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Development of VET Training on Energy Efficient Stoves and Fireplaces – ENEFFIS

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Certification Scheme OF A STOVE BUILDER

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Satakunnan koulutuskuntayhtymä

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1. DESCRIPTION OF THE CERTIFICATION SCHEME OF A STOVE BUILDER

1.1. Purpose and object of the certification scheme of a stove builder (*hereinafter Certification Scheme*):

The document aims to define the certification scheme for stove builders proving their qualifications. It provides the framework for the assessment and awarding (certification) of a stove builder's qualification.

The document describes pre-conditions and procedures for obtaining a certificate of a stove builder. The certification can be carried out by a VET institution or a professional trade association.

1.2. Main terms and definitions:

European Qualifications Framework (EQF) is a translation tool that helps communication and comparison between qualifications systems in Europe. It has been developed to promote workers' and learners' mobility between countries and facilitating their lifelong learning.

Qualification is the entirety of person's possessed competencies or professional experience and possessed competencies necessary for a certain professional activity, recognised in accordance with the procedure laid down by legal acts of the country.

Levels of qualification are descriptions of what a learner knows, understands and is able to do in terms of learning outcomes.

Competence is the ability to perform a certain activity on the basis of the entirety of acquired knowledge, skills, abilities and values.

Limits of competencies are restrictions of activity, evidences of competencies.

Awarding body is an organisation which issues the certificate of professional stove builder. The Awarding body shall be comprised of the representatives of following institutions:

- 1) VET school, representing training of a stove builder,
- 2) Professional association of stove builders, representing working masters,
- 3) Representative of national agency, responsible for fire safety or construction safety.

1.3. Titles of qualifications and their levels:

No	Titles of qualification	EQF level
1	Assistant stove builder	3
2	Stove builder	4
3	Master stove builder	5

1.4. Pre-conditions for obtaining a professional qualification certificate:

1.4.1. Assistant stove builder

In order to obtain a qualification of an assistant stove builder EQF level 3 the applicant must prove the following:

- a) the applicant has successfully completed stove builder training either in a VET institution or under a qualified master.

1.4.2. Stove builder

In order to obtain a qualification of stove builder EQF level 4 the applicant must prove the following:

- a) the applicant has successfully completed stove builder training in a VET institution;
- b) the applicant has gathered work experience in the field of building stoves under a qualified master for at least 3 years (in case of DUAL education system the applicant is considered to be in VET training and work based learning simultaneously, fulfilling both criteria).

1.4.3. Master stove builder

In order to obtain a qualification of master stove builder EQF level 5 the applicant must prove the following:

- a) the applicant has taken part in at least 3 training courses for stove builders in order to upgrade their competences;
- b) the applicant has work experience as a stove builder (minimum 5 years).

1.5. Documents to be submitted for certification process:

1.5.1. Assistant stove builder

In order to obtain a qualification of assistant stove builder EQF level 3 the applicant must submit the following documents at least 30 days before the certification process takes place:

- a) application to take part in validation of competences;
- b) written proof of completed stove builder training by VET institution OR a reference letter from a qualified stove builder confirming the training in the workplace. The training certificate must state the name of the bearer, issuing organisation, length, period and learning outcomes of the training.

1.5.2. Stove builder

In order to obtain a qualification of stove builder EQF level 4 the applicant must submit the following documents at least 30 days before the certification process takes place:

- a) application to take part in validation of competences;
- b) written proof of completed training by VET institution. The training certificate must state the name of the bearer, issuing organisation, length, period and learning outcomes of the training.
- c) reference letter from a qualified stove builder confirming the training in the workplace and containing the assesment of competences demonstrated during the work period.

1.5.3. Master stove builder

In order to obtain a qualification of master stove builder EQF level 5 the applicant must submit the following documents at least 30 days before the certification process takes place:

- a) application to take part in validation of competences;
- b) written proof of completed stove builder further training course. The training certificate must state the name of the bearer, issuing organisation, length, period and learning outcomes of the training;
- c) portfolio of work representing the work undertaken in the past 5 years demonstrating his/her professional competences.

1.6. Procedure for validation of competences

1.6.1. Assistant stove builder

The assistant stove builder documents shall be assessed either in the VET institution or by a professional stove builders' association, and he/she can be assigned a task, for example to build a part of the solid fuel heat release appliance, in order to verify the competences of preparing the workplace and building the appliance according to given specification/drawing.

1.6.2. Stove builder

The stove builder documents shall be assessed either in the VET institution or by a professional association stove builders' and he/she can be assigned a task, for example to build or install a part of the solid fuel heat release appliance or make calculations for an appliance in order to verify the competences of preparing the workplace, building/installation and making drawings for an appliance. The applicant will be interviewed to understand their ability to advise customer and organise the work of others.

1.6.3. Master stove builder

The master stove builder applicant documents shall be assessed either in the VET institution or by a professional stove builders' association. The applicant will then be interviewed on the basis of the portfolio presented in order to validate the necessary competences. The applicant can be assigned a task, for example making a technical specification including drawings for an appliance or making and documenting a technical assessment for an existing solid fuel heating appliance.

1.7. Awarding a professional qualification certificate:

In case the validation of competences has been successful the awarding body which can be either VET institution or professional stove builders' association awards the applicant a professional qualification certificate. The certificate states the EQF level and name of the qualification (for example, Stove builder, EQF level 4) and the name of the issuing organisation. The certificate also lists all the competences that have been validated in the certification process.

Assignments for assessment of skills

TEST QUESTIONS

1. Name 3 qualities of a heat storage stove compared to light heating appliances (fireplace, light stove, cooking stove):
 - 1) High heat output
 - 2) Longer heat storage time
 - 3) Lower nominal output
 - 4) Heavy weight
 - 5) Can be part of house building construction

2. Heat storage stoves are regarded as healthy heating appliances. Which qualities of a heat storing stove support this argument?
 - 1) They create a healthy inner climate in a building
 - 2) The stoves look nice in the interior design
 - 3) The heat radiating from the stove is suitable for human inhabitation as the heat waves issued by the stove resemble that of the sun
 - 4) The temperature in the room can be lower than with convectional heating to ensure similar comfort
 - 5) The stove has no impact on the inner climate

3. Which quality of the stove can be brought out as negative quality
 - 1) The inertia of the storage stove is big
 - 2) The stoves are heavy and take a lot of space
 - 3) The cycle of heating is time consuming

4. What type of solid fuels are suitable for stoves
 - 1) Wood logs
 - 2) Wood pellets
 - 3) Grain pellets
 - 4) Wood briquet
 - 5) Peat briquet

5. Name the three main factors that influence the burning process in the combustion chamber.
 - 1) Temperature
 - 2) How fast is the burning process
 - 3) Mixing of combustion air and gasses released during burning process
 - 4) Size of the combustion chamber
 - 5) Location of the combustion chamber

6. What physical qualities influence the heat storage of a construction material?
 - 1) Heat capacity of the material
 - 2) Weight of the material
 - 3) Colour of the material

7. How does the glass in the stove door influence the burning process?
 - 1) Too small glass does not allow to view the burning process properly
 - 2) Too big glass lowers the temperature in the combustion chamber

8. How do cracks in the construction of the stove influence the heat storage?
 - 1) They do not influence the operation of the stove as far as no smoke is getting out.
 - 2) The cracks lower the heat storage capacity of the stove as the heat escapes too fast.
 - 3) The cracks are dangerous for the stove constructionally.

9. How to compensate the line expansion in the stove construction?
 - 1) Leave strain gauge at the end of flue construction blocks
 - 2) Build combustion chamber structurally apart from the rest of the stove
 - 3) Leave strain gauge/air slit between inner and outer shell of the stove
 - 4) Leave strain gauge around the grill at the bottom of the combustion chamber
 - 5) Leave strain gauge around the door of the combustion chamber
 - 6) Use mineral wool where you feel there might be an issue with heat expansion

10. When is it necessary to install a starter closure valve in the flues.
 - 1) The chimney is too short
 - 2) Big difference of heights around the building
 - 3) The combustion chamber is not working properly in the fire starting phase

TEST QUESTIONS (ANSWER SHEET)

1. Name 3 qualities of a heat storage stove compared to light heating appliances (fireplace, light stove, cooking stove):
 - 1) High heat output TRUE
 - 2) Longer heat storage time TRUE
 - 3) Lower nominal output TRUE
 - 4) Heavy weight FALSE
 - 5) Can be part of house building construction FALSE

2. Heat storage stoves are regarded as healthy heating appliances. Which qualities of a heat storing stove support this argument?
 - 1) They create a healthy inner climate in a building TRUE
 - 2) The stoves look nice in the interior design FALSE
 - 3) The heat radiating from the stove is suitable for human inhabitation as the heat waves issued by the stove resemble that of the sun TRUE
 - 4) The temperature in the room can be lower than with convectional heating to ensure similar comfort TRUE
 - 5) The stove has no impact on the inner climate FALSE

3. Which quality of the stove can be brought out as negative quality
 - 1) The inertia of the storage stove is big TRUE
 - 2) The stoves are heavy and take a lot of space FALSE
 - 3) The cycle of heating is time consuming TRUE

4. What type of solid fuels are suitable for stoves
 - 1) Wood logs TRUE
 - 2) Wood pellets FALSE
 - 3) Grain pellets FALSE
 - 4) Wood briquet TRUE
 - 5) Peat briquet FALSE

