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Swedish Board of Accreditation and Conformity Assessment's Regulations on the inspection of thermal energy meters

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The Swedish Board for Accreditation and Conformity Assessment (Swedac) prescribes¹ the following with reference to Section 4 of the Ordinance (1993:1066) on units of measurement, measurements and measuring instruments, Section 7 of the Ordinance (1994:99) on water and thermal meters and Section 3 of the Ordinance (2011:811) on accreditation and technical verification.

Scope

Section 1 These Regulations contain provisions on requirements for and inspection of thermal energy meters used to measure the amount of thermal energy supplied to buildings where there is one or more dwellings and there is an obligation to measure in accordance with the District Heating Act (2008:263).

Definitions

Section 2 For the purposes of these Regulations, words and terms are used within the meaning of Section 2 of STAFS 2022:5² on thermal energy meters. In addition, for the purposes of these regulations:

1) *district heating company* means a legal or natural person carrying out district heating activities under the District Heating Act (2008:263);

2) *seal* means physical or software-based protection against unauthorised alteration of the metrological characteristics of a thermal energy meter;

3) *entry into service* means the first use of a thermal energy meter for the purposes specified in Section 1;

¹ See Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

² The Swedish Board of Accreditation and Conformity Assessment's Regulations (STAFS 2022:5) on thermal energy meters

4) *in service* means that a thermal energy meter installed at a metering point is in service;

5) *repair* means an action aimed at restoring the intended function of a thermal energy meter without changing the original characteristics, purpose or type of the meter or any of its sub-assemblies;

6) *modification* means repair or maintenance of a thermal energy meter.

Responsibility for compliance with the requirements

Section 3 The district heating company shall ensure that the thermal energy meter meets the requirements and undergoes the inspection laid down in these Regulations.

Requirements for thermal energy meters

Section 4 Requirements for the entry into service of thermal energy meters are set out in STAFS 2022:5 on thermal energy meters.

A thermal energy meter that has been taken out of service may be put back into service provided that it has been inspected and found to comply with the requirements of these Regulations.

Section 5 The thermal energy meter shall be installed in such a way that it reliably measures the thermal energy likely to occur at the delivery point.

Section 6 The error indication of an in-service thermal energy meter or sub-assembly shall be less than or equal to the values for statistical verification shown in Table 1b or 2b.

Table 1a

Test points for meters put into service in accordance with the requirements of STAFS 2006:8³ on thermal meters, STAFS 2016:5⁴ on thermal energy meters and STAFS 2022:5 on thermal energy meters.

	Test points	Maximum permissible error
Flow sensor	$q_i \leq q \leq 1,1q_i$ $0,1q_p \leq q \leq 0,11q_p$ $0,9q_p \leq q \leq 1,0q_p$ ¹⁾	Class 1: $E_f = \pm (1 + 0.01q_p/q)$, but not greater than $\pm 5\%$. Class 2: $E_f = \pm (2 + 0.02q_p/q)$, but not greater than $\pm 5\%$. Class 3: $E_f = \pm (3 + 0.05q_p/q)$, but not greater than $\pm 5\%$.
Integrating unit	$\Delta\Theta_{\min} \leq \Delta\Theta \leq 1,2\Delta\Theta_{\min}$ ²⁾ , $10 \text{ K} \leq \Delta\Theta \leq 20 \text{ K}$, $\Delta\Theta_{\max} - 5 \text{ K} \leq \Delta\Theta \leq \Delta\Theta_{\max}$ ³⁾	$E_c = \pm (0,5 + \Delta\Theta_{\min} / \Delta\Theta)$

³ The Swedish Board for Accreditation and Conformity Assessment's (Swedac) Regulations and general advice (STAFS 2006:8) on thermal meters

⁴ The Swedish Board for Accreditation and Conformity Assessment's (Swedac) Regulations (2016:5) on thermal energy meters

