# HEAT RELEASE RATE Updates

## Materials Working Forum Webinar #3
## June, 2020
## FAATC, NJ

Michael Burns, FAA Tech Center

June, 2020

Federal Aviation Administration

# Ground Rules for Webinars and Zoom Meetings

Zoom Meeting Ground Rules:

- Everyone PLEASE go on mute
- Use raised hand feature (under participants button) to ask a question
- A panelist will read or call on participant to ask their question, as time permits
- Once question has been answered, click raised hand to "un-raise"

# WEBINAR (0900 TO 1000):

1. HR2 Update – FAATC (Mike Burns)

   - 15 minutes (0900 to 0915)

2. Observed Interactive Effects on OSU Apparatus – Boeing (Theodoros Spanos)

   - 25 minutes (0915 to 0940)

3. HR2 TRL6 Update – Boeing (Yaw Agyei)

   - 20 minutes (0940 to 1000)

# Agenda

- BACKGROUND
- HR2 R&D Project Status
  - R&D Heater
  - HR2 sonic choke research
    - Specifications
    - Installation
    - Calibration/Theoretical Data (Volume flow vs. Temp., Press.)
  - Task Group input

# HR2 Update

BACKGROUND

- OSU Voltage Round Robin (March 2019 - Boeing)
- Implemented globar voltage and current monitoring (April 2019)
- TRL 5 (Repeatability) – May 2019
- NPRM released and on our FAA web site (July 2019; Chapter A4 - Heat Release Rate Test)
- Conference Presentations (October 2019)
    - Detailed HR2 / OSU description of changes (M. Burns - FAATC)

# HR2 Update

BACKGROUND (Continued)

- Summary of Airflow Effects on Material Heat Release Results using OSU Calorimeter (T. Spanos - Boeing)
- HR 2 Nominal Operating Parameters Range (Y. Agyei - Boeing)

- Current work (June 2020):
  - Investigation into MFC replacement with sonic choke – In progress (Mobile - Nominal Operating Parameters)
  - TRL 6 (Reproducibility) – In progress
  - R&D heater development – In progress

# HR2 R&D Heater

BACKGROUND

- Zone heater was developed to eliminate globars and to provide a more uniform and safer heater assembly
- First prototype used two heating zones
- FAA tests showed more efficient heating (less current) but not enough zonal adjustment
- Three zone unit manufactured with three different resistances

# HR2 R&D Heater

# HR2 R&D Heater

- The actual heater is complete with identical resistive heaters in all three zones
- Putting together an independent power supply unit with three separate AC/DC power supplies controlled by three Wallow controllers
- This will be shipped to the FAA Technical Center as soon as able to do so

# HR2 Sonic Choke

- If inlet pressure and temperature to the sonic choke can be regulated accurately, the MFC can be replaced.
- Estimated uncertainty in mass flow rate of air approximately +/- 0.5% traceable to NIST
- FAATC acquired sonic choke / equipment (Fall 2019)
- Temperature control:
  - Thermal Transfer Products heat exchanger
  - Remcor Chiller/Heater
  - Type-K TC

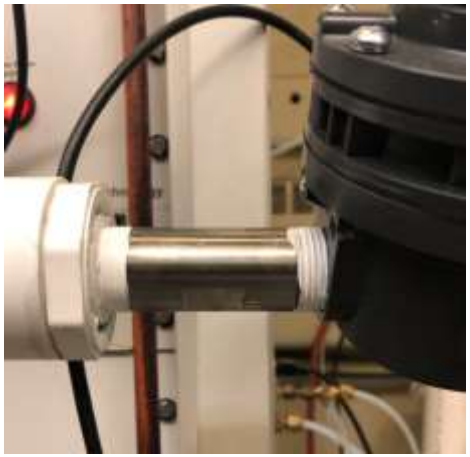
# HR2 Sonic Choke

- Pressure control:

- Pressure regulator

✓ ControlAir #7100-EAE

✓ ~ $340 each



- High-accuracy pressure gauge

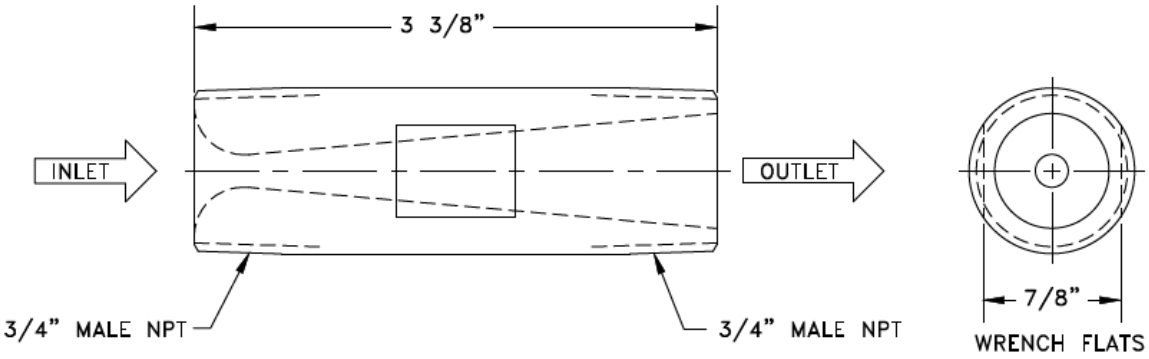
✓ PX309-050A10V

✓ ~ $270 each

- Flow tolerance of 20.0 ± 0.4 SCFM correlates to 34.7 ± 0.7 psia

# HR2 Sonic Choke

DO NOT SCALE DRAWING




**Testing & Certifications**

The following are included with supply of this Venturi.

| | YES | NO |
|---|---|---|
| Flow Calibration | ☒ | ☐ |
| Hydrotest | ☐ | ☒ |
| Weld Dye Pen. | ☐ | ☒ |
