Rules

eu.bac
Certification Programme
for
Home and Building Automation Products and Systems

Part 2 -1: Specific Rules for Electronic Individual Zone Control Equipment

In accordance with EN15500

(Agreed by eu.bac Technical Working Group 2021-04-21)

European Building Automation and Controls Association eu.bac

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Foreword

This document has been prepared by eu.bac task group ETT-IZC.
It is based on EN15500-1(2017) and TR 15500-2(2016). In addition to EN15500-1 and TR15500-2, some clarifications have been made with respect to testing.
Special test conditions have been specified for water floor heating and electrical floor heating.
Currently there is no standard available which covers certification of Electronic radiator valves. Therefore, testing of electronic radiator valves is done with the same application as for radiator heating, but Control to Set Point Deviation (CSD) has to be handled in a different way. (See Annex B).

1 Introduction, General Remarks

1.1 Introduction

Part 2-1, *Specific Rules for Electronic Individual Zone Control (IZC) Equipment* is complementary to Part 1, *General Rules of the eu.bac certification rules for automation products and systems for home and building automation.*

These Specific Rules in compliance with Part 1 *General Rules of the eu.bac certification rules for automation products and systems for home and building automation* define how to obtain and maintain certification, the application of the system and the details of the procedures in the field of IZC equipment in accordance with EN15500-1 and TR15000-2.

1.2 Scope

The scope of these “Specific Rules” includes electronic individual zone control equipment as described in EN15500-1. In accordance with EN15500-1 and TR 15500-2 the test procedures described in the specific rules cover room temperature control performance only. Humidity control and air volume control are not part of the test procedure.

1.3 Beginning of validity

Specific Rules for Electronic Individual Zone Control Equipment: Version 4.5 has been valid since February 2016. Follow-up tests may be carried out based on version 4.5 (until May 2021) or the current version.

All other tests must be done based on this version, as soon as the new version is accepted and published.

1.4 Related documents

[1] eu.bac certification programme for home and building automation products and systems, Part 1: General Rules – 2/2016

[2] EN 15500-1: 2017 Energy Performance of Buildings – Control for heating, ventilating and air conditioning applications – Part 1: Electronic individual zone control equipment – Modules M3-5, M4-5, M5-5

[3] TR 15500-2: 2016, Technical Report Energy Performance of Buildings – Control for heating, ventilation, and air-conditioning applications – Part 2: Accompanying TR EN15500-1:2015 – Modules M3-5, M4-5, M5-5

[4] EN12098-5: Controls for heating systems.
Part 5: Start-stop schedulers for heating systems, 2015

1.5 Terms and definitions, Abbreviations

eu.bac conformity

The requirements for eu.bac conformity are defined in Annex B

Building protection, frost protection

Building protection and frost protection are used in [2] as equals. In this document, the term building protection will be used for heating applications to describe the lowest level of room temperature to be maintained to protect the building.

Abbreviations

AV	Actuator / valve combination
CA	Control accuracy
CAV	Constant air volume system
CCS	Chilled ceiling system
CSD	Control to set point deviation
CSDh	Control to set point deviation heating
CSDc	Control to set point deviation cooling
EMC	Electromagnetic compatibility
ERV	Electronic radiator valve
ETT	eu.bac test tool
IZC	Electronic individual zone control
VAV	Variable air volume system

2 Application

Defined in [1]

3 Requirements of assurance of conformity

3.1 Quality management system

As described in clause 1.6.1 of the General Rules [1].

3.2 Quality Plan

Supplementary conditions to clause 1.6.2 of the General Rules [1]:

The applicant has to make the following information available about his methods for assuring conformity with EN15500-1 and the specific rules.

- Description of surveillance made during production in respect of:
  - Analogue and/or digital parameter settings and display
  - Input accuracy (e.g. room temperature sensor)
  - Hardware accuracy and tolerances
  - Characteristics of sensors
  - Downloading correct Software
  - Correct Labelling
  - Correct Product documents
- Description of periodical conformity checks which include at least
  - Electrical safety
  - Electromagnetic compatibility

Conformity checks have to be repeated at least every 3 years

- Description of the control of purchased materials and components relative to the properties:
  - - Heat and fire resistance
  - - Creep age
  - - Control accuracy
- Description of the test procedures during and at the end of production including test equipment
- Description of the procedures for the identification and segregation of non-conforming products.
- Description of the procedures for introducing any modifications to the certified product and the control of the associated changes to internal documentation.
- Description of the calibration methods and programme for the test equipment.

3.3 Records

The applicant shall undertake to maintain for at least six years the records necessary to confirm that he continually operates his quality system to the requirements of this scheme.

4 Initial Tests and Inspections Procedure

4.1 Initial type test

4.1.1 Delivery by the manufacturer

The applicant shall send the samples (series products or 0-series products) and the required documents (see below) to the test laboratory

4.1.1.1 Product information

- Installation instructions
- User operating instructions
  Installation instructions and user operating instructions have to include all information mentioned in chapter 8 “Marking and Documentation” of EN15500.
- Product classification and designation
  - Controller type (e.g. fixed function, configurable/programmable)
  - Input specification (e.g. sensors, other signals)
  - Output specification (valve type, actuator type)
  - Power supply
  - Operating and storage ambient conditions
  - Protection class (e.g. IP30)
  - Compliance with electrical safety
  - Compliance with electromagnetic compatibility
- Selection of applications to be tested (from those listed below)
  - Heating system (radiator heating)
  - Electronic radiator valve
  - Water floor heating
  - Fan coil unit system 2 pipes or 4 pipes *)
  - Fan coil unit system 2 pipes/ 2 wires
  - Variable air volume system without heating/cooling coil
  - Variable air volume system with heating/cooling coil
  - Ceiling system (heating/cooling)
  - Electric convector
  - Electric floor heating
  - Electric ceiling heating
  - Chilled beam (heating/cooling, 2 pipes or 4 pipes) *)

Remark: in accordance with EN15500-1 and TR15500-2 the test procedures cover room temperature control performance only.

*) For the certification test, 2 pipes fan coil application and 2 pipes chilled beam application will be used for testing

In order to cover all basic fan coil applications, tests should include water heating, water cooling and electrical heating.
E.g. Water heating and cooling test by fan coil unit system 2 pipes and electrical heating test by fan coil unit system 2 pipes/ 2 wires.

- Parameter settings for the required application test
- Self-declaration documents (Annex A)

4.1.1.2 Material

- Number of controllers to be delivered: 3
- Number of controllers to be tested: 1
- Connectors for the connection with the test bench
- Description of how to disconnect the room temperature sensor
- Valve and actuator (see Annex E)
  Ball valves have to be prepared by the valve manufacturer according to Annex K

4.1.2 Electrical requirements

For requirements in EN15500-1 concerning

- Supply voltage
- Protection against electric shock
- Electromagnetic compatibility
- Degree of protection

In deviation of EN15500-1, chapter 5.6 Electrical requirement, Requirement 5.6.3 is not valid. The following statement for Electrical Safety is valid:
The controls shall comply with the requirements of EN 60730-1 series.
In addition to this change, Marking and Documentation of protection class is only required, if applicable.

The applicant has to provide a declaration of conformity with the relevant standards.

