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OPERATING LIMITATIONS AND INFORMATION
(Propulsion Considerations)

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Section 1. Operating Limitations

Section 25.1521 Powerplant limitations.

a. **Rule Text.**

(a) General. The powerplant limitations prescribed in this section must be established so that they do not exceed the corresponding limits for which the engines or propellers are type certificated and do not exceed the values on which compliance with any other requirement of this part is based.

(b) Reciprocating engine installations. Operating limitations relating to the following must be established for reciprocating engine installations:

(1) Horsepower or torque, r.p.m., manifold pressure, and time at critical pressure altitude and sea level pressure altitude for --

(i) Maximum continuous power (relating to the unsupercharged operation or to operation in each supercharger mode as applicable); and

(ii) Takeoff power (relating to unsupercharged operation or to operation in each supercharger mode as applicable).

(2) Fuel grade or specification.

(3) Cylinder head and oil temperatures.

(4) Any other parameter for which a limitation has been established as part of the engine type certificate except that a limitation need not be established for a parameter that cannot be exceeded during normal operation due to the design of the installation or to another established limitation.

(c) Turbine engine installations. Operating limitations relating to the following must be established for turbine engine installations:

(1) Horsepower, torque or thrust, r.p.m., gas temperature, and time for --

(i) Maximum continuous power or thrust (relating to augmented or unaugmented operation as applicable).

(ii) Takeoff power or thrust (relating to augmented or unaugmented operation as applicable).

(2) Fuel designation or specification.

(3) Any other parameter for which a limitation has been established as part of the engine type certificate except that a limitation need not be established for a parameter that cannot be exceeded during normal operation due to the design of the installation or to another established limitation.

(d) Ambient temperature. An ambient temperature limitation (including limitations for winterization installations, if applicable) must be established as the maximum ambient atmospheric temperature established in accordance with 25.1043(b).

(Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-42, 43 FR 2323, Jan. 16, 1978; Amdt. 25-57, 49 FR 6849, Feb. 23, 1984; Amdt. 25-72, 55 FR 29786, July 20, 1990.)

b. **Intent of Rule.** The intent of this rule is to require the establishment of powerplant limitations that will not exceed the corresponding limits set forth for the engines and propellers as type certificated, as well as other powerplant installation compliance requirements.

c. **Background.**

(1) The regulatory history shows that this requirement originated in Section 718 of the Civil Air Regulations (CAR) 4b, December 31, 1952. Amendment 25-AD (29 FR 18289 December 24, 1964) added Part 25 [New] to the Federal Aviation Regulations and replaced Part 4b of the CAR. It was part of the Agency recodification program announced in Draft Release 61-25, published in the Federal Register on November 15, 1961 (26 FR 10698). This rule was recodified from CAR 4b.718 without substantial change.

(2) Notice of Proposed Rulemaking 75-25 (40 FR 24664, June 9, 1975) proposed to revise § 25.1521(e) [currently § 25.1521(d)]. It was only one proposal in a series of proposals on powerplant cooling requirements and ambient temperature operating limitations and information for Part 23, 25, 27, and 29 aircraft. Proposed § 25.1521(e), in conjunction with § 25.1043(b), would require that an ambient temperature operating limitation be established as the maximum atmospheric temperature at which compliance with the powerplant cooling requirements is shown.

Amendment 25-42 (43 FR 2302, January 16, 1978) followed Notice 75-25 and adopted the proposal. The following excerpt from the preamble of that Amendment discusses the a comment received in response to the Notice and provides further guidance on the intent of the rule:

> In response to these proposals, one commenter states that no justification for safety or other reasons had been presented for establishing the proposed operating limitations, and that no safety justification existed. The commenter also states that the FAA cooling tests and correction factors are very conservative. Thus, it would be necessary to correct cooling tests to at least the equivalent of 125° F at sea level to avoid restrictive operating limitations, and that this would result in increased cooling drag and poorer performance.

After considering these comments, the FAA believed that it did not have enough information to justify the proposed requirements for reciprocating engines in Part 23 airplanes and Part 27 rotorcraft. However, because of the differences between reciprocating and turbine engine installations, particularly with regard to engine components and accessories, and because of the effects of high temperature operation on turbines, Part 23 already required ambient temperature limitations for turbine engines. For the same reasons, the FAA believed that ambient temperature limitations for turbine engines also should be established for Part 27 helicopters. Parts 25 and 29 already required temperature limitations for reciprocating engines, as well as turbine engines; this was because the reciprocating engine installations in the Part 25 and 29 aircraft are generally more complex than those used in Part 23 and Part 27 aircraft. Thus, the proposed § 25.1521(e) was adopted without substantive change.

(2) Amendment 25-57 (49 FR 6832, February 23, 1984) corrected typographical errors and references in the rule, and made other nonsubstantive changes.

(3) Notice of Proposed Rulemaking 84-21 (49 FR 47358, December 3, 1984) proposed a change to the rule that would clarify the applicability of such limitations to the airplane and ensure that they are not overlooked during the airplane certification process. Section 25.903 requires each engine to be type certificated. Any limitation established as a condition of the engine type certificate is, therefore, a limitation on the airplane by reference, regardless of whether the parameter is specified in § 25.1521.

