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Epoxy & Urethane Products

FOR TOOLING & INDUSTRIAL APPLICATIONS

Epoxy Tooling Materials

Epoxy N-Fusion

Adhesives

Poly Filler

WYN-STIK

Tooling Urethanes

Replicast

Poly-Cure 1000®

AEROPOXY

Materials for Prototypes & Production

MVS Marine & Vehicle Systems





PTM&W Industries PRODUCTS

This PTM&W Catalog is a full-line product listing and reference guide with product descriptions to aid in selecting the correct material for your application. The basic product descriptions and physical properties in this guide are augmented by the full product bulletins available on our web site. Once a selection has been made, handling, curing recommendations, and full cured properties are shown on the individual product bulletins.

Our Web Site includes an extensive list of "Frequently Asked Questions", as well as, reprints of a number of Technical Papers that can help to familiarize you with the proper use of our products in a variety of applications. If you cannot find the answers to your questions there, we welcome your call to discuss your application and determine the proper material or solution.

When you have determined the products you need, we have several ways
for you to place your order:

- On our Web Site, under the Distribution heading, a US map is displayed. Select the state in which you are located, and a listing of the Distributors in that State, plus our Regional Manager for that area, appears. Please place your order with our Distributor for your area.
- If no distributor is listed for your state, please call our office listed therein, and below, to place your order.

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Epoxy N-Fusion and Laminating Systems for Room Temperature Service

PRODUCT LINE DESCRIPTION

Vacuum-Assist Resin-Transfer Method (VARTM) is the procedure of infusing a resin matrix into plies of dry fabric using vacuum to draw the resin into the plies. Low mixed viscosities and longer gel times are characteristics of VARTM resins. There are a number of advantages of this process over using wet lay-up or pre-preg materials: low material costs, out-of-autoclave curing, low-temperature demolding, and room-temperature material storage. The larger the tool or part, the more the VARTM process makes sense.

This page describes two systems used for making tools or production parts, with service temperatures $\leq 150^{\circ}\text{F}$., by the VARTM process. PT2712 comes with a variety of hardeners to meet your working-time requirements. It can be demolded after RT-curing. Very large tools or structural parts have been made with this system. PT2752 A/B is a toughened epoxy for high-impact resistant laminates. It can successfully be infused and/or laminated by wet lay-up methods. This system needs a $110\text{--}120^{\circ}\text{F}$ cure to obtain its toughness.

PRODUCTS

PT2712

PT2712 is a low viscosity epoxy system designed for the fabrication of parts and structures by the resin infusion method. This system flows extremely well, and produces dense, void-free laminates routinely. The cured properties of this system are very high, so it produces items with good strength and toughness with excellent long-term stability. Three hardeners are available for use with this resin, which provide a range of working times. The three hardeners are identical except for reaction time, so no matter which hardener is chosen, the user can expect the same high performance properties.

PT2752

PT2752 is a high strength toughened epoxy system that is an ideal material for the production of very durable parts and structures that possess very high cured properties. With a low mixed viscosity, it is well suited to the resin infusion process, where it flows readily into the reinforcing fabric. It also performs very well in traditional hand lay-up operations and proves to be a quite versatile material for producing all types of parts and structures. Parts and structures that are subjected to high stress loads and severe impact abuse are good candidates for the tough nature of PT2752.

PRODUCT SPECIFICATIONS & TYPICAL MECHANICAL PROPERTIES

NOTE: For full specifications and properties, including recommended curing cycles, refer to the individual product bulletins available on our web site at www.ptm-w.com.

	PT2712 A/B	PT2752 A/B
Color	Light Amber	Light Amber
Mixed Viscosity, cps	320 centipoise	650 cps
Cured Hardness	86 Shore D	87 Shore D
Specific Gravity, gms./cc	1.08	1.09
Density, lb./cu.in.	.039	.0394
Tensile Strength, psi	41,415 psi	51,800 psi
Flexural Strength, psi	54,683 psi	57,435 psi
Compressive Strength, psi	15,930 psi	12,656 psi
Glass Transition Temp., DMA Tg Onset (E') Tg Peak	161°F 204°F	170°F 189°F



Epoxy N-Fusion and Laminating Systems for High Temperature Service

PRODUCT LINE DESCRIPTION

Vacuum-Assist Resin-Transfer Method (VARTM) is the procedure of infusing a resin matrix into plies of dry fabric using vacuum to draw the resin into the plies. Low mixed viscosities and longer gel times are characteristics of VARTM resins. There are a number of advantages of this process over using wet lay-up or prepreg materials: low material costs, out-of-autoclave curing, low-temperature demolding, and room-temperature material storage. The larger the tool or part, the more the VARTM process makes sense.

This page describes three systems used for making tools or production parts, with service temperatures up to 450°F., by the VARTM and wet lay-up processes. **PT5712/14** has been used to make large, 300°F service tools (40' long) without benefit of an autoclave. **PT5760** is ideal for VARTM tooling with service temperatures up to 400°F. **PT2876**, because of its higher viscosity is normally used for wet lay-ups, but could be infused if the processed at a higher temperature. This system can be used in service at temperatures $\geq 450^\circ\text{F}$. PT2876 is ideal for tying on backup structure for extremely high-temperature epoxy or BMI tooling.

PRODUCTS

PT5712 & PT5714 A/B

These resin systems are low viscosity resins that have found good acceptance for use in vacuum infusion fabrication and tooling processes. Their low mixed viscosities allow good penetration into the reinforcing fabrics, producing dense, void-free structures. These products are identical, except for color: PT5712 is an amber system and PT5714 is pigmented black.

PT5760 A/B

PT5760 is designed for infusing composite tools for service temperatures of 400° F. and above. This product is ideal for the vacuum-assisted resin transfer molding (VARTM) process, due to it's low viscosity, excellent wet-out properties, and long working time. PT5760 offers high heat resistance and mechanical properties, and will provide durable, dimensionally stable, high-temperature infused tools.

PT2876 A/B

PT2876 is an unfilled amber epoxy laminating system designed for the highest service temperature applications. The extended working time of PT2876 allows enough time for vacuum-bagging, yet will set well enough at room temperature to allow the laminate to be demolded from the pattern for post curing. Long tool life is obtainable for autoclave service temperatures up to 450°F., if proper fabrication techniques are use during construction. This system will easily wet-out carbon and fiberglass tooling fabrics. It can also be used for making high-temperature service composite parts.

PRODUCT SPECIFICATIONS & TYPICAL MECHANICAL PROPERTIES

NOTE: For full specifications and properties, including recommended curing cycles, refer to the individual product bulletins available on our web site at www.ptm-w.com.

	PT5712 & 14 A/B	PT5760 A/B	PT2876 A/B
Color	Amber (PT5712, Black (PT5714)	Amber	Amber
Mixed Viscosity, centipoise	575 cps	690 cps	2,700 cps
Cured Hardness	86 Shore D	87-88 Shore D	90 Shore D
Specific Gravity, gms./cc	1.105	1.082	1.10
Density, lb./cu.in.	0.0399	0.0391	0.0398
Tensile Strength, psi	46,970 psi	37,180 psi	35,448 psi
Flexural Strength, psi	74,727 psi	74,188 psi	54,306 psi
Compressive Strength, psi	15,007 psi	20,347 psi	23,381 psi
Glass Transition Temp., DMA			
Tg Onset (E')	272°F	367.9°F	399°F
Tg Peak	302°F	423.3°F	457°F

EPOXY N-FUSION

PT2712 Low Viscosity System for Tough Parts & Structures

DESCRIPTION

PT2712 is a low viscosity epoxy system designed for the fabrication of parts and structures by the resin infusion method. This system flows extremely well, and produces dense, void-free laminates routinely. The cured properties of this system are very high, so it produces items with good strength and toughness with excellent long-term stability.

Three hardeners are available for use with this resin, which provide a range of working times. The hardeners have gel times of approximately 1 hour, 2 hours and 3 hours, so, by proper selection between the three, it is possible to easily infuse any size structure. The three hardeners are identical except for reaction time, so no matter which hardener is chosen, the user can expect the same high performance properties. The mixed viscosity with all three hardeners is just over 300 centipoise, so the material flows very well, even in thin walled areas. It penetrates heavy fabric sections and wets out quickly for further ease of production.

PRODUCT SPECIFICATIONS

	PT2712-A	Part B	Part B1	Part B2	Part B3	ASTM Method
Color	Amber Clear	Amber				Visual
Viscosity, centipoise	1000 cps	25 cps			60 cps	D2392
Specific Gravity, gms./cc	1.10	.97			.99	D1475
Mix Ratio, By Weight By Volume		100 : 22 By Weight 4 to 1 By Volume				PTM&W
Pot Life, 4 fl. Oz. Mass @ 77°F		~ 1 Hour (70 min.)	~ 2 Hours (122 min.)	~ 3 Hours (175 min.)	40 minutes	D2471

HANDLING and CURING

The four hardeners for PT2712 will cure completely at room temperature, if required. In the case of smaller parts and structures made with the faster hardeners B and B3, the material will gel hard overnight at normal ambient temperatures. At this point in the cure, the bag and ancillary infusion materials can be removed from the laminate and the part can be sanded or trimmed as required. Full cure with these 2 hardeners will be achieved in 4 to 6 days at normal room temperature. Warmer summer temperatures will shorten this cure and a cooler environment will increase cure time.

When using Part B1 or B2, for larger structures, longer time must be given at all cure stages to allow proper curing with this slower reacting hardener. Well over 24 hours at room temperature is required before the structure can be removed and sanded, with the exact time depending upon laminate size and shop environment. Tests with standard laminate samples made with Part B2 hardener have shown that full cured properties are reached in 10 days at 75°F for example.

In all instances, a heat cure will shorten the curing time of PT2712. In situations where the laminate can be placed in an oven after a room temperature gel, curing times of 8 to 10 hours at 180°F or 14 to 18 hours at 150°F will provide 90% of full cured properties. When an oven has not been available or practical, due to the size of the structure, for example, structures have been tented with plastic or tarps and then lights or space heaters have been used as the heat source for curing. Also, plywood boxes have been fabricated to enclose the structure for curing in this manner. Experimentation will determine the best method to use for the individual structure and shop conditions.

