ASHRAE Philadelphia Chapter

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MEETING COSTS

Fees are based on online reservations and prepayment.

$50 Member
$85 Non-Member
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QUAKER CITY CLIMATE

Lunch Meeting

Thursday, September 18, 2025

11:30 AM - 1:30 PM

"Impacts of Climate Change and Urbanization on Future Building Performance"

Presented by

Drury B. Crawley, Ph.D.
ASHRAE Distinguished Lecturer

Location

Del Frisco's
1428-1432 Chestnut Street
Philadelphia, PA 19102

Click here for directions.

Click here to register.

See page 4 for more information.

Synopsis:

With the increasing interest in climate change driven by human activity, recent research has focused on the impact of climate change or urban heat island on building operation and performance across the world. But this work usually aggregates the energy and peak demand impacts across a broad sector. In a recent study, impacts on the operating performance of an office building were estimated based on climate change and heat island scenarios in 25 locations (20 climate regions). This presentation presents the variation and differences among the 20 regions when climate change is introduced. The focus is on changes in comfort conditions, building equipment operation as well as daily patterns of energy performance using prototypical buildings that represent typical, good, and low-energy practices around the world. Other issues such as fuel swapping as heating and cooling ratios change, impacts on environmental emissions, and how low-energy building design incorporating renewables can significantly mitigate any potential climate variation are also presented.

GBCI Approved | 2 CE Hour | 0920020234
AIA Approved | 2 LU/HSW | Crawley05

2025-2026

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President's Message

Dear Philadelphia ASHRAE Chapter Members,

We are excited to kick off another great Chapter year filled with technical sessions, social events, a refrigeration tour, and of course the highly anticipated annual golf outing!

The Board of Governors has been hard at work following the annual ASHRAE Region III Chapters Regional Conference (CRC) in Richmond, VA. At CRC, board members and committee chairs attend workshops designed to provide tools and resources to succeed in their roles.

The Philadelphia Chapter received several awards at the CRC, including multiple Research Promotion (RP) honors made possible by the support of our generous Chapter Members and Sponsors. It's also worth noting that the Philly Chapter was the only chapter to receive the APEX Award this year, recognizing our achievement of consistently setting new RP goals for the past five years. Thank you all – this accomplishment would not have been possible without your support.

I would also like to take a moment to recognize our board members who received individual awards at CRC this year:

Presidential Award of Excellence (PAOE)
Jason Trefz – President 2024-2025
- PAOE – Minimum in 5 of the 6 categories: Chapter Operations, Chapter Technology Transfer, Grassroots Government Activities, Membership Promotion, Research Promotion and Student Activities
- Special Citation – Minimum in 5 of the 6 categories, with a minimum of 5,500 points
- Honor Roll – PAOE for at least four consecutive years

Membership Promotion (MP)
Richard Adrian – MP Chair 2024-2025
- Co-Pilot – Recognizes MP Chairs that have shown real effort in all areas of the committee's goals.

Research Promotion Chapter Accomplishments (RP)
- Gold Treasury Ribbon – $10,000 or larger chapter investment
- APEX – A new high has been set consistently for the past 5 years
- Goal – Matching or exceeding Goal
- High Five – Setting a new high in dollars raised by the Chapter in the last 5 years

Our first technical session takes place on September 18th at Del Frisco's Double Eagle Steakhouse, beginning at 11:30 AM. We are thrilled to have ASHRAE Distinguished Lecturer, Dru Crawley, Ph.D., who will present the "Impacts of Climate Change and Urbanization on Future Building Performance." Space is limited, so be sure to reserve your spot today!

I cannot stress enough that the success of our Chapter is a direct result of the time, energy, and support of our Members. We are working to increase engagement opportunities, and we welcome your feedback on ways to improve your experience. I look forward to connecting with all of you throughout the Chapter Year.

Sincerely,

Tyler A. Holland
Philadelphia Chapter President
c021@ashrae.net
(303) 552-1226

CRC Award Photos

ASHRAE Region III Chapters Regional Conference (CRC) in Richmond, VA - August 2025



Jason Trefz /
Presidential Award of Excellence (PAOE)



Richard Adrian / Co-Pilot Award



Tyler A. Holland / Chapter Service Award



Philadelphia Chapter /
Research Promotion Chapter Accomplishments (RP)

September Lunch Meeting

Thursday, September 18, 2025

11:30 AM - 1:30 PM

"Impacts of Climate Change and Urbanization on Future Building Performance"

Click here to register.

