NOISE MITIGATION OF SMALL PTAC SYSTEMS

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1 Abstract

In order to meet the facade noise level requirements of an Ontario municipality, mitigation of externally generated noise from already-installed packaged terminal air conditioning (PTACs) systems on several residential towers was required. Several noise mitigation methods were developed which could be retrofitted into the existing units. These mitigation methods and the design process are discussed.

2 PTAC Systems

PTAC systems are used to provide heated or cooled air in a number of applications, from residential apartments and condominiums, to hotels and motels.

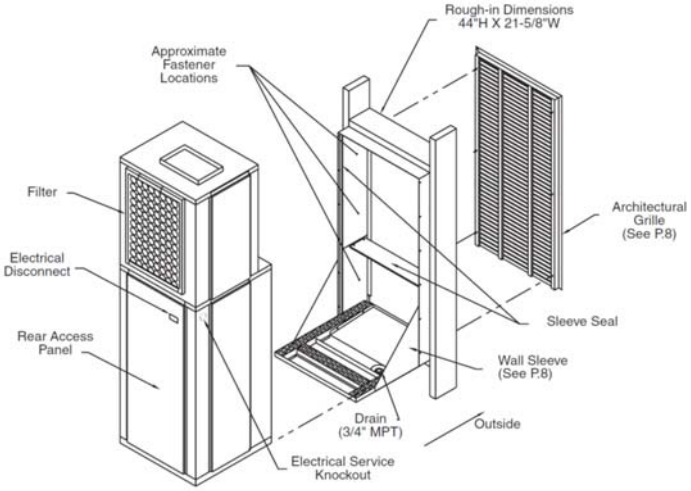

Figure 1: PTAC system general assembly [1]

Heating for the unit is provided either by electrical heat or by hot water from central boilers. Cooling is provided by an internal air conditioning unit consisting of a compressor, heat exchanger, fan and condenser.

The condenser and compressor are cooled using outside air which is drawn in through and exhausted out of the unit through a louvre on the outside of the building. Thus, noise from the unit can radiate into the outdoor environment, and can affect other units in the same building, or off-site receptors/ residences.

There are a number of noise guidelines for these types of "through the wall" air conditioning units. The Regional Municipality of Waterloo has adopted Ontario Ministry of the Environment and Climate Change (MOECC) Publication NPC-300 guideline limits as applying to the cumulative noise of these units, as well as other noise sources on-site (e.g., make-up air units, exhaust fans, etc.). As a result, for many buildings/ developments, the applicable cumulative noise guideline limits are 45 dBA at night, and 50 dBA during the daytime (L_{eq} (1hr) sound exposures, in dBA).

As a result, for a number of Waterloo development projects, noise mitigation was required, to address noise from PTAC units in existing buildings which were being converted to condominium ownership, and for new construction, where the PTAC systems had already been selected and purchased.

Novus was retained to conduct environmental noise impact assessments for several of these residential developments. This paper discusses the mitigation measures which were developed as a result.

3 PTAC Systems

Noise assessments conducted for the various residential developments under consideration, indicated that noise reductions up to 10 dBA were required. No manufacturer's noise control measures were available.

An examination of the PTAC systems indicated the fan and compressor provided the vast majority of noise emitted to the outdoor environment as shown in **Figure 2**:

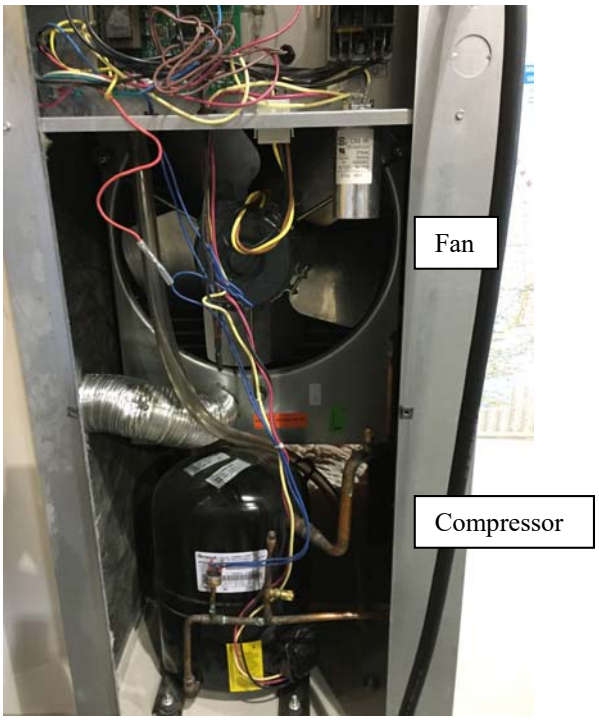

Figure 1: Noise sources in PTAC system

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Noise is emitted to the environment through an intake air louvre at the bottom of the unit (opposite the compressor), and through an exhaust air louvre at the top of the unit (opposite the propeller fan and condenser).

A primary concern was that the mitigation measures should be able to be installed from inside the building, if possible.

4 Insert Louvres

Parklane Mechanical Acoustics [2] was retained to develop small acoustic louvres which could be inset into the installation sleeve for the unit.

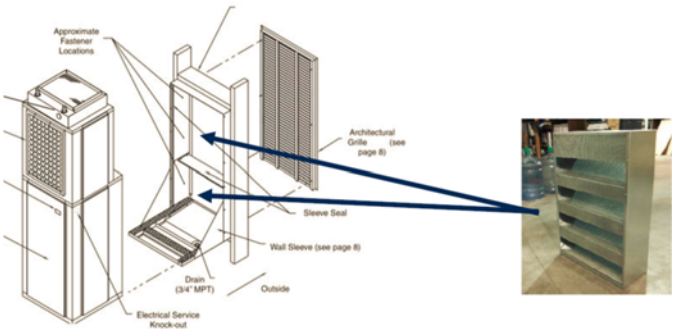

Figure 3: Installation Location for Insert Louvres

These insert louvres were used in conjunction with a compressor noise blanket. Option A placed a louvre in the condenser exhaust air outlet area only. Option B placed louvres in both the exhaust air and intake air openings. The following sound level reductions were achieved:

Option	Octave Band Dynamic Insertion Loss (dB)						
	125	250	500	1000	2000	4000	8000
A	4	4	7	7	6	5	6
B	5	5	8	11	11	14	13

Table 1: Insertion Losses for Acoustic Louvre Options

While the insert louvre solution works, it proved difficult in practice to ensure that the louvres were installed properly. In addition, the solution is costly (~ $ 1,000 per PTAC unit, for Option B). For several residential developments which required lower sound level reductions, other solutions were investigated.

5 Replacement Fans and Compressor Blankets.

Noise from the compressor can be easily reduced through the use of a compressor blanket.

The propeller fan supplied with the unit is shown in **Figure 4**. The supplied fan is an inexpensive, low-efficiency type which can create significant noise. Novus worked with Multi-Wing America [3] to identify a replacement low-noise airfoil/ scroll blade fan with the same flow rates and static pressure requirements.

Example fans were purchased and tested along with compressor noise blankets in a semi-anechoic test chamber at Total HVAC Solutions in Waterloo.

Figure 4: Original and Final Replacement Fan for PTAC Units

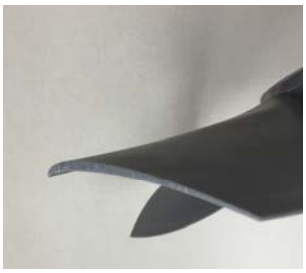

Figure 5: Profile of Replacement Fan Blade

The following sound level reductions were achieved:

Option	Octave Band Dynamic Insertion Loss (dB)						
	125	250	500	1000	2000	4000	8000
C	4	6	5	5	4	9	9

Table 2: Insertion Losses for Fan Replacement Option

The fan replacement solution does not provide the same high level of insertion loss as the Insert Louvre Option B, but is much cheaper (~ $ 200) and easier to install. This solution was optimal for a number of the residential developments under consideration.

Acknowledgments

Thanks to Randy Montag at Total Engineered HVAC Solutions Inc., Greg Downey at Parklane Mechanical Acoustics and David Cisan at Multi-Wing America fans.

References

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[2] www.parklanemechanical.com/
[3] www.multi-wing.net/