

Sound Level Tests

Noise level tests were performed at the 10 Burleigh Road location on Friday, December 4, 2015 and on Monday, December 7, 2015 at the request of the Vassalboro Planning Board. The device used was a Extech Digital Sound Level Meter, model #407730, that is factory calibrated and accompanied by a Certificate of Compliance.

A truck was parked in a designated space, outside of the building, on the west side, directly behind the front of the building that faces Route 201 and Burleigh road. With the refrigeration unit running to simulate normal activity, decibel readings were taken at different spots on the property and also on the abutters property located south of the facility on the opposite side of the street at Lot # 4, Map # 5 with the permission of Linda Frazier, one of the owners of the property who also attended the planning Board Meeting on December 1, 2015. Linda also witnessed some of the readings on her property. Readings were taken at 10:40 am on Friday, the 4th and at 4:15 am on Monday the 7th of December at approximately 4' off the ground as recommended, and in the Town ordinance. Where the readings are taken, the trucks location, and the time are documented.

The unit was set on "continuous" run in "road" speed for the worst case scenario. If parked outside they will be set on "city" speed and put in "Auto Start/Stop" mode



The World's Sixth Sense™

Certificate of Compliance

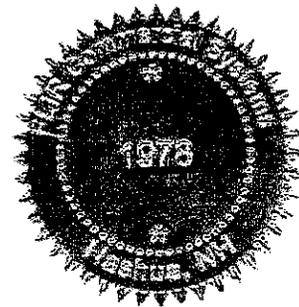
We hereby certify that to the best of our knowledge, the instruments listed below meet or exceed the specifications stated in the appropriate instruction manuals. All instruments are calibrated at the factory following completion of production. FLIR Commercial Systems, Inc., an ISO 9001:2008 certified company, inspects its incoming shipments using an approved sampling plan with an AQL. All incoming inspections are performed using test equipment that is traceable to National Standards.

CUSTOMER: Poultry Products
11 Bemis Road
Hooksett, NH 03106

MODEL NUMBER	UPC	DESCRIPTION	SERIAL NUMBER	COO
407730	793950407301	SOUND LEVEL METER DIGITAL	10132218	CHINA




Steve Hyde
Technical Support
FLIR Commercial Systems, Inc.



Date: December 3, 2015

Refrigeration Unit Information

2 different units could be parked outside, a Carrier 760, or a Carrier 660. The maximum dBA for the 660 in "high" speed is 68.2, the maximum dBA for the 760 in "high" speed is 66.9. These levels are taken at 23' from the units. These tests were taken with 5 different microphones located in 5 different places at 1.2 meters off the ground. The sound decreases from the max of 66.9 to 44.59 over a 300' span in the open with no cover from buildings, trees, etc....., at 450' it goes down to 41.07 dBA. This documentation is provided from Glenn Harding of Carrier Transicold of Boston, the area representative.

These units will be set on "Auto Start/Start mode" which means they will only be running when the temperature rises above the temperature set point or goes below the set point. They do not run continuously and all units are shut off completely when they are being loaded or unloaded to maintain temperature as long as possible.



Jeff Yeaton <jeffy@ppne.biz>

RE:

1 message

Glenn Harding <gharding@powerprodsys.com>

Fri, Dec 4, 2015 at 8:53 AM

To: Jeff Yeaton <jeffy@ppne.biz>

Jeff:

My humble apologies. The on line calculator that I used to get the numbers below had a glitch in it. I went back to the drawing board with old fashion pencil and paper and these numbers actually make more sense:

Based upon the worst case scenario (high speed cool - 66.9 dBa @ 23 feet).

Sound level @ 300 feet is 44.59 dBa.

Sound level @ 450 feet is 41.07 dBa.

I included the information below, but to summarize it:

Sound intensity follows the inverse square law and we can use the following equation:

$$\Delta L = |10 \cdot \lg \frac{r_2^2}{r_1^2}| = |20 \cdot \lg \frac{r_2}{r_1}|$$

$$L_2 = L_1 - |10 \cdot \lg \frac{r_1^2}{r_2^2}|$$

L1 = dB level at location 1

L2 = dB level at location 2

R1 = distance 1 from sound source

R2 = distance 2 from sound source

Following this equation, the dB level will be reduced 6 dB each time the distance from the source is doubled.

Sorry about the confusion. I am not sure my professors at the UMass School of Engineering would be proud of my recollection of these laws.

I included some more details below.

Please give me a call if you have any questions.

Glenn Harding

Carrier Transicold of Boston

(339) 227-0246

Formulas for distance attenuation – Sound intensity calculation

The value of the sound intensity increases inversely squared with increasing distance from the sound source, that means with $1/r^2$:

$$\begin{aligned} I &\propto \frac{1}{r^2} \\ \frac{I_2}{I_1} &= \frac{r_1^2}{r_2^2} \\ I_2 &= I_1 \cdot \left(\frac{r_1}{r_2}\right)^2 \end{aligned}$$

$$r_2 = r_1 \cdot \sqrt{\frac{I_1}{I_2}}$$

Where:

I_1 = sound intensity 1 at closer distance r_1 from the sound source

I_2 = sound intensity 2 at more far distance r_2 from the sound source

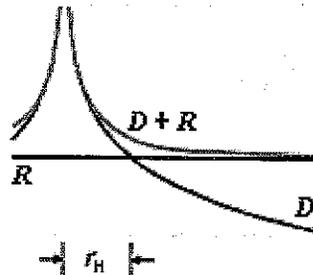
r_1 = closer distance r_1 from the sound source

r_2 = more far distance r_2 from the sound source

Note! Since the sound intensity level is difficult to measure, it is common to use sound pressure level measured in decibels instead.
 Doubling the sound pressure raises the sound pressure level (SPL) by 6 dB.
 Doubling the sound intensity raises the sound intensity level by 3 dB.

