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Evaluation #

200510-H

Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2658
Madison, WI 53701-2658

Wisconsin Building Products Evaluation

Material

Mini-Duct Central Heating
and Air Conditioning System

Manufacturer

Unico, Inc.
7401 Alabama Ave.
St. Louis, MO 63111

SCOPE OF EVALUATION

GENERAL: Unico's mini-duct central heating and air conditioning system is approved for use as an alternate heating and cooling system for residential and commercial applications (new and existing construction).

Comm requirements below in accordance with the current **Wisconsin Uniform Dwelling Code for 1- & 2-family dwellings:**

- **Heating and Air Conditioning Equipment and Systems:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements below.
- **Heating, Ventilating and Air Conditioning:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **ss. Comm 23.02, 23.03, 23.04, 23.08(5)(c),(d), 23.09 and 23.18.**

The **IMC** requirements below in accordance with the current **Wisconsin Amended ICC Code:**

- **Listed and Labeled:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 301.4(a) [Comm 64.0301(2)].**
- **Labeling:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 301.5 and s. IMC 301.6.**
- **Electrical:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 301.7 [Comm 64.0301(3)].**
- **Heating and Cooling Load Calculations:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 312.1.**
- **Ducts:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **ss. IMC 603.1, 603.2, and 603.4.**
- **Flexible air Ducts and Flexible Air Connectors:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 603.5 through 603.5.4.**

- **Registers, Grilles and Diffusers:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 603.15**.
- **Insulation:** The Unico mini-duct central heating and air conditioning system was evaluated in accordance with the requirements of **s. IMC 604.1, 604.7 and 604.13**.

DESCRIPTION AND USE

GENERAL: The Unico mini-duct central heating and air conditioning system is a Small-Duct High-Velocity (SDHV) air conditioning and heating system as defined by the Department of Energy. The product consists of an air handler with coil designed to match a small duct system. The air handler is designed for lower air volumes and higher static pressures. The duct system is designed for air velocities up to 3000 ft/min and to deliver air into the conditioned space through a series of small openings less than 6 square inches (outlets) with discharge velocities between 1000 and 2000 ft/min. The duct system generally consists of a main trunk (plenum) approximately 9 inches diameter and a multitude of 2-inch diameter flexible factory insulated branch ducts (manufactured by Unico). The branch ducts are specially designed to act as a sound-absorbing muffler (sound attenuator).

TESTS AND RESULTS

- **Capacity and Efficiency:** ARI Standard 210/240 listed and certified by ARI as an indoor coil in the Unitary Products Certification program. Meets federal minimum efficiency standards.
- **Air handlers:** listed for electrical safety by Intertek Testing Services (ETL symbol) in accordance with UL Standard 1995.
- **Small Ducts:** listed as an Air Duct by Intertek Testing Services (ETL symbol) in accordance with UL Standard 181.
- **Definition of SDHV Systems:** (per DOE) A heating and cooling product that contains a blower and indoor coil combination that:
 1. Is designed for, and produces, at least 1.2 inches [of water] of external static pressure when operated at the certified air volume rate of 220-350 CFM per rated ton of cooling; and
 2. When applied in the field, uses high velocity room outlets generally greater than 1000 fpm which have less than 6.0 square inches of free area.

The values specified are minimum or maximum values. Typical systems operate between 1.0 and 1.8 inches of water in the main duct and are rated at 250 CFM per “nominal” ton (nominal means nameplate rating of the outdoor condensing unit). Duct velocity is typically between 1000 to 2000 fpm at the outlets and between 2000 and 2800 fpm in the main duct.

- **Typical Installed Duct Leakage:** less than 5%.
- **Rated R-value of Unico Ductwork:** R-3.5, R-4.2, R-6.0, R-8.0 (effective R-values are higher see below).

