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TYPE: QUALITY ASSURANCE	PAGE NO. 1 OF 12
	SPECIFICATION NO. TIG Q-023
TITLE: FLOW DOWN OF GENERAL AND CUSTOMER QUALITY SYSTEM REQUIREMENTS FOR SUPPLIERS OF PRODUCTS AND SERVICES	DATE ISSUED: 4/24/2018
	DATE REVISED: NEW

1.0 PURPOSE:

This procedure provides a method for flowing Ti Group and/or customer and general quality requirements to suppliers. It is Supplier's responsibility to ensure implementation of these requirements within its organization and flow-down to their sub tier suppliers.

2.0 APPLICATION:

Purchase orders/Conversion releases issued to all TI Group suppliers shall contain Code 01, where applicable. Class V suppliers are exempt from this requirement. These may contain additional codes listing other requirements that apply.

3.0 RESPONSIBILITY:

3.1 The Quality system requirements for the supplier will be identified in Code 01 for that supplier on the TIG Q-023 Matrix.

3.2 The Arconic Responsible User is responsible for the flow down of TI Group and/or customer requirements defined by this procedure. At the time of issuance of the purchase order/conversion release the applicable codes and descriptions shall be added.

3.3 By accepting the purchase order, the supplier/contractor shall also be indicating that they accept all identified flow downs.

3.4 The supplier is responsible for meeting the Quality Management System requirements identified by Code 01. The supplier shall also be responsible for meeting any additional requirements identified by code on the purchase order.

3.4.1 Control of Nonconforming Product

3.4.1.1 For nonconformities detected at the supplier facility, the supplier shall:

- Complete a rejection report / deviation request
- Forward the rejection report / deviation request to the ARCONIC quality assurance representative for disposition.

3.4.1.2 For nonconformity detected by the Supplier on a product already delivered, the Supplier shall promptly notify ARCONIC via a disclosure letter to the ARCONIC quality assurance and procurement representative. The Disclosure letter shall include as a minimum:

- Affected material identification including part number(s) along with traceability number, quantity delivered and date delivered
- A clear description of the nonconformity
- Potential impact, if known
- Inspection procedure along with acceptance criteria, as required

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- Instructions for the disposal of retrieved nonconforming items.

3.4.2 The supplier shall be responsible for ensuring that their personnel are aware of their contribution to product or service conformity, contribution to product safety and importance of ethical behavior.

3.5 It is the Supplier's responsibility to understand and comply with all clauses, terms and conditions specified within a contract, a purchase order, and with all other applicable requirements. Failure to do so may result in product rejection and may affect the Supplier's status and expose them to monetary penalties.

3.5.1 A supplier may be charged back for all costs incurred by ARCONIC due to Supplier noncompliance to any applicable requirement.

3.6 Suppliers shall not guess or interpret requirements including but not limited to drawing / model, specification, or condition of supply if conflict or confusion exists. Contact the assigned Quality Assurance representative to initiate the process of clarification.

3.7 The ARCONIC procurement representative is the only authorized person to issue or revise purchase orders.

4.0 Order of Precedence

The requirements specified in this specification are intended to be complementary to ARCONIC, end user, and industry specifications, as well as all other requirements which may be applicable, including any Legal, regulatory or administrative requirements.

In the case where requirements of this specification are in conflict with the requirements of end user specifications, industry specifications, or engineering drawing / models, the latter requirements will take the following precedence:

- 1) Procuring document (purchase order),
- 2) Applicable engineering documents (condition of supply)
- 3) Associated process specifications, and
- 4) Other referenced specifications.

Contact the ARCONIC procurement representative for further information and to advise him or her that such a conflict exists.

By issuing this document, ARCONIC in no way represents, warrants or guarantees that the supplier, by complying with all the requirements herein contained, complies with all requirements.

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5.0 FLOWDOWN:

5.1 Characteristic Flow down

Where a special requirement or a critical characteristic is to be flowed down to a Subcontractor, the characteristic shall be documented on the Conversion Release/Purchase Order. A complete description of the requirement or characteristic and what is expected from the subcontractor shall be detailed.

