Revision index	Date of implementation
C	15/03/2017

Technical Specification F

ISOLE profile

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Preamble

The "ISOLE" profile is intended to facilitate the expression of the suitability for use of insulation materials according to the needs expressed by users and stated in numerous standards texts, such as those appearing on page 16. It is obtained from the characteristics defined in the European standards, apart from specific cases for which the criteria defined in the European standards are insufficient in their current state to cover the needs of a specific application, or when the European standards do not express performance in a harmonised, convenient manner, for example, if the same criterion has different meanings depending on the standard of reference.

I	Mechanical properties under the effects of compression with 5 levels: I1 to I5.
S	Resistance to differential movements with 5 levels: S1 to S5.
O	Water resistance with 3 levels: O1 to O3.
L	Mechanical properties for cohesion and bending with 4 levels: L1 to L4.
E	Ability to withstand water vapour with 5 levels: E1 to E5.

When the ISOLE levels are certified, the associated characteristics must be checked by a factory production control, defined in the relevant product standard.

1 I Level - Mechanical properties under the effects of compression

1.1 Definitions

The following magnitudes shall be used in this chapter:

d_5	Thickness of the product in m, measured on 2 test specimens at 5 measurement points, according to standard NF EN 823 with a 50 ± 1.5 Pa distributed load panel.
d_{10}	Thickness of the product in m, measured on 2 test specimens at 5 measuring points (the same as those used to determine d_5), according to standard NF EN 823 with a 100 ± 1.5 Pa distributed load panel.
SC1 a_i; SC1 b_i SC2 a_i; SC2 b_i	Classification of insulating underlayer under screed or floating slab and under tiling defined in standard NF DTU 52.10 P1-2). The test conditions are defined in Technical Specification No.6.

1.2 I Level

I1	$$\frac{d_5 - d_{10}}{d_5} \leq 0{,}25$$ on average on 5 measurements and $$\frac{d_5 - d_{10}}{d_5} \leq 0{,}35$$ for each measurement. Products having a compression resistance of 10% according to standard NF EN 826 CS (10) ≥ 0.5 kPa are deemed to satisfy this criterion without having to perform any tests.
I2	SC2 b
I3	SC2 a
I4	SC1 b
I5	SC1 a

2 S Level - Resistance to differential movements

2.1 Definitions

The following magnitudes shall be used in this chapter:

d	Thickness of the product in m
G	Shear modulus in Pa according to standard NF EN 12090
α	Coefficient of linear thermal dilation
$\left\|\Delta\varepsilon\right\|_{23°C}$	Variations in dimensions in m/m in length and width at 23°C, 50% RH according to standard EN 1603, taking the maximum of $\Delta\varepsilon_\ell$ and $\Delta\varepsilon_b$ (maximum between the length and width variations). The cut-off value for measurements (maximum deviation of 0.05% between two consecutive measurements) corresponds to a total variation of 0.5%.
$\left\|\Delta\varepsilon\right\|_{48h\,à\,70°C}$	Variations in dimensions in m/m in length and width obtained after conditioning for 48 hours at 70°C according to standard EN 1604, taking the maximum of $\Delta\varepsilon_\ell$ and $\Delta\varepsilon_b$ (maximum between the length and width variations).
$\left\|\Delta\varepsilon\right\|_{30\,à\,90\%\,HR}$	Variations in dimensions in m/m in length and width obtained according to standard EN 1604 measuring the difference at 23°C between an atmosphere at 30 % relative humidity and 90 % relative humidity, until the relative stabilisation in each of the 2 atmospheres, taking the maximum of $\Delta\varepsilon_\ell$ and $\Delta\varepsilon_b$ (maximum between the length and width variations). Stabilisation is deemed to have been reached if the maximum variation over 7 days of $\Delta\varepsilon_\ell$ and $\Delta\varepsilon_b$ is less than 0.05 %. If the product is non-hygroscopic, this difference is considered to be negligible.

