



# Appendix

## Products by Trade Name or Manufacturer

Manufacturer	Material	Page
3M	Abrasives	90
3M	Adhesives	67
3M	Scotch-Brite Abrasive Pads	94
3M	Mold Release Agents	105
3M	Morson Platinum Body Filler	59
3M	Respirators	108
3M	Roloc Discs & Holders	93
3M	Sprayon Blue Layout Fluid	81
Adhesive Systems, Inc. (ASI)	Adhesives	61
Adolf	Cope and Drag Inserts	70
Airtech	Sheers	101
Alvin Labs	Lab-metal	58
Araldite	Adhesives	61
Bacolac	Sealer	102
Bluestar	Silicone Rubbers	26
Cab-O-Sil	Fumed Silica	49
Chavant	Styling Clay	112
Chem-Trend	Release Agents	104
Cleveland	Vibrators	81
Devcon	Adhesives	60, 63
Devcon	Repair Materials	58
Devcon	Tooling Resins	23, 31
Dike-O-Lastic	Ejector Buttons	78
Dike-O-Seal	Preform Strips	77
Dike-O-Seal	Gating Components	81
Disa-Matic	Wiper Blades	81
Duratec	Polyester Surface Primer	103
Dux-Bak	Parting Bags	81
Dymo	Tapewriter	89
Dynalite	Repair & Build Up Material	59
F-Bond	Cyanoacrylate Adhesive	64
Freeman	Epoxy Tooling Plastics	30
Freeman	Machinable Wax	2, 52
Freeman	Pattern Coating	102
Freeman	Polyurethane Tooling Plastics	18
Freeman	Quik-Fil	57
Freeman	Repro Fast Cast Urethanes	16
Freeman	Sheet Wax	53
Freeman	TUF Products	56
Freeman	Wax Release	104
Freeman	Wood Glue	66
Freeman	Wood & Plaster Sealer	102
Freeman-Palmer	Pattern Plates	68

Manufacturer	Material	Page
Fre-Sealer	PVC Lacquer	113
Gas Vac II	Vacuum Degassing Unit	98
Huntsman	Ren Shape Tooling Boards	3
Huntsman	Tooling Plastics	17
Jiffy	Mixer	98
Johnson	Paste Wax	104
Kutzall	Carbide Rotary Burrs	101
Marbalease	Polymer Concrete Release	104
Match-Lok	Buttons	70
Michael Engineering	Super 'E' Meter Mixing Machine	99
Mold-Lock	Alignment Buttons	70
Ohaus	Measuring Scales	99
Palmer	Pattern Plates	68
Partall	PVA Mold Release	104
Peerless	Core Box Clamps	79
Perfect Plank	Pattern Lumber	8
Plast-Econ	Modeling Clay	112
Plunge	Mixer	99
Pro-Cast	Tooling Plastics	17
Puma Polymers	Tooling Plastics	21
Red Devil	Mixer	98
RenCast	Polyurethanes	17
RenGel	Epoxy Surface Coats	36
RenLam	Epoxy Laminating Resins	33
RenRelease	Releases	105
RenPaste	Epoxy Tooling Materials	41
RenPIM	Rapid Cast Polyurethanes	25
RenShape	Modeling Material	3
Repro	Tooling Plastics	16
Richlite	Fibre Laminate Sheets	13
Roloc	Abrasive Discs & Pads	93
Roovers	Embossing Press	89
Safe-T-Planer	Wagner	100
Shalco	Blowplate Gasket	77
Shalco	Super Vents	74
Sprayon	Aerosol Mold Releases	105
Striptube	Core Box Seal	77
Tecbond	Hot Melt Adhesives	66
True-Line	Dowels	73
TUF	Repair & Build-up Material	56
USC	Polyester-Base Repair Materials	59
U.S.G.	Industrial Plasters	42
Ventistamp	Core Box Air Release Vents	74
Wagner	Safe-T-Planer	100

## Alphabetical Product Listings

### A

Abrasive Cartridge Rolls	95
Abrasive Cleaner Bar	91
Abrasive Discs & Holders	94
Abrasive Discs, Sanders	91
Abrasive Hand Pads, 3M Scotch-Brite	94
Abrasive Sheets	90
Abrasive Sleeves, Sanders	92
Acetate Sheet	85
Acetone Solvent	113
Acid Brush	110
Adhesives, Araldite	61
Adhesives, ASI	63
Adhesives, Cyanoacrylate	64
Adhesives, Devcon	63, 64
Adhesives, Epoxy	60
Adhesives, Freeman F-Bond	64
Adhesives, Freeman White Glue	66
Adhesives, Hot Melt	66
Adhesives, Huntsman Ren-Weld	67
Adhesives, Methacrylates	63
Adhesives, Polyurethanes	64
Adhesives, 3M	67
Adolf Cope & Drag Buttons	70
Aerosil 200 Fumed Silica	49
Alcohol Lamp	54
Alcohol Solvent	113
Alder, Perfect Plank	9
Alumina Trihydrate (ATH), Mia 67	48
Aluminum Fillers	48
Aluminum Honeycomb	51
Aluminum Oxide Abrasive Discs	91
Aluminum Paint Pot	102
Aluminum Pattern Plates	68
Aluminum Powder	48
Aluminum Puffs	48
Aluminum Sand	48
Aluminum Sheet	85
Aprons	108
Araldite Adhesives	61
Aramid Fiber Honeycomb	51
Armorboard	85

