

MACHINED PRODUCTS

Material	Code	Specifications
Aluminum	AL	QQ-A225/3D 2011-T3
Brass	B	ASTM – B – 16 -92, Alloy-UNS-No. C360002
Copper- Tellurium	C	ASTM-B-301-96, Alloy-C14500 Temper-HO2- half hard
Delrin	D	ASTM-D-4181-97, Natural, Long-term service, temperature 200°F UL - 94 HB, Virgin Grade.
Fibre	F	ASTM-D-710-97 UL97HB Maximum Service temperature 230° F.
Glass Epoxy	GE	MIL-1-24768/27 -(GEE-F) 25 Feb. 92. G10 UL 94 VE-0
Kel-F	KF	MIL-P-46036, ASTM-D-1430-95. TYPE I Grade I, Class B, C. UL 94 VE – 0
*Nylon Virgin Grade	N	LP-410-Natural 6/6, ASTM-D-4066-96A Natural. Service temperature 210°F UL 94HB, Polyamides (Nylon)
Phenolic – Paper	PH	MIL-I-24768/11-92 FBG Service temperature 285°F UL-94 HB
Phenolic – Linen	PHL	MIL-I-24768/13-92 FBE Service temperature 265°F UL-94 HB
A.B.S.	PA	A.B.S. ASTM-D-4673-96-Natural, Service temperature 160°F UL-94 HB
Lexan	L	Polycarbonate (Lexan) ASTM-D-3935-94-PC, 110 B34720. Continuous usage temperature 250°F U -94 V-2
P.V.C.	PP	P.V.C. round only L.P. 1036 Service temperature 140°F UL-94 VO Tolerances: 1/2 Diameter and under +.010, -.000 over 1/2 diameter + .020, -.000
Rulon – Standard Grade	AR	Operating temperature range -400° to 550°F Color – maroon, non-flammable UL -94 V0
+Stainless Steel	SS	ASTM-A581, 582-95b, (non-magnetic) 303 Series, Condition A. For Socket Head Cap Screws ASME/ANSI B18.3-1998 ASTM-F-837
Steel	S	ASTM-A-108-93 (12L14), QQ-S-637
Teflon	T	Virgin Rod – ASTM-D-1710-91A, Type I, Grade I, Class A Continuous service temperature 500°F UL 94 VO, Virgin Grade
ULTEM 1,000	UL	ASTM-D-5205-96, PEI-0113 Recommended for high heat applications to 340°F, UL 94 VO
Vespel	VE	MIL-P-46112, service temperature 500°F, UL 94 VO

STAMPED PRODUCTS

Material	Specifications
Aluminum	QQ-A250/1F thru QQ-A250/29A ASTM-B-209-93, AMS 4037
Brass	ASTM-B-36-91 AEL, AMS-4505
Phosphate Bronze	ASTM B-103, AMS-4510
Beryllium Copper	ASTM B-194, AMS-4532
Copper	ASTM-B-152-97A, AMS-4500
Delrin	ASTM-D-4181-97, Natural, Long-term service, Temperature 200°F UL-94 HB
Fiber	ASTM-D-710-97 UL 94HB Maximum service temperature 230°F
Glass Melamine-G5	MIL-I-24768/8-92 GSG Maximum recommended continuous operating temperature of 465°F UL 94 VO
Glass Silicone-G7	MIL-I-24768/17-92 GSG Maximum recommended continuous operating temperature of 465°F UL-94 VO
Glass Epoxy-G10	MIL-I-24768/27-(GEE-F) 25 Feb.92 UL 94 VE-O
Kel-F	ASTM-D-1430-95 AMS 3650 UL 94 VE-0
*Nylon	LP-410-Natural 6/6, ASTM-D-4066-96A Natural. Service temperature 210°F UL 94 HB
Phenolic – Paper	MIL-I-24768/11-92 FBG Service temperature 285°F UL-94HB
Phenolic Linen	MIL – I-24768/13 92 FBE Service temperature 265°F UL-94 HB
A.B.S	ASTM-D-4673-96-Natural Service temperature 160°F UL-94 HB
Lexan	ASTM-D-3935-94-PC 110, B34720 continuous usage temp. 250°F UL-94 V-2
Plastic	LP-535-E, ASTM-D-1784-97
Stainless Steel	18-8PH (302-304 series)
Spring Steel	QQ-S-700, ASTM-A-684, AMS5120
Teflon	ASTM-D-3293, ASTM-D-1710-96, Type I, Grade I, Class A UL 94 VO
ULTEM 1,000	ASTM-D-5205-96, PEI-0113 UL 94 VO
**Polyethemide	

*LP/410 Self-extinguishing, melting point degrees F° 480, Deformation under load 122°F with 2,000 PSI.**
Machine Screws low carbon-1010, Socket Head Machine Screws 4037-RC39/45

*** ULTEM 1000 Polyetherimide is a high heat and flame resistant polymer with low smoke properties specifically designed by General Electric. Available in Round Only.

