

SUBJECT: FASTENERS – DIP SPIN ZINC RICH INORGANIC COATING

1.0 SCOPE & PURPOSE. This Material & Process Specification establishes requirements for the dip spin fastener coating used at AGCO's Hesston and Beloit Operations.

2.0 SOURCE REFERENCE. Hesston Operations engineering standards committee is responsible for the content of this specification. The following Standards have been used for reference.

ISO 10683
ISO 9227
ISO 10289
ISO 16047
ISO 1463
IFI 166
IFI 566
ASME B1.3
ASTM B117
ASTM B568
ASTM E376
ASTM D3359
M&PS 705100286
CMS M1047 Part 10 (MF)

3.0 HISTORY. M&PS 705100300 formerly covered all fastener finish requirements at Hesston Corporation, Hay & Forage Industries and AGCO Hesston Operations. This included the following drawing callouts:

Non Plated (NP)
Black Finish (BF)
Plated, Zinc & Clear (Z&C)
Zinc & Yellow (Z&Y)
Phos & Oil (P&O)
Black Phos & Oil (BP&O)
Cad & Wax & Yellow (CW&Y)
Zinc & Cobalt (ZCO)
Zinc - Cobalt & Teflon (ZCOT)

3.1 M&PS 705100300 was revised to specify zinc & yellow (hexavalent) only in 2003.

3.2 Additional Material & Process Specifications were created to cover the remaining fastener plating requirements.

3.3 M&PS 705100300 was revised in the spring of 2013 from zinc & yellow (hexavalent) electroplated finish to a non-electrolytically applied inorganic dip spin coating conforming to ISO 10683.

4.0 FINISH. The standard or default coating / finish for fasteners supplied under M&PS 705100300 shall be a chrome free inorganic dip spin finish. All coatings supplied under this specification must be RoHS, WEEE and ELV compliant. Only coatings that meet all requirements and performance criteria detailed in this specification can be supplied.

5.0 APPEARANCE. The fastener coating / finish shall have a silver / light gray matte appearance. The coating shall be uniform in appearance and free of runs or sags. Fastener coatings conforming to this specification shall show no signs of blistering, flaking, peeling or uneven film thickness buildup that could adversely affect the coatings performance and function.

6.0 CORROSION RESISTANCE. All approved dip spin coatings must conform to the following requirements.

6.1 Distinct white corrosion visible to the unaided eye on significant surfaces is not acceptable at the conclusion of a 96 hour NSST. Some discoloration or dulling (blushing) may occur to the appearance of the fastener prior to the end of the NSST.

6.2 Distinct red corrosion visible to the unaided eye on significant surfaces is not acceptable at the conclusion of a 240 hour NSST.

6.3 Rating of NSST fastener test specimens shall be in conformance with ISO 10289.

6.4 M&PS 705100286 will provide the accepted procedure for nitrogen corrosion resistance testing. Refer to M&PS 705100286 for nitrogen resistance requirements.

7.0 COATING THICKNESS. The minimum coating thickness shall be 8 μ m (0.0003 inch) on significant surfaces.

7.1 ASTM B568, ASTM E376 and ISO 1463 provide approved methods used for measuring coating thickness.

7.2 A maximum coating thickness will not be specified, however the coating thickness for threaded fasteners shall not adversely affect normal installation and removal practices. Threaded fasteners are manufactured with a thread allowance for plating or coatings under ASME B1.1

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and B1.13M. It is understood that threaded fasteners are gaged prior to plating or coating.

7.3 After coating, screw threads shall be gaged by the relevant basic size GO thread ring or plug gage, ie:

- The GO thread ring gage for tolerance position h for external ISO metric screw threads.
- The GO thread plug gage for tolerance position H for internal ISO metric screw threads.
- The GO thread ring gage for Class 3A external unified inch screw threads.
- The GO thread plug gage for Class 2B or 3B internal unified screw threads.

7.4 If AGCO and its supplier are unable to reach agreement using the gaging criteria shown in Section 7.3, AGCO's fastener supplier may be allowed to use mating thread criteria for free spinning threaded components using formulas shown in Sections 7.4.1 and 7.4.2. Ultimately, AGCO's supplier is responsible to develop the appropriate thread dimensions before coating in order to achieve the proper thread tolerance class. Threads may be produced undersized to accommodate the coating provided the finished product meets all expected mechanical requirements for that grade or class of fastener.

7.4.1 For free spinning metric fastener components, the maximum allowable spin on input torque in N-m is $0.001 \times D^3$ where D is the nominal thread diameter in mm.

7.4.2 For free spinning inch fastener components, the maximum allowable spin on input torque is calculated by the formula shown in 7.4.1 after a direct conversion from inch to metric values is established.

7.5 IFI 166 (inch) and IFI 566 (metric) provide approved methods of inspection and acceptance of thread nicks on externally threaded fasteners.

7.6 Dip Spin Coatings are not recommended and should not be specified on threaded fasteners smaller than M4.

8.0 COEFFICIENT OF FRICTION REQUIREMENT.

All dip spin fastener coatings supplied to AGCO shall have a coefficient of friction of 0.15 +/- 0.03 as tested and in total conformance with ISO 16047.

9.0 COATING PERFORMANCE VERIFICATION. All coating applicators shall document their coatings performance thru NSST. If additional Nitrogen resistance testing is required it must be identified on an individual fastener drawing by specifying M&PS 705100286.

9.1 Neutral Salt Spray Test (NSST) shall be conducted on the fastener coatings in conformance with ISO 9227 or ASTM B117.

9.2 No Nitrogen resistance cycle tests are required to be in conformance with this specification.

9.3 Frequency of testing coatings will be agreed upon by AGCO and its fastener supplier.

9.4 The coating applicator shall retain the NSST and Nitrogen resistance test results for a period of 3 years and make these results available to AGCO upon request.

10.0 ADDITIONAL PHYSICAL REQUIREMENTS.

10.1 Adhesion. The dip spin coating shall be tightly bonded to the metal substrate and must be able to withstand normal handling without compromising the coating performance requirements.

10.2 Method of testing adhesion of the coating to the metal substrate shall conform to ASTM D3359, Scribe-Grid test or equivalent.

11.0 HYDROGEN EMBRITTLEMENT RELIEF. The dip spin coating process normally does not expose high strength fasteners to hydrogen embrittlement. Baking for hydrogen embrittlement relief is not required unless an unknown process was used to introduce hydrogen during processing. Hesston's fastener supplier will be responsible for securing fasteners from sources that conform to proper processing of high strength fasteners to assure they are free of hydrogen embrittlement.

12.0 PREVAILING TORQUE NUTS. At Hesston, most prevailing torque nuts have been cadmium plated with a yellow hexavalent conversion coating and wax dipped. This was the standard finish on hex

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flange top lock, hex center lock and hex top lock nuts to prevent galling during assembly. The cad wax and yellow plating requirement for all metal prevailing torque nuts is being replaced with the approved dip spin finish per this specification with a friction modifier added. The appropriate friction modifier will be added to all prevailing torque nuts over the standard dip spin coating.

12.1 Expected coefficient of friction for all metal prevailing torque nuts with a dip spin coating and torque modifier added shall be 0.12 +/- .03 as tested per the IFI standard procedure.

13.0 CONVERTING PREVIOUSLY ELECTRO-PLATED FASTENER STOCK. Converting electro-plated fastener stock to an approved dip spin coating will be permitted with agreement established between AGCO's Hesston & Beloit Operations and its fastener supplier. Agreement of pretreatment and processing of existing electroplated stock must be established prior to the recoating of stock.

13.1 The dip spin coating thickness on recoated threaded fasteners shall not adversely affect standard thread fit requirements or assembly or disassembly practices. After refinishing, threaded fasteners must assemble to the free spinning mating fastener with the maximum spin on input torque established in Section 7.4.1 (metric) and 7.4.2 (inch) of this specification.

14.0 NYLON INSERT NUTS. Due to the manufacturing process required the dip spin coatings will be added after the nylon insert has been crimped into position. A lower baking temperature to set the dip spin coating is required. Baking the dip spin coating at a lower temperature for a longer period of time will not adversely affect the nylon insert. As a result of the lower baking temperature, the NSST hours are reduced for nylon insert nuts to 96 hours to white corrosion.

15.0 PURCHASED ASSEMBLIES. Assemblies that contain hardware that are purchased complete need not conform to Section 8.0 of this specification.

15.1 Other coatings can be supplied on purchased complete assemblies as long as the hours to white and red corrosion, CoF and appearance is the same as the dip spin coatings identified in this specification.

16.0 EXTERNALLY THREADED FASTENERS WITH THREAD LOCKING PATCHES OR BANDS.

The dip spin coating must be applied to an externally threaded fastener prior to the thread locking patch or band being applied.

17.0 COTTER PINS. Un-plated touch points may occur inside the cotter pin legs using dip spin coatings the same as occurred on electroplated cotter pins.

18.0 STANDARD DRAWING CALLOUT. To prevent revising every fastener drawing at Hesston, the standard plating or finish note will not change on Hesston fastener drawings. One of the following notes will appear on Hesston drawings.

PLATE PER M&PS 705100300
or
PLATED PER M&PS 705100300
or
PLATING PER M&PS 705100300

All hardware/fasteners drawings specifying M&PS 705100300 shall be furnished with an inorganic dip spin coating conforming to this specification.

19.0 MATERIAL CONFORMANCE REQUIREMENT. All changes in coating material, processes, material formulation, appearance, etc must have written approval by Hesston and Beloit Operation's Quality Assurance and Engineering Departments prior to implementation of the change.

20.0 RELATED AGCO SPECIFICATIONS. Fastener coatings supplied under the following Specification conform to Massey Ferguson Standard CMS M1047 Part 10 for AGCO's Jackson, Beloit and Hesston facilities in North America using Massey Ferguson fastener part numbers.

CPS 5035 Coating–Fastener (Jackson Operations)

CPS 5035D (Bolt)
CPS 5035E (Nut)
CPS 5035F (Washer)

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Revision History.

05 rev. – revised entire specification, Hesston's default fastener plating was electroplated Zinc & Yellow (hexavalent).

06 rev. – changed to an inorganic zinc rich dip spin coating

07 rev. – added sections 14.0, 15.0, 16.0 & 17.0 (revised this note)

08 rev. – revised section 6.4

09 rev – revised section 15.1, eliminated ZnCoat.

10 rev – Revised Cof in Sect. 8.0. Revised 9.0 & 9.2, added 15.1

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