

#### Titanium Metals Corporation

100 Titanium Way, Toronto, OH 43964 Telephone (740) \$37-5694, Fax (740) \$37-5653

### Approved Certificate

Page 1 of 4

TWS Titanium

CERT ID 06934DCF02 03-DEC-2010 20:53:13 GMT PURCHASE ORDER 20067571

SOLD TO CUSTOMER TIMET Service Center St. Louis 109 Interstate Drive, Wentrville, MO 63385

HEAT NUMBER 06934DC

GRADE TIMETAL®6-4

TMS Titall.

SHIP TO ADDRESS TIMET Service Center St. Louis 109 Interstate Drive, Wentzville, MO 63385

mium Sample

Sample Cert

TEST NUMBER S5568

#### PRODUCT DESCRIPTION .080" SO Sheet

#### DELIVERY CONDITION Annealed

Specifications

This material complies with the following specifications:

AMS 4911 L ASTM F 1472 -08 DMS 1592 G ISO 5832-3 7/1/96

Melt Method

Melt/Process Location

TIMET - Morgantown, PA, USA / TIMET - Toronto, OH, EB+VAR

Compliance Statements

- The Cert The litarium. In accordance with AMS-T-9046 B cancellation notice, material is tested and certified to Table 1 superceding specification AMS 4911 Rev L.
- Surface free from alpha case and product conforms to the other technical requirements of the referenced specification(s).

Microstructure examined and acceptable to the order specifications.

he Cert The

- TIMET-Toronto is an approved supplier of this product per DMS QPL 1592 Issue 18. Ingot melted in accordance with DMS 2442; 3. TIMET-Morgantown, PA, is an approved ingot source per DMS QPL-2442 Issue 18.
- 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.

um Sample

- TIMET-Toronto has a Quality Management System that is in compliance with ISO 9001:2008, ANSI/ISO/ASQ Q9001-2008 and Cert TMS Titanium AS 9100:2001 Revision B, Certificate No. UQA 0113328, through Lloyd's Register Quality Assurance, effective 24-Jul-03. NS Titanium Sam
- Customer will accept TIMET EXCEPTION to microstructure requirements of ISO 5832-3.

TNS Titanium



ible Cert IMS This test report shall not be reproduced except in full, without the written appripal of TIMET.

The intentional recording of false, fictilious, or fraudulent statements or entries on the certificate may be punished as a felony under federal law



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20067571

SOLD TO CUSTOMER

TIMET Service Center St. Louis 109 Interstate Drive, Wentzville, MO 63385

Ingot Chemical Analysis

(Weight percent)

Cert TMS Titanium Unless otherwise noted, Ingot Chemical Analysis performed at Morgantown Process Lab, 900 Hemlock Road, Morgantown, PA, 19543, US

| Sample III | Fe   | V    | Al   | CG.   | O    | N N   | ) X      |   |
|------------|------|------|------|-------|------|-------|----------|---|
| TOP        | 0.15 | 3.96 | 6.23 | 0.021 | 0.19 | 0.005 | <0.0005  | 5 |
| BOTTOM     | 0.14 | 3.95 | 6.27 | 0.020 | 0.19 | 0.006 | < 0.0005 | < |

Product Analysis

(Weight percent)

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

Sample ID H 41 22 48

#### Chemistry Statements

Residual elements each less than 0.10% maximum, 0.40% maximum total.

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: the tite 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.

Balance titanium.