- Switching relays

The ratings of the relay contacts have to be declared. Number of switching operations at
- Resistive charge (x A) and
- Inductive charge (y A, cosφ)

4.1.3 Environmental conditions

For requirements in EN15500-1 concerning

- Ambient temperature
- Heat and fire resistance

The applicant has to provide a declaration of conformity with the relevant standards.

4.1.4 Data protection

The applicant has to provide a declaration of conformity with the requirements in EN15500-1 concerning data protection.

4.1.5 Sensors

Specification of the sensors as described in Annex D

4.1.6 Temperature control accuracy

Temperature control accuracy will be measured in the test house as described in EN 15500-1 and TR 15500-2. The test results are only valid in the tested control loop (Sensor – Controller –Actuator/Valve) for the conditions stated in the test report summary.

The test results may also be used in combination with other control loop elements (Sensor, Actuator/Valve) if those elements fulfil the requirements of interchangeability as defined in chapter 6.

Temperature control accuracy is measured in comfort mode.

The test will be executed on a test bench as described in TR 15500-2. Either a sensor resistor simulator or a real sensor in a climatic chamber will be used as a temperature interface to the controller.
In case of resistor simulator, the time constant of the room temperature sensor needs to be defined.

The simulation model used in the test is based on a wall hanging room temperature sensor. Therefore, the test needs to be carried out with a wall hanging room temperature sensor (climatic chamber) or in case of sensor resistor simulator; the time constant of a wall hanging room temperature sensor will be used in the simulation model. Room temperature sensor time constant needs to be measured in accordance to Annex D.

Based on measurements done with several wall hanging room temperature sensors, shortest time constants are in the range of 6 minutes and more. Therefore, minimum time constant used for testing will be 6 minutes.

The measurement of the time constant is in the responsibility of the manufacturer. If the self-declared time constant is less than 6 minutes, the test house will replace the time constant declaration by a fixed value of 6 minutes.

Additional test conditions for climatic chamber testing are described in Annex F.
The test for VAV application is done on a test bench according to Annex L.
For applications using rotary valves, the measurement equipment described in Annex K shall be used.

Controllers with self-learning function of the control parameters have to pass a teach-in period as described by the manufacturer before the temperature control accuracy test will start.

Adjustment of the room temperature set point is carried out by the test laboratory. Therefore, it is important to have a proper description of how to adjust the room temperature set point to 20°C for heating and 24°C for cooling (especially for analogue settings).

In deviation to TR15500-2, transition Time T1 for water floor heating will be 10’800s (3h) instead of 5400s(1.5h).

Remark: with shorter transitions time, the impact of the controller on the measured CA value is too small.

4.1.7 Controller operating mode

Comfort, economy and building protection modes shall be available.

Economy mode and building protection mode will be tested as described in

Annex C. Building protection mode will be tested in heating applications only.

4.1.8 Clock, time switching function

An internal or external time switching function (external contact or network function) is required for changing operating modes. The requirements of clock and time switching functions are in accordance with EN12098-5 [4]

Self-declaration of the applicant for switching times and the clock is required if an internal switching function is available.

Clock

Resolution of setting

Accuracy (+/-minutes/year) (environment condition for the controller: 10 ..40°C)

Switching times

Number of set point changes per day

Resolution of settings

Accuracy of switching time

Category of switching time function (in accordance with EN12098-5 [4])

4.1.9 Person-machine interface

Self-declaration of the applicant for

- Adjustment of the room temperature set point
- Change of the operating mode
- Clock setting (if available)
- Time schedule (if available)
- Set point resolution:

  For analogue operating elements, it should be clear how to change the temperature set point for 1K (marking on device or description in the user manual)

4.1.10 Classification and designation

The data required in chapter 7 (Classification and designation) of EN15500-1 should be available either in the product data sheet or in the user manual.

4.1.11 Marking and documentation

Marking and documentation should fulfil the requirements of EN15500-1.

4.2 Initial inspection

Supplementary conditions to clause 1.9.3 of the General Rules:

The initial inspection shall include a verification of the manufacturer's Quality Management System, the quality plan and the maintenance of records according to clauses 3.1, 3.2 and 3.3.

Details of the inspection are described in COBAC checklist for inspection (see Annex J)

5 Surveillance Procedure

For follow up tests, inspection and certification, the timetable in Annex C of the General Rules [1] applies.

5.1 Modifications and enhancement of the product

The licensee is obliged to inform the certification body of modification and enhancement made to the product or production process which may affect conformity of the product or any other point mentioned in clause 4.

The certification body will decide whether additional inspection and/or follow up tests have to be carried out.

5.2 Modifications of the specific rules or referred standards

If eu.bac decides to change the specific rules or if the referred standards are changed, the certification body shall make all necessary arrangements for the implementation of these modified rules which may involve testing and inspection.

If the new test procedures are available, all follow up tests and inspections will be based on the modified rules, if not otherwise mentioned in chapter 1.3 (beginning of validity).

5.3 Inspection

The continuing inspection includes the same elements as the initial inspection.

5.4 Follow-up test (after 36 months)

The applicant has to send 3 samples (series products, production not older than 6 months) to the test laboratory. The follow-up test includes the same elements as the initial test.

If deviation of the measured CA value in the follow-up test is $\leq$ 0.2K for motorized actuators or $\leq$ 0.4K for thermal actuators, the CA value measured in the first test will stay the same in the CLMS system.
The limits of $\leq$ 0.2K applies for all applications, except applications with thermal actuators.

If deviation is larger than 0.2 (0.4 K), a second test will be carried out by the test house. If the deviation is still larger than accepted, the manufacturer has to explain the reason for the different results within 6 months.
If the manufacturer is not able to explain the deviation within this time frame, he will lose his certificate.
For derived products, no follow-up test is required.
If deviation is larger than 0.2K (0.4K) based on modified specific rules, the new CA value will be published in CLMS.

5.5 Follow-up test for Prolongation

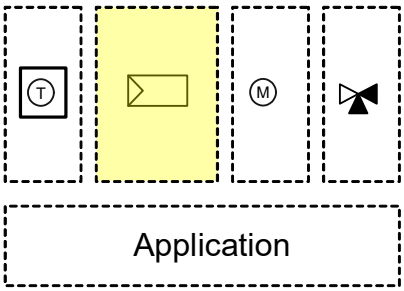
For the prolongation of the certificate, the test procedures will be used as described in the initial test chapter 4.1 of this document.
The CA value will stay the same in the CLMS, if the tolerances defined in chapter 5.4 Follow-up test (after 36 months) are met. If the tolerances are not met, the new CA value will be published in the CLMS.
If test procedures have been modified changing the CA value since the previous test and are to apply according to chapter 1.3 (Beginning of validity), the new CA value will be published in the CLMS.
For derived products, the test house/certification body will decide, if retesting of a product is needed.

5.6 External complaints

Complaints concerning the self-declaration part of the manufacturer, the certification body will ask the test house to check the documents of the manufacturer, which describe how the self-declaration part was tested.

6 Validity of test results, interchangeability of control loop elements like sensor and valve/actuator combination

For the measurement of the CA value, a controller is tested as part of a control loop, consisting of the loop elements room temperature sensor / controller / actuator / valve.



A controller may be used in combination with other control loop elements different to the ones used in the certification test, if they fulfil the requirements of the interfaces to each other, and if the basic characteristics of the replaced control loop elements are the same.

In addition to the electrical interfaces (sensor / controller and controller / actuator/valve combination) which need to fit to each other, some basic characteristics for the room temperature sensor and for the actuator/valve combination need to be fulfilled.

A 3rd party test by a eu.bac authorised test house is required to validate interchangeability. Based on this test result and the self-declaration of the manufacturer, eu.bac will declare the interchangeability (see Interchangeability declaration). This declaration is valid for 6 years. By applying via CLMS (www.eu.bacCert.eu) for the interchangeability declaration the applicant also agrees to meet the test costs and declaration fee.

Details of the fees are fixed in the Admission + Certification/License fees of these Specific Rules. The test costs need to be agreed by the applicant and the test house.

The control loop element used in the test is characterised by an acronym.
All devices that pass interchangeability testing with the same acronym may be used to replace the control loop element used in the certification test.

Controllers with special requirements, different to the control loop element characteristics, which are not covered by interchangeability testing (e.g. special algorithms for thermal actuators using special type of thermal actuators), have a special acronym.

The interchangeability declaration does not confirm the usability of the actuator/valve combination with each certified controller.
Restrictions made by the controller manufacturer always have to be checked by the planner/consultant/installer.

All devices that pass the test will be listed in CLMS.

6.1 Actuator/valve combination

The dimensioning of the valve in accordance with the real plant (hydraulic system, including pump, pipes ...) has a large impact on the control behaviour. This may not be tested on a universal test bench, which is independent of the real plant. Therefore, this property will not be taken into account for the evaluation of the interchangeability of a valve.

Another important property is the valve characteristic. The impact of the valve characteristic depends on the hydraulic system and on the application.

Other important properties that have an impact on the control accuracy are

- Mechanical play between actuator and valve
- Electro-mechanical characteristics such as resolution, hysteresis, threshold

Other properties such as running time only show a minor impact and will not be taken into account.

6.1.1 Interchangeability testing of actuator/valve combinations

For the declaration of “interchangeability”, an actuator/valve combination will be tested in a real control loop with a reference controller.
The test result (CA-value) will be compared with the test result performed with a reference actuator/valve combination, which is well characterised and used as part of a certified controller.

This test will show the impact of mechanic play and different electro-mechanical characteristics.

For all types of motorized actuators and for electro thermal actuators with 0-10V input, the actuator/valve combination will be accepted as interchangeable, if

$$CA_{exch} - CA_{ref} <= 0.2$$

For all electro thermal actuators with 2-point positioning signal or PWM/PDM input (Puls width modulation or Puls duration modulation), the actuator/valve combination will be accepted as interchangeable, if

$$CA_{exch} - CA_{ref} <= 0.3$$

In order to limit the number of tests, this test will be performed only for one example of a family of valve and actuators.

Family of actuator/valve combinations

Typically, an actuator may be combined with different valve-families. Combinations of actuator with different valve-families need to be tested separately.
Only one example of a valve family will be tested.

A valve family is defined as follows:

- A family may cover products with different body materials (e. g. brass, grey cast iron etc.)
- A family may cover products with different pipe connections (e. g. inside thread, flange etc.)
- A family may cover 2-way and 3-way products
- Products of a valve family must have the same characteristics of control path A – AB
- Products of a valve family must fit to the same actuator

For the test, a valve type may be selected, which fits with the eu.bac measurement equipment.

The actuator/valve manufacturer shall declare the equivalence of mechanical coupling between actuators and valves within a family of actuator/valve combinations in a self-declaration document. The actuator/valve manufacturer shall inform the test house for each change of the mechanical coupling. The test house will decide if retesting is needed.

Actuator/Valve Acronyms

The actuator/valve combination used in the test is characterised by an acronym. All actuator/valve combinations listed in CLMS with the same acronym may be used to replace the actuator/valve combination used in the test.

Stroke or rotary actuators are not distinguished.

Control Loop Element	Specification	Characteristic	Acronym
Actuator	Input / Power supply	230V	230V
		24Vac	24Vac
		24Vdc	24Vdc
		Bus powered	BP
		Battery powered	Batt
	Drive	Motorised Actuator	MA
		Thermal Actuator	TA
	Drive Type	0-10V Drive	0-10V
		2 point Drive	2P
		3 point Drive	3P
		Puls-width modulation Drive	PWM
		Bus - Modbus	BM
		Bus - KNX	BK
		Bus - BACnet	BB
		Bus - LON	BL
		Bus – XXX (others)	BX
		RF-Zigbee	RFZ
		RF – proprietary*)	RFP
Valve	Type	2 way / 3way valve	2-3WV
		6 way valve	6WV
	Characteristic	Linear	L
		Equal percentage	EP

Details concerning interchangeability testing see Annex N

6.2 Room temperature sensor characteristics

The main sensor property which has an impact on the control accuracy is the time constant.

Temperature sensors with the “same” time constant as the time constant used for the certification test may be declared as an “exchangeable control loop element”, which may be exchanged without affecting the CA value of the control loop.

The time constant shall be measured as described in the specific rules for sensors.

The time constant of a room temperature sensor will be accepted as the same as the sensor to be exchanged, if

$$t_{const\_exch} <= t_{const\_ref} * 1.3$$

t_{const_ref} = time constant of the sensor used in the certification test

t_{const_exch} = time constant of the sensor to be used

REMARK: Details concerning interchangeability testing of room temperature sensors will be defined in a later version of this document.

7 Product families

7.1 Product families with different number of control loops

In addition to derived products, room temperature controls may be available as product family, consisting of controls with different numbers of I/O’s having different numbers of control loops with the same control characteristic. The behaviour of all control loop needs to be identical.

In this case, only one control loop of one product out of this family will be tested.

The test house must decide, if a performance test needs to be performed, to verify the “identical behaviour”.
If a product is accepted as “product family”, retesting will only be done with one controller out of the family.

8 Requirements for test laboratories

Supplementary conditions to clause 1.7.3 of the General Rules [1]

8.1 Inter laboratory comparison test

Repeatability for inter laboratory comparison test as defined in Annex G

8.2 Test devices

Test devices and other items related to the test shall be kept at the test house until the test results are accepted by the applicant and the certification body.

Annex A

Items to be Declared by the Controller Manufacturer

A1: Electrical requirements

Electrical safety

Electrical safety in accordance with EN15500

Electromagnetic compatibility

Electromagnetic compatibility in accordance with EN15500

Electrical and mechanical protection

Electrical and mechanical protection in accordance with EN15500

Switching relays

Number of switching operations at:
- Resistive load
- Inductive load

A2: Environmental conditions

Ambient temperature

Heat and fire resistance

A3: Data protection

In case of mains powered: 12h

In case of battery powered: 45 seconds, low battery warning

A4: Sensor specification

Type of Sensor

Sensor characteristic: [Temp vs. measured value e.g.Ω]

Accuracy: [e.g. +/-0.8K between 15...28°C, accuracy at 20°C and 24°C]

Time constant [s]: see Annex D

A5: Clock, time switch function

(Only for built in timers)

Clock

Accuracy (min/year) (environment condition: 10...40°C)

Resolution of setting

Time schedule (local or network) (in accordance with EN12098-5)

Internal or external time switch function

Number of set point changes per day

Resolution of setting

Accuracy of switching time

Category of switching time function

A6: Person-machine interface

Room temperature set point adjustment

Set point resolution

Change of operating mode

Clock adjustment (if available)

Time switch function setting (if available)

Items to be declared by the Actuator / Valve Manufacturer

Declaration of the manufacturer that the Actuator /Valve combinations are using the identical construction for mechanical connection as tested under 3rd party test by the eu.bac authorised test house

Annex B: eu.bac conformity

eu.bac conformity is based on the requirements of EN15500-1. In addition to EN15500-1, eu.bac conformity demands some additional requirements (e.g. smaller CA values than required in EN15500-1).

