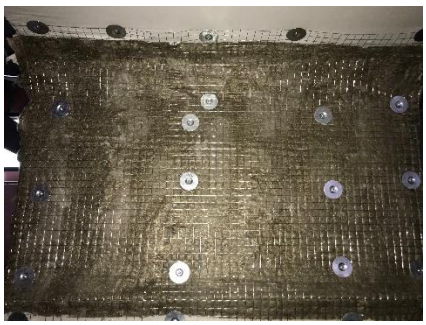
EcoMat

Fire resistant basalt textile fiber based Fire protection systems installations

Instruction


Preface

The instructions for the installation of fire protection systems on the basis of non-woven thermal insulation mat and tiles (hereinafter referred to as "Ecomati", "mat", "Ecomata Tile") produced by "Basalt Fibers" Ltd. This instruction contains a detailed description of the installation steps, the necessary components and equipment.

Reference information includes descriptions of materials, technical characteristics, areas of use, as well as their conditions of transportation and storage.

Instructions for installation of fire-retardant, fire-protection systems with "Ecomat" are prepared in accordance with the technological regulations of "Fire-fighting systems installation and inspection" defined by the international standard BS EN 1366-2.

Content

1. General information on Fire protective systems

1.1 Fire protective systems from basalt textile fibers

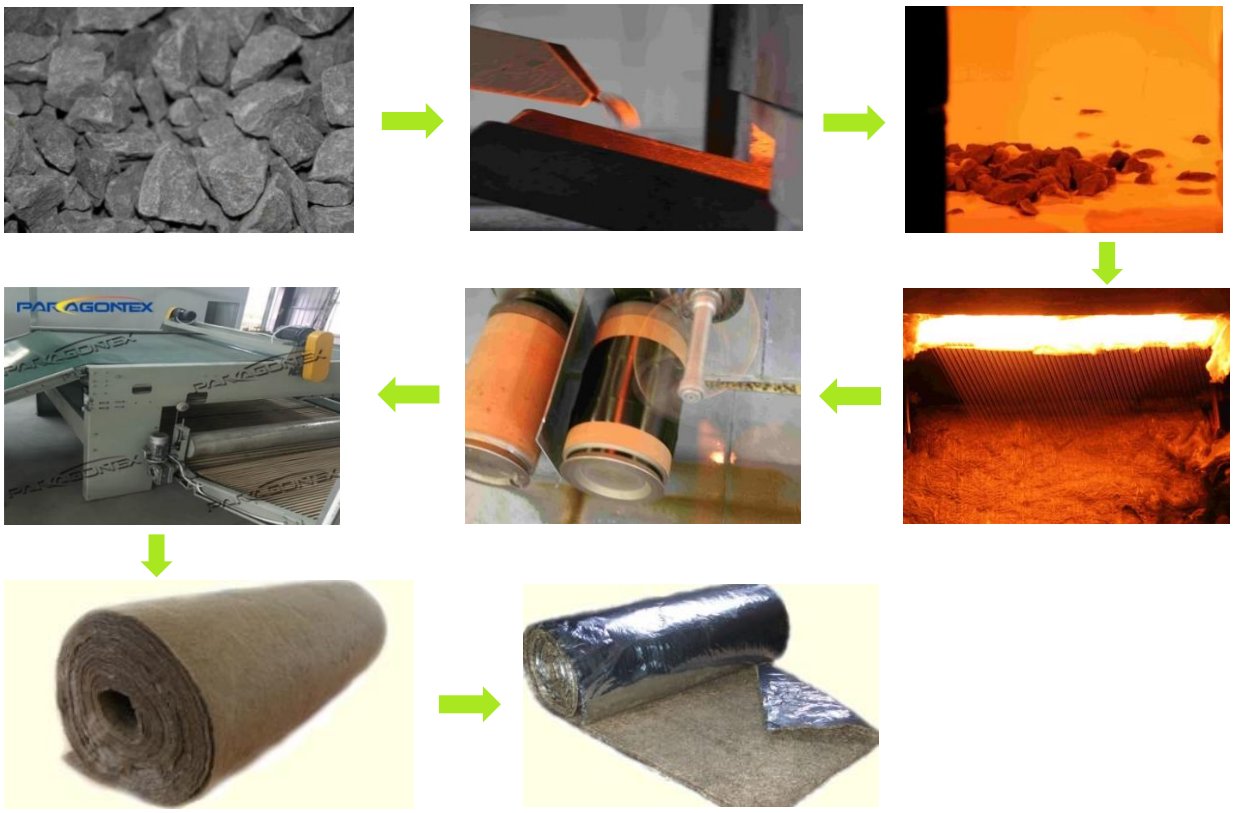
Basalt fibers non-woven thermal insulation and fire-resistant mat, tile and low density mats ("ecomat") are made from textile fibers obtained from basalt ore rocks. Accordingly, as raw textiles are of an inorganic origin, these products are a non-burnable.

Ecomat is an intertwined layer of basalt textile fibers bonded together by natural gravity forces and fixed by a needling.

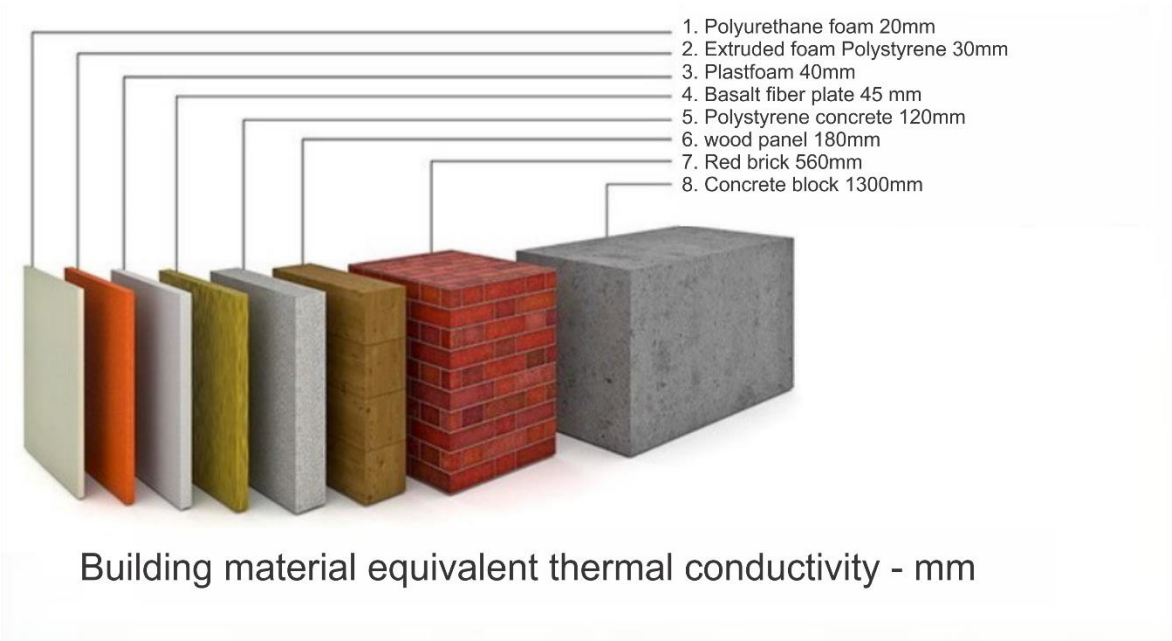
These types of ecomat (with or without fiber glass reinforced foil covering) are used as heat and sound insulation for heaters, furnaces, foundries, exhaust systems, steam turbines, pipelines, and refrigerators. Also to protect building structures from the effects of high temperatures generated during fires.

Ecomat is produced in different thicknesses, surface masses, volumetric densities and covering materials.

These types of ecomat are used to increase the fire resistance of various metal and reinforced concrete structures, including roof profiled sheets and air ducts made from them.




Fire resistance of basalt textile based non-burnable insulation


1. Polyurethane foam 20mm
2. Extruded foam Polystyrene 30mm
3. Plastfoam 40mm
4. Basalt fiber plate 45 mm
5. Polystyrene concrete 120mm
6. wood panel 180mm
7. Red brick 560mm
8. Concrete block 1300mm
Building material equivalent thermal conductivity - mm

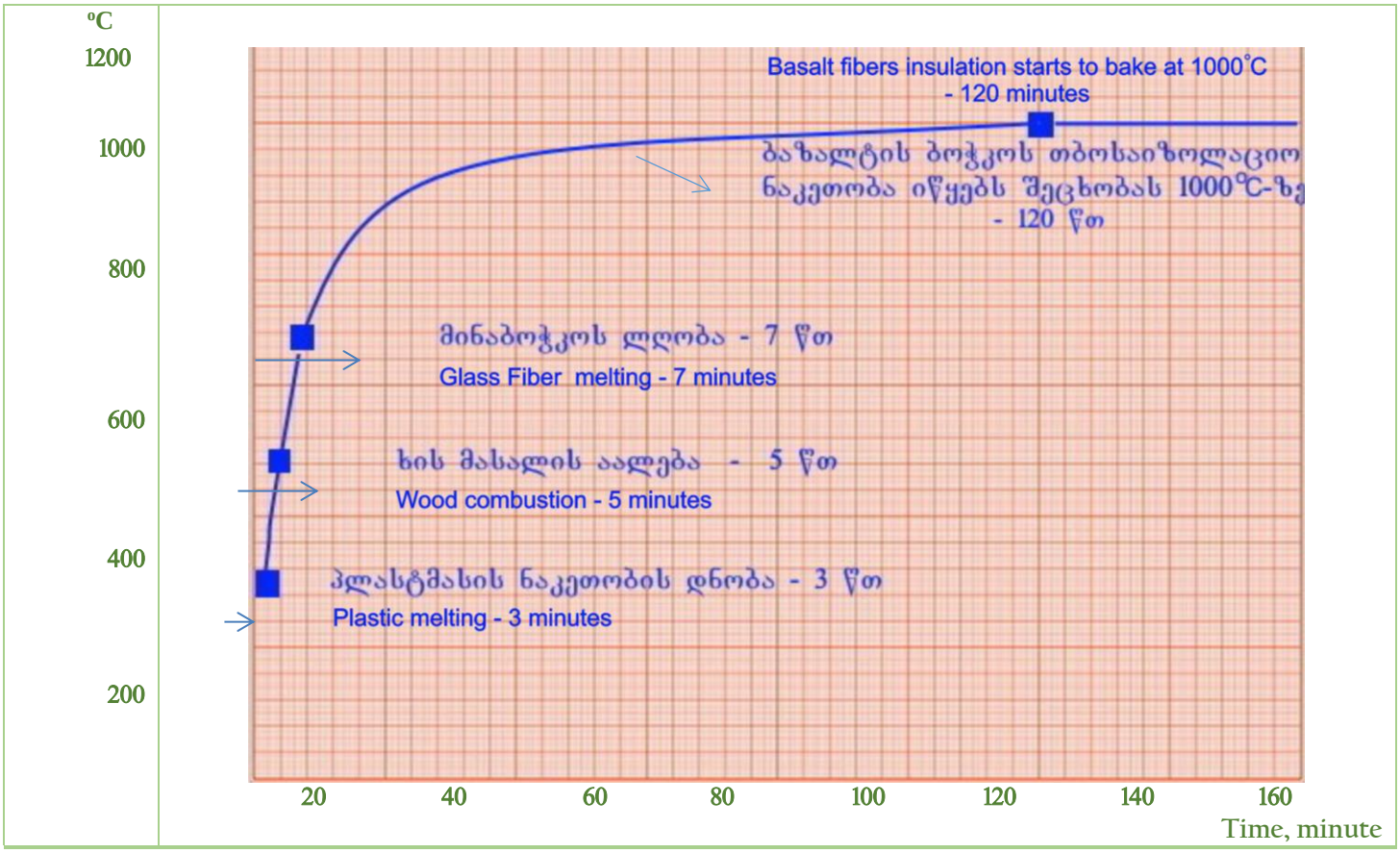


Figure 1. Behavior of some thermal insulation materials under fire conditions

1.1.1 Advantages of Ecomat

- All types of ecomat represent a non-burnable, ecologically clean product;

