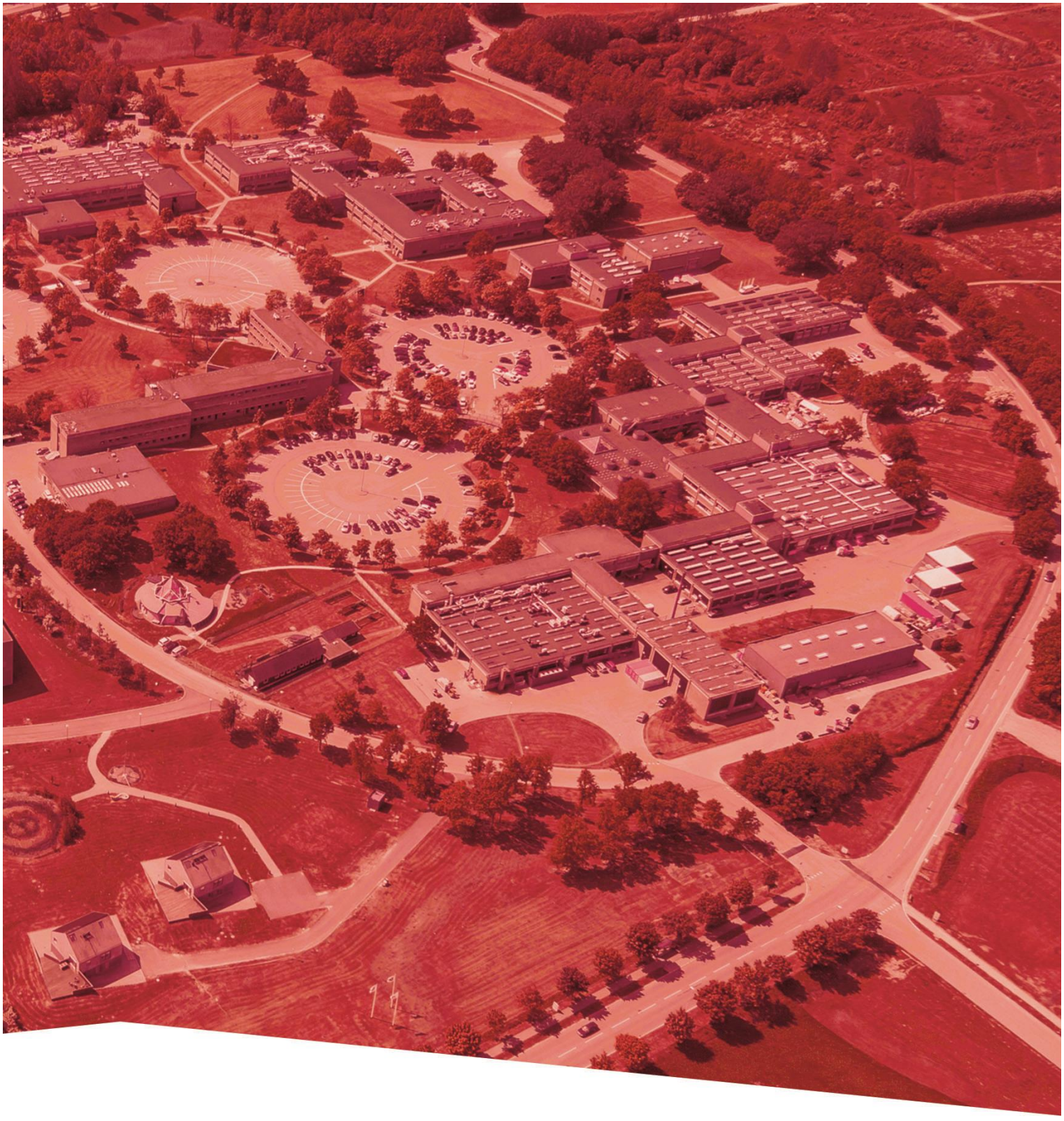

Testing ROCKWOOL insulation from CPH airport hangar 4

DANISH
TECHNOLOGICAL
INSTITUTE

DANISH
TECHNOLOGICAL
INSTITUTE

Testing ROCKWOOL insulation from CPH airport hangar 4

Udarbejdet for:
ROCKWOOL A/S
Hovedgaden 584
2640 Hedehusene

Prepared by
Teknologisk Institut
Gregersensvej 1
2630 Taastrup
Energy Efficiency and Ventilation

January 2023
Authors: Alexander V. Souproun and Christian N. Nielsen

DANISH
TECHNOLOGICAL
INSTITUTE

1. Introduction

Danish Technological Institute (DTI) have been assigned to sample and test the existing insulation slabs of a hangar building at Copenhagen airport (CPH). The insulation slabs are made of stone wool, a type of mineral wool but the manufacturing date, product name and product specifications are otherwise unknown.

Testing and sampling were carried out by the Thermal Laboratory, TELA at Danish Technological Institute. Danish Technological Institute is an independent party and is accredited to test and evaluate construction products in accordance with (CPR) EU/305/2011. The Thermal Laboratory, TELA holds part of the accreditation and is evaluated by DANAK[1] reg no. 300. All tests were conducted accredited in accordance with international requirements (ISO/IEC 17025:2017) and in accordance with the General Terms and Conditions of Danish Technological Institute.

Danish Technological Institute have conducted the following tests:

- Thermal conductivity (EN 12667:2001 and EN 13162:2012 + A1:2015)
- Moisture content (carefully wrapped on the building site)
- Length, width, and thickness (dimensions): (EN 822 and EN 823)
- Density
- Compressive strength (EN 826:2013)

2. Sampling

Sampling was made by representatives (Alexander V. Souproun and Christian N. Nielsen) from Danish Technological Institute followed by an observer from ROCKWOOL.
The sampling took place December 14th, 2022, at Copenhagen airport, Hangar 4 (built in 1958). 15 full size samples of insulation slabs were taken from the façade of the building (see Figure 1). 5 slabs were used for testing at DTI and the remaining 10 were delivered to ROCKWOOL. The insulation slabs were oriented vertically and covered by trapezoidal metal wall panels and a layer of cardboard wind-stop (see Figure 2). The inner side of the insulation slabs were partially glued to the building wall, therefore extra care should be taken during the dismounting process to avoid unnecessary damage of the slabs (see Figure 3). No water damage has been observed and all slabs were evaluated OK.

[1] https://danak.org/about-danak

Figure 1. Photo of CPH Hangar 4. Insulation samples were covered by trapezoidal metal wall panels.

Figure 2. Insulation slabs behind trapezoidal metal wall panels and cardboard wind-stop.

Figure 3. Insulation slabs were glued to the wall.

3. Moisture content

Relative moisture content has been calculated based on two methods: 1) weighing and drying at 110 °C and 2) weighing and conditioning at room temperature 18-22 °C. Drying in the oven showed little bit higher moisture content (0.34 %) compared to conditioning in the Lab (0.23 %)

3.1. Drying of two slabs in an oven at 110 °C for three days

Two slabs were weighed just after arrival and after 72 hours (3 days) long drying process. Results are presented in a table below.

Table 1. Moisture content results for drying at 110 °C.

	Sample 1	Sample 2	
Weight at arrival:	1.1815	1.1030	
After drying at 110 °C	1.1784	1.0985	
Moisture content	0.26 %	0.41 %	(72 hours)
Average, %		0.34 %	

3.2. Conditioning in the Laboratory premises at room temperature 18-22 °C

The duration of the conditioning was 14 days. In this period the weight of each slab was measured three times: at arrival, at five days after arrival and at 14 days after arrival. The weight loss during the last 14 days was less than 0.05 %.

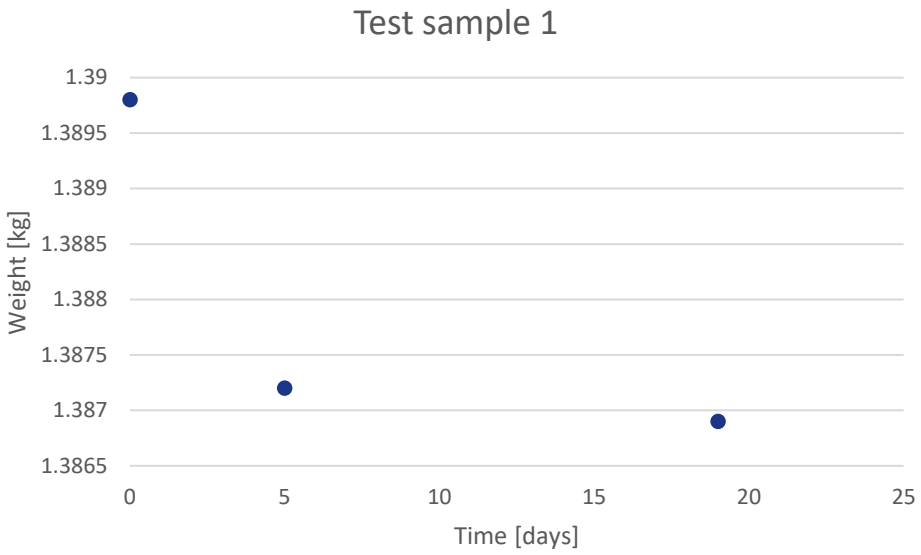

Figure 4. Example of weight measurement for one slab.

Table 2. Moisture content results for drying at room temperature.

Test sample No.	14.12.2022 kg	19.12.2022 kg	02.01.2023 kg	Diff. 14.12.2022 to 02.01.2023 kg	Relative moisture
1	1.3898	1.3872	1.3869	0.0029	0.21 %
2	1.2784	1.2768	1.2765	0.0019	0.15 %
3	1.5883	1.5862	1.5854	0.0029	0.18 %
4	1.3449	1.3404	1.3400	0.0049	0.36 %
				Average	**0.23 %**

4. Thickness

The average thickness of the 4 slabs is 75.4 mm. The detailed results are disclosed in Table 3 and further details can be found in the test report in appendix A2.

Table 3. Detailed thickness test results (19.12.2022) from report 22081T according to EN 823:2013.

Nominal thickness mm	75,0							
Measured. at	50	Pa						
Test No.	1	2	3	4	Mean mm	Std. dev. mm	Correction	Mean mm
1	77,0	80,3	81,2	80,6	79,8	1,91	-4,0	75,8
2	78,2	80,4	79,6	79,4	79,4	0,88	-4,0	75,4
3	75,0	80,3	80,2	81,2	79,2	2,84	-4,0	75,2
4	76,5	78,8	80,4	81,1	79,2	2,04	-4,0	75,2
						Mean to the nearest mm		75
						Std. dev. for mean:		0,28
						Std. dev. all:		1,84
						Dev. from nom.		0,4
						Dev. from nom. %		0,5
						T Class		**5**

5. Length and width

Width and length measured according to EN 822 resulted in the following table.

Table 4. Test results for length and width.

Test sample	Length, mm	Width, mm
1	1240	885
2	1230	890
3	1237	890
Average:	1236	888

6. Thermal conductivity

Thermal conductivity test gave the following result: λ_{10} = 0,03538 W/(m·K) at density during the test: 31,3 kg/m³. Further details regarding thermal conductivity can be found in the test report in appendix A1.

7. Compressive strength

Three of the same samples used for thermal conductivity tests were used for testing compressive strength. The average compressive strength of 3 samples was 1,04 kPa (tested flatwise).

Appendix

Appendices are attached as separate documents. The following documents have been sent separately:

A1. Test report for thermal conductivity test
A2. Thickness test report
A3. Compression strength test report
Pictures taken during sampling procedure at Hangar 4

DANISH
TECHNOLOGICAL
INSTITUTE