On the other hand, some requirements in EN15500-1 are handled less restrictively, because this would limit the range of products which could be certified. Therefore, some modified requirements are made too.

The following additional and modified requirements are made for eu.bac conformity:

B 1 Additional requirement for eu.bac conformity

The following requirements are requested in addition to the requirements in EN 15500:

B 1.1 Temperature control accuracy compliancy

CA value calculation used for eu.bac conformity depends on the type of test bench.

CA Value calculation

Resistance simulator test bench

Control accuracy CA will be calculated as defined in EN15500-1 [2].

Climatic box, air channel test bench

CSD measured on the climatic box/air channel test bench may deliver different results because of the range of air velocity (0.05 ...0.15 m/sec) which is allowed for the test bench.
Therefore, controller accuracy CA will be calculated based on the measured CV value only. CSD will not be taken into account.

Control accuracy limit

Control accuracy CA limit for conformity compliance depends on the application to be tested.

For hot water radiator heating systems, fan coil unit systems, VAV systems, chilled ceiling systems, CA <= 1.4 is requested.

For water floor heating, electric convector, electric floor heating, electric ceiling heating, CA <= 1.8 is requested.

Control accuracy will be published with a resolution of 0.1K.

Control to set point deviation CSD

(This applies for resistance simulator test bench only)

In addition to the CA requirements, control to set point deviation (CSD) has to be within a certain limit.

In case of heating mode, a positive deviation from the set point will be taken into account for the calculation of the CA-Value. A negative CSD will not be taken into account.

In heating mode, $|CSDh|$ has to be higher or equal than the CA limit defied above.

$|CSDh| \leq 1.4$ or 1.8 K*

In cooling mode, a negative deviation from the set point will be taken into account for the calculation of the CA-value. A positive CSD will not be taken into account.

In cooling mode, CSDc has to be lower or equal than 0.5K.

$|CSDc| \leq 1.4$ or 1.8 K*

*) 1.4K applies for hot water radiator heating system, fan coil unit system, VAV system, chilled ceiling system applications

1.8K applies for water floor heating, electric convector, electric floor heating, electric ceiling heating applications

Control to set point deviation CSD for ERV

The manufacturer has to state the deviation between the displayed and the controlled set point. The set point in the eu.bac test will be selected correspondingly.

The stated set point deviation given by the manufacturer has to be lower than 1.8K

B 1.2 Controller Functions

In addition to the requested operating modes, a time switching function (local, network or external input) is requested.

B 2 Special test procedures

B 2.1 Special test procedure for applications with thermal actuators

Repeatability of eu.bac testing with thermal actuators is much more critical than with motorized actuators. (Variation of running time of thermal actuators).
Therefore, the following procedure will be used for tests with thermal actuators
To prevent random results, tests with thermal actuators will be carried out twice

- The result will be the average value of both test (CA-value)
- If the difference between two tests is >= 0.3K, a third test will be performed
- In this case, the result will be the average value of all three tests

The calculated value will be brought up to a round value with 0.1 K resolution, e.g. a calculated value of 0.25 will be brought up to 0.3

Annex C: Description of Additional eu.bac Tests

Annex C contains the description of additional eu.bac tests which are not specified in EN15500-1[2].

C.1 Operating Mode

EN15500-1 requires at least three operating modes.
Temperature control accuracy compliance will be tested in comfort mode.

C.1.1 Comfort mode

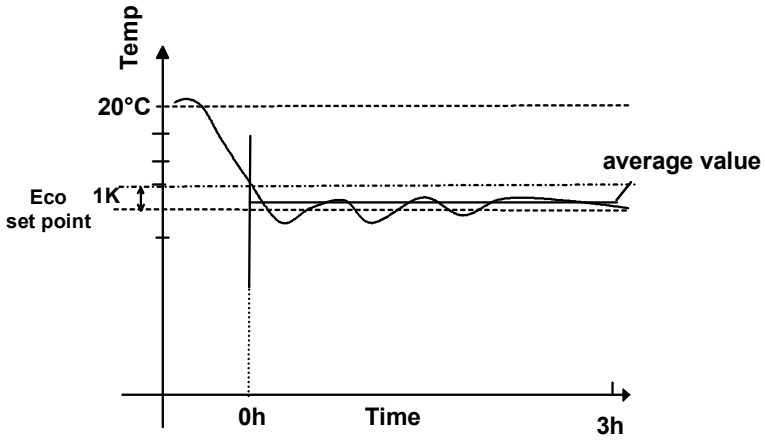
Room temperature set point for heating and cooling as defined in TR15500-2.

C.1.2 Economic mode

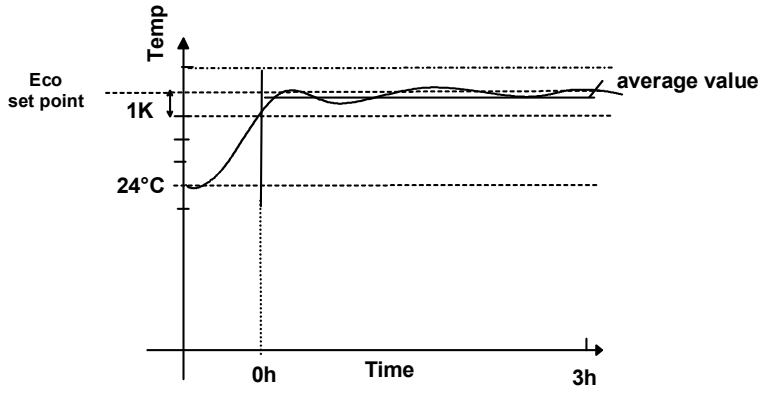
Economic mode testing will only verify if the temperature for economic mode is maintained. The average temperature shall be in a range of +/-1K of the set point for economic mode. The average value will be calculated by the average of the peak values after the measured room temperature has reached the reduced set point +1K for heating or reduced set point -1K for cooling.

Set point for economic mode heating must be at least 2°K lower than comfort level.

Set point for economic mode cooling must be at least 2°K higher than comfort level.



