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*INERTANCE provides the engineering and field services specialized in noise & vibration sector towards customer as follows;*

- *Noise & Vibration Analysis*
- *Rotor Dynamics Analysis*
- *Pulsation Study*
- *Acoustic and Flow Induced Vibration*
- *Surge, Water Hammer Analysis*

## INTRODUCTION

INERTANCE was founded to provide the engineering and field services specialized in noise & vibration sector towards customers, which contribute to make the comfortable work and residential place.

INTERANCE has performed the sincere investigation to control the noise & vibration problem in environmental, building and industrial area. We have successfully designed and evaluated many kinds of subject in line with API, ISO, ASHRAE and any other international standards.

INERTANCE's capabilities for noise & vibration include as follows;

- |                           |  |
|---------------------------|--|
| 1) Noise study            | - Noise contour map<br>- Industrial & environmental noise assessment<br>- Noise control design and survey                              |
| 2) Mechanical vibration   | - Rotor dynamics analysis<br>- Lateral vibration anlysis<br>- Torsional vibration analysis<br>- Field balancing & vibration monitoring |
| 3) Vibration in pipe      | - Acoustic induced vibration<br>- Flow induced vibration<br>- Pulsation study for reciprocating equipment<br>- Surge analysis          |
| 4) HVAC noise & Vibration | - Duct silencer sizing for noise criteria<br>- Isolator design   |

Based on professional experience and talent, INERTANCE is ready to offer the best solutions with necessary arrangements. Please don't hesitate to contact us at '[admin@inertance.com](mailto:admin@inertance.com)' with your interest and inquiries.

Prepared by: Jini, Leem (PE, Noise & Vibration)

Signatures of Authorized Person

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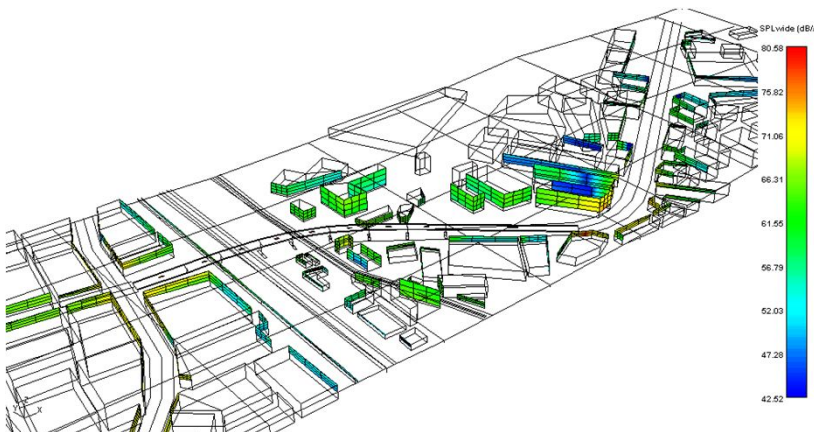
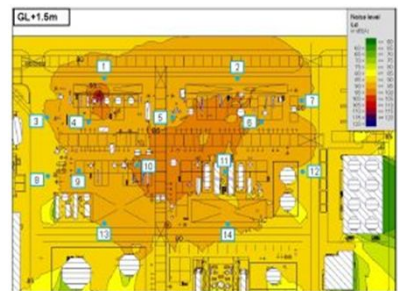
# NOISE STUDY

INERTANCE has performed the environmental and industrial noise assessment to be in line with applicable local noise limits against transportation and industrial noise around residential area.

Site & Road investigations are carried out to predict the estimated noise level during day & night time, which can be shown as noise contour map respectively, and it is determined if the noise contour measure as anti-noise facilities (ex. Barrier) should be designed. Noise contour map is used to understand the noise status propagated around interested area, which is often verified via noise verification survey.

Industrial noise assessment has considered the noise impact by plant facilities such as gas, petroleum, chemical, power plant, in which many kinds of noise sources have been applied. INERTANCE has predicted the noise levels by rotating equipment, piping system, valves based on our experience in the specialized field, and the same has been considered to the equipment arrangement via noise allocation study during initial design stage.

