

CPSC Meeting Log: Carrier Corporation

CPSC Attendees	Commissioner Mary Boyle Eva Caldera
Date of Meeting	May 1, 2024
Date of Log Creation	May 6, 2024
Log Creator	Jacob Murray

ATTENDEES	AFFILIATION
Jason Thomas	HVAC
Kate Martinez	HVAC
Paul Haydock	HVAC
Neal Cohen	Neal Cohen Law LLC
Boaz Green	Neal Cohen Law LLC
DIAL-INS	AFFILIATION
Dane Pedersen	Bracewell

MEETING NOTES:

Participants discussed: points in the attached presentation regarding safety standards for furnaces; additional materials were offered for further review.



NEMOTO NAP-78SU
CO H2 Sensor FAQ L

NEMOTO NAP-78SU CO/H₂ Sensor FAQ List.

GROUP 1:

1. Considering the NAP 78SU sensor, is there only one option in that sensor or are there any variations that have been developed in recent years (since 2019)?
2. What types of products use the NAP 78SU sensor today? Are they non-condensing or condensing?
3. If condensing products use this sensor, how is it that they are applied, especially with the limitations on relative humidity? Basically, how is this sensor used in high-efficiency boilers or other types of heaters?
4. Is this sensor used in European heating appliances? If so, is it widespread use, or minimal?
5. This sensor has a very large range of CO measurement (0 to 20,000 ppm). The application for U.S. furnaces and boilers would like to have a sensor with high accuracy (~5%) at roughly 400 to 500 ppm. So, that would be a sensor with a maximum of 1000 ppm (0.1%). Is this something that Nemoto can do?
6. Can this sensor be made to operate in saturated flue gas (100% RH)? What would it take to overcome this obstacle?
7. Carrier furnaces are multipoise. That means they are installed vertically (upflow), or with turning onto either side (Horizontal) or upside-down (Downflow). The NAP 78SU sensor manual limits the orientation of the sensor to vertical. We would need the sensor to be capable of any orientation of the appliance. What are the obstacles for increasing the capability to allow multipoise use?
8. As near as I can tell, there isn't a UL certification for this sensor. Does Nemoto have a certification of this sensor? If so, what are the details? If not, how difficult would it be to get a certification of the part?

日本語訳

GROUP 1

Question	Answer
1. Considering the NAP 78SU sensor, is there only one option in that sensor or are there any variations that have been developed in recent years (since 2019)?	There are no variations available; essentially, only one option is offered.
2. What types of products use the NAP 78SU sensor today? Are they non-condensing or condensing?	It is exclusively used in boilers, and the models employed include both non-condensing and condensing types.
3. If condensing products use this sensor, how is it that they are applied, especially with the limitations on relative humidity? Basically, how is this sensor used in high-efficiency boilers or other types of heaters?	We do not specify methods for reducing relative humidity. Some manufacturers take some measures to prevent condensation, but we cannot give you the details because it is the manufacturer's know-how.

	<p>And there are installation guidelines to prevent condensation water from affecting only one side of the sensor. The sensor should be aligned with the blades' longitudinal direction parallel to the ground, and the sensor head's mesh should be installed perpendicular to the ground.</p>
<p>4. Is this sensor used in European heating appliances? If so, is it widespread use, or minimal?</p>	<p>No. Sales are primarily within Japan.</p>
<p>5. This sensor has a very large range of CO measurement (0 to 20,000 ppm). The application for U.S. furnaces and boilers would like to have a sensor with high accuracy (~5%) at roughly 400 to 500 ppm. So, that would be a sensor with a maximum of 1000 ppm (0.1%). Is this something that Nemoto can do?</p>	<p>Resolution (~5%) cannot be guaranteed. While it is possible to measure 100ppm over a short period, achieving high accuracy at 500ppm becomes extremely challenging under varying wind and temperature conditions.</p>

<p>6. Can this sensor be made to operate in saturated flue gas (100% RH)? What would it take to overcome this obstacle?</p>	<p>The device can operate. However, using it in a manner that allows condensation to contact the sensor's elements is not recommended. Additionally, the installation method described in the point Question 3 (about sensor installation) is necessary.</p>
<p>7. Carrier furnaces are multipoise. That means they are installed vertically (upflow), or with turning onto either side (Horizontal) or upside-down (Downflow). The NAP 78SU sensor manual limits the orientation of the sensor to vertical. We would need the sensor to be capable of any orientation of the appliance. What are the obstacles for increasing the capability to allow multipoise use?</p>	<p>Similar to the issues raised in Questions 3 and 6, it is essential to prevent water accumulation inside the sensor to ensure that not only a single element is submerged. Even if the sensor is protected against immersion, it is also necessary to prevent condensation droplets from impacting the sensor elements.</p>

	<p>In addition, zero offset and temperature dependency of the sensor may also change depending on the orientation.</p> <p>Furthermore, to avoid the scenario where a strong flow of gas-laden or moist air impacts only one side of the sensor element, it is important to design the system such that both elements are exposed to the same amount of exhaust gas, regardless of the orientation of the multipoise casing.</p>
<p>8. As near as I can tell, there isn't a UL certification for this sensor. Does Nemoto have a certification of this sensor? If so, what are the details? If not, how difficult would it be to get a certification of the part?</p>	<p>No, this sensor has not any certification. Currently, there is no UL standard specifically for "boiler sensors" In the world.</p>

In other words, you will need to adjust the installation and measurement method so that our sensors can be used to measure the CO concentration in the standard in your boiler.

Therefore, to obtain UL certification for this sensor, establishing a new standard with UL would be necessary.
(like CPSC - current situation!)

Haydock, Paul

From: tmckechnie@nemoto.co.jp
Sent: Monday, February 26, 2024 2:50 PM
To: Haydock, Paul
Subject: [External] Re: AHR Meeting - Follow-up
Attachments: NAP-78SU_FAQ_英訳済1.1 Carrier.docx

Categories: External, Orange Category

Hi Paul,
please see attached.

Regards,
Tom McKechnie
Technical & Sales Consultant,
North America Region
Nemoto & Co. Ltd.
604 761 7363
tmckechnie@nemoto.co.jp
www.nemoto.eu

From: Haydock, Paul <paul.haydock@carrier.com>
Sent: February 26, 2024 4:53 AM
To: Tom McKechnie <tmckechnie@nemoto.co.jp>
Subject: RE: AHR Meeting - Follow-up

Hi Tom,

Just checking-in with you on the status of our request. Let me know if I need to provide anything else to you.

Thanks,

Paul Haydock

From: Haydock, Paul
Sent: Wednesday, February 14, 2024 11:28 AM
To: tmckechnie@nemoto.co.jp
Subject: RE: AHR Meeting - Follow-up

Hi Tom,

Glad to hear from you, and thanks for the reply. I'm curious, are you asking me to pay for shipping, or do you need my shipping information? Please advise.

My shipping information would be:

Attn: Paul Haydock

Carrier – Building 9
7304 W. Morris St.
Indianapolis, IN 46231
Phn. (317) 416-2219

Thanks,

Paul

From: tmckechnie@nemoto.co.jp <tmckechnie@nemoto.co.jp>
Sent: Tuesday, February 13, 2024 6:27 PM
To: Haydock, Paul <paul.haydock@carrier.com>
Subject: [External] Re: AHR Meeting - Follow-up

Hi Paul,
sorry I haven't made much progress, I could not pin down the right guys for the call I planned last week, will keep working on it.
No problem on the samples, I will arrange for 10 pieces to be sent. I think we will have your shipping account to charge the ship cost to but will let you know if not.
I have not used Arduino but I will check with our R&D, it may be something they want to try out.

