



ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc.

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SPC/GPC MINUTES COVER SHEET

(Minutes of all SPC/GPC Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

SPC/GPC NO.: SSPC 15 ISSUE DATE: August 28, 2006

SPC/GPC TITLE: Safety Standard for Refrigeration Systems

DATE OF MEETING: June 25, 2006 LOCATION: Quebec, PQ (Canada)

Attendance

Members Present	Status	Others Present	Status
Dennis Dorman	VM	Stephen Duda	NVM & Liaison TC 9.01
Doug Reindl	VM-Chair	Robert Richard	Guest
Marty Timm	VM	Joel Solis	Guest
Gene Troy	VM	Claude Wilkinson	Guest
		Mike Vo	Guest
		Mark Adams	Guest
Members Absent	Status	Jay Kohler	NVM
Jim Calm	VM	John Vucci	NVM
Danny Halel	VM	Daniel Kuespert	NVM
		Todd Jekel	Guest
		Ron Vallort	Guest
		Bruce Griffith	Guest
		Sean Kolling	Guest
		Gary Zyhowski	NVM
		Norm Panabaker	NVM
		Phillip Johnson	NVM
		Rick Heiden	Guest

DISTRIBUTION:

ALL MEMBERS OF SSPC 15

LIAISONS: SPLS: Dean Borges Staff: Mark Weber

Meeting Summary

Action Items:

Responsible Party: C. Wilkinson

Action: Establish an SSPC 15 website in accordance with ASHRAE PC website standards.

Due Date: Dallas Meeting 2007.

Responsible Party: M. Timm and D. Kuespert

Action: Review ASHRAE specifications for establishing an online process for accepting public review comments as they pertain to public review drafts. Coming soon, public review comments will only be accepted online.

Due Date: Dallas Meeting 2007.

Responsible Party: D. Reindl and all SSPC 15 Members

Action: D. Reindl will obtain an electronic copy of the proposed MOP changes regarding restricted membership of one voting member per committee from any common parent organization, to circulate to SSPC 15 members for review and comments. Comments on the proposed change should be submitted to ASHRAE Staff member Angie Hood with a cc: to D. Reindl and SSPC 15 liaison Steve Bushby.

Due Date: August 20, 2006.

Responsible Party: C. Radcliff, D. Showalter, G. Troy

Action: Update your incomplete Bio/Bias forms.

Due Date: August 18, 2006

Responsible Party: P. Johnson, M. Timm

Action: Respond to proposed changes in IFC F51 (related to refrigerant detectors) and F52 (emergency shutoff requirements). Johnson will attend CIS meeting; Timm will work on a response.

Due Date: As soon as possible

Responsible Party: D. Reindl

Action: Respond to 15-2004 Addendum a Public Review Comments.

Due Date: September 24, 2006

Responsible Party: D. Dorman & J. Kohler

Action: Compose one or more CM Change Proposals to drop Appendix A and Table 1, create a new informative Appendix G replicating Std. 34's tables, but include a statement saying that Std. 34 governs in case of conflict.

Our Table 1 footnotes would become statements and are moved to Appendix G. Editorial references throughout Std. 15 to “Table 1” are revised to refer to Appendix G.

Due Date: Dallas Meeting 2007

Responsible Party: D. Reindl

Action: Obtain letter ballot from absent members, proposing to send CM Change Proposal #Duda 15-05-12-0003 to publication public review.

Due Date: As soon as possible

Responsible Party: S. Duda, G. Zyhowski

Action: Continue to refine CM Change Proposal #McClure 15-05-12-0004-001.

Due Date: Dallas Meeting 2007

Responsible Party: D. Reindl

Action: Prompt Tom Watson for input on ventilation of office or workshop located in a machinery room.

Due Date: Dallas Meeting 2007

Responsible Party: M. Timm

Action: Find definition for secondary fluids from ASHRAE terminology guide or other sources.

Due Date: Dallas Meeting 2007

Responsible Party: D. Dorman, C. Wilkinson

Action: D. Dorman will issue User’s Guide errata to Steve Comstock; and Wilkinson should add these to the SSPC 15 website.

Due Date: As soon as possible

Responsible Party: D. Reindl

Action: Obtain letter ballot from members at the Chicago 2006 Winter Meeting on a Change Proposal that would bring SSPC 15 into consistency with UL.

Due Date: As soon as possible

SUMMARY OF MOTIONS:

Secretary's Note: All votes recorded herein are formatted as Aye-Nay-Abstain-Absent. Chair voted unless noted otherwise.

