U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: Engine Fire Protection § 33.17 **Date:** 05/20/2025 **AC No:** 33.17-1B
Initiated By: AIR-625

1 PURPOSE.

This advisory circular (AC) provides definitions, guidance, and acceptable methods, but not the only methods, to demonstrate compliance with the engine fire protection requirements of title 14 Code of Federal Regulations (14 CFR 33.17).

2 APPLICABILITY.

2.1 The guidance provided in this AC is for engine manufacturers, modifiers, foreign regulatory authorities, Federal Aviation Administration (FAA) engineers, and the Administrator's designees.

2.2 This is a guidance document. Its content is not legally binding in its own right and will not be relied upon by the Department as a separate basis for affirmative enforcement action or other administrative penalty. Conformity with the guidance document is voluntary only and nonconformity will not affect rights and obligations under existing statutes and regulations.

2.3 The FAA will consider other methods of demonstrating compliance that an applicant may elect to present. Terms such as "should," "may," and "must" are used only in the sense of ensuring the applicability of this particular method of compliance when the acceptable method of compliance in this document is used. If the FAA becomes aware of circumstances in which following this AC would not result in compliance with the applicable regulations, the FAA may require additional substantiation as the basis for finding compliance.

2.4 This material does not change or create any additional regulatory requirements or authorize changes in or permit deviations from existing regulatory requirements.

3 CANCELLATION.

This AC cancels AC 33.17-1A, *Engine Fire Protection § 33.17*, dated August 3, 2009.

4 RELATED MATERIAL.

4.1 Title 14, Code of Federal Regulations (14 CFR).

The following 14 CFR regulations are related to this AC. You can download the full text of these regulations from the Federal Register website at eCFR.

- Section 33.17, *Fire Protection.*
- Section 33.71, *Lubrication system*.
- Section 33.75, *Safety analysis*.
- Section 23.2440, *Powerplant fire protection*.
- Section 25.1189, *Shutoff means*.
- Section 29.1189, *Shutoff means*.

4.2 FAA Advisory Circular.

AC 20-135, *Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards and Criteria* is related to the guidance in this AC. The latest version of the AC referenced in this document is available on the FAA website at FAA Advisory Circulars and on the Dynamic Regulatory System.

4.3 FAA Reports.

The following reports are related to the guidance in this AC. The latest version of each is available on the FAA Fire Safety website.

- U.S. Department of Transportation. Federal Aviation Administration. Powerplant Engineering Report No. 3A, *Standard Fire Test Apparatus and Procedure*, Revised March 1978.
- U.S. Department of Transportation. Federal Aviation Administration. Report No. SAE AS1055D, *Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components*, dated August 2007.
- U.S. Department of Transportation. Federal Aviation Administration. Report No. SAE AIR 1377, *Fire Test Equipment for Flexible Hose and Tube Assemblies*, dated April 01, 1978.
- U.S. Department of Transportation. Federal Aviation Administration. Report No. FAA-RD-76-213, *Re-evaluation of Burner Characteristics for Fire Resistance Tests*, dated January 1977.
- U.S. Department of Transportation. Federal Aviation Administration. SAE Report No. 690436, *Ignition of Aircraft Fluids on High Temperature Engine Surfaces*, by William T. Westfield, dated February 01, 1969.
- U.S. Department of Transportation. Federal Aviation Administration. Report No. FAA-RD-75-155, *Ignition and Propagation Rates for Flames in a Fuel Mist*, by C.E. Polymeropoulos, dated October 1975.

- U.S. Department of Transportation. Federal Aviation Administration. Report No. FAA-ADS-14, *A Study of the Flammability of Magnesium*, by Paul Boris, Systems Research and Development Service, FAA, dated April 1964.

