available to him when seated at his station, and this is designed and installed so that it (see AMC 25.1447(c)(2)) –

(i) Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand within 5 seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties; and

(ii) Allows, while in place, the performance of normal communication functions.

(3) There must be sufficient outlets and units of dispensing equipment of a type similar to that required by sub-paragraph (c)(1) of this paragraph in all other areas that may be occupied by passengers or crew members during flight. (See AMC 25.1447 (c)(3))

(4) Portable oxygen equipment must be immediately available for each cabin crew member. The portable oxygen equipment must have the oxygen dispensing unit connected to the portable oxygen supply. (See AMC 25.1447(c)(4).)

[Amdt 25/12]
[Amdt 25/13]
[Amdt 25/18]
[Amdt 25/19]

AMC 25.1447(c) Equipment standards for oxygen dispensing units

ED Decision 2003/2/RM

Where Operational Regulations do not require all passengers to be provided with oxygen, (c)(3) and (c)(4) may not apply.

AMC 25.1447(c)(1) Equipment standards for oxygen-dispensing units

ED Decision 2017/015/R

1 When oxygen masks are presented, oxygen should be supplied to the mask but without flow.

2 Oxygen flow from the mask should be initiated automatically on pulling the mask to the face.

3 Facilities for manual presentation by a crewmember should be provided on each dispensing unit.

4 Indication of the operation of the automatic presentation system should be provided at the appropriate flight-crew station.

5 The design of the automatic presentation system should take into account that when the landing field altitude is less than 610 m (2000 feet) below the normal preset automatic presentation altitude, the automatic presentation altitude may be reset to landing field altitude plus 610 m (2000 feet).

6 A supplemental oxygen supply should be provided for each passenger lying on a bed or a seat that can be converted into a bed. Except for cases where the occupant's head location during sleeping is obvious, a placard indicating the correct sleeping position should be installed, unless the passenger oxygen system is designed to account for any sleeping position.

7 Sufficient illumination should be provided at all times or automatically when necessary (i.e. without the need of a crew action and without delay) at each location where supplemental oxygen is provided so that in the event of oxygen mask presentation, the user has sufficient visibility to enable quick donning.

[Amdt 25/19]

AMC 25.1447(c)(2) Equipment standards for oxygen dispensing units

ED Decision 2003/2/RM

Unless it is required that the pilot at the control is wearing his mask and breathing oxygen while the altitude exceeds 7620 m (25 000 feet), the design of the flight-crew masks and their stowages should be such that each mask can be placed in position and put into operation in not more than five seconds, one hand only being used, and will thereafter remain in position, both hands being free.

AMC 25.1447(c)(3) Equipment standards for oxygen-dispensing units

ED Decision 2017/015/R

It is acceptable that oxygen outlets/units of dispensing equipment are not provided within an area where people are likely to congregate (for instance a waiting area for lavatory facilities, a bar/lounge area etc.), provided the applicant demonstrates that sufficient oxygen-dispensing outlets are within five feet or five seconds reach of the area and that no visual obstruction exists between the potential oxygen users and the outlets, such as curtains or partitions, unless another method of indication (e.g. an 'oxygen in use' light) is provided in the area.

There should be at least two outlets and units of dispensing equipment in toilets, washrooms, galley work areas etc. In such areas where occupancy of more than two persons can be expected, the number of outlets (within the area or within five feet or five seconds reach) should be consistent with the expected maximum occupancy.

In the case of a shower, there should be an oxygen outlet and unit of dispensing equipment immediately available to each shower occupant without stepping outside the shower. Reaching through an opened shower cubicle door is acceptable, in which case the door should be sufficiently transparent so that the location of the mask and the required actions to access it are immediately obvious.

[Amdt 25/13]
[Amdt 25/15]
[Amdt 25/19]

AMC 25.1447(c)(4) Equipment standards for oxygen dispensing units

ED Decision 2003/2/RM

1 The equipment should be so located as to be within reach of the cabin crewmembers while seated and restrained at their seat stations.

2 The mask/hose assembly should be already connected to the supply source, and oxygen should be delivered with no action being required except turning it on and donning the mask.

3 Where a cabin crewmember's work area is not within easy reach of the equipment provided at his seat station, an additional unit should be provided at the work area.

CS 25.1449 Means for determining use of oxygen

ED Decision 2003/2/RM

There must be a means to allow the crew to determine whether oxygen is being delivered to the dispensing equipment.

CS 25.1450 Chemical oxygen generators

ED Decision 2015/019/R

(a) For the purpose of this paragraph, a chemical oxygen generator is defined as a device, which produces oxygen, by chemical reaction.

(b) Each chemical oxygen generator must be designed and installed in accordance with the following requirements:

(1) Surface temperature developed by the generator during operation may not create a hazard to the aeroplane or to its occupants.

(2) Means must be provided to relieve any internal pressure that may be hazardous.

(3) Comply with CS 25.795(d).

(c) In addition to meeting the requirements in sub-paragraph (b) of this paragraph, each portable chemical oxygen generator that is capable of sustained operation by successive replacement of a generator element must be placarded to show –

(1) The rate of oxygen flow, in litres per minute;

(2) The duration of oxygen flow, in minutes, for the replaceable generator element; and

(3) A warning that the replaceable generator element may be hot, unless the element construction is such that the surface temperature cannot exceed 37.8°C (100°F).

[Amdt 25/17]

CS 25.1453 Protection of oxygen equipment from rupture

ED Decision 2007/020/R

(a) Each element of the system, excluding chemical oxygen generators, must have sufficient strength to withstand the maximum working pressures and temperatures in combination with any externally applied load, arising from consideration of limit structural loads that may be acting on that part of the system in service.

(1) The maximum working pressure must include the maximum normal operating pressure, the transient and surge pressures, tolerances of any pressure limiting means and possible pressure variations in the normal operating modes. Transient or surge pressures need not be considered except where these exceed the maximum normal operating pressure multiplied by 1·10.

(2) Account must be taken of the effects of temperature up to the maximum anticipated temperature to which the system may be subjected.

(3) Strength demonstration using proof pressure and burst pressure coefficients specified in Table 1 is acceptable, unless higher stresses result when elements are subjected to combined pressure, temperature and structural loads.

(i) The proof and burst factors in Table 1 must be applied to maximum working pressure obtained from sub-paragraph (a)(1) with consideration given to the temperature of sub-paragraph (a)(2).

(ii) Proof pressure must be held for a minimum of 2 minutes and must not cause any leakage or permanent distortion.

(iii) Burst pressure must be held for a minimum of 1 minute and must not cause rupture but some distortion is allowed.

TABLE 1

Systems Element	Proof Factor	Burst Factor
Cylinders (i.e. pressure vessels)	1·5	2·0
Flexible hoses	2·0	4·0
Pipes and couplings	1·5	3·0
Other components	1·5	2·0

(b) Oxygen pressure sources and tubing lines between the sources and shut-off means must be –

(1) Protected from unsafe temperatures; and

(2) Located where the probability and hazard of rupture in a crash landing are minimised.

(c) Parts of the system subjected to high oxygen pressure must be kept to a minimum and must be remote from occupied compartments to the extent practicable. Where such parts are installed within occupied compartments they must be protected from accidental damage.

(d) Each pressure source (e.g. tanks or cylinders) must be provided with a protective device (e.g. rupture disc). Such devices must prevent the pressure from exceeding the maximum working pressure multiplied by 1·5.

(e) Pressure limiting devices (e.g. relief valves), provided to protect parts of the system from excessive pressure, must prevent the pressures from exceeding the applicable maximum working pressure multiplied by 1·33 in the event of malfunction of the normal pressure controlling means (e.g. pressure reducing valve).

(f) The discharge from each protective device and pressure limiting device must be vented overboard in such a manner as to preclude blockage by ice or contamination, unless it can be shown that no hazard exists by its discharge within the compartment in which it is installed. In assessing whether such hazard exists consideration must be given to the quantity and discharge rate of the oxygen released, the volume of the compartment into which it is discharging, the rate of ventilation within the compartment and the fire risk due to the installation of any potentially flammable fluid systems within the compartment.

[Amdt 25/4]

CS 25.1455 Draining of fluids subject to freezing

ED Decision 2003/2/RM

If fluids subject to freezing may be drained overboard in flight or during ground operation, the drains must be designed and located to prevent the formation of hazardous quantities of ice on the aeroplane as a result of the drainage.

CS 25.1457 Cockpit voice recorders

ED Decision 2020/024/R

(See AMC 25.1457)

(a) Each cockpit voice recorder required by the operating rules must be approved and must be installed so that it will record the following:

(1) Voice communications transmitted from or received in the aeroplane by radio.

(2) Voice communications of flight-crew members on the flight deck.

(3) Voice communications of flight-crew members on the flight deck, using the aeroplane's interphone system.

(4) Voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

(5) Voice communications of flight-crew members using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of sub-paragraph (c)(4)(ii) of this paragraph.

(b) The recording requirements of sub-paragraph (a)(2) of this paragraph must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crew members on the flight deck when directed to those stations. The microphone must be so located and, if necessary, the pre-amplifiers and filters of the recorder must be so adjusted or supplemented, that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder must be installed so that the part of the communication or audio signals specified in subparagraph (a) of this paragraph obtained from the following sources is recorded on at least four separate channels:

(1) From each boom, mask, or hand-held microphone, headset, or speaker used at the first pilot station.

(2) From each boom, mask, or hand-held microphone, headset, or speaker used at the second pilot station.

(3) From the cockpit-mounted area microphone.

(4) From:

(i) each boom, mask, or handheld microphone, headset or speaker used at the stations for the third and fourth crew members; or

(ii) if the stations specified in subparagraph (c)(4)(i) of this paragraph are not required or if the signal at such a station is picked up by another channel, each microphone on the flight deck that is used with the passenger loudspeaker system if its signals are not picked up by another channel.

No channel shall record communication or audio signals from more than one of the following sources: the first pilot station, second pilot station, cockpit-mounted area microphone, or additional crew member stations.

As far as is practicable, all the sounds received by the microphones listed in subparagraphs (c)(1), (2) and (4) of this paragraph must be recorded without interruption irrespective of the

position of the interphone-transmitter key switch. The design must ensure that sidetone for the flight crew is produced only when the interphone, public address system or radio transmitters are in use.

(d) Each cockpit voice recorder must be installed so that –

(1) (i) It receives its electrical power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardising service to essential or emergency loads; and

(ii) It remains powered for as long as possible without jeopardising emergency operation of the aeroplane;

(2) If the recorder has a recording duration of less than 25 hours, there is an automatic means to stop the recording within 10 minutes after crash impact;

(3) There is an aural or visual means for pre-flight checking of the recorder for proper operation;

(4) Any single electrical failure that is external to the recorder does not disable both the cockpit voice recorder function and the flight data recorder function;

(5) There is a means for the flight crew to stop the cockpit voice recorder function upon completion of the flight in a way such that re-enabling the cockpit voice recorder function is only possible by dedicated manual action;

(6) It has an alternate power source:

— that provides at least 10 minutes of electrical power to operate both the recorder and the cockpit-mounted area microphone; and

— to which the recorder and the cockpit-mounted area microphone are switched automatically in the event that all other power to the recorder is interrupted either by a normal shutdown or by any other loss of power; and

(7) If the recorder is deployable:

(i) It has an automatic deployment capability that is engaged no later than when the aeroplane is airborne and that remains engaged as long as the aeroplane is airborne;

(ii) The automatic deployment capability and the emergency locator transmitter integrated in the deployable recorder cannot be manually disengaged from the cockpit when the aeroplane is capable of moving under its own power;

(iii) The deployment occurs upon the detection of severe structural damage that causes the immediate break-up of the aeroplane;

(iv) The deployment occurs upon the immersion of the aeroplane in water;

(v) An assessment of the effects of unintended deployment is made in accordance with the specifications of CS 25.1309;

(vi) Effects on persons other than aeroplane occupants and on search-and-rescue services are taken into account when assessing the unintended deployment failure condition;

(vii) There is no means to manually deploy the recorder while the aeroplane is capable of moving under its own power; and

(viii) An alert is provided to the flight crew when the flight recorder is no longer attached to the aeroplane.

(e) If the recorder is not deployable, the container of the recording medium must be located and mounted so as to minimise the probability of the container rupturing, the recording medium being destroyed, or the underwater locating device failing as a result of any possible combinations of:

(1) impact with the Earth's surface;

(2) the heat damage caused by a post-impact fire; and

(3) immersion in water.

If the recorder is deployable, the deployed part must be designed and installed so as to minimise the probability of the recording medium being destroyed or the emergency locator transmitter failing to transmit (after damage or immersion in water) as a result of any possible combinations of:

(1) the deployment of the recorder;

(2) impact with the Earth's surface;

(3) the heat damage caused by a post-impact fire; and

(4) immersion in water.

(f) If the cockpit voice recorder has an erasure device or function, the installation must be designed to minimise the probability of inadvertent operation and actuation of the erasure device or function during crash impact.

(g) The container of the cockpit voice recorder must –

(1) Be bright orange; however, if the recorder is deployable, the surface that is visible from outside the aeroplane, when the recorder is installed, may be of another colour;

(2) Have reflective tape affixed to its external surface to facilitate locating it;

(3) Have, if the recorder is not deployable, an underwater locating device on or adjacent to the container which is secured in such a manner that they are not likely to be separated during crash impact;

(4) Have, if the recorder is deployable, an integrated emergency locator transmitter that automatically starts emitting upon deployment; and

(5) Be, if the recorder is deployable, able to float on water and self-oriented so that the transmission of the emergency signal is not impeded.

[Amdt 25/23]
[Amdt 25/26]

AMC 25.1457 Cockpit voice recorders

ED Decision 2020/024/R

1. General

The installation of a recorder with an ETSO authorisation against ETSO-C123c (or equivalent standard accepted by EASA) satisfies the approval requirement in CS 25.1457(a).

In showing compliance with CS 25.1457, the applicant should take account of EUROCAE Document No ED-112A 'MOPS for Crash Protected Airborne Recorder Systems' or a later revision.

'Deployable recorder' designates a flight recorder installed on the aeroplane which is capable of automatically deploying from the aeroplane.

'CVR system' designates the cockpit voice recorder (CVR) and its dedicated equipment (e.g. dedicated sensors or transducers, amplifiers, dedicated data busses, dedicated power source).

2. Combination recorders

a. If the recorder performs several recording functions (i.e. it is a combination recorder), the means for pre-flight checking the recorder for proper operation should indicate which recording functions (e.g. FDR, CVR, data-link recording, etc.) have failed.

b. When two flight data and cockpit voice combination recorders are installed, either because they are required or because they are an acceptable alternative to a flight data recorder and a cockpit voice recorder, then these two fight data and cockpit voice combination recorders should be connected to separate power buses.

3. Automatic means to stop the recording after a crash impact

The automatic means to stop the recording (which is required if the recorder has a recording duration of less than 25 hours) should operate even if a power supply is still available.

The automatic means to stop the recording within 10 minutes after a crash impact may rely on:

a. dedicated crash impact detection sensors. In that case, negative acceleration sensors (also called 'g-switches') should not be used as the sole means of detecting a crash impact; or

b. the recording start-and-stop logic, provided that this start-and-stop logic stops the recording 10 minutes after power is lost on all engines (and, when applicable, the APU) when the aeroplane is on the ground.

4. Means for pre-flight checking of the recorder

The means for pre-flight checking of the recorder should be able to detect and indicate the following:

a. A loss of electrical power to the flight recorder system;

b. A failure of the data acquisition and processing stages;

c. A failure of the recording medium and/or drive mechanism; and

d. A failure of the recorder to store the data in the recording medium as shown by checks of the recorded data including, as far as is reasonably practicable for the storage medium concerned, its correct correspondence with the input data.

5. Means for the flight crew to stop the cockpit voice recorder function

The means required for the flight crew to stop the cockpit voice recorder function after the completion of the flight is needed in order to preserve the recording for the purpose of investigating accidents and serious incidents. In fulfilling this requirement, it is acceptable to use circuit breakers to remove the power to the equipment. Such a means to stop the cockpit voice recorder function is not in contradiction with CS 25.1357(f), because it would not be used under normal operating conditions, but after an accident or a serious incident has occurred.

6. Power sources

a. An alternate power source is a power source that is different from the source(s) that normally provides (provide) power to the cockpit voice recorder function.

In CS 25.1457(d)(6), a 'normal shutdown' of power to the cockpit voice recorder means a commanded interruption of the power supply from the normal cockpit voice recorder power bus; for example, after the termination of a normal flight. 'All other power' means the electrical power source(s) used for normal operation of the cockpit voice recorder function. The following applies to the installation of an alternate power source:

i. A tolerance of 1 minute on the 10 minutes minimum power requirement of CS 25.1457(d)(6) is acceptable;

ii. The use of aeroplane batteries or other power sources is acceptable, provided that electrical power to the essential and critical loads is not compromised;

iii. If the alternate power source relies on dedicated stand-alone batteries (such as a recorder independent power supply), then these batteries should be located as close as practicable to the recorder;

iv. The means for performing a pre-flight check of the recorder for proper operation should include a check of the availability of the alternate power source;

v. If the cockpit voice recorder function is combined with other recording functions within the same unit, the alternate power source may also power the other recording functions; and

vi. If two flight data and cockpit voice combination recorders are installed, either because they are required, or because they are an acceptable alternative to single-function recorders, then only one recorder needs to have an alternate power source for the cockpit voice recorder function. This should be the combination recorder that is located closer to the cockpit area.

b. If the cockpit voice recorder function has a recording duration of less than 25 hours, the electrical power to this function should not be supplied for more than 10 minutes after power is lost on all engines (and, when applicable, the APU) when the aeroplane is on the ground.

7. Recorder container

The attachment of the recorder container should comply with the specifications given in EUROCAE Document No ED-112A.

The container of a non-deployable recorder should be installed in the rear section of the aeroplane and in an area that increases the chances of the equipment surviving crash impact forces and the heat damage caused by a fire. However, it should not be installed where aft-mounted engines may crush the container during impact.

If two combination flight data and cockpit voice recorders (non-deployable) are installed, then the container of the recorder that is dedicated to the cockpit voice recorder function may be located near the flight crew compartment if at least one recorder is installed in the rear section.

8. Deployable recorder

If the recorder is deployable:

a. The automatic deployment capability should be available as long as the aeroplane is airborne; this should include cases in which electrical power is lost from the engines and APU.

In the event of a landing on water, the deployment should occur upon the immersion of the aeroplane in water; this means that the automatic deployment capability should remain available after contact with the water for a certain period in order to allow automatic deployment upon immersion;

b. The assessment of the effects of unintended deployment of the recorder in flight should include:

i. The effects on the continued safe flight and landing of the aeroplane. This assessment should cover the normal flight envelope of the aeroplane and include the following aspects:

— Potential impact on aeroplane structure, including flight control surfaces, and on systems; and

— Aerodynamic effects caused by the cavity created in the structure after deployment.

In order to address the effects of the impact on the aeroplane after deployment, the applicant should:

— either demonstrate that impact with the aeroplane is extremely improbable;

— or demonstrate continued safe flight and landing after impact damage, considering all flight phases. The demonstration should include the effect of the damage to the structure and systems on residual strength, stability, control and aeroelasticity:

— Residual strength should be demonstrated in accordance with AMC 25.571, Section 10.(c); and

— Freedom from aeroelastic instability should be demonstrated within the aeroelastic stability envelope as defined by CS 25.629(b)(2); and

ii. The effects on persons other than aeroplane occupants due to unintended deployment while the aeroplane is airborne, in particular the risk of serious or fatal injuries for persons being hit by the deployed part.

Several methods can be adopted in order to quantify the probability of causing serious or fatal injuries to the persons on the ground associated with unintended deployment of a recorder. However, the following variables should be used:

— The density of population, with reasonable correction factors related to time exposure and shielding such as being indoors and shielded by, for example, buildings, or being in a means of transportation; and

— The size and weight of the deployed part.