Motion: D. Dorman

Second: M. Timm

Text: Approve the SSPC 15 January 22, 2006 (Chicago) Meeting Minutes as written.

Vote: Motion Passed 4-0-0-2

Motion: M. Timm

Second: D. Dorman

Text: Approve the committee's formal response to Duda CM Change Request 15-05-12-0003, which would effectively issue the Change Request as modified to Publication Public Review.

Vote: Motion Passed 4-0-0-2. Letter ballots shall be sent to the 2 absent voting members.

Motion: D. Dorman

Second: G. Troy

Text: Adjourn.

Vote: Motion Passed 4-0-0-2

MINUTES

I. Call to Order

- a) Call to Order - Doug Reindl, Chairman, called the meeting to order at 1:08 pm in room 205C of the Quebec Convention Center in Quebec City, QC. Four Voting members (of six) were in attendance; thereby, constituting a quorum.

II. Introduction of Members And Guests

- a) Self-introductions of members and guests were made around the table as the attendance roster was circulated. D. Reindl welcomed all members and visitors. A quorum was verified.

III. Approval of Chicago January 22, 2006 Meeting Minutes

- a) D. Dorman offered a Motion to approve the Chicago January 22, 2006 Meeting Minutes. M. Timm offered a Second. No corrections nor discussion. The Chicago January 22, 2006 Meeting Minutes were approved by Show-of-Hands Vote (4-0-0-2). MOTION PASSED.

Secretary's Note: All votes recorded herein are formatted as (Aye-Nay-Abstain-Absent); Chair voting unless noted otherwise.

IV. Summary of PC Chair's Breakfast

- a) PC Websites are available for all Project Committees. Each PC must assign a webmaster in order to access and utilize a PC website. Claude Wilkinson of Ft. Worth, TX volunteered to be our Webmaster. ACTION ITEM.
- b) The ASHRAE Standards committee is continuing to refine and implement the streamlining processes that were undertaken three years ago.
- c) Public review comments will be accepted only online and posted to a common database for easy access for review. Martin Timm and Daniel Kuespert will review specifications for online process. ACTION ITEM.
- d) There is a proposed PC MOP change that is being driven by concerns of multiple voting members from a common parent organization serving on project committees. Conceivably, this would prohibit people from different branches of the Federal Government from participating as voting members on PCs because they are part of the same "parent organization." Discussion on state versus federal funding; what about people who work via federal government grants; consultants who work mostly on government projects; consultants who used to work for a company but who retire and work as an independent contractor for the same company. Reindl has requested an electronic copy of the proposed MOP changes to circulate to SSPC 15 members for review and comments. Comments on the proposed change should be submitted to ASHRAE Staff member Angie Hood (ahood@ashrae.org) with a cc: to D. Reindl (dreindl@wisc.edu) and SSPC 15 liaison Steve Bushby (steven.bushby@nist.gov). ACTION ITEM.
- e) Open-ended Discussion: How much funding is required for a person to be influenced?

V. Roster Update

- a) Roster Changes: New voting members are Steve Duda, Ajay Chatlani, Phil Johnson, Jay Kohler, Martin Timm; effective July 1, 2006.

- b) Incomplete Bio/Bias forms: Carl Radcliff, Daryl Showalter, Gene Troy – due not later than August 18 in order to retain status. ACTION ITEM.

VI. Liaison reports (Liaisons)

- a) **CIS** – (Phil Johnson) Proposed changes in ICC: IFC F51, related to refrigerant detectors, must now transmit a signal to an approved location. F52 emergency shutoff requirements are expanded to include A1 & B1 refrigerants, and now include automatic shutdown of equipment on detection; IMC M118 updates the refrigerant table to match ASHRAE 34. Uncertain as to when comments are due back to CIS. Phil will attend CIS meeting and report back. Martin Timm volunteered to work on a response. ACTION ITEM.
- b) **Std. 34** – (Jim Calm not present). Addendum U was approved. Jay Kohler volunteered to informally liaison for 15 & 34.
- c) **Refrigeration Committee** – (Joe Pillis not present) Bruce Griffith: Reaffirmed ammonia position document and looking into position statements on other natural refrigerants. Tabled HFC discussion for now. Webinar on refrigeration offered for chapter meetings. Discussion of refrigeration award, first time given at this meeting. Will not proceed on refrigeration textbook for college students. ASHRAE HQ may look at low-charge natural refrigerants as part of the green upgrade. Consider an RTAR for life cycle efficiency of all refrigerants.
- d) **TC 9.01** – (Duda). The committee inquired of Duda as to the status of the RTAR on Machinery Room Ventilation rates. *Post-meeting Secretary's Note: An e-mail dated June 30, 2006 from Piotr Domanski advised that this RTAR has been approved and has been assigned the number RTAR-1448.*
- e) No other reports were given.

