

ภาคผนวก ข-8

เอกสารรับรองบุคลากรด้านสิ่งแวดล้อม



ที่ อก ๐๓๑๓/ ๓ ๑ ๓ ๕

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กรมโรงงานอุตสาหกรรม

ถนนพระรามที่ ๖ เขตราชเทวี

กรุงเทพฯ ๑๐๕๐๐

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เรื่อง หนังสือรับแจ้งการมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน

เรียน ผู้รับใบอนุญาตประกอบกิจการโรงงาน บริษัท กัลป์ เอ็นซี จำกัด

อ้างถึง คำขอเลขที่ ๐๑๙๕ ลงรับวันที่ ๑๓ กุมภาพันธ์ ๒๕๖๒

ตามคำขอที่อ้างถึง ท่านแจ้งการเปลี่ยนแปลงบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ของ โรงไฟฟ้าพนนทรี ทะเบียนโรงงานเลขที่ ๓-๘๘(๒)-๑๐/๕๙ ปจ ประกอบกิจการผลิตพลังงานไฟฟ้าจากเชื้อเพลิง ก๊าซธรรมชาติ เพิ่มประเภทหรือชนิดของโรงงานลำดับที่ ๑๐๒ ประกอบกิจการเกี่ยวกับการผลิตและหรือ จำหน่ายไอน้ำ ตั้งอยู่ ณ เลขที่ ๔๑๘ หมู่ที่ ๑ ตำบลนทรี อำเภอกบินทร์บุรี จังหวัดปราจีนบุรี

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว รับแจ้งการเปลี่ยนแปลงบุคลากรด้านสิ่งแวดล้อม ประจำโรงงาน และให้ท่านยื่นคำขอแจ้งการมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงานครั้งต่อไป ภายในวันที่ ๒๑ ธันวาคม ๒๕๖๓ โดยมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ดังนี้

ผู้จัดการสิ่งแวดล้อม			นายพนพล เงินโสม		
ลำดับ	ผู้ควบคุมระบบบำบัด	เลขทะเบียน	มลพิษน้ำ	มลพิษอากาศ	มลพิษกากอุตสาหกรรม
๑	นายลิขิต เปรมโยธิน	๑๒๓-๕๕-๐๐๔๐๖		✓	
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๑	นายสรเสรีญ ทองสา			✓	
๒	นายประยูร สุดตา			✓	
๓	นายพนฤทธิ์ พุกเพชร			✓	

หมายเหตุ ๑. การแจ้งการมี/ยกเลิก/เพิ่มเติม/เปลี่ยนแปลง บุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ต้องส่งหนังสือฉบับนี้ด้วย

๒. ยกเลิกหนังสือรับแจ้งการมีบุคลากรด้านสิ่งแวดล้อมประจำโรงงาน ที่ อก ๐๓๑๓/๑๘๔๗๕ ลงวันที่ ๑๕ ธันวาคม ๒๕๖๐

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ



(นายกัมปนาท รุ่งเรืองชัยศรี)

ผู้อำนวยการกองส่งเสริมเทคโนโลยีสิ่งแวดล้อมโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

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ภาคผนวก ข-9

กิจกรรมการมีส่วนร่วมกับชุมชนและกิจกรรมชุมชนสัมพันธ์

ภาพกิจกรรม CR/ CSR

GNC

January – May 2022

มอบของขวัญวันเด็ก ประจำปี 2565



คณะครูจำนวน 5 โรงเรียนในพื้นที่โดยรอบโรงไฟฟ้า เป็นตัวแทนรับมอบที่หน้าโรงไฟฟ้า เนื่องจากสถานการณ์



มอบเครื่องมือแพทย์ให้กับโรงพยาบาลกบินทร์บุรี

มอบเครื่องวัดความอืดตัวของออกซิเจนในเลือด เนื่องในโอกาสทำบุญปีใหม่โรงไฟฟ้าพนนทรี 2565



Thank You



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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APPROVED WITH COMMENTS Approved subject to Incorporation of comments	AWC X
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Revision History

Rev.A: FOR APPROVAL

System design Philosophy and process description

Project #: 364
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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
- 2nd 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.

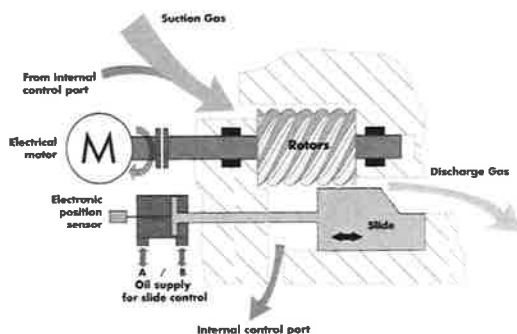


Figure 1

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 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. By-pass line is shown on P&ID and it is a line connecting outlet line and inlet line with 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, PLC automatically will open and regulate 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 till 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 allow 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 executed from the HMI. The Signal 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 signal 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 CO₂ 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

เอกสารการตรวจสอบ Silencer

Applicable Equipment List for Near Field Noise Measurement
Project: GNC

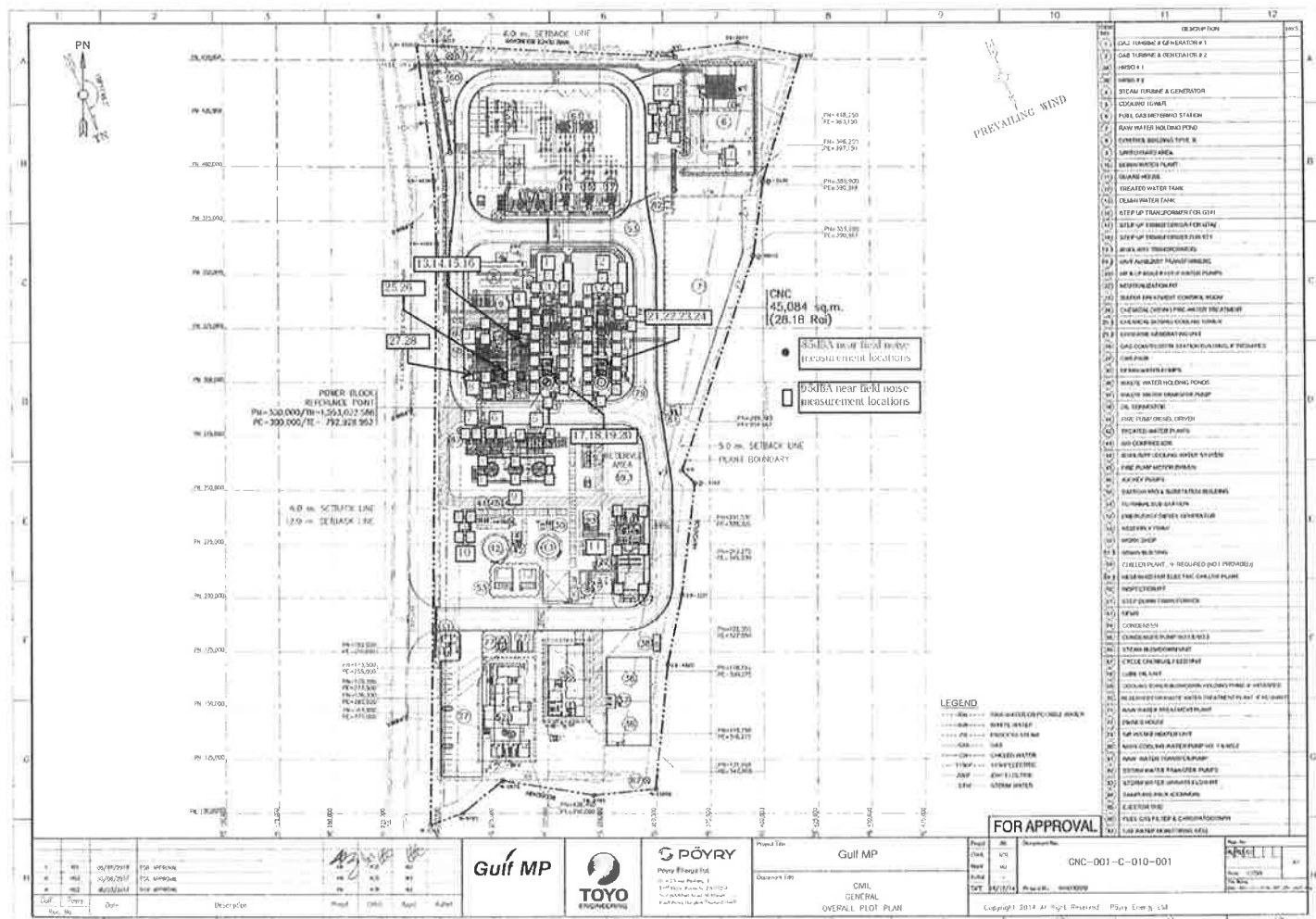
Rev. 3/11

1

Date :