- Unlike fiberglass, it does not contain phenolic resins harmful to health;

- Unlike fiberglass, it does not contain elemental fibers less than 5 microns in diameter, so it is non-carcinogenic;

- Unlike foam, it is much more elastic, non-fragile and non-flammable;

- The hygroscopicity of basalt fiber is less than 1% (fiberglass is 10-20%), so it does not absorb water from the air, thus it is protecting the structures from moisture;

- Compared to existing competitors, the thermal conductivity of "Ecomat" is one of the best (0.031 W / m K);

- The operating temperature range (-267) - (+850) ° C is the widest, allowing the user to achieve the highest possible heat, noise and fire resistance with the smallest possible volumes of insulation;

- The porous structure of basalt fiber mat, slab and low density DS mats makes them an effective heat-insulating and sound-absorbing multifunctional material that protects the construction from fire, frost and noise.

1.1.2 Ecomat is A1 class nonburnable fire resistant insulation material

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www.bre.co.uk

BRE Global Test Report

EN ISO 1182: 2010 Non-combustibility test on Ecomat 8-135-1100 (Basalt Needle Mat)

Prepared for: The British Georgian Basalt Co. Ltd
Date: 20 December 2017
Report Number: P109900-1000 Issue 1

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Prepared for:

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UK

UKAS TESTING
0578

bre

Prepared by

Name M Walford

Position Chemist

Signature 

Authorised by

Name J Hunter

Position Section Leader – Reaction to Fire

Date 20 December 2017

Signature 

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Table of Contents

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1 Objective

To assess the performance of the sample described in Section 2 of this report when subjected to the tests specified in EN ISO 1182: 2010 Incorporating Corrigendum August 2010[1].

2 Sample

2.1 Traceability

The test samples were supplied by the test sponsor. BRE Global were not involved in the sample selection process and therefore cannot comment upon the relationship between the samples supplied for test and the product supplied to market.

2.2 Description of sample and test format.

Test sponsor	The British Georgian Basalt Co. Limited 17B Denbigh Place London, SW1V 2HB UK
Manufacturer of sample	Basalt Fibers LLC Kazbegi Ave, 16 Tbilisi Georgia 0161
Place of manufacture	Georgia
Trade name	Ecomat 8-135-1100 (Basalt needle mat)
Sample reference	Ecomat 8-135-1100
Sample description (as provided by test sponsor/manufacturer)	Basalt needle mat
Description of sample (as received)	Ten sheets of grey/green matting
Test sponsor's product data	
Generic type of product	Basalt needle mat
Mass per unit area, g/m²	1100 ± 10%
Thickness, mm	8 ± 5%
Colour	Grey, greenish
Flame retardant treatment added or organic content limited during production	Note 1
European product standard, if applicable	Note 1
Measured sample data	
Mean apparent sample density (kg/m³)	159.21 (from 151.17 to 181.46)
Mean apparent sample thickness (mm)	49.32 (from 47.44 to 51.37)

Mean sample mass per unit area (g/m²)	1611.95 (range 1469.43 - 1858.59)
Colour (core)	Green
Test information	
Orientation aspects	Symmetrical
Test sponsor's sampling identification	Note 1
BRE Global sample number	E10315
Sample receipt date(s)	25 September 2017
Sample test date(s)	16 and 30 November 2017
Additional information	Note 1

Note 1: This information was not supplied by the test sponsor.

2.3 Specimen preparation

The sample was prepared in accordance with the test standard by a representative of BRE Global Limited.

3 Conditioning

The specimens were conditioned as required by the standard.

4 Results

4.1 Tabulated data

Deviations: There were no deviations from the test standard.

Table 1: Furnace temperature rise

Run No.	T_m (°C)	T_f (°C)	ΔT (°C)
3	806.3	798.2	8.1
4	802.4	792.2	10.2
5	812.2	809.3	2.9
6	796.6	788.6	8.0
7	808.5	805.2	3.3
Mean value			**6.5**

T_m = maximum furnace temperature
T_f = final furnace temperature
ΔT = temperature rise (T_m - T_f)

Table 2: Mass loss

Run No.	Initial mass (g)	Final mass (g)	Δm (%)
3	14.36	14.23	0.91
4	13.98	13.84	1.00
5	15.53	15.42	0.71
6	12.37	12.20	1.37
7	13.02	12.84	1.38
Mean value			***1.1***

Δm = mass loss expressed as a percentage of the initial mass of the specimen

Table 3: Duration of sustained flaming

Run No.	Duration of sustained flaming t_f (s)
3	0
4	0
5	0
6	0
7	0
Mean value	**0**

4.2 Observations

No sustained flaming was observed in any of the test runs.

5 Conclusions

EN ISO 1182[1] does not contain acceptance criteria and therefore this test report does not indicate a pass or fail of the product.

The mean temperature difference (ΔT) was 6.5 °C

The mean mass loss (Δm) was 1.1 %

No sustained flaming (tf) was observed.

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6 Validity

These test results relate to the behaviour of the sample in the form in which it was tested; the results do not necessarily relate to products produced as a result of further processing or refinement of the sample under test.

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons, it is recommended that the relevance of test and classification reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test or classification to ensure that they are consistent with current practices, and if required may endorse the report.

7 Reference

1. EN ISO 1182: 2010 Incorporating corrigendum August 2010. Reaction to fire tests for products – Non-combustibility test. CEN, Avenue Marnix 17, B-1000 Brussels. 2010.

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Appendix A

Table A.1: Test sponsor's product description

Company: Basalt Fibers	
Parameter	**Details (if applicable)**
Trade name	Ecomat 8-135-1100
General description	Basalt needle mat, a mechanically bonded mat material on a backing of textile basalt fibers
Name and address of manufacturer of product	Basalt Fibers Kazbegi Ave. 16 Tbilisi Georgia 0161
Place of manufacture	Georgia
Product reference/number	Ecomat 8-135-1100
Thickness, mm (ISO 3616: 2001)	8 ± 5%
Surface density, g/m² (ISO 3374: 2000) volume	1100 ± 10%
Density Thermal, kg/m³	135 ± 10%
Mass per unit area	Note 1
Generic type of product	Basalt needle mat for heat insulation and sound absorption
Stability long term, °C (ISO 8301: 1991)	750
Thermal stability short term, °C ISO 8302: 1991)	850
Thermal conductivity, W/m.K (ISO 8894-1: 2010)	0.031
Basalt fiber diameter, µm (ISO 137: 1975)	10 - 16
Sound absorption at 5.0 kHz, % (ISO 10534-1: 1996)	75 ± 5%
Colour	Grey, greenish
Sizing	Silan
Flame retardant treatment added or organic content limited during production (yes/no), if yes give details	Note 1
European product standard, if applicable	Note 1
Industry/in-house product standard, if applicable	Note 1
Attestation of conformity systems, if applicable	Note 1
Adhesive (if applicable)	Not applicable
Face to be tested	Symmetrical
Orientation aspects	Not applicable
Sampling Identification Reference	Not applicable
Additional information	The chemical composition of the material has been supplied and is held in confidence on the laboratory file

Note 1: This information was not supplied by the test sponsor.

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Figure A.1: Photograph of the test specimen

Appendix B

B.1 Furnace calibration

Calibration of furnace used in Non - combustibility test EN ISO 1182 (IN 2579) In association with TC IN 2869/T2 and Logger IN 2724

This calibration was carried out in accordance with the requirements of Reaction to fire tests for building products. Non-combustibility test (EN ISO 1182)

Calibration of Non-combustibility test EN ISO 1182 carried out on: 30/04/2015

Furnace wall temperature readings

Vertical axis	1 at + 30mm	2 at 0mm	3 at - 30mm
A	826.8 °C	827.6 °C	832.0 °C
B	834.0 °C	828.0 °C	831.0 °C
C	829.0 °C	827.0 °C	802.0 °C

Average furnace wall temperature was:

T_{avg} = 826.4 °C

Mean temperatures measured on the three horizontal axis of furnace

$T_{avg\ axis\ 1}$ = 829.9 °C

$T_{avg\ axis\ 2}$ = 827.5 °C

$T_{avg\ axis\ 3}$ = 821.7 °C

Deviations of the temperatures measured on the three axis

$T_{dev\ axis\ n} = (T_{avg} - T_{avg\ axis\ n}) / T_{avg} \times 100$

$T_{dev\ axis\ 1}$ = 0.43 %

$T_{dev\ axis\ 2}$ = 0.14 %

$T_{dev\ axis\ 3}$ = 0.57 %

Average deviation of the average temperature measured on the three levels

$T_{dev\ axis} = (T_{dev\ axis1} + T_{dev\ axis2} + T_{dev\ axis3})/3$

$T_{dev\ axis}$ = 0.38 °C

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Average temperatures measured on the three levels

$T_{avg\ level\ n} = (T_{1a}+T_{2a}+T_{3a})/3$

$T_{avg\ level\ a} = 828.8\ °C$

$T_{avg\ level\ c} = 831.0\ °C$

$T_{avg\ level\ c} = 819.3\ °C$

Deviations of mean wall temperatures on each of the three levels

$T_{dev\ level\ n} = (T_{avg} - T_{avg\ level\ n})/ T_{avg} \times 100$

$T_{dev\ level\ a} = 0.29\ \%$

$T_{dev\ level\ b} = 0.56\ \%$

$T_{dev\ level\ c} = 0.86\ \%$

Average deviation of the average temperature recorded on each of the three levels:

$T_{avg\ level\ n} = (T_{avg\ level\ a} + T_{avg\ level\ b} + T_{avg\ level\ c})/3$

$T_{avg\ level\ n} = 0.57\ \%$

The standard requires that the average furnace wall temperature to be:

$T_{avg} = 835 \pm 10\ °C$

Furnace gave: $T_{avg} = 826.4\ °C$

The Standard also requires that:

$T_{dev\ axis}$ shall be less than 0.5 %

Furnace gave: $T_{dev\ axis} = 0.38\ \%$

The standard also requires that

$T_{avg\ level}$ less than 1.5 %

Furnace gave: $T_{avg\ level} = 0.57\ \%$

The vertical temperature profile measured along the central axis of the furnace was within the limits as specified by the standard.

