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Document Title: SCHEDULE OF TECHNICAL REQUIREMENT FOR FABRICATION OF HIGH STRENGTH FRICTION GRIP BOLTING ASSEMBLIES WITH DIRECT TENSION INDICATOR WASHER (SUITABLE FOR PRELOADING) FOR USE IN RAILWAY BRIDGES, ROB & FOB.			

**RESEARCH DESIGNS AND STANDARD ORGANISATION
MANAK NAGAR, LUCKNOW-226011**

Document No. : BS-S-7.5.3.1-7

Document Title: **SCHEDULE OF TECHNICAL REQUIREMENT FOR FABRICATION OF HIGH STRENGTH FRICTION GRIP BOLTING ASSEMBLIES WITH DIRECT TENSION INDICATOR WASHER (SUITABLE FOR PRELOADING) FOR USE IN RAILWAY BRIDGES, ROB & FOB.**

S.No.	Amendment Date	Version	Reasons for Amendments
1.	23-03-2023	1.2	Amendment in Para related to Hot Dip Galvanizing facilities.
2.	10-08-2020	1.1	Amendment in Para related to Zinc Flake Coating (Annexure A), and some minor change in Para 5.0 and 7.0. It will be effective from 31.01.2021.
3.	04-04-2019	1.0	STR approved by Railway Board.

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SCHEDULE OF TECHNICAL REQUIREMENT FOR FABRICATION OF HIGH STRENGTH FRICTION GRIP BOLTING ASSEMBLIES WITH DIRECT TENSION INDICATOR WASHER (SUITABLE FOR PRELOADING) FOR USE IN RAILWAY BRIDGES, ROB & FOB

1.0 Scope

This specification covers the norms for objective evaluation of capability and capacity of any firm for manufacture and supply of HSFG bolting assemblies with direct tension indicator washer (suitable for preloading) for use in railway bridges, ROB & FOB

2.0 Procedure for Registration of Firms for manufactures and supply of HSFG bolting assemblies with direct tension indicator washer (suitable for preloading) for use in railway bridges, ROB & FOB.

2.1 The firm interested in getting registered shall study this document carefully and will ensure availability of:

- (i) The required infrastructure, machinery, tools & plant.
- (ii) Space required for manufacturing, testing and storage viz. manufacturing floor, Godown, store, office and test lab etc.
- (iii) Testing and measuring equipment duly calibrated.
- (iv) Trained technical manpower.
- (v) Past Experience Criteria.
- (vi) Quality Assurance Aspects.

2.2 In case manufacturer is satisfied that the infrastructure and other available requirements listed above are commensurate with the stated requirements, then firm shall apply for registration ON-LINE on the RDSO website. All relevant documents like vendor approval guidelines, application form, schedule of technical requirement (STR), latest version of relevant specifications (if applicable), etc. are available on the RDSO website. The requisite charges as specified on website are to be deposited through the means as specified on the RDSO website.

2.2.1 The firm has to submit ONLINE the complete application form, self compliance of STR along with all necessary documents in support of self compliance of STR and documents in support of other important aspects of application. The firm has also to submit the undertakings as mentioned in Document No. BS-G-4.2.3-1 (latest version) titled "Guidelines for Registration and Quality Audit of Vendors in Bridge & Structure Directorate" available on RDSO Website.

2.2.2 For detailed procedure for Registration and other related aspects, refer to Document No. BS-G-4.2.3-1 (latest version) titled "Guidelines for Registration and Quality Audit of Vendors in Bridge & Structure Directorate" available on RDSO Website.

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3.0 Norms for Acceptance:

To qualify for manufacture and supply of HSFG bolting assemblies with direct tension indicator washer (suitable for preloading) for use in Railway Bridges, ROB & FOB, the firm must satisfy the requirements laid down in Para 4, 5, 6, 7, 8, 9 & 10 below. The specifications/codes commonly referred in this document considered with latest correction slips/Versions in vogue.

Note: Kindly note that after registration, the firm has to supply the HSFG Bolts, Nuts & Washers for use in Railway Bridges, ROB & FOB as per approved QAP.

