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Executive Summary:

My name is Steve Ferguson, the Manager of Codes with ASHRAE. This is an appeal on Items 159 and 160 on procedural and technical grounds. In a general summary, item 159 establishes a hard 5 foot limit on all flexible air connectors, and item 160 establishes a hard 5 foot limit on factory-made flexible air ducts and connectors. There were significant technical issues raised in opposition to accepting these limitations in both items during public comment – specifically, there is no technical reason to prevent proper installation of these types of products in accordance with manufacturer's instructions, and subsequently no written response that contained the "reasons therefor" was provided to any objector in accordance with Section 2.6 of the ANSI Essential Requirements for either item. Therefore, I am requesting that both Items 159 and 160 be disapproved.

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Appeal on Item 159

In this appeal I will demonstrate how there is no technical justification to support the 5 foot limitation on flexible air connectors, and how Section 2.6 "Consideration of Views and Objections" of ANSI Essential Requirements was not complied with.

Summary of Actions Related to Item 159

A proposal was submitted by Mr. Phil Ribbs on behalf of the UMC Code Review Task Group which does the following related to the technical issues in this appeal:

1) Requires flexible air ducts and connectors to comply with UL 181
2) Requires flexible air ducts and connectors to be installed in accordance with manufacturer's instructions and the SMACNA HVAC Duct Construction Standards– Metal and Flexible.
3) Prevents all flexible air *connectors* from being more than 5 feet.

The proposal contained other requirements that are unrelated to this appeal, as shown in the publicly distributed Report on Comments.

At the first Technical Committee (TC(meeting, this proposal was approved as submitted, and during the public comment period, 13 public comments were submitted that contained technical reasons to modify the proposal, as shown in the publicly distributed Report on Comments.

Of the submitted comments, 8 proposed to modify the proposal by deleting the sentence that limits flexible connectors to 5 feet and prevents connectors from penetrating a wall, floor, or ceiling. These were comments 2-9 that were submitted by by Mr. Taylor (ASHRAE Representative on the TC), Mr. Sarmento, Mr. Hunt, Mr. Blaevoet, Mr. Singh, Mr. Williams, Mr. Friedman, and Mr. Siedl. These comments contained technical reasons to not limit the length of flexible air connectors in all applications as proposed.

Three of the comments, comments 1, 10, and 11, proposed further modifications to the proposal and also contained technical reasons to not limit the length of flexible air connectors in all applications as proposed.

Comment 12, asked for rejection of the proposal and contained technical reasons to not limit the length of flexible air connectors in all applications as proposed.

A 13th comment was submitted that proposed a replacement proposal and also contained technical reasons to not limit the length of flexible air connectors in all applications as proposed.

These comments were presented to the TC at the meeting in Las Vegas on May 1, 2013All comments were rejected by the TC for the following reason "The public comment is being rejected based on the action taken for Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors".

On the various comment responses, 5 TC members (Mr. Buuck, Mr. Cabot, Ms Carroll, Mr. Feehan and Mr. Taylor) voted negatively that contained technical reasons in support of their opposition. As shown in the publicly distributed Report on Comments. All of the TC members opposed limiting the length of flexible air connectors in all applications as proposed:

Item 159 was raised for discussion at the assembly consideration session where the technical issues were raised again, along with a statement that no written responses explaining the "reasons therefore" were provided to objections. The IAPMO membership upheld the recommendation to approve as submitted.

Reasoning for Appeal on Technical Grounds of Item 159

As previously stated in the summary, Item 159 does the following three things:

1) It requires flexible air ducts and connectors to comply with UL 181
2) It requires flexible air ducts and connectors to be installed in accordance with manufacturer's instructions and the SMACNA HVAC Duct Construction Standards – Metal and Flexible.
3) It prevents ALL flexible air connectors from being more than 5 feet.

In the reason statement of the proponent, there is only one reason provided to justify the 5 foot limitation.

The 5 feet limitation for flexible air duct connectors coincides with the 2009 ASHRAE Handbook and "HVAC Flexible Duct Pressure Loss Measurements" which is a study submitted by Texas A&M University.

There is no such 5 foot limitation for flexible air connectors in the 2009 ASHRAE Handbook of Fundamentals (hereinafter referred to as Handbook). It should also be noted the 2009 ASHRAE Handbook is not a standard and what is contained in the Handbook is only a suggestion. The relevant excerpt from the Handbook is as follows:

The ASHRAE 2009 Fundamentals Handbook (page 21.7 and 21.18) reads that "for commercial systems, flexible ducts should be… no more than 5 ft in length, full stretched."

A similar suggestion is also included in the more recent 2013 Handbook; however, the limiting length recommendation was changed to 6 feet, and this was intended to give design guidance to the engineer and was never intended to be included in code language such as "shall be limited to 5 feet." There are many applications where flexible air ducts longer than 5 feet can be properly used when installed in accordance with the manufacturers recommendations and relevant industry installation guides and standards.

This is a suggested recommendation (please note the use of the word "should" instead of "shall") that applies to flexible air ducts, but is not intended to firmly limit the designers ability to install longer lengths of flexible air ducts.

Likewise, the Texas A&M University study "HVAC Flexible Duct Pressure Loss Measurements"[1] is limited to pressure losses in flexible air ducts. It concludes that if a flexible duct is installed in accordance with manufacturer's instructions and the relevant duct construction standards, then the pressure losses in the duct are minimal, and the flexible duct performs as well as other ducting products.

There are two technical reasons why Item 159 should be disapproved:

[1] This research project was completed as an ASHRAE Research Project and sponsored by ASHRAE Technical Committee (TC) 5.2 Duct Design

1) The suggested 5 foot limitation in the ASHRAE 2009 Handbook is specifically only for flexible air ducts. This proposal only limits flexible air connectors. These are *different products*[2]. There is no justification in the written record of Item 159 to support a 5 foot limitation for flexible air connectors.
    a. From flexibleduct.org "UL (Underwriters Laboratories) in their **UL 181 Standard for Factory-Made Air Ducts and Air Connectors**, defines two categories of flexible "ducts" :

       The UL Listed Flexible Air Duct must pass all of 15 tests in the UL 181 Standard. Air Ducts are labeled with a square or rectangular label showing their respective listing. There is no limitation on the length of runs when using UL Listed Air Ducts.