It follows that the furnace (IN 2579) used for these tests complies with the ISO 1182: 2010 standard for Non-combustibility.

Report Ends

THOMAS BELL-WRIGHT
INTERNATIONAL CONSULTANTS

6762

In accordance with UKAS accreditation to ISO 17065
Certification is Hereby Granted

to

Basalt Fibers LLC

Mshvidoba Str 7a,
Rustavi, Georgia

for

"Basalt Needle Mat- ECOMAT 8-135-1100"

(ASTM E84-18, BS EN 13501-1:2007+A1:2009 Classification)

which, subject to limitations described on the following pages and continued listing on www.tbwcert.com, complies with Product Certification Scheme *SD03 Exterior Wall Assemblies, Cladding, Curtain Walls, Building Materials, Products and Assemblies*

In witness whereof this Certificate is issued this 16th day of January, 2019

THOMAS BELL-WRIGHT INTERNATIONAL CONSULTANTS
CERTIFIED

Thomas F. Bell-Wright
Certification Director

Nick Purcell
Certification Manager

Certificate Number: TBW0300414

Initial registration: January 16, 2019 Issued: January 16, 2019 Expiration: January 15, 2022
File Name: SG176 Deutsche Basalt Fibers LLC Save Date: 16/01/19 9:36 AM

"Basalt Needle Mat- ECOMAT 8-135-1100"

1. Certification is given to "Basalt Needle Mat- ECOMAT 8-135-1100" insulation material subjected to Reaction to Fire tests according to test requirements of Classification standard BS EN 13501-1:2007+A1:2009 – "Fire classification of construction products and building elements-Part 1: Classification using data from reaction to fire test" and for Reaction to Fire performance to test standard ASTM E84-18 for Flame Spread Index (FSI) and Smoke Developed Index (SDI). "Basalt Needle Mat- ECOMAT 8-135-1100" insulation material has achieved the following classification:

Classification according BS EN 13501-1:2007+A1:2009	*Classification according to ASTM E84-18 test result* (Note 1)
Class A1	**Class A**

Note 1: Flame Spread Index (FSI)= 0, Smoke Developed Index (SDI)= 5, Classification is based on International Building Code 2015, Section 803.1.1

2. Certification is subject to the limitations stated herein. Readers of this document should be familiar with Reaction to Fire Testing and the requirements of ISO/IEC 17065:2012. This Certification will be listed on www.tbwcert.com, while it remains current. The Certification is not valid if it is not listed.

3. The product is approved on the basis of TBWIC Product Certification Scheme SD03 for Exterior Wall Assemblies, Cladding, Curtain Walls, Building Materials, Products and Assemblies which includes pre-test sampling, evidence of performance (Reference report: SG191-3 Rev.0, SG190 Rev.0), Technical Verification and Proof of Performance, compliance to Factory Production Control requirements and surveillance & Re-certification Inspection/ Audits.

4. **Limitations:**

   4.1. This Certification covers the specifications of product as described in Section 5.

   4.2. Individual product components or their properties are not to be modified, substituted or eliminated.

   4.3. This certification pertains to the tested material as a standalone product only; it does not extend to the overall system, construction or wall assembly onto which it will be installed or become a component thereof.

   4.4. Reaction to Fire performance of the product was measured under controlled conditions based on the fire test requirements of BS EN 13501-1:2007+A1:2009 Classification Standard and ASTM E84-18 as described in the reference reports. Respective test result shall not be used as sole criteria for fire-hazard or fire-risk assessment of an installation system or assembly under actual fire conditions.

   4.5. The test (and Certification) do not address the following:
   a. Measurement of heat transmission
   b. Effect of aggravated flame spread behaviour of an assembly resulting from proximity of combustible walls and ceilings
   c. Any Resistance to Fire rating
   d. Toxicity level of smoke developed during combustion

Certification Manager
Nick Purcell

Certificate number: TBW0300414

Seal number: 100818

Issued: 16 Jan. 2019
Valid to: 15 Jan. 2022

5. **Product Details**

Product Name: **"Basalt Needle Mat- ECOMAT 8-135-1100"**

Product Description: Mechanically bonded mat material on backing of textile basalt fibres

Thickness: 8 mm ± 5%

Density: 130 to 135 kg/m³

6. **Typical Product Configuration**

Figure 1: Typical product configuration

7. **Approved Manufacturing Location**

Basalt Fibers LLC
Mshvidoba Str 7a,
Rustavi, Georgia

Certificate number: TBW0300414

Page 3 of 3

Certification Manager
Nick Purcell

Seal number: 100818

Issued: 16 Jan. 2019
Valid to: 15 Jan. 2022

DANISH
TECHNOLOGICAL
INSTITUTE

Teknologiparken
Kongsvang Allé 29
DK-8000 Århus C
Tlf. +45 72 20 10 00
Fax +45 72 20 10 19

info@teknologisk.dk
www.teknologisk.dk

E.B.A.S Roving
6 Gulua str.
Tbilisi, 0114,
Georgia

Att.: Mr. Zaza Bakhia

2004.06.28
1001892-04-03
Lab no. 04109
ASE/vem

Dear Mr. Bakhia,

Tests of Basalt Fibre Mat

Please find enclosed the original, signed test report regarding thermal conductivity test and loss on ignition test performed as indirect testing of reaction to fire properties.

From the test reports the following results may be extracted:

Thermal conductivity (Average):	0.0327 W/mK
Organic content (Average):	0.61% (weight)

The results of thermal conductivity lie within the same range as other thermal insulation products used for general building application as well as insulation of building equipment and industrial installations.

The organic content is determined at less than 1 per cent, which allows for at so-called Euroclass A1 CWFT (Classified Without Further Testing). The same classification is expected to be applicable for the shipbuilding industry.

DANISH
TECHNOLOGICAL
INSTITUTE

If we can be of any service regarding the options mentioned in our letter dated 2004.03.05, please contact us.

Please do not hesitate to contact us if you have any questions or comments.

Yours sincerely,
Danish Technological Institute, Building Components

Anders Elbek

Direct tel: +45 7220 1126
Direct fax: +45 7220 1111

E-mail: anders.elbek@teknologisk.dk

Enclosed: Test report TI no. 1211013-01
Test report DIFT no. PF11826a
Invoice dated 2004.06.28

DANAK

Reg No. 12

2004-06-15

File No.: *PF11826a*
Serial No.: *9631*
Ref.: *CAH/DB*
Encl.: *0*

Test Report

Felt not woven combined from basalt and glass fibres FBF-8-1200-G.

Teknologisk Institut
Teknologiparken
Kongsvang Allé 29
8000 Århus C
Denmark

Danish Institute of Fire and Security Technology

Jernholmen 12
DK-2650 Hvidovre
Tel.: +45 36 34 90 00
Fax: +45 36 34 90 01
E-mail: dift@dift.dk
www.dift.dk

The present test report supersedes DIFT's test report dated 2004-06-10 under the above file number

1 SPONSOR

Teknologisk Institut
Teknologiparken
Kongsvang Allé 29
8000 Århus C
Denmark

2 PRODUCT

Insulation material.

Trade Name

Felt not woven combined from basalt and glass fibres FBF-8-1200-G.

3 NAME OF MANUFACTURER

E.B.A.S ROVING. Tbilisi 0114, GEORGIA.

4 TEST METHOD

The test was performed in accordance with EN 13820:2003 "Thermal insulating materials for building applications – Determination of organic content".

5 SAMPLE

On 2004-04-29 DIFT's laboratory received the following sample:

1 pcs. of felt combined from basalt and glass fibres with dimensions 3955 x 1005 x 8 mm.

The sample was marked "E.B.A.S-Roving" L.T.D. 6, Gylyastr. Bbilisi, 380014, Georgia.

Density at 20°C (undried): 144 kg/m³ at the state of receipt determined by weight and measures of the sample.

The following information was given by the sponsor:

- thickness 8.5 mm
- density 140 kg/^{3}
- weight per unit area 1200 g/m^2

Five specimens were prepared from the sample.

6 CONDITIONING

On 2004-05-04 the specimens were stored in a conditioning room with an atmosphere of relative humidity of 50 ± 5% at a temperature of 23 ± 2°. The specimens were kept in this room until the tests were performed.

7 TEST METHOD

The test was performed in accordance with

EN 13820:2003 — Thermal insulating materials for building applications – Determination of organic content.

8 TEST RESULTS

Date of test: 2004-05-24 to 2004-05-28.

Specimen No.	1	2	3	4	5	Average
Ignition loss %	0.47	0.69	0.62	0.69	0.59	0.61

The average weight loss at 500°C was determined to be 0.61% after drying at 105°C.

Dan Bluhme
Head of Department

/

Charlotte A. Hellensberg
Laboratory technician

Teknologisk Institut
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Kongsvang Allé 29
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Reg.nr. 300

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P.O.Box 141
DK-2630 Taastrup
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Fax +45 72 20 20 19
info@teknologisk.dk
www.teknologisk.dk

Test Report

Date: 2004.05.11 Report no. 04020 TI no. 1211013-01 Page: 1 of 1

Requisition:
Teknologisk Institut - Byggeri
Attn: Anders Elbek
Teknologiparken, 8000 Århus C

Manufacturer:
EBAS Roving LTD, Georgia

Samplet from:
-

Invoice to:
Teknologisk Institut, Byggeri
Attn: Anders Elbek
Teknologiparken, 8000 Århus C

Test sample:
Test sample as received: -
Materiel: EBF-8-1200-G
Dimensions [mm]: 1000 x 3000 x 10
Label: -
Id. no. - Requisition no. -

Table 1: Test specimens after preparation

		1	2
Length	mm	608	606
Width	mm	603	601
Thickness, EN 823: Pa	mm	-	-
Weight at arrival	kg	-	-
Weight before test	kg	0,899	0,913
Weight after test	kg	0,900	0,913
Change of mass during test	kg	0,000	0,000
Density during test	kg/m³	116,3	118,7
Thickness during test	mm	21,1	21,1
Thickness before test	mm	21,1	21,1
Thickness after test	mm	21,1	21,1
Change of thickness	mm	0,0	0,0
Moisture during test	weight %	-	-

Test specimen: As delivered and cutted

Conditioning
None

Dates:
Test sample: -
Test sample received: 2004.05.04
Testing: 2004.05.07

Procedure:
Determination of the basic thermal conductivity of building materials, λ_{10} W/(m·K). Standard used: EN 822, EN 823, EN 12667, EN 13162 and ISO 8302.

