AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL

PROPOSTA DE (INSIRA AQUI O TIPO DE ATO)

Submeto à apreciação de Vossa Senhoria Proposta de Instrução Suplementar sobre (ementa), nos termos da minuta anexa.

ANAC AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL	**INSTRUÇÃO SUPLEMENTAR - IS** **IS Nº 20-135** **Revisão A**	
Aprovado por:	Portaria x	
Assunto:	Métodos aceitáveis para a demonstração de cumprimento de requisitos de contenção de fogo em sistemas propulsivos.	**Origem:** SAR
Data de emissão:	x	

1. OBJETIVO

1.1 Esta Instrução Suplementar (IS) oficializa qual é a norma técnica aceita pela Anac para fornecer as orientações, os métodos e os critérios que podem ser seguidos por fabricantes aeronáuticos, para demonstrarem cumprimento com os requisitos aplicáveis de contenção de fogo de materiais instalados em sistemas propulsivos, como por exemplo motores aeronáuticos e unidades auxiliares de potência (APUs), bem como suas respectivas paredes de fogo, naceles e carenagens, por meio de ensaios de fogo em laboratório.

1.2 Os principais objetivos dos materiais de contenção de fogo são: isolar uma chama proveniente de um motor ou APU, impedir que outras fontes de combustível ou ar alimentem o fogo existente, e garantir que os sistemas de controle funcionem de forma eficaz para permitir o corte seguro do motor, ou da APU. Além disso, os materiais devem manter sua capacidade de suportar as cargas operacionais previstas após a ocorrência do fogo, para que haja tempo suficiente para a detecção adequada do fogo, o seu reconhecimento pela tripulação, e as subsequentes ações corretivas. Também não pode haver entrada de gases resultantes de sua queima no sistema de ar-condicionado da aeronave.

1.3 Os ensaios de fogo devem simular um ambiente provável de fogo no motor ou na APU, de modo a comprovar que os materiais e componentes atenderão a contenção necessária para atender aos objetivos acima, quando expostos a um evento de fogo durante operação da aeronave.

2. REVOGAÇÃO

Não aplicável a esta revisão.

3. FUNDAMENTOS

3.1 Regulamentação aplicável

3.1.1 A Anac adota integralmente, na língua inglesa, os regulamentos "*Title 14 Code of Federal Regulations Parts* 23, 25, 27, 29 e 33" originais, da autoridade de aviação civil *Federal Aviation Administration (FAA)*, do *Department of Transportation* dos EUA. Cópias destes regulamentos estão apresentadas no mesmo sítio eletrônico que contém os RBACs.

3.1.2 Conforme determinado pelos acima mencionados requisitos do *Code of Federal Regulations* da FAA, um requerente de certificado de tipo de um motor ou aeronave deve demonstrar que seu produto cumpre com alguns requisitos de contenção de fogo, como os listados abaixo, por exemplo:

a) *23.2330 - Fire protection in designated fire zones and adjacent areas. (a) Flight controls, engine mounts, and other flight structures within or adjacent to designated fire zones must be capable of withstanding the effects of a fire (...). (c) In designated fire zones, terminals, equipment, and electrical cables used during emergency procedures must be fire-resistant.*

b) *23.2440 - Powerplant fire protection. (...) Each component, line, fitting, and control subject to fire conditions must: (...); (2) Be fire-resistant if carrying flammable fluid, gas or air, or is required to operate in the event of a fire; and (3) Be fireproof or enclosed by a fireproof shield if storing concentrated flammable fluids (...).*

c) *25.867 - Fire protection: other components. (a) Surfaces to the rear of the nacelles, within one nacelle diameter of the nacelle centerline, must be at least fire-resistant. (...).*

d) *25.1191 - Firewalls. (...) (b) Each firewall and shroud must be: (1) Fireproof; (2) Constructed so that no hazardous quantity of air, fluid, or flame can pass from the compartment to other parts of the airplane; (...).*