N.B.: α is given by default at 6×10^{-5} K^{-1}

2.2 S levels

The criteria to be complied with according to the level are described in detail in the following table.

S1	$\left|\Delta\varepsilon\right|_{23°C} + \left|\Delta\varepsilon\right|_{30\,à\,90\%\,HR} \leq 0.01$
S2	S1 level achieved and $G \times \left|\Delta\varepsilon\right|_{23°C} \times d \leq 400$ Pa.m
S3	S2 level achieved and $\left|\Delta\varepsilon\right|_{48hrs\,at\,70°C} \leq 0.004$ N.B. for thicknesses greater than 120 mm, it is not necessary to satisfy the S2 level.
S4	S3 level achieved and $(50\alpha + \left|\Delta\varepsilon\right|_{48hrs\,at\,70°C} + \left|\Delta\varepsilon\right|_{30\,à\,90\%\,HR}) \times G \leq 15.10^3$ Pa

S5	S4 level achieved and, depending on the dimensions of the product,
	
	   • Format 500 x 500 mm² or less
	
	$\left|\Delta\varepsilon\right|_{48hrs\,at\,70°C} \leq 0.003$ and no individual value greater than 0.0035
	
	The test is performed on test specimens having lateral dimensions less than or equal to 500 mm x 500 mm or on samples of the products in real dimensions if these are less or at least 200 mm x 200 mm for samples which have been cut up.
	
	   • Larger formats
	
	$\left|\Delta\varepsilon\right|_{23°C} \leq 0.0015$ and $\left|\Delta\varepsilon\right|_{48hrs\,at\,70°C} \leq 0.0025$
	
	Tests can be performed on test specimens having lateral dimensions less than or equal to 500 mm x 500 mm.
	
	N.B. the dimensions of the test specimens are to be adapted to the measuring devices whilst at the same time maintaining the criteria according to the dimensions of the finished products.

3 O level - water resistance

3.1 Definitions

The following magnitudes shall be used in this chapter:

$\dfrac{\Delta d}{d}$	Variation in thickness when subjected to partial humidification, defined in paragraph 3.1.1
E_p	Moisture absorption in weight, defined in paragraph 3.1.2
E_v	Moisture absorption in volume, defined in paragraph 3.1.2
Wp	Water absorption in the short term (24 hours) by partial immersion measured according to standard NF EN 1609 – Method A

3.1.1 Variation in thickness when subjected to partial humidification

The test involves measuring the variation in thickness between the initial dry state and the dry state after humidification.

The thickness is measured according to standard EN 823 on 3 test specimens.

The test methods are described in detail below.

3.1.1.1 Test specimens

The tests are performed on three test specimens measuring 350 mm x 350 mm having no facing or from which the facing has been removed.

3.1.1.2 Test procedure

- Measure thickness (d_i) in the initial dry state under a pressure of 50 $\pm$ 1.5 Pa.

- Then lay the test specimens flat on a perforated panel or a grid and spray them evenly using a spray located one metre vertically above the test specimens.

- The quantity of water sprayed on the surface of each of the test specimens for a period of 12 $\pm$ 2 minutes is 1 $\pm$ 0.1 litre.

- Then dry the test specimens in an oven at 50°C until constant mass is reached.

- Measure the thickness (d_h).

3.1.1.3 Expression of the results

Calculate the thickness variations Δd in mm and the percentage variation in % based on individual measurements by the equations:

$$\Delta d = d_i - d_h$$

$$\frac{\Delta d}{d} = \frac{d_i - d_h}{d_i} \, x \, 100$$

The result is the mean of the variations of the three measurements.

$$\text{Percentage variation} = \frac{1}{3}\left(\sum \frac{\Delta d}{d}\right)$$

3.1.2 Moisture absorption in weight and volume

The moisture absorption is determined as follows in the absence of a specific European standard.

The purpose of the tests is to assess the hygroscopicity of an insulation product by measuring the variations in weight after stabilisation in two regulated atmospheres at $23 \pm 2°C$ and $20 \pm 5\%$ RH and $23 \pm 2°C$ and $90 \pm 5\%$ RH.

3.1.2.1 Measuring device

The measuring device includes:

- regulated enclosures or conditioned chambers allowing atmospheres to be obtained of $23 \pm 2°C$ and 90 ± 5 %; $23 \pm 2°C$ and $20 \pm 5\%$ relative humidity

- a balance with an accuracy of 5.10^{-2} g.

3.1.2.2 Preparation and conditioning of the test specimens

The test specimens are composed of straight prisms with a square cross-section having sides of 250 mm, the thickness of which is close to the average of the thicknesses produced.

For each target atmosphere, prepare a series of three test specimens from three different panels, wadding or felts, in the selected thickness.

The tests specimens can be those used to measure the dimensional variations according to relative humidity.

3.1.2.3 Test procedure

Weigh the test specimens immediately before placing them in the conditioned atmospheres.

Place a series of three tests specimens in a regulated atmosphere at $23 \pm 2°C$ and $90 \pm 5\%$ relative humidity and another series of three test specimens in a regulated atmosphere at $23 \pm 2°C$ and $20 \pm 5\%$ relative humidity.

3.1.2.4 Expression of the results

The mass variations are divided by the volume of each corresponding test specimen, specifying the variation sign:

- Mass variations in volume: $\dfrac{1}{10}\dfrac{\Delta p}{v}$ expressed in %

Where p is expressed in kg and v in m^3

The results of the mass variations in volume are expressed as follows:

Test specimens	1	2	3	Mean
23°C and 90% RH				
23°C and 20% RH				

The difference in mass variation in volume E_v between 23°C and 90% RH and 23°C and 20% RH is given by the difference of the means:

$$E_v = \left(\frac{1}{3}\Sigma\frac{\Delta p}{10v}\right)_{90\% \, HR} - \left(\frac{1}{3}\Sigma\frac{\Delta p}{10v}\right)_{20\% \, HR}$$

The difference in mass variation in weight E_p between 23°C and 90% RH and 23°C and 20% RH is given by the formula:

$$E_p = \frac{E_v}{\rho_a} \text{ in \%}$$

where ρ_a is the density expressed in kg/m^3.

3.2 O level

The criteria to be complied with according to the level are described in detail in the following table.

O1	$\dfrac{\Delta d}{d} < 7,5\%$ and $E_p < 15\%$ and $E_v < 1.5\%$
O2	O1 level achieved and Wp < 1.0 kg/m²
O3	O2 level achieved and Wp < 0.2 kg/m²

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4 L level - Mechanical properties for cohesion and bending

4.1 Definitions

The following magnitudes shall be used in this chapter:

l	Width of the product in m
L	Length of the product in m
e	Thickness of the product in m
P	Weight corresponding to • 10 m of product for products in rolls, • 3 panels identical to those tested for products in panels
F_m	Maximum tractive force recorded during the application of traction parallel to the surfaces, performed according to standard NF EN 1608, in N.
d	Deviation under its own weight measured according to standard NF DTU 20.1 P1-2 (Appendix C).
r_{mt}	Resistance to maximum traction corresponding to the internal cohesion of the test specimen, recorded during the application of traction perpendicular to the surfaces according to standard NF EN 1607 and divided by the area of the cross-section of the test specimen, in kPa.

4.2 L level

The criteria to be complied with according to the level are described in detail in the following table.

