

**Titanium Metals Corporation****Approved Certificate**

100 Titanium Way  
 Toronto, OH, 43964  
 Telephone (740) 537-5694, Fax (740) 537-5653

Page 1 of 6

**CERT ID**  
 H31639-C1X  
 12-FEB-2020 17:29:45 GMT

**SOLD TO CUSTOMER**  
 TIMET Service Center St. Louis  
 1250 Interstate Drive, Wentzville, MO 63385

**PURCHASE ORDER** 20160916

**HEAT NUMBER** H31639  
**GRADE** TIMETAL06-4 ✓

**SHIP TO ADDRESS**  
 TIMET Service Center St. Louis  
 1250 Interstate Drive, Wentzville, MO 63385

**TEST NUMBER**  
 S17533

✓ **PRODUCT DESCRIPTION**  
 0.063" SQ Sheet

✓ **DELIVERY CONDITION**  
 Annealed

✓ **Specifications**

This material complies with the following specifications:

AMS 4911 N  
 AMS-T-9046 A AB-1 COND A  
 ASTM B 265 -15 Grade 5  
 ASTM F 1472 -14  
 DMS 1592 H  
 ISO 5832-3 7/1/96  
 MIL-T-9046 J AM 2 AB-1 COND A

✓ **Additional Specifications**

AMS 4911 P  
 AMS 4911 R  
 ASME SB 265 -19 Grade 5

**Melt Method**  
 3-VAR

✓ **Melt/Process Location**  
 TIMET - Henderson, NV, USA /  
 TIMET - Toronto, OH, USA

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### Compliance Statements

1. ✓ Surface free from alpha case and product conforms to the other technical requirements of the referenced specification(s).
2. ✓ During the manufacturing process, this material has not come in contact with mercury or radioactive luminescent materials, as such, it is certified to be free of mercury and radioactivity.
3. ✓ Microstructure examined and acceptable to the order specifications.
4. Bend testing performed meets or exceeds the requirements of the ordered specifications.
5. TIMET-Toronto is an approved supplier of this product per DMS QPL 1592 Issue 19. Ingot melted in accordance with DMS 2442E R-1; TIMET-Henderson, NV, is an approved ingot source per DMS QPL-2442 Issue 20.
6. Ingot calculated beta transus = 1844°F top and 1850°F bottom.
7. No weld repair has been performed on this material.
8. Material complies with DFARS 252.225-7008.
9. Material certificate in compliance with EN 10204:2004 Type 3.1.
10. The recording of false, fictitious, or fraudulent statements or entries on this document may be punishable as a felony under Federal Statutes including federal law, Title 18, Chapter 47.
11. ✓ TIMET-Toronto has complied with all metal stock producer requirements of AS6279 A.
12. TIMET-Toronto has a Quality Management System that is in compliance with ISO 9001:2015, and AS 9100:2016 Revision D. (AS9100 certificate is available at [www.timet.com](http://www.timet.com))
13. Customer will accept TIMET EXCEPTION to microstructure requirements of ISO 5832-3.
14. This revised certificate supersedes all previously issued certificates but does not in any way alter, amend, waive, or modify the terms and conditions of the original sale as contained on TIMET's sales acknowledgement.
15. TIMET-Toronto has complied with all metal stock producer requirements of AS6279 B.
16. This material is capable of the service center providing LCS compliance.
17. ✓ TIMET-Toronto is an Approved Process Source for The Boeing Company as specified in D1-4426, processor code number BE10041722.
18. ✓ Heat treatment in accordance with MIL-H-81200 B, replaced by AMS-H-81200 D.

### ✓ Ingot Chemical Analysis (Weight percent)

Unless otherwise noted, Ingot Chemical Analysis performed at Henderson Process Lab, 181 N. Water Street, Henderson, NV, 89015, USA

|                  | Fe   | V    | Al   | C     | O    | N     | Y       |
|------------------|------|------|------|-------|------|-------|---------|
| <b>Sample ID</b> |      |      |      |       |      |       |         |
| <b>TOP</b>       | 0.19 | 3.98 | 6.42 | 0.026 | 0.18 | 0.006 | <0.0004 |
| <b>BOTTOM</b>    | 0.18 | 3.96 | 6.46 | 0.020 | 0.20 | 0.006 | <0.0004 |

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**SOLD TO CUSTOMER**TIMET Service Center St. Louis  
1250 Interstate Drive, Wentzville, MO 63385**PURCHASE ORDER** 20160916**✓ Product Analysis  
(Weight percent)**

Unless otherwise noted, Product Analysis performed at Toronto Laboratory, 100 Titanium Way, Toronto, OH, 43964, USA

**H****Sample ID**

|           |    |
|-----------|----|
| <b>22</b> | 33 |
| <b>27</b> | 23 |

**Chemistry Statements**

1. Hydrogen values reported in PPM. Hydrogen determined by inert gas fusion per ASTM E1447. Carbon determined by combustion per ASTM E1941. Oxygen and Nitrogen determined by inert gas fusion per ASTM E1409. Henderson Melt: Metallics determined by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) per ASTM E2371. Morgantown Melt: Copper and Boron by atomic spectrometry (ingot only) and all other elements by x-ray fluorescence spectrometry.
2. Residual elements each less than 0.10% maximum, 0.40% maximum total.
3. Balance titanium.

