่งของเข้า-ออก  
โรงไฟฟ้า

ให้เขียนแยกคนละชุด

นำเข้าเขียน 1 ชุด

**นำออกเขียน 1 ชุด**

วันต่อวัน

โขนำของ เข้า-ออกโรงไฟฟ้า Material gate pass

ผู้มีอำนาจอนุญาตนำของออกโรงไฟฟ้า

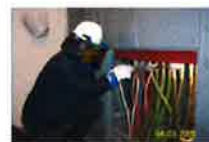
- Authorized person of material gate pass

- Plant manager
- Operation manager
- Maintenance manager
- Shift leader <sup>หัวหน้ากะ</sup> Plant manager/Operation manager และ Maintenance manager

**ใบอนุญาตทำงาน Work permit**

### Electrical Work Permit

Electrical High Voltage Work – Any maintenance or repair on or near energized electrical equipment of equal to or greater than 480 VAC.



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**ใบอนุญาตทำงาน Work permit**

**ชนิดของใบอนุญาต Type of Work Permit**

- |   |  |
|---|--|
| 1.  | ใบอนุญาตทำงาน (Work Permit) ให้ออกอนุญาตแก่แรงงานทั้งชาวไทยและต่างชาติที่มีคุณสมบัติตามที่กำหนดไว้แล้วในกฎกระทรวงว่าด้วยการจ้างงานชาวต่างชาติ โดยใบอนุญาตประเภทนี้จะมีอายุการใช้งาน (Hazardous Work Permit) ควบคุมด้วย |
| 2.  | ใบอนุญาตทำงานพิเศษอันตราย (Hazardous Work Permit) ประกอบด้วยได้แก่   |
| 1. Electrical Work permit (งานไฟฟ้าแรงสูง)        | 6 Excavation Work permit (ขุดดิน)  |
| 2. Mechanical Work permit (งานเครื่องจักรกล)      | 7.Chemical Work permit (งานใช้วัตถุอันตราย)  |
| 3.Cutting Welding Hot Work permit                 | 8 Slings, Rigging and Cranes permit (งานสลิง ใช้อุปกรณ์ยกของ)  |
| (งานเชื่อม ลัด ใช้อุปกรณ์ยกของ)                   |  |
| 4. Confined Spaces Entry permit (งานในพื้นที่ปิด) | 9. Ladder and Scaffold permit (งานบันได โครงสร้าง)   |
| 5.Radiography Work permit (งานรังสี)              |  |
|   | Hazardous Work Permit ต้องมีการทำ Safety Checklist   |
|   | แบบ B ควบคุมด้วย   |

ใบอนุญาตทำงาน **Work permit**

### Mechanical Work Permit.

- Maintenance gas or liquid at pressures of 100 psig (6.8 Bar) or greater, or temperatures 150° F (65° C) or greater (flammable chemicals or fuel).





## ใบอนุญาตทำงาน Work permit



## Cutting/Welding Hot Work Permit

- Maintenance requiring welding, burning, grinding, or similar work involving open flames, high temperatures or sparks.



## ใบอนุญาตทำงาน Work permit



## Radiography Work Permit



## ใบอนุญาตทำงาน Work permit



## Confined Space Entry Permit



## ใบอนุญาตทำงาน Work permit



## Excavation Work Permit



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## ใบอนุญาตทำงาน Work permit



## Chemical Work Permit



## ใบอนุญาตทำงาน Work permit



## Ladder and Scaffolding Permit



## ใบอนุญาตทำงาน Work permit



## Lifting work



## ใบอนุญาตทำงาน Work permit



ฟอร์มใบอนุญาตทำงาน  
Work permit Form.

