



Appendix

Products by Trade Name or Manufacturer

Manufacturer	Material	Page	Manufacturer	Material	Page
3M	Abrasives	102	Huntsman	Tooling Plastics	10
3M	Adhesives	67	Husky	Dowels	76
3M	Scotch-Brite Abrasive Pads	106	Hyperlast (Synair)	Tooling Plastics	40
3M	Respirators	115	Jesco	Plastics Dispenser	95
Adolf	Cope and Drag Inserts	79	Jiffy	Mixer	95
Alvin Labs	Lab-metal	60	Johnson	Paste Wax	112
Araldite	Adhesives	64	KOL	Mixer	95
Bacolac	Sealer	110	Krylon	Fusion Paint	111
Bessey	Clamps	101	Magic Blanket	Nitrogen Spray	115
Blehm	Adhesives	68	Mar-Hyde	Primer	111
Blehm	Epoxies	39	Match-Lok	Buttons	79
Buck Bros.	Chisels	100	Michael Engineering	Super 'E' Meter Mixing Machine	95
Cab-O-Sil	Fumed Silica	131	Ohaus	Measuring Scales	101
Chavant	Styling Clay	114	Ostalloy	White Duplicating Metal	113
Cleveland	Vibrators	82	Palmer	Pattern Plates	70
Devcon	Adhesives	63	Partall	PVA Mold Release	112
Devcon	Repair Materials	62	Perfect Plank	Pattern Lumber	48
Devcon	Tooling Resins	39, 62	Plast-Econ	Modeling Clay	114
Dike-O-Lastic	Ejector Buttons	80	Plunge	Mixer	95
Dike-O-Seal	Preform Strips	75	Quik-Fil	Tooling Board Repair Paste	59
Dike-O-Seal	Gating Components	81	Rapid-Patch	Repair Material	60
Disa-Matic	Wiper Blades	83	Red Devil	Mixer	94
Duratec	Polyester Surface Primer	110	RenCast	Polyurethanes	10
Dux-Bak	Parting Bags	82	RenGel	Epoxy Surface Coats	24
Dykem	Blue Layout Fluid	82	RenLam	Epoxy Laminating Resins	26
Dymo	Tapewriter	91	RenLease	Releases	112
Dynalite	Repair & Build Up Material	60	RenPaste	Epoxy Tooling Materials	28
Econo-Fil	Repair Material	59	RenPIM	Rapid Cast Polyurethanes	15
Fusion	Paint	111	RenShape	Modeling Material	43
Freeman	Cold Glue	69	Repro	Tooling Plastics	2
Freeman	Epoxy Tooling Plastics	5	Rhodia	Silicone Rubbers	32
Freeman	F-Bond Cyanoacrylate Adhesives	61	Richlite	Fibre Laminate Sheets	53
Freeman	Machinable Wax	54	Roloc	Abrasive Discs & Pads	105
Freeman	Pattern Coating	110	Roovers	Embossing Press	91
Freeman	Polyurethane Tooling Plastics	8	Safe-T-Planer	Wagner	97
Freeman	Quik-Fil	59	Shalco	Blowplate Gasket	75
Freeman	Repro Fast Cast Urethanes	2	Shalco	Super Vents	72
Freeman	Sheet Wax	55	Sprayon	Aerosol Mold Releases	113
Freeman	Tooling Plastics	5	Striptube	Core Box Seal	75
Freeman	TUF Products	58	Superior	Aluminum Solder	60
Freeman	Wax Release	112	Tecbond	Hot Melt Adhesives	68
Freeman	Wood & Plaster Sealer	110	True-Line	Dowels	77
Freeman-Palmer	Pattern Plates	70	TUF	Repair & Build-up Material	58
Fre-Sealer	PVC Lacquer	37	U.S.G.	Industrial Plasters	36
Gas Vac II	Vacuum Degassing Unit	94	Ventistamp	Core Box Air Release Vents	72
Hula Girl	Mixer	95	Wagner	Safe-T-Planer	97
Huntsman	Ren Shape Tooling Boards	43	Wetzler	Clamps	101

