

- ❖ Prüfstelle nach Bauproduktenverordnung (EU) Nr. 305/2011, notified body number: NB 1625
- ❖ Prüflabor nach DIN EN ISO/IEC 17025:2005, DAkkS Nr. D-PL-17727-01-00
- ❖ Prüf-, Überwachungs- und Zertifizierungsstelle nach LBO, Kennziffer: NRW 15
- ❖ Prüf-, Überwachungs- und Zertifizierungsstelle im bauaufsichtlichen Zulassungsverfahren
- ❖ DIN CERTCO Prüfstelle, Kennziffer: PL139

Test report on a comparison test between an insulation material made of calcium silicate and an insulation material made of mineral wool with a fireplace in accordance with EN 13229:2001/A2:2004/AC:2007

<u>Testing station</u>	RRF Rhein-Ruhr Feuerstätten Prüfstelle GmbH
Name, Address	Im Lipperfeld 34 b D-46047 Oberhausen Telefon: +49(0)208-607041 - 0, Fax: +49(0)208-607041 - 28
Reference No.	RRF - SB 17 4612-2
<u>Manufacturer</u>	Skamol A/S
Name, Address	Sletvej 2C, DK-8310 Tranbjerg J
Trademark	Skamol Group
<u>Product</u>	Insulation material and mortar
Type, batch, serial number:	SkamoEnclosure Board SkamoEnclosure Structural Plaster
Initiator	Manufacturer
Date of delivery	12. Dezember 2017
Test location	Im Lipperfeld 34 b, 46047 Oberhausen
Technician	Teuwsen, T.

Brief summary by testing laboratory:

The above mentioned Insulation material was undergone a safety test according to DIN EN 13229 chapter 4.9, for the purpose of comparison with mineral wool.

This test report has been drawn up without prejudice to the rights of third parties in respect of private trademark rights of the initiator or manufacturer and may not be published in extracts.

The test report consisting of pages 1 to 15 and the appended test documentation a to b contains the results of the testing relating to this standard.

This test report is the translation of the original German test report. In case of doubts, the German version is valid

This test report replaces test report no. RRF - 17 4612-1 of 17. december 2018.



Oberhausen, 16. january 2019

(Place and date)

S. Müller
(Dipl.-Ing. S. Müller)

(stamp and signature of the
head of the testing laboratory)

Description of the insulation material SkamoEnclosure Board

The insulation material SkamoEnclosure Board, with the technical approval Z-43.14-449 is made of calcium silicat hydrates. The measurements of the board is 1000 x 610 x 40 mm.

The insulation board SkamoEnclosure Board was arranged as fire prevention to the lateral test wall according to DIN EN 13229. The installation of the insulation board was made according to the approval Z-43.14-449. On the opposing lateral side the insulation boards, made of mineral wool according to AGI Q 132, with a heating conductivity of 0,040 W/(mK), was installed according to DIN EN 13229. The test was made with different thicknesses of the insulation. Between the layers of the insulation board of 40 mm, the temperature an the same position was measured. As a finish to the respective insulation layer a test wall was installed according to DIN EN 13229. (Test installation as seen on page 4 ff.)

The comparison measurements were made with a commercially available inset appliance with a combustion chamber floor size of 0,144 m². The testing range was attached vertically. The fireplace was completely, with a heating chamber according to TROL (*Technische Regel zur Planung, Dimensionierung und Erstellung von Warmluftöfen, Kachelöfen und Putzöfen, Zentralen Warmluftschwerkraftheizungen, Feuerstätten über zwei Geschosse, Flächenheizungen, Hypokausten, Grundöfen, offenen Kaminen, Heizkaminen, Herden und Backöfen*), encapsulated, where the convection air outlets were closed. The surface temperature between the insulation boards and the testing walls were recorded. In the test report, only the "hotspots" temperature is presented. With the help of the recorded data, a lineary interpolation of an "insulation-layer-thickness-comparison-graph" was calculated. The end of the test was defined at a limit temperature of 85 °C on the test wall.

The SkamoEnclosure Board insulation boards were glued together, according to the manufacturer's information, with the SkamoEnclosure Structural Plaster mortar. The evaluation of the bonding is also part of this test order. For results see page 7.

The safety test was carried out with the test fuel spruce (6 x 4 cm) according to DIN EN 13229 chapter A 4.9.

The corpus of the used inset appliance is made of sheet steel with:

- the measurement of 1900 x 580 x 515 mm (h x w x d)
- a mass of about 210 kg
- rectangular base
- flue spigot optionally on the top or rear side of the appliance
- straight inspection window in the self closing, single leaf, raisable combustion chamber door
- combustion air controller under the inspection window
 - for primary air through the grate
 - for secondary air through the inspection window
- convection air channel between the rear wall of the corpus and the insulation board with a distance of 100 mm
- convection air channel between the lateral wall of the corpus and the insulation board with a distance of 100 mm respectively
- frontally arranged convection air outlets for the warm air outlet closed and cold air inlet of 160 cm²
- rear and lateral wall of the combustion chamber made of chamotte
- baffle made of sheet steel
- base of the combustion chamber made of chamotte with gap grate made of cast iron
- ash can behind the combustion chamber door

Specifications of the test combustible fuels used according to Table B.1

fuel	W [%]	Ash [%]	Volatiles [%]	H [%]	C [%]	S [%]	Hu [kJ/kg]	Analyse RA-Nr.
Spruce	14,3	0,61	84,6	6,90	42,50	0,01	15557	16-06918-001

