

Preparation of steel substrates before application of paint and related products — Tests for the assessment of surface cleanliness —

Part 4:

Guidance on the estimation of the probability of condensation prior to paint application

1 Scope

This International Standard gives guidance on the estimation of the probability of condensation on a surface to be painted. It may be used to establish whether conditions at the job site are suitable for painting or not.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8502. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8502 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4677-1:1985, *Atmospheres for conditioning and testing — Determination of relative humidity — Part 1: Aspirated psychrometer method.*

ISO 4677-2:1985, *Atmospheres for conditioning and testing — Determination of relative humidity — Part 2: Whirling psychrometer method.*

ISO 8601:1988, *Data elements and interchange formats — Information interchange — Representation of dates and times.*

3 Probability of condensation

The relative humidity of the air and the steel surface temperature are the basis for the estimation of the probability of condensation, but there is no simple rule to employ. The situation is complex because there are a multitude of factors which have an influence on the condensation and evaporation of moisture, such as

- heat conductance of the structure;
- solar radiation on the surface;
- flow of ambient air around the structure;
- contamination by hygroscopic substances on the surface.

These factors sometimes provoke wetting or prevent drying locally on the surface; e.g. where the surface temperature remains low or tends to fall due to heat losses or where the air becomes quickly saturated due to reduced ventilation. Naturally, the same factors sometimes have the opposite effect. Therefore any test results should be interpreted with the greatest care.

Unless otherwise agreed, the steel surface temperature generally should be at least 3 °C above the dew-point when paints are used.

NOTE 1 For paints that are tolerant to moisture on the surface, a temperature difference less than 3 °C may be acceptable.

Other temperature differences may be specified by the paint manufacturer, or agreed by the interested parties.

If the difference between the surface temperature and the dew-point is below or will fall below the required and/or agreed minimum, the probability of condensation should be considered as being "high".

If the difference is above and will remain above the required and/or agreed minimum, the probability of condensation should be considered as being "low".

It is important to judge whether a temperature drop, sufficient to cause condensation, is likely to occur during the critical period. Table 1 may be used to help with this determination.

If the relative humidity is 85 % or higher, then painting should be judged critically as the dew-point is a maximum of 2,5 °C away.

If the relative humidity is high (92 % or dew-point 1,3 °C away), painting should only be considered if conditions can be confidently expected to remain static or improve during the application and drying period.

NOTE 2 This period is usually approximately 6 h.

If the relative humidity is apparently satisfactory (for example 80 % or dew-point 3,4 °C away), the environmental conditions over an appropriate time period ahead, often about 6 h, should still be considered in order to ascertain that dew conditions will not occur.

4 Instruments

The following instruments should be used, although instruments other than those described may be used provided they have an equivalent or greater accuracy.

a) For air temperature measurements, mercury thermometers or digital electronic thermometers, accurate to $\pm 0,5$ °C.

b) For air humidity measurements, any of the following instruments:

1) Aspirated psychrometers and whirling (sling) hygrometers, including tables for calculation of humidity (see ISO 4677-1 and ISO 4677-2, respectively), accurate to ± 3 % RH.

NOTE 3 The aspirated psychrometer is the reference instrument type according to the World Meteorological Organization (WMO).

2) Digital electronic hygrometers based on measurement of capacitance change of polymer films, accurate to ± 3 % RH and capable of operating at any relative humidity in the range 0 % RH to 100 % RH and at any temperature in the range - 40 °C to +80 °C.

3) Digital electronic hygrometers based on measuring the resistance change in a salt bridge, accurate to ± 2 % RH and capable of operating at any relative humidity in the range 0 % RH to 97 % RH and at any temperature in the range 0 °C to 70 °C.

c) For surface temperature measurements, digital electronic thermometers, accurate to $\pm 0,5$ °C.

NOTE 4 Magnetic surface thermometers may be used provided they have the required accuracy and are left on the surface for sufficient time to reach the surface temperature.

5 Procedure

5.1 Using the instruments described in 4 a) and 4 b), measure the air temperature to the nearest 0,5 °C and the relative humidity.

5.2 Calculate the dew-point, which is a logarithmic function of the vapour pressure at the actual temperature. There are tables or charts from which the dew-point can be determined. Their parameters are air temperature and relative humidity. Such a table is given in annex A. Commercial dew-point calculators of sufficient accuracy may also be used.

Table 1 — Temperature drop needed for condensation to occur, as a function of the relative humidity

Relative humidity, %	98	95	92	90	85	80
Temperature drop, °C	0,3	0,8	1,3	1,6	2,5	3,4

NOTE — The figures are mean values for air temperatures from 0 °C to 35 °C. For a given air temperature, more accurate figures can be obtained from annex A.

5.3 Using the instrument described in 4 c), measure the steel surface temperature. Take at least one temperature measurement for every 10 m² of the surface and adopt the lowest measured temperature in calculating the dew point.

NOTE 5 When selecting locations for temperature measurements, any variation in the thickness of the steel and the effect of shade should be considered.

5.4 Estimate the minimum surface temperature (above the dew-point) that is needed to avoid condensation under the prevailing environmental conditions.

6 Test report

The test report should include the following:

- a) a reference to this part of ISO 8502 (i.e. ISO 8502-4);
- b) the date of carrying out the measurements (including the day and hour), expressed in accordance with ISO 8601;
- c) a description of the instruments used;
- d) the calculated dew-point;
- e) the measured steel surface temperature;
- f) the difference between the steel surface temperature and the dew-point;
- g) the minimum temperature difference needed to avoid condensation;
- h) an estimate of the probability of condensation as being "high" or "low".