5 DEFINITION OF KEY TERMS.

For the purposes of this AC, the following definitions apply:

- External Lines, Fittings, and Other Components. Engine parts that convey flammable fluids and are external to the main engine casings, frames, and other major structures. These parts include, but are not limited to, fuel or oil lines, accessory gearboxes, pumps, heat exchangers, valves, and engine fuel control units.
- Fire Hazard. The unintentional release or collection of flammable fluids; vapor or other materials; a failure or malfunction, which results in an unintentional ignition source within a fire zone; the potential for a hazardous condition as the result of exposure to a fire or a sustained or non-self-extinguishing fire.
- Fire Resistant. The capability of a part or component to perform those functions intended to be performed while exposed to the heat and other conditions that are likely to occur at the particular location, and to withstand a 2000°F average flame temperature (± 150°F individual thermocouple tolerance) for a minimum of 5 minutes.
- Fireproof. The capability of a part or component to withstand, as well as or better than steel, a 2000°F average flame temperature (± 150°F individual thermocouple tolerance) for a minimum of 15 minutes, while still performing those functions intended to be performed when exposed to a fire.
- Hazardous Condition. Any hazardous engine effect listed in § 33.75(g)(2), or any other result of exposure to fire that would prevent the continued safe operation or shutdown of the engine.
- Hazardous Quantity. An amount of flammable fluid, vapor, or other material that could be ignited and create a fire that increases the overall fire hazard or results in a hazardous condition.

6 GENERAL.

6.1 Intent and Objectives.

The overall requirement of § 33.17 is to ensure that the design, materials, and construction methods used minimize the likelihood of the occurrence and spread of a fire. The primary objectives are to:

- Contain, isolate, and withstand a fire,
- Prevent any source of flammable material from feeding an existing fire,
- Ensure that engine functions intended to be performed in the event of a fire are maintained, and
- Avoid hazardous conditions.

6.2 Coordination with the Certification Branch.

The applicant should coordinate with the appropriate Certification Branch (formerly Aircraft Certification Office) early in the program to identify parts and components that must comply with § 33.17(b)–(e).

6.3 Fire Protection Capability - Determination of Fireproof vs. Fire Resistant.

- Section 33.17(b) requires each external line, fitting, and other component that contains or conveys flammable fluid during normal engine operation—excluding certain tanks and associated shutoff means and supports—to be fire-resistant or fireproof, as applicable.
- Section 33.17(c) generally requires, with one exception, that flammable fluid tanks and associated shutoff means and supports be fireproof. Therefore, the Administrator determines the required level of fire protection capability for each component or part subject to fire protection evaluation.
- Section 33.17(e) requires engine control system components located in a designated fire zone to be either fire-resistant or fireproof.

6.3.1 Fire Resistant Criteria for Components Conveying Flammable Fluids.

In general, components conveying flammable fluids can be evaluated to a fire-resistant standard, provided the normal supply of flammable fluid can be stopped by a shutoff feature (see § 33.71(c)(8)). For example, the fire-resistant criterion is typically applied to engine fuel system components, as the five-minute exposure to the test flame, as described in AC 20-135, *Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards and Criteria* (see paragraph 4.2 of this AC), represents a reasonable time for the flightcrew to recognize a fire condition, close the appropriate fuel shutoff valves, and shut down the appropriate engine, thereby cutting off the fuel source.

6.3.2 Fireproof Criteria for Oil System Components.

6.3.2.1 Turbine engine oil system components may continue to flow oil after the engine has been shut down due to continued rotation (windmilling). This may include the rotation of gearbox-mounted oil pumps and subsequent oil flow through the lubrication system. The supply of oil to the fire might persist as long as rotation effects are present or until the oil supply is depleted.

6.3.2.2 Section 33.17(b) requires certain components which include, but are not limited to, oil system components, to be fire resistant or fireproof. Therefore, oil system components should be evaluated from a fire hazard perspective (e.g., quantity, pressure, flow rate) to determine whether the fire-resistant or fireproof standard applies.

- If oil flow can be shut off or the oil supply will be depleted in less than five minutes, oil system components should be fire resistant, as defined in paragraph 5 of this AC.

- If oil remains in the system for more than five minutes, oil system components should be fireproof, as defined in paragraph 5 of this AC.

6.3.2.3 Historically, most oil system components have been evaluated to a fireproof standard.

6.3.3 Evaluation of Other Flammable Fluid Components.

Other flammable fluid components and parts, such as those in hydraulic and thrust augmentation systems, should also be evaluated per paragraphs 6.3, 6.3.1, and 6.3.2 of this AC. However, flammable fluid tanks must generally be fireproof per § 33.17(c) and are discussed in paragraph 9.1 of this AC.

6.3.4 Fire Protection for Engine Control System Components.

6.3.4.1 Section 33.17(e) requires all engine control system components located in a designated fire zone to be either fire-resistant or fireproof, as determined by the Administrator. Similar to § 33.17(b), the Administrator determines the level of fire protection required. The requirement does not differentiate between control technologies (e.g., electronic, mechanical, fiber-optic). However, if a component contains or conveys flammable fluid, § 33.17(b) applies. For non-flammable fluid control components, the fire-resistant or fireproof standard is determined as described in paragraph 6.3 of this AC.

6.3.4.2 Control components include, but are not limited to:

- Electronic controllers,
- Electro-mechanical metering devices,
- Electrical harnesses,
- Valves, and
- Fiber optic devices.

6.3.5 Shutoff Means for Flammable Fluids.

Sections 23.2440(d), 25.1189(a), 27.1189(a), and 29.1189(a) require a means to shut off or otherwise prevent flammable fluids (for part 27 aircraft) or hazardous quantities of flammable fluids (for part 23, 25, and 29 aircraft) from flowing into, within, or through designated fire zones. However, in part 25 and part 29 aircraft, shutoff means are not required for turbine engine oil systems when all system components in a designated fire zone, including oil tanks, are fireproof or located in areas not subject to engine fire conditions.

6.4 Fire Test Pass/Fail Criteria.

In general, the following fire test pass/fail criteria, which determine whether a part or component is fireproof or fire-resistant, have been applied and found to be acceptable:

6.4.1 Representative Pass/Fail Criteria.

The following examples, which are not exhaustive, illustrate two situations and acceptable outcomes after a fire.

6.4.1.1 A safe engine shutdown that does not result in any hazardous engine effects as defined in § 33.75(g)(2), at any time during the fire test period.

6.4.1.2 A shutoff valve, if required to be fireproof by § 33.17(b) or 33.17(c), should be operable to the closed position after five minutes of fire exposure or should be default closed. It should maintain this closed position without leaking hazardous quantities for the full 15-minute fireproof test.

6.4.2 No Hazardous Leakage.

The test article should not leak hazardous quantities of flammable fluids, vapors, or other materials during or after the test.

- Pressurized lines should remain pressurized throughout the test.
- Post-test observation of the test article for a period after the test flame is removed, and with the test article still pressurized, is generally needed to determine if leakage has occurred and its extent.
- Hazardous quantity is defined in paragraph 5 of this AC.

6.4.3 No Support of an Existing Fire.

The constituent material of the test article or flammable fluid leaking from it must not support an existing fire event.

6.4.4 No Residual Fire.

6.4.4.1 A rapid self-extinguishing flame and no re-ignition after test flame removal, at the conclusion of a fire test that is used to determine if a part or component is fireproof or fire resistant, indicates an acceptable outcome. Fires that persist after flame removal may be:

- Combustion of the test article's constituent material.
- Combustion of flammable fluid leaking from the component (excluding firewalls).

6.4.4.2 In general, these residual burning events typically result in test failures unless it can be shown that the residual fire does not significantly increase the overall fire hazard. The acceptability of such a test result will be determined on a case-by-case basis and will consider the type and function of the component under test.

6.4.5 No Firewall Failure.

See paragraph 9.5 of this AC for a discussion of firewalls.

6.4.6 No Other Hazardous Condition.

At no time during or after the test should a hazardous condition result. A hazardous condition is defined in paragraph 5 of this AC.

7 MATERIALS DESIGN ASSESSMENT.

7.1 General Considerations.

7.1.1 When demonstrating compliance with § 33.17(a), the applicant should conduct a design assessment of materials. Experience has shown that certain materials (e.g., magnesium and titanium alloys), may require specific design precautions to prevent an unacceptable fire hazard. Consideration should be given to:

- The potential for fire when certain materials rub together or contact hot gases.
- The fire or explosion hazards associated with abradable linings.

7.1.2 Any materials used for abradable linings need to be assessed to ensure they do not introduce fire or explosion hazards.

7.2 Use of Titanium.

7.2.1 Many titanium alloys used in the manufacture of engine components can ignite and sustain combustion under certain conditions. In general, titanium fires:

- Burn very rapidly and intensely.
- Generate highly erosive molten particle spray.
- Have been known to burn through compressor casings, leading to radial expulsion of molten or incandescent metal.

7.2.2 When showing compliance with § 33.17(a), the applicant should assess the overall design for vulnerability to titanium fires. If this assessment cannot rule out the possibility of a sustained fire, the applicant should show that a titanium fire will not result in a hazardous condition.

7.3 Use of Magnesium.

7.3.1 Many magnesium alloys used in the manufacture of engine components are highly combustible when in finely divided form, such as chips or powder. Therefore, magnesium use should be carefully evaluated particularly when:

- Used in thin sections.
- Subject to rubbing or high scrubbing speeds.

7.3.2 Additional information on the use of magnesium parts in aircraft engines can be found in FAA Report No. FAA-ADS-14, *A Study of the Flammability of Magnesium* (see paragraph 4.3 of this AC).

7.3.3 When showing compliance with § 33.17(a), the applicant should assess the overall design for vulnerability to magnesium fires. If this assessment cannot rule out the possibility of a sustained fire, the applicant should show that a magnesium fire will not result in a hazardous condition.

7.4 **Abradable Linings.**

7.4.1 Many fan, compressor, and turbine modules have abradable linings between rotating blade tips and stator casings, and in certain seal applications. Depending upon the material used in the abradable lining, experience has shown that:

- Fire or explosion can occur in the presence of an ignition source if a significant amount of lining is removed during rubs between the rotor and stator, or in labyrinth seals.
- Under certain conditions, a mixture of small abradable particles and hot flowpath gases or hot bearing compartment air can auto-ignite.

7.4.2 The applicant should evaluate these situations for each fan, compressor, turbine stage with abradable linings, and other rotating seal applications.

7.5 **Absorbent Materials.**

If absorbent materials are used in close proximity to flammable fluid system components, they must be treated or covered to prevent the absorption of a hazardous quantity of flammable fluid.

7.6 **Fiber and Resin Materials.**

7.6.1 Certain fiber and resin materials, such as aramid fiber (e.g., Kevlar fabric) or carbon/graphite composites, may be combustible under certain conditions.

- In engines, aramid fabric is typically used as part of fan rotor containment systems.
- Carbon/graphite composites have also been used for fan blades, thrust reverser components, and other parts.

7.6.2 When showing compliance with § 33.17(a), the applicant should assess the overall design for vulnerability to fires supported by these materials. If this assessment cannot rule out the possibility that these materials could ignite, the applicant should show that a fire which burns these materials will not result in a hazardous condition.

8 **CONDUCT OF FIRE TESTS.**

8.1 **Test Equipment.**

8.1.1 Guidance on acceptable burner types, burner configurations, and other test hardware can be found in:

- AC 20-135 (see paragraph 4.2), and
- FAA Report No. 3A, *Standard Fire Test Apparatus and Procedure* (see paragraph 4.3).

8.1.2 Pre and post-test calibrations of burner equipment are generally required. The applicant should ensure:

- Measured burner flame temperature fluctuations during the test are within the prescribed limits described in AC 20-135, and
- Test burner controlling parameters remain constant during the test.

8.1.3 Experience has shown that the measured temperature of the flame could be affected by the presence of the component under test.

8.2 Flame Impingement Location.

The FAA has accepted the following methods for determining fire test flame impingement locations:

8.2.1 General Method.

The test flame should be applied to the test article feature(s), which are determined by analysis or test, to be critical for surviving the effects of the fire. For this approach, the determination of the flame impingement location(s) should consider, at a minimum, the following potential factors:

- Materials,
- Geometry,
- Part critical features,
- Local torching effects,
- Vibration,
- Internal fluid level, pressure, and flow rate,
- Surface coatings,
- Fire protection features,
- Wetting, and
- Other factors not listed may also apply.

8.2.2 Installation Analysis Method.

8.2.2.1 This method considers all potential sources of fire in the intended installation when determining the test flame impingement location requirements. The intent is to:

- Identify locations or features that cannot be directly impinged by fire.
- Evaluate critical features at locations that can be directly impinged.

