

## Chromate-Treated Zinc Mechanical Plate

EMPIS Finish F75B2 identifies a zinc mechanical plate with a chromate conversion coating as follows:

Procedures to minimize danger from hydrogen embrittlement			
Not treated (1)	Treated (2)	Controlled processing and treating (3)	Minimum thickness of mechanical plate, inch
F75B2A	F75B2A2	F75B2A3	0.00015
F75B2B	F75B2B2	F75B2B3	0.0002
F75B2B5 (4)	F75B52B7 (4)	F75B52B9 (4)	0.0002
F75B2B6 (4)	F75B52B8 (4)	F75B52B10 (4)	0.0002
F75B2C	F75B2C2	F75B2C3	0.0003
—	F75B2C4 (4)	—	0.0002
F75B2C6 (4)	F75B2C5 (4)	—	0.0002 - 0.0008
F75B2D	F75B2D2	F75B2D3	0.0005
F75B2E	F75B2E2	F75B2E3	0.001
F75B2F	F75B2F2	F75B2F3	0.0016
F75B2G	F75B2G2	F75B2G3	0.002
F75B2H	F75B2H2	F75B2H3	Heavy coating

### REFERENCED DOCUMENTS:

ASTM A153 .....	Zinc Coating (Hot-Dip) On Iron and Steel Hardware
ASTM B117 .....	Operating Salt Spray (Fog) Apparatus
ASTM B487 .....	Metal And Oxide Coating Thickness By Microscopic Examination Of A Cross Section
ASTM E376 .....	Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods

### European Union:

Directive (2002/95/EC) ..... Restriction of Hazardous Substances (RoHS)

### PROPERTIES:

Thickness of plate: (All EMPIS designations except F75B2H, H2, and H3)

All material shall have a thickness of plate on significant surfaces (5), as follows:

EMPIS designation	Thickness of mechanical plate, inch
F75B2A, A2, A3	0.00015 – 0.0003
F75B2B, B2, B3, B5, B6, B7, B8, B9, B10, C4	0.0002 – 0.0004 (6)
F75B2C, C2, C3	0.0003 – 0.0005
F75B2C5, C6	0.0002 – 0.0008 (10)
F75B2D, D2, D3	0.0005 – 0.00075
F75B2E, E2, E3	0.001 – 0.0015
F75B2F, F2, F3	0.0016 – 0.002
F75B2G, G2, G3	0.002 – 0.003

Thickness of plate: (EMPIS designations F75B2H, H2, and H3 only)

Type of material being plated			Minimum surface coating of zinc, oz/ft <sup>2</sup> (7)	
			Average of specimens tested (8)	Any individual specimens
Castings - Malleable iron, steel			2.00	1.80
Rolled, pressed and forged (except those listed below)	Thickness, inch	Length, inch		
	0.188 and over	Over 8	2.00	1.80
	Under 0.188	Over 8	1.50	1.25
	Any	8 and under	1.30	1.10
Bolts, drive screws and similar articles, over 0.375 inch diameter. Washers, 0.188 and 0.250 inch thick.			1.25	1.00
Screws, stove bolts and bolts; rivets, nails and similar articles, 0.375 inch and under in diameter. Washers under 0.188 inch thick. Springs 0.192 inch and thicker.			1.00	0.85

(See last page of this document for all footnotes.)

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### PROPERTIES: (continued)

Salt spray resistance – The coating shall withstand exposure to salt spray for minimum hours as indicated in the table below without showing appreciable corrosion (presence of more than 6 rust spots per square foot that are visible to the unaided eye or any corrosive spots larger than 0.062 inch in diameter) on the designated significant surfaces (corrosion at the edges of the test specimen shall not constitute failure).