Mechanical Properties

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



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Jet, 43964, Ut

290)

Acted 30 Minutes @ 1400°F AC

1X105
P/F

JS PASS

Bend Test, T-Direction, R/T, (ASTM E 290)
BF 5.0

Test Condition: Mill Annealed 30 Minutes @ 1400°F AC

Sample ID 20X105
P/F

/ARYOUS PASS

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PURCHASE ORDER 20067571

Sample Cert This Titamium S SOLD TO CUSTOMER TIMET Service Center St. Louis 109 Interstate Drive, Wentzville, MO 63385 ritanium Sample Cert

Sample

Titaniu

| Sample ID | 0.2YS       | U.T.S.  | 2inEI |
|-----------|-------------|---------|-------|
| ,         | ksi         | ksi     | %     |
| 41        | 143         | G 151 S | 14    |
| 48        | <b>(150</b> | 157     | 14    |

| Sample ID | 0.2YS         | U.T.S. | 2inEL |
|-----------|---------------|--------|-------|
| 10        | ksi           | ksi S  | % 👗   |
| 41        | <b>\</b> 2141 | 150    | 120   |
| 48        | 141           | 153    | 12)   |

|  |                        |  |  | C (S)                            |  |                              |  |
|--|------------------------|--|--|----------------------------------|--|------------------------------|--|
| RT                                     | T - Longitudinal       | (ASTM E 8)                             |  |                                  | NS Titanium                            | Sample Cert                  | TMS Titanium                             |
| Tes                                    | t Condition: Mil       | Annealed 30 Min                        | nutes @ 1400°F AC                                | 76                               |  | 60                           |  |
| Şar                                    | nple ID                | 0.2YS                                  | U.T.S.   | 2inEL                            | 12 (1                                  |                              | 5  |
|  | 50                     | ksi                                    | ksi  | %                                |  | <b>\</b> @                   | M's M's                                  |
| 41                                     |                        | 143                                    | 151  | 14                               |  | ~0/                          | 11, 10,                                  |
| 48                                     | 1/1/1                  | <b>CI50</b>                            | 157  | 14<br>14                         | V. H.O.                                | di,                          |  |
|  | 0100                   | YW.                                    |  | \Ø)                              |  | CO                           | Vilo C                                   |
| RT                                     | r - Transverse (A      | ASTM E 8)                              |  | 76                               | 2                                      | Sample Cer                   |  |
| Tes                                    | t Condition: Mill      | l Annealed 30 Mii                      | nutes @ 1400°F AC                                |                                  | $\mathcal{U}$ , $\mathcal{U}$          |                              | 12 14                                    |
| Sar                                    | aple ID                | 0.2YS                                  | U.T.S.   | 2inEL                            | 1. 10.                                 | 76                           | My in                                    |
|  | ".(1)                  | ksi c                                  | ksi 🕥  | % 🙏                              |  | W.                           |  |
| 41                                     | in.                    | <b>©141</b>                            | 150  | 12 Ø                             | V. IZC                                 | all of                       | 1 XIII                                   |
| 48                                     | 71, VC                 | 141                                    | 153  | 12)                              | C                                      | 50 (10                       |  |
| V.                                     | V(1)                   |  | - Cli  | 10                               |  | 10                           | TMS Titanium                             |
|  | 60                     |  | Metallu Metallu                                  | rgical Properties                | Stanium Way Tacanto                    | H 43964. IIS                 | $\langle L_{\mu},, L_{\mu} \rangle$      |
| )                                      |                        | Unices otherwise note                  | Netaliu<br>d, testing performed at Tor           | unto transmitory, 100 1          | resident Anià' teletion o              | H, 43964, US)                | TWS Titanium                             |
| N.C.                                   | ro Exam - Trans        | TATO TION                              | 5 50   |                                  |  | n Sample Cer                 | X X                                      |
|  | C 4, KROLLS            |  |  | C.O.                             |  | 5                            |  |
| The                                    | Condition: Mill        | Annealeri 30 Mir                       | nutes @ 1400°F AC                                |                                  | 5                                      |                              | S.                                       |