VII. Standard 15-2004 Addenda (Reindl)

- a) **Addendum a** – Two comments received during the public review of this CM proposal; Reindl is unable to resolve one and has had discussions with the other commenter. The commenter is concerned that the proposed publicly reviewed version of the standard will allow hydrostatic relief of refrigerant to the environment. The commenter is very much opposed to changes that would permit such relief points. Old version (pre-addendum) required relief to some other part of the system. Commenter does not want any refrigerant released to atmosphere. Proposed solution: “Consideration must be given to hydrostatic expansion due to temperature rise of liquid refrigerant trapped in or between closed valves. A hydrostatic relief device or other means shall be provided to prevent over-pressurization. Relief into a lower pressure portion of the system is allowed. **Relief to atmosphere is also allowed if the requirements of 9.7.8 are met.**” (bold denotes new addition during discussion at the meeting). D. Reindl will take this response back to the commenter. ACTION ITEM.
- b) ASHRAE 34-2004 Addendum U was published and approved. It adds a new section to specify the criteria to determine recommended “Refrigerant Concentration Limits (RCL)” in occupied spaces. It adds RCL values to Tables 1 & 2. ASHRAE 15 needs to make changes consistent with the adoption of Addendum U. It is proposed that we drop Appendix A and Table 1, create a new informative Appendix G replicating Std. 34’s tables, but include a statement saying that Std. 34 governs in case of conflict. Our Table 1 footnotes would become statements and are moved to Appendix G. Editorial references throughout Std. 15 to “Table 1” are revised to refer to Appendix G. Refer to [Attachment A](#) for more information. Procedurally, D. Dorman & J. Kohler now need to submit these items into one or more CM Change Proposals. ACTION ITEM.

VIII. CM Change Request Update

- a) Kutz – 15-05-12-0001-001 & 002 (Reindl) – Gave an update. Appendix F revision is progressing and nearing completion. Will be Addendum C.
- b) Radcliffe 15-05-12-0002 (Radcliffe) Not present; no action; Tabled for next meeting.
- c) Duda 15-05-12-0003 (Duda) See [Attachment B](#). M. Timm offered a Motion to approve for publication public review; D. Dorman offered a Second. Little discussion. Approved by Show-of-Hands Vote (4-0-0-2). MOTION PASSED subject to letter ballot vote of 2 absent voting members. ACTION ITEM.
- d) McClure 15-05-12-0004-001 (removal of refrigerant vapor) (Zyhowski): See [Attachment C](#). Lengthy Discussion followed. Duda and Zyhowski will continue to refine. ACTION ITEM.
- e) McClure 15-05-12-0004-002 (refrigerant detectors) (Halel): Not present; no action taken; tabled for next meeting.

IX. Update on related standards

- a) IIR-2 (Troy & Kuespert) 100 comments from 15 commenters on first public review; will probably have a 2nd public review period.
- b) ISO 5149 (Kohler) Report on subcommittee meeting earlier today. Focus of the task group is on flammability issues; internationally the flammability standards differ from North American standards. Next meeting is in September 2006 in Korea.
- c) UL (Radcliffe) Absent; no report.

X. Other Business

- a) Office or workshop located in machinery room (Vucci): Doing some research on this topic; has not yet found significant information. His data so far is anecdotal. D. Reindl will prompt Tom Watson for input. ACTION ITEM.
- b) Definition for secondary fluids: Jim Calm (via e-mail) says it should be changed to say “heat transfer fluids” instead. M. Timm pointed out the ASHRAE terminology guide and he will report back with definitions. ACTION ITEM.
- c) D. Dorman User’s Guide errata: Dennis has accumulated a list. He should send these to Steve Comstock; and Wilkinson should add these to the SSPC 15 website. These are true errata, not substantive changes; thus no committee approval nor vote is required. Dorman will send to Doug Reindl for circulation. ACTION ITEM.
- d) Gene Troy brought up an issue regarding wiring of refrigerant leak detector through a BAS and not directly to a hard-wired alarm; also whether the leak detector should be on UPS. Pertains to paragraph 8.11.2.1. Discussion but no action taken.
- e) Jay Kohler brought up that SSPC 15 is not yet consistent with UL. A review of the Chicago minutes turned up a vote that SSPC 15 did pass a change proposal to bring the document in line. D. Reindl will take an action item to obtain letter ballot vote from those absent in Chicago. ACTION ITEM.

