

VIBRO-ACOUSTICS PROJECT SOLUTIONS

Case Study Compilation

A collection of select Noise Control Project Solution Vibro-Acoustics has designed and manufactured



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Baystate Medical Center

Application: AHU Silencers (Centrifugal Fans)

CHALLENGE

- > Limited Silencer Connection Sizes
- > Insufficient Straight Duct

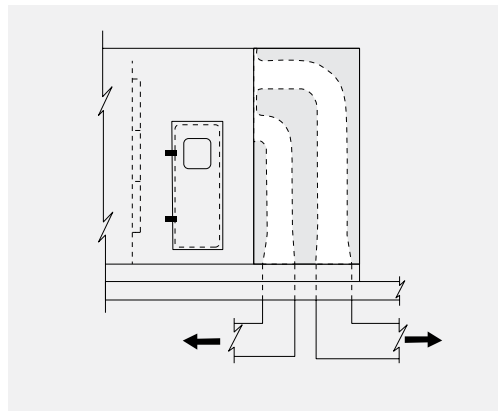
Limited space and no straight run of ductwork connected the 30,000 CFM air handling unit to the supply and return ductwork on the floor below.

Silencer sections aerodynamically connect air handling unit to distribution ductwork.

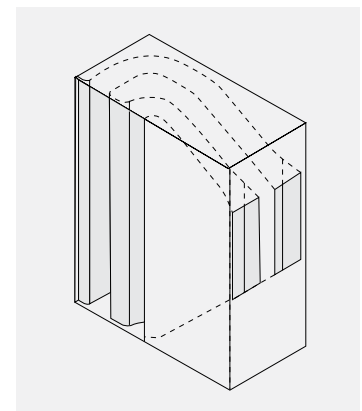
SOLUTION

AHU SILENCER SECTIONS (CENTRIFUGAL FANS)

Both the supply and return silencer sections were designed with streamlined internal acoustic baffles and connections which matched the air handling unit's and the distribution ductwork. The resulting configuration was elbow/transitional silencing sections.



Elevation drawing of elbow/transitional silencing section connecting air handling unit to distribution ductwork.



Air handling unit supply silencing section above. Duct connections shown on the right, air handling connections on the left.

Waterpark Office Building

Application: AHU Silencers (Axial Fans)

CHALLENGE

- > Low Frequency Noise
- > Excessive Energy Consumption

The specified noise criterion was Nc-35 including the ultra low frequency octave band centered at 63 hz. Minimum energy was also an objective. Breakout noise through the ceiling adjacent to the mechanical rooms was the critical path.

To ensure performance, a prototype fan / silencer system was specified to be factory tested and witnessed by the consulting engineer.

25 compact mechanical rooms in the office tower required 22,500 CFM horizontal axial fan/silencing systems expand into occupied ceiling spaces.

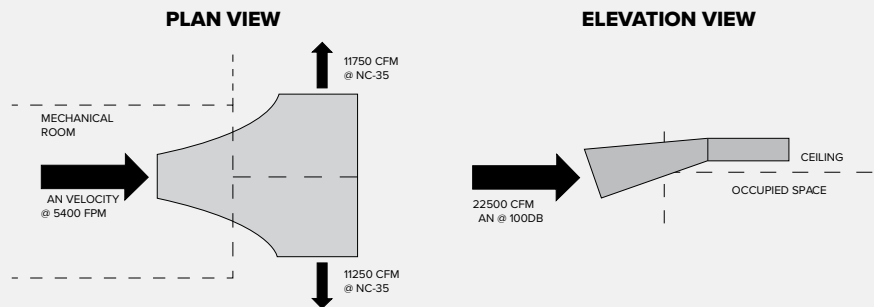
SOLUTION

AXIAL FAN / SILENCER PACKAGE SUPPLY

The consulting engineer specified variable pitch-in-motion axial fans for min. ultra-low frequency rumble and energy consumption. Silencers were designed to minimize aerodynamic losses. The resulting transitioning “y” discharge silencing, reduced both generated noise and energy losses.

PROTOTYPE TESTING

V-A built and tested a full scale prototype system, including an AHU and inlet discharge silencing systems to prove performance.



Schematic view shows critical transitioning “y” silencer required to achieve NC-35 and low energy consumption

MetroCenter

Application: AHU Silencers (Centrifugal Fans)

CHALLENGE

- > Low Frequency Noise
- > Insufficient Straight Duct

Multiple units supplied were 18,000, 27,000 and 30,000 CFM. Forward curved fans at the higher airflow capacities generate considerable low frequency noise, particularly below 125 Hz. They are also more sensitive to discharge conditions than backward inclined fans in terms of both efficiency and noise generation. A further complication was the very limited space on the discharge side plus the turning and splitting of airflow into opposite directions.

Forward curved fans in onfloor AH units for multi-story building require special air discharge systems and low frequency silencing.

SOLUTION

SPECIAL LOW FREQUENCY SILENCERS AND COMPLETE DISCHARGE SILENCING PACKAGES

Typical special low frequency silencers have connection sizes of 21" x 78" and 16" x 78" whereas the outside body dimensions are 36" x 78". The larger bodies are designed for noise reduction effectiveness at low frequencies without increasing pressure drops to unacceptable amounts. The discharge package consists of an acoustic plenum with a special fan diffuser discharge and a 'T' silencing system which connects to the supply ductwork (see photo of internal air passages). Vibro-Acoustics also supplied the intake silencers which completed the total silencing package.



Left: Internal perforated metal air passages for T discharge silencers are shown before installation into silencer casings and glass fiber packing. Right: AHU discharge silencer on its side. One duct connection is on the left and AHU connection is on the right.

Ajax-Pickering Hospital

Application: Diesel Ventilation

CHALLENGE

- > Low Frequency Noise
- > Environmental Noise
- > Breakout Noise

Noise from the diesels radiates out the ventilation gratings to the outdoor environment and the hospital windows above. Standard silencing could not provide the 63 Hz acoustic insertion loss specified by the acoustical consulting engineer.

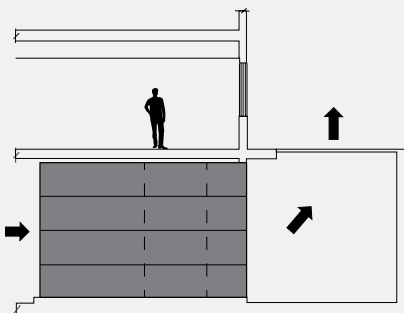
Potential low frequency flanking through the silencer walls was a major problem.

The low frequency rumble from hospital diesel ventilation system well controlled by specially installed silencing system.

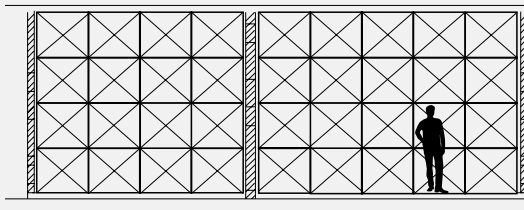
SOLUTION

LOW FREQUENCY SILENCERS, PROTOTYPE SILENCER TESTED & HTL CONTROL PRODUCTS

VA designed a composite silencer consisting of very thick splitters for low frequency noise control, a plenum section and standard acoustic splitters, all installed in series. A prototype silencer module was tested in the V-A lab which is qualified for testing at 63Hz. Concrete silencer outside walls, the concrete house-keeping pads and 1/4" flashing plates were all supplied by V-A.

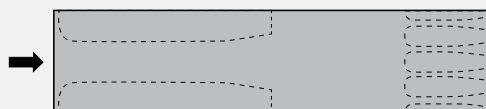


Side View: Exhaust silencer bank
13' high x 20' long



Left View: Diesel discharge silencer bank of modules (15' wide x 13' high)

Right View: Diesel intake silencer bank of modules (19' wide x 13' high)



Top View: Exhaust silencer module consisting of (from left to right) very low frequency module, plenum, and low/mid frequency module.

PROJECT SOLUTIONS

Gravenhurst Correctional Institute

Application: Diesel Ventilation

CHALLENGE

- > Low Frequency Noise
- > Excessive Pressure Drop
- > Oversize for Shipment

Noise from the diesel room would radiate through the air louvers positioned at high level. Substantial low frequency noise reduction was required and very little pressure drop was permissible.

The elbow silencer was very big to handle the very large CFM. It measured over 12'x 12'x 7' and could not be shipped nor installed in one piece.

SOLUTION

SPECIAL ELBOW SILENCING AND SECTIONAL DESIGN

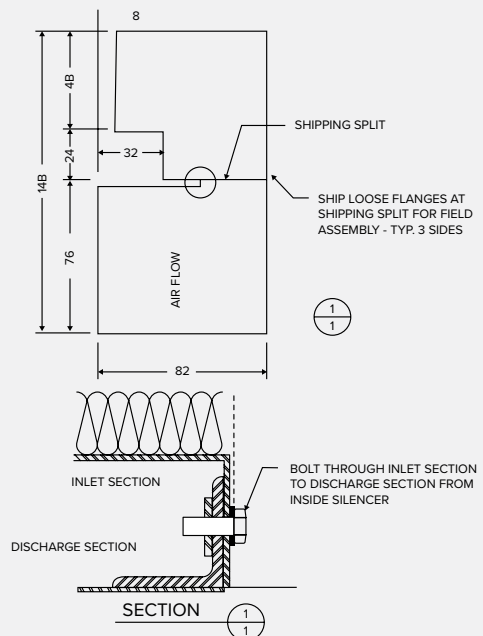
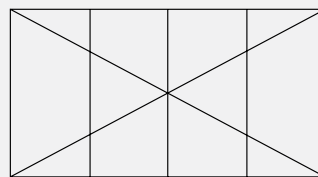
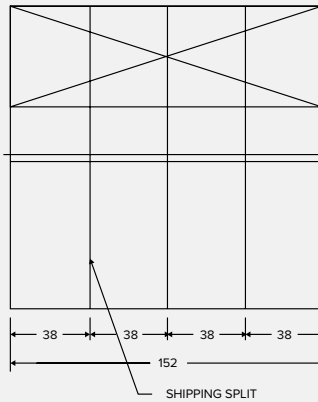
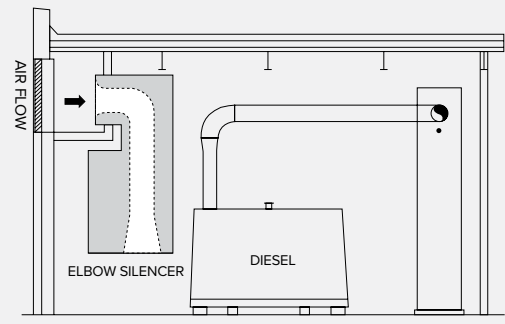
A special elbow silencer was designed having a much larger body size than the air inlet and outlet size. This design provided extra low frequency noise reduction while keeping pressure drop to a minimum.

The silencer was shipped in 8 pieces. Loose flanges were provided for the bolted shipping split as shown on the right.

Special silencing reduces environmental noise from cogeneration diesel ventilation system.

Diesel room ventilation silencing controls noise radiating to the outdoor environment.

Below: Details of elbow silencer shipping and installation split.



Metropolitan Life Office Building

Application: AHU Silencers (Centrifugal Fans)

A multi-story office building was upgraded by reducing noise from existing on-floor AHUs.

CHALLENGE

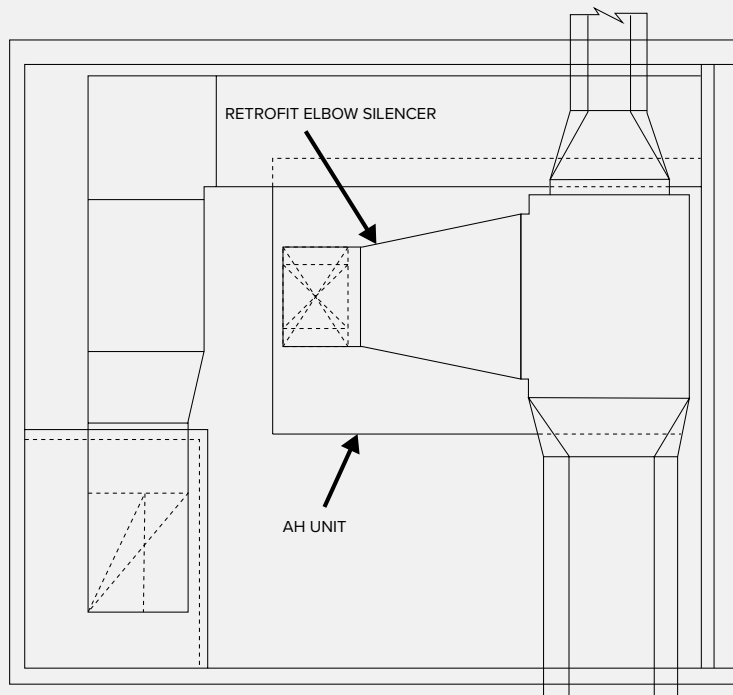
- > Insufficient Straight Duct
- > Excessive Energy Consumption
- > Excessive Pressure Drop
- > Unacceptable Installed Performance

Special silencers had to fit into the existing ductwork and there were no straight runs. Saving energy was a prime objective. Since the fans and motors existed, added pressure drop had to be minimal. Guaranteed performance was required because of the substantial investment and the critical nature of the retrofit upgrade. Multiple silencers, all the same size, were required.

SOLUTION

TRANSITIONAL ELBOW SILENCERS, EX-TYPE ELBOW SILENCERS AND SILENCER WITNESS TEST

Transitional elbow silencers were designed to replace existing the duct fittings. The body size of the silencer was designed to be much larger than the connection size allowing more free area within the silencer. A witness test on an actual size production silencer was conducted in the V-A aero-acoustic laboratory for the mechanical and acoustical consultants. Performance was achieved in the lab and in the final installation.



Mechanical room drawing (plan view) shows existing ductwork and complex fitting replaced by the elbow transitional silencer.

Motorola Semiconductor Facility

Application: Fan Silencers (Axial)

❗ CHALLENGE

- > Insufficient Straight Duct
- > Excessive Energy Consumption
- > Exposed Glass Fiber
- > Undivided Responsibility
- > Fan Access

Space for the 16 air handling units was very limited and there was no straight ductwork at the fan connections. Since the 72,000 CFM, 60 HP fans run continuously, energy consumption was an important consideration.