R-value Equivalence: To make the R-value comparison the small diameter Unico ducts are compared to an equivalent amount of insulation on a conventional 6” diameter ducts which would produce the same percentage heat loss. Several factors are significant in this calculation including the Unico system greater coil temperature drop, smaller duct diameters (curvature factor) and faster air velocity. Calculations considered unconditioned attics at both 140°F (Table 1) and 120°F (Table 2) with various lengths of ducts.

**Table 1
Unico 2" Diameter Duct Calculated Equivalent R-Values^{1,2}
Compared to 6" Duct @ 140°F Attic Temperature**

Unico Part Number	10 ft. Duct Length	15 ft. Duct Length	20 ft. Duct Length	25 ft. Duct Length	30 ft. Duct Length
UPC-26C	4.8	4.2	3.8	3.4	3.1
UPC-26C-R4	6.2	5.4	4.9	4.4	3.9
UPC-26C-R6	8.9	7.6	6.8	6.1	5.4
UPC-26C-R8	11.3	9.6	8.5	7.6	6.7

1. R-values shown are for 6-inch duct yielding the same percentage heat gains as Unico ducts for the given lengths.
 2. Calculations based on the following coil temperature drops 6" duct @ 17°F and 2" Unico Ducts @ 25°F.

Table 1
Unico 2" Diameter Duct Calculated Equivalent R-Values^{1,2}
Compared to 6" Duct @ 120°F Attic Temperature

Unico Part Number	10 ft. Duct Length	15 ft. Duct Length	20 ft. Duct Length	25 ft. Duct Length	30 ft. Duct Length
UPC-26C	4.7	4.0	3.7	3.3	3.0
UPC-26C-R4	6.0	5.2	4.7	4.2	3.8
UPC-26C-R6	8.5	7.3	6.5	5.8	5.2
UPC-26C-R8	10.8	9.2	8.1	7.3	6.4

1. R-values shown are for 6-inch duct yielding the same percentage heat gains as Unico ducts for the given lengths.
2. Calculations based on the following coil temperature drops 6" duct @ 17°F and 2" Unico Ducts @ 25°F.

LIMITATIONS OF APPROVAL

General: 1) The design and installation of the proprietary air handling unit is beyond the scope of this approval. 2) The indoor unit must bear the ETL seal showing conformance to ANSI/UL 1995. 3) All components of the system, including the condensing unit, shall comply with and be installed in accordance with the applicable code. 4) Ducts must be sized according to the manufacturer’s published sizing tables. 5) This approval is not valid unless Group 1A refrigerants are used.

The **Comm** and **IMC** limitations below are in accordance with the current **Wisconsin Uniform Dwelling Code, for 1 & 2 family dwellings** and the current **Wisconsin Amended ICC Code** for commercial buildings respectively:

- The Unico mini-duct central heating and air conditioning system is approved for installation without balancing dampers (volume dampers), as required in **s. IMC 603.15**.
- Per **s. IMC 603.4 Nonmetallic ducts**: The flexible duct and flexible duct connectors are to be installed in the field, i.e., they shall be stretched such that the maximum sag is no greater than 1/2" per foot per foot of support spacing. Supports shall not be located greater than 5 feet apart. Supports shall consist of 1" minimum bands used such that the support system does not damage the duct or cause an out of round shape. See SMACNA HVAC Duct Construction Standards Metal and Flexible, sections 3.19 through 3.22.
- The heating/cooling appliance used with the Unico mini-duct central heating and air conditioning system shall be installed as required in **ss. IMC 304.8, 304.9, (306 in general), 306.5 and 306.6**.
- Condensate disposal shall be addressed per **IMC 307**.
- The Unico mini-duct central heating and air conditioning system is approved as an alternate heating and cooling system for residential and commercial applications (new and existing construction).
- The Unico mini-duct central heating and air conditioning system shall be installed in accordance with the applicable **Comm** and **IMC Code sections**, this approval and the manufacturer’s installation instructions.

This approval will be valid through December 31, 2010, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: August 23, 2005 By: _____

Lee E. Finley, Jr.
 Product & Material Review
 Integrated Services Bureau