| Weld Certs | ☐ | ☒ |
| Radiograph 100% | ☐ | ☒ |
| Cleaning Spec. | ☐ | ☒ |
| Material Certs. | ☒ | ☐ |

***Fox 3/4" Sonic Choke***

***Fox Part No. 625442***

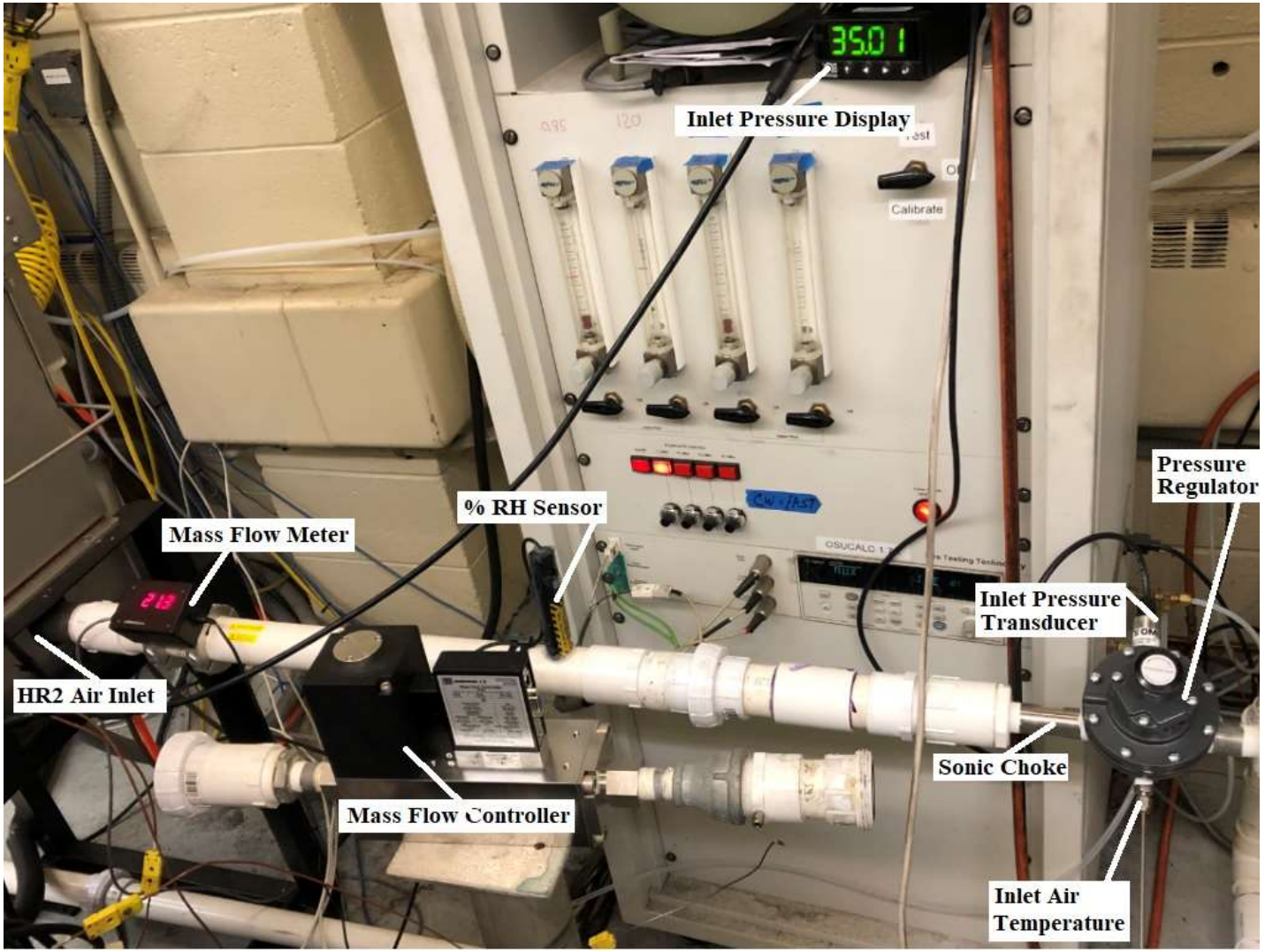
***Fluid Media:*** *Air at 34.7 psia, 72.5° F*
***Line Size:*** *3/4" Sch 40 pipe*
***Material:*** *304 Stainless Steel*
***Throat Dia:*** *Approx. Dt = 0.208"*
***Design Flow Rate:*** *Approx. 0.0269 lbs/sec of Air at 34.7 psia*
***Configuration:*** *3/4" male NPT ends*