4.0 General and Infrastructural Requirements:

Detailed information with necessary documents in support is required for following items:-

- 4.1 The manufacturer must have adequate organization including supervisors, skilled worker and other categories of manpower to execute the work in competent manner. (Enclose list of staff along with Qualification & experience of employees).
- 4.2 A proper organization must exist to perform the functions of purchasing of various raw materials, bought-out components, consumables, etc. and for maintaining the purchasing documents including inspection certificates, test certificate etc. (Enclose list of staff along with Qualification & experience of employees).
- 4.3 A proper procedure for maintenance of records for receipt and consumption of raw material including steel should be in vogue or developed so as to allow verification by railway's representative.
- 4.4 Adequate power supply should be arranged through distribution agencies with back up through captive generation. (Necessary documents in support to be enclosed).
- 4.5 Covered bay area with proper handling facilities should be available to handle day-to-day manufacturing of HSFG Bolts, Nuts & Washers for use in Railway Bridges, ROB& FOB.
- 4.6 The premises should have covered storage area to store raw material and finished products.
- 4.7 Covered shed area protected from rain, dust etc. should be provided for surface preparation and coating. Adequate space for storing manufactured component awaiting painting shall be available.

Note: For Para 4.5 to 4.7 Applicant has to submit ONLINE a neat copy of plan of work premises & show detail of items given below:-

- (a) Covered bay area with proper handling facilities available to handle day-to-day production of HSFG bolting assemblies with direct tension indicator washer (suitable for preloading) for use in railway bridges, ROB & FOB.
- (b) Area for storing raw material & finished products etc.

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(c) Area for separate line for inspection and testing of HSFG bolting assemblies.

(d) Covered shed area protected from rain, dust etc, available for surface preparation and Hot dip galvanization and Zinc flakes.

4.8 An adequately equipped and drawing Office is required for preparation of drawings. (Enclose list of staff along with Qualification & experience of employees).

4.9 The manufacturer should be capable of designing required fixtures, templates etc. as required for manufacturing work (Enclose list of staff with qualification and experience).

4.10 Firm should submit the details of equipments/machinery i.e. make, model, year of manufacture, machine no. etc. for Equipments and Machineries mentioned in Para 5 to 7 preferably in a chart form (machinery owned by sister concerns will not be accepted).

4.11 After registration of firm it is mandatory to inform RDSO through FAX (followed by confirmation copy through courier/speed post) as soon as any machinery is removed from the firm's premise (even for repair etc.). RDSO should be informed again, when the machinery is brought back and made operational.

4.12 Firm is required to give an undertaking that if at any time after approval is accorded, some machinery is found deficient without intimation to RDSO, and then it will be presumed that machinery was not there since beginning and firm's approval will be withdrawn immediately.

5.0 Facilities required for manufacturing and supply of HSFG Bolts, Nuts & Washers for use in Railway Bridges, ROB, FOB.

5.1 Following machines/equipment shall be available with the manufacturers for supply of HSFG bolting assemblies with direct tension indicator washer (suitable for preloading).

Provide quantity, make, model no., S.No., capacity, year of manufacture/ commissioning, Machine number etc. preferably in a chart form as applicable):

- i. Continuous Heat Treatment Furnace (Hardening, Oil Quenching & Tempering).
- ii. Cold Forging Machines with min. & max. Dia. & Length OR Hot Forging Machines with min. & max. Dia. & Length.
- iii. Head Trimming Machines
- iv. Threads Rolling Machines
- v. Bull block wire drawing machine
- vi. Hot dip galvanizing facilities in accordance to ISO 10684 (Latest version)
- vii. Zinc flake coating facility in accordance to Annexure "A".
- viii. Elcometer.

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ix. Adequate no. of measuring instruments (micrometers, dial gages, vernier calipers, Go-No-Go gauges).

x. Automatic weighing system.

Note: (i) If Zinc flake coating facility is not in house, it can be outsourced. If outsourced, submit a copy of MOU with outsourced agency. The MOU should have validity of minimum 60 months. The outsourced agency shall have Zinc flake coating facility as per Annexure "A". The provisions in Annexure 'A' must be ensured by applying firm before MOU. It is binding on the manufacturer to get the work done from the party with whom MOU is signed and test report of Zn Flake coating by them should be submitted along with each and every supply lot or as desired by customer/Zonal Railways.

(ii) The list of machineries given in Annexure "A" with quantity, make, model no., S.No., capacity, year of manufacture/commissioning, Machine number etc. preferably in a chart form as applicable must be a part of MOU.

(iii) The areas where in house hot dip galvanization facility is not permitted due to some government regulation/environment conditions, outsourcing of hot dip galvanization facility may be considered subjected to submission of undertaking by firm in this regard on non judicial stamp paper of appropriate value as applicable in concerned state, duly notarized and witnessed.