### B

Bacolac Sealer	102
Band Saw Accessories	97
Band Saw Tire Cement	97
Band Saw Tires	97
Beeswax	55
Bench Rammer	80
Bench Scale, Ohaus	99
Birch Plywood	84
Bits, Machine	100
Blade, Wipers, Disa-Matic	83
Blind Gauging Wax	55
Blowplate Gasket – Shalco	77
Bluestar Accessories	29
Bluestar, Silicone Rubbers	26
Bodi Rollers	111
Bottles, Glue	66
Brad Point Drill Bits	101
Brads, Wire	96
Brass Dowels	72
Brass Escutcheon Pins	96
Brass Rod	81
Brass Sheet	85
Brush, Acid	110

Brushes, Assorted	110
Brushes, Throwaway	110
Bulb, Paste	80
Burrs, Rotary, Karbide Kutzall	101
Buttons, Adolf	70
Buttons, Dike-O-Lastic Ejector	78
Buttons, Match-Lok	70
Buttons, Mold-Lock	70

### C

Cab-O-Sil Fumed Silica	49
Cabinet, Pattern Letters	88
Calcium Carbonate, Mia 61	48
Carbon Fiber Cloth	47
Carbon Fiber Tape, Unidirectional	48
Cartridge Rolls, Abrasive	95
Cartridge Rolls, Mandrels	95
Casting Resin, Polyurethanes	15
Casting Resins, Epoxy	30
Celastoc Solvent (MEK)	113
Cement, Band Saw Tire	97
Cement, Disc	71
Cement, Fillet	78
Cement, USG Gypsum	46
Ceramic Spheres, (Mia 64)	48
Chainlock Plates Freeman-Palmer	68
Chavant Modeling Clay	112
Chemwax 500	104
Chopped Strand Mat	46
Clay, Plast-Econ Epoxy Modeling	112
Clays, Chavant Modeling	112
Cleaner Bar, Abrasive	91
Cleaner, Hand	109
Clean-Up Supplies	109
Cloth, Fiberglass	44
Coatings, Pattern	102
Cold Glue	66
Color Pastes, DW	49
Color Pastes, Polyester	49
Color Tints, Freeman	49
Compact Scale, Ohaus	99
Concrete Release, Marbalease	104
Cope & Drag Inserts, Adolf	70
Core Box Clamps, Peerless	79
Core Box Seals	77
Core Box Vents	74
Core Vent Wax	55, 78
Corrugated Fasteners	97
Cotton Flock	49
Countersink Cutter	100
Cups, Paper & Plastic	109
Cyanoacrylate Adhesives	64

### D

Degassing Unit, Gas Vac	98
Devcon Repair Materials	58
Di-Dup Wax Fillet	55
Digital Bench Scale, Ohaus	99
Dike-O-Lastic Ejector Buttons	78
Dike-O-Seal Preform Strips	77
Disc Cement	91
Discs, State Sander Abrasive	91
Discs, 3M Abrasive Roloc	93
Dispenser, for TUF Products	57
Dispensing Gun, Adhesives	65
Dispensing Nozzels, Adhesives	65
Double Face Tape	113

Dowels, Malleable Iron	73
Dowels, Husky	71
Dowels, True-Line Steel	73
Dowels, Square Head Brass	72
Dowels, Square Head Steel	72
Dowels, Wood	73
Drill Bits	100
Drill, Vent Inserting	77
Drums, Expandable Rubber for Spindle Sanders	92
Dry Parting, Dux-Bak	81
Drywall Screws	97
Duratec Primers	103
Dux-Bak Dry Parting	81
Dyes & Pigments	49
Dymo Tape Embosser	89
Dynalite Repair Material	59

### E

Eastern White Pine Pattern Lumber	10
Ejector Buttons, Dike-O-Lastic	78
Electronic Scale, Ohaus	99
Embosser, Dymo Tape	89
Embossing Press, Roovers	89
Embossing Tapes	89
Epoxy Adhesives, Araldite	61
Epoxy Casting Resins	30
Epoxy Hand Cleaner	109
Epoxy Laminating Resins	33
Epoxy Repair Materials	58
Epoxy Surface Coats	36
Epoxy, Resin Infusion Systems	39
Epoxy, Resin Systems	42
Epoxy, Specialty Tooling Pastes	40
Escutcheon Pins, Brass	96
Eurobirch Plywood	83
Euroform Plywood	83