EMPIS designation	Hours resistance, min
F75B2A, A2, A3	24
F75B2B, B2, B3, B5, B6, B7, B8, B9, B10	48
F75B2C, C2, C3, C4, C5, C6	96
F75B2D, D2, D3	144
F75B2E, E2, E3	192
F75B2F, F2, F3	250
F75B2G, G2, G3	300
F75B2H, H2, H3	—

Adhesion – The adhesion of the coating after testing according to referee test methods, shall be such that when examined at a magnification of 4X it does not show separation from the base metal. The formation of cracks in the deposit caused by rupture of the base metal which does not result in flaking, peeling, or blistering of the deposit shall not be considered as nonconformance to this requirement. EMPIS designations F75B2H, H2 and H3 shall conform to adherence requirements of ASTM A153.

Hydrogen embrittlement – Parts specified to be processed using EMPIS designations F75B2A2 through F75B2H3, plus additional parts as specified, shall be substantially free from hydrogen embrittlement as determined by referee clamp test.

### ADDITIONAL REQUIREMENTS:

Preparation – The material to be plated shall be substantially free from flaws or other imperfections that will be detrimental to the appearance or the protective value of the coating. It shall be subjected to such cleaning and plating procedures as are necessary to yield deposits as specified herein except that no procedure shall be of such nature as to cause hydrogen embrittlement of hardened steel parts.

Preparation of EMPIS designations F75B2A3 through F75B2H3 – Processing of these parts prior to plating shall be controlled to minimize the danger from hydrogen embrittlement. Procedures to control treatments including heat treating and surface cleaning shall be agreed upon.

Plating – The zinc coating as required by this specification shall be applied by tumbling (or otherwise agitating) the parts in a suitable mixture of nonmetallic impactors (glass beads), zinc powder, a chemical promoter, and water. The coating shall cover completely all visible surfaces, including roots of threads, recesses, and sharp corners.

Minimizing danger from hydrogen embrittlement, EMPIS designations F75B2A2 to F75B2H2, C4 and C5 – When called for by designation, hardened steel parts shall be processed to minimize the danger from hydrogen embrittlement. Suitable processing for EMPIS designations F75B2A2, B2, C2, C4 and C5 shall be a minimum hold time for finished parts of 48 hours at room temperature under ventilated conditions or a heat treating time with ventilation after plating of at least one hour above 200 °F (93 °C) part temperature before chromate treatment; or as may be otherwise specified. Thicker plate and EMPIS designations B7 through B10 shall be processed as agreed and specified. Acceptable reduction of hydrogen embrittlement can be established by clamp testing of samples.

Minimizing danger from hydrogen embrittlement, EMPIS designations F75B2A3 to F75B2H3 – When called for by designation, parts shall be suitably processed for a minimum hold time for finished parts of 48 hours at room temperature under ventilated conditions or a heat treating time with ventilation after plating of at least one hour above 200 °F (93 °C) temperature before chromate treatment or other coating processes. Additional suitable processes including thermal treatments after designated pre-plating operations shall be agreed upon.

Chromate treatment – EMPIS designations F75B2B5 through B10, C4, C5 and C6 are processed only with trivalent chromium and are therefore in compliance with European Directive (2002/95/EC), Restriction of Hazardous Substances (RoHS). For all other designations the chromate treatment shall be either a chemical or electrochemical treatment in an aqueous solution of salts, acids, or both, and containing hexavalent chromium and activating acid radicals to produce a smooth, distinct, protective film, colored iridescent bronze including olive drab, yellow and when specified, clear.

Process approval – Process approval shall be as specified. After evaluation of a trial lot and approval, no significant changes in manufacture shall be made without consulting the purchaser as to the possible effect on production. Testing of initial trial lot and periodic sample testing shall be as agreed upon by processor and purchaser.