Amendment 25-72 (55 FR 29756, July 20, 1990) followed Notice 84-21 and adopted the proposal. Additionally, the basic format of the rule was changed for clarity and consistency with § 33.7, which pertains to engine ratings and operating limitations. The following excerpt from the preamble to the Amendment provides additional guidance on the intent of the rule:

> The only commenter on this proposal to clarify the powerplant limitations of § 25.1521 states that the phrase *.". . . and do not exceed the values on which compliance with any other requirements of this part is based"* is unnecessary and too general. The commenter further notes that compliance with certain requirements (e.g., § 25.175) is based on less than rated power or thrust. The FAA does not concur with the commenter's assessment. The limitations of the powerplant, as installed, have been, by definition, the corresponding limits for which the engines and propellers have been type certificated under parts 33 and 35 of this chapter (or predecessor regulations) or, in the case of derated engine installations, lesser values on which compliance with other requirements of part 25 is based. The use of derated engine installations in transport category airplanes is becoming more prevalent. It is therefore necessary that the basis

for establishing powerplant limitations be well understood. The commenter correctly notes that compliance with certain requirements is based on less than rated power or thrust; however, by definition, compliance with those requirements would have no bearing on compliance with proposed § 25.1521(a).

The same commenter recommends the use of the phrase *.". . . must be established"* in lieu of the phrase *.". . . established"* in proposed § 25.1521 (b) and (c). The FAA concurs that the former phase is preferable.

d. **Compliance/Policy Methods.**

(1) Advisory Circular (AC) 25-13, "Reduced and Derated Takeoff Thrust (Power) Procedures," is based on information and policy contained in FAA Orders 8000.39 and 8000.58, which were officially cancelled upon the issuance of AC 25-13. Policy, where relevant, may be referenced to these orders, and is current policy if so included. The following text contains current policy applicable to Automatic Takeoff Thrust Control Systems (ATTCS) and reduced thrust operations:

The FAA does not concur that (ATTCS) System operations and "reduced thrust operations using the assumed temperature method" should be integrated. The FAA previously had a policy wherein automatic takeoff thrust control system operations were separate from "reduced thrust" operations, such that when conducting "reduced thrust" takeoffs, the ATTCS was disarmed. We have recently reviewed this policy and have concluded that with certain restrictions, ATTCS may be "armed" when scheduling "reduced thrust" takeoff operations.

We now accept that the operator may arm the ATTCS during "reduced thrust" takeoffs; however, no performance or weight credit is to be allowed. Furthermore, the applicant or operator must demonstrate that the airplane does not have adverse handling or controllability characteristics and the operating engine(s) must not exhibit adverse operating characteristics or exceed operating limits (in the event an engine fails or there is loss of power on an engine which causes the ATTCS to function) during the takeoff. Also, the AFM must furnish information, instructions and procedures, as required, regarding the peculiarities of normal and abnormal operations when scheduling reduced thrust operations and an "armed" ATTCS together.

(2) The following text contains current policy that pertains to reduced/derated thrust operations.

As a condition to the use of derated thrust, operators must assure that engines are capable of achieving full rated takeoff thrust, including full power lever angle capability with EEC operating, without exceeding the corresponding certificated engine limits.

When takeoff is made using Derate 1 or Derate 2, the approach and landing climb performance must be based on the corresponding derate unless it has been determined that the engines are capable of achieving full rated takeoff thrust.

(3) The following policy is from an FAA memorandum, dated, March 22, 1982, which was in response to a request from an FAA Aircraft Certification

Office requesting guidance and clarification regarding selection of powerplant limitations equal to or less than the approved ratings and limitations of the engine [as shown on the engine Type Certificate Data Sheet (TCDS)].

> This office concurs with the observations and interpretations made in your letter of February 12, 1982. Specifically, we agree that the airframe manufacturer is free to select powerplant limitations equal to or less than the approved ratings and limitations of the engine as shown on the engine Type Certificate Data Sheet (TCDS). We further concur that considerations of powerplant ratings and limitations under Part 25 or Order 8000.39 refer to the approved airframe powerplant limitations as selected by the airframe manufacturer.
>
> Operation of an engine at reduced thrust or power while maintaining the turbine gas temperature (TGT) limit which corresponds to a higher rated power permits, in effect, allows a greater degree of engine deterioration prior to rejecting the engine for failure to make takeoff power within the TGT limit. In order to prevent airworthiness problems related to this additional deterioration, the applicant must substantiate that the deterioration permitted by the selected power and TGT limits does not constitute an airworthiness concern. Alternatively, the TGT limit must be lowered commensurate with the reduced power desired. The applicant may require assistance from the engine manufacturer to obtain substantiation for the increased deterioration or an alternate TGT limit.

(4) The following material was provided in a FAA letter to an applicant in 1985 and provides guidance on revisions to an airplane flight manual.

> The letter proposed a revision to the subject Airplane Flight Manual Appendix concerning the use of derate thrust and airplane performance. Based upon the nature of this change, certain features of this proposed Flight Manual Appendix Revision do not comply with current policy regarding engine ratings and airplane performance. The purpose of this letter is to clarify issues that have been raised recently concerning the subject of ratings and airplane performance relative to this policy.
>
> During the original derate Appendix review, several meetings between our two staffs were held to discuss this subject. The primary point of discussion centered around the differences between “derate” and “reduced thrust” philosophy. It was pointed out at that time that, in general, derate thrust involved a complete airplane flight from takeoff to landing. As such, takeoff performance would be predicated upon the same thrust levels as those of airplane landing performance. A common application of this derate philosophy has involved airplanes equipped with various versions of a particular engine. Use of derate on these aircraft/engine combinations often involve an aircraft equipped with one or more of these engines with a given full rate Flight Manual (takeoff and landing). Numerous appendices have been approved which provide full flight performance information whereby the user may elect to operate the airplane at ratings commensurate with a lower thrust version of this engine. When this is accomplished, all airplane performance is predicated on this lower thrust level, which is now effectively a derate of the full rate level.
>
> The engine power setting phase of any takeoff (40 to 80 knots for many aircraft) constitutes a point in the operation whereby the crew must determine if all engines are in fact producing required thrust for takeoff by observing cockpit instruments. An engine’s inability to produce required thrust (by observing the

appropriate thrust indicating parameter) is justification for aborting the takeoff attempt and determining the nature of the problem. This process, implied in the performance rules of Part 25 of the Federal Aviation Regulations (FAR) and fundamental to the ratings/limits assessment of § 25.1521, has been shown to establish a level of engine thrust capability which exists for the remainder of the flight. This subject Flight Manual revision incorrectly allows airplane landing performance to be predicted on higher thrust than that which was used for takeoff, thereby, effectively defeating the rationale behind the power check event during each takeoff which has been inherent in transport aircraft certified under FAR 25/CAR 4b. Obviously, due to the effects of temperature and pressure on the parameter margins available on turbine engines, a takeoff within limits on a cool day does not ensure that an approach/go around made in hot day conditions at a destination airport can be made to the same thrust without exceeding engine limits. However, by requiring go around thrust to be higher than takeoff thrust, as proposed in the subject AFM Appendix, this potential ambient induced disparity for turbine engines becomes even more aggravated.

Currently, FAA policy material which provides guidance for an operation of the type proposed in this appendix (i.e., predicating landing performance on thrust levels higher than those used for takeoff) is contained in FAA Order 8000.39, “Reduced Thrust Takeoffs - Turbojet Powered Transports.” This order covers the occasional use of reduced thrust for takeoff when operational considerations permit, as opposed to operation on an airplane with a full time derated engine installation.

The current thrust derate Appendix requires, as a condition for use of the derate performance, the operator to establish that the engines are capable of producing full rated takeoff thrust. This requirement was the outcome of numerous meetings between our two offices during the original derate proposal where several major factors became evident. Three of these were:

(1) The Thrust Management Computer (TMC) on the aircraft which were to be delivered with the derate appendix programmed with derate takeoff target thrust levels but with full rate go around target thrust levels.

(2) It would require several months to reprogram the TMC’s to contain derate go around targets. Considering that a committed derate equipped airplane delivery was only a week or two away at the time these issues were surfaced, TMC reprogramming was considered to not be a feasible alternative.

(3) It was agreed that, considering the “full throttle” philosophy inherent in the engine control system, “full throttle” power set TMC targets would not be unreasonable to expect where rapid crew response was a factor.

Based upon these issues, it was decided at the time of these earlier discussions that the “full rate” go around TMC targets would be acceptable, provided airplane go around performance was predicated on the same thrust ratings used for takeoff, thereby, maintaining consistency with the full flight rating philosophy. It was agreed upon by both the aircraft company and FAA at that time, however, that since full rate go around targets were being permitted to be displayed while using derate takeoff, the requirement that some type of full rate engine capability determination be established similar to that now discussed in Order 8000.39 such that some degree of assurance that the full rate targets would not result in engine limits exceedance.

It was not intended, however, that this requirement to establish a full rate capability program was to ever be a substitute for, or equivalent to, the full flight rating philosophy. As stated earlier, the takeoff thrust levels and inherent decisions which must be made during the takeoff regarding the engines capability to produce required thrust (e.g., fuel flow, EPR, Nl, etc.) are implied to exist through the remainder of that flight including landing. Special engine systems such as Automatic Performance Reserve (APR) or water injection have features that provide the equivalent to this full flight rating philosophy but are beyond the scope of this letter.

In summary, establishing airplane go around performance based on higher thrust than that which takeoff performance was predicated upon would be effectively accomplishing a "reduced thrust" operation without consideration for the issues associated with Order 8000.39. Approval of this revision cannot be extended at this time.

(5) The following excerpts are from an FAA memorandum, dated August 19, 1994, which provides current policy on engine inoperative ten-minute takeoff thrust/power rating.

The Joint Aviation Requirements (JAR) allow the use of takeoff thrust/power for up to ten minutes after the shutdown or failure of one or more engines. However, Part 1 of the Federal Aviation Regulations (FAR) defines *rated takeoff thrust/power* as limited to five minutes of operation. At some airports (mostly foreign) the maximum allowable airplane takeoff weight is limited by the climb gradient capability (at maximum continuous thrust/power) needed to clear distant obstacles after takeoff. The availability of takeoff thrust/power for use up to ten minutes enables some foreign operators to dispatch at an increased gross weight relative to U.S. operators under these conditions. U.S. operators have expressed a desire to be treated equally in similar circumstances in order to be competitive.

The FAA's Transport Standards Staff has reviewed Part 25 and determined that no revisions are needed to provide the flexibility for an engine inoperative "10-minute" takeoff thrust/power rating. The limiting phrase is found in Part 1 in the definition of *rated takeoff thrust/power*. The Engine and Propeller Standards Staff is proposing a regulatory change to Part 1 to harmonize the FAR with the JAR. The proposed wording would extend the current definition of *rated takeoff thrust/power* for turbine engines in Part 1 as follows:

." . . and limited in use to periods of not over 5 minutes for takeoff operation, *and, for turbojet (including turbofan) and turbopropeller engines, when specifically requested by the engine type certificate holder, to periods of not over 10 minutes for engine inoperative takeoff operations.*"

The FAA's Engine and Propeller Directorate has verified that the engine inoperative "10-minute" rating is well within the boundaries of the engine certification standards of Part 33 for turbine engines.

Since the Part 1 definition is not limiting with respect to ratings selected by the engine manufacturer for abnormal operations, we have adopted the following procedure to allow the FAA approved transport category Airplane Flight Manual (AFM) to be revised to incorporate instructions regarding the engine inoperative "10-minute" takeoff thrust/power rating for airplanes with turbine engine installations. Upon receipt of a written request from an applicant seeking an

engine inoperative “10-minute” takeoff thrust/power rating the following items will be addressed:

a. The engine type certificate holder shall request in writing to the cognizant aircraft or engine certification office for approval of an engine inoperative “10-minute” takeoff thrust/power rating for the relevant turbine engine models.

b. The aircraft or engine certification office shall ensure that the relevant engine Type Certification Data Sheet is revised to note the extended turbine engine rating.

c. The transport category airplane type certificate holder shall request in writing to the cognizant Aircraft Certification Office (ACO) the desire to establish the engine inoperative “10-minute” takeoff thrust/power rating for the relevant airplane/engine model(s). The request should include the engine type certificate holder’s “endorsement” of the extended turbine engine rating.

d. The transport category airplane type certificate holder shall present the appropriate AFM revisions concerning the engine inoperative “10-minute” takeoff thrust/power operation to the ACO for review and approval.

e. The ACO shall ensure that the relevant airplane Type Certification Data Sheet is revised to note the extended turbine engine rating.

The engine inoperative “10-minute” rating operation should be processed as an engineering approval unless there are actual hardware changes. The AFM revision should specify that using takeoff thrust/power for more than five minutes (not to exceed ten minutes) is approved for use only in the event of an inoperative engine(s) due to shutdown or failure. The AFM obstacle clearance charts (see §§ 121.189(d) and 135.379(d)) should be revised to reflect the increased climb capability.

This interim procedure, which is available upon request, may be used to provide the additional obstacle clearance capability for U.S. operators. When the Part 1 amendment is effective the normal certification procedures will apply.

(6) Current transport category airplane compliance material for this section has been contained in Advisory Circular 25 -13, “Reduced and Derated Takeoff Thrust (Power) Procedures,” dated May 4, 1988. However, AC 25-13 has now been cancelled with the issuance of this Propulsion Mega AC and its material has been incorporated in this Mega AC at Section 25.101.

e. **References.**

(1) Civil Air Regulations 4b, December 31, 1953.

(2) Amendment 25-AD (29 FR 18289, December 24, 1964).

(3) Notice of Proposed Rulemaking 75-25 (40 FR 24664, June 9, 1975).

(4) Amendment 25-42 (43 FR 2302, January 16, 1978).

(5) Notice of Proposed Rulemaking 84-21,(49 FR 47358, December 3, 1984).

(6) Amendment 25-72 (55 FR 29756, July 20, 1990).

(7) Advisory Circular 25-13, “Reduced and Derated Takeoff Thrust (Power) Procedures,” May 4, 1988 [incorporated in total into this Propulsion Mega AC].

(8) FAA Order 8000.39, “Reduced Thrust Takeoffs - Turbojet Powered Transports” [cancelled].

Section 25.1522 Auxiliary power unit limitations.

a. **Rule Text.**

If an auxiliary power unit is installed in the airplane, limitations established for the auxiliary power unit, including categories of operation, must be specified as operating limitations for the airplane.

(Amdt. 25-46, 43 FR 50598, Oct. 30, 1978; Amdt. 25-72, 55 FR 29786, July 20, 1990)

b. **Intent of Rule.** The intent of this rule is self-evident.

c. **Background.**

(1) This rule was first proposed in Notice of Proposed Rulemaking 75-31 (40 FR 29410, July 11, 1975). The explanation given for the proposal was:

> If an auxiliary power unit that meets the requirements of TSO C77 is installed in the airplane, the limitations established for that auxiliary power unit under the TSO including the categories of operation must be specified as operating limitations for the airplane. This proposal would make it clear that limits established under the TSO for an APU must be made applicable to the installation in the airplane.

Amendment 25-46 (43 FR 50578, October 30, 1978) followed Notice 75-31 and adopted the proposal. The following excerpt is from the preamble to that Amendment and discusses the comments received in response to the Notice:

> One commenter suggests that the proposed new § 25.1522 be revised so that it would also apply to auxiliary power units (APU) that do not meet the requirements of TSO-C77 (§ 37.183). The FAA does not agree. The proposal recognizes that operating limitations established under a TSO do not have to be reestablished as a part of airplane type certification. However, an airplane type certificate applicant would have to develop appropriate operating limitations during the airplane type certification for any installed APU not manufactured under the provisions of a TSO. Such APU operating limitations would then become part of the aircraft type design.
>
> Another commenter, while agreeing with the proposal, suggests that proposed § 25.1552 be revised to require also that each APU meet the requirements of TSO-C77. The FAA does not agree. TSO-C77 is applicable only to gas turbine powered APU's. The suggested revision would require that APU's other than gas turbine units be manufactured to the standards which are appropriate to, and established only for, the manufacture of gas turbine auxiliary power units.

(2) Notice of Proposed Rulemaking 84-21 (49 FR 47358, December 3, 1984) proposed a revision of § 25.1522 to its current requirement. Amendment 25-72 (55 FR 29756, July 20, 1990) followed Notice 84-21 and adopted the proposal. The following excerpt is from the preamble to the Amendment:

The existing rule specified that limitations must be established if an auxiliary power unit (APU) meets the requirements of TSO-C77, implying that such limitations need not be established for those APU's that are approved in conjunction with the type certification process for the airplanes on which they are installed and do not have TSO-C77 authorization. Such limitations are, in fact, required for APU's that do not have TSO-C77 authorization by §§ 25.1301 and 25.1309. This change places the requirement for limitations for all APU's in the same section for clarity.

d. **Compliance/Policy Methods.**

(1) The following guidance information regarding Auxiliary Power Unit (APU) indications was developed to assist in the certification of APU's with self monitoring features.

The latest revision on record for TSO-C77a is dated July 20, 1981.

The latest revision listed above is acceptable for inflight essential APU's; however, many recent essential APU's have been certified which do not meet the requirements of Section 6.16 of the TSO for auto shutdown by overspeed only. With the implementation of two crew cockpit design, the elimination of the flight engineer has resulted in a need to provide self monitoring and auto shutdown under certain conditions which could result in unsafe operation. Essential APU's installed on two crew configured aircraft must provide reliable operation and also a means to avoid unsafe operating conditions. Therefore, the APU self monitoring auto shutdown feature must be evaluated to assure that reliability of the APU is maintained at levels which assure availability of critical functions provided by the essential unit.

(2) Information regarding current FAA policy for APU cockpit displays is provided below.

The requirements for APU flight deck instrumentation have developed into a certification issue for APU installations that use an electronic control unit designed to maintain certain parameters within normal ranges when operated within the approved flight and ground operating envelopes. FAA regulations require adequate APU instrumentation to assure safe operation within the APU's approved limitations.

Certain APU parameters are, by design, monitored by the APU electronic control unit, and in the event a monitored parameter reaches its operating limit, or a fault develops, an automatic APU shutdown is initiated. Depending on the integrated design in the airplane and the automatic protective features of the airplane electrical system, together with the protective features built into the APU control unit, an automatic fault shutdown can have a resulting action essentially the same as the flightcrew would take under the same fault or condition event. This kind of installation may delete the need for certain of the APU flight deck instruments required by part 25 of the Federal Aviation Regulations (14 CFR part 25). In general, however, some kind of APU status (off or operating), along with fire protection status has been found to be required.

If such a system is submitted to the FAA for approval, the FAA can make an equivalent safety finding in accordance with § 21.21(b)(1) where the

compensating features provide the equivalent level of safety as that provided by the installation of the required flight deck instrumentation.

The criteria used previously for making equivalent safety findings relative to APU instruments have largely been dependent on:

- the parameters monitored,
- the automatic protective features of the airplane electrical system,
- the intended use of the APU (i.e. ground only, flight nonessential, or flight essential use with Minimum Equipment List (MEL) dispatch),
- crew compliment,
- APU faults that automatically shut down the APU,
- the fault display in the cockpit, along with the internal monitoring capability of the APU electronic control unit, and
- other safety related operating features.

The equivalency finding must satisfy the basic tenet that the total automatic features and capability must perform the same action as the flight crew under the same normal and non-normal conditions prior to, during, and following APU operation.

As a general rule, each installation should be investigated for its unique features, and operational envelope. However, as noted above, the following minimum features and operating parameters should be investigated:

- Fire.
- Overspeed.
- Electronic Control Unit (ECU) failure.
- Load Compressor Reverse Flow (if a separate load compressor is a feature).
- Overtemperature (Exhaust Gas Temperature (EGT)).
- Low Oil Pressure.
- Variable Inlet Geometry (APU inlet door position).
- High Oil Temperature.
- Loss of Cooling System Capability.
- Loss of D.C. Power.
- Loss of Rotor(s) Speed Signals.
- Self monitoring features that detect and make known to the flight crew failure of the APU control features noted herein..
- Loss of EGT signals.
- Flammable fluid leakage.
- Any features of the APU electrical generation system, the pneumatic bleed system, and the hydraulic system (if installed), that are unique, or interface with the APU ECU should be investigated relative to the

requirement for automatic shutdown to prevent a potential hazard to the airplane and its associated systems.

- Any features of the APU which may be required as part of the Technical Standard Order to which the APU has been evaluated.

This policy is specifically directed only to that requirement for providing appropriate instrumentation, markings, and limitations for APU installation (Reference § 25.901(d)). Other regulations affecting the installation must be complied with over and above the equivalency finding for the APU flight deck instrumentation. Note that an APU installation must comply with the provisions of § 25.1461. Advisory Circular (AC) 20-88A titled "Guidelines on the Marking of Aircraft Powerplant Instruments (Displays)" contains additional FAA policy on powerplant instrument displays.

e. **References.**

(1) Notice of Proposed Rulemaking 75-31 (40 FR 29410, July 11, 1975).

(2) Amendment 25-46 (43 FR 50578, October 30, 1978).

(3) Notice of Proposed Rulemaking 84-21 (49 FR 47358, December 3, 1984).

(4) Amendment 25-72 (55 FR 29756, July 20, 1990).

(5) Advisory Circular 20-88A, "Guidelines on the Marking of Aircraft Powerplant Instruments (Displays)," September 30, 1985.

(6) Advisory Circular 25-8, "Auxiliary Fuel System Installation," May 2, 1986 [Incorporated in total in this Propulsion Mega AC at Section 25.952].

Section 25.1529 Instructions for Continued Airworthiness.

a. **Rule Text.**

The applicant must prepare Instructions for Continued Airworthiness in accordance with Appendix H to this part that are acceptable to the Administrator. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first airplane or issuance of a standard certificate of airworthiness, whichever occurs later.

(Amdt. 25-54, 45 FR 60173, Sept. 11, 1980)

b. **Intent of Rule.** The intent of this rule is to establish the requirement for a maintenance manual with a separate and specific airworthiness limitations section. The airworthiness limitations sections were intended to define the limits of the type certification approval of the specific airplane design characteristics.

c. **Background.**

(1) Notice of Proposed Rulemaking 69-10 (34 FR 5440, March 14, 1969),proposed to add the requirement to provide maintenance manuals for airplanes type certificated under Parts 23 and 25 of the regulations. Section 25.1529, then titled "Maintenance Manuals," required information that the applicant considered essential for proper maintenance be made available to the owner at the time of delivery of the airplane. Numerous items were listed that must be considered in developing the essential information.

Amendment 25-21 (35 FR 303, January 8, 1970) followed Notice 69-10 and adopted the proposal. One issue in the proposal that created concern among commenters to the Notice related to the proposed requirement that the airplane manufacturer make maintenance manuals available to the owner at the time of delivery of the airplane. Most commenters gave wholehearted support to the proposal; however, several stated that manufacturers do make maintenance manuals available and therefore the proposed requirement is unnecessary. The FAA was aware that some manufacturers provide or make available manuals containing maintenance information, however, the FAA was not aware that all manufacturers make all the information considered essential for proper maintenance available at the time of delivery of an airplane. Furthermore, there were no standards prescribing the minimum content, distribution, and time the information must be made available to the person who needs it.

The following excerpt from the preamble to that Amendment provides further clarification.

> Several comments express concern that the issuance of a type certificate for the airplane would be withheld pending the production of the maintenance manual

> and its approval by the FAA. [*FAA's response:*] However, it should be clearly understood that the rule merely requires the manual to be available to the owner at the time of delivery of an airplane and that it need contain only that information which the manufacturer considers essential for proper maintenance. It was not intended that the manufacturer had to supply each of the items listed unless it considers such information essential for proper maintenance. To remove any possible confusion in this regard, proposed §§ 23.1529 and 25.1529 have been revised to make it clear that the manufacturer must consider the listed items in determining the information essential for proper maintenance of his airplane.

(2) Notice of Proposed Rulemaking 75-31(40 FR 29410, July 11, 1975) proposed to revise § 25.1529, including its heading, to read as follows:

> The applicant must prepare Instructions for Continued Airworthiness in accordance with Appendix H to this part that are acceptable to the Administrator.