| San                                    | iple ID                | MT-PRE                                 | MT-OCC   | OVERAL                           | (i) (DE                                | (0)                          | n. M                                     |
| )                                      | .11.0 125              | Micr                                   | Micr   | P/F                              | 1, 1                                   | 0/0                          | The solution                             |
| 41                                     |                        | Pi                                     |  | PASS                             | 1.4.0                                  |                              |  |
| 48                                     | ill'                   | D1                                     | Si- Si   | PASS                             |  | 60,                          | V. V |
|  |                        | <u> </u>                               | <del>/////////////////////////////////////</del> |                                  |  |                              |  |
| \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | in the                 |  |  | <b>\O</b>                        | YW.                                    | 7,                           | 100                                      |
|  | 60,                    | X                                      |  | 201                              |  | , 16                         | X6, "10                                  |
| 9                                      |                        | C (S)                                  | 1.1.0  | 1, 1                             | 100                                    |                              |  |
|  | 14,                    | O                                      | ~\\\ G'  | 0° CO                            |  |                              | X .x 0 .x                                |
|  | il)                    | (0)                                    | 5  |                                  | G'                                     | 5                            | O, VIII                                  |
|  | anium Samusanium Samus | 5. ×6/                                 | S Titanium S                                     | ample Cert                       | TWS Titarill                           | in Sample                    | ert TMS Titanium                         |
| 11                                     |                        | X                                      |  | 46.                              |  | ), Ye                        | . N ~                                    |
|  | C'o                    |  | 10 x 20  | 3/1                              |  | ν6.                          |  |
|  | ~                      | ()                                     | CIV C  |                                  | 7.7.0                                  | a all                        | ert Titarium                             |
|  |                        | × 01                                   | S' A   |                                  |  | 50                           | of its                                   |
|  | Will be                | 010                                    |  | 16                               | INST                                   | JIM C                        |  |
|  | کی رح                  |  | " Ulo  | 2/6                              | VAL.                                   |                              | 5  |
|  | C-01                   | X                                      | ~x0,   | N                                |  |                              | W "                                      |
| <b>`</b>                               |                        | C (C)                                  |  | <i>S</i> <sub>1</sub> , <i>X</i> |  | W                            | 1, 10                                    |
|  | 10                     | G                                      | 5  | ~ (C)                            |  | C.D.                         | X wall                                   |
|  | il),                   | 10                                     | n a  | O                                | 5                                      | 5                            | O Vilo                                   |
|  |                        | ,0'                                    | · · · · · · · · · · · · · · · · · · ·            | 10                               | M                                      | .0                           |  |
|  | Ka Y                   |  |  | 20,                              | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | 7, 16                        | 1/2                                      |
|  | Accredited             | Materials Testing Laboratory           | This test report shall not                       | he reproduced except i           | n full without the write               | approval of TIMET.           | VB. V                                    |
| AS.                                    | Naacan i               | ISG/IEC 97025<br>Nondestrusive Teating |  |                                  |  | entries on the certificate m | gy he nunished                           |
| <b>*</b>                               |                        | Heat Treating                          | The intentional recording                        | or tarse, richtions, of          | NUMBER OF STREET STREET                | etterad but the Aderstown in | m) washinina                             |