L1	$F_m > P$, value to be satisfied for at least 4 test specimens out of 5
L2	$d \leq 0.12$ m
L3	$r_{mt} > 50$ kPa for at least 4 test specimens out of 5
L3(120)	$r_{mt} > 120$ kPa for at least 4 test specimens out of 5
L3(150)	$r_{mt} > 150$ kPa for at least 4 test specimens out of 5
L4	$r_{mt} > 180$ kPa for at least 4 test specimens out of 5

5 E level - Ability to withstand water vapour

5.1 Definitions

The following magnitudes shall be used in this chapter:

Z	Resistance to water vapour diffusion in m².h.Pa/mg determined according to standard NF EN 12086.
1/Z	Water vapour permeability W in mg/m².h.Pa. $1/Z = \dfrac{\delta_{air}}{d \; x \; \mu}$
δ_{air}	Water vapour permeability of air in mg/(m.h.Pa) according to NF EN 12086.
µ	Resistance to water vapour diffusion index according to NF EN 12086.
d	Thickness of the product in m.
Sd	Thickness in m of a layer of air having the same permeability as the material under consideration. Sd = Z x δ_{air} = µ x d

Conversion factors (reading of the multiplication factor in line):

	$g/(m^2.h.mmHg)$	$kg/(m^2.s.Pa)$	$mg/(m^2.h.Pa)$
$g/(m^2.h.mmHg)$	1	$2.084.10^{-9}$	7.502
$kg/(m^2.s.Pa)$	$4.798.10^{+8}$	1	$3.6.10^{+9}$
$mg/(m^2.h.Pa)$	0.1333	$2.778.10^{-10}$	1

For example: 1 $mg/(m^2.h.Pa)$ = 0.1333 $g/(m^2.h.mmHg)$

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5.2 E levels

The criteria to be complied with according to the level are described in detail in the following table.

E1		$Z \leq$	0.44	2.27	$\leq 1/Z$			Sd $\leq$	0.3
E2	0.44	$< Z \leq$	2.22	0.45	$\leq 1/Z <$	2.27	0.3	$< Sd \leq$	1.5
E3	2.22	$< Z \leq$	8.85	0.113	$\leq 1/Z <$	0.45	1.5	$< Sd \leq$	6
E4	8.85	$< Z \leq$	133	0.0075	$\leq 1/Z <$	0.113	6	$< Sd \leq$	90
E5	133	$< Z$			$\leq 1/Z <$	0.0075	90	$< Sd$	

Appendix A

Levels obtained without testing

Appendix A – Level obtained without testing

For certain product families, the following ISOLE levels are allocated by default without testing.

		EPS	XPS	PUR manufactured in a continuous process	PUR manufactured in blocks
I	1	X	X	X	X
	2	X	X	X	X
	3	X if ρ > 13 kg/m^3 and if e ≤ 100 mm	X	X if e ≤ 100 mm	X if e ≤ 100 mm
	4	X if ρ > 24 kg/m^3 and if e ≤ 100 mm	X if e ≤ 100 mm	X if e ≤ 100 mm	X if e ≤ 100 mm
	5	X if ρ > 24 kg/m^3 and if e ≤ 100 mm			
S	1	X		X	
	2				
	3				
	4				
	5				
O	1	X	X	X	X
	2	X	X	X	X
	3		X	X	
L	1	X	X	X	X
	2	X	X	X	X
	3	X if ρ > 13 kg/m^3	X		
	4		X		
E	4			X if certificate of tightness to water vapour for coating	

ρ : density of the product

e: thickness of the product

Appendix B

(Information)
Examples of use of certified properties

Appendix B - Examples of use of certified properties

1 Preamble

The ISOLE profile and the thermal resistance R_D given on the product's information label can be used to compare them to the minimum values required for use of an insulation material for a specific purpose.

Thermal resistance R_D is used to check compliance with the thermal regulation(s) currently applicable or the thermal rules and calculation of coefficient U.

The minimum ISOLE levels to comply with the usage requirements are indicated in the diagrams and tables below, giving an overview of the applications.

