

Acoustic Review Memorandum

To: Jennifer Wampler, Ewing Cole
From: Steve Volaric, SM&W
Date: April 1, 2021
Re: United Therapeutics Corp. Project 242T
8800 Cameron St. Silver Spring, MD 20910

Generator Progress Acoustic Review Summary

This memo provides a summary of our review of the recently provided, new generator information for the G3520 2000 kw unit(s), with the enclosure options and info (info received on March 23, 2021).

This information has been given in overall levels - estimated generator noise source at 112 dBA and enclosure acoustic performance in -25, -30, and -40 dBA increments.

To better predict future noise levels more detailed, octave band performance of both the generator noise and enclosure performance would need to be provided and reviewed. It is possible, even likely that this information is not available, at least with the specific generator model (and at operating conditions) with the enclosure.

Plus, hot gas discharge mufflers need to be designed and determined – type, number (more than one in series is likely needed).

However, despite the limitations of review of the overall dBA info, our review suggests that an enclosure in the -35 to -40 dBA range, along with appropriate hot gas discharge mufflers will be needed in effort to achieve the nighttime code limit of 55 dBA at the near property line. This includes the benefits and limitations of the presently considered sound barrier wall location per latest plans.

These types of enclosures are custom items, and as mentioned more detailed octave band info would need to be analyzed, including specific acoustic performance of the enclosure, mufflers, etc. In these situations we strongly recommend that a factory mockup test of the generator(s) and enclosure should be conducted to determine and confirm acoustic performance. This way any additional measures that may need to be added, revised, or upgraded compared to the construct of the standard enclosures can be made prior to installation.

In conclusion, the design will incorporate the above-listed systems, including the sound attenuated generator enclosure, hot gas discharge mufflers and acoustic screen walls, and continue to develop these strategies to meet the local noise ordinance.

This concludes our comments at this time. Should you have any questions or comments, kindly advise.

End of memo



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Acoustic Review Memorandum

To: Jennifer Wampler, Ewing Cole.
From: Steve Volaric, SM&W
Date: February 23, 2021
Re: United Therapeutics Corp. Project 242T
8800 Cameron St. Silver Spring, MD 20910

Rooftop Equipment Acoustic Review Summary

This memo presents a summary of comments and recommendations following review of equipment cutsheets and data for proposed rooftop equipment for the 242T lab building, including cooling towers, high plume exhaust fans, and rooftop air handling units.

Cooling Towers

A review of selection and sound data for the BAC Series 3000 XES3E-1222-12M model cooling towers indicates noise code compliance at the nearby residential property lines considering the acoustic screen wall indicated on progress documents. It is noted that the towers are selected with low noise type fans. In effort to maintain code compliance and also limit exceedance over current community noise levels (including at nearby mid-rise residential locations further from the site), the following is recommended:

- Specify the octave band sound pressure level data at 5 feet for the top, end, and inlet sides provided in the manufacturer's published data (see attached) to limit potentially "noisier" alternate selections.
- Maximize the height of the sound barrier screen wall surrounding the towers, which would ideally be approx. 2-3 feet taller than the height of the units, to help break line of sight to nearby residential buildings.

High Plume Exhaust Fans

A review of selection and sound data for the rooftop high plume exhaust fans – Greenheck Vektor MD-22 types – indicates that sound attenuation on both the fans' discharge sides and by-pass air plenums is required in effort to maintain community noise code limits. The sound data reveals strong "tonal" quality, which is typical of these types of high pressure/speed high plume lab fans. The following sound attenuation is thus recommended, which requires further coordination and review in the detailed design phase:

- Discharge Noise Control - Provide manufacturer's 'Inline Attenuating Silencer' and "Attenuating Wind Bands" for each fan (please refer to the attached excerpt from the manufacturer's brochure. Specific information, cutsheets, and sound data on these items were not noted on web and internal database searches but should be requested from the equipment vendor or manufacturer's representatives for additional acoustic review and confirmation of performance.
- By-Pass Air Noise Control – In addition to the above, sound attenuation is required on the units' by-pass air plenum openings to help limit fan noise emissions. It is recommended that 5' foot L medium velocity sound attenuators (Vibro-Acoustics RFL-MV types or similar; see attached) be provided at the by-pass openings, sized and selected for as minimal pressure drops as possible (max. 0.15" +/- range). Transitions/plenum and sizing to be coordinated. Note that providing standard baffle type sound attenuators is recommended in this application over acoustic louvers due to pressure drop issues typ. associated with AC louvers (which can be upwards of 0.5" or higher).



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Air handling and Energy Recovery Units

A review of selection and sound data for the rooftop air handing – Nortek Air Solutions Temtrol / AHU 3713 indicates a strong tonal quality in the sound data due to the high speed fan array type unit (see data excerpt below with “spike” in the data at 250 Hz).

Openings - Condition 1				Octave Band Freq. Sound Power (db re: 10E-12 watts)									
Tag	Title	Cabinet Liner	Area	63	125	250	500	1k	2k	4k	8k	LwA	Lw
A	SA Opening	Solid	13.8 ft ²	89	82	91	79	77	75	72	62	85	94
B	OSA Opening	Solid	3.1 ft ²	69	67	88	73	70	70	70	68	82	89
C	RA Opening	Solid	11.2 ft ²	74	72	94	79	76	76	76	74	88	94
<i>Casing Radiated</i>				78	72	79	59	56	55	54	51	72	82
<i>Floor Radiated</i>				72	66	72	43	38	35	35	35	64	76

1. Fan data accuracy as per AMCA 311 (63Hz +6 dB, remaining bands +3 dB with an additional 3 dB available in any one band). Model predictive accuracy is ±6 dB. Fan and modeling accuracy is based on ideal flow patterns and design conditions. Projected fan and system sound levels are provided for comparison purposes only, actual levels may vary.

2. Sound power projections are not valid for opening velocities over 1,500 ft/min.

3. Sound power projections are not valid with VFD motor control carrier frequencies of less than 8KHz.

To help maintain noise code limits and limit the tone of the unit to the outdoors the following is recommended:

- Provide 5-ft long standard baffle type sound attenuators (per attached and as recommended above for EF by-pass air emissions) to help limit noise thru the O/A intake path. Attenuators can potentially be provided in unit (although would grow the length of unit), of in rooftop ductwork/plenum arrangement. Film lined alternatives may need to be considered for reasons other than acoustics. To be coordinated.
- Provide any available manufacturer’s upgraded casing construction options to upgrade the construction and help limit the transmission of the tonal fan noise thru the casing. Options to be reviewed and recommended to be considered.

For the ERU, sound data was not provided in the equipment cutsheet, but similar treatment to the exhaust and O/A openings as described above (5 +/- foot long standard baffle types selected for minimum pressure drops) is anticipated to be necessary due to the fan types and relatively high speed selections. Information to be provided for review.

It is recommended that the noise control approaches presented herein be added to appropriate drawing notes, schedules, specs sections to clearly indicate these items, which require further coordination and “final” selection in the detailed design phase.

This concludes our comments at this time. Should you have any questions or comments, kindly advise.

End of memo



Baltimore Aircoil Company
Cooling Tower Selection Report

Version: 8.11.0 NA
 Product data correct as of: October 15, 2020

Project Name: UT HALPERT 242T
 Selection Name: CT-1, -2, -3
 Project State/Province:
 Project Country: United States
 Date: October 23, 2020

Model Information

Product Line: Series 3000
 Model: XES3E-1222-12M
 Number of Units: 3
 Fan Type: Low Sound Fan
 Fan Motor: (1) 20.00 = 20.00 HP/Unit

