



# **Concealed and Recessed Sprinklers**

## **Requirements and Test Methods**

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# Guidelines for Water Extinguishing Systems

## Concealed and Recessed Sprinklers

### Requirements and Test Methods

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# 1 Scope

These Guidelines specify requirements and test methods for concealed and recessed sprinklers with K factors 57 and 80 and nominal operating temperatures of 68°C to 93°C for the use in sprinkler systems according to VdS CEA 4001 (see Notes 1 and 2).

These Guidelines are applicable to pre-finished sprinklers and to sprinklers assembled at the construction site (see Note 3).

*Note 1: According to VdS CEA 4001 : 2005-09 concealed and recessed sprinklers with K factors 57 and 80 may be used in systems for fire hazard classes LH (K57), OH1 (K80), OH2 (K80) and OH3 (K80). Therefore, the scope of these Guidelines is limited accordingly.*

*Note 2: The typical nominal operating temperature for sprinklers in systems for fire hazard classes LH, OH1, OH2 and OH3 is 68°C. It is only in exceptional cases that sprinklers with nominal operating temperatures up to 93°C are used. Therefore, the scope of these Guidelines is limited accordingly.*

*Note 3: Concealed and recessed sprinklers may be pre-finished products with their own type designation (i.e. fully finished unit comprising sprinkler, housing and cover). However, concealed sprinklers may also be assembled from several separate components at the construction site (e.g. sprinkler, housing, escutcheon, cover).*

*Note 4: Concealed and recessed sprinklers are of different construction (e.g. cover fixed or detachable, cover permeable or impermeable to water, deflector fixed or movable, housing ventilated or non-ventilated) and/or installation requirements (e.g. specified range for distance deflector/ceiling, ceiling construction/material). Depending on the construction and installation requirements these Guidelines specify different requirements and test methods for different sprinklers.*

*Note 5: Concealed and recessed sprinklers may be installed in massive ceilings or in false ceilings. However, the installation in false ceilings is limited to cases in which during a fire the pressure below the false ceiling may be assumed to be higher than the pressure above the false ceiling. The installation in false ceilings of concealed and recessed sprinklers into which water can permeate is limited to cases in which the false ceiling space is **not** protected by a water extinguishing system.*

## 2 Normative references

These Guidelines incorporate, by dated or undated references, provisions from other publications (e.g. European Standards EN or International Standards IEC), which are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to these Guidelines only when incorporated in them by amendment or revision. For undated references the latest edition of the publication referred to applies.

DIN EN 12259-1	Fixed firefighting systems – Components for sprinkler and water spray systems – Part 1: Sprinklers
VdS CEA 4001	VdS CEA Guidelines for sprinkler systems – Planning and installation

### 3 Definitions

For the use of these Guidelines the following definitions apply:

**Concealed sprinkler:** recessed sprinkler with a cover

**Recessed sprinkler:** sprinkler in which all or part of the thermally sensitive element is above the plane of the ceiling

**Flush ceiling sprinkler:** pendant sprinkler integrated in the ceiling with the thermally sensitive element below the plane of the ceiling

### 4 Requirements

#### 4.1 Technical documentation

4.1.1 The manufacturer shall specify whether the sprinkler

- is manufactured pre-finished or
- is assembled from separate components at the construction site.

4.1.2 The following documents are required:

*Note: The following specifications apply to pre-finished sprinklers. Sprinklers assembled on site from separate components shall fulfil these specifications analogously.*

a) Manufacturing documentation:

- assembly drawing; and
- drawings of all components.

The marking acc. 4.2 shall be documented in the drawings.

For concealed sprinklers with movable deflectors the position of the deflector both in stand-by and in operating position shall be specified including dimensions.

*Note: For concealed sprinklers with movable deflectors the function of the deflector (motion and water distribution) shall be defined. In the tests the deflector shall always take the position specified in the documentation.*

b) User documentation:

- data sheet; and
- installation instructions.

The installation instructions shall include at least the following:

- a description of the permitted installation conditions; and
- type and order of installation.

## c) Document list:

- a list (with its own designation, drawing number, revision status, date) including all above-mentioned documents (each with designation, drawing number, revision status and date).

## 4.2 Marking

**4.2.1** All markings shall be non-detachable, non-flammable and permanent unless in the following explicitly stated otherwise.

The marking “Nicht anstreichen“ or “Do not paint“ on the cover shall be well legible in the installation position.

