



May 26, 2020

Ruby Willmann
Relativity Space

Subject: Relativity Space Noise to Property Line
Acoustical Analysis

Dear Ruby,

Based on our review of provided equipment information and project site plans, as well as our recent phone conversations, we provide the following comments regarding noise transfer to the property line from the HPU and LN₂ tanks.

We anticipate that, without acoustical treatment, this equipment will produce noise levels exceeding the City of Long Beach Noise Ordinance limits, and recommendations for addressing these excesses with respect to HPU is provided in this report. Coordination regarding the acoustical measures required for the LN₂ tanks is still ongoing, but we anticipate that provision of screening walls, mufflers on the equipment, and/or operational control can practicably be implemented to achieve the project requirements.

1 CRITERIA

We understand that the project site is subject to the City of Long Beach Noise Ordinance and is located in Noise District 1. Therefore, noise transfer to neighboring property lines is limited as outlined below.

Time Period	Daytime limits (7am – 10pm)	Nighttime limits (10pm – 7am)
More than 30 cumulative* minutes in any hour	50 dBA	45 dBA
More than 15 cumulative* minutes in any hour	55 dBA	50 dBA
More than 5 cumulative* minutes in any hour	60 dBA	55 dBA
More than 1 minute in any hour	65 dBA	60 dBA
Any period of time	70 dBA	65 dBA

* “cumulative” is noted to include continuous or non-continuous periods of time

It is our understanding that the nearest neighboring property line is the southern property line, approximately 120 feet from the proposed equipment location.

2 EQUIPMENT INFORMATION

2.1 HPU

From the product vendor, we understand that the HPU produces sound pressure levels of 89 dBA at a distance of 7 feet from the equipment. We understand that this equipment will run for more than 30 minutes in any given hour but will not be operated during nighttime hours. Therefore, the City noise limit at the property line for this unit is 50 dBA.

2.2 LN₂ Tanks

Given that the manufacturer is not able to provide acoustical measurement data for this equipment, your team is working to measure similar installed equipment at another Relativity Space location. Upon completion and review of this testing, noise levels for this equipment will be documented under separate cover.

3 ACOUSTICAL RECOMMENDATIONS

3.1 HPU

Given the equipment noise level of 89 dBA at 7 feet, and the arrangement of nearby buildings, we anticipate that the noise level from the HPU in operation will be approximately 65 dBA at the southern property line. This means that an additional 15 dBA of attenuation will be required.

In order to achieve this level of attenuation, we recommend constructing a screening wall with acoustical absorption on the inner face of the wall. The acoustical requirements of this wall are as follows:

- Solid and continuous (i.e. no gaps at ground level, no louvers, etc.)
- Total mass of at least 4 lbs/ft².
- Extends at least 15' above the ground or 5' above the top of the HPU, whichever is greater.
- Provide acoustical door seals (similar to those shown in the attached Detail DR/1A) at any doors through the wall. Preferably, locate such doors on the north side of the enclosure.
- Provide acoustical absorption suitable for exterior applications on the interior faces of the wall. Specify this treatment with a minimum acoustical performance of NRC 0.75. One product that will achieve this performance is Pyrok Acoustement 40 (1-5/8" thickness).

3.2 LN₂ Tanks

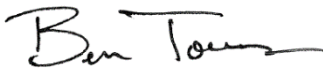
Given that these tanks will be located in the same area as the HPU, we assume that the recommended barrier wall will enclose these tanks as well, and we understand that the vents for these tanks are approximately 2' above ground level, so the barrier wall will provide considerable attenuation of the vent noise.

Additionally, we understand that mufflers are available for these vents, so if the barrier attenuation is not sufficient, mufflers will be provided.

If the combination of barrier attenuation and mufflers is not sufficient, we understand that operational control of the tanks can be implemented. We understand that the use of the vents can be altered to produce lower flow levels and consequently lower noise. If necessary, such operational control will be implemented to ensure that the remaining required noise level reductions are achieved to comply with the Noise Ordinance. As such, a practicable noise control strategy will be developed.

We trust that this is adequate for your current needs. Please do not hesitate to contact us if you have any further question.

