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**Test and assessment of abrasive
blast-cleaned substrates before
application of paints**

ICS 25.220.10; 77.140.01

Reference number : JIS Z 0313 : 2004 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Association of Corrosion Control (JACC)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently JIS Z 0313 : 1998 is replaced with this Standard.

This revision has been made based on ISO 8501-1 : 1988 *Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*, ISO 8501-1 : 1988/Suppl: 1994 *Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*, ISO 8502-2 : 1992 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 2 : Laboratory determination of chloride on cleaned surfaces*, ISO 8502-3 : 1992 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 3 : Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)*, ISO 8502-4 : 1993 *Preparation of steel substrates before application of paints 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*, ISO 8502-5 : 1998 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 5 : Measurement of chloride on steel surfaces prepared for painting (ion detection tube method)*, ISO 8502-6 : 1995 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 6 : Extraction of soluble contaminants for analysis—The Bresle method*, ISO 8502-8 : 2001 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 8 : Field method for the refractometric determination of moisture*, ISO 8502-9 : 1998 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 9 : Field method for the conductometric determination of water-soluble salts*, ISO 8502-10 : 1999 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 10 : Field method for the titrimetric determination of water-soluble chloride*, ISO 8503-2 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 2 : Method for the grading of surface profile of abrasive blast-cleaned steel—Comparator procedure*, ISO 8503-3 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 3 : Method for the calibration of ISO surface profile comparators and for the determination of surface profile—Focusing microscope procedure* and ISO 8503-4 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 4 : Method for the calibration of ISO surface profile comparators and for the determination of surface profile—Stylus instrument procedure* for the purposes of making it easier to compare this Standard with International Standards; to prepare Japanese Industrial Standard conforming with International Standards; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Test and assessment of abrasive blast-cleaned substrates before application of paints

Introduction This Japanese Industrial Standard has been prepared based on **ISO 8501-1** : 1988 *Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*, **ISO 8501-1** : 1988/Suppl : 1994 *Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*, **ISO 8502-2** : 1992 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 2 : Laboratory determination of chloride on cleaned surfaces*, **ISO 8502-3** : 1992 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 3 : Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)*, **ISO 8502-4** : 1993 *Preparation of steel substrates before application of paints 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*, **ISO 8502-5** : 1998 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 5 : Measurement of chloride on steel surfaces prepared for painting (ion detection tube method)*, **ISO 8502-6** : 1995 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 6 : Extraction of soluble contaminants for analysis—The Bresle method*, **ISO 8502-8** : 2001 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 8 : Field method for the refractometric determination of moisture*, **ISO 8502-9** : 1998 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 9 : Field method for the conductometric determination of water-soluble salts*, **ISO 8502-10** : 1999 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 10 : Field method for the titrimetric determination of water-soluble chloride*, **ISO 8503-2** : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 2 : Method for the grading of surface profile of abrasive blast-cleaned steel—Comparator procedure*, **ISO 8503-3** : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 3 : Method for the calibration of ISO surface profile comparators and for the determination of surface profile—Focusing microscope procedure* and **ISO 8503-4** : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 4 : Method for the calibration of ISO surface profile comparators and for the determination of surface profile—Stylus instrument procedure with modifying some technical contents*.

Portions sidelined or underlined with dots are the matters modified from the original International Standards. The list of modification with its explanation is given in annex 2 (informative)

1 Scope This Standard specifies the method for tests and assessment, by visual assessment or with a measuring instrument, of the cleanliness, probability of condensation and surface roughness on the steel surface on which surface preparation was performed by abrasive blast-cleaning before applying paints to steel products and coating related products for the corrosion prevention and rust prevention.

Remarks : The International Standards corresponding to this Standard are as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 8501-1 : 1988 *Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings* (MOD)

ISO 8501-1 : 1988/Suppl : 1994 *Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings* (MOD)

ISO 8502-2 : 1992 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 2 : Laboratory determination of chloride on cleaned surfaces* (MOD)

ISO 8502-3 : 1992 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 3 : Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)* (MOD)

ISO 8502-4 : 1993 *Preparation of steel substrates before application of paints 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* (MOD)

ISO 8502-5 : 1998 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 5 : Measurement of chloride on steel surfaces prepared for painting (ion detection tube method)* (MOD)

ISO 8502-6 : 1995 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 6 : Extraction of soluble contaminants for analysis—The Bresle method* (MOD)

ISO 8502-8 : 2001 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 8 : Field method for the refractometric determination of moisture* (MOD)

- ISO 8502-9 : 1998 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 9 : Field method for the conductometric determination of water-soluble salts (MOD)*
- ISO 8502-10 : 1999 *Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 10 : Field method for the titrimetric determination of water-soluble chloride (MOD)*
- ISO 8503-2 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 2 : Method for the grading of surface profile of abrasive blast-cleaned steel—Comparator procedure (MOD)*
- ISO 8503-3 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 3 : Method for the calibration of ISO surface profile comparators and for the determination of surface profile—Focusing microscope procedure (MOD)*
- ISO 8503-4 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 4 : Method for the calibration of ISO surface profile comparators and for the determination of surface profile—Stylus instrument procedure (MOD)*

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect or the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply.

JIS B 0601 : 1982 *Definitions and designation of surface roughness*

JIS B 0651 *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Nominal characteristics of contact (stylus) instruments*

Remarks : **ISO 3274** : 1996 *Rules and procedures for the measurement of surfaces roughness using stylus instruments* is identical with the said standard.

JIS K 0101 *Testing methods for industrial water*

JIS K 0557 *Water used for industrial water and wastewater analysis*

JIS Z 0103 *Glossary of terms used in rust and corrosion preventive technology*

JIS Z 0310 *Abrasive blast-cleaning methods for surface preparation*

JIS Z 0311 *Metallic blast-cleaning abrasives*

JIS Z 0312 *Non-metallic blast-cleaning abrasive*

JIS Z 1522 *Pressure sensitive adhesive cellophane tapes*

JIS Z 8806 *Humidity—Measurement methods*

ISO 8503-1 : 1988 *Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates—Part 1 : Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces*

3 Definitions For the purposes of this Standard, the definitions given in **JIS Z 0103** and **JIS Z 0310** apply.

4 Visual assessment of cleanliness The standard of assessment of a rust grade of the steel surface before performing the surface preparation by abrasive blast-cleaning and a rust removal degree with respect to a cleanliness of the abrasive blast-cleaned steel surface by visual check shall be specified.

In addition, before abrasive blast-cleaning, it shall be confirmed that there are not oils observed by visual check and scratches on the steel surface detrimental to painting.

- a) **Assessment of rust grade** Before abrasive blast-cleaning, a grade of mill scale adhesion or rust formation on the steel surface shall be assessed by visual check with four stages shown in table 1.

When assessing, the examples of representative photographs attached to **ISO 8501-1** shall be used as references.

Table 1 Rust grade

Rust grade	State of steel surface
A	Most parts are covered with hard mill scales, and even if there are rusts, they are very few.
B	Rusts are starting, and mill scales are coming off.
C	The whole surface is covered with rusts, and even if there are mill scales, they are easy to be scraped off.
D	Together with the whole surface being covered with rusts, a fairly large number of pitting are observed on the steel base.

- b) **Assessment of rust removal grade** A finishing grade of the abrasive blast-cleaned steel surface shall be assessed by visual check with four stages shown in table 2. When assessing, the examples of representative photographs attached to **ISO 8501-1** and **ISO 8501-1 Supplement** shall be used as references.

Remarks : **ISO 8501-1 Supplement** is for different type of abrasive and the photograph shows an example of the finish Sa 3.