### F

Fast-Cast Urethanes, Freeman	14
Fasteners, Corrugated	97
Fasteners, Link-Lock	79
Fast Set 505 Adhesive	60
F-Bond Cyanoacrylate Adhesive, Freeman	64
Fiberglass, Chopped Strand Mat	47
Fiberglass Cloth	44
Fiberglass Strand	16, 46
Fiberglass Tape	45
Fiberglass Tooling Fabrics	44
Fiberglass, Veil Cloth	46
Fiberglass, Woven Roving	46
Fibre-Laminate, Richlite	13
Fillers, Aluminum	48
Fillers, Tooling Plastic	48
Fillet Cement	78
Fillet Cement Thinner	See Acetone Solvent
Fillet, Di-Dup Wax	54
Fillet, Leather	78
Fillet Shapers	59
Fillet Tools	54
Fillet Wax	54
Fir Plywood	84
Flake Shellac	103
Flexane Primers	102
Flock, Cotton	49
Formula Five Clean & Glaze	103



## Alphabetical Product Listings [CONT'D.]

<b>F</b>		<b>L</b>		<b>O</b>
Formula Five Mold Release Wax .....	104	Lab Metal .....	58	Ohaus Scales.....
Freeman Color Tints .....	49	Lab Solvent .....	58	Optical Soluble Wax .....
Freeman Fast Set 505 Adhesive.....	60	Laminates, Richlite Fibre .....	13	
Freeman-Palmer Pattern Plates.....	68	Laminating Resin, Epoxy.....	33	<b>P</b>
Freeman Wax Release.....	104	Laminating Resin, Repro.....	16	Paddles, Wood Mixing.....
Fre-Sealer, PVC.....	43	Lamp, Alcohol .....	54	Pads, Scotch-Brite Abrasive.....
Fumed Silica .....	49	Lance Pyrometer.....	80	Paint Pot.....
		Latex Disc Cement .....	91	Paper Cups .....
<b>G</b>		Layout Fluid.....	81	Paraffin Wax.....
Garnet Abrasives .....	90	Leather Fillet .....	78	Partall Mold Releases.....
Gas Vac II .....	98	Letters, Pattern.....	86	Particle Board.....
Gating Components Dike-O-Seal.....	81	Link-Lock Fasteners.....	79	Parting Bags, Dux-Bak .....
Gauging Wax .....	55	Logos, Pattern Letter .....	88	Paste Bulb.....
Gel Coat Mini Sprayer .....	99	Lok-In Pattern Letters .....	86	Paste Wax, Johnson.....
Glass Bubbles, Mia 67.....	48	Lumber, Perfect Plank .....	8	Paste Wax, Trewax.....
Glass Fibers, Milled .....	49	Lumber, Rough Sawn Pattern .....	10	Pattern Coatings, Freeman .....
Gloves, Plaster.....	43			Pattern Knives.....
Gloves, Vinyl Latex, Nitrile.....	108	<b>M</b>		Pattern Letters.....
Glue Bottles.....	66	Machinable Wax Adhesive, 3M.....	67	Pattern Letter Logos .....
Glue, Freeman Cold .....	66	Machinable Wax, Freeman.....	52	Pattern Letters Cabinet.....
Glue, Styro .....	67	Magnesium Pattern Plates, Dowmetal .....	69	Pattern Lumber, Perfect Plank .....
Graduated Plastic Cups.....	109	Mahogany Pattern Lumber.....	11	Pattern Lumber, Rough Sawn .....
Graphite Powder, Mia 84.....	49	Malleable Iron Dowels .....	73	Pattern Plates, Freeman-Palmer .....
Grease Stick, Matchless.....	97	Malleable Iron Rapping Plates.....	81	Pattern Plywood.....
Gypsum Cement.....	42	Mandrels, Cartridge Rolls .....	95	Pattern Release 202 .....
		Manila Hemp.....	43	Peerless Core Box Clamps .....
<b>H</b>		Maple Pattern Lumber .....	11	Perfect Plank Alder.....
Hand Cleaners .....	103	Marbalease Concrete Release .....	104	Perfect Plank Jelutong.....
Hand Pad, Scotch-Brite .....	94	Marbalease, Polymer Concrete Release .....	104	Perfect Plank Mahogany.....
Hand Pumps, Miapoxy 100 .....	99	Masking Tape .....	113	Perfect Plank Pine .....
Hand Riddle .....	80	Mask, 3M Respirator.....	108	Perfect Plank Poplar .....
HDO Plywood .....	84	Masonite Sheet Material .....	85	Pigments & Dyes .....
Hemp, Manila.....	43	Match-Lok Buttons .....	70	Pinch Dogs.....
Hi-Performance Sealer .....	102	Matchless Grease Stick.....	97	Pine Pattern Lumber.....
Holders, Lok-In Patter Letters.....	86	Maxim Fast.....	58	Pine Plywood .....
Holders, Roloc Disc .....	93	Maxvents, Ventistamp .....	74	Pins, Escutcheon, Brass.....
Honeycomb .....	51	MDO Plywood.....	84	Pitch Solvent.....
Hot Melt Foundry Adhesives .....	66	Medium Density Fiberboard, MDF .....	13	See Xylene Solvent
Huntsman Adhesives.....	66	Melaboard .....	85	Plast-Econ Modeling Clay.....
Huntsman Epoxies.....	37	Meltvents FS, Ventistamp.....	74	Plaster Accessories .....
Huntsman Polyurethanes .....	18	Meter-Mix Machine, Michael.....	99	Plaster Gloves.....
Huntsman Release Agents.....	104	Methacrylate Adhesives, Araldite .....	63	Plaster Release.....
Huntsman Repair Materials.....	58	Methyl Ethyl Ketone (MEK) .....	113	Plaster Rubber Mixing Containers.....
Huntsman Seamless Modeling Paste .....	12	Mia Fillers.....	48	Plasters, U.S.G., Industrial .....
Huntsman Tooling Boards .....	3	Mia Vacuum Bagging Supplies .....	50	Plastic Cups .....
Husky Dowels, Freeman .....	71	MicroCrystalline Wax .....	55	Plastic Portion Resin Scale .....
		Mineral Spirits .....	113	Plastic Sheet, Acetate.....
<b>I</b>		Milled Cotton Fibers, Cotton Flock .....	49	Plates, Pattern, Freeman-Palmer .....
Insert Drills, Core Boxes .....	77	Mixer, Jiffy .....	98	Plates, Rapping.....
Inserts, Cope & Drag, Adolf.....	70	Mixer, Plunge .....	98	Plunge Mixer .....
		Mixing Bowls, Rubber .....	43	Plunger Can .....
<b>J</b>		Mixing Paddles, Wood.....	109	Plywood.....
Jelutong Pattern Lumber .....	10	Mixer, Red Devil.....	98	Pneumatic Dispenser - TUF Products.....
Jiffy Mixer .....	98	Mixer, Super E.....	99	Polyester Coloring Pastes .....
Johnson Paste Wax.....	104	Modeling Clays, Chavant.....	112	Polyester Primers.....
		Mold Cleaners, Semi-Permaenent .....	106	Polyester Repair Materials.....
<b>K</b>		Mold Primers, Semi-Permanent .....	106	Polyester Resins & Gelcoats .....
Karbide Rotary Burrs, Kutzall .....	101	Mold-Lock, Alignment Buttons.....	70	Polyurethane Adhesives .....
Kevlar Fabrics .....	46	Mold Releases .....	104	Polyurethane Repair Materials .....
Knives, Pattern.....	101	Mold Sealers, Semi-Permanent.....	106	Polyurethanes, Fast-Cast .....
Krylon Primer .....	103	Mouth-Type Spray Can.....	80	Polyurethanes, Intermediate Cure.....
Kutzall, Carbide Rotary Burrs .....	101	Multi-Spur Drill Bits .....	100	Polyurethanes, Overnight Cure .....
				Polyurethanes, Rapid Cure .....
<b>N</b>				Poplar Pattern Lumber.....
Nails .....	97			Portion Scale, Plastic Resin .....
				Powder, Aluminum.....
				Prepared Shellac .....