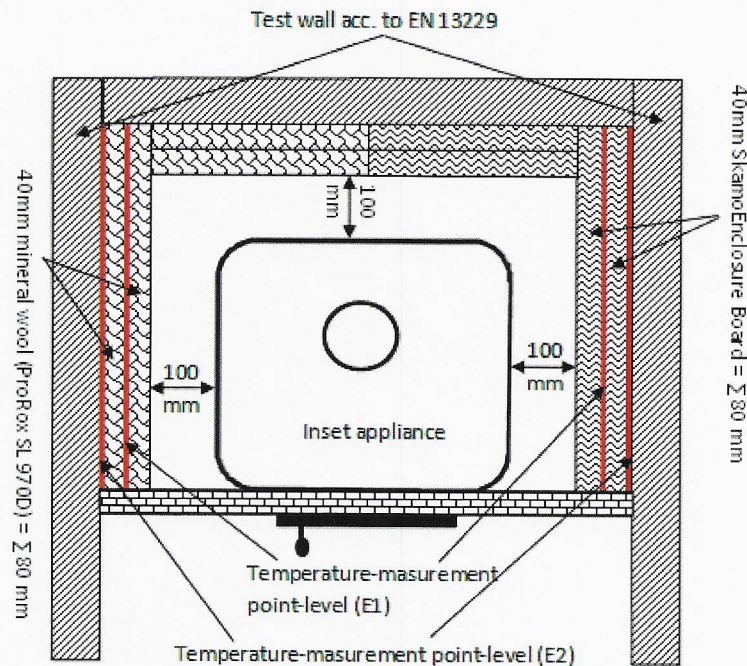
Analyses of samples have been carried out by the UCL Umwelt Control Labor GmbH, Josef-Rethmann-Str. 5, 44536 Lünen (accredited testing laboratory to DIN EN ISO/IEC 17025:2005) and by the RAG Ruhranalytik Laboratorium für Kohle und Umwelt GmbH, Wilhelmstr. 98, 44649 Herne (accredited testing laboratory to DIN EN ISO/IEC 17025:2005).

Table of measuring instruments

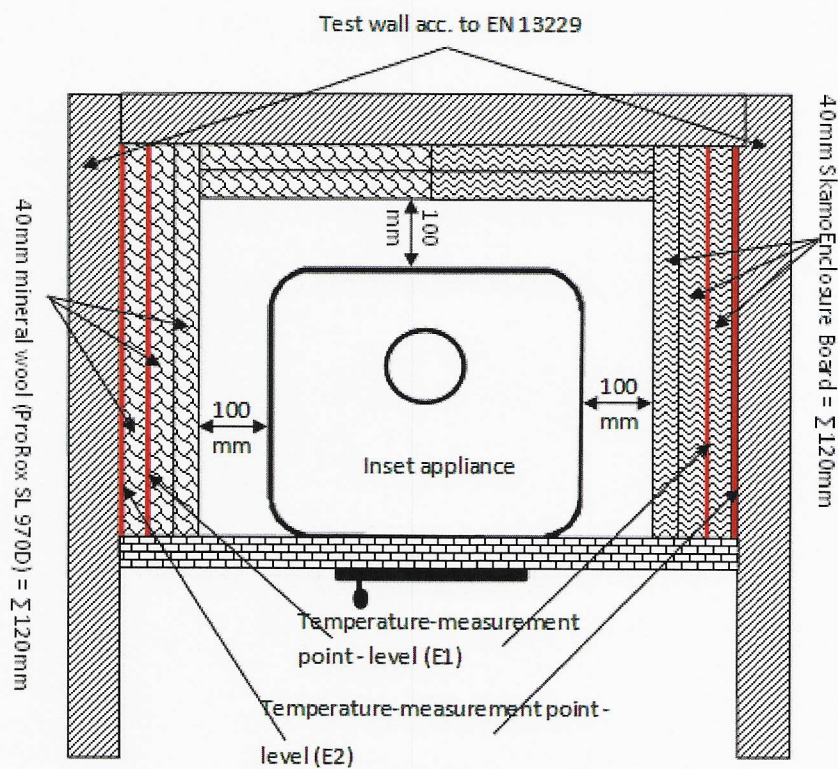
Measuring object	Measuring principle	Type / Device No.	Measuring range	Measuring precision
CO ₂	NDIR	Rosemount Typ: NGA 2000 PM 102	0 - 20 %	± 1 % applied on effective range final value
Temperature	Thermocouple NiCr-Ni; acc. DIN EN 60584-1 DIN EN 60584-2	Measuring converter Delphin Systeme	140 °C 960 °C	Thermocouple < 1 % applied on effective range final value
Fuel consumption	Platform Scale	PM 111	20 - 600000 g	± 20 g
Measurement value logging	Datalogger	Delphin Technology AG PM 206	0-20 mA, 0-10000 mV, 0-800 °C	± 0,01 from end value; ± 0,01 from the measurement range



