

## Technical Specification

# Copper Antiseize coating specification for Invessel components

This document specifies the requirements for supply of copper Anti Seize Coating (ASC) on component threads which will be installed in the ITER Vacuum Vessel.

Approval Process			
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<i>Change Log</i>			
<b>Copper Antiseize coating specification for In vessel components (TLLFHC)</b>			
<i>Version</i>	<i>Latest Status</i>	<i>Issue Date</i>	<i>Description of Change</i>
v1.0	Signed	16 Feb 2017	
v2.0	Signed	31 Mar 2017	Modification requested by the reviewers were discussed and included as shown in the track change version which is attached. New version was sent to reviewers prior to uploaded in IDM.
v3.0	Approved	03 May 2017	Corrected typos Double reference removed Corrected reference AD3 Updated ASTM standard version Modified the referenced paragraph in the text Added metallography as the reference thickness characterization Adding standard reference to material definition Added in vessel other items in the scope Remove the repetitions of in vessel items in the text Replace bolt by component Replaced reference to AD7 by AD 5 inspection in Chapter 5 Added surface corrosion & chock prevention for the packaging Specified average thickness
v4.0	Approved	15 Dec 2021	Specification has been revisited base on industrial standards for cooper plating coating ISO 4042 and ISO 1456  Specification has been created using the DOORS

## Table of Contents

<b>1</b>	<b>SCOPE.....</b>	<b>2</b>
<b>2</b>	<b>INTRODUCTION .....</b>	<b>2</b>
<b>3</b>	<b>REFERENCED/APPLICABLE DOCUMENTS .....</b>	<b>2</b>
<b>4</b>	<b>DEFINITION OF COMPONENT CLASS .....</b>	<b>2</b>
<b>5</b>	<b>ANTI-SEIZE COATING (ASC) REQUIREMENTS .....</b>	<b>3</b>
<b>6</b>	<b>QUALITY ASSURANCE .....</b>	<b>3</b>
6.1	QUALITY ASSURANCE REQUIREMENTS.....	3
6.2	PROCEDURAL COMPLIANCE.....	4
<b>7</b>	<b>RECEIPT AND INITIAL INSPECTION OF COMPONENTS.....</b>	<b>4</b>
<b>8</b>	<b>ADDITIONAL QUALITY CONTROL .....</b>	<b>4</b>
<b>9</b>	<b>CLEANING.....</b>	<b>4</b>
<b>10</b>	<b>PACKAGING &amp; HANDLING .....</b>	<b>4</b>
<b>11</b>	<b>DOCUMENTATION .....</b>	<b>5</b>
11.1	DELIVERABLE DOCUMENTATION.....	5
11.2	ACCEPTANCE.....	5
<b>12</b>	<b>REQUIREMENTS PROVIDED FOR COATING SUPPLIER FOR INFORMATION (FASTENER SUPPLIER RESPONSIBILITY TO DEFINE FOR ASC COATING).....</b>	<b>6</b>
12.1	APPLICABILITY .....	6
12.2	QUALITY CONTROL REQUIREMENTS.....	6
12.3	CONTROL POINTS .....	6

## 1 SCOPE

[I] This document specifies the requirements for the application of copper Anti Seize Coating (ASC) on components (bolts, nuts, inserts & other items) which will be installed in the ITER Vacuum Vessel.

## 2 INTRODUCTION

[II] Fastener loads for the in vessel components are high and require the use of similar mating materials for bolts & nuts. ASC is required on threaded components to ensure assembly/disassembly by preventing seizing of parts.

[16TS-CuASC-173-R] The Application of the ASC shall be performed according to European standard ISO 4042 [AD1](#).

[II] An additional set of requirements are described in section 12 for information. These requirements are formally defined in technical specifications for procurement of ITER components and intended to ensure compatibility with the ITER Vacuum Handbook [AD3](#) and Quality control.