5.2 (a) Heat mark of the raw material shall be embossed on the bolt head, Apart from heat mark, length of bolt shall also be embossed on the bolt head, in addition to name of manufacturer and grade of bolt material. [Refer specification no BS-S- 7.5.3.1-5 Latest Version Available on RDSO Website]

(b) Preferably the heat mark of the raw material shall also be embossed on the nut and washers. [Refer specification no BS-S-7.5.3.1-5 Latest Version Available on RDSO Website]

5.3 Material to be procured and manufacturing process must meet the requirement of relevant specifications (Latest version).

6.0 Testing facilities required for manufacturing and supply of HSFG Bolts, Nuts & Washers for use in Railway Bridges, ROB & FOB.

6.1 Following machines/equipment shall be available with the manufacturer, as required in manufacturing of HSFG bolts as per EN 14399: (Provide quantity, make, model no., S.No., capacity, year of manufacture/commissioning, Machine number etc. preferably in a chart form as applicable).

- Microscope/Profile projector for threads laps.
- Spectroscope (For chemical composition testing)
- Hardness Tester
- Universal/Tensile testing machine
- Impact testing machine
- Microscope for measurement of decarburization
- Hardness testing and tempering furnace

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- Magna Flux for crack detection.
- Adequate no. of measuring instruments and gauges (Vernier calipers/Screw Gauges, Thread Plug Gauge, Thread Ring Gauge, Go-No-Go gauges).
- Elcometer.
- Torque Tester e.g. Electronic torque wrenches or click torque wrenches, or dial torque wrenches etc.

Note: Whenever inspecting authority advises for outside testing, the testing shall be done in NABL approved lab only.

6.2 The following requirements specified in 4.2 to 4.5 of EN 14399-1:2015, are assessed through the verification of the properties of the involved components and/or bolting assemblies, as applicable

SN	Type (bolting Assemblies)	Test procedure	Testing Apparatus	Result after testing
1	Angle to failure during tightening	Bolting assemblies shall be tested according to EN 14399-2:2015, 6.5, to evaluate the margin against over tightening.	Testing apparatus and set up shall be in accordance with EN 14399-2:2015, Clause 6.	The results shall meet the requirements specified in EN 14399-3, EN 14399-9 for the relevant type.
2	Axial load	Suitability for preloading of bolting assemblies shall be carried out in accordance with EN 14399-2:2015, Clause 6.	Testing apparatus and set up shall be in accordance with EN 14399-2:2015, Clause 6.	The results shall meet the requirements specified in EN 14399-3, for the relevant type.
3	Compression load (Bolting assembly with DTI)	Compression load testing of assemblies which include direct tension indicators shall be carried out in accordance with EN 14399-9:2009, 5.3.	Testing apparatus and set up shall be in accordance with EN 14399-9:2009, 5.3.	The results shall meet the requirements specified in EN 14399-9.

6.3 The following requirements specified EN 14399-1:2015 are assessed through the verification of the properties of the involved components and/or bolting assemblies, as applicable:

SN	Property class (bolting assemblies)	Test procedure	Testing Apparatus	Result after testing
1	Elongation (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.7.	Tensile test meter shall be in accordance with ISO 7500-1	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
2	Tensile strength (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.2 or 9.7.	Tensile test meter shall be in accordance with ISO 7500-1	The results shall meet the requirements specified in EN 14399-3, for the relevant

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				property class.
3	Strength under wedge loading (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.1.	Tensile test meter shall be in accordance with ISO 7500-1	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
4	Tensile yield strength (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.7.	Tensile test meter shall be in accordance with ISO 7500-1	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
5	Proof load (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.6.	Tensile test meter shall be in accordance with ISO 7500-1	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
6	Proof load (nuts)	Testing shall be carried out in accordance with EN ISO 898-2:2012, 9.1.	Tensile test meter shall be in accordance with ISO 7500-1, Class 1 or better	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
7	Impact strength (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.14.	Impact testing machine shall be in accordance with ISO 148-1	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
8	Hardness (bolts)	Testing shall be carried out in accordance with EN ISO 898-1:2013, 9.9.	Hardness tester shall be in accordance with ISO 6507-1, ISO 6506-1, ISO 6508-1.	The results shall meet the requirements specified in EN 14399-3, for the relevant property class.
9	Hardness (nuts)	Testing shall be carried out in accordance with EN ISO 898-2:2012, 9.2.	Hardness tester shall be in accordance with ISO 6507-1, ISO 6506-1, ISO 6508-1.	The results shall meet the requirements specified in EN 14399-3, for the relevant property class
10	Hardness (washers)	Testing shall be carried out in accordance with EN ISO 6507-1 or EN ISO 6508-1.	Hardness tester shall be in accordance with ISO 6507-1 or ISO 6508-1.	The results shall meet the requirements specified in EN 14399-5, or EN 14399-6.
11	Hardness (direct tension indicators and nut face washers)	Testing shall be carried out in accordance with EN ISO 6507-1.	Hardness tester shall be in accordance with ISO 6507-1.	The results shall meet the requirements specified in EN 14399-9.
12	Compression load (direct tension indicators)	Testing shall be carried out in accordance with EN14399-9:2009, Clause 3.4.	Testing shall be carried out in accordance with EN14399-9:2009, Clause 3.4.	The results shall meet the requirements specified in EN 14399-9 for the relevant property designation.