+ Stainless Steel type A-286 excellent service up to 1300°F requiring high strength and good corrosion resistance.

Flame Resistance: Exceptional flame resistance with a limiting oxygen index and low NBS smoke evolution make ULTEM 1000 polyetherimide ideal for interior components in aircraft, bus, and other vehicles where such properties are required.

Properties: High heat resistance; Exceptional flame retardance – U.L. V-O rated; Low smoke; High dielectric strength; Low dissipation factor over a wide frequency range; Stable dielectric constant over varying temperatures and frequencies; Outstanding mechanical properties; Broad chemical resistance; Excellent machinability; Transparent.

NON-METALLIC MATERIALS - APPROXIMATE VALUES

	Delrin	Vulcan-ized Rubber	Glass Epoxy G10	Glass Silicone G7	Glass	Kel F
Dielectric Strength v/ mil (short time)	400-465	150-260	400	350	350-400	630
Dielectric Constant @1000 kc	3.7	4-7	5.4	7-6	4.7	2.4
Power FactorA 1000 kc		.03-.08	.015	.08		
Tensile Strength (psi)	10,000	6,000-12,000	35,000	37,000	18,000-23,000	4600-5700
Shear Strength (psi)		11,000-15,000	19,000		17,000	5800
Compressive Strength (psi)	18,000	20,000-30,000	55,000 (flat)	65,000 (flat)	46,000	32,000-80,000
Elongation (%)	30					150
Flexural Strength (psi)	14,000	12,000-20,000	80,000 (flat)	85,000 (flat)	20,000-25,000	5200
Modulus of Elasticity (psi)	380,000	750,000	2,200,000	2,300,000	1,200,000	150,000
Hardness	R112	R80-R100	M100	M120	M100	R113
Specific Gravity	1.42	1.0-1.5	1.8	1.0	1.7	2.1
Thermal Conductivity (btu/hr/sq.ft/°F)		.25	.17	.29	.17	.15
Specific Heat (btu/lb/°F)		.37		20		.22
Resistance to Continuous Heat (°F)	212	212	280	300	460	390
Water Absorption (%)	.12	16-28	.15	.20	.2-3	.005

NON-METALLIC MATERIALS - APPROXIMATE VALUES *continued*

	Neo- prene	*Nylon Pure(1)	Nylon Moly- Sulfide (M)	Phenolic LE	**Teflon	Polyethylene UHMW
Dielectric Strength v/ mil (short time)	-	385	358	2228	460	KV/CM-900
Dielectric Constant @1000 kc	-	3.4	-	-	2.0	2.3
Power Factor @1000 kc	-	.04	-	5.2	<.0005	@50HZ<.0002
Tensile Strength (psi)	1600	10,500	12,300	10,000- 14,000	1800	3,100
Shear Strength (psi)	-	9,600	-	11,000- 15,000	-	6,300
Compressive Strength (psi)	-	13,000	-	37,000 (flat)	1700	-
Elongation (%)	300	80.	8-150	-	110	300 Molded
Flexural Strength (psi)	-	13,800	18,000	20,000 (flat)	-	-
Modulus of Elasticity (psi)	-	400,000	675,000	1,000,000	58,000	-
Hardness	50-70 SDH	R115	R115	M113	50-70 SDH	73°RC4
Specific Gravity	1.23	1.14	1.16	1.33	2.1-2.3	.930 - .936
Thermal Conductivi- ty (btu/hr/sq.ft/°F)	-	.14	-	.17	.15	2.9
Specific Heat (btu/lb/°F)	-	.4	-	.4	.25	@68°F - 0.99
Resistance to Continuous Heat (°F)	178	300	400	250	600	-22°F - to 180°F
Water Absorption (%)	-	1.5	1.5	1.5	.006	73°- NIL