Speaker Bio:

Drury B. Crawley, Ph.D.

ASHRAE Distinguished Lecturer



Dru Crawley is Bentley Fellow and Director, Building Performance Research focusing on building performance, zero-energy Buildings, decarbonization, digital twins, smart cities, sustainability, and resilience. Prior to being elevated to Bentley Fellow in 2014, he led development of Bentley's building performance software suite for four years. Before joining Bentley in 2010, Dr. Crawley developed and managed EnergyPlus and the USDOE's Commercial Buildings Initiative (now Better Buildings Initiative and Alliances) promoting creation of net-zero-energy buildings.

With more than 40 years of experience in buildings energy efficiency, renewable energy, and sustainability, he has worked in engineering software development, government research and standards development organizations, as well as building design and consulting companies. He received his PhD in Mechanical Engineering from University of Strathclyde in Glasgow, Scotland on the topic of building simulation as a policy tool, and a Bachelor of Architecture from University of Tennessee, and is a registered architect.

Dr. Crawley is active in ASHRAE (Director-At-Large on ASHRAE Board, member of Task Force on Building Decarbonization, Chair of Standard 169 (Climatic Data for Building Design Standards), member of SSPC 189.1 (Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings), as well as a member of Standards PC 105R, 140, 205R, 209R, 228P, and 229P. He is a former member and Chair of Standards Committee as well a past member of the Technical Activities, Research Administration, Advocacy, and Grassroots Government Activities Committees, and past chair of Technical Committees 2.8, 4.2, 4.7, and 7.1). He was elevated to ASHRAE Fellow in 2009 and achieved ASHRAE BEMP (Building Energy Modeling Professional) certification in October 2012, and received the ASHRAE Standards Achievement Award (2022), ASHRAE Exceptional Service Award (2013), Service to ASHRAE Research Award (2012), Distinguished Service Award (2003), and Symposium Best Paper Award (1999) for "Which Weather Data Should You Use for Energy Simulations of Commercial Buildings?"

He is also active in the International Building Performance Simulation Association (IBPSA Vice President since 2018, at-large board member since 1998, Fellow in 2012, Regional Affiliate Liaison since 2006), IBPSA-USA (IBPSA-USA board member since 2013, President 2019-2021, Vice President 2017-2019, and Treasurer 2013-2017), U. S. Green Building Council (USGBC, past vice chair and member, Energy & Atmosphere Technical Advisory Group; past member, Research Committee; past research Liaison), the American Institute of Architects (AIA), an Affiliate member of CIBSE, and serves on the editorial boards of three international journals. He has written more than 125 papers and articles, testified before the U.S. Congress, lectured at more than 40 universities, and made more than 400 presentations on building energy efficiency, sustainability, and renewable energy throughout the world. As an ASHRAE Distinguished Lecturer, he has given more than 200 presentations and workshops for nearly 1000 ASHRAE chapters throughout the world.

If you have any questions or require assistance registering, please reach out to:
Anthony Rodio, P.E., MBA | ARodio@Unitasengineering.com | M: (609) 703-9095

Government Affairs Committee News

Send any questions or comments to Andrew Mondell, Government Affairs Committee Chair, at Andrew.Mondell@AMZenergysystems.com.

New York Building Code Council Finalizes First State All-Electric Building Code

On July 25, the New York State Fire Prevention and Building Code Council voted to approve an all-electric building code, making New York the first state in the nation to prohibit gas and other fossil fuels in most new buildings. The new all-electric code is required under the state's All-Electric Buildings Act, which became law in 2023. Additionally, on July 23, a federal court ruled that the law is not preempted by the federal Energy Policy and Conservation Act, and that the state can proceed with implementing it. The new building code requirements apply to all new buildings below 7 stories, and commercial and industrial buildings below 100,000 square feet, starting December 31, 2025. All-electric requirements for buildings over 100,000 square feet will begin in 2029. Buildings currently account for 31% of greenhouse gas emissions statewide, the largest category of emissions. This code update also includes references to ANSI/ASHRAE/IES Standard 90.1-2022, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, with some New York State-specific amendments. The full text of the code update can be found on the New York Department of State website here.