e) *25.1193 - Cowling and nacelle skin. (...) (e) Each airplane must: (1) Be designed and constructed so that no fire originating in any fire zone can enter, either through openings or by burning through external skin, any other zone or region where it would create additional hazards; (...); and (3) Have fireproof skin in areas subject to flame if a fire starts in the engine power or accessory sections.*

f) *27.1183 - Lines, fittings, and components. (a) Except as provided in paragraph (b) of this section, each line, fitting, and other component carrying flammable fluid in any area subject to engine fire conditions must be fire resistant, except that flammable fluid tanks and supports which are part of and attached to the engine must be fireproof or be enclosed by a fireproof shield unless damage by fire to any non-fireproof part will not cause leakage or spillage of flammable fluid. (...).*

g) *27.1194 Other surfaces. All surfaces aft of, and near, powerplant compartments, other than tail surfaces not subject to heat, flames, or sparks emanating from a powerplant compartment, must be at least fire resistant.*

h) *29.903 Engines. (...). (c) Category A; control of engine rotation. For each Category A rotorcraft, there must be a means for stopping the rotation of any engine individually in flight, except that, for turbine engine installations, the means for stopping the engine need be provided only where necessary for safety. In addition - (1) Each component of the engine stopping system that is located on the engine side of the firewall, and that might be exposed to fire, must be at least fire resistant; or*

i) *29.1201 - Fire extinguishing system materials. (...) (b) Each system component in an engine compartment must be fireproof.*

j) *33.17 - Fire protection. (...) (b) Except as provided in paragraph (c) of this section, each external line, fitting, and other component, which contains or conveys flammable fluid during normal engine operation, must be fire resistant or fireproof, as determined by the Administrator. Components must be shielded or located to safeguard against the ignition of leaking flammable fluid. (...) (d) An engine component designed, constructed, and installed to act as a firewall must be: (1) Fireproof.*

3.1.3 Para cada projeto a ser certificado, o fabricante propõe os requisitos aplicáveis e os meios de cumprimento. Recomenda-se uma coordenação antecipada com a Anac para acordar os MOCs aceitáveis, evitando assim problemas ao longo da campanha de certificação. O fabricante da aeronave deve também coordenar antecipadamente com os fornecedores de motor e APU para acordar com eles os dados de cumprimento necessários para subsidiar a certificação da aeronave. Essa coordenação antecipada é recomendada para evitar alterações adicionais no escopo de cumprimento com os requisitos durante o processo de certificação.

3.2 Meio Aceitável de Cumprimento

3.2.1 O artigo 14 da Resolução nº 30, de 21 de maio de 2008, que instituiu o RBAC e IS e estabelece critérios para a sua elaboração, dispõe em seu § 1º, alterado pela Resolução nº 162, de 20 de julho de 2010, que o administrado que pretenda demonstrar o cumprimento de requisito previsto em RBAC poderá adotar os meios e procedimentos especificados em IS ou apresentar meio ou procedimento alternativo devidamente justificado, exigindo-se a análise e concordância expressa do órgão competente da Anac.

3.2.2 O § 2º do artigo 14 da Resolução nº 30, de 21 de maio de 2008, supracitado, dispõe que o meio ou procedimento alternativo mencionado no § 1º deste artigo deve garantir nível de segurança igual ou superior ao estabelecido pelo requisito aplicável ou concretizar o objetivo do procedimento normalizado em IS.

3.2.3 O § 3º do artigo 14 da Resolução nº 30, de 21 de maio de 2008, supracitado, dispõe que a IS não pode criar requisitos ou contrariar requisitos estabelecidos em RBAC, ou outro ato normativo.

4. DEFINIÇÕES

4.1 Duas das definições mais fundamentais para se classificar, de acordo com sua resposta ao fogo, os materiais a serem utilizados em sistemas de contenção de fogo de sistemas propulsivos, resumidas para formar um entendimento da Anac sobre elas, são apresentadas a seguir. Essas duas definições visam concatenar os conceitos distribuídos pelos RBAC nº 1, *Code of Federal Regulations part* 1 do FAA, nas *Advisory Circulars* 20-135 e 33.17-1 também do FAA, e nos *Certification Specifications* da Easa.

41.1 Resistente ao fogo**:** é a capacidade de um material em suportar a aplicação de calor por uma chama, com temperatura de 1100°C ± 80°C e fluxo de calor de 116 kW/m² ± 10 kW/m², por um período de 5 minutos, sem qualquer falha que possa criar um risco para a aeronave. Costuma ser mais aplicável aos componentes de sistemas pneumáticos, elétricos e hidráulicos, e aos controles de sistemas propulsivos. Seria o equivalente à capacidade de suportar pelo menos tão bem quanto o alumínio, o calor e outras condições que provavelmente ocorrerão quando houver um incêndio numa zona de contenção de fogo, mantendo o material em conformidade com sua finalidade de projeto.

4.1.2 À prova de fogo: é a capacidade de um material em suportar a aplicação de calor por uma chama, por um período de 15 minutos, sem qualquer falha que possa criar um risco para a aeronave. A chama terá as seguintes características: temperatura de 1100°C ± 80°C; fluxo de calor de 116 kW/m² ± 10 kW/m². Seria o equivalente à capacidade de suportar, pelo menos tão bem quanto aço ou titânio, o calor produzido por um incêndio grave de longa duração numa zona de contenção de fogo, mantendo o material em conformidade com sua finalidade de projeto.

4.2. As demais definições aplicáveis à contenção de fogo em instalações propulsivas estão apresentadas na última revisão da norma AS6826, da SAE.

5. DESENVOLVIMENTO

5.1 Histórico

5.1.1. Considerando que existiam diversos materiais orientativos para esse tipo de ensaios de fogo (AC 20-135, ISO 2685, AC 33.17-1, FAA *Engineering Report* 3A, RTCA DO-160 e DO-357, etc.), e que em algumas vezes levavam a variações nas execuções dos ensaios e nos critérios de aprovação, sentia-se a necessidade de que uma nova norma fosse criada para fornecer aos fabricantes de aeronaves e motores metodologias de ensaio e critérios de aprovação mais consolidados, harmonizados, e modernos, que pudessem ser considerados meios aceitáveis pelas suas respectivas autoridades de aviação civil para cumprimento dos requisitos aplicáveis a sistemas de propulsão.

5.1.2 Assim sendo, em 2018 o FAA pediu à SAE *International* que desenvolvesse uma nova norma para complementar a AC 20-135. Assim, um comitê da SAE foi constituído pela FAA, com membros de AACs do mundo todo e de fabricantes de aeronaves e de motores. A AS6826, norma que foi produto deste esforço conjunto, baseou-se na já mencionada AC 20-135, representando uma evolução significativa desta última, e foi elaborada com base em bem-sucedidos programas de certificação, e nas melhores práticas aeronáuticas internacionais.

5.1.3 A AS6826 é, portanto, a norma aeroespacial que fornece aos fabricantes metodologias de ensaio de fogo e critérios de aprovação que foram considerados meios aceitáveis de cumprimento por AACs de diversos países, como FAA, Easa, TCCA e Anac, para atender aos requisitos aplicáveis de proteção contra fogo em sistemas de propulsão.

5.2 Demonstração de cumprimento

5.2.1 Pelos motivos descritos no item anterior, fabricantes de produtos aeronáuticos a serem certificadas no Brasil podem considerar as informações contidas na última revisão da norma AS6826, da SAE, para demonstrarem cumprimento com os requisitos aplicáveis. Projetos que apresentarem configurações, características operacionais ou aspectos ambientais exclusivos, além dos discutidos na AS6826, precisarão de discussão previamente com a Anac.

5.2.2 Esta IS formaliza, portanto, a incorporação da última revisão da norma AS6826, emitida pela *SAE International*, como um meio de cumprimento aceitável para a Anac.

