SLOVENSKI STANDARD
SIST EN 12098-2:2002

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Regulacijske naprave za sisteme ogrevanja - 2. del: Naprave za optimizacijo delovanja toplovodnih ogrevalnih sistemov na osnovi vklop-izklop

Controls for heating systems - Part 2: Optimum start-stop control equipment for hot water heating systems

Mess-, Steuer- und Regeleinrichtungen für Heizungen - Teil 2: Ein-/Ausschalt-Optimierer für Warmwasserheizungen

Régulation pour les systemes de chauffage - Partie 2: Optimiseurs d'intermittences pour les systemes de chauffage a eau chaude

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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems
97.120	Avtomatske krmilne naprave za dom	Automatic controls for household use

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English version

Controls for heating systems - Part 2: Optimum start-stop control equipment for hot water heating systems

Régulation pour les systèmes de chauffage - Partie 2: Optimiseurs d'intermittences pour les systèmes de chauffage à eau chaude

Meß-, Steuer- und Regeleinrichtungen für Heizungen - Teil 2: Ein-/Ausschalt-Optimierer für Warmwasserheizungen

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

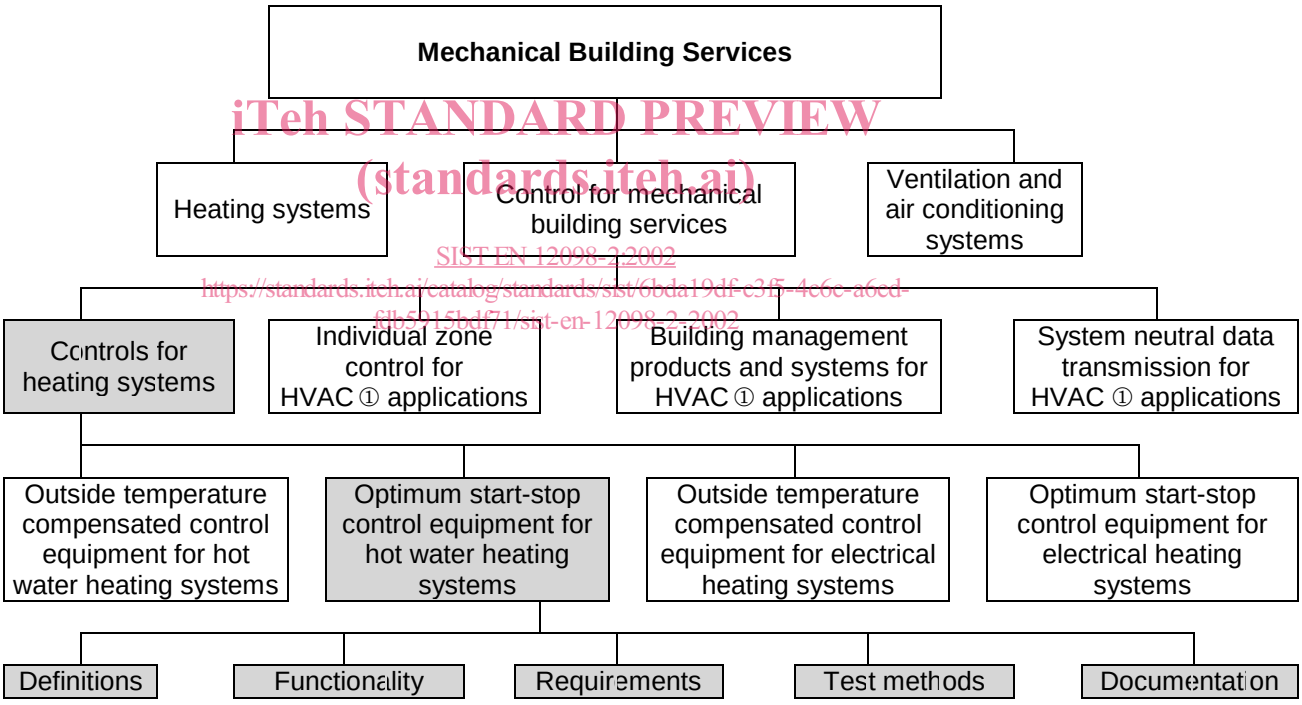
Foreword

This European Standard has been prepared by Technical Committee CEN/TC 247 "Controls for mechanical building services", the secretariat of which is held by SNV.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.