## Alphabetical Product Listings [CONT'D.]

Prep Solvent.....	113
Pressure Sensitive Tape.....	51
Primers.....	103
Pro-Cast Tooling Plastics.....	17
PVA-Based Mold Releases.....	105
PVC, Fre-Sealer.....	43
Pyrometer, Lance.....	80

### Q

Quik-Fil Tooling Board Repair Paste.....	57
--	----

### R

Rags, Shop.....	109
Rammer, Bench.....	80
Rapping Plates.....	81
Red Devil Mixer.....	98
Release Agents, Semi-Permanent.....	106
Release, Freeman Wax.....	104
Release, Plaster.....	43
Releases, PVA, Silicone & Wax.....	104
Ren Tooling Products.....	See Huntsman
RenShape Tooling Board.....	3
Repair Material, TUF Products.....	56
Repair Materials, Epoxy.....	58
Repair Materials, Maxim Fast.....	58
Repair Materials, Mia Plas-Fil.....	59
Repair Materials, Polyester.....	59
Repair Materials, Polyurethane.....	58
Repair Paste, Quik-Fil Tooling Board.....	57
Repro Tooling Plastics.....	14
Resin Dyes & Pigments.....	49
Resin Infusion Epoxy Systems.....	39
Respirators, 3M.....	108
Richlite Fibre-Laminates.....	13
Riddles, Hand.....	80
Rod, Brass.....	81
Rollers.....	111
Rolls, Abrasive Cartridge.....	95
Roloc Abrasives.....	93
Roovers Embossers & Tapes.....	89
Rotary Burrs, Carbide Kutzall.....	101
Rotary Surfacers.....	100
Round Rapping Plates.....	81
Roving, Woven Fiberglass.....	46
Rubber Drums for Spindle Sanders.....	92
Rubber Mixing Containers.....	43
Rubbers, Bluestar Silicone.....	27
Russian Birch Plywood.....	83