## 3 REFERENCED/APPLICABLE DOCUMENTS

[II] The following Codes and Standards shall be referred:

	Description	Reference
AD1	Fasteners — Electroplated coatings	ISO 4042
AD2	Metallic and other inorganic coatings — Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium	ISO 1456
AD3	ITER Vacuum Handbook (IVH)	ITER_D_2EZ9UM
AD4	IVH Appendix 4 (Accepted fluids)	ITER_D_2ELN8N
AD5	IVH Appendix 13 (cleaning)	ITER_D_2ELUQH
AD6	ITER Procurement Quality Requirements	ITER_D_22MFG4
AD7	Requirements for Producing a Quality Plan	ITER_D_22MFMW
AD8	Procedure for the management of Deviation Request	ITER_D_2LZJHB
AD9	Procedure for Management of Nonconformities	ITER_D_22F53X
RD1	Quality Classification Determination	ITER_D_24VQES
RD2	IVH Appendix 15 (baking)	ITER_D_2DU65F

## 4 DEFINITION OF COMPONENT CLASS

[II] ITER In-vessel fasteners are defined as:

1. Vacuum Quality Class (VQC) - 1B in accordance with [AD3](#)
2. Quality Class 1 in accordance with [RD1](#)

## 5 ANTI-SEIZE COATING (ASC) REQUIREMENTS

[16TS-CuASC-95-R] The component shall be coated with copper by the process of electrodeposition (electroplating) in accordance with ISO 4042.

[16TS-CuASC-96-R] The copper shall have a purity of >99.9%

[16TS-CuASC-168-R] Copper purity shall be validated by Material certification in accordance with EN 10204 3.1 and provided for each coating batch.

[16TS-CuASC-103-R] The minimum copper coating thickness shall be 5 micron, maximum coating thickness including the sublayer shall be as per reference [AD1](#).

[16TS-CuASC-169-R] Coating thickness on each part/batch shall be measured to confirm achievement of the requirement

[16TS-CuASC-170-R] All Coating fluids and materials using for the process shall be in accordance with VHB accepted materials [AD3 #AD3](#), [AD4 #AD4](#), [AD5](#)

[16TS-CuASC-171-R] Coating adhesion shall be in accordance with paragraph 6.4 of [AD2](#)

[16TS-CuASC-172-R] Coating appearance shall be in accordance with paragraph 6.1 of [AD2](#)

[16TS-CuASC-91-R] All components surfaces marked as uncoated on the detailed drawings shall be masked or not wetted, to avoid any copper deposition.

[16TS-CuASC-92-R] The masking product shall be in accordance with the Vacuum Handbook Accepted materials [AD3 #AD3](#), [AD4 #AD4](#), [AD5](#).

[I] NOTE: Solderability and stress relief requirements are not applicable to the ASC

## 6 QUALITY ASSURANCE

### 6.1 Quality Assurance Requirements

[16TS-CuASC-68-R] The coating supplier's quality management system shall be certified to ISO 9001: 2015 or equivalent standard.

[I] The general requirements are addressed in ITER Procurement Quality Requirements [AD6](#).

[16TS-CuASC-186-R] Prior to commencement of the contract, a Quality Plan (QP) should be submitted for IO approval in accordance with Procurement Requirements for Producing a Quality Plan [AD7](#). The QP should describe the organization for the contract; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities.

[I] All requirements of this Technical Specification and subsequent changes proposed by the Contractor during the execution of the Contract are subject to the Deviation Request process described in Procedure for the management of Deviation Request [AD8](#). When a non-conformance is identified, the contractor are subject to the Non-conformance Report process describe in Procedure for management of Nonconformities [AD9](#).

[I] Documentation developed as the result of the contract should be retained by the performer for a minimum of 5 years and then may be discarded at the direction of the IO.

## 6.2 Procedural compliance

[16TS-CuASC-77-R] The supplier shall submit the coating procedure to IO for approval after an assessment that all aspects of processing are covered by appropriate QA documentation and Quality Control (QC) procedures.