5.2 System Flow downs

In addition to "Code 01", Ti Group shall also flow down Quality System Requirements to the extent necessary to ensure that characteristics not verifiable upon receipt are adequately controlled by the subcontractor. Again this shall be done via the Conversion Release/Purchase Order.

5.3 Responsibility

Purchasing, Conversion, and Quality Assurance will be responsible for the administration.

6.0 ARCONIC Supplier Approvals

6.1 All suppliers of critical to quality products and services must be first approved by ARCONIC. This approval can only be granted by the ARCONIC Quality Assurance and Procurement Departments.

6.2 Under no circumstances can a supplier sub contract any work without the express approval of the ARCONIC Quality Assurance and Procurement Departments.

6.3 All suppliers after initial approval are subject to periodic evaluation based on the following:

6.3.1 Supplier performance will be graded based on the following minimum requirements:

6.3.1.1 On time delivery performance: Target $\geq 90\%$

6.3.1.2 Product quality performance: Target $\geq 90\%$ non defective

6.3.1.3 Accuracy of required documentation: Target 100% deliveries with complete and accurate documentation.

6.3.1.4 Performance to corrective and/or preventative actions issued to the supplier.

6.3.2 Changes to suppliers manufacturing or processing capability.

6.3.3 Periodic audit.

6.4 Unsatisfactory performance to any item in section 7.3 will result in a SCAR and could be cause for approval to be revoked, suspended, or limited, at the sole discretion of ARCONIC Quality Assurance and Procurement Departments.

6.4.1 Limits placed on a supplier may include but are not limited to the following:

6.4.1.1 Suppliers may be placed on probation. Probation status requires the supplier to submit a Corrective Action Plan within 14 days.

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- 6.4.1.2 Obtaining source inspection from ARCONIC Quality Assurance at the suppliers expense
- 6.4.1.3 Reimbursing ARCONIC for reasonable costs incurred at the point of manufacture (i.e. Supplier site) to verify product conformance
- 6.4.1.4 Reimburse ARCONIC for reasonable costs incurred by ARCONIC at the point of receipt to verify product conformance.

7.0 Second & Third Party Approvals

7.1 Where required the supplier shall obtain and maintain certifications as directed by ARCONIC.

7.1.1 Required third party certifications by the ARCONIC may include but are not limited to the following:

- 7.1.1.1 ISO 9001
- 7.1.1.2 AS 9100
- 7.1.1.3 NADCAP Approval for special processes

7.1.2 At the sole discretion of ARCONIC, suppliers who do not have the required third party certifications may be audited by ARCONIC to the applicable requirements and approved upon recommendation of an ARCONIC Approved Lead Auditor.

7.1.3 OEM / End user approvals (second party approval).

8.0 ARCONIC Source Inspection

8.1 Source Inspection can be imposed on a Supplier as decided by ARCONIC Quality Assurance for various reasons and is not to be construed as punitive. Source Inspection criteria include but are not limited to:

- 8.1.1 Part of new supplier qualification
- 8.1.2 Poor quality or delivery performance

8.2 Source inspection can include required observation of processing, verification of finished material, or additional inspection requirements.

8.3 Specific requirements will be communicated to suppliers via the purchase order, condition of supply documents, or additional specification requirements.

9.0 Foreign Object Damage (FOD) Prevention

9.1 All suppliers are required to prevent foreign objects from contaminating material(s).

9.2 Where required specific FOD requirements will be communicated to suppliers via the purchase order, condition of supply documents, or additional specification requirements.

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10.0 Change to Supplier's Organization

Supplier shall notify ARCONIC of any changes in its organization affecting manufacturing site location, manufacturing processes, certification status, approved Sub-tier suppliers and subcontractors or other pertinent ARCONIC changes that could affect the product. Written notification of changes shall be sent to ARCONIC quality assurance and procurement representative prior to implementation. Supplier will describe the nature of the change, including justification, scheduled date and point of incorporation and impact on manufacturing and logistics concerns.

