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REVISION

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APPROVED MATERIALS & PROCESSES SUBSTITUTION LIST

NOTE: THIS DOCUMENT HAS BEEN INTENTIONALLY MODIFIED AND REDUCED TO 9 SHEETS FOR THE PURPOSE OF SUPPLIER INFORMATION AND PUBLIC USE ONLY. FOR A COMPLETE DOCUMENT IN ITS ENTIRETY CONTACT VACCO INDUSTRIES CORRESPONDING APPROVED BUYER OR CONFIGURATION CONTROL TO REQUEST A COPY.

VI-AMSL-1900, Rev. —

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.

TABLE 1
Metallic Materials

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks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

¹ Condition A refers to the annealed condition.

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks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 ¹	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 MMPSD
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

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	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

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks
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

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	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.
		Condition A			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
		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
		Annealed	Seamless	MIL-T-8808	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
		Annealed	Seam Welded Tubing	MIL-T-6737	AMS 5575	Not in MMPDS
				MIL-T-8808	AMS 5556	Not in MMPDS
		Annealed	Seamless	MIL-T-8808	AMS 5571	Not in MMPDS

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	FORM	SUPERSEDED SPEC./ OBSOLETE MATERIAL DESCRIPTION	SUPERSEDING SPEC./ MATERIAL DESCRIPTION	Remarks
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-T-9047	AMS 6931	MMPDS Section 5.4.1
		STA			AMS 6930	
		Annealed	Sheet, Plate	MIL-T-9046 AMS-T-9046	AMS 4911	MMPDS Section 5.4.1
		STA			AMS 4904	
	Various		Investment Casting	MIL-T-81915	AMS-T-81915	Not in MMPDS.

ALLOY	COMMERCIAL DESIGNATION	Condition ¹	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	