

THE INTERNATIONAL AIRCRAFT FIRE AND CABIN SAFETY RESEARCH CONFERENCE

SAE A-22 AND AS6826 STATUS

April 2024

A-22 Powerplant Fire Protection and Flammability Testing Committee

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Secretary: Brian Stewart (Spirit AeroSystems)

Abstract

This presentation will brief the aerospace fire safety community on the activities of SAE A-22 Fire Protection and Flammability Testing Committee.

The A-22 Committee was chartered in 2018 to address the FAA's Tasking Request to develop industry standards to be used as the basis for an updated FAA Advisory Circular AC20-135. Regulatory and Industry representatives had expressed a need to update the content of the AC, and wide variations in fire test approaches and pass/fail criteria had developed over time across the industry.

The AS6826 Powerplant Fire Test Standard currently nearing initial publication provides fire test methodologies and pass/fail criteria that have been found to be acceptable by the Regulatory Authorities to meet the applicable propulsion system component and powerplant installation fire protection requirements.

The A-22 Committee is also developing additional standards, recommended practices, and informational documents to address fire safety for engine combustor burn-through, engine mounts, and electrical wiring interconnection systems. There are currently six (6) As, ARP, and AIR documents in work at this time.

SAE A-22: Background and Purpose

The SAE A-22 Fire Protection and Flammability Testing Committee was initially formed in March 2018 to support the update of FAA AC20-135.

The committee is comprised of individuals from across the industry including aviation certification authorities.

The committee is responsible for creating and maintaining technical standards pertaining to acceptable means of testing aircraft and propulsion system components and their installations (CFR/CS 23, 25, 27, 29, and 33).

The committee works with regulatory authorities to ensure that the standards developed support certification requirements across the globe.

While the initial task was to improve upon the existing AC20-135 powerplant installation fire test standard, the scope has grown to include harmonizing test methodologies, developing recommended practices, and maintaining other test standards.

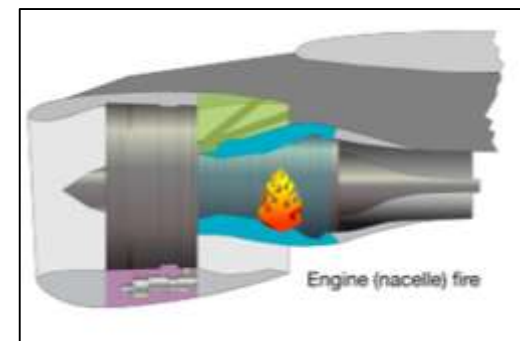
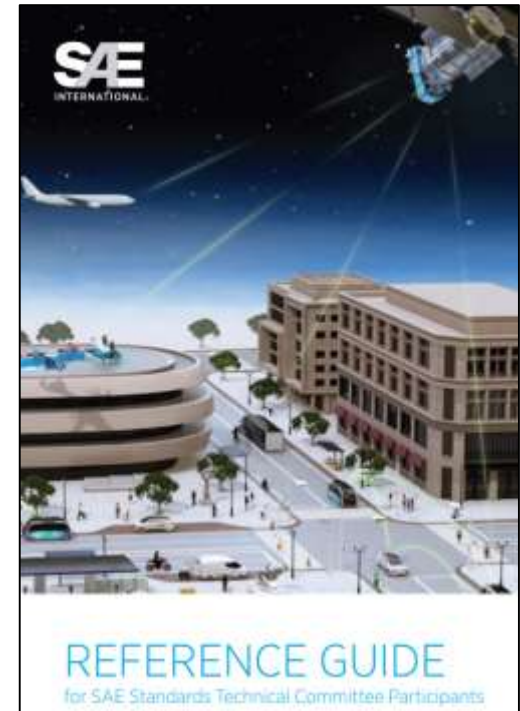


Image Courtesy of Airbus

SAE A-22 Committee Objectives and Initial Program of Work

The objectives of the committee are to:

- Develop and publish SAE Technical Reports for testing of fire protection systems, components, and structure
- Define fire test requirements for aircraft and propulsion systems
- Develop performance standards for fire certification testing of aircraft and propulsion systems
- Define the sensitivities and accuracy of equipment used to conduct fire and flammability testing
- Harmonize global testing methodologies

INITIAL PROGRAM OF WORK

Develop SAE standards or recommended practices to address the FAA Tasking Request to develop industry standards to update **AC 20-135**, *Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards and Criteria*. The proposed standards will be used to demonstrate compliance with powerplant fire protection requirements. In addition, methods used to calibrate and set-up a new **sonic burner** as an optional replacement for existing fire test burners will be developed.