**4.2.2** Pre-finished sprinklers shall be marked as follows:

- information acc. DIN EN 12259-1; and
- “VdS”.

In addition, the cover shall be marked as follows:

- name or code of manufacturer/supplier; and
- “Nicht anstreichen“ or “Do not paint“; and
- “VdS”;
- sprinklers that may be used with the cover. This marking may be done using an adhesive label (flammable) or similar.
- type designation of the cover. If not marked on the product itself, the type designation must be given in the installation instructions and on the packaging.

**4.2.3** The components of sprinklers assembled at the construction site shall be marked as follows:

Sprinkler:

- details acc. DIN EN 12259-1; and
- “VdS”.

Housing:

- name or code of manufacturer/supplier; and
- “VdS”.
- sprinklers that may be used with the housing. This marking may be done using an adhesive label (flammable) or similar.
- type designation of the housing. If not marked on the product itself, the type designation must be given in the installation instructions and on the packaging.

Escutcheon:

- name or code of manufacturer/supplier; and
- “VdS”.
- type designation of the escutcheon. If not marked on the product itself, the type designation must be given in the installation instructions and on the packaging.

Cover:

- name or code of manufacturer/supplier; and
- “Nicht anstreichen“ or “Do not paint“; and
- “VdS”.
- sprinklers that may be used with the cover. This marking may be done using an adhesive label (flammable) or similar.
- type designation of the cover. If not marked on the product itself, the type designation must be given in the installation instructions and on the packaging.

If other or further components are used, these requirements shall be fulfilled analogously.

### 4.3 Design features and installation conditions

**4.3.1** The nominal K factor of concealed and recessed sprinklers **shall** be 57 or 80.

**4.3.2** The nominal operating temperature of concealed and recessed sprinklers **shall** be between 68°C and 93°C.

**4.3.3** For concealed sprinklers with a cover disengaging due to heat exposure, the manufacturer **shall** specify a nominal operating temperature of the cover.

The nominal operating temperature **shall** be between 8°C and 20°C below the nominal operating temperature of the sprinkler.

**4.3.4** In the installed condition the cover of concealed sprinklers **shall** be detachable without using any special tools (e.g. during inspections).

*Note: A visual inspection of concealed sprinklers shall be possible.*

**4.3.5** Concealed sprinklers **should** be designed such that no water can accumulate in the cover.

*Note: If water can accumulate in the cover of a concealed sprinkler (e.g. due to leaky pipework or leaky sprinkler), this might cool down the cover and impair operation of the sprinkler.*

**4.3.6** The manufacturer **shall** specify the design features and installation conditions as follows or analogously (see also Note 4 in Clause 1):

Feature, installation condition	Examples of manufacturer's specifications
Fastening of deflector	Deflector fixed Deflector movable
Criterion for disengagement of cover	Only heat required Only water flow required Heat or water flow required (each single criterion is sufficient)
Tightness of housing (see note)	Housing tight Housing not tight (e.g. defined ventilation opening)
Distance deflector/housing edge (especially also in case of screwed on cover fixtures)	Distance determined by design (tolerance _____) Distance adjustable (range: _____ to _____)
Ceiling construction/material (see note)	Concrete ceiling (massive ceiling) False ceilings made of light materials

Note (see also Note 5 in Clause 1):

The requirements and test methods specified in these Guidelines refer to the following application conditions only:

- installation in massive ceilings and
- installation in false ceilings in cases where during a fire the pressure below the false ceiling may be assumed to be higher than the pressure above the false ceiling.

In case of mounting in massive ceilings it may be assumed – irrespective of the tightness of the housing – that no air flow can occur through the ceiling and the housing. In case of mounting in false ceilings (with a pressure difference in the case of fire) only with sprinklers whose housing is tight by construction it is assumed that no air flow can occur through the housing. However, with sprinklers whose housing is not tight by construction it may be assumed that an air flow occurs through the housing, thus accelerating sprinkler operation.

Sprinklers requiring an air flow through the housing in order to fulfil the requirements for dynamic response behaviour are not appropriate for massive ceiling installation.

## 4.4 Performance characteristics

### 4.4.1 General

Concealed and recessed sprinklers shall fulfil any applicable requirements of EN 12259-1 with the explanations specified in 4.4.2.

Note: According to EN 12259-1 particularly the requirements for the dynamic response sensitivity are not applicable.