8.2.2.2 If the applicant chooses this installation analysis method, it should be based on the actual intended installation and should consider, at a minimum, the potential factors noted in paragraph 8.2.1, and the following potential installation factors:

- Cowling and nacelle structure,
- Adjacent structure shielding,
- Undercowl airflow,
- Aircraft engine build-up hardware,
- Fuel sources,
- Air sources, and
- Other factors not listed may also apply.

8.2.2.3 Such installation analyses should avoid simple generalities, such as “the most likely flame direction is vertical assuming fuel collects at the bottom of the cowl.” The analysis should generally be coordinated with the installer before submitting the test plan.

8.2.2.4 Each new installation must be re-evaluated against the original fire protection substantiation to confirm its applicability to the new installation. If necessary, a notation in the installation instructions should explain any limitations.

8.2.2.5 Lastly, fire protection features such as fire shields, fire protective coatings, or other fire prevention methods should be given due consideration, ensuring their use is not discouraged or invalidated for fire prevention purposes.

8.3 **Operating Parameters for Test Articles.**

8.3.1 The test article’s operating characteristics and parameters should be consistent with, but conservative relative to, conditions that may occur during an actual fire situation in the type design product. For example, if high internal fluid flow increases the heat sink effect and reduces fire susceptibility, a minimum flow condition should be specified for the test. The same principle applies to internal fluid temperatures, fluid quantity, or other parameters.

8.3.2 This evaluation primarily concerns critical in-flight operating conditions, including continued rotation (windmilling and propeller feathering) after shutdown.

8.3.3 When evaluating test conditions, consideration of engine basic failure states (e.g., mechanically damaged components, or locked main rotors) is generally not required.

8.3.4 Additionally, any facility slave hardware used to establish boundary conditions for the test (e.g., simulated engine heat exchanger) should replicate type design operation.

9 OTHER CONSIDERATIONS.

9.1 Flammable Fluid Tanks.

9.1.1 Flame Impingement Location.

9.1.1.1 In the absence of an acceptable installation assessment, the fire test flame should be applied to the tank locations or features identified, by analysis or test, as the most critical for surviving the effects of the fire. These locations or features are least likely to survive the test conditions or meet the test pass/fail criteria.

9.1.1.2 When selecting the flame application locations, all features of the tank assembly should be considered. Typical tank installation features include, but are not limited to:

- Tank body,
- Inlet and outlet assemblies,
- Sight-gauge,
- Drain plug,
- Magnetic chip detector,
- Quantity sender assembly,
- Vent line assembly,
- Fill cap and scupper,
- Mounts,
- Shutoff valve,
- Temperature sensor, and
- Air/fluid separator assembly.

9.1.1.3 Tanks may be designed and manufactured with any combination of the features listed in paragraph 9.1.1.2 of this AC or other features not listed and of varying materials. Therefore, in some instances, compliance with § 33.17 may require additional data from:

- Other fire tests,
- Multiple location testing,
- Subcomponent level tests, or
- Service experience covering all tank assembly features.

9.1.1.4 Additional factors in determining flame impingement location should be considered, including:

- Vent system performance (e.g., oil tank fire tests have failed due to high internal pressure and inadequate venting).
- The absence of a heat sink effect for tank features at or above the operating level (that is, the water line) of the tank's fluid contents.
- The effect of any special protective features (e.g., shields, coatings, feature placement, etc.) incorporated into the design when developing the fire test plan.

9.1.2 Other Test Parameters.

9.1.2.1 For fluid quantity, the tank quantity at the start of the test should not exceed the minimum dispatchable quantity minus the normal gulping volume unless a greater quantity is more severe.

9.1.2.2 For flow rate, the first five minutes of the test should be conducted at the most critical operating condition (typically a minimum flight idle flow rate). The subsequent ten minutes should be conducted at an engine shutdown flow rate, considering continued rotation. Alternatively, the applicant may opt to run the entire 15-minute test under the most critical condition—the worst case of engine operating—or in-flight shutdown conditions.

9.1.3 Fluid Temperature and Internal Pressure.

- Fluid temperature should be at its maximum value (whichever is greater: steady-state or transient limit established under § 33.7) at the start of the test unless a lower temperature is more severe.
- Tank internal pressure should be set to normal working pressure for the operating conditions at the start of the test. These values may fluctuate due to the test conditions.