Air Quality Alerts Issued Across Canada and Northeastern United States

Wildfires in Manitoba and Saskatchewan are sending smoke across central Canada, down into the Great Lakes region and into the Northeastern United States. This has caused local health authorities to issue air quality alerts, warning that even people who are not in at-risk populations can still suffer adverse health effects due to smoke exposure from time spent outdoors. Cities and towns closest to the wildfires have suffered the worst air quality, while cities further away such as New York City and Toronto are experiencing hazy conditions and moderate Air Quality Index (AQI). ASHRAE publishes ASHRAE Guideline 44-2024, *Protecting Building Occupants From Smoke During Wildfire and Prescribed Burn Events*, which provides recommendations to safeguard indoor air quality (IAQ) during wildfire and prescribed burn events. ASHRAE also issues a Public Policy Information Brief on Wildfire Smoke, and a longer, more comprehensive Position Document on Indoor Air Quality.

ASHRAE Offers Expertise and Assistance Following Legionnaires' Disease Outbreak in New York City

Over the past several weeks, a major outbreak of Legionnaires' Disease has affected the residents of Central Harlem in New York City, with 3 fatalities and 90 total cases to date. Legionnaires' Disease is a type of pneumonia caused by the bacteria Legionella, which can grow in warm water between 77-113 degrees Fahrenheit. ASHRAE Standard 188, *Legionellosis: Risk Management for Building Water Systems*, was created to help building owners mitigate the risk of this bacteria growth. Both New York City and New York State require certain building owners' water management plans to align with some sections of Standard 188 but do not currently incorporate the full standard. The city health department plans to adopt stricter rules for Legionella risk management early next year, with increased penalties for noncompliant building owners and a new requirement for bacteria sampling to be conducted by a certified lab. On August 11, ASHRAE President Bill McQuade sent a letter to the New York City Acting Health Commissioner offering technical expertise and assistance as the city responds to the public health crisis, which can be found here.

May 15, 2025 Meeting Photos

Airflow Management for Laboratory Facilities at Fogo de Chão in Philadelphia



John Maiorana presenting the
Debra H. Kennoy Scholarship to Courtney Schwegler



Jason Trefz presenting Liberty Bell to Speaker
Dr. Kishor Khankari



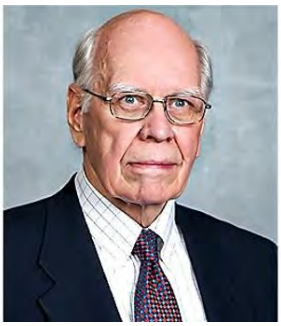
Hogan Cuny presenting the
Otto Gessner Award to Erin Rees Batting



Greg Wharton presenting the
SMCA Award to Joseph John Rizzuto



In Memoriam - Daniel J. Ebbert



Daniel J. Ebbert, Jr. of Cherry Hill, NJ passed away on July 19, 2025, at age 87. Dan was a Life Member of ASHRAE and a Member since 1978. He served as President of the Philadelphia Chapter for the 1988-1989 year.

He was widowed since the passing of his wife of over 50 years, Judith Lodge Ebbert, in 2022. He was a devoted father to his sons Daniel J. Ebbert III, of North Wales, PA, and David Lodge Ebbert of West Lafayette, IN.

Daniel was born and raised in the Mt. Washington neighborhood of Pittsburgh, PA in 1937. He attended the University of Dayton before transferring to the University of Pittsburgh to complete a Degree in Business and Engineering. Dan served in the U.S. Army ROTC while at Dayton, then in U.S. Army Reserve until 1966.

His career began in 1961 with a position at Hercules moving to Cumberland, MD, to work on the Polaris (missile) Development Program. In 1963, he transferred to Port Ewen, NY as an Application Engineer, and later became a Field Engineer in Washington, DC. When he moved to Philadelphia, PA, in 1966, he joined ITT Nesbitt, Inc. as a sales engineer focusing on new construction HVAC sales for the educational and commercial markets. This was the start of what came to be his career in building and automation controls. Most notably, he was with Robertshaw from 1973-78, Johnson Controls from 1978-1990.



Click here to register and join us at Caesar's Palace!



Past Presidents at the May Meeting

(left to right) Jason Trefz, Dan Brown, Judd Vail, Tim Reinking, Michael Calabrese, Jeff Crozier, Jeffrey Gilbeaux

ASHRAE
PHILADELPHIA CHAPTER

BASIC HVAC SYSTEM DESIGN COURSE

COURSE IS COMPLETELY ON-LINE

Classes will meet Tuesdays and Thursdays from 6:15 PM to 8:30 PM beginning in October and continuing until the middle of March.

