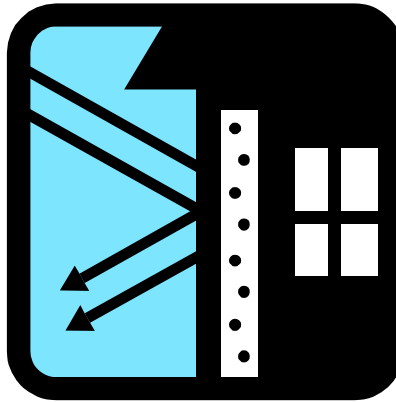


TIPS FOR INSULATING YOUR HOME AGAINST AIRCRAFT NOISE



Provided by the
Metropolitan Airports Commission
Aviation Noise & Satellite Programs Office



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INTRODUCTION

The Purpose of This Guide

This guide has been developed in response to numerous requests from homeowners asking for information about methods the Metropolitan Airports Commission (MAC) has implemented successfully to reduce interior noise levels in homes. This guide is intended as a means to share information with homeowners about sound transmission; it explains the elements of the MAC's Residential Sound Mitigation Program within the federally-recognized 65 DNL contour area. ***It is not intended for use as a "how to" manual.***

Who May Find This Guide Useful

- Homeowners/Homebuyers
- Builders
- Cities
- Realtors

DISCLAIMERS

- This guide is intended to be used as an informational guide - it is not intended for use as a "how to" manual.
- Insulating a home for noise reduction tends to tighten a home. Homeowners should have their homes tested for indoor air quality before and after home modifications.
- Homeowners should consult with professional contractors for their home's individual needs (e.g., HVAC, windows and doors, etc.).
- The Metropolitan Airports Commission claims no responsibility for decisions homeowners make based on the information contained in this guide.
- The Metropolitan Airports Commission takes no responsibility for decisions homeowners may make based on any of the recommended reading and/or reference materials contained in this pamphlet.
- Any modifications completed by homeowners are the sole responsibility of the homeowner.

NOISE CONTROL BASICS

How Outside Noise Gets Inside a Home

Sound travels from the exterior to the interior of a home in two ways: through solid structural elements and through the air.

Although sound energy in the form of vibrations can be deflected by solid structural elements of a home – such as walls – some of those vibrations can make it through the walls and into a home.

Openings in a home, such as space around windows and doors, mail slots and vents, allow air to travel directly from the exterior to the interior of a home. **Wherever air can infiltrate a home, sound can as well.**

Noise Level Reduction

A home's Noise Level Reduction (NLR) is the number of decibels a home attenuates from its exterior to interior when all openings (windows and doors) are closed.

Homes constructed in cold climates like Minnesota typically provide a NLR of between 27-30 decibels without additional measures to insulate against noise. So, for example, if 75 decibels of sound were produced on the ground by a single aircraft overflight, 45 decibels of sound would be produced inside a home that attenuates 30 decibels.

Reducing Sound Transmission into a Home

Some primary approaches for reducing sound transmission into a home are:

1. Eliminating openings
2. Using higher-rated Sound Transmission Class (STC) windows and doors
3. Adding mass to walls or ceilings
4. Adding absorptive materials between the studs or joists in a wall

The STC rating is a measure of a material's ability to insulate against sound; the higher the STC rating, the better insulating properties the material will have. ***The MAC's sound insulation program uses a standard of 40 STC.***

Generally, windows allow more noise inside a home than do walls. Because of this, the more space windows take up on a wall the more the overall noise protection decreases. Typically, using acoustical windows does more to improve the sound insulation performance than any other design modification does.

THE METROPOLITAN AIRPORTS COMMISSION'S (MAC) PROGRAM

The MAC's Residential Sound Mitigation Program within the federally-recognized 65 DNL noise contour was very successful in reducing interior noise levels for homes within the most noise-impacted areas. According to homeowner surveys, the program has increased homeowners' enjoyment of their homes by making it easier to watch television, talk on the phone and sleep at night.

Below are the methods typically used to reduce transmission of exterior noise into a home; the MAC has employed all of these methods to some degree:

- Re-conditioning or replacement of prime windows/doors
- Installing acoustical storm windows/doors
- Adding wall and attic insulation
- Baffling roof and attic vents
- Installing central air -conditioning (if not existing)
- Modifying ventilation (when necessary for health and safety reasons)

Windows and Doors

A home's interior noise level can be reduced through differing degrees of treatment. For instance, some homes may only need their windows or doors *re-conditioned*, while others may need all new windows or a combination of the two.

To ensure the tightness necessary to achieve an STC 40 rating, homeowners may be able to re-condition their home's existing prime windows or doors by:

- Re-glazing panes that are loose
- Replacing cracked or broken panes
- Installing weather stripping (both windows and doors)
- Adding insulation to weight cavities
- Installing vinyl jamb liners
- Trimming sides of existing sashes to fit with new jamb liners

In more severe cases, complete replacement of window sashes or the entire window or door may be necessary.

The MAC's research showed that adding an operable acoustic storm window to a tight-fitting prime window results in an STC rating of 40. (A typical window with storm can provide an STC rating between 27 and 30.)

New acoustic products are superior, but are also more expensive. Acoustical storm windows and doors are significantly different from regular storms. They may have thicker glass and a higher grade of aluminum, which act to prevent sound from entering a home, and are also very

effective at reducing air infiltration. (These products are not available through the standard building supply stores.) When acoustical storm windows and doors are installed, two inches of dead air space is created between the prime window or door and the storm. This dead air space acts to prevent noise from entering a home.

Casement windows alone do not provide a high STC rating and acoustical storm windows cannot be installed outside the crank-out windows. Some options for casement windows include:

- Replace windows with custom, acoustically-rated casement windows with extra-thick glass
- Replace windows with a new slider or double-hung window with an acoustical storm
- Add an interior glazing panel to the existing casement window at the screen location (not recommended for bedroom windows for safety and code reasons)

Insulate Sidewalls

- Sidewall cavities should be insulated to capacity. (This does not apply to homes with brick, stucco or stone exterior siding.)
- Insulate attic areas to capacity, or up to 14 inches, whichever is applicable.
- Consult a home insulation contractor.

Baffle Roof Vents

Baffle roof vents in attic spaces to minimize noise transmission while still allowing airflow. A baffle can be as simple as installing insulation board under the roof vent, while leaving both ends open to allow the vent to operate normally.

- Vent Baffling
 - Attic vent baffling
 - Roof vent baffling
 - Chimney treatment (if required)
 - Mail slot sealing
- Sealing Attic Bypasses (This is more a treatment to improve indoor air quality and to keep warm, moist air from migrating to the attic spaces, helping to reduce ice dams during the winter.)

Install Central Air-Conditioning

Installing central air-conditioning or another type of cooling system allows people inside the home to be comfortable during the warmer months without the need to open windows and doors for a breeze.

Through-the-wall air-conditioning units are not recommended, as they allow air, and thus noise, to infiltrate the home.

The method and cost of adding central air-conditioning depends on a home's heating system. It is relatively easy, in most cases, to add a central air-conditioning system to homes with a forced air heating system. It becomes more difficult and costly with hydronic (boiler heat) or gravity (large "octopus" furnace) systems.

Consult a certified HVAC contractor for the best solution for your home.

A Word about House "Tightness" and Maintaining Proper Ventilation

Acoustic modifications tend to make houses "tighter." For health and safety purposes, the following is suggested:


- Have your indoor air quality tested by a qualified professional.
- Have your home's furnace/boiler, water heater, and other gas combustion appliances checked by a professional.
- Correct any problems with venting or carbon monoxide production.
- Ensure adequate fresh airflow through the house by installing a quiet, low-volume exhaust fan or a balanced ventilation system if necessary.
- Have your home checked for tightness after acoustical retrofits are completed.

TIPS ON CHOOSING CONSULTANTS AND CONTRACTORS

- Prior to signing a contract with a contractor, know in advance what treatments or improvements you are planning to have completed.
- Invite multiple contractors to visit the home and provide cost estimates on an identical scope of work.
- Determine whether the contractor has experience with acoustic products or installation of acoustically-rated storm windows or doors.
- Determine whether any of the work will be sub-contracted. If so, investigate the subcontractor(s) to the same degree as the primary contractor.
- Ensure the contractor is licensed, bonded and insured. Verify that the contractor's license is current.
- Ask for references.
- Contact the Better Business Bureau to find out if the contractor has any outstanding, un-resolved complaints.