This information is not regulatory, normative or prescriptive and targets the most common usages. The standards texts currently applicable should be checked according to the following abbreviations:

- DTA: Document Technique d'Application (Technical Application Document)

- DTU: Document Technique Unifié (Unified Code of Practice)

- AT: Avis Technique (Technical Assessment)

- ETA: European Technical Approval

- CPT: Cahier des Prescriptions Techniques (Technical Specifications)

N.B. Water vapour permeability

Water vapour permeability appears on the certificate with the statement of the MU or Z characteristics, reflected by the E level information in the ISOLE classification. The structures must be designed to avoid any condensation inside the walls or on the surface of them. The design rules require the permeability or resistance to water vapour of each of the components of the walls to be taken into account.

These design rules or calculations appear in the DTU guidelines, the Technical Approvals or other building standards.
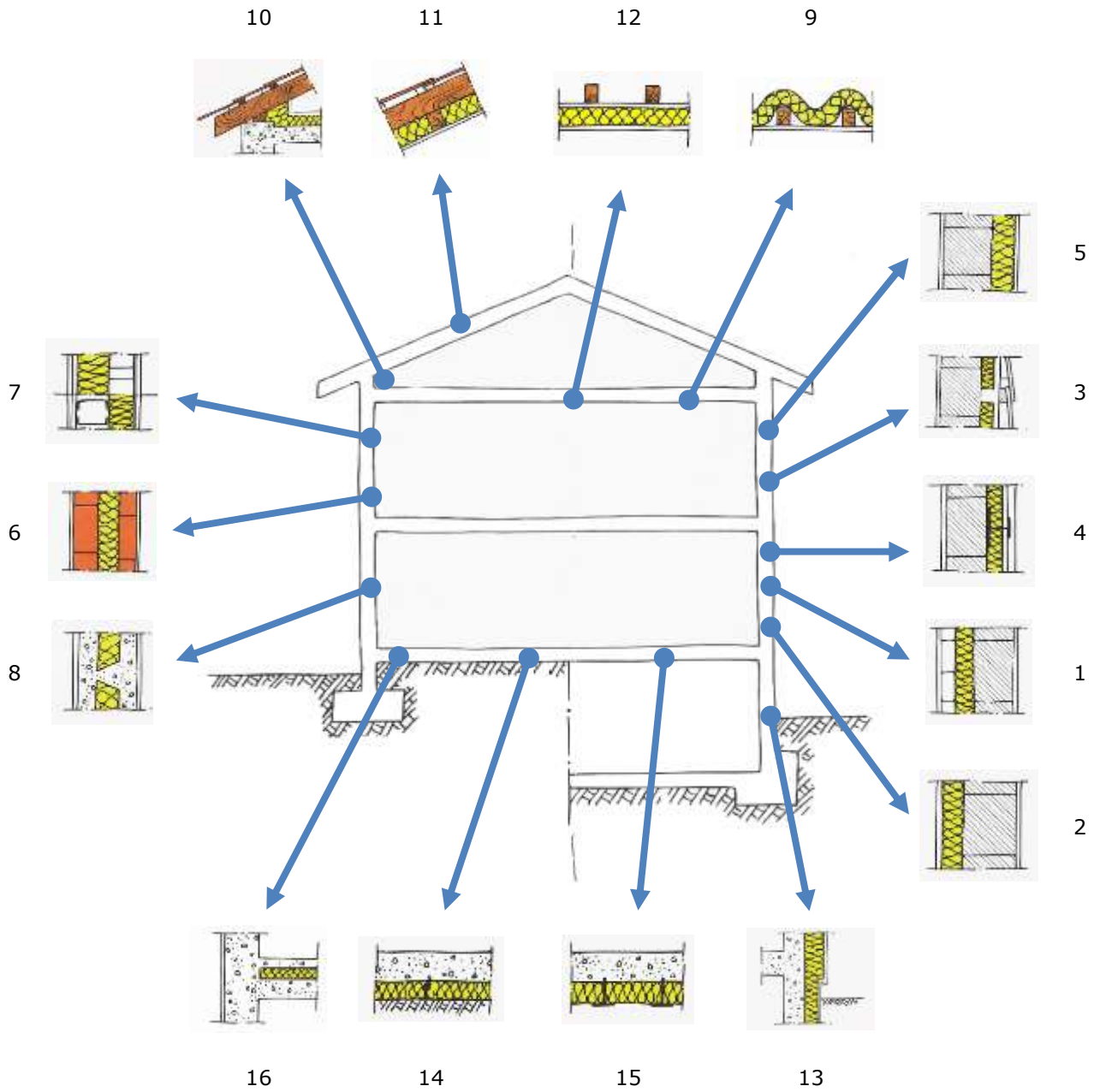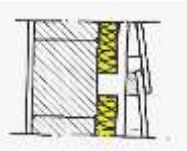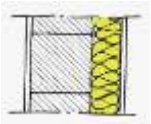
Figure 1 - Position of the insulation material in the structure