This standard is one of a series of product standards for "Controls for Heating Systems". It considers Definitions, Functionality, Requirements, Test methods, and Documentation for hot water heating controls with optimum start or optimum start-stop functions.

The position of this standard in the series of standards about mechanical building services comes out of the illustration below:



① HVAC: Heating, ventilation, air conditioning.

NOTE This illustration was updated and deviates from Part 1.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Equipment which controls the heating supply in buildings according to outside and/or room temperature is necessary to reduce the energy consumption of heating plants and maintain comfort level. Fixed switching times for intermittent scheduling, like an outside temperature controller according to EN 12098-1:1996, may not lead to energy saving and comfort optimisation. An optimum start-stop controller schedules switching times in relation with measured variables. Its function brings a high level of energy saving without reduction of desired comfort. It complements a main controller like an outside temperature controller (OTC).

The optimum start-stop function also brings benefits to the user because it is easier to programme. The user sets the time at which comfort conditions should apply, rather than the switch-on or switch-off times of the plant. Without the optimum start-stop function, switch times may have to be manually changed to achieve energy savings and acceptable comfort levels.

NOTE Optimum start-stop functions is illustrated by Figure 1: Heating periods are different from scheduled occupation periods. These differences, due to thermal inertia, depend mainly on heating loads (or temperatures differences). A start-stop optimiser controls these switchings, using outside and/or room temperatures or their differences in relation to setpoints.

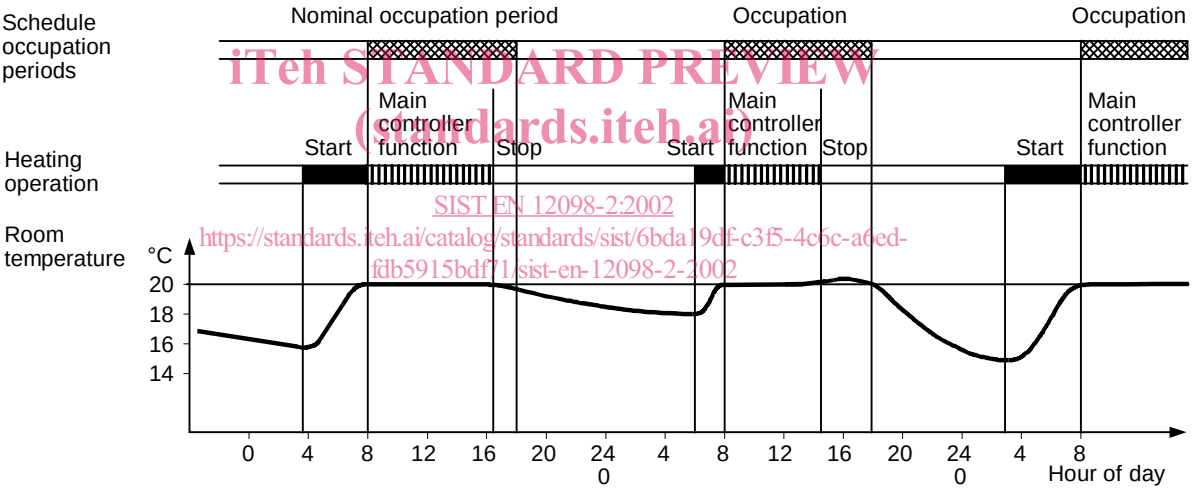


Figure 1 - Relation between occupation, heating and room temperature

Adaptive functions are easier to commission because they require fewer installation adjustments and no readjustment.

Included in this standard are the main equipment characteristics which assist in reaching these energy saving and comfort objectives.

Characteristics which are directly tested include:

- accuracy of sensors
- part load characteristics

Characteristics which are required to be indicated by the manufacturer include:

- time constants

Other characteristics of the equipment are tested indirectly by measuring responses dependent on them, for example:

- differential
- dead band

NOTE This standard, therefore, conforms to the requirements and objectives of the interpretative document n° 6 "Energy Economy and Heat Retention" relating to the Construction Product Directive (89/106/EEC).

