
**Anodizing of aluminium and its alloys —
Rating system for the evaluation of
pitting corrosion — Chart method**

*Anodisation de l'aluminium et de ses alliages — Système de cotation de
la corrosion par piqûres — Méthode reposant sur des images-types*



Reference number
ISO 8993:2010(E)

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8993 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 2, *Organic and anodic oxidation coatings on aluminium*.

This second edition cancels and replaces the first edition (ISO 8993:1989), which has been technically revised.

Anodizing of aluminium and its alloys — Rating system for the evaluation of pitting corrosion — Chart method

1 Scope

This International Standard specifies a chart rating system based on standard charts that provides a means of defining levels of performance of anodic oxidation coatings on aluminium and its alloys that have been subjected to corrosion tests.

This rating system is applicable to pitting corrosion resulting from

- accelerated tests,
- exposure to corrosive environments, and
- practical service tests.

This International Standard takes into account only pitting corrosion resulting from penetration of the protective anodic oxidation coating.

NOTE ISO 8994^[3] describes a similar rating system based on defined grids.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

significant surface

part of the article covered or to be covered by the coating, for which the coating is essential for serviceability and/or appearance

NOTE 1 Adapted from ISO 2064:1996^[1], definition 3.1.

NOTE 2 The edges of an article are not normally included in the significant surface.

2.2

corrosion pit

surface corrosion defect at which the anodic oxidation coating is penetrated

NOTE Discoloration or other surface defects which do not penetrate the anodic coating do not count as corrosion pits.

3 Procedure for rating

3.1 Sample preparation

A sample area of at least 5 000 mm² is necessary.

Use one of the following methods to remove corrosion products or deposits on the surface so that corrosion pits may be clearly discerned:

a) wipe with a slurry of fine pumice to abrade away corrosion products and dirt, then rinse in clean water and air dry;

or

b) dip for 5 min to 10 min in 30 % nitric acid, prepared by diluting 1 volume of concentrated nitric acid ($\rho_{20} = 1,40$ g/ml) with 1 volume of water at 20 °C to 25 °C; rinse and dry as indicated in a);

or

c) dissolve the anodic oxidation coating in a hot phosphoric acid/chromic acid mixture; rinse and dry as indicated in a) so that pitting in the aluminium substrate may be discerned;

NOTE 1 ISO 2106^[2] describes the preparation and use of this reagent for the purposes of dissolution of the anodic oxidation coating.

NOTE 2 This method is particularly useful for dark-coloured anodic oxidation coatings.

WARNING — Chromium (VI) is toxic and shall be handled properly. Chromium(VI) solutions are hazardous to the environment and severely hazardous to waters.

or

d) wipe with soft textile gauze dipped in dilute hydrochloric acid solution (100 ml of 35 % to 37 % HCl, made up to 1 000 ml with distilled water or deionized water) to remove deposited copper, then rinse and dry as indicated in a).

3.2 Determination of chart rating

Select an area of at least 5 000 mm² on the significant surface of the sample.

NOTE A mask with an opening of 50 mm × 100 mm can be used to define the area to be evaluated.

Compare the size and frequency of corrosion pits on the cleaned significant surface with the rating charts given in Figures 1 to 7. The rating charts show the maximum limit of corroded area for rating designation. The rating chart will be the chart designation which most closely resembles the corroded sample, for example, B2 or C5. Disregard effects on the edges of samples. A rating of A indicates no visible corrosion, and a rating of H indicates the greatest degree of corrosion covered by this International Standard.

A conversion of chart rating to percentage area of the significant surface covered by corrosion pits is indicated in Table 1.

Table 1 — Conversion of chart rating to percentage area covered by corrosion pits

Chart rating	Percentage area of corrosion pits
A	None
B1 B2 B3 B4 B5 B6	$\leq 0,02$
C1 C2 C3 C4 C5 C6	$> 0,02$ and $\leq 0,05$
D1 D2 D3 D4 D5 D6	$> 0,05$ and $\leq 0,07$
E1 E2 E3 E4 E5 E6	$> 0,07$ and $\leq 0,10$
F1 F2 F3 F4 F5 F6	$> 0,10$ and $\leq 0,25$
G1 G2 G3 G4 G5 G6	$> 0,25$ and $\leq 0,5$
H1 H2 H3 H4 H5 H6	$> 0,5$

4 Expression of results

Express the result of the examination as the chart rating and/or the percentage area covered by corrosion pits, as appropriate.

