

# SISMALAB

>>Soluzioni Ingegneristiche Sperimentali Antisismiche

## TEST REPORT

<b>SAMPLE</b>	SPECIAL SLIDING TEST MATERIAL HI 3
<b>CLIENT</b>	HIRUN INTERNATIONAL

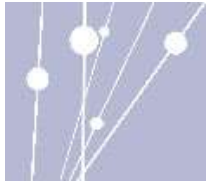
<b>TEST REPORT NUMBER</b>	101/2020
<b>TEST REPORT CODE</b>	TR_101_2020_LAB_92_2018
<b>SISMALAB ORDER</b>	92_2018
<b>TEST PERFORMER</b>	CARAMIA CIRO

Rev	00	01	02	03	04	05	06
Data	11/08/2020						

THIS TEST REPORT CONSISTS OF 6 PAGES

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SUBJECTED TO DUTY STAMP FOR USE ACCORDING TO ITALIAN LAW D.P.R. 642/72***

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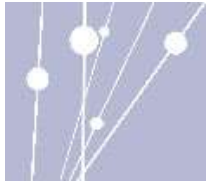
## GENERAL REFERENCES

TYPE OF TEST	<i>EN 1337-2:2004 – Test procedure HI-PROC 18.007-rev.1</i>	
LOCATION	<i>Sismalab Srl</i>	
ADDRESS	<i>C.da Alezza, 6 Crispiano -TA- 74012</i>	
APPLICANT	<i>HIRUN INTERNATIONAL</i>	
DEVICE TESTED	<i>HI 3 <math>\Phi</math> 75 mm</i>	
SISMALAB DEVICE CODE	<i>3462</i>	<i>3463</i>
TEST REPORT CODE	<i>TR_101_2020_LAB_92_2018</i>	
TEST REPORT ISSUE DATE	<i>11/08/2020</i>	

## TESTING MACHINE



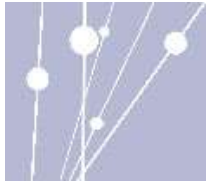
Vertical load	500	kN
Vertical stroke	200	mm
Horizontal load	75	kN
Horizontal stroke	$\pm 100$	mm
Temperature range	-50 / +70	°C



Sample description HI3	The test has been performed on two samples of plastic material delivered by Hiron International, identified as HI3, with dia. 75 mm and thickness 6 mm. The samples are provided with cavities in accordance to the geometrical requirements as mentioned in the reference documents. Samples are identified with laboratory codes 3462 and 3463. Picture of the sample is included in the following pages
Sample description Stainless steel	The test has been performed with stainless steel polished sliding parent material type 1.4404+2B in accordance with EN 10088-2 (AISI 316 L) with polished surfaces up to obtain roughness Rz lower than 1 µm in accordance with EN ISO 4287. Surface hardness in accordance with the requirements mentioned in the reference documents.
Sample description lubricant	The test has been performed using lubricant type KLUBER Syntheso 8002 supplied by Hiron International, batch no. KA00092779, for which the qualification certificate, supplied by Hiron International, is attached to this test report. The lubricant is qualified in accordance to EN 1337-2.
Test Conclusion	The sample tested show, at the end of the test, material wear off, reducing its thickness, and circumferential deformation. The values recorded on the tested sample can be considered normal after 50.000 m sliding path.

Environment conditions ( 24±3) °C

Sample	Test Item	Technical Requirement	Results
3462 ( HI 3 )	Sliding wearing test	After the tests the sample shall be disassembled by the test machine and checked by geometry and visually inspected. At the end of the test the friction coefficients, measured in the final PHASE A, shall be lower than the one mentioned in the reference documents	At the end of the test some sign of plastic deformation and material wearing have been detected. Friction coefficients measured have been compared with the requirements.