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Titaniu.

Tests on Other Material

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

Batch: H15174-C1X (S5581)

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

ible Cert

Test Condition: Periodic Test: Mill Annealed 30 Minutes @ 1400°F AC + Lab Annealed 20 Minutes @ 1325°F AC

Sample ID

20X105 bend

PASS

Batch: H15174-CIX (S5581) RTT - Longitudinal (ASTM E 8)

Test Condition: Periodic Test: Mill Annealed 30 Minutes @ 1400°F AC + Lab Annealed 20 Minutes @ 1325°F AC

Sample 10

0.2YS

<u>dksi</u> 147 U.T.S. ksi

14

155

Results are from TIMET Quality Control Records on file

Sales Order # 296122 Item # 20

The Titanium Sample Cort This tianium sample cert Jim Sample Cert TMS Titanium



Titanium Sample Cert.



#### Attachment to Product Certification

| Samp     |  | Attachment to Product Certification Repail Printout Customer P.O. Number/Date  |
|----------|--|--|
| r, arii  | II. SUBJECT IN SUI   | The the like of Co. Elifo  |
| Sille    | TIMET  | Attachment to Product Certification Repail Printout Customer P.O. Number/Date 22557 LINE 6/Jul 13, 2010 TIMET Sales Order Number/Date 292023/Jul 13, 2010 TIMET Packing List Number/Scheduled Ship Date 80446767/Dec 10, 2010  |
| No axal  | St. Louis Mill Sales   | Repait Printout Customer P.O. Number/Date 2.2557 LINE 6/Jul 13, 2010   |
| S        | 109 Interstate Drive WENTZVILLE MO 83385 USA   | TIMET Sales Order Number/Date 292023/Jul 13, 2010  |
| LINE     | Tel:800-753-1550 Fax:638-887-9098<br>Shipping Plant: St. Louis Service Center  | TIMET Sales Order Number/Date 292023/Jul 13, 2010 TIMET Packing List Number/Scheduled Ship Date 80446767/Dec 10, 2010  |
| (ita)    | Tel:B00-753-1550 Fax:636-887-9098 Shipping Plant: St. Louis Service Center   |  |
| MS       | Sample Cert This Tital   | illing Sample Cert This Titanium Sample Cert This Titanium   |
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| Site     | Customer Item # Customer Mater   |  |
| INS THE  | Customer Item # Customer Material 000010 125153 TIME Specifications  |  |
| LW2 Lixs | Customer Item # Customer Material 000010 125153 TIME Specifications  | ETAL® 6-4 Titanium Aero Sheet  : 01 AMS 4911 * L : 02 AMS-T-9046 * B AB1 COND A : 03 ASTM B 265 * -09A GR 5 : 04 ASTM F 1472 * -08   |
| TMS Tite | Customer Item # Customer Materia  000010 125153 7/M/  Specifications  Batch Number   | ETAL® 6-4 Titanium Aero Sheet  : 01 AMS 4911 * L : 02 AMS-T-9046 * B AB1 COND A : 03 ASTM B 265 * -09A GR 5 : 04 ASTM F 1472 * -08 : 05 DMS 1592 * G : 06 MIL-T-9046 J AM2 AB-1 CONDA : 06934DCY05 133.000LB   |
| TWS Tite | Customer Item # Customer Materia  000010 125153 7/M/  Specifications  Batch Number Batch Dimensions Batch Number of Pieces   | ETAL® 6-4 Titanium Aero Sheet  : 01 AMS 4911 * L : 02 AMS-T-9046 * B AB1 COND A : 03 ASTM B 265 * -09A GR 5 : 04 ASTM F 1472 * -08 : 05 DMS 1592 * G : 06 Mil-T-9046 J AM2 AB-1 CONDA : 06934DCY05 133.000LB 133.000LB : 0.080" X 36.000" X 96.000" : 3.000  |
| TWS Tit? | Customer Item # Customer Material  000010 125153 Time  Specifications  Batch Number Batch Dimensions Batch Number of Pieces Country of Origin Heat Number Test Number  | ### 15   |
| INS LIES | Customer Item # Customer Materia  000010 125153 TIME  Specifications  Batch Number Batch Dimensions Batch Number of Pieces Country of Origin Heat Number Test Number Batch Number Batch Dimensions Batch Number of Pieces  | #ETAL® 6-4 Titanium Aero Sheet  : 01 AMS 4911 * L : 02 AMS-T-9046 * B AB1 COND A : 03 ASTM B 265 * -09A GR 5 : 04 ASTM F 1472 * -08 : 05 DMS 1592 * G : 06 MIL-T-9046 J AM2 AB-1 CONDA : 06934DCY05 133.000LB 133.000LB : 0.080" X 36.000" X 96.000" : 3.000 : USA : 06934DC : \$5568 : 06934DCY07 896.000LB 896.000LB : 0.080" X 36.000" X 96.000" : 20.000 |
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order. This Attachment to Product Certification meets the requirements of the above referenced order. This Attachment to Product Certification is specific to your referenced order, is an integral part of and amends the physical and chemical test reports attached. All specification(s) and revision(s) that differ from the attached have been approved for inclusion by the producing facility.

Authorized TIMET Signature THE THERITA

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