### S

Safe-T-Planer, Wagner.....	100
Safety Plunger Can.....	109
Sand Paper.....	See Abrasives
Scales, Ohaus.....	99
Scale, Plastic Portion Resin.....	99
Scotch Bright Discs (3M).....	93
Scotch Bright Hand Pads (3M).....	94
Screen Core Vents.....	75
Screws, Drywall.....	97
Screws, Wood.....	96
Sculpture Wax.....	55
Sealant Tape.....	51
Sealer, Devcon.....	102
Sealer, Wood & Plaster.....	102
Seals, Core Box.....	77
Seamless Modeling Paste.....	12

Semi-Permanent Mold Release Systems.....	106
Shalco Blowplate Gasket.....	77
Shalco Super Vents.....	74
Shapers, Fillet.....	59
Shears.....	101
Sheet, Acetate.....	85
Sheet, Aluminum.....	85
Sheet, Brass.....	85
Sheets, Abrasive.....	90
Sheet Wax Adhesive.....	67
Sheet Wax, Freeman.....	53
Shellac, Prepared & Flake.....	103
Shop Rags.....	109
Silicon Carbide Coated Abrasive Mesh.....	90
Silicone-Based Mold Releases.....	105
Silicone Rubbers, Bluestar.....	27
Silicone Spray Release.....	105
Sleeves.....	108
Sleeves, Abrasive, State Sanders.....	92
Slicks & Trowels.....	97
Slotted Core Vents.....	76
Sol-U-Carv.....	55
Soluble Wax, Optical.....	55
Solvents.....	113
Spherecore Core Material.....	51
Spray Can, Mouth-Type.....	80
Sprayer, Gel Coat Mini.....	99
Sprayon Mold Releases.....	105
Sprue Cutters, Tapered.....	80
Square Head Dowels, Brass.....	72
Square Head Dowels, Steel.....	72
Steel Dowels, True-Line.....	73
Steel Pinch Dogs.....	96
Steric Acid.....	43
Stick Wax Lubricant.....	97
Stitchmat.....	46
Strand, Fiberglass.....	16, 46
Stripube.....	77
Styro Glue.....	67
Sugar Pine Pattern Lumber.....	10
Super E Mixer, Michaels.....	99
Surface Coat, Epoxies.....	36
Surface Coat, Repro.....	16
Surface Primers.....	103
Surfacers, Rotary.....	100
Surfacing Primers.....	103
Synlube 531.....	104

### T

Tape, Aluminum & Zinc Embossing.....	89
Tape, Double-Face.....	113
Tape, Fiberglass.....	45
Tape, Masking.....	113
Tape, Pressure Sensitive.....	51
Tape, Sealant.....	51
Tape, Unidirectional Carbon Fiber.....	47
Tapered Sprue Cutters.....	80
Tapewriter Dymo.....	89
Tecbond Hot Melt Adhesives.....	66
Thinner, Fillet Cement.....	See Acetone Solvent
Throwaway Brushes.....	110
Tire Cement, Band Saws.....	97
Tires, Band Saw.....	97
Tongue Depressors.....	109
Tooling Board Adhesives.....	67
Tooling Fabrics, Fiberglass.....	44
Trewax Paste Wax.....	104
Triple Beam Balance, Ohaus.....	99
Trowels & Slicks.....	79

True-Line Dowels, Freeman.....	73
TUF-Carv Repair Material.....	57
TUF-Fil Repair Material.....	56

### U

Unidirectional Carbon Fiber Tape.....	47
Urethane Adhesives, Araldite.....	64
Urethane Protectants.....	109
Urethane Tooling Board, Ren Shape.....	4
USG Industrial Plasters.....	42

### V

Vacuum Bagging Supplies.....	50
Vacuum Degasser, Gas Vac.....	98
Vent Cleaners.....	77
Vent Inserting Drill.....	77
Ventistamp Zanatta Vents.....	74
Vent Plugs.....	77
Vents, Core Box.....	74
Vents, Shalco Super.....	74
Vibration Inducers.....	81
Victory Brown Wax.....	55

### W

Walnut Shells.....	48
Wax, Blind Gauging.....	55
Wax, Core Vent.....	58, 78
Wax Fillet.....	54
Wax Fillet, Di-Dup.....	54
Wax, Freeman Machinable.....	52
Wax, Miscellaneous.....	55
Wax, Paste.....	104
Wax Release, Formula Five.....	104
Wax Release, Freeman.....	104
Wax, Sheet Freeman.....	53
Wax-Based Mold Releases.....	104
Wedges.....	110
White Cold Glue.....	66
Wiper Blades, Disa-Matic.....	81
Wire Brads.....	96
Wire Nails.....	97
Wood & Plaster Sealer, Freeman.....	102
Wood Dowels.....	73
Wood Flour, Mia 62.....	49
Wood Glue.....	66
Wood Mixing Paddles.....	109
Wood Screws.....	96
Woven Roving, Fiberglass.....	46