Results
See table 2.
Measurement uncertainty: ± 2%

Table 2: Test results

Test no.		1
Mean surface temperature of specimen	Hot side °C	19,89
	Cold side °C	0,09
Mean temperature difference	K	19,79
Mean temperature	°C	9,99
Temperature in cabinet	°C	10,8
Room temperature	°C	10,6
Mean thermal conductivity	W/(m·K)	0,0327
Heat flow $q_{measured}$	W/m²	30,66
Thermal resistance $R_{measured}$	m²·K/W	0,65

q and R at 21,11 mm

Conditions:
The test has been carried out in accordance with the conditions given by Danak as printed on the reverse of this report. The test results in this report are only valid for the tested specimens. Excerpts from the report may only be published, if the laboratory has approved the excerpt.

Operator:
PAL

Used measuring apparatu rs equipment:
1) Horizontal GHP 270-T-2050, incapsulated in a thermostatic controlled box,
2) Thermometer for box temperature 270-T-2093
3) Shunt resistor 270-T-2082
4) Data logger 270-T-2060
5) Slide calliper 270-T-2052
6) Telescoping gauge and slide calliper 270-T-2052,
7) Balance 270-T-2054 for weight of the sample,
8) Laboratory temperature 270-T-2070 and
9) Laboratory air humidity 270-T-2088

Remarks:
Deviations from the standard: None

Otto Paulsen
Head of Laboratory
Thermal Laboratory, TELA
DTI Industry and Energy, Taastrup

1.1.3 Temperature resistance parameters for various types of Ecomat with different technical characteristics according to the international standard for fire damper systems (BS EN 1366-2)

1. Purpose of the work

The aim of the present work was to investigate the temperature conductivity of basalt textile fiber thermal insulation materials by heating a horizontal surface electric oven to 450 ° C for 240 minutes (4 h).

The following sample materials were used in the experiment:

1. Basalt textile fiber needling mat ECOMAT 15-170-2800 F
   15 mm thick, density 170 kg / m3, surface density 2800 g / m2,
   With fiberglass-reinforced, metalized polimer, foil coating.

2. Basalt textile fiber needling mat ECOMAT 15-170-2800
   15 mm thick, density 170 kg / m3, surface density 2800 g / m2,
   Without fiberglass-reinforced, metalized polymer, foil coating.

3. Basalt textile fiber needling mat ECOMAT ECOMAT 25-185-4800 F
   25 mm thick, density 185 kg / m3, surface density 4800 g / m2,
   With fiberglass-reinforced, metalized polymer foil coating.

4. Basalt textile fiber needling mat ECOMAT ECOMAT 25-185-4800
   25 mm thick, density 185 kg / m3, surface density 4800 g / m2,
   Without fiberglass-reinforced, metalized polymer, foil coating.

5. Basalt fibers low density needling mats ECOMAT DS 50-50-2600 F
   50 mm thick, density 50 kg / m3, surface density 2600 g / m2,
   With fiberglass-reinforced, metalized polimer, foil coating.

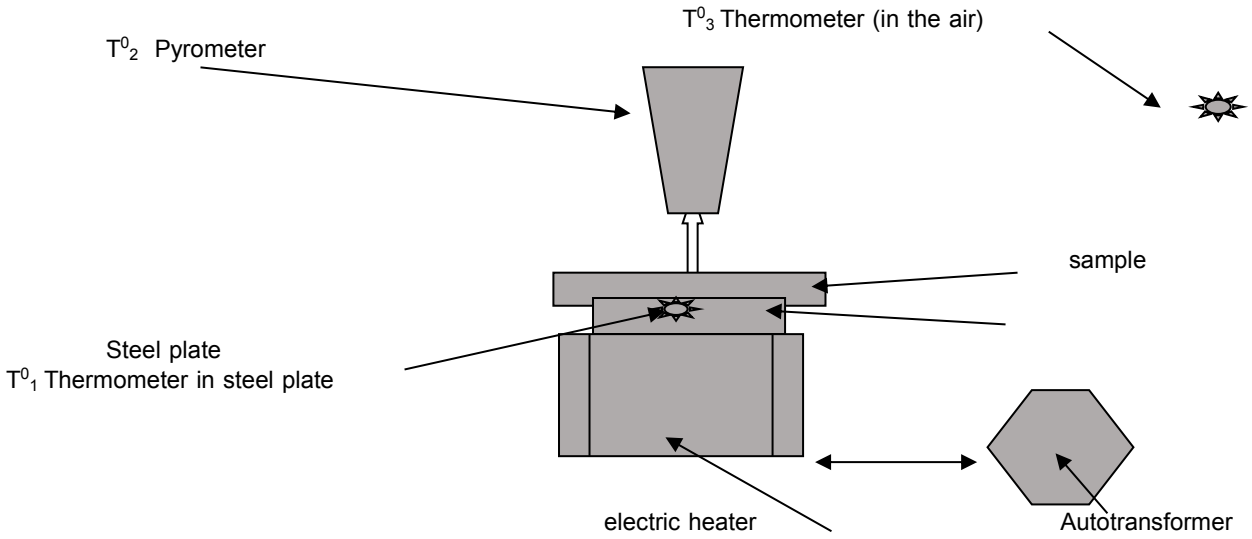
6. Basalt fibers low density needling mats ECOMAT DS 50-50-2600
   50 mm thick, density 50 kg / m3, surface density 2600 g / m2,
   Without fiberglass-reinforced, metalized polymer, foil coating.

7. Basalt textile scutched fiber tile BAF 50 – 70 / 3500 F,
   50 mm thick, density 70 kg / m3, surface density 3500 g / m2,
   With fiberglass-reinforced, metalized polimer, foil coating.

8. Basalt textile scutched fiber tile BAF 50 – 70 / 3500,
   50 mm thick, volumetric density 70 kg / m3, surface density 3500 g / m2,
   Without fiberglass-reinforced, metalized polymer, foil coating.

The work was in progress 27.05. – 18.06. 2020.

2. Diagram of a vertical device for determining the temperature conductivity



3. Experiment settings

1. Geometric dimensions of the samples: length - 250 mm, width - 250 mm, thickness 15; 25; 50 mm.
2. Thicknesses were measured at 9-9 points on each sample.
3. Test sample heater - electric stove with nichrome spiral 220 v, 1000 w.
4. Temperature on the surface of an electrically heated steel plate - 450 ^{0}C.
4. 30 mm thick steel plate with a hole for the thermometer between the sample and the oven.
5. Measurement of temperature on the surface of the test specimens with a pyrometer - in the center of the testing space.
6. Distance between the upper surface of the test specimens and the pyrometer - 150-200 mm.
7. Frequency of temperature measurement on the surface of the test samples with a pyrometer:
   30, 60, 90, 120, 150, 180, 210, 240 minutes.

4. Places and means for temperature measurements

T^0_1- Temperature in the lower surface center of the heated sample
Using mercury thermometer with the partions of 1^{0}C.
T^0_2- Temperature in the upper surface center of the heated sample
Using pyrometer Infrarot thermometer -20 … +320 ^{0}C.
T^0_3- Environment temperature in the laboratory, near the electric heater
Using mercury thermometer with the partions of 1^{0}C.

Remark:
1. The purpose of the 30 mm thick steel plate placed on the surface of the stove is to evenly and uniformly transfer the heat energy released by the stove heating element to the lower surface of the test sample.
2. A test sample of a heat-insulating material covered with fiberglass-reinforced, metallized polymer foil was placed on an electric stove with a foil cover on upper side.
3. The metallized polymer foil was glued to the samples with PVA glue and dried in a dry closet at 100-105 ^{0}C for 3 hours to remove residual moisture.

5. Process of the experiment.

(working tables)

5.1. Basalt textile fiber needling mat ECOMAT 15-170-2800 F
With fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 1

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
30	450	110	30,0	
60	450	110	30,0	
90	450	110	31,0	
120	450	109	31,5	
150	450	110	31,5	
180	450	110	32,0	
210	450	111	33,0	
240	450	110	33,0	
Average	***450***	***110***	***31,5***	

5.2. Basalt textile fiber needling mat ECOMAT 15-170-2800

Without fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 2

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
30	450	150	30,0	
60	450	150	30,0	
90	450	151	30,0	
120	450	150	30,0	
150	450	150	30,0	
180	450	150	31,0	
210	450	151	31,0	
240	450	150	31,5	
Average	***450***	***150***	***30,5***	

5.3. Basalt textile fiber needling mat ECOMAT 25-185-4800 F
With fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 3

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
30	450	89	33,0	
60	450	90	33,0	
90	450	91	33,0	
120	450	90	33,0	
150	450	90	33,5	
180	450	90	33,5	
210	450	90	33,5	
240	450	90	33,0	
Average	***450***	***90***	***33***	

5.4. Basalt textile fiber needling mat ECOMAT 25-185-4800
Without fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 4

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
30	450	115	30,0	
60	450	115	30,0	
90	450	115	30,0	
120	450	114	30,0	
150	450	115	30,0	
210	450	115	31,0	
240	450	115	31,5	
Average	***450***	***115***	***33,5***	

5.5. Basalt fibers low density needling mats ECOMAT DS 50-50-2600 F
With fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 5

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
				Temperatures on the surface of the mat was measured on spots 2-2: 1 - In the not needled areas of the mat 2 - In the needled areas of the mat
30	450	85-90	35,0	
60	450	84-90	35,0	
90	450	85-91	35,0	
120	450	86-93	35,0	
150	450	88-95	35,0	
180	450	87-95	35,5	
210	450	86-94	35,5	
240	450	88-96	35,0	
Average	***450***	***86-94***	***35***	
		90		

5.6. Basalt fibers low density needling mats ECOMAT DS 50-50-2600
Without fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 6

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
				Temperatures on the surface of the mat was measured on spots 2-2: 1 - In the not needled areas of the mat 2 - In the needled areas of the mat
30	450	108-118	33,0	
60	450	112-120	33,0	
90	450	114-124	33,0	
120	450	110-120	33,0	
150	450	114-125	33,5	
180	450	115-125	33,5	
210	450	113-123	33,5	
240	450	114-124	33,0	
Average	***450***	***113-122***	***33***	
		117		

5.7. Basalt textile scutched fiber tile BAF 50 – 70 / 3500 F,
With fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

Table 7

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
				Due to the non-uniformity of the slab on the surface temperatures were measured on spots 2-2:In low and high density areas
30	450	85-93	32,0	
60	450	85-96	32,0	
90	450	83-91	32,0	
120	450	83-91	32,0	
150	450	84-93	33,0	
180	450	85-94	33,5	
210	450	86-94	34,0	
240	450	85-93	34,0	
Average	***450***	***84-93***	***33***	
		89		

5.8. Basalt textile scutched fiber tile BAF 50 – 70 / 3500,
Without fiberglass-reinforced, metalized polimer, foil coating.

