Fort Wayne Metals Research Products Corp

PHN 260.747.4154
FAX 260.747.0398

9609 Ardmore Avenue
Fort Wayne, IN 46809

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CERTIFICATION OF COMPLIANCE

Certification: **1366334-1**	Manufactured Date: **06/03/2021**	Batch: **17836882**	Kimberly M. Wolf Certified By Kim Wolf Department Team Leader
Customer: **TNS Korea**		Sales Order: **1108584**	
Customer Part: **FWMTNS001HR002**		Purchase Order: **TNS #200221-005 3of9**	
Quantity Shipped: **420.299 kg (1933 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			3 June, 2021 Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **5 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **8V64240**

Batch Description: **Coil**

Aluminum (Al) (%)	6.0900	Balance	Titanium
Carbon (C) (%)	0.0245	Cobalt (Co) (%)	< 0.1000
Hydrogen (H) (%)	0.0053	Iron (Fe) (%)	0.2000
Nitrogen (N) (%)	0.0045	Other Single Trace (%)	< 0.1000
Oxygen (O) (%)	0.1100	Total Trace Elements (%)	< 0.3000
Vanadium (V) (%)	3.8900	Yttrium (Y) (%)	< 0.0010
RM Country of Origin	USA	RM DFARS Compliant	Compliant
Ultrasonic Tested	Yes		

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.00000 / -0.00787 mm** | **Discrete Part Length +24.9987 / -24.9987 mm**

Batch Description: **Centerless Ground and Polish**

Diameter (mm)	4.99491	Discrete Part Length (mm)	2,517.7750
Breakload (kg)	1,998	Tensile Strength (mpa)	1,000
Elongation (%)	17.4	Yield Load (kg)	1,660
Yield Strength (mpa)	831	Hydrogen (H) (%)	0.0020
Cold Work (%)	7.1	MetLab Report Number	21-05-74407
Beta Transus (°C)	972.0000	Reduction of Area (%)	41.8
Microstructure	A1	Rockwell Hardness C (ea)	37.00

TESTING PROPERTIES

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CERTIFICATION OF COMPLIANCE

Certification: **1366334-1**	Manufactured Date: **06/03/2021**	Batch: **17836882**	Certified By Kim Wolf Department Team Leader 3 June, 2021 Date
Customer: **TNS Korea**		Sales Order: **1108584**	
Customer Part: **FWMTNS001HR002**		Purchase Order: **TNS #200221-005 3of9**	
Quantity Shipped: **420.299 kg (1933 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **5 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

Crosshead Speed (mm/min)	1.2446	Secondary Crosshead Speed (mm/min)	25.4000
Gauge Length (mm)	50.8000		

Batch Description: **Eddy Current Tested**

Eddy Current Test	Pass

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CERTIFICATION OF COMPLIANCE

Certification: **1350725-1**	Manufactured Date: **02/04/2021**	Batch: **16281896**	Chase Strader Certified By Chase Strader Inspector 4 February, 2021 Date
Customer: **TNS Korea**		Sales Order: **1109201**	
Customer Part: **FWMTNS001HR029**		Purchase Order: **TNS #200221-005 2of10**	
Quantity Shipped: **122.923 kg (1571 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **3 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **A9K98**

Batch Description: **Coil**

Aluminum (Al) (%)	5.8850	Balance	Titanium
Carbon (C) (%)	< 0.0100	Cobalt (Co) (%)	< 0.0100
Hydrogen (H) (%)	0.0013	Iron (Fe) (%)	0.1800
Nitrogen (N) (%)	< 0.0100	Other Single Trace (%)	0.1000
Oxygen (O) (%)	0.1100	Total Trace Elements (%)	0.4000
Vanadium (V) (%)	3.9000	Yttrium (Y) (%)	< 0.0010
RM Country of Origin	USA	RM DFARS Compliant	Compliant
Ultrasonic Tested	Yes		

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.00000 / -0.00584 mm** **Discrete Part Length +24.9987 / -24.9987 mm**

Batch Description: **Centerless Ground and Polish**

Diameter (mm)	2.99593	Discrete Part Length (mm)	2,501.9000
Breakload (kg)	713	Tensile Strength (mpa)	992
Elongation (%)	21	Yield Load (kg)	609
Yield Strength (mpa)	847	Hydrogen (H) (%)	0.0020
Cold Work (%)	9.5	MetLab Report Number	20-12-71598
Beta Transus (°C)	973.0000	Reduction of Area (%)	48.1
Microstructure	A1	Rockwell Hardness C (ea)	31.00

