



Flexible Air Duct and Flexible Air Connectors Installation and Energy Use

Commissioning Agents presentation 6/8/2017

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International Certification Board **(ICB)**
Testing Adjusting and Balancing Bureau **(TABB)**

Research on Installing of flex duct and connectors

- No Study to date has found flex to be installed as per local building code.
- ASHRAE RP-1333
 - **7.2.4 General**
 - every installation was not in compliance with Manual D and ADC (2003) requirements. Page 44
- **Published in ASHRAE HVAC&R Research Journal, Vol. 10, No. 3, July 2004**
 - In our tests, a compression of around 15% was used as a moderate compression case typically found in field installation and represents a “Normal Stretch” flexible duct scenario

Air Duct Council or ADC (formerly Air Diffusion Council)

- <http://www.flexibleduct.org/>
- Association for flex duct manufactures
- Codes refer to this through manufacture guidelines which sends one to these installation requirements
- Download for free or request a hard copy of the installation guide
- Disclaimer I am not against flex duct or it use, I am against improperly installed flex duct, I am against the use of air connectors that can endanger occupants of a building
- Ralph Koerber is at the ADC and is a very good resource for flex information rkoerber@atcoflex.com

Current inspection process is not working

- City inspectors
 - Do not have easy access to installation code requirements
 - How many in attendance have seen the ADC manual?
 - It is not in the current code books what has to be done to install flex properly
 - Codes refer to other standards, inspectors typically do not possess
- Commissioning agents
 - Need to understand the data around flex for owners, knowing higher energy use due to improper flex installation is simply not looked at or understood by building inspectors.
- Owners
 - Flex can be cheaper when not installed properly but cost energy use 24/7 after occupancy
- Facility tech
 - Occasionally they install flex and might not know how to install it

IMC and IRC on Flex vs, Metal ducts

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Exception: Continuously welded and locking-type longitudinal joints and seams in ducts operating at static pressures less than 2 inches of water column (500 Pa) pressure classification shall not require additional closure systems.

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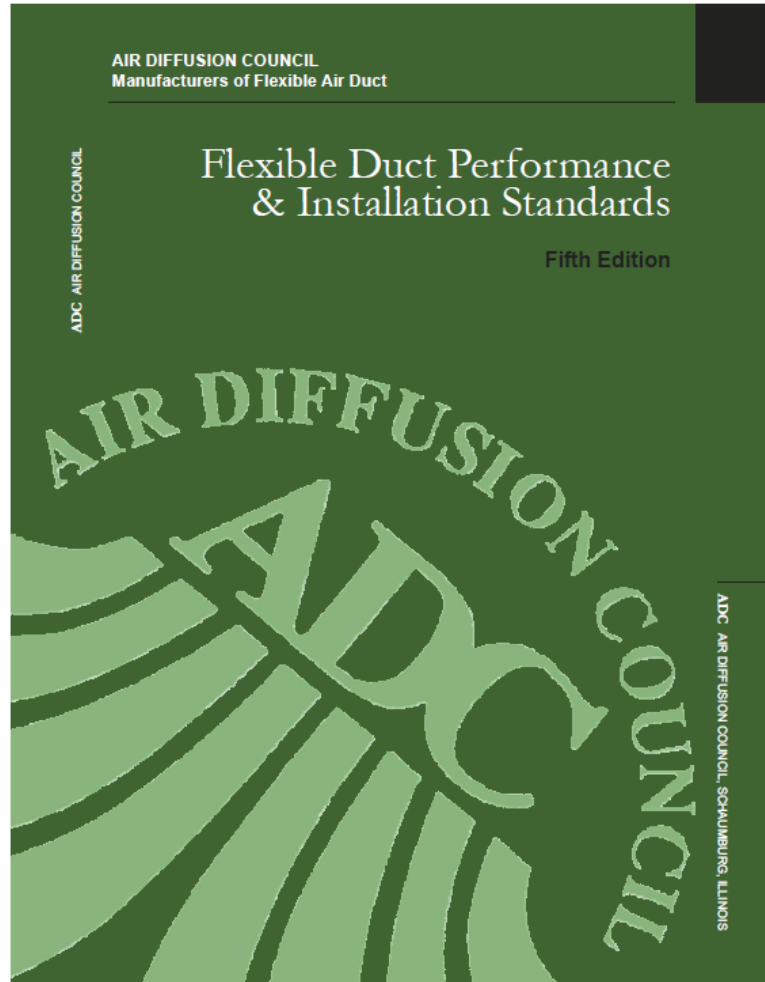
603.10 Supports. Ducts shall be supported at intervals not to exceed 12 feet (3658 mm) and shall be in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible*. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's instructions.