11.0 No Change Clause

Supplier shall make no change in manufacturing processes or source of supply without express consent of the ARCONIC quality assurance and procurement department. This requirement is also to be flowed down through Supplier Supply Chain.

12.0 Right of Access

The Supplier shall grant access to ARCONIC, ARCONIC customers, or any applicable government or regulatory agency to any areas and/or records that are part of work performed under an ARCONIC purchase order.

13.0 Control of Records

13.1 Quality and supplier records relevant to the products and services provided shall be kept for a minimum of ten years after delivery of the last item on a purchase order and shall not be destroyed unless written approval is obtained from ARCONIC procurement.

13.1.1 Additional ARCONIC purchase specifications may impose stricter record retention requirements.

13.2 Records/data stored by electronic means shall have a secure backup system.

14.0 Identification and Traceability

14.1 All material shall be identified in accordance with applicable purchase order requirements, specification requirements, drawing requirements, and contractual requirements.

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15.0 ARCONIC Property

- 15.1 ARCONIC may provide to Supplier, raw material, Conversion material, and tools, etc. These supplied goods shall be subject to receiving inspection in accordance with Supplier's procedures.
- 15.2 Supplier shall report in writing, via rejection report any non-conformance related to received goods.
- 15.3 ARCONIC supplied goods shall be stored in a segregated area to prevent unauthorized used and adequately protected against damage and degradation.

16.0 Preservation of Product

- 16.1 Packaging shall be done in accordance with the engineering drawings, specifications, condition of supply, and / or as specified on the purchase order. In all circumstances, the guidelines of ASTM-D3951 apply in order to prevent physical, contamination and corrosion damage in transit.
- 16.2 Supplier shall pack the products to prevent damage and deterioration taking into account method of shipment, location of shipment and destination of receipt, as well as time associated with shipment.
- 16.3 Product received from the Supplier in a damaged condition due to improper packaging or showing evidence of rust or surface corrosion will be rejected.
- 16.4 Product with shelf life shall not have more than 25% of the life elapsed at time of receipt at ARCONIC.

17.0 Prevention of Counterfeit Parts

- 17.1 The supplier shall plan, implement, and control processes, appropriate to the products and services provided, for the prevention of counterfeit or suspect counterfeit part use and their inclusion in product(s) delivered to ARCONIC.

18.0 Country of Origin

- 18.1 If requested, supplier shall disclose to ARCONIC, on an annual basis, on conflict minerals reporting template, if any material contains tin, tantalum, tungsten or gold ("3TGs") that is necessary to the functionality or production of such material manufactured by you or supplied by you to ARCONIC and to use commercially reasonable efforts to conduct a reasonable country of origin inquiry to determine the country of origin of such 3TGs. Supplier further agrees to provide any additional documentation requested by RTI to ensure compliance with Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (the "Act").

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18.2 If supplier identifies that the country of origin of the 3TGs is the Democratic Republic of the Congo or its adjoining countries, Angola, Burundi, Central African Republic, the Republic of the Congo, Rwanda, South Sudan, Tanzania, Uganda, and Zambia, then it shall use commercially reasonable efforts to conduct, and assist ARCONIC in conducting, due diligence on the chain of custody of the source of the 3TGs for the purpose of identifying the smelter of those 3TGs. In addition, supplier agrees to require of its lower tier sellers this same obligation.