ADDITIONAL RESOURCES

Wyle Laboratories

 Web Site – www.wyle.com

“New Construction Acoustical Design Guide”

(<http://www.eccog.org/common/ewe/documents/MCAS%20Cherry%20Point%20Acoustical%20Design%20Guide.pdf>)

Federal Aviation Administration

“FAA Guidelines for the Sound Insulation of Residences Exposed to Aircraft Noise” prepared by Wyle Labs, October 1992 (can be found on www.wyleacoustics.com web site)

(http://www.fican.org/pdf/Wyle_Sound_Insulation.pdf)

United States Environmental Protection Agency

“A Do-It-Yourself Guide to Sealing and Insulating with Energy Star®: Sealing Air Leaks and Adding Attic Insulation”


(http://www.energystar.gov/ia/partners/publications/pubdocs/DIY_Guide_May_2008.pdf)

 Web site: www.energystar.gov

 Phone: **1.888.782.7937**

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Appendix A

PRODUCTS INSTALLED BY THE METROPOLITAN AIRPORTS COMMISSION RESIDENTIAL SOUND MITIGATION PROGRAM

PRODUCT MANUFACTURERS' CONTACT INFORMATION

- A. Mon-Ray, Inc.: 801 Boone Ave N, Golden Valley MN 55427; 800.544.3646
- B. Sound Control Systems (SCS): 2333 Eastbrook Dr, Brookings SD 57006; SD 57006; 800.334.1328

METAL DOORS

- A. The following steel door manufactures have been approved by the MAC:
 - 1. Peachtree, Inc. "Avanti" Series
 - 2. Masonite International Corporation "Sta-Tru-HD" Series Entry Door System
 - 3. Therma-Tru "Profiles" or "Pro-Edge"
 - 4. PEM Millwork
 - 5. Pella Premium Steel Entry Doors
 - 6. Taylor "Uni-Door" standard and fire-rated models
- B. The following Steel Terrace models have been approved:
 - 1. Peachtree "Prado" Patio Doors
 - 2. Andersen 200 Series Hinged Inswing Patio Door

FIBERGLASS DOORS

- A. The following prime door manufacturers, subject to compliance with this Specification and Sound Insulation requirements, are approved:
 - 1. Peachtree "Newport"
 - 2. Peachtree "Newport Vintage"
 - 3. Masonite International Corporation "Parliament 8 Panel"
 - 4. Therma-Tru "Fiber Classic" Embossed Series
- B. The following terrace door manufacturers subject to compliance with this Specification and Sound Insulation requirements, are approved:
 - 1. Masonite International Corporation "Wood Grain Textured"
 - 2. Therma-Tru "Fiber Classic" Patio Door System

WOOD DOORS AND FRAMES

- A. The following manufacturers, subject to compliance with the Specifications and Noise Mitigation requirements are approved:
 - 1. Wood Solid Core doors
 - a. Doorcraft Doors by Jeld-Wen
 - b. Eggers Industries

- c. Graham Manufacturing
 - d. Mohawk Doors by Masonite
 - e. Lynden Flush Door
 - f. Illinois Flush Door
 - g. Young Door Company
2. Wood Door Panels
 - a. Buffelen Doors
 - b. Simpson Doors
 3. Wood Swinging Patio Doors
 - a. Buffelen "Thermal" B-5001, B-5510, B5515
 - b. Marvin "Wood Inswing French Door"
 - c. Park-Vue Swinging Pation Door
 - d. Simpson "Mastermark" Exterior French Doors
 - e. Andersen 400 Series Frenchwood Hinged Patio Door
 4. Wood Sliding Patio Doors
 - a. Marvin "Sliding" Pation Door
 - b. Marvin "Ultimate Sliding" French Patio Door
 - c. Park-Vue Patio Door
 - d. Larson W-82 AL Clad Wood
 - e. Andersen Narrowline Gliding Patio Door
 - f. Andersen 400 Series Frenchwood Gliding Patio Door
 5. Stave Appearance Doors
 - a. Pinecrest
- B. Approved Acoustical Storm Panels for prime door applications:
1. New acoustical storm panel, 1.4" laminated glass: Monray 603-DP and Sound Control Systems (SCS) S703-D

SLIDING GLASS STORM DOORS

Mon-Ray, Inc.
 Colors: White, Tan, Brown
 805-PSD with 1/8" tempered glass

Sound Control Systems (SCS)
 Colors: White, Tan, Brown
 T82 w/ insulated glass and integral
 3/16" tempered glass storm door

Note: The above products may be used with thicker glass than specified, at the discretion of the manufacturer. All glazing in sliding glass storm doors shall meet the International Building Code requirements for safety glass and be clearly labeled.