TESTING PROPERTIES

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CERTIFICATION OF COMPLIANCE

Certification: **1350725-1**	Manufactured Date: **02/04/2021**	Batch: **16281896**	Chase Strader Certified By **Chase Strader** Inspector
Customer: **TNS Korea**		Sales Order: **1109201**	
Customer Part: **FWMTNS001HR029**		Purchase Order: **TNS #200221-005 2of10**	
Quantity Shipped: **122.923 kg (1571 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			**4 February, 2021** Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **3 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

Crosshead Speed (mm/min)	0.3556	Secondary Crosshead Speed (mm/min)	6.3500
Gauge Length (mm)	50.8000		

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CERTIFICATION OF COMPLIANCE

Certification: **1365949-1**	Manufactured Date: **06/07/2021**	Batch: **16241179**	Certified By Kim Wolf Department Team Leader 7 June, 2021 Date
Customer: **TNS Korea**		Sales Order: **1108584**	
Customer Part: **FWMTNS001HR002**		Purchase Order: **TNS #200221-005 3of9**	
Quantity Shipped: **213.188 kg (980 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **5 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **8T63873**

Batch Description: **Coil**

Aluminum (Al) (%)	5.9700	Balance	Titanium
Carbon (C) (%)	0.0205	Cobalt (Co) (%)	< 0.1000
Hydrogen (H) (%)	0.0021	Iron (Fe) (%)	0.1800
Nitrogen (N) (%)	0.0065	Other Single Trace (%)	< 0.1000
Oxygen (O) (%)	0.1250	Total Trace Elements (%)	< 0.3000
Vanadium (V) (%)	3.9350	Yttrium (Y) (%)	< 0.0010
RM Country of Origin	USA	RM DFARS Compliant	Compliant
Ultrasonic Tested	Yes		

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.00000 / -0.00787 mm** | **Discrete Part Length +24.9987 / -24.9987 mm**

Batch Description: **Centerless Ground and Polish**

Diameter (mm)	4.99745	Discrete Part Length (mm)	2,508.2500
Breakload (kg)	1,961	Tensile Strength (mpa)	981
Elongation (%)	18.7	Yield Load (kg)	1,623
Yield Strength (mpa)	812	Hydrogen (H) (%)	0.0010
Cold Work (%)	7.0	MetLab Report Number	21-05-74209
Beta Transus (°C)	971.0000	Reduction of Area (%)	47.9
Microstructure	A1	Rockwell Hardness C (ea)	34.00

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CERTIFICATION OF COMPLIANCE

Certification: **1365949-1**	Manufactured Date: **06/07/2021**	Batch: **16241179**	Certified By Kim Wolf Department Team Leader 7 June, 2021 Date
Customer: **TNS Korea**		Sales Order: **1108584**	
Customer Part: **FWMTNS001HR002**		Purchase Order: **TNS #200221-005 3of9**	
Quantity Shipped: **213.188 kg (980 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **5 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

Crosshead Speed (mm/min)	1.2446	Secondary Crosshead Speed (mm/min)	25.4000
Gauge Length (mm)	50.8000		

Batch Description: **Eddy Current Tested**

Eddy Current Test	Pass

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CERTIFICATION OF COMPLIANCE

Certification: **1383582-1**	Manufactured Date: **09/03/2021**	Batch: **16241072**	Penny E Gibson Certified By **Penny Gibson** Inspector
Customer: **TNS Korea**		Sales Order: **1108580**	
Customer Part: **FWMTNS001HR022**		Purchase Order: **TNS #200221-005 2of9**	
Quantity Shipped: **426.467 kg (3065 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			**3 September, 2021** Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Hard**	
Size: **4.0 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **8R64962**

Batch Description: **Coil**

Aluminum (Al) (%)	6.1850	Balance	Titanium
Carbon (C) (%)	0.0180	Cobalt (Co) (%)	< 0.1000
Hydrogen (H) (%)	0.0036	Iron (Fe) (%)	0.1950
Nitrogen (N) (%)	0.0055	Other Single Trace (%)	< 0.1000
Oxygen (O) (%)	0.1150	Total Trace Elements (%)	< 0.3000
Vanadium (V) (%)	3.8000	Yttrium (Y) (%)	< 0.0010
RM Country of Origin	USA	RM DFARS Compliant	Compliant
RM Melt Method	PAM + VAR	Ultrasonic Tested	Yes