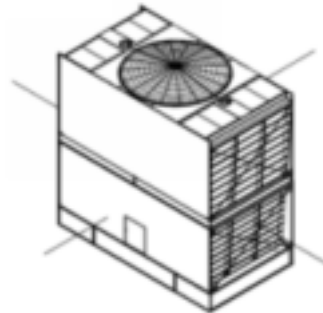
IBC 2018 Code Compliance: No
 California OSHPD Project: No
 Special Seismic Certification: No
 Intake Option: None
 Internal Option: None
 Discharge Option: None

Total Standard Fan Power: Full Speed, 20.00 BHP/Unit

Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

Top Sound Pressure (dB)		
Octave Band	Distance	
	5 ft.	50 ft.
1	80	70
2	80	71
3	79	70
4	76	64
5	73	60
6	67	55
7	63	51
8	61	48
A-wgtd	78	67

Air Inlet Sound Pressure (dB)		
Octave Band	Distance	
	5 ft.	50 ft.
1	79	67
2	80	66
3	79	68
4	73	65
5	67	60
6	61	52
7	58	49
8	54	45
A-wgtd	75	66



End Sound Pressure (dB)		
Octave Band	Distance	
	5 ft.	50 ft.
1	74	69
2	74	63
3	72	65
4	65	59
5	61	55
6	54	47
7	47	41
8	45	37
A-wgtd	68	61

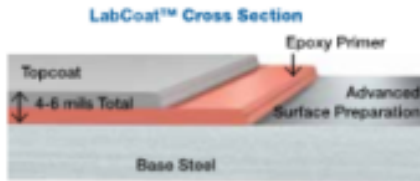
End Sound Pressure (dB)		
Octave Band	Distance	
	5 ft.	50 ft.
1	74	69
2	74	63
3	72	65
4	65	59
5	61	55
6	54	47
7	47	41
8	45	37
A-wgtd	68	61

Total Sound Power (dB)		
Octave Band	Center Frequency (Hertz)	Lw
1	63	103
2	125	103
3	250	102
4	500	97
5	1000	93
6	2000	87
7	4000	83
8	8000	80
A-wgtd		99

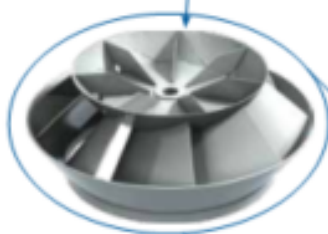
Air Inlet Sound Pressure (dB)		
Octave Band	Distance	
	5 ft.	50 ft.
1	79	67
2	80	66
3	79	68
4	73	65
5	67	60
6	61	52
7	58	49
8	54	45
A-wgtd	75	66

Note: The use of frequency inverters (variable frequency drives) can increase sound levels.
Extra Notes: Sound data provided by CTI ATC-128 sound test code revision 2019

LabCoat™ corrosion resistant coating – Electrostatically powder coated with corrosion resistant Hi-Pro™ Polyester topcoat with an epoxy primer, protects against a wide spectrum of acids, alkalis and solvents.



Back pressure blades – Additional blades on the back of the impeller create a vacuum, preventing contaminated exhaust from escaping through the shaft opening into the fan housing.



Mixed flow impeller – Specially configured blades move air with lower energy consumption and reduced sound generation. Available with AMCA Spark C or B construction.



Direct Drive – Arrangement 2 with motor service and removal without any contact of contaminated airstream. Includes 200,000-hour bearings as standard.

Bypass damper – Opposed airfoil blade dampers provide for full airflow control throughout the damper's operating range. Dampers are sized specifically for volumes and pressures required on the application providing superior system control. Heavy-duty construction up to 15 in. wg (3,736 Pa). Factory provided and mounting available.

Options and Accessories



Inline Attenuating Silencer



Attenuating Windband

Attenuating options – Reduce total sound levels without loss of discharge velocity. Tested as an assembly with fan housing.



Sure-Aire™ airflow monitoring – Without invasive probes, provides airflow measurement accuracy within 3%.

Stack extension – For projects that require additional discharge height or effective plume height.