Alphabetical Product Listings

A

Abrasive Cartridge Rolls.....	107
Abrasive Cleaner Bar.....	103
Abrasive Discs & Holders.....	106
Abrasive Discs, Sanders.....	103
Abrasive Hand Pads, 3M Scotch-Brite.....	106
Abrasive Sheets.....	102
Abrasive Sleeves, Sanders.....	104
Acetate Sheet.....	115
Acid Brush.....	96
Adhesives, Araldite.....	64
Adhesives, Blehm.....	68
Adhesives, Devcon.....	63
Adhesives, Freeman F-Bond.....	61
Adhesives, Freeman White Glue.....	69
Adhesives, Hot Melt.....	68
Adhesives, Huntsman Ren-Weld.....	67
Adhesives, 3M.....	67
Adolf Cope & Drag Buttons.....	79
Alcohol Lamp.....	109
Alcohol Solvent.....	111
Aluminum Fillers.....	31
Aluminum Honeycomb.....	31
Aluminum Oxide Abrasive Discs.....	103
Aluminum Pattern Plates.....	70
Aluminum Powder.....	31
Aluminum Puffs.....	31
Aluminum Sand.....	31
Aluminum Sheet.....	83
Aluminum Solder.....	145
Apron, Patternmakers'.....	115
Araldite Adhesives.....	64
Assorted Brushes.....	96

B

Bacolac Sealer.....	110
Bags, Parting, Dux-Bak.....	82
Balance, Ohaus Triple Beam.....	101
Band Saw Accessories.....	97
Band Saw Blades.....	97
Band Saw Tire Cement.....	97
Band Saw Tires.....	97
Bar, Abrasive Cleaner.....	103
Beeswax.....	56
Bench Rammer.....	83
Bench Scale, Ohaus.....	101
Birch Plywood.....	86
Bits, Machine.....	98
Bits, Router.....	99
Blade, Wipers, Disa-Matic.....	83
Blades, Band Saw.....	97
Blehm Styro Sealer.....	111
Blind Gauging Wax.....	56
Blowplate Gasket – Shalco.....	75
Bottles, Glue.....	69
Brad Point Drill Bits.....	98
Brads, Wire.....	93
Brass Dowels.....	77

Brass Escutcheon Pins.....	92
Brass Rod.....	83
Brass Sheet.....	83
Brush, Acid.....	96
Brushes, Assorted.....	96
Brushes, Throwaway.....	96
Bulb, Paste.....	83
Burrs, Rotary, Karbide Kutzall.....	99
Buttons, Adolf.....	79
Buttons, Dike-O-Lastic Ejector.....	80
Buttons, Match-Lok.....	79
Buttons, Mold-Lock.....	79

C

Cab-O-Sil Fumed Silica.....	31
Cabinet, Pattern Letters.....	90
Cartridge Rolls, Mandrels.....	107
Cartridge Rolls, Abrasive.....	107
Celastoc Solvent (MEK).....	109
Cement, Band Saw Tire.....	97
Cement, Disc.....	103
Cement, Fillet.....	109
Ceramic Spheres, Macrolite.....	31
Chainlock Plates Freeman-Palmer.....	70
Chavant Modeling Clay.....	114
Champ II, Ohaus Bench Scale.....	101
Chisels.....	100
Clamps, Metalworking.....	101
Clay, Blehm Epoxy Modeling.....	39
Clay, Plast-Econ Epoxy Modeling.....	114
Clays, Chavant Modeling.....	114
Cleaner Bar, Abrasive.....	103
Cleaner, Epoxy Hand.....	115
Cloth, Fiberglass.....	30
Coatings, Pattern.....	110
Cold Glue.....	69
Compact Scale, Ohaus.....	101
Containers, Mixing.....	109
Cope & Drag Inserts, Adolf.....	79
Core Box Seals.....	75
Core Box Vents.....	72
Core Vent Wax.....	80
Corrugated Fasteners.....	93
Cotton Flock.....	30
Countersink Cutter.....	99
Cups, Paper & Plastic.....	109
Cutters.....	99