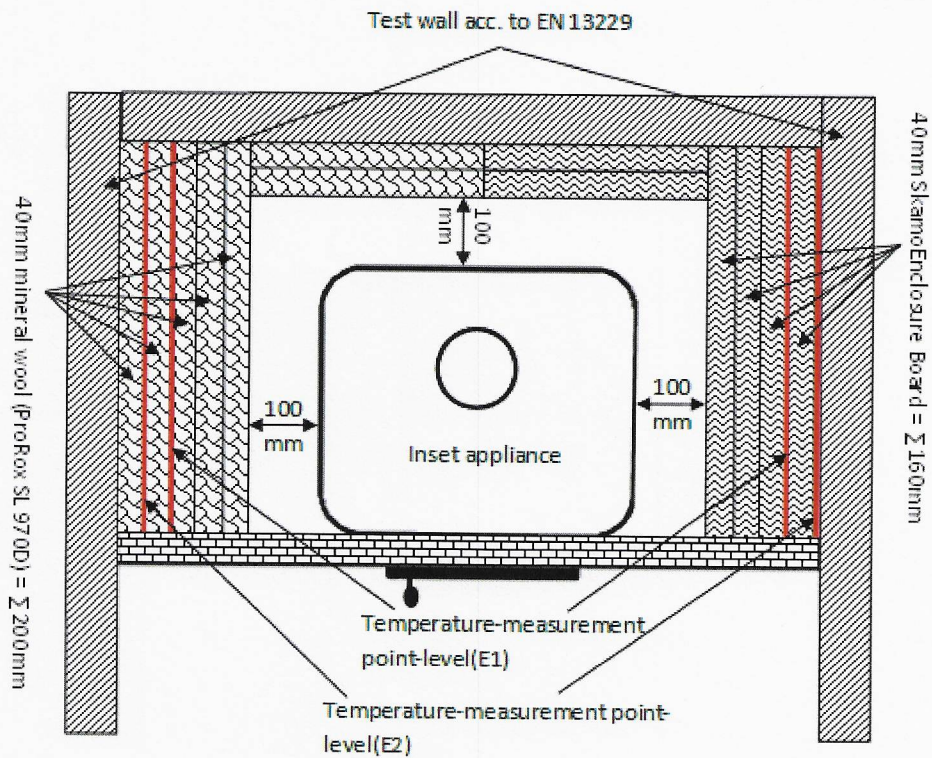
Test installation



Map. 1 Sectional view from above: test installation test day 1:
80 mm SkamoEnclosure Board and 80 mm mineral wool



Map. 2 Sectional view from above: test installation test day 2:
120 mm SkamoEnclosure Board and 120 mm mineral wool



Map. 3 Sectional view from above: test installation test day 3:
160 mm SkamoEnclosure Board and 200 mm *) mineral wool



Map. 4 Inner view of the test installation of the first test

*) Based on the expected high temperatures of the test wall made of mineral wool, a greater insulation board thickness was chosen. This serves as protection for the combustible test wall. The measurement also took place at the layer thickness of 160 mm.



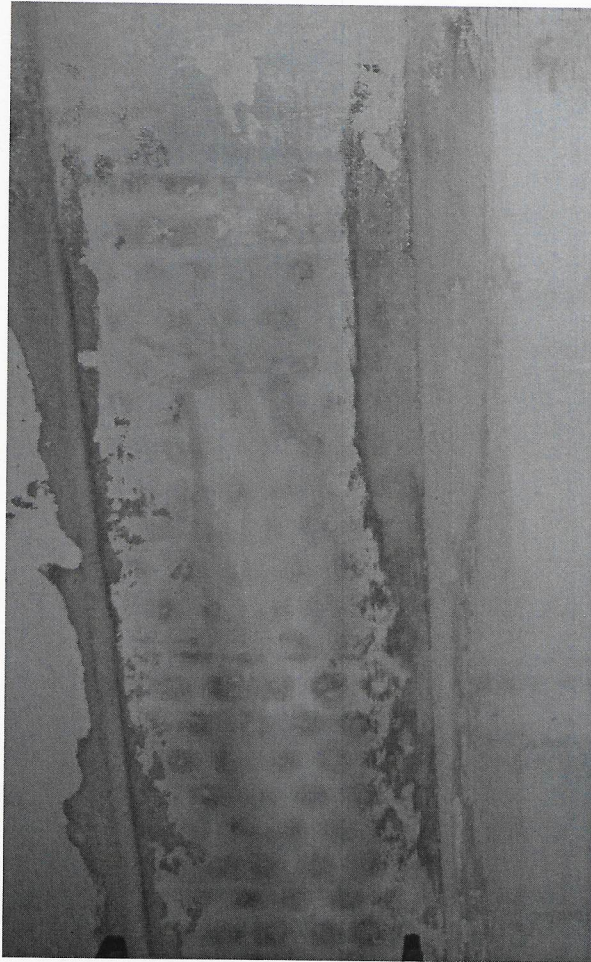
Map. 5 Test installation of the first test - Installation is heated dry (still with open convection air channels)



Map. 6 Test installation of the third test day - installation frontal-lateral open, to show the insulation layer thickness
Warm air outlet 0 cm² and cold air inlet 160 cm²



Evaluation of the mortar SkamoEnclosure Structural Plaster

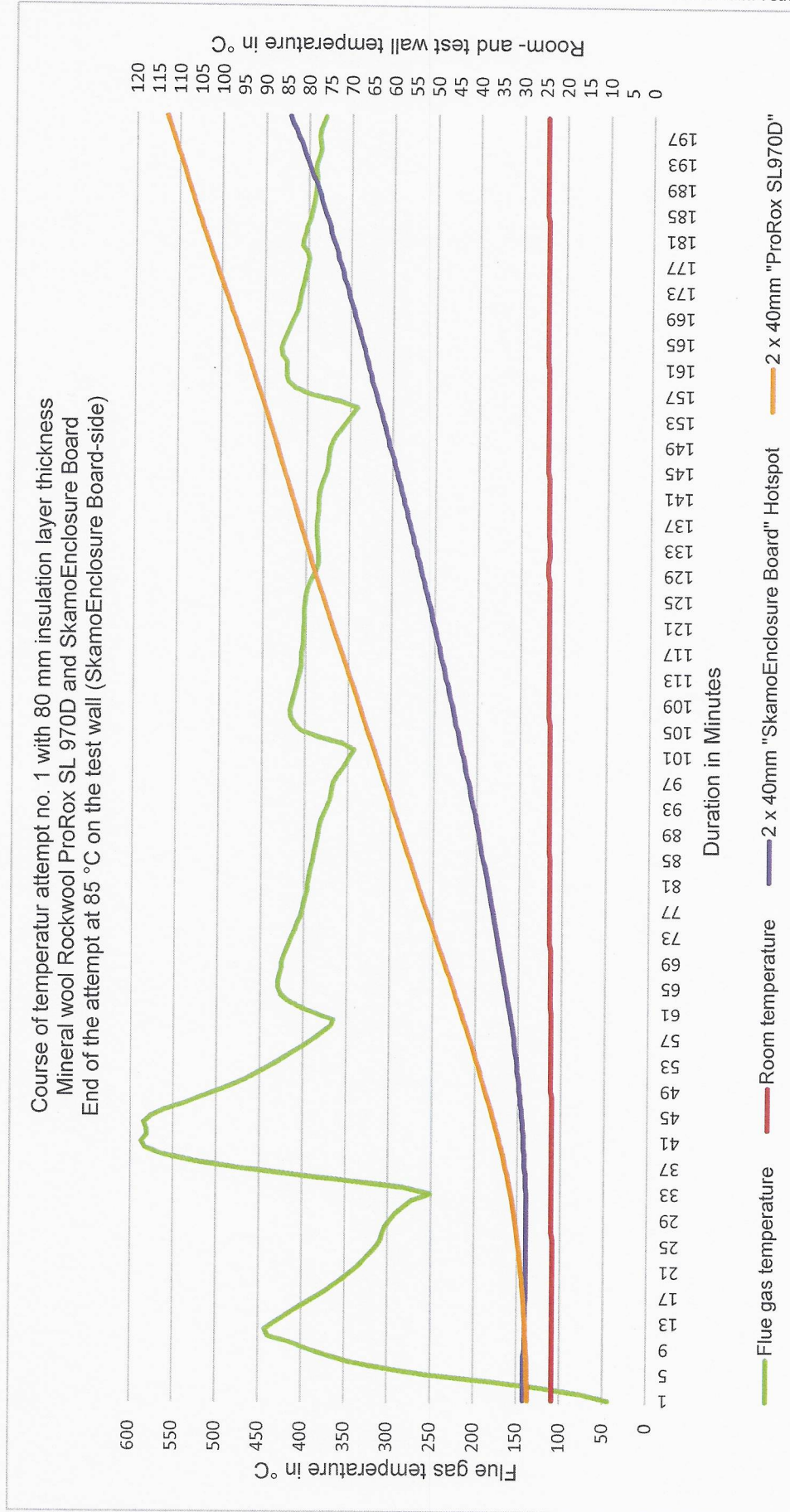


Map. 7 Vertical heading joint bonding with SkamoEnclosure Structural Plaster with single SkamoEnclosure Board stripes on the rear wall

The board was bonded all over (Mortar was spread with a V-notch trowel). The heading area was also provided with mortar. To evaluate the resulted overload, the rear wall of the heating chamber was made of SkamoEnclosure Board stripes. Thus creating some heading joints, that were bonded together. This bonding was maintained throughout the whole test process. Because the test results do not represent a long-term test, there cannot be an assertion about the durability and reliability. Principally the boards should always be bonded offset. To avoid thermal bridges, there has to be made sure, that the joints are not installed above each other. Another condition for the save offset of the boards, an additional fixation has to be provided on the protective wall.

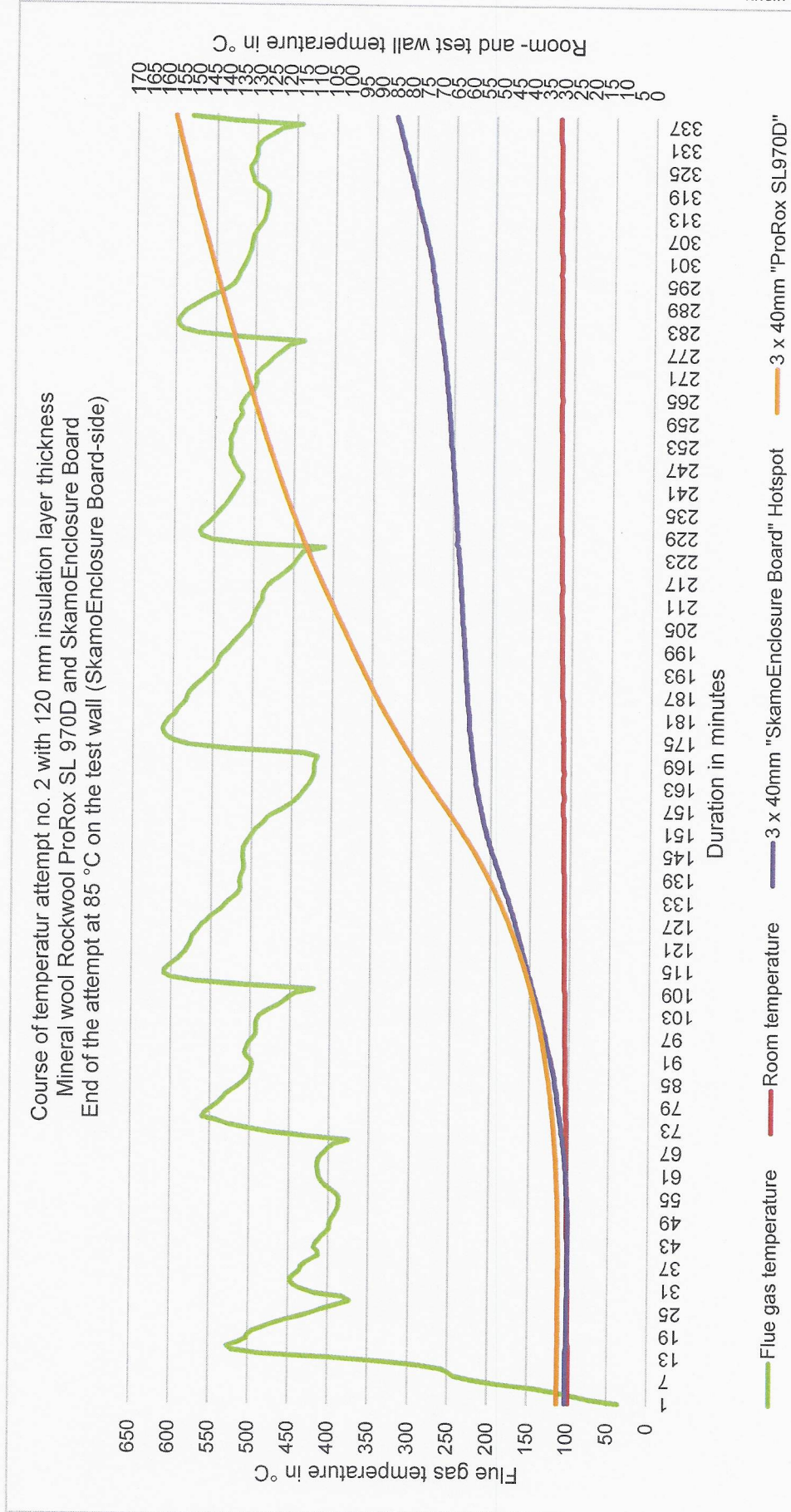
If the above mentioned criteria are minded, the joint mortar SkamoEnclosure Structural Plaster is qualified for the processing of the SkamoEnclosure Board.

Graphical depiction of the temperature profile

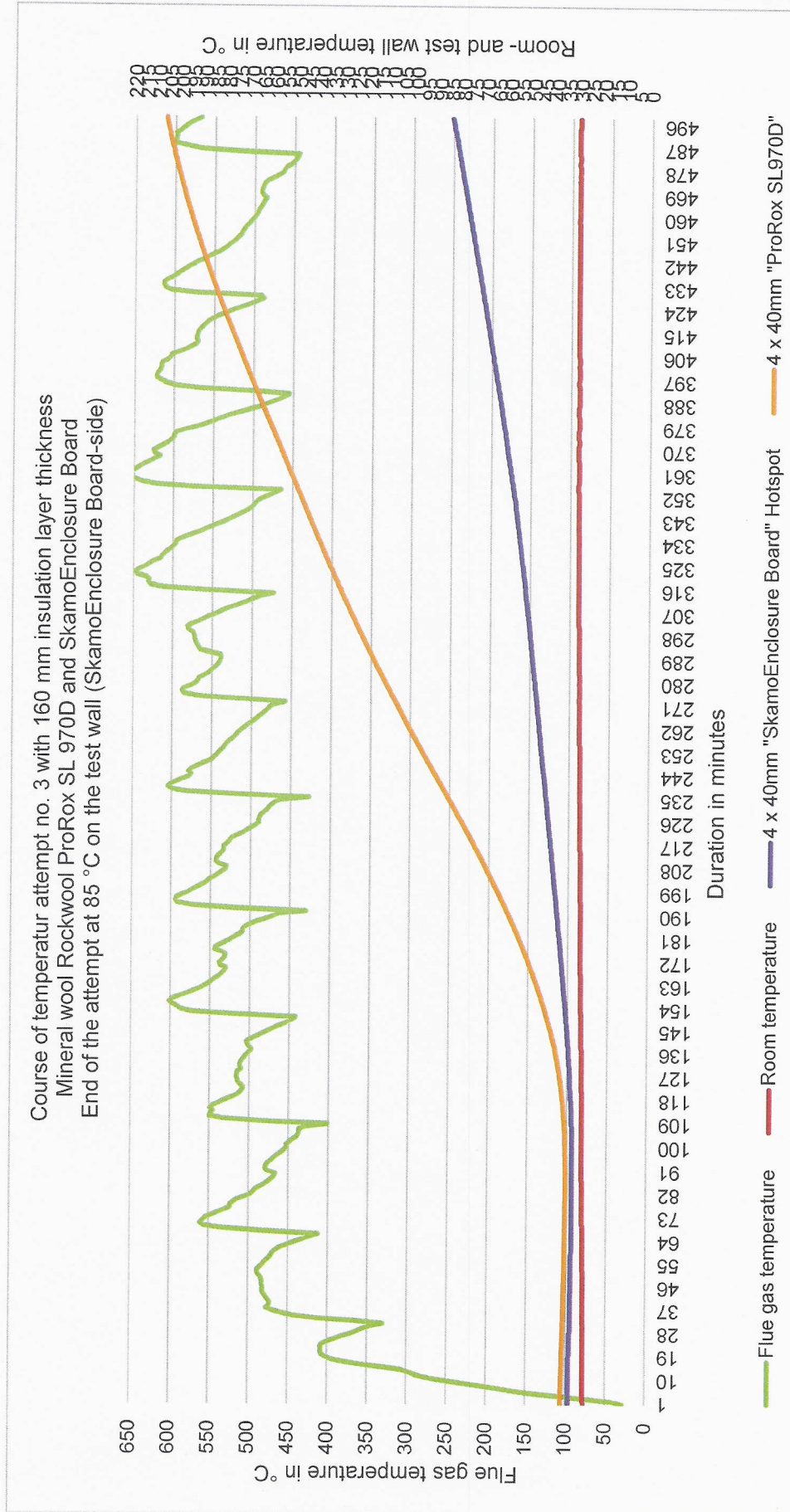


Graph 1 (test no. 1): Temperature profile of the hotspots on the respective test wall
 End of the test at 85 °C on the SkamoEnclosure Boards test wall





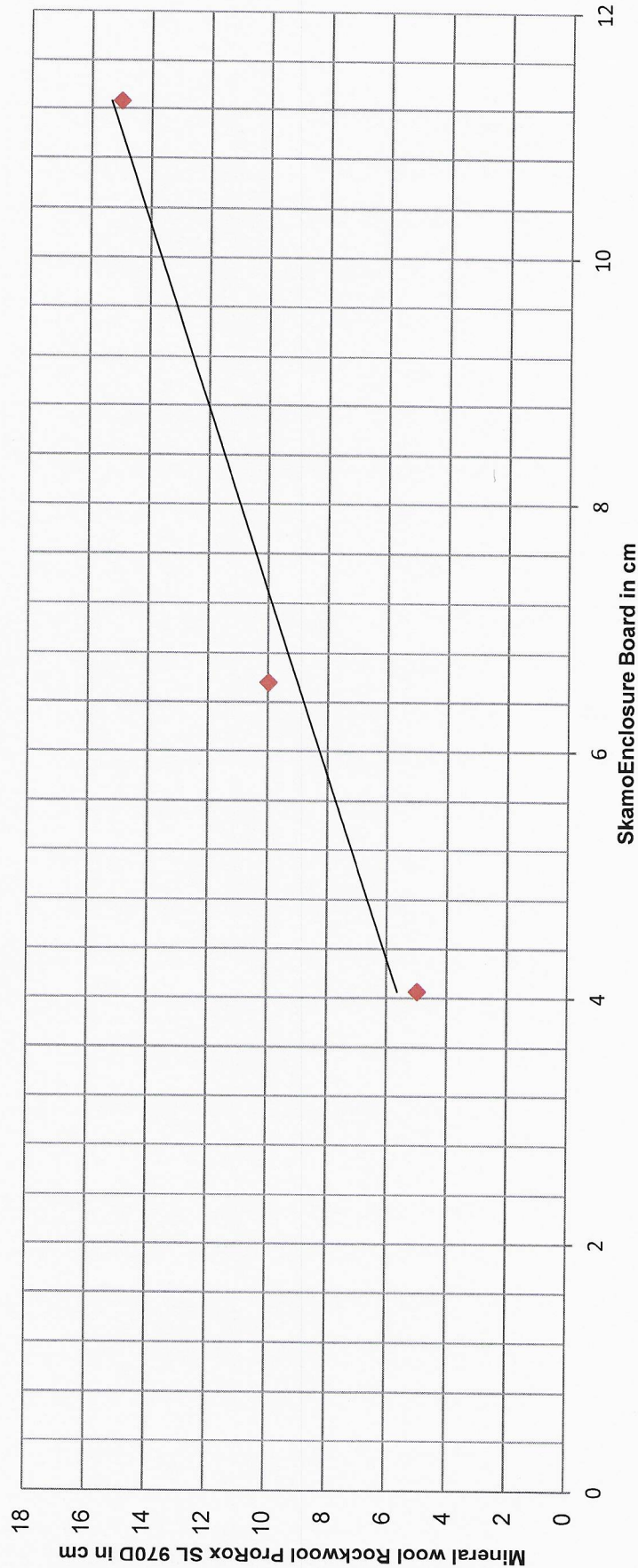
Graph 2 (test no. 2): Temperature profile of the hotspots on the respective test wall
 End of the test at 85 °C on the SkamoEnclosure Boards test wall



Graph 3 (test no. 3): Temperature profile of the hotspots on the respective test wall (or evaluation layer)
 End of the test at 85 °C on the SkamoEnclosure Boards test wall

Graphical depiction of the regression curve

Depiction of the test results to a heating insulation layer thickness comparison curve
Comparison of SkamoEnclosure Board vs Mineral wool ProRox SL 970D
Installation: acc. to TR OL / with closed convection air outlets
Fireplace: Inset appliance acc. to EN 1