INERTANCE can design the powerful & compact noise control devices, which have been applied to various noise sources to keep the relevant noise limits. INERTANCE has a capability to perform the noise survey with valid measurements at any necessary locations. Ambient noise survey will be used as back ground data for noise contour map, and the noise verification survey will be performed after finalizing the noise allocation study.



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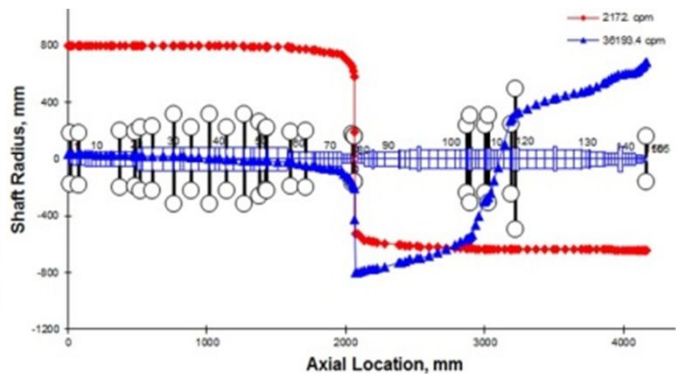
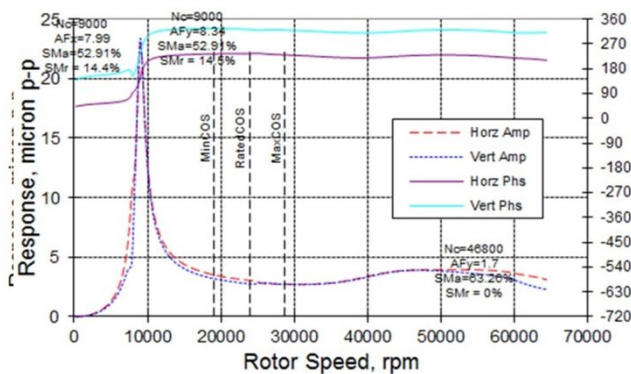
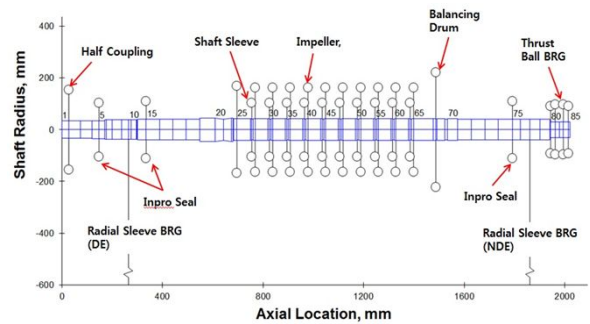
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# MECHANICAL VIBRATION

INERTANCE has performed the lateral vibration analysis (rotor dynamics analysis) with necessary design tools for turbo-machinery that includes centrifugal and axial compressors, centrifugal pumps, steam & gas turbines, motors, and gear applications. The rotor components including blades, impellers, etc have been modeled based on manufactured drawings, which can generate a mass-elastic lateral model of rotor assembly. In addition, the linearized coefficients are calculated for various bearing types with application of any seal type step by step. INERTANCE can provide various kinds of rotor dynamics analysis as requested in API standards.

Train torsional analysis has been carried out in order to ensure the mechanical reliability in rotating machinery. The analysis results provided by INERTANCE can be used to determine the location which has the torsional resonance relative to potential excitation. In case of any potential risks occurs, for example critical speeds are interfered within operating range, the stress analysis has to be performed to prevent the torsional fatigue failure. INERTANCE can provide various kinds of rotor dynamics analysis as requested in API standards as below.

INERTANCE provides the engineering services for field measurement for turbo-machinery to resolve the vibration issue as trouble shooting. As a result of vibration monitoring, the root cause analysis has been performed, and the relevant counter measures have been applied. In case the turbo-machinery has the vibration issue caused by unbalance, INERTANCE can perform the field balancing. In addition to that, INERTANCE has applied single and dual plane method, and also verified the balancing technic without phase measurement.