19.0 CODES

19.1 The "Supplier Requirements Matrix" details codes, which may be flowed down are shown on the subsequent pages.

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ARCONIC AES TI Group. - SUPPLIER REQUIREMENTS MATRIX		
Specification No. Q-023		
CODE	SUBJECT	REQUIREMENT
*01	Quality System Requirements	<p>1) The supplier is responsible for meeting all requirements of specifications, drawings, and other purchase order instructions relating to the following:</p> <ul style="list-style-type: none"> - Requirements for approval of product or process - Personnel qualifications - Requirements for inspection, testing and certification - Release of products and services <p>2) Supplier record procedure shall include what production records, test records and test samples are kept, and where the records and test samples are stored for final retention. Supplier record procedure shall include the minimum time each record and test sample are kept. Procedures for record retention must be approved by ARCONIC purchasing location.</p> <p>3) The supplier shall notify ARCONIC purchasing location of any change in product and/or process definition. If fixed practices are in place approval of any product and/or process changes must be granted in writing by ARCONIC purchasing location prior to making the change.</p> <p>4) All requirements of Q-023 and the purchase order must be flowed down to any sub-tier supplier.</p> <p>5) If, in the event that during the P.O. review the Sub-tier determines that the requirements of the P.O. or specification cannot be met, the Sub-tier must: (1) notify ARCONIC purchasing location and, (2) prior to processing obtain revised P.O. and/or instructions, in writing, stating services to be performed that are within capabilities of the Sub-tier.</p> <p>6) The supplier must notify ARCONIC in writing, using Form 4252 or other applicable deviation request form of any nonconforming material.</p> <p>7) For purchased products or services, ARCONIC purchasing location must issue in writing approval to ship any nonconforming material.</p> <p>8) The supplier shall allow right of access by ARCONIC, its customers, and all appropriate regulatory or governmental authorities shall have the right to enter supplier's facility at reasonable times to inspect the facility, goods, materials, applicable records, and any property of Purchaser covered by this order.</p> <p>9) The supplier shall plan, implement, and control processes, appropriate to the products and services provided, for the prevention of counterfeit or suspect counterfeit part use and their inclusion in product(s) delivered to ARCONIC</p>
02	Gage & Instrument Calibration	<p>A. Gage and instrument calibration procedures and system must conform to ISO-10012 & ISO/IEC 17025.</p> <p>B. The Vendor shall have a calibration procedure system that meets ISO-10012 specification for all process control equipment and recording instruments.</p>
03	Raw Material Certification	Certifications shall state "This material was produced by the process approved by ARCONIC".
04	100% Dimensional Inspection	100% dimensional inspection required unless your sampling plan has been approved, in writing, by ARCONIC purchasing location Quality Assurance. Copies of the inspection reports shall be submitted with each shipment.
05	First Article Inspection	First Article Inspection shall be performed in accordance with the latest revision of AS 9102.
06	Nonconformances	<p>If at any time the Sub-tier detects a process violation, purchase order noncompliance, raw material nonconformance or part nonconformance, ARCONIC purchasing location shall be informed as soon as practicable. Nonconforming material or parts shall be segregated and tagged as nonconforming. Tags shall indicate the nature of the nonconformance. Root cause & corrective action shall be determined and submitted within 10 working days of detection of the nonconformance unless otherwise agreed upon by ARCONIC purchasing location Quality Assurance.</p> <p>NOTE: Critical nonconformance must be addressed within 48 hours when so directed by ARCONIC purchasing location Quality Assurance. ARCONIC disposition shall be obtained prior to release.</p>
07	Software Quality Assurance	Subcontractor's Software Quality Assurance System shall have approval of the ARCONIC purchasing location Quality Assurance
08	Heat Treatment/Instrumentation	Titanium subcontractor must comply with and certify to the current revision of AMS H-81200 and AMS 2750. The heat treatment suppliers must be NADCAP certified.
09	Customer Source Inspection	ARCONIC inspection/witness is required on this purchase order. Contact ARCONIC purchasing location five (5) working days prior to performing services as required by the purchase order to arrange for source inspection/witness of operations or as required by P.O. or conversion release.
10	RTI Customer Source Insp.	ARCONIC's customer source inspection/witness is required on this P.O. Contact five (5) working days prior to performing services as required by this P.O. to arrange for source inspection/witness of operations or as required by P.O. or conversion release.
11	Obsolete	Obsolete
12	Raw Material Inspection	100% inspection required unless your inspection sampling plan has been approved by ARCONIC purchasing location Quality Assurance. Copies of the inspection reports shall be submitted with each shipment.
13	Approving & Implementing Specs. & Operating Procedures	<p>A. Supplier procedure for approving and implementing specifications and operating procedures shall include how all changes or additions are documented and controlled.</p> <p>B. Supplier procedure shall include how old specifications and operating procedures are removed from service and how new ones are put in service.</p> <p>C. Supplier procedure shall include how ARCONIC is notified of all significant changes in the processing of the material.</p>

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1000 Warren Avenue
Niles, Ohio 44446



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14	Obsolete	Obsolete
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ARCONIC AES TI Group. - SUPPLIER REQUIREMENTS MATRIX		
Specification No. Q-023		
CODE	SUBJECT	REQUIREMENT
15	Approving & Disqualifying Suppliers	A. The Vendor shall maintain a list of approved suppliers B. The Vendor shall have a procedure for approving all suppliers C. The Vendor shall have a procedure for disqualifying and requalifying suppliers
16	Procedure for Certification of Raw Material	A. Supplier procedure shall include how production and test records are reviewed prior to the material being shipped. B. Supplier procedure shall include how the certification is reviewed to insure all the required information is included. C. Supplier procedure shall include who is authorized to approve the material for shipment and to sign the certification.
17	First Time Raw Material Inspection	A. The First Time Raw Material Inspection Report shall contain all applicable characteristics required by the P.O. and/or the purchase specification. The report shall be dated and signed by the person performing the inspection and testing, and shall be verified by another person. The first time raw material shall be tagged, "First Time Raw Material". B. The first Raw Material Report shall be approved by a RTI representative prior to the vendor becoming an approved supplier of the raw material. A copy of the First Time Raw Material Report shall be forwarded to RTI Quality Assurance when the finished material is shipped.
18	Statistical Process Control	A. The Vendor shall have a statistical quality control procedure approved by ARCONIC B. The object of the statistical process control procedure is to continually reduce variation in the process. A CPK of 1.33 is considered the minimum acceptable level for any key characteristic of the material. C. Where SPC is required, copies of control charts, the control plan, and supporting documentation shall be available upon request.
19	Test Laboratory Control	The Vendor shall have a test laboratory or use a test laboratory that is NADCAP approved.
20	Calibration Procedure	The Vendor shall have a calibration procedure and system that meets ISO-10012 & ISO/IEC 17025 specifications for all process control equipment and recording instruments.
21	Corrective Actions	The Vendor shall have a Corrective Action procedure and system which shall be to identify and correct out of control situations and to improve process capability.
22	In-Process Audits	A. The Vendor shall monitor the effectiveness of their process by conducting periodic audits. B. The audit procedure and schedule shall be approved by executive management to assure independence and to establish the effectiveness of the system.
23	Buyer Evaluation	ARCONIC's customer has the right of access to Sub-tier facilities when accompanied by ARCONIC personnel.
24	Source Verification by Customer	Where specified in the contract, ARCONIC's customer or his representative shall be afforded the right to verify at source or upon receipt that purchased product conforms to specified requirements. Verification by the customer shall not absolve the Supplier of the responsibility to provide acceptable product nor shall it preclude subsequent rejection.
25	Customer Verification Limitation	When ARCONIC's customer or his representative elects to carry out verification at the sub-contractor's plant, such verification shall not be used by the Supplier as evidence of effective control of quality by the sub-contractor.
26	Quality Plan	A quality plan shall be prepared and submitted for ARCONIC's approval. Once developed, any deviation from the plan must be reported immediately to ARCONIC.
27	RTI Observation	A. ARCONIC observation required - processing shall not take place unless observed by a qualified ARCONIC employee. B. ARCONIC source inspection required.
28	Lab - Rolls Royce Approval	Laboratory shall be approved by Rolls Royce before laboratory work is performed.
29	Lab - Pratt & Whitney Approval	Laboratory shall be approved by Pratt & Whitney before laboratory work is performed.
30	ASTM	All testing shall be in accordance with applicable ASTM specification
31	Tensile Test	Tensile testing must be conducted at a strain rate of .065 in./in. minimum +/- .002 in./in. through yield with target rate being .003.
32	Calibration Procedures	Written calibration procedures must be sent to RTI for all equipment or gages that are calibrated under this order. Any revision or change in procedure must be approved by ARCONIC Quality Assurance.
33	As Found - As Left	All calibration shall be conducted in accordance with the latest revision of ISO-10012 & ISO/IEC 17025, including "As Found" and "As Left" conditions.
34	Method of Calibration - ASTM	Method of calibration shall be in accordance with the latest revision of all applicable ASTM specifications including but not limited to, the following:
35	Calibration Traceability	All verification devices and/or standards utilized shall be traceable to N.I.S.T. and a copy of the certification shall be provided to RTI with calibration documentation.
36	Standards Change	Changes or revisions of industry standards shall be the responsibility of the company performing the calibration.
37	Subcontracting	No work shall be subcontracted without the prior written approval of ARCONIC TI Group.
38	Metal Assessment	Must certify that material supplied is free from radioactive contamination. Radioactivity is defined as 0.19 uSv (microsieverts) and above. Background levels in the United States range from 0.05 to 0.15 uSv.

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ARCONIC AES TI Group. - SUPPLIER REQUIREMENTS MATRIX		
Specification No. Q-023		
CODE	SUBJECT	REQUIREMENT
39	Quality Manual	Quality Manual must be in English
40	Acceptance Sampling	Where acceptance sampling is performed and the customer prior approval of the sampling plan, the plan shall be submitted to ARCONIC for customer approval.
41	Personnel Qualification	Personnel shall be qualified to Special Processes in accordance with appropriate specifications and industry standards. Evidence of qualification shall be provided.
42	Changes	ARCONIC shall be notified in advance of changes in product/process definition and obtain written approval.
43	Right of Access	ARCONIC, ARCONIC's customers and Regulatory authorities shall have the right of access to all facilities involved in the order and to all applicable records.
44	Audit	Annual audit required.
45	Flowdown	Supplier must flow down to sub-tier suppliers the applicable requirements in the purchasing documents, including key characteristics where required.
46	Domestically Melted Material	Material must be melted domestically, and certification must state that material has been melted in the United States.
47	GE Lab Approval	The vendor shall have a test laboratory or use a test laboratory that is GE S400 approved.
48	Foreign Object Debris/Damage (FOD) Prevention	The vendor shall maintain a FOD prevention program that, at a minimum, contain the following elements: Design and/or Manufacturing Process Review, Performance Measurement, Training, Material Handling and Parts Protection, Housekeeping, Tool Accountability, Hardware Accountability, Lost Items, Physical Entry Control into FOD Critical Areas, and FOD Focal Point(s).
49	Minimum Requirements for Purchased Type K, N, and S Thermocouples	<ol style="list-style-type: none"> 1. All type K and N thermocouples will be fabricated from special limits of error thermocouple wire, and all type S thermocouples will be fabricated from reference grade thermocouple wire. 2. All thermocouples will have their manufacturer's name or logo, calibration ID, and spool sequence number permanently marked on the thermocouple connector. 3. Certifications will be provided for all purchased thermocouples. 4. The thermocouple certification will include the front, back, and average corrections for all tested temperatures. 5. All type K, N, and S thermocouples will be tested from 400° F thru 2200° F at 200° F intervals. 6. All type K and N thermocouples will have a front and back correction of less than the greater of +/- 2° F or +/- 0.4% of the tested temperature. 7. All type K and N thermocouples will have a difference between the front and back corrections of less than 2° F. 8. All type S thermocouples will have a front and back correction of less than the greater of +/- 1° F or +/- 0.1% of the tested temperature. 9. All type S thermocouples will have a difference between the front and back corrections of less than 1° F.

Note: **When ARCONIC is referenced, it refers to one of the following companies that issued the Purchase Order/Conversion Release.**

ARCONIC AES Niles
ARCONIC AES Alloys
ARCONIC AES Martinsville

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ARCONIC RMI Titanium Group
 1000 Warren Avenue
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Approved by:



R Jarvis, Management Representative
Titanium Group

4/25/18
Date



Ryan Behenna, VP Melt & Mill Segment - AES

4/25/18
Date



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CHANGE HISTORY:

Newly issued TI Group specification dated 4/24/2017. M Orologas.

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