1 Scope

This standard applies to electronic equipment which controls heating systems with water as the heating medium and a flow temperature up to 120 °C. The signals can be processed by using either analogue or digital techniques, or both. The particular equipment to which this standard applies covers both :

- stand-alone start optimisers or start-stop optimisers, taking priority to the main controller during periods.
- controllers which contain an integrated optimum start or an optimum start-stop control function.

It applies both to adaptive and fixed parameters control functions and sets minimum acceptable standards for functions, performance and documentation.

NOTE The optimum start-stop function can be integrated within a main control device such as an outside temperature compensated (OTC) controller. In this case the controller would be expected to meet both Part 1 and Part 2 of this standard (see EN 12098-1:1996).

Safety requirements on heating systems and heating control systems remain unaffected by this standard. The actuators and the dynamic behaviour of the valves are not covered in this standard.

This control equipment may or may not be connected to a data network.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12098-1:1996
Controls for heating systems – Part 1: Outside temperature compensated control equipment for hot water heating systems

EN 60529
Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)

EN 60730-1
Automatic electrical controls for household and similar use – Part 1: General requirements (IEC 60730-1:1993, modified)

EN 60730-2
Automatic electrical controls for household and similar use – Part 2: Particular requirements for thermal motor protectors (IEC 60730-2 series, modified)

IEC 60038
EC standard voltages

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in EN 12098-1:1996 and the following apply.

3.1
start-stop optimiser
control device which performs optimum start-stop functions. It consists of the electronic controller, sensors and output signals, but does not include the actuating equipment (see Figure 2).

It overrides signal(s) issued by a main controller, from switch-off time to beginning of nominal occupation period. Start-stop optimisers and main control functions can be included in a single device.

The optimum stop function is optional, a start optimiser performs an optimum start function and a fixed switch-off time function.