D

Degassing Unit, Gas Vac.....	94
Di-Dup Wax Fillet.....	108
Digital Bench Scale, Ohaus.....	101
Dike-O-Lastic Ejector Buttons.....	80
Dike-O-Seal Preform Strips.....	75
Dike-O-Seal Gating Components.....	81
Disc Cement.....	103
Discs, State Sander Abrasive.....	103

Discs, 3M Abrasive Roloc.....	105
Dispenser, Plastic Resin, Jesco.....	94
Dispenser, For TUF Products.....	59
Double Face Tape.....	115
Dowels, Malleable Iron.....	78
Dowels, Husky.....	76
Dowels, True-Line Steel.....	77
Dowels, Square Head Brass.....	77
Dowels, Square Head Steel.....	78
Dowels, Wood.....	113
Drill Bits.....	98
Drill, Vent Inserting.....	75
Drums, Expandable Rubber for Spindle Sanders.....	104
Dry Parting, Dux-Bak.....	82
Drywall Screws.....	93
Duplicating White Metal, Ostalloy.....	113
Dux-Bak Dry Parting.....	82
Dyes & Pigments.....	41
Dymo Tape Embosser.....	91
Dynalite Repair Material.....	60

E

Eastern White Pine Pattern Lumber.....	50
Econo-Fil.....	59
Ejector Buttons, Dike-O-Lastic.....	80
Electronic Scale, Ohaus.....	101
Embosser, Dymo Tape.....	97
Embossing Press, Roovers.....	91
Embossing Tapes.....	91
Epoxies, Devcon.....	39
Epoxies, Freeman.....	5
Epoxies, Huntsman.....	21
Epoxy Adhesives, Araldite.....	65
Epoxy Hand Cleaner.....	115
Epoxy Modeling Clay, Blehm.....	39
Escutcheon Pins, Brass.....	92

F

F-Bond Cyanoacrylate Adhesive, Freeman.....	61
Fast-Cast Urethanes, Freeman.....	8
Fasteners, Link-Lock.....	82
Fasteners, Corrugated.....	93
Fiberglass Cloth.....	30
Fiberglass Strand.....	4
Fiberglass Tape.....	30
Fiberglass Tooling Fabrics.....	30
Fibre-Laminates, Richlite.....	53
Files, Assorted.....	100
Fillers, Aluminum.....	31
Fillet Cement.....	109
Fillet Cement Thinner.....	109
Fillet, Di-Dup Wax.....	108
Fillet, Leather.....	108
Fillet Shapers.....	109
Fillet Tools.....	109
Fillet Wax.....	108

Alphabetical Product Listings [CONT'D.]

F

Fir Plywood	86
Flake Shellac.....	111
Flock, Cotton.....	30
Flock, Glass	30
Forstner Drill Bits.....	98
Fre-Sealer, PVC.....	37
Fumed Silica, CAB-O-Sil	31

G

Garnet Abrasives	103
Gas Vac II.....	94
Gauging Wax.....	56
Gating Components Dike-O-Seal	81
Glass Flock	30
Gloves, Plaster	37
Gloves, Vinyl Latex, Nitrile	109
Glue Bottles.....	69
Glue, Freeman Cold.....	69
Glue, Styro	68
Grease Stick, Matchless	97

H

Hand Cleaner, Epoxy.....	69
Hand Pad, Scotch-Brite	106
Hand Riddle	80
Hemp, Manila	37
Hula Girl Mixer	95
Huntsman Adhesives.....	64
Huntsman Epoxies.....	20
Huntsman Fillers	31
Huntsman Polyurethanes.....	10
Huntsman Release Agents.....	112
Huntsman Repair Materials.....	60
Huntsman Seamless Modeling Paste	52
Huntsman Tooling Boards.....	43

I

Inserts, Cope & Drag, Adolf.....	79
----------------------------------	----

J

Jelutong Pattern Lumber	50
Jesco Plastic Dispenser.....	95
Jiffy Mixer	95
Johnson Paste Wax	112

K

Knife & Gouge Sets, Freeman.....	100
Knives, Pattern	100
Kol Mixer.....	95

L

Lab Metal	60
Lab Solvent	60
Laminates, Richlite Fibre	53
Lamp, Alcohol	109
Lance Pyrometer.....	83
Layout Fluid, Dykem Blue	82
Leather Fillet	108
Letters, Pattern.....	88
Link-Lock Fasteners.....	82
Lumber, Rough Sawn Pattern	50
Lumber, Perfect Plank.....	48