### X

Xylene Solvent.....	113
---------------------	-----

### Z

Zanatta, Ventistamp Vents.....	74
Zinc Embossing Tape.....	89

## Appendix

Glossary.....	118
Sealing/Releasing Procedures.....	119
Metric & English Conversions Table.....	120
Reference Tables.....	120
Calculating Material Requirements.....	121
Fractions, Decimals, Millimeters.....	121

## Glossary of Plastic Tooling Terms

**Adhesion** – The state in which two surfaces are held together by interfacial force.

**Coefficient of Thermal Expansion** – The fractional change in length of a material for a unit of change in temperature. Normally expressed in “inch-per-inch, per degree Fahrenheit”.

**Compressive Strength** –  $\frac{1}{2}$ " x  $\frac{1}{2}$ " x 1" specimen is mounted in a compression-type tester between two heads that exert pressure at a constant rate of movement until the specimen fails by rupturing or deforming to a % of its' height. Normally expressed in “pounds per square inch”, this test provides the maximum load sustained, divided by the original area of the specimen.

**Cure** – To change the physical properties of a plastic or resin by chemical reaction, which may be condensation, polymerization, or addition: usually accomplished by the action of either heat or catalyst or both, and with or without pressure.

**Deflection Temperature** – The temperature at which a 5" x  $\frac{1}{2}$ " x  $\frac{1}{2}$ " specimen deflects .010 inches under a stated load of 66 or 264 pounds per square inch.

**Density** – Mass per unit volume of a substance, expressed in units such as grams per cubic centimeter, pounds per cubic foot or pounds per gallon.

**Endothermic** – Pertaining to a reaction which is accompanied by the absorption of heat.

**Exothermic** – Pertaining to a reaction which is accompanied by the evolution (giving off) of heat.

**Flexural Modulus** – The ratio, within the elastic limit, of the applied stress on a test specimen in flexure to the corresponding strain in the outermost fibers of the specimen.

**Flexural Strength** – 5" x  $\frac{1}{2}$ " x  $\frac{1}{8}$ " specimen is placed on supports 4" apart and a standard load is applied to the center of the specimen at a specified rate. The maximum stress in the outer fiber at the moment of crack or break is expressed in “pounds-per-square-inch”.

**Glass Transition Temperature (Tg)** – A reversible change that occurs when plastic is heated to a certain temperature range, characterized by a rather sudden transition from a hard, glassy, or brittle condition to a flexible or elastomeric condition.

**Gel Time** – With reference to thermosetting resins, the interval of time between introduction of the catalyst and the formation of a semi-solid system consisting of a network of aggregates in which a liquid is held. The initial jelly-like solid phase that develops during the formation of a resin from a liquid, usually a 4-fluid ounce mass.

**Percentage of Elongation** – Increase in length of a specimen at the instant before rupture occurs. Normally expressed as a percentage.

**Plasticity** – The ability of a material to withstand continuous and permanent deformations by stress exceeding the yield value of the material without rupture. The opposite of elasticity.

**Post-curing** – The process of forming an uncured thermosetting resin article, then completing the curing after the article has been removed from its forming mold or mandrel.

**Pot-life (working life)** – The period during which a compound, after mixing with a catalyst, solvent or other compounding ingredients, remains suitable for its intended use.

**Shore Hardness (Indentation Hardness)** – The hardness of a material as determined by either the size of an indentation made by an indenting tool under a fixed load, or the load necessary to produce penetration of the indenter to a pre-determined depth. To measure the Shore hardness of a material a Shore testing instrument is used which is comprised of spring-loaded indenter point projecting through a hole in a presser foot and a device to indicate the distance the point projects beyond the face of the foot. The scale readings range from 0 (for 0.100 penetration) to 100 (for zero penetration). A Shore “A” instrument employs a “sharp” indenter point with a load of 822 grams. The Shore “D” instrument employs a “blunt” point and the load is 10 pounds.

**Taber Wear Index** – The ability of a material to withstand mechanical action such as rubbing, scraping or erosion, that tends to progressively remove material from its surface. Usually expressed in milligrams loss per number of cycles per a given load.

**Tensile Modulus** – The ratio of stress to corresponding strain below the proportional limit of the material. Expressed normally in pounds-per-square-inch.

**Tensile Strength** –  $\frac{1}{8}$ " thick x  $\frac{3}{4}$ " to  $\frac{1}{2}$ " wide x  $8\frac{1}{2}$ " long specimen is inserted in an Instron Tester and is pulled apart at specified rates until the specimen fails by separating. Usually expressed in pounds-per-square-inch.

**Thermoforming** – The process of forming a thermoplastic sheet into a three-dimensional shape by clamping the sheet in a frame, heating it to render it soft and flowable, then applying differential pressure to make the sheet conform to the shape of a mold or die positioned below the frame.

