1. SCOPE

This document defines technical requirements for condition of supply 6Al-4V ELI TITANIUM ALLOY INGOT dedicated to the aeronautic and medical industries.

2. SUMMARY OF CHANGES

Revision	Date	Changes
A 00	19 July 2011	Creation
A 01	8 August 2011	Width tolerance; sampling
A 02	7 October 2011	Corrected typo in Al% max (6,50 and not 6,30%)
B 00	June 15th, 2012	§4: Traceability requirement. Changed "critical parameter" by "key parameter". Add the date or issue/version of all the requirements. §5: Add STMU M01 for surface and preparation of ingot before delivery. Precisions for minimum size for the samples §6: Precisions for the identification and marking ingot requirements to take in consideration UKTMP comments and proposals given to the phone meeting performed in April 17th, 2012. §7: New title for §7 "certificate of conformance" and link between certificate and concession request. Add the N° of VAR used in the certificate §8: Document retention extended to 50 years and new mail address for UKAD. Appendix n° 2 added for beta transus calculation Appendix 3: Corrected Al% max (6,30 and not 6,50%) Added aims for Al, V, Fe and O. Added min for O and corrected the maximum value for O (0.130 and not 0,120 %). Corrected the other elements total (0,30 and not 0,40%)
B01	November 26th, 2013	§4: Add the AMS2380, ASTM B299, ASTM B348-13 and new version of ASTM F136, ISO 5832-3-2012, AMS 2249, EN 2954-002, EN 2858-1, EN 2858-2, EN 10204, STMU M01, STMU QSE, FDVAR, and PTC. Add requirements for Beta transus Temperatures (min/max) and range. Add capability requirement and add macrostructure requirement. §5: Add reference at STMU M01. Cancel information about the technic for the crown elimination. §6: Correction of "yy" :year of start of production and add precision for marking. §7: Change Title and add EN 10204, additional requirement for certificate of the ingot. Add precision to take in consideration UKTMP comments (Mail UKTMP of November 26th, 2013) §8: Add reference at STMU QSE §9: Add UKTMP precision for the shipment condition §10: Add precision for the authorized dispersion and for number of digits in chemical content results. §13: Cancel "Drawing of pins" and add mention to STMU M01 for quantity and the machining of pin's. §14: Add ingot range introduction number

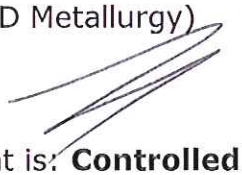
3. DOCUMENT APPROVAL

Document preparation and approved by:

Name: Marc CABANO (UKAD Quality)
Signature
Date: November 26th, 2013

Document checked

Name: Laurent CLUZEL (UKAD Metallurgy)
Signature
Date: November 26th, 2013



The diffusion of this document is: **Controlled**

4. REQUIREMENTS

Dimensions

- Diameter: 914 mm +/- 10mm
- Weight: 7300 Kg +/- 100 Kg

Process: Ingot elaborated by double VAR melting and in accordance with a grade 1 melting quality process as described in the AMS2380.
Electrode melting from materials having a total carbon content of no more than 0,08%.

Raw materials, melting practice and chemistry according to:

- AMS2380 revision F (Reaffirmed 2013)
- ASTM B299 – 2013
- ASTM B348 – 2013
- AMS 4931 revision D
- AMS 6932 revision A
- ASTM F136 – 2012a
- ISO 5832-3 – 2012
- AMS2249 revision G
- AIMS 03-20-000 issue 2
- AIMS 03-09-000 issue 3
- AIMS 03-18-000 issue 6
- ABM 8-4062 issue 2
- EN 2954-002 – 2012
- EN2858-1 – 08/1994
- EN2858-2 – 08/1994
- FD VAR 00202028-001-12, applicable revision put in the UKAD order
- PTC 00202028-003-11, applicable revision put in the UKAD order
- All the appendices of this STMU
- EN10204 - 2004 for the release certificate and statement of conformity
- STMU M01, applicable revision put in the UKAD order
- STMU QSE, applicable revision put in the UKAD order

Unless in qualification process, sampling for chemistry from top and bottom at least and in accordance with the pins location's described in the STMU M01

The Management System for Quality, Safety and Environment of the supplier shall be compliant to the STMU QSE.

Quality System of the supplier shall ensure traceability of material and means used for the manufacturing of ingots.

In the event of a conflict, the most stringent requirement takes precedence. If there is a conflict between this UKAD document and the conditions of the purchase order, the purchase order shall take precedence.

All documents and procedures required by these documents must be available in English at the producer's plant.
Manufacturing process shall be established and sent with a process issue to UKAD for approval. This manufacturing process shall at least define melting process, controls and include key parameters.

In the purpose of receiving material conform to the purchase order and control of introduction ranking, UKAD will not accept material with another process issue. All process change must be submitted to UKAD's quality department to be qualified.

It shall be the supplier's responsibility to positively ensure that the original charge materials are completely free from all foreign matter. In the event that inclusion of any type are detected, all material exhibiting inclusions, or suspected of containing inclusions from that particular heat shall be subject to rejection.