M

Machinable Wax, Freeman	54
Machinable Wax Adhesive, 3M.....	67
Machine Bits.....	98
Macrolite Ceramic Spheres	31
Magic Blanket Nitrogen Spray	115
Magnesium Pattern Plates, Dowmetal	71
Mahogany Pattern Lumber.....	51
Malleable Iron Dowels.....	78
Malleable Iron Rapping Plates.....	82
Mandrels, Cartridge Rolls	107
Manila Hemp	37
Mar-Hyde Primer.....	111
Masking Tape	115
Mask, 3M Respirator.....	115
Masonite Sheet Material	87
Match-Lok Buttons	79
Matchless Grease Stick	97
Medium Density Fiberboard, MDF	53
Methacrylate Adhesives, Araldite	66
Milled Cotton Fibers, Cotton Flock	30
Mixer, Hula Girl.....	95
Mixer, Jesco	95
Mixer, Jiffy	95
Mixer, KOL Portable	95
Mixer, Plunge	95
Mixing Bowls, Rubber	37
Mixing Containers	37
Mixing Paddles, Wood	109
Mixer, Red Devil.....	94
Mixer, Super E.....	95
Modeling Clays, Blehm Epoxy	39
Modeling Clays, Chavant.....	114
Mold-Lock Buttons	79
Mold Releases	112
Mouth-Type Spray Can	82
Multi-Spur Drill Bits	98

N

Nails.....	92
------------	----

O

Ohaus Scales.....	101
Ostalloy White Duplicating Metal	113

P

Paddles, Wood Mixing	109
Pads, Scotch-Brite Abrasive	160
Paper Cups	109
Partall Mold Releases.....	112
Parting Bags, Dux-Bak	82
Paste Bulb	83
Paste Wax, Johnson	112
Pattern Coatings, Freeman.....	110
Pattern Knives.....	100
Pattern Letters.....	88
Pattern Letters Cabinet.....	90
Pattern Lumber, Perfect Plank	48
Pattern Lumber, Rough Sawn	50
Pattern Plates, Freeman-Palmer	70
Pattern Plywood.....	84
Perfect Plank Jelutong	48
Perfect Plank Mahogany	48
Perfect Plank Pine.....	48
Pigments & Dyes	41
Pinch Dogs.....	92
Pine Pattern Lumber	50
Pine Plywood	84
Pins, Escutcheon, Brass	92
Pitch Solvent	97
Plast-Econ Modeling Clay.....	114
Plaster Gloves	37
Plaster Release.....	37
Plasters, U.S.G., Industrial.....	37
Plastic Aluminum, Devcon	39, 62
Plastic Cups	109
Plastic Gloves	109
Plastic Resin Dispenser, Jesco	95
Plastic Portion Resin Scale	101
Plastic Sheet, Acetate.....	115
Plastic Steel, Devcon	39, 62
Plastics, Freeman Tooling	5
Plastics, Repro Tooling.....	2
Plastics, Huntsman Tooling.....	10
Plates, Pattern, Freeman-Palmer	70
Plates, Rapping.....	82
Plug Cutter, Spiral.....	99
Plunge Mixer	95
Plywood.....	84
Pneumatic Dispenser - TUF Products.....	59
Polyurethanes, Freeman.....	8
Polyurethanes, Devcon	38
Polyurethanes, Huntsman	10
Portable Mixer, KOL	95
Portion Scale, Plastic Resin.....	101
Powder, Aluminum	31
Prepared Shellac	111
Primers.....	110
Putty, Devcon	62
PVA Mold Release.....	113
PVC, Fre-Sealer.....	37
Pyrometer, Lance.....	83

Alphabetical Product Listings [CONT'D.]

