



**CROFT**

## **3979A O-ring NCT Test Temperature Reduction - SARP Impact**

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**Croft Associates Ltd**  
F4 Culham Science Park  
Culham, Abingdon  
Oxon, United Kingdom  
OX14 3DB

**T:** +44 (0)1865 407740  
**F:** +44 (0)1865 407449  
**E:** [info@croftltd.com](mailto:info@croftltd.com)  
**W:** [www.croftltd.com](http://www.croftltd.com)




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## 1 Introduction

The Safety Analysis Report for Package (SARP) design No. 3979A contains a requirement to perform thermal ageing tests on batches of the O-ring seals procured for the Containment Vessel, as specified Chapter 8, section 8.1.5.2 of the SARP (CTR 2008/10: Docket No. 71-9337 [1]). This test requirement identifies two separate tests:

*The temperature of the O-rings shall be maintained for 1000 hours at 150°C to 155°C for the 150°C test or for 24 hours at 200°C to 205°C for the 200°C test.*

## 2 Change Proposal

Due to material test repeatability issues, as identified and discussed in Test Report CTR 2021/24 [2], the NCT 1000 hour 150°C test is to be reduced to 1000 hours at a slightly reduced temperature, 130°C (with the test performed between 130 to 135°C), however, the HAC test requirement will remain unchanged.

## 3 SARP Temperature Impact Assessment

The impact on the SARP assessment of reducing the NCT temperature test requirement is considered and assessed in Table 1, addressing each reference to the use of the 150°C seal temperature limit identified within the SARP and assessing its impact, if any, on safety functions.

The conclusion of the assessment performed is that there are no safety issues related to this change proposal, all assessments performed in the SARP employ bounding temperature limits in terms of structural, thermal, containment and pressure assessments.

The maximum NCT temperature assessed in the SARP was 116.4°C, therefore the temperature reduction continues to provide a safety margin over actual operating temperatures.

## 4 References

- [1] Croft, "CTR 2008/10, Safety Analysis Report Safkeg-LS Design No. 3979A," Revision 7.
- [2] Croft, "CTR 2021/24, LS 3979A (3980) O-ring Seal," Issue A, 2021.

**Table 1 - NCT Temperature Reduction - SARP 3979A Safety Impact Assessment**

SARP Section	Subject	Reference location	NCT temperature reduction Safety Impact	Justification/Comments
2, Table 2-12	Mechanical Properties of SA-320/A320 Grade L43 Bolting Steel	Page 2-22	None, used to provide an upper bound on material properties.	The reduced NCT temperature range fits within the temperature range listed
2.3.2	Examination. Material Tests	Page 2-24	None, the second paragraph describes the proposed tests	The reduced temperature NCT test continues to provide a safety margin over actual NCT temperatures
2.7.1.1	End Drop, Containment Vessel Evaluation	Page 2-50, 2 <sup>nd</sup> para	None, used to provide an upper bound on material temperatures.	The reduced NCT temperature range fits within the bounding temperature range assessed.
2.7.1.2	Side Drop, Containment Vessel Evaluation	Page 2-53, 2 <sup>nd</sup> para	None, used to provide an upper bound on material temperatures.	The reduced NCT temperature range fits within the bounding temperature range assessed.
2.7.1.3	Corner Drop, Containment Vessel Evaluation	Page 2-56, 2 <sup>nd</sup> para	None, used to provide an upper bound on material temperatures.	The reduced NCT temperature range fits within the bounding temperature range assessed.
3.1.3	Summary Tables of Temperatures, Table 3-2 Summary of Calculated Package Temperatures with 10 W Internal Heat Load under NCT	Page 3-4	None, an arbitrary Containment vessel lid seal seal material temperature limit of 150°C is referenced in the last column	The reduced temperature NCT test of 130°C continues to provide a safety margin over actual NCT temperature of 116.4°C.
3.1.3	Summary Tables of Temperatures, Table 3-3 Summary of Package Temperatures for HAC Thermal Test	Page 3-5, Table note 1	None, discussed temperature excursions above NCT during HAC.	The note references an upper NCT temperature of 150°C, however, the HAC seal material test requirement remains the same, test at 200°C (the most recent tests are reported in CTR 2021/24 [2]).
3.2.2	Component Specifications	Page 3-10, 7 <sup>th</sup> para	None, quotes manufacturers temperature ranges	The reduced temperature NCT test of 150°C to 130°C continues to provide a safety margin over actual NCT temperature of 116.4°C.

SARP Section	Subject	Reference location	NCT temperature reduction Safety Impact	Justification/Comments
				The subsequent leakage tests performed after the 1000 hour NCT (and HAC) test are significantly more searching than manufacturers data.
3.2.2	Component Specifications	Page 3-11, 1 <sup>st</sup> para	None, quotes an arbitrary upper temperature limit of 150°C, much higher than actual NCT temperatures.	The reduced temperature NCT test of 150°C to 130°C continues to provide a safety margin over actual NCT temperature of 116.4°C.
4.1	Description of the Containment System,	Page 4-2, 3 <sup>rd</sup> para	None, references an upper NCT temperature of 150°C, but actual temperature is 116.4°C	The reduced temperature NCT test of 150°C to 130°C continues to provide a safety margin over actual NCT temperature of 116.4°C. The 200oC test continues to demonstrate acceptable performance at temperature excursions above 130°C, as reported in CTR 2021/24 [2].
8.1.5.2	Containment Vessel O-rings	Page 8-3, 1 <sup>st</sup> , 2 <sup>nd</sup> and 6 <sup>th</sup> para's	None. This section lists the NCT and HAC seal material test requirement only, the revised NCT test temperature of 130°C for 1000 hours ensures a reliable and repeatable material test.	As noted in the above assessments, reducing the NCT seal material test from 150°C to 130°C retains a sufficient safety margin over actual NCT temperatures. As noted in CTR 2021/24 [2], additional tests were performed at 140°C, demonstrating that there are no potential failures just over the revised NCT temperature limit.