**Thermoplastics** – Resins or plastic compounds which in their final state as finished articles are capable of being repeatedly softened by increased temperature and hardened by decrease of temperature by means of physical change.

**Thermosetting Plastics (thermosets)** – Resins or plastic compounds which in their final state as finished articles are substantially infusible or insoluble. Thermosetting resins are often liquids at some stage in their manufacture or processing, which are cured by heat, catalyst or other chemical means. After being fully cured, thermosets cannot be reliquified by heat.

**Thixotropy** – A flow characteristic evidenced by a decrease in viscosity of a fluid when it is stirred at a constant or increasing rate of shear. When the stirring or shearing is discontinued, the apparent viscosity of the fluid gradually increases back to the original value. Changes in both directions are dependent on time as well as shear.

**Viscosity** – The thickness of a substance and its resistance to flow. The higher the viscosity number, the thicker the substance.

# Preparation of Patterns/Molds

## Sealing A Wood Pattern/Model

(also applies to plaster and sheet wax)



1. Apply one coat of Freeman Wood and Plaster Sealer (a fairly thin viscosity, lacquer-based paint) to the bare wood surface using a pure bristle brush and allow the material to absorb into the wood.



2. After the first coat has dried (about half an hour), you'll notice that the sealer has swelled the grain and made it rough. Using sand paper or Scotch-Brite®, lightly sand the surface to make it smooth again. Sanding is not necessary when working with plaster or sheet wax.



3. Wipe off the pattern with a cloth and then apply a second coat of sealer.



4. After allowing the second coat to dry overnight, lightly sand the wood again and wipe it off with a cloth.

5. You are now ready to apply the release agents.

## Applying Release Agents



1. Cover the entire surface with Freeman Wax Release (a semi-paste, typically applied with a brush).

2. Allow this coat to dry or immediately wipe the off excess with a cloth.



3. We suggest at least two coats of Wax Release to make sure your entire part is covered evenly.

4. Next, you'll need to apply two layers of Partall PVA mold release (a polyvinyl alcohol) with brush or a spray.



5. Each coat will require a half hour of drying time unless you use a fan or air hose.

6. After the second coat of PVA has dried thoroughly, apply a final coat of Freeman Wax Release.



7. Buff this last coat very gently so as not to break through the layers of the PVA.

### Additional Notes:

- Epoxy, urethane, or metal patterns require only the use of wax release agents. Apply three coats and lightly buff after each.
- Plaster patterns should be dried in an air-circulating oven at 120°-125° F for 16 hours, or in dry air for 48 hours before applying sealer.
- Plaster patterns can also be sealed with Freeman Fre-Sealer (PVC).

## Metric & English Conversions Table

### Liquid Volume

When you know	You can find	If you multiply by
ounces	milliliters	30
pints	liters	0.47
quarts	liters	0.946
gallons	liters	3.785
milliliters	ounces	0.034
liters	pints	2.1
liters	quarts	1.0567
liters	gallons	0.2642

### Mass

When you know	You can find	If you multiply by
ounces	grams	28.35
pounds	kilograms	0.4536
short tons (2000 lbs)	metric tons	0.9
grams	ounces	0.03527
kilograms	pounds	2.2046
metric tons (1000 kg)	short tons	1.1

### Length

When you know	You can find	If you multiply by
inches	millimeters	25.4
feet	centimeters	30.48
yards	meters	0.9144
miles	kilometers	1.6093
millimeters	inches	0.03937
centimeters	inches	0.39370
meters	yards	1.0936
kilometers	miles	0.6214

### Area

When you know	You can find	If you multiply by
square inches	square centimeters	6.452
square feet	square meters	0.0929
square yards	square meters	0.836
square miles	square kilometers	2.5899
acres	square hectometers	0.4
square centimeters	square inches	0.155
square meters	square yards	1.196
square kilometers	square miles	0.3861
square hectometers	acres	2.5

## Reference Tables

### Shore Hardness Guidelines

Material	Approximate Shore A	Approximate Shore D
Rubber band, white eraser	25-30	-
Pink eraser	35-45	-
Rubber stamp	40-55	-
Hard eraser, inner tube	45-65	-
Leather belt, tire tread	65-75	-
Rubber shoe sole	75-85	25-30
Tap washer, skateboard wheel	85-95	30-40
Garden hose	95-100	40-50
Hard book cover	-	50-55
Golf ball	-	55-65
Wood yard stick	-	70-75
White board	-	75-80
Bowling ball, bone	-	85-90

### Temperature

When you know	You can find	If you
Fahrenheit	Celsius	subtract 32 and then multiply by .55
Celsius	Fahrenheit	multiply by 1.8 and then add 32

