



U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Airworthiness and Operational
Approval of Cockpit Voice Recorder
Systems

Date: 7/22/16

AC No: 20-186

Initiated by: AFS-300

Change:

1 GENERAL INFORMATION.

1.1 Purpose. This advisory circular (AC) provides guidance for compliance with applicable regulations for the airworthiness and operational approval for required cockpit voice recorder (CVR) systems. Non-required installations may use this guidance when installing a CVR system as a voluntary safety enhancement. This AC is not mandatory and is not a regulation. This AC describes an acceptable means, but not the only means, to comply with Title 14 of the Code of Federal Regulations (14 CFR). However, if you use the means described in this AC, you must conform to it in totality for required installations.

1.2 Audience. We, the Federal Aviation Administration (FAA), wrote this AC for you, the aircraft manufacturers, CVR system manufacturers, aircraft operators, Maintenance Repair and Overhaul (MRO) Organizations and Supplemental Type Certificate (STC) applicants.

1.3 Cancellation. This AC cancels AC 25.1457-1A, Cockpit Voice Recorder Installations, dated November 3, 1969.

1.4 Related 14 CFR Parts. Sections of 14 CFR parts 23, 25, 27, 29, 91, 121, 125, 129, and 135 detail design substantiation and operational approval requirements directly applicable to the CVR system. See Appendix A, Flowcharts, to determine the applicable regulations for your aircraft and type of operation. Listed below are the specific 14 CFR sections applicable to this AC:

- Part 23, § 23.1457, Cockpit Voice Recorders.
 - Part 23, § 23.1529, Instructions for Continued Airworthiness.
 - Part 25, § 25.1457, Cockpit Voice Recorders.
 - Part 25, § 25.1529, Instructions for Continued Airworthiness.
 - Part 27, § 27.1457, Cockpit Voice Recorders.
 - Part 27, § 27.1529, Instructions for Continued Airworthiness.
 - Part 29, § 29.1457, Cockpit Voice Recorders.
 - Part 29, § 29.1529, Instructions for Continued Airworthiness.
-

- Part 91, § 91.609, Flight Data Recorders and Cockpit Voice Recorders.
- Part 91, § 91.1045, Additional Equipment Requirements.
- Part 121, § 121.359, Cockpit Voice Recorders.
- Part 125, § 125.227, Cockpit Voice Recorders.
- Part 129, § 129.24, Cockpit Voice Recorders.
- Part 135, § 135.151, Cockpit Voice Recorders.

- 1.5 Related Guidance.** New models of CVR equipment manufactured after December 19, 2013, must meet the minimum performance standards (MPS) qualification and documentation of European Organization for Civil Aviation Equipment (EUROCAE) document ED-112A, *Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems*. ED-112A sections specific to CVR systems are detailed in Technical Standard Order (TSO) TSO-C123c and this AC.
- 1.6 CVR Purpose.** A CVR system records the aural environment of the cockpit and communications to, from, and between flightcrew members, and in some cases required data link messages to assist investigations of accidents and incidents. The objective is met by complying with the current requirements in parts 23, 25, 27, 29, 91, 121, 125, 129, and 135.
- 1.7 Obsolete Technology.** We are phasing out magnetic tapes through mandates and voluntary efforts and replacing them with modern solid-state recorders. These new recorders not only enhance safety but also benefit you directly, as they avoid the high costs and technical problems of maintaining outdated recorders. Modern recorders do not require the hourly replacement of tapes and calendar weighing of thermal capsules. Also, existing tape recorders no longer meet the most recent FAA TSO minimum performance standards.
- 1.8 Applicants.** The term “applicant” in this AC is intended to describe type certificate (TC), amended TC or Supplemental Type Certificate (STC) applicants seeking approval of a required CVR system.
- 1.9 Operators.** This AC uses the term “operator” to mean pilot in command (PIC), renter-pilot, operating certificate holder, or air carrier certificate holder. An operator may use an aircraft that complies with CVR requirements of the appropriate part (part 91, 121, 125, 129, or 135). We have developed a series of flowcharts in Appendix A to assist in determining equipment requirements dependent on the applicable operating and aircraft certification rules. When using the charts in Appendix A, you should understand the initial certificate of airworthiness (IC of A) date also includes post-delivery equipment installations including data link communication (DLC) system.

Note: DLC system is defined as the components installed on the aircraft that are necessary to provide the DLC function. The DLC function uses an approved message set, as determined by the current edition of AC 20-160 (e.g., CPDLC application hosted in the Flight Management Computer), the datalink router (e.g.,

hosted in the Communications Management Unit), the radios (e.g., VHF, HF Datalink, Satcom), and related antennas. FANS 1/A and ATN B1 systems comprise DLC equipment. Refer to the current edition of AC 20-140 for additional information.

2 TYPE CERTIFICATION.

2.1 Purpose of This Section. This section provides information for type certification of a CVR system. The applicant must obtain FAA approval to install or retrofit a CVR and components. The applicant may apply for a TC, amended TC, STC, or other manner of approval, and the applicant must demonstrate compliance with the applicable regulations included in the type certification basis for the aircraft. Applicant may use Appendix A as an aid to determine CVR certification requirements based on the applicable operating rules. An applicant must demonstrate compliance with the appropriate certification requirements, as instructed by the approving Aircraft Certification Office (ACO) or Flight Standards District Office (FSDO).

2.2 CVR Substantiating Data. The CVR system description must include:

1. The make and model or part number of the CVR or combined CVR/flight data recorder (FDR);
2. A listing of each channel recorded and its duration;
3. A list of additional information recorded (image and data link);
4. Identification of power source or sources;
5. Description of independent power source;
6. Identification of components of the CVR system that meet TSO standards, including the TSO number and any authorized deviations from the TSO requirements;
7. Description of the bulk erasure function;
8. Method of compliance with the requirement for an underwater locating device (ULD) when required by operating rules;
9. Description of structural alterations associated with the installation;
10. A wiring diagram and system schematic that describes all dedicated wires and identifies all interfaces to other installed equipment and systems, including cockpit area microphones, summation amplifiers and control unit;
11. Description of design for automatic switching to area microphone in the event of primary power source loss;
12. Method of retrieval and reading recorded communication;
13. Any special procedures related to an aircraft storage program where the CVR/ULD remains installed in the aircraft during storage;

14. Instructions for continued airworthiness (ICA);
15. Physical location of the CVR installation;

Note: You must locate and mount CVRs to minimize the probability of container rupture from crash impact and subsequent fire damage to the recorder. Where duplicate recording systems are installed, such as with two combination CVR/FDR systems, you may install the second system as close as practicable to the cockpit.

16. Description of the start and stop logic; and
17. Description of the means to synchronize the CVR recording with other flight recorder recordings (e.g., microphone keying).

2.3 Intended Function. The CVR system must be designed to perform its intended function, as required by §§ 23.1301, 25.1301, 27.1301, and 29.1301.

2.3.1 Continuous Operation. The CVR system must operate continuously from the use of the checklist before the flight to completion of the flight to the final checklist at the end of flight. The CVR system must retain recorded communication for the minimum time required by operational rules.

2.3.2 Communication Sources. The CVR must record the following communication sources, as specified by the applicable operating part:

1. Voice communication to and from the aircraft's radio systems;
2. Voice communication of flightcrew members on the flight deck to include hand microphone, boom microphone, and oxygen mask microphone;
3. Flight deck voice communications by installing a cockpit-mounted area microphone located in the best position to record voice communications originating at the first and second pilot stations, and voice communications of additional flight deck crew members;
4. Voice communication of flightcrew members using the interphone system;
5. Voice or audio signals from navigation or approach aids received in the headsets or speakers;
6. Required DLC as the output signal from the communication unit that translates the signal to useable data when data link is installed;
7. Voice communication of flightcrew members using the passenger address system, if installed; and
8. Audio warnings or alerts from the avionics systems, including but not limited to radio altimeter, altitude alerter, terrain awareness and warning system, traffic collision avoidance system, autopilot, master caution.

2.3.2.1 Fixed-wing CVR systems must record the following sources on separate dedicated channels:

- First pilot station audio;
- Second pilot station audio;
- Cockpit area microphone; and
- Passenger loudspeaker system and any third and fourth crewmember stations audio.

2.3.2.2 Rotorcraft CVR systems must record the following sources on separate dedicated channels:

- First pilot station audio;
- Second pilot station audio;
- Cockpit area microphone or the continually energized or voice-actuated lip microphone at the first and second pilot stations; and
- Third and fourth crewmember stations, if applicable, and/or each microphone on the flight deck used with the passenger loudspeaker system.

2.3.3 Aircraft Installed Performance. The applicant must install the CVR system per EUROCAE Document (ED) ED-112A, “Minimum Operational Performance Specification For Crash Protected Airborne Recorder Systems,” dated September 2013, Chapters 2-5 and I-6.

2.4 **Demonstrate Performance.** The applicant must demonstrate the CVR system performs as intended per ED-112A Chapters 2-5 and I-6. Use ED-112A Annex I-A for postflight evaluation of the flight test recordings.

Note: Using the flight test data, you must confirm the CVR begins to operate no later than the start of the preflight checklist and continues to operate until completion of the final postflight checklist.

2.5 **Equipment.** The applicant must present evidence that the equipment is FAA-approved using the following TSOs:

- TSO-C121b, Underwater Locating Devices (Acoustic) (Self-Powered). A ULD manufactured under TSO-C121b, or later revision, is FAA-approved.
- TSO-C123c, Cockpit Voice Recorder Equipment. A CVR meeting the requirements of TSO-C123c, or later revision, is FAA-approved.
- TSO-C124c, Flight Data Recorder Equipment. If applicable, an FDR meeting the requirements of TSO-C124c, or later revision, is FAA-approved.

- TSO-C155a, Recorder Independent Power Supply. If applicable, a Recorder Independent Power Supply (RIPS) manufactured under TSO-C155a, or later revision, is FAA-approved.
- TSO-C177a, Data Link Recorder Equipment. If applicable, data link recorder (DLR) equipment manufactured under TSO-C177a, or later revision, is FAA-approved.

2.6 Combined CVR/FDR Systems. You may install a combined CVR/FDR system.

2.6.1 Airplane Requirements. Airplanes which require two separate recorders; a single combination CVR/FDR may not serve as both the required CVR and the required FDR. You may use a combination FDR and CVR system for either the required FDR or CVR. You may install two combination FDR and CVR units in the airplane, with one unit designated as the CVR to support the independent power source requirement, which may be located close to the cockpit.

2.6.2 Rotorcraft Requirements. On rotorcraft, one combination FDR and CVR unit may be installed to meet the requirement for an FDR and a CVR. Applicants must install the combination FDR and CVR unit such that no single electrical failure external to the recorder can disable both the CVR and the FDR functions.

2.7 DLR. A DLR must comply with §§ 23.1457(a)(6), 25.1457(a)(6), 27.1457(a)(6), 29.1457(a)(6), 91.609(j), 121.359(k), 125.227(i), 129.24, and 135.151(h). In applying these regulations, aircraft are divided into two groups: those manufactured on or after the effective date of the rule, and those manufactured before that date.

1. Those airplanes or rotorcraft manufactured on or after the effective date must record messages that use the approved message set when both of the following conditions are met:
 - The aircraft is required to have both a CVR and an FDR; and
 - The aircraft has DLC equipment installed.
2. Those airplanes or rotorcraft manufactured before the effective date of the rule must record messages that use the approved message set when both of the following conditions are met:
 - The aircraft is required to have both a CVR and an FDR; and
 - No DLC equipment for the make, model, and series (M/M/S) of the aircraft was approved before the effective date of the rule.

2.7.1 Software Requirements. A DLR may be a standalone line replaceable unit (LRU), a function in a CVR, or combination CVR/FDR. If the CVR includes software, you must develop the software according to RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, dated December 1, 1992, to at least the software level consistent with the failure condition classification defined in TSO-C123c. While TSO-C123c requires compliance with RTCA/DO-178B, the FAA published AC 20-115C, Airborne Software Assurance, on July 19, 2013, encouraging applicants to

use RTCA/DO-178C, Software Considerations in Airborne Systems and Equipment Certification, dated December 13, 2011.

- 2.7.2 Recording Requirements.** Data link recordings must be retrievable in a readable format that includes date and time stamp.
- 2.8 Weight and Balance (W&B).** Installation or removal of equipment affects the aircraft W&B. A report must show the net change in weight and moment (or arm and moment) and how the net change was determined. If the installation results in changes to the W&B procedures in the flight manual, you must submit a flight manual supplement to the ACO for approval, and must adjust aircraft records to show such change.
- 2.9 Electrical Load Analysis (ELA).** Installation or removal of equipment affects the electrical load to the aircraft power distribution system. A report must show the net change in the electrical load on each affected bus and how you computed this net change. The net change to the load carrying capability of the essential bus must not result in interruption or otherwise adversely affect power distributed to other loads on that bus. Refer to §§ 23.1351, 25.1351, 27.1351, and 29.1351.
- 2.10 Electrical Power Sources.** The CVR must receive its operating electrical power from the bus that allows maximum reliability for the CVR system. The CVR should be added to an essential or emergency bus unless the electrical load does not allow it.
- 2.10.1 Connection to Power Source.** You should connect the CVR and FDR to power buses that are separate and supplied by independent power sources. If the applicant can't add the CVR system to the emergency or essential bus, the applicant should provide two separate and independent sources of electrical power for the CVR and FDR.
- 2.10.2 Power Sources.** Separate aircraft power sources are not required for installation of a single combination FDR/CVR system. If more than one electrical power input is available on the combination FDR/CVR units, then connection with a separate and independent electrical power bus is recommended.
- 2.10.3 Independent Power Source.** Depending on the intended operation, see Appendix A for applicability. One CVR or combined CVR/FDR must have an independent power source that provides 10 ± 1 minutes of electrical power to operate both the CVR and the cockpit-mounted area microphone. If an RIPS is used to meet this requirement, then the RIPS must be located as close as practicable to the CVR.
- 2.11 Circuit Protection Devices.** Circuit protection devices must handle anticipated loads for the CVR system. Refer to §§ 23.1357, 25.1357, 27.1357, and 29.1357, as appropriate. The circuit breaker (CB) rating, location, and name of CB label should be identified in the ICA and Airplane Flight Manual (AFM) or Rotorcraft Flight Manual (RFM) and supplements.
- 2.12 Preflight Monitoring.** The installation must have an aural or visual means to check the recorder for proper operation.

- 2.13 Flight Manual Applicability.** You must review the AFM or RFM and supplements to determine whether they are compatible with the CVR system installation. You must provide an approved AFM or RFM Supplement to eliminate incompatibilities.
- 2.14 ICAs.** You must provide ICAs as part of the substantiating data. Under the requirements of §§ 23.1529, 25.1529, 25.1729, 26.11, 27.1529, or 29.1529, and the latest FAA published ICA guidance, these instructions must be included as a minimum and be provided to the operator or maintainer. Details are immediately below and in section 3.
- 2.14.1 Operational Check.** The flightcrew must perform operational checks before the first flight of the day. The extent of this check is reliant on the system failure analysis conducted at initial application. System failure analysis must take into consideration all failure modes and effects. This requirement is satisfied if the applicant can demonstrate built-in test equipment (BITE) that can notify the flightcrew of a CVR LRU failure. BITE checks are limited to the CVR LRU and do not detect failures of other CVR system components (e.g., CAM). These BITE check limitations must be noted in the ICA and AFM or RFM and supplements.
- 2.14.2 System Functional Check.** The applicant must develop system functional checks that verify entire CVR system performance that may be part of a scheduled task, and must include:
1. Audio Quality. Verify the audio quality of all required input channels.
 2. Duration. Verify the CVR recording duration meets the intended recording duration.
 3. Self-Tests. Confirm that the CVR LRU BITE checks hidden functions related to fault notification.
 4. Secondary Power. Ensure secondary or independent power sources perform as intended, including any automatic switching function.
 5. Data Link. If installed, DLRs should be downloaded and the messages converted to a text-based format for legibility.
- 2.15 Removal and Replacement.** The applicant must provide removal and replacement instructions for CVR system equipment and dedicated sensors, and must include instructions for conducting a functional check of the equipment.
- 2.16 Data Retrieval.** The applicant must include instructions to retrieve data from the CVR to facilitate post-accident/ incident investigations.
- 2.17 ULD Installation and Maintenance.**
- 2.17.1 CVR Attachment Hardware.** The ULD to CVR attachment hardware must be designed to minimize the possibility of the ULD separating from the CVR during crash impact. Refer to the current versions of TSO-C123 and ED 112, Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems, for more information on ULD attachment hardware test requirements.

2.17.2 ULD Battery Maintenance. Provide instructions for periodically replacing the ULD battery, conducting operational checks, and cleaning of the ULD. The battery replacement period must be consistent with the battery manufacturer's life limit.

Note: If the ULD battery is not accessible, the instructions must be for replacement of the ULD itself.

Note: Perform the ULD operational checks with test equipment model numbers specified by the ULD manufacturer.

2.18 Installation Design. You may design the installation to accommodate CVR system equipment of different part numbers or of different models and part numbers. Since we accept these CVR systems, you may select either CVR for installation. In this case, the installer must provide a list identifying the interchangeable items of equipment by make, model, and part number.

2.19 Electrical Wiring Interconnection System (EWIS). For installation on certain part 25 aircraft of a CVR system requiring alteration or modification of EWIS components, you must assess whether EWIS ICA is required as part of the substantiating data. Under the requirements of 14 CFR part 26, § 26.11 and § 25.1729, you must provide these instructions, if required, to the operator or maintainer. As a minimum, they must include the procedures and intervals to inspect and maintain additional or modified EWIS components pertaining to the installation of the CVR system.

3 CONTINUED AIRWORTHINESS REQUIREMENTS.

3.1 Purpose of This Section. This section provides information for developing continued airworthiness requirements of a CVR system to ensure retention of intelligible recordings. During the certification process a comprehensive system analysis must be conducted to identify functions, if defective, would not be readily apparent to flightcrews and maintenance personnel. Applicants must provide the basic requirements for continued airworthiness of a CVR system as part of the data package submitted during TC, amended TC, or STC approval.

3.2 Continuous Airworthiness. A typical maintenance program must include all the checks necessary at specified intervals to ensure the CVR system operates as certified. The aircraft manufacturer or system designer/installer must provide the basic maintenance program recommendations. However, factors such as aircraft age, system design, and aircraft operation must be taken into account when developing the maintenance program. The following are typical parts found in a CVR system maintenance program:

3.2.1 Operational Check. The operational check typically verifies that there are no CVR system fault indications. You may use a comprehensive self-test and automatic fault reporting in lieu of a scheduled operational check.

3.2.2 System Functional Check. This check includes but is not limited to verification of intelligible audio recordings from all sources, backup power performance, automatic termination and fault indication operation.

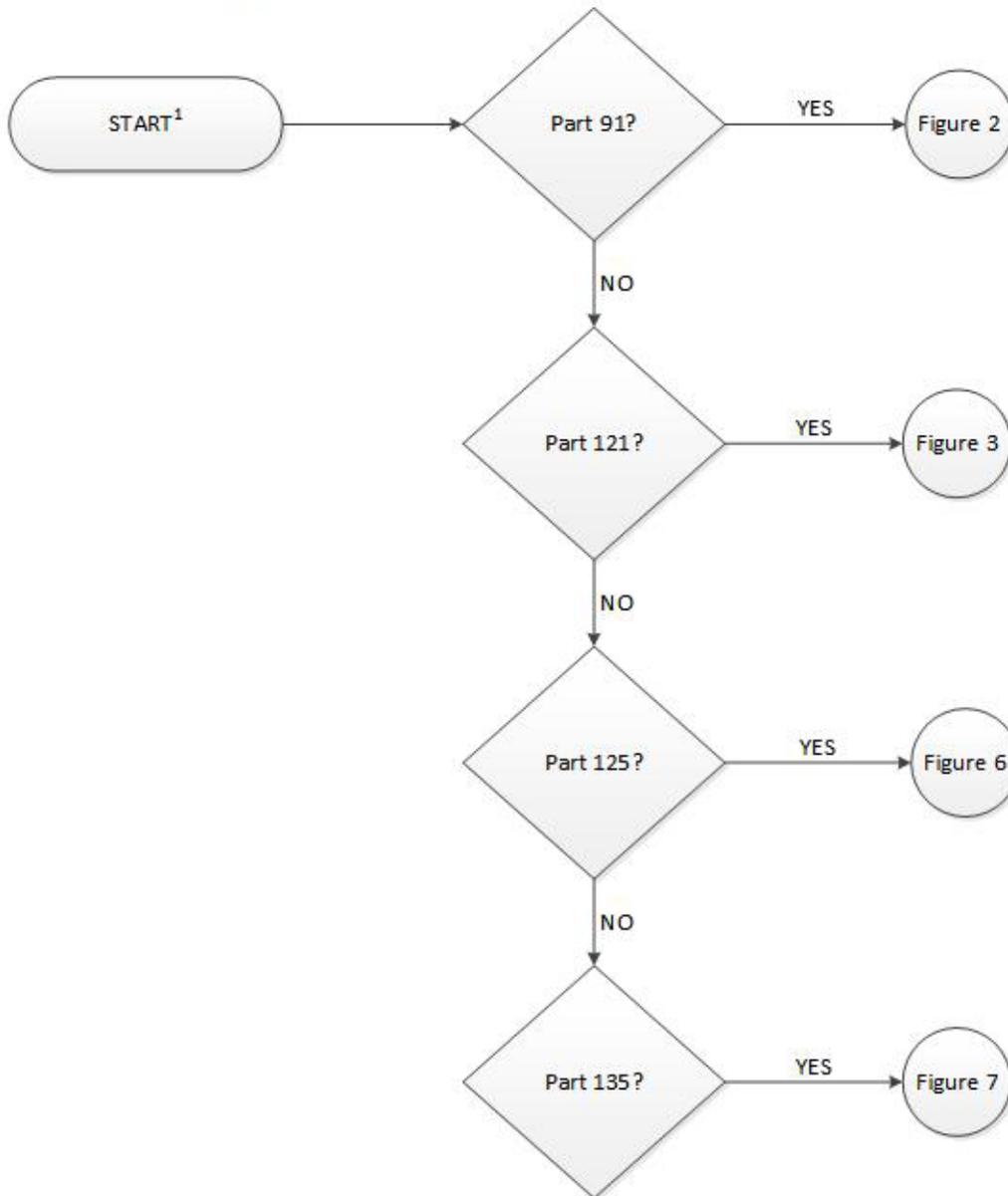
- 3.2.3 Discard Tasks.** You must periodically replace the ULD battery or the ULD itself. Historically, ULD batteries are non-rechargeable and the applicant must discard the batteries using local procedures.
- 3.2.4 Retention of Data.** Maintenance and operational programs must address retention of voice and data link recordings following an accident or occurrence. This could be accomplished by inclusion in flightcrew checklists or company standard operating/emergency procedures and simply removing recorder power. Following an accident or occurrence requiring immediate notification of the National Transportation Safety Board (NTSB), recorded information must be retained for a minimum of 60 days or, if requested by the Administrator of the Board, for a longer period.
- 3.3 Configuration Control.** A CVR recording medium is not interchanged between aircraft without close supervision. Operators' programs should include a requirement to erase stored data before installing a serviceable and previously used unit. This should be included in any post-installation functional check.
- 3.4 ICAs.** You must either follow the applicant's provided ICAs as part of your maintenance program or develop your own. The ICA must identify all requirements that would have been established at certification and any others subsequently identified by the FAA, such as those applicable under an Airworthiness Directive (AD).
- 3.5 Storage.** While most CVRs and ULDs are shipped and stored using manufacturer instructions, you should consider the CVR and the ULD, if attached, in your aircraft storage program. Some ULD batteries may require special temperature control if placed in extended storage while installed on the aircraft.

A handwritten signature in black ink, appearing to read "John Barbagallo". The signature is stylized with a large initial "J" and "B" and a cursive "Barbagallo".

John Barbagallo
Deputy Director, Flight Standards Service

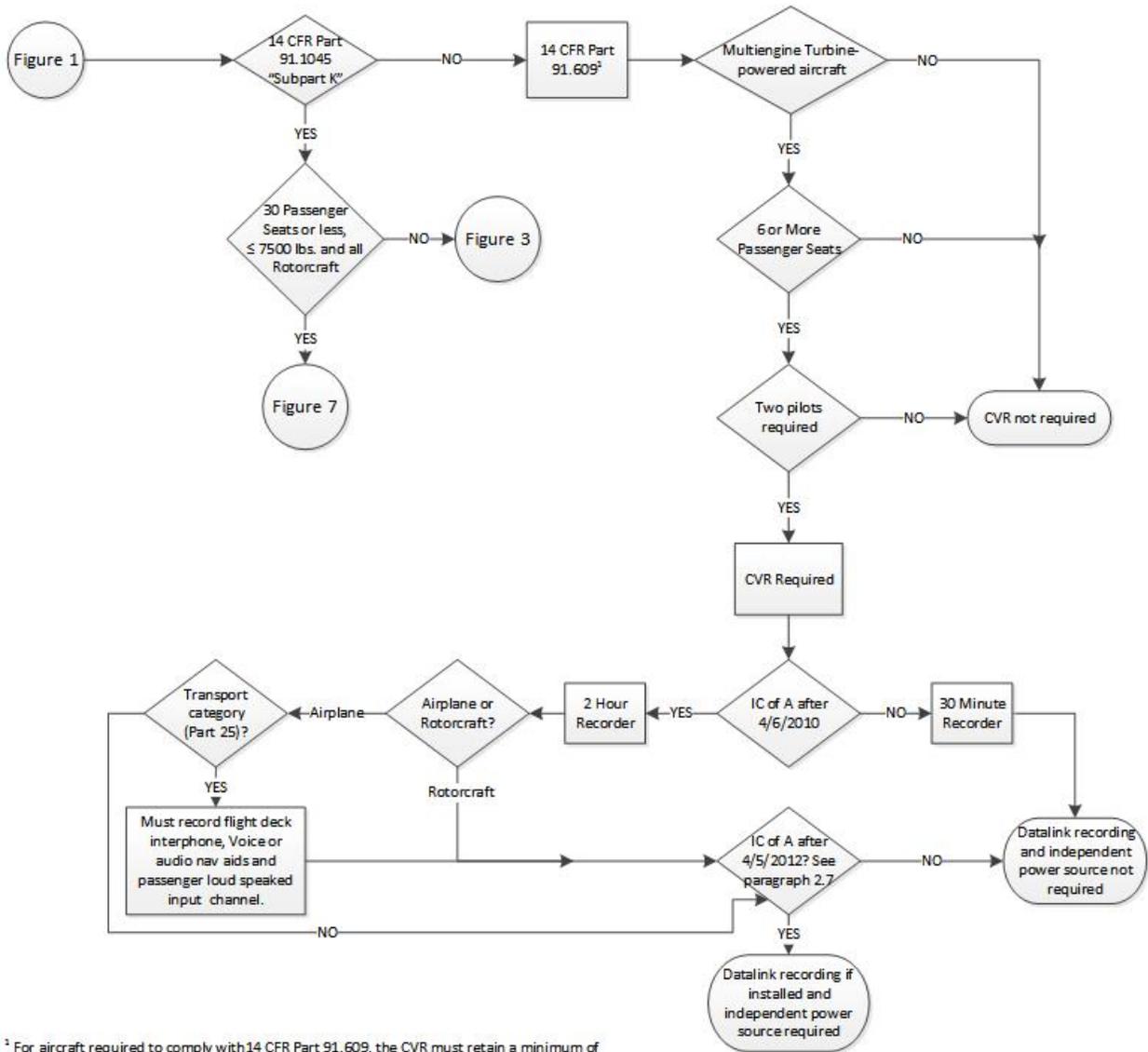
APPENDIX A. FLOWCHARTS

Figure 1. Aircraft Groupings



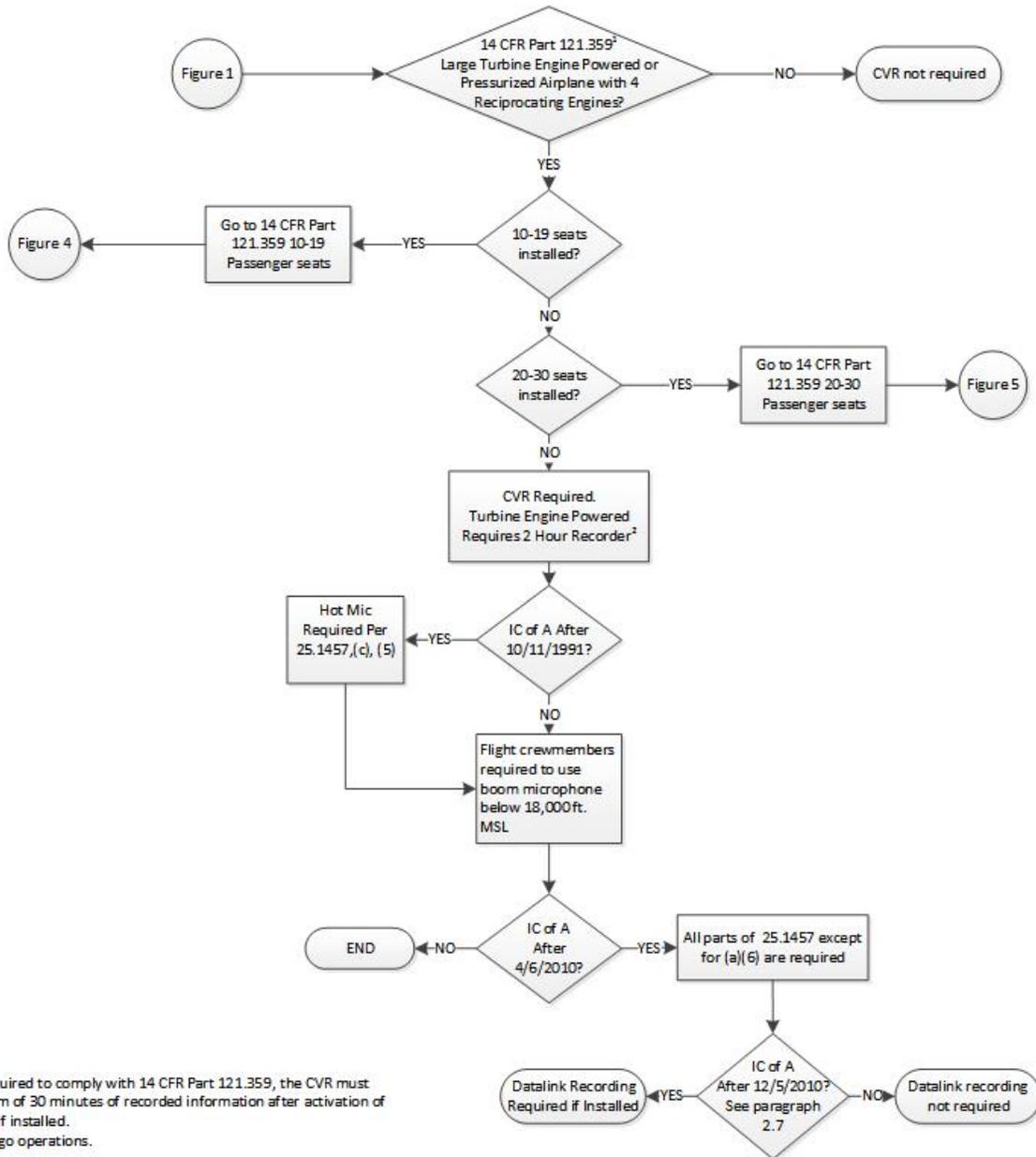
¹ For Part 129 operators of U.S. registered aircraft, solely outside the United States the cockpit voice recorder must record the information that would be required if the aircraft were operated under Part 121, 125 or 135 of this chapter and must be installed by the compliance times required by that part as applicable to the aircraft.

Figure 2. Part 91



² For aircraft required to comply with 14 CFR Part 91.609, the CVR must retain a minimum of 15 minutes of recorded information after activation of erasure feature, if installed.

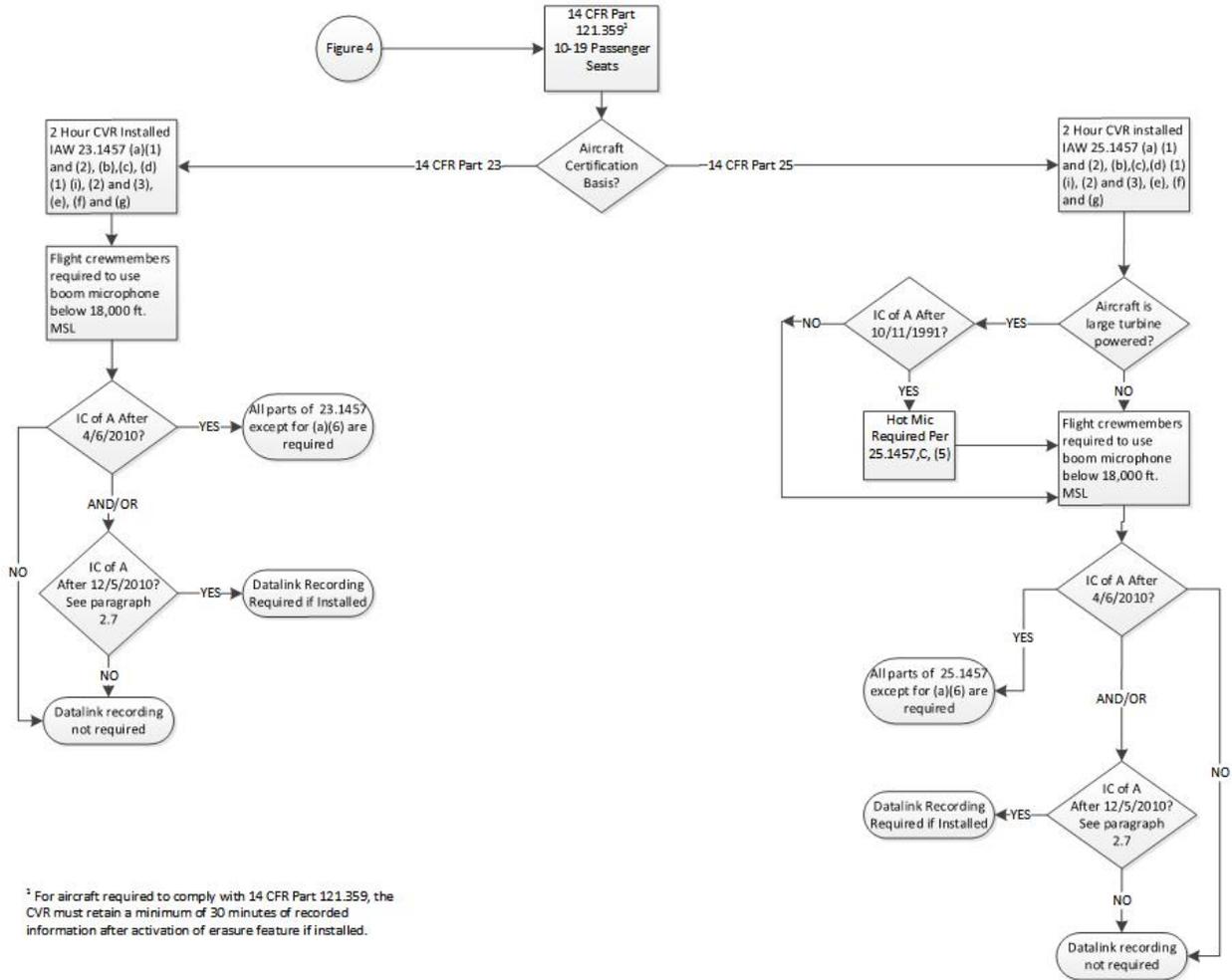
Figure 3. Part 121



¹ For aircraft required to comply with 14 CFR Part 121.359, the CVR must retain a minimum of 30 minutes of recorded information after activation of erasure feature if installed.

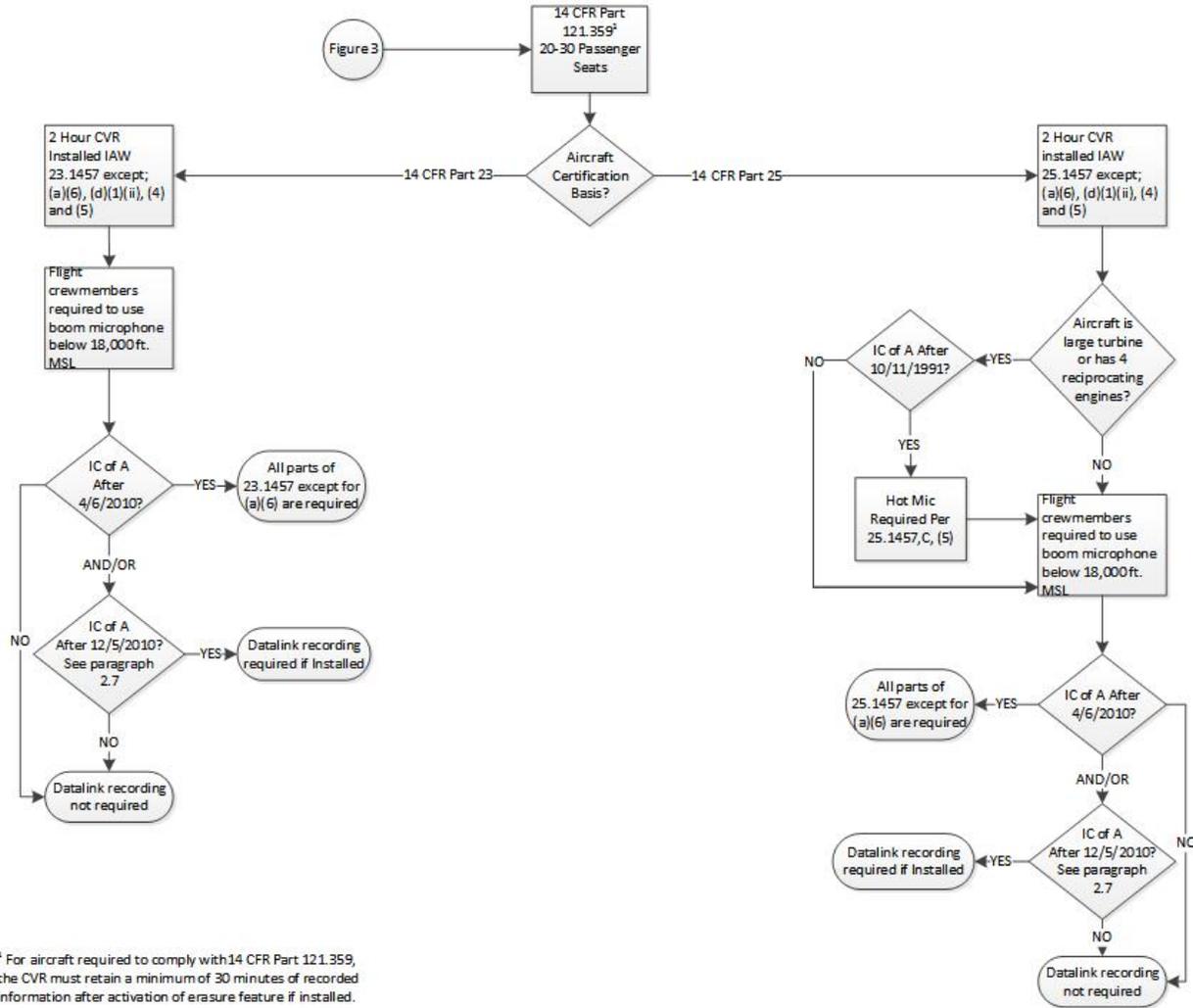
² Includes all cargo operations.

Figure 4. Part 121, 10-19 Passenger Seats



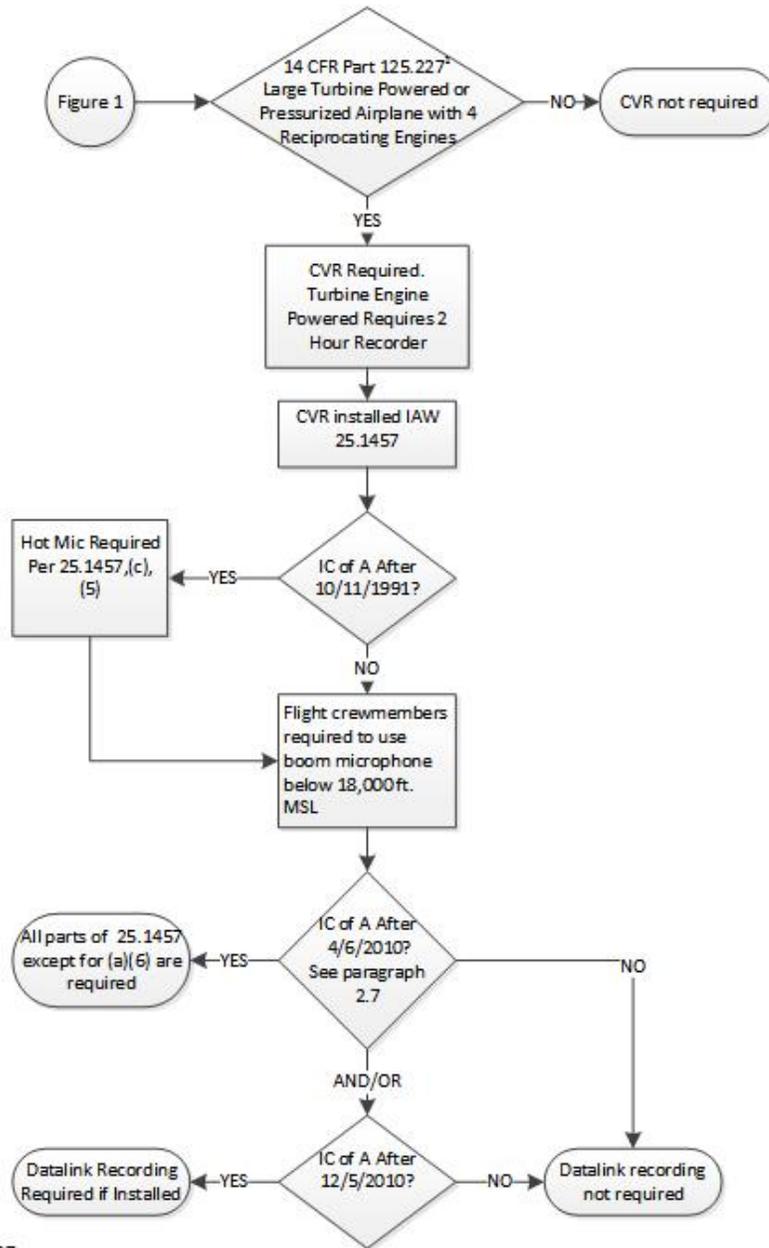
² For aircraft required to comply with 14 CFR Part 121.359, the CVR must retain a minimum of 30 minutes of recorded information after activation of erasure feature if installed.

Figure 5. Part 121, 21-30 Passenger Seats



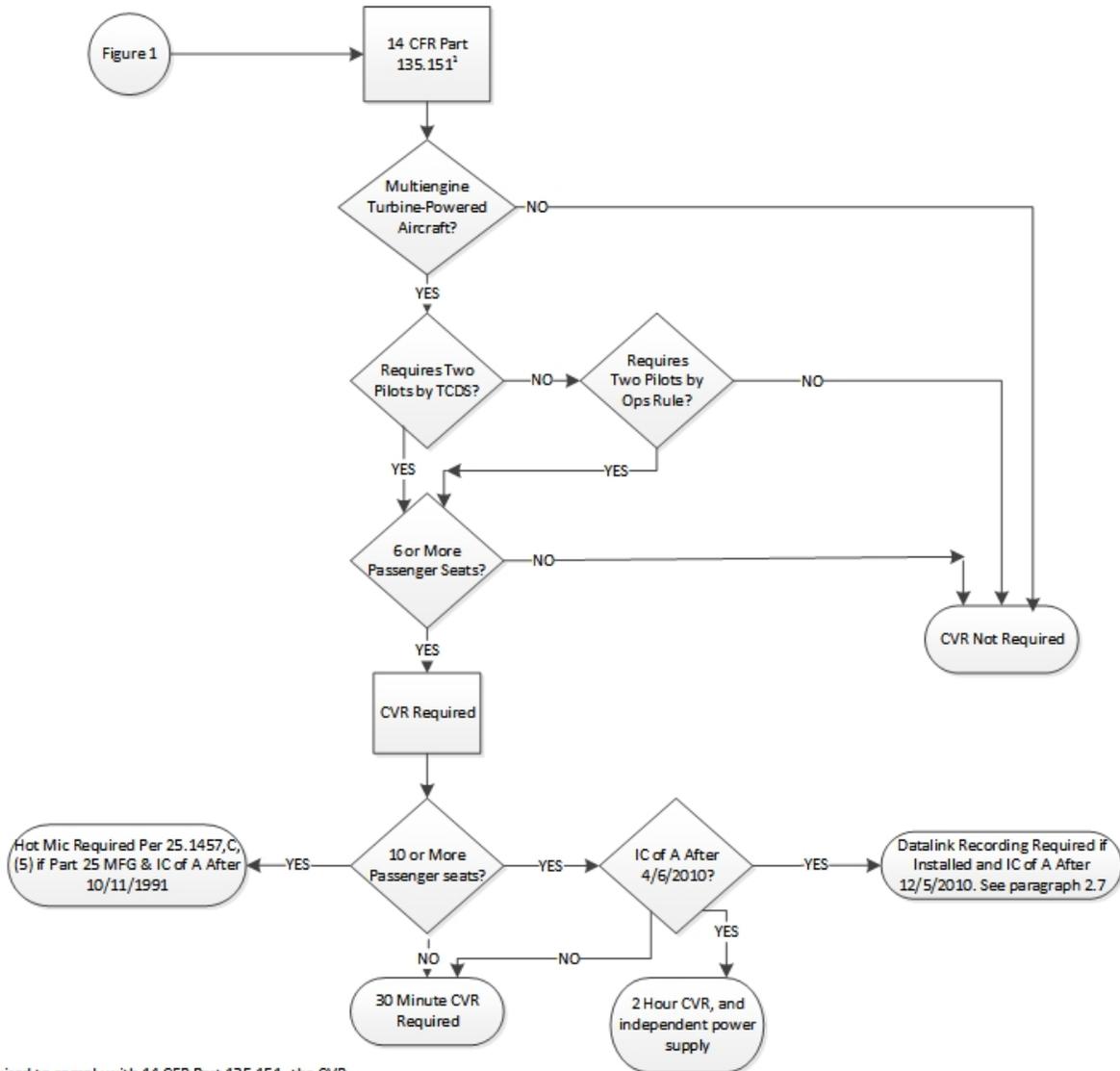
² For aircraft required to comply with 14 CFR Part 121.359, the CVR must retain a minimum of 30 minutes of recorded information after activation of erasure feature if installed.

Figure 6. Part 125



² For aircraft required to comply with 14 CFR Part 125.227, the CVR must retain a minimum of 30 minutes of recorded information after activation of erasure feature if installed.

Figure 7. Part 135



¹ For aircraft required to comply with 14 CFR Part 135.151, the CVR must retain a minimum of 15 minutes for 19 or less passenger seats or 30 minutes for 20 or more passenger seats of recorded information after activation of erasure feature if installed.

Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting Aircraft Maintenance Division (AFS-300) at 9-AWA-AFS-300-Division-Directives@faa.gov or the Flight Standards Directives Management Officer.

Subject: AC 20-186, Airworthiness and Operational Approval of Cockpit Voice Recording Systems

Date: _____

Please check 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.

Submitted by: _____

Date: _____