5 Test report

The test report shall include at least the following information:

- a) a reference to this International Standard;
- b) the type and identification of the product tested and, where appropriate, the anodizing, exposure and corrosion test procedure;
- c) the method of sample preparation used (see 3.1);
- d) the comparison method used, for example, whether the comparison was done visually or electronically; in the case of comparison by an electronic method, the specification of the test apparatus shall also be given;
- e) the chart rating and/or the percentage area covered by corrosion pits (see Clause 4);

NOTE The acceptable chart rating will normally be specified in the relevant corrosion test or product specification.

- f) the date of the test.

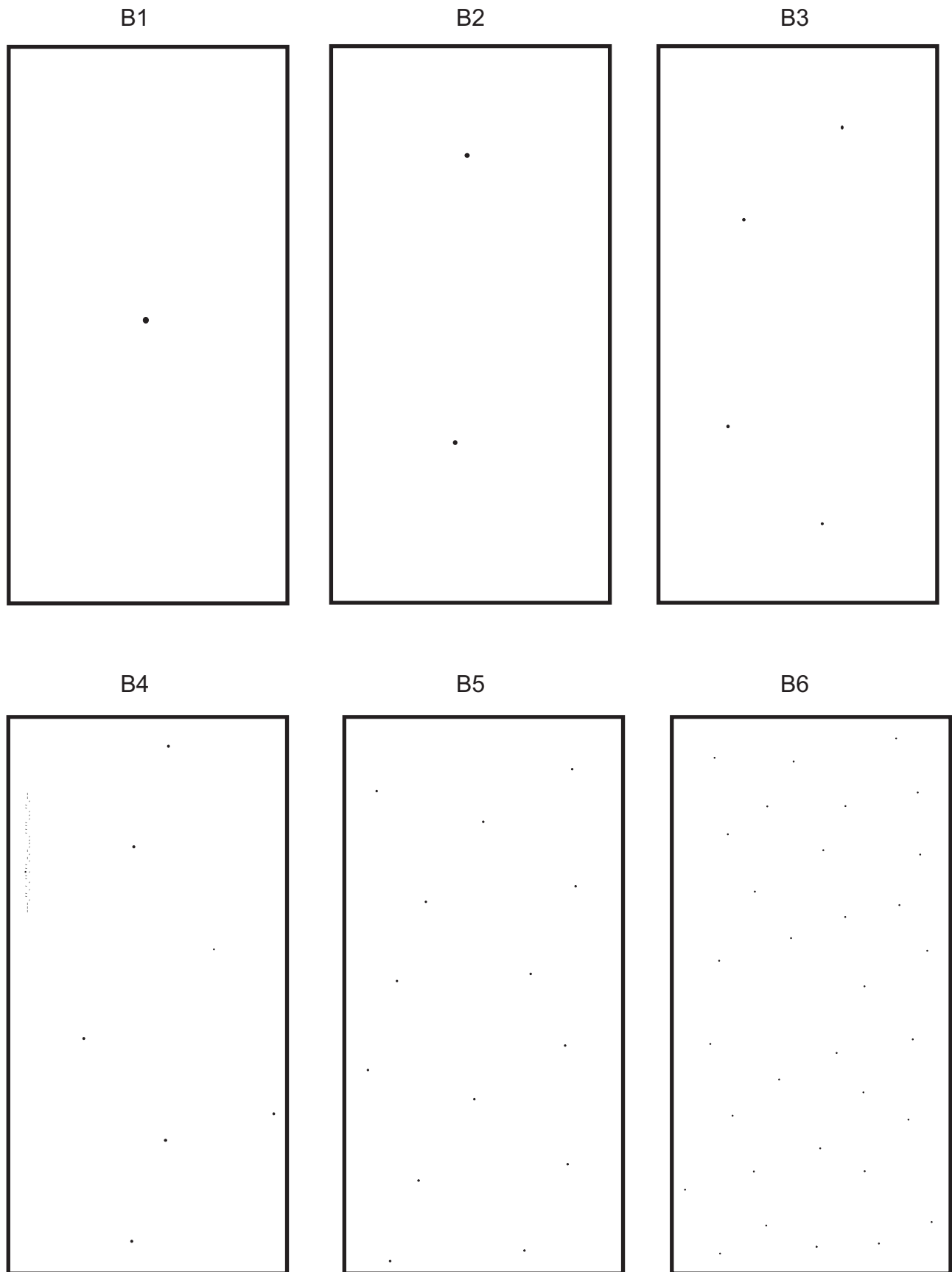


Figure 1 — Rating charts for designation B
(Area of defects $\leq 0,02\%$)

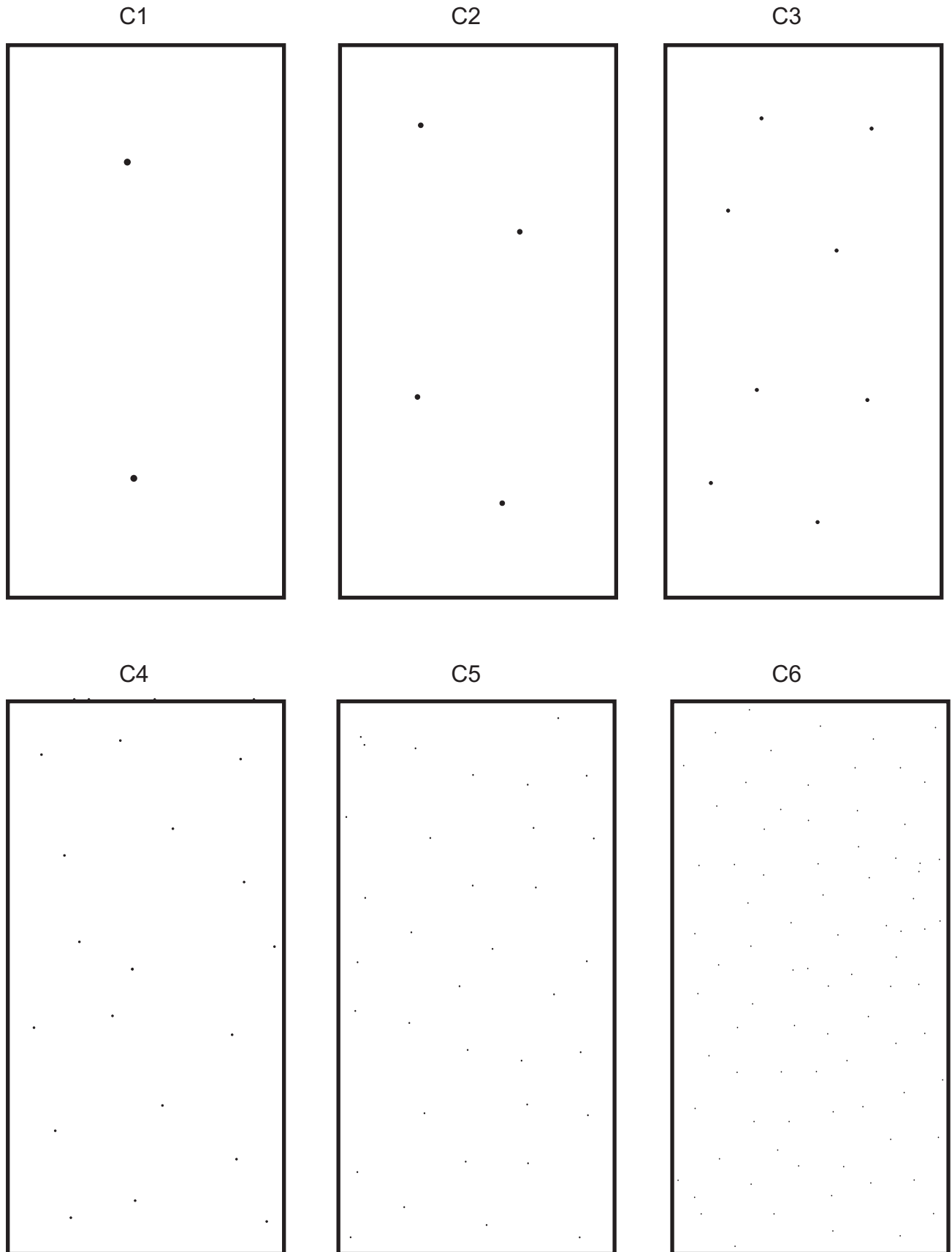


Figure 2 — Rating charts for designation C
 (Area of defects > 0,02% and ≤ 0,05 %)