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### REFEREE METHODS:

- Salt spray resistance ..... ASTM B117
- Thickness of plate (All designations except F75B2H, H2 and H3) ..... ASTM B487 (9)
- Thickness of plate (F75B2H, H2, and H3 only) ..... ASTM A153
- Sampling – Samples shall be taken at random and shall represent 1 percent of the number of pieces in the shipment. No less than 3 samples for the testing:
- Adhesion (all designations except F75B2H, H2 and H3) – Determined by scraping the surface of the coated part to expose the base metal and examining at 4x for evidence of nonconformance. Alternately, the article is bent through an angle of 180 degrees on a diameter equal to the thickness of the article, and then examined at 4x for evidence of nonadhesion. EMPIS designations F75B2H, H2 and H3 shall conform to the adhesion requirements of ASTM A153.
- Clamp test - Hydrogen embrittlement – Parts shall be clamped, extended, or otherwise flexed to approximate the stress induced in the intended application and held in position as follows:
1. Compressed for one minute and inspected.
  2. Compressed for three hours and reinspected.
  3. Compressed again for 96 hours and reinspected.

After such tests, no parts shall show visible signs of failure. Where the application is not obvious, the test shall be by agreement between manufacturer and purchaser.

### SAFETY AND HANDLING:

Obtain a Safety Data Sheet (SDS) from the supplier for additional information.

### APPROVAL:

Final approval of material to this specification is based on factory trial. After approval, no changes in composition or processing that can affect quality or characteristics of the material furnished to this specification shall be made without prior notification and approval of the purchaser.

### CERTIFICATE OF TEST:

When requested, the supplier shall submit promptly to the purchaser at the point of delivery a certificate of test showing the results of tests for properties required by this specification. This certificate shall be addressed to the section, unit, or person specified on the purchase order, and shall contain the EMPIS designation, the purchase order number, and the quantity shipped so that the certificate may be identified with the shipment.

### PACKING AND MARKING:

All material shall be shipped in suitable containers to give adequate protection against damage or loss during transit and storage.

All containers shall be legibly marked with the purchase order number, supplier's name, and the EMPIS designation of material or part.

### DOCUMENT REVISION STATUS:

Rev	Description	Revision Date
S7	Added restrictions for coating thickness on threads	1995 Sep 30
S8	Added B5 and B6 RoHS compliant designations	2007 Jan 31
S9	Added designations B7, B8, B9, B10, C4 and general format update	2014 Jul 31
S10	Added note (4) to C4 designation table and added C4 to chromate treatment requirement section	2015 Dec 31
S11	Added designation C5	2016 Aug 31
S12	Added designation C6	2016 Dec 31

### FOOTNOTES:

(1)	Normally specify for steels with a low carbon analysis and with a hardness less than HRC 30.
(2)	Normally specify for steels with a medium carbon analysis and with a hardness range of HRC 35-47.
(3)	Normally specify for steels with a high carbon analysis and/or hardness HRC greater than 47.
(4)	Compliant with RoHS, EMPIS designations F75B2B5, B7 and B9 green color, EMPIS designations F75B2B6, B8, B10, C4, C5 and C6 color as applied.
(5)	Significant surfaces shall be those surfaces that are visible or subject to wear or corrosion, or both. Significant surfaces shall be designated on the part drawing.
(6)	The screw thread portion of externally threaded products that are mated with nuts or enter internally tapped holes shall have a total thickness of deposit between 0.0002 - 0.0003 inch.
(7)	For pieces over 5 feet in length, the weight of the coating shall be the average of the determination made at each end and the middle of the article.
(8)	The number of specimens to be tested per order shall be agreed upon at the time of purchase by the manufacturer and the purchaser.
(9)	Alternate methods are permitted as a suitable means of determining plating thickness; however, in the case of dispute, metallographic methods per ASTM B487 shall be the basis for acceptance or rejection of the material for plating thickness.
(10)	For threaded fasteners, the coating thickness should be in the range 0.0002" – 0.0008" with an aim to 0.0005". This thickness on significant surfaces is intended only to meet the salt spray corrosion test requirement. The fastener MUST independently meet the strength, torque – tension relationship, salt spray and dimensional requirements of the part.