Q

Quik-Fil Tooling Board Repair Paste59

R

Rammer, Bench83
 Rapid Patch Repair Material.....60
 Red Devil Mixer.....94
 Rapping Plates.....82
 Release, Freeman Wax112
 Release, Plaster.....37
 Releases, PVA, Silicone & Wax.....112
 Ren Tooling Products.....See Huntsman
 RenShape Tooling Board.....43
 Repair Material, Econo-Fil59
 Repair Material, Rapid Patch.....60
 Repair Material, TUF Products58
 Repair Paste, Quik-Fil Tooling Board.....59
 Repro Tooling Plastics.....2
 Resin Dyes & Pigments41
 Respirators, 3M.....115
 Rhodia Accessories35
 Rhodia Addition Cure Silicones32
 Rhodia Aerospace Silicones.....35
 Rhodia Condensation Cure Silicones32
 Richlite Fibre-Laminates53
 Riddles, Hand.....80
 Rod, Brass83
 Rolls, Abrasive Cartridge.....107
 Roloc Abrasives105
 Roovers Embossers & Tapes91
 Rotary Burrs, Karbide Kutzall99
 Round Rapping Plates.....82
 Router Bits99
 Rubber Drums for Spindle Sanders104
 Rubbers, Rhodia Silicone32

S

Safe-T-Planer, Wagner97
 Sand Paper (See Abrasives)
 Sanding Sticks106
 Saw Blades, Band.....97
 Scales, Ohaus.....101
 Scale, Plastic Portion Resin.....101
 Scotch Bright Discs (3M)105
 Scotch Bright Hand Pads (3M).....106
 Screws, Drywall.....93
 Screws, Wood92
 Sealer, Blehm Styro111
 Sealer, Wood & Plaster.....110
 Seals, Core Box75
 Shalco Blowplate Gasket.....75
 Shalco Super Vents.....72
 Shapers, Fillet109
 Sheet Wax, Freeman55

Sheet Wax Adhesive.....68
 Sheet, Acetate115
 Sheet, Aluminum.....83
 Sheet, Brass.....83
 Sheets, Abrasive102
 Shellac, Prepared & Flake111
 Shells, Walnut.....31
 Silicone Rubbers, Rhodia32
 Silicone Spray Release.....112
 Sleeves, Abrasive, State Sanders104
 Slicks & Trowels81
 Solder, Aluminum60
 Solvent, Alcohol111
 Solvent, Pitch97
 Spheres, Macrolite Ceramic31
 Spiral Plug Cutter.....99
 Spray Can, Mouth-Type82
 Sprue Cutters, Tapered.....83
 Square Head Dowels, Brass77
 Square Head Dowels, Steel78
 Stamps, Steel.....100
 Steel Dowels, True-Line77
 Steel Stamps.....100
 Steric Acid37
 Strand, Fiberglass.....4
 Styro Glue68
 Styro Sealer, Blehm111
 Sugar Pine Pattern Lumber.....50
 Super E Mixer, Michaels95
 Superior Aluminum Solder.....60
 Surface Coat, Repro4

T

Tape, Aluminum & Zinc Embossing.....91
 Tape, Double-Face.....115
 Tape, Fiberglass.....30
 Tape, Masking.....115
 Tapered Sprue Cutters.....83
 Tapewriter Dymo91
 Tecbond Hot Melt Adhesives68
 Thinner, Fillet Cement.....109
 Throwaway Brushes.....96
 Tires, Band Saw.....97
 Tire Cement, Band Saws.....97
 Tongue Depressors.....109
 Tooling Fabrics, Fiberglass30
 Tooling Plastics, Devcon39
 Tooling Plastics, Freeman5
 Tooling Plastics, Freeman Repro.....2
 Tooling Plastics, Huntsman.....10
 Tooling Plasters, U.S.G.36
 Triple Beam Balance, Ohaus.....101
 Trowels & Slicks81
 TUF-Blend Repair Material.....59
 TUF-Carv Repair Material58
 TUF-Fil Repair Material58

U

Urethane Adhesives, Araldite66
 Urethane Protectants115
 Urethane Repair Mat'l., Rapid Patch.....60
 Urethane Tooling Board, Ren Shape.....43
 Urethanes, Freeman5
 Urethanes, Devcon39
 Urethanes, Huntsman.....10
 U.S.G. Industrial Plasters.....36