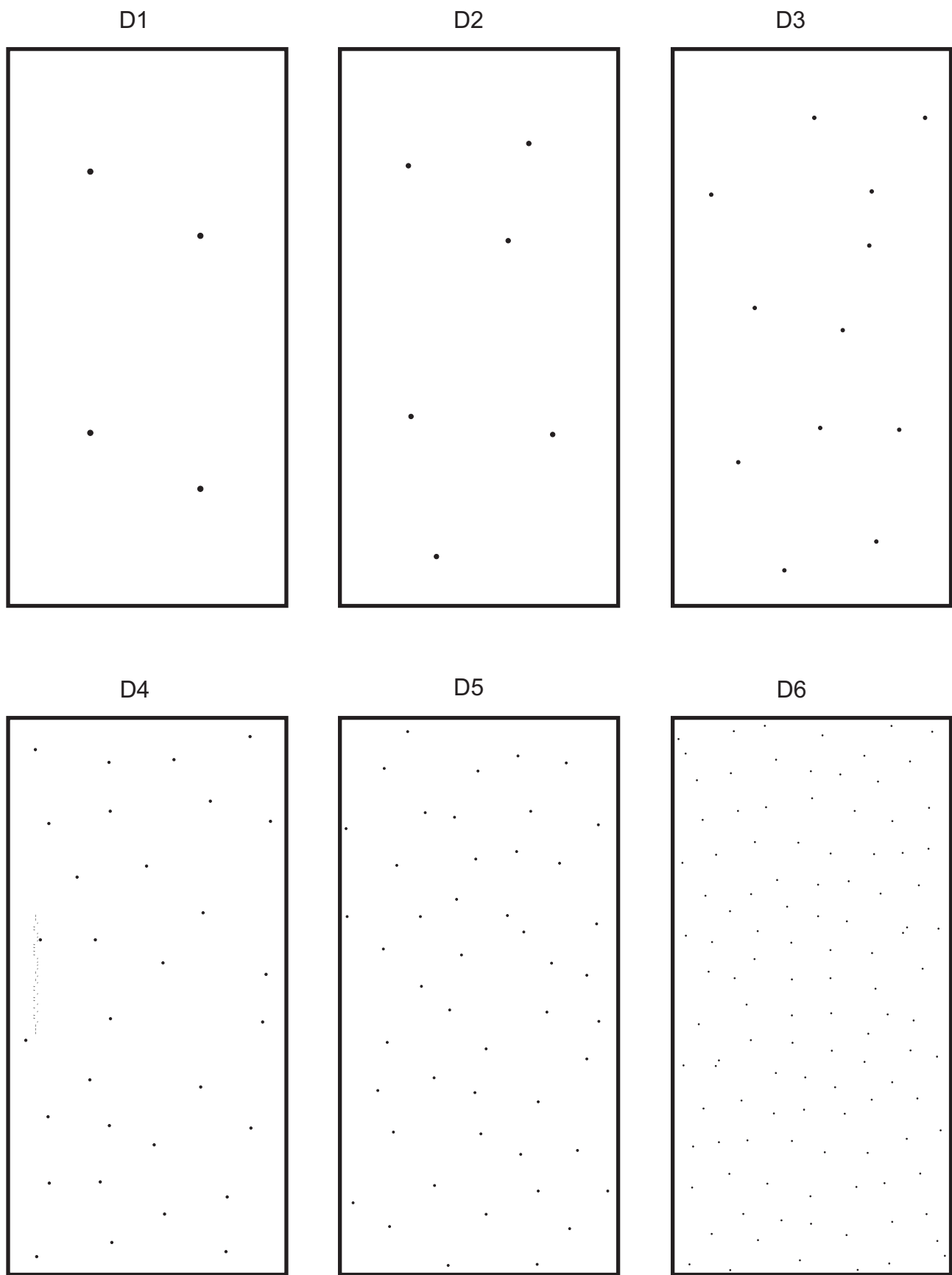


Figure 3 — Rating charts for designation D
(Area of defects > 0,05 % and ≤ 0,07 %)