Economic mode testing heating



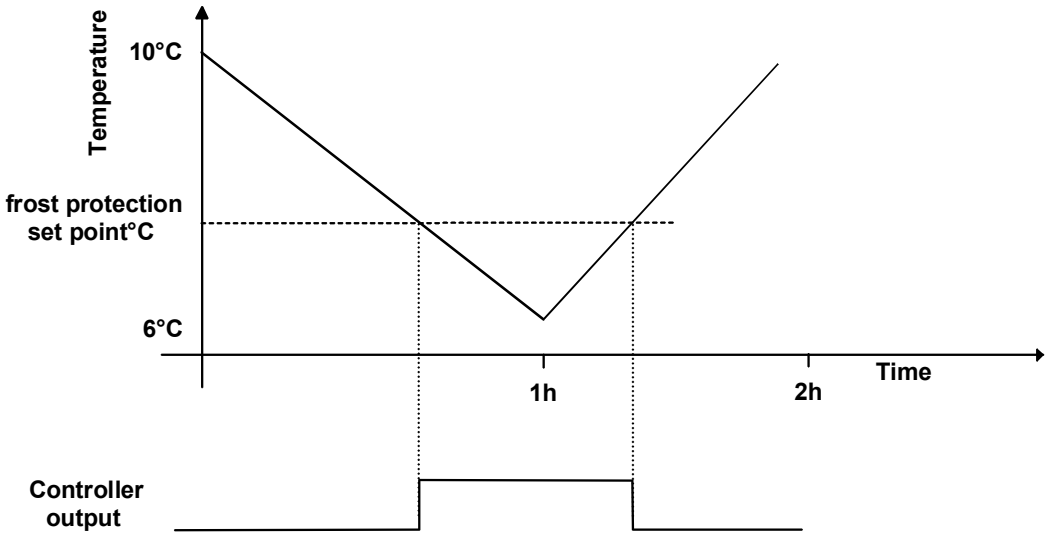
Economic mode testing cooling

C.1.3 Building protection mode

Heating

Open loop test to verify if the controller maintains a minimum set point in building protection mode. If the room temperature is lower than the indicated building protection set point, heating should be activated.

Building protection set point may be defined by the manufacturer. The test will be accepted if the controller starts heating at building protection set point +/- 1K.



Building protection set point has to be in the range from 4°C ≤ x ≤ 14°C.

Cooling

Building protection mode for cooling is not part of the eu.bac test procedures.

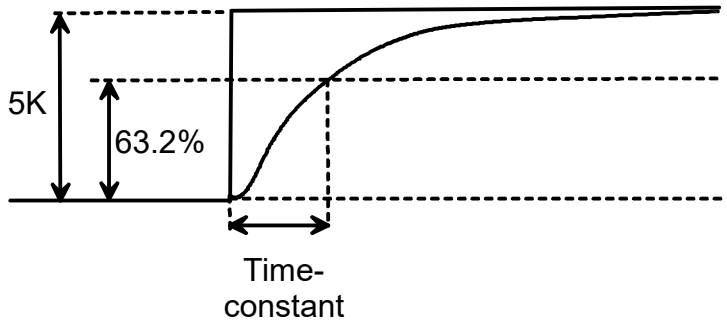
Annex D: Room Temperature Sensor Characteristics

No international standards are available for the characterisation of room temperature sensors.

For the test bench using resistor sensor simulators, the time constant of the room temperature sensor has to be taken into account. The manufacturer has to deliver the time constant for the room sensor.

As soon as eu.bac specific rules for temperature sensors are available, the time constant has to be measured based those specific rules. In the meantime, the time constant should be measured as described below.

Time constant[s]



Air velocity for measurement of time constant has to be in the range of 0.1-0.15m/sec.

Sensor accuracy

Sensor accuracy shall be defined between 15°C and 28°C and at 18°C, 20°C and 25°C

Update rate

For room units with a communication interface to the controller, (e.g. LON or others) the update rate (e.g. every minute, change of value 0.1K) for the room temperature value has to be specified.

Annex E: Valve and Actuator Characteristics

Valve types

Two basic types of valves are used

- Globe valve
- Ball valve

Valve characteristics

2-way valve

- Linear
- Equal percentage

3-way valve

- Linear/linear
- Equal-percentage/linear

6-way valve

(Details about 6-way valve see below)

Remark

In case of globe valves, a 3-way valve will be used on the test bench, because this arrangement allows easier measurement of the stroke.

For applications to be tested with 2-way valve, ETT will use a 2-way valve model for the plant simulation.

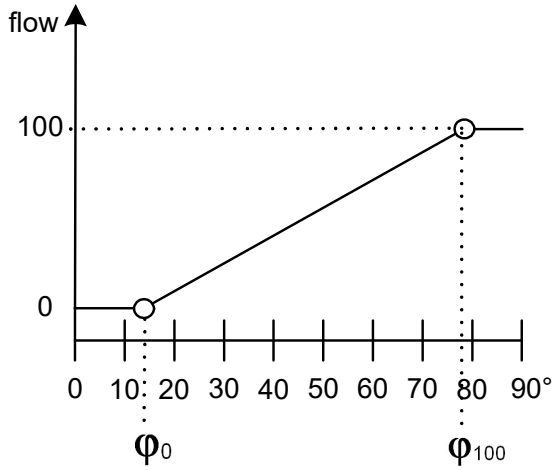
The valve type and characteristic used for the certification test needs to be defined by the manufacturer.

Valve characteristic	
Globe valve	Linear
	Equal-percentage
Ball valve	Linear
	Equal-percentage
6 way valve	Linear
	Equal-percentage

Additional parameters for ball valve characteristics

2-way ball valve

Typical rotation angle for a 2-way ball valve is 0..90°.



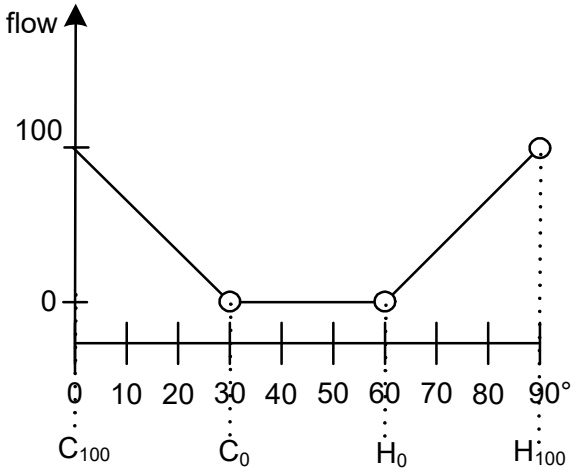
Ball valves may have a linear or equal-percentage characteristic in a certain range, defined by φ_0 and φ_{100}.

φ_0 and φ_{100} need to be delivered by the manufacturer of the ball valve.

φ_0 and φ_{100} will be taken into account for the calculation of the flow.

6-way ball valve

A special type of ball valve, called 6-way valve is available.
This valve allows heating and cooling to be controlled with a single valve/actuator combination.
For cooling, the maximum flow position is at C_{100} and minimum flow is at C_0, for heating minimum flow is at H_0 and maximum flow is at H_{100}.



C_{100} and H_{100} are defined as 0 and 90° (0 and 100%).
C_0 and H_0 need to be defined by the manufacturer.

Remark:
Heating and cooling may be the other way round ($C_{100} \leftrightarrow H_{100}$, $C_0 \leftrightarrow H_0$)

Actuator characteristic

Two basic types of actuators are used:

- Stroke actuator
- Rotary actuator

In addition to the basic types, the drive type (control signal input) needs to be differentiated.