       The UL Listed Flexible Air Connector must pass only 12 of the 15 tests of the UL 181 tests, and is labeled with a round shaped label, which states "*for installation lengths not over 14 feet*". An installer may not increase the 14-foot limitation by using a splice between 14' sections of Air Connectors. This length limitation is set by the requirements in NFPA 90A & 90B Standards."
    b. This proposal requires flexible ducts and connectors to comply with UL Standard 181, but as stated above, flexible air connectors do not have to pass all 15 tests found in UL 181, which adds confusion – how does one comply?

2) If flexible ducts are installed using the two new requirements:
    a. Flexible air ducts and connectors must comply with UL 181.
    b. Flexible air ducts and connectors must be installed in accordance with manufacturer's instructions and the SMACNA HVAC Duct Construction Standards – Metal and Flexible.

The Texas A&M study published by ASHRAE demonstrates how flexible duct performs when properly installed. Even if the study were correctly applied to flexible air connectors, its conclusions do not support a 5 foot limitation for flexible air connectors. Included below are the general recommendations from that research report – note there is no mention of limiting the length of flexible ducts, and nor are flexible connectors mentioned:

> "7.2.4 General
> 1. Flexible duct should be installed in a fully stretched or as close as reasonable, but not more than 4% compression. One challenge that the industry faces is that improperly installed flexible duct is difficult to detect, since compression is difficult to see or measure when installed.
> 2. Flexible ducts should not be compressed or forced through constrained building features since this will also increase the pressure loss by choking the airflow.
> 3. Abushakra et al. (2002) show that loss coefficients for bends in flexible ductwork vary widely from condition to condition, with no uniform or consistent trends. Loss coefficients vary from a low of 0.87 to a high of 3.27. Flexible duct elbows should not be used in lieu of rigid elbows. For comparison purposes an 8 in. die stamped 90º elbow with a centerline r/D ratio of 1.5 the loss coefficient is 0.11.
> 4. Flexible ducts should be sealed properly. Tape and mastic used to close and seal flexible air ducts and flexible air connectors shall be list ed and labeled to UL 181B, Part 1 or Part 2 and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Mechanical fasteners for use with nonmetallic flexible air ducts shall be either stainless-steel worm-drive hose clamps

[2] http://www.flexibleduct.org/ADC_FAQs.asp

or non-metallic straps listed and labeled to UL 181B, Part 3, and marked "181B-C." Non-metallic mechanical fasteners shall have a minimum tensile strength rating of 150 lb. force. When non-metallic mechanical fasteners are used, beaded fittings are required, and the maximum duct positive operating pressure shall be limited to 6 in. w.c.
5. As a subject for future work, it is recommended that ASHRAE study actual installations. As part of the preparation for this project, numerous housing and industrial installations were reviewed. In this limited survey, it was found that every installation was not in compliance with Manual D and ADC (2003) requirements. "[3]

Item 159 should be disapproved as there is no technical justification that supports a 5 foot limitation for flexible air connectors. In fact, the references provided by the proponent are for flex duct, not flexible connectors, and the proposed 5 foot limitation is not consistent with any published documents, including the most recent versions of the documents referenced in the proponent's reason statements.

Reasoning for Appeal on Procedural Grounds of Item 159

There were 17 unresolved objectors (Mr. Taylor was both a commenter and a negative TC voter), and all of the objectors objected to the 5 foot limitation for flexible air connectors. The current written record of reasons for taking action is not responsive to the issues raised, there was a lack of consideration of views and objections, and the objectors were not advised in writing of the disposition of the objection and the reasons therefor as required by Section 2.6 "Consideration of Views and Objections" of ANSI Essential Requirements.

Section 2.6 of the ANSI Essential Requirements states (underline for emphasis):

> Prompt consideration shall be given to the written views and objections of all participants, including those commenting on the PINS announcement or public comment listing in Standards Action. In connection with an objection articulated during a public comment period, or submitted with a vote, an effort to resolve all expressed objections accompanied by comments related to the proposal under consideration shall be made, and each such objector shall be advised in writing (including electronic communications) of the disposition of the objection and the reasons therefor.

The current written record of reasons for taking action is not responsive to the issues raised.

The current written record of reasons for taking action is not responsive to the issues raised. As previously demonstrated in the technical portion of the appeal, the written reasons in support of the 5 foot limitation do not apply to flexible air connectors:

1) The 5 foot suggested limitation in the ASHRAE 2009 Handbook of Fundamentals is specifically only for flexible air ducts. This proposal only limits flexible air connectors. They are *different products*[4]. There is no justification in the written record of Item 159 to support a 5 foot limitation for flexible air connectors.
2) If flexible ducts are installed using the two new requirements:
    a. Flexible air ducts and connectors must comply with UL 181

[3] Source – ASHRAE (2011). *Research Project 1333- "HVAC Flexible Duct Pressure Loss Measurements"* retrieved from http://rp.ashrae.biz/page/ASHRAE-D-RP-1333-20120307.pdf
[4] http://www.flexibleduct.org/ADC_FAQs.asp

b. Flexible air ducts and connectors must be installed in accordance with manufacturer's instructions and the SMACNA HVAC Duct Construction Standards – Metal and Flexible.

The Texas A&M study published by ASHRAE demonstrates how flexible duct performs when properly installed not flexible air connectors. Even if the study were correctly applied to flexible air connectors, its conclusions do not support a 5 foot limitation for flexible air connectors.

The only written reasoning that is provided by the TC in response to comments on Item #159 is "The public comment is being rejected based on the action taken for Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors."

The reasons provided by the TC in response to comments on Item #160 are as follows:

1) TC reasoning for initially rejecting Item #160 at the first TC meetings:

"**COMMITTEE STATEMENT:**
The proposed change is overly restrictive and would ban the installation of flexible air ducts that are longer than 5 feet."

2) TC reasoning for approving Item #160 as modified at the second TC meetings:

"**COMMITTEE STATEMENT:**
The proposed modification will clarify the intent of the section in regards to the use of factory-made flexible air ducts and connectors."

Note that the modification exempted residential spaces from the new requirement, and had nothing to do with the 5 foot limitation.

None of those reasons from the TC in Item #160 are responsive to the issues related to the 5 foot limitation for flexible air connectors raised by the objectors, therefore the TC response to all objectors on Item #159 is not responsive to any of the issues raised.

There was a lack of consideration of views and objections

As stated in the technical appeal:

"There are two technical reasons why Item 159 should be disapproved:
1) The suggested 5 foot limitation in the ASHRAE Handbook of Fundamentals is specifically only for flexible air ducts. This proposal only limits flexible air connectors. They are *different products*[5]. There is no justification in the written record of Item 159 to support a 5 foot limitation for flexible air connectors.
2) If flexible ducts are installed using the two new requirements:
    a. Flexible air ducts and connectors must comply with UL 181
    b. Flexible air ducts and connectors must be installed in accordance with manufacturer's instructions and the SMACNA HVAC Duct Construction Standards – Metal and Flexible.

[5] Ibid

> The Texas A&M study published by ASHRAE demonstrates how flexible duct performs when properly installed not air connectors. Even if the study were correctly applied to flexible air connectors, its conclusions do not support a 5 foot limitation for flexible air connectors."

ALL of the justification in the written record is specific to flexible air ducts, and none of it is related to flexible air connectors. It is possible that the TC did not understand that these are two distinctly different products during their consideration of the objections.

If the TC did not realize flexible air ducts and connectors were different products, and they applied the supposed justification for flexible ducts to flexible air connectors, then the TC could not have properly considered all views and objections in Item #159. As Mr. Koerber stated in public comment #13:

> "Factory-made rigid and flexible air ducts are already covered in Section 603.3, so only flexible air connectors should be included in this section. The modification clearly indicates that the section pertains to the installation of factory-made flexible air connectors"

In public comment 11, Mr. Guttman states:

> "Furthermore, the limitations of lengths for air connectors but not 'air ducts' is confusing, as the paragraph uses both terms in other sentences but not in this one…"

This sentence demonstrates there is confusion about the different types of products, and how the language in this section is confusing as it relates to flexible air connectors.

Additionally, as part of public comment 11, Mr. Guttman proposes to remove the requirement related to flexible air connectors penetrating a wall, floor or ceiling:

> "…in facilities where critical room pressure relationships shall be maintained at all times in accordance with other provisions of this code ~~and shall not penetrate a wall, floor, or ceiling~~. …"

In response to this, the committee stated

> "The public comment is being rejected based on the action taken for item #160 as it provides clarity in regards to the 5 feet limitation for flexible air connectors."

The issue with that is there is no part of Item #160 that has anything to do with flexible air connectors penetrating a wall, floor, or ceiling, and this portion of the comment has nothing to do with limiting the length of flexible air connectors. By responding in such a manner, it is clear that the TC never gave any consideration to Mr. Guttman's comments related to flexible air connectors penetrating a wall, floor or ceiling. If Item #159 is published, this will be the only location in the UMC where flexible air connectors will be prevented from penetrating a wall or ceiling. The language he is trying to strike and replace in this proposal is going forward in addition to Item #160.

None of these issues were addressed in the one sentence response from the committee on both of these comments, and while the TC may have voted on the response to the public comment, it appears that technical issues raised in the comments were never considered.

Further, if Items #159 and #160 were competing and related proposals, and the TC was trying to decide between one or the other, it would have been reasonable to respond to all commenters and objectors stating that all Item ##159 was being disapproved in favor of #160, or vice versa.

However that was not the case. In this circumstance, the end result was that both Items #159 and #160 were approved. The end result is two different sections that do two different things. A response that states a comment (one Item #159) is being rejected in favor of action on another proposal (Item #160) is not appropriate and demonstrates a lack of consideration of the issues on the original proposal when they will both be published at the end of the process.

The objectors were not advised in writing of the disposition of the objection and the reasons therefor

As previously stated, the TC response to public comments 1-12 was simply:

> "The public comment is being rejected based on the action taken for item #160 as it provides clarity in regards to the 5 feet limitation for flexible air connectors."

TC members, Mr. Buuck, Mr. Cabot, Ms Carroll, Mr. Feehan, and Mr Taylor, objected to this reasoning, and voted negatively on the responses. Much of the reasoning had to do with issues of increased cost and unjustified requirements. Nothing in the TCs response to public comments, nor item #160 is related to many of the issues raised in the negative votes submitted by TC members.

Further, as demonstrated in the previous section, multiple comments were submitted with justification also unrelated to the TC response and Item #160.

While a written response was provided, it was unrelated to the issues provided to the TC, and is non-compliant with the ANSI Essential Requirements. In the end, Items #159 and #160 were both approved, which results in some duplicative and some differing requirements.

Conclusion and Requested Relief Item #159

There is no technical justification that supports a 5 foot limitation on flexible air connectors. Further, the current written record of reasons for taking action is not responsive to the issues raised, there was a lack of consideration of views and objections, and the objectors were not advised in writing of the disposition of the objection and the reasons therefor as required by Section 2.6 "Consideration of Views and Objections" of ANSI Essential Requirements.

You will note that I am also appealing Item #160. Since the committee's written response only cites Item #160, if my appeal on Item #160 is granted, then Item #159 must also be granted as the TC written statement would be completely invalidated (rather than unresponsive to the technical issues).

For these reasons, I request Item #159 be disapproved..

Steve Ferguson

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Appeal on Item 160

In this appeal I plan to demonstrate how there is no technical justification to support the 5 foot limitation on flexible air ducts connectors, and demonstrate how Section 2.6 "Consideration of Views and Objections" of ANSI Essential Requirements was not complied with.