Original Top 10 Industry Needs

1	Post-Test Burning & Backside Ignition
2	Burner & Flame Temperature
3	Flame Calibration
4	Definitions: Fireproof, Fire-Resistant, Heat Flux
5	Test Pass/Fail Criteria including TSO hoses
6	Thermocouples (Size, Type, Number)
7	Environment and Operating Conditions
8	Panel Size
9	Materials
10	Harmonize with Other Specifications and References

SAE A-22 Committee Participants

- Current SAE Roster Includes **220+ Individual Participants from Across the Industry** and Regulatory Authorities
- Consistent and Meaningful Support from FAA, EASA, TCCA, ANAC , JCAB, CAA, CAAI, and CAAC

Airplane Mfg.

Airbus
Boeing
Bombardier
Boom Supersonic
COMAC
Daher
Embraer
Gulfstream
Heart Aerospace
Honda
Northrup Grumman
Odys Aviation
Plasecki
Textron/Cessna
Turkish Aerospace

Engine Mfg.

GE
Honeywell
Pratt & Whitney
Rolls-Royce
SAFRAN



Government Institutions

FAA Tech Center
Naval Air Systems Command (NAVAIR)
National Research Council (Canada)
ONERA (France)

Standards

NACE
SAE

Helicopter Mfg.

Airbus
Bell/Textron
Sikorsky/Lockheed

Testing Facilities

ACES
Accufleet
Aeroblaze
CTA
DGA
Element
Govmark
Lefae-Emitech
NIAR
NTS
Resonate

Commodity Manufacturers

AIM Altitude
GKN
Safran Nacelles
Spirit AeroSystems
RTC/PW/UTC/Collins
ST Engineering
Zodiac Aerospace

Academia/Research

Concordia Univ. Montreal
Rescoll (Bordeaux Univ.)
Stanford University
University of Cincinnati
Wichita State University



Certification Authorities

Brazil (ANAC)
Canada (TCCA)
China (CAAC)
Europe (EASA)
Israel (CAAI)
Japan (JCAB)
United Kingdom (CAA)
United States (FAA)

Component Mfg.

Air Liquide Tech
Akro Fire
Eaton
JPR Hutchinson
Meggitt
Luxfer MEL Tech.
Parker
Shanghai Aircraft
TA Aerospace
Titeflex
Trelleborg
Triumph
Unison Industries

MRO

Ametek
MHIRJ

Industry Consultants

Danker Associates
GE Aviation
Marlin Engineering
Nacelle Group
Waldron Aerosystems
Gordon & Gordon Engineering