PACKAGING WEIGHTS

	Gallon Kit	Pail Kit	Drum Kit
PT2712 Part A	9 lb.	36 lb.	500 lb.
Part B, B1, B2 or B3	2 lb.	8 lb.	111 lb. (3 @ 37 lb.)

TYPICAL MECHANICAL PROPERTIES

		PT2712 A / B *1	ASTM Method
Mix Ratio,	By Weight By Volume	100 : 22 By Weight (All 4 Hardeners) 4 to 1 By Volume (All 4 Hardeners)	PTM&W
Pot Life, @ 77°F		Part B - 70 min.; Part B1 - 122 min.; Part B2 - 175 min.; Part B3 - 40 min.	D2471
Color		Light Amber	Visual
Mixed Viscosity, centipoise		320 cps.	D2393
Cured Hardness, Shore D		86 Shore D	D2240
Specific Gravity, grams, cc		1.08	D1475
Tensile Strength, psi	Cast Bar	10,960 psi	D638
Elongation, % at Yield	Cast Bar	6.3 %	
Tensile modulus, psi	Cast Bar	486,610 psi	
Tensile Strength, psi	Laminate*2	41,415 psi	D638
Elongation, % at Break	Laminate*2	2.54 %	
Tensile modulus, psi	Laminate*2	2,792,062 psi	
Flexural Strength, psi	Cast Bar	18,942 psi	D790
Flexural Modulus, psi	Cast Bar	528,460 psi	
Flexural Strength, psi	Laminate*2	54,683 psi	D790
Flexural Modulus, psi	Laminate*2	2,876,867 psi	
Compressive Strength, psi		15,930 psi	D695
Compressive Modulus, psi		491,503 psi	
Izod Impact Strength, ft-lbs / in	Method A	1.093	D256
Glass Transition Temperature, DMA Tg Onset (E')		161°F	D4065
Tg Peak		204°F	
Thermal Coefficient of Expansion, Range:40°C to 60°C		5.42 x 10 ⁻⁵ in./in. °F	D696

*1: The 4 Hardeners for PT2712 are Functionally Identical Except for Reaction Time, so Cured Properties are The Same for All.

*2: Tensile and Flexural Properties were Determined with a 1/8 inch Laminate Style 7500 Boat & Tooling Fiberglass Cloth, Resin Content of 40%.

SAFETY and HANDLING

PTM&W epoxy products are made from raw materials carefully chosen to minimize or even eliminate toxic chemicals, and therefore offer the user high performance products with minimum hazard potential when properly used. Generally, the PTM&W epoxy resins and hardeners will present no handling problems if users exercise care to protect the skin and eyes, and if good ventilation is provided in the work areas. However, all epoxy resins and hardeners can be irritating to the skin, and prolonged contact may result in sensitization; and breathing of mist or vapors may cause allergenic respiratory reaction, especially in highly sensitive individuals. As such, avoid contact with eyes and skin, and avoid breathing vapors. Wear protective rubber apron, clothing, gloves, face shield or other items as required to prevent contact with the skin. In case of skin contact, immediately wash with soap and water, followed by a rinse of the area with vinegar, and then a further wash with soap and water. The vinegar will neutralize the hardener and lessen the chances of long term effects. Use goggles, a face shield, safety glasses or other items as required to prevent contact with the eyes. If material gets into the eyes, immediately flush with water for at least 15 minutes and call a physician. Generally, keep the work area as uncluttered and clean as possible, and clean up any minor spills immediately to prevent accidental skin contact at a later time. Keep tools clean and properly stored. Dispose of trash and empty containers properly. Do not use any of these types of products until Material Safety Data Sheets have been read and understood.

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PT2752 A/B

High Strength Toughened Infusion & Laminating System

DESCRIPTION

PT2752 is a high strength toughened epoxy system that is an ideal material for the production of very durable parts and structures which possess very high cured properties. With a low mixed viscosity, it is well suited to the resin infusion process, where it flows readily into the reinforcing fabric. It also performs very well in traditional hand lay-up operations and proves to be a quite versatile material for producing all types of parts and structures. Parts and structures that are subjected to high stress loads and severe impact abuse are good candidates for the tough nature of PT2752.

PRODUCT SPECIFICATIONS

	PT2752 Part A	PT2752 Part B	ASTM Method
Color	Light Amber	Light Amber	Visual
Viscosity, @77°F, centipoise	13,000 cps	60 cps	D2392
Specific Gravity, gms./cc	1.16	0.96	D1475
Mix Ratio	100 : 40 By Weight or 2 to 1 By Volume		PTM&W
Pot Life, 4 fl.oz. Mass @ 77°F	55 - 66 minutes		D2471

HANDLING and CURING

The high performance ingredients and additives used in PT2752 require a heat cure to develop optimum properties with this system. PT2752 will gel hard overnight at room temperature, but the material is brittle at this stage. Even after 3 weeks at room temperature, the material will achieve only 2/3 of ultimate properties, and it is still brittle! It must be given some heat to cure sufficiently for service. Also, **the part or structure must be supported during heat cure** to prevent sag or distortion at elevated temperature before full cure. The amount and duration of the heat cure needed can be determined by the end use of the part or structure. The more heat applied, the higher the resulting strengths and heat resistance. The following test results can be used to determine the cure cycle best suited to your application:

Allow to Gel @ Room Temp.	Initial Cure	Post Cure	% of Full Cure Attained
6 - 8 Hours	Overnight @ 115°F		79 %
Overnight @ Room Temp.		5 - 6 Hours @ 150°F	85 %
6 - 8 Hours	Overnight @ 150°F		98 %
6 - 8 Hours	Overnight @ 150°F	2 - 3 Hours @ 175-180°F	100 %

PACKAGING WEIGHTS

	Gallon Kit	Pail Kit	Drum Kit
PT2752 Part A	9 lb.	35 lb.	450 lb.
PT2752 Part B	3.6 lb.	2 @ 7 lb. ea.	180 lb.
Kit	12.6 lb.	49 lb.	630 lb.

TYPICAL MECHANICAL PROPERTIES

	PT2752 A/B		ASTM Method
Mix Ratio, By Weight, Volume	100 : 40 By Weight or 2 to 1 By Volume		PTM&W
Color	Light Amber		Visual
Mixed Viscosity, @77°F, centipoise	650 cps		D2393
Pot Life, 4 fl. Oz. Mass, @77°F	55 - 65 minutes		D2471
Cured Hardness, Shore D	87 Shore D		D2240
Specific Gravity, grams, cc	1.09		D1475
Density, lb./cu. Inch lb. / gallon	0.0394 9.1 lb.		D792
Specific Volume, cu. in./lb.	25.4		
Tensile Strength, psi, Cast Bar	8,968 psi (62 MPa)		D638
Elongation at Break, % Cast Bar	8.54 %		
Tensile modulus, psi Cast Bar	421,855 psi (2,909 MPa)		
	Glass Laminate ¹	Carbon Laminate ²	
Tensile Strength, psi Laminate	51,800 psi (357 MPa)	90,854 psi (627 MPa)	D638
Elongation at Break, % Laminate	1.77 %	1.41 %	
Tensile modulus, psi Laminate	3,796,836 psi (26,185 MPa)	6,373,907 psi (43,958 MPa)	
Flexural Strength, psi Cast Bar	15,393 psi (106 MPa)		D790
Flexural Modulus, psi Cast Bar	455,033 psi (3,128 MPa)		
Flexural Strength, psi Laminate	57,435 psi (396 MPa)	95,926 psi (662 MPa)	D790
Flexural Modulus, psi Laminate	3,363,756 psi (23,198 MPa)	5,317,661 psi (36,674 MPa)	
Compressive Strength, psi	12,656 psi (87 MPa)		D695
Compressive Modulus, psi	467,834 psi (3,226 MPa)		
Izod Impact Strength, Method A, Notched, ft.lb./in. of notch	2.184 (116.6 J/m)		D256
Glass Transition Temperature, DMA: Tg, E' (Onset) Tg, Peak	170°F 189°F		D4065
Coefficient of Thermal Expansion, Range 40°C to 80°C	4.75 x 10 ⁻⁵ in./in./ °F		D696

1. Properties Determined with 14 Plies Style 7781 Fabric, 0° Rotation, 33% Resin Content, Infused, Cured Overnight @ 150°F.

2. Properties Determined with 16 Plies 3K - 2X2 Carbon Twill, 0°, 45°, 90°, 45° Rotation, 35% Resin Content, Infused, Cured Overnight @ 150°F.

SAFETY and HANDLING

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PT5712 & PT5714 Low Viscosity Systems for Parts or Tooling

DESCRIPTION

PT5712 and PT5714 are low viscosity epoxy resin systems that have found good acceptance for use in vacuum infusion fabrication and tooling processes. The low mixed viscosity of these systems allow them to penetrate the reinforcing materials easily and completely, producing a void-free, dense composite structure.

PT5712 and PT5714 have very good hot strength, so cured parts or tooling fabricated with them can provide good service in elevated temperature operating conditions. PT5714 is a black version of PT5712.

PRODUCT SPECIFICATIONS

	PT5712 & 14 Part A	Part B	Part B1	ASTM Method
Color	PT5712 - Amber PT5714 - Black	Amber	Amber	Visual
Viscosity,	1800 cps	40 cps	50 cps	D2392
Specific Gravity, gms./cc	1.14	0.96	0.95	D1475
Mix Ratio By Weight		100 : 20 By Weight		PTM&W
Pot Life, 4 fl.oz. Mass @ 77°F		80 - 90 minutes	175 - 185 minutes	D2471

HANDLING and CURING

There are two hardeners available for use with these resins, for different size applications, and both hardeners will gel at normal shop temperatures. In the thin film of the infusion process, the material will gel hard in 18 to 24 hours at these temperatures. At this point, the laminate must be post cured to complete its cure and develop full physical properties and heat capabilities. A typical post cure would be: Gel at room temperature, followed by an oven post cure of 3 to 4 hours each at 150°F and 250°F, followed by a final cure of at least 8 hours at 300°F. If the final curing temperature can be increased to 375°F instead of 300°F, then 4 to 6 hours at the 375° temperature will complete the cure.

