Document title

Humidity trials

Project

Pilot test of Integrity Products CUI

Drain Plug at

Inquiry by

……

Customer

Supplier

Integrity Products

Contact persons

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Document type

Report

Comments

A study of the sensitivity of the humidity sensitivity of the hydrophilic elastomer used in the CUI Plug has been requested by the project.

This report documents the sensitivity levels determined for the two versions of hydrophilic material tested.

Classification

Internal

Pages

4

Revision	Date	Description	Supplier. Prepared by	Supplier. Reviewed by	Supplier. Approved by	Customer. Approved by
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Contents

1.1 Background and purpose

The pilot project aims at having the CUI plug installed on ……. During discussions, the request was raised for the experimentally determining the sensitivity of the expanding elastomer to humidity.

A prime question was whether a more sensitive elastomer could be used, in order to make the plug indicate at lower humidity levels than 100 %RH.

1.2 Experimental

The hydrophilic material tested in these trials was ……. This is the same elastomeric rubber formula that's used in Integrity Products CUI Drain Plug, and is the most water sensitive ….. quality available.

In order to investigate whether a higher sensitivity quality could be used to give indications between 90-100 %RH, two different surface textures was tested:

1. Standard surface texture, consistent with the surface texture used in the Integrity Products CUI Drain Plug

2. Excessively cut and indented surface textures.

The picture blow shows the surface textures of the two variants:

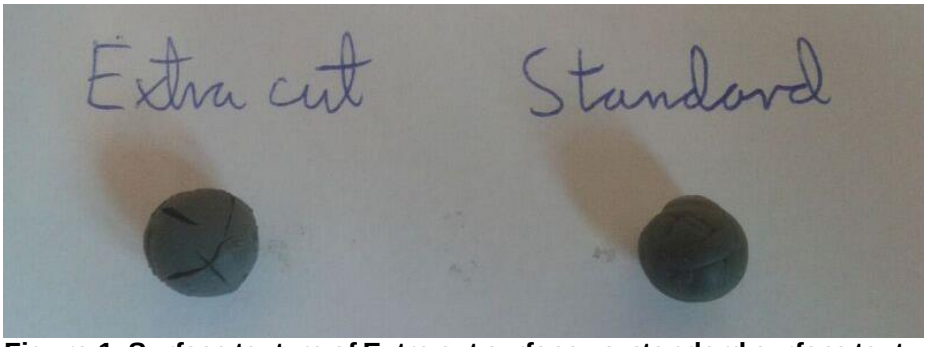

Figure 1: Surface texture of Extra cut surface vs. standard surface texture

4 Plugs with each elastomer quality was then installed inside a climate chamber. Due to the underlying support blocking the plugs from indicating in a standing position, the plugs were laid on their sides. The picture below shows the experimental setup in the climate chamber:

Figure 2: Experimental setup in climate chamber

Both qualities of elastomer where then exposed to the humidity conditions listed below, where all the plugs were dried for 1 week between each experiment. Higher than ambient temperatures were deliberately chosen, in order to subject the samples to a high level of absolute humidity and to speed up the absorption process.

Elastomer variant	1rst trial	2nd trial	3rd trial	4th trial
NNNN Standard texture	Cycling at 30-70 %RH 1 week at 30°C	Constant 90 %RH 24h at 30°C	Constant 93 %RH 24h at 40°C	Constant 98 %RH 24h at 30°C
NNNNN Extra cut texture	Cycling at 30-70 %RH 1 week at 30°C	Constant 90 %RH 24h at 30°C	Constant 93 %RH 24h at 40°C	Constant 98 %RH 24h at 30°C

1.3 Results

The table below summarizes the results obtained from these trials:

Elastomer variant	1rst trial	2nd trial	3rd trial	4th trial
NNNNN Standard texture	No indication	No indication	No indication	All plugs indicate
NNNNN Extra cut texture	No indication	No indication	Only one plug indicated*	All plugs indicate

* Attempts were made to replicate the indication given by the plug that indicated 93 %RH, without success. This suggests that the indication may have resulted from some experimental error, and not increased sensitivity in the extra cut elastomer.

1.4 Conclusion

- No **significant** different was measured between the two surface textures tested.
- The prospect of increasing the surface texture to make the plug indicate at lower relative humidity is not supported by the results obtained in these tests.
- The experiments indicate that a relative humidity close to 100% is necessary in order to achieve indication of the plug.
- Based on the level of absolute humidity required to cause indication in these tests, the plug is not expected to indicate as a result of transient warm/humid weather.