6. APÊNDICES

6.1. APÊNDICE A – Lista de reduções.

6.2. APÊNDICE B – Controle de Alterações

7. DISPOSIÇÕES FINAIS

Os casos eventualmente omissos serão dirimidos pela SAR/Anac.

APÊNDICE A – LISTA DE REDUÇÕES

AAC	Autoridade de Aviação Civil
AMC	*Acceptable Means of Compliance*
Anac	Agência Nacional de Aviação Civil
APU	*Auxiliary Power Unit*
AS	*Aerospace Standard*
CFR	*Code of Federal Regulations*, do FAA
CS	*Certification Specifications*, da Easa
Easa	*European Aviation Safety Agency*
FAA	*Federal Aviation Administration*
IS	Instrução Suplementar
MOC	*Means Of Compliance*
RBAC	Regulamento Brasileiro de Aviação Civil
SAE	Organização internacional de fomento e normatização de sistemas da mobilidade (antigamente "*Society of Automotive Engineers*")
SAR	Superintendência de Aeronavegabilidade

APÊNDICE B – CONTROLE DE ALTERAÇÕES

Não aplicável a esta revisão.

ARQUIVO ANEXO - VERSÃO EM INGLÊS

ANAC AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL	**SUPPLEMENTAL INSTRUCTION - IS** **IS Nº 20-135** **Revision A**	
Approved by:	Portaria x	
Subject:	Acceptable Methods for Showing Compliance with Fire Containment Requirements in Propulsion Systems	**Originating Department:** SAR
Issue date:	x	

1. PURPOSE

1.1 This Supplemental Instruction formalizes which guidance may be used by aeronautical manufacturers to show compliance of materials to be installed in propulsion system, such as aircraft engines, Auxiliary Power Units (APUs), and their respective nacelles and firewalls, to the applicable fire protection requirements, through laboratory testing.

1.2 The primary purposes of firewalls or such components are to isolate a flame originating from an engine or APU, and to prevent fuel or air from feeding the existing fire, as well as to ensure that their engine control systems will work as expected to allow safe engine or APU shutdowns. Furthermore, materials and components must maintain adequate resistance to flight and operational loads expected to be present after fire occurrence, to allow for proper fire detection, crew recognition, and subsequent corrective actions. Finally, gas emissions from those materials must not enter the aircraft's air conditioning system.

1.3 Laboratory fire testing must simulate the likely fire environment in an engine or APU compartments to show that the chosen materials will provide the necessary containment to meet the above objectives when exposed to a fire event during aircraft operation.

2. CANCELLATION

Not applicable to this revision.

3. INTRODUCTION

3.1 Applicable Certification Requirements

3.1.1 Anac fully adopts, in the English language, the original "Title 14 Code of Federal Regulations Parts 23, 25, 27, 29, and 33" issued by the Federal Aviation Administration (FAA), U.S. Department of Transportation. Copies of these regulations are available on the same website that contains the RBACs.

3.1.2 As required by the provisions of the FAA Code of Federal Regulations referenced above, an applicant for a type certificate for an engine or an aircraft must demonstrate that its product complies with certain fire containment requirements, such as those listed below, e.g.:

a) 23.2330 - Fire protection in designated fire zones and adjacent areas. (a) Flight controls, engine mounts, and other flight structures within or adjacent to designated fire zones must be capable of withstanding the effects of a fire (…). (c) In designated fire zones, terminals, equipment, and electrical cables used during emergency procedures must be fire-resistant.

b) 23.2440 - Powerplant fire protection. (…) Each component, line, fitting, and control subject to fire conditions must: (…); (2) Be fire-resistant if carrying flammable fluid, gas or air, or is required to operate in the event of a fire; and (3) Be fireproof or enclosed by a fireproof shield if storing concentrated flammable fluids (…).

c) 25.867 - Fire protection: other components. (a) Surfaces to the rear of the nacelles, within one nacelle diameter of the nacelle centerline, must be at least fire-resistant. (…).

d) 25.1191 - Firewalls. (…) (b) Each firewall and shroud must be: (1) Fireproof; (2) Constructed so that no hazardous quantity of air, fluid, or flame can pass from the compartment to other parts of the airplane; (…).

e) 25.1193 - Cowling and nacelle skin. (…) (e) Each airplane must: (1) Be designed and constructed so that no fire originating in any fire zone can enter, either through openings or by burning through external skin, any other zone or region where it would create additional hazards; (…); and (3) Have fireproof skin in areas subject to flame if a fire starts in the engine power or accessory sections.

f) 27.1183 - Lines, fittings, and components. (a) Except as provided in paragraph (b) of this section, each line, fitting, and other component carrying flammable fluid in any area subject to engine fire conditions must be fire resistant, except that flammable fluid tanks and supports which are part of and attached to the engine must be fireproof or be enclosed by a fireproof shield unless damage by fire to any non-fireproof part will not cause leakage or spillage of flammable fluid. (…).

g) 27.1194 Other surfaces. All surfaces aft of, and near, powerplant compartments, other than tail surfaces not subject to heat, flames, or sparks emanating from a powerplant compartment, must be at least fire resistant.

h) 29.903 Engines. (…). (c) Category A; control of engine rotation. For each Category A rotorcraft, there must be a means for stopping the rotation of any engine individually in flight, except that, for turbine engine installations, the means for stopping the engine need be provided only where necessary for safety. In addition - (1) Each component of the engine stopping system that is located on the engine side of the firewall, and that might be exposed to fire, must be at least fire resistant; or

i) 29.1201 - Fire extinguishing system materials. (…) (b) Each system component in an engine compartment must be fireproof.

j) 33.17 - Fire protection. (…) (b) Except as provided in paragraph (c) of this section, each external line, fitting, and other component, which contains or conveys flammable fluid during normal engine operation, must be fire resistant or fireproof, as determined by the Administrator. Components must be shielded or located to safeguard against the ignition of leaking flammable fluid. (…) (d) An engine component designed, constructed, and installed to act as a firewall must be: (1) Fireproof.

3.1.3 For each certification program, the regulatory framework specifies the applicable requirements and their acceptable means of compliance. Early coordination with Anac is recommended for agreement on the acceptable MOCs, thus avoiding compliance issues later in the certification campaign. The aircraft manufacturer should also coordinate in advance with engine and APU suppliers for them to provide the compliance data necessary to support his aircraft certification. This early coordination is recommended to avoid additional changes to the requirement compliance scope during the certification process.

3.2 The Supplemental Instruction

3.2.1 Article 14 of Anac's Resolution #30, issued on May 21, 2008, which established the RBAC and Supplemental Instruction concepts, as well as the criteria for their development, provides in its paragraph #1, as amended by Anac's Resolution #162, issued on July 20, 2010, that an applicant wishing to show compliance with a requirement set forth in the RBAC may adopt the means and procedures specified in Supplemental Instructions, or present an appropriately justified alternate procedure, which will demand Anac's evaluation and approval.

3.2.2. Article 14, paragraph #2 of Resolution #30 issued on May 21, 2008, as mentioned previously, also provides that the alternative means or procedure mentioned in paragraph #1 of that article must ensure a level of safety equal to or greater than that established by the applicable requirement or achieve the objective of the procedure standardized in the Supplemental Instruction.

3.2.3 Finally, article 14, paragraph 3 of Resolution #30 issued on May 21, 2008, cited above, stipulates that a Supplemental Instruction must not create new requirements or contradict those established in the RBACs.

4. BASIC DEFINITIONS

4.1 Two of the most important definitions for the materials to be used in powerplant fire containment systems, regarding their response to fire and consolidated with Anac's understanding of them, are set forth below. Those two definitions below aim to summarise the terminology found in RBAC nº 1, FAA Title 14 Code of Federal Regulations part 1, FAA Advisory Circulars 20-135 and 30.17-1, and Easa's Certification Specifications.