6.4 The manufacturer shall submit relevant documents related to compliance of testing equipment/ apparatus as per specification given in EN 14399 or referred specification.

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6.5 The chemical composition of materials used in manufacturing of HSFG bolting assemblies shall be in accordance to IS 898-1:2013, 6.

6.6 The HSFG bolting assemblies shall meet all the applicable mechanical and physical properties in accordance to IS 898-1:2013, 7.

7.0 Qualifying criterion:

Firm should have certified "Satisfactory Performance" of these Bolts from at least three past users at the time of application. Work against one PO shall be treated as one past user. Satisfactory Performance certificate issued by Government organizations, Public sector undertakings or corporations, Private companies having minimum annual turnover of Rs. 500 crores will only be considered valid for this requirement.

Note: (i) Previous experience shall be considered only for the works completed during the last five financial years and upto the date of application in the current financial year.

(ii) Performance certificate from private individuals can also be accepted provided the annual turnover for any year in last five years is more than 500 Crores. In support of this, the applicant has to submit necessary certificates e.g. audited balance sheets or CA certificate or Income tax returns.

8.0 Quality Assurance:

To ensure good and consistent quality of product, there shall be:

8.1 Assessment and Verification of Constancy of Performance (AVCP) shall be strictly followed in accordance to Clause 6 of EN 14399-1:2015.

8.2 Proper packing procedure to avoid corrosion during transportation and storage before actual use of HSFG bolts assembly is required. HSFG bolt, nut, plain washer and DTI washers should be assembled in manufacturer's premises and packed in carton box. Weight of each carton box shall not exceed 20 Kg. These carton boxes should be packed in wooden box and should be transported to site.

8.3 HSFG bolts, nuts, washers, and DTI shall cover tolerances on dimensions and shape as specified in Clause 4.4 of EN 14399-1:2015. It is relevant for the ability of components to be matched together in order to provide the declared performances of the bolting assemblies.

8.4 The number of samples of high-strength structural bolting assemblies for preloading to be tested and/or assessed shall be in accordance with Table 6 of EN 14399-1:2015. The results of the determination of the product-type shall be part of the test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the high-strength structural bolting assemblies for preloading to which they relate.

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- 8.5 All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.
- 8.6 All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use; wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures and the records retained for the period defined in the manufacturer's FPC procedures.
- 8.7 The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance.
- 8.8 Individual components of high-strength structural bolting assemblies as well as their packages shall be identifiable and traceable with regard to their manufacture (manufacturer's identification mark). The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes on labels and markings on high-strength structural bolting assemblies are inspected regularly.
- 8.9 A system should be in force for analysis of defects noticed during internal and external inspections of the final product and sub-assemblies. A dynamic arrangement for a feed back to the source of defects and for rectification should be in vogue. Performa which is being followed shall be enclosed.
- 9.0 Quality Audit:**
- 9.1 Quality Audit of the Registered Vendors will be done every five year.
- 9.2 The firm should satisfy the following requirements to continue as approved vendor
- The firm should continue to maintain the infrastructure, facilities and Machineries & plants as required at the time of Quality Audit as per prevailing STR.
 - The firm should have successfully executed/completed at least three works of Railway Bridge HSFG bolting assemblies with direct tension indicator washer. For the purpose of this clause, successful fabrication of at least one span against a multiple span will be considered/treated as completed work.
 - The firm should not have any adverse report from any of the Railways.
- 9.3 For Quality Audit, firm will be inspected for facilities provided as per para 4 to 8 of this STR, which in turn will be verified, after inspection by the RDSO team. The firm should also give an undertaking that organizational and infrastructural requirement as required at the time of Quality Audit have been maintained.
- 9.4 If the firm does not satisfy the criteria given in prevailing STR, its name will be removed from approved list and firm shall have to apply afresh in case it desires to be registered again.
- 10.0** Following specifications/codes (Latest version) commonly referred in connection with manufacturing of HSFG bolt must be available with manufacturer.