This proposal would require the preparation of comprehensive maintenance instructions that would be made available, under proposed § 21.50, upon delivery of each aircraft. Under this proposal, the applicant of a type certificate would be required to submit, prior to the issuance of a type certificate, Instructions for Continued Airworthiness that conform in form and content with the standards specified in proposed Appendix H. The applicant would also be required to submit a program for making changes to those instructions.

Likewise, the Notice proposed the addition of "Appendix H - Instructions for Continued Airworthiness." Appendix H would require that an inspection program to provide for the continued airworthiness of the aircraft be included in the Instructions. The Appendix would specify the requirements for the preparation and content of the document material.

The FAA recognized that at the time that the airplane is type certificated, the Instructions for Continued Airworthiness may not be complete. The instructions and the program that would be required by Appendix H for making changes, as they exist at type certification, would be the basis on which the type certificate is issued.

Amendment 25-54 (45 FR 60154, September 11, 1980) followed Notice 75-31 and adopted the proposal. The following excerpts from the preamble to that Amendment provide further clarification of this rule:

> A commenter notes that, although the explanation for § 23.1529 makes it clear that the Instructions for Continued Airworthiness need not be finalized until delivery of the first airplane, the proposal itself seems to require that they be finalized before type certification. The commenter suggests that this point be clarified. The FAA agrees, and §§ 23.1529, 25.1529, 27.1529, 29.1529, 31.82, 33.4, and 35.4, are revised accordingly.
>
> In response to a commenter representing a group of scheduled air carriers, the FAA notes that, except for the Airworthiness Limitations section, there is no requirement that any operator/owner use the Instructions for Continued Airworthiness referred to in §§ 23.1529, 25.1529, 27.1529 and 29.1529. Moreover, the new §§ 43.13(a), 43.16, and 91.163(c) allow the use of other

methods. In particular, the use of maintenance manuals and continuous airworthiness maintenance programs developed under current Parts 121, 123, 127, and 135, or an inspection program approved under current § 91.217(e), would be acceptable alternatives to the Airworthiness Limitations section.

This commenter also suggests that language be added to § 25.1529 to make it clear that alternatives to the Instructions for Continued Airworthiness (except the Airworthiness Limitations section) may be used. This suggestion was not adopted because §§ 43.16 and 91.163(c) make this provision sufficiently clear.

(4) A recent in-depth review of airplane fuel tank systems showed that additional emphasis on the long term maintainability of airplane fuel systems is necessary. The FAA is considering a proposal to amend Appendix H that would require the Airworthiness Limitation Section to include: ". . . *each mandatory replacement time, inspection interval, related inspection procedure and any critical design configuration control limitations approved under § 25.981 for the fuel system."* Although this proposal is still under consideration, applicants should consult their local Aircraft Certification Office regarding any Special Conditions that may be proposed on a specific project prior to adoption of the proposal.

d. **Compliance/Policy Methods.**

(1) Current transport category airplane policy and compliance material for this section has been contained in Appendix H of Part 25, which specifies the general requirements for the preparation of instructions for continued airworthiness as required by §25.1529.

In conjunction with Appendix H and other related regulations, current policy also is reflected in Advisory Circular 25.1529-1, "Instructions for Continued Airworthiness of Structural Repairs on Transport Airplanes," dated August 1, 1991. The intent of AC 25.1529-1, is to ensure that damage tolerant structure will remain damage tolerant after it has been repaired. The AC includes definitions of:

- damage tolerance,
- fail-safe,
- safe-life,
- primary structure,
- principal structural elements, and
- single and multiple load paths.

In addition, the AC provides guidance on:

- the required content of the structural repair manual,
- approval requirements as part of repair documentation,
- substantiation of repairs, and
- the basis for the inspection program.

(2) Advisory Circular (AC) 25-19, "Certification Maintenance Requirements," should be consulted when showing compliance with this rule. That AC provides guidance on the selection, documentation, and control of Certification Maintenance Requirements (CMR). It also provides instructions for coordinating the Maintenance Review Board (MRB) and CMR selection processes in order to minimize the impact of CMR's on airplane operators.

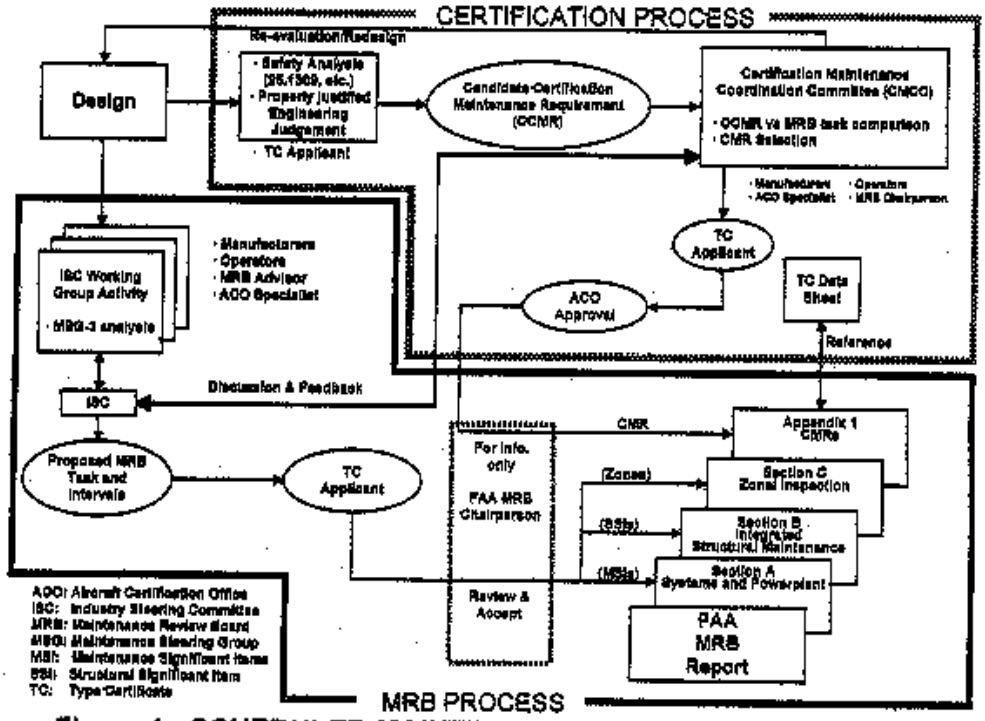

Figure 1: SCHEDULED MAINTENANCE TASK DEVELOPMENT

(3) The following excerpt is from an FAA Policy Memorandum issued October 28, 1993, which presents the policy guidelines to assure uniformity of Time Limited Dispatch (TLD) policy that is applied to engines fitted with Full Authority Digital Engine Control (FADEC) systems. An attachment to this memorandum defines the FAA's Engine and Propeller Directorate policy regarding TLD of engines fitted with FADEC systems.

> The objective of the TLD approach is to preserve suitable FADEC system integrity while minimizing dispatch delays and cancellations caused by the system. The control system may be allowed to continue to operate with faults present, providing the resultant system operation and reliability are adequate, and operating exposure in this less redundant state is appropriately limited. The definition of the dispatchable configurations in terms of the faults and with associated dispatch intervals will be an engine data sheet limit. This becomes a part of the Type Design for the subject engines. A statistical analysis is submitted by the applicant that substantiates the reliability of the proposed configuration with faults for the associated dispatch intervals.
>
> After a series of meetings in 1988 and 1989, the FAA and industry developed guidelines for TLD. Using these guidelines, dispatchable configurations for FADEC systems could be defined by applicants that would meet FAA airworthiness requirements for a dispatch interval. These guidelines were included in an FAA document that came to be known in the industry as Draft 4 dated March 17,1989. Although the document was widely distributed throughout the industry and was informally used by the FAA and applicants as a policy document, it was never issued as the FAA TLD policy.
>
> Recently, requests for changes to Draft 4 guidelines were received from engine, control and aircraft manufacturers. These changes included requests to extend the dispatchable intervals and to simplify the reporting system. These requests were based on the positive correlation between analysis and the in-service experience that has been accumulated on engines on which these TLD guidelines have been applied. This field service experience has been presented to the FAA as data to support the request for changes based on system maturity. The FAA is in agreement with most of the requested changes based upon the supporting data. However, these changes are not appropriate for entry level systems without the requisite field experience and supporting data. Therefore, in order to accommodate the requested changes, the FAA has defined guidelines for entry level systems and mature systems.
>
> In addition, it has become evident to the FAA that several areas of TLD require clarification. Areas in need of clarification include the application of average fault exposure time to maintenance practices and definition of terms.
>
> The attached policy document is a modification of Draft 4 to incorporate changes requested by industry, to clarify a number of areas by providing additional information and to provide a document useful to the FAA and industry that states the Engine and Propeller Directorate policy regarding time limited dispatch of engines fitted with FADEC systems.
>
> Any proposed change to the attached stated policy must be coordinated with ANE-100 prior to any agreement with an applicant.

e. **References.**

Notice of Proposed Rulemaking 69-10 (34 FR 5440, March 14, 1969)

Amendment 25-21 (35 FR 303, January 8, 1970).

Notice of Proposed Rulemaking 75-31 (40 FR 29410, July 11, 1975)

Amendment 25-54 (45 FR 60173, September 11, 1980).

Advisory Circular 25-19, “Certification Maintenance Requirements,” November 28, 1994.

Advisory Circular 25.1309-1A, “System Design and Analysis,” June 21, 1988.

Advisory Circular 25.1529-1,” Instructions for Continued Airworthiness of Structural Repairs on Transport Airplanes,” August 1, 1991.

Advisory Circular 120-17A, “Maintenance Program Management through Reliability Methods,” March 27, 1978.

Advisory Material Joint (AMJ) 25.1309, “System Design and Analysis” [issued by the Joint Aviation Authorities (JAA)].