## 7 RECEIPT AND INITIAL INSPECTION OF COMPONENTS

[16TS-CuASC-83-R] Upon receipt of components by the coating supplier, the condition of the packaging, desiccant (if present) and humidity indicator (if present) shall be recorded.

[16TS-CuASC-155-R] The packages shall be stored in a dry, secure area until the components are required for inspection.

[16TS-CuASC-84-R] The components shall be visually inspected on a statistical basis (10% random sampling of the complete delivery). This initial incoming inspection shall look for signs of damages (indentation, scratches cracks etc) or contamination on the surfaces to be coated. The Inspection plan should be delivered to the fastener or component supplier. A report shall be issued describing inspection and results. This constitutes a Hold Point.

## 8 ADDITIONAL QUALITY CONTROL

[16TS-CuASC-115-R] Thread shall be controlled with GO/NO-GO gauges as required in reference [AD1](#).

## 9 CLEANING

[16TS-CuASC-126-R] Following the coating process all components should be cleaned in conformance with IO requirements [AD3 #AD3](#), [AD4 #AD4](#), [AD5](#).

## 10 PACKAGING & HANDLING

[16TS-CuASC-129-R] The coating supplier shall provide details of how their products should be stored and handled.

[16TS-CuASC-130-R] The storage and packaging shall prevent any oxidation of the coated surface.

[16TS-CuASC-131-R] The packaging shall prevent any surface damages resulting from handling or transportation.

## 11 DOCUMENTATION

### 11.1 Deliverable Documentation

**[16TS-CuASC-140-R]** The Copper-coating supplier shall issue a certificate of conformance with each batch of coated components released including following information:

- Identification of Supplier.
- Certificates of used material
- Calibration certificate of measurement equipment
- Batch number
- Results of all analysis and inspections that is performed according to this specification.
- List of used fluids and liquids
- Solvent type
- Solvent temperature,
- Cleaning duration,
- Time and date of cleaning operation;
- Cleaning operator

### 11.2 Acceptance

**[16TS-CuASC-142-R]** Documentation shall be provided prior to delivery. Material and certification shall be in compliance with this specification. Material cannot be accepted if they do not comply with this specification.

**[I]** All documents shall be in the English language and all measures shall be given in the metric system SI.

**[I]** Each document shall be provided as an electronic file in both PDF and doc format.

## **12 REQUIREMENTS PROVIDED FOR COATING SUPPLIER FOR INFORMATION (FASTENER SUPPLIER RESPONSIBILITY TO DEFINE FOR ASC COATING)**

### **12.1 Applicability**

[I] These requirements are formally defined in technical specifications for procurement of ITER components and intended to ensure compatibility with the ITER Vacuum Handbook and Quality control.

The responsibility for implementation of these requirements shall be specified by the component supplier.

These typically include quality control, production and validation requirements.

- Quality Control points to be made during the activities, these can include Hold points, notification Points, Authority to proceed Points.
- Receipt and initial inspection of components
- Qualification program
- Acceptance of processes

### **12.2 Quality Control Requirements**

[I] The supplier should provide a Quality Plan for IO formal approval prior any activities.

[I] A Manufacturing and Inspection plan (MIP) shall be provided for each batch of coatings.

### **12.3 Control Points**

[I] Control points will be defined by the fastener supplier for the scope of work for the ASC coating.

Some Hold Points (HP) will be required for the activities identified in this specification. A Hold Point (HP) is a milestone where the Supplier is required to notify the IO, that it has completed a specific task or a specific deliverable and must stop the associated processes until a HP Clearance is issued. The HP Clearance shall be issued on the basis of clearly identified Quality Control data and acceptance test results to be provided to the IO at the time of the request. The IO shall have a maximum of 10 working days to review the Suppliers' justification documentation in support of releasing the HP and to confirm or reject it. In case of clearance, the Supplier shall resume its activity. In case of rejection, the Supplier shall develop a recovery plan that shall be submitted and reviewed by the IO within 10 working days of submission.