PACKAGING WEIGHTS

	Gallon Kit	Pail Kit	Drum Kit
PT5712 or PT5714 Part A	8 lb.	40 lb.	500 lb.
Part B or B1	1.6 lb.	8 lb.	105 lb. (3 @ 35 lb. ea.)
Kit	9.6 lb.	48 lb.	605 lb.

TYPICAL MECHANICAL PROPERTIES

		PT5712 or PT5714 A with B or B1	ASTM Method
Color		PT5712 - Amber PT5714 - Black	Visual
Mixed Viscosity, centipoise	@ 77°F @ 90°F	575 cps 400 cps	D2393
Cured Hardness, Shore D		84 Shore D	D2240
Specific Gravity, grams, cc		1.105	D1475
Density,	lb. / cu. in. lb. / gallon	.0399 9.23	D792
Tensile Strength, psi ⁽¹⁾	Laminate - 10 oz. (7500) Fabric Laminate - 8 oz. (181) Fabric ¹	37,100 pdi 46,970 psi	D638
Elongation at Break, % ⁽¹⁾	Laminate - 10 oz. (7500) Fabric Laminate - 8 oz. (181) Fabric ¹	2.1 % 1.6 %	
Tensile modulus, psi ⁽¹⁾	Laminate - 10 oz. (7500) Fabric Laminate - 8 oz. (181) Fabric ¹	3,988,675 psi 3,197,430 psi	
Flexural Strength, psi ⁽¹⁾	Laminate - 10 oz. (7500) Fabric Laminate - 8 oz. (181) Fabric ¹	59,110 psi 74,727 psi	D790
Flexural Modulus, psi ⁽¹⁾	Laminate - 10 oz. (7500) Fabric Laminate - 8 oz. (181) Fabric ¹	2,612,766 psi 3,345,683 psi	
Compressive Strength, psi		15,007 psi	D695
Compressive Modulus, psi		384,653 psi	
Izod Impact Strength, ft-lbs / in of Notch, Method A - Notched		1.7	D256
Glass Transition Temperature, DMA: T _g Onset (E') Peak		272°F 302°F	D4065
Coefficient of Thermal Expansion, Range 40°C to 60°C		3.755 x 10 ⁻⁵ in./in./ °F	D696

⁽¹⁾ Tensile and Flexural Properties were Determined with .125" Laminates Made By Resin Infusion Process with Style 7500, 10 oz. Tooling Cloth and Style 181, 8 oz. Industrial Fabric.

SAFETY and HANDLING

PTM&W epoxy products are made from raw materials carefully chosen to minimize or even eliminate toxic chemicals, and therefore offer the user high performance products with minimum hazard potential when properly used. Generally, the PTM&W epoxy resins and hardeners will present no handling problems if users exercise care to protect the skin and eyes, and if good ventilation is provided in the work areas. However, breathing of mist or vapors may cause allergenic respiratory reaction, especially in highly sensitive individuals. As such, avoid contact with eyes and skin, and avoid breathing vapors. Wear protective rubber apron, clothing, nitrile rubber gloves, face shield or other items as required to prevent contact with the skin. In case of skin contact, immediately wash with soap and water, followed by a rinse of the area with vinegar, and then a further wash with soap and water. The vinegar will neutralize the hardener and lessen the chances of long term effects. Use goggles, a face shield, safety glasses or other items as required to prevent contact with the eyes. If material gets into the eyes, immediately flush with water for at least 15 minutes and call a physician. Generally, keep the work area as uncluttered and clean as possible, and clean up any minor spills immediately to prevent accidental skin contact at a later time. Keep tools clean and properly stored. Dispose of trash and empty containers properly. Do not use any of these types of products until Material Safety Data Sheets have been read and understood.

PT5712 & PT5714 Bulletin / InDesign / 042214-C3



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PT5760

High Temperature Infusion Resin System

DESCRIPTION

PT5760 A/B is a two-part epoxy system using the latest resin technology, designed for infusing composite tools for service temperatures of 400° F. and above. This product is ideal for the vacuum-assisted resin transfer molding (VARTM) process, due to its low viscosity, excellent wet-out properties, and long working time. PT5760 A/B offers high heat resistance and mechanical properties, and will provide durable, dimensionally stable, high-temperature infused tools.

PRODUCT SPECIFICATIONS

	PT5760-A	PT5760-B For Infusion	PT5760-B1 For Backup Tie-In	ASTM Method
Color	Amber	Amber Clear	Amber Clear	Visual
Viscosity,	1,660 cps	120 cps	1,800 cps	D2392
Specific Gravity, gms./cc	1.17	0.94	0.98	D1475
Mix Ratio, By Weight; By Volume	100 : 50 By Weight; 100 : 62 By Volume		100 : 46 By Weight	PTM&W
Pot Life, 4 fl.oz. Mass @ 77°F	10.6 hours		3.4 hours	D2471

HANDLING and CURING

Infusing parts or tooling with PT5760 is not unlike our PT2712, PT5712 or other standard infusion resins on the market but there are subtle differences that the user needs to be aware of and adjust to. The primary difference being its 10.5 hour pot life, which causes it to take longer to cure hard at room temperature. Due to this extended gel time of PT5760 the infused laminate will not gel hard after an overnight cure at 74°F. With this in mind the user will have to determine, based on their shop set-up and capacity, which curing method is most suitable for them. The goal here is to give the user options with regard to curing.

It takes approximately 26-30 hours for PT5760 to gel hard at room temperature (RT) @ 74°F so the vacuum needs to be left on for the duration of this period. The amount of heat that is applied, and when it is introduced, will determine on how soon the vacuum can be removed.

CURE OPTION #1:

After infusion, the laminate is allowed to set at RT for 48 hours. At this stage the peel ply and flow media will be the easiest to remove, but great care should be taken so the laminate is not lifted or delaminated as the resin is in a very “glassy” state at this point. Protective gloves and eyewear should be worn. Any backup structure could be tied in at this point.* If PT5760 A/B is used for tying in the backup structure, it must also be allowed to set at RT for 48 hours before heat is applied. If PT5760 A/B1 is used to tie-in the backup structure, 16 to 24 hours room temperature set before applying heat is sufficient. The initial 24 hour cure should start when it is determined that the backup structure tie-ins are hard. It is recommended that 120°F not be exceeded unless the laminate has been allowed to set longer at RT (72 hours or more), but in any case, 130°F-140°F should be the highest initial low temp cure. After this 24 hour cure and the laminate is allowed to cool, the tool can be removed from the master and curing can continue unsupported. At this point, from a 120°F start temperature, the temperature can be set to increase at ½°/minute (30°F per hour) without stopping until the final temperature is achieved (10 hours to 420°F), then hold final temperature for 1 additional hour. Curing to 25°F above the service temperature is recommended. If oven temp is not computer controlled, slowly ramp in 50-60°F increments, hold for 2-4 hours at each temperature and repeat until required service temperature is achieved.

OPTION 1 SUMMARY:

1. Cure at Room Temp (RT) for 48 hours
2. Carefully remove peel ply, not disturbing infused laminate
3. Tie in backup structure with PT5760 A/B1*
4. Cure backup structure tie-ins at RT for 48 hours.
5. Heat from RT to 120°F & dwell at 120°F for 12 hrs or overnight.
6. Cool to RT and remove tool from pattern.
7. Stabilize the tool @ 120°F, then raise the temperature ½°/minute until you have reached 25°F above your use temperature and dwell 1 hour at that temperature. An alternate is to raise the temperature from 120°F in 50°F increments, dwelling 3 hours at each stage.

CURE OPTION #2:

After infusion, laminate is allowed to set at RT for 16-24 hours. With vacuum left “on”, heat the laminate to 90-120°F until the laminate is hard, or preferably, for an additional 18-24 hours. Remove peel ply and flow media with care as mentioned in cure #1. Backup structure can be tied in at this time* as referenced in cure #1. Place laminate (still on master) in oven at 120°F for 24-30 hours. **NOTE:** If the laminate has only seen enough temperature to set the resin hard before tying in the backup structure, further low temp curing at 120°F is recommended so the resin does not soften after the vacuum and bag are removed and temperature increased. Again, once it is determined the laminate and tie-ins are hard, the 24 hour, 120°F clock can start. Allow to cool, remove from master and cure unsupported as in Cure #1.

OPTION 2 SUMMARY:

1. Cure at Room Temp (RT) for 24 hours.
2. With infused laminate under vacuum, heat to 90-120°F until laminate is hard (18 - 24 hours).
3. Carefully remove peel ply.
4. Tie in backup structure with PT5760 A/B1*
5. Cure backup structure tie-ins 24 hours at 120°F, while on the pattern.
6. Cool to Room Temperature and remove from the pattern.
7. Post Cure Tool per Option #1.

CURE OPTION #3:

In the event the tool needs to be produced faster than the above methods, infusing with resin and laminate warmed to 90°F will allow the resin to set hard in 16-18 hours. This creates a lower viscosity of the resin (down to 400 cps) with only a 2 hour sacrifice of gel time to 8.5 hours (150 gram mass). All the steps in the prior 2 cures can be followed from here depending on the user desires.

OPTION 3 SUMMARY:

1. Pre-heat resin, hardener and pattern to 90°F and infuse.
2. Allow to gel, then remove peel ply and cure per Option 1 or 2.

* **BACKUP TIE-IN METHOD** – Because of the long pot life of PT5760, we recommend using the PT5760 Part A resin with the Part B1 hardener for tying-in backup structure. This resin/hardener combination has a faster gel time than when using the Part B hardener, and will cure hard overnight at 72°F or higher shop temperatures. Depending upon fabric being used for tie-ins, it may be desirable to add a small amount of fumed silica (Cab-O-Sil or equivalent) to the resin/hardener mixture to minimize drainage on vertical surfaces.