Classes are in **virtual format** (live Zoom sessions). Students are responsible for their own devices and internet connection.

This is a demanding one-year course that introduces students to the fundamentals of HVAC design.

2025-2026 Course Subjects Include:

Fundamentals and Psychrometrics
Load and Heat Transfer Fundamentals
Load Calculations
Pumps, Piping & Piping Systems
Basic Steam & Boilers
Fans, Air Distribution & Duct Design
Refrigeration
Controls & Instrumentation
Equipment Selection

The class is a great way to further, or even begin, a career in HVAC.

The Basic Class tuition is $1,400 ($1,200 for ASHRAE Members who have paid both their National and Philadelphia Chapter dues). Tuition includes all course materials.

Class size is limited to 30 students. To enroll, complete and submit the application including a **non-refundable** deposit of $200 payable to "Philadelphia Chapter ASHRAE".

If you would like to enroll or receive further information, please contact:

Hope Silverman
Philadelphia Chapter ASHRAE
994 Old Eagle School Road, Suite 1019
Wayne, PA 19087-1866
Phone 610-971-2169
E-mail: hope@mmco1.com
Web site: www.ashraephilly.org

Philadelphia Chapter ASHRAE

Basic HVAC System Design Course Application
2025-2026

Personal Information

Name: _____
Last First Middle Initial

Home Address: _____
Street City State Zip

Phone No.: _____ Application Date: _____

Email: _____

Current or Most Recent Employment

Employer: _____ From: _____ To: _____ Total _____
Firm Name Date Date Years

Business Address: _____
Street City State Zip

Job Title: _____ Phone: _____

Email: _____

Discipline: ____Engineer ____CAD/Designer ____CAD/Drafting ____Sales Rep ____Trades ____Administration

Learning Goals

Please describe what you hope to learn and take away from this class.

_____

_____

_____

Education

	School (Name & Location)	Years Attended	Major	Degree Or Diploma
High School				
College				
Other				

PAYMENT

AMOUNT:

Members: _____ $200 Deposit _____ $1,000 Balance Due _____ $1,200 Total Fee
Members are those who have paid their ASHRAE National and Philadelphia Chapter Dues

Non-Members: _____ $200 Deposit _____ $1,200 Balance Due _____ $1,400 Total Fee

PAYMENT AND REFUND DEADLINES:

- The deposit is non-refundable.
- The remainder of the course fee must be paid prior to the first evening of class.
- After the first two class sessions (first two nights), there will be *NO REFUNDS*.

PAYMENT BY CHECK: _____ (made payable to "Philadelphia Chapter ASHRAE")

PAYMENT BY CREDIT CARD: ____ VISA ____ MasterCard ____ American Express

Total Amount to be Billed to Card: _____

Credit Card Number: _____

Expiration Date: _____

CVV: _____

Name on Card (please print): _____

Billing Address for Card: _____

_____

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Email for Receipt: _____

RETURN THIS FORM WITH PAYMENT TO:

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Philadelphia Chapter ASHRAE
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hope@mmco1.com

For Official Use Only

Date Received: _____ Tuition: _____ Deposit: _____ Check No.: _____ Balance _____

The Philadelphia Chapter
of the
American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

994 Old Eagle School Road
Suite 1019
Wayne, PA 19087-1866
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Republication of material contained herein is expressly forbidden without official Chapter authorization. The Chapter does not speak or act for the Society. Any member with material to submit for inclusion in the *Climate* can send the information to:

Hope Silverman
P 610-971-2169
hope@mmco1.com

Material can include letters to the editor, member news, upcoming events, comments on chapter programs or issues, etc.

New Philadelphia Chapter Members

Amelia Aguila
Mohd Salman Alimi
Gladysh G Felix Almonte
Dave Antonacci
Nicholas Beale
Dylan J Boles
Emidio Bucci
Sammi Chan
Joshua W. Chapman
Christopher Terrell Covington
Nick DeRenzo
Jonathan Patrick Durkin
Gary Dutton
Shawn Ellis
Jack T Ennis
Fernanda Gomez
Dante A Grilli
Daniel Henry
George Michael Hibbs, Jr
Cody Hopkins
Rachel Anne Innella
Chase Kaiser
Ryan S Kennedy
Richard Lamont Kimball
John David Konieczny
Jonathan Lees
Christian Cappel Lipa
Isandro Malik
Emily Malin
Noreshvarman Manisagar
Connor Murphy
Frank North
Nnadozie Obi
Ravindra Pradhan
Saurabh Raskar
Carbon Reform
Earn Sakornpan
Ryan Schulok
Elena Maria Senouillet
Brendan Smith
Kurk W Snyder
Keith Supernavage
Christian T Zapata
Michael Zazula

What are the benefits of paying Philadelphia Chapter *dues** ?