2018/1/28

Sr. #	KKS tag	Equipment	Type of test	Remarks
For 85 dBA near field noise				
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	
For 95 dBA near field noise				
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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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, 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

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)

Issued date : February 8, 2018

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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)

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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
8:28:19 - 8:28:29	86.3	8:33:19 - 8:33:29	87.3	8:38:19 - 8:38:29	84.8
8:28:29 - 8:28:39	86.2	8:33:29 - 8:33:39	87.3	8:38:29 - 8:38:39	78.5
8:28:39 - 8:28:49	86.2	8:33:39 - 8:33:49	87.2	8:38:39 - 8:38:49	78.3
8:28:49 - 8:28:59	86.2	8:33:49 - 8:33:59	87.1	8:38:49 - 8:38:59	84.1
8:28:59 - 8:29:09	86.3	8:33:59 - 8:34:09	87.2	8:38:59 - 8:39:09	85.2
8:29:09 - 8:29:19	85.4	8:34:09 - 8:34:19	87.2	8:39:09 - 8:39:19	85.7
8:29:19 - 8:29:29	86.5	8:34:19 - 8:34:29	87.1	8:39:19 - 8:39:29	86.5
8:29:29 - 8:29:39	86.5	8:34:29 - 8:34:39	86.9	8:39:29 - 8:39:39	86.6
8:29:39 - 8:29:49	86.8	8:34:39 - 8:34:49	86.8	8:39:39 - 8:39:49	87.2
8:29:49 - 8:29:59	86.7	8:34:49 - 8:34:59	86.7	8:39:49 - 8:39:59	87.3
8:29:59 - 8:30:09	86.8	8:34:59 - 8:35:09	86.7	8:39:59 - 8:40:09	87.6
8:30:09 - 8:30:19	86.7	8:35:09 - 8:35:19	86.6	8:40:09 - 8:40:19	88.0
8:30:19 - 8:30:29	86.7	8:35:19 - 8:35:29	86.6	8:40:19 - 8:40:29	88.4
8:30:29 - 8:30:39	86.7	8:35:29 - 8:35:39	86.5	8:40:29 - 8:40:39	88.6
8:30:39 - 8:30:49	86.7	8:35:39 - 8:35:49	86.4	8:40:39 - 8:40:49	88.6
8:30:49 - 8:30:59	86.8	8:35:49 - 8:35:59	86.4	8:40:49 - 8:40:59	88.9
8:30:59 - 8:31:09	86.7	8:35:59 - 8:36:09	86.2	8:40:59 - 8:41:09	89.3
8:31:09 - 8:31:19	86.7	8:36:09 - 8:36:19	86.3	8:41:09 - 8:41:19	89.3
8:31:19 - 8:31:29	86.9	8:36:19 - 8:36:29	86.4	8:41:19 - 8:41:29	89.5
8:31:29 - 8:31:39	87.0	8:36:29 - 8:36:39	86.4	8:41:29 - 8:41:39	89.4
8:31:39 - 8:31:49	87.0	8:36:39 - 8:36:49	86.2	8:41:39 - 8:41:49	89.6
8:31:49 - 8:31:59	87.0	8:36:49 - 8:36:59	86.2	8:41:49 - 8:41:59	89.6
8:31:59 - 8:32:09	87.1	8:36:59 - 8:37:09	86.3	8:41:59 - 8:42:09	89.7
8:32:09 - 8:32:19	87.1	8:37:09 - 8:37:19	86.5	8:42:09 - 8:42:19	89.8
8:32:19 - 8:32:29	87.1	8:37:19 - 8:37:29	86.5	8:42:19 - 8:42:29	89.8
8:32:29 - 8:32:39	87.3	8:37:29 - 8:37:39	86.2	8:42:29 - 8:42:39	89.1
8:32:39 - 8:32:49	87.3	8:37:39 - 8:37:49	85.9	8:42:39 - 8:42:49	89.8
8:32:49 - 8:32:59	87.4	8:37:49 - 8:37:59	85.7	8:42:49 - 8:42:59	89.1
8:32:59 - 8:33:09	87.5	8:37:59 - 8:38:09	85.9	8:42:59 - 8:43:09	89.7
8:33:09 - 8:33:19	87.5	8:38:09 - 8:38:19	85.8	8:43:09 - 8:43:19	89.6
Guaranteed Value*		95	dB(A)		



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

Issued date : February 8, 2018

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Tel. 085-020-0134
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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
8:43:19 - 8:43:29	90.1	8:48:19 - 8:48:29	90.8	8:53:19 - 8:53:29	90.9
8:43:29 - 8:43:39	90.4	8:48:29 - 8:48:39	90.7	8:53:29 - 8:53:39	90.7
8:43:39 - 8:43:49	90.8	8:48:39 - 8:48:49	90.8	8:53:39 - 8:53:49	91.0
8:43:49 - 8:43:59	91.0	8:48:49 - 8:48:59	90.7	8:53:49 - 8:53:59	90.6
8:43:59 - 8:44:09	91.1	8:48:59 - 8:49:09	90.7	8:53:59 - 8:54:09	90.8
8:44:09 - 8:44:19	91.1	8:49:09 - 8:49:19	90.8	8:54:09 - 8:54:19	90.9
8:44:19 - 8:44:29	91.1	8:49:19 - 8:49:29	90.9	8:54:19 - 8:54:29	90.6
8:44:29 - 8:44:39	91.0	8:49:29 - 8:49:39	90.7	8:54:29 - 8:54:39	91.0
8:44:39 - 8:44:49	91.3	8:49:39 - 8:49:49	90.9	8:54:39 - 8:54:49	90.8
8:44:49 - 8:44:59	91.0	8:49:49 - 8:49:59	90.7	8:54:49 - 8:54:59	90.7
8:44:59 - 8:45:09	91.1	8:49:59 - 8:50:09	90.8	8:54:59 - 8:55:09	91.1
8:45:09 - 8:45:19	91.2	8:50:09 - 8:50:19	90.9	8:55:09 - 8:55:19	90.7
8:45:19 - 8:45:29	91.1	8:50:19 - 8:50:29	90.6	8:55:19 - 8:55:29	90.9
8:45:29 - 8:45:39	91.3	8:50:29 - 8:50:39	90.9	8:55:29 - 8:55:39	91.1
8:45:39 - 8:45:49	91.1	8:50:39 - 8:50:49	90.7	8:55:39 - 8:55:49	90.7
8:45:49 - 8:45:59	91.4	8:50:49 - 8:50:59	90.9	8:55:49 - 8:55:59	91.0
8:45:59 - 8:46:09	91.1	8:50:59 - 8:51:09	90.7	8:55:59 - 8:56:09	90.7
8:46:09 - 8:46:19	91.0	8:51:09 - 8:51:19	91.1	8:56:09 - 8:56:19	91.0
8:46:19 - 8:46:29	91.1	8:51:19 - 8:51:29	90.9	8:56:19 - 8:56:29	90.9
8:46:29 - 8:46:39	91.1	8:51:29 - 8:51:39	91.1	8:56:29 - 8:56:39	90.7
8:46:39 - 8:46:49	91.1	8:51:39 - 8:51:49	90.9	8:56:39 - 8:56:49	91.0
8:46:49 - 8:46:59	91.0	8:51:49 - 8:51:59	91.0	8:56:49 - 8:56:59	90.6
8:46:59 - 8:47:09	90.9	8:51:59 - 8:52:09	90.8	8:56:59 - 8:57:09	90.8
8:47:09 - 8:47:19	91.2	8:52:09 - 8:52:19	91.0	8:57:09 - 8:57:19	90.9
8:47:19 - 8:47:29	90.9	8:52:19 - 8:52:29	90.7	8:57:19 - 8:57:29	90.5
8:47:29 - 8:47:39	91.1	8:52:29 - 8:52:39	90.9	8:57:29 - 8:57:39	91.0
8:47:39 - 8:47:49	90.8	8:52:39 - 8:52:49	90.8	8:57:39 - 8:57:49	90.9
8:47:49 - 8:47:59	90.9	8:52:49 - 8:52:59	90.9	8:57:49 - 8:57:59	90.8
8:47:59 - 8:48:09	90.7	8:52:59 - 8:53:09	90.7	8:57:59 - 8:58:09	91.2
8:48:09 - 8:48:19	90.8	8:53:09 - 8:53:19	90.9	8:58:09 - 8:58:19	90.8
Guaranteed Value*		95	dB(A)		