Temperature sensor	$35^{\circ}\text{C} \leq \Theta \leq 45^{\circ}\text{C}$, $70^{\circ}\text{C} \leq \Theta \leq 85^{\circ}\text{C}$, $\Theta_{\text{max}} - 30 \text{ K} \leq \Theta \leq \Theta_{\text{max}}$ ⁴⁾	$E_t = \pm (0,5 + 3\Delta\Theta_{\text{min}} / \Delta\Theta)$
Complete meter	$q_i \leq q \leq 1,1q_i$ och $\Delta\Theta_{\text{max}} - 5 \text{ K} \leq \Delta\Theta \leq \Delta\Theta_{\text{max}}$ ³⁾ $0,1q_p \leq q \leq 0,11q_p$ and $10 \text{ K} \leq \Delta\Theta \leq 20 \text{ K}$ $0,9q_p \leq q \leq 1,0q_p$ ¹⁾ and $\Delta\Theta_{\text{min}} \leq \Delta\Theta \leq 1,2\Delta\Theta_{\text{min}}$ ²⁾	Class 1: E_f (class 1)+ E_c + E_t Class 2: E_f (class 2)+ E_c + E_t Class 3: E_f (class 3)+ E_c + E_t

¹⁾ A maximum test point of $q_s/2$ is permitted.

²⁾ A minimum test point of 5 K is permitted.

³⁾ A maximum test point of 90 K is permitted.

⁴⁾ A maximum test point of 90 °C is permitted.

Table 1b

Test points for statistical verification of meters put into service in accordance with the requirements of STAFS 2006:8 on thermal meters, STAFS 2016:5 on thermal energy meters and STAFS 2022:5 on thermal energy meters.

	Test points	Maximum permissible error
Flow sensor	$0,1q_p \leq q \leq 0,11q_p$ $0,9q_p \leq q \leq 1,0q_p$ ¹⁾	Twice the maximum permissible error as set out in Table 1a
Integrating unit	$10 \text{ K} \leq \Delta\Theta \leq 20 \text{ K}$, $\Delta\Theta_{\text{max}} - 5\text{K} \leq \Delta\Theta \leq \Delta\Theta_{\text{max}}$ ³⁾	
Temperature sensor	$35^{\circ}\text{C} \leq \Theta \leq 45^{\circ}\text{C}$, $70^{\circ}\text{C} \leq \Theta \leq 85^{\circ}\text{C}$, $\Theta_{\text{max}} - 30 \text{ K} \leq \Theta \leq \Theta_{\text{max}}$	
Complete meter	$0,1q_p \leq q \leq 0,11q_p$ and $10 \text{ K} \leq \Delta\Theta \leq 20 \text{ K}$ $0,9q_p \leq q \leq 1,0q_p$ ¹⁾ and $\Delta\Theta_{\text{min}} \leq \Delta\Theta \leq 1,2\Delta\Theta_{\text{min}}$	

¹⁾ A maximum test point of $q_s/2$ is permitted.

²⁾ A minimum test point of 5 K is permitted.

³⁾ A maximum test point of 90 K is permitted.

⁴⁾ A maximum test point of 90 °C is permitted.

Table 2a

Test points for other meters.

	Test points	Maximum permissible error
Flow sensor	q_{min} , q_t , q_n according to the certificate, but not higher flows than class 3A.	q_{min} : $\pm 5\%$ for classes 2 and 3 q_t and q_n : $\pm 2\%$ for class 2 q_t and q_n : $\pm 3\%$ for class 3

Integrating unit	$\Delta T = 50^{\circ}\text{C} \pm 10^{\circ}\text{C}$ $\Delta T = 20^{\circ}\text{C} \pm 10^{\circ}\text{C}$	According to the certificate, but not more than according to class 1
Temperature sensor	$\Delta T = 50^{\circ}\text{C} \pm 10^{\circ}\text{C}$ $\Delta T = 30^{\circ}\text{C} \pm 10^{\circ}\text{C}$ $\Delta T = 20^{\circ}\text{C} \pm 10^{\circ}\text{C}$	$\pm (0.4+10/\Delta T)\%$ but not more than $\pm 4\%$ The measurement uncertainty must not be greater than 0.04°C

Table 2b

Test points for statistical verification for other meters.