9.1.4 Test Setup Considerations.

The tank design and its intended application should be reviewed to ensure the test setup accurately reflects the most critical flame impingement orientation and operating conditions for the intended application. The aircraft certification requirements in parts 23, 25, 27, and 29 rely heavily on the fire prevention findings established in part 33. Failure to adequately test may result in aircraft installation issues.

9.2 **Air Sources.**

The applicant should evaluate the effect of fire on components that convey bleed air and evaluate whether their failure could increase the severity or duration of a fire within a fire zone.

9.3 **Engine Mounts.**

The aircraft regulations govern the fire protection requirements for engine mount systems, including those within the engine type design. Compliance is demonstrated as part of the aircraft certification process. The engine manufacturer should coordinate with the installer to minimize the risk of installation-related certification issues.

9.4 **Hot Surface Ignition.**

Information about hot surface ignition is available in the following reports:

- SAE Report No. 690436, *Ignition of Aircraft Fluids on High Temperature Engine Surfaces*, and
- FAA Report No. FAA-RD-75-155, *Ignition and Propagation Rates for Flames in a Fuel Mist*.

9.5 **Firewalls (§ 33.17(d)).**

9.5.1 If a component's primary function is that of a firewall and it is part of the engine type design, the firewall must comply with § 33.17(d).

9.5.2 For test demonstrations:

- At no time during or after the fire test should the firewall component fail to contain the fire within the intended zone or area.
- Acceptable evidence of fire containment includes:
    - No burn-through holes
    - No failures at any attachment or fire seal points around its periphery
    - No backside ignition
    - No continued burning after the test flame is removed
    - No hazardous quantity of fuel or fuel/air mixture leaking around or passing through the firewall

9.5.3 The firewall should contain the fire without creating a hazardous condition.

9.5.4 Pressure and mechanical loading effects on the firewall structure and associated fire seals must be considered when evaluating overall firewall capability and testing under § 33.17. AC 20-135 provides additional guidance for testing and evaluating firewalls and fire seals.

9.5.5 Firewall components will also be evaluated under aircraft requirements when installed on the aircraft (e.g., §§ 23. 2440, 25.1191, 25.1193, 27.1191, 27.1193, 29.1191, and 29.1193).

9.5.6 Firewalls must be protected against corrosion per § 33.17(d)(3).

9.6 **Shielding (§ 33.17(b)).**

9.6.1 Section 33.17(b) requires that each component containing or conveying flammable fluid during normal engine operation be shielded or located to prevent ignition of leaking flammable fluid.

9.6.2 Ignition sources include:

- Hot surfaces with temperatures at or above the typical auto-ignition temperature for aviation fuels, oils, and hydraulic fluids or
- Components producing an electrical discharge.

9.6.3 Compliance has been demonstrated through:

- Installation of drainage shrouds around flammable fluid lines or fittings,
- Installation of spray shields to deflect leaking fuel away from ignition sources, and
- Component placement on the engine that minimizes the likelihood of starting and supporting a fire.

9.6.4 The overall substantiation should show that leaked flammable fluid is unlikely to impinge on an ignition source to the extent that it starts and supports a fire.

9.6.5 For kerosene-type fuels, an auto-ignition temperature of 450°F has been accepted. However, fuel/air ratio, nacelle venting, and other factors may influence hot surface ignition risks for a given design. SAE Report No. 690436 and FAA Report No. FAA-RD-75-155 provide additional information related to hot surface ignition.

9.7 **Drains and Vent Systems (§§ 33.17(b) and 33.17(f)).**

9.7.1 Certain drain and vent systems may be exempt from § 33.17(b) requirements if they can be shown they do not typically contain or convey flammable fluids during normal engine operation.

9.7.2 Examples of drain and vent systems that may or may not require compliance:

- Requires compliance. A shrouded fuel manifold, considered a single assembly, cannot be separated into its main fuel line and outer drain line, which would flow if the main manifold failed.
- May not require compliance: A combustor drain line that typically drains residual fuel after an aborted engine start.

9.7.3 A drain or vent system that would convey a hazardous quantity of flammable fluid during continued rotation may need to meet a fireproof standard. Similarly, a drain collection reservoir that stores a hazardous quantity of flammable fluid would likely require fireproof evaluation.