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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
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)					



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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



Thepman Yommana
(Thepman Yommana)
Technical Manager

TY/SS/AS/CJ

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Analysis Report

SAMPLE DESIGNATED AS : Noise Level MEASUREMENT DATE : February 7, 2018
MEASUREMENT LOCATION : HRS12 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
9:46:05	78.5	9:51:05	78.5	9:56:05	78.7
9:46:15	78.7	9:51:15	78.7	9:56:15	78.8
9:46:25	78.7	9:51:25	78.5	9:56:25	78.8
9:46:35	78.8	9:51:35	78.5	9:56:35	78.4
9:46:45	78.7	9:51:45	78.6	9:56:45	78.5
9:46:55	78.6	9:51:55	78.6	9:56:55	78.7
9:47:05	78.4	9:52:05	78.7	9:57:05	78.8
9:47:15	78.6	9:52:15	78.6	9:57:15	78.8
9:47:25	78.7	9:52:25	78.4	9:57:25	78.8
9:47:35	78.7	9:52:35	78.3	9:57:35	78.9
9:47:45	78.7	9:52:45	78.5	9:57:45	78.8
9:47:55	78.8	9:52:55	78.5	9:57:55	78.7
9:48:05	78.6	9:53:05	78.5	9:58:05	78.7
9:48:15	78.6	9:53:15	78.5	9:58:15	78.8
9:48:25	78.6	9:53:25	78.5	9:58:25	79.0
9:48:35	78.5	9:53:35	78.6	9:58:35	78.9
9:48:45	78.7	9:53:45	78.6	9:58:45	78.9
9:48:55	78.7	9:53:55	78.5	9:58:55	79.0
9:49:05	78.8	9:54:05	78.5	9:59:05	79.1
9:49:15	79.0	9:54:15	78.6	9:59:15	79.0
9:49:25	78.6	9:54:25	78.6	9:59:25	79.1
9:49:35	78.5	9:54:35	78.7	9:59:35	79.3
9:49:45	78.4	9:54:45	78.7	9:59:45	79.4
9:49:55	78.4	9:54:55	78.8	9:59:55	79.3
9:50:05	78.4	9:55:05	78.7	10:00:05	79.1
9:50:15	78.6	9:55:15	78.4	10:00:15	79.0
9:50:25	78.6	9:55:25	78.4	10:00:25	78.9
9:50:35	78.6	9:55:35	78.4	10:00:35	78.9
9:50:45	78.7	9:55:45	78.5	10:00:45	78.8
9:50:55	78.5	9:55:55	78.6	10:00:55	78.8
				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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Analysis Report

SAMPLE DESIGNATED AS : Noise Level MEASUREMENT DATE : February 7, 2018
MEASUREMENT LOCATION : HRS12 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
10:01:05	78.9	10:06:05	84.8	10:11:05	87.7
10:01:15	79.1	10:06:15	83.1	10:11:15	85.2
10:01:25	79.1	10:06:25	85.6	10:11:25	87.8
10:01:35	79.1	10:06:35	85.6	10:11:35	88.1
10:01:45	78.9	10:06:45	85.8	10:11:45	87.9
10:01:55	77.7	10:06:55	84.7	10:11:55	88.1
10:02:05	77.8	10:07:05	84.5	10:12:05	87.4
10:02:15	78.1	10:07:15	85.2	10:12:15	86.9
10:02:25	78.5	10:07:25	86.2	10:12:25	88.2
10:02:35	79.3	10:07:35	85.5	10:12:35	88.1
10:02:45	80.2	10:07:45	84.8	10:12:45	88.4
10:02:55	80.4	10:07:55	84.1	10:12:55	88.8
10:03:05	80.8	10:08:05	83.6	10:13:05	88.9
10:03:15	81.2	10:08:15	85.9	10:13:15	88.7
10:03:25	81.3	10:08:25	86.4	10:13:25	86.9
10:03:35	81.5	10:08:35	85.7	10:13:35	88.4
10:03:45	79.9	10:08:45	87.1	10:13:45	87.3
10:03:55	78.8	10:08:55	87.2	10:13:55	86.7
10:04:05	80.0	10:09:05	85.9	10:14:05	87.0
10:04:15	81.0	10:09:15	86.8	10:14:15	89.1
10:04:25	81.4	10:09:25	87.5	10:14:25	88.8
10:04:35	82.2	10:09:35	87.7	10:14:35	86.4
10:04:45	82.7	10:09:45	88.0	10:14:45	89.2
10:04:55	82.2	10:09:55	88.0	10:14:55	88.8
10:05:05	82.9	10:10:05	87.7	10:15:05	89.5
10:05:15	82.7	10:10:15	87.6	10:15:15	88.8
10:05:25	85.2	10:10:25	87.7	10:15:25	87.7
10:05:35	85.5	10:10:35	87.9	10:15:35	88.0
10:05:45	84.7	10:10:45	87.9	10:15:45	88.2
10:05:55	84.5	10:10:55	86.2	10:15:55	88.3
Guaranteed Value*		95	dB(A)		

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Shenzhen SGS Auto

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E 165734

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Shenzhen SGS Auto



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

Issued date : February 8, 2018

CLIENT : TOYO ENGINEERING CORPORATION
CONTACT : Mr. Osamu Yamasaki
ADDRESS : 1126/2 Vanit 2 Building 11th Floor, New Petchburi Road, Makkasan,
 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 : HRS12 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
10:16:05 - 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

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 : HRS12 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
10:31:05 - 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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SGS (Thailand) Limited

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

Issued date : February 8, 2018

CLIENT : TOYO ENGINEERING CORPORATION
CONTACT : Mr. Osamu Yamasaki
ADDRESS : 1126/2 Vanit 2 Building 11th Floor, New Petchburi Road, Makkasan, 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 : 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

CLIENT : TOYO ENGINEERING CORPORATION
CONTACT : Mr. Osamu Yamasaki
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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

E 165723

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

Issued date : February 7, 2018

CLIENT : TOYO ENGINEERING CORPORATION
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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

E 165724



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

Issued date : February 7, 2018

CLIENT : TOYO ENGINEERING CORPORATION
CONTACT : Mr. Osamu Yamasaki
ADDRESS : 1126/2 Vanit 2 Building 11th Floor, New Petchburi Road, Makkasan, Rajchathewi, Bangkok 10400
 Tel. 085-020-0134 Email : osamu.yamasaki@toyo-eng.com

Analysis Report

SAMPLE DESIGNATED AS : Noise Level
MEASUREMENT LOCATION : HRS612 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

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

Analysis Report

SAMPLE DESIGNATED AS : Noise Level
MEASUREMENT LOCATION : HRS612 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
Tel. 085-020-0134

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 Srihomee

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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E 165722