GENERAL INFORMATION

The point at which to remove peel ply and flow media is entirely up to the technician, and there are challenges of doing so before and after a cure. As mentioned, the peel ply and flow media are easier to remove the “greener” the laminate is, or before any cure, as long as the laminate is hard and beyond the state where it could soften or de-compact. It is not recommended that the peel ply and flow media are removed after curing above 120°F as they will be very difficult to remove and you risk the chance of lifting the laminate off the master before the backup structure can be tied in.

STORAGE GUIDELINES

The shelf life of PT5760 Part A is 6 months when stored at 70°F or lower. Lower temperatures will prolong shelf life, while storage at higher temperatures will shorten shelf life. The shelf life of PT5760 Parts B & B1 is 12 months when stored dry in the original containers from 60°F to 90°F. Both resin and hardener components must be protected from moisture. Reseal opened containers with a dry nitrogen purge after each use.

PACKAGING WEIGHTS

	Gallon Kit	Pail Kit	Drum Kit
PT5760 Part A	7 lb.	37 lb.	475 lb.
PT5760 Part B	3.5 lb.	18.5 lb.	238 lb.
Kit	10.5 lb.	55.5 lb.	713 lb.
PT5760 Hardeners Bulk Pack	Quart - 2 lb.	G	Pail - (Part B-37 lb.) (Part B1-34 lb.)

TYPICAL MECHANICAL PROPERTIES

	PT5760 A / B ⁽¹⁾		ASTM Method
Color	Amber		Visual
Mixed Viscosity, centipoise	690 cps		D2393
Pot Life, 4 fl. Oz. Mass, @77°F	10.6 hours		D2471
Cured Hardness, Shore D	87-88 Shore D		D2240
Cured Specific Gravity, grams, cc	1.082		D1475
Density, lb./cu. Inch lb. / gallon	0.0391 9.03		D792
Specific Volume, cu. in./lb.	25.59		
CAST SAMPLES	Cast Samples		
Tensile Strength, psi, (MPa)	5,927 psi (40.9 MPa)		D638
Elongation at Break, %	1.13%		
Tensile modulus, psi, (MPa)	585,840 psi (4,039.4 MPa)		
Flexural Strength, psi, (MPa)	17,118 psi (118 MPa)		D790
Flexural Modulus, psi, (MPa)	544,697 psi (3,755.7 MPa)		
LAMINATED SAMPLES	7781 Glass Fabric ⁽²⁾	5HS Carbon Fabric ⁽³⁾	
Tensile Strength, psi, (MPa)	37,180 psi (256.4 MPa)	65,551 psi (451.97 MPa)	D638
Elongation at Break, %	1.32%	0.73%	
Tensile modulus, psi, (MPa)	2,806,819 psi (19,35. MPa)	9,091,785 psi (62,688 MPa)	
Flexural Strength, psi, (MPa)	74,188 psi (511.5 MPa)	94,990 psi (654.9 MPa)	D790
Flexural Modulus, psi, (MPa)	3,251,914 psi (22,422 MPa)	7,009,190 psi (48,328.4 MPa)	
Compressive Strength, psi, (MPa)	20,347 psi (140.3 MPa)		D695
Compressive Modulus, psi, (MPa)	453,163 psi (3,124.6 MPa)		
Glass Transition Temp., DMA: E' (Onset) Tg (Peak)	367.9°F (188.1°C) 423.3°F (219.1°C)		D4065

(1) Properties in this bulletin were derived with specimens prepared with the following cure cycle: Overnight @ 150°F, followed by an oven post cure of 1 Hour each at 200°F, 250°F, 300°F, 350°F, and 2 hours @ 400°F.

(2) Infused Samples Consisting of 12 Plies 7781 Glass Fabric, 0° - 90° Orientation, with 30% Resin Content.

(3) Infused Samples Consisting of 6 Layers 5 Harness Satin Carbon Fabric, 0° - 90° Orientation, with 34% Resin Content.

SAFETY and HANDLING

PTM&W epoxy products are made from raw materials carefully chosen to minimize or even eliminate toxic chemicals, and therefore offer the user high performance products with minimum hazard potential when properly used. Generally, the PTM&W epoxy resins and hardeners will present no handling problems if users exercise care to protect the skin and eyes, and if good ventilation is provided in the work areas. However, breathing of mist or vapors may cause allergenic respiratory reaction, especially in highly sensitive individuals. As such, avoid contact with eyes and skin, and avoid breathing vapors. Wear protective rubber apron, clothing, nitrile rubber gloves, face shield or other items as required to prevent contact with the skin. In case of skin contact, immediately wash with soap and water, followed by a rinse of the area with vinegar, and then a further wash with soap and water. The vinegar will neutralize the hardener and lessen the chances of long term effects. Use goggles, a face shield, safety glasses or other items as required to prevent contact with the eyes. If material gets into the eyes, immediately flush with water for at least 15 minutes and call a physician. Generally, keep the work area as uncluttered and clean as possible, and clean up any minor spills immediately to prevent accidental skin contact at a later time. Keep tools clean and properly stored. Dispose of trash and empty containers properly. Do not use any of these types of products until Material Safety Data Sheets have been read and understood.

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PT2876 A/B

High Temperature Epoxy Laminating System

DESCRIPTION

PT2876 A/B is an unfilled amber epoxy laminating system designed for the highest service temperature applications. The extended working time of PT2876 A/B allows enough time for vacuum-bagging, yet will set well enough at room temperature to allow the laminate to be demolded from the pattern for post curing. Long tool life is obtainable for autoclave service temperatures up to 450°F., if proper fabrication techniques are used during construction. This system will easily wet-out carbon and fiberglass tooling fabrics. It can also be used for making high-temperature service composite parts.

PRODUCT SPECIFICATIONS

	PT2876 Part A	PT2876 Part B	ASTM Method
Color	Amber	Amber	Visual
Viscosity, @77°F, centipoise	3,200 cps	3,000 cps	D2392
Specific Gravity, gms./cc	1.17	0.98	D1475
Mix Ratio	100 A : 46 B, By Weight		PTM&W
Pot Life, 4 fl.oz. Mass @ 77°F	4.5 - 5 hours		D2471

HANDLING and CURING

PT2876 A/B may be demolded from the pattern after a minimum of 24 hours at $\geq 75^{\circ}\text{F}$. Care should be taken during removal, as the system may retain some brittleness at this stage. To avoid this brittleness, allow the resin to gel hard, attach backup structure, then place the laminate in a cold oven and heat to 100-120°F for a minimum of 12 hours. Allow to cool to RT and demold. Post cure the tool by placing into a cold oven and raise to 150°F for 6 hours, raise to 450°F in 100°F increments, dwelling for 4 hours at each stop. Turn off oven and allow it to cool to RT.

PT2876 can develop considerable heat buildup in larger masses, so it is advisable to mix smaller quantities at a time to minimize this condition. If larger batches are mixed at once, divide the mixed batch among several workers to again minimize the heat buildup. Avoid leaving mixed quantities of material sitting in a container after a job is finished, as over time, the resulting exotherm can cause the material to boil and give off noxious, potentially irritating fumes.

PACKAGING WEIGHTS

	Gallon Kit	Pail Kit	Drum Kit
PT2876 Part A	8.75 lb.	43 lb.	435 lb.
PT2876 Part B	4 lb.	20 lb.	200 lb.
Kit	12.75 lb.	63 lb.	635 lb.

TYPICAL MECHANICAL PROPERTIES

	PT2876 A/B				ASTM Method
Mix Ratio, By Weight	100 A : 46 B				PTM&W
Color	Amber				Visual
Mixed Viscosity, @77°F, centipoise	2,700 cps				D2393
Pot Life, 4 fl. Oz. Mass, @77°F	4.5 - 5 hours				D2471
Cured Hardness, Shore D	90 Shore D				D2240
Specific Gravity, grams, cc	1.10				D1475
Density, lb./cu. Inch lb. / gallon	0.0398 9.2				D792
Specific Volume, cu. in./lb.	25.1				
	Cast Samples	Laminate Samples (Fabric Type)			
		(Style 7500 Glass) 38% Resin Content	(Style 7781 Glass) 35% Resin Content	(6K Carbon) 45% Resin Content	
Tensile Strength, psi	5,442 psi 38 MPa	29,213 psi 201 MPa	35,448 psi 244 MPa	61,615 psi 425 MPa	D638
Elongation at Break, %	1.060% Yield 1.095% Break	1.59% Break	1.38% Break	1.05% Break	
Tensile modulus, psi	525,074 psi 3,621 MPa	2,216,990 psi 15,290 MPa	2,841,195 psi 19,694 MPa	6,453,940 psi 44,510 MPa	
Flexural Strength, psi	15,555 psi 107 MPa	43,415 psi 299 MPa	54,306 psi 375 MPa	76,348 psi 527 MPa	D790
Flexural Modulus, psi	560,327 psi 3,864 MPa	2,320,447 psi 16,003 MPa	2,893,655 psi 19,956 MPa	5,776,906 psi 39,841 MPa	
Compressive Strength, psi	23,381 psi 161.2 MPa				D695
Compressive Modulus, psi	474,385 psi 3,271 MPa				
Glass Transition Temperature, DMA: Tg, E' (Onset) Tg, Peak	Onset: 204°C (399°F) - ASTM D7028 Peak: 236°C (457°F) - ASTM D4065				

SAFETY and HANDLING

PTM&W epoxy products are made from raw materials carefully chosen to minimize or even eliminate toxic chemicals, and therefore offer the user high performance products with minimum hazard potential when properly used. Generally, the PTM&W epoxy resins and hardeners will present no handling problems if users exercise care to protect the skin and eyes, and if good ventilation is provided in the work areas. However, breathing of mist or vapors may cause allergenic respiratory reaction, especially in highly sensitive individuals. As such, avoid contact with eyes and skin, and avoid breathing vapors. Wear protective rubber apron, clothing, nitrile rubber gloves, face shield or other items as required to prevent contact with the skin. In case of skin contact, immediately wash with soap and water, followed by a rinse of the area with vinegar, and then a further wash with soap and water. The vinegar will neutralize the hardener and lessen the chances of long term effects. Use goggles, a face shield, safety glasses or other items as required to prevent contact with the eyes. If material gets into the eyes, immediately flush with water for at least 15 minutes and call a physician. Generally, keep the work area as uncluttered and clean as possible, and clean up any minor spills immediately to prevent accidental skin contact at a later time. Keep tools clean and properly stored. Dispose of trash and empty containers properly. Do not use any of these types of products until Material Safety Data Sheets have been read and understood.

