

**ASSIUT HYDROCRACKING COMPLEX (AHC)
ANOPC**

**ACOUSTIC INSULATION
FOR PIPES, VALVES AND FLANGES**

1

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1. SCOPE

Scope of the present document specification is to define the special requirements of acoustical insulation for pipes, valves and flanges with the aim of reducing the noise emitted by these items for Assiut Hydrocracking Complex (AHC).

The criteria under the scope of present document are applicable only to new units.

The present document should be read in conjunction with the following project specifications:

- 079254C-0000-JSD-6000-01: Plant Noise Control Specification
- 079254C-0000-JSD-6000-02: Equipment Noise Control Specification

2. DEFINITIONS

The following terms as used in this specification shall have the meanings denoted:

Noise:

Any unwanted sound which can produce, at least potentially, undesirable effects or reactions in humans.

Noise Level:

The sound level or sound pressure level of a sound which is categorized as noise.

Sound Pressure Level (SPL):

The sound pressure level is an indication of the loudness of a noise and it is the quantity measured by sound level meters. The sound pressure level is expressed in decibels (dB) and is defined as follows:

$$SPL = 20 * \log_{10} \frac{P}{P_0}$$

Where:

SPL = Sound Pressure Level (dB)

P₀ = Reference Sound Pressure, 2*10⁻⁵ N/m² (1 N/m² = 1 Pa)

P = Sound Pressure (N/m²)

Sound Power:

The sound power is a measure of the acoustic power, measured in watts and emitted by a source.

Sound Power Level (PWL):

The sound power level is expressed in decibels (dB) and is defined as follows:

$$PWL = 20 * \log_{10} \frac{W}{W_0}$$

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Where:

PWL = Sound Power Level (dB)

W_o = Reference Sound Power, 10^{-12} W

W = Sound Power (W)

Sound Level:

The sound pressure level when frequency-weighted according to the standardized A or C reference scales used in sound-level meters.

dB(A):

The sound level which is measured on the A-weighted scale of a sound-level meter. The A-weighted scale represents closely the sensibility of the human ear.

Band Level:

The sound pressure level in a particular frequency band, for example, the 500 Hz octave band level.

Octave Band:

A range of frequencies whose upper band limit frequency is nominally twice the lower band limit frequency. The following eight octave bands are usually adequate for plant noise study: 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz.

Narrow Band Noise:

When the noise from a source contains a pure tone or narrow band component which is a noticeable to ear as a noise of distinguishable pitch, and which represents a dominant feature of the total source noise, then the source noise shall be regarded as containing narrow band noise for the purpose of this specification.

Background Noise:

The noise without a particular source of emission.

Impulsive Noise:

When a noise contains significant irregularities, such as bang, clanks, or thumps, or if the noise is only existent momentarily and is of a character to attract attention, then it shall be considered as impulsive for the purpose of this specification.

Work Area:

The work area is defined as any position greater than 1 m from equipment surface (including piping systems) accessible to personnel, or any position where a person's ear may be exposed to noise, during normal work activities up to 8 h/day.

Restricted Area:

Restricted areas are those areas in the plant where it is not reasonably possible to reduce the noise level below the work area limit. In those areas, the presence of operators without hearing protection shall be maximum 2 h/day.

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3. MATERIALS

The following materials shall be used:

First Insulating Layer (internal)	Mineral wool with density of 80 kg/m ³ min. (Same mineral wool material used for hot insulation)
Impedance Layer (1st or 2nd where specified)	High density membrane (rubber filled) or equivalent material with density of 10 kg/m ³ min.
Other Insulating Layer (2nd or 3rd where specified)	Mineral wool with density of 80 kg/m ³ min. (Same mineral wool material used for hot insulation)
External Finishing	Aluminum sheeting as per hot thermal insulation

In general, specified material shall be endurable to the service temperature, do not deform as a result of absorbing moisture and shall not be corrosive against equipment and piping surface.

4. CLASSIFICATION OF ACOUSTICAL INSULATION

Two classes of acoustic insulation are defined and these are denoted as A and B.

Type A:

Three insulating layers (120 mm as total thickness), with a single impedance layer and an external finishing sheet shall be provided (as specified on Table 1, shown in the attachment A) for ensure the proper acoustical insulation for the lines connected with compressor's discharge. These type of acoustic insulation (heavy type) have to reduce the noise level generated from the compressor's discharge.

Type B:

Two insulating layers (80 mm as total thickness), with a single impedance layer and an external finishing sheet shall be provided (as specified in Table 1, shown in the attachment A) for ensure the proper acoustical insulation for lines connected with a compressor's suction, control valves with high noise level and upstream the silencers.

The dimension of the acoustic insulation for the two defined classes shall be as indicated in Table 1 (Attachment A), unless otherwise specified.

5. INSTALLATION CRITERIA

The insulating thickness, the characteristics and the extent of acoustical insulation are shown in the Table 1.

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- The total thickness of the first insulating layer shall be achieved with several (at least two) mattresses laid one upon the other. Each mattress shall have thickness between 10 mm and 50 mm.
- The various layers and mattresses shall be placed so that the junction lines will result staggered among them.
- The layer shall be compacted and fitted together by means of metallic ties situated at a reciprocal distance not greater than 250 mm.
- The insulation shall be completely extended to the valves, flanges and other piping components.
- The components requiring a periodic access shall be insulated with dismantling type elements.
- Insulating type for valves, flanges and piping components shall be the same insulation type of the relevant pipe line as shown in Table 1. Joints shall be sealed to prevent noise leakage.
- Demountable parts of acoustic insulation heavier than 25 kg shall have lifting lugs.
- The external sheet shall be overlapped of 25 mm at least and suitably sealed with the appropriated mastic,
- The impedance layer shall not be damaged or drilled during installation.
- The contact points between external sheet and piping components and/or frameworks, supports and equipment, shall be protected with resilient material gaskets suitable for temperature and environmental conditions.
- Where acoustical and hot insulation are specified, the first insulating layer shall be done by already provided hot insulation also if the material is different from mineral wool; where acoustical and cold insulation are specified, the acoustical one shall be overlapped to the cold one, with exclusion of external finishing that will be placed in the most external position.
- Where is not possible to install all the acoustic insulation thickness foreseen, the thickness of each acoustic insulation layers will be reduced up to 20 mm, but impedance layers must be always applied.

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ATTACHMENT 1
LINES AND EQUIPMENT LIST FOR ACOUSTICAL INSULATION



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TABLE 1. LINES AND EQUIPMENT LIST FOR ACOUSTICAL INSULATION

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