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Model Form SGT 01/04

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	
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 ₁	12.946 cm ²
9 Outlet Diameter	出口の径	do	150 mm
10 Outlet Area	出口面積	A ₂	176.714 cm ²
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 _G	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 ₀	7.38001 MPaA
22 Ratio Volume at Throat from (3)	のど部の比容積 (3)式より	V ₁	0.0352 m ³ /kg
23 Pressure at Outlet from (4)	出口圧力 (4)式より	P ₂	0.3 MPaA
24 Ratio Volume at Outlet from (5)	出口部比容積 (5)式より	V ₂	0.4563 m ³ /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 ₁	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 ²
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 ₁	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																																																																																																																									
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<table border="1"> <tr> <td>1 Item No.</td> <td>アイテム番号</td> <td></td> <td></td> </tr> <tr> <td>2 Tag No.</td> <td>弁番号</td> <td></td> <td>11/12LBA10AA401</td> </tr> <tr> <td>3 Fukui Use 1</td> <td>福井 使用欄 1</td> <td></td> <td>15L-032A-C/0</td> </tr> <tr> <td>4 Fukui Use 2</td> <td>福井 使用欄 2</td> <td></td> <td>20150 2251,2258,2265-1-2</td> </tr> <tr> <td>5 FUKUI Style</td> <td>型式番号</td> <td></td> <td>SL651-C2-M2(T)</td> </tr> <tr> <td>6 Size</td> <td>サイズ</td> <td></td> <td>2*H*3</td> </tr> <tr> <td>7 Throat Diameter</td> <td>のど部の径</td> <td>dt</td> <td>26.6 mm</td> </tr> <tr> <td>8 Orifice Area</td> <td>吹出し面積</td> <td>A₁</td> <td>5.557 cm²</td> </tr> <tr> <td>9 Outlet Diameter</td> <td>出口の径</td> <td>do</td> <td>80 mm</td> </tr> <tr> <td>10 Outlet Area</td> <td>出口面積</td> <td>A₂</td> <td>50.265 cm²</td> </tr> <tr> <td>11 Fluid</td> <td>流体名</td> <td></td> <td>STEAM</td> </tr> <tr> <td>12 Mol. Wt.</td> <td>分子量</td> <td>M</td> <td>18</td> </tr> <tr> <td>13 Specific Heat Ratio</td> <td>比熱比</td> <td>k</td> <td>1.28</td> </tr> <tr> <td>14 Relieving Temp.</td> <td>吹出温度</td> <td>T</td> <td>472 °C</td> </tr> <tr> <td></td> <td></td> <td></td> <td>745 K</td> </tr> <tr> <td>15 Set Pressure</td> <td>設定圧力</td> <td>Ps</td> <td>67.55 barG</td> </tr> <tr> <td></td> <td></td> <td></td> <td>6.755 MPaG</td> </tr> <tr> <td>16 Allowable Over Press.</td> <td>許容超過圧力</td> <td>Ac</td> <td>3 %</td> </tr> <tr> <td>17 Atmos. Press.</td> <td>大気圧</td> <td>Pa</td> <td>0.101 MPaA</td> </tr> <tr> <td>18 Gas Constant</td> <td>ガス定数</td> <td>R</td> <td>8.314 J / (mol·K)</td> </tr> <tr> <td>19 Relieving Pressure from (2)</td> <td>吹出し量決定圧力 (2)式より</td> <td>P₀</td> <td>7.05865 MPaA</td> </tr> <tr> <td>20 Ratio Volume at Throat from (3)</td> <td>のど部の比容積 (3)式より</td> <td>V₁</td> <td>0.04875 m³/kg</td> </tr> <tr> <td>21 Pressure at Outlet from (4)</td> <td>出口圧力 (4)式より</td> <td>P₂</td> <td>0.4287 MPaA</td> </tr> <tr> <td>22 Ratio Volume at Outlet from (5)</td> <td>出口部比容積 (5)式より</td> <td>V₂</td> <td>0.4349 m³/kg</td> </tr> <tr> <td>23 Speed at Throat from (6)</td> <td>のど部流体速度 (6)式より</td> <td>U</td> <td>664 m/s</td> </tr> <tr> <td>24 Power Level at Valve from (1)</td> <td>音響出力*1 (1)式より</td> <td>PWL₁</td> <td>145 dB</td> </tr> <tr> <td>25 Center Frequency from (7)</td> <td>中心周波数 (7)式より</td> <td>f</td> <td>1660 Hz</td> </tr> <tr> <td>26 Surface Density</td> <td>二次側配管材の面密度 *2</td> <td>m</td> <td>43.2 kg/m²</td> </tr> <tr> <td>27 Power Level from Table (A)</td> <td>音響出力 (A)表より</td> <td>PWL</td> <td>144 dBA</td> </tr> <tr> <td>28 Sound Pressure Level from (9)</td> <td>音圧レベル (9)式より</td> <td>SPL</td> <td>137 dBA</td> </tr> </table>				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	7 Throat Diameter	のど部の径	dt	26.6 mm	8 Orifice Area	吹出し面積	A ₁	5.557 cm ²	9 Outlet Diameter	出口の径	do	80 mm	10 Outlet Area	出口面積	A ₂	50.265 cm ²	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				745 K	15 Set Pressure	設定圧力	Ps	67.55 barG				6.755 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 ₀	7.05865 MPaA	20 Ratio Volume at Throat from (3)	のど部の比容積 (3)式より	V ₁	0.04875 m ³ /kg	21 Pressure at Outlet from (4)	出口圧力 (4)式より	P ₂	0.4287 MPaA	22 Ratio Volume at Outlet from (5)	出口部比容積 (5)式より	V ₂	0.4349 m ³ /kg	23 Speed at Throat from (6)	のど部流体速度 (6)式より	U	664 m/s	24 Power Level at Valve from (1)	音響出力*1 (1)式より	PWL ₁	145 dB	25 Center Frequency from (7)	中心周波数 (7)式より	f	1660 Hz	26 Surface Density	二次側配管材の面密度 *2	m	43.2 kg/m ²	27 Power Level from Table (A)	音響出力 (A)表より	PWL	144 dBA	28 Sound Pressure Level from (9)	音圧レベル (9)式より	SPL	137 dBA
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9 Outlet Diameter	出口の径	do	80 mm																																																																																																																								
10 Outlet Area	出口面積	A ₂	50.265 cm ²																																																																																																																								
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																																																																																																																								
			745 K																																																																																																																								
15 Set Pressure	設定圧力	Ps	67.55 barG																																																																																																																								
			6.755 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 ₀	7.05865 MPaA																																																																																																																								
20 Ratio Volume at Throat from (3)	のど部の比容積 (3)式より	V ₁	0.04875 m ³ /kg																																																																																																																								
21 Pressure at Outlet from (4)	出口圧力 (4)式より	P ₂	0.4287 MPaA																																																																																																																								
22 Ratio Volume at Outlet from (5)	出口部比容積 (5)式より	V ₂	0.4349 m ³ /kg																																																																																																																								
23 Speed at Throat from (6)	のど部流体速度 (6)式より	U	664 m/s																																																																																																																								
24 Power Level at Valve from (1)	音響出力*1 (1)式より	PWL ₁	145 dB																																																																																																																								
25 Center Frequency from (7)	中心周波数 (7)式より	f	1660 Hz																																																																																																																								
26 Surface Density	二次側配管材の面密度 *2	m	43.2 kg/m ²																																																																																																																								
27 Power Level from Table (A)	音響出力 (A)表より	PWL	144 dBA																																																																																																																								
28 Sound Pressure Level from (9)	音圧レベル (9)式より	SPL	137 dBA																																																																																																																								

| $$PWL_1 = 20 \log \frac{dt}{1000} - 10 \log v_1 + 80 \log U - 53 \quad (1)$$ $$P_0 = P_s \left(1 + \frac{Ac}{100} \right) + P_a \quad (2)$$ $$v_1 = \frac{RT}{1000 \times MP_0} \quad (3)$$ $$P_2 = \left(\frac{2}{k+1} \right)^{\frac{k}{k-1}} \frac{A_1}{A_2} P_0 \quad (4)$$ $$v_2 = \left(\frac{P_0}{P_2} \right)^{\frac{1}{k}} v_1 \quad (5)$$ $$SPL = PWL - 10 \log (2\pi r^2) \quad (9)$$ r = 1m (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。 | Octave band / オクターブバンド | Hz | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | OA | |--------------------------------|-----|-----|-----|-----|-----|------|------|------|------|-----| | PWL ₁ | dB | 134 | 135 | 135 | 136 | 136 | 137 | 136 | 135 | 145 | | A Weighting / A特性補正 | dB | -26 | -16 | -9 | -3 | 0 | 1 | 1 | -1 | - | | Transmission Loss / 透過損失 TL(8) | dB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | | 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																																																																																																																											
<table border="1"> <tr> <td>1 Item No.</td> <td>アイテム番号</td> <td></td> <td></td> </tr> <tr> <td>2 Tag No.</td> <td>弁番号</td> <td></td> <td>11/12HAD50AA401</td> </tr> <tr> <td>3 Fukui Use 1</td> <td>福井 使用欄 1</td> <td></td> <td>15L-032A-C/0</td> </tr> <tr> <td>4 Fukui Use 2</td> <td>福井 使用欄 2</td> <td></td> <td>20150 2253,2260,2267-1-2</td> </tr> <tr> <td>5 FUKUI Style</td> <td>型式番号</td> <td></td> <td>SL231(T)</td> </tr> <tr> <td>6 Size</td> <td>サイズ</td> <td></td> <td>4*P*6</td> </tr> <tr> <td>7 Throat Diameter</td> <td>のど部の径</td> <td>dt</td> <td>75.7 mm</td> </tr> <tr> <td>8 Orifice Area</td> <td>吹出し面積</td> <td>A₁</td> <td>45.007 cm²</td> </tr> <tr> <td>9 Outlet Diameter</td> <td>出口の径</td> <td>do</td> <td>150 mm</td> </tr> <tr> <td>10 Outlet Area</td> <td>出口面積</td> <td>A₂</td> <td>176.714 cm²</td> </tr> <tr> <td>11 Fluid</td> <td>流体名</td> <td></td> <td>STEAM</td> </tr> <tr> <td>12 Mol. Wt.</td> <td>分子量</td> <td>M</td> <td>18</td> </tr> <tr> <td>13 Specific Heat Ratio</td> <td>比熱比</td> <td>k</td> <td>1.29</td> </tr> <tr> <td>14 Relieving Temp.</td> <td>吹出温度</td> <td>T</td> <td>177.8 °C</td> </tr> <tr> <td></td> <td></td> <td></td> <td>450.8 K</td> </tr> <tr> <td>15 Set Pressure</td> <td>設定圧力</td> <td>Ps</td> <td>8.27 barG</td> </tr> <tr> <td></td> <td></td> <td></td> <td>0.827 MPaG</td> </tr> <tr> <td>16 Allowable Over Press.</td> <td>許容超過圧力</td> <td>Ac</td> <td>3 %</td> </tr> <tr> <td>17 Atmos. Press.</td> <td>大気圧</td> <td>Pa</td> <td>0.101 MPaA</td> </tr> <tr> <td>18 Gas Constant</td> <td>ガス定数</td> <td>R</td> <td>8.314 J / (mol·K)</td> </tr> <tr> <td>19 Relieving Pressure from (2)</td> <td>吹出し量決定圧力 (2)式より</td> <td>P₀</td> <td>0.95281 MPaA</td> </tr> <tr> <td>20 Ratio Volume at Throat from (3)</td> <td>のど部の比容積 (3)式より</td> <td>V₁</td> <td>0.21853 m³/kg</td> </tr> <tr> <td>21 Pressure at Outlet from (4)</td> <td>出口圧力 (4)式より</td> <td>P₂</td> <td>0.1329 MPaA</td> </tr> <tr> <td>22 Ratio Volume at Outlet from (5)</td> <td>出口部比容積 (5)式より</td> <td>V₂</td> <td>1.0062 m³/kg</td> </tr> <tr> <td>23 Speed at Throat from (6)</td> <td>のど部流体速度 (6)式より</td> <td>U</td> <td>518 m/s</td> </tr> <tr> <td>24 Power Level at Valve from (1)</td> <td>音響出力*1 (1)式より</td> <td>PWL₁</td> <td>142 dB</td> </tr> <tr> <td>25 Center Frequency from (7)</td> <td>中心周波数 (7)式より</td> <td>f</td> <td>691 Hz</td> </tr> <tr> <td>26 Surface Density</td> <td>二次側配管材の面密度 *2</td> <td>m</td> <td>55.7 kg/m²</td> </tr> <tr> <td>27 Power Level from Table (A)</td> <td>音響出力 (A)表より</td> <td>PWL</td> <td>140 dBA</td> </tr> <tr> <td>28 Sound Pressure Level from (9)</td> <td>音圧レベル (9)式より</td> <td>SPL</td> <td>133 dBA</td> </tr> </table>				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	7 Throat Diameter	のど部の径	dt	75.7 mm	8 Orifice Area	吹出し面積	A ₁	45.007 cm ²	9 Outlet Diameter	出口の径	do	150 mm	10 Outlet Area	出口面積	A ₂	176.714 cm ²	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				450.8 K	15 Set Pressure	設定圧力	Ps	8.27 barG				0.827 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 ₀	0.95281 MPaA	20 Ratio Volume at Throat from (3)	のど部の比容積 (3)式より	V ₁	0.21853 m ³ /kg	21 Pressure at Outlet from (4)	出口圧力 (4)式より	P ₂	0.1329 MPaA	22 Ratio Volume at Outlet from (5)	出口部比容積 (5)式より	V ₂	1.0062 m ³ /kg	23 Speed at Throat from (6)	のど部流体速度 (6)式より	U	518 m/s	24 Power Level at Valve from (1)	音響出力*1 (1)式より	PWL ₁	142 dB	25 Center Frequency from (7)	中心周波数 (7)式より	f	691 Hz	26 Surface Density	二次側配管材の面密度 *2	m	55.7 kg/m ²	27 Power Level from Table (A)	音響出力 (A)表より	PWL	140 dBA	28 Sound Pressure Level from (9)	音圧レベル (9)式より	SPL	133 dBA
1 Item No.	アイテム番号																																																																																																																										
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| $$PWL_1 = 20 \log \frac{dt}{1000} - 10 \log v_1 + 80 \log U - 53 \quad (1)$$ $$P_0 = P_s \left(1 + \frac{Ac}{100} \right) + P_a \quad (2)$$ $$v_1 = \frac{RT}{1000 \times MP_0} \quad (3)$$ $$P_2 = \left(\frac{2}{k+1} \right)^{\frac{k}{k-1}} \frac{A_1}{A_2} P_0 \quad (4)$$ $$v_2 = \left(\frac{P_0}{P_2} \right)^{\frac{1}{k}} v_1 \quad (5)$$ $$SPL = PWL - 10 \log (2\pi r^2) \quad (9)$$ r = 1m (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。 | Octave band / オクターブバンド | Hz | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | OA | |--------------------------------|-----|-----|-----|-----|-----|------|------|------|------|-----| | PWL ₁ | dB | 133 | 134 | 134 | 135 | 134 | 133 | 131 | 130 | 142 | | A Weighting / A特性補正 | dB | -26 | -16 | -9 | -3 | 0 | 1 | 1 | -1 | - | | Transmission Loss / 透過損失 TL(8) | dB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | | PWL | dBA | 107 | 118 | 125 | 132 | 134 | 134 | 132 | 129 | 140 | | | | |

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

株式会社 福井製作所



ATA-FO-6 044-rev0

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."