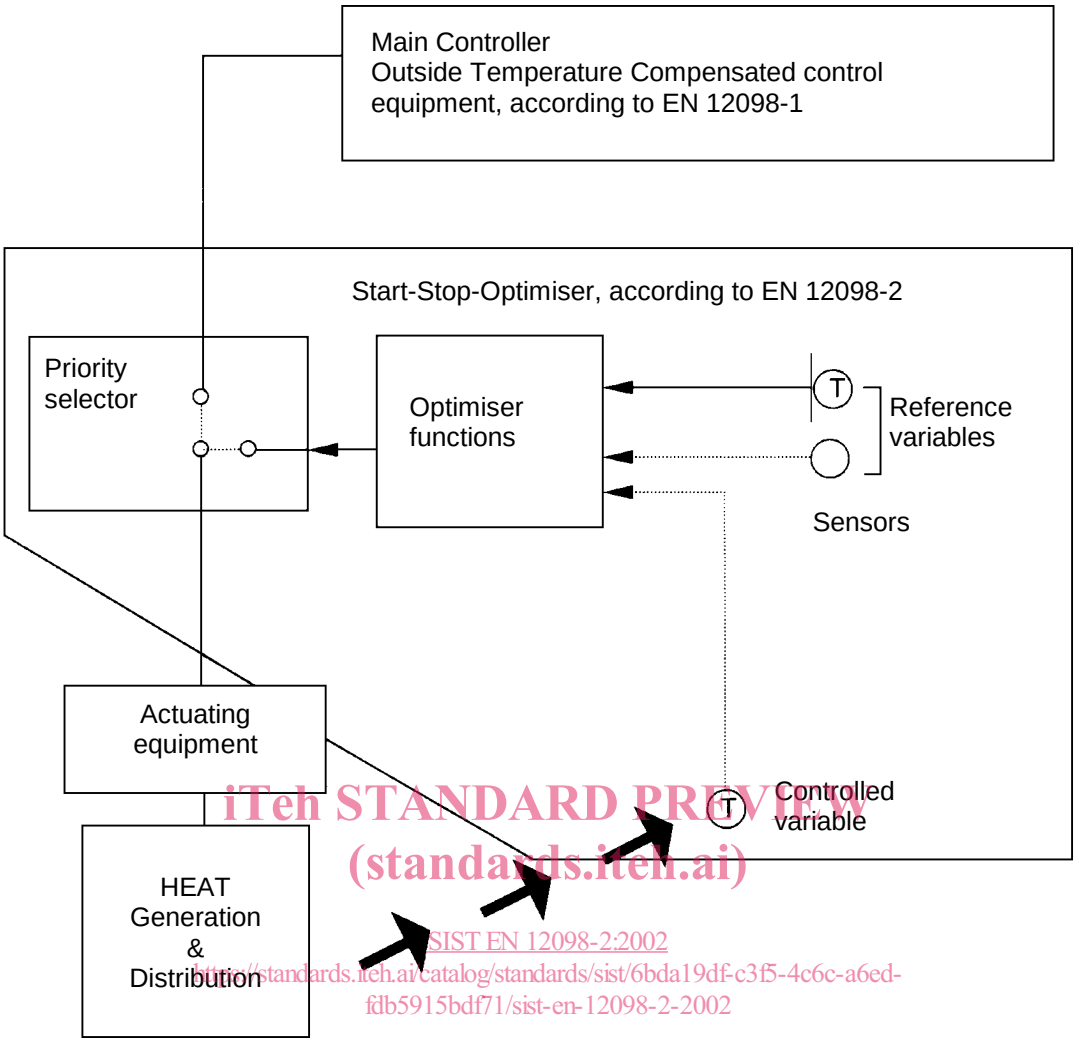


Figure 2 - Example of control equipment for heating systems

3.2
optimum start
this function controls the switch-on time such that the room temperature reaches the nominal room temperature from a lower level (e.g. reduced or stand-by room temperature), at a predefined time: the beginning of nominal occupation period.

3.3
adaptive optimum start
added function to optimum start, which recalculates the parameters used to determine the switch-on time, based on measured room temperature as feedback information.

3.4
optimum stop
this function controls the switch-off time, anticipates the end of nominal occupation period in reference to the room temperature, such that the natural fall of the room temperature during nominal occupancy period is kept within acceptable limits satisfying comfort needs.

3.5
adaptive optimum stop
added function to optimum stop, which recalculates the parameters used to determine the switch-off time, based on measured room temperature as feedback information.

3.6
actuating equipment
equipment providing the means by which the controller affects the controlled variable (*according to 3.2 of EN 12098-1:1996).*

See Figure 2.

3.7
controlled variable of the optimiser
boiler and/or supply water temperature controlled by start-stop optimiser, during its control period, i.e. from switch-off time to beginning of nominal occupation period.

3.8
output signals
signals generated by the controller for operating the actuating equipment *(according to 3.4 of EN 12098-1:1996).*

3.9
reference variable(s) of the optimiser
for optimum start function: the outside temperature or the room temperature, or both, used to determine the switch-on time, with or without other influencing variables (see 3.2).

For optimum stop function: the room temperature used to determine the switch-off time, with or without other influencing variables (see 3.3).

3.10
outside temperature
reference variable that is measured with a sensor fitted outside the building, mainly intended to measure the air temperature (*according to 3.6 of EN 12098-1:1996).*

3.11
nominal room temperature
resulting room temperature in the building arising in nominal operation of the controller. It is dependant on the design of the heating system and can be different for individual rooms (*according to 3.8 of EN 12098-1:1996).*

3.12
reduced room temperature
reduced room temperature compared with the nominal room temperature resulting from operation at a reduced set point (*according to 3.9 of EN 12098-1:1996).*

3.13
stand-by room temperature
room temperature resulting from switching off the heating (*according to 3.10 of EN 12098-1:1996).*

3.14
beginning of nominal occupation period
user programmed time for which the nominal room temperature should begin to apply.

3.15
switch-on time
point in time at which the controller starts-up the heating or increases the boiler/supply water temperature in order to reach the nominal room temperature (*according to 3.12 of EN 12098-1:1996)*

This time is automatically determined by the optimum start function.

3.16
end of nominal occupation period
user programmed time for which the nominal temperature should decrease under the nominal room temperature.

3.17
switch-off time
point in time at which the controller switches off the heating or decreases the boiler/supply water temperature (*according to 3.13 of EN 12098-1:1996).*

This time is automatically determined by the optimum stop function.