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.00000 / -0.00787 mm** **Discrete Part Length +24.9987 / -24.9987 mm**

Batch Description: **Centerless Ground and Polish**

Diameter (mm)	3.99415	Discrete Part Length (mm)	2,508.2500
Breakload (kg)	1,530	Tensile Strength (Mpa)	1,198
Elongation (%)	16.2	Yield Load (kg)	1,270
Yield Strength (Mpa)	994	Hydrogen (H) (%)	0.0090
Cold Work (%)	48.1	Beta Transus (°C)	973.0000
Alpha Case Free	Pass	Microstructure	A1
MetLab Report Number	21-07-75340	Reduction of Area (%)	38.0
Rockwell Hardness C (ea)	37.00		

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CERTIFICATION OF COMPLIANCE

Certification: **1383582-1**	Manufactured Date: **09/03/2021**	Batch: **16241072**	Penny E Gibson Certified By **Penny Gibson** Inspector
Customer: **TNS Korea**		Sales Order: **1108580**	
Customer Part: **FWMTNS001HR022**		Purchase Order: **TNS #200221-005 2of9**	
Quantity Shipped: **426.467 kg (3065 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			**3 September, 2021** Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Hard**	
Size: **4.0 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

TESTING PROPERTIES

Crosshead Speed (mm/min)	1.2446	Secondary Crosshead Speed (mm/min)	25.4000
Gauge Length (mm)	50.8000		

Batch Description: **Eddy Current Tested**

Eddy Current Test	Pass

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CERTIFICATION OF COMPLIANCE

Certification: **1351862-1**	Manufactured Date: **02/26/2021**	Batch: **16241404**	Kristin Davis
Customer: **TNS Korea**		Sales Order: **1108591**	Certified By Kristin Davis Inspector
Customer Part: **FWMTNS001HR004**		Purchase Order: **TNS #200221-005 6of9**	
Quantity Shipped: **208.653 kg (374 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			26 February, 2021 Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **8 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **8T63873**

Batch Description: **Coil**

Aluminum (Al) (%)	5.9700	Balance	Titanium
Carbon (C) (%)	0.0205	Cobalt (Co) (%)	< 0.1000
Hydrogen (H) (%)	0.0022	Iron (Fe) (%)	0.1800
Nitrogen (N) (%)	0.0065	Other Single Trace (%)	< 0.1000
Oxygen (O) (%)	0.1250	Total Trace Elements (%)	< 0.3000
Vanadium (V) (%)	3.9350	Yttrium (Y) (%)	< 0.0010
RM Country of Origin	USA	RM DFARS Compliant	Compliant
Ultrasonic Tested	Yes		

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.00000 / -0.00889 mm** **Discrete Part Length +49.9999 / -49.7459 mm**

Batch Description: **Centerless Ground and Polish**

Diameter (mm)	7.99719	Discrete Part Length (mm)	2,527.3000
Breakload (kg)	5,267	Tensile Strength (mpa)	1,028
Elongation (%)	17.4	4D Elongation (%)	17.4
Yield Load (kg)	4,466	Yield Strength (mpa)	872
Cold Work (%)	37.2	Hydrogen (H) (%)	0.0030
Beta Transus (°C)	971.0000	MetLab Report Number	21-01-71868
Microstructure	A1	Rockwell Hardness C (ea)	34.00
Reduction of Area (%)	49.9		

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CERTIFICATION OF COMPLIANCE

Certification: **1379961-1**	Manufactured Date: **09/15/2021**	Batch: **16241180**	Penny E Gibson Certified By **Penny Gibson** Inspector
Customer: **TNS Korea**		Sales Order: **1108584**	
Customer Part: **FWMTNS001HR002**		Purchase Order: **TNS #200221-005 3of9**	
Quantity Shipped: **797.506 kg (3668 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			**15 September, 2021** Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **5 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **W1B17**

Batch Description: **Coil**

Aluminum (Al) (%)	5.9150	Balance	Titanium
Carbon (C) (%)	0.0200	Cobalt (Co) (%)	< 0.0100
Hydrogen (H) (%)	0.0015	Iron (Fe) (%)	0.1500
Nitrogen (N) (%)	0.0100	Other Single Trace (%)	0.1000
Oxygen (O) (%)	0.1100	Total Trace Elements (%)	0.4000
Vanadium (V) (%)	3.9600	Yttrium (Y) (%)	< 0.0009
RM Country of Origin	USA	RM DFARS Compliant	Compliant
RM Melt Method	VAR + VAR	Ultrasonic Tested	Yes