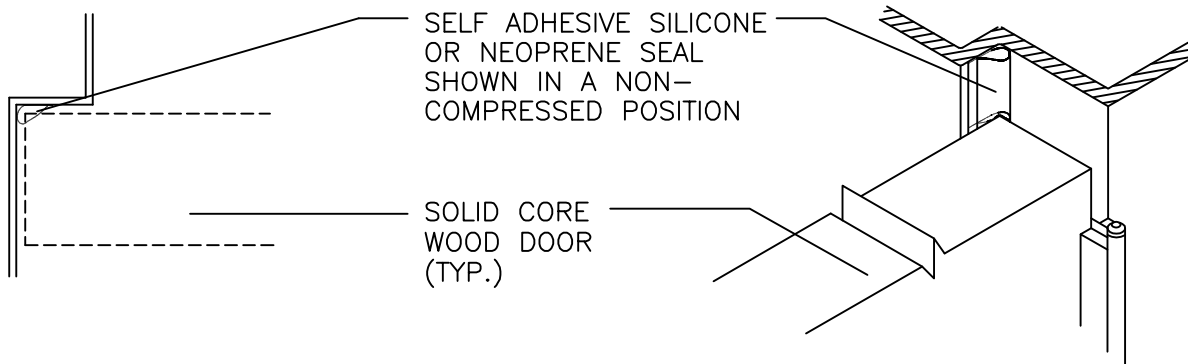
Yours Sincerely,
Newsom Brown Acoustics, LLC



Ben Toews
Consultant

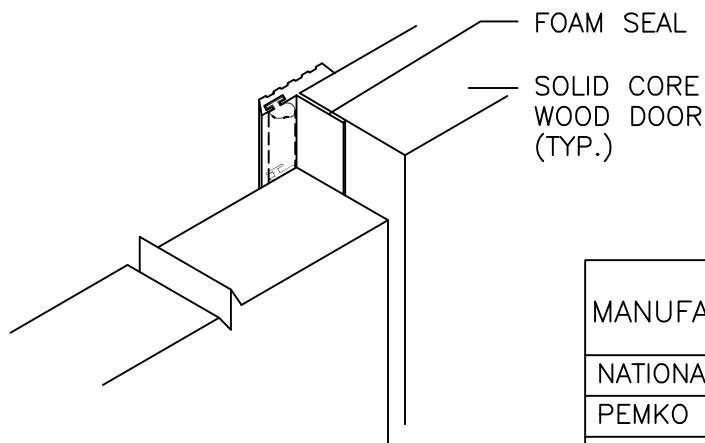


Martin Newsom
Principal



STRIKE JAMB

HINGE JAMB
(HEAD SIMILAR)



ASTRAGAL SEAL

MANUFACTURER	PERIMETER	ASTRAGAL*
NATIONAL GUARD		178
PEMKO	S 88	355CS
REESE	797	
ZERO		1840

* NO ACOUSTICAL TEST DATA FROM MANUFACTURER

NOTES:

1. INSTALL DOOR IN FRAME WITH 1/8" MAX. TOLERANCE @ HEAD, HINGE & STRIKE JAMB.
2. PERIMETER SEAL SHALL ALWAYS BE MIN. SEMI COMPRESSED WITH DOOR CLOSED.
3. IF TOLERANCE @ PERIMETER IS GREATER THAN 1/8" & DOOR CANNOT BE ADJUSTED, REPLACE WITH 1/2" SEAL INSTEAD OF 1/4" SEAL.



DOOR SEAL DETAILS

June 12, 2020

Ruby Willmann
Relativity Space

Subject: Relativity Space Noise to Property Line
Acoustical Analysis

Dear Ruby,

We understand that Relativity Space proposes to install new equipment at the facility at 3500 East Burnett Street in Long Beach, CA. The installed equipment will include an HPU and multiple LN₂ tanks.

Based on our review of provided equipment information and project site plans, as well as our recent phone conversations, we provide the following comments regarding noise transfer to the property line from the HPU and LN₂ tanks.

We anticipate that, without acoustical treatment, this equipment will produce noise levels exceeding the City of Long Beach Noise Ordinance limits, and recommendations for addressing these excesses with are provided in this report.

1 CRITERIA

We understand that the project site is subject to the City of Long Beach Noise Ordinance and is located in Noise District 1. Therefore, noise transfer to neighboring property lines is limited as outlined below.

Time Period	Daytime limits (7am – 10pm)	Nighttime limits (10pm – 7am)
More than 30 cumulative* minutes in any hour	50 dBA	45 dBA
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More than 1 minute in any hour	65 dBA	60 dBA
Any period of time	70 dBA	65 dBA

* “cumulative” is noted to include continuous or non-continuous periods of time

It is our understanding that the nearest neighboring property line is the southern property line, approximately 120 feet from the proposed equipment location.

2 EQUIPMENT INFORMATION

2.1 HPU

From the product vendor, we understand that the HPU produces sound pressure levels of 89 dBA at a distance of 7 feet from the equipment. We understand that this equipment will run for more than 30 minutes in any given hour but will not be operated during nighttime hours. Therefore, the City noise limit at the property line for this unit is 50 dBA.