XI. Adjournment

- a) Next Meeting: Sunday, January 28, 2007 at 1:00 pm CST in Dallas, Texas.
- b) D. Dorman offered a Motion to adjourn. G. Troy offered a Second. Approved unanimously by Voice Vote. Chairman Reindl declared the meeting adjourned at 4:59 pm local time.

End of Minutes

Respectfully submitted by:



Stephen W. Duda
Acting Secretary



ASHRAE 15
Summer 2006

ATTACHMENT A

Background

- ASHRAE 34 - 2004 Addenda U was published and approved 4/21/06
 - Summary of the Contents of Addenda U
 - Adds a new section to specify the criteria to determine recommended “**Refrigerant Concentration Limits**” (RCL) in occupied spaces
 - Adds RCL values to Tables 1 (compounds) and 2 (blends)
- ASHRAE 15 needs to make changes consistent with the adoption and use of Addenda U and RCL
- **Premise**: For purposes of ASHRAE 15, RCL can be used in a like manner as “Refrigerant Quantity Limits” is used in the present standard.

Change 1

Adopting Tables 1 and 2 from Addenda U

CONCEPT

- Eliminate Table 1 (including footnotes to Table 1)
- Eliminate Appendix A
- Create new Appendix G – informative appendix
 - Replicate Tables 1 and 2 from ASHRAE 34 Addenda U in Appendix G. Call them Table G1 and Table G2.
 - Put a statement preceding Table G1 and Table G2 that ASHRAE 34 governs
- Table 1 footnotes become statements that precede Table G1 and Table G2

Change 1

Adopting Tables 1 and 2 from Addenda U

Present Footnotes

^aThe refrigerant safety groups in Table 1 are not part of ASHRAE Standard 15. The classifications shown are from ASHRAE Standard 34, which governs in the event of a difference.

^bTo be used only in conjunction with Section 7.

^cTo correct for height, H(ft), above sea level, multiply these values by $(1 - 2.42 \times 10^{-5}H)$. To correct for height, h(km), above sea level, multiply these values by $(1 - 7.94 \times 10^{-5}h)$.

^dThe quantity of each component shall comply with the limits set in Table 1 for the pure compound, and the total volume % of all components shall be calculated per Appendix A (not to exceed 67,000 ppm by volume for any refrigerant blend).

^eThe basis of the table quantities is a single event where a complete discharge of any refrigerant system into the occupied space occurs. The quantity of refrigerant is the most restrictive of a minimum oxygen concentration of 19.5% or as follows:

Group A1—80% of the cardiac sensitization level for R-11, R-12, R-13B1, R-22, R-113, R-114, R-134a, R-500, and R-502. 100% of the IDLH (21) for R-744. Others are limited by levels where oxygen deprivation begins to occur.

Groups A2, A3—Approximately 20% of LFL.

Group B1—100% of IDLH for R-764, and 100% of the measure consistent with the IDLH for R-123.

Groups B2, B3—100% of IDLH or 20% of LFL, whichever is lower.

^fThe quantity is unlimited when R-718 (water) is used as the refrigerant.

Proposal: Eliminate Footnote c., d., part of e and f. Footnotes a., b., part of e are rewritten and precede Table G1 and Table G2 as follows:

Table G1 (G2) is given for information only. Refrigerant data and safety classifications given in Table G1 (G2) is governed by ASHRAE Standard 34. The refrigerant data and safety classifications are to be used in conjunction with Section 7. The basis of Table G1 (G2) is a single event where a complete discharge of any refrigerant system into the occupied space occurs. To correct for altitudes above sea level refer to ASHRAE 34.

Change 2

Wording Changes to Section 6

- Par. 6.1
 - **Single-Compound Refrigerants.** Single-compound refrigerants shall be classified into safety groups, ~~based on toxicity and flammability~~, in accordance with *ANSI/ASHRAE Standard 34*. The classifications indicated in *ANSI/ASHRAE Standard 34* shall be used for refrigerants that have them assigned. Other refrigerants shall be classified in accordance with the criteria in Standard 34; such classifications shall be submitted for approval to the authority having jurisdiction.