Details concerning actuator characteristics see chapter 6.1.1 (Interchangeability testing of actuator/valve combinations).

The manufacturer has to deliver an actuator or to specify the type of actuator to be used for the test.

Annex F: Climatic chamber /air channel test bench

F.1. Test conditions for electrical heating

All tests with room units with self-heating are performed in the climatic chamber/air channel test bench. The electrical load that has to be switched, depends on the test

Electrical floor heating:	585 W
Electrical convector heating:	700 W
Electrical ceiling heating:	725 W

F.2. Air velocity

Air velocity has to be kept in the range of 0.1m/sec (-0/+0.05m/sec) for all measurements.

F.3. Mounting of a test device in the air channel

The test device will be mounted on a block of isolation material.

The size of this block is 10x10x10 cm.

F.4. Flow direction

From the bottom to the top

Annex G: Inter Laboratory Comparison Test

Repeatability

The test results for temperature control accuracy CA shall not deviate by more than +/- 0.1K

Annex H: Test report summary

Example

Test Report Summary

Product Information	
Licence Number:	
Licensee:	
Product Identification	
Test Specifications	
Tested Application:	
Temperature Sensor	
- Type:	
- Time Constant:	
Actuator Identification	
- Type:	
Valve Identification	
- Characteristic	
AV Acronym	
Fan Speed (For Fan Coil Applications)	
- Characteristic	
Test Result	
Temperature Control Accuracy C_A according EN 15500	

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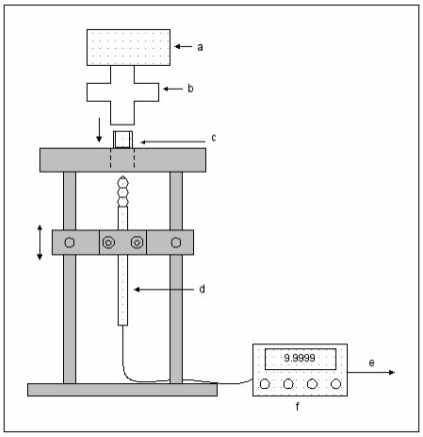
Annex J: COBAC Checklist for Inspection

COBAC checklist for inspection may be found on eubac.org together with all other certification documents.

Annex K: Measurement Equipment for Valve Position Measurement

The type of test equipment for stroke actuators and globe valves is described in [2]. In order to measure the stroke position, a 3-way valve will be used for the test, even if a two-way valve is needed for the application.



Measurement equipment as described in [2]

For rotary actuators and ball valves, the measurement equipment is not described in [2]; therefore, the equipment is described in this document.

Measurement equipment for ball valves and rotary actuators
The rotation measurement will be carried out by a magnetic angle sensor (D) with 0-10V output. On the valve, a position magnet (e) needs to be mounted.

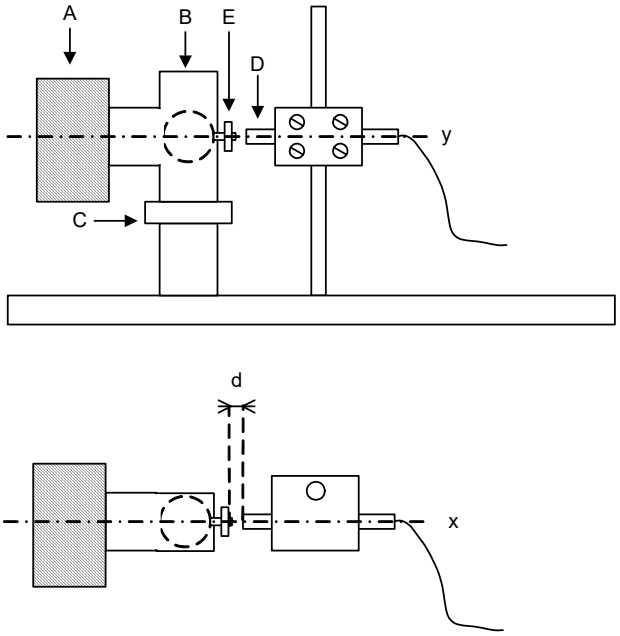


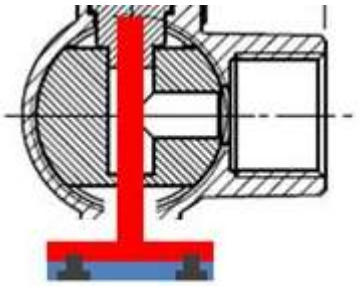
Figure: Mechanical Interface for the measurement of ball valve rotation

Key:

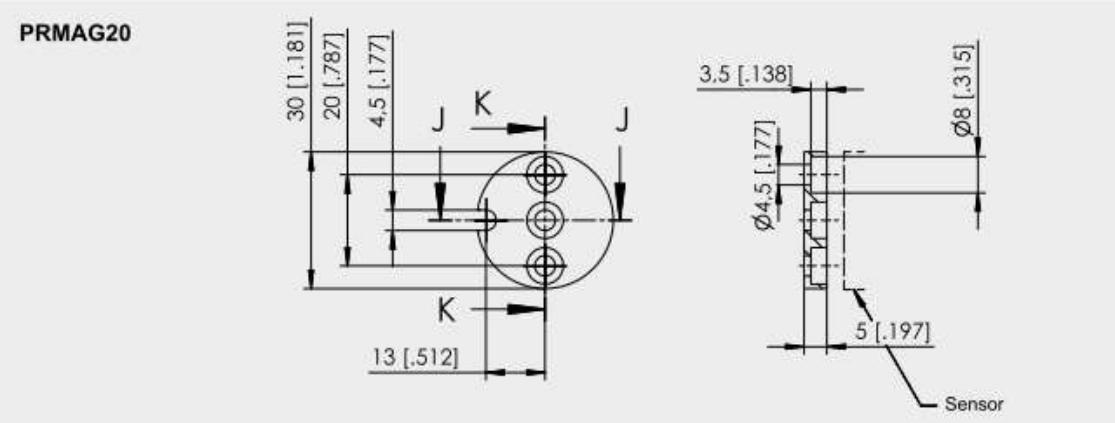
A	actuator
B	ball valve
C	Connection nipple (1/2‘)
D	Magnetic Angle Sensor Posirot PRAS1 from ASM
E	Position magnet PRMAG20

The sensor (D) position needs to be adjusted to the ball valve position and should be in the middle of the position magnet (E).
The axis of the sensor should be on the rotating axis of the ball valve.
The distance between position magnet and sensor (d) has to be <=6.5 mm.
The deviation of the two axis (rotating axis of ball valve and sensor) has to be <= 3mm. The angle between the two axis has to be <= 5°.

There are several mechanical elements between actuator and ball which can cause mechanical clearance. The only way to make sure that the valve position of the ball is measured and not just the position of the actuator is if the ball valve is prepared by the manufacturer in a way that allows the position magnet to be mounted on the valve. The position magnet should be connected to the ball itself or at least to the mechanical part, which is connected to the ball (not the actuator).



The dimensions of the magnet are described below.



The test equipment is able to measure the rotation angle: between 0..105°.
0..90° is the typical range for ball valves.