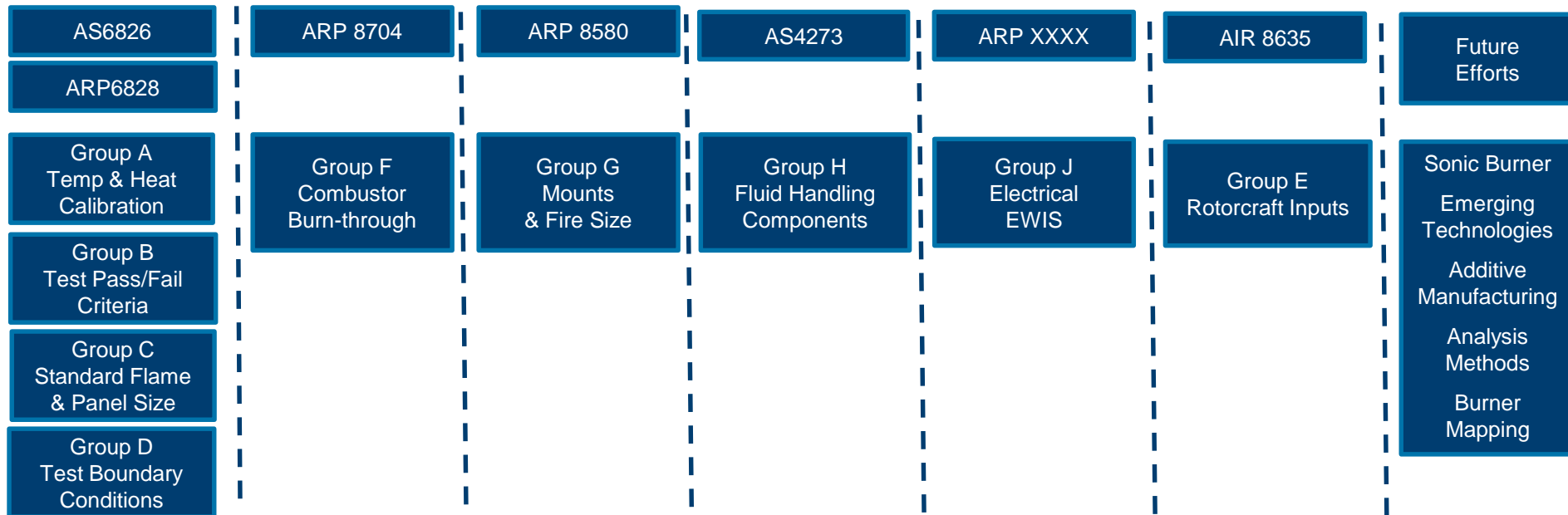


Transport
Canada

SAE A-22 Committee Groups and Documents

Committee is Currently Organized into Groups to develop multiple Standards

- AS 6826 – Powerplant Fire Test Standard
- ARP 6828 – Powerplant Installation Level Fire Safety Assessment
- AS 4273 – Fire Testing of Fluid Handling Components for Aircraft Engines and Installations
- ARP 8704 - Combustor Burn-through Guidance
- ARP 8580 - Protection of Engine Mounts, Flight Controls, and Other Structure
- ARP xxxx - Powerplant EWIS Compliance for Fire Protection
- AIR 8635 – Rotorcraft Fire Test Loading Conditions



AS6826 Powerplant Fire Test Standard: 2024 Significant Accomplishments

1st ballot - Aug 28 to Sep 24, 2023

- 23 / 26 Voted
- 1 Approve, 20 Disapprove, 2 Waive

240 technical comments addressed by the committee

2nd ballot – March 20 to April 16, 2024

This month's meeting marks our 50th all-committee meeting



AS6826 Powerplant Fire Test Standard: Significant Changes

- Calibration for heat transfer rate only uses copper tube water apparatus
 - Apparatus design included in the Standard
 - No change to 4500 BTU/Hr minimum requirement
- Added post-test heat transfer rate validation (no temperature calibration required)
 - 4500 BTU/Hr minimum if copper tube can be cleaned
 - 4100 BTU/Hr minimum if copper tube cannot be cleaned
- Pre-test calibration for flame temperature will use rake of 7 thermocouples (TC), 1/16 inch (1.6 mm) nominal dia.
 - $2000 \pm 150^{\circ}\text{F}$ ($1093 \pm 83^{\circ}\text{C}$) for each TC (no change)
- 2000°F (1093°C) minimum for average of 5 center thermocouples
(calculation excludes the 2 edge thermocouples)



Photo Courtesy of ACES



Photos Courtesy of Aeroblaze Labs

AS6826 Powerplant Fire Test Standard: Significant Changes

- Existing legacy burners allowed, consistent with AC20-135 Change 1
 - ISO2685 gas burner not allowed
- Sonic burner allowed if calibrated same as legacy burners
- Added instructions for defining boundary conditions
 - Loads, vibration, pressure, flow, etc.
 - Ground and flight conditions
- Pass/Fail criteria defined
 - Prescriptive: can be assessed at the laboratory
 - Perform/maintain the fire-intended function
 - No burn-through, backside ignition, flame penetration
 - Residual flames on fire side must be recorded and justified for acceptance; size and duration assessed
 - No flammable fluid leakage