Change 3

Wording Changes to Section 7

- Par. 7.2 – present wording
 - **Refrigerant Quantity Limits.** The quantity of refrigerant in each independent circuit of high probability systems shall not exceed the amounts shown in Table 1, except as provided in 7.2.1 and 7.2.2, based on volumes determined in accordance with 7.3. For refrigerant blends not listed in Table 1, the amount of each component shall be limited in the same manner and the total of all components in each circuit shall not exceed the quantity that would equal 69,100 ppm by volume upon release to the volume determined by 7.3.
- Par 7.2 – proposed wording
 - **Refrigerant Concentration Limits.** The concentration of refrigerant in the occupied space due to a complete discharge of each independent circuit of a high probability system shall not exceed the limits shown in Table G1 and G2, except as provided in 7.2.1 and 7.2.2. The volume of the occupied space shall be determined in accordance with 7.3.

Change 4

Revisions to the Forward

Present Forward (relevant affected paragraphs only)

While ANSI/ASHRAE 15-2004 is written as a self-standing document, it includes references to other standards. One of those standards is ANSI/ASHRAE 34, which prescribes the Refrigerant Classification System and Table 1 quantities that are important to the use of this standard. Changes to ANSI/ASHRAE 15 are closely coordinated with those to ANSI/ASHRAE 34.

Table 1 shows the amount of refrigerant in a given space that, when exceeded, requires a machinery room. When a refrigerant is not classified in ANSI/ASHRAE 34 or its addenda or shown in Table 1, it is the responsibility of the owner of a refrigerating system to make this judgment. For blends, Appendix A is offered to aid in determining allowable concentrations.

Proposed Forward

While ANSI/ASHRAE 15-2004 is written as a self-standing document, it includes references to other standards. One of those standards is ANSI/ASHRAE 34, which prescribes the Refrigerant Classification System and Refrigerant Concentration Limits that are important to the use of this standard. Changes to ANSI/ASHRAE 15 are closely coordinated with those to ANSI/ASHRAE 34. Table G1 and Table G2 shows the amount of refrigerant in a given space that, when exceeded, requires a machinery room. When a refrigerant is not classified in ANSI/ASHRAE 34 or its addenda it is the responsibility of the owner of a refrigerating system to make a judgment concerning the need for a machinery room.

Change 5

Editorial Changes due to Elimination of Table 1 & Addition of Appendix G

- Editorial Change: Replace “Table 1” with “Table G1 and Table G2”.
 - Word search reveals (Staff should verify and correct as necessary)
 - 7.2.1 >> 1 place
 - 7.5.1.2 >> 2 places
 - 8.10.3 >> 2 places
 - 9.15 >> 1 place
- Editorial Change: Revise “Contents” to Eliminate Appendix A and Add Appendix G.

ATTACHMENT B

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

FORM FOR RESPONSE TO CHANGE PROPOSAL

DATE January 31, 2006

SSPC NO. 15

PROPOSAL NUMBER: Duda 15-05-12-0003

RESPONDER'S NAME _____

ADDRESS _____

TELEPHONE _____

FAX _____

Proposal Number(s) 15-05-12-2003

<p>Project Committee Action:</p> <p><input type="checkbox"/> Proposed change accepted for public review without modification</p> <p><input checked="" type="checkbox"/> Proposed change accepted for public review with modification (See below)</p> <p><input type="checkbox"/> Proposed change accepted for further study (See below)</p> <p><input type="checkbox"/> Proposed change rejected (See below)</p> <p><input type="checkbox"/> More information is needed (See below)</p>
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Project Committee Response:

The Project Committee accepts the referenced change proposal with respect to technical meaning but modifies the change proposal's written format as follows:

Revise Paragraph 9.7.8 to read as follows:

For systems in which any one or more of the following conditions apply, pressure-relief devices and fusible plugs shall discharge to the atmosphere at a location not less than 15 ft (4.57 m) above the adjoining ground level and not less than 20 ft (6.1 m) from any window, ventilation opening, or exit in any building.

(a) Any system containing a Group A3 or B3 refrigerant.