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EN 14399 with following parts

Part 1: General requirements

Part 2: Suitability of preloading

Part 3: System HR-Hexagon bolt and nut assemblies

Part 5: Plane washers

Part 6: Plain chamfered washers

Part 9: System HR or HV -Direct tension indicators for nut and bolt assemblies

Notes:- 1. The other specifications mentioned in above specifications are also to be adhered as detailed in the relevant specifications.

2. Above codes/documents are to be considered with latest correction slips/Versions in vogue.

11.0 RESPONSIBILITY AND AUTHORITY:

The following table indicates responsibility related to this document:-

Activity	Responsible	Approver	Supporting	Consulted	Informed
Creation, maintenance of this document	DBS-II/ Inspection	ED/B&S	DD Insp., ADE/Insp. and Staff of DD/Insp.	-	Through intranet/ soft copy.
Compliance of Directive contained in this document	ADE- I/B&S/ Insp./ DD/Insp.	DBS-II	Directorate staff	-	-
Requirement of Deviation from Directive	DBS-II	ED/B&S	DD/Insp., ADE/Insp.	-	Through intranet/soft copy

ABBREVIATION:

ED = Executive Director/B&S

DBS = Director/Joint Director(B&S)/Inspection

ADE/Insp. = Assistant design Engineer/Inspection

ADE = Assistant Design Engineer/Inspection

SE = Section Engineer/Inspection

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Annexure-A

REQUIREMENT OF ZINC FLAKE COATING FOR USE IN HIGH STRENGTH FRICTION GRIP (HSFG) BOLTS, NUTS & WASHERS FOR USE IN RAILWAY BRIDGES.

1. Scope:

This document covers the norms for minimum facility for any firm for manufacturing and supply of ZINC FLAKE COATING FOR USE IN HIGH STRENGTH FRICTION GRIP (HSFG) BOLTS, NUTS & WASHERS FOR USE IN RAILWAY BRIDGES.

2. The applying firm for registration of HSFG bolt assemblies must ensure that these facilities are available in premises in case if facilities are with applying firm. In case outsourced, then applying firm must ensure that these facilities are available with the outsourced agency.

3. The firm shall study this document carefully and will ensure availability of:

- (a) The required infrastructures, machinery & plant.
- (b) Space required for Coating/manufacturing, testing and storage viz. manufacturing floor, Godown, store, office and test lab etc.
- (c) Testing and measuring equipment duly calibrated.
- (d) Trained technical manpower.
- (e) Past Experience Criteria.
- (f) Quality Assurance Aspects.

4. General and Infrastructural Requirements: Detailed information with necessary documents in support is required for following items:-

- 4.1 The firm must have adequate organization including supervisors, skilled worker and other categories of manpower to execute the coating work in competent manner.
- 4.2 A proper organization must exist to perform the functions of purchasing of various raw materials, bought-out components, consumables etc. and for maintaining the purchasing documents including inspection certificates, test certificates etc.
- 4.3 A proper procedure for maintenance of records for receipt and consumption of raw material should be in vogue or developed.
- 4.4 Adequate power supply should be arranged through distribution agencies with back up through captive generation.
- 4.5 Cover bay area with proper handling facilities should be available to handle day-to-day use of zinc flake coating for use in High strength friction grip (HSFG) bolts, nuts & washers for use in Railway Bridges. The premises should have covered storage area to store raw material and finished products.

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- 4.6 Covered shed area protected from rain, dust etc. should be provided for surface preparation and coating. Adequate space for storage fabricated component awaiting painting shall be available.

Note: Following demarcated areas shall be available:

- (a) Covered bay area with proper handling facilities available to handle day-to-day coating.
 - (b) Area for storing raw material & finished products etc.
 - (c) Separated area for accepted and rejected material.
 - (d) Covered shed area protected from rain, dust etc, available for surface preparation and coating.
- 4.7 Firm should submit the details of equipments/machinery i.e. make, model, year of manufacture, machine no. etc. for Equipments and Machineries mentioned in Para 5 to 7 preferably in a chart form. This shall be part of MOU and must be ensured by applying firm for registration of HSFG bolting assemblies. (Machinery owned by sister concerns will not be accepted).
- 4.8 Firm must comply all environment clearance from Local/State/Central authority regarding operation of plant.
- 4.9 Firm should have duly trained and certified Operator from Coating Line Manufacturer.
- 4.10 Firm should be ISO: 9001:2015 or latest certified.
- 5.1 Facilities required for manufacturing and supply of Zinc flake coating for use in High strength friction grip (HSFG) bolts, nuts & washers for Bolts, Nuts & Washers for use in Railway Bridges.