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PTM&W INDUSTRIES PRODUCT LINES

EPOXY TOOLING MATERIALS

The PTM&W epoxy tooling line is an extensive group of materials designed to provide tough, durable molds, patterns and tools for both room temperature and high temperature service. Included in these products are surface coat systems, laminating materials and casting compounds that are tailored for specific areas of application. A broad range of products are available in each group, and by proper selection, the requirements of an application can be closely matched, for consistent high-quality results.

These tooling materials are designed for ease-of-use, and their cured properties will usually exceed the requirements of the application. With over 40 years of experience, we have the knowledge base to develop and produce tooling materials that are of minimum hazard potential and which provide consistent high-performance results in the most demanding applications.

Surface Coats		Laminating Systems		Casting Systems		Specialty Materials	
Room Temp.	High Temp.	Room Temp.	High Temp.	Room Temp.	High Temp.	Room Temp.	High Temp.
PT1105	PT1520	PT2050	PT2520	PT4151	PT4925	PT5315	PT5965
PT1154	PT1540	PT2059	PT2620	PT4250	PT4935	PT5326	HT ₂ C
PT1158	PT1554	PT2114	PT2846	PT4420		PT5331	
PT1414	PT1935		PT2848	PT4431		PT5355	
	PT1945		PT2876	PT4450		RT ₂ C	
	PT1995			PT4455			

EPOXY N-FUSION

Vacuum-Assist Resin-Transfer Method (VARTM) is the procedure of infusing a resin matrix into plies of dry fabric, under vacuum, to make composite laminates. In this process, dry plies of fabric are laminated onto a hard mold surface along with release plies, flow media, vacuum lines, and resin distribution lines, with the entire laminate placed under a vacuum bag. Infusion resin/hardeners are batch-mixed and sucked into the laminate, by vacuum, through resin distribution lines. VARTM-type resin systems are identified by very low mixed viscosities and longer working times.

Resin infusion for tooling has a number of advantages over using prepreg tooling materials: much lower material costs; easier ply positioning; less chance of delamination; no autoclave required; room-temperature demold; free-standing post cure; no refrigerated storage and long shelf life.

Resin infusion for production parts offers the same advantages as for tooling. This process is usually reserved for large structures such as boats or composite car bodies.

Resin Infusion for Parts	Resin Infusion For Tooling
PT2712, PT2752 High Impact	PT5712 & PT5714, PT5760, PT2876

ADHESIVES

We manufacture a wide variety of structural adhesives for industrial applications. From thin liquid systems to smooth thixotropic pastes, we have formulas that will provide strong structural bonds to a wide variety of surfaces. Many of our adhesives are tailored to specific uses and individual applications. If you have a requirement that cannot be fulfilled by our standard products, let us select or design a high performance adhesive that works for you.

Liquid Adhesives	Fast-Set System	Special Purpose Pastes	High Strength Adhesives
ES6209	ES6220	ES6228	ES6265
ES6210		ES6249	ES6279
		ES6259	ES6292

REPLICAST FAST CURE CASTING SYSTEMS FOR MOLDS OR PARTS

The REPLICAST 600 Series is a line of highly filled fast setting urethane tooling compounds. They have low shrinkage and good cured stability for a wide variety of general purpose industrial tooling applications. **REPLICAST 616** has a faster setting time, and castings can be demolded a little sooner than with REPLICAST 612. **REPLICAST 612**, being a little slower setting than REPLICAST 616, can be used for larger castings, and when the lowest shrinkage is required.

REPLICAST Unfilled is a low viscosity material for general casting uses, and **REPLICAST 112** is a three component system consisting of prepackaged kits of REPLICAST Unfilled and PA0738 non-metallic bulk filler. The user can adjust the finished casting properties by varying the amount of bulk filler incorporated into the mix.

Filled - for Smaller Castings	Filled - For Larger Castings	Low Viscosity Unfilled System	Versatile 3-Component System
REPLICAST 616	REPLICAST 612	REPLICAST Unfilled	REPLICAST 112

PTM&W INDUSTRIES PRODUCT LINES

TOOLING URETHANES

The Tooling urethanes that we manufacture can be grouped into four categories, which divide them by hardness and related end uses:

Soft Urethane Elastomers for Tough, Flexible Tooling and Molds - These products, generally 50 Shore Hardness and under, are ideally suited for applications such as bumpers, pads, flexible molds or soft parts

where a high degree of flexibility & toughness is required. Their relatively high tensile strengths make them good performers for masking or holding fixtures where the tooling needs to be stretched to apply and remove.

Mid-Range Hardness Urethanes for High Strength Tooling and Molds - These products are tough elastomeric urethanes that are generally in the 60 - 80 Shore A hardness range. They perform very well in light metal forming dies such as brake form pads. Their slightly tougher nature, compared to softer materials, makes them ideal for applications such as very tough high strength flexible molds, and they produce durable, abrasion resistant shapes and parts, cutting pads, fixtures and flexible parts.

Hard Elastomeric Urethane Tooling Materials - These products range in hardness from Shore A-90 to Shore D-60, and are workhorse metal forming materials. They are also used extensively in the foundry, where they are capable of outlasting metal patterns in many applications. Shore A-90 and Shore A-95 urethane systems are harder flexible elastomers with very tough cured properties that make excellent metal forming tooling and are useful in many other demanding industrial applications. Forming dies, die springs, stripper pads, patterns, gears and tough parts are all applications in which these hard elastomers excel. Shore D-60 urethane systems are exceptionally tough, hard elastomers that have cured characteristics which make them well suited for some very demanding industrial uses.

Rigid Urethane Elastomer - This very hard system - 75 Shore D - is plastic-like in appearance, yet provides the inherent toughness and durability of engineering elastomers. It works very well in tooling applications such as patterns, molds and fixtures. It is ideal for the fabrication of high strength rigid parts such as seals, bushings and prototype items.

Soft, Flexible Systems	Mid-Range Hardness	Hard Elastomers	Rigid Urethane Elastomer
PT7240 (40A) PT7250 (50A)	PT7260 (60A) PT7265 (65A) PT7275 (75A) PT7280 (80A)	PT7290 (90A) PT7295 (95A) PT7660 (60D) PT7665 (60D)	PT7705 (75D)

PROTOTYPING MATERIALS

The epoxy and polyurethane products that we manufacture for prototyping applications combine ease of handling with superior cured physicals, to provide short run and production parts with many beneficial properties. The proper choice from these products will allow the user to duplicate the properties of a number of engineering plastics with low-cost tooling in a very short time. They cover a broad range of

applications, both rigid and flexible, and include high performance materials for clear casting as well as excellent UL Listed fire retardant systems.

Hi-Impact & Clear	Machine Dispense & Hand Pour	Fire Retardant	Flexible
PT5409 Hi-Impact PT8902 Hi-Impact PT8925 Clear	PT8907 PT8908 PT8917 PT8918 PT8970	PT8919 PT8948 PT8949 PT8964	PT8952 Hi-Impact PT8955 PT8957 PT8959
			PT8442 (40A) PT8452 (50A) PT8462 (60A) PT8472 (70A)

ACCESSORY PRODUCTS

Release Agents	Bulk Fillers	Accessory Products
PA0801 Paste Wax PA0810 PVA Film Release PA0828 Silicone Release PA0868 Washable Silicone Release	PA0738 Alumina Filler	2-Inch Tooling Brushes Plastic Squeegees/Spreaders Epoxy Color Dispersions Urethane Color Pastes

POLY FILLER

The POLY FILLER products are two component polyester filler paste systems that provides the user both unique ease of handling and high performance cured characteristics. A significant advantage of the POLY FILLER products over other materials of this type is their very low cured shrinkage. This feature allows faster application and repairs than with other filler pastes, which usually must be applied in several layers

because of their high shrinkage rate! POLY FILLERS can be troweled to a feather edge without rolling or skipping. They can be used to fill tiny pinholes without lifting. The dry, tack-free nature of the cured POLY FILLER paste provides for easier working with tools and prevents loading the sandpaper. Once applied and cured, the POLY FILLER materials will bond quite well to most surfaces such as aluminum, copper, fiberglass, epoxy, steel, plaster, graphite and kevlar laminates. They will also accept all types of enamel, epoxy, lacquer and paint stains as a surface finish. The Poly Filler line consists of **POLY FILLER RT**, a product for room temperature applications; and **POLY FILLER HT**, which utilizes an excellent high temperature resin base, and therefore can be subjected to service temperatures in excess of 400°F.

SURFACE COAT SYSTEMS for EPOXY TOOLING

PRODUCT LINE DESCRIPTION

Epoxy surface coats are generally paste-viscosity resins designed to be applied by brush or squeegee to a model or pattern and function as the surface of the cured tool. They generally possess handling properties that facilitate easy mixing and application, and their cured properties provide a tough, durable surface that can be sanded or scribed with ease. Products are available for room temperature service as well as elevated service temperature applications.

ROOM TEMPERATURE SERVICE SURFACE COATS

	PT1105	PT1154	PT1158	PT1414
Description	White general purpose surface coat with smooth thixotropic viscosity. Applies well to severely contoured surfaces without drain or run-off.	Thixotropic off-white, soft paste viscosity surface coat that has a lower mixed viscosity than PT1105 for faster & easier application to broad flat tooling surfaces.	A white, very low viscosity surface coat system for special applications where its ability to duplicate fine detail is very important.	Blue abrasion resistant surface coat and die casting resin. The extremely hard surface wears well in demanding applications. Can be cast in thin sections for facing dies, and is an excellent adhesive which will bond very well to a variety of surfaces.
Hardeners Available:	Part B: 100:11 20 min. Part B1: 100:13 18-20 min.	Part B: 100:14 20 min.	Part B: 100:14 18-19min.	Part B: 100 : 14 30 - 35min.
Color	White	Off-White	White	Blue
Mixed Viscosity, cps	Thixotropic Paste	Thin Paste	Very Thin Paste	50,000 cps
Specific Gravity	1.25 - 1.27	1.35	1.29	1.71
Cured Hardness	88 - 91 Shore D	86 - 88 Shore D	91 Shore D	90 Shore D
Tensile Strength	6,300 psi	6,730 psi	9,355 psi	6,500 psi
Flexural Strength	7,100 psi	14,604 psi	19,659 psi	9,700 psi
Compressive Strength	15,300 psi	16,030 psi	15,553 psi	17,400 psi

HIGH TEMPERATURE SERVICE SURFACE COATS

	PT1520	PT1540	PT1554
Description	Gray general purpose aluminum filled surface coat for intermediate high temperature service, with a smooth thixotropic paste viscosity.	Black graphite filled surface coat for high temperature service, with a thin paintable viscosity.	Gray general purpose aluminum filled surface coat system with slightly lower viscosity than PT1520.
Hardeners Available:	Part B: 100 : 9 55-60 min.	Part B: 100 : 15 20-25 min. Part B1: 100 : 13 50-60 min.	Part B: 100 : 12 25-30 min. Part B1: 100 : 10 50-60 min.
Color	Gray	Black	Gray
Mixed Viscosity, cps	150,000 cps	Thin Paste	106,000 cps
Specific Gravity	1.48	1.18	1.42
Cured Hardness	90 Shore D	82 - 85 Shore D	90 Shore D
Tensile Strength	11,593 psi	6,560 psi	9,850 psi
Glass Transition Temp. ,Tg	310°F	271°F	260°F
Coef. of Thermal Expansion	2.96 x 10 ⁻⁵ in./in./ °F	2.31 x 10 ⁻⁵ in./in./ °F	3.26 x 10 ⁻⁵ in./in./ °F

	PT1935	PT1945	PT1995
Description	Black high temperature surface coat that can be polished to a high gloss when cured.	Black high temperature surface coat with special characteristics developed for prepreg layup tooling. Carbide filled for a tough hard surface that resists damage caused by cutting prepreg on the tool surface.	Black graphite filled surface coat for high temperature service, with thermal expansion characteristics designed for high performance composite tooling.
Hardeners Available:	Part B: 100 : 12 40-45 min. Part B1: 100 : 13 90-120 min.	Part B: 100 : 10 40-45 min. Part B1: 100 : 11 90-120 min.	Part B: 100 : 12 50-60 min. Part B1: 100 : 13 2 - 3 hours
Color	Black	Black	Black
Mixed Viscosity, cps	52,000 cps	144,000 cps	140,000 cps
Specific Gravity	1.39	1.48	1.39
Cured Hardness	90 Shore D	90 Shore D	89 Shore D
Tensile Strength	5,420 psi	6,810 psi	7,690 psi
Glass Transition Temp. ,Tg	308°F	295°F	310°F
Coef. of Thermal Expansion	2.74 x 10 ⁻⁵ in./in./ °F	2.20 x 10 ⁻⁵ in./in./ °F	2.56 x 10 ⁻⁵ in./in./ °F

LAMINATING SYSTEMS for EPOXY TOOLING

PRODUCT LINE DESCRIPTION

Epoxy laminating resin systems consist of both unfilled materials and filled products that are intended for use with reinforcing fabrics to construct high performance composite tooling and prototype and/or production parts. Products intended for use in normal ambient temperature service as well as those designed for elevated temperature applications are listed below. The pertinent handling and cured properties of these systems are listed to aid in selecting the right material for your application.

ROOM TEMPERATURE SERVICE LAMINATING SYSTEMS

	PT2050	PT2059	PT2114
Description	Medium viscosity, unfilled, light amber laminating resin that is designed for structural and production applications. It has excellent wet-out of fiberglass, carbon and aramid fibers, and has very good cured properties.	General purpose unfilled system for use in fabricating tooling or structures for room temperature service applications. It has good handling and cured properties.	White filled laminating system with easy handling characteristics for durable stable tooling. It has minimum drain on vertical and contoured surfaces.
Hardeners Available:	Part B: 100 : 23 20 - 30 min. Part B1: 100 : 27 60 - 65 min. Part B2: 100 : 27 2 hours	Part B: 100 : 19 40 - 50 min. Part B1: 100 : 19 100 - 120 min.	Part B: 100 : 18 30 min. Part B1: 100 : 18 50 - 60 min.
Color	Amber	Amber	White
Mixed Viscosity, cps	950 cps	900 - 1000 cps	3100 cps
Specific Gravity	1.12	1.09	1.38
Tensile Strength	45,362 psi	31,030 psi	29,200 psi
Flexural Strength	65,308 psi	65,048 psi	32,850 psi
Flexural Modulus	2,530,000 psi	1,941,597 psi	2,524,300 psi
Tg by TMA Method	180°F	168°F	189°F

	PT2125	PT2179
Description	White, room temperature laminating system with slightly heavier viscosity than PT2114. An economical filled system for general tooling uses.	White filled laminating system for producing a wide variety of tooling and fixtures that are economical and durable.
Hardeners Available:	Part B: 100 : 15 30 - 35 min.	Part B: 100 : 13 30 min. Part B1: 100 : 16 20 - 25 min.
Color	White	White
Mixed Viscosity, cps	4200 cps	5000 cps
Specific Gravity	1.45	1.43
Tensile Strength	31,420 psi	26,390 psi
Flexural Strength	41,400 psi	43,153 psi
Flexural Modulus	2,010,000 psi	2,730,000 psi
Tg by TMA Method	180°F	196°F

HIGH TEMPERATURE SERVICE LAMINATING SYSTEMS

	PT2520	PT2620	PT2846	PT2848
Description	Medium viscosity, unfilled, light amber laminating resin that is designed for the construction of tooling and components that will operate in the intermediate high temperature range.	Gray filled intermediate high temperature laminating resin for tools and fixtures. Filled to allow lower shrinkage and laminating on vertical and severely contoured surfaces without runoff.	Amber unfilled high temperature epoxy laminating resin designed specifically for demanding high performance composite tooling. Good handling & fabric penetration and high physical properties.	Black, lightly filled high temperature epoxy laminating resin designed specifically for demanding high performance composite tooling. Good handling & fabric penetration and high physical properties
Hardeners Available:	Part B: 100 : 16 45-50 min. Part B1: 100 : 19 4-4.5 hrs.	Part B: 100:13.5 40 - 45 min. Part B1: 100:11 75 - 90 min. Part B2: 100:15 2.5 - 3 hrs.	Part B: 100:19 40 - 45 min. Part B1: 100:22 2.5 - 3 hrs. Part B2: 100:9.5 3 - 4 hrs.	Part B: 100:16.5 40 - 45 min. Part B1: 100:20 2.5 - 3 hrs. Part B2: 100:15 3.5 - 4 hrs.
Color	Amber	Gray	Amber	Black
Mixed Viscosity, cps	1,900 cps	4,000 - 5,000 cps	4,000 - 4,500 cps	4,000 - 4,500 cps
Specific Gravity	1.17	1.29	1.17	1.24
Tensile Strength	36,680 psi	29,250 psi	29,440 psi	28,920 psi
Flexural Strength	52,679 psi	45,333 psi	44,643 psi	41,028 psi
Flexural Modulus	3,010,000 psi	3,090,000 psi	3,270,000 psi	3,106,270 psi
Tg by TMA Method	315°F (w/B1)	185°F (w/B2)	370°F (w/B2)	336°F (w/B2)

EPOXY CASTING SYSTEMS

for ROOM TEMPERATURE SERVICE

PRODUCT LINE DESCRIPTION

Epoxy casting resins are versatile products that can provide an excellent solution to a variety of industrial applications. They generally contain a filler of some type that is provided to produce specific handling or cured properties. These fillers can be of a metallic nature, or of a variety of non-metal fillers. The specific fillers used can provide lower shrinkage, higher compressive strengths, better metal forming properties, or other characteristics suited to a particular use. A variety of systems, for room temperature service are listed here. Each has different hardeners available, to more closely match the material to the application. The products listed here are designed to be used in normal ambient temperature applications where no external heat is applied.

ROOM TEMPERATURE SERVICE EPOXY CASTING SYSTEMS

	PT4151	PT4250	PT4420
Description	A tan non-metallic filled system with features especially designed for tough metal forming applications.	A bright white, non-metallic filled system well suited to a variety of tooling and production operations.	Gray aluminum filled system with good cured toughness and easy machining.
Hardeners Available	Part B: 100 : 25 2 hrs. Part B1: 100 : 26 5-6 hrs.	Part B: 100 : 9.5 45-50 min. Part B1: 100 : 19 2-3 hrs.	Part B: 100 : 8.5 50-60 min. Part B1: 100 : 17 2-3 hrs.
Color	Tan	White	Gray
Mixed Viscosity, cps	6,500 cps	1,300 cps	80,000 cps
Cured Hardness, Shore D	85 D	87 D	89 D
Specific Gravity, gms./cc	1.34	1.56	1.69
Specific Volume, cu. in./lb.	20.7	17.7	16.4
Tensile Strength, psi	9,200 psi	7,000 psi	9,650 psi
Flexural Strength, psi	13,500 psi	12,500 psi	6,400 psi
Compressive Str., psi	17,000 psi	13,000 psi	16,000 psi