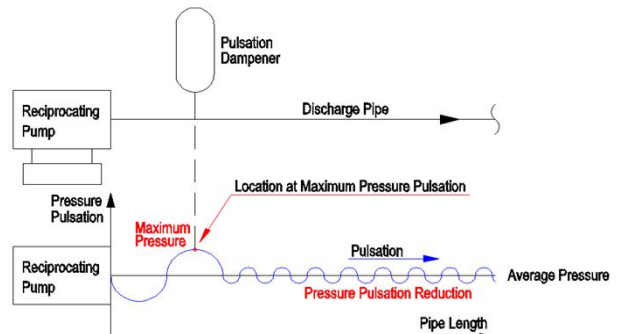
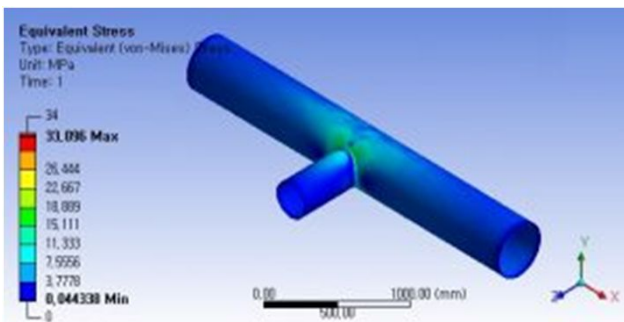
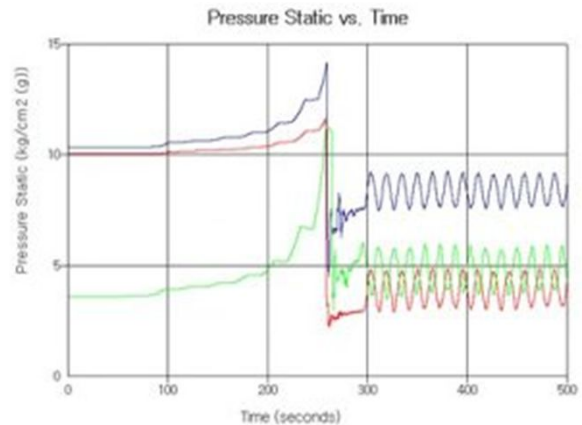
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## VIBRATION IN PIPE

INERTANCE has performed the acoustic induced vibration for piping system, and has provided the best solution in order to prevent the likelihood of fatigue failure caused by **acoustic induced vibration**. Pressure reducing system such as control valve and pressure safety valve in piping system is subject to rapidly decreasing pressure by flow restriction, which create the high velocity fluid, turbulent mixing and may cause the acoustic energy. The sound power levels are calculated as per process condition, and it is key parameters in problem concerning acoustically induced vibration.

INERTANCE has performed the **surge analysis** for long pipeline as well as network system with various process upset conditions. This analysis study has used a computer based mathematical model of the system to calculate the surge pressure of transient events. The surge phenomenon like water hammer describes a transient condition in piping systems caused when changing pressure or flow boundary condition, or changing operating condition of equipment such as pump and valve, etc. The surge pressure by transient condition is much higher than steady state, in which we should check if the piping design pressure is acceptable as per maximum allowable surge pressure.

The **pulsation study** for reciprocating compressor could be performed, and INERTANCE has a capability to perform Design approach as per API 618, 674 and 688. The objective to perform the pulsation study is to avoid problems with vibration, performance, reliability, and flow measuring error caused by acoustical interaction between the compressor and the relevant piping system.



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# HVAC NOISE & VIBRATION

HVAC equipment is the major sources of noise in building, and its effects on the speech interference & noise environment in each room have to be considered properly. INERTANCE has estimated the noise effects from HVAC equipment and designed the relevant control devices as per noise & room criteria. Airborne noise is passed through duct line of air supply/return system, and the sizing of duct silencer is the most important factor to determine the grade of noise & room criteria. INERTANCE has considered the transmission paths of noise and specification of air handling units in order to calculate the noise level in each room, and the silencer dimension has been calculated with proper air velocity as per room types.

The vibration is normally generated by HVAC equipment and fluid behavior inside of ducts and pipes, which is the major source of occupant complaints in modern buildings. INERTANCE can design the anti-vibration isolator in order to minimize the vibration transmissibility from HVAC system. HVAC equipments including ducts & piping system as well as rotating equipments should be mounted on suitable anti-vibration isolator, and they can reduce the vibration transmitted level to critical area. INERTANCE can design most effective isolator according to relevant guidelines.