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.00000 / -0.00787 mm** | **Discrete Part Length +24.9987 / -24.9987 mm**

Batch Description: **Annealed**

Diameter (mm)	4.99745	Discrete Part Length (mm)	2,508.2500
Breakload (kg)	1,913	Tensile Strength (mpa)	956
Elongation (%)	19.2	Yield Load (kg)	1,613
Yield Strength (mpa)	807	Hydrogen (H) (%)	0.0020
Cold Work (%)	0.0	MetLab Report Number	21-08-76353
Beta Transus (°C)	997.5000	Reduction of Area (%)	46.9
Microstructure	A1	Rockwell Hardness C (ea)	30.00

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CERTIFICATION OF COMPLIANCE

Certification: **1379961-1**	Manufactured Date: **09/15/2021**	Batch: **16241180**	Penny E Gibson Certified By **Penny Gibson** Inspector
Customer: **TNS Korea**		Sales Order: **1108584**	
Customer Part: **FWMTNS001HR002**		Purchase Order: **TNS #200221-005 3of9**	
Quantity Shipped: **797.506 kg (3668 ea)**			
Finish: **Centerless Ground & Polished, Chamfer**			**15 September, 2021** Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **5 mm x 2500 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

Crosshead Speed (mm/min)	1.2446	Secondary Crosshead Speed (mm/min)	25.4000
Gauge Length (mm)	50.8000		

Batch Description: **Centerless Ground and Polish**

Eddy Current Test	Pass

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CERTIFICATION OF COMPLIANCE

Certification: **1389588-1**	Manufactured Date: **08/10/2021**	Batch: **18374585**	Chase Strader Certified By **Chase Strader** Inspector
Customer: **TNS Korea**		Sales Order: **1138249**	
Customer Part: **-**		Purchase Order: **TNS #210623-004**	
Quantity Shipped: **49.477 kg**			
Finish: **Etched**			**10 August, 2021** Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **1.63 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

RAW MATERIAL CHARACTERISTICS

Heat Number: **H33385**

Batch Description: **Round Wire**

Aluminum (Al) (%)	6.0450	Balance	Titanium
Carbon (C) (%)	0.0190	Cobalt (Co) (%)	< 0.1000
Hydrogen (H) (%)	0.0029	Iron (Fe) (%)	0.1700
Nitrogen (N) (%)	0.0090	Other Single Trace (%)	< 0.1000
Oxygen (O) (%)	0.1050	Total Trace Elements (%)	< 0.3000
Vanadium (V) (%)	4.0000	Yttrium (Y) (%)	< 0.0004
RM Country of Origin	USA	RM DFARS Compliant	Compliant
Ultrasonic Tested	Yes		

FINISHED GOOD MATERIAL CHARACTERISTICS

Size Tolerance: **Diameter +0.0127 / -0.0127 mm**

Batch Description: **Annealed**

Diameter (mm)	1.6261	Breakload (kg)	225
Tensile Strength (Mpa)	1,062	Elongation (%)	10.7
Yield Load (kg)	171.5	Yield Strength (Mpa)	810
Hydrogen (H) (%)	0.0050	Alpha Case Free	Pass
Beta Transus (°C)	967.0000	MetLab Report Number	21-08-75962
Microstructure	A1		

TESTING PROPERTIES

Crosshead Speed (mm/min)	1.7780	Secondary Crosshead Speed (mm/min)	25.4000

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CERTIFICATION OF COMPLIANCE

Certification: **1389588-1**	Manufactured Date: **08/10/2021**	Batch: **18374585**	Chase Strader Certified By **Chase Strader** Inspector
Customer: **TNS Korea**		Sales Order: **1138249**	
Customer Part: **-**		Purchase Order: **TNS #210623-004**	
Quantity Shipped: **49.477 kg**			
Finish: **Etched**			10 August, 2021 Date
Alloy: **Ti-6Al-4V ELI**		Condition: **Annealed**	
Size: **1.63 mm**			
Specification: **ASTM F136**			

The material in this shipment has been certified to comply to the above specification

Gauge Length (mm) 254.0000

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