5. Name the three main factors that influence the burning process in the combustion chamber.
 - 1) Temperature TRUE
 - 2) How fast is the burning process TRUE
 - 3) Mixing of combustion air and gasses released during burning process TRUE
 - 4) Size of the combustion chamber FALSE
 - 5) Location of the combustion chamber FALSE

6. What physical qualities influence the heat storage of a construction material?
- 1) Heat capacity of the material TRUE
 - 2) Weight of the material TRUE
 - 3) Colour of the material FALSE
7. How does the glass in the stove door influence the burning process?
- 1) Too small glass does not allow to view the burning process properly FALSE
 - 2) Too big glass lowers the temperature in the combustion chamber TRUE
8. How do cracks in the construction of the stove influence the heat storage?
- 1) They do not influence the operation of the stove as far as no smoke is getting out. FALSE
 - 2) The cracks lower the heat storage capacity of the stove as the heat escapes too fast. TRUE
 - 3) The cracks are dangerous for the stove constructionally. FALSE
9. How to compensate the line expansion in the stove construction?
- 1) Leave strain gauge at the end of flue construction blocks TRUE
 - 2) Build combustion chamber structurally apart from the rest of the stove TRUE
 - 3) Leave strain gauge/air slit between inner and outer shell of the stove TRUE
 - 4) Leave strain gauge around the grill at the bottom of the combustion chamber TRUE
 - 5) Leave strain gauge around the door of the combustion chamber TRUE
 - 6) Use mineral wool where you feel there might be an issue with heat expansion FALSE
10. When is it necessary to install a starter closure valve in the flues.
- 1) The chimney is too short TRUE
 - 2) Big difference of heights around the building TRUE
 - 3) The combustion chamber is not working properly in the fire starting phase TRUE

PRACTICAL ASSIGNMENT

Calculate the measurements for the stove's combustion chamber and flue lengths according to heat requirement of the building taking into account the stove calculation standard EN 15544:2009.

Heat requirement $P_n = 3,4 \text{ kW}$.

1. Calculate the necessary amount of fuel (wood) (m_B 24) in one fortnight ($t_n = 24\text{h}$).
2. Calculate the necessary amount of wood (m_B 12) for 12 hour heat accumulation period.
3. Calculate the height of the combustion chamber, if the width of the chamber is 30 cm and depth is 50 cm. Use the maximum amount of fuel for 12-hour heat accumulation as the basis for calculation.
4. Calculate the minimum flue length (L_{Zmin}) for the stove (for 12-hour heat accumulation)

Maximum fuel amount:

$$m_B = \frac{P_n \cdot t_n}{3,25}$$

In calculating the factor 3,25 it is taken into account the energy release value of the wood is $4,16 \text{ kWh*kg}^{-1}$

And heating appliance efficiency is 0,78 (78 %). ($4,16 \cdot 0,78 = 3,25 \text{ kWh*kg}^{-1}$.)

m_B is maximum amount of fuel (kg)

P_n nominal heat output (kW)

t_n heat accumulation period (h)

Height of the combustion chamber:

$$H_{BR} = \frac{900 \cdot m_B - 2 \cdot A_{BR}}{U_{BR}}$$

where

H_{BR} is the height of the combustion chamber (cm)



- m_B maximum amount of fuel (kg)
 A_{BR} is floor area of the combustion chamber (cm²)
 U_{BR} is the the circumference of the combustion chamber (cm)

The minimal length of the flue in case:

$$L_{Zmin} = 1,3 \cdot \sqrt{m_B}$$

where

- L_{Zmin} is minimal flue length (cm)
 m_B maximum amount of fuel (kg)

Calculate the necessary heat load of the building. The measurements of the room are floor 4 x 6 m and height 2,5 m. The room has two external walls (4 and 6 m). In one of the external walls there is a window with measurements 3,5 m². The building has two stories, under and above the room are heated rooms.

The difference between internal and external temperatures is room temperature +21°C, outside temperature -22°C.

- 1. Calculate the difference between internal and external temperatures Δt .**
- 2. Calculate the area of the walls through which heat loss takes place.**
- 3. Calculate the heat loss through the walls.**
- 4. Calculate the necessary heat load for the room.**

Heat loss through the walls:

$$N = U \cdot S \cdot (t_2 - t_1)$$

where

- N is heat loss (W)
 U thermal conductivity factor (W/m²K)
 S area of the window (m²)
 $(t_2 - t_1)$ difference between internal and external temperatures

Thermal conductivity factors for the room:

Outer wall	$U = 0,28 \text{ W/m}^2\text{K}$
Ceiling	$U = 0,22 \text{ W/m}^2\text{K}$
Floor	$U = 0,22 \text{ W/m}^2\text{K}$
Window	$U = 1,2 \text{ W/m}^2\text{K}$