### Properties of Metal Casting

	Wt. Lbs. Cu. In.	Wt. vs Mahogany	Shrink In./Ft.	Melt Pt. °F
<b>Aluminum</b>	.0975	3.1 x	5/32	1,220
<b>Brass</b>	.2961	9.5 x	3/16	1,616
<b>Copper</b>	.3210	10.1 x	3/16	1,981
<b>Cast Iron</b>	.2670	8.5 x	1/8	2,105
<b>Steel</b>	.2835	9.5 x	1/4	2,500
<b>Zinc</b>	.2565	8.2 x	5/16	788

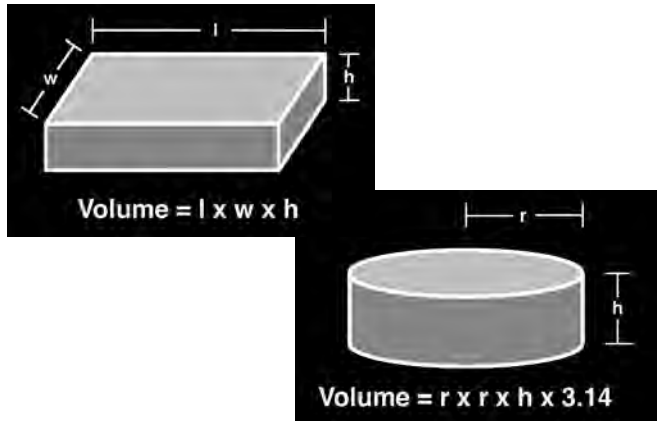
### Viscosity Guidelines

Viscosity in Centipoise (@ 75°F)	Similar in Consistency to:
1	= Water
500	= #10 Motor Oil
2,500	= Pancake Syrup
10,000	= Honey
25,000	= Chocolate Syrup
50,000	= Catsup
250,000	= Peanut Butter
>1,000,000	= Paste Caulking

## Calculating Material Requirements

### Step One:

Calculate the volume of the part (or mold) in cubic inches. Follow whichever shape is closest to your model or mold:



### Step Two:

Find the volumetric yield for the material you have selected. This number, which can be found in most specification tables, represents how much coverage your material will achieve.

If the Volumetric Yield is not available, you can calculate it based on the specific gravity (density).

- 1) Find the specific gravity (or density) of the material (on the specification table and/or MSDS). This is measured in grams per cubic centimeter (grams/cm<sup>3</sup>)
- 2) Take 27.68 divided by the density (grams/cm<sup>3</sup>) and this gives you the Volumetric Yield (in<sup>3</sup>/lb.)

### Step Three:

Divide the volume of the part in cubic inches (step 2) by the volumetric yield (step 1) to determine the amount of material required in pounds

$$\frac{\text{Volume of Model or Mold (in.}^3\text{)}}{\text{Volumetric Yield (in}^3\text{/lb.)}} = \frac{\text{Weight of Product Required (lbs.)}}{\text{Required (lbs.)}}$$

### Step Four:

Select package size and quantity based on calculated weight of product required.

## Fractions, Decimals, Millimeters

Fractions	Decimals	Millimeters
1/64	.0156	0.3969
1/32	.0313	0.7938
3/64	.0469	1.1906
1/16	.0625	1.5875
5/64	.0781	1.9844
3/32	.0938	2.3813
7/64	.1094	2.7781
1/8	.125	3.1750
9/64	.1406	3.5719
5/32	.1563	3.9688
11/64	.1719	4.3656
3/16	.1875	4.7625
13/64	.2031	5.1594
7/32	.2188	5.5563
15/64	.2344	5.9531
1/4	.250	6.3500
17/64	.2656	6.7469
9/32	.2813	7.1438
19/64	.2969	7.5406
5/16	.3125	7.9375
21/64	.3281	8.3344
11/32	.3438	8.7313
23/64	.3594	9.1281
3/8	.375	9.5250
25/64	.3906	9.9219
13/32	.4063	10.3188
27/64	.4219	10.7156
7/16	.4375	11.1125
29/64	.4531	11.5094
15/32	.4688	11.9063
31/64	.4844	12.3031
1/2	.500	12.7000

Millimeters	Decimals	Fractions
13.0969	.5156	33/64
13.4938	.5313	17/32
13.8906	.5469	35/64
14.2875	.5625	9/16
14.6844	.5781	37/64
15.0813	.5938	19/32
15.4781	.6094	39/64
15.8750	.625	5/8
16.2719	.6406	41/64
16.6688	.6563	21/32
17.0656	.6719	43/64
17.4625	.6875	11/16
17.8594	.7031	45/64
18.2563	.7188	23/32
18.6531	.7344	47/64
19.0500	.750	3/4
19.4469	.7656	49/64
19.8438	.7813	25/32
20.2406	.7969	51/64
20.6375	.8125	13/16
21.0344	.8281	53/64
21.4313	.8438	27/32
21.8281	.8594	55/64
22.2250	.875	7/8
22.6219	.8906	57/64
23.0188	.9063	29/32
23.4156	.9219	59/64
23.8125	.9375	15/16
24.2094	.9531	61/64
24.6063	.9688	31/32
25.0031	.9844	63/64
25.4000	1.000	1