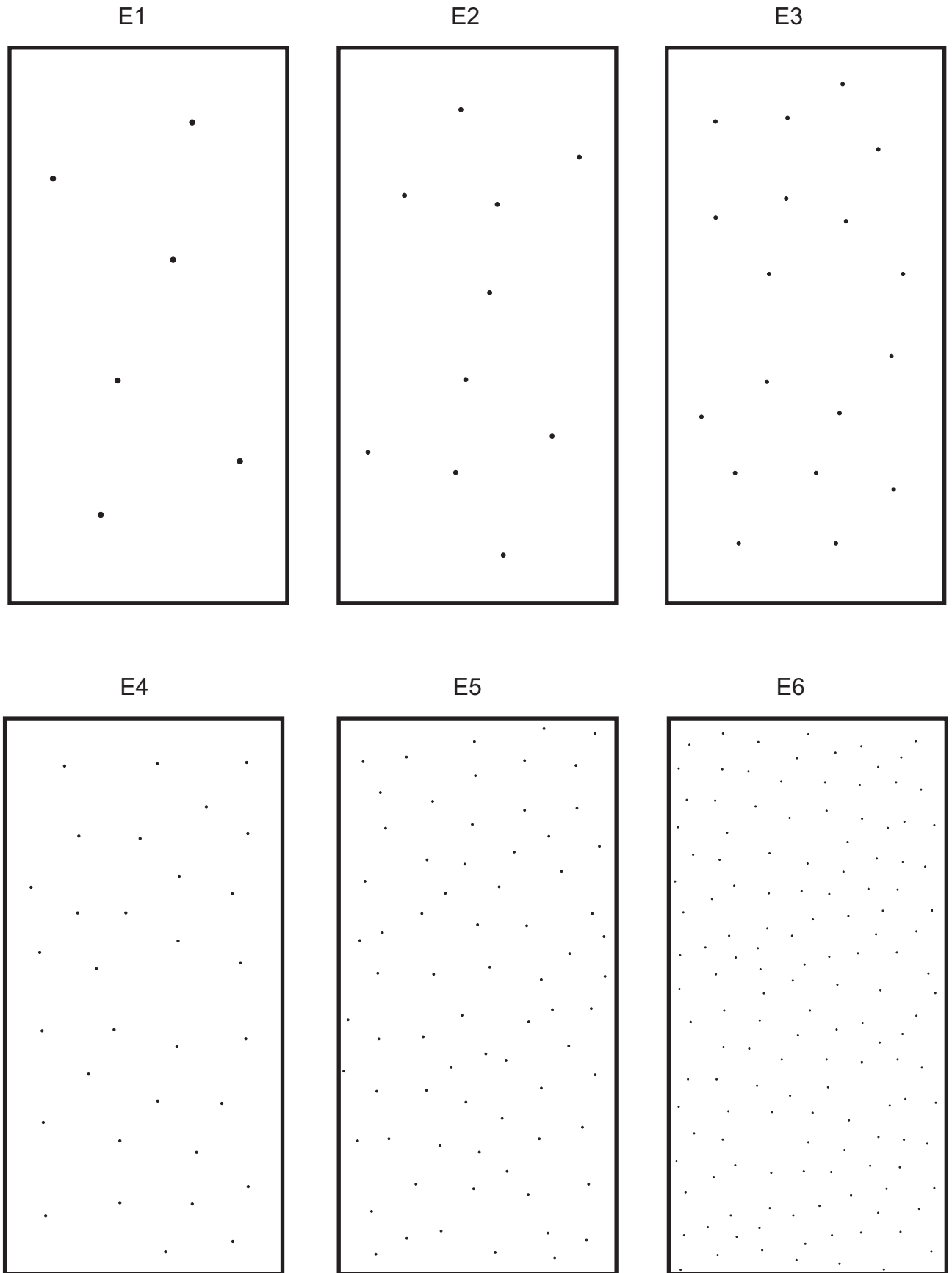


Figure 4 — Rating charts for designation E
 (Area of defects > 0,07 % and ≤ 0,10 %)