Table 2 Rust removal grade

Rust removal grade	State of steel surface
Sa 1	There are not mill scales adhered weakly ⁽¹⁾ , rusts, paint films, foreign matters and visible oils, grease, soils on the surface which are visible without use of a magnifying glass.
Sa 2	There are not most mill scales, rusts, paint films, foreign matters and visible oils, grease, soils on the surface which are visible without use of a magnifying glass. All of the remaining contaminants are firmly adhered ⁽²⁾ .
Sa 2½	There are not visible mill scales, rusts, paint films, foreign matters, oils, grease and soils on the surface which are visible without use of a magnifying glass. All of the remaining contaminants are present in such a degree that the trace is observed as only a few spotted or striped stains.
Sa 3	There are not visible mill scales, rusts, paint films, foreign matters, oils, grease and soils on the surface which are visible without use of a magnifying glass and they present a uniform metal color.

Notes (1) The adhesion with the degree capable of peeling by using the putty knife to which a cutting edge is not attached.

(2) The adhesion with the degree not capable of peeling by using the putty knife to which a cutting edge is not attached.

5 Test and assessment of cleanliness by measuring instrument

5.1 Saline matter adhered to surface

5.1.1 Sampling method of adhering salts The sampling method of adhering salts shall be as follows:

Perform either a local measurement or a wide range average measurement according to the form of saline matter which is anticipated to adhere to the steel surface in accordance with the agreement between parties concerned with delivery. However, when measuring the conductivity in accordance with the method B in 5.1.3, the measurement is carried out directly on the surface covered with the measuring vessel of the densitometer used for salts, so that it is unnecessary to take the test portion separately. The area in this case is equivalent to the sampling from a local part.

a) **Sampling for local measurement** Sampling for local measurement shall be as follows:

- 1) **Summary** Put water into a small patch made of rubber attached to the abrasive blast-cleaned surface, dissolve saline matters, take the aqueous solution, and let it be the sample.
- 2) **Instrument and reagent** The instrument and reagent shall be as follows:
 - 2.1) Rubber patch made of durable and flexible material (for example, polyethylene foam) and of a form capable of boring the centre. The patch is such that one surface is coated with a thin rubber film and other surface is coated with adhesive and covered with removable protective paper (see figure 1). The standard dimensions of the rubber patch are given in table 3.

Table 3 Standard dimensions of rubber patch

Unit: mm²

Patch size	Compartment area
A-0155	155 ± 2
A-0310	310 ± 3
A-0625	625 ± 6
A-1250	1 250 ± 13
A-2500	2 500 ± 25

Unit: mm

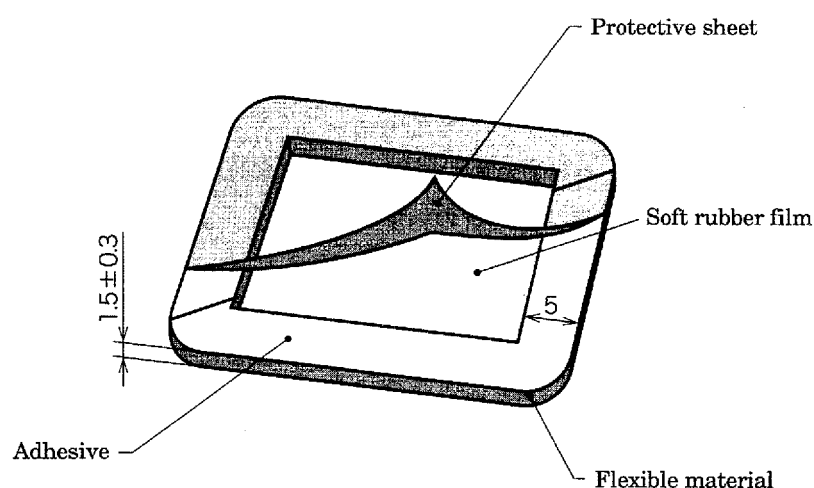


Figure 1 Example of rubber patch

- 2.2) **Syringe** A capacity of about twice the space volume of the patch made of rubber.
- 2.3) **Water** Water specified in JIS K 0557.
- 3) **Operation** The operation shall be carried out as follows:
 - 3.1) Attach a patch made of rubber to the abrasive blast-cleaned surface.
 - 3.2) Put a needle into the patch, and put water into the inside with a syringe.
 - 3.3) Stir the inside of patch by making the cylinder of syringe reciprocate.
 - 3.4) Suck water in the patch with the syringe, and let it be the sample for analysis.
- b) **Sampling for wide range average measurement** The sampling for wide range average measurement shall be as follows:
 - 1) **Summary** Wipe off the abrasive blast-cleaned surface divided into a block of 50 cm square with the cloth which was dipped in water, and let the aqueous solution which was contained in the cloth be the sample.

2) **Instrument and reagent** The instrument and reagent shall be as follows:

- 2.1) **Adhesive tape** It shall be water-resistant, and after peeling, its adhesive shall not be easy to be remained on the abrasive blast-cleaned surface.
- 2.2) **Wiping cloth** A clean gauze or non-woven fabric.
- 2.3) **Glove** A clean and thin glove made of rubber or plastics.
- 2.4) **Water** Water specified in JIS K 0557.
- 2.5) **Container** A clean container of sufficient capacity when of filled with the used water and cloth.

3) **Operation** The operation shall be carried out as follows:

- 3.1) Prepare water of 150 ml.
- 3.2) Partition the abrasive blast-cleaned surface into a block of 50 cm square with the adhesive tape, and let the whole of the range be the surface to be sample.

Remarks : If it is impossible to take a square of 50 cm in one side as in the case of shape steel, etc., let the range of area as nearly equivalent as possible be the surface to be sampled, and calculate the area.

- 3.3) Hold a wiping cloth (hereafter referred to as "cloth") by the hand wearing gloves, dip the cloth in water in such a degree that water does not drip from it, wipe off the surface to be sampled carefully, and put the cloth into the container.
- 3.4) Exchange the cloth, perform the second wiping, and put the cloth also into the container.
- 3.5) Using water remained after wiping work, wash the used gloves on the container, and put the running water into the container without spilling water.
- 3.6) Put water remained into the container, stir, and let water in the container be the sample for analysis.
- 3.7) For a blank test, dip a new cloth of the same quantity as that of the used cloth into a new water of 150 ml, and analyze also the water.

5.1.2 Analysis method of adhering chloride saline matter For the quantitative analysis of adhering chloride saline matter extracted, perform abbreviated analysis method A or method B in field, or a precision analysis in a laboratory in accordance with the agreement between parties concerned with delivery. If questions arise with respect to the accuracy of abbreviated analysis, perform the precision analysis.

a) **Field method using detecting tube (method A)** by means of detecting tube as shown below:

- 1) **Summary** Measure chloride-ion concentration in a sample aqueous solution with a chloride-ion indicator tube.

2) **Instrument** The instrument shall be as follows:

- 2.1) **Chloride-ion detecting tube** A chloride-ion detecting tube which determines, with chromatography, the chloride-ion concentration in the moisture sucked up by a capillary phenomenon from the lower end of a glass thin tube, utilizing the color reaction of chloride ion with silver chromate of analytical-reagent class which is made to impregnate to silica sand of about 0.2 mm in particle diameter packed into the glass thin tube of 2 mm to 3 mm in internal diameter.

Information : The chloride-ion detecting tube is widely used in a field in Japan as the water quality detecting tube for chloride ions.

3) **Operation** The operation shall be carried out as follows:

- 3.1) Cut off the both upper and lower ends of a chloride-ion indicator tube, and dip the lower end into the sample aqueous solution extracted.
- 3.2) Read the numerical value of the upper limit of the discoloring section of the filler inside the chloride-ion indicator tube.
- 3.3) Use three chloride-ion indicator tubes to the same sample, and let the mean value be the measured value.
- 4) **Determination of chloride surface density** Chloride density per unit surface area of the matter measured is obtained by calculating the mass of the chloride included in the total value of the test portion from the chloride ion concentration in the sample aqueous solution in the terms of sodium chloride and dividing it by the area sampled, and is expressed in mg/m^2 . In the case of the method in 5.1.1 b), let the residual quantity obtained by deducting the quantity of saline matter which was contained in the new cloth be the mass of saline matter.

Remarks : When the area to be sampled is the area of 50 cm square and the total quantity of water to be used is 150 ml in the method in 5.1.1 b), the value expressed in ppm becomes the numerical value in units of mg/m^2 in equivalent sodium chloride as it is.

b) **Field method for titrimetric determination (method B)** by means of titrimetric determination as shown below:

Caution: When handling hydrogen fluoride and mercury nitrate solution, in the working field, pay full attention to the safety of the workers in the field and its environment and ensure the safe disposal of waste solution on the basis of the related laws and regulations to conserve the environment. Disposal of zinc which absorbed mercury shall be carried out as stipulated in the related laws and regulations.

- 1) **Summary** Dropping reagent in succession from the mouth of the reagent bottle to the aqueous solution of the sample to measure an appropriate chloride concentration from the number of drops. The reagents are water containing sodium fluoride and hydrogen fluoride as the solvent, diphenylcarbazone and bromophenol blue as indicators and mercuric nitrate solution for dropping.
- 2) **Instruments and reagents** as given in the following:

- 2.1) **Plastic beaker** of suitable size for receiving sample aqueous solution.
- 2.2) **Solvent** consisting of distilled or de-ionized water containing sodium fluoride of mass rate 0.1 % and hydrogen fluoride of mass rate 0.08 %.
- 2.3) **Bottle A** Brown bottle which is capable of dripping each about 0.04 ml, containing approximately 20 ml of the solution of the stock solution volume rate 1 % prepared by adding 0.5 g of crystallized diphenylcarbazone and 0.05 g of crystallized bromophenol blue to 75 ml of ethyl alcohol of volume rate 95 % and then adding ethyl alcohol of volume rate 95 % so as to come to the total volume of 100 ml. This indicator shall be checked once a year to be usable for the titration of chloride concentration using, for example, ordinary tap water.
- 2.4) **Bottle B** containing approximately 20 ml of 0.5 mol/L solution of nitric acid and capable of releasing approximately 0.05 ml dropwise.
- 2.5) **Bottle C** containing approximately 20 ml of 0.036 mol/L solution of mercuric nitrate and capable of releasing approximately $0.050 \text{ ml} \pm 0.002 \text{ ml}$ dropwise.
- 2.6) **Bottle D** containing approximately 20 ml of 0.007 2 mol/L solution of mercuric nitrate and capable of releasing approximately $0.050 \text{ ml} \pm 0.002 \text{ ml}$ dropwise.
- 2.7) **Container for liquid wastes** of the volume of about 250 ml. Containing a small piece of pure zinc of about 5 g for absorbing mercury.
- 3) **Operation** The operation shall be as follows:
 - 3.1) Put the aqueous solution of the test portion taken using the solvent in 2.2) in a plastic beaker.
 - 3.2) Add 2 drops of the reagent from the bottle A and mix by carefully swirling until the colour becomes a homogeneous blue.
 - 3.3) Add 2 drops of the agent from the bottle B. The aqueous solution turns to yellow.
 - 3.4) Add drops of the reagent one by one from the bottle C briefly swirling the beaker after each addition. Continue dropping until the colour of the solution turns from yellow to blue and note the number of drops required for the colour change. If only 1 drop is required for turning colour to blue and a more accurate chloride-ion density is needed, a series of the operation is repeated replacing the bottle C with the bottle D.
 - 3.5) On completion of the titration, discard the contents of the plastic beaker into the waste container.
- 4) **Determination of chloride surface density** The chloride surface density of the test portion solution corresponding to the number of drops from the bottle C and bottle D is determined by the volume of the sampled test portion solution. If the Bresle patch specified in 5.1.1 a), 2.1) or its equivalent is used, the effective area covered by its patch is $1\,250 \text{ mm}^2$ and the total volume of taken test portion is titrated, the chloride surface density corresponding to the number of drops becomes the values given in table 4 in the terms of sodium chloride.