Following machines/equipment shall be available with the firm for supply of Zinc flake coating for use in High strength friction grip (HSFG) bolts, nuts & washers for use in Railway Bridges (Provide quantity, make, model no., S.No., capacity, year of manufacture/commissioning, Machine number etc. preferably in a chart form as applicable):

5.1.1 Automatic or Semi automatic Cleaning/Degreasing line

The cleaning of HSFG Bolts, Nuts and Washers for use in Railway Bridges, ROB and FOB before Zinc flake Coating should be done by using the process as mentioned in Para 4.4 of ISO 10683-2018(Latest Version). The cleaning shall be done by Alkaline process. The firm should have adequate cleaning capacity to achieve desired output.

5.1.2 Shot Blasting Machine

For surface activation of HSFG Bolts, Nuts and Washer for use in Railway Bridges, ROB and FOB before Zinc Flake Coating shot blasting should be done using Stainless Steel shots. The Firm should have minimum one Shot blasting machines to reach shot type SS Shots with desirable shot size 250-750 μ m and Shot Blasting Time 15 \pm 5 minutes. The firm should have adequate capacity to achieve desired output.

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Document Title: SCHEDULE OF TECHNICAL REQUIREMENT FOR FABRICATION OF HIGH STRENGTH FRICTION GRIP BOLTING ASSEMBLIES WITH DIRECT TENSION INDICATOR WASHER (SUITABLE FOR PRELOADING) FOR USE IN RAILWAY BRIDGES, ROB & FOB.			

5.1.3 (i) Automatic Dip Spin Coating Machine with Conveyor Curing Furnace

The HSFG Bolts, Nuts and Washers for use in Railway Bridges, ROB and FOB must be coated using the automatic coating line with conveyor curing furnace. The Minimum required specifications of the Automatic Coating Line with Conveyor Curing furnace should have pre heating zone facility up to 150 °C and curing zone upto 350 °C. The facility should have coating cycle time of 3 minutes. And temperature controlling unit should be in range of ± 5 °C. The firm should have adequate capacity to achieve desired output.

(ii) Spray Coating Facilities

The firm should have coating facilities with spray method. An automatic or manual spray chamber with facility to transport the material for baking/curing process. The firm should have adequate capacity to achieve desired output.

5.1.4 Air Cooling Facilities

Air fans of adequate capacity should be there to achieve proper cooling.

5.3 Material to be procured and coating process must meet the requirement of relevant specifications (current version).

6.0 Testing facilities required for manufacturing and supply of Zinc flake coating for use in High strength friction grip (HSFG) bolts, nuts & washers for use in Railway Bridges

6.1 Following machines/equipment shall be available with the manufacturer, as required in supply of Zinc Coating per EN 10683 (Latest Version) : (Provide quantity, make, model no., S.No., capacity, year of manufacture/commissioning, Machine number etc. preferably in a chart form as applicable).

- Coating Thickness Gauge
- Salt Spray Chamber
- Thread Gauge (NOTE: Thread Gauges of the respective Bolts to be provided by the manufacturer)
- Digital pH meter
- Digital coating weight machine
- Lab Oven
- Hydrometer
- Adequate No. of measuring instruments and gauges (Verniercaliper, Screw Gauges)
- Thread Gauge (NOTE: Thread Gauges of the respective Bolts to be provided by the manufacturer in case material is sent to Job Coater With whom manufacturer has entered in MOU)
- Burette for titration to measure test concentration.
- Zhan cup viscosity meter

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- Adhesion Test tape
- Elcometer

The firm should have calibration certificate (Latest) of all testing machine.

7.0 Quality Assurance:

To ensure good and consistent quality of product, there shall be check in form of quality audit by applying firm from time to time:

- 7.1 All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.
- 7.2 All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use; wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures.
- 7.3 The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance.
- 7.4 A system should be in force for analysis of defects noticed during internal and external inspections of the final product and sub-assemblies. A dynamic arrangement for a feed back to the source of defects and for rectification should be in vogue. Performa which is being followed shall be enclosed.

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