2.2 LN₂ Tanks

It is our understanding that noise generated by the LN₂ tanks occurs when the units are expelling materials from a vent outlet. In-situ acoustical measurements of similar LN₂ tanks were performed at a Relativity Space facility in Mississippi. We understand that the equipment measured had the same venting pressure and a similar flow rate to the equipment proposed at the Long Beach site. Sound

measurements were collected with a factory-calibrated sound level meter at a distance of 25' from the vent. It was observed that noise levels were highest at the beginning of the process and then gradually decreased. The maximum measured noise level was approximately 102 dBA at a distance of 25'.

We understand that this venting process may last more than 30 minutes, but will not occur during nighttime hours. Therefore, the City noise limit at the property line for this unit is 50 dBA.

3 ACOUSTICAL RECOMMENDATIONS

3.1 HPU

Given the equipment noise level of 89 dBA at 7 feet, and the arrangement of nearby buildings, we anticipate that the noise level from the HPU in operation will be approximately 65 dBA at the southern property line. This means that an additional 15 dBA of attenuation will be required.

In order to achieve this level of attenuation, we recommend constructing a screening wall with acoustical absorption on the inner face of the wall. The acoustical requirements of this wall are as follows:

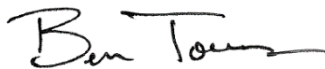
- Solid and continuous (i.e. no gaps at ground level, no louvers, etc.)
- Total mass of at least 4 lbs/ft².
- Extends at least 15' above the ground or 5' above the top of the HPU, whichever is greater.
- Provide acoustical door seals (similar to those shown in the attached Detail DR/1A) at any doors through the wall. Preferably, locate such doors on the north side of the enclosure.
- Provide acoustical absorption suitable for exterior applications on the interior faces of the wall. Specify this treatment with a minimum acoustical performance of NRC 0.75. One product that will achieve this performance is Pyrok Acoustement 40 (1-5/8" thickness).

3.2 LN₂ Tanks

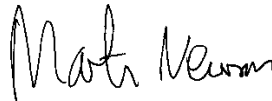
We have received a cutsheet for a muffler with a dynamic insertion loss sufficient to attenuate noise levels at the nearest property line to below 50 dBA. We understand that this muffler (or one with similar acoustical performance) will be specified for the LN₂ tanks. We expect that this solution will comply with the Noise Ordinance requirements at the nearest property line.

We trust that this is adequate for your current needs. Please do not hesitate to contact us if you have any further question.

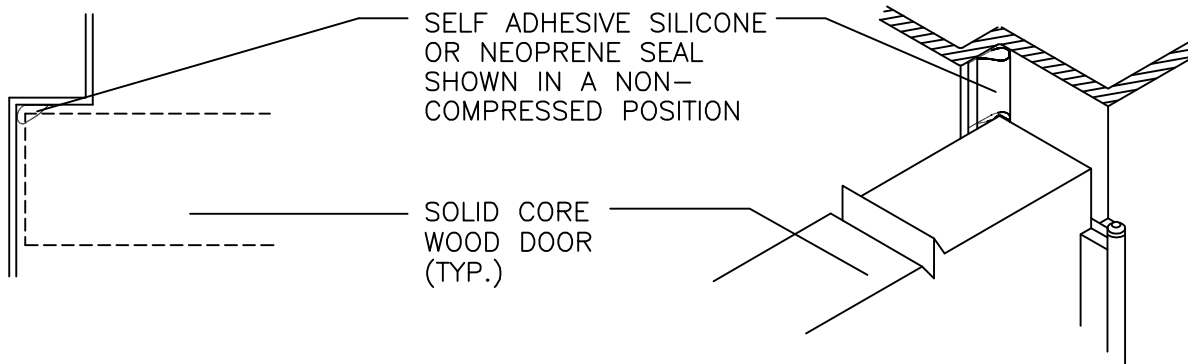
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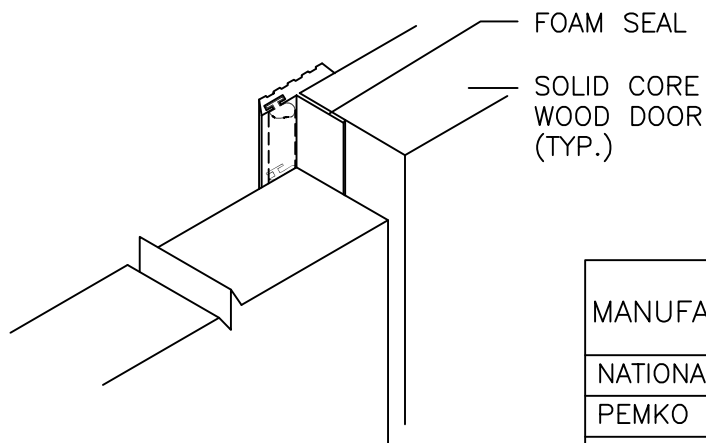


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DOOR SEAL DETAILS