Summary of Actions Related to Item 160

A proposal was submitted by Mr. David Dias which prevents factory-made flexible air ducts and connectors from being more than 5 feet.

At the first TC meeting, this proposal was rejected because "The proposed change is overly restrictive and would ban the installation of flexible air ducts that are longer than 5 feet." During the public comment period, a comment was submitted by Craig Loeffler to approve the proposal as submitted.

At the second TC meeting, the TC voted to accept the proposal as modified. The modification changed "ridged" to "rigid" and added an exception for "residential occupancies". The committee statement was "The proposed modification will clarify the intent of the section in regards to the use of factory-made flexible air ducts and connectors"

Three TC members (Mr. Buuck, Ms Carroll, and Mr. Taylor) voted negatively including technical reasons in support of their opposition. As shown in the publicly distributed Report on Comments. All of the TC members opposed limiting the length of flexible air connectors in all applications, including non-residential occupancies.

Item 160 was raised for discussion at the assembly consideration session where the technical issues were raised again, along with a statement that no written responses explaining the "reasons therefore" were provided to objections. The IAPMO membership upheld the recommendation to approve as submitted.

Reasoning for Appeal on Technical Grounds on Item 160

This proposal limits the lengths of both flexible ducts and flexible air connectors to no more than 5 feet. There is no justification to put a hard limit of 5 feet on these products, which have been shown through research[6] to perform as well as other similar products provided they are installed properly, and the proposal does nothing to ensure they are installed properly. The proposal assigns an arbitrary limit with no evidence that supports the claimed reasons for submitting the proposal. The following technical statements were made in the written record that support rejecting this proposal:

> **COMMITTEE STATEMENT:**
> The proposed change is overly restrictive and would ban the installation of flexible air ducts that are longer than 5 feet.

[6] http://www.ibsadvisorsllc.com/_library/lbnl-49012_Compression_Effects_on_Pressure_Loss_in_Flexible_HVAC_Ducts.pdf Published in the ASHRAE Research HVAC&R Research Journal, Volume 10, No. 3, July 2004 and
"Research Project-1333 -- HVAC Flexible Duct Pressure Loss Measurements" Published in May 2011.

Buuck:

Furthermore, I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1,UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Carroll:

The public comment should be rejected based on the following reasons:

A. There was some important information that was not considered when we discussed this proposal (and Item #159).It is my understanding that ASHRAE was going to speak on this at the UMC TC meeting in Las Vegas but were not present for Item #160. The following was taken verbatim from the ASHRAE TC5.2 Duct Design committee minutes in conclusion to numerous meetings on this specific subject with the recommendation that the code not limit the length of air duct or connectors.

The final vote of ASHRAE TC5.2 Duct Design was recorded as: "The Chair enters the following motion, second by Ralph Koerber, for a vote of ASHRAE TC5.2 (Duct Design) as follows:

1. The ASHRAE 2009 Fundamentals Handbook (page 21.7 and 21.18) reads that "for commercial systems, flexible ducts should be… no more than 5 ft in length, full stretched."
2. This is also included in the more recent 2013 handbook; however, the limiting length recommendation was changed to 6 feet.
3. This was intended to give design guidance to the engineer and was never intended to be included in code language such as "shall be limited to 5 feet.
4. It is the recommendation of the ASHRAE Technical Committee TC5.2 duct design that any code language limiting the length of flexible duct or air connectors, due to language in the ASHRAE Handbook as referenced above, to 5 or 6 feet be stricken."

B. Discussions at the UMC TC meetings indicated two potential concerns with flexible duct – improper installation and loss of airflow due to inadequate extension. Limiting the length of flexible duct and flexible air connectors to 5 feet will NOT ensure proper installation of these products and will not ensure proper extension and air flow. What this limitation WILL do is add significant construction costs.

Taylor:

Not only is there no substantiation for the 5 foot limit as a safety or public health consideration (see my
public comments on # 159), the last clause of this proposed change makes no sense: flex ducts are in fact primarily used to make connections from rigid ducts to air outlets which generally includes a change in direction from horizontal to vertical that would constitute an elbow. Does this language mean that flex duct has to be run only dead straight? This has no purpose other than to increase construction costs.

There is no statement provided in response to any of those issues in the written record. Further, the Technical Committee specifically agreed that flex duct should not be limited in this manner "The proposed change is overly restrictive and would ban the installation of flexible air ducts that are longer than 5 feet."

<u>Reasoning for Appeal on Procedural Grounds</u>

There were numerous comments made on Item 160 that specifically stated that flex duct and flexible connectors should not be limited to 5 feet, including a statement that said exactly that from the Technical Committee.

None of those objections were responded to in writing.

Section 2.6 "Consideration of Views and Objections" of ANSI Essential Requirements states:

> "In connection with an objection articulated during a public comment period, or submitted with a vote, an effort to resolve all expressed objections accompanied by comments related to the proposal under consideration shall be made, and each such objector shall be advised in writing (including electronic communications) of the disposition of the objection and the reasons therefor."

There is a comment from the committee *specific to the modification made only. The* TC reasoning from second hearing is specific only to the modification states:

> Reasoning: The proposed modification will clarify the intent of the section in regards to the use of factory-made flexible air ducts and connectors.

The modification exempts residential occupancies, and the modification changes "ridged" to "rigid". However, there are no written objections to either of these modifications, and there's no written response that explains why the original proposal, with the 5 foot limitation for all occupancies, was accepted. The only written reasoning that explains any action on the 5 foot limitation is a written statement from the committee that the limitation is overly restrictive – the written justification is in agreement with the objections. It seems that after the second TC meeting, the TC did the exact opposite of their previous action, and there's no explanation of why that was done in the written record.

Conclusion and Requested Relief on Item #160

At no point in time does the written record of Item #160 state why the 5 foot limitation was accepted. Further, the written record provides reasons from the TC why the 5 foot limitation should *not be* accepted. By not providing, in writing, the reasons for setting this limitation of 5 feet there is a violation of Section 2.6 of the ANSI Essential Requirements.