Evidence of melt caused defects found after hot working, forging, hot rolling to hot rolled coil or bar at finished size bar or coil is cause for rejection back to the melt supplier.

The melt conditions shall ensure the capability of the forged product macrostructure:

- Uniform structure of fine or medium grain sizes,
- No imperfections such as pipe, cracks, porosity, laps, folds, pitted areas, segregation and inclusions, detrimental to usage of the forgings.
- In accordance with the EN 2954-200 requirement: finer than the 2MA40 level.

Beta Transus: the beta transus temperature shall be determined by calculation.
The calculation method described in appendix 2 has to be used
Beta Transus: Beta-transus must be 965°C ≤ BT temperature ≤ 985°C and beta-transus temperature range shall not exceed 10°C for each ingot.

5. DELIVERY CONDITION

Ingot surface quality must be suitable for forging. See appendix 3 for examples of expected surface.

See STMU M01 for ingot surface preparation before delivery and the number and sampling spots (pin's locations).

Unusual yield loss from forging could be cause for rejection.
Radioactivity: the maximum gamma-radioactivity emitted by the product shall be no more than 0,35 microsieverts/hour.

6. IDENTIFICATION AND MARKING

The identification of the ingot is done on the top of each ingot: heat number, grade and vendor name.
Branding iron or steel impression is required for the heat number:
Heat number marking rule:

yyxxxxK23A

The abbreviations of this ingot code stand for:
yy: year of start of production
xxxx: increasing number
K: Kazakhstan
23: 2-digit grade
A stands for the reference/title 23A to this specification

For the grade and vendor name markings, the impression can be done on the same face of the heat number marking. Branding iron or steel impression is required.
The complete marking for the ingot identification is:
yyxxxxK23A
Grade 23
UKTMP

7. RELEASE CERTIFICATE WITH STATEMENT OF COMPLIANCE

The certificate of the ingot shall be established in accordance with the EN10204 requirement: release certificate type 3.1 of the EN10204 standard with the inspection results and statement of compliance to the UKAD order.

UKTMP shall provide before each shipment a certificate of conformance including

- UKAD and ARDOR purchase order number
- Material identification by grade
- Heat number
- Reference the EN10204 standard with the version issue
- Reference to the present specification with the version issue
- Reference to the STMU M01 and STMU QSE with the revision issue
- Reference to the FDVAR and PTC with the revision issue
- Delivered weight and dimensions
- Chemical analysis from ingot's top and bottom and for each additional location of the pin's required in the STMU M01.
- Beta transus temperature from ingot's top and bottom and for each additional location of the pin's according to STMU M01. It shall be expressed in °C
- The certificate must include a statement that the lot is free of radioactive and mercury contamination
- Melt country of origin and vendor's melt facility
- Date and N°VAR used for the first and second melt.
- The report shall be legible and reproducible in full
- The concession request accepted by UKAD (if any) must be referenced and attached to the certificate.

8. FILING

See the STMU QSE for the archiving requirement.
Any deviation must be reported before shipment by email to UKAD quality department or by mail to the following address:

UKAD
Département Qualité
RD62 - Lieu dit La Croix de Biolet
63780 Saint Georges de Mons – France

9. SHIPPING INSTRUCTION

Delivery of ingots in maritime railway containers or in trucks on pallets providing side loading to the truck.

10. Appendix 1

Element	Ingot requirement (Weight %)		
	Min	Max	Aim
Aluminum	5,50	6,30	6,15
Vanadium	3,50	4,50	4,00
Iron		0,25	0,15
Hydrogen		0,0020	-
Oxygen	0,09	0,13	0,11
Carbon		0,080	
Nitrogen		0,030	-
Copper			-
Boron			-
Silicon			-
Yttrium		0,0050	-
Ruthenium			-
Palladium			-
Titanium			-
Other elements each		0,10	-
Other elements total		0,30	-

Nota: see the AMS 2249 for the authorized dispersion min/max on the ingot in accordance with the range of the different elements.

The chemical content results will be given with same digits after comma as noted in the table of ingot requirements (for example: O2 max 0.13 => results with two digits after comma and C max 0,080=> results with three digits after comma)

11. Appendix 2

Beta transus calculation using elements % content

$$T_\beta = 960 + 19{,}4.(Al - 6) - 8{,}3.(V - 4) - 19{,}4.Fe + 139.C + 194.O_2 + 560.N_2 - 600.H_2$$

12. Appendix 3

Figure 1 - acceptable surface

Figure 2 - unacceptable: top with crown (acceptable surface)

13. Appendix 4

See the STMU M01 for the quantity and the machining of pins.

14. Appendix 5 – VENDOR APPROVAL

This approval sheet has to be sent back to UKAD's quality with the following filled in for approval of this specification.

This specification has been reviewed and is accepted with no deviation.

The specifications mentioned in this specification have been reviewed and are accepted.

The changes have to be implemented as soon as possible and the introduction range is to be documented by UKTMP: introduction ingot number to be precise just after.

The last revision of this specification will be destroyed or stamped obsolete or for reference only (when applicable).

Ingot range introduction number: .....

Vendor: .....

Name: .....

Position: .....

Visa and date: