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Beele Engineering BV
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Subject
Statement of TNO concerning the RISE-system

Date
February 13, 2007

Our reference
TQS-RAP-07-335/id1

E-mail
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Dear Mr. Beele,

Direct dialling
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Herewith we sent you the statement of TNO Quality Services BV concerning the RISE system.

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1 INTRODUCTION

Project number
E07.0145

Chamber of Commerce
Veluwe and Twente
081563361

We have witnessed the RISE/ NOFIRNO system in an A-0 class deck penetration. The result was that the RISE / NOFIRNO system fulfilled the criteria according to IMO Resolution A.754 (18) maintaining integrity and stability (test report no. 0702-061). In this test the standard sleeves were replaced by NOFIRNO sleeves and the FIWA sealant was replaced by the NOFIRNO sealant. Recently an evaluation was made of the FIWA and the NOFIRNO sealant. The result was that the NOFIRNO sealant shows better (mechanical) properties. The question rises whether in all test (reports), the FIWA sealant can be replaced by the NOFIRNO sealant.

The goal was to evaluate the different test reports in order to give an answer to that question.

2 TEST REPORTS

- 1 RISE penetrations under artic conditions (February 6, 2006)
- 2 Electric strength of FIWA sealant (April 19, 2004)
- 3 Gasoline resistance of FIWA (December 21, 1999)
- 4 Influence of gasses on the function of FIWA sealant (March 4, 2002)
- 5 Chemical and biological attack of FIWA (October 30, 2000)
- 6 Influence of UV on FIWA sealant (March 21, 2003)
- 7 Helium pressure test on RISE multi cable penetration (March 19, 1999)
- 8 Adhesion of FIWA sealant to GRP (February 16, 2004)
- 9 Ageing tests on the RISE system (August 26, 1999)
- 10 Dynamic cycling test on a RISE transit system (September 19, 2001)

TQS works according to The Standard
Conditions for reaserch instruction given
to TNO.

The Standard Conditions will be sent on
request.



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3 EVALUATION OF THE FIWA AND NOFIRNO SEALANT

In table 1 the results of the mechanical and physical properties of the FIWA sealant and the NOFIRNO sealant are summarized.

Table 1 Evaluation FIWA versus NOFIRNO

Property	FIWA sealant	NOFIRNO sealant
Hardness (Shore-A)	33-35	42
Modulus at 100% elongation (MPa)	0.7	0.7
Tensile strength (MPa)	0.85	1.12
Elongation at break (%)	147	214

In both compounds the base polymer is the same silicone polymer with an initial hardness of the gum compound of 20 Shore A. After compounding the hardness differs, the NOFIRNO sealant shows a higher hardness because of the higher filler content and shows also better mechanical properties. This is due to the fact that NOFIRNO sealant contains no large particles in the compound in comparison to the FIWA sealant.

4 EVALUATION OF THE DIFFERENT REPORTS

The reports could be divided in investigations of the chemical or the mechanical behaviour. Most of the properties mentioned in reports 1 - 8 such as temperature resistance, electrical strength, influence of gasses, chemical and biological attack, hot air ageing, cold resistance, UV-behaviour and gasoline resistance are related to the chemical structure of the silicone polymer. These properties hardly change by compounding.

The mechanical properties such as hardness, modulus, tensile strength, elongation, dynamic cycling and adhesion are related to the fillers and filler grade (reports 9, 10 and table 1). As can be seen from the table, the elongation at break of the NOFIRNO sealant is higher than the FIWA sealant. The NOFIRNO sealant shows more flexibility, this gives a better dynamic behaviour. Also a higher hardness gives an improvement of the RISE-NOFIRNO system.

In addition, a pressure test was carried out by using a pressure vessel with an extender ID 207 mm and steel pipe OD 159 mm. The sealing was carried out with NOFIRNO sleeves and NOFIRNO sealant. A pressure test in steps of 0.5 bar up to 2.5 bar gave no leakages.



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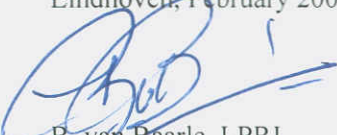
5 CONCLUSION

With reference to the TNO reports, the FIWA sealant may be replaced by the NOFIRNO sealant. The mechanical and physical properties of NOFIRNO are the same or better than of the FIWA sealant. Additionally the pressure test up to 2.5 bars gave no leakages.

We trust that this statement of TNO fulfils your question.

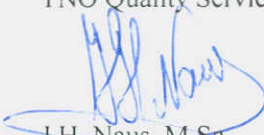
Yours faithfully,

Eindhoven, February 2007



B. van Baarle, LPRI
Author

TNO Quality Services BV



J.H. Naus, M.Sc.
Authorisation