Regards,
Tom McKechnie
Technical & Sales Consultant,
North America Region
Nemoto & Co. Ltd.
604 761 7363
tmckechnie@nemoto.co.jp
www.nemoto.eu

From: Haydock, Paul <paul.haydock@carrier.com>
Sent: February 12, 2024 9:16 AM
To: Tom McKechnie <tmckechnie@nemoto.co.jp>
Subject: RE: AHR Meeting - Follow-up

Hi Tom,

Thanks for the response last week. Is there any follow-up from your side after the meeting you spoke of?

Getting samples would be a good starting place. Is it too much to ask for 6-10 samples? Also, do you have what are your best practice information on how to operate the sensor? I like to use Arduino boards and programming form ad hoc testing. If there are ideas how to hook up with the basic Arduino Uno, that would be very helpful.

Thanks,

Paul Haydock

From: tmckechnie@nemoto.co.jp <tmckechnie@nemoto.co.jp>
Sent: Monday, February 5, 2024 3:21 PM

Haydock, Paul

From: tmckechnie@nemoto.co.jp
Sent: Monday, February 5, 2024 3:21 PM
To: Haydock, Paul
Subject: [External] Re: AHR Meeting - Follow-up

Categories: External, Orange Category

Hello Paul,

glad to meet you again at the AHR, thanks for the comprehensive list of questions. As you can imagine there was considerable interest in the sensor at the show and questions have started to come in and as they are starting to add up, they are going to take some time to work through, so as you suggest, we will work on responding to the various questions as we go.

I plan on having a call on this with the factory this week to get things started.

In the meantime if you need any additional samples let me know.

Regards,

Tom McKechnie
Technical & Sales Consultant,
North America Region
Nemoto & Co. Ltd.
604 761 7363
tmckechnie@nemoto.co.jp
www.nemoto.eu

From: Haydock, Paul <paul.haydock@carrier.com>
Sent: February 2, 2024 11:31 AM
To: Tom McKechnie <tmckechnie@nemoto.co.jp>
Subject: AHR Meeting - Follow-up

Hi Tom,

It was nice to meet with you at the AHR convention in Chicago last week (1/22). Glad to speak with you as it has been a while since the CSA meetings (CO Sensor Working Group from 2016-2018). Just to recall, our conversations at AHR and during the CO Sensor Working Group have to do with the possibility of using the CO sensor to monitor appliance flue gas CO levels.

I do have a number of questions for you if you can let me know your thoughts and suggestions. First, I should explain what products of ours that I am interested in the CO sensor.

At Carrier Corporation we manufacture gas heating appliances (furnaces) for residential and commercial applications. These furnaces range in size and complexity. All of the products we develop for the North American market are gas-fired central furnaces that use gas-to-air heat exchangers. We sell oil-burning furnaces and gas-hydrionic heating appliances as well, but we don't develop and manufacture them. My area of expertise is in the residential gas furnace applications. We manufacture two residential gas furnace platforms. One being an 80% AFUE model line which has a non-condensing exhaust 150-200°C. The other platform includes high-efficiency 92% and >95% condensing

models that have saturated humid exhaust at 25-60°C. You can view our products at the Carrier product website listed here.

<https://www.carrier.com/residential/en/us/products/furnaces/>

There is no doubt that your organization has heard about the recent Notice of Proposed Rulemaking regulation set forth by the U.S. Consumer Safety Product Commission (CPSC) (links below). Ron Jordan who attended the CSA CO Sensor Working Group has set this rulemaking into motion. It is complicated, but the justification stems from the knowledge and application of the Nemoto NAP-78SU CO sensor in Japan and European markets. It is regarding this rulemaking and NAP-78SU sensor that I have several questions.

1. Considering the NAP 78SU sensor, is there only one option in that sensor or are there any variations that have been developed in recent years (since 2019)?
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If it is helpful to respond to each question individually, that would be fine. I would rather have quick answers on a few then wait until there is a full package of answers for all of the questions. Also, I'm sure more questions will be coming forth.

Thanks for your assistance!

Paul Haydock
Principal Engineer – NA HVAC/Residential Furnaces
Carrier Corporation
7310 W. Morris St.
Indianapolis, IN 46231
(317) 416-2219

Notice of Proposed Rulemaking, CPSC Docket 2019-0020-0022
<https://www.regulations.gov/document/CPSC-2019-0020-0022>

To: Haydock, Paul <paul.haydock@carrier.com>

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Haydock, Paul

From: Haydock, Paul
Sent: Friday, February 2, 2024 2:32 PM
To: Tom McKechnie (tmckechnie@nemoto.co.jp)
Subject: AHR Meeting - Follow-up

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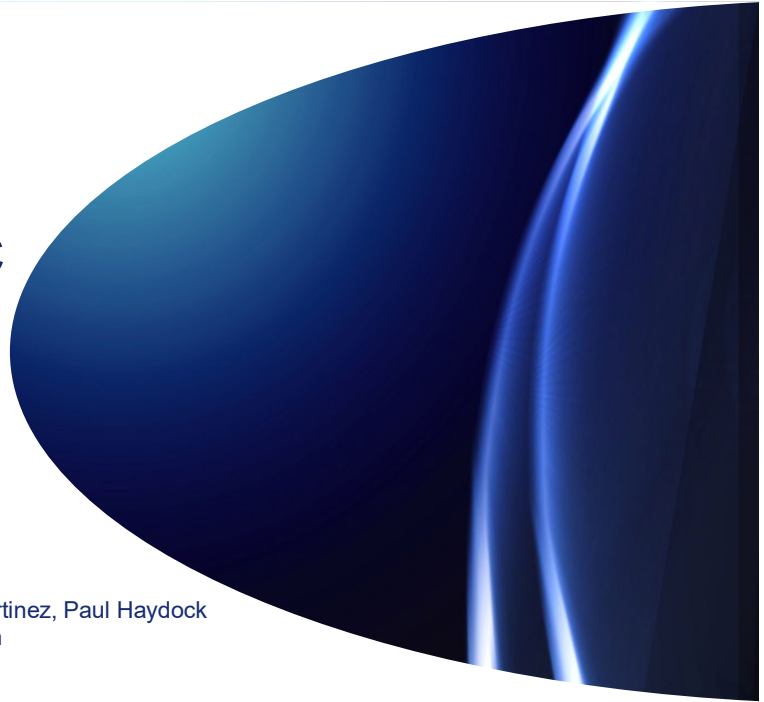


CARRIER & CPSC MEETING

May 1, 2024

Safety Standard – CPSC-2019-0021

Carrier Team: Jason Thomas, Kate Martinez, Paul Haydock
Counsel: Neal Cohen, Boaz Green



Product Safety Focus

Focus on product safety is paramount to Carrier in all aspects of the product value stream.

Vision

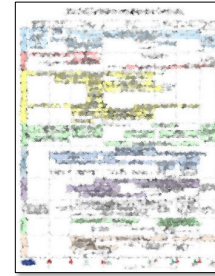
Deliver outstanding products ... that are always reliable, compliant, and safe for customer use across the value stream

Culture

Safety of Employees, customers, and the public is paramount. Never compromise safety to save money or schedule.

Process

Safety and compliance assurance through robust processes.



New Product Development Process Overview



2

Brief Overview of Comments

- Carrier shares interest in product safety and the goal of reducing potential CO exposure
- NPR did not identify and analyze reasonable alternatives
- NPR did not show rule is feasible
- Cost benefit deficiencies
- Proposed effective date of 18 months is unreasonable
 - Requires shortcuts to well -established safety product development protocols
 - Will lead to potential safety and performance problems



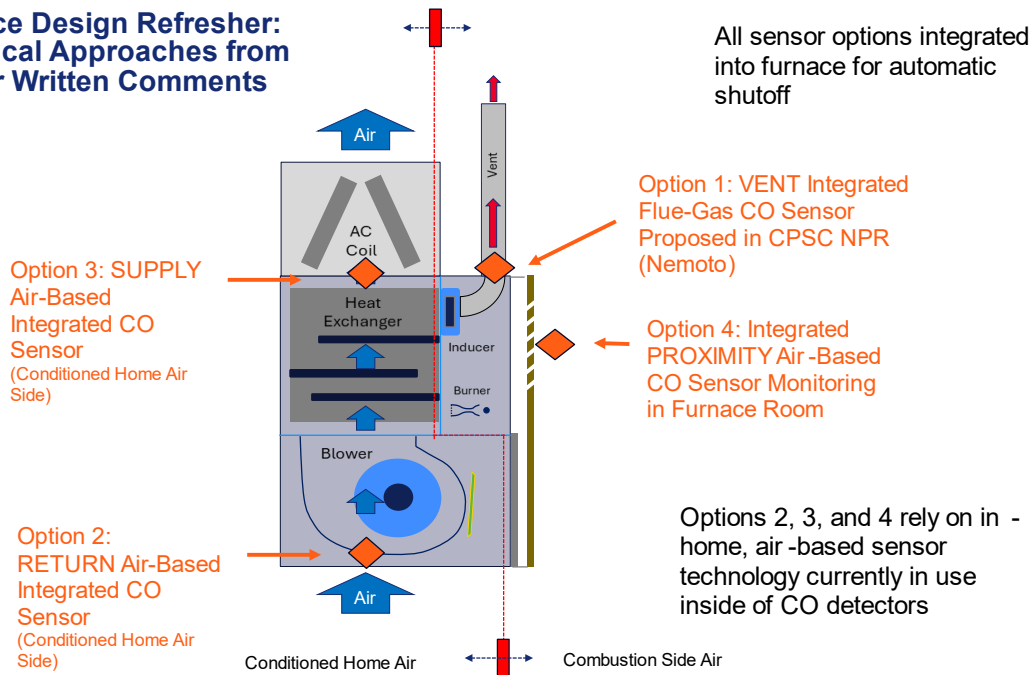
3

ALTERNATIVE TECHNICAL APPROACHES



4

Furnace Design Refresher: Technical Approaches from Carrier Written Comments



5

Alternative Technical Approaches

Option	Design Option	Senses CO	Shuts down appliance	Technical Readiness	Reliability	Availability & Supply Chain	Consumer Cost	NPR Included
1	Flue-gas sensor (NPR)	Yellow	Green	Red	Red	Red	\$\$\$	Yes
	Indirect Method (NPR)	Red	Green	Red	Yellow	Red	\$\$	Yes
2, 3, & 4	Integrated Air-based sensor	Green	Green	Green	Green	Green	\$\$	No
	CO Alarm / Detector	Green	Red	Green	Green	Green	\$	No



Concept Considerations Summary

Concepts	Discussion
Integrated air-based sensor	<ul style="list-style-type: none"> Not evaluated in NPR (by neither Staff nor consultants) Capable of being integrated into appliance control for automatic shut down of appliance IDI data provided during CSA working group supports air-based sensor efficacy Widely used; large variety of sensors and suppliers available
Flue-gas sensor approach	<ul style="list-style-type: none"> The only direct measure option considered in NPR NPR does not provide evidence of use in gas furnaces <ul style="list-style-type: none"> Sensor identified in NPR used exclusive to Japanese boilers (not furnaces) Flue-gas sensors not technically capable for gas furnaces in U.S.A. <ul style="list-style-type: none"> Sensor manufacturer states clearly, "< 95% RH (non-condensing)" Not demonstrated in multi-poise gas furnaces Failure rate and unanticipated outcomes are cause of considerable concern CPSC's NPR consultants identify incapability and question viability of flue-gas sensor Limited supply chain <ul style="list-style-type: none"> Single source for industry Ability of supplier to meet capacity for U.S. heating appliance industry not shown
Implementation timeline	<ul style="list-style-type: none"> 18-mo <ul style="list-style-type: none"> Does not consider company established safety & development qualification procedures Does not consider overlapping or conflicting regulations (DOE AFUE, R454b, PFAS) Multi-year development time is necessary for a control adaptation



End of Section 1 of the Presentation

- Thank you for your attention.
- We will proceed with the closed proprietary section of the meeting shortly.