Discounts:

- $200 Discount for Basic HVAC Design Class
- Discounts on Monthly Chapter Meetings
- Free access to the Digital Directory
- And much more!

* Note that Philadelphia Chapter Membership Dues are $50/year.

To receive discounts, please remit you Chapter dues when renewing online or applying for a new membership. Feel free to upgrade online by clicking here or contact c021@ashrae.net for assistance.

Membership Advancement

If you are currently an ASHRAE Associate Member, becoming a full Member is easier than you think! The following count toward the required **12 points** to advance to full membership status. You must update your ASHRAE online biography and send an email to membership@ashrae.org to advance.

Non-accredited degree = 4 points
PE = 4 points
Accredited degree = 6 points
Industry experience = 1 point/year

NOTE: For more information on the CTTC article found on the following pages, go to: https://www.ashrae.org/technical-resources/free-resources/supplier-directory-supplier-white-papers

PRODUCT APPLICATION

A technical bulletin for engineers, contractors and students in the air movement and control industry

The Safety of A2L Refrigerants in Direct Gas-Fired HVAC Equipment

The EPA Technology Transition Act has required the HVAC/R industry to transition to lower-GWP (global warming potential) refrigerants. Class A1 refrigerants, which have a higher GWP but no flame propagation, were widely used prior to the act. Class A2L refrigerants, which have a low GWP but can propagate flame, are the new standard beginning in 2025. The industry has worked diligently to address safety concerns for many of the most common air-conditioning and heat pump applications while maintaining similar performance, design, and efficiency. The use of direct gas-fired furnaces in HVAC equipment with new refrigerants, while a small portion of the industry, deserves close consideration. Greenheck has collaborated with industry organizations, experts, and nationally recognized testing laboratories to determine that its products joint-listed between UL 60335-2-40 and ANSI/CSA Z83.8 sufficiently address the risks presented with A2L refrigerants.

Direct gas furnaces are an effective source of heat in HVAC products where a significant amount of outdoor air needs to be heated, either to provide comfort to an occupied space directly or be used as a scavenger air source to regenerate desiccants. Natural gas or propane is delivered through redundant safety valves to a line burner placed in an open airstream without the need for a heat exchanger. The line burner and surrounding profile plates work together to inject air across the burner, where it mixes with the gaseous fuel to burn cleanly.



Figure 1. Make-up air unit with direct gas-fired furnace

Comparison of A1 and A2L Refrigerants

Previous generations of A1 refrigerants used in air-conditioners and heat pumps were combustible in open flames but would not sustain a flame on their own under normal conditions. Outside of the moderate increase in flammability risk, new A2L refrigerants are very similar to their A1 predecessors. R-410A was the predominate refrigerant used in air-conditioning and heat pump products since 2010, and the top two replacement refrigerants that will comply with hydrofluorocarbon (HFC) GWP phasedown requirements are R-32 and R-454B.

NOTE: This document addresses the use of direct gas-fired furnaces with A2L refrigerants in combined heating and cooling appliances. Direct gas-fired furnaces that are used as independent appliances, such as industrial ovens and process heaters, must be evaluated based on local building codes to address the risks of thermal degradation, combustion, and fire from refrigerant leaked into the presence of open flames.

 Copyright © 2024 Greenheck Fan Corp.

What's similar between R-410A, R-32, and R-454B?

1. R-32 is a major constituent in all three refrigerants.
2. All three refrigerants are combustible.
3. The products of combustion and thermal degradation are the same.

What's different?

Flammable concentrations of R-32 and R-454B in stagnant environments create a risk of fire when exposed to higher-energy ignition sources such as open flames, high-energy electrical arcing, or surface temperatures above 800°C (1472°F). Industry experience has determined that combustible A2L mixtures do not ignite when local mixture velocities exceed three times the refrigerant's burning velocity.[1] For A2L refrigerants, the risk of ignition is abated when in the presence of airflows of 30 cm/s (60 ft/min).

