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REVISION A

**APPROVED MATERIALS & PROCESSES SUBSTITUTION LIST**

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## APPROVED MATERIALS & PROCESSES SUBSTITUTION LIST

### 1.0 SCOPE

The Approved Materials & Processes Substitution List (AMPSL) is the sole authorization for substitution of raw materials, processes and/or their specifications without requiring additional specific engineering activity. This specification addresses the current status of the government and industry specifications for materials and processes, providing a superseding document for some of the more commonly referenced, cancelled Military, Federal, and Industry specifications.

### 2.0 PURPOSE

The AMPSL facilitates procurement of the acceptable materials and processes to assist manufacturing. The AMPSL also avoids unnecessary costs, by eliminating the need to unnecessarily revise drawings and internal process specifications to update cancelled material specifications. The AMPSL also provides a resource for the responsible Design Engineer to determine the current specifications when he generates new drawings or updates current drawings.

### 3.0 SPECIFICATION SUPERSEDEENCE TABLES

The attached tables list material specifications that have been superseded, and their authorized substitution material specification. They also provide the most current material specifications, and are the authority to permit the use of the current material specification in lieu of an obsolete specification, barring any Program or Contract restrictions to do so (such as described in 4.1 below).

The tables include a Remarks field with additional information, such as “MMPDS”, which is the Metallic Materials Properties Development and Standardization handbook. The MMPDS is an accepted source for metallic material allowables for the FAA, the DoD, and NASA. It is a good design practice to select a material specification which is listed in MMPDS.

### 4.0 REQUIREMENTS

#### 4.1 Customer Requirements

Certain customers have specific requirements for the use, or non-use, of superseding specifications. VACCO is contractually obligated to honor customer requirements, and the customer requirements take precedence over the AMPSL. Examples of these customer requirements include:

- 1) use of a specific specification(s) that is current
- 2) use of only the current specifications
- 3) use of a specific specification(s) that is cancelled, with no provision to allow usage of a current specification(s)
- 4) use of only the specifications that are already on the drawings

#### **4.2 Decision to Invoke the AMPSL**

The AMPSL shall be used for new product development, new part detail drawings or related documentation in need of a VACCO approved and released material. Only released materials are allowed for use, unidentified materials shall be requested through a Materials Change Request (5.2) form to be added to the database for use. For existing legacy products this AMPSL may be used for substitutions or alternates unless otherwise specified on the document that *substitutions or alternates are not allowed*.

If exceptions apply to the use of the AMPSL for a particular program, this requires verification of the conflicting requirement. This verification shall be documented in writing by a VACCO Quality Assurance or Contracts department representative (may be a memo or e-mail maintained with the Quality Records) and must be based on a complete review of the applicable contract documents. This verification should be approved by the responsible VACCO Project Engineer.

#### **4.3 Who May Use the AMPSL**

The AMPSL may be used by Material Requirement personnel, Material Purchasing personnel, or part fabrication supplier, after verification that the customer does not have a conflicting requirement.

#### **4.4 Reversibility**

Unless otherwise noted, the authorized replacement specification is not reversible: i.e. a cancelled specification cannot replace a current specification.

#### **4.5 Different Specifications on Assembly and Detail Drawings**

Where the Engineering design detail drawing and the assembly drawing lists the same material, but different material specifications, either specification can be used, if one specification is an AMPSL approved superseding specification of the other. New VACCO assembly drawings can use current material specifications, without the absolute need to update what are otherwise cancelled or superseded material specifications on the detail drawings with the specifications listed in this AMPSL.

It is considered appropriate engineering practice to have the most current specification on both the detail and assembly drawings. Therefore, it is recommended to update both the assembly and detail drawings with current specifications when the drawings are updated for any other reason.

If it is desired to retain the old specification on a drawing for whatever reason, one option is to have one dash number retain the old specification, and have a new dash number provide the new specification.

#### **4.6 Material Substitution by a Supplier**

Material substitution by a material supplier or a parts supplier requires verification that the customer does not have a conflicting requirement. When a substitution is made by a material supplier or a parts supplier, the supplier's certification shall reflect both the original material and its specification referenced on the Engineering drawing, and also the substitute material and its specification. A statement is required to show the reference table number of this specification which authorizes the substitution. The substitution shall be verified by the supplier's Quality Assurance personnel.

#### **5.0 Configuration Control**

##### **5.1 AMPSL Materials Database**

All materials and substitution lists shall be managed through the Engineering PLM Configuration Control System. Only approved members of the Materials and Process organization are allowed to create new, modify and approve or reject a Materials Change Requests (5.2).

##### **5.2 Materials Change Request**

Any VACCO employee can suggest additional specification for inclusion to the electronic PLM AMPSL database. All requests are presented via PLM through a Material Change Request (MCR) form. M&P will review the suggested MCR to determine inclusion on the AMPSL material database. If the suggested specification is acceptable with certain restrictions, or additional requirements, these restrictions or requirements will be noted.

##### **5.3 Revisions**

All managed database records shall be released and revision controlled via PLM Configuration Control System. Released records are not allowed to be edited or updated without a MCR to describe the description of changes. All revisions shall be identified with a revision letter starting with "-" and subsequently followed by "A,B,C,D....AA" etc.

**TABLE 1**  
Metallic Materials

ALLOY	COMMERCIAL DESIGNATION	Condition <sup>1</sup>	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks	
Aluminum	2024		Bars, Rods, Shapes, Tubing, and Wire; Extruded	QQ-A-200/3	AMS-QQ-A-200/3	MMPDS Section 3.2.4	
	6061			QQ-A-200/8	AMS-QQ-A-200/8	MMPDS Section 3.6.2	
	7075	Gen		QQ-A-200/11	AMS-QQ-A-200/11 AMS 4154 (T6, T6510, T6511) AMS 4617 (T73, T73511, T73510)	AMS-QQ-A-200/11 in MMPDS Section 3.7.8.	
		T76		QQ-A-200/15	AMS-QQ-A-200/15 AMS 4317	AMS-QQ-A-200/15 in MMPDS Section 3.7.8	
	1100		Bars, Rods, Wire; Rolled or Cold Finished	QQ-A-225/1 AMS-QQ-A-225/1	ASTM B211, Alloy 1100	Not in MMPDS	
	2024			QQ-A-225/6	AMS-QQ-A-225/6	MMPDS Section 3.2.4	
	6061			QQ-A-225/8 AMS-QQ-A-225/8 QQ-A-325	AMS 4115 (O) AMS 4116 (T4) AMS 4117 (T6, T651) AMS 4128 (T451)	MMPDS Section 3.6.2	
		7075			QQ-A-225/9	AMS-QQ-A-225/9 AMS 4124 (T73, T7351)	MMPDS Section 3.7.8
	1100			Sheet, Plate	QQ-A-250/1 AMS-QQ-A-250/1	ASTM B209, Alloy 1100	Not in MMPDS
	2024				QQ-A-250/4	AMS-QQ-A-250/4	MMPDS Section 3.2.4

<sup>1</sup> Condition A refers to the annealed condition.

ALLOY	COMMERCIAL DESIGNATION	Condition <sup>1</sup>	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks	
Aluminum	2219		Sheet, plate	QQ-A-250/30	AMS-QQ-A-250/30 AMS 4031 (F) AMS 4601 (T31, T351) AMS 4599 (T81, T851) AMS 4600 (T37) AMS 4613 (T87)	AMS-QQ-A-250/30 & AMS 4031 are in MMPDS section 3.2.14.	
	5083			QQ-A-250/6 AMS-QQ-A-250/6	AMS 4056	MMPDS Section 3.5.2	
	6061			QQ-A-250/11 AMS-QQ-A-250/11 QQ-A-327	AMS 4025 (O) AMS 4026 (T4, T42, T451) AMS 4027 (T6, T62, T651)	MMPDS Section 3.6.2	
	7075			QQ-A-250/12	AMS-QQ-A-250/12	MMPDS Section 3.7.8	
	Various			Casting	MIL-A-21180	AMS-A-21180	354, 359, A201.0, A356.0, A357.0 & C355.0 in MMPDS
				Forging	MIL-A-22771	AMS-A-22771	2014, 2618, 6061, 6151, 7050, 7075, 7175, 7049 & 7149 are in MMPSD.
				Forging	QQ-A-367	AMS-QQ-A-367	2014, 2618, 6061, 7075, 7049 & 7149 are in MMPSD.
	5052		Tube	WW-T-700/4	AMS-WW-T-700/4	Not in MMPDS	
	6061			WW-T-700/6	AMS-WW-T-700/6	MMPDS Section 3.6.2	
				MIL-T-7081 AMS-T-7081	AMS 4081 (T4) AMS 4083 (T6)	MMPDS Section 3.6.2	
Aluminum Bronze	UNS C61400, C63000, C63200, C64200		Rod, Bar and Shapes	QQ-C-465	ASTM B150/B150M	For alloy C61400, round rods only. C32000 shapes up to 5" have lower yield. Not in MMPDS.	

ALLOY	COMMERCIAL DESIGNATION	Condition <sup>1</sup>	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks
Brass, Naval	464		Bars	QQ-B-637, Comp. 1	ASTM B21/B21M Alloy 464 Temper for temper	Not in MMPDS
Copper	C11000 (CDA 110)		Sheet, Strip Plate	QQ-C-576 Annealed 1/4 H 1/2 H H	ASTM B152/B152M O25 H01 H02 H04	Not in MMPDS
Copper- Beryllium	UNS C17000 UNS C17200		Strip	QQ-C-533 A 1/4 H 1/2H H AT 1/4 HT 1/2 HT HT	ASTM B194 TB00 TD01 TD02 TD04 TF00 TH01 TH02 TH04	TB00, TD01, TD02 & TD04 are in MMPDS section 7.3.2
	UNS C17200		Bars, Rods	QQ-C-530 A AT H HT	ASTM B196/B196M TB00 TF00 TD04 TH04	Not in MMPDS
			Wire	QQ-C-530 A ¼ H ½ H H AT H HT	ASTM B197/B197M TB00 TD01 TD02 TD04 TF00 TD04 TH04	Not in MMPDS

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ALLOY	COMMERCIAL DESIGNATION	Condition <sup>1</sup>	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks
Magnesium	AZ31B-0		Sheet, Plate	QQ-M-44	AMS 4375	MMPDS section 4.2.1
Magnesium	AZ31B-H24		Sheet, Plate	QQ-M-44	AMS 4377	MMPDS section 4.2.1
	AZ31B-H26		Sheet, Plate	QQ-M-44	AMS 4376	MMPDS section 4.2.1
Steel, Carbon and Low Alloy	1010-1020	HRCQ = Hot Rolled Commercial Quality	Sheet, Strip	QQ-S-698 ASTM A569/A569M	ASTM A1011/A1011M	Not in MMPDS
		Cold Rolled	Strip	QQ-S-698	ASTM A109/A109M Temper for temper	Not in MMPDS
	1020	Cond A, Hot rolled	Plate, Shapes	QQ-S-635	ASTM A827/A827M	Not in MMPDS
	1020/1025	Annealed	Sheet, Strip	MIL-S-7952	AMS 5046	1025 in MMPDS Section 2.2.1
Steel, Stainless, Austenitic	301	Condition A (Annealed)	Sheet, Strip, Plate	MIL-S-5059 or QQ-S-766	AMS 5901	MMPDS Section 2.7.1
		¼ Hard			AMS 5517	MMPDS Section 2.7.1
		½ Hard			AMS 5518	MMPDS Section 2.7.1
		¾ Hard			AMS 5902	MMPDS Section 2.7.1
		Full Hard			AMS 5519	MMPDS Section 2.7.1
	302	Condition A	Sheet, Strip, Plate	MIL-S-5059 or QQ-S-766	AMS 5516	MMPDS Section 2.7.1
		¼ Hard			AMS 5903	MMPDS Section 2.7.1
		½ Hard			AMS 5904	MMPDS Section 2.7.1
		¾ Hard			AMS 5905	MMPDS Section 2.7.1
		Full Hard			AMS 5906	MMPDS Section 2.7.1

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Steel, Stainless, Austenitic	302		Shim Stock	MIL-S-22499/3 MIL-DTL-22499/3	AMS-DTL-22499/3	Not in MMPDS	
	302		Bar / Wire	QQ-S-763 or AMS QQ-S-763	AMS QQ-S-763	Should not be specified for new design. Not in MMPDS.	
					AMS 5636	Not in MMPDS	
	302, 304, 304L		Screen (Wire Cloth)	RR-W-360 ASTM E437	ASTM E2016	Not in MMPDS	
	302 / 316	Condition A and B	Bars, Wire	MIL-S-7720	AMS-S-7720	Not in MMPDS	
	304	Annealed	Sheet, Strip, Plate		MIL-S-5059 or QQ-S-766	AMS 5513	MMPDS Section 2.7.1
		1/4 Hard				AMS 5910	MMPDS Section 2.7.1
		1/2 Hard				AMS 5911	MMPDS Section 2.7.1
		3/4 Hard				AMS 5912	MMPDS Section 2.7.1
		Full Hard				AMS 5913	MMPDS Section 2.7.1
		1/8 hard	Welded and Seamless Tubing	MIL-T-6845	AMS-T-6845	Not in MMPDS	
		Various	Bar / Wire / Forgings	QQ-S-763	AMS QQ-S-763	Should not be specified for new design. Not in MMPDS	
	Condition A	AMS 5639			Not in MMPDS		
	304L	Condition A	Sheet, Strip, Plate	QQ-S-766	AMS 5511	Not in MMPDS	
		Condition A	Bar / Wire / Forgings	QQ-S-763	AMS QQ-S-763	Should not be specified for new design. Not in MMPDS	
AMS 5647					Not in MMPDS		

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ALLOY	COMMERCIAL DESIGNATION	Condition <sup>1</sup>	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks			
Steel, Stainless, Austenitic	316	Condition A	Sheet, Strip, Plate	MIL-S-5059 or QQ-S-766	AMS 5524	MMPDS Section 2.7.1			
		¼ Hard		MIL-S-5059	AMS 5907	MMPDS Section 2.7.1			
	316	Various	Bar, Wire, Forgings	QQ-S-763	AMS-QQ-S-763	Should not be specified for new design. Not in MMPDS.			
		Condition A			AMS 5648	Not in MMPDS.			
	316L	Condition A	Sheet, Strip, Plate	QQ-S-766	AMS 5507	Not in MMPDS.			
		Various	Bar / Wire/ Forgings	QQ-S-763	AMS-QQ-S-763	Should not be specified for new design. Not in MMPDS.			
					AMS 5653	Not in MMPDS.			
	321	Various	Bars, Wire, Forgings	QQ-S-763	AMS-QQ-S-763	Should not be specified for new design. Not in MMPDS.			
		Condition A			AMS 5643	Not in MMPDS			
	321	Condition A	Sheet, Strip, Plate	MIL-S-6721, Comp. Ti QQ-S-766	AMS 5510	MMPDS Section 2.7.1			
					Annealed	Seam Welded Tubing	MIL-T-6737	AMS 5576	Not in MMPDS
							MIL-T-8808	AMS 5557	Not in MMPDS
	AMS 5570	Not in MMPDS							
	347	Annealed	Sheet, Strip, Plate	MIL-S-6721, Comp. Cb and Ta QQ-S-766	AMS 5512	MMPDS Section 2.7.1			
					Seam Welded Tubing	MIL-T-6737	AMS 5575	Not in MMPDS	
						MIL-T-8808	AMS 5556	Not in MMPDS	
					Seamless	MIL-T-8808	AMS 5571	Not in MMPDS	

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Steel, Stainless, Martensitic	410		Bars, Wire, Forgings	QQ-S-763	AMS 5613	Not in MMPDS
	420		Bars, Wire, Forgings	QQ-S-763	AMS 5621	Not in MMPDS
	440A	Condition A	Bars, Wire, Forgings	QQ-S-763	AMS 5631	Not in MMPDS
	440C	Condition A	Bars, Wire, Forgings	QQ-S-763	AMS 5630	Not in MMPDS
Steel, Stainless, Ferritic	405	Annealed	Bars and Shapes	QQ-S-763	ASTM A276	Not in MMPDS
	430	Annealed	Bars and Forgings	QQ-S-763	AMS 5627	Not in MMPDS
	446	Annealed	Bars and Shapes	QQ-S-763	ASTM A276	Not in MMPDS
Steel, Stainless, Precipitation Hardenable	17-4 PH		Sheet, Strip	MIL-S-81506	AMS 5604	MMPDS Section 2.6.9
	17-7 PH	Condition C	Wire	SAE AMS 5673	AMS 5678	Capable of CH900. Not in MMPDS.
	17-7 PH	Condition A	Sheet	MIL-S-25043	AMS 5528	MMPDS Section 2.6.10
	17-7 PH	Condition C	Sheet	MIL-S-25043	AMS 5529	Not in MMPDS.
Titanium	6AL-4V	Annealed	Bars	MIL-T-9047	AMS 6931	MMPDS Section 5.4.1
		STA		AMS-T-9047	AMS 6930	
	6AL-4V	Annealed	Sheet, Plate	MIL-T-9046	AMS 4911	MMPDS Section 5.4.1
		STA		AMS-T-9046	AMS 4904	
Various		Investment Casting	MIL-T-81915	AMS-T-81915	Not in MMPDS.	

ALLOY	COMMERCIAL DESIGNATION	Condition <sup>1</sup>	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks
Nickel Based	Inconel 625	Solution treated	Plate, Sheet		AMS 5599	MMPDS Section 6.3.3
	Inconel 718	Solution treated	Plate		AMS 5596	MMPDS Section 6.3.5
	Inconel 718	Solution treated	Bars, Forgings, and Rings		AMS 5662 AMS 5664	MMPDS Section 6.3.5 Each spec has a different solution heat treatment. Typically AMS 5662 is more readily available, but AMS 5664 has better low temperature fracture toughness. A fracture analysis may show AMS 5662's fracture toughness to be adequate.
		Solution treated	Investment Casting		AMS 5383	MMPDS Section 6.3.5
	Inconel X750	Spring Temper	Wire		AMS 5699	Not in MMPDS
Cobalt Base Alloys	Elgiloy	Solution Heat Treated & cold rolled.	Strip	MB0170-044 MB0170-102	AMS 5876	Not in MMPDS. Should have drawing note with the AMS spec to restrict Be to 0.05wt% max. AMS allows up to 0.1wt%. Elgiloy Specialty Metals states that above 0.05wt%, the ductility can drop. MB0170-044 restricts Be to less than 0.05wt%, and requires a higher tensile strength than the AMS spec.
		Solution Heat Treated, cold drawn, and aged.	Wire	MB0170-044	AMS 5834	

**TABLE 2**  
Non-Metallic Materials

Compound	Product Designation	Application	FORM	SUPERSEDED SPEC./ OBSOLETE/PROHIBITED MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks
Epoxy-Polyamide, Solvent Based & High Solid	PRIMER	Coating and wet installation of fasteners	Two Parts Liquid	MIL-C-23377	MIL-PRF-23377, Type I, Class N	Obsolescence of spec. containing solvent based primers
Epoxy-Polyamide, High Solid	PRIMER	Coating and wet installation of fasteners	Two Parts Liquid	MIL-PRF-23377, Type I, Class C1 or Class C2	MIL-PRF-23377, Type I, Class N	Substitution of chromated primer to meet OSHA & EPA requirements
Epoxy-Polyamide, High Solid	PRIMER	Coating and wet installation of fasteners	Two Parts Liquid	MIL-PRF-23377, Type II, Class C1 or Class C2	MIL-PRF-23377, Type II, Class N	Same as above
Epoxy-Polyamide, Water borne	PRIMER	Coating and wet installation of fasteners	Two Parts Liquid	MIL-C-85582	MIL-PRF-23377, Type I, Class N	Obsolescence of spec. Avoiding entrapment of water from Waterborne primer, in wet installation
Epoxy-Polyamide, Water borne	PRIMER	Coating and wet installation of fasteners	Two Parts Liquid	MIL-PRF-85582, Type I, Class C1 or Class C2	MIL-PRF-23377, Type I, Class N	Avoiding entrapment of water from Waterborne primer, in wet installation
Epoxy-Polyamide, Water borne	PRIMER	Coating and wet installation of fasteners	Two Parts Liquid	MIL-PRF-85582, Type II, Class C1 or Class C2	MIL-PRF-23377, Type II, Class N	Same as above

**APPENDIX A**

**SUBSTITUTE PROCESSES LIST**

PROCESSES	TYPE OF PROCESSES	Method	FORM	SPECIFICATION CALLED OUT	STATUS	AUTHORIZED SUBSTITUTE	Remarks
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-8625, TYPE III	ACTIVE	AMS 2469	HARD ANODIZING. CORROSION PROTECTIVE HARD SURFACE
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	AMS 2469	ACTIVE	-	NEWER SPEC FOR HARD ANODIZING, SUGGESTED FOR NEW DRAWINGS
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	AMS 2468	CANCELLED	AMS 2469	HARD ANODIZING
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-8625, TYPE II	ACTIVE	NONE	SULFURIC ACID ANODIZING. NO SUBSTITUTION. CORROSION PROTECTIVE
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-8625, TYPE IIB	ACTIVE	NONE	THIN SULFURIC ACID ANODIZING. NO SUBSTITUTION. USED FOR PAINT BASE
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-8625, TYPE I & IB	ACTIVE	NONE	CHROMIC ACID ANODIZE, HAZARDOUS- SUGGESTED TO BE REPLACED BY TYPE II ANODIZING, WITH ENGINEERING APPROVAL
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-63576A, TYPE I	CANCELLED without substitution (8/13/1998)	AMS 2482, TYPE 1 can be used	HARD ANODIZING IMPREGNATED WITH TEFLON



PROCESSES	TYPE OF PROCESSES	Method	FORM	SPECIFICATION CALLED OUT	STATUS	AUTHORIZED SUBSTITUTE	Remarks
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-63576A, TYPE II	CANCELLED without substitution (8/13/1998)	NONE	HARD ANODIZING COATED WITH TEFLON
Anodizing	Electrochemical	Immersion	Finished Aluminum Parts	MIL-A-63576, TYPE III	CANCELLED without substitution (8/13/1998)	NONE	HARD ANODIZING COATED WITH TEFLON AND HEAT CURED
Chemical Conversion Coating	Electro-less	Immersion	Finished Aluminum Parts	MIL-C-5541, CLASS 1A	CANCELLED	MIL-DTL-5541, TYPE I, CLASS 1A	ALSO CALLED ALODINE OR, CHEM FILM. CORROSION PROTECTIVE
Chemical Conversion Coating	Electro-less	Immersion	Finished Aluminum Parts	MIL-C-5541, CLASS 3	CANCELLED	MIL-DTL-5541, TYPE I, CLASS 3	ALSO CALLED ALODINE OR, CHEM FILM. MODERATE CORROSION PROTECTIVE WITH LOW ELECTRICAL RESISTIVITY
Chrome Plating	Electrochemical	Immersion	Any substrate	QQ-C-320, Class 1	CANCELLED	AMS-QQ-C-320, CLASS 1	CORROSION PROTECTIVE TYPE I: BRIGHT FINISH TYPE II: SATIN FINISH
Chrome Plating	Electrochemical	Immersion	Any substrate	QQ-C-320, Class 2	CANCELLED	AMS-QQ-C-320, Class 2	ENGINEERING PLATING (HARD)
Chrome Plating	Electrochemical	Immersion	Any substrate	AMS-QQ-C-320, Class 1	CANCELLED	AMS 2460, Class 1	CORROSION PROTECTIVE TYPE I: BRIGHT FINISH TYPE II: SATIN FINISH

PROCESSES	TYPE OF PROCESSES	Method	FORM	SPECIFICATION CALLED OUT	STATUS	AUTHORIZED SUBSTITUTE	Remarks
Chrome Plating	Electrochemical	Immersion	Any substrate	AMS-QQ-C-320, Class 2	CANCELLED	AMS 2460, Class 2	ENGINEERING PLATING (HARD)
Chrome Plating	Electrochemical	Immersion	Any substrate	AMS 2460	ACTIVE	-	NEWER SPEC, SUGGESTED IN NEW DRAWINGS
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	QQ-N-290, Class 1	CANCELLED	AMS-QQ-N-290, Class 1	CORROSION PROTECTIVE
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	QQ-N-290, Class 2	CANCELLED	AMS-QQ-N-290, Class 2	ENGINEERING PLATING (HARD)
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	AMS-QQ-N-290, Class 1	ACTIVE	-	CORROSION PROTECTIVE
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	AMS-QQ-N-290, Class 2	ACTIVE	-	ENGINEERING PLATING (HARD)
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	AMS 2403	ACTIVE	-	GENERAL PURPOSE NI PLATING, CORROSION/WEAR PROTECTIVE. NEWER SPEC, SUGGESTED IN NEW DRAWINGS
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	AMS 2423	ACTIVE	-	HARD NI PLATING (HARDNESS $\geq 400\text{HV}$ ). NEWER SPEC, SUGGESTED IN NEW DRAWINGS

PROCESSES	TYPE OF PROCESSES	Method	FORM	SPECIFICATION CALLED OUT	STATUS	AUTHORIZED SUBSTITUTE	Remarks
Electrodeposited Nickel Plating	Electrochemical	Immersion	Any substrate	AMS 2424	ACTIVE	-	LOW STRESSED NI PLATING, CORROSION PROTECTION WITHOUT AFFECTING FATIGUE LIFE (HARDNESS ≤300 HV100). NEWER SPEC, SUGGESTED FOR NEW DRAWINGS
Electroless Nickel Plating (contains Phos)	Chemical	Immersion	Any substrate	MIL-DTL-26074, Class 1, 2, 3 & 4	CANCELLED	SAE-AMS-C-26074	
Electroless Nickel Plating (contains Phos)	Chemical	Immersion	Any substrate	SAE-AMS-C-26074, Class 1, 2, 3 & 4	STABILIZED	AMS 2404	CAN BE USED FOR EXISTING PROGRAMS.
Electroless Nickel Plating (contains Phos)	Chemical	Immersion	Any substrate	AMS 2404	ACTIVE	-	GENERAL PURPOSE NI PLATING, CORROSION/WEAR PROTECTIVE. TYPICALLY USED TO PROVIDE UNIFORM BUILD-UP ON INTRICATE SHAPES. NEWER SPEC, SUGGESTED IN NEW DRAWINGS
”	”	”	”	AMS 2404, Class 1	ACTIVE	-	NO POST PLATING THERMAL TREATMENT (SOFTER)

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PROCESSES	TYPE OF PROCESSES	Method	FORM	SPECIFICATION CALLED OUT	STATUS	AUTHORIZED SUBSTITUTE	Remarks
”	”	”	”	AMS 2404, Class 2	ACTIVE	-	THERMAL TREATED AT ≥ 450 °F TO HARDEN DEPOSIT over 800 HK100
”	”	”	”	AMS 2404, Class 3	ACTIVE	-	THERMAL TREATED AT 375 °F FOR NON-HEAT TREATABLE AL ALLOYS
”	”	”	”	AMS 2404, Class 4	ACTIVE	-	THERMAL TREATED AT 250 °F FOR HEAT TREATABLE AL ALLOYS
Electroless Nickel Plating (High Phos )	Chemical	Immersion	Any substrate	ASTM B656	WITHDRAWN	-	AMS 2404 OR ASTM B733 CAN BE USED WITH M&P APPROVAL
Electroless Nickel Plating (High Phos: 1-13%by wt.)	Chemical	Immersion	Any substrate	ASTM B733	ACTIVE	-	HIGH P MAKES HARDNESS CLOSE TO RC 70 AFTER HEAT TREATMENT, EQUAL TO CHROME PLATING. HIGH P ALSO PROVIDES GOOD LUBRICITY AND CORROSION RESISTANCE.
Passivation	Chemical	Immersion	Stainless Steel substrate	QQ-P-35	CANCELLED	AMS-QQ-P-35 AND ASTM A967	
Passivation	Chemical	Immersion	Stainless Steel substrate	AMS-QQ-P-35	CANCELLED	AMS 2700	

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PROCESSES	TYPE OF PROCESSES	Method	FORM	SPECIFICATION CALLED OUT	STATUS	AUTHORIZED SUBSTITUTE	Remarks
Passivation	Chemical	Immersion	Stainless Steel substrate	AMS 2700	ACTIVE	-	VACCO PREFERES AMS 2700 OVER ASTM A967 FOR NEW DESIGNES
Passivation	Chemical	Immersion	Stainless Steel substrate	ASTM A967	ACTIVE	-	
Passivation, Cleaning & De-Scaling	Chemical/Mechanical	Immersion/Blasting	Stainless Steel substrate	ASTM A967	ACTIVE	-	INCLUDES DIFFERENT PROCESSES
Electropolishing	Electrochemical	Immersion	Stainless Steel substrate	ASTM B912	ACTIVE	-	Enhances surface finish and also results passivated surface. Additional passivation is not necessary
Tin-Lead Plating (50-70% Sn, 29-49% Pb)	Electrochemical	Immersion	Any substrate	MIL-P-81728	CANCELLED	AMS-P-81728	
Tin-Lead Plating (50-70% Sn, 29-49% Pb)	Electrochemical	Immersion	Any substrate	AMS-P-81728	ACTIVE	-	
High Purity Aluminum Coating	Mechanical	Ion Vapor Deposition		MIL-DTL-83488	ACTIVE	-	CORROSION PROTECTIVE

**APPENDIX B**

**SUBSTITUTION OF MATERIALS/PROCESSES TRADE NAME**

MATERIALS/PROCESSES	TYPE OF MATERIALS/ PROCESSES	UNS NUMBER	POPULAR COMMERCIAL NAME IN INDUSTRY	ANY OF THE SPECIFICATION CALLED OUT (NOT INTERCHANGABLE )		AUTHORIZED SUBSTITUTE	Remarks
INCONEL 718	Nickel based alloy	N07718	INCONEL 718	AMS 5662, AMS 5663, AMS 5664, AMS 5589, AMS 5590, AMS 5596, AMS 5597, ASTM B637	↔	PYROMET 718	Inconel 718, a trade name for this alloy from Specialty Metals (Inventor) is used all over the Industry e.g., in specs like MMPDS, NASA MAPTIS, AMS 2774 (for Heat Treatment), and in many customer/supplier documents. <b>RECOMMENDATION: For new drawings, use UNS N07718 (Inconel 718)</b>
INCONEL 625	Nickel based alloy	N06625	INCONEL 625	AMS 5581, AMS 5599, AMS 5666, ASTM B446, MIL-DTL-24687, AMS 5590, AMS 5596, AMS 5597	↔	PYROMET 625	Inconel 625, a trade name for this alloy from Specialty Metals (Inventor) is used all over the Industry e.g., in specs like MMPDS, NASA MAPTIS, AMS 2774 (for Heat Treatment), and in many customer/supplier documents. <b>RECOMMENDATION: For new drawings, use UNS N06625 (Inconel 625)</b>
Copper-Nickel-Tin Alloy	77Cu-15Ni-8Sn	C72900	Toughmet 3 TS 160U	AMS 4597, ASTM B929, ASTM B249		Toughmet 3 TS 160U	Toughmet 3 TS is solution annealed, cold finished and hardened to TX-TS temper
Chemical Conversion Coating	Chemical	Immersion	Finished Aluminum Parts	MIL-DTL-5541, CLASS 3	↔	ALODINE; CHEM FILM	Chemical Conversion Coating is the name of this process, also commonly known in the Industry as Alodine or, Chem Film