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✓ **Mechanical Properties**

Unless otherwise noted, testing performed at Toronto Laboratory, 100 Titanium Way, Toronto, OH, 43964, USA

Bend Test, L-Direction, R/T, (ASTM E 290)

BF 4.5

Test Condition: [MILL] Annealed 30 Minutes @ 1400°F, AC

**20X105**

**Sample ID**            **P/F**  
22/27                    PASS

Bend Test, T-Direction, R/T, (ASTM E 290)

BF 4.5

Test Condition: [MILL] Annealed 30 Minutes @ 1400°F, AC

**20X105**

**Sample ID**            **P/F**  
VARIOUS                PASS

Bend Test, T-Direction, R/T, (ASTM E 290)

BF 4.5

Test Condition: [MILL] Annealed 30 Minutes @ 1400°F, AC

**10X180**

**Sample ID**            **P/F**  
VARIOUS                PASS

RTT - Longitudinal (ASTM E 8) After Fracture

Test Condition: [MILL] Annealed 30 Minutes @ 1400°F, AC

|                  | <b>0.2YS</b> | <b>U.T.S.</b> | <b>2inEL</b> |
|------------------|--------------|---------------|--------------|
| <b>Sample ID</b> | <b>ksi</b>   | <b>ksi</b>    | <b>%</b>     |
| 22               | 150          | 158           | 12           |
| 27               | 149          | 158           | 14           |

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**PURCHASE ORDER** 20160916**RTT - Transverse (ASTM E 8) After Fracture**

Test Condition: [MILL] Annealed 30 Minutes @ 1400°F, AC

|                  | 0.2YS | U.T.S. | 2inEL |
|------------------|-------|--------|-------|
| <b>Sample ID</b> | ksi   | ksi    | %     |
| 22               | 143   | 153    | 14    |
| 27               | 142   | 154    | 14    |

**Metallurgical Properties**

Unless otherwise noted, testing performed at Toronto Laboratory, 100 Titanium Way, Toronto, OH, 43964, USA

**Micro Exam - Transverse  
ETTC 4, KROLLS, 100X**

Test Condition: [MILL] Annealed 30 Minutes @ 1400°F, AC

|                  | MT-PRE | MT-OCC | OVERALL |
|------------------|--------|--------|---------|
| <b>Sample ID</b> | Micr   | Micr   | P/F     |
| 22               | P3     | -      | PASS    |
| 27               | P3     | -      | PASS    |

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**Tests on Other Material**

Unless otherwise noted, testing performed at Toronto Laboratory, 100 Titanium Way, Toronto, OH, 43964, USA

Batch: H31788-C2R (S17973)  
Bend Test, T-Direction, R/T, (ASTM E 290)  
BF 5.0  
Test Condition: Periodic Test: [MILL] Annealed 30 Minutes @ 1400°F, AC + [LAB] Annealed 20 Minutes @ 1325°F, AC

**20X105**

| Sample Id | bend |
|-----------|------|
| 4         | PASS |

Batch: H31788-C2R (S17973)  
RTT - Longitudinal (ASTM E 8) After Fracture  
Test Condition: Periodic Test: [MILL] Annealed 30 Minutes @ 1400°F, AC + [LAB] Annealed 20 Minutes @ 1325°F, AC

**0.2YS U.T.S. 2inEL**

| Sample Id | ksi | ksi | %  |
|-----------|-----|-----|----|
| 4         | 143 | 152 | 14 |

Results are from TIMET Quality Control Records on file  
Sales Order # 524065 Item # 20  
v.3

*Michael Giovannone*



**Michael Giovannone**

**2020.02.12 12:30:43**

**-05'00'**

Michael Giovannone - Certification Specialist

**Version History**

- v.1 21-AUG-2019 Original Version
- v.2 06-FEB-2020 Certificate revised, per customer request, to include AMS 4911 R, AS6279 B, ASME SB 265-19 Grade 5, LCS compliance.
- v.3 12-FEB-2020 Certificate revised to add DI-4426, MIL-H-81200 B and AMS-H-81200 D.

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