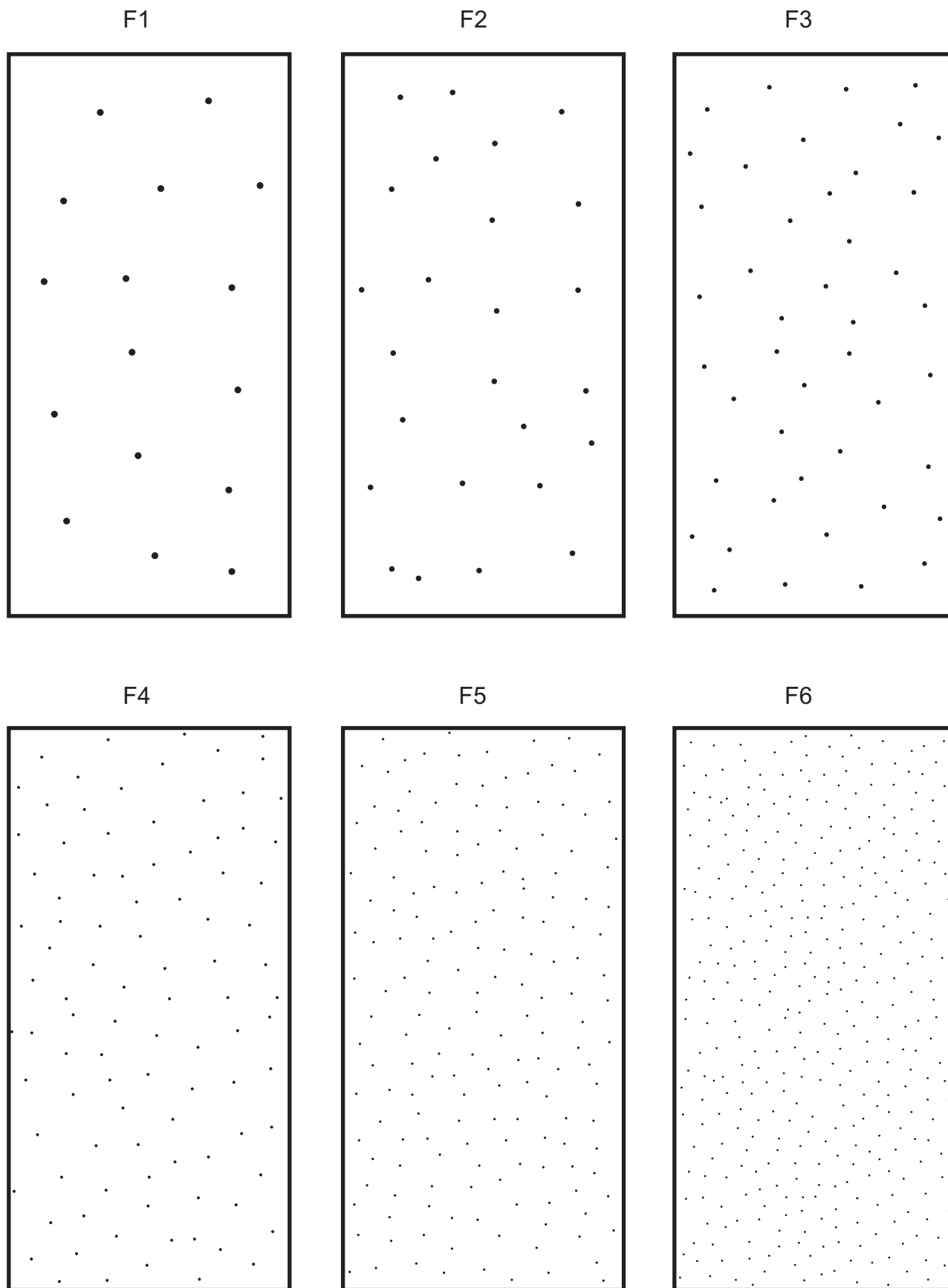


Figure 5 — Rating charts for designation F
(Area of defects $> 0,10\%$ and $\leq 0,25\%$)

