

*Indian Standard*TECHNICAL SUPPLY CONDITIONS FOR
THREADED STEEL FASTENERS

PART XII PHOSPHATE COATINGS ON THREADED FASTENERS

(Second Revision)

- 1. Scope** — Covers threaded steel fasteners with coating consisting of zinc phosphate that is intended to be used in conjunction with a sealant for protection against corrosion.
- 2.** Phosphate coating shall be sealed with suitable oil of rust-preventive type.
- 3. Mass of Phosphate Coating** — The mass of coating that consists of zinc phosphate shall have a coating weight of 2.5 g/m² to 4.5 g/m² of treated surface.
- 4. Designation** — The designation of a bolt or screw with phosphate coating shall include the letter 'P' for phosphating. [see also IS : 1367 (Part XVI) - 1979 Technical supply conditions for threaded steel fasteners : Part XVI Designation system and symbols (*second revision*)].

Example :

A hexagon-head bolt conforming to, for example, IS : 1364, of size M 20, length 75 mm, product grade A, property class 8.8 and with phosphate coating shall be designated as :

HEX BOLT M 20 × 75 IS : 1364-A-8.8-P.

5. Inspection, Sampling and Testing

- 5.1 Freedom from Defects** — The surface of phosphate coated fasteners shall be matt without any excessively crystalline appearance. They shall be free from untreated patches and from flaky and uneven deposits.
- 5.2 Verification of Coating** — A chemical method for verifying the presence of a phosphate coating is given in Appendix A.
- 5.3 Dimensional Accuracy**
- 5.3.1** In case of unthreaded features, dimensions apply before coating.
- 5.3.2** For threaded features, the permissible dimensional variations will be applicable before coating. However, after coating, the threads shall not transgress the maximum material limit for tolerance position H or h. If required by the purchaser, fasteners may be checked at random for dimensions after de-phosphating.
- 5.4 Test for Mass of Coating** — Test for mass of coating shall be in accordance with IS : 3618-1966 'Phosphate treatment of iron and steel for protection against corrosion'
- 5.5 Test for Resistance to Corrosion** — The resistance of sealed fasteners to corrosion shall be tested in the laboratory by means of Salt Spray Test as described in Appendix B. The tested fasteners shall be practically rust free after the stipulated duration.

Adopted 23 December 1981

© May 1982, BIS

Gr 2

APPENDIX A

(Clause 5.2)

CHEMICAL TEST FOR THE PRESENCE OF A PHOSPHATE COATING

A-1. Reagent — Dissolve 8 g of ammonium molybdate in 80 ml of distilled water. Add 12 ml concentrated hydrochloric acid ($d = 1.14$), 20 g ammonium chloride and 10 ml of saturated potassium persulphate solution. The reagent shall be freshly prepared.

A-2. Procedure — Add one drop of the reagent to the test surface. The appearance of a blue colour within 30 s indicates the presence of a phosphate coating.

A plain untreated fastener shall be used as control.

APPENDIX B

(Clause 5.5)

SALT SPRAY TEST

B-1. Test Equipment

B-1.1 The equipment required for Salt Spray Test consists of a fog chamber, a salt solution reservoir, a supply of suitably conditioned compressed air, one or more atomizing nozzles, specimen supports, provision for heating the chamber, and necessary means of control.

The size and detailed construction of the equipment are optional, provided the conditions obtained meet the requirements of this test. The chamber shall be insulated to avoid temperature gradients, particularly with a chamber temperature of $35^{\circ}\text{C} \pm 2^{\circ}\text{C}$. With small cabinets, this is conveniently effected by means of a double skin construction, incorporating a water jacket for temperature control.

B-1.2 Drops of solution which accumulate on the ceiling or cover of the chamber shall not be permitted to fall on the specimens being tested.

B-1.3 Drops of solution which fall from the specimen shall not be returned to the solution reservoir for re-spraying.

B-1.4 The spray from the atomizing nozzle or nozzles shall be prevented from impinging directly on the test specimen by means of suitable baffles. The solution condensing on the baffles may be returned to the salt solution reservoir; this can effect a substantial economy in rate consumption of the solution. Adjustable baffles are of assistance in obtaining a uniform collection rate throughout the test zone of the chamber.

B-1.5 Materials of construction shall be such that they will not affect the corrosiveness of fog (glass, rubber or certain plastic materials are suitable).

B-1.6 The equipment shall be sited so as to be in diffused light and away from radiators or other sources of heat and draughts in order to facilitate temperature control.

