

SUBJECT : **Maximum Oxygen Working Pressure and Pressure Limiting Performance**

REQUIREMENTS incl. Amdt. : **CS 25.1453(e) Amdt. 4**

ASSOCIATED IM/AMC¹ : Yes ☐ / No ☒

ADVISORY MATERIAL :

INTRODUCTORY NOTE:

The following Equivalent Safety Finding has been classified as important and as such shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

IDENTIFICATION OF ISSUE:

Large transport aeroplanes are equipped with a pressurized oxygen gaseous system which delivers pressure regulated oxygen to the flight crew and flight observers for hypoxia protection in the event of cabin pressure loss and protective breathing capability for smoke and toxic environment. Depending on the system architectures, such gaseous system could also provide hypoxia protection for the cabin occupants.

Gaseous oxygen systems incorporate a pressure regulation function as well as a pressure limiting function. The pressure limiting function protects parts of the system from excessive pressure that can lead to unsafe conditions in the case of failure of the pressure regulation function.

CS 25.1453 (a)(1) provides the definition of the maximum working pressure and stipulates that 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.

CS 25.1453(e) specifies that pressure limiting devices (e.g relief valves), provided to protect parts of the oxygen system 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).

¹ In case of SC, the associated Interpretative Material and/or Acceptable Means of Compliance may be published for awareness only and they are not subject to public consultation.

If the performance of the pressure limiting device at system level is verified (such as Transient Pressure Level (TPL) test as described in §5.2 of AMC25.1441(b) of CS 25 amendment 21 or in the equivalent Oxygen Hazard Fire Risk Analysis (OHFRA) interpretative material when defined at project level), and considering any non-extremely improbable malfunctions of the normal pressure controlling means, there can be cases, including transients, where the demonstrated performance of the pressure limiting function of oxygen systems may exceed the prescribed pressure of CS 25.1453(e).

In these cases, compliance with CS 25.1453(e) is not fully demonstrated. However, an equivalent level of safety can be provided by the application of compensating factors.

Considering all the above, the following Equivalent Safety Finding is proposed:

Equivalent Safety Finding to CS 25.1453(e) Amdt. 4**Maximum Oxygen Working Pressure and Pressure Limiting performance**

Whenever the maximum relief pressure, including transients, demonstrated at system level (such as Transient Pressure Level (TPL) test as described in §5.2 of AMC25.1441(b) of CS 25 amendment 21 or in the equivalent Oxygen Hazard Fire Risk Analysis (OHFRA) interpretative material when defined at project level and considering any non-extremely improbable malfunctions of the normal pressure controlling means), exceeds the pressure ratio of 1.33 as required per CS 25.1453(e) when compared to the maximum working pressure, an equivalent level of safety can be demonstrated applying the following compensating factors:

1. The definition of the maximum working pressure specified in CS 25.1453 (a)(1) must be amended to consider the maximum relief pressure, including transients, demonstrated at system level, divided by 1.33.
2. This amended (increased) maximum working pressure shall be used when showing compliance with CS 25.1453 (a)(3) and CS 25.1453(e).

This ensures that any pressure rise resulting from the operation of pressure limiting device of the oxygen system in case of loss of pressure regulation will never exceed the proof pressure of any system element exposed to the pressure rise.

The considerations of (1) & (2) for the working pressure correction could be disregarded for proof and burst qualification of oxygen mask assembly (mask & stowage box) provided that the mask assembly, if installed during the test, is demonstrated serviceable after the TPL testing, or is required to be replaced after any in-service event leading to rapid oxygen cylinder depletion associated with the relief valve actuation.