

HRR² Task Group Updates

2012 February Materials Meeting Singapore

Materials Working Group

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February, 2012



Federal Aviation
Administration



Agenda

- HRR² Development Timeline
- Proposed Changes to Test Apparatus
- Chapter 5 Revision / Maintenance Schedule
- Prototype Development
- Ongoing Research
- 2012 Heat Release Round Robin
- Next



HRR² DEVELOPMENT PLAN TIMELINE

Phase I: Nov 2010 – Nov 2011 (Completed)

- Eliminate or reduce a major portion of variables that may have an impact on data in the test apparatus.

Phase II: Nov 2011 – Jan 2012 (Completed)

- Standardize / Improve the test method.
- Draft changes to Chapter 5 of the FAA Fire Test Handbook.

Phase III: Jan 2012 – May 2012

- Establish potentially new pass/fail criteria based on the improvements that were made that could have impacted data of current aviation materials.
- Finalize revision to Heat Release Chapter

Proposed Changes to HRR² Apparatus

THERMOPILE

- Replaced current welded bead with 1/16” exposed bead / sheathed thermocouples
- Exact length and type wire on Extension Harness

OVERLAP CRITERIA

Seam weld construction is desired, however, should an overlap be necessary it shall not be greater than 3/8” on any component and kept to a minimum.



Proposed Changes to HRR² Apparatus

INSULATION SPECIFICATION

- Low density, high temperature, flat duct insulation board
- Thickness of 1” (25mm) nominal
- Thermal conductivity of 0.033 W/m², °K (0.23 BTU-in/ft², °F, hr) +/- 15%

SPECIMEN LOCATION WITHIN HOLDING CHAMBER

- Sample face shall be located 9 +/- 0.5” from the inner radiation doors while in holding chamber prior to testing

CHANGES TO METHANE GAS CALIBRATION PROCESS

- Replacing wet test meter with mass flow meter
- Made changes to the equation (due to the use of mass flow meters)
- Replacing flow rate settings of 1 – 4, 1 – 6, 1 – 8, 1 – 6, 1 – 4 L/min with 1 – 2, 1 – 3, 1 – 4, 1 – 3, 1 – 2 SLPM
- Added 25°F range (tolerance) on upper thermocouples at baseline heat flux



Proposed Changes to HRR² Apparatus

AIRFLOW

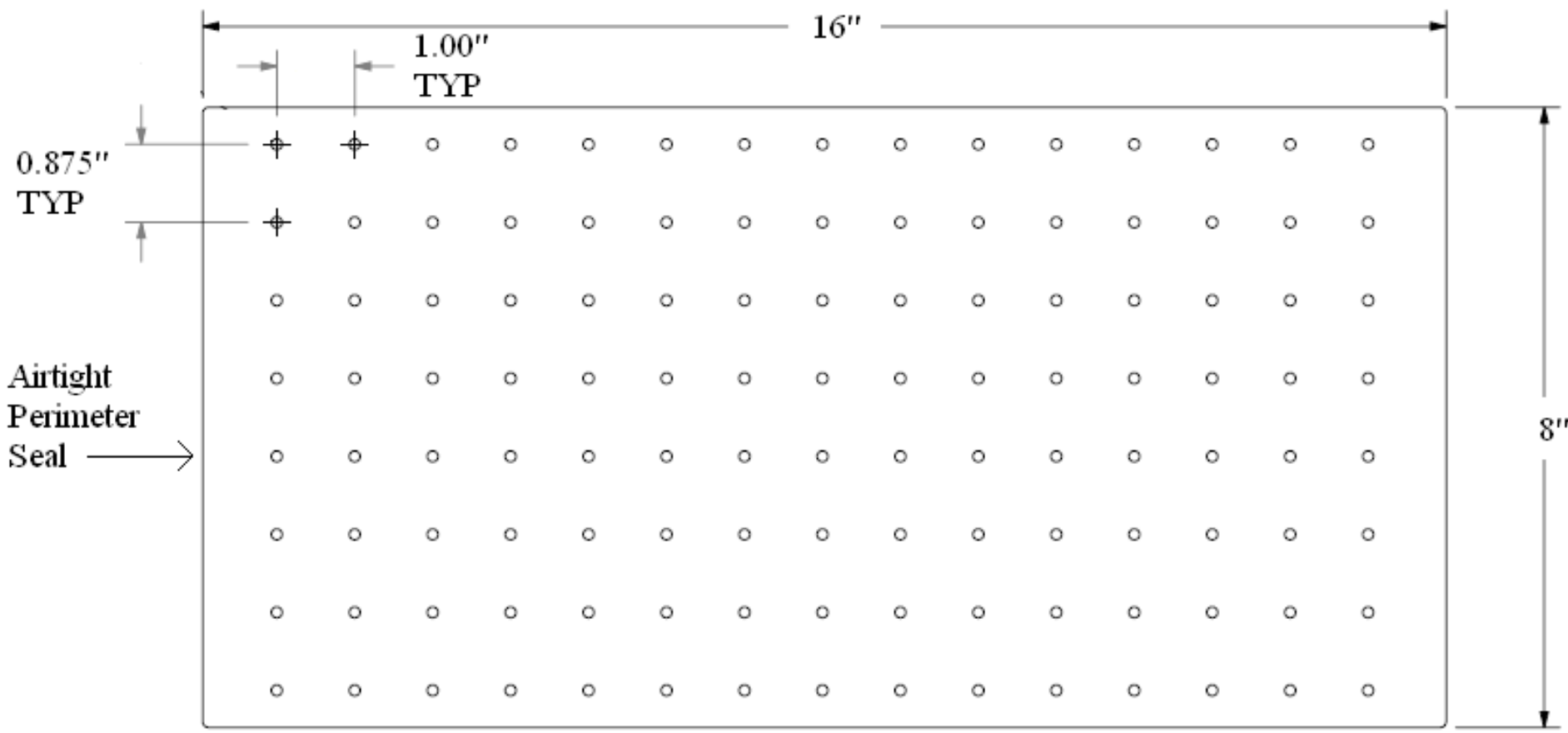
- Replacing orifice plate/mercury manometer air flow control system with split flow, independent control:
 - Chamber Flow @ 0.01 m³/s (600 FPM)
 - Cooling Flow @ 0.03 m³/s (1800 FPM)
- Installing mixing plate or foam between the lower two air distribution plates (in progress)

SECOND STAGE PLATE

- Standardized hole pattern in second stage plate at 8 rows of 15 holes (0.1405 diameter) @ 1" x 7/8" centers.
- Added perimeter seal or gasket to prevent air leakage around edge.