B-2. Test Samples

B-2.1 The number of test specimens to be used, as well as the criteria for the evaluation of the test results, shall be defined in the specifications of the product being tested or shall be mutually agreed upon by the purchaser and the supplier.

B-2.2 Select samples of the fasteners which are free from accidental damage and dirt.

B-3. Position of Specimens during Test

B-3.1 The specimens shall be suspended by cotton, nylon or any suitable thread vertically. Unless otherwise specified, the specimens shall be supported between 15° to 30° from the vertical and preferably parallel to the principal direction of horizontal flow of fog through the chamber. The test specimens shall be at least 30 mm from any other specimen and 35 mm from any wall of the chamber.

B-3.2 The specimens shall not contact each other or any metallic material.

B-3.3 Each specimen shall be so placed as to permit free settling of fog on all specimens.

B-3.4 The salt solution from one specimen shall not be allowed to drip on to any other specimen.

B-4. Test Solution

B-4.1 Preparation of Solution— Dissolve 50 ± 5 g sodium chloride in each litre of distilled or de-ionized water or water containing less than 100 ppm of total dissolved solids and substantially free from dissolved heavy metals particularly nickel, copper and iron. The pH of the solution shall be such that, when atomized under the test condition, the collected solution will be in the pH range of 6.5 to 7.2.

B-5. Air Supply

B-5.1 The compressed air supply to the nozzle or nozzles for atomizing the salt solution shall be free from oil, oil vapour and dirt, and shall be maintained between 0.67 bar and 1.72 bar (1 bar \approx 1 kg/cm²).

B-5.2 The air shall be saturated with moisture by means of water wash or humidifying tower, after suitable filtration. It is preferable to operate the tower at temperature well above the chamber temperature to ensure wet fog to offset heat losses and to maintain the required temperature in the chamber. The tower temperature should be adjusted, so that both the collection rate and composition of collected fog are kept within the specified limits. For guidance, the following table shows lower temperature at different air pressures required to offset the cooling effect of expansion at the nozzle or nozzles to atmospheric pressure with a chamber temperature of 35°C.

Air pressure, bar	0.8	1.0	1.1	1.2
Temperature, °C	45.4	47.2	48.4	49.5

The nozzle or nozzles may be operated intermittently by means of a suitable timer and relay actuating a solenoid valve in the air supply, providing that the fog is maintained continuously. This provides means of adjusting the collection rate and it also ensures a more consistent fog distribution with minimal directional effects.

B-6. Test Conditions

B-6.1 Temperature— The exposure zone of the test chamber shall be maintained at $35 \pm 2^\circ\text{C}$.

B-6.2 Atomization and Quality of Fog— At least two clean fog collectors shall be placed in the exposure zone in the proximity of the test specimens, one near to a nozzle and another as far as possible from nozzle. They shall be positioned so that no test solution falling from the test specimen is collected. The fog shall be such that for each 8 000 mm² of horizontal collecting area there will be collected in each collector from 1 to 2 ml of solution per hour determined over an operating period of at least 16 hours. (Standard laboratory glass funnels or dishes with 100 mm dia have horizontal area of 8 000 mm²). The collected spray solution shall contain 50 ± 10 g/l of sodium-chloride (specific gravity 1.0255 to 1.040 0 at 25°C) and pH shall be 6.5 to 7.2.

B-7. Continuity of Test

B-7.1 Unless otherwise specified in the specifications of the product being tested, the test shall be continuous for the duration of the entire test period. Continuous operation implies that the chamber be closed and the spray operating continuously except for the short daily interruptions necessary to inspect, rearrange, or remove test specimens, to check and replenish the solution in the reservoir, and to make necessary recordings. Operations shall be so scheduled that these interruptions are kept at a minimum.

B-8. Period of Test

B-8.1 The period of test shall be 48 hours.

B-9. Procedure

B-9.1 The following procedure shall be carried out :

- 1) Expose the specimen in the cabinet for the specified period.
- 2) Remove the specimen, wash in cold running water and dry off.

B-9.2 There shall be no rust formation on immediate visual examination.

EXPLANATORY NOTE

Consequent to the decision to revise IS : 1367-1967, splitting it into separate parts, this standard on requirements for phosphating of fasteners has been formulated. Although IS : 3618-1966 'Phosphate treatment of iron and steel for protection against corrosion' covers the general requirements for phosphating, a need was felt for special requirements of fasteners.

In the preparation of this standard, assistance has been taken from BS : 3189-1973 'Phosphate treatment of iron and steel,' issued by the British Standards Institution.