9.7.4 Each drain or vent system component’s function should be carefully reviewed to determine compliance. Additionally, drain and vent system flow capacity should be at least equal to the maximum flow rate the system may need to convey.

9.8 Electrical Bonding (§ 33.17(g)).

9.8.1 Electrical bonding is a means to protect against the effects of unintentional electrical discharges or fault currents. Specifically, bonding can help minimize the risk of the ignition of flammable materials from static electrical discharges.

9.8.2 Section 33.17(g) requires that components, modules, or equipment that may cause or are susceptible to such effects must be electrically bonded (grounded) to the main engine reference. Conductive parts are considered bonded when they are mechanically interconnected to maintain a common electrical potential.

9.8.3 This may be shown through:

- Examination of the type design drawings,
- Electrical continuity checks, and
- Physical inspection of a representative engine.

9.8.4 An additional benefit of good electrical bonding of engine components is minimizing electromagnetic interference of electrical equipment, especially controls.

9.9 Powerplant Designated Fire Zones.

Powerplant-designated fire zones are regions of a powerplant installation as identified in §§ 23.2440, 25.1181, and 29.1181.

10 CERTIFICATION TEST PLANS.

10.1 Required Information.

Certification test plans should include, but are not limited to, the following information:

- Component name(s),
- Part number(s),
- Part detail drawing(s) or sketches (e.g., denote critical features),
- Installation drawing(s) or sketches (e.g., describe installation in an engine),
- Description of component operation,
- Hardware reconciliation to type design (test article and installation connections),
- Definition and range of component operating parameters,
- Flame direction/impingement analysis,
- Fireproof/fire-resistant analysis,
- Test equipment, test set-up, calibrations, and test fluids,
- Test methods and procedures,
- Test pass/fail criteria,
- Data recording methods,

- Applicable regulations, and
- Time and place of test.

10.2 Submission and Approval.

The proposed certification test plan should include, at minimum, the information described in paragraph 10.1 of this AC. Before conducting the fire testing, the plan should be submitted to the applicable Certification Branch for coordination and approval.

11 COORDINATION WITH THE INSTALLER.

11.1 Coordination.

11.1.1 The Certification Branch and engine manufacturer should review the part 33 compliance plan to ensure the fire prevention intent and objective of each applicable section of part 33 are met.

11.1.2 Regarding the aircraft requirements of parts 23, 25, 27, and 29 listed in AC 20-135, the applicant should be encouraged to review these sections with the installer early in the program. Early coordination helps minimize potential installation problems after engine certification.

11.2 Additional Ground Capability.

11.2.1 The capability of some engine firewalls is affected by backside airflow driven by engine operation or aircraft in-flight speed. These conditions differ when the engine is shut down and not windmilling on the ground.

11.2.2 Ground conditions to consider include:

- Engine operation for five minutes, followed by
- Engine shut down for 10 minutes (i.e., no scrubbing airflow).

11.2.3 Any additional tests necessary for a particular engine firewall to comply with the aircraft requirements discussed in paragraph 9.5 of this AC may be conducted in conjunction with § 33.17(d) engine certification tests. This is permissible if it can be shown that these tests are at least as severe as § 33.17(d) certification tests.

11.2.4 The following should be documented in the installation instructions required by § 33.5:

- The engine firewall,
- Other engine components installed in a fire zone that require additional ground capability, and
- Assumptions made during certification.

11.2.5 The applicant should provide the aircraft manufacturer with these assumptions made during engine certification for consideration in the installation design process.

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12 AC FEEDBACK FORM.

For your convenience, the AC Feedback Form is the last page of this AC. Note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this AC on the Feedback Form.

DANIEL J. ELGAS

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Director, Policy and Standards Division
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Advisory Circular Feedback Form

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If you find an error in this Advisory Circular, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by emailing this form to 9-AVS-AIR-Directives-Management-Officer@faa.gov or faxing it to the attention of LOB/SO at (202) 267-1813.

Subject:____________________ Date: _______________

Mark all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph __________on page _________.

☐ Recommend paragraph ______ on page be changed as follows:

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

☐ Other comments:

☐ I would like to discuss the above. Please contact me using the information below.

Submitted by:__________________________________ Date: ______________________