***Calibration at CEESI:***

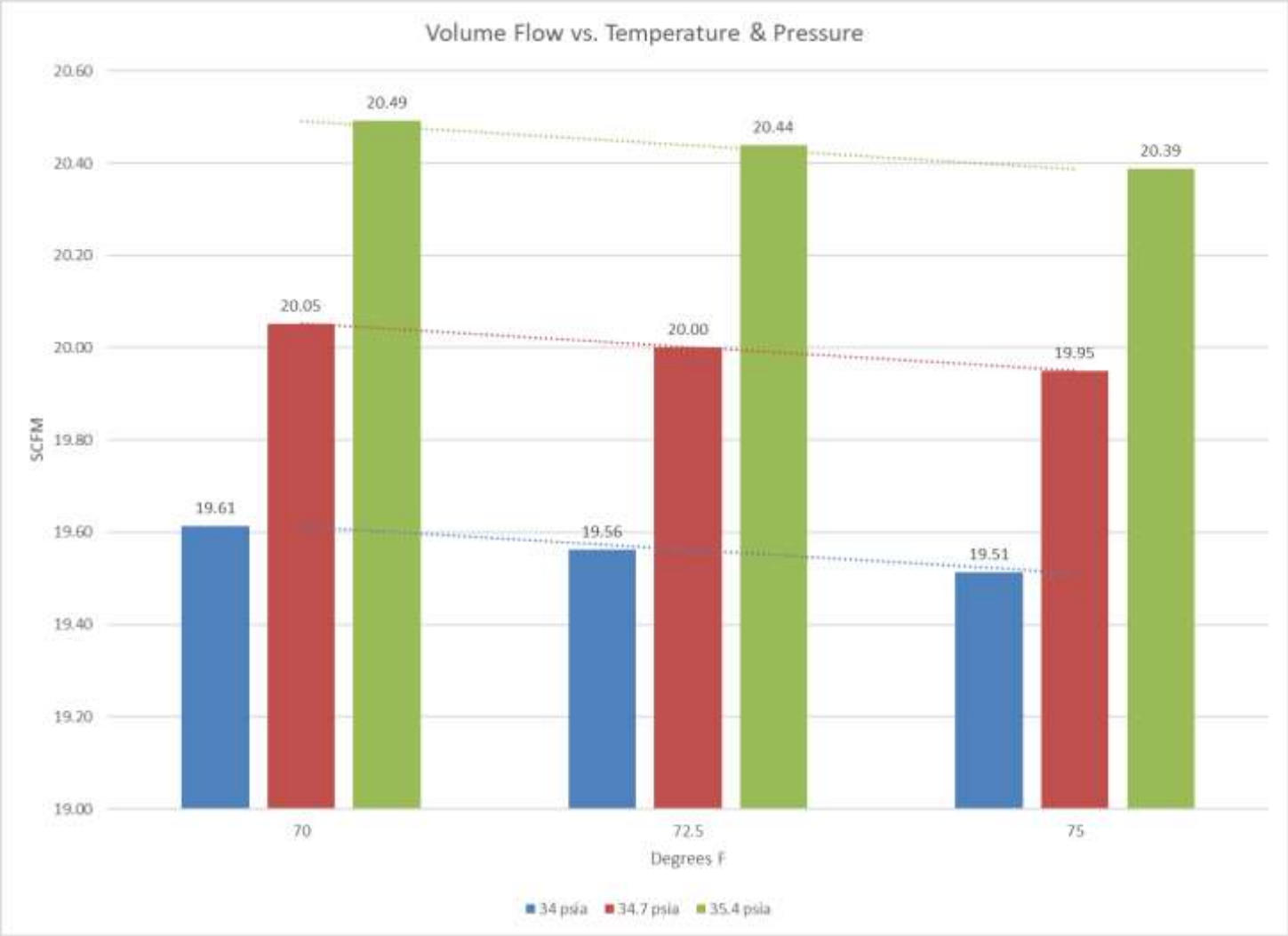
***Description:*** *Air Flow Test at ambient temperature; "As Found" testing*
***Choked Flow:*** *Approximately (6-10) Data Points taken over an inlet pressure range of about 24.7 to 44.7 psia*
***Accuracy:*** *Estimated uncertainty in mass flowrate of air approx. ± 0.5% traceable to NIST*

| | | | |
|---|---|---|---|
| CONTRACT NO. | | Fox Venturi Products | |
| APPROVALS | DATE | Dover, NJ USA | www.foxvalve.com |
| DRAWN BY EAN | 07/18/19 | 3/4" Sonic Choke, Male NPT | |
| APP. BY | | For Fire Safety R&D | |
| MATERIAL SS 304 | | For: DOT/FAA Atlantic City, NJ | |
| FINISH 32 RMS | | SIZE B / REVISION / DRAWING NO 625442 | |
| TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS: ± 1/8" | | SCALE | SHEET # OF |

# HR2 Sonic Choke



# HR2 Sonic Choke Theoretical Data



# HR2 Sonic Choke

HR2 Sonic Choke

- Cost: $950
- Colorado Engineering Experiment Station Inc. (CEESI) Calibration: $1,785
- Some questions for TG members:
  - How/where to install (lower plenum, remotely etc.)?
  - Distance from inlet fitting to lower plenum?
  - Change lower plenum 1½” opening to accommodate a ¾” female NPT (choke/pressure regulator)?
  - Location of pressure transducer and TC as standard configuration?

# HR2 Sonic Choke

HR2 Sonic Choke

- Temperature requirements will change from the lower plenum temperature TC 72.5 ± 2.5°F to the sonic choke inlet temperature.
- Use of pressure or temperature sensors
  - Absolute pressure gauge required (0-50 psia)
  - Type K TC
- Frequency of calibration of pressure and temperature sensors

# HR2 Sonic Choke

HR2 Sonic Choke

- Filtration requirements: Specific filter recommendation? Micron size?
- Calibration frequency (none required)? CEESI does not give a specific re-calibration interval.

  "The sonic choke does not have any moving parts, and assuming there are no changes to internal dimensions or surface finish performance should be consistent."
- Cleaning requirements or standardized method?
- If desired, update placeholder document.

# Questions?