* Nylon - UL Rating 94V-2 **Teflon - Non-flammable

METALLIC MATERIALS - TYPICAL APPROXIMATE VALUES

	Aluminum 2011-T3 Federal Spec QQ-A- 225/3D	Beryllium Copper Annealed	Beryllium Copper Heat Trtd	Brass (HOH)	Copper
Tensile Strength (psi)	68,000	70,000	180,000	70,000	34,000
Shear Strength (psi)	41,000	–	–	36000	23000
Elongation (%)	20	45	6	30	45
Modules of Elasticity (psi)	10,600,000	19,000,000	19,000,000	15,000,000	17,000,000
Hardness	RB75	RB78	R15N-78-81	RB77	45 Brinell
Specific Gravity	2.77	8.26	8.26	8.46	8.90
Melting Point °F	1180	1600-1800	1600-1800	1660-1715	1949-1981
Electrical conductivity (% of Copper)	30	17	22	26	100
Thermal Conductivity (BTU/hr/ft2/°F/ft)	70	68	68	70	222
Coef. of Thermal Expansion (in/in°F)(106)	12.9	9.3	9.3	10.2	9.3
Specific Heat (BTU/lb/°F)	.23	.10	.10	.09	.09

	Phos. Bronze (Spring- Temp.)	Solder (60-40)	Steel (12L14)	Spring Steel (Heat Trtd)	Stainless
Tensile Strength (psi)	100,000	6,400	78,000	194,000	90,000
Shear Strength (psi)	–	5,700	45,000	–	67,000
Elongation (%)	4	45	30	4	55
Modules of Elasticity (psi)	16,000,000	–	30,000,000	30,000,000	28,000,000
Hardness	RB95	15 Brinell	aRB63	R15N-B2.5-84.5	RB90
Specific Gravity	8.86	8.86	7.85	7.85	7.90
Melting Point °F	1920	362-374	2765	2765	2600-2680
Electrical conductivity (% of Copper)	15	12	12	10	2.4
Thermal Conductivity (BTU/hr/ft2/°F/ft)	40	28	34	29	10
Coef. of Thermal Expansion (in/in°F)(106)	9.9	12.2	6.5	6.7	9.6
Specific Heat (BTU/lb/°F)	.09	.05	.11	.11	.12

NOTE: Information listed above was obtained from charts of various manufacturers and is intended for comparison of materials only. MW Components assumes no obligation or liability in using the above material or product for a specific application.

AMERICAN STANDARD HARDWARE (ASE)

Material Rod & Bar	Ordering Code	Material Specifications	RoHS Compliant
Aluminum	AL	QQ-A-225/3, QQ-A225/6, AMS 4120, QQ-A-225/8, AMS 4117, QQ-A-200/9, AMS 4156	Yes
Brass	B	ASTM-B-16, ASTM-B927/B927M-09, ASTM B453	Yes
Nylon	N	LP-410A, D 4066	Yes
Phenolic – Paper	PH	MIL-P-79 Type PBE, MIL-I-24768/10	Yes
Phenolic – Tube	PH	MIL-P-79 Type PGB, MIL-I-24768/11	Yes
Phenolic – Linen	PHL	MIL-P-79 Type FBE, MIL-I-24768/13	Yes
Steel	S	ASTM-A108-07, ASTM-A108-13	Yes
Stainless Steel	SS	ASTM-A-581, A-582	Yes
Teflon	TE	ASTM-1710	Yes
Delrin	D	ASTM-D-4181	Yes

AMERICAN STANDARD HANDLES

Material Rod & Bar	Ordering Code	Material Specifications	RoHS Compliant
Aluminum	A	QQ-A-225/8, AMS 4117, QQ-A-200/9, AMS 4156	Yes
Aluminum (Ferrules Only)	AL	QQ-A-225/3, QQ-A-225/6, AMS 4120, QQ-A-225/8, AMS 4117, QQ-A-200/9, AMS 4156	Yes
Brass	B	ASTM-B-16, ASTM-B927/B927M-09, ASTM B453	Yes
Steel	S	ASTM-A108-07, ASTM-A108-13	Yes
Stainless Steel	SS	ASTM-A-581, A-582, ASTM-A484-11	Yes
Phenolic – Linen	PHL	MIL-P-79 Type FBE, MIL-I-24768/13	Yes
Steel	S	ASTM-A108-07, ASTM-A108-13	Yes
Stainless Steel	SS	ASTM-A-581, A-582	Yes

METRIC HARDWARE & HANDLES

Material Rod & Bar	Ordering Code	Material Specifications	RoHS Compliant
Aluminum	AL	QQ-A-225/3, QQ-A225/6, AMS 4120, QQ-A-225/8, AMS 4117, QQ-A-200/9, AMS 4156	Yes
Aluminum (Handles Only)	A	QQ-A-225/8, AMS 4117, QQ-A-200/9, AMS 4156	Yes
Brass	B	ASTM-B-16, ASTM-B927/B927M-09, ASTM B453	Yes
Nylon	N	LP-410A, D4066	Yes
Steel	S	ASTM-A108-07, ASTM-A108-13	Yes
Stainless Steel	SS	ASTM-A-581, A-582, ASTM A484-11	Yes

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