V

Vacuum Degasser, Gas Vac94
 Vent Cleaners.....75
 Vent Inserting Drill.....75
 Ventistamp Zanatta Vents72
 Vents, Shalco Super72
 Vents, Core Box72
 Vibration Inducers82

W

Walnut Shells31
 Wax Adhesive, Sheet.....68
 Wax, Blind Gauging56
 Wax, Core Vent80
 Wax Fillet, Di-Dup108
 Wax, Paste112
 Wax Release, Freeman112
 Wax, Freeman Machinable.....54
 Wax Fillet.....108
 Wax, Sheet Freeman55
 White Cold Glue.....69
 White Metal, Duplicating, Ostaloy.....113
 Wiper Blades, Disa-Matic83
 Wire Brads93
 Wire Nails92
 Wood & Plaster Sealer, Freeman110
 Wood Dowels113
 Wood Mixing Paddles109
 Wood Screws92
 Woodworking Clamps.....101

Z

Zanatta, Ventistamp Vents72
 Zinc Embossing Tape.....91
 Zip Grip Adhesive, Devcon63

Appendix

Glossary120
 Sealing/Releasing Procedures121
 Metric & English Conversions Table.....122
 Reference Tables122
 Calculating Material Requirements123
 Fractions, Decimals, Millimeters123

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.

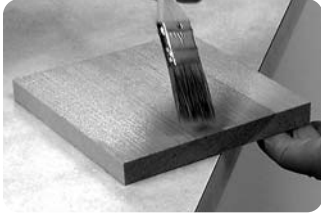
Thixotropy – A flow characteristic evidenced by a decrease in viscosity of a fluid when it is stirred at a constant or increasing rate of shear. When the stirring or shearing is discontinued, the apparent viscosity of the fluid gradually increases back to the original value. Changes in both directions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

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.

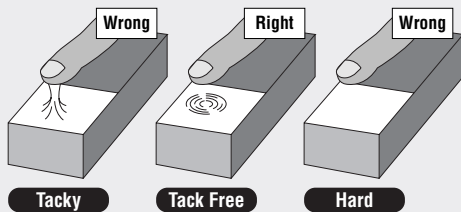


Additional Notes:

- 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).

Almost tack-free – Testing A Surface Coat

The surface coat should dent, but leave no deposit on the finger. At this stage the next coat is applied; surface coat (2nd application), coupling coat, or laminate as required.



Instructional videos available online and on DVD.

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
Aluminum	.0975	3.1 x	⁵ / ₃₂	1,220
Brass	.2961	9.5 x	³ / ₁₆	1,616
Copper	.3210	10.1 x	³ / ₁₆	1,981
Cast Iron	.2670	8.5 x	¹ / ₈	2,105
Steel	.2835	9.5 x	¹ / ₄	2,500
Zinc	.2565	8.2 x	⁵ / ₁₆	788

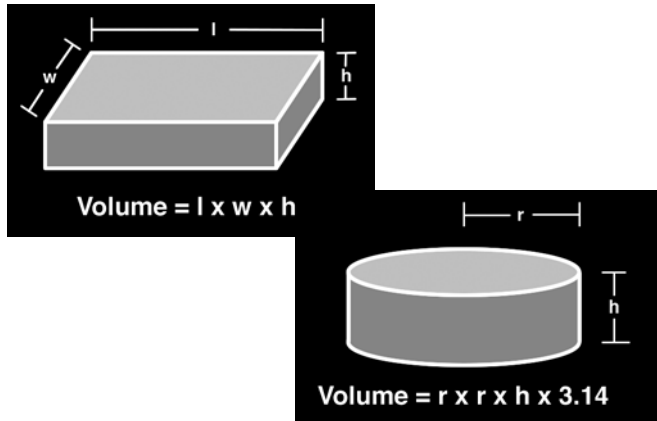
Viscosity Guidelines

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/cm³)
- 2) Take 27.68 divided by the density (grams/cm³) and this gives you the Volumetric Yield (in³/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

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

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
3/16	.1719	4.3656
11/64	.1719	4.3656
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
5/16	.2969	7.5406
19/64	.2969	7.5406
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