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2 Vertical walls

	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
INSIDE INSULATION OF HEAVY WALLS	1		*Insulation behind lining partition*					DTU 20.1 and DTU 23.1	Recommended ISOL level which is not intended to replace the DTU.
			Type II or II wall	1	1	2	2		
			Type I or IV wall	1	1	1	2		
	2		*Insulation glued onto one or two plasterboard panels*					AT EN 13950 DTA	
			Complex with insulation	1	2	2	3		Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure
			Other complexes (1)	1	2	2	3		Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure

(1): The definition of the levels required is the responsibility of the competent Committee for Standardisation or the Specialised Group (see corresponding Standards and Technical Assessments).
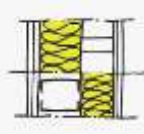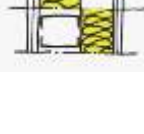
	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
OUTSIDE INSULATION OF HEAVY WALLS	3-a		Insulation inserted inside exterior wall cladding, traditional cladding (1)	1	1	2	2	Cladding CPT (wood + metal) DTU 41.2	Recommended ISOL level which is not intended to replace the DTU.
	3- b		Insulation for insulating wall panel	2	4	3	4	AT	Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure
	3-a		Insulation for wall panel	3	1	2	2	AT	Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure
	4		Insulation inserted inside a thin stone covering	1	1	2	2	DTU 55.2	Recommended ISOL level which is not intended to replace the DTU.
	5-a		Insulation glued and covered with a thin layer of reinforced or hydraulic rendering (1)	2	4	3	4	ETA and DTA	Recommended ISOL level which is not intended to replace the ETA/DTA
	5-b		Insulation attached mechanically and covered with a thin layer of reinforced rendering	2	5	3	4	ETA and DTA	Recommended ISOL level which is not intended to replace the ETA/DTA
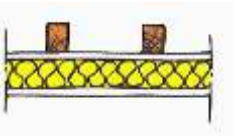
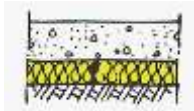|	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
INTEGRATED OR INTERMEDIATE INSULATION	6		Insulation inserted inside a double wall	1	1	2	2	DTU 20.1	Recommended ISOL level which is not intended to replace the DTU.
	7-a		Insulation between a frame (wood, metal, concrete) and lightweight walls	1	1 to 4	2	2	DTU 31.2	Recommended ISOL level which is not intended to replace the DTU.
	7-b		Insulation inserted inside double skin cladding	1	1	2	2	professional practices	Recommended ISOL level which is not intended to replace professional practices
	8		Insulation inserted inside a prefabricated concrete panel	2	1	2	3	AT	Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure

3 Roof and roof space

	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
INSULATION IN THE FLOOR OF ROOF SPACES	9		Insulation laid without covering on the floor of the roof space	1	1	1	1	Roof space CPT	According to the use
	10-a		Insulation covered by a wooden floor on joists	1	1	1	1	Roof space CPT	According to the use
	10-b		Insulation laid on heavy-duty flooring and covered with load distribution panels	3	1	1	1	DTU 51.11	Recommended ISOL level which is not intended to replace DTU 52 (2.5 mm under 40 kPa load)
	10-c		Insulation laid on lightweight flooring and covered with load distribution panels	3	1	1	1	Roof space CPT	According to the use

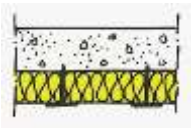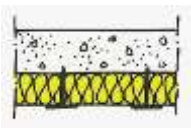|	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
INSULATION IN SLOPING ROOFS OR CEILINGS	11-a		Insulation under pitched roof under small roofing elements	1	1	1	1	Roof space CPT	According to the use
	11-b		Insulation under pitched roof under continuous roofing or metal sheets	1	1	1	1	Roof space CPT	According to the use
	11-c		Insulation on the underside of industrial roofs	1	1	2	2	DTU 40.31 and DTU 40.45	Recommended ISOL level which is not intended to replace the DTU.
	11-d		Insulation added to heavy sloping over-roof	1	1	1	1	DTU 40.35	Recommended ISOL level which is not intended to replace the DTU.
	12		Insulation on suspended ceilings	1	1	1	1	DTU 58.1	Recommended ISOL level which is not intended to replace the DTU.

4 Floors and base structures

	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
FLOOR DIRECTLY ON THE SOIL	13		Vertical insulation of foundations or buried walls around the edge of soil; insulation placed on the inner or outer side, used as formwork or added	2	1	3	3	DTU 20.1 and 23.1	Recommended ISOL level which is not intended to replace the DTU.
	14-a		Insulation of floor slabs placed directly on soil for individual dwellings	*	1	2	2	DTU 13.3 part 3	Recommended ISOL level which is not intended to replace the DTU. Required DTU performance: Es ≥ 2.1 MPa
	14-b		Insulation of floor slabs placed directly on soil for other buildings	*	1	2	2	DTU 13.3 part 1 or 2	Recommended ISOL level which is not intended to replace the DTU. Required DTU performance: Es ≥ 2.1 MPa and Es/e ≥ 50 MPa/m

* Level I defined in these specifications does not make it possible to justify compliance with the requirements of the DTU guidelines 13.3. To avoid confusion, the recommended level I was deleted for Revision B of these specifications.

	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
FLOOR OVER CELLAR	15-a		Peripheral insulation of the base structure	3	1	3	3	AT	Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure
	15-b		Insulation attached mechanically on underside of floor above cellar	1	1	1	2		According to the use
FLOOR OVER CRAWL SPACE	15-c		Insulation of walls from the outside	2	1	3	3	AT	Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure
	15-d		Insulation of walls from the inside	2	1	3	3		According to the use

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	Reference number in Figure 1		Use	I	S	O	L	Standards document(s)	Requirement
SCREED AND SLABS	*Coverings sealed with mortar applied directly onto the insulation*								
	16-a		under service loads ≤ 500 kg/m²	5	1	2	2	NF DTU 52.1	insulation classed at least SC1a
			under service loads ≤ 200 kg/m²	4	1	2	2		insulation classed at least SC1b
	Screed or slab								
	16-b		under service loads ≤ 500 kg/m²	3	1	2	2	DTU 26.2 NF DTU 52.1	insulation classed at least SC2a
			under service loads ≤ 200 kg/m²	2	1	2	2		insulation classed at least SC2b
	16-c		low temperature hot water heated floor	3	1	2	2	DTU 65.14 NF DTU 52.1	insulation classed at least SC2a Ch
	Radiant floor heating								
	16-d		cellular plastic insulation	4	1	2	2	CPT PRE AT	Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure
			mineral wool insulation	3	1	2	2		Recommended ISOL level which is not intended to replace the requirements of the technical assessment for the procedure