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Test report: 202300598-R001			
Client: Lubo International B.V.	Reference: Mr. P. de Bruine (peterdebruine@lubointernational.com)	Order number: Mail 17-1	Technician: N. Akkermans
Component: Dry lubrication	Size bolting: M24 Sw36	Loadcell: Boltsafe SM-200 (serialnumber: 20022108)	Test date: 19-01-2024

Procedure

The lubrication and bolting has been tested at the ITIS test laboratory in Goes according to Lubo International B.V.'s purchase order and instructions.

During the first test three different bolts have been tightened and recorded (only 2 bolts were provided with a loadcell).

The purpose of the test was to record the difference in force after cooling down and recording the "break-loose" torque.

The purpose of the second test was to record and calculate the friction coefficient of the bolts at cryogenic (-196°C) temperature.

Scope of Bolting

Lubrication Manufacturer : Lubo Internation B.V.
Type : Dry lubrication

Requirements and limits

Environmental conditions : Draft free environment with an ambient temperature of 10°C±10°C
Test temperatures : Room temperature and -196°C
Starting torque bolting 1 : 200.0Nm (Loadcell 1 s/n: 241313)
Starting torque bolting 2 : 300.0Nm (Loadcell 2 s/n: 3022040)
Starting torque bolting 3 : 400.0Nm (not provided with a loadcell)

Calculation at 20.0°C according to EN-1591-1, whereby $\mu_t = \mu_n$. (As calculated by DME-Services B.V.)

Nm	KN	μ	σ (N/mm ²)
80.0	20,0	0,124	52,0
90.0	24,0	0,116	63,0
100.0	28,0	0,110	73,0
110.0	30,0	0,113	79,0
120.0	34,0	0,108	89,0
130.0	36,0	0,111	94,0
140.0	40,0	0,107	105,0
150.0	42,0	0,110	110,0
160.0	44,0	0,112	115,0
170.0	46,0	0,114	120,0
180.0	50,0	0,110	131,0
190.0	54,0	0,108	141,0
200.0	56,0	0,110	147,0

Approved signatory		
 A. Floor 		
A. Floor	12-02-2024	



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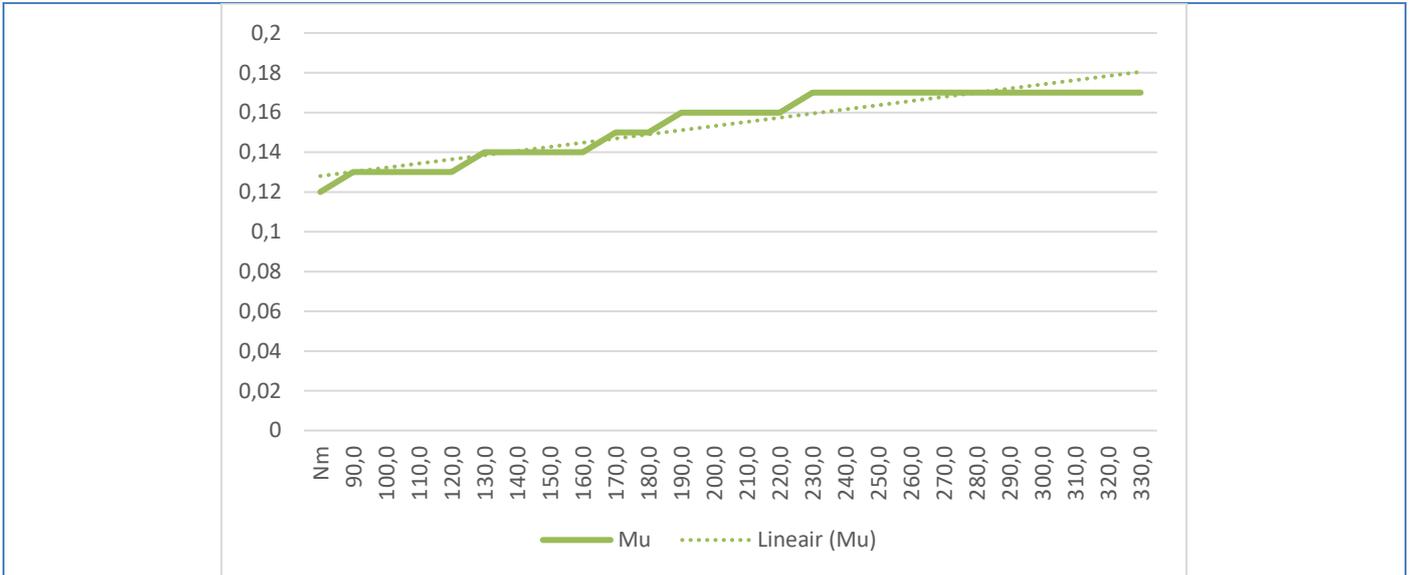
Test results test 1

Test	Tested bolting	Start Force (@20.0°C)	End Force (@-196°C)	ΔForce	"Break-loose" (-196°C)	Uncertainty	Pass / Fail
1	Bolting set 1	62.KN	64.0KN	2.0KN	242.0Nm	n.a.	n.a.
2	Bolting set 2	85.0KN	90.0KN	5.0KN	440.0Nm	n.a.	n.a.
3	Bolting set 3	400.0Nm	n.a.	n.a.	470.0Nm	n.a.	n.a.

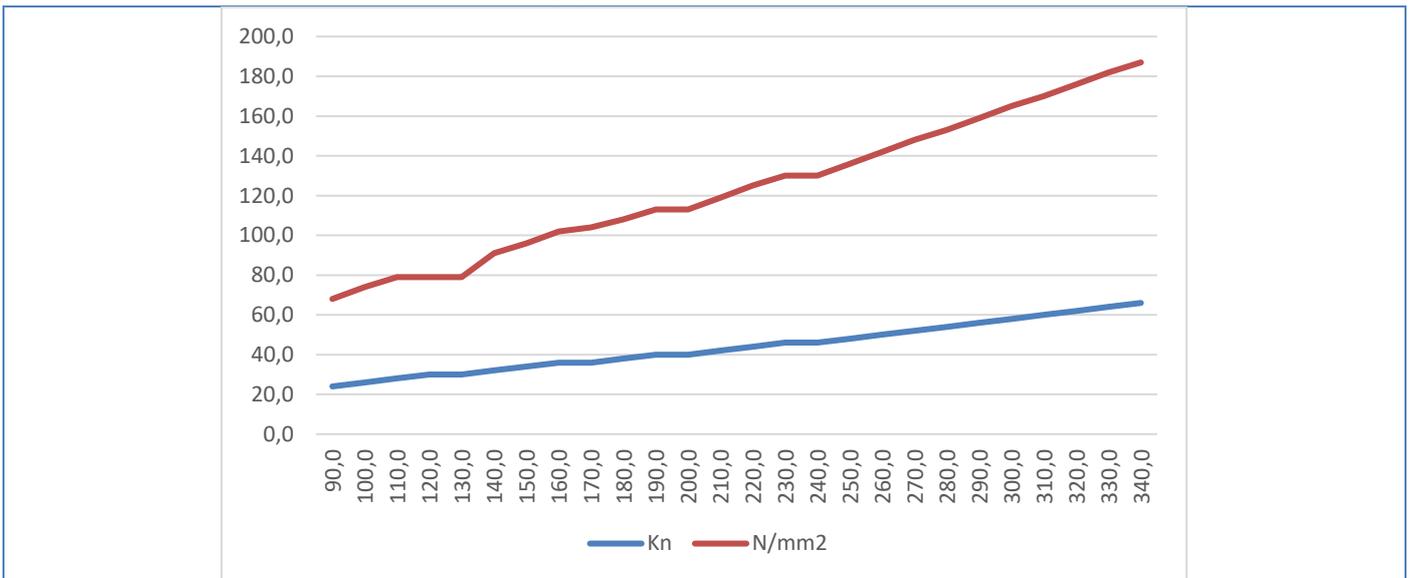
Test results test 2 (performed with Bolting set 1 and loadcell Sensor 1)

Test	Nm	Kn	N/mm2	Mu 1	Uncertainty	Pass / Fail
1	90,0	24,0	68,0	0,12	n.a.	n.a.
2	100,0	26,0	74,0	0,13	n.a.	n.a.
3	110,0	28,0	79,0	0,13	n.a.	n.a.
4	120,0	30,0	79,0	0,13	n.a.	n.a.
5	130,0	30,0	79,0	0,13	n.a.	n.a.
6	140,0	32,0	91,0	0,14	n.a.	n.a.
7	150,0	34,0	96,0	0,14	n.a.	n.a.
8	160,0	36,0	102,0	0,14	n.a.	n.a.
9	170,0	36,0	104,0	0,14	n.a.	n.a.
10	180,0	38,0	108,0	0,15	n.a.	n.a.
11	190,0	40,0	113,0	0,15	n.a.	n.a.
12	200,0	40,0	113,0	0,16	n.a.	n.a.
13	210,0	42,0	119,0	0,16	n.a.	n.a.
14	220,0	44,0	125,0	0,16	n.a.	n.a.
15	230,0	46,0	130,0	0,16	n.a.	n.a.
16	240,0	46,0	130,0	0,17	n.a.	n.a.
17	250,0	48,0	136,0	0,17	n.a.	n.a.
18	260,0	50,0	142,0	0,17	n.a.	n.a.
19	270,0	52,0	148,0	0,17	n.a.	n.a.
20	280,0	54,0	153,0	0,17	n.a.	n.a.
21	290,0	56,0	159,0	0,17	n.a.	n.a.
22	300,0	58,0	165,0	0,17	n.a.	n.a.
23	310,0	60,0	170,0	0,17	n.a.	n.a.
24	320,0	62,0	176,0	0,17	n.a.	n.a.
25	330,0	64,0	182,0	0,17	n.a.	n.a.
26	340,0	66,0	187,0	0,17	n.a.	n.a.

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Data graph 1: Friction coefficient at -196°C



Data graph 2: Force and Torque at -196°C

This test report documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI). The test result(s) and conclusion(s) in this report related to the sample(s) tested as described herein and must not be used to claim product certification. This test report may not be reproduced in whole or in part, without written approval of ITIS B.V. The test meets the requirements of ISO 9001: 2015 as verified and certified by TÜV SÜD Management Service GmbH, certificate number: 12 100 43628 TMS.

The test laboratory has not been responsible for the sampling stage (sample has been provided by the client). Test results stated in this report apply to the samples as received.

Applied decision rule: Measurements are reported as "Pass" – If the measurement results are within (or below) the specification limit when the measurement with its (upper) uncertainty limit is taken into account".

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