January 16, 2002

- (b) Any system containing more than 6.6 lb (3 kg) of a Group A2, B1, or B2 refrigerant.**
- (c) Any system containing more than 110 lb (50 kg) of a Group A1 refrigerant.**
- (d) Any system for which a Machinery Room is required by the provisions of 7.4.**

The discharge shall be terminated . . . [remainder of paragraph 9.7.8 unchanged].

cc: Manager of Standards, ASHRAE, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305

January 16, 2002

ATTACHMENT C

ASHRAE Std. 15-2004

8.11.5 The mechanical ventilation required to exhaust an accumulation of refrigerant due to leaks or a rupture of the system shall be capable of removing air from the machinery room in not less than the following quantity:

$$Q = 100 \times G^{0.5} (Q = 70 \times G^{0.5})$$

where

Q = the airflow in cubic feet per minute (liters per second),

G = the mass of refrigerant in pounds (kilograms) in the largest system, any part of which is located in the machinery room.

A part of the refrigerating machinery room mechanical ventilation shall be

- (a) operated, when occupied, to supply at least 0.5 cfm per square foot (2.54 L/s per square meter) of machinery room area or 20 cfm (9.44 L/s) per person and
- (b) operable, when occupied at a volume required to not exceed the higher of a temperature rise of 18°F (10°C) above inlet air temperature or a maximum temperature of 122°F (50°C).

When a refrigerating system is located outdoors more than 20 ft (6.1 m) from building openings and is enclosed by a penthouse, lean-to, or other open structure, natural or mechanical ventilation shall be provided. The requirements for such natural ventilation are as follows:

- (c) The free-aperture cross section for the ventilation of a machinery room shall be at least

$$F = G^{0.5} (F = 0.138G^{0.5})$$

where

F = the free opening area in square feet (square meters),

CM-15-05-12-0004/001 (K. McClure)

Re: 8.11.5 Proposed change REFRIGERANT VAPOR REMOVAL

When the exhaust is used to remove refrigerant vapors, the suction opening of the exhaust fan ductwork **to shall be no less than 24”** from the floor or the lowest part of the Room where refrigerant gas is likely to accumulate. All refrigerants except ammonia Are heavier than air.

Comments

- Grammar is incorrect. Clarification is needed from the submitter. *It is believed that what was intended was to require suction opening to be **no more than 24”** from the floor.*
- Regarding ammonia - There are other refrigerants that are lighter than air.
- Standard 15-2004 does not specify a height limit or provide for a specific location for exhaust air duct inlet openings.
 - Standard 15 requires that the inlet and outlet exhaust locations do not lead to recirculation.
 - The User’s Manual provides guidance by indicating that such duct inlets should be located in the breathing space (a height of 5’ or less).
 - The User’s Manual suggests that the inlet and outlet exhaust locations should set up an effective sweeping action that does not leave any dead zones.

Recommendation

Incorporate the User’s Manual points above, incorporate a phrase indicating that inlet and outlet duct location should take into account the density of the refrigerant relative to air [akin to 8.11.5 (d)].

- 8.11.5 (d) Location of the gravity ventilation openings shall be based on the relative density of the refrigerant to air.

Recommended changes – 8.11.5

- Placement after (b)

When the exhaust is used to remove refrigerant vapors, the suction opening of the exhaust fan ductwork shall be located in the breathing space (a height of 5' or less).

Location of the ventilation openings shall take into account the density of the refrigerant relative to air.

- Suction exhaust openings for heavier-than-air refrigerants shall be located in the lower portion of the breathing space not greater than 36 inches from the floor.
- Suction exhaust for lighter-than-air refrigerants shall be taken from the ceiling but not lower than the highest 15% of ceiling height.

Note: The suction opening and return air opening locations should set up an effective sweeping action that does not leave any dead zones.

Openings to serve low points in machinery rooms, i.e., pump pits?

Recommended changes – 8.11.5

- Placement after the definition of G

When the exhaust is used to remove refrigerant vapors due to leaks or rupture of the system, location of the ventilation openings shall take into account the density of the refrigerant relative to air. The suction opening(s) of the exhaust fan ductwork shall be located as follows:

- Heavier-than-air refrigerants: Locate the entire opening as close as practical to the floor, but not to exceed 36 inches above the floor. Additional exhaust opening(s) shall be located to exhaust pump pits or other low points in the machinery room where refrigerant can accumulate.
- Lighter-than-air refrigerants: Locate in the ceiling or at wall locations not lower than the highest 15% of the room's volume. Additional exhaust opening(s) shall be located to exhaust recesses in irregular ceilings where refrigerant can accumulate.
- Note: The suction opening and return air opening locations should set up a sweeping action across the room; for example, by locating openings on opposite sides of the room or in diagonally opposite corners.