I request that approval of Item #160 as modified be overturned and be disapproved.

Item # 159 **Comment Seq # 045**

UMC 2015 – (603.4):

SUBMITTER: Phil Ribbs
Chair, UMC Code Review Task Group (see Code Review Task Group Report II Item # 94)

RECOMMENDATION:

Add new text as follows:

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air connector lengths shall be not more than 5 feet (1524 mm) and shall not penetrate a wall, floor, or ceiling. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

(renumber remaining sections)

SUBSTANTIATION:

(Attachments for Item 159 are included in the substantiation CD presented to the TC)

1. Many HVAC installations utilize flexible air ducts and connectors, and the UMC does not provide specific requirements for flexible air ducts and connectors that can be used by designers for factory-made air ducts.
2. Flexible air ducts are considered factory-made air ducts. However, a separate section for flexible air ducts and connectors is being added for ease of use of the code. Unlike flexible air ducts and connectors, not all factory-made air ducts are required to comply with UL 181. UL 181 addresses requirements which include preformed lengths of flexible or rigid ducts, materials in the form of boards for field fabrication of lengths of rigid ducts, and preformed flexible air connectors. The user is to refer to the manufacturer's installation instructions and SMACNA for the installation of flexible air ducts since both sources will provide installation instructions for flexible air ducts and connectors.
3. The 5 feet limitation for flexible air duct connectors coincides with the 2009 ASHRAE Handbook and "HVAC Flexible Duct Pressure Loss Measurements" which is a study submitted by Texas A&M University.
4. Where protected, a flexible air duct is permitted to penetrate a fire-rated assembly and a flexible air connector is prohibited to penetrate an assembly (fire-rated or not). This is because an air connector is not tested for spread of flame.
5. The temperature limitation is the industry standard for warm air. The material in flexible air ducts and air connectors are only tested to resist a temperature up to 250°F (121°C).

COMMITTEE ACTION: Accept as Submitted

A PUBLIC COMMENT(S) WAS SUBMITTED FOR REVIEW AND CONSIDERATION.

PUBLIC COMMENT 1:

SUBMITTER: Marguerite Carroll, UL, LLC

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, and shall be installed in accordance with the manufacturer's installation instructions~~,~~ and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air connector lengths shall be not more than ~~5~~14 feet (~~1524~~ 4267 mm) and shall not penetrate a wall, floor, or ceiling. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Flexible air connectors which are listed to UL 181 are allowed by the standard in lengths up to 14 feet. This product is specifically evaluated for the maximum length up to 14 feet, and the manufacturer's installation instructions are reviewed to ensure proper installation up to this length. The requirements for these flexible air connectors have been included in the UL 181 standard for over 35 years. UL closely monitors field reports submitted through its market surveillance program, and we have not been made aware of any field issues with these products in lengths up to 14 feet when properly installed in accordance with the listing and manufacturers installation instructions.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation is not in accordance with the standard (UL 181) or the listings for flexible connectors.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs.

0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.

- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 2:

SUBMITTER: Steven T. Taylor, P.E., Taylor Engineering LLC/Rep. ASHRAE liaison to the UMC Technical Committee
Jeff Stein, P.E., Taylor Engineering LLC

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. ~~Flexible air connector lengths shall be not more than 5 feet (1524 mm) and shall not penetrate a wall, floor, or ceiling.~~ The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

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It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:
The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:
BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

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It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 3:

SUBMITTER: Craig Sarmento, Beutler Corporation

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. ~~Flexible air connector lengths shall be not more than 5 feet (1524 mm) and shall not penetrate a wall, floor, or ceiling.~~ The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Flexible duct is an ubiquitous element in both residential and commercial HVAC systems. It is cost effective, safe, and in many applications more energy efficient than the metal ducts that would be used to replace it. The proponents of this change are in error in two ways: they are proposing this change based upon energy saving benefits alone, which is specifically outside the purview of the UMC, and the change will actually harm fire and life safety by reducing the number of projects that are subjected to inspection.

Safety of flexible duct systems does not appear to be an issue in this proposal, as neither the appropriate Technical Committee handling the safety of flexible duct systems nor even the proponent of this measure claim that there is a safety issue with existing duct systems. Instead, the proponent of this change makes an argument that is factually incorrect, as well as being inappropriate, and is based on energy savings.

It is factually incorrect in that by only detailing the type of material, but not dealing with other elements of duct design, it fails to take into account the efficiency of the entire system. By confusing the performance of a component with the overall performance of a system. The proponent of this change has made a fundamental error in evaluation. Furthermore, not only can larger flex duct have both lower static pressure drops and lower costs than a similar length of smaller diameter metal ductwork, flexible duct is much more easily formed into long changing radius curves needed in the actual built environment; further improving the true energy performance of a system that contains flexible duct to a system that contains metal duct. The point is further proven by the absence of compelling peer reviewed research to support the conclusion that systems using flexible duct use more energy than systems using metal ductwork.

It is inappropriate in the absence of evidence of both a compelling fire/life safety issue and a means to address it; and the UMC is the wrong venue to use. The purpose of the UMC is to "provide minimum standards to safeguard life or limb, health, property, and public welfare", while other standards such as ASHRAE 90.1 or California's own Title 24/Part 6 are focused directly upon energy.

Finally, there is a very substantial likelihood that adoption of such a proposal would actually reduce safety in buildings. The existing built environment, both residential and commercial, is designed assuming the use of flexible duct from the size of overhead plenums to the diameter of openings in open web trusses that the ducts must pass through the geometry of spaces. To arbitrarily mandate rigid ductwork into spaces that were specifically designed to accommodate flexible duct installations will impose tremendous burdens on replacement contractors. Those that chose to go around the rules will have a price advantage, but will also need to hide their work from inspectors, thereby driving more replacement projects underground. Thus, this proposal is a net negative to fire and life safety. There is no positive benefit from those who follow the rules, if it is adopted, and significantly negative safety implications by driving projects away from responsible contractors and inspectors.