STORM DOORS

Mon-Ray, Inc.	Sound Control Systems (SCS)	Hess Manufacturing
White, Tan, Brown, Green	White, Tan, Brown, Green	White, Brown, Green
802-L with 3/16" glass	SCS 720-04 with 3/16" glass	--
803-S with 1/8" glass	SCS 730-04 with 3/16" glass	FL with 1/8" glass
803-SG with 1/8" glass	--	FL-G with 1/8" glass
803-H with 1/8" glass	SCS 730-37 with 3/16" glass	WT with 1/8" glass

803-HG with 1/8" glass	SCS 730-41 with 3/16" glass	WT-G with 1/8" glass
803-P with 1/8" glass	SCS 730-36 with 3/16" glass	CLA with 1/8" glass
803-PG with 1/8" glass	SCS 730-42 with 3/16" glass	CLA-G with 1/8" glass
803-X with 1/8" glass	SCS 730-35 with 3/16" glass	CB with 1/8" glass
803-XG with 1/8" glass	SCS 730-43 with 3/16" glass	CB-G with 1/8" glass
803-M with 1/8" glass	SCS 730-36 NP with 3/16" glass	HL with 1/8" glass
803-MG with 1/8" glass	SCS 730-42 NP with 3/16" glass	HL-G with 1/8" glass
803-T with 1/8" glass	SCS 730-35 SPL with 3/16" glass	JT with 1/8" glass
803-TG with 1/8" glass	SCS 730-43 SPL with 3/16" glass	JT-G with 1/8" glass
804-S with 1/8" glass	SCS 720-33 with 3/16" glass	--
804-L with 1/8" glass at inserts and 1/4" laminated glass at kickpanel	SCS 720-34 with 3/16" glass at inserts and 1/4" laminated glass at kickpanel	--
804-H with 1/8" glass	SCS 730-07 with 3/16" glass	--
804-HG with 1/8" glass	SCS 730-41 with 3/16" glass	--
804-P with 1/8" glass	SCS 730-03 with 3/16" glass	--
804-PG with 1/8" glass	SCS 730-42 with 3/16" glass	--
804-X with 1/8" glass	SCS 730-06 with 3/16" glass	--
804-XG with 1/8" glass	SCS 730-06 with 3/16" glass	--
804-M with 1/8" glass	SCS 730-03 NP with 3/16" glass	--
804-MG with 1/8" glass	SCS 730-42 NP with 3/16" glass	--
804-T with 1/8" glass	SCS 730-03 SPL with 3/16" glass	--
804-TG with 1/8" glass	SCS 730-42 SPL with 3/16" glass	--
Acoustical panel at P-150 with 1/4" laminated glass security door	SCS S744-D with 1/4" laminated glass	--

Note: The above products may be used with thicker glass than specified, at the discretion of the manufacturer. All glazing in storm doors shall meet the International Building Code requirements for safety glass and be clearly labeled.

VINYL WINDOWS AND PATIO DOORS

- A. Vinyl Windows. Only the following non-acoustically rated vinyl window models from respective manufacturers shall be used:
1. Thermal Line Windows
 - a. Model 1090, Double-hung
 - b. Model 1030, Glider
 - c. Model 1040/1050, Fixed
 - d. Model 1010, Casement

2. Tru-View by Lindsay Sash, Inc.
 - a. Model 710 Double-hung
 - b. Model 730 Slider
 - c. Model 840 Casement, Fixed
 3. Andersen Windows – Renewal Series (Fibrex)
 - a. Double-hung Window
 - b. Awning Window
 - c. Fixed Window
 - d. Gliding Window
 - e. Casement Window
- B. Vinyl Sliding Patio Doors. Only the following non-acoustically rated vinyl sliding patio doors shall be used:
1. Thermal Line 5100 patio doors, for use with existing or new wood blindstops and brickmolds
 2. Andersen Perma-Shield Gliding Patio Door

