European Union Aviation Safety Agency

COMMENT RESPONSE DOCUMENT

EASA CRD of Proposed ESF-F25.1453-01
Maximum Oxygen Working Pressure and Pressure Limiting Performance
[Published on 18 June 2020 and officially closed for comments on 9 July 2020]

Commenter 1: Aerolite – Chris Berry – Mechanical Systems CVE - EMS Installations – 07/09/2020

Comment # 1

The requirement CS 25.1453(e) is read across to generic EASA CRIs for fast jets and EMS Oxygen Systems.

The Applicants Position for these CRIs is typically the same as that used in the ESF to CS 25.1453(e):

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)

Does the use of an EASA CRI negate the need for an ELOS, or will EASA now issue an ELOS in addition to the CRI, when the TPL Result is greater than a factor of 1.33 above the safety relief valve set point?

EASA response: *Not accepted*

Whenever the CS25 applicable certification basis is amendment 4 onward and the TPL results exceed the pressure ratio of 1.33 as required per CS25.1453(e), applicants can request the addition of the subject ESF to the certification basis of the oxygen system to be certified. The EASA Certification Review Item (CRI) is just a document used for recording of the discussion between the applicant and EASA on project level. The finally agreed ESF is the result / conclusion of the discussion between the applicant and EASA and is usually defined in the Appendix of the CRI that has been released on project level.

Comment # 2

The requirement to divide by 1.33 is too conservative when CS 25.1453(a)(1) is considered.

Since 'transient or surge pressures need not be considered except where these exceed the maximum normal operating pressure multiplied by 1.10', the maximum working pressure should be calculated by dividing the maximum relief pressure by 1.5 [1.33 x 1.1].

The increased maximum working pressure is then only be applicable if the maximum relief pressure is greater than 1.10 x the maximum working pressure.

EASA response: *Not accepted*

EASA disagrees with the proposed modified approach for 2 reasons:

1) ***Increased factor would lead to a reduced design margin compared to the proof pressure and would not then achieve an equivalent safety level.***

   As an example: for a nominal oxygen system with a maximum working pressure of 100 psig, the installed margin between the relief and the proof pressures is 100x(1.5-1.33) = 17 psig.

   In case of a TPL exceedance of 160 psig, the EASA ESF would result in a respective augmented maximum working and proof pressures of 120 and 180 psig (=>20 psig margin compared to the TPL) while the proposed modified approach would lead to a respective augmented maximum working and proof pressure of 106 and 160 psig (=>0 psig margin compared to the TPL value)

2) ***Although the Transient Pressure Level (TPL) test is supposed to replicate a transitory behaviour for a nominal system, the exceedance above the 1.33 factor due the performance of the pressure limiting device may last for several seconds and could not be always considered as a transient.***

Comment # 3

Stipulating the CS 25.1453(a)(3)(i) Table 1 proof and burst factors is too conservative.

The proof and burst factors should be commensurate with the failure condition probability as determined by a system safety analysis in accordance with CS 2x.1309.

Typically, the TPL Test considers failure conditions identified as 'extremely remote' or 'remote'.

Using the AMC 25.1438 factors for 'remote', the proof factor would be 1, and a burst factor would be 2.

EASA response: *Not accepted*

Although the CS25.1438 and 1453 both address the proof and burst aspects, they are not comparable since CS25.1438 deals specifically with pneumatic & pressurization systems served by air and not oxygen. Moreover, the 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) is applicable to any non-extremely improbable malfunctions and is not strictly limited to remote or extremely remote failure conditions.

Commenter 2: Safran Aerotechnics – Greter Vincent – Oxygen System Engineer, Senior Expert, SAE A10 member / Design Office – 08/07/2020

Comment # 4

For us, the proposed change for ESF CS 25.1453(e) Amdt 4 can have very adverse effects.

The current CS25.1453 proposes an approach and coefficient that has yielded good results in terms of both safety and operation, while still providing enough flexibility for the design to allow very good performance and optimized system weight. This has been in-service for decades.

The proposed change on the method to determine proof and burst value of equipment will most likely result in an increase of the theoric proof and burst value.

Products currently available on the market would not pass these new criteria.

A redesign of these products would result in new compromises:

- To achieve new targeted value, we would have to replace, for example, current soft sealing means. The new, harder sealing means compatible with higher pressure should have worse sealing performances in extreme temperature (in particular at low temperature where soft sealing is usually preferred).
- We will have to re-inforce structural aspects, which will result in overall weight increase of the system.
- New products will not have the benefit of the long-term history products and will not follow the same robust maintenance and safety plan.

There are many other aspects in favor of keeping the current text as is or slightly modified, but not deeply modified as proposed here. It cannot easily be developed here, but we will be pleased to elaborate if necessary.

Our proposal if the current text is to be amended:

No change to current regulation text CS25.1453 except end of section A(3)(i) modified as follows:

(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 subparagraph (a)(2). *And burst pressure shall never be under 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).*

EASA response: *Partially accepted*

EASA disagrees with the proposed modified approach as it would further promote the relaxation of the pressure limitation function performance and would lead to safety regression.

The proposed ESF aims at keeping the relieved pressure always below the proof pressure to prevent any uncontrolled oxygen leakage in the system in case of pressure regulation malfunctions in accordance with the initial intent of the CS25.1453(e).

The proposed modified text and approach could result in exceeding the proof pressure in case of pressure regulation failure, in creating permanent distortion in the system and in releasing oxygen beyond the dedicated oxygen relief port.

EASA agrees that the change of design principle of reliable complex oxygen products such as the oxygen full face mask and stowage box) should be avoided whenever possible and will amend the ESF accordingly.