For these reasons, I recommend in the strongest possible terms the deletion of the third sentence of Section 603.4.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:
The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:
BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

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- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
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It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 4:

SUBMITTER: Marshall Hunt, P.E., Pacific Gas & Electric Company

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. ~~Flexible air connector lengths shall be not more than 5 feet (1524 mm) and shall not penetrate a wall, floor, or ceiling.~~ The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

The input by Steven Taylor is on point particularly in reference to the importance of duct sizing. Energy efficiency for buildings in California is covered by Title 24. If this was an energy issue, it would be in Title 24. The proponent should present their proposal to the relevant energy efficiency code organizations.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

TThe public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

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CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

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PUBLIC COMMENT 5:

SUBMITTER: Jeffrey P. Blaevoet, P.E., Guttmann & Blaevoet Consulting Engineers

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. ~~Flexible air connector lengths shall be not more than 5 feet (1524 mm) and shall not penetrate a wall, floor, or ceiling.~~ The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Restricting the length of flexible ductwork is an unnecessary burden on designers and building owners. There is no guarantee this will save energy or improve safety, and would increase construction costs. This could also be interpreted as a restriction on fabric ducts and other innovative products.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

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CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

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PUBLIC COMMENT 6:

SUBMITTER: Gurdaver Singh, Guttmann & Blaevoet Consulting Engineers

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. ~~Flexible air connector lengths shall be not more than 5 feet (1524 mm) and shall not penetrate a wall, floor, or ceiling.~~ The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Restricting the length of flexible ductwork is an unnecessary burden on designers and building owners. There is no guarantee this will save energy or improve safety; however it would increase construction costs. Correct sizing the flexible duct, setting performance criteria, and making sure the installation is correct especially through walls, floors, and ceilings is more important if energy is the true concern. This change could also be interpreted as a restriction on fabric ducts and other innovative products that are used by designers to meet the higher energy efficiency targets set by the code. Unless there are safety or health concerns, the use of flexible ducts should be left to the design team as tool to use in awkward coordination situations in the field. The purpose of the UMC is to provide minimum standards to safeguard life or limb, health, property, and public welfare. Unless a rationale based on improving safety, health, etc. can be provided; this change should not be made.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

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CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

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It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 7:

SUBMITTER: Art Williams, Air Systems

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air connectors ~~lengths~~ shall ~~be not more than 5 feet (1524 mm) and shall~~ not penetrate a wall, floor, or ceiling. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Industry best practices already allow for flexible duct lengths greater than 5 feet when proper size criteria and installation practices are followed.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 8:

SUBMITTER: Glenn Friedman, P.E., Taylor Engineering LLC

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air connectors ~~lengths shall be not more than 5 feet (1524 mm) and~~ shall not penetrate a wall, floor, or ceiling. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Limiting flexible duct length will not improve building safety and will increase first costs. This is also not an energy improvement because energy usage depends on duct sizing, not on the type of duct alone. Therefore, the language "lengths shall be not more than 5 feet (1524 mm)" should be deleted.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 9:

SUBMITTER: Reinhard Seidl, Taylor Engineering LLC

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air ducts ~~connector lengths shall be not more than 5 feet (1524 mm) and~~ shall not penetrate a wall, floor, or ceiling. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

The stated reason for limiting flexible duct lengths to reduce pressure loss does not make sense from a technical perspective, and limiting the length of flex duct to 5 feet increases costs without benefits. All undersized ducts have too much pressure drop. It is the designer's responsibility to size the duct (flexible or not) in accordance with the project's energy goals and in compliance with energy codes. This has nothing to do with the material choice, and can be done with either flexible duct or hard duct. The proposed revision allows the designer the flexibility in coming to the correct design decision.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 16 **NEGATIVE:** 5 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

FEEHAN: The five foot limitation is not in accordance with the current standard or listings for flexible air connectors (UL 181). I agree with the substantiation submitted with the public comment. Also, limiting the length will increase construction cost.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 10:

SUBMITTER: Stephen Poe, Critchfield Mechanical Inc

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air connector lengths shall be not more than ~~5~~7 feet (~~1524~~2134 mm) and shall not penetrate a wall, floor, or ceiling. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

Item # 159 proposes to limit flexible air ducts and connectors to 5 feet maximum length. Flexible air ducts are currently used for sound attenuation of airflow at virtually every supply diffuser in large commercial buildings. The standard acoustic flex duct for a diffuser in an office building is 7 feet in length. For example, you can Google "JP Lamborn Acoustic Ducting AMF-07." The 7 foot length is required for adequate acoustic noise attenuation of the airflow as it enters the diffuser into the occupied space. The maximum length of the flexible air duct should be set at 7 feet, and not 5 feet.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken on Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 20 **NEGATIVE:** 1 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 11:

SUBMITTER: Steven Guttmann, Guttmann & Blaevoet Consulting Engineers

RECOMMENDATION:

Request to accept the code change proposal **as modified** by this public comment.

603.4 Flexible Air Ducts and Connectors. Flexible air ducts and connectors shall comply with UL 181, shall be installed in accordance with the manufacturer's installation instructions, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction. Flexible air connector lengths shall be not more than ~~5~~10 feet (~~1524~~ 3048 mm) in facilities where critical room pressure relationships shall be maintained at all times in accordance with other provisions of this code ~~and shall not penetrate a wall, floor, or ceiling~~. The temperature of the air to be conveyed in a flexible air duct or connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

The proposed deletion eliminates the limitation of "flexible air connector" lengths. The justification by the submitter was that this aligns with the 2009 ASHRAE Handbook. However, the handbook does not require this limitation, but rather suggests the trade-offs in increased air flow resistance (and thus, energy use) should be considered. Energy concerns can be offset in other ways, and does not require this length limitation. For decades, California has limited the use of flexible air ducts to 10 feet, but only in hospitals due to concerns about installation methods with longer flex ducts causing potential air balance problems in a facility that has critical air balance requirements. Furthermore, the limitation of lengths for "air connectors" but not "air ducts" is confusing, as the paragraph uses both terms in other sentences but not in this one, even though for all intents and purposes they refer to the same manufactured item. The proposed length limitation does not appear to improve the health, safety, or welfare of the public in any meaningful way.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken for Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 21 **NOT RETURNED:** 1 Garza

PUBLIC COMMENT 12:

SUBMITTER: Christine Tsai/Craig Malaer/ Kristopher Kyle, Webcor Builders

RECOMMENDATION:

Request to **reject** the code change proposal by this public comment.

SUBSTANTIATION:

Flex duct is, technically, a perfectly acceptable solution. To install sheet metal duct where flex duct can be installed only serves to increase the revenue of the installers and manufacturers.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:
The public comment is being rejected based on the action taken for Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 17 **NEGATIVE:** 4 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:
BUUCK: I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

PUBLIC COMMENT 13:

SUBMITTER: Ralph Koerber, ATCO Rubber Products, Inc./Rep. Air Diffusion Council (ADC)

RECOMMENDATION:

Request to **replace** the code change proposal by this public comment.

603.4 Factory-Made Flexible Air Connectors. Factory-made flexible air connectors shall be permitted to be installed in an occupancy covered by this code. Air connectors shall be installed in accordance with the manufacturer's installation instructions and with their listing.

Factory-made air connectors shall not pass through a wall, partition, or enclosure of a vertical shaft that is required to have a fire resistance rating of 1 hour or more. Factory-made air connectors shall not exceed 14 feet (4267 mm) in length and shall not pass through floors.

Factory-made air connectors shall be installed with not less than 4 inches (102 mm) of separation from earth, except where installed as a liner inside of concrete, tile, or metal pipe, and shall be protected from physical damage. The temperature of the air to be conveyed in an air connector shall not exceed 250°F (121°C).

SUBSTANTIATION:

The recommendations for Section 603.3 (Item # 158) clarifies the installation requirements for factory-made rigid and flexible air ducts. Therefore, Section 603.4 is necessary to clarify the installation requirements for factory-made flexible air connectors due to their limited-use boundaries. Factory-made rigid and flexible air ducts are already covered in Section 603.3, so only flexible air connectors should be included in this section. The modification clearly indicates that the section pertains to the installation of factory-made flexible air connectors. Factory-made flexible air connectors, just as with factory-made air ducts, should be installed in accordance with the manufacturer's installation instructions and the listing. Furthermore, including the requirement to install products per the SMACNA HVAC Duct Construction Standards - Metal and Flexible may conflict with UL 181 and SMACNA, as they have different requirements. The code language already requires, in Section 602.3, that factory-made air ducts and air connectors be installed per the conditions of their listing which are included in the manufacturer’s installation instructions.

COMMITTEE ACTION: Reject the public comment

COMMITTEE STATEMENT:

The public comment is being rejected based on the action taken for Item # 160 as it provides clarity in regards to the 5 feet length limitation for flexible air connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 17 **NEGATIVE:** 4 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: I have a couple issues with the Committee’s decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

Secondly, no attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

CABOT: The five foot limitation conflicts with the flexible air connectors standard (UL 181).

CARROLL: The five foot limitation on flexible air connectors is not in accordance with the standard or the listings for these products.

TAYLOR: I strongly recommend striking the third sentence from Section 603.4 as it limits the length of flexible duct. The purpose of the UMC (Section 101.2) "is to provide minimum standards to safeguard life or limb, health, property, and public welfare…." Limiting flexible duct length does not meet any of these goals and it will unnecessarily increase first cost. The rationale provided by the proponent is improved energy efficiency. However:

- As noted above, energy efficiency is not under the purview of the UMC. Energy standards, such as ASHRAE 90.1, California's Title 24, etc. explicitly cover this scope yet neither of these standards include any direct restriction on flex duct length. Why? Because these standards are based on life cycle cost analysis and no one has ever shown that flex duct increases life cycle costs.
- Even if energy efficiency was a valid premise, this proposal is incomplete. Fan energy depends not only on the roughness of the duct but on how it is sized. A 8 inch diameter "smooth" sheet metal duct conveying 200 cfm will have almost twice the friction rate of a 10 inch "very rough" flexible duct conveying 200 cfm (0.075"/100' vs. 0.042"/100') per SMACNA data. The UMC does not address how to size ducts (e.g. limit friction rate) so it is quite possible that contractors will install 8 inch metal ducts instead of 10 inch flexible ducts to offset the cost premium of metal vs. flexible and increasing energy use in doing so.
- While flex leak duct is rougher than a sheet metal duct, it has two advantages over sheet metal. It reduces leakage and improves insulation. First, leakage is reduced because there are no longitudinal joints at all, and generally fewer transverse joints because flex ducts come in long lengths (up to 25 feet in one section), and requires no offsets. Sheet metal duct offsets are often made with adjustable elbows which have very high leakage. Second, insulation is improved because it is installed perfectly (factory installed around the whole duct) and protected by a tough plastic barrier vs. field installed duct wrap that is clipped on and easily ripped off. These two benefits of flex duct are likely to offset any energy impact of increased duct roughness.

It is important to understand who is really behind this proposal and why. I suspect that the sheet metal unions are behind it because it requires more sheet metal and will be more money in their pockets. But the effect on society will be negative because it will drive up the cost of construction.

Item # 160 **Comment Seq # 046**

UMC 2015 – (603.3.1):

SUBMITTER: David Dias
Sheet Metal Worker's Local 104

RECOMMENDATION:

Add new text as follows:

603.3.1 Factory-Made Flexible Air Ducts and Connectors. Factory-made flexible air ducts and connectors shall be not more than 5 feet (1524 mm) in length and shall not be used in lieu of ridged elbows or fittings.