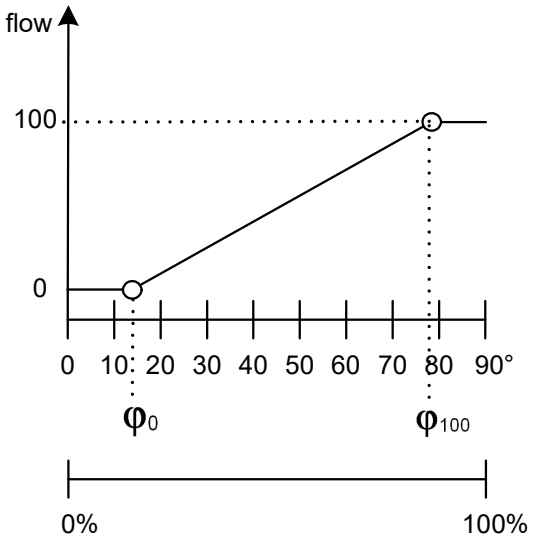
Calibration procedure for ball valves and rotary actuators

A similar procedure is used for the calibration of rotary actuators/balls valves position measurement as for stroke actuators/globe valve combinations.

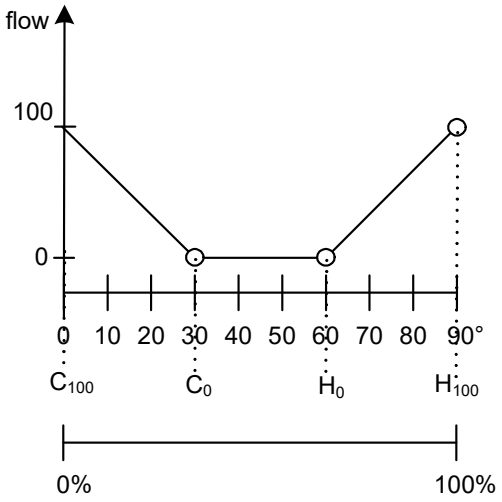
For heating applications, a low room temperature is applied to the controller to force the actuator to move to the maximum opening position and then a high room temperature is applied, to force the actuator to move to the minimum opening position. (Vice versa for cooling)

The measured minimum and maximum angles are used as 0% and 100% limits.

φ_0 and φ_{100}, given by the manufacturer, will be interpolated in accordance to the measured 0% and 100% limits.

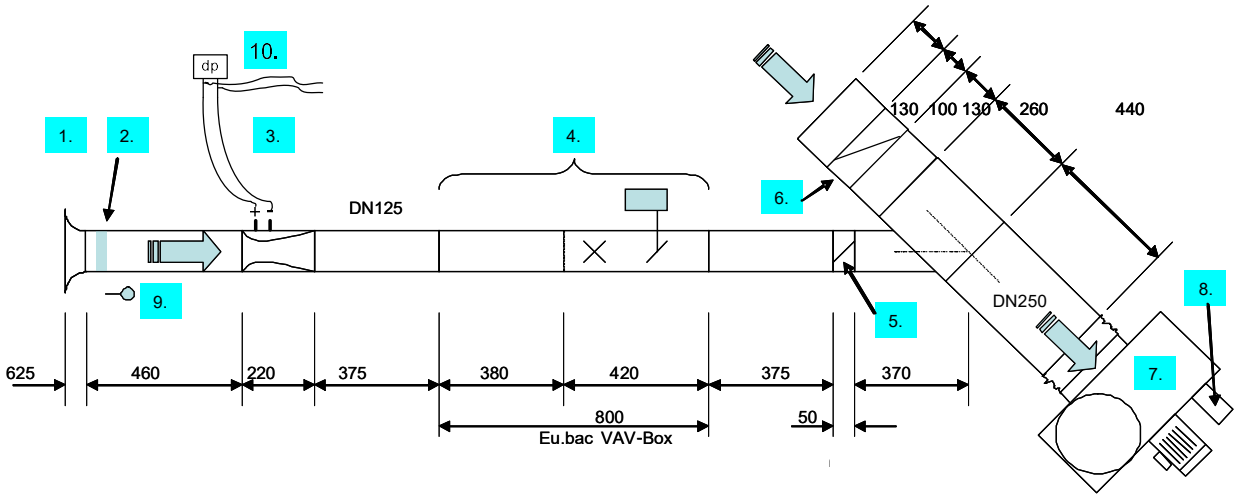


The same applies for the 6-way valve. Co and Ho will be interpolated in accordance to the measured 0% and 100% limits (min and max).



Annex L: VAV Test Bench

In deviation to EN15500, a real VAV air channel is used for testing, because the generation of a pressure signal by a pressure generator did not work as expected.



Key:

1	Intake trumpet
2	PC tubes core
3	Venturi nozzle (VSML 2 125M, Beck)
4	eu.bac VAV-Box, test device
5	Iris
6	Bypass damper
7	Fan
8	Variable speed drive
9	Temperature sensor
10	Pressure sensor, pressure output

The air flow is generated by a fan which is controlled by a VSD. Only a part of the flow goes into the air channel which is used for the test device.
The air flow is measured by a Venturi nozzle. For the test device, either a 0-10V signal from a pressure sensor (300Pa=10V) or the pressure measured on the nozzle is available.

For the test of a VAV controller, a standard VAV-box is available. The damper actuator needs to be delivered by the manufacturer.

Device which is used today:
Inner diameter ductwork 125mm, spindle diameter 16mm

Rotating direction: counter clockwise

If the test has to be done with a specific VAV box, this box has to be delivered in order to fit into the test bench. (Inner diameter 125mm, max length 800mm)