VINYL WINDOWS WITH INTEGRAL STORM WINDOWS

A. Approved Manufacturers:

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> 1. Sound Solutions Windows
404300 Series Min. 40 STC
<u>Vinyl Window</u>
White, Tan
DH*: 1/8" DS 1/2" air, 1/4" glass
Slider: 1/8" DS 1/2" air, 1/4" glass | <u>Aluminum Storm</u>
White, Tan, Brown
min. 1/8" DS glass
min. 1/8" DS glass |
| <ol style="list-style-type: none"> 2. Harvey Windows
<u>Vinyl Window</u>
White, Tan
DH: 1/8" glass, 5/8" air, 3/32" glass
Slider: 1/8" glass, 5/8" air, 3/32" glass | <u>Aluminum Storm</u>
White, Tan, Brown
min. 1/8" glass
min. 1/8" glass |
| <ol style="list-style-type: none"> 3. Mon-Ray Inc.
<u>Vinyl Window</u>
White, Tan
DH (8400): 1/8" glass, 9/16" air, 1/8" glass
Slider (8500): 1/8" glass, 1/2" air, 1/8" glass
DH (7400): 1/8" glass, 9/16" air, 1/8" glass
Slider (7500): 1/8" glass, 7/16", air, 3/16" glass | <u>Aluminum Storm</u>
White, Tan, Brown
min. 1/8" glass
min. 1/8" glass
min. 1/8" glass
min. 1/8" glass |
| <ol style="list-style-type: none"> 4. Sound Control Systems (SCS)
<u>Vinyl Window</u>
White, Tan, Brown
Casement (T803): 3/16" glass, 15/32" air, 1/8" glass
Slider (T603/604): 1/8" glass, 9/16" air, 1/8" glass
DH Extreme Tandem: 1/8" glass, 9/16" air, 1/8" glass
Picture (T503/504): 1/8" glass, 9/16" air, 1/8" glass | <u>Aluminum Storm</u>
White, Tan, Brown
min. 3/16" glass
min. 3/16" glass
min. 3/16" glass
min. 3/16" glass |

* DH = Double-hung

Note: The above products may be used with thicker glass than specified, at the discretion of the manufacturer. All glazing in storm windows shall meet the International Building Code requirements for safety glass and be clearly labeled.

STORM WINDOWS

	Mon-Ray, Inc.	Sound Control Systems
	White, Tan, Brown	White, Tan, Brown
DH* Recessed	604 w/ min. 3/16" glass at single glazed or w/ min. 1/8" glass at thermal glazed or w/ min. 1/8" glass	S203 w/ min. 3/16" glass
DH Flush	504 w/ min. 3/16" glass at single glazed, or w/ min. 1/8" glass thermal glazed, or w/ min. 1/8" glass	S204 w/ min. 3/16" glass
DH Overlap	404 w/ min. 3/16" glass at single glazed, or w/ min. 1/8" glass thermal glazed, or w/ min. 1/8" glass	--
DH Overlap	604 w/ min. 1/8" glass w/min. 3/16" glass	S203 OL w/ min. 3/16" glass
Slider Recessed	605 w/ min. 1/4" glass	S603 w/ min. 1/4" laminated glass
Slider Flush	505 w/ min. 3/16" glass	S604 w/ min. 3/16" glass
Slider Overlap	405 w/ min. 1/4" glass	--
Slider Overlap	605 w/ min. 1/4" glass	S603 OL w/ min.1/4" laminated glass
Fixed Recessed	603 w/ min. 3/16" glass	S503 w/ min. 3/16" glass
Fixed Flush	503 w/ min. 3/16" glass	S504 w/ min. 3/16" glass
Fixed Overlap	402 or 403 w/ min. 3/16" glass	--
Fixed Overlap	603 w/ min. 3/16" glass	S503 OL w/ min. 3/16" glass
Fixed Min. Frame	P-170 w/ min. 3/16" glass	--
Fixed Min. Frame	--	S703 w/ min. 3/16" glass
Exterior Storm Panel at Inswing Sash	P-170-PL w/ min. 3/16" glass	S703 w/ min. 3/16" glass
Interior Glazing Panel	P-150 w/ min. 3/16" tempered glass P-150 w/ V-seal, min. 1/4" lam. glass P-150 w/ adjustable stop, min. 3/16" tempered glass	--
Interior Glazing Panel	503-PL w/ min. 3/16" tempered glass 603-PL w/ min. 3/16" tempered glass	--
Interior Glazing Panel	P-130 w/ min. 3/16" tempered glass	S744 w/ min. 3/16" safety glass
Operable Skylight Glazing Panel	503-POS w/ 1/4" laminated glass	S734 O w/ min. 3/16" laminated glass

Fixed Skylight Glazing Panel	503-PFS w/ 1/4" laminated glass	S734 S w/ min. 3/16" laminated glass
Metal Prime Window Slider	1500 w/ 1/8" DSB glass	--
Metal Prime Window DH	1400 w/ 1/8" DSB glass	--

* DH = Double-hung

Note: The above products may be used with thicker glass than specified, at the discretion of the manufacturer. All glazing in storm windows shall meet the International Building Code requirements for safety glass and be clearly labeled.