<b>VACCO</b> VACCO INDUSTRIES ESCO CAGE CODE: 99517		<b>ENGINEERING CHANGE                  REQUEST/NOTICE</b>		ECR NO. <u>20967</u>	
INITIATED BY: <u>Rick Noriega</u>		DEPT. <u>ENG.</u>	DATE <u>1/11/2017</u>	DOCUMENT NO. <u>VI-AMPSL-1900</u>	REV. <u>A</u>
REASONS/REMARKS <u>TO INITIATE A PLM DATABASE PROCESS</u>				DOCUMENT TITLE <b>Approved Materials &amp; Processes Substitution List</b>	
				CHARGE NO. <u>O/H</u>	
DESCRIPTION OF THE CHANGE:  <b>DOCUMENTS NUMBER WAS: VI-AMSL-1900 IS: VI-AMPSL-1900</b>  <b>PARA. 4.2 WAS:</b> Use of the AMPSL for a particular program requires verification that the customer does not have a conflicting requirement. This verification shall be documented in writing by a VACCO Quality Assurance or Contracts department representative (may be a memo or e-mail maintained with the Quality Records) and must be based on a complete review of the applicable contract documents. This verification should be approved by the responsible VACCO Project Engineer.  <b>DELETED PARA 5.0</b> 5.0 Updates Engineering or Quality can suggest additional specifications for inclusion to this document. M&P will review the suggested superseding specification to determine inclusion in the AMPSL. If the suggested specification is acceptable with certain restrictions, or additional requirements, these restrictions or requirements will be noted.  <b>ADDED NEW SECTION 5.0</b>  <b>ADDED TABLE 2</b>  <b>ADDED APPENDIX A: SUBSTITUTE PROCESSES LIST</b>  <b>ADDED APPENDIX B: SUBSTITUTION OF MATERIALS/PROCESSES TRADE NAME</b>					
OTHER DRAWINGS/DOCUMENTS AFFECTED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO (IF CHECKED YES - SEE ATTACHED LIST)					
ECR DISPOSITION: <input checked="" type="checkbox"/> ACCEPT <input type="checkbox"/> REJECT <input type="checkbox"/> HOLD FOR LATER REVISION			ECN INCORPORATION DISPOSITION: <input checked="" type="checkbox"/> INCORPORATE IMMEDIATELY <input type="checkbox"/> HOLD FOR NEXT REVISION		
CHECKER	<u>N/A</u>	DATE	MATERIAL DISP.	R U S O	CHANGE CLASSIFICATION
PROJECT ENGINEER	<u>N/A</u>	<u>—</u>	ON ORDER	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CLASS I <input type="checkbox"/>
ENGINEERING MANAGER	<u>[Signature]</u>	<u>1/11/2017</u>	IN PROCESS	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CLASS II <input checked="" type="checkbox"/>
QUALITY ASSURANCE	<u>[Signature]</u>	<u>01/12/17</u>	IN STOCK	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	RECORDS ONLY <input type="checkbox"/>
MANUFACTURING ENG.	<u>N/A</u>	<u>—</u>	IN ASSY'S	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CHANGE INITIATION
PRODUCTION CONTROL	<u>N/A</u>	<u>—</u>	IN SERVICE	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CUSTOMER DIRECTION <input type="checkbox"/>
M&P ENGINEER	<u>[Signature]</u>	<u>01/12/2017</u>	* OTHER		CORRECTION <input type="checkbox"/>
CONTRACTS	<input type="checkbox"/> INFO ONLY <input type="checkbox"/> APPROVAL <input checked="" type="checkbox"/> N/A	<u>N/A</u>	MAT'L DISPOSITION LEGEND R = REWORK S = SCRAP U = USE O = OTHER		DESIGN IMPROVEMENT <input checked="" type="checkbox"/>
INCORPORATED BY:	<u>J. TORRES</u>	DATE	<u>01/11/2017</u>	EFFECTIVITY S/N <u>upon</u> DATE <u>Release</u>	
CHECKED BY:	<u>[Signature]</u>	DATE	<u>1-12-2017</u>	ENG. INCORP. APPROVAL <u>[Signature]</u>	DATE <u>1/11/2017</u>

FORM VI-ECN-1

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