Attachment 3

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

PSV set	GNC					Noise correction curve equation
	Test date	Test Pmax	None			
			Measured dBA	Corrected dBA		
harg	yyyy/mm/dd	harg				
HPRS11				Criteria ≤ 90 dBA		
HP drum	70.67	60.0	90.0	90.9	$90.9 = 5.92583E+00(nv) + 6.97769E+01$	
HP S-H	67.55	60.0	90.0	90.5	$90.5 = 4.30671E+00(nv) + 7.68143E+01$	
LP drum	6.27	7.0	90.0	90.8	$90.8 = 4.87262E+00(nv) + 8.46530E+01$	
LP S-H	7.4	6.0	90.0	90.7	$90.7 = 3.65038E+00(nv) + 8.76884E+01$	
HPRS12						
HP drum	70.67	60.0	90.0	90.9	$90.9 = 5.92583E+00(nv) + 6.97769E+01$	
HP S-H	67.55	60.0	90.0	90.5	$90.5 = 4.30671E+00(nv) + 7.68143E+01$	
LP drum	6.27	7.0	90.0	90.8	$90.8 = 4.87262E+00(nv) + 8.46530E+01$	
LP S-H	7.4	6.0	90.0	90.7	$90.7 = 3.65038E+00(nv) + 8.76884E+01$	

By Fukui
Original message from Fukui (Japanese)
1) 中心周波数及びTABLE Bより各周波数に対する補正値を求める。
2) 80barの場合、中心周波数761HzのPをP1としP1の補正値になります。
3) $10 \times \log(10^{(P1/10)} + 10^{(P2/10)} + 10^{(P3/10)} + 10^{(P4/10)} + 10^{(P5/10)} + 10^{(P6/10)} + 10^{(P7/10)} + 10^{(P8/10)} + \dots)$ (1式)
4) (1式)がPWLと同等になるように各周波数でのPを求める。P1からP8は各周波数でのPWL(下表参照)
5) 80barの場合、中心は1000Hzとなる(1000Hzで補正値)のでP5を算出したPWL1を初期値として144, 143, 142...と1づつ減らしていく
(1式)が最もPWL1に近い値となるP5を決定していきます。P5以外のPはP1+P5+P1で求めます。例P1=P5+P1
6) $PWL1+A$ weighting+Transmission lossより各周波数でのPWLを求めます。
7) (1式)のPに各周波数でのPWLを代入することによってPWLが求まります。

English translation
1) Calculate center frequency per equation 7 on the PSV noise calculation sheet and obtain A weighting correction from the table B below
2) In case P=80bar, center frequency is 761 Hz. Therefore use A weighting correction for 770Hz(=761Hz) as per table B
3) $10 \times \log(10^{(P1/10)} + 10^{(P2/10)} + 10^{(P3/10)} + 10^{(P4/10)} + 10^{(P5/10)} + 10^{(P6/10)} + 10^{(P7/10)} + 10^{(P8/10)} + \dots)$ (Equation 1)
4) Determine all of P1 to be overall PWL1 per equation 1 above and overall PWL1 per PSV noise calculation sheet is equal.
5) In case P=80bar, center frequency is 1000Hz. Therefore A weighting correction at PS is zero. The other P1 can be automatically calculated from the above table B.
Adjust figure of P5 manually in order for overall PWL1 per noise calculation sheet equals to PWL1 per above equation 1.
6) Obtain PWL = PWL1+A weighting+Transmission loss
7) By entering PWL for each frequency in the above equation 1, Overall PWL (after corrections)

TABLE B													
Center Frequency					63	125	250	500	1000	2000	4000	8000	
63	P				80	0	-1.2	-2.4	-3.8	-4.8	-6	-7.2	-8.4
80	P				180	-0.6	0	-1.2	-2.4	-3.8	-4.8	-6	-7.2
100	P				355	-1.2	-0.6	0	-1.2	-2.4	-3.8	-4.8	-6
125	P				710	-1.8	-1.2	-0.6	0	-1.2	-2.4	-3.8	-4.8
160	P				1400	-2.4	-1.8	-1.2	-0.6	0	-1.2	-2.4	-3.8
200	P				2800	-3	-2.4	-1.8	-1.2	-0.6	0	-1.2	-2.4
250	P				5600	-3.6	-3	-2.4	-1.8	-1.2	-0.6	0	-1.2
315	P				11200	-4.2	-3.6	-3	-2.4	-1.8	-1.2	-0.6	0
					F1	F2	F3	F4	F5	F6	F7	F8	
Octave band Hz					63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	

HRSG PSV Silencer Noise Test

Name		HP SHV PSV						
Tag		11/12/BA10DA001						
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 diameter	in	5.557	5.557	5.557	5.557	5.557	5.557	
Orifice area	sq in	30	30	30	30	30	30	
Outlet area	cm ²	50.265	50.265	50.265	50.265	50.265	50.265	
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 factor	in	473	473	473	473	473	473	
Relieving factor	deg C	745	745	745	745	745	745	
Set pressure	kg	87.55	89	81	97	94	90	
Set pressure	MPa(g)	6.755	6.5	6.1	5.7	5.4	5	
Allowable over press.	kg			3				
Allowable over press.	%			3				
Pressure, Press	kg	0.101	0.101	0.101	0.101	0.101	0.101	
Gas constant	R	8.314	8.314	8.314	8.314	8.314	8.314	
Relieving pressure from (2)	MPa	0.05856	0.75600	0.38400	0.97200	0.56300	0.51100	
Ratio volume at throat from (1)	m ³ /kg	0.04372	0.050634	0.05392	0.05760	0.060764	0.065332	
Pressure at outlet from (4)	MPa	0.4827	0.4128	0.3877	0.3627	0.3459	0.3310	
Speed at outlet from (3)	kg	0.4349	0.4213	0.4089	0.5141	0.5423	0.5846	
Speed at throat from (1)	kg	663.7	663.7	663.7	663.7	663.7	663.7	
Center Frequency from (7)	Hz	1659	1659	1659	1659	1659	1659	
Power level at PSV from (1)	dB	144.9	144.7	144.4	144.1	143.9	143.6	
Power level from table (A)	dB	143.4	143.7	143.7	142.6	142.4	142.1	
Sound pressure level from (B)	dB	155.4	135.2	134.9	134.8	134.4	134.6	
Δ SPL (Design - Case)	dB	0	-20	-30	-40	-40	-130	
At Silencer								
Design = 95dBA	dB	95	94.80	94.50	94.20	94.00	93.70	
Other case = 95dBA - Δ SPL	dB							

Table A

Parameter	67.95 barg	100 barg	150 barg	200 barg	300 barg	400 barg	600 barg	800 barg	1000 barg
Octave band	Hz	63	125	250	500	1000	2000	4000	8000 (A)
PWL1	dB	134.3406	134.9406	135.5406	136.1406	136.7406	137.3406	136.1406	134.9406
A weighting	dB	-26	-18	-9	-3	0	1	1	-1
Transmission loss	dB	0	0	0	0	0	0	0	0
PWL	dB(A)	108.3406	116.9406	126.5406	133.1406	136.7406	138.3406	137.1406	133.9406

Pair	65 barg									
	Hz	63	125	250	500	1000	2000	4000	8000	DOA
Octave band										
PWL	dB	134.1406	134.7406	135.3406	135.9406	136.5406	<u>137.1406</u>	135.9408	134.7406	144.7
A weighting	dB	-26	-10	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	108.1406	118.7406	126.3406	132.9406	136.5406	138.1406	136.9408	133.7406	143.2

Pipe	El. burg									
Octaves band	Hz	63	125	250	500	1000	2000	4000	8000	10A
PWL1	dB	133.8406	134.4400	135.0406	135.6400	136.2406	136.8400	135.0400	134.4400	144.4
A weighting	dB	-26	-18	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dB(A)	107.8406	116.4400	126.0406	132.6400	136.2406	137.8400	136.0400	133.4400	143.9

Pwr		57 erg											
Octave band	Hz	(3)	125	250	500	1000	2000	4000	8000	OA			
PWL-1	dB	133.5406	134.1406	134.7406	135.3406	135.9406	136.5406	135.3406	134.1406	144.1			
A weighting	dB	-2.6	+18	-9	-3	0	1	1	-1				
Transmission loss	dB	0	0	0	0	0	0	0	0				
PWL	dBA	107.5406	118.1406	125.7406	132.3406	135.9406	137.5406	136.3406	133.1406	142.6			

Par	54 bag									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	JA
PWL1	dB	133.3406	133.9406	134.5406	135.1406	135.7406	136.3406	136.9406	133.9406	143.9
A weighting	dB	-26	-19	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	107.3406	117.9406	125.5406	132.1406	135.7406	137.3406	136.9406	132.9406	142.4

Port	50 bag									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	16000
PWL1	dB	133.040	123.640	134.240	134.840	135.440	136.040	134.840	133.640	143.6
A weighting	dB	-28	-16	-3	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	107.040	117.640	125.240	131.840	135.440	137.040	135.840	132.640	142.1

Attachment 3

HRSG PSV Silencer Noise Test

LP drum PSV								
Tag		1112N4-0800AA001						
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	A1 sqm	45.007	45.007	45.007	45.007	45.007	45.007	
Outlet diameter	mm	156	156	156	156	156	156	
Outlet area	A2 sqm	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	
Design pressure	P deg.C	177.4	174.0	171.0	167.3	164.4	160.8	
Relieving temp.	T K	405.0	446.955	443.959	440.8262	437.449	433.8303	
Set pressure	P barg	0.227	7.7	7.1	6.5	5.9	5.3	
Set pressure	P MPaG	0.0217	0.771	0.71	0.65	0.59	0.53	
Alleviate over press.	Ac N		3	3	3	3	3	
Alleviate Press.	P barg	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 MPaG	0.052010	0.094100	0.032300	0.707650	0.708700	0.648000	
Ratio volume at throat (3)	V1 m3/kg	0.23532	0.23091	0.24398	0.24261	0.285103	0.309756	
Pressure at outlet from (4)	P2 MPa	0.11259	0.1247	0.1161	0.1074	0.0988	0.0988	
Ratio vol. at outlet from (5)	V2 m3/kg	1.0684	1.0534	1.1347	1.2169	1.2129	1.2129	
Speed at throat (6)	U m/s	519.3	516.1	514.3	512.5	510.5	508.4	
Critical frequency from (7)	F Hz	691	688	686	683	681	678	
Power level at PSV from (1)	PW1 dB	141.1	141.3	140.9	140.5	140.0	139.5	
Power level from table (A)	PWL dB	136.1	136.1	136.2	137.8	137.8	138.8	
Sound pressure level from (8)	SPL dBA	131.2	130.2	130.7	129.9	129.0	128.0	
Δ SPL (Design - Case)	dBA	0	-0.40	-0.40	-1.30	-1.70	-2.20	
At Silencer								
Other case = 95dBA	- Δ SPL							
PWL	dBA	86	84.80	84.10	83.80	83.30	82.80	

Table A

Pipe	8.27 barg									
Octave band	fz	63	125	250	500	1000	2000	4000	8000	1A
PWL1	dB	132.526	133.1826	133.7826	134.3826	133.1826	131.9826	130.7826	129.5826	141.7
A weighting	dB	-24	-16	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	106.526	117.1826	124.7826	131.3826	133.1826	132.9826	131.7826	128.5826	139.0

Port	7.7 barg									
Octave band	Hz	83	125	250	500	1000	2000	4000	8000	1/A
PWL1	dB	132.1826	132.7826	133.3826	133.9826	132.7826	131.5826	130.3826	129.1826	141.3
A weighting	dB	-29	-16	-8	-2	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	106.1826	116.7826	124.3826	130.9826	132.7826	132.5826	131.3826	128.1826	136.6

Pos	7.1 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	131.7626	132.3626	132.9626	133.5626	132.3826	131.1826	129.9826	128.7826	140.9
A weighting	dB	-26	-16	-8	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dB(A)	105.7626	116.3626	123.9626	130.5626	132	132.1826	130.9626	127.7826	136.2

Pwr	6.5 barg									
Octave band	Hz	63	125	250	500	1000	2000	4000	8000	OA
PWL1	dB	131.3626	131.8626	132.5626	<u>133.8626</u>	131.8626	130.7826	129.5826	128.3626	140.5
A weighting	dB	-26	-16	-8	-2	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	105.3626	115.8626	123.5626	130.8626	131.8626	131.7826	130.5826	127.3626	137.5

Pre	5.9 barg									
Octave band	Hz	83	125	250	500	1000	2000	4000	8000	OA
PWL 1	dB	130.6826	131.4826	132.0826	132.6826	131.4826	130.2826	129.0826	127.8826	140.0
A weighting		-26	-16	-9	-3	0	1	1	-1	
Transmission loss	dB	0	0	0	0	0	0	0	0	
PWL	dBA	104.6826	115.4826	123.0826	129.6826	131.4826	131.2826	130.0826	126.8826	137.3

Parameter	Hz	63	125	250	500	1000	2000	4000	8000	OA
Octave band PWL	dB	130.3626	130.9826	131.5826	132.1826	130.9826	129.7826	128.5826	127.3826	139.5
A weighting		-26	-16	-9	-3	0	1	1	-1	
Transmission loss		0	0	0	0	0	0	0	0	
PWL	dBA	104.3626	114.9826	122.5826	129.1826	130.9826	130.7826	129.5826	126.3826	136.8

Attachment 3

Name
LPS/H PSV

HP drum PSV Silencer for GNC, GNRV1 and GNRV2 (LM6000 site)

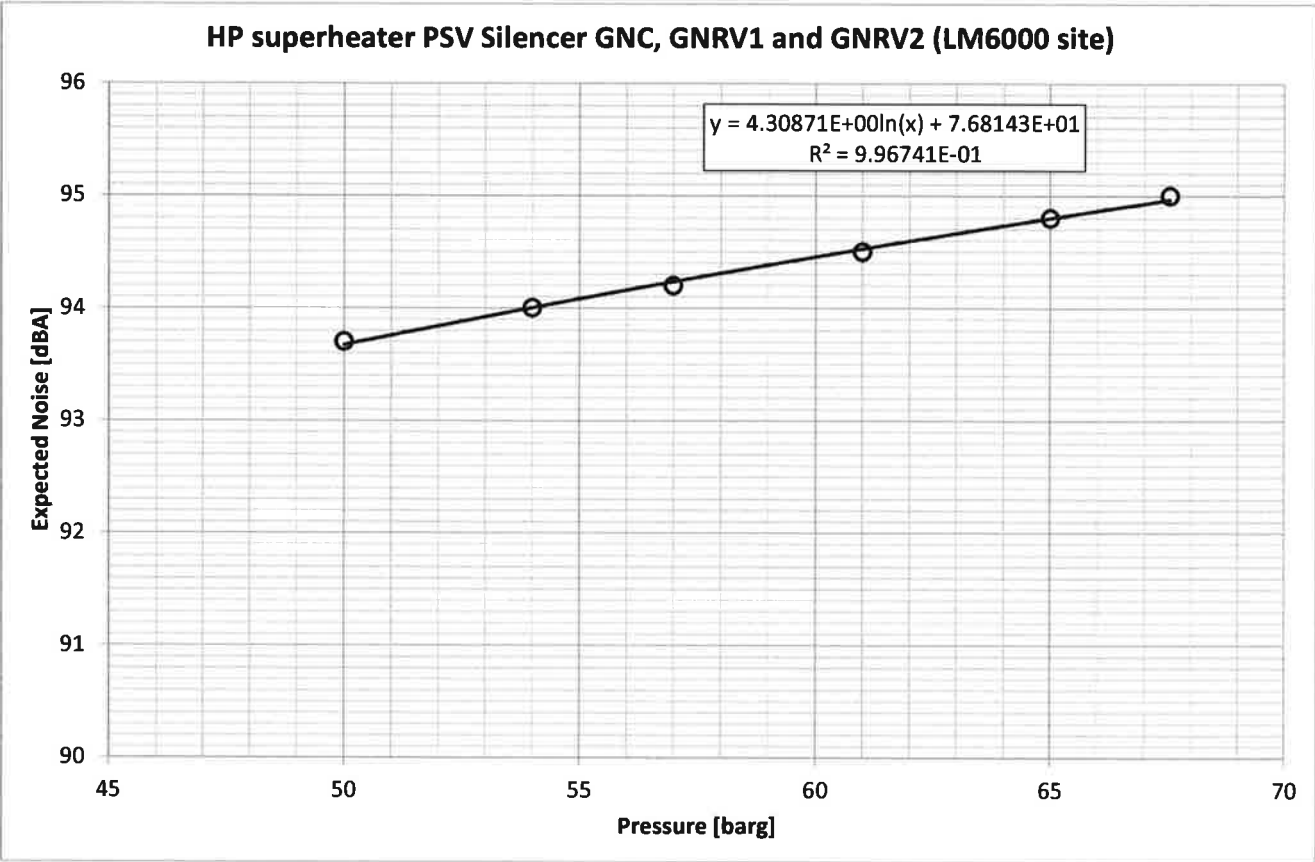
Expected Noise [dBA]

Pressure [barg]

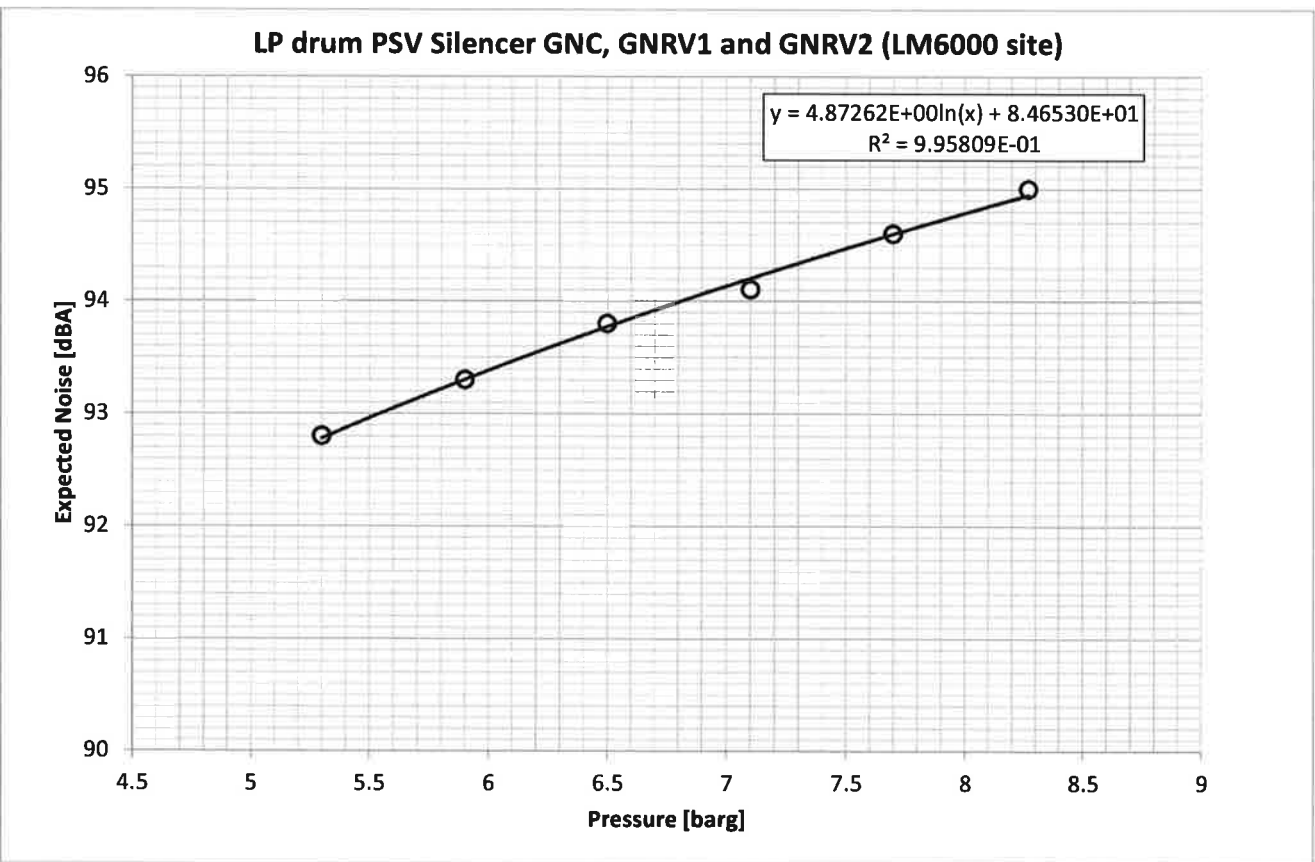
$y = 5.92583E+00 \ln(x) + 6.97769E+01$
 $R^2 = 9.98892E-01$

Expected Noise [dBA]	Pressure [barg]
94.8	51.5
95.2	52.5
95.5	54.5
95.8	56.5
96.2	58.5

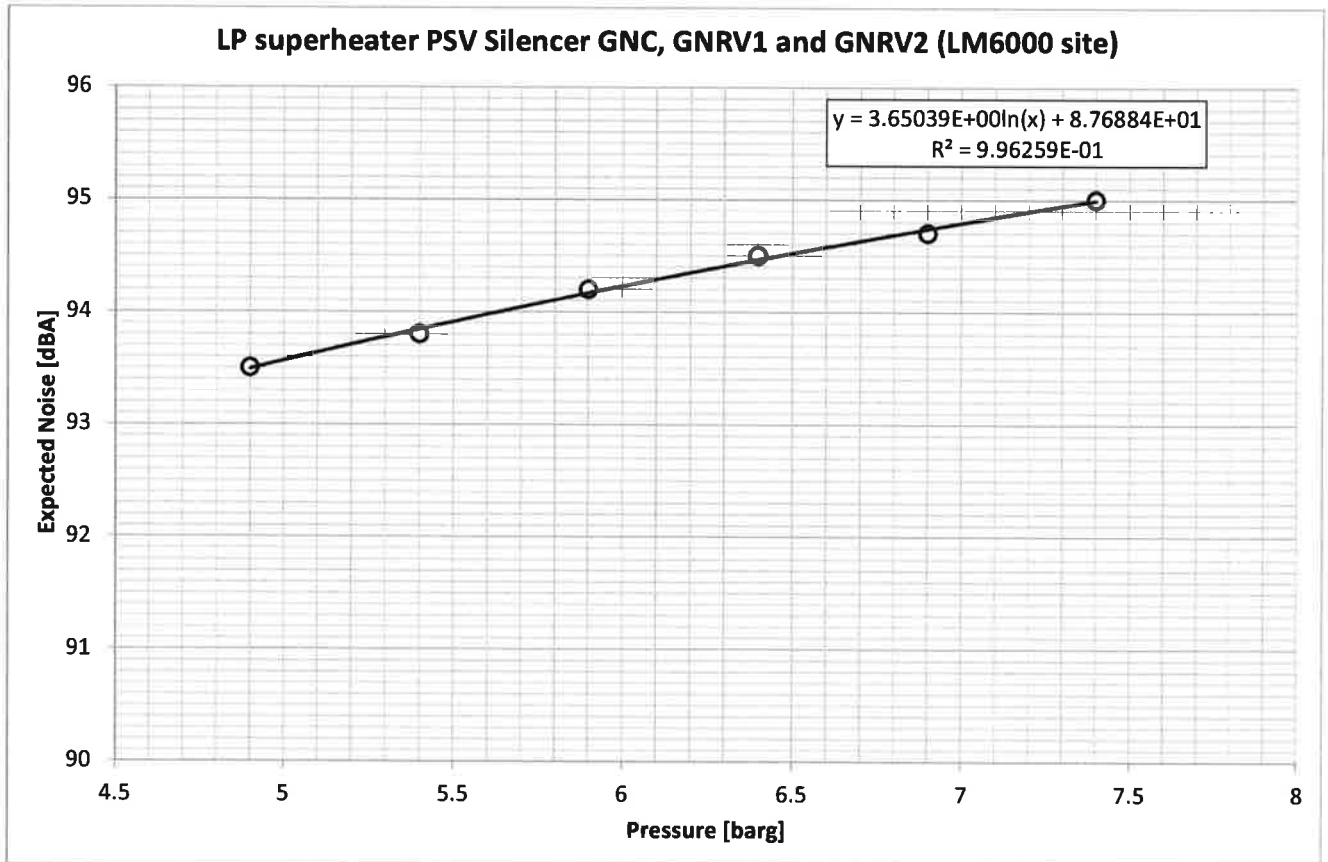
Attachment 3



Attachment 3



Attachment 3



ภาคผนวก ข-12

ผังแสดงชั้นระดับเสียง (Noise Contour)