	PT4431	PT4450	PT4455
Description	Gray aluminum filled casting resin with lower viscosity for easier pouring and good detail reproduction. Works well with PA0703 aluminum needle bulk filler.	Black iron filled resin with lower viscosity for easier handling and pouring.	Black highly filled casting resin with very high cured properties. High iron content yields very low cured shrinkage for accurate castings
Hardeners Available	Part B: 100 : 11 50-70 min. Part B1: 100 : 23 2-63hrs. Part B2: 100 : 25 5-6 hrs.	Part B: 100 : 11.5 45-50 min. Part B1: 100 : 24 2-3 hrs.	Part B: 100 : 6 50-60 min. Part B1: 100 : 12 2-3 hrs.
Color	Gray	Black	Black
Mixed Viscosity, cps	5,400 cps	6,500 cps	18,000 cps
Cured Hardness, Shore D	90 D	89 D	90 D
Specific Gravity, gms./cc	1.51	1.62	2.24
Specific Volume, cu. in. / lb.	18.3	17.1	12.4
Tensile Strength, psi	8,900 psi	8,450 psi	8,300 psi
Flexural Strength, psi	10,450 psi	11,870 psi	9,400 psi
Compressive Strength, psi	15,800 psi	12,200 psi	17,500 psi

EPOXY CASTING SYSTEMS

for HIGH TEMPERATURE SERVICE

PT4925 PRODUCT DESCRIPTION

PT4925 is an aluminum filled high temperature epoxy resin for use in making cast tools and parts requiring heat resistance and good thermal conductivity. PT4925 has a high aluminum content which insures these properties and allows easy machining of the finished castings. It handles easily, filling mold cavities well, and it reproduces fine details in the pattern surface with ease. Service temperature in the 400°F range is routine with PT4925 and, with the proper hardener selection, it will perform very well in cyclic 500°F temperature applications. PT4925 does not contain vinyl cyclohexane diepoxide (VCHD) or other regulated ingredients. Typical uses for PT4925 include foundry patterns, vacuum form molds, matched dies, compression mold dies, autoclave fixtures and spacers and other applications where good stability and thermal conductivity are required.

PT4935 PRODUCT DESCRIPTION

PT4935 is a gray, aluminum filled epoxy resin that can be used for a wide variety of applications where good heat resistance is required. It has a relatively low viscosity, so it mixes and pours easily, and duplicates details very well without trapping air or leaving surface porosity. The aluminum filler in PT4935 makes it easy to machine when cured. This resin has been especially formulated to be virtually non-settling in long term storage. PT4935 provides accurate, dimensionally stable molds and tooling with very high physical properties. These features make PT4935 an ideal choice for constructing vacuum form molds, compression, injection and blow molds, stretch dies, low production dies; bonding, molding and nesting fixtures, patterns and core boxes, RTM tooling, general repairs and backup for metal sprayed surfaces. PT4935 utilizes the latest material technologies, it contains no hazardous classified or restricted ingredients, for improved safety in the work place.

TYPICAL PHYSICAL PROPERTIES

	PT4925	PT4935
Description	Gray high temperature epoxy casting resin with a very high aluminum filler content. Finished casting looks, feels and machines like an aluminum casting. Very good heat resistance and thermal conductivity, and very high compressive strength.	Gray casting resin with excellent heat resistance and handling qualities. Lower viscosity allows easy mixing and pouring to pick up fine detail with ease. Fillers do not hard pack in transit or storage. Works well with PA0703 aluminum needles bulk filler.
Hardeners Available	Part B: 100 : 8 40 - 50 min. Part B1: 100 : 10 3 - 4 hrs. Part B2: 100 : 10 8 - 12 hrs.	Part B: 100 : 10 50 - 60 min. Part B1: 100 : 12 3.5 - 4 hrs. Part B2: 100 : 12 8 - 10 hrs.
Color	Metallic Gray	Metallic Gray
Mixed Viscosity, cps	117,000 cps	25,000 cps
Cured Hardness, Shore D	91 D	91 D
Specific Gravity, gms./cc	1.69	1.58
Specific Volume, cu. in./lb.	16.4	17.5
Tensile Strength, psi	8,100 psi	7,790 psi
Flexural Strength, psi	17,239 psi	16,155 psi
Compressive Str., psi	20,760 psi	21,846 psi
Tg by DMA Method	309°F	285°F
Coef. of Thermal Expansion Range: 50°C to 100°C	2.91×10^{-5} in./in./ °F	4.63×10^{-5} in./in./ °F



POLYURETHANE CASTING SYSTEMS for TOOLING APPLICATIONS

Soft Urethane Elastomers for Tough, Flexible Tooling and Molds

The Shore A-40 and A-50 urethane systems that are described here are tough, soft, highly resilient polyurethane elastomers that have good handling characteristics and cured properties. These high physical properties make them ideally suited for applications such as bumpers, pads, flexible molds or soft parts where a high degree of flexibility & toughness is required. Their relatively high tensile strengths make them good performers for masking or holding fixtures where the tooling needs to be stretched to apply and remove. These two systems are very low in viscosity, so they mix and pour with great ease. They will duplicate the finest surface detail without trapping air. They are very clear, and light amber in tint, so they can be easily pigmented if desired, for a broad range of finished part colors.

	PT7240	PT7250
Description	Amber soft, very resilient Shore A-40 system with a low mixed viscosity, high tear strength, good tensile strength and abrasion resistance.	Light amber soft Shore A-50 urethane with very good balance of properties for easy handling and good performance in a variety of uses.
Color	Light Amber	Light Amber
Mix Ratio, By Weight	100 : 75	100 : 70
Mixed Viscosity, cps	825 cps	950 cps
Pot Life, @ 77°F	25 minutes	20 minutes
Cured Hardness, Shore A	40 A + 5	50 A + 5
Specific Gravity, gms./cc	1.057	1.056
Specific Volume, cu. in./lb.	26.2	26.2
Tensile Strength, psi	800 psi	775 psi
Elongation @ Break, %	525 %	450 %
Tensile Modulus, @ 100% Elongation	175 psi	200 psi
@ 200% Elongation	300 psi	375 psi
@ 400 % Elongation	520 psi	550 psi
Tear Strength, Die C, pli	180 pli	165 pli
Compression Set, Method B	45 %	30 %
Bashore Rebound	65 %	64 %

MID-RANGE HARDNESS URETHANES for HIGH STRENGTH TOOLING and MOLDS

The systems described here are tough elastomeric urethanes in the middle range hardness, for flexible materials that have good handling and cured properties. These slightly harder elastomers in the 60 – 80 Shore A hardness range perform very well in light metal forming dies such as brake form pads. Their slightly tougher nature, compared to softer materials, makes them ideal for applications such as very tough high strength flexible molds, and they produce durable, abrasion resistant shapes and parts, cutting pads, fixtures and flexible parts. All four systems are light colored materials that can be easily pigmented if desired. They release air very well and pour easily.

	PT7260	PT7265	PT7275	PT7280
Description	A snappy and resilient 60 Shore A elastomer with excellent cured properties.	Tough, durable high performance medium viscosity Shore A-65 urethane elastomer with excellent tensile strength, high elongation, and very high abrasion resistance.	A 75 Shore A system with outstanding high elongation and very high tear strength for this hardness.	A quick curing Shore A-80 material with very good toughness, high tensile strength and elongation.
Color	Light Amber	Light Amber	Light Amber	Light Amber
Mix Ratio, By Weight	100 : 55	100 : 53	100 : 30	100 : 80
Mixed Viscosity, cps	1350 cps	2900 cps	3000 cps	1550 cps
Pot Life, @ 77°F	20 min.	35 min.	30 min.	25 - 30 min.
Cured Hardness, Shore A	60 A + 5	65 A + 5	75 A + 5	80 A + 5
Specific Gravity	1.06	1.042	1.048	1.05
Specific Vol., cu. in./lb.	26.1	26.5	26.4	26.5
Tensile Strength, psi	1400 psi	1300 psi	2550 psi	2785 psi
Tear Strength, Die C, pli	195 pli	190 pli	305 pli	352 pli
Compression Set, Meth. B	55 %	66 %	76 %	80 %
Bashore Rebound	60 %	49 %	45 %	39 %

HARD ELASTOMERIC URETHANE TOOLING MATERIALS

These 95 Shore A and 60 Shore D hardness elastomers are workhorse metal forming materials. In some instances, they can produce successful tooling for forming applications where nothing else works! They are also used extensively in the foundry, where they are capable of outlasting metal patterns in many applications. The Shore A-90 and Shore A-95 urethane systems described here are harder flexible elastomers with very tough cured properties that make excellent metal forming tooling and are useful in many other demanding industrial applications. Forming dies, die springs, stripper pads, patterns, gears and tough parts are all applications in which these two elastomers excel. The two Shore D-60 urethane systems are exceptionally tough, hard elastomers that have cured characteristics which make them well suited for some very demanding industrial uses. Both of these systems have very high tensile and tear strengths and excellent elongation, so tooling or parts made with these materials are very durable. They have very good resistance to abrasion, so they are ideal for the production of foundry tools and patterns. These materials work hard and solve problems!

	PT7290 A/B	PT7295 A/B	PT7660 A/B	PT7665 A/B
Description	A tough urethane tooling elastomer with a longer working time and low viscosity which is very easy to mix and cast.	An excellent metalworking elastomer with very high cured properties. It has low shrinkage, very good elongation and outstanding tensile strength and abrasion resistance.	Tough tooling elastomer that is ideal for demanding foundry and industrial applications. It has a fast cure for quicker tool production. In addition to the natural tan, it is available in <u>red</u> and <u>black</u> versions.	This system has a longer working time and very low shrinkage which makes it ideal for larger patterns and tools. Cured material machines well for casting a near-net shape, and then machining the pattern to final dimensions.
Color	Amber	Black	Amber	Tan
Mix Ratio, By Weight	100 : 64	100 : 50	100 : 44	100 : 60
Mixed Viscosity, cps	1800 cps	5250 cps	2,600 cps	5,000 cps
Pot Life	40 - 45 min.	45 - 50 min.	26 minutes	112 minutes
Cured Hardness, Shore Durometer	90 Shore A \pm 5	95 Shore A \pm 5	60 Shore D \pm 5	60 Shore D \pm 5
Specific Gravity, gms./cc	1.055	1.10	1.06	1.09
Specific Volume, cu. in./lb.	26.3	25.2	26.1	25.3
Tensile Strength, psi	3,581 psi	4,000 psi	6,014 psi	5,005 psi
Elongation at Break, %	920 %	225 %	646 %	554 %
Tensile modulus @ 100% Elongation	1,086 psi	1,620 psi	1,896 psi	1,765 psi
Tensile modulus @ 200% Elongation	1,393 psi	2,075 psi	2,457 psi	2,363 psi
Tensile modulus @ 400% Elongation	2,110 psi	2,740 psi	4,071 psi	3,850 psi
Tear Strength, Die C, pli	430 pli	525 pli	565 pli	661 pli
Compression Set, Method B	90 %	43 %	88 %	56 %
Bashore Rebound	42 %	48 %	48 %	53 %

RIGID URETHANE ELASTOMER

This very hard system –75 Shore D– is plastic-like in appearance, yet provide the inherent toughness & durability of engineering elastomers. It works well in tooling applications such as patterns, molds and fixtures, and is ideal for the fabrication of high strength rigid parts such as seals, bushings & prototype items.