450 ^{0}C

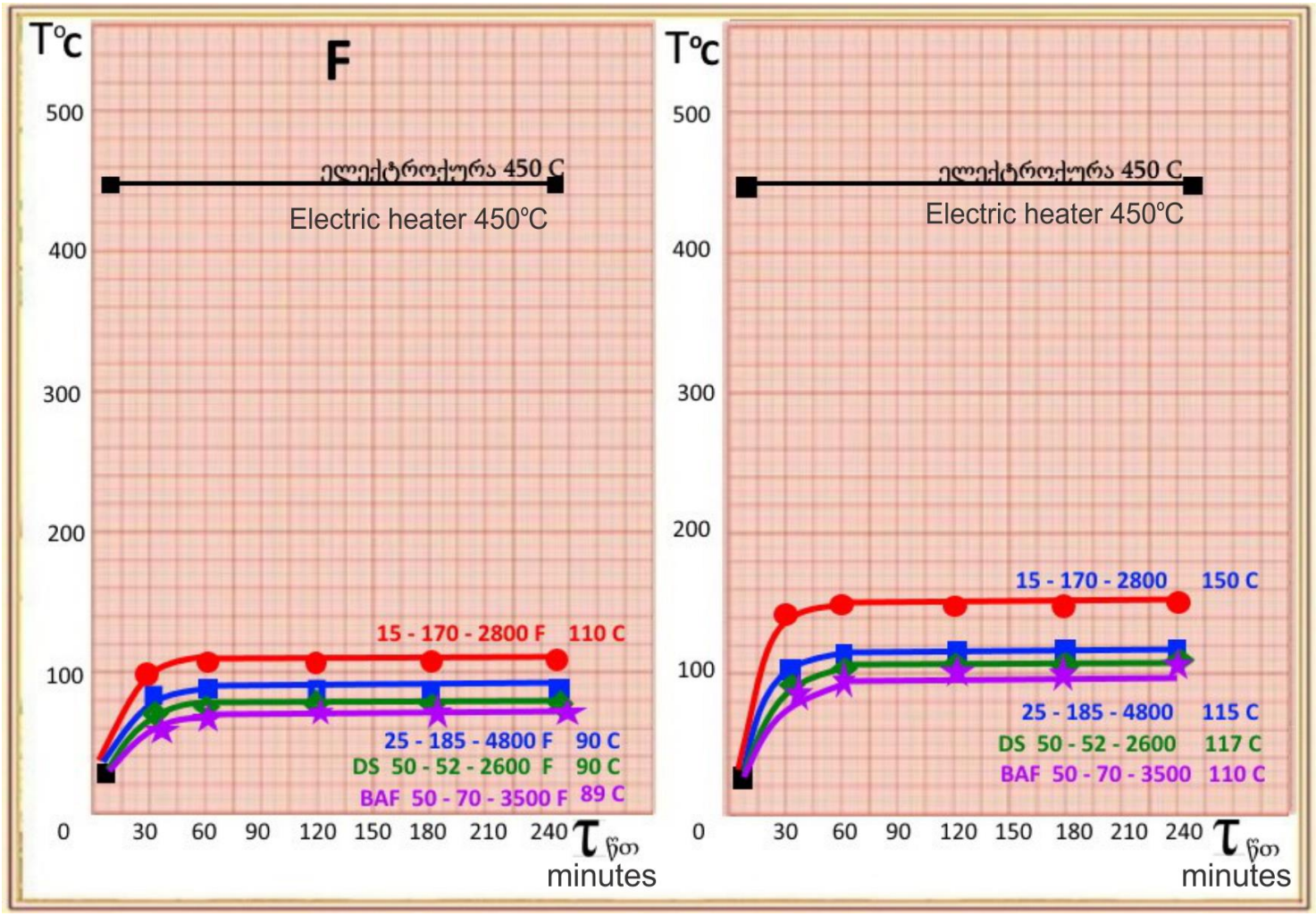
Table 8

Time	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature in the laboratory, near the electric heater	Remark
Min.	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C	
				Due to the non-uniformity of the slab on the surface temperatures were measured on spots 2-2:In low and high density areas
30	450	104-120	35,0	
60	450	102-120	34,5	
90	450	104-119	34,0	
120	450	103-119	34,0	
150	450	102-116	32,5	
180	450	101-118	32,5	
210	450	100-117	33,0	
240	450	100-116	33,0	
Average	***450***	***102-118***	***33,5***	
		110		

5.9. Basalt textile fiber thermal insulation needling mat,
Non-woven low-density mat,
Basalt textile scutched fiber tile
Comparative table for average thermal conductivity
For heating up to 450 ^{0}C temperature during 240 minutes (4 hours)

Table 9

Material description	Thickness	Temperature in the lower surface center of the heated sample	Temperature in the upper surface center of the heated sample	Environment temperature
	mm	T_1 ^{0}C	T_2 ^{0}C	T_3 ^{0}C
Basalt textile fiber needling mat ECOMAT 15-170-2800 F, with foil	15	450	110	31,5
Basalt textile fiber needling mat ECOMAT 15-170-2800, without foil	15	450	150	30,5
Basalt textile fiber needling mat ECOMAT ECOMAT 25-185-4800 F, with foil	25	450	90	33
Basalt textile fiber needling mat ECOMAT ECOMAT 25-185-4800, without foil	25	450	115	33,5
Basalt fibers low density needling mats ECOMAT DS 50-50-2600 F, with foil	50	450	86-94 (90)	35
Basalt fibers low density needling mats ECOMAT DS 50-50-2600, Without foil	50	450	113-122 (117)	33
Basalt textile scutched fiber tile BAF 50 – 70 / 3500 F, With foil	50	450	84-93 (89)	33
Basalt textile scutched fiber tile BAF 50 – 70 / 3500, Without foil	50	450	102-118 (110)	33,5



1.1.4 Comparative analysis of Ecomat characteristics with alternative materials used in fire protection systems

The only Rockwool product that can bear 600°C is the Rockwool-wired mat. This product has a specific density of 105 kg/m3 and a thermal conductivity coefficient on 600 ° C is 0.167. Our product – Ecomat (check Technical Data Sheet below) has a specific gravity of 150 kg/m3 and a thermal conductivity coefficient at the same temperature of 0.154 (see table 2). Based on these data, at an internal temperature of 600 °C, the surface will be held at 50 °C using an Ecomat 8/1100 with a thickness of 104 mm, and the same can be obtained using a Rockwool wired mat with a thickness of more than 165 mm. Such difference in the thickness of the insulating material is obtained based on the combination of differences in the coefficients of thermal conductivity and thermal inertia of the material (this technical parameter mainly depends on the density of the insulating material).

Structural integrity of the fire damper insulations is defined by the pressure transferred from the damper to the insulation up to the pressure level when damper disintegrates due to the hot air pressure going through the

damper. Insulation structural integrity performance against such pressures is defined by the composition and structural parameters of the insulation. When comparing ECOMAT 24/3200 and Rockwool Wired Mat from structural integrity perspective, the following parameters need to be considered:

Table 1: Ecomat and Rockwool wired mat comparison of structural composition

	Rockwool Wired Mat 50	Rockwool Wired Mat 80	ECOMAT 24/3200
Length of the elementary fiber in the mat, mm	0.5 – 25		70 mm – 80 mm
Mat thickness used for comparison, mm	50		24
Fiber length to mat thickness proportion, %	25.5		312.5
Diameter of the elementary fiber, μ[1]	1 – 30		9-16
Method used for fiber binding	Chemical binders[2]		Nonwoven needling
Mat tensile strength, kN/m	0.17	0.17	1.3
Elongation limit[3], %			9

Notes:

1. Fibers under 5 μ diameter, is considered carcinogenic;
2. Chemical binders starts to burn and evaporation and thus degrades as a binder;

Greater the limit, without compromising structural continuity and integrity, the better the insulation performs when fire dumps deform;

Table 2: Ecomat and Rockwool wired mat comparison for technical parameters

	Wired mat 50	Wired mat 80	Wired mat 105	Ecomat 24/3200	Standard
Thermal conductivity, Wt/mK					EN 12667:2001
λ_{50}	0.042	0.039	0.039	0.031	
λ_{100}	0.052	0.045	0.045	0.033	
λ_{125}	0.057	0.050	0.049		
λ_{150}	0.062	0.053	0.052		
λ_{200}	0.075	0.062	0.059	0.041	
λ_{250}	0.089	0.072	0.068		
λ_{300}	0.106	0.087	0.078	0.054	
λ_{350}	0.127	0.99	0.089		
λ_{400}	0.151	0.115	0.102	0.078	
λ_{500}	0.215	0.153	0.131	0.115	
λ_{600}	-	0.198	0.167	0.154	
λ_{640}	-	0.220	0.191		
Λ_{700}	-	-	-	0.208	
Work temperature, °C	-180 ÷ +500	-180 ÷ +650	-180 ÷ +680	-220 ÷ +800	EN 14706:2005
Max. work temperature, °C	+650	+750	+800	+1000	CI/SfB||(2-)|Rm1|K2| November 2008
Temperature of melting, °C	+1000	+1000	+1000	+1400	

Table 3: Ecomat and Rockwool wired mat comparison for areas of application

Areas of application		Product	Ecomat 24/3200	Rockwool wired mat 50	Rockwool wired mat 80	Rockwool wired mat 105
Reservoirs	< 250°C	Lesser < 3m				
	> 250°C	Bigger > 3m				
Boilers	< 250°C	Lesser < 3m				
		Bigger > 3m				
Furnaces	< 250°C					
	> 250°C					
Flue gas removal		Thermal insulation				
		Acoustic insulation				
Pipelines						
Thermal insulation		T < 250°C				
		250°C < t < 500°C				
		500°C < t < 640°C				
		640°C < t < 660°C				
		660°C < t < 700°C				
		700°C < t < 800°C				
Prevention of condensate						
Acoustic insulation						
Fire resistance						
Air ducts						
Thermal insulation		Square				
		Circle				
Fire resistance						
Acoustic insulation						