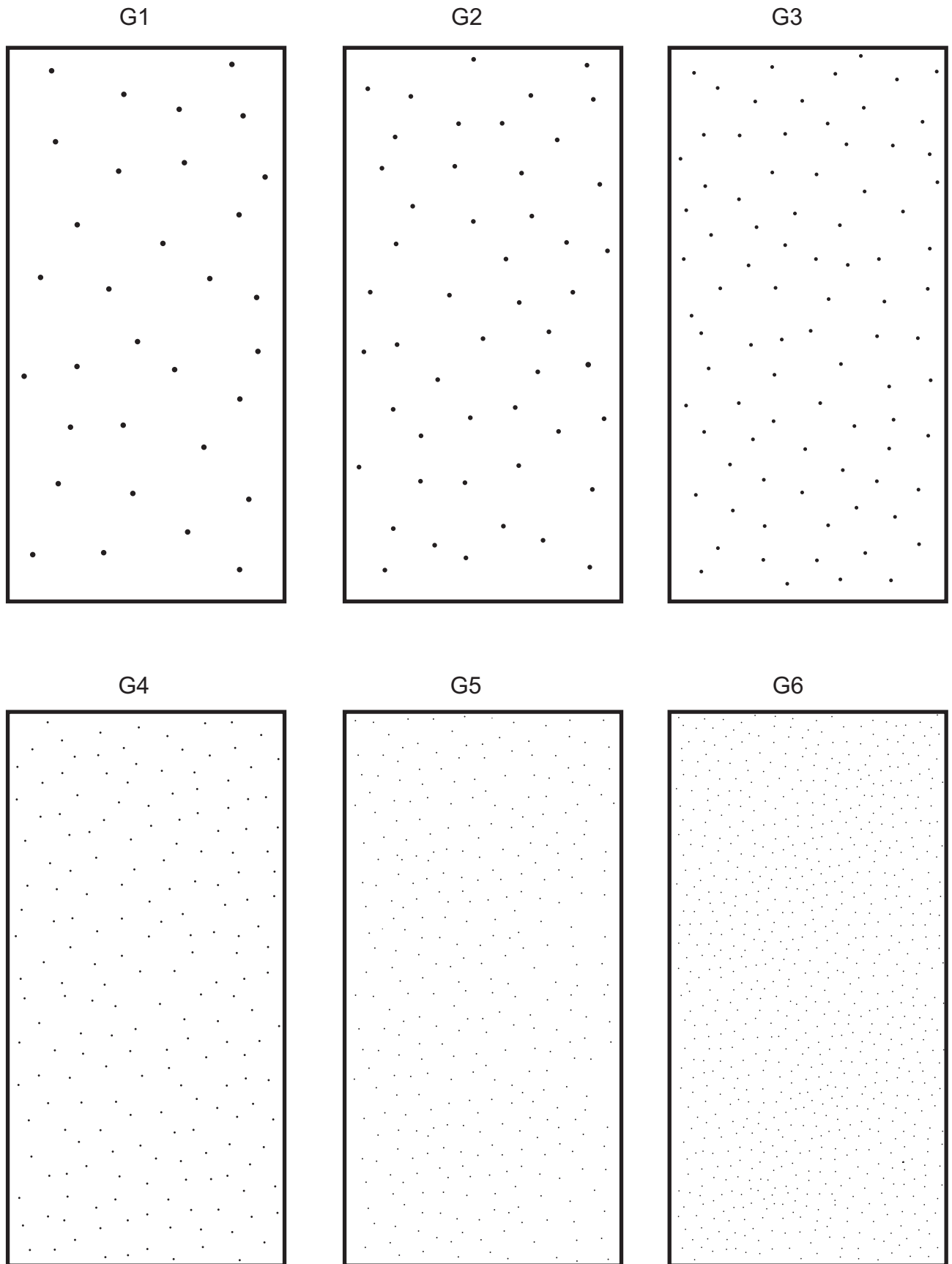


Figure 6 — Rating charts for designation G
 (Area of defects > 0,25 % and ≤ 0,5 %)

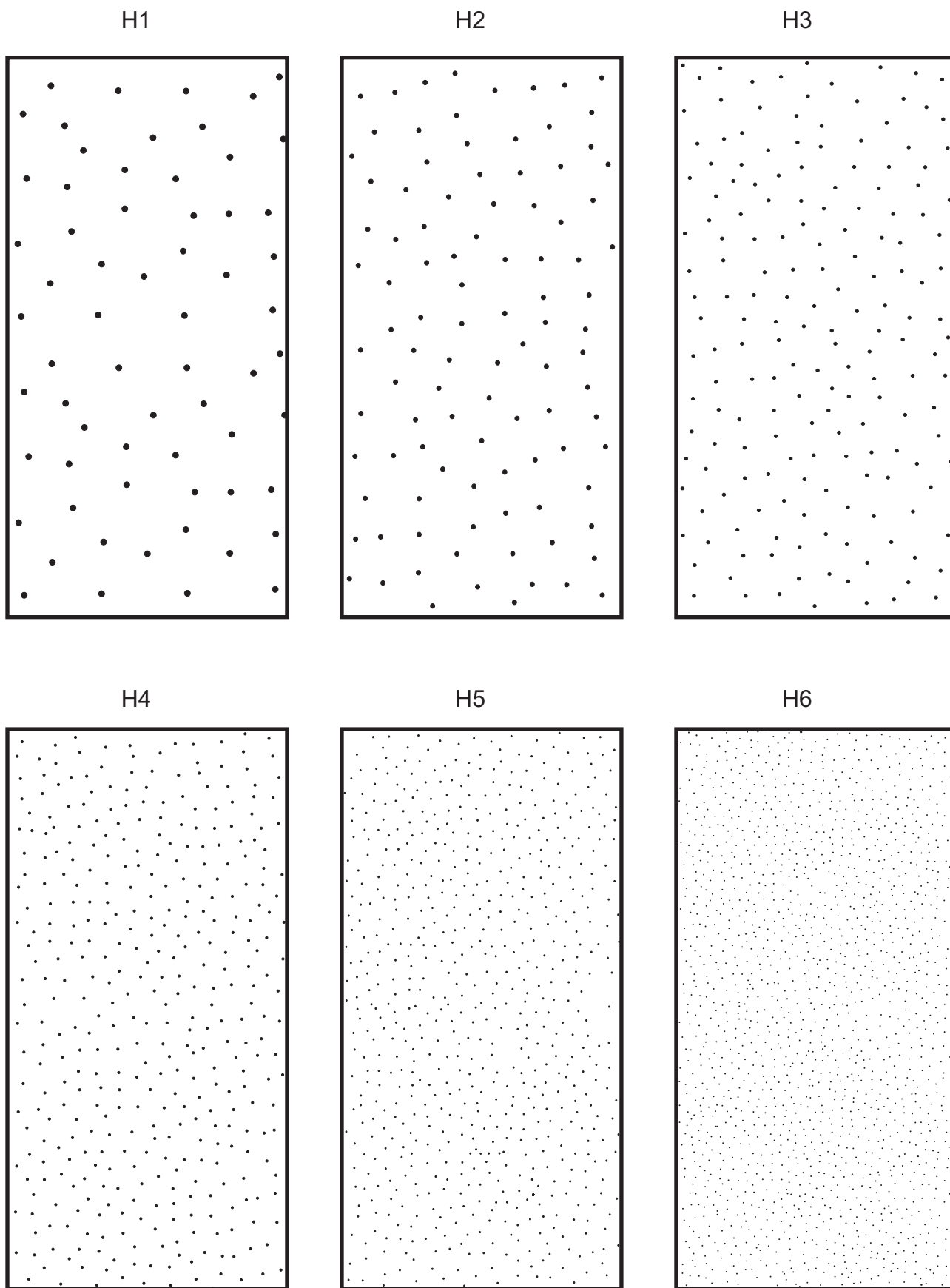


Figure 7 — Rating charts for designation H
(Area of defects > 0,5 %)

Bibliography

- [1] ISO 2064:1996, *Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness*
- [2] ISO 2106, *Anodizing of aluminium and its alloys — Determination of mass per unit area (surface density) of anodic oxidation coatings — Gravimetric method*
- [3] ISO 8994, *Anodizing of aluminium and its alloys — Rating system for the evaluation of pitting corrosion — Grid method*