SUBSTANTIATION:

More often than not flexible ducts are not installed to SMACNA standards. They are not cut to proper lengths, strapped at proper intervals, used for elbows, punctured, pinched off, and damaged in other ways resulting in a poor installation and excessive energy wasted. By limiting flexible ducts to 5 feet most of these problems are eliminated.

COMMITTEE ACTION: Reject

COMMITTEE STATEMENT:

The proposed change is overly restrictive and would ban the installation of flexible air ducts that are longer than 5 feet.

Note: Item # 160 failed to achieve the necessary ⅔ affirmative vote of returned ballots. In accordance with Section 4-3.5.2 of the Regulations Governing Committee Projects, a public comment is requested for this proposal. The technical committee will reconsider this proposal as a public comment.

A PUBLIC COMMENT(S) WAS SUBMITTED FOR REVIEW AND CONSIDERATION.

PUBLIC COMMENT (Assembly Action):

SUBMITTER: Craig Loeffler, Self

RECOMMENDATION:

Request to accept the code change proposal **as submitted** by this public comment.

SUBSTANTIATION:

Flexible duct is being used beyond its original intent. More often than not the flex is not installed properly or cut to proper length, creating compression and sag. When used as elbows, the radius is often very tight pinching or choking off the duct. Flex is also susceptible to rodents chewing through the flex or dropping feces in the air stream that cannot be cleaned without being damaged. These problems will result in improper air flow which has an adverse effect on the efficiency of the HVAC system, and reduces the IEQ (Indoor Environmental Quality) for the building occupants in which can have an effect on their health and safety. Looking at the numerous other studies and reports, which have been around for over a decade showing the problems with flex duct being improperly installed, we can conclude the problems with the longevity of the flex duct system and airflow issues still exist. By limiting flex duct to 5'-0" the aforementioned problems are greatly reduced or eliminated altogether.

COMMITTEE ACTION: Accept the public comment as amended

Amend comment as follows:

603.3.1 Factory-Made Flexible Air Ducts and Connectors. Factory-made flexible air ducts and connectors shall be not more than 5 feet (1524 mm) in length and shall not be used in lieu of ~~ridged~~ rigid elbows or fittings.

Exception: Residential occupancies.

COMMITTEE STATEMENT:

The proposed modification will clarify the intent of the section in regards to the use of factory-made flexible air ducts and connectors.

TOTAL ELIGIBLE TO VOTE: 22

VOTING RESULTS: **AFFIRMATIVE:** 18 **NEGATIVE:** 3 **NOT RETURNED:** 1 Garza

EXPLANATION OF NEGATIVE:

BUUCK: Even though an exception was added to exempt residential occupancies, I have to vote negative on this ballot item for the precedence it sets. My reason is based on the lack of any evidence in the proponent's substantiation (as well as the Committee statement) and the fact that the Committee did not try to address any of the issues mentioned.

Furthermore, I have a couple issues with the Committee's decision to restrict flexible air connectors to a length of 5 feet. First, there was very little data offered to support the decision. No data was given, only personal experience, to prove that this was really a widespread issue. As was stated in the substantiation for Public Comment 1, UL is not aware of any field issues with these products when installed per the listing and the manufacture's installation instructions. Before something this restrictive is approved for the code, the Committee should have much stronger evidence to stand on.

No attempt was made to address the main problems that some Committee members saw regarding the product, namely resistance to airflow and sagging, beyond shortening the allowable length to an arbitrary number. I understand that the number is in the 2009 ASHRAE Handbook, but, unlike UL 181, it is not an ANSI consensus standard with the required due process and openness. If the Committee really wanted to address the issues, they could have. The code already requires flex connectors to be one size larger than smooth duct, and, as the submitter of Public Comment 2 stated, 10 inch flexible duct has less friction than an 8 inch smooth duct.

Finally, the new language which states that flexible connectors "shall not be used in lieu of rigid elbows or fittings" would seem to defeat the purpose of flexible connectors altogether, since they are made to replace the elbows required to make the last connection between a duct or plenum and a diffuser. This could be construed as banning flexible connectors from all commercial occupancies. This language is unclear and will lead to inconsistent and overly-restrictive enforcement.

CARROLL: The public comment should be rejected based on the following reasons:

A. There was some important information that was not considered when we discussed this proposal (and Item #159). It is my understanding that ASHRAE was going to speak on this at the UMC TC meeting in Las Vegas but were not present for Item #160. The following was taken verbatim from the ASHRAE TC5.2 Duct Design committee minutes in conclusion to numerous meetings on this specific subject with the recommendation that the code not limit the length of air duct or connectors.

The final vote of ASHRAE TC5.2 Duct Design was recorded as:

"The Chair enters the following motion, second by Ralph Koerber, for a vote of ASHRAE TC5.2 (Duct Design) as follows:

1. The ASHRAE 2009 Fundamentals Handbook (page 21.7 and 21.18) reads that "for commercial systems, flexible ducts should be… no more than 5 ft in length, full stretched."
2. This is also included in the more recent 2013 handbook; however, the limiting length recommendation was changed to 6 feet.
3. This was intended to give design guidance to the engineer and was never intended to be included in code language such as "shall be limited to 5 feet."

4. It is the recommendation of the ASHRAE Technical Committee TC5.2 duct design that any code language limiting the length of flexible duct or air connectors, due to language in the ASHRAE Handbook as referenced above, to 5 or 6 feet be stricken."

B. Discussions at the UMC TC meetings indicated two potential concerns with flexible duct – improper installation and loss of airflow due to inadequate extension. Limiting the length of flexible duct and flexible air connectors to 5 feet will NOT ensure proper installation of these products and will not ensure proper extension and air flow. What this limitation WILL do is add significant construction costs.

TAYLOR: Not only is there no substantiation for the 5 foot limit as a safety or public health consideration (see my public comments on # 159), the last clause of this proposed change makes no sense: flex ducts are in fact primarily used to make connections from rigid ducts to air outlets which generally includes a change in direction from horizontal to vertical that would constitute an elbow. Does this language mean that flex duct has to be run only dead straight? This has no purpose other than to increase construction costs.