See Table 1 for a more detailed overview of differences and similarities.[2]

Concerns and Risks of Flame Exposure for A2L Refrigerants

Risk evaluation and mitigation require imagination of what risks exist, the severity of outcome if the risks aren't mitigated, the likelihood those risks exist, and the direct and social cost of requiring additional safety measures. Not all risks can be mitigated reasonably. One could require all HVAC units using A2L refrigerants to prevent a risk of fire when struck by space debris falling to Earth. But the structural design changes, additional testing needed, and of course the low likelihood would make this requirement a bit excessive.

Refrigerant Combustion/Thermal Decomposition Byproducts

The primary risk of refrigerant exposure to a flame is that the refrigerant will decompose or oxidize and create hydrogen chloride and hydrogen fluoride. While theoretically plausible but statistically unlikely, chlorinated and fluorinated refrigerants could create carbonyl halides if combustion happens in the absence of water vapor. Risks to exposure are most prevalent when torches are used for service and repair of refrigerating equipment. These risks are minimized through properly recovering refrigerant prior to service work and proper ventilation in the service area.

Refrigerant Comparisons			
Refrigerant Number	**R-410A**	**R-32**	**R-454B**
Safety Classification	A1	A2L	A2L
Refrigerant Composition	50% R-32 (HFC) 50% R-125 (HFC)	100% R-32 (HFC)	68.9% R-32 (HFC) 31.1% R-1234yf (hydrofluoroolefin, or HFO)
Lower Flammability Limit (LFL)	–	14%	11%
Upper Flammability Limit (UFL)	–	29%	22%
Auto-Ignition Temperature	–	648°C	496°C
Hot Surface Ignition Temperature	–	> 800°C	> 800°C
Minimum Ignition Energy	–	30–100 MJ	100–300 MJ
Heat of Combustion	5.91 MJ/kg	9.5 MJ/kg	9.9 MJ/kg
Burning Velocity	–	6.7 cm/s	5.2 cm/s
Products of Thermal Decomposition	Hydrogen fluoride	Hydrogen fluoride	Hydrogen fluoride
Products of Combustion	Hydrogen fluoride, Carbonyl fluoride	Hydrogen fluoride, Carbonyl fluoride	Hydrogen fluoride, Carbonyl fluoride

Table 1

Outside of direct service operations, there have been no known hydrogen fluoride (HF) exposure incidents in normal operation between the mobile and stationary HVAC/R industries.[3] With proper design and safety measures incorporated into direct gas-fired equipment to avoid flammable concentrations of A2L refrigerants, the exposure risk to HF chemicals hasn't significantly changed with the industry's transition to low-GWP refrigerants.

Flame Expansion and Heat Release

Industry testing documented in AHRI Test Report 8028 sprayed high leak rates of refrigerants at an open 120 kW sand burner in a large open space to observe the flame and the heat release rate.[4] The release rate of refrigerants was close to 50 g/s, which approaches a theoretical heat release rate of 475 kW for complete combustion of R-32 refrigerant. The results of the testing showed that the maximum heat release measured was 80 kW, indicating a 17% effective combustion scenario. The same 80 kW heat release was also observed during testing with R-410A refrigerant. Significant flame expansion wasn't observed for either classification of refrigerant, and the difference in flammability level did not create additional risks. Combustion effectiveness was low because when sprayed out, the refrigerant was not well-mixed with air. Also, the cooled refrigerant chilled the flame through the expansion process, and the local velocity of refrigerant prevented some flammable concentration levels from igniting.

Risk of Fire

The increased risk of fire with A2L refrigerants played out mainly in confined-room testing where leaked refrigerant was stagnant and exposed to high-energy electrical arc devices and open burners.[5] In these scenarios, A2L refrigerants can ignite and propagate. These tests helped solidify the refrigerant charge and room size limits used in product safety standards and building codes to prevent refrigerant from reaching flammable thresholds in confined spaces. Additionally, new mitigation strategies such as air circulation and ventilation can be used to help keep leaked refrigerant well-mixed at low flammability levels and avoid localized high concentrations of A2L refrigerants.

Product Design Safety Features

As part of the direct gas-fired design process for A2L refrigerants, Greenheck has implemented mandatory requirements from the relevant product safety standards and designed additional safety features to address risks. These safety features include limited charge requirements, strategically compartmentalizing components and mounting coils downstream of the burner, and adding refrigerant leak detection systems in key locations.

Table 2 on the next page gives information on specific safety measures and whether they are required by any code or product standard.

Safety Measure	Element of Refrigerant Safety	Required by Code	Required by Product Standard
Air Proving by Pressure Switches	Low- and high-air differential pressure switches guarantee that sufficient airflow is present for the direct gas-fired furnace to operate. Airflow velocities in direct gas-fired equipment need to be around 1,525 cm/s (3,000 ft/min) at the entrance to the burner and transition to typical air-handler velocities of 152 cm/s (300 ft/min) or greater, well above the ignition threshold for A2L refrigerants.	–	ANSI Z83.8
Fan Proving by Variable Frequency Drive	Products will use direct-drive fans with variable frequency drives that verify motor rotation before allowing heat to operate. This is a redundant verification that airflow is sufficiently high and above the ignition threshold for A2L refrigerants.	–	UL 60335-2-40
Heat Exchanger Location/Isolation	Greenheck products place refrigerant heat exchangers downstream of the direct gas-fired furnace to prevent leaked refrigerant from being drawn into the flame during operation. Only the refrigerant heat exchanger tubes are exposed to the burner. All potential leak points such as brazed joints and return bends are compartmentalized to force refrigerant leaks downstream of the furnace or are isolated from the air handling cabinet.	–	ANSI Z83.8
Airstream Refrigerant Detection System	An airstream leak detection sensor mounted by the refrigerant heat exchanger will detect leaks at 12% of refrigerant lower flammability limit (LFL). At this level, the system will disable furnace operation and force the fan to operate to address refrigerant mitigation requirements for the occupied space.	ASHRAE 15 for Ducted Equipment	UL 60335-2-40
Refrigerant Cabinet Leak Detection System	The refrigerant cabinet leak detection sensor will detect leaks at 12% of refrigerant LFL for non-airstream-mounted refrigerant components, and also disable furnace operation and initiate fan operation.	–	UL 60335-2-40
Pre-purge Timing for Furnace Operation	The pre-purge timing of the direct gas-fired furnace provides an additional safety element. It requires several fresh air changes of the air-handling cabinet prior to allowing the furnace to operate. This will force any leaked refrigerant that may have accumulated during off-cycle operation below the LFL threshold of the refrigerant detection sensors. It also acts as a redundant measure to airstream leak detection sensors, coil placement, airflow proving, and fan proving to prevent refrigerant from reaching the burner during furnace operation.	–	ANSI Z83.8
Limited Charge Equipment	The use of microchannel outdoor coils, short piping runs, and relative cooling capacity creates low refrigerant charges. Even in catastrophic leak rate scenarios, the average refrigerant concentrations will be below the refrigerant's LFL due to the dilution from supply airflow.	–	–

Table 2

References

1) Goetzler, Bill, and Matt Guernsey, Sean Faltermeier, and Michael Droesch. ***AHRI Project No. 8016: Risk Assessment of Class 2L Refrigerants in Commercial Rooftop Units.*** Air-Conditioning, Heating, and Refrigeration Institute. 2016. https://www.ahrinet.org/system/files/2023-08/AHRI_8016_Final_Report.pdf

2) Data for Table 1 was derived from multiple sources, including refrigerant manufacturer technical documents as well as reports by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) and its research division, the Air-Conditioning, Heating, and Refrigeration Technology Institute (AHRTI).

3) "AHRI Refrigerant Webinar Series – Webinar 5: Refrigerant Ignition in Open Flame/Hot Surfaces: Has Anything Fundamentally Changed?" Webinar from Air-Conditioning, Heating, and Refrigeration Institute. October 21, 2020. https://www.ahrinet.org/news-events/events/webinars/ahri-refrigerant-webinar-series

4) Hunter, George. ***AHRI Report No. 8028: A2L Refrigerants and Firefighter Tactical Considerations.*** Air-Conditioning, Heating, and Refrigeration Institute. 2021. https://www.ahrinet.org/system/files/2023-08/AHRI-8028_Final_Report.pdf

5) Gandhi, Pravinray, and George Hunter, Randall Haseman, and Brian Rodgers. ***AHRTI Report No. 9007-01: Benchmarking Risk by Whole Room Scale Leaks and Ignitions Testing of A2L Refrigerants.*** Air-Conditioning, Heating, and Refrigeration Technology Institute, Inc. 2017. https://www.ahrinet.org/system/files/2023-07/AHRI_9007-01_Final_Report_1.pdf

P.O. Box 410 • Schofield, WI 54476
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