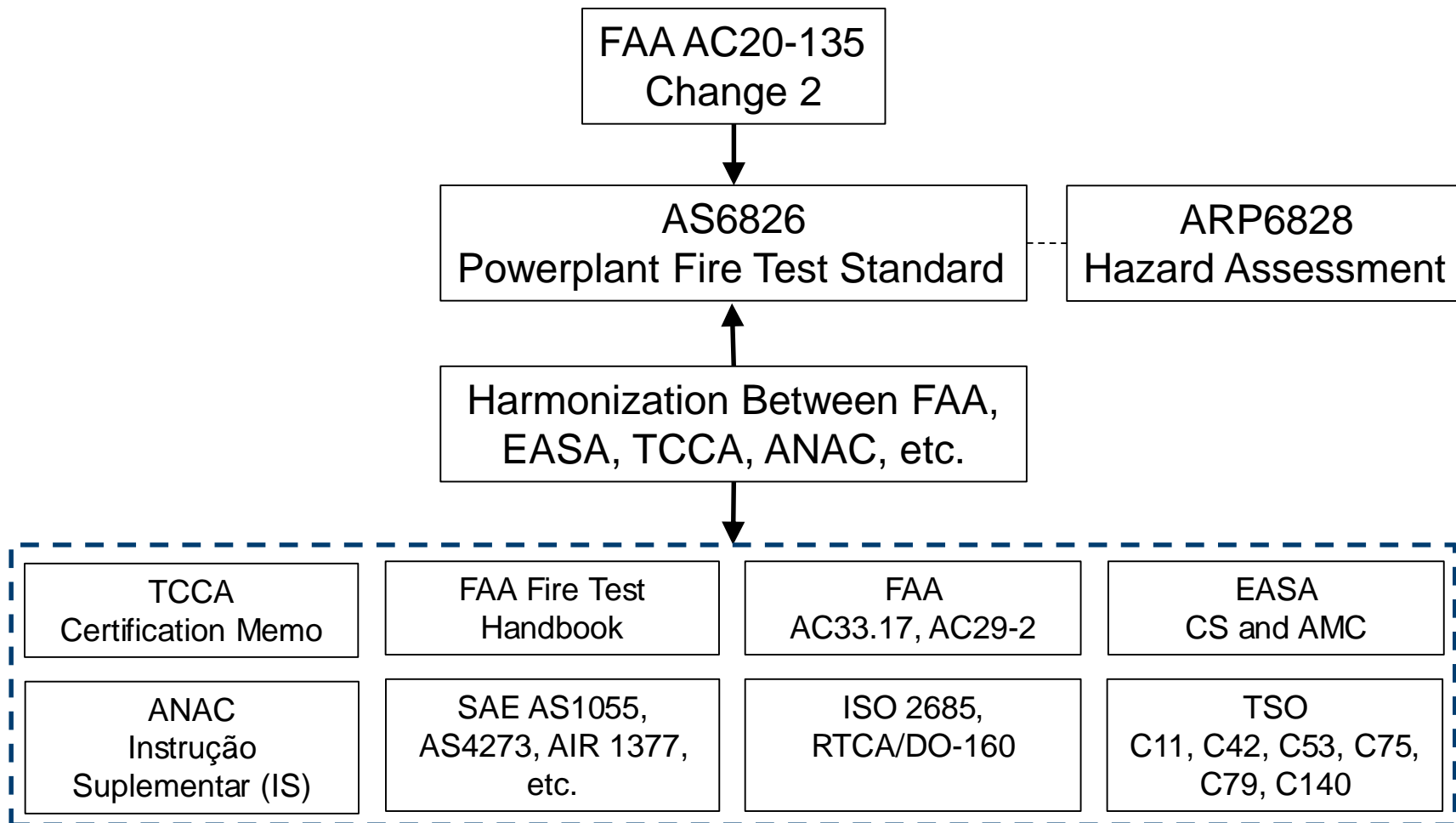


Photo Courtesy of Eaton Aerospace



Photo Courtesy of Resonate

AS6826 Fire Test Standard Implementation: AC20-135 and Other Updates



Note, the new AS6826 fire test standard is intended to provide acceptable means of compliance to be recognized by FAA AC20-135 (for example, similar to AC20-155A for Lightning Protection)

SAE A-22 Documents – Roadmap & General Timelines

Are we there yet? Almost on AS6826...

AS 6826

Powerplant Fire Test Standard

- 2nd balloting: In Progress
- Document publication Q2/Q3 2024
- FAA AC20-135 and other Regulatory Authority document revisions: 2024 – 2025

AS 4273

Fire Testing of Fluid Handling Components

- Q3 2024
- Revise or stabilize document

ARP 6828

Powerplant Installation Level Fire Safety Assessment

- Completion: 2024
- Balloting and publication: 2024/2025

ARP 8580

Fire Protection of Aircraft Engine Mounts, Flight Controls, and Other Flight Structures

- Completion: 2024/2025

ARP 8704

Minimizing the Hazards of Engine Combustor Case Burn Through

- 1st ballot: Completed 4th quarter 2023
- Update Based on Balloting In work

AIR 8635

Rotorcraft Fire Test Loading Conditions

- In development

ARP xxxx

Powerplant EWIS Compliance for Fire Protection

- In development

...Plus future efforts – Sonic burner development, burner mapping ARP, emerging technologies...