	Test points	Maximum permissible error
Flow sensor	$0,1q_n, q_n$ för $q_n < 15\text{m}^3/\text{h}$ $0,2q_n, q_n$ för $q_n \geq 15\text{m}^3/\text{h}$	$\pm 6\%$
Integrating unit	$\Delta T = 50^{\circ}\text{C} \pm 10^{\circ}\text{C}$	Twice as large as the maximum permissible error according to class 1
Temperature sensor	$\Delta T = 50^{\circ}\text{C} \pm 10^{\circ}\text{C}$	$\pm 1.2\%$ The measurement uncertainty must not be greater than 0.1°C

Section 7 An in-service thermal energy meter shall be sealed.

Section 8 When a thermal energy meter is removed from service prior to inspection, it shall be stored under conditions that do not alter its metrological properties.

Inspection

General provisions

Section 9 An in-service thermal energy meter shall be inspected for compliance with requirements for maximum permissible error. The inspection referred to in Section 15(1) may be carried out by means of statistical verification.

Section 10 During the inspection, the error indication of the thermal energy meter or sub-assembly shall be determined and compared to the maximum permissible error. The result shall be documented in an inspection report.

For the purpose of the comparison, the error indication shall be less than or equal to the maximum permissible error to give a successful result.

Section 11 In the case of broken seals, resealing shall be carried out by the inspection body or the manufacturer of the meter. The seal shall be implemented in the manner and to the extent indicated in the EU type-examination certificate or equivalent documentation.

Section 12 If a batch is accepted after statistical verification, thermal energy meters or sub-assemblies that are in service and included in the batch may continue to be in service.

If a batch is rejected on the basis of statistical verification, all meters or sub-assemblies in the batch shall be taken out of service within one year. However, if it is reliably possible to locate and isolate faulty meters or sub-assemblies in a batch, the remaining meters or sub-assemblies in the batch need not be taken out of service.

Determining the error indication of a thermal energy meter

Section 13 The error indication of the thermal energy meter or sub-assembly shall be determined by inspecting at least the test points specified in Section 6.

The measurement uncertainty in determining the error indication shall include the measurement method, the measuring equipment and the meter's or sub-assembly's resolution. The measurement uncertainty may not exceed 1/5 of the current maximum permissible error unless otherwise specified in Section 6 and shall be determined with a coverage probability of at least 95 per cent.

Section 14 Flow sensors shall be inspected with liquid within the temperature range specified in the EU-type examination certificate or equivalent documentation.

Temperature sensors shall be tested without thermowells. The individual temperature sensors in the sensor pair shall be tested in the same temperature bath at temperatures within each of the three temperature ranges specified in Section 6. The error indication shall be calculated according to the methods set out in SS-EN 1434-5:2022.

When thermal energy meters are to be inspected

Section 15 A thermal energy meter shall be inspected:

- 1) no later than the ninth calendar year after the meter was put into service and no later than every fourth calendar year thereafter;
- 2) after modification;
- 3) where metrological seals are broken; and
- 4) when it can be assumed, for some other reason, that the metrological characteristics of the meter have changed.

The first paragraph shall apply only to meters that are to be put back into service or remain in service.

Statistical verification

Section 16 For statistical verification purposes, thermal energy meters or sub-assemblies shall be divided into batches. A batch shall consist of at least the number of meters or sub-assemblies specified in the Annex to these Regulations. Thermal energy meters or sub-assemblies constituting a batch shall:

- 1) have been put into service for no longer than a period of two years; and

2) be covered by the same EU type-examination certificate or equivalent document.

If the batch consists of flow sensors, they must also have the same nominal flow and have been in service in the same production network.

Integrating units and temperature sensor pairs may belong to batches consisting of sub-assemblies from different district heating companies.

The start date for the first inspection interval shall be set at the middle of the two-year period referred to in the first paragraph.

Section 17 The number of thermal energy meters or sub-assemblies to be inspected in a batch during statistical verification shall be as set out in the Annex to these Regulations.

The Annex also sets out the conditions under which the batch is to be considered approved.

The selection of meters or sub-assemblies shall be representative of the batch.

The number of meters and sub-assemblies in a selection may be increased. An increase in the number in a selection and the reason for the increase shall be documented.

Section 18 A thermal energy meter or sub-assembly in a selection shall be replaced if:

- 1) its metrological seal has been broken;
- 2) it has been damaged by external influences; or
- 3) it is not in operational condition for some other reason.

A meter or sub-assembly may be replaced if:

- 1) it can no longer be located; or
- 2) it is not possible to access it.

A meter or sub-assembly may not be replaced after an inspection measurement has been initiated.

Documentation

Section 19 When a thermal energy meter or sub-assembly is in service, and for three years thereafter, the following documentation and data relating to the meter or sub-assembly shall be available for supervision:

- 1) the manufacturer's serial number or the district heating company's identification number on the meter or sub-assembly;
- 2) the number of the EU type-examination certificate or equivalent document;
- 3) the flow range for flow sensors;
- 4) the temperature difference range for integrating units and temperature sensor pairs;
- 5) production network;
- 6) the date on which the meter was put into service;
- 7) the date on which the meter or sub-assembly was last inspected, or, in the case of statistical verification, the date on which the batch of which the meter or sub-assembly was a part was last verified;
- 8) the inspection report from the most recent actual inspection; and
- 9) the reason for removal.

Inspection bodies

Section 20 Inspection of thermal energy meters and sub-assemblies shall be carried out by a type A, B or C inspection body accredited for this task under Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and repealing Regulation (EEC) No 339/93.

The inspection may be carried out by the same person within a type C inspection body who carried out installation or modification as long as this does not compromise the results of the inspection.

Section 21 If an inspection body, which is accredited by an accreditation body other than Swedac, intends to carry out prescribed inspections, the inspection body shall notify Swedac of this. The accreditation decision shall be attached to the notification. The inspection body shall also notify Swedac immediately if the accreditation decision is changed or withdrawn.

Section 22 The inspection body shall participate in meetings for the exchange of experience and comparative measurements or studies designated by Swedac.

Other

Section 23 Swedac may, in individual cases and if there are specific reasons for doing so, grant exemptions from the application of these Regulations.

1. This statute shall enter into force on 1 April 2026.
2. The statute repeals the Board's Regulations and general advice (STAFS 2007:2) on the periodic inspection of water and thermal meters.
3. Decisions on extended maximum service life that have been issued on the basis of STAFS 2007:2 or other previous regulations shall remain valid even after this statute has entered into force. The extension applies as specified in the decision, either for a certain total period of time or for a certain number of years beyond the maximum service life under the provision in force at the time the decision was issued.
4. STAFS 2007:2 may continue to be applied until 31 March 2027.

On behalf of Swedac

ULF HAMMARSTRÖM

Mikael Schmidt

Annex

Sampling plan

Batch size	Number of meters to be inspected	Number of meters or sub-assemblies whose error indication exceeds the maximum permissible error	
		Quantity for the batch to be accepted	Quantity for the batch to be rejected
17-25	17	0	≥ 1
26-50	22	0	≥ 1
51-90	24	0	≥ 1
91-150	26	0	≥ 1
151-280	28	0	≥ 1
281-500	32	0	≥ 1
501-1200	50	≤ 1	≥ 2
1201-3200	80	≤ 3	≥ 4
3201-10000	125	≤ 5	≥ 6
10001-35000	200	≤ 10	≥ 11