Sample	Test Item	Technical Requirement	Results
3463 ( HI 3 )	Sliding wearing test	After the tests the sample shall be disassembled by the test machine and checked by geometry and visually inspected. At the end of the test the friction coefficients, measured in the final PHASE A, shall be lower than the one mentioned in the reference documents	At the end of the test some sign of plastic deformation and material wearing have been detected. Friction coefficients measured have been compared with the requirements

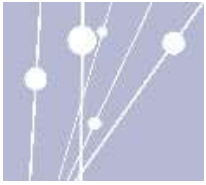
The test has been performed in accordance with the following test matrix, considering the material characteristic compression resistance strength  $f_k$  bigger than 180 MPa

**Long-term friction test programme for dimpled and lubricated flat surfaces**

	Example for 50.000 m total slide path						
Phase Number	1	2	3	.....	9	10	11
Type	A <sub>1</sub>	B	A <sub>1</sub>	.....	A <sub>1</sub>	B	A <sub>1</sub>
Distance	22 m	5.000 m	22 m	.....	22 m	5.000 m	22 m

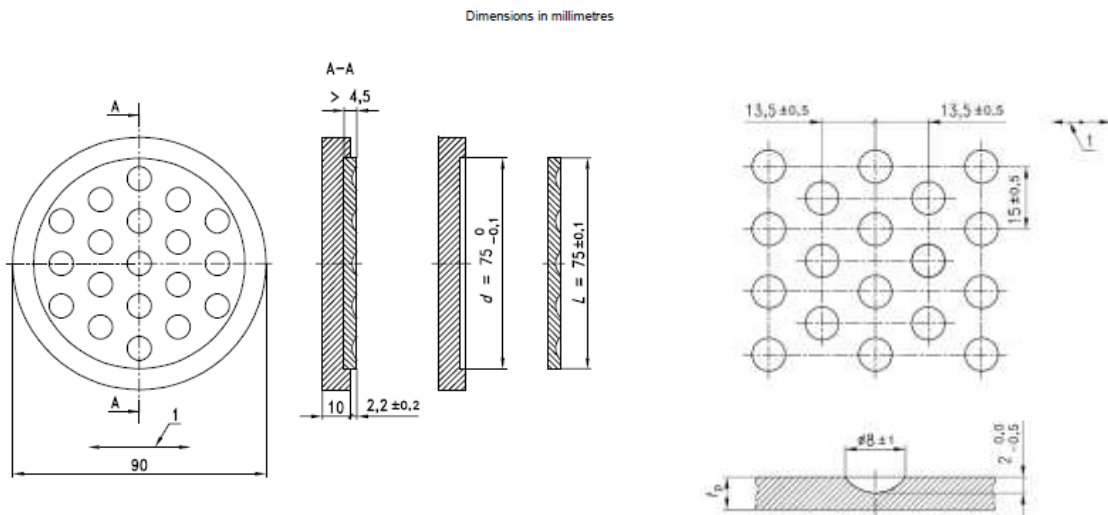
**Friction test conditions for special sliding material in accordance with Table 1**

Type A (phase 1,3,5 ... Temperature-Programme-Test) according to Table 1			
Contact pressure of lubricated special sliding material	$\sigma_p$	$0,33 f_{k0}^{+3}$	MPa
Temperature	$T$	0/-10/-20/-35/-50/+35/+21 ( $\pm 1$ )	°C
Temperature gradient		$0,5 \pm 1,0$	°C/min
Preload time	$t_{pl}$	1	H
Sliding distance	$s$	$10_0^{+0,5}$	mm
Dwell time at the end of the strokes	$t_0$	12 $\pm$ 1	S
Number of cycles (two strokes)	$N$	1100	
Sliding speed (constant)	$v$	$0,4_0^{+0,1}$	mm/s
Dwell between phases	$t_0$	1	h



Type B (phase 2, 4, 6 ...) according to Table1			
Contact pressure of lubricated special sliding material	$\sigma_p$	$0,33 f_{k0}^{+3}$	MPa
Temperature	$T$	$21 \pm 1$	°C
Temperature gradient		$0,5 \pm 1,0$	°C/min
Sliding distance	s	$8^{+0,5}$	mm
Number of cycles (two strokes)	$N$	312.500	
Sliding speed (constant)	$v$	$15 (\pm 0,1)$	mm/s

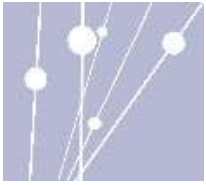
The tested sample has the geometrical characteristics shown in the following drawing, in accordance with the test requirements



## Test results

The record sheet of thickness and diameter of sliding material HI 3 measured before test and after test.

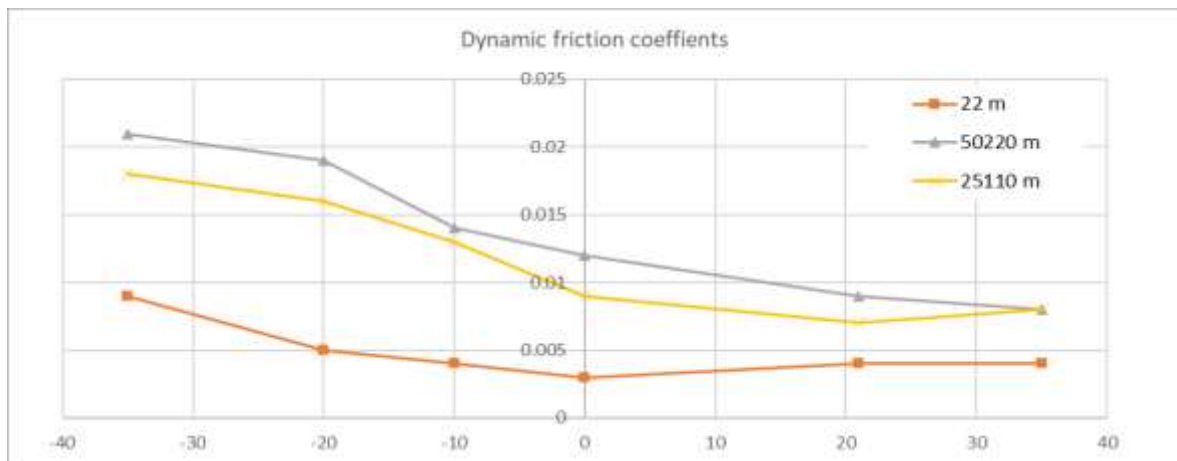
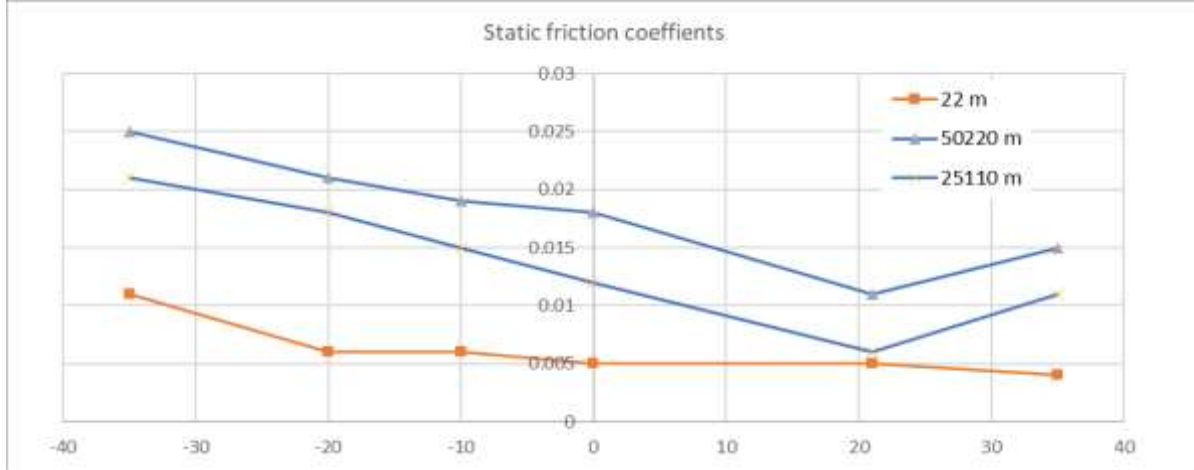
	Thickness	Diameter
Before the test	5.9 mm	74.93 mm
After the test	3.5 mm	76.41 mm
Variation	- 2.4 mm	1.48 mm

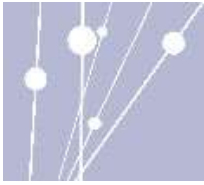


Static and dynamic coefficients of friction in the phase A of lubricated sheet made of HI 3 in combination with stainless steel plate at 60MPa contact pressure.

Temp. / °C	Total slide path (m)						Requirements EN 1337-2	
	22 m		25110 m		>50220 m			
	$\mu_{s,T}$	$\mu_{dyn,T}$	$\mu_{s,T}$	$\mu_{dyn,T}$	$\mu_{s,T}$	$\mu_{dyn,T}$	$\mu_{s,T}$	$\mu_{dyn,T}$
0	0.005	0.003	0.012	0.009	0.018	0.012	0.025	0.020
-10	0.006	0.004	0.015	0.013	0.019	0.014		
-20	0.006	0.005	0.018	0.016	0.021	0.019	0.040	0.030
-35	0.011	0.009	0.021	0.018	0.025	0.021	0.050	0.040
+35	0.004	0.004	0.011	0.008	0.015	0.008		
+21	0.005	0.004	0.006	0.007	0.011	0.009	0.020	0.015

**NOTE**  $\mu_{s,T}$  and  $\mu_{dyn,T}$  are the corresponding coefficients of friction at mentioned cycles at the relevant temperature.





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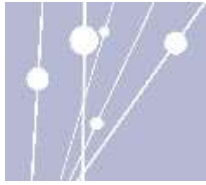
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Picture of samples of HI 3 sliding material before the execution of the test in combination with stainless steel plate at 60MPa contact pressure.



Pictures of sample of HI 3 sliding material after the execution of the test in combination with stainless steel plate at 60MPa contact pressure.





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Quality certificate referred to the lubricant used in the test



Materialprüfungsanstalt - Universität Stuttgart  
P.O. Box 80 11 40 · D-70511 Stuttgart, Germany



9910 021 118-91 Ger/Jg/hö  
29 October, 2018

### Inspection Certificate 3.2 (according to DIN EN 10 204)

Orderer: Klüber Lubrication München SE & Co. KG  
Geisenhausenerstraße 7  
D-81379 München

Manufacturer: Klüber Lubrication München SE & Co. KG

Test Item: Lubricant: Syntheso 8002 (BRÜCKENL.QUALIT)  
Batch-No./ Code number: KA00092779

Batch Size: 500 kg (20 hobbocks 25 kg each)

Date of Official Sample Drawing: 24 October, 2018

Labelling: Self-adhesive label from the manufacturer on each hobbock

Test Specification: Accordance of infrared spectrum and requirements for the lubricant with respect to the physical and chemical properties and the tribological behaviour of dimpled lubricated PTFE sheets in combination with hard chromium in short-term friction tests as specified in EN 1337-2

#### Infrared spectrum:

The accordance of the infrared spectrum of Batch-No. KA00092779 with the reference spectrum (IR-Nr. KA00008621) is confirmed.

#### Tribological behaviour:

Maximum coefficient of friction	T = +21 °C		T = 0 °C		T = -35 °C		T = -35 °C	
	$\mu_{s,1}$	$\mu_{dyn,1}$	$\mu_{s,1}$	$\mu_{dyn,1}$	$\mu_{s,1}$	$\mu_{dyn,1}$	$\mu_{s,T}$	$\mu_{dyn,T}$
Required value	≤ 0.012	≤ 0.005	≤ 0.018	≤ 0.012	≤ 0.035	≤ 0.025	≤ 0.018	≤ 0.012
Test result	0.009	0.003	0.013	0.006	0.030	0.009	0.012	0.010

**Test result:** The permissible tolerances of above-mentioned requirements are fulfilled. <sup>1)</sup> Each hobbock was sealed and marked with the acceptance-stamp immediately after sample drawing. The manufacturer has issued an Inspection Certificate 3.1 (according to DIN EN 10 204) for the physical and chemical properties of the lubricant



S. Gerber  
Dipl.-Ing. S. Gerber  
Head of Department  
Calibration / Bearing / Passive Safety

<sup>1)</sup> Opinions and Interpretations are not subject to accreditation

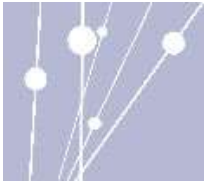
In compliance with DIN EN ISO/IEC 17025 accredited Testing Lab recognized by DAkkS Deutsche Akkreditierungsstelle GmbH. Accreditation valid for testing methods listed in the certificates (Reg. No. D-PL-11016-00). Designation as Technical service by the Kraftfahrt-Bundesamt (KBA) - Federal Motor Transport Authority. Certified on the basis of DIN EN ISO 9001:2008 by the TÜV. PÜZ body approved by DIBt and ZLS. Body notified to EU 0672 and 1080

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HIRUN INTERNATIONAL

**DEVICE TESTED**

SPECIAL SLIDING TEST MATERIAL HI 3