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## ใบอนุญาตทำงาน Work permit

✓Gulf NC

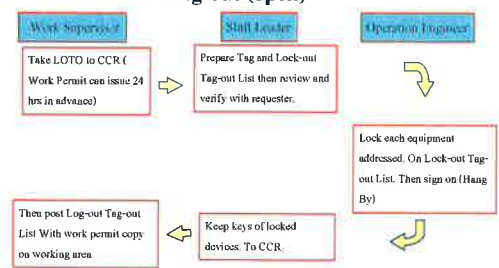
## ใบอนุญาตทำงาน Work permit

✓Gulf NC

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## Lock-out Tag-out (open)

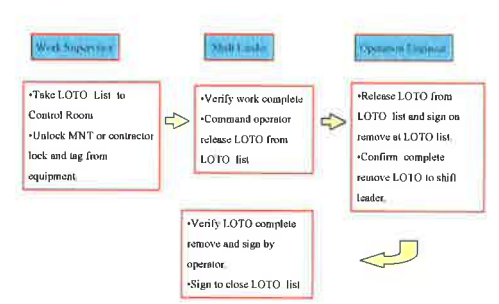
✓Gulf NC



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## Lock-out Tag-out (close)

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## LOTO Equipment

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## ใบอนุญาตทำงาน Work permit

✓Gulf NC

ฟอร์มใบติดแยกอุปกรณ์ LOTO Form

ข้อกำหนดสำหรับงาน เกิดประกายไฟ  
Hot work requirement.

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- ต้องมีการตรวจวัดความเข้มข้น ก๊าซไวไฟ < 10 % ก่อนและระหว่างปฏิบัติงาน
- Must be verified LEL, % below 10 % before and during work.
- ต้องมีถังดับเพลิง และผ้ากันไฟไว้ในพื้นที่ปฏิบัติงาน.
- Fire extinguisher and fire blanket must be please on working area.
- กำหนดให้มีผู้เฝ้าระวัง ระหว่างการปฏิบัติงาน
- Fire watch require.

ข้อกำหนดสำหรับงาน ที่อับอากาศ  
Confined space requirement.

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- ผู้อนุญาตปฏิบัติงาน/ผู้ช่วยเหลือ/ผู้ควบคุมงาน
- Only trained and certified person can work in term of Permit-supervisor / operator / rescue.
- ผู้ปฏิบัติงาน จะต้องมีผลการตรวจร่างกาย โดยระบุสามารถปฏิบัติงานในที่อับอากาศได้
- Health check up for work in confined space are required and verified by doctor.
- ต้องมีการตรวจวัดความเข้มข้น ออกซิเจน , ก๊าซไวไฟ < 10 % ก่อนและระหว่างปฏิบัติงาน
- Must be verified O2, LEL, % below 10 % before and during work.

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## เอกสารที่ต้องแนบพร้อม Work permit Document required with work permit

### All work

- JSA (Job safety analysis)
- List name of worker

### Special / hazardous work

- P&I Diagram
- Safety training certificate (confined space, scaffolder, lifting, fork lift etc.)
- Confined space health check up must more than 6 months with medical confirmation sheet.



## ตัวอย่างการวิเคราะห์ความปลอดภัยของงาน Job Safety analysis example

ขั้นตอนการทำงาน	อันตราย	ผลกระทบ	มาตรการป้องกัน
1. เดินเข้าพื้นที่ทำงาน	1.1 เดินชนสิ่งกีดขวาง	1.1 บาดเจ็บ	1.1 เดินอย่างช้าๆ และระวัง
2. ตรวจสอบพื้นที่ทำงาน	2.1 เดินชนสิ่งกีดขวาง	2.1 บาดเจ็บ	2.1 เดินอย่างช้าๆ และระวัง
3. เดินขึ้นบันได	3.1 เดินชนสิ่งกีดขวาง	3.1 บาดเจ็บ	3.1 เดินอย่างช้าๆ และระวัง
4. เดินลงบันได	4.1 เดินชนสิ่งกีดขวาง	4.1 บาดเจ็บ	4.1 เดินอย่างช้าๆ และระวัง

## การวิเคราะห์ความปลอดภัยของงาน Job Safety analysis

- ขั้นตอนการทำงาน (Describe task)
- อันตรายของงาน (Hazard)
- มาตรการป้องกัน (Preventive measure)



## การตรวจสอบอุปกรณ์ Equipment and Tool inspection



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## แผนฉุกเฉิน Emergency response plan

- กรณีเกิดเหตุฉุกเฉินใดๆ เช่น ควันไหม/น้ำมันรั่วไหล, อุปกรณ์ฉุกเฉิน, รั่วไหล, เครื่องควบคุม, เจ้าหน้าที่ของโรงไฟฟ้า, พนักงานรักษาความปลอดภัย โดยแจ้งรายละเอียดข้อหาตามดังนี้
  - มาตรการป้องกัน
  - มาตรการแก้ไข
  - มาตรการระงับ
  - มาตรการอพยพ
- เมื่อเกิดเหตุฉุกเฉินใดๆ ให้รีบแจ้งการอพยพ ไปยังจุดนัดรวมกลุ่มทันที และไปรายงานถึงผู้จัดการความปลอดภัย ซึ่งมี จุดนัดรวมกลุ่มดังนี้
  - อาคารควบคุมอาคาร Admin



## จุดรวมพล Assembly point



## แผนฉุกเฉิน Emergency response plan

- In case of fire, spill or serious injuries. Call safety (085-346-5161). Control room, Gulf staff or intercom giving the following information
  - What happened.
  - Where it happened.
  - When it happened.
  - Are there person involved injured.
  - Who is reporting.
- Full evacuation is needed when fire alarm occurred, stop work and assemble at the main assembly point.
  - Main assembly point at Admin building.
  - Second assembly point at behind security house.



## แผนฉุกเฉิน Emergency response plan

- งานทุกงานต้องทำขึ้นภายใต้การควบคุมของแผนปฏิบัติงาน
- All work must be done under our Work permit program.
- เมื่อมีการรั่วไหล จะต้องดำเนินการแก้ไขทันที จะต้องไม่มี ควันไหม/น้ำมัน ไหลลงทางระบายน้ำภายในโรงไฟฟ้า
- All spillage must be dealt with immediately. No oil, chemical or solid materials must be allowed to enter any part of the storm water drainage system.
- จะต้องมีรายงานอุบัติเหตุ/อุบัติการณ์/อันตราย ต่อหัวหน้างานโดยทันที
- Report all near miss/accident/hazard to your immediate supervisor.
- สูบปุ๋ยหรือยาฆ่าเชื้อพิษ บริเวณที่จัดหิ้วไปใช้เท่านั้น ห้ามสูบลอยอากาศและเศษเหล็ก
- Smoking is only allowed where RHD ASHTRAY is located.

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## การจัดการของเสีย Waste management



- ขยะ/กากที่เหลือทิ้งจะต้องทิ้งหรือกำจัดในจุดที่ทางโรงไฟฟ้าจัดเตรียมไว้ให้
- All trash, garbage must be disposed at corresponding waste bins located.



## สัญลักษณ์และป้ายเตือนความปลอดภัย Signs and Safety Signs



สีของป้ายเตือน	ความหมาย	ตัวอย่าง	รูป
สีแดง	ห้าม	ห้ามสูบบุหรี่	รูป 1
สีน้ำเงิน	บังคับ	บังคับสวมหมวกนิรภัย	รูป 2
สีเขียว	ปลอดภัย	ปลอดภัย	รูป 3
สีเหลือง	เตือน	เตือนอันตราย	รูป 4

## สัญลักษณ์และป้ายเตือนความปลอดภัย Signs and Safety Signs



รูป	สี	ความหมาย	ตัวอย่าง
รูป 1	สีแดง	ห้าม	ห้ามสูบบุหรี่
รูป 2	สีน้ำเงิน	บังคับ	บังคับสวมหมวกนิรภัย
รูป 3	สีเขียว	ปลอดภัย	ปลอดภัย
รูป 4	สีเหลือง	เตือน	เตือนอันตราย

## สัญลักษณ์และป้ายเตือนความปลอดภัย Signs and Safety Signs



ตัวอย่างป้ายเตือนความปลอดภัย

**ห้าม Prohibition Signs**

**บังคับ Mandatory Signs**

**เตือนอันตราย Hazard Signs**

**ความปลอดภัย Safety Condition**

**จราจร Traffic Signs**

THANK YOU