4.1.1 FIRE RESISTANT: the ability of a material to withstand the application of heat from a flame, with a temperature of 1100°C ± 80°C and a heat flux of 116 kW/m² ± 10 kW/m², for a period of 5 minutes, without any failure that could pose a risk to the aircraft. This is usually most applicable to components of pneumatic, electrical, and hydraulic systems (flammable or not), and to propulsion systems controls. It is equivalent to the ability to withstand, at least as well as aluminium, the heat and other conditions likely to arise when a fire breaks out in a fire containment zone, maintaining that zone in compliance with its design purpose.

4.1.2. FIRE PROOF: the ability of a material to withstand the application of heat from a flame for a period of 15 minutes without failure that could pose a risk to the aircraft. The flame must have the following characteristics: temperature of 1100°C ± 80°C; heat flux of 116 kW/m² ± 10 kW/m². It is equivalent to the ability to withstand, at least as well as steel or titanium, the heat produced by a severe, long-lasting fire in a fire containment zone, maintaining that zone in compliance with its design purpose.

4.2 Other definitions applicable to fire containment testing in propulsion systems are presented in the latest revision of SAE AS6826 standard.

5. DEVELOPMENT

5.1 Background

5.1.1 Because there were several guidance materials for this type of fire testing (FAA AC 20-135, ISO 2685, FAA AC 33.17-1, FAA Engineering Report 3A, RTCA DO-160 and DO-357, etc.), which sometimes led to variations in test executions and approval criteria, there was a need for a new and unique standard that could provide aircraft and engine manufacturers with more consolidated, harmonized, and modern test methodologies and approval criteria that could be considered acceptable means of compliance by worldwide civil aviation authorities for meeting the propulsion systems applicable requirements.

5.1.2 So, in 2018, FAA asked SAE International to develop a new standard which could complement Advisory Circular 20-135. A SAE committee was started by the FAA, with members from CAAs, aircraft and engine manufacturers. AS6826 was the result of that work, representing a significant evolution of AC 20-135, since it was developed based on successful certification programs and international aeronautical best practices.

5.1.3 Therefore, SAE's AS6826 is a new aerospace standard that provides applicants with fire test methodologies and approval criteria that have been considered acceptable means of compliance by CAAs from several countries, such as FAA, Easa, TCCA and Anac, to meet applicable fire protection requirements for propulsion systems.

5.2 Showing compliance

5.2.1 Based on all the reasons stated above, the manufacturers of aeronautical products to be certified in Brazil are allowed to follow SAE's AS6826, in its latest revision, as a guidance for them to show compliance with the applicable powerplant fire containment requirements. Nevertheless, powerplant installation designs with unique configurations, operational characteristics, or environmental aspects beyond the ones discussed in SAE's AS6826 will require coordination with Anac.

5.2.2 This Supplemental Instruction aims to formalize the incorporation of the latest revision of SAE's AS6826 standard, issued by SAE International, as a means of compliance acceptable to Anac.

6. APPENDICES

6.1 Appendix A – List of Acronyms

6.2. Appendix B – Changes Control

7. FINAL CONSIDERATIONS

Any issues should be addressed by Anac's airworthiness department (SAR).

APPENDIX A – LIST OF ACRONYMS

AMC	Acceptable Means of Compliance
Anac	Agência Nacional de Aviação Civil (Brazilian Civil Aviation Authority)
APU	Auxiliary Power Unit
AS	SAE's Aerospace Standard
CAA	Civil Aviation Authority
CFR	Code of Federal Regulations, FAA
CS	Certification Specifications, Easa
Easa	European Aviation Safety Agency
FAA	Federal Aviation Administration
IS	Anac's Supplemental Instruction
MOC	Means of Compliance
RBAC	Regulamento Brasileiro de Aviação Civil (Brazilian Civil Aviation Regulation)
SAE	International Organization for the Promotion and Standardization of Mobility Systems (formerly the Society of Automotive Engineers)
SAR	Anac's Airworthiness Department

APPENDIX B – CHANGES CONTROL

Not applicable.