603.11 Furnace connections. Ducts connecting to a furnace shall have a *clearance* to combustibles in accordance with the furnace manufacturer's installation instructions.

IMC, IRC, and UMC code on flex

- Go to the manufacture instructions and they all reference to install as per the ADC or the Air Diffusion Council.
- Or they take all the info from the ADC manual and use the installation instructions.
- Same pics

Your Flex installation bible!



Installation Requirements . . . continued

- d. Keep bends greater than or equal to one (1) duct diameter bend radius.

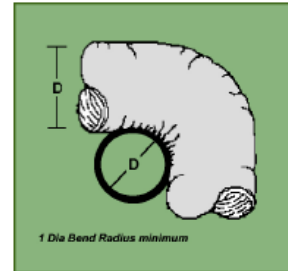


Figure 11

- e. Properly route and support the flexible duct runs.

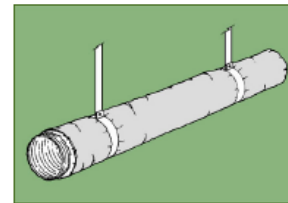


Figure 12

- Care shall be taken to minimize sagging or snaking of the duct between supports and minimize pressure loss caused by excessive direction changes to the airflow.

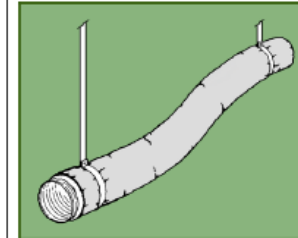


Figure 13

- Ducts shall not be crimped against joist or truss members, pipes, wires, etc. as this increases pressure loss and reduces air flow.

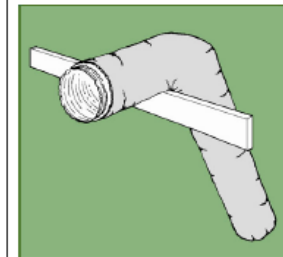


Figure 14

Cost to install flex vs metal duct

- It is actually cheaper to install metal ducts than flex installed properly (these are some but not all the requirements)
 1. Install flex duct fully extended. Do not install in the compressed state or use excess length.
 2. Install horizontal flex duct **hangers at least every 4 feet** (1.2 m).
 3. Install **vertical** flex duct hangers at **least every 6 feet** (1.8 m)
 4. Install flex duct so that **sag** does not exceed **½ in. per ft** (42 mm per m). That means no more than 1" of sag between hangers.
 5. Use flex duct supports that are ridged and at 1.5 inch (38 mm) minimum wide (no cloth hangers). Hanger shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supporting section rests on the hanger.
 6. Install flex duct so that bends exceed one duct diameter radius. Do not bend ducts across sharp corners such as pipes, wires, joists or trusses.
 7. Do not install non-metallic flex duct with screws penetrating the inside liner.
 8. All flex duct connections shall be attached to a **2" ridged collar with a bead**. The flex must be pulled over at least 1" over the bead before a fasten strap is affixed. **Beads on connections are optional when using metal worm-gear clamps.**
 9. All tapes, mastics, and non-metallic clamps shall be listed and labeled with UL 181
 10. After pulling insulation jacket tight on the connection use at least 2 full wraps of UL 181 approved tape or a clamp can be used in place of the 2 full wraps of approved UL 181 tape.

Flex duct and flex connectors

- Flex duct passes UL testing for being a flex duct or connector (3 less)
- Flex connectors do not have to pass all the UL Duct testing test.
 - Do not pass flame penetration testing
 - Do not pass the puncture test
 - Do not pass the impact test
- Confusion in labeling? No standard on labeling req.
- The rectangular performance label is 4 times the size of air connector round UL label,
- The round indicator label is about the size of a dime
- A rectangular indicator label is used for flex duct



IMHO

- Cheapest = Installed flex improperly
- Installed metal duct
- Highest cost per foot is properly installed flex duct

Some of the test UL 181 Duct Testing

Test for Surface Burning Characteristics

Burning Test

Mold Growth and Humidity Test

Low Temperature and High Temperature Test

Static Load Test

Erosion Test

Pressure and Collapse Tests

High Temperature and Humidity (as part of the Corrosion test)

Corrosion Resistance Test

Leakage Test

Puncture Test

Impact Test

Flame Penetration Test

UL 181 Duct test Not Required for Air connectors

- **Puncture Test**
- **Impact Test**
- **Flame Penetration Test**

Installing flex typical issues (just the start)

- A **five foot length** of vertical flex requires at least one hanger, a 9 foot length of flex requires at least 2 hangers.
- Sag between hangers not more than $\frac{1}{2}$ " per foot, which means not more than **1 inch of sag** between hangers. (2 feet to center of hangers $2 \times \frac{1}{2} = 1$ ")
- Beaded collars. When is the last time you have seen a beaded collar screwed on the diffuser so the flex can not **pull off** as easy?
- A +6 foot piece of vertical flex requires at least one hanger. How often have you seen hangers on any vertical run flex.