For a optimum stop function, the switch-off time is a variable based on the user programmed end of nominal occupation period.

3.18
nominal occupation period
operating period during which nominal room temperature should apply.

3.19
optimum start period
operating period between the switch-on time and the beginning of nominal occupation period.

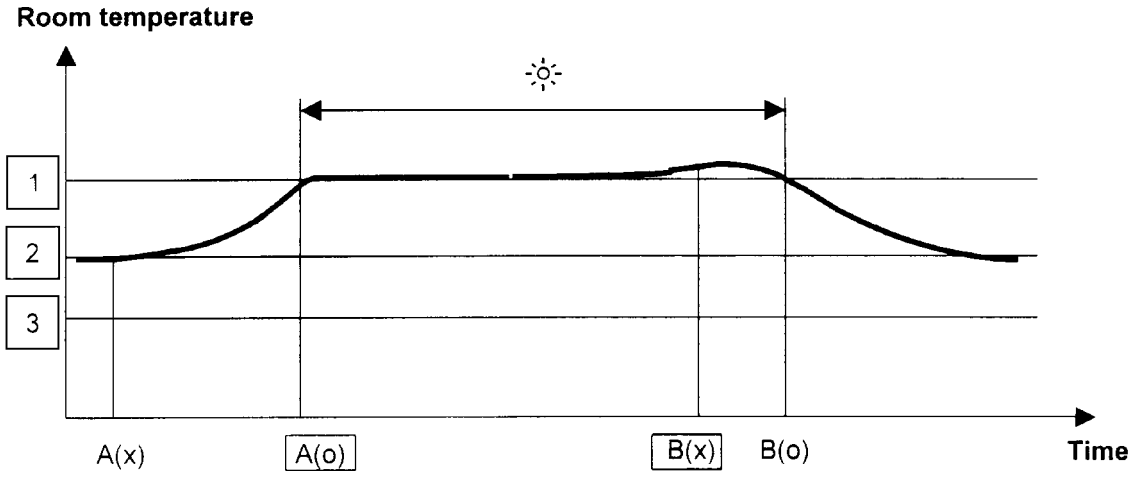
3.20
optimum stop period
operating period between the switch-off time and the end of nominal occupation period.

3.21
reduced operation
operating period from the switch-off time up to the switch-on time, maintaining a reduced room temperature compared with the nominal room temperature (*according to 3.15 of EN 12098-1:1996)*

3.22
stand-by operation
mode in which the heating is switched-off (*according to 3.16 of EN 12098-1:1996).*

3.23
manual operation
mode in which the controller is inactive and the actuating equipment can be manipulated manually (*according to 3.17 of EN 12098-1:1996).*

3.24
frost protection operation
function in all operation modes (except manual operation) to prevent the heating system from freezing by providing specific output signals to actuators *(according to 3.18 of EN 12098-1:1996).*



1: nominal room temperature
2: reduced room temperature
3: stand-by room temperature

A(o): beginning of nominal occupation period (fixed)
A(x): switch-on time (variable)
B(o): end of nominal occupation period (fixed)
B(x): switch-off time (variable)

A(o) - B(o): nominal occupation period
A(x) - A(o): optimum start period
B(x) - B(o): optimum stop period
B(x) - A(o): priority to the start-stop optimiser
A(o) - B(x): priority to a main controller

Figure 3 - Temperature-time curve

4 Functionality

4.1 Functional Objectives

4.1.1 General

Optimum start-stop control equipment achieves high levels of energy saving by reducing, or preferably, switching off heating systems and controlling optimum start heating by taking account of the thermal inertia of the building and heating system, in such a way that the recovery to the nominal room temperature from a lower room temperature is done in the minimum time.

The start period duration and the controlled variable are relative to reference variable(s) which fall into three classes:

Class A: reference variable is measured outside temperature (and temperature setpoints), with or without other influencing variables.

Class B: reference variable is measured room temperature (and temperature setpoints), with or without other influencing variables.

Class C: reference variables are measured outside and room temperature (and temperature setpoints), with or without other influencing variables.

Classes may be capable of more than one function. Table 1 shows those possibilities :