In addition, concealed and recessed sprinklers shall fulfil the requirements specified in 4.4.3 to 4.4.5, where applicable.



Where applicable and appropriate, tests may involve either the entire sprinkler or individual components (e.g. corrosion tests). This *particularly* applies to sprinklers assembled at the construction site.

#### 4.4.2 Explanations to the requirements of EN 12259-1

##### 4.4.2.1 Water distribution

If a range is specified for the distance deflector/housing edge, the test schedule will stipulate whether several tests with different distances (maximum / minimum distance) are carried out.

##### 4.4.2.2 Operating temperature

For concealed sprinklers whose cover disengages due to heat exposure the requirements for the operating temperature of sprinklers from EN 12259-1 shall be applied analogously to the operating temperature of the cover. A respective test shall be carried out.

##### 4.4.2.3 Function test

In the function test and in all function verification tests also the special features of the concealed sprinkler are assessed, e.g.:

- intended disengagement of cover;
- intended motion of deflector, if applicable.

Any feature that is not according to the requirements is assessed as a fault.

The following applies especially to concealed sprinklers with movable deflector:

- the deflector shall have reached its final operating position at 0,35 bar (as specified in the technical documentation), and
- remain in the operating position once it has been reached.

#### 4.4.3 Response sensitivity

This requirement applies to all concealed and recessed sprinklers.

*Note: Concealed and recessed sprinklers are used as an alternative to flush ceiling sprinklers. The requirement and test specified in this clause shall achieve that in practice a concealed or recessed sprinkler installed in accordance with the manufacturer's installation instructions does not operate any later than a flush ceiling sprinkler of RTI Class Standard A installed at the same spot.*

In a dynamic response sensitivity test according to EN 12259-1 (plunge test) with plunge test conditions for Standard Sprinklers concealed and recessed sprinklers shall operate within  $t_{\max}$ .

$$t_{\max} = \frac{-200 * \ln \left[ 1 - \Delta T_{ea} (1 + 2 / u^{1/2}) / \Delta T_g \right]}{u^{1/2} * (1 + 2 / u^{1/2})}$$

with  $t_{\max}$  = maximum operating time in seconds

$u, \Delta T_{ea}, \Delta T_g$  according to EN 12259-1

In the test the sprinkler is installed tight (any openings of the housing sealed) in the upper wall of the wind tunnel – as installed in false ceilings.

*Note: At the manufacturer's request housings which are not tight do not necessarily have to be sealed. However, in this case the test does not provide evidence for the suitability for massive ceilings.*

The air velocity and the air temperature are measured ( $20 \pm 5$ ) mm below the wall of the wind tunnel.

#### **4.4.4 Reliable operation of covers reacting to heat only**

This requirement applies to concealed sprinklers whose cover disengages due to heat exposure only.

*Note: In the case of concealed sprinklers whose cover disengages due to heat exposure only, the intended water distribution will be permanently prevented if the water flow is released before the cover disengages.*

The cover shall disengage reliably before the sprinkler operates, when 20 sprinklers are exposed to a hot air flow coming from different directions.

For testing, the sprinklers shall be installed in a horizontal board approx. 10 mm thick (standard material for false ceilings) and exposed to a pressure of 10 bar (compressed air).

*Note: Direction, velocity and temperature of the hot air flow shall be determined after evaluation of the test method.*

#### **4.4.5 Reliable operation of covers reacting to water flow**

This requirement applies to concealed sprinklers whose cover disengages due to water flow.

The cover shall disengage completely and after 1 minute at latest when water flows through the sprinkler at a pressure of 0,35bar maximum.

## **5 Tests**

### **5.1 Test conditions and test specimens**

#### **5.1.1 Test conditions**

The tests are carried out at a temperature of  $(25 \pm 10)^\circ\text{C}$ , unless otherwise specified for a certain test.

The tolerance for all test parameters is  $\pm 5\%$ , unless otherwise specified.

#### **5.1.2 Test specimens**

A test schedule is set up taking into account any special design features.

## **5.2 Compliance inspection**

In a visual and measurement check it is determined whether the test samples correspond to the description in the technical documentation (drawings, parts lists and installation instructions), and whether the samples comply with the requirements of these Guidelines as can thus be checked.

## **5.3 Performance characteristics**

see Clause 4.

## **5.4 Other tests**

If special construction or new manufacturing processes make it necessary, additional tests will be agreed with the manufacturer.