Not all but some requirements for installing flex.

- Install flex duct fully extended. Do not install in the compressed state or use excess length.
- Install horizontal flex duct hangers at least every 4 feet (1.2 m).
- Install vertical flex duct hangers at least every 6 feet (1.8 m)
- Install flex duct so that sag does not exceed $\frac{1}{2}$ in. per ft (42 mm per m). That means no more than 1" of sag between hangers.
- Use flex duct supports that are ridged and at 1.5 inch (38 mm) minimum wide (no cloth hangers). Hanger shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supporting section rests on the hanger.

Not all but some requirements for installing flex. (cont)

- Install flex duct so that bends exceed one duct diameter radius. Do not bend ducts across sharp corners such as pipes, wires, joists or trusses.
- Do not install non-metallic flex duct with screws penetrating the inside liner.
- All flex duct connections shall be attached to a 2" ridged collar with a bead. The flex must be pulled over at least 1" over the bead before a fasten strap is affixed. Beads on connections are optional when using metal worm-gear clamps.
- All tapes, mastics, and non-metallic clamps shall be listed and labeled with UL 181
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Current proposals to the ICC, IMC flex changes

Do not allow screws to penetrate inside liner of flex

- The ADC does not allow this.
- Not one manufacture allows this
- Every open a chip bag and it tears very easy once it starts to tear?
Milar

Current proposals to the ICC, IMC flex changes

Eliminate the use of flex duct in inaccessible spaces

- Not cleanable as per manufacture and the ADC
- ADC and manufactures mandate if flex needs to be cleaned it should be replaced
- Rodent damage
- Contamination of any kind
- Behind wall cavities
- LBL study on flex straps and failure rates

ASHRAE Research Project RP-1333

- Shows resistance in normally installed flex duct, up to 8 times the resistance.
- ASHRAE 500k to determine flex is more restrictive than flex duct
- No standard to which flex duct is manufactured
 - Small internal wires closer together
 - Larger internal wires further apart
 - No way to say what resistance flex duct is due to no manufacturing standard
- Gets away from previous used data
- Flex duct was pulled with 25 lbs of pressure at each end and tested to determine the resistance, it is not installed with this pressure on the ends but yet if referred to as a factor 1 as a multiplier for 4% compression confused me too.

Lawrence Berkley Lab test

- Dr. Culp
- Resistance factors
- Elbows made of flex can have up to 20 times the resistance
- Remember the large internal wires with larger spacing?
- Well think of what happens to those internal wires when the duct is bent 90%

Fans and Energy use

- Fans can only make Total Pressure (TP)
- Engineers and installers determine how that TP is used
- The TP can be used as Static Pressure (SP) and/or Velocity Pressure (VP)
- SP is the pump me up pressure
- VP is the pressure from the movement of air
- More flex = more SP
- Improperly installed flex = more SP
- If SP goes up VP has to go down, VP is movement
- Less VP means the fans needs to speed up = more energy = more \$ 24/7
- $TP = VP + SP$

6" X 25' FLEX ALUMINUM FOIL
DUCT

\$22⁷⁸

0000-591-966



12 016





Not a UL listed strap as required



CI STRAPS

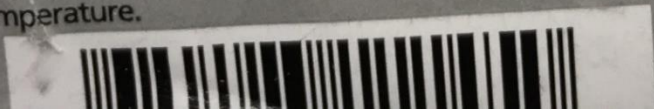
Y:
AG
METER:



Best when used with Tensioning Tool
For use with UL Non-Metallic
Air Ducts and Air Connectors

Long exposure to cold temperatures (32°F and below) or high heat and humidity (>90% RH) prior to installation will reduce the effectiveness of strap and will cause brittleness and/or decrease tensile strength. For best results, keep bags sealed and stored at room temperature.

DUTY
LENGTH:





Thank you John Hamilton TABB

- Make sure you accept ICB/TABB certified balancing reports 😊
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