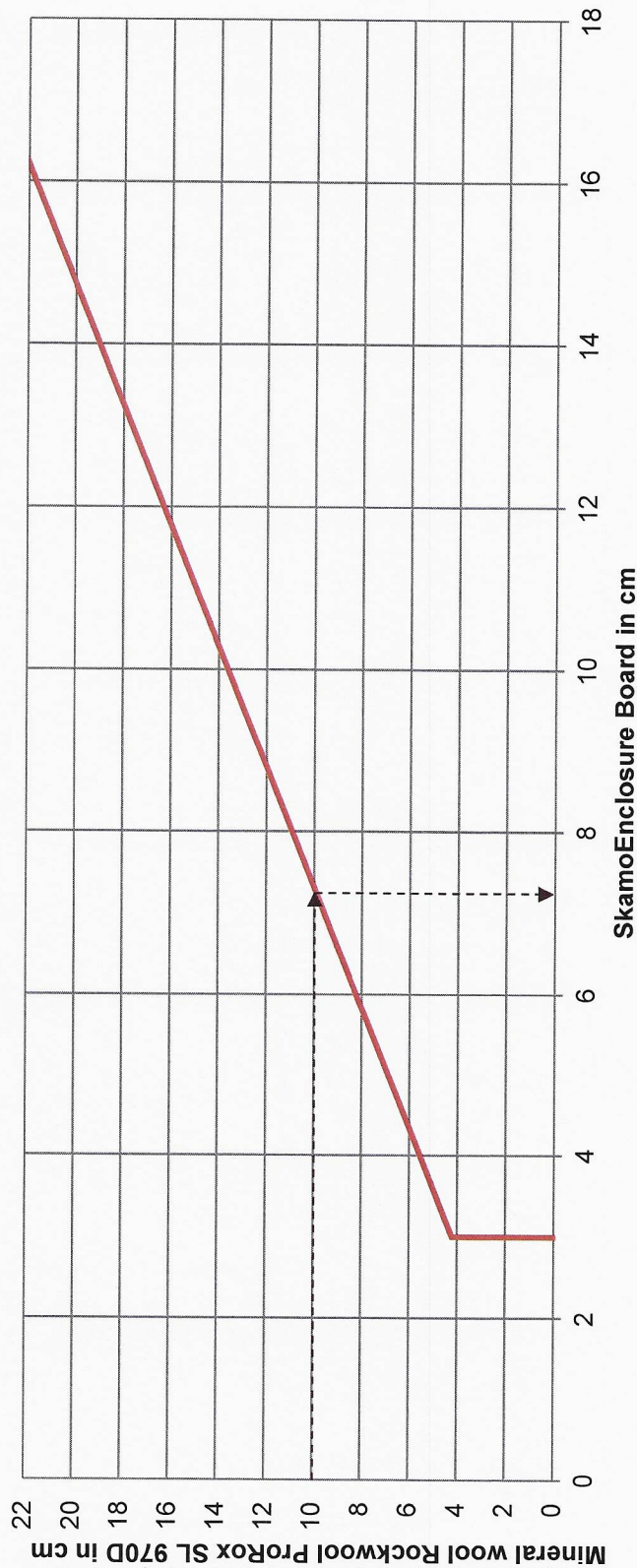


Function of the lineary regression $y = 1,3448x + 0,1972$

Graph 4: Depiction of the regression curve: Determination of the single curve points based on a lineary interpolation

Graphical depiction of the heating insulation equivalence curve

Working graph for the determination of the insulation layer thickness of "SkamoEnclosure Board" for the inset appliance acc. to TR OL* as a replacement for insulation



Example:

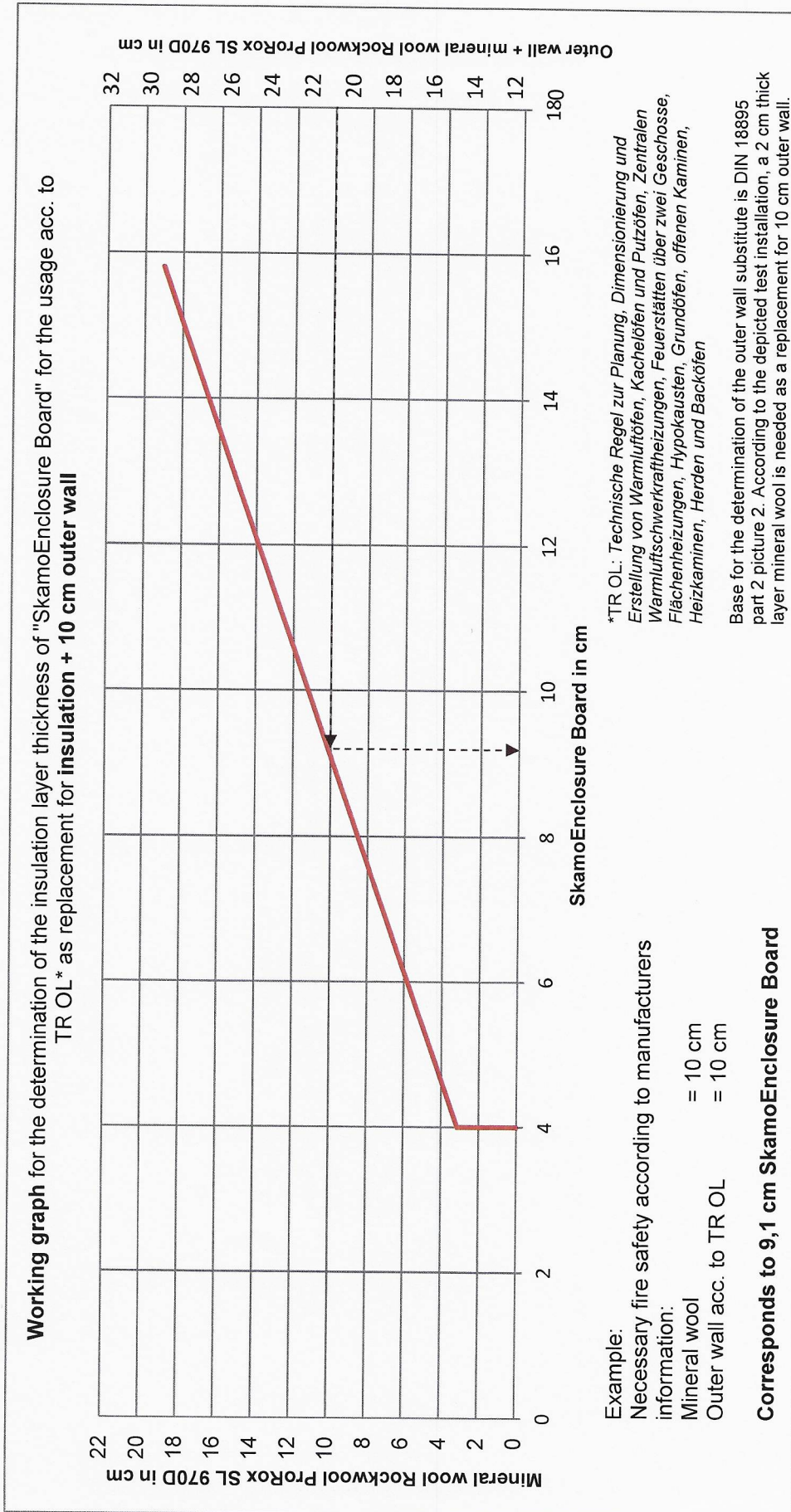
Necessary insulation made of mineral wool acc. to the manufacturers information = 10 cm

Corresponds to 7,3 cm SkamoEnclosure Board

*TR OL: Technische Regel zur Planung, Dimensionierung und Erstellung von Warmluftöfen, Kachelöfen und Putzöfen, Zentralen Warmluftschwerkraftheizungen, Feuerstätten über zwei Geschosse, Flächenheizungen, Hypokausten, Grundöfen, offenen Kaminen, Heizkaminen, Herden und Backöfen

Graph 5: Depiction of the heating insulation equivalence curve under the usage of SkamoEnclosure Board as a replacement for an insulation.

Graphical depiction of the fire prevention insulation equivalence curve according to TR OL*



Graph 6: Depiction of the fire prevention insulation equivalence curve under usage of SkamoEnclosure Board as replacement for die fire safety measurements according to TR OL*



Testing the fire safety according to section A.4.9.1, A.4.9.2, A.4.9.3

	Requm. acc. to.	Test result	Test result	Test result	
Test no.		V1	V2	V3	
Day of test, date	DD.MM.YY	10.05.17	17.05.17	23.05.17	
Test fuel	A.4.9.1.1	Spruce	Spruce	Spruce	
Test amount (total) incl. Ignition process	kg	A.4.9.1.1	18,50	29,63	48,25
Number of test amount		5	8	13	
Floor size of the combustion chamber	m ²		0,144		
Calculated mass of fuel per test duration	kg		3,70		
Test duration *)	hh,00	3,32	5,63	8,30	
<u>Setting of the controls</u>					
- Combustion air control		100 % open	100 % open	100 % open	
Bottomgrate		open	open	open	
Combustion chamber (door)		closed	closed	closed	
Mean flue draught	Pa	6.1	15	15	15
Mean room temperature	°C		23	29	29
<i>Distance between inset appliance and heat insulation</i>					
<i>to the rear</i>	mm		100	100	100
<i>to the side</i>	mm		100	100	100
<i>Layer strenght of mineral wool</i>	mm		80	120	160 **)
<i>SkamoEnclosure Board</i>	mm		80	120	160
Comment:					
*) The end of the test duration was set at a temperature of 85 °C on the lateral test wall with SkamoEnclosure Board					
**) The total insulation thickness of mineral wool (Rockwool ProRox SL 970D) is 200 mm. The evaluation for the lineary interpolation is refers to a insulation thickness of 160 mm.					

Data for the determination of the lineary regression:

Determination of the test duration to a limit temperature of 85 °C on the "SkamoEnclosure Board"-test wall

Test day	Measurement level (Hotspot)	Mineral wool Rockwool ProRox SL 970D [cm]	Time to limit temp. 85°C mineral wool [Min]	Skamo- Enclosure Board [cm]	Time to limit temp. 85°C Skamo- Enclosure Board [Min]
10.05.2017	E1	8,0	142	8,0	199
	E2	4,0	31	4,0	57
17.05.2017	E1	12,0	178	12,0	338
	E2	8,0	68	8,0	180
23.05.2017	E1	16,0	234	16,0	498
	E2	12,0	134	12,0	254