The sound pressure level L_p to plot against the distance of the sound source r

Kugelquelle



D : direct field of the spherical source
 R : reflected field (diffuse field)
 r_H : critical distance

If we double the distance, the value for the sound pressure falls to a half (50%) of its initial value.

If we double the distance, the value for the sound intensity falls to a quarter (25%) of its initial value.

This corresponds to a decrease in level by (-)6 dB.

For the level change in dB we get:

$$\Delta L = \left| 10 \cdot \lg \frac{r_2^2}{r_1^2} \right| = \left| 20 \cdot \lg \frac{r_2}{r_1} \right|$$

$$L_2 = L_1 - \left| 10 \cdot \lg \frac{r_1^2}{r_2^2} \right|$$

A doubling of distance from the sound source in the direct field will reduce the "sound level" by (-)6 dB, no matter whether that are sound intensity levels or sound pressure levels! This will reduce the sound intensity I (energy quantity) to $1/2^2 = 1/4$ (25 %) and the sound pressure p (field quantity) to $1/2$ (50 %) of the the initial value.

The inverse square law $1/r^2$ shows the distance performance of energy quantities and the inverse distance law $1/r$ shows the distance performance of field quantities.

Energy quantities are proportional to squared field quantities – e.g. $I \sim p^2$.

How is the sound level dependent from the distance to the sound source?

The sound pressure level shows in the free field situation a reduction of 6 dB per doubling of distance; that means the **sound pressure** drops to a half and not a quarter.

It is the **sound intensity**, that drops to a quarter of the initial value.

From: Jeff Yeaton [mailto:jeffy@ppne.biz]
Sent: Thursday, December 03, 2015 12:29 PM
To: Glenn Harding <gharding@powerprodsys.com>
Subject: Re:

Thats great info, can you just give me the calculation your using and i can take it from there??

On Thu, Dec 3, 2015 at 11:22 AM, Glenn Harding <gharding@powerprodsys.com> wrote:

Jeff:

I am reaching into the back corners of my brain, but I was able to find the equation to find the dBa readings at 100 yards and 150 yards from the running Carrier unit.

Based upon the worst case scenario (high speed cool - 66.9 dBa @ 22 feet).

Sound level @ 100 yards is 33.74 dBa.

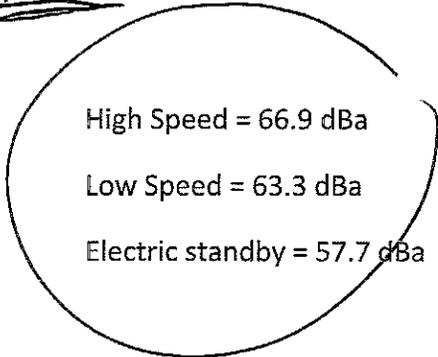
Sound level @ 150 yards is 30.01 dBa.

I can make other calculations at other distances.

Jeff:

I am trying to get more details so that we can make an educated guess at the sound level of these units after the sound travels 100 to 150 yards, but for now this is what I have:

Supra 760 noise levels



High Speed = 66.9 dBa
Low Speed = 63.3 dBa
Electric standby = 57.7 dBa

I will share more information once I get it.

Please give me a call if you have any questions.

Thank you.

Glenn Harding

Carrier Transicold of Boston

(339) 227-0246

From: Jeff Yeaton [mailto:jeffy@ppne.biz]
Sent: Wednesday, December 02, 2015 8:30 AM
To: Glenn Harding <gharding@powerprodsys.com>
Subject: Re:

Thanks, i appreciate it

On Wed, Dec 2, 2015 at 8:26 AM, Glenn Harding <gharding@powerprodsys.com> wrote:

Jeff:

I sent a request into the factory to get some real information from the engineering group. All I could find in my system is "marketing" type stuff that says that the noise levels are "significantly reduced".

	Condition	<u>Supra 660</u>
without Stealth	<i>High Cool</i>	68.2
	<i>Low Cool</i>	66.0
	<i>Standby</i>	59.7

Company Policy and Procedures

Only one truck would be parked outside running, the rest of the trucks will be inside the building with the front overhead doors closed, if all the trucks will fit inside they will be left inside. We have measured and they appear to fit but we have not had access to actual park them inside and close the doors because the owner has parked cars inside at this time.

In addition to the refrigeration units settings, and parking the vehicles inside, there will be additional policies and procedure put in place to cut down noise levels and to be the least intrusive that we can be with respect to all the neighbors.

All drivers will only use the South entrance of Burleigh road directly off of Route 201 to enter and exit the property with their work trucks. Upon entering the property drivers will be instructed to shut off their refrigeration units and dim their lights whenever possible. They will also be instructed to be as discreet and courteous with their own vehicles when entering and exiting the property.

The trucks are currently equipped with Back up Alarms. They will either be disconnected or if possible a switch will be installed to turn the alarm off while on the property. This will be done to the "regular" vehicles that we lease or own. Occasionally a truck or tractor may have to be rented or subbed to replace one of our vehicles because of a breakdown, needed repairs, or scheduled maintenance. We would have no control over the back up alarms if these vehicles were equipped with one, however this is normally swapped out during regular business hours by our lessors, and they also will be informed of the policy we have when entering and exiting the property as well.

All employees, lessors, contractors, utility personnel, plow drivers, etc..... will be instructed on the new policies and procedures prior to occupying the building. An additional sign may be put up near the entrance displaying the procedures if necessary.