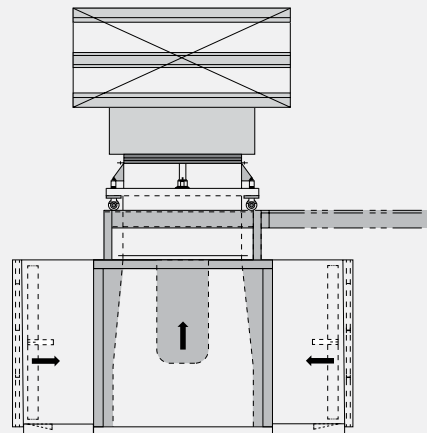
Special requirements for the clean room application were specified. Additionally, a special design was required for fan mounting and access

Special silencers for 16 vertical 60" diameter vaneaxial fans control noise to clean room facility.

🛡️ SOLUTION

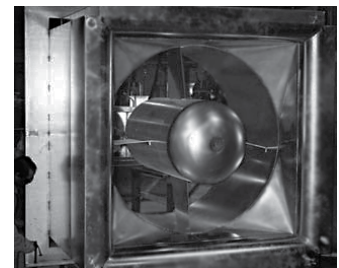
SPECIAL FAN SILENCERS, IAQ SILENCERS, PACKAGED SUPPLY AND SPECIAL ROLL OUT SYSTEM

Aerodynamic fan elbow silencers were designed to reduce noise at the source. The discharge silencers were round - rectangular transitional types and the inlet designs consisted of cone silencers directly connected to the fan inlets and mounted in acoustic inlet boxes. Acoustic grade glass fiber was wrapped in glass fiber cloth. Silencers were cleaned, shrink wrapped and shipped to site with protective crating. V-A supplied the fan and silencer systems as complete packages. These included roll out mechanical systems for quick fan access and structural support systems for the fans. The latter are built into the inlet boxes. (Coil/filter boxes connecting directly to the inlet boxes were also supplied).



Elevation of unit showing cone inlet silencer, elbow discharge silencer and fan roll out system.

Below: Bottom view of cone inlet silencer.



Autoroute Tunnel Ville Marie

Application: Inlet / Exhaust Openings

CHALLENGE

> Insufficient Straight Duct

There was no straight length of duct for standard silencing to control the noise from two large tunnel ventilation axial flow fans.

Below: Schematic elevation of the silencing system

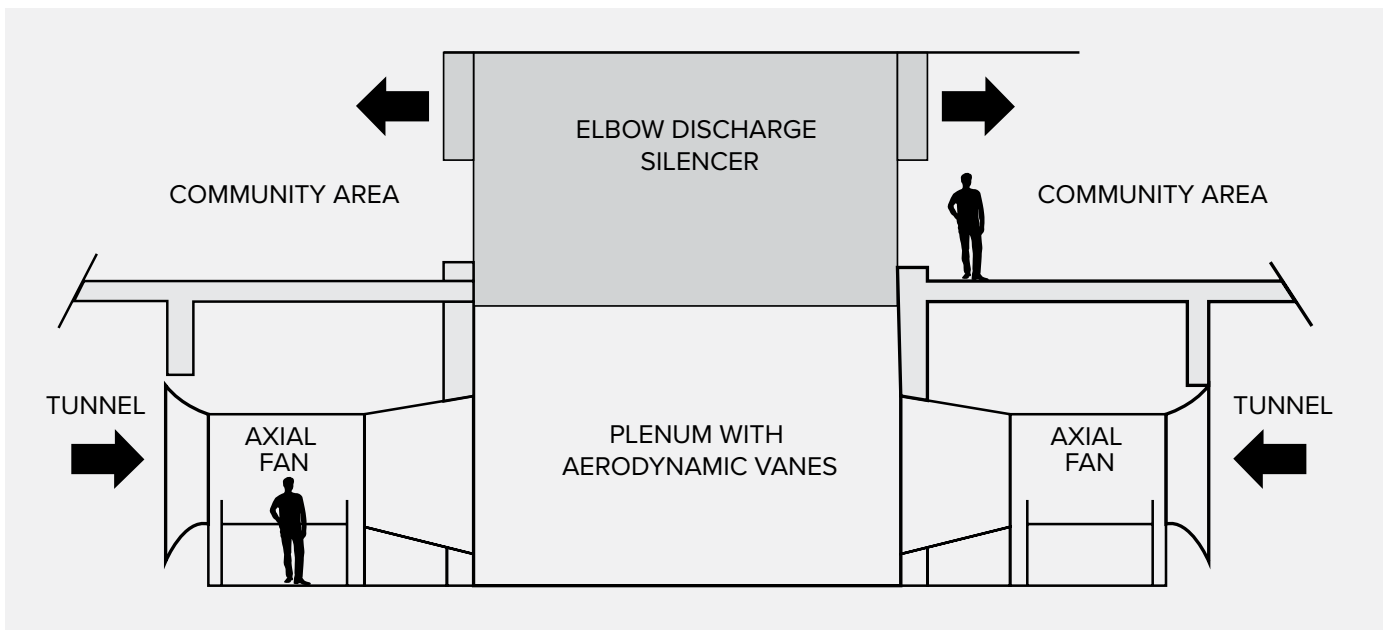
Huge fan silencing system reduced environmental noise.

SOLUTION

T-ELBOW / PLENUM SILENCER

A huge T-elbow-plenum silencing system was supplied for air discharge in two directions. A combination of acoustic splitters and turning vanes maximize acoustic performance and minimize pressure drop.

Note: Double the space would be needed to accommodate standard rectangular silencers.



Power Station El Paso, Texas

Application: Fan Silencers (Centrifugal)

CHALLENGE

- > Insufficient Straight Duct
- > Insufficient Duct Length

To protect against employee hearing loss, retrofit silencing was required for two forced draft fans supplying the boiler. However there was insufficient space to supply standard silencers.

The silencers were close coupled to the high pressure fans exposing them to substantial aerodynamic forces.

Special fan silencers fit the restricted space at a thermal power station.

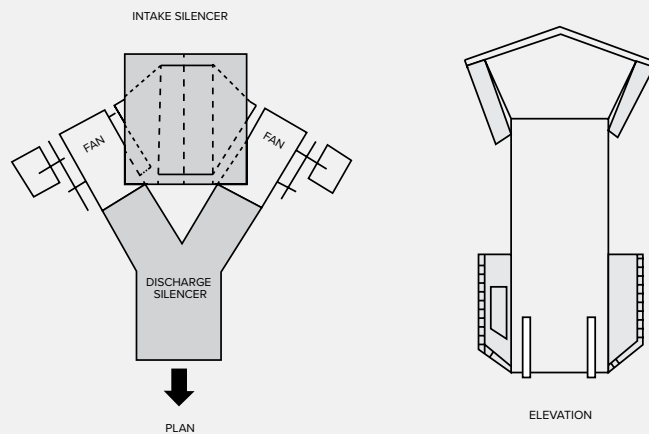
SOLUTION

SPECIAL SILENCER DESIGN & HEAVY DUTY CONSTRUCTION

One intake silencing system was supplied to control the noise from both fan inlets. It consists of a singular air inlet box, common silencer, weatherhood, birdscreen and support legs.

The fan discharge “pair-of-pants” silencing system is made up of discharge duct silencer and supporting structural steel.

Silencing systems were supplied class III construction, heavy gauge and all welded. Casings were continuously welded.



Plan view of common intake and “pair-of-pants” discharge silencing systems. Elevation shows common intake silencing systems.

PROJECT SOLUTIONS

Charles Tupper Office Building

Application: Duct Silencers (Axial Fan Systems)

🚩 CHALLENGE

- > Break-Out Noise
- > Fit Existing Ducts

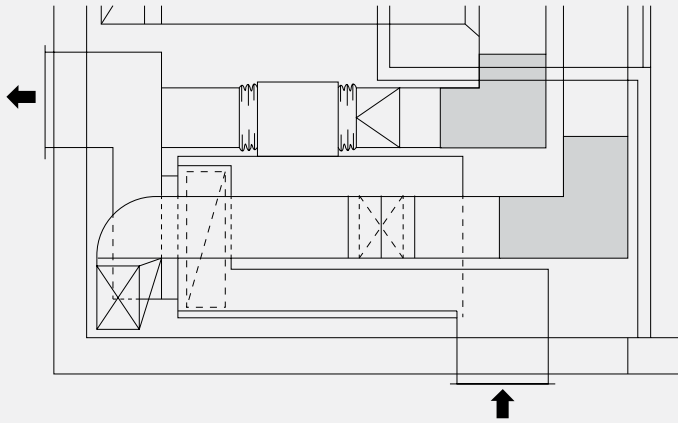
Fans and air handling units located in mechanical rooms adjacent to occupied spaces are scattered throughout the building. Return fans are axial type. Most existing ducts have elbow fittings in the occupied ceiling space adjacent to the mechanical room walls. Break-out noise from these duct regions was the most common and biggest problem.

🎯 SOLUTION

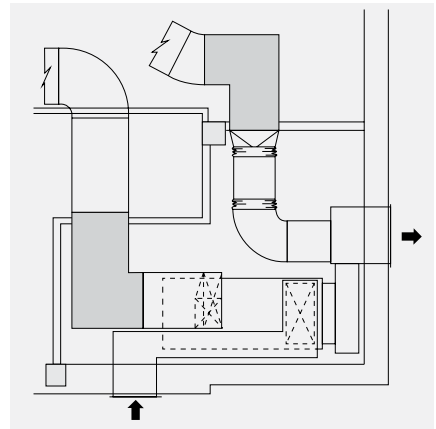
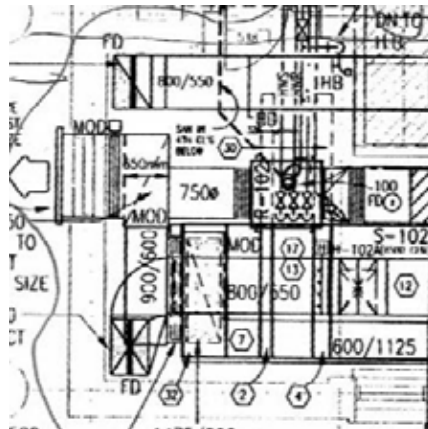
ELBOW SILENCERS WITH HTL WALLS

Most silencers are elbow type to fit the existing ductwork. To prevent break-out noise, silencers located at the mechanical room walls were supplied with higher transmission loss (HTL) walls.

Existing office building upgrade to NC-35 uses Vibro-Acoustics' fit-the-duct silencers to reduce fan noise.



Above: Simplified plan drawing (adapted from original)
Left: Mechanical equipment room. Plan view.
Right: Elbow silencers installed in equipment room walls to reduce breakout noise.



One London Place

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

> Duct Breakout Noise

A rectangular duct connected two fans in a mechanical room located on one side of a conference room to a duct shaft on the other side of the room. This duct, conveying 100,000 CFM, could only be located through the ceiling of the conference room. It was impossible to relocate the fans, duct shaft or conference room, thus, a noise control solution was needed.

*Note: The original duct design covered most of the ceiling width and $\frac{2}{3}$ of the ceiling length!

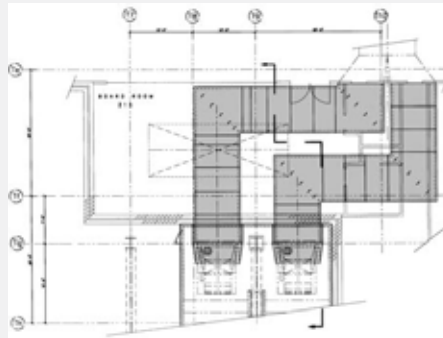
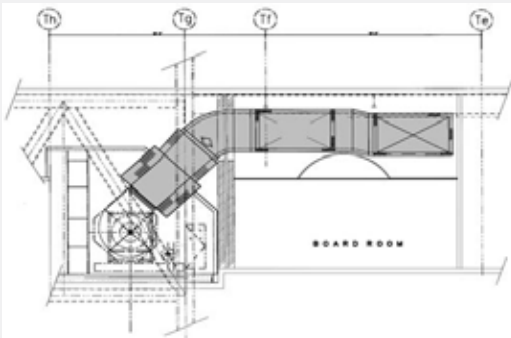
Vibro-Acoustics fan silencers and high transmission loss duct control breakout noise from a conference room ceiling

SOLUTION

LOW FREQUENCY SILENCING AND HIGH TRANSMISSION LOSS (HTL) CONSTRUCTION

Max low frequency silencing was installed in the limited space between the fans and conference room. Ductwork was designed for the lowest possible duct velocity, while allowing thick high transmission loss (HTL) walls. The original design of a huge duct* connected to the two fans with a pair-of-pants fitting was replaced with a 2-duct design. This improved airflow, acoustics and ease of installation. The ceiling was also HTL construction.

The objective of this challenging installation was to obtain the best acoustical environment in the space. In addition to the investment of noise control materials, the total composite construction was very carefully detailed and the installation supervised with care. Noise in the conference room was lowered to below NC-35.



Left: Elevation - Fan low frequency and RLP silencing with HTL walls over the boardroom.

Right: Plan View - Large RLP silencers with HTL walls over the boardroom.

Gateway Arena

Application: Duct Silencers (Centrifugal Fan Systems)

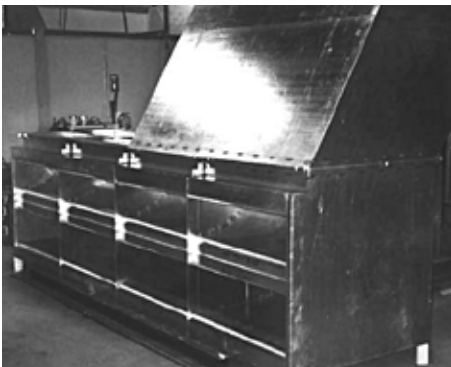
CHALLENGE

- > Breakout Noise
- > Insufficient Straight Duct
- > Installation Time

Huge rectangular ducts, over 20 feet wide, pass over the upper seats at the arena. This exposes the spectators to tremendous areas of duct radiated noise from large return fans.