Pressure measurement:
Beck Venturi Nozzle Beck-vrs 125, nozzle constant c= 25.6

DeltaP@Vnom= 300Pa @ 440 m^3/h

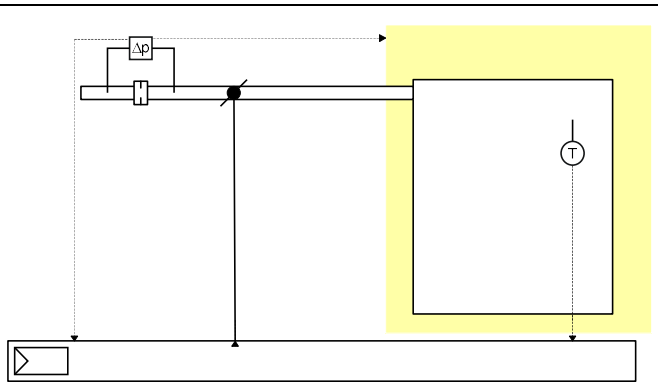
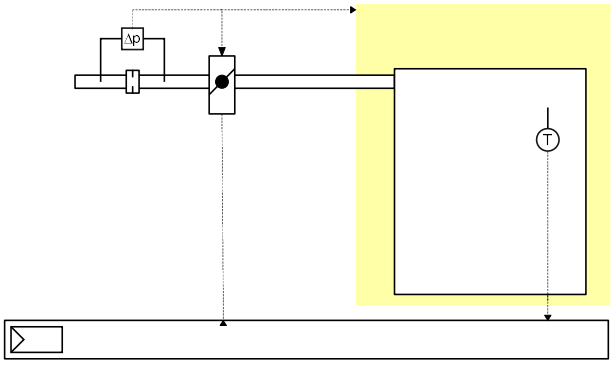
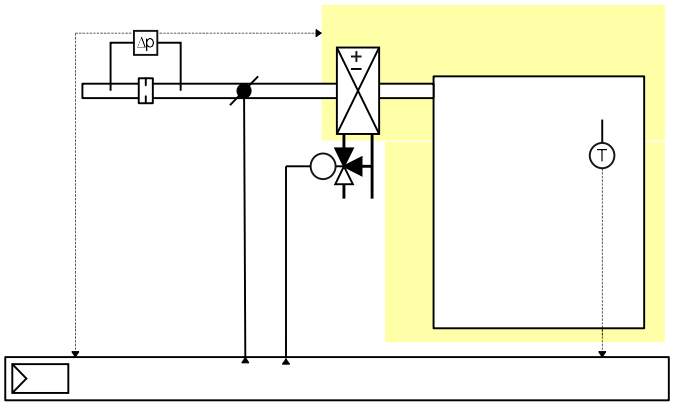
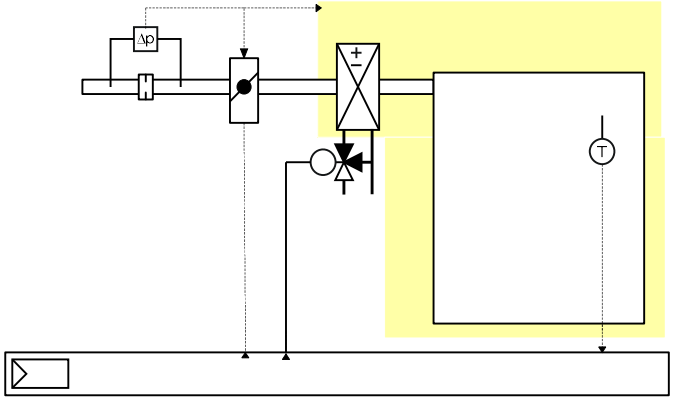
Maximum pressure (damper 100% open: ~190Pa, 350m3/h)
For the test system, a pressure sensor with a measuring range of 300Pa is used.

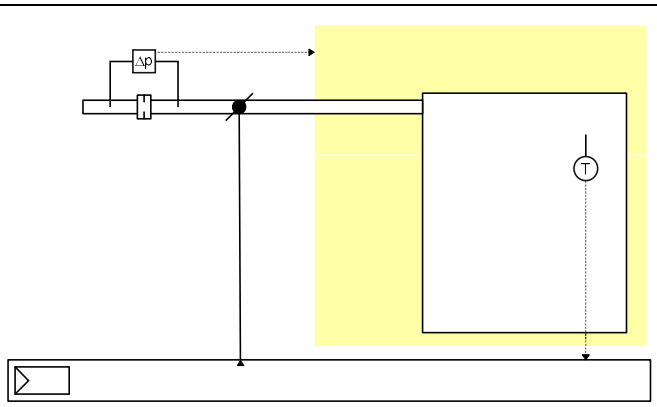
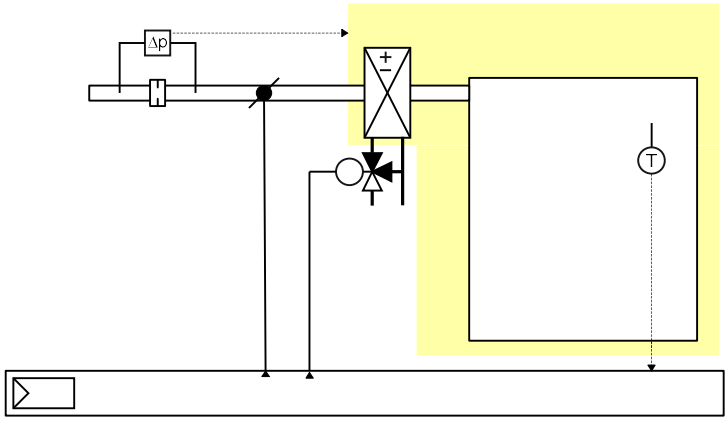
Connection tubes for the pressure measurement: (inner diameter): 5mm

Parameter settings for the controller:

DeltaP@Vnom= 300Pa @ 440 m^3/h
Minimum air flow for comfort operation: 55 m3/h (~ 5Pa)
Maximum air flow: 233m3/h (~ 85Pa)
Rotating direction: counter clockwise (damper opening is counter clockwise)

Annex M: Overview VAV Applications and Configurations

Pressure independent VAV without heating/cooling coil		
1a 1b	• Heating or cooling by air • Pressure sensor connected to the controller via tubes (1a) or via 0-10V signal (1b). • Damper is controlled by the DUT (Device under test)	
2a 2b	• Heating or cooling by air • Pressure sensor connected to the Damper via tubes or via 0-10V signal. • Damper gets the flow set point by the DUT. • Damper includes flow control	
Pressure independent VAV with heating/cooling coil		
3a 3b	• Heating by air and reheater • Cooling by air and air cooler • Pressure sensor connected to the controller via tubes or via 0-10V signal. • Damper is controlled by the DUT (Device under test)	
4a 4b	• Heating by air and reheater • Cooling by air and air cooler • Damper gets the flow set point by the DUT. • Damper includes flow control	

	Pressure dependent VAV without heating/cooling coil	
5	• Heating or cooling by air • Pressure sensor only used for simulation model • Damper is controlled by the DUT (Device under test)	
	Pressure dependent VAV with heating/cooling coil	
6	• Heating by air and reheater • Cooling by air and air cooler • Pressure sensor only used for simulation model • Damper is controlled by the DUT (Device under test)	

Annex N: Interchangeability test procedure for actuator/valve combinations

For 2-way and 3-way valves, the test will be performed with a controller for the radiator water heating application.
Different controllers or controller configurations will be used, in order to test different electrical interfaces.
Interchangeability test with radiator application will be valid for all other applications.
The test will be performed with linear valve characteristics, independent of the valve characteristic of the device to be tested.

In case of actuator/valve combinations with “programmable” valve characteristic (on the actuator side), the test will be performed with linear “valve” characteristic.
This A/V-Combination will be listed as linear Valve and equal-percentage Valve.
If the actuator/valve combination is only available with “equal-percentage valve characteristic”, the test will be performed with equal-percentage valve characteristic for the reference measurement and for the measurement for the device under test.

The test house needs to perform a reference test (comfort mode only) with the reference configuration.
(Controller with radiator heating application and appropriate electrical interface) using a reference actuator/valve combination. The result of this test is the CA_{ref}.

For the interchangeability testing, the reference controller will be used in combination with the actuator/valve combination to be tested. The test result is CA_{exch}.

If $CA_{exch} - CA_{ref} <= CA_{Diff}$

the actuator/valve combination “interchangeability” will be declared.
Remark: The result is YES/NO, not a CA value.

The value CA_{Diff} depends on the type of actuator/valve combination and is defined in chapter 6.

Valve position measurement will be performed as described in Annex K.
The manufacturer needs to prepare the valve/actuator combination in a way to allow the valve movement to be measured.