Fan monitoring – Designed to allow facilities and maintenance the ability to stay connected with their critical ventilation products. The fan monitoring system package includes a preprogrammed monitor along with a wide selection of commonly applied sensors.



- Reduces unexpected downtime
- Assists with planned maintenance
- Monitors process and critical fan components
- Communicates with building automation systems

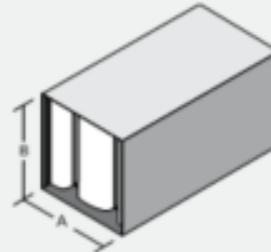
CERTIFIED PERFORMANCE DATA

RFL-MV-F1

Rectangular Film Lined
Medium velocity silencer
(<1250 fpm)

How to Specify Example:

32 X 21 RFL-MV-F1 X 60



Insertion Loss (IL)

+ : "forward flow" where noise & airflow move in same direction (e.g. supply side)

- : "reverse flow" where noise & airflow move in opposite directions (e.g. return side)

See [Silencer Selection Instructions](#). DL above 50dB may be limited due to noise flanking around the silencer or along the duct walls. If more than 50dB DL is required, contact your local Vibro-Acoustics Representative or call 1-800-565-8401.

Length (in.)	Face Velocity (ft. per min)	Octave Band - Hz/Dynamic Insertion Loss (dB)							
		63	125	250	500	1000	2000	4000	8000
36	- 1250	4	7	14	17	16	15	15	9
	0	3	6	13	16	15	16	14	9
	+ 1250	3	5	12	16	15	16	14	8
60	- 1250	7	10	20	21	24	25	16	10
	0	6	9	20	20	23	24	17	10
	+ 1250	5	8	18	19	23	24	17	9
84	- 1250	10	14	27	25	32	34	18	10
	0	8	12	26	24	31	32	19	11
	+ 1250	8	11	25	23	31	33	20	10
108	- 1250	12	17	35	32	49	42	21	12
	0	11	15	33	30	39	38	22	12
	+ 1250	10	14	31	29	40	40	23	12

Pressure Drop (PD)

Pressure drops are reported in accordance with ASTM E477 methods and are based upon ideal flow conditions (5 diameters of straight duct on silencer inlet and 10 on outlet). Less than ideal conditions will result in an increase in pressure drop due to System Effects. See [Silencer System Effects Data](#).

Length (in.)	Face Velocity (ft. per min) / Pressure Drop (in.w.g.)						
	500	750	1000	1250	1500	1750	2000
36	0.03	0.07	0.13	0.21	0.30	0.40	0.53
60	0.04	0.10	0.18	0.28	0.40	0.54	0.70
84	0.06	0.12	0.22	0.34	0.50	0.67	0.88
108	0.07	0.15	0.26	0.41	0.59	0.81	1.06

Acceptable (D < 0.35") Caution (>0.35") Pressure Drop may be too high for certain applications

Cross Section Sizes*

- "A" dimension (in.)
- 15-16
- 29-32
- 58-64
- 87-96
- 116-128
- 145-160
- 174-192
- 203-224
- 232-240

"B" dimension ANY SIZE

Approx. weight 6.0 lbs/cu.ft.

See [Rectangular Silencer Cross-Section Dimensions](#) to ensure selection matches ductwork dimensions.

Generated Noise (GN)

@ 5 sq.ft. face area

Length (in.)	Face Velocity (ft. per min)	Octave Band - Hz/Generated Noise (dB re 10 ⁻¹² watts)							
		63	125	250	500	1K	2K	4K	8K
All	- 1250	54	51	50	50	50	51	42	31
	- 750	52	41	39	37	39	33	22	24
	+ 750	52	38	36	33	32	29	21	24
	+ 1250	56	51	47	45	45	47	39	30

GN correction chart at right must be used to correct GN to other face areas. →

Face Area (sq.ft.)	2.5	5	10	20	40	80
dB	-3	0	+3	+6	+9	+12