Table 4: Ecomat and Rockwool wired mat comparison for temperature regimes

Product	Fire resistance limit, min
Ecomat 24/3200	∞ (Unlimited)
Wired mat 25mm	60
Wired mat 30mm	90
Wired mat 40mm	120
Wired mat 50mm	150
Wired mat 60mm	180
Wired mat 70mm	240

Figure 1: Ecomat and Rockwool wired mat comparison for thickness shrinkage

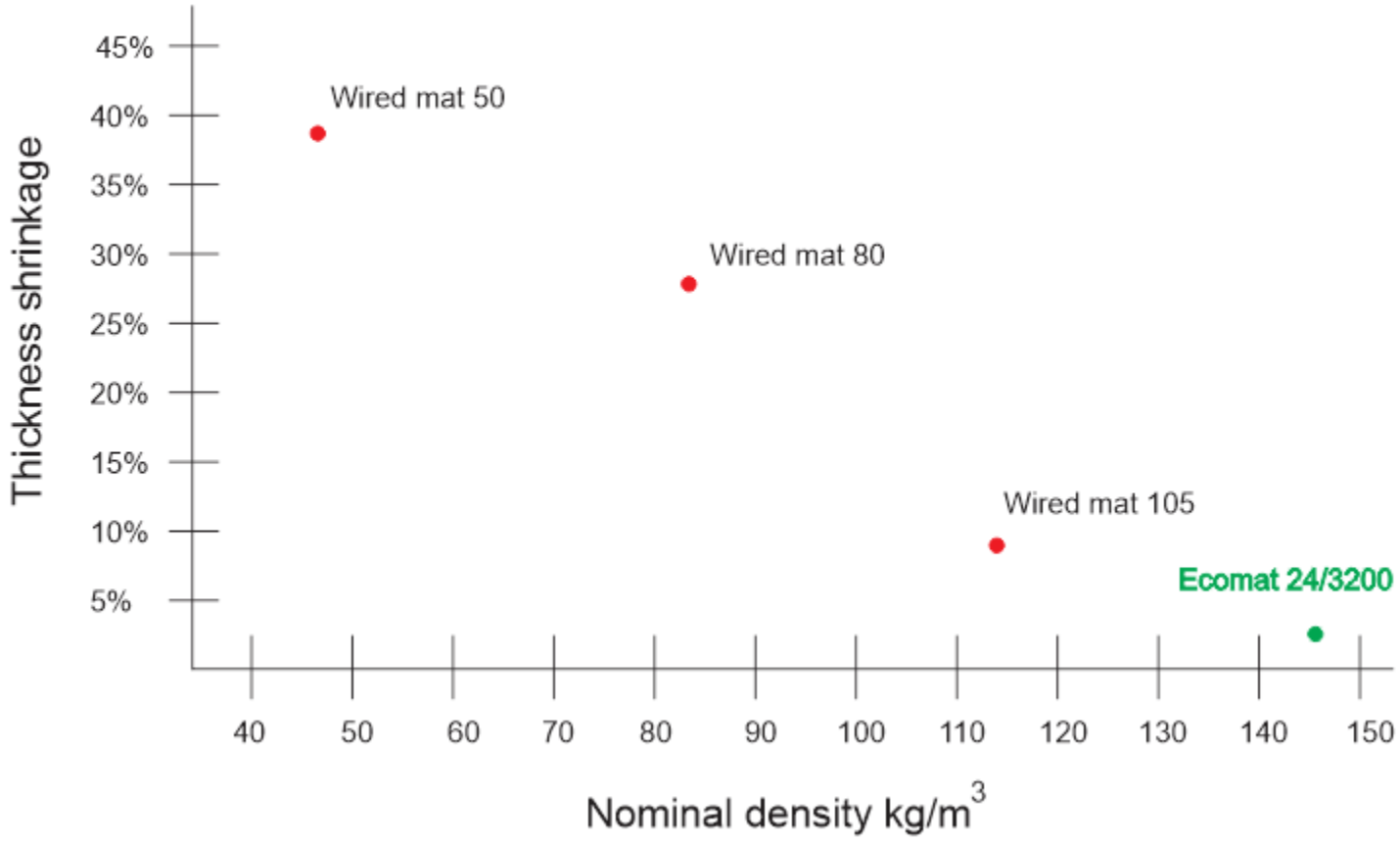


Table 5: Identification for Basalt needling mats

Product	Description
Ecomat 24/3200	Basalt needling mat
Ecomat 24/3200 f	Basalt needling mat with reinforced foil

1.1.5 Fire protection systems

Compared to classical fire protection methods of structures such as bricklaying, increasing the protective layer of concrete, etc., modern, highly efficient solutions using basalt fiber thermal insulation materials have multifunctional applications and have much less loads on load-bearing structures.

Installation of such systems is less time consuming and can be performed at any ambient temperatures.

This instruction describes the fire protection systems of the following structures:

- Air dampers and air ducts;

- Profiled sheets.

- Steel constructions;

- Reinforced concrete structures;

1.2.1 Examples of fire protection systems of structures

1.1 General recommendations for carrying out the work

1.1.5 Transportation and storage

During transportation, the material must be protected from the effects of atmospheric precipitation.

To prevent damage of the material during transportation, the load must be secured.

Unloading of material after transportation must be carried out accurately, without damaging the product.

Products should be stored in a closed warehouse. It is allowed to store it in a hanger, where it will be protected from atmospheric precipitation.

1.1.6 Rules for working with the material

When working with basalt fiber material it is necessary to use personal protective equipment.

basalt fibers material packaging must be opened only directly at the installation site. Only work with completely dry products. The material must be protected from atmospheric precipitation during the work.

A knife, scissors or a saw are used to cut the "Ecomat" mat or tile. It is not allowed to rip or tear the material.

It is not allowed to apply load to the low density (below 105 kg / m3) basalt mats or slabs, walk on it, stack other materials on top.

“When working with Ecomat tiles it is necessary to:

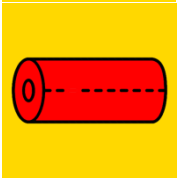
- Unpack the tile

- Check the integrity of the tile.

Cut the deformed part and trim the edges.

When working with the rolled materials (mats) it is necessary to:

- Accurately remove the wrapping tape at torsos.



- Cut the wrapping tape on the longitudinal seam without damaging the material.

Roll must be rolled out and accurately shaked from the edges

To restore thickness and shape, spread the roll for at least 5 minutes.

2. Fire protection system for fire dampers and air ducts

Fire dampers and air duct system itself is a good fire spreader in case of fire.

The flow of air and the air thinning in the fire dampers or air ducts, help to spread the fire inside the building at high speed.

Because it is impossible to prevent 100% of fires and its spread, fire resistance performance of air duct and fire dampers is an important issue.

This means make it possible to create an additional time for evacuation of people and material valuables.

For this purpose, "Basalt Fibers" Ltd. has developed a fire protection system for fire dampers and air ducts, which is based on the following products produced from basalt textile fiber:

ECOMAT 25-185-4800;

ECOMAT 25-185-4800 F;

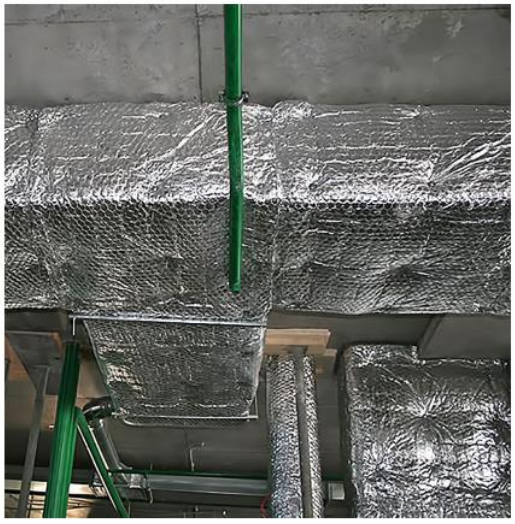
ECOMAT DS 50-70-3500;

ECOMAT DS 50-70-3500 F .

These products provide a fire resistance range of 60 - 240 minutes depending on the type of product.

In addition to the fire protection function, this system also performs thermal and sound insulation functions. The ecomat used in the system is the A-I class Fire resistant material which allows this system to be used without restriction on any object. (See 1.1.2)

Outside the building it is necessary to consider a protective layer of fire dampers and air ducts.



Markings:

ECOMAT 25-185-4800 is a 25 mm basalt fiber needling mat with a density of 185 kg/m3 and a weight of 4800 g/m2. COMAT 25-185-4800 F is the same, but with the fiberglass-reinforced, metalized polimer foil. ECOMAT DS 50-70-3500 is 50 mm low density (DS) mat, with the density of 70 kg/m3, and weight - 2600 g/m2. ECOMAT DS 50-70-3500 F is the same, but with the fiberglass-reinforced, metalized polimer foil.

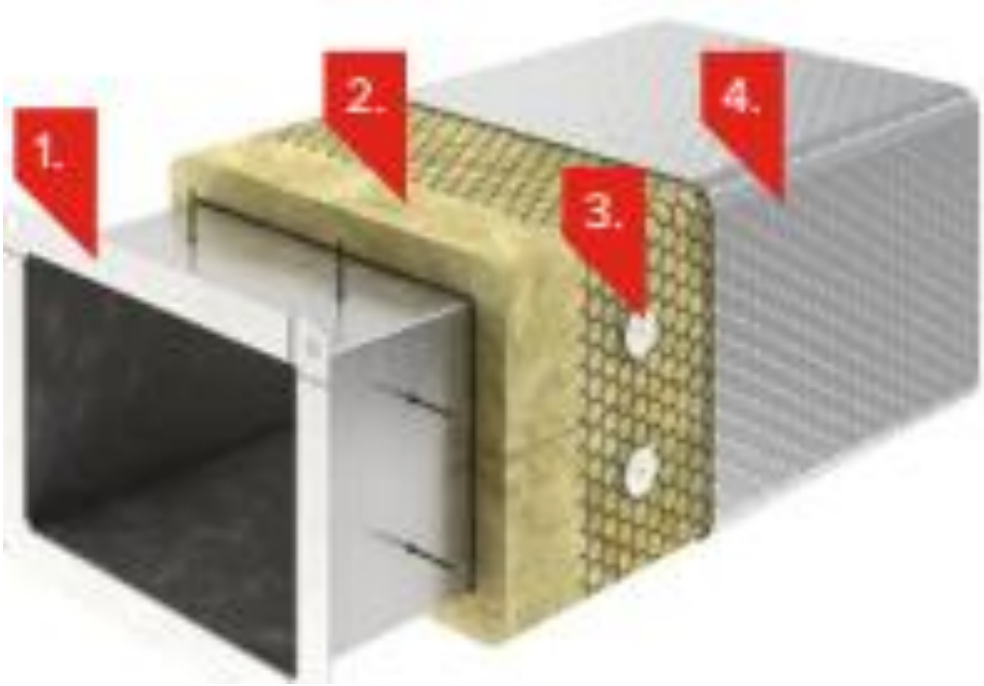
Together with 50 mm (DS) low density mat there are the same type of (DS) mats with the thicknesses 25, 80, 100 mm.

All the parameters are described in details in chapter 6.

2.1 System description

2.1.1 System: Fire protection – air duct

Fireproofing of air ducts and fire dampers.



System composition:

1 - Steel air duct casing

2 - Basalt fiber mats or low density basalt fiber mats with or without fiberglass reinforced, metallized polymer foil. E.x. ECOMAT 25-185-4800 or ECOMAT DS 50-70-3500 F.

3 - Metal glazed pin CT / WP2 and holding washer PW2 Termoclip.

4 – Fastening wire and aluminum tape (for edging).

2.2 Advantages of the system

- Easy installation;
- Technology;
- No need for additional processing of the structure;
- Vibration resistance;

- Aesthetic appearance;

- Durability;

- Installation is possible at any time of the year, as it is not a "wet" process.

2.3 Fire resistance limit

Depending on the thickness of fire resistant ECOMAT 25-185-4800 mats or ECOMAT DS 50-70-3500 low-density mat , the fire resistance range of the fire dampers or air duct is 60 -240 minutes.

ECOMAT 25-185-4800 and ECOMAT DS 50-50-3500 mate fire resistance for various thicknesses:

Thickness, mm.	Unit	Indicator	
		ECOMAT 25-185-4800	ECOMAT DS 50-70-3500
25	Minute	EI 60	
50	minute		EI 90

2.4 Installation of fire protection system

2.4.1 Necessary materials, tools and individual means of protection

- Measuring roll

- Knife, scissors or small saw

- hammer

- nipper tool

- welding Machine

- Respirator, goggles, gloves

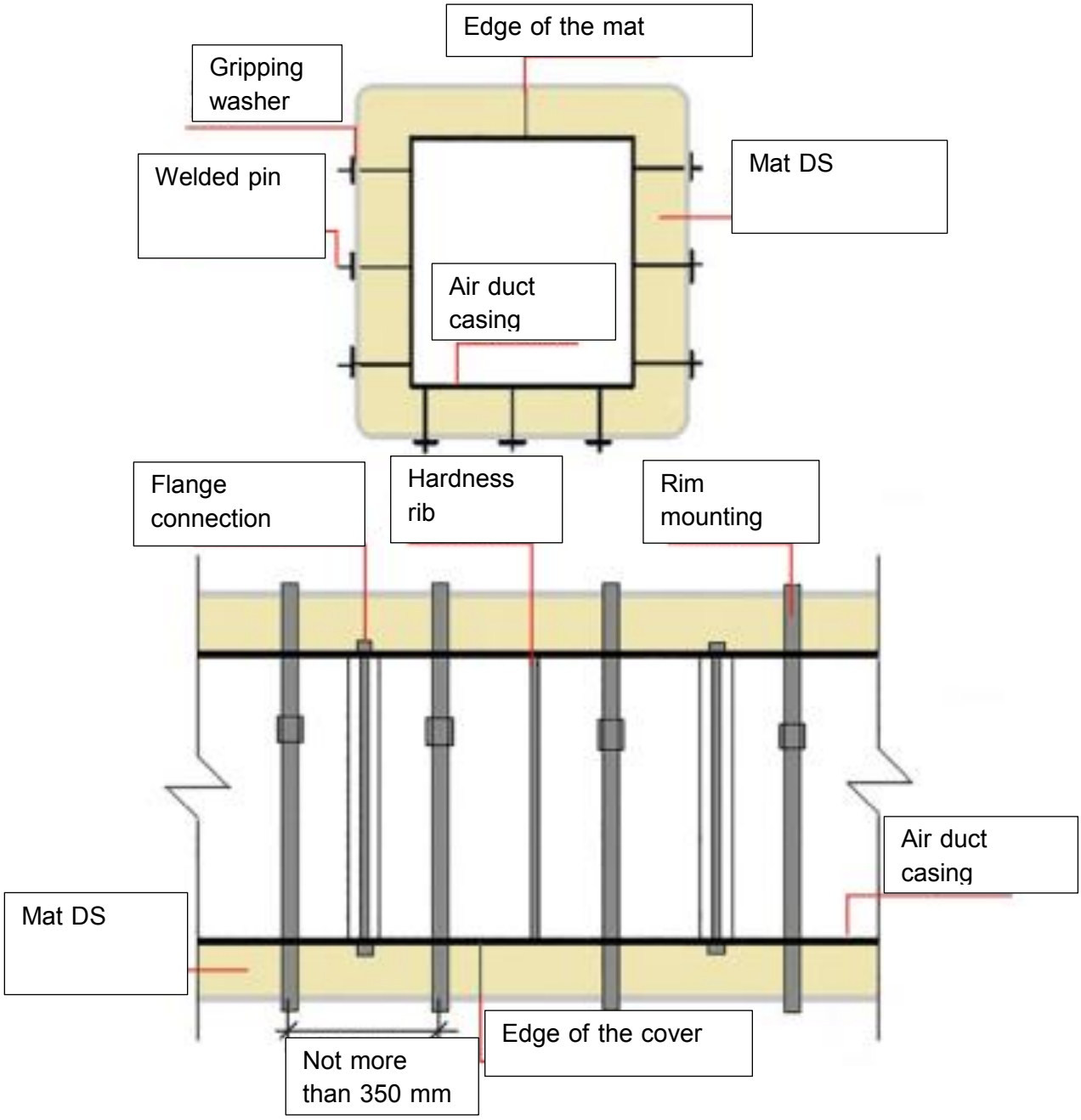
- Pin and washer

- mat or low density (DS) mat

2.4.2 Choosing the method for mounting

Mounting fire resistant mats for fire dampers and air duct can be done with welded pins and clamps, as well as steel rods or fastening wires.

In the first case a specialized welding device is required.


Edge of the mat
Gripping washer
Welded pin
Mat DS
Air duct casing
Flange connection
Hardness rib
Rim mounting
Air duct casing
Mat DS
Edge of the cover
Not more than 350 mm

2.4.3 Mounting method 1 - With welding pins and gripping washers

Preparation of air duct casing.

The casing of the fire dampers and air duct must be made of steel sheet, with the thickness of not less than 0.8 mm, must have correct geometric dimensions and reliable attachment to the load-bearing elements of the building.

Flanged joints must be reinforced with fire resistant materials (fireproof sealant, basalt fiber tape, asbestos cord, etc.).

The outer surfaces of the fire dampers or air duct shall be prepared for impulse-condenser welding, so cleaned of dirt and, if necessary, degreased.

If the surface is primed or painted. Then the welding places should be well abraded, for good contact with the metal.

Cutting fire protective mat.

It is recommended to cut basalt fiber needling mat or low density mats with a knife or scissors.

The cut is made in a manner to cover the entire perimeter of the dire damper or air duct by at least 50 mm edge over covering.

Attention: It is not recommended to place the edges of the mats on the bottom side of the fire dampers of air ducts.

Adjustment of the welding machine.

Read the instructions of the device before work. It is necessary to choose a welding parameters depending on the type of pins. Adjust the welding machine voltage.

Preparation of pins and grip washer.

The pins must be straight. If necessary, straighten them so that they can be inserted smoothly into the welding machine.

The number of washers should be equal to the number of welded pins.

All washers should have four-way connectors to attach to the pins.

Welding of pins

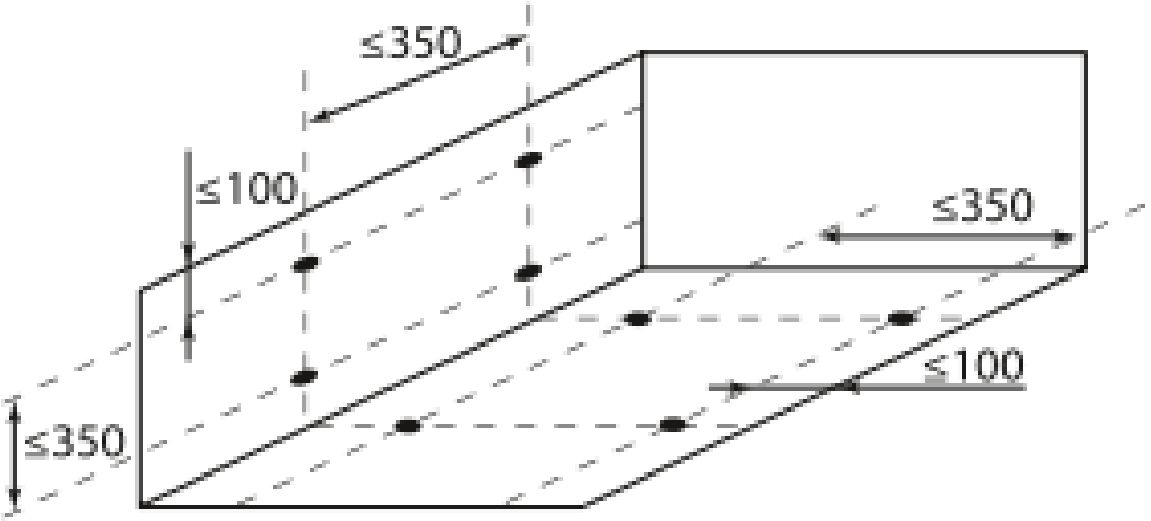
By means of contact or impulse-condenser welding machine, the pins are welded to fire damper or air duct.

The welding points of the pins are marked according to the structural features of the fire damper or air duct (size, configuration, cross-section).

The following rules are recommended when installing fire dampers or air duct pins:

- Maximum distance between pins vertically and horizontally – 350 mm.

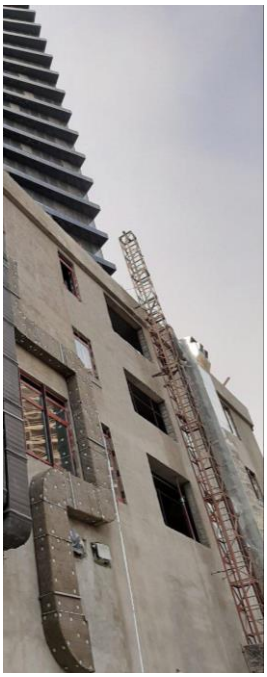
- Maximum distance from the edge of the air duct to the first row of pins – 100 mm.


≤350
≤100
≤350
≤100
≤350

Mounting mat

Pre-cut basalt or low-density mat mats are hung on welded pins so that the pins do not bend..

The mats are hung so that the traverse of the fire damper or air duct is below it and the flanged joints are covered with mats.



Washer mounting

Once the mats are hung, they are fixed with washers.

The sharp ends of the pins are cut with a nipper tool. Leave only 2-3 mm for fixing washers, or for fixing them using protective caps.

The washers are hidden by pieces of mat and fixed with aluminum adhesive tape.

Mat fixing

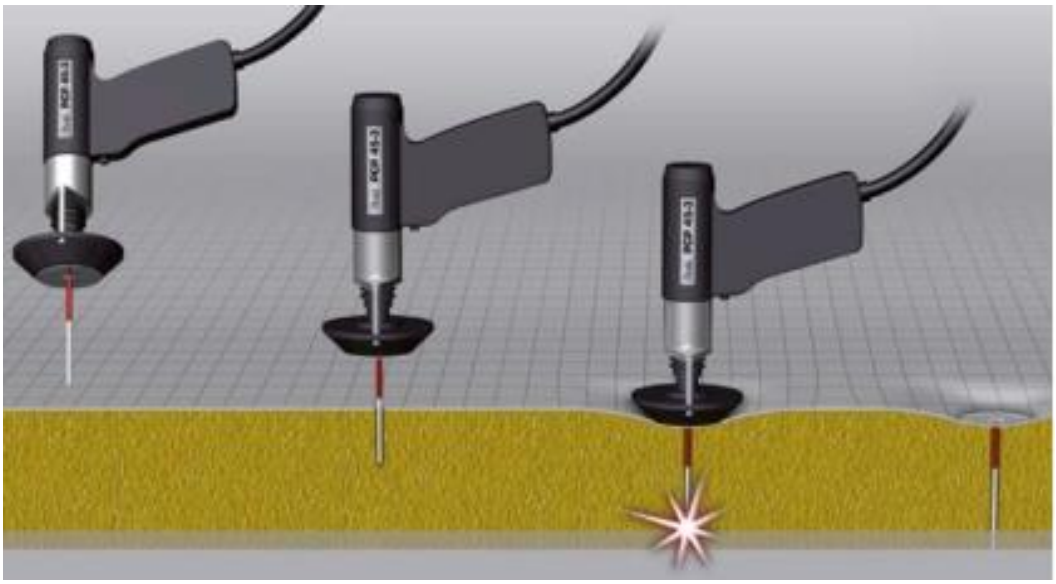
On each cut mats will be fixed with each other using steel wire and edges will be enhanced with the cutted additionally cutted mat parts and fixed with wire. In addition the edges of the two mats should be connected with aluminum tape.

Attention: Outside the building it is necessary to consider a layer of fire damper or air duct insulation.

Welding of pins through insulation.

There is a possibility to attach the pins directly through the mats.

In this case, combined pins with locking bars are used as fastening elements.



2.4.4 Mounting method 2 – using rims

Rims may also be used to fix fire resistant mats.

Steel galvanized tape with a thickness of not less than 0.8 mm and a width of not less than 15-20 mm (GOST 3560) or galvanized wire with a diameter of 1-2 mm can be used as a rim.

Mounting using rims or wires is accomplished with the pitch not less than 350mm.

The edges of the two mats should be connected with aluminum tape.

For high cross-section (800 mm or more) fire dampers or air ducts, the pitch shall be no more than 200 mm to prevent fire protective mats from hanging down.

Fire protection of fire damper and air duct hangers.

Fire protection is carried out with the same material as the surfaces of the fire dampers or air ducts. Hangers do not require for any other equipment. Pre-cut pieces of mats are wrapped around the hanger and fixed with wire.

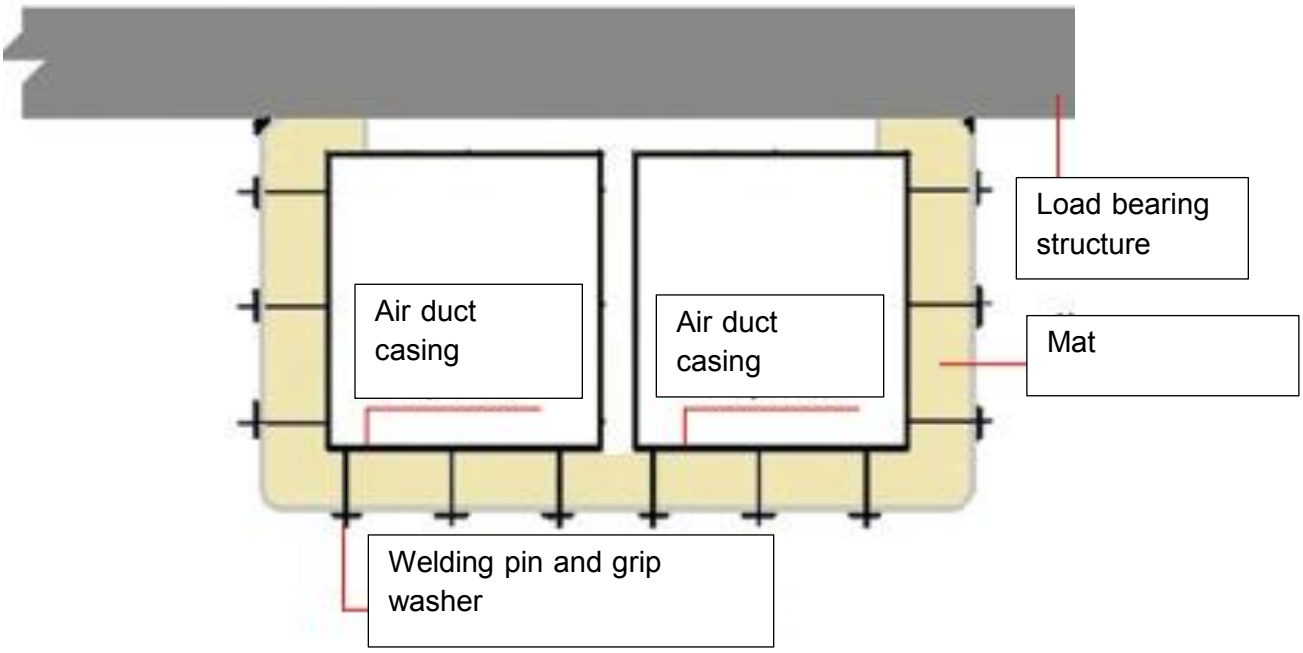
2.4.5 Installation of fire dampers or air ducts with building structures

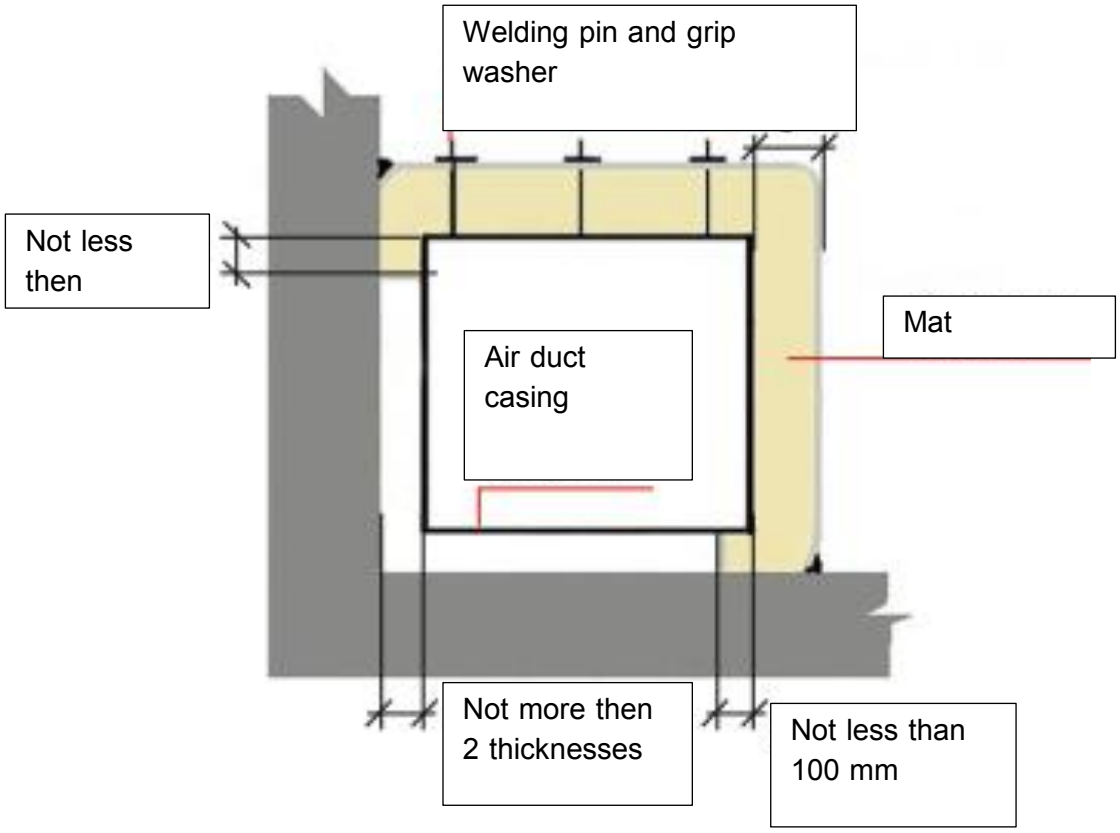
In places where fire dampers or air ducts are not connected to the building structures, the fire resistant mat should be cut off. In the construction of the fire dampers or air duct hardness rib must be considered in the joints of the corners.

After the installation of the fire resistant mats, places where the fire dampers or air duct and the load-bearing elements of the building connect must be covered with a sand-cement solution.

Two Fire dampers or air ducts located close to each other, side by side can be insulated together with a single mat.

In case when distance between casings of two air ducts, or between air ducts and building structures is less then thickness on two fire resistant mats, then mats must be fixed at the available spots and fixed between casing and structure space, and after any air space between them must be accurately sieled with the fire protective material, with not less than 100 mm depth.


Load bearing structure
Air duct casing
Air duct casing
Mat
Welding pin and grip washer


Welding pin and grip washer
Not less then
Mat
Air duct casing
Not more then 2 thicknesses
Not less than 100 mm