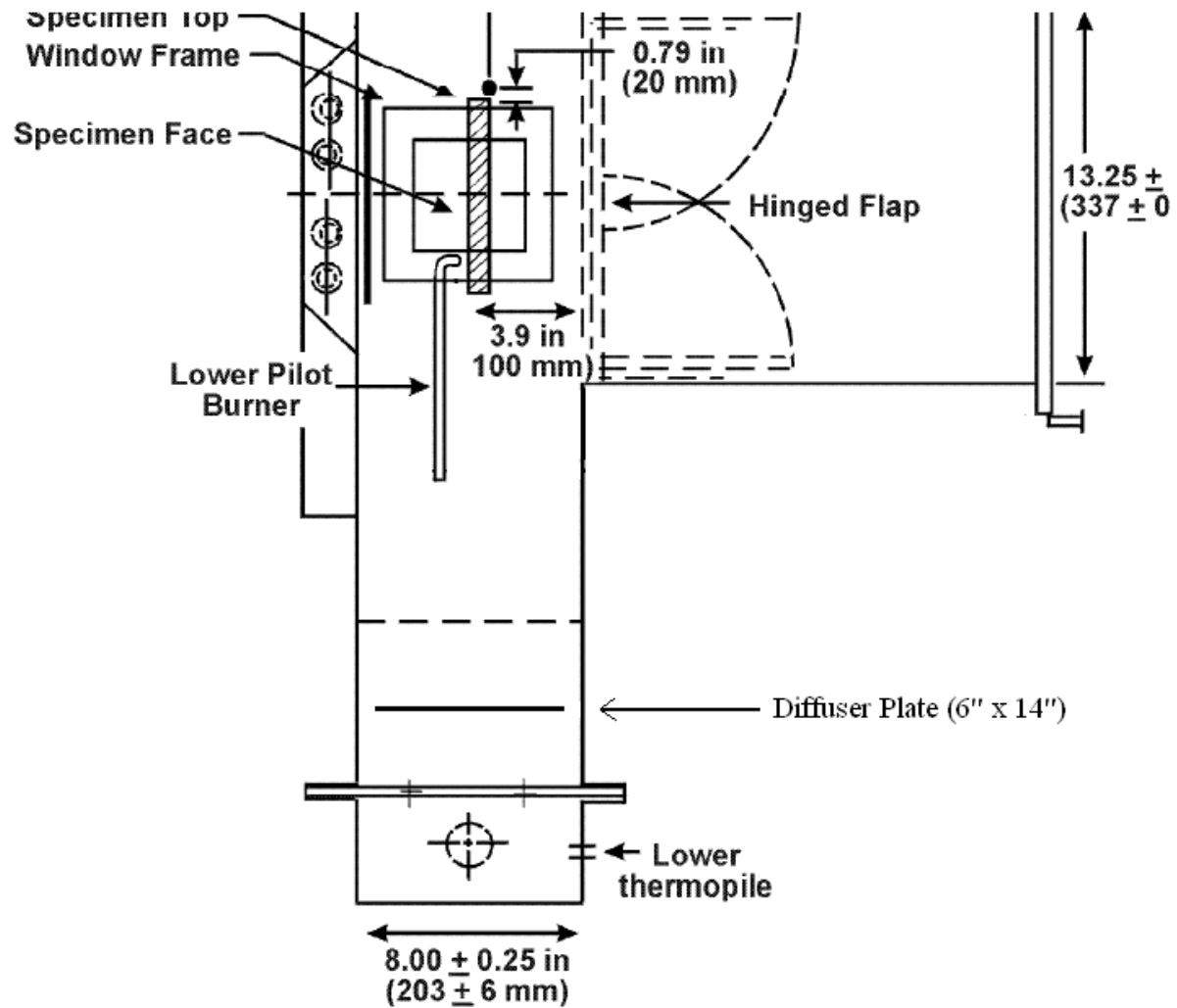
SECONDARY PLATE - STANDARDIZED HOLE PATTERN



8 Rows of 15 Holes @ 0.1405 Diameter
(#28 Drill Hole)



SECONDARY PLATE - STANDARDIZED HOLE PATTERN



Proposed Changes to HRR² Apparatus

HEAT FLUX – GAUGE, METHOD OF SETTING AND CORNER UNIFORMITY SPECIFICATION

- Replacing the use of Gardon type heat flux gauges with Schmidt-Boelter type heat flux gauges.
- The lower pilot burner will remain in position while setting heat flux.
- The HFG calibration assembly will remain in place until a stable reading is obtained.
- The center heat flux range @ $3.65 \pm 0.05 \text{ W/cm}^2$.
- All four corner heat flux range @ $3.65 \pm 0.10 \text{ W/cm}^2$.



CHAPTER 5 REVISION

Scope

Definitions

Principle of the Method

Apparatus

- Heat Release Rate Apparatus
- Apparatus Components

Test Specimen

- Specimen Number
- Specimen Size
- Specimen Preparation
- Specimen Orientation
- Conditioning



CHAPTER 5 REVISION

Calibration Procedure of Equipment

- Heat Flux Calibration (Center)
- Heat Flux Uniformity Calibration (Corners)
- Determination of the Calibration Factor (K_h)

Preparation/Performance of Test

- Preparation
- Performance of Test
- Preparation of Further Test Runs

Presentation of Results

Requirements

Test Report



MAINTENANCE SCHEDULE GUIDANCE

COLD CHECKLIST

Daily, Weekly, Monthly, Quarterly, 5 year, 10 year, On Condition

HOT CHECKLIST

- Procedural checklist
- Uniformity requirement



FAA TECH. CENTER HRR² PROTOTYPE



- New Thermopile System
- Split-Airflow Measurement and Control (REF 0°C,760 mmHg)
- New Second Stage Plate incorporating new hole pattern / seal / mixing foam
- Software changes incorporating new gas calibration parameters / equation
- Holding chamber preheat position established
- Insulation within specification
- Overlap areas within specification
- Mass Flow Meter used for gas calibration (REF 0°C,760 mmHg)
- Schmidt-Boelter HFG's (ordered)

ONGOING RESEARCH - AIRFLOW

Improvements to laminar airflow through environmental chamber using:

- Flat Plate
- Aluminum Core Honeycomb
- Flat Plate / Aluminum Core Honeycomb (Combined)
- Foam
- Flat Plate / Foam (Combined)

Airflow Measurement - Vane Type Anemometer / Hot wire anemometer

Inconsistent readings were improved by using a “Funnel” type adapter covering approximately 10 holes

Results

- Using Flat Plate located 2” from 8-hole plate - higher heat flux reading with no change in power setting
- Using Flat Plate / Aluminum Core Honeycomb (Combined) - even higher reading
- Airflow at sample face was dramatically worse with the lower and upper pilot flamelets dancing wildly and upper pilot occasionally extinguishing
- Foam – Somewhat same results
- Dramatic change to burn characteristics of a know panel configuration



ONGOING RESEARCH - AIRFLOW

Airflow measurements using Omega HH-30 anemometer - 20 hole combined flow (ft/min)

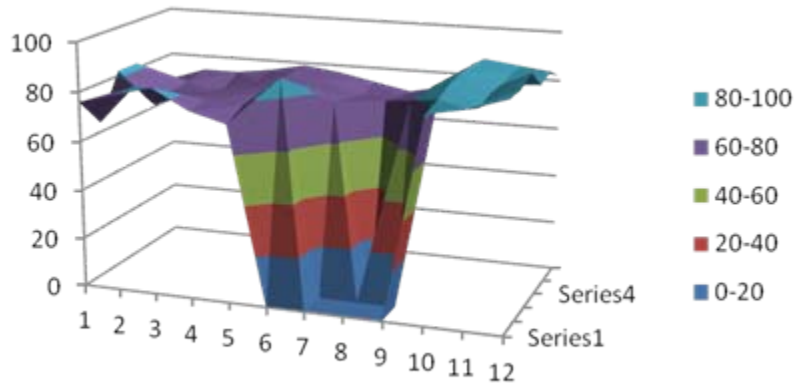
		No Diffuser					
Globars		76	64	82	82	60	69
		80	80	69	71	72	74
		84	77	74	72	69	74
		76	77	76	74	74	76
		72	76	77	77	79	79
			88	82	76	77	77
				76	74	72	74
					74	72	71
				79	79	77	74
		82	84	87	88	88	87
		85	82	84	84	85	85
		90	90	93	85	87	82

Radiation Doors

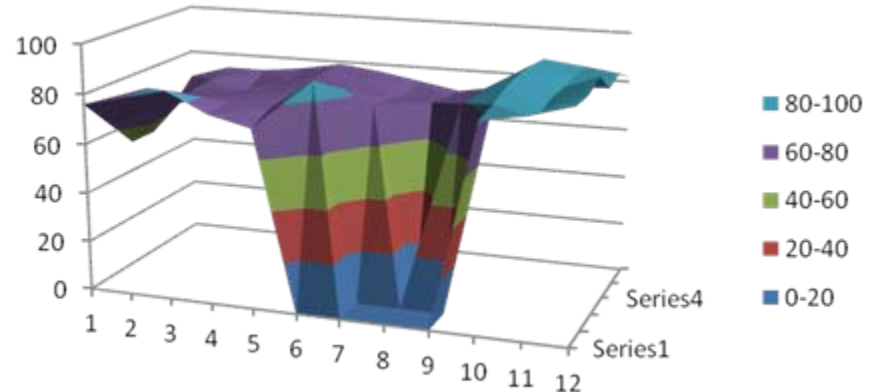
		2" Baffle w/ 2" Foam Block Diffuser					
Globars		76	64	52	52	60	69
		80	80	69	71	72	74
		84	77	74	72	69	74
		76	77	76	74	74	76
		72	76	77	77	79	79
			88	82	76	77	77
				76	74	72	74
					74	72	71
				79	79	77	74
		82	84	87	88	88	87
		85	82	84	84	85	85
		90	90	93	85	87	82

Window

Standard Deviation: 6.059311



Standard Deviation: 7.875905



ONGOING RESEARCH - Plate



2012 Heat Release Round Robin

- Sponsored by FAA Tech Center
- Labs Will Be Contacted For Participation
- Materials To Be Shipped Out Shortly
- Data Presented At June Materials Meeting



NEXT

- Begin Testing using prototype HRR² machine incorporating all changes
- Complete design change of Intermediate mixing plate / foam
- Complete Revision to Chapter 5 of the FAA Fire Test Handbook.
- Complete Maintenance Schedule Guidance Material