There was insufficient straight duct in the above mentioned ductwork to apply straight silencers for the substantial acoustic insertion loss needed.

Bolted flange construction was taking too long for installation.



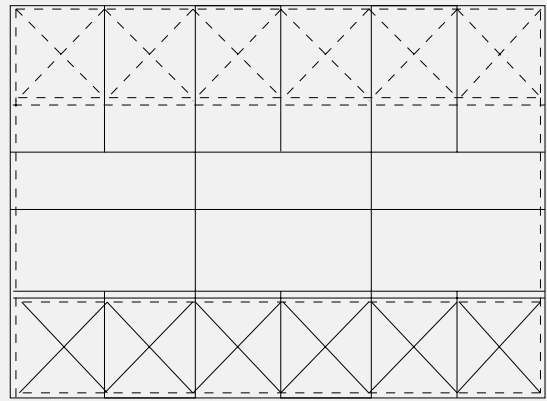
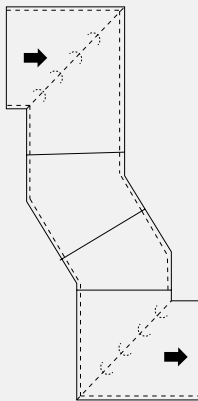
Elbow silencer HTL system component for duct system (inlet view).

Special silencing, including high transmission loss construction, controls fan noise at Cleveland's Gateway Arena.

SOLUTION

SILENCERS AND DUCTS HAVING HIGH TRANSMISSION LOSS (HTL) WALLS, ELBOW SILENCERS AND FIELD WELDING

HTL construction consisted of 10 gauge walls and acoustic glass fiber, protected by 22 gauge perforated metal. Elbow silencers, incorporating HTL casings, were supplied in modular sizes for assembly on site. Finally, the substitution of field welding proved to be a faster process for this project.



Left: End view of HTL silencing system
Right: Plan view of HTL silencing system 24 ft. wide installed overhead of spectators. Modular assembly from 4 ft. by 4 ft. elbow silencers shown

CBC Headquarters

Application: Duct Silencers (Centrifugal Fan Systems)

❗ CHALLENGE

- > Breakin / Breakout Noise
- > Acoustical Duct Lining

Sheet metal ducts penetrating the high sound transmission loss studio walls were a major sound transmission path requiring noise control treatment. To save costs, much return ducting was eliminated. This increased the noise breakout problem.

The original design concept called for most of the ductwork to have internal acoustical duct lining.

Cost savings were achieved and the design noise criteria were met for the huge* CBC broadcasting center.

🎯 SOLUTION

HIGH TRANSMISSION LOSS DUCT WALLS AND SILENCERS TO REDUCE DUCT LINING COSTS

Silencers with high transmission loss (HTL) walls were installed at the point of penetration. Where there was no connecting ductwork, elbow silencers with HTL walls were supplied. Careful design of the ductwork and silencers adequately controlled generated noise and provided sufficient sound attenuation so that almost all the internal lining was eliminated. The one exception was the ductwork serving the three large roof top TV studios. However, even there, much of the lining was eliminated.

*The largest architectural commission ever awarded in Canada which consolidated CBC radio and television studios from 24 different locations.



Silencer with HTL wall construction

Right: CBC building during construction. Note the 3 large roof top studios still exposed (largest is approx. 70 ft. high.)



Camden Amphitheater

Application: Rooftop Units

CHALLENGE

> Compounded problems

The rooftop air handling units had open return air inlets to the ceiling plenums. High silencer acoustic insertion loss was specified to reach the required low noise criteria. To minimize generated noise a low pressure drop was also required.

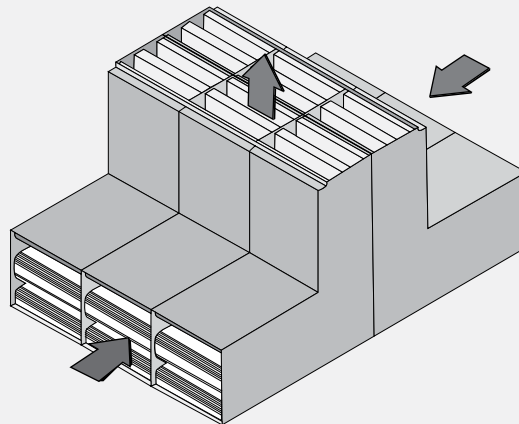
T-elbow silencers achieve high acoustic insertion loss for world class convertible amphitheater.

SOLUTION

T-ELBOW SILENCERS, EX-TYPE

T-elbow silencers were supplied having an acoustic insertion loss of 32 dB at 125 Hz and a pressure drop of 0.21" w.g. Each "T" silencer was made up of 6 elbow silencers installed back to back. To achieve the pressure drop, elbow silencers were "ex-type" having a larger body size than the unit connection size.

Note: This unique theater is a prototype for future multi-purpose entertainment facilities and is the first indoor/outdoor facility of its kind in the U.S. Flexible design challenges were accentuated by uses ranging from 25,000 seat outdoor pop music events to 1,600 seat indoor classical concerts.



Left: V-A supplied silencers for this indoor/outdoor facility in Camden, NJ.

Right: T-elbow silencers were sized to fit the rooftop units' connections and ceiling plenum space. The connection size was 47" x 108" and outside body size was 56" x 108". The bottom area was 158" x 108" requiring modular elbow silencer assembly.

Pickering Community Center

Application: Duct Silencers (Centrifugal Fan Systems)

❗ CHALLENGE

- > Insufficient Straight Duct
- > Insufficient Duct Length
- > No Redesign Time
- > Energy Consumption

There were no straight runs of duct for the installation of standard silencers. In addition, duct runs were short between the air handling units and the sports facilities surrounding the large mechanical room.

There was no time to redesign the mechanical room and compromise the design so that standard silencers could be applied.

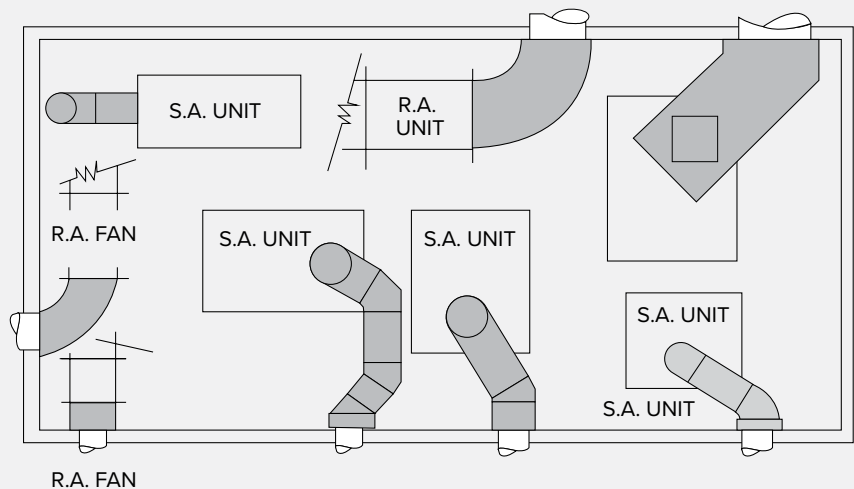
Energy conservation was important since the sports facility is open for long hours each day, seven days a week.

Special silencers for community center save space, energy and consultant's design time.

🎯 SOLUTION

“FIT-THE-DUCT” SILENCERS, EX, RLP AND CLP SILENCERS

The application of special fit-the-duct silencers saved critical design time. The optimum design for AH unit access, avoiding stratification etc. did not have to be compromised. Low pressure drop silencing was applied, including straight through type without splitters and centerpods wherever possible.



The plan view of the mechanical room showing location of silencers to “fit-the-ducts.”

PROJECT SOLUTIONS

Film House Studios

Application: Rooftop Units

CHALLENGE

> Rooftop Noise

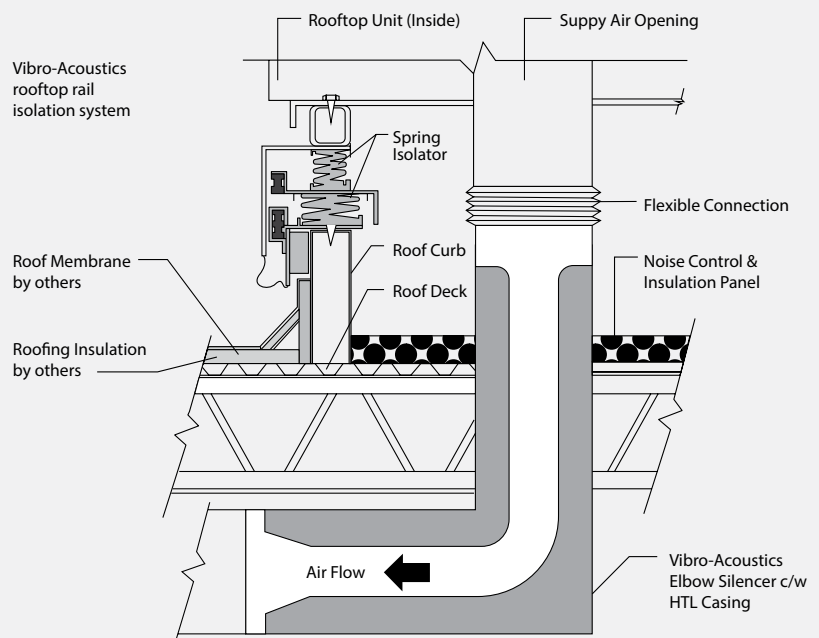
This post-production facility, used for adding sound tracks to film productions, was incorporated into an existing building. Noise levels were critical to maintain the recording quality. Strategic placement of mechanical equipment over projection rooms helped keep mechanical noise levels in studios below NC-15.

SOLUTION

NOISE CONTROL PACKAGE

Acoustical and mechanical consultants specified a V-A rooftop noise control package with rooftop curbs, unit support channels, noise control insulation panels, spring isolators with a deflection of 3 inches, elbow silencers with HTL casings and flex connections. This package, with the addition of V-A silencers placed downstream at the studios, was designed to control the noise and vibration from the rooftop units. Foley Studios achieved NC-11 in a facility which is now recognized as one of the best of its kind.

An ultra-quiet recording studio required a commercial rooftop unit that was silenced to achieve less than NC-15.



Vibro-Acoustics' noise and vibration control package was designed to meet the project's critical specifications.

The standard commercial rooftop unit required special noise control treatment, including strategic rooftop placement.

PROJECT SOLUTIONS

Niagara Casino

Application: Rooftop Units

CHALLENGE

- > Rooftop Unit Noise
- > Environmental Noise
- > Thermal Control
- > Reliable Delivery

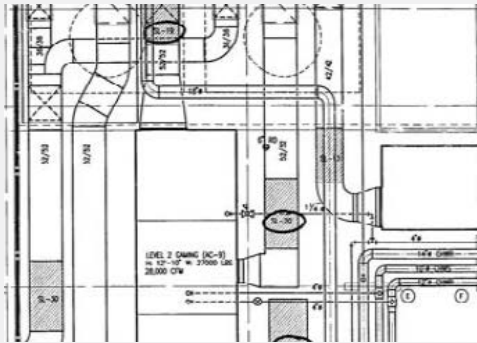
Outdoor noise could radiate from the rooftop units to hotels adjacent to the casino. Ducts on the roof were not externally insulated. The project was extremely fast track.

SOLUTION

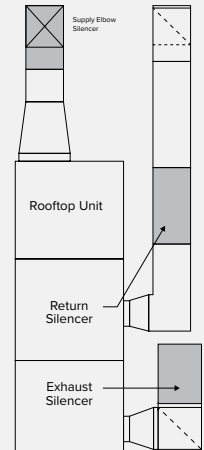
EXHAUST SILENCERS, SPECIAL SILENCER CONSTRUCTION AND 2 WEEK DELIVERY

A silencer was installed on each of the unit exhaust air openings. Silencers on the roof were designed to have internal acoustical/thermal insulation on all four walls, protected by a perforated metal covering. This applied to supply and return silencers. The contractor's project manager made surprise visits to V-A's manufacturing plants to determine the reliability of our company to supply as needed. We received the order and supplied drawings with our bid and delivered the products in 2 weeks!

Niagara Fallsview Casino fast track project required special rooftop unit silencing.



Above: Project Contract Drawing
Right: Simplified Plan View



Above: Side view of exhaust and return silencing.



Left: Hotels surround the rooftop units

Nortel Plant Infrastructure

Application: Rooftop Units



CHALLENGE

> Rooftop unit noise

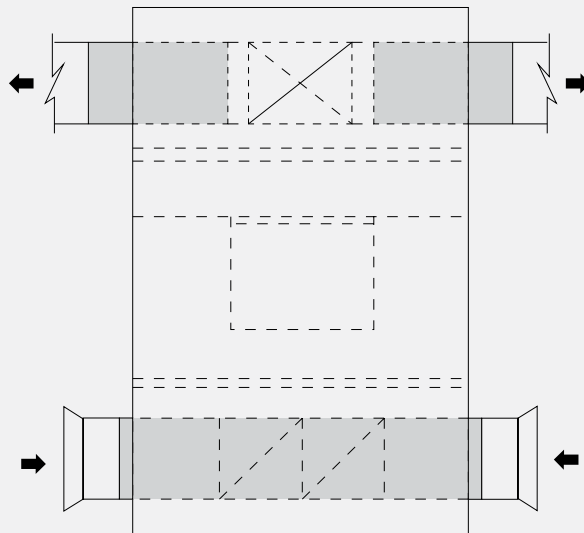
Noise levels exceeded NC-50 before treatment. There were strict limitations that the noise control treatment could not significantly reduce the air supply quantities nor add appreciable weight to the existing roof structure. (Subsequent to the original building design the structural code had been made more stringent.) A strict budget restraint also applied and the project was fast track.

SOLUTION

T SILENCERS

“T” silencers to reduce noise from the unit return and exhaust fans, were installed just below the roof line. On the less critical supply side, straight rectangular silencers were installed after the existing discharge “T”. All silencers were selected for low pressure drops so that no changes to the existing units were necessary.

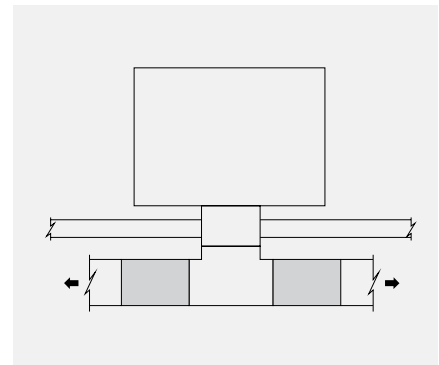
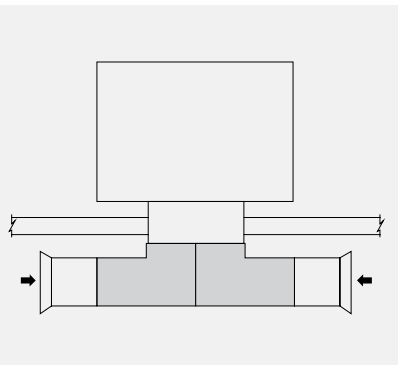
Noise control retrofit of 53 existing HVAC rooftop units helps convert high tech manufacturing space to offices.



Left: Plan view of rooftop unit showing ducts connecting ducts and silencers.

Bottom Left: End view showing return air “T” silencers (two elbow silencers back to back).

Bottom Right: Other end view showing retrofit straight supply silencers installed into the existing ductwork.



IBM Celestica

Application: AHU Silencers (Centrifugal Fans)

CHALLENGE

- > High velocity airflow
- > Limited space and fast delivery

High duct velocities resulted from the limited space between the air handling unit and the existing steel above. The unit was so close to the occupied space that only 8' of double elbows existed at one return. Because of the space limitations and the fast track schedule a quick assembly design was required.

SOLUTION

SILENCING SYSTEMS

Complex aerodynamic silencing systems were designed to use the length between the unit and the adjacent occupied space. The space between the structural steel was utilized to expand the silencer outside body dimensions. This allowed much higher velocities without excessive pressure drops and generated noise.

Silencing systems for large air handling unit are squeezed into existing mechanical room of high tech manufacturer

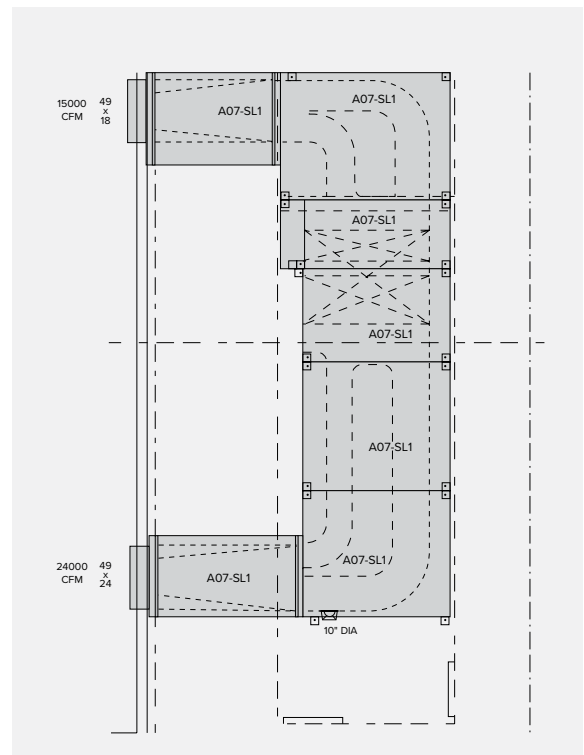
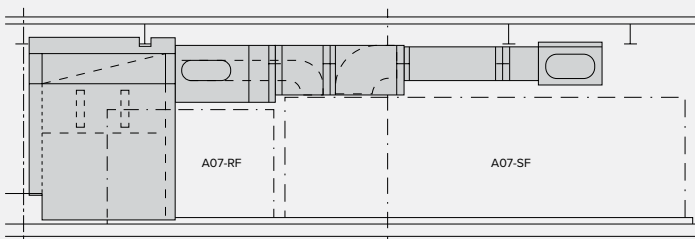
Special rectangular to oval transitional silencers were supplied for connection to some distribution ductwork.

The overall design was created by the consulting engineer. It was our job to design the internals of the silencing systems to achieve the best possible noise criteria and pressure drop.

Silencer sections were designed to bolt together on site and hanging brackets were built into the flanges. Construction was class 2 - 16 gauge and all external seams continuously welded. The first product was shipped in two weeks and the order was completed in eight.

Right:
Plan view

Below:
Side Elevation: 3 – 18,000 lb. silencers, designed as systems in modular form, are installed over air handling units. Note the oval connections for the distribution ductwork.



Chicago Tribune Office Building

Application: Fan Silencers (Axial)

CHALLENGE

- > High velocity airflow
- > Excessive energy consumption

The existing shaft space prevented the reduction of the riser air velocity below 5,000 FPM. The large air volume take-offs at each floor required special designs for noise control and to minimize generated noise at the fittings.

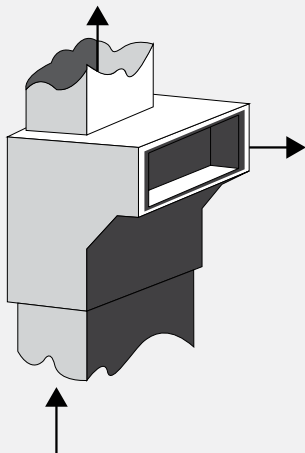
Generally, high velocity systems result in high pressure drops across duct components such as elbows and duct take-offs which, in turn, result in high energy consumption.

A retrofit 240,000 CFM air handling system is squeezed into very limited space in a historic building.

SOLUTION

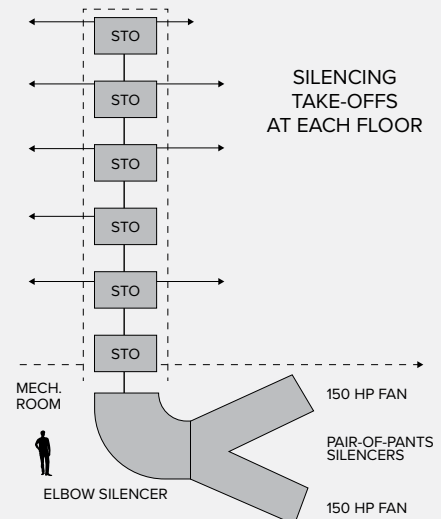
SPECIAL TAKE-OFF SILENCERS AND STEAMLINED SILENCING

Special silencer take-offs were designed for each floor which were total pressure driven. They also were designed to provide a self-balancing system which reduced the overall total duct system pressure drop. Aerodynamic discharge “pair-of-pants” transition and elbow silencers were also designed to connect two fans in parallel with minimum pressure drop.



Left: Special duct take off fitting with built-in silencing (STO).

Right: Silencing was built into the duct take-offs. “Pair-of-pants” and huge elbow fitting on the fan discharges.



University of Toronto Power Plant

Application: Fan Silencers (Centrifugal)

❗ CHALLENGE

- > Potential hearing damage
- > High inlet velocity

Noise radiating from the unducted inlet box of a heavy duty forced draft fan was well in excess of the hearing conservation criteria of 85 dBA.

Applying an inlet silencer having an outside body dimension equal to the inlet flange would result in too high a silencer internal velocity. This in turn would result in an unacceptably high pressure drop and excessive energy consumption.

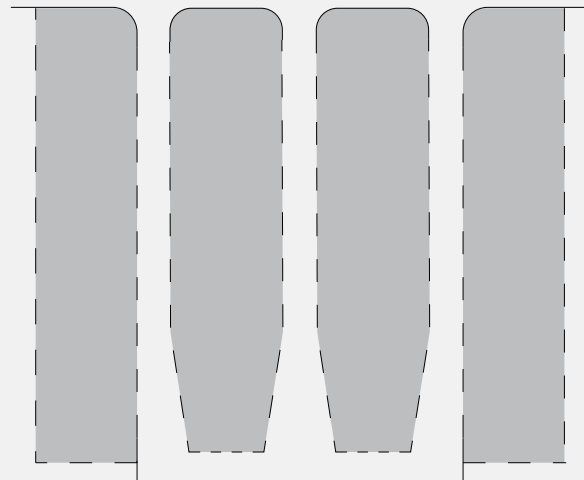
Retrofit heavy duty fan silencer reduces noise from boiler forced draft fan.

🎯 SOLUTION

HEAVY DUTY INLET AND EX MODEL SILENCER

A heavy duty silencer was installed on the inlet box of the forced draft fan which reduced the noise to less than 80 dBA within five feet of the fan. The silencer outlet flange matched the inlet damper flange to which it was connected.

The silencer was designed to have substantial thickness of acoustic media totally external to the connection size. This effectively reduced the fan silencer internal velocity for the same acoustic insertion loss in the same length of five feet.



Right: Systematic of splitter design shows external half splitters (EX model).

Cape Breton Regional Hospital

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

- > Excessive Energy Consumption
- > Exposed Glass Fiber in Ducts

Since most air systems in the hospital would be operating around the clock, fan silencing was used to add minimum pressure. NC-30 was the specified criteria for patient and operating rooms. No glass fiber was allowed in the ducts servicing the operating suites.

SOLUTION

SILENCER SYSTEMS WITHOUT CENTER-BODIES OR SPLITTERS (RLP & CLP)

Silencers were designed to have internal air passages the same size as the connecting ducts. Outside body dimensions are 8, 12 and 16 in. greater than the connection sizes, depending upon the most critical frequency to be attenuated and the space available. Silencing systems varied in length between 12 and 14 ft. including 45 and 90 degree elbow silencers for some systems.

Fan silencing systems for hospital consume minimum energy and have no glass fiber in operating suite silencers.

SOLUTION CONT.

Circular no-media silencers are installed in the supply ducts and rectangular no-media silencers in the return systems.

RLP and CLP silencing systems were supplied. By allowing the silencing outside dimensions to exceed the duct cross section, the pressure drop was almost reduced to that of empty ductwork. Note the recessed construction for the I-beam to save space.

PROJECT SOLUTIONS

Manchester Cogeneration Plant

Application: Inlet / Exhaust Openings

CHALLENGE

- > Excessive Pressure Drop
- > Environmental Conditions
- > Aesthetics

A very low pressure drop had to be achieved since the turbine hall relies on convection to exhaust 450,000 CFM.

Design for a very long silencer life was necessary since it was built into the structure and is not accessible for replacement. Also, the installation is on the coast, exposed to salt air.

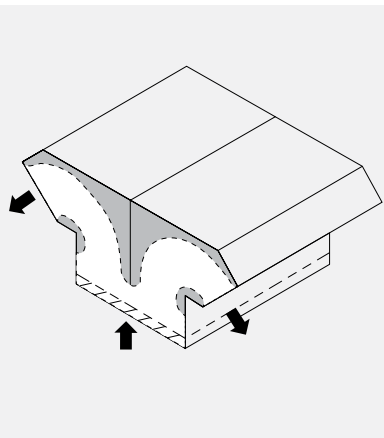
Aesthetics was of importance as the silencers are viewable from the street.

Special ridge vent silencers for a cogen plant reduce noise escaping from the turbine hall to the neighborhood.

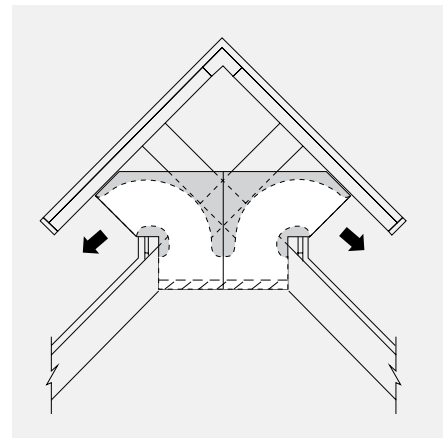
SOLUTION

T ELBOW SILENCERS, SPECIAL SILENCER CONSTRUCTION AND SPECIAL PAINT

Special "T" elbow silencers were supplied in 8' sections which were built into 3 - 100' long ridge vents (48 silencers in total). A scale model was tested in the aero-acoustic laboratory. Special silencer construction included no welds to the galvanized sheet metal parts. Finally, special black-out paint was applied to the discharge legs of all silencers.



T Elbow silencer 8 feet long is a modular section of silencing 100 feet long.



Cross section of ridge vent silencing built into structure.

Motorola Semiconductor Facility

Application: Fan Silencers (Axial)

CHALLENGE

- > Excessive Energy Consumption
- > Exposed Glass Fiber

Since the 60,000 CFM, 40 HP fans run continuously, energy consumption was an important consideration and proof of performance was specified.

Special construction requirements for the clean room application were specified.

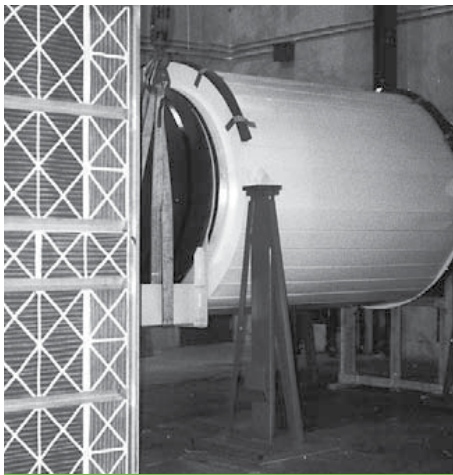
Special silencers for 17 vertical 60” diameter vaneaxial fans control noise to clean room facility.

SOLUTION

SPECIAL CIRCULAR SILENCERS, FULL SCALE TESTING AND IAQ SILENCERS

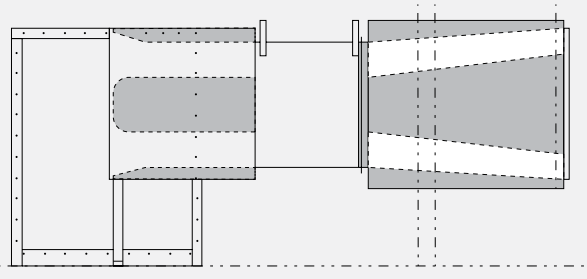
Fan circular silencers were designed to be directly connected to the fans to reduce noise at the source. The discharge silencers are round cone transitional type which connect to the 70” circular ductwork. The open inlet silencers have special aerodynamic designs to accelerate the inlet air flow and direct it to the axial fan blades. Center-bodies for inlet and discharge silencers are sized to match fan hubs and motors respectively. A full scale aerodynamic design of the fan/silencing system was tested and optimized in our facility. It was then shipped to an air handling unit test facility for final witness testing by the consulting engineer and customer to ensure it met the maximum energy consumption allowable.

Acoustic grade glass fiber was wrapped in glass fiber cloth. Silencers were cleaned, shrink wrapped and shipped to site with protective crating.



Above: AH Unit discharges into reverberation chamber (test set-up)

Right: Elevation - Axial fan silencing



PROJECT SOLUTIONS

NASA Clean Room

Application: Fan Silencers (Axial)

CHALLENGE

- > Insufficient Duct Length
- > Excessive Energy Consumption
- > Undivided Responsibility

There was limited length of duct to control noise from 153,000 CFM, 200 HP flow fans.

Since the fans were to run continuously, minimum energy consumption was the objective.

Undivided responsibility for the supply of fans, silencers, acoustic enclosures, structural steel, vibration bases and electrical work.

Vibro-Acoustics designed and tested six 200 HP fan-silencer packages for the NASA clean room.

SOLUTION

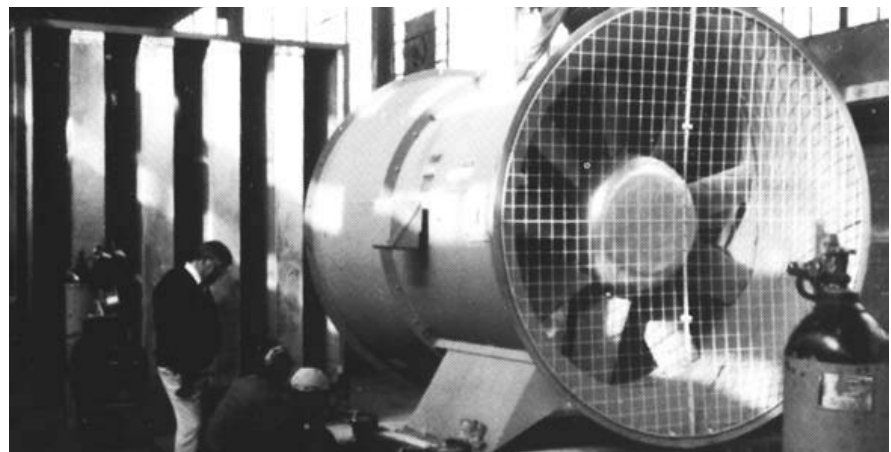
CLOSE-COUPLED RECTANGULAR SILENCERS, OPTIMIZED DESIGN AND TESTING AND FAN/SILENCER PACKAGE SUPPLY

10' x 10' rectangular silencers were close-coupled to the axial fans. Splitters were designed to be full height and rugged construction to distribute the airflow. Full scale testing and optimization of all the designs were completed before shipment. Performance witness tests were also completed. The six units were tested and supplied as packages, each 10' x 10' x 36' long.



Silencer with HTL wall construction

Right: CBC building during construction. Note the 3 large roof top studios still exposed (largest is approx. 70 ft. high.)



Goderich Ventilation Shaft

Application: Fan Silencers (Axial)

🚫 CHALLENGE

- > Insufficient Duct Length
- > Environmental Noise
- > Environmental Conditions

Axial fan intake noise could radiate to the nearby recreational boating docks and adjacent office building. There was only sufficient silencing length at the fan intakes to control the low frequency noise.

Aesthetics and corrosion resistance were major concerns.

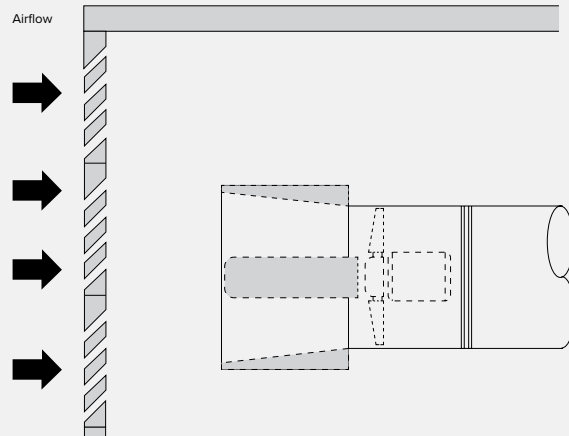
Large axial ventilation fans posed a noise problem to the outdoor environment.

🎯 SOLUTION

ACOUSTICAL LOUVERS

An acoustical louver intake house was supplied by Vibro-Acoustics to provide sufficient mid and high frequency attenuation when installed in series with the fan silencing.

A special corrosion-resistant aluminum alloy was used for the construction of the intake house including acoustical louvers.



Left: Multi-sided acoustical louvers control noise from ventilation axial fans. The entire intake house was fabricated by Vibro-Acoustics using aluminum alloy. Above: Schematic elevation: Fan silencing system comprises acoustical louvers and fan inlet silencer installed in series.

IBM Headquarters Office Building

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

- > Acoustical Duct Lining
- > Insufficient Straight Duct
- > Unacceptable Installed Performance

The original specification called for internal acoustic duct lining downstream of the 1,200 fan powered boxes. There was insufficient straight length of duct between the boxes and the first fittings downstream, which were very complicated. The cost of lining such complex duct fittings so that glass fiber dusting and erosion is well controlled was estimated to be substantial.

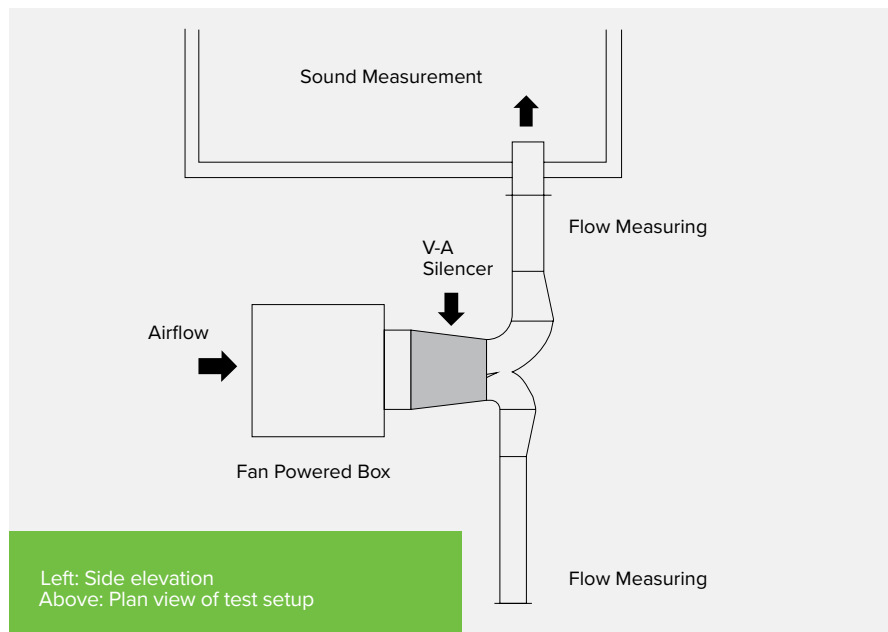
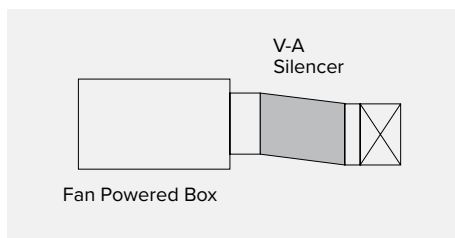
Proof of performance was required for the replacement of the duct liner with rectangular dissipative silencers. The pressure drop could not exceed 0.1 inches, excessive generated noise could not be introduced and the objective was NC-35.

Special silencers replace specified acoustical lining for better results with a cost saving.

SOLUTION

TRANSITIONAL RECTANGULAR SILENCERS AND PROOF-OF-PERFORMANCE TESTING

By substituting silencers for duct lining there was a total cost saving. Total cost includes the extra cost of enlarging the ductwork and special duct construction to receive the acoustic lining. Quality control problems for duct lining installation were eliminated. A witness test by the consulting engineer and the sheet metal contractor was successfully completed in the V-A facility.



Sunnybrook Health Sciences Center

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

> Acoustical Duct Lining

The high cost of installing the specified duct lining, including the quality control required to prevent IAQ problems, provided an opportunity for value engineering.

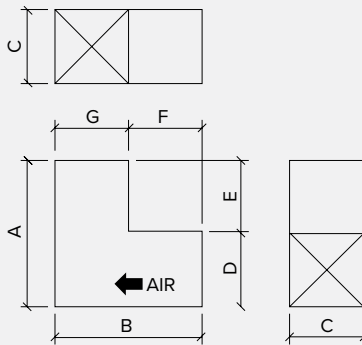
SOLUTION

NO-MEDIA SILENCERS

The selections of no-media rectangular silencers required that more than half of them be elbow type. To do otherwise would introduce high pressure drops due to system effects. There were sufficient lengths of straight duct to propose more than 40% straight silencers.

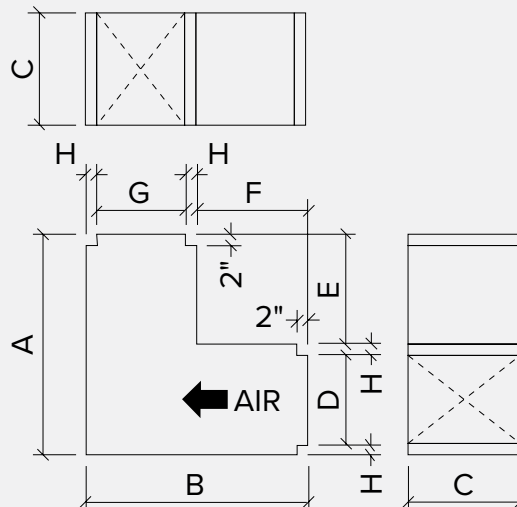
Also, to keep pressure drops low, two thirds of both straight and elbow type no-media silencers were 'EX' type. These designs have outside body dimensions greater than duct dimension sizes, allowing more internal flow area for the same acoustic insertion loss.

No-media silencers replace the specified acoustical duct lining at a saving in cost and improvement in IAQ.



Left: Standard dimensional approval drawing for rectangular elbow silencers.

Below: EX type elbow silencers have outside body dimensions greater than connection sizes. They were supplied in the greatest quantity. This design improves performance for the same length.



Green Timbers School

Application: Cross-talk / Transfer Duct

CHALLENGE

> Acoustical Duct Lining

Lined transfer ducts are costly and do not have performance ratings.

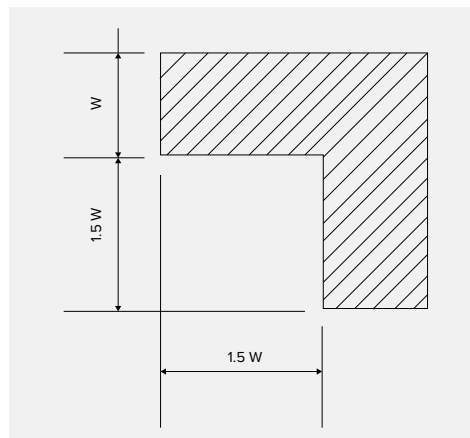
SOLUTION

CROSS-TALK SILENCERS

Vibro-Acoustics submitted acoustic performance for a variety of silencer sizes. These sizes were selected to pass the air quantities specified without excessive pressure drops. All pressure drops selected were less than 0.05 inches.

A table of cost comparisons revealed that the cross-talk silencers were approximately half the price of sheet metal elbows plus lining. The acoustic performance was doubled in the lower and mid-frequency range and equal in the higher. As a result the substitution was successfully completed.

Cross-talk silencers replace lined transfer elbows at a lower cost and improved performance.



The sizes from the chart below were specified for the airflow quantities listed. Locations were noted on the drawings. Lengths were to be determined from the drawing to the left.

ACOUSTICALLY LINED TRANSFER ELBOW LEGEND

A	12" x 12"	0 – 500 CFM
B	12" x 12"	500 – 1000 CFM
C	12" x 12"	
D	12" x 12"	1000 – 1500 CFM
E	12" x 12"	
F	12" x 12"	
G	12" x 12"	1500 – 2500 CFM
H	12" x 12"	
I	12" x 12"	

Bruce Peninsula Health Center

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

> Acoustical Duct Lining

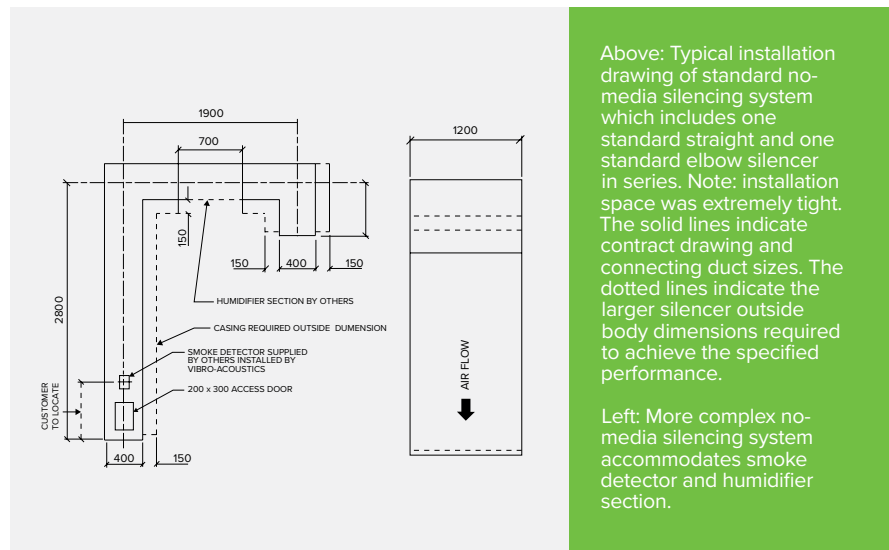
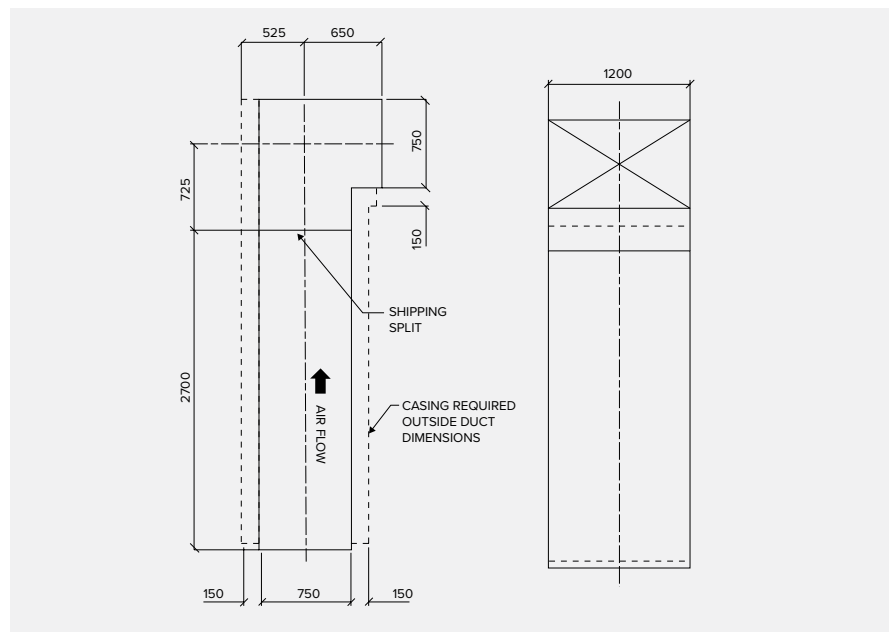
Government guidelines do not permit the application of internal duct lining in health care facilities. To compound the problem, the acoustic insertion loss requirements were substantial due to the low noise criteria needs of the space.

SOLUTION

NO-MEDIA SILENCING SYSTEMS

Since there were no long lengths of straight duct and acoustic insertion loss needs were great, most of the silencing systems included duct fittings, particularly elbows. In addition, accommodation had to be made to install and access such duct accessories as smoke detectors and humidifiers. It must be noted that internal insulation should not be installed near humidifiers. Insulation exposed to dirt and high vapor pressure or water particles is a great breeding ground for micro-organisms.

Fan silencing in health care facility achieved without the use of glass fiber.



Above: Typical installation drawing of standard no-media silencing system which includes one standard straight and one standard elbow silencer in series. Note: installation space was extremely tight. The solid lines indicate contract drawing and connecting duct sizes. The dotted lines indicate the larger silencer outside body dimensions required to achieve the specified performance.

Left: More complex no-media silencing system accommodates smoke detector and humidifier section.

Litton Systems Clean Room

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

- > Unreliable Ratings
- > Insufficient Duct Length
- > Insufficient Straight Duct
- > No Glass Fiber

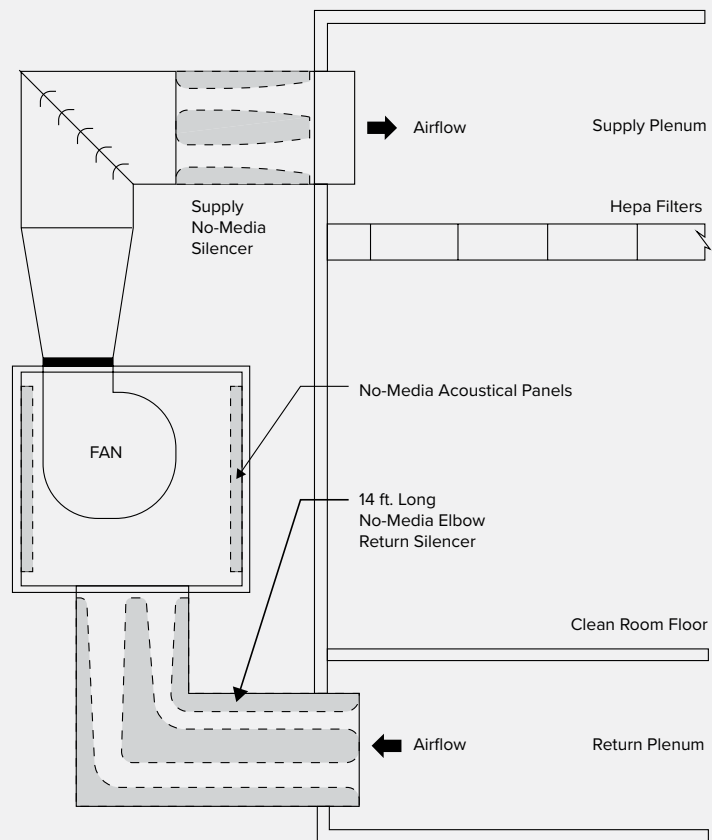
There was not sufficient space to achieve the optimum noise reduction required. Therefore, accurate silencer performance rating was extremely critical for both the specification and the final result.

SOLUTION

NO-MEDIA ELBOW SILENCER, WITNESS LAB TEST, NO-MEDIA PANELS, PACKAGE SUPPLY

A 14 ft. long no-media prototype elbow silencer was designed to achieve max acoustic insertion loss in the space allowed. It was witness tested by the engineer in the V-A laboratory and the performance was included in the specification as the basis of design. No-media acoustical panels were supplied for installation in the return air plenum for an extra boost in performance. Standard no-media straight silencers were installed in the supply duct, which completed the V-A package.

Multiple fan silencing systems, having no glass fiber, reduce noise in high tech clean room.



Schematic elevation of clean room silencing system which uses no glass fiber (one of multiple systems).

PROJECT SOLUTIONS

Lietrim Computer Center

Application: AHU Silencers (Centrifugal Fans)

CHALLENGE

- > Unacceptable Installed Performance

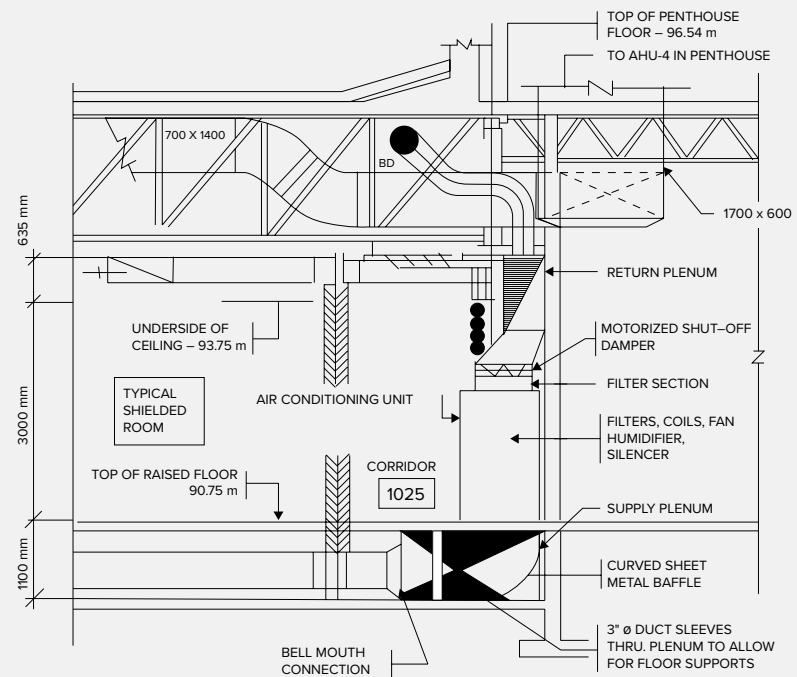
Multiple units delivering 2,500, 5,000 and 10,000 CFM were to be installed at a facility having a specified noise criteria of RC-40 in both the computer room and corridors. Proof-of-performance was to be supplied by witness testing mock-ups of all three unit sizes by the owner.

SOLUTION

RECOMMENDATIONS OF DESIGN CHANGES & SUPPLY OF STANDARD DUCT SILENCERS

Each air conditioning unit and its associated ductwork and standard silencers were mocked up and tested. Sound intensity measurements were used to determine the amount of breakout noise through the unit casings. As a result of the subsequent improvements made to the casing, the specified RC-40 criteria was achieved.

Noise from 46 computer room air-conditioning units could not exceed RC-40.



Above: Typical installation drawing of standard no-media silencing system which includes one standard straight and one standard elbow silencer in series. Note: installation space was extremely tight. The solid lines indicate contract drawing and connecting duct sizes. The dotted lines indicate the larger silencer outside body dimensions required to achieve the specified performance.

PROJECT SOLUTIONS

CBC Headquarters

Application: AHU Silencers (Centrifugal Fans)

CHALLENGE

- > Unacceptable Installed Performance
- > Unacceptable Performance
- > Low Frequency Noise

This \$250 million design build project included approx. 150 acoustically sensitive spaces consolidated into a high rise building. Detailed mechanical rooms and duct designs were not complete by the time building construction contracts were awarded. Separate acoustical consultants for the developer and tenant (CBC) were responsible to ensure the design noise criteria were achieved.

To reduce costs and speed up design and final completion, 55 on floor AHUs were substituted for the original concept of remote mechanical rooms to serve studios and offices. CBC had multiple existing studio locations being consolidated into a single building, which were all served by remote fans, there was considerable concern that the noise criteria would be met.

The major challenge was to reduce 63 Hz octave band noise from the AHU forward curved fans to meet the specified noise criteria.

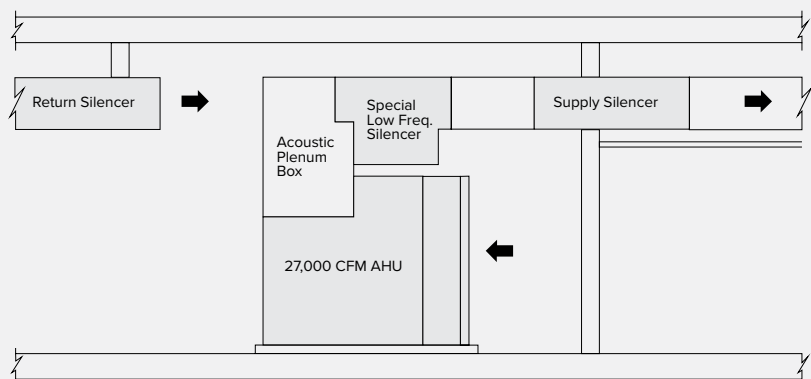
Time and dollar savings were achieved and the design noise criteria were met for the huge CBC broadcasting center.

SOLUTION

V-A SUPPLIED APPLICATION ENGINEERING & PRODUCT TO MEET SPECIFIED NOISE CRITERIA, MOCK-UP TESTING & DESIGN/TESTING OF LOW FREQUENCY SILENCERS

V-A supplied all the mechanical noise & vibration control products required to achieve the specified noise criteria. We were responsible for analyzing all the duct systems and selecting/ supplying all the necessary products to control fan, AHU, variable volume box and breakout/breakin noise. 1400+ silencers were supplied along with a considerable square footage of HTL duct.

A full size mock-up of the on floor mechanical room and adjacent office were constructed at the V-A facility. A typical 27,000 CFM AHU with V-A silencers, supply ducting, VAV box and diffuser assemblies were installed to simulate exact site operating conditions. Witness tests verified acceptable performance. 25 low frequency silencer designs and locations were tested in the mock-up described above to achieve the project noise criteria.



Full scale CBC mock-up for acoustic/ aerodynamic testing in V-A's facility.

Toronto Skydome

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

- > Unacceptable Installed Performance

The specified criteria shown below had to be attained. However, the design was not complete and silencers could not be selected at the time of bid.

A mechanical contractor required a firm bid prior to the project design and final supply of silencers that met the specified noise criteria.

SOLUTION

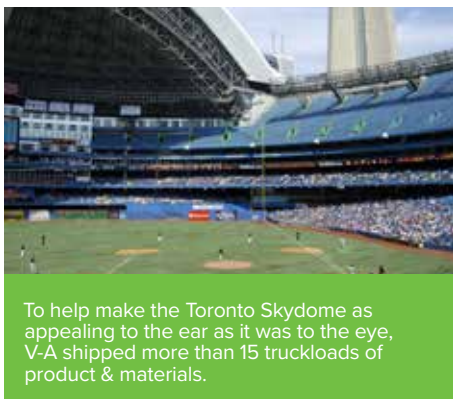
V-A BID, SUPPLIED AND MET THE NOISE CRITERIA

V-A worked with the successful design/build team to secure the contract and meet the noise criteria within budget. V-A supplied 95 straight rectangular and 9 elbow rectangular silencers for the 1,000,000 CFM air supply in the seating areas and for the 250,000 CFM supply and return air in the concourse. In addition, vibration isolation for 4 cooling towers, 4 chillers and 30 pumps was supplied. V-A is proud to have helped make this sports facility ready for World Series Champions, the Toronto Blue Jays.

SOUND CRITERIA SPECIFICATION

All mechanical equipment shall be selected and/or attenuated so that contributions of the mechanical equipment and systems to occupied spaces shall not exceed the following maximums:

- > Public/private spectator areas & public/club concourse areas **NC-45**
- > Front offices, team facilities, stadium personnel, first aid, media lounge and all dining areas **NC-40**
- > Club level/press box areas **NC-35**
- > Sound system control room, scoreboard control room & all media areas **NC-25**



To help make the Toronto Skydome as appealing to the ear as it was to the eye, V-A shipped more than 15 truckloads of product & materials.

403/421 Bloor Office Building

Application: Cooling Towers/Outdoor Equipment

❗ CHALLENGE

- > Environmental Noise
- > Insufficient Straight Duct

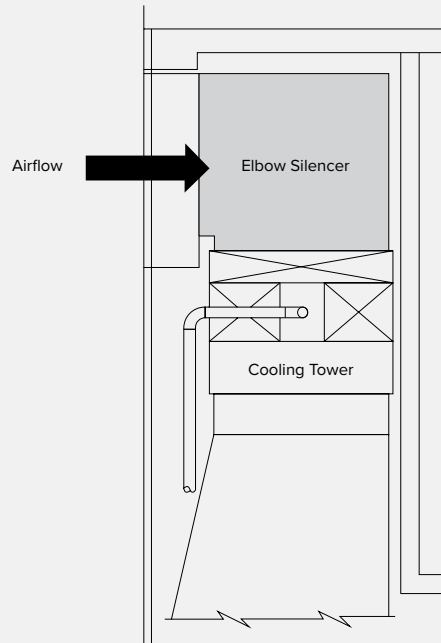
After the original installation, excessive noise radiated to the surrounding environment. There was no straight run of duct and very limited length for silencing between the architectural louver and the cooling tower inlet.

Outdoor noise problem from a cooling tower was solved by fitting an elbow silencer into a very limited space.

🎯 SOLUTION

ELBOW SILENCER

A retrofit transitional elbow silencer, having a very large cross-sectional area (approx. 100"x100"), was supplied to connect to both the louver and the tower. The outside length of the elbow silencer was 222".



Plan view: A large elbow silencers was designed and supplied to fit into the existing limited space.

Guggenheim Museum Storage Building

Application: Cooling Towers/Outdoor Equipment

CHALLENGE

> Environmental Noise

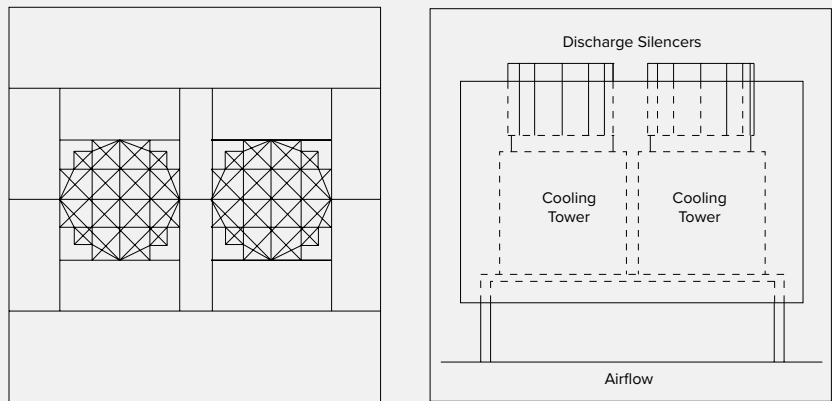
The noise control package had to control inlet and discharge fan noise and casing radiation. The design also had to prevent short-circuiting air flow and have a low pressure drop to minimize the reduction of the tower rated capacity.

SOLUTION

SILENCERS AND ENCLOSURE PACKAGE

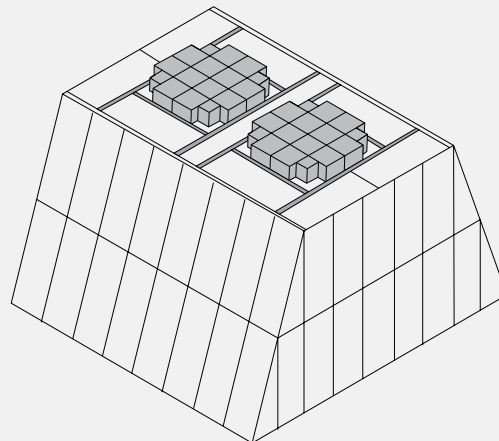
Modular rectangular silencers were combined with sheet metal safing at each fan's discharge to form a circular shaped silencer which matched the fan's shape. Both towers were enclosed with acoustic panels. This huge acoustic enclosure was designed to serve as acoustical inlet plenum silencing having very low pressure drop. It also reduces tower and silencer casing radiated noise.

Noise from existing cooling towers on a Guggenheim Museum building is controlled by Vibro-Acoustics' silencing package.



Left: Plan view of cooling tower silencing package
Right: Elevation

Below: Retrofit package includes an acoustical enclosure around the cooling towers which also acts as an acoustical intake plenum silencing.



York Administration Center

Application: Cooling Towers/Outdoor Equipment

CHALLENGE

- > Environmental Noise
- > Insufficient Duct Length
- > Excessive Pressure Drop

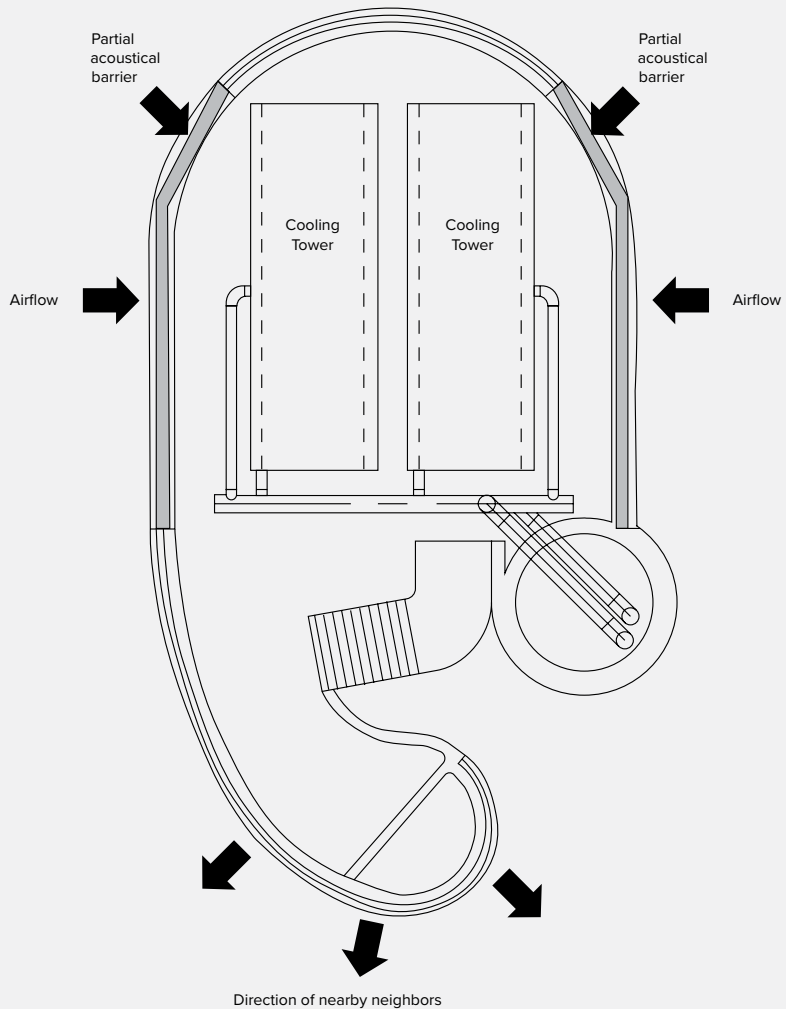
Two cooling towers on the roof of an office building radiated excessive noise to homes nearby. The brick wall partial barrier helped reduce the noise, but not enough. A solid barrier in front of the dominant noise source (air intakes) would cause excessive pressure drop and short circuiting of exhaust to the intake. There was insufficient length in front of the intakes for low pressure drop silencers.

SOLUTION

ACOUSTICAL LOUVER BARRIER

Line of sight from the cooling tower intakes to the homes nearby was blocked by partial acoustical louver barriers on each side of the towers.

Retrofit partial acoustical louver barrier solves neighborhood noise problem.



Plan view

PROJECT SOLUTIONS

Armstrong Manufacturing Plant

Application: Stacks

❗ CHALLENGE

- > Environmental Conditions
- > Environmental Noise
- > Unreliable Ratings

Noise radiating from the air stack outlet to the neighborhood had to be reduced. Because of the particulate matter in the airstream, standard dissipative silencers could not be considered.

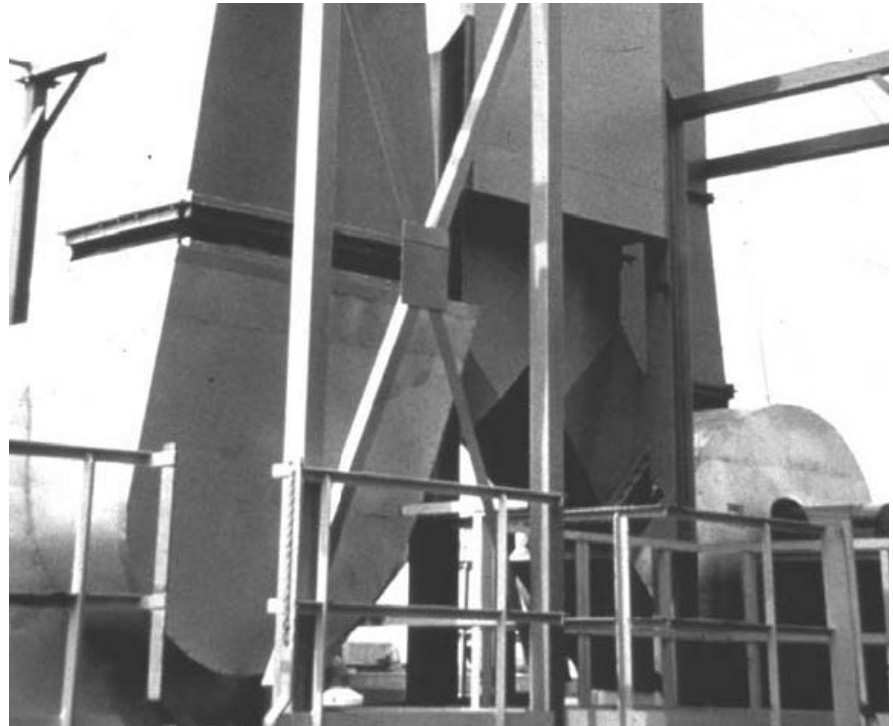
Special design 'non-plug' stack silencer continues to perform.

🎯 SOLUTION

NON-PLUG SILENCER AND STACK AND SCALE MODEL TEST

A 'non-plug' silencer was designed and supplied to prevent the exhaust air particulate contaminant from plugging the silencer and degrading the acoustic performance. Access ports were included to test for contaminant concentrations during production.

To ensure the success of the design, a scale model of the silencer was tuned for peak performance at 250 Hz and tested in the V-A laboratory. The system was still performing well after 3 years.



Vibro-Acoustics designed and supplied a special silencer / exhaust stack package for the 90,000 CFM tile line dust collection system.

PROJECT SOLUTIONS

William Davis Computer Center

Application: Stacks

CHALLENGE

- > Aesthetics
- > Energy Consumption

Fans were located in the penthouse atop a glass atrium. Connecting ducts were not allowed to pass through the atrium. However they were to be a very visible part of the architecture. In addition, all ductwork inside the building is exposed.

Since the building was to be in use continuously, silencing was to require minimum pressure drop and energy consumption.

Air supply stacks are an aesthetic component of the architectural design of a university computer facility.

SOLUTION

SPECIAL STACKS, CLP SILENCING SYSTEMS AND SILENCER RETURNS

14 vertical air stacks, 7 on each side of the building, were designed and supplied by V-A to be external to the atrium, structurally self supporting and follow the contour of the atrium glass. Each stack was fabricated from 3/16 inch steel plate and has thermal and vapor barriers. Both skins were stringently tested to ensure there was no leakage. Each entire assembly was supplied in one piece.

Silencing consists of an acoustic glass fiber liner running the full length of each stack and protected by a perforated metal liner. There were no center pads or splitters to add pressure drop.



PROJECT SOLUTIONS

Wyeth-Lederle Vaccines

Application: Fan Silencers (Axial)

CHALLENGE

- > Very Small Equipment Room
- > Environmental Conditions
- > Unreliable Performance

The attic space, used for storage, was to be converted to a mechanical room for the supply and exhaust systems. There were to be no extensive structural changes and components had to be sized to pass through a relatively small opening in the building wall. The design was to achieve NC-40 to NC-45 in the labs on the floor below.

The original design used the attic walls for the intake plenum. This necessitated frequent cleaning and painting the walls.

The design was customized to fit the space and resulted from calculation, not test data.

Plan view of "space-saving" retrofit air handling system supplied by Vibro-Acoustics.

1. Fan discharge silencer with acoustical splitters for distributing air to filters
2. Fan roll-out system for fan repair
3. Fan inlet silencer with streamlining for greater than 90° air entry

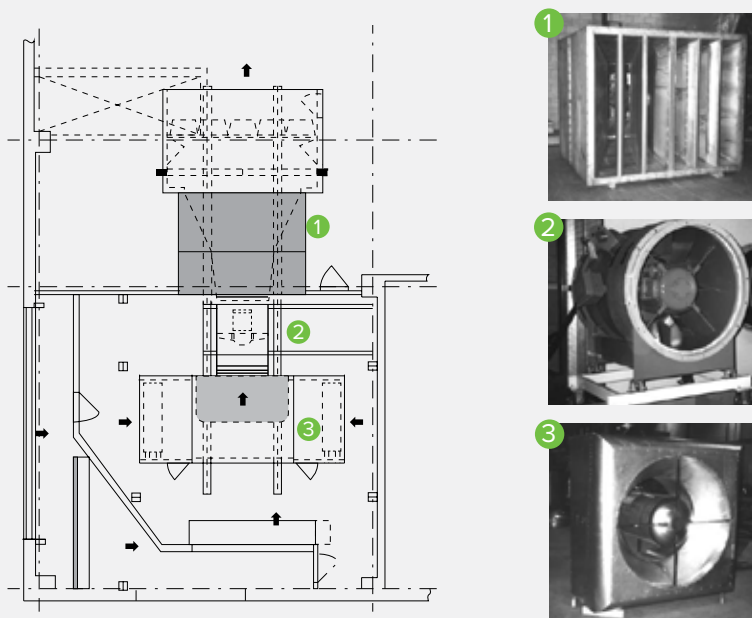
Retrofit fan/silencing package is fitted into an existing attic space to serve labs below.

SOLUTION

HORIZONTAL AXIAL FAN / SILENCER PACKAGE SUPPLY, AND VIBRO-ACOUSTICS PLENUM

V-A supplied the complete factory designed field-built air handling unit. Fan silencers were special because of the tight space conditions. Inlet and discharge plenums were shipped as panels for field assembly. Cooling coils completed the package.

The V-A intake plenum was enlarged to cover the walls and eliminate cleaning and painting. This resulted in an overall cost saving and better cleaning surfaces.



BCE Place

Application: AHU Silencers (Centrifugal Fans)

CHALLENGE

- > Very Small Equipment Room

The bankrupt air handling manufacturer, on a large multi-story office tower, left the building owner with half of their units on site missing fans and noise control. The remaining half of the building was completely without air handling units. The building core had been poured and openings were based on the ill-fated air handling unit manufacturer's dimensions.

Bankrupt on-floor air handling unit manufacturer leaves building owner with concrete openings and no equipment.

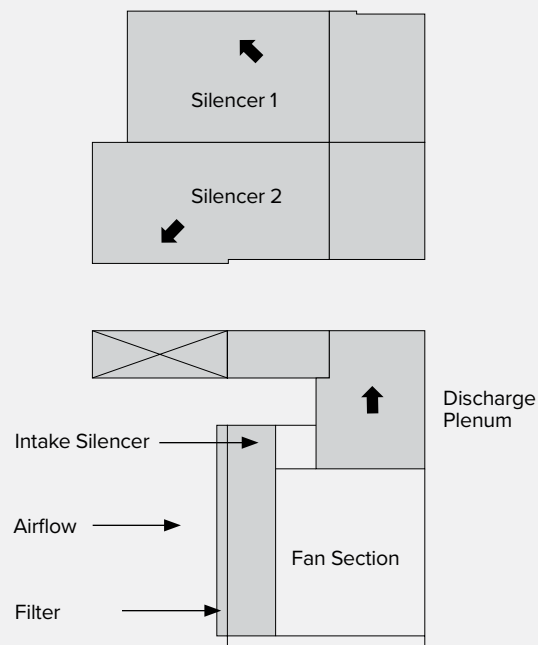
Silencing package (shaded area) supplied by Vibro-Acoustics.

Vibro-Acoustics tests and supplies silencers for on-floor handling units to achieve NC-40.

SOLUTION

AHU TESTING AND SILENCING SUPPLY

V-A was contracted, in conjunction with a new manufacturer of air handling units, to supply and test on-floor air handling compartment units to finish the project. Utilizing the V-A test facility, a mock-up of the site configuration was produced and tested to achieve the specified NC-40 criteria. A systems package of fans and Vibro-Acoustics' silencers achieved the rated air quantity and static pressure while utilizing the existing concrete openings and limited space.



Shipp Center

Application: Duct Silencers (Axial Fan Systems)

🚩 CHALLENGE

- > Very Small Equipment Room

Space was limited to a very small floor area for a 10,000 CFM return fan to be installed on each floor.

🎯 SOLUTION

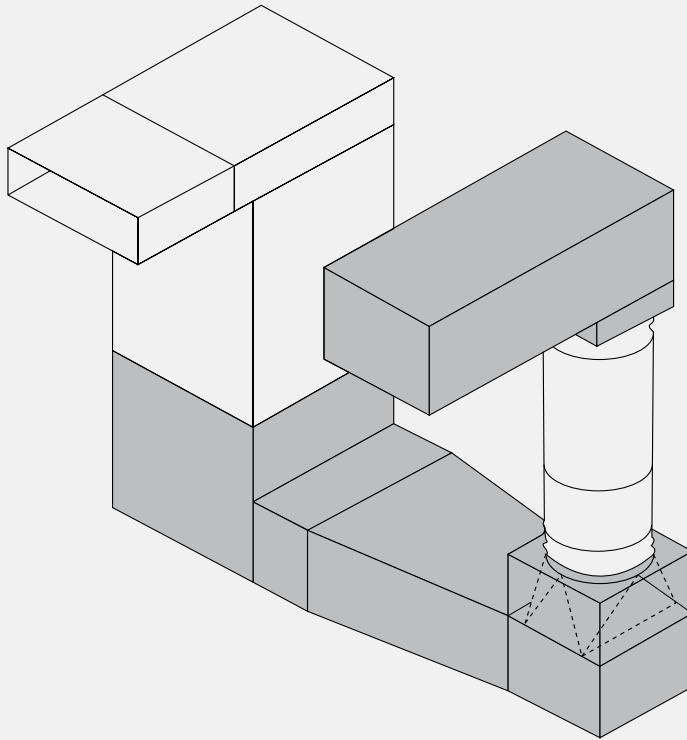
SPECIAL SILENCING FOR VERTICAL AXIAL FANS

The return silencers, at floor level, were supplied in 3 pieces consisting of: an elbow, straight and transitional rectangular-to-round elbow silencers. They were “open-type” with no internal splitters, except turning vanes. All four walls were lined with 4” thick acoustic fiberglass held under compression and protected from fiber erosion by perforated metal.

The supply silencers were elbow round-to-rectangular, supplied in one piece.

All silencers had 18 gauge casings.

Special silencing permits axial return fans to be installed in “closet-type” space on each floor of multi-story office building.



Axial return fan silencer component: Rectangular-to-round transitional elbow silencer with turning vanes. Pictured above: Isometric drawing of vertical axial fan silencing system. It fits in a closet-type space having floor dimensions only a few inches larger than the system footprint. A portion of the silencing is external to the closet-type space.

PROJECT SOLUTIONS

Niagara Courthouse Theatre

Application: AHU Silencers (Axial Fans)

CHALLENGE

> Fans in Occupied Space

An historic courthouse building was to be converted to a theater but there was no internal traditional space for the air conditioning ductwork and equipment. Also, fans could not be placed on the roof because of structural limitations.

SOLUTION

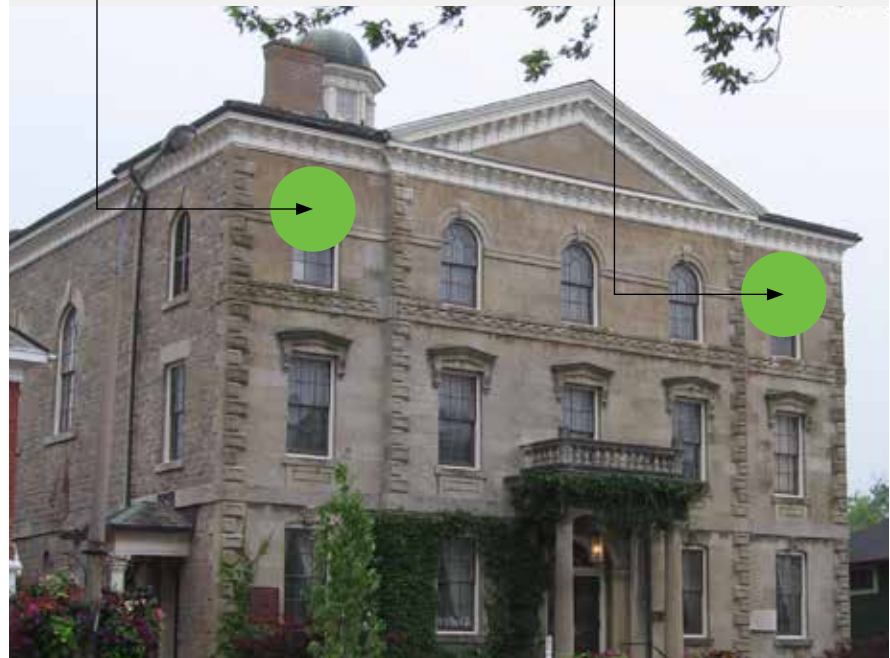
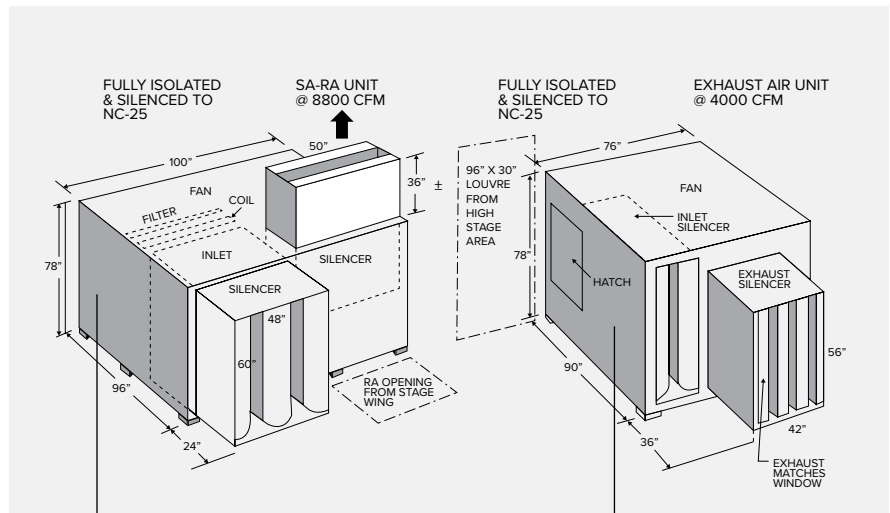
FAN/SILENCER PACKAGES

V-A proposed fan-silencer packages for both the supply and exhaust be located in the upper stage corners. These units would be within 15 feet of the actors on stage. Budget pricing was submitted for three noise criteria: NC-20, 25 and 30. Packages included fans, silencers, enclosures, coils and filters.

NC-25 was chosen which V-A guaranteed and NC-22 was achieved. (The spotlight dimmer made more noise than the quiet air conditioning units.)

Vibro-Acoustics retrofit air conditioning units for "Courthouse Theatre" were located in upper stage corners and achieved NC-22. Note how the silencers are recessed into the units due to severe space limitations.

Theater air conditioning addition requires NC-25 but has no traditional space for fans and silencers.



Roy Thomson Hall

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

> Ultra-Critical Sound Criteria

To achieve first class listening conditions for the symphony hall, acoustical consultants Bolt Beranek and Newman Inc. (BBN) set NC-15 as the sound criteria design goal. The problems they solved to control the noise are described in their paper entitled "The Sound of NC-15". The following solutions are excerpts from the article.

SOLUTION

"It really takes a team coordinated effort" led by the acoustical consultants to achieve such a stringent design goal.

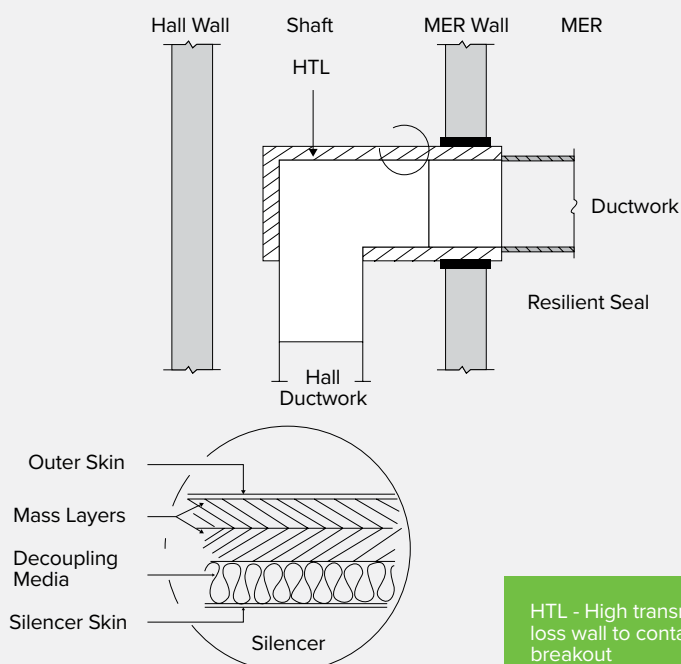
"V-A offered to set up a test...to allow the acoustical consultant to witness and actually take part in a test to verify acoustical performance of the elbow silencers...they successfully performed to their acoustical rated values. The decision was made to accept and use them and it proved to be a good decision."

Elbow silencers with factory-built HTL casings, specified by the acoustical consultants, reduce breakout noise.

World famous acoustical consulting firm specified, and Vibro-Acoustics supplied, noise control products to successfully achieve "The Sound of NC-15".

SOLUTION CONT.

"The entire package of high TL return boxes and silencers was designed and built by the same silencer noise control manufacturer, so that acoustical performance for the package became the sole responsibility of one agency. These elements performed to the predicted acoustical levels published in the manufacturer's certified data tables." The package also included "special custom-made acoustical enclosures for all the fans" and vibration isolation for mechanical equipment, ducting and piping.



HTL - High transmission loss wall to contain noise breakout

National Arts Center

Application: Duct Silencers (Centrifugal Fan Systems)

CHALLENGE

- > Ultra-Critical Sound Criteria
- > Unreliable performance
- > Unacceptable installed performance

An opera hall and three other auditoria in one complex posed special problems. Because of limited space, large mechanical rooms were located immediately adjacent to the ultra-quiet spaces. The challenge was to reduce the fan noise so special double concrete walls were not required.

The special panel constructions specified had never been tested.

After V-A received the order for the silencers, enclosures and vibration isolation for the 66 fan systems, we were asked by the contractor to bid on prefabricated HTL duct systems as an alternative to contractor site built systems.

Acoustical consultants specified special HTL silencing construction and testing to achieve ultra-quiet results.

SOLUTION

ACOUSTICAL CONSULTANTS SPECIFIED SPECIAL NOISE CONTROL, VIBRO-ACOUSTICS SUPPLIED A NOISE AND VIBRATION CONTROL PACKAGE, TESTING IN THE V-A LABORATORY AND PROJECT MANAGEMENT

Acoustical consultants specified special designs for the 66 fan systems requiring high transmission loss (HTL) panels for ductwork, silencers and enclosures to reduce sound break-out and break-in. Special designs included a panel range of 4" to 8" thickness having a weight up to 30psf.

The acoustical consultant witnessed the transmission loss testing, to the ASTM standard, of the heaviest 8 inch panels assembled into a 14' wide by 10' high wall system. Smaller panels, typical of duct wall size, were tested and a TL design index was developed for HTL duct wall application.

Our successful bid included full time project management responsibilities and the on-site layouts of all the 66 fan enclosure systems and critical connecting ductwork requiring HTL construction and silencers.