WOOD AND CLAD WOOD WINDOWS

- A. Fixed acoustical window units listed below may be of any sash construction type as long as the sash frame and glazing type match the unit that was tested and approved. Only the following wood window manufacturers and models shall be used:
1. Marvin Windows: Double-hung, slider and fixed windows. Acoustical casement, acoustical awning and acoustical fixed windows and clad Ultimate double-hung w/ operable aluminum storm window - 1/8" annl
 2. Vetter Windows: Fixed windows
 3. Windsor Windows: Fixed windows
 4. A-Craft Windows: Double-hung and fixed windows. Acoustical fixed window.
 5. Loewen Windows: Acoustical casement, awning and fixed windows. Double-hung and fixed windows.
 6. H-Window Company: Acoustical pivot awning and fixed windows
 7. For Cottage/Inswing windows:
 - a. Sashes: A & A Millwork, Marvin, A-Craft, Kampmann Sash & Door Inc.
 - b. Frames: A & A Millwork, Shaw Lumber, A-Craft, Kampmann Sash and Door Inc. and Lamperts.
 8. Kolbe & Kolbe: Double-hung and fixed windows. Only non-clad units are approved.
 9. Pella Architect Series: Aluminum Clad Wood
 - a. Casement: Insulated Glass
 - b. Double-hung: Insulated Glass
 - c. Fixed Frame: Insulated Glass
 10. Andersen Windows – Renewal Series (Fibrex)
 - a. Double-hung
 - b. Awning Window
 - c. Fixed Window
 - d. Gliding Window
 - e. Casement Window
 12. Larson Manufacturing – Larson AL Clad Wood Windows
 - a. Double-hung, W200
 - b. Picture Window: W500
 - c. Horizontal Sliding Window: W-600

- d. Fixed Narrow Lite w/storm: W-700
- 13. Hurd Windows – Premium Clad Wood
 - a. Double-hung
 - b. Sliding Window
- 14. SP Custom Carpentry Windows
 - a. Double-hung
 - b. Sliding Window
 - c. Fixed Window
- B. The styles for wood prime double-hung, including fixed windows of double-hung sash construction, shall be classified as follows:
 - 1. Wood finish jambs Marvin Windows, Loewen Windows
 - 2. Vinyl jamb liners A-Craft Windows, Kolbe & Kolbe, Lindsay Windows

PRIME WINDOW RECONDITIONING AND SASH REPLACEMENT

- A. Only the following replacement wood sashes/jamb liner kits from respective manufacturers shall be used: A-Craft Windows, Marvin Windows, Lindsay Windows, Loewen Windows or Kolbe & Kolbe.
- B. Only the following jamb liner assemblies shall be used for reconditioning existing double-hung wood sashes: A-Craft Windows, J.W. Window Components, Marvin Windows, Mon-Ray MR-RC, or Lindsay Windows.

AIR-CONDITIONING AND FURNACE COMPONENTS

- A. Gas-fired furnaces and sealed combustion gas-fired furnaces: Armstrong, Gibson, Nordyn, Trane, Lennox, Carrier, Bryant, Arcoaire, RUUD, Heil, Tempstar, Amana, Luxaire, Comfortmaker, Janitrol by Goodman Manufacturing, Evcon, York or equal.
- B. Residential air-cooled condensing units: Trane, Lennox, Carrier, Bryant, Arcoaire, RUUD, Heil, Tempstar, Luxaire, Comfortmaker, Janitrol by Goodman Manufacturing, Villager ACS Series, Evcon, York, Gibson, Nordyne, Philco or equal.
- C. Ductless air conditioning units: Sanyo, Mitsubishi, Bryant, Carrier, Goodman, Samsung, Fujitsu, LG Electronics or equal.
- D. High-velocity air-conditioning: SpacePak - Local rep: J.L.Sontag 952-933-7768, Model No: ESP-2430 D/V Unico (Auer Steel 763-971-2010), Model M Series.

FIREPLACE DAMPERS

- A. The following exterior fireplace damper shall be used (no substitutions):
 - 1. Chim-A-Lator Delux

INSULATION

- A. The following insulation shall be used in attics and in non brick, rock, stucco, or masonry side walls:
 - 1. Blown Cellulose