	PT7705
Description	Bright white low viscosity system with a long working time and good room temperature cures. This material works very well for hand pouring prototype plastic models and parts where the handling characteristics allow easy filling of complicated molds.
Color	White
Mix Ratio, By Weight	100 : 100
Mixed Viscosity, cps	300 cps
Pot Life	30 - 40 minutes
Cured Hardness, Shore D at 77°F at 150°F	75 Shore D 68 Shore D
Specific Gravity, gms./cc	1.10
Specific Volume, cu. in./lb.	25.2
Tensile Strength, psi	5,000 psi
Elongation at Break, %	20 %
Compressive Strength, psi	7,000 psi



Rigid Polyurethane Systems for Prototype & Production: Hand-Cast and Vacuum-Cast Products

This section describes PTM&W Industries' polyurethane casting systems designed for processing using hand-casting and vacuum-casting methods.

The products in this group have low mixed-viscosities and longer working times to allow sufficient time for hand mixing, vacuum degassing, casting and pressurizing before the material gels. These systems work very well in vacuum-casting machines, like MCP equipment.

You will find our casting systems to be among the highest performing available on the market. Products like PT8902 and PT8952, while requiring a heated post-cure, generate the highest impact strengths for hard, rigid polyurethanes. A few of these products are certified to UL94-V0 flame-retardant specifications, and PT8902 is certified to USP Class-VI requirements.

Some of the same products listed in this group are also shown with faster-setting hardeners in another section called Twin-Tube and Machine Dispense Products. Normally, those materials set up too rapidly to be used in hand-cast and vacuum-cast processes.

We suggest using PTM&W urethane-based color pastes for color-casting. Pigments from other manufacturers may work, but some have proven to be incompatible with our urethanes, resulting in streaking or molted colors, or retarded cures and tacky surfaces.

Please contact us at 800 421-1518 or info@ptm-w.com, if you have questions about our products or processing requirements.



Rigid Polyurethanes for Hand-Cast and Vacuum Cast Applications

PRODUCTS

PT8902

This urethane system is designed to allow you to produce the toughest parts available for prototype applications! It is a low viscosity urethane system with a very useable pot life. PT8902 forms an extremely tough white, opaque solid when cured. PT8902 has a notched Izod impact strength of over 2.0! PT8902 is Certified to USP Class VI requirements.

PT8948 & PT8949

These companion materials have been designed specifically for hand pouring or mechanized casting of larger parts. They have easy to use volumetric ratios and low viscosities for easy degassing and filling of complicated molds. PT8948 cures to a translucent solid, and PT8949 cures to a brilliant opaque white, but since no pigments are used in either system, they can easily be tinted or colored.

PT8925

Transparent, water-white urethane casting system that is very useful for the production of tough, impact resistant clear parts. Three hardeners are available for producing various size parts from thin-walls to mass castings. Parts B1 and B2 are appropriate for hand cast and vacuum casting uses. Part B3 works well in machine use. The cured parts have excellent toughness and durability.

PT8952

PT8952 is a system developed to provide a tough, impact-resistant material for the production of durable short run and prototype parts. A performance companion to the PT8902 high impact casting system, PT8952 produces parts with very high Izod impact strength with the added benefit of excellent fire retardant characteristics. PT8952 is UL listed for UL 94V-0 at 0.1 inch (2.6 mm) thickness (UL File No. E238713), and meets the requirements of FAR 28.853 for flammability.

PT8955

PT8955 casting system that has been developed to allow the production of parts that are tough, durable and fire retardant. Cured parts are UL Listed for UL94 V-0 at 0.1 inch (2.6 mm) thickness. The natural color of this material is a very bright white, and it accepts pigments and colorants readily for a broad range of final colors to suit the application requirements. PT8955 has excellent hot strength, which prevents sagging or distortion in parts that are exposed to higher ambient temperatures in service.

PT8957

PT8957 provides a tough, impact-resistant material for the production of durable short run and production parts. PT8957 in thinner section parts will possess both high impact strength as well as good fire retardant performance. PT8957 meets the requirements of FAR 28.853 for flammability in 0.043 inch (1.1 mm) thickness. PT8957 will solve the problem of brittle fire retardant parts!! It has very good Izod Impact strength, tensile and flexural strength, for outstanding toughness.

PT8964

PT8964 is a two-component urethane casting system with very high temperature resistance that produces prototype and production parts with excellent cured properties. With an easy 2 to 1 mix ratio by weight or volume and very low mixed viscosity, PT8964 processes quickly and allows the casting of complicated configurations in a timely manner. Two hardeners are available for producing either natural amber or black parts.

PT8970

PT8970 is a Shore D-70 urethane system that has a high degree of toughness, and excellent stability for this hardness range. It is a good material for various types of tools and fixtures. Panels and parts made with PT8970 have high impact strength and resistance to cracking, for long, durable service. Part B hardener is more suited to hand casting larger parts, and Part B1 is intended for machine dispensing. Black versions of both hardeners are available.

PRODUCT SPECIFICATIONS and TYPICAL MECHANICAL PROPERTIES

Note: For full specifications and properties with all of the available hardeners, including recommended curing cycles, refer to the individual product bulletins in the next section of this booklet.

	PT8902	PT8948	PT8949	PT8925	PT8952	PT8955	PT8957	PT8964	PT8970
Viscosity-Resin	80 - 100 cps	80 cps	100 cps	400 cps	60 cps	175 cps	120 cps	960 cps	1250 cps
Viscosity-Hardener	650 cps	900 cps	1300 cps	1440 cps	650 cps	4300 cps	750 cps	450 cps	1150 cps
Cured Hardness	85 Shore D	80 - 82 Shore D	70 - 75 Shore D	80 - 85 Shore D	85 Shore D	85 Shore D	88 Shore D	84 Shore D	70 Shore D
Specific Gravity	1.15	1.11	1.08	1.14	1.17	1.205	1.20	1.14	1.108
Izod Impact	2.1	0.46	0.42	0.75	1.6	0.76	1.42	1.72	4.4
Tensile Strength	10,010 psi	10,514 psi	7,263 psi	10,080 psi	10,650 psi	7,480 psi	10,676 psi	9,565 psi	5,314 psi
Flexural Strength	15,575 psi	14,438 psi	9,428 psi	13,576 psi	15,445 psi	14,333 psi	16,743 psi	11,100 psi	4,869 psi
Tg (Method)	213°F (DMA)	286°F (TMA)	212°F (TMA)	166°F (TMA)	211°F (TMA)	192°F (TMA)	203°F (TMA)	298°F (DMA)	300°F (DMA)



Rigid Polyurethane Systems for Prototype & Production: Twin-Tube and Machine Dispense Products

This section describes PTM&W Industries' polyurethane casting systems designed for processing using twin-tube cartridges and machine dispensers, mixed through static mixers.

These products have low mixed-viscosities, short working times and faster demold times, to allow quick cycling of molds. Most products listed here obtain full properties with room-temperature cures.

All products are listed with mix ratios shown by weight and by volume. You will find a page showing recommended static mixers for each product. Other static mixers may be sufficient, but those we suggest have been tested in our applications lab and have been proven to work.

You will find our casting systems to be among the highest performing available on the market. Products like PT8902 and PT8952, with our fast-setting hardeners, generate the highest impact strengths for hard, rigid polyurethanes with room-temperature cures. A few of these products are certified to UL94-V0 flame-retardant specifications, and PT8902 is certified to USP Class-VI requirements.

Some of the same products listed in this group are also shown with slower-setting hardeners in another section called Hand-Cast and Vacuum-Cast Products. Normally, those materials set up too slowly for twin-tube or machine casting, except where you need the extra working time for very large castings.

We suggest using PTM&W urethane-based color dispersions for color-casting. Pigments from other manufacturers may work, but some have proven to be incompatible with our urethanes, resulting in streaking or molted colors or retarded cures and tacky surfaces.

Please contact us at 800 421-1518 or info@ptm-w.com, if you have questions about our products or processing requirements.



Rigid Polyurethanes for Twin-Tube and Machine Dispense Production

PRODUCTS

PT8902

This urethane system is designed to allow you to produce the toughest parts available for prototype applications! It is a low viscosity urethane system with a very useable pot life. PT8902 forms an extremely tough white, opaque solid when cured. PT8902 has a notched Izod impact strength of over 2.0! PT8902 is Certified to USP Class VI requirements.

PT8907

A fast urethane casting system for machine dispensing that provides tough, durable parts with high impact strength. Two hardeners are available: Part B for fast demold at room temperature, and Part B1 for larger parts. Parts B and B1 can be blended for intermediate working times to suit the application. Both hardeners are black. A buff-colored version is available - the part number is PT8909.

PT8908

A fast urethane casting system for machine dispensing. This is a modification of our PT8907, with a longer pot life and lower mixed viscosity, to allow casting of larger parts. It develops strength quickly, and allows fast demold times for more cycles per day. PT8908 is not brittle in thin sections, and its heat resistance is very good.

PT8925

Transparent, water-white urethane casting system that is very useful for the production of tough, impact resistant clear parts. Three hardeners are available for producing various size parts from thin-walls to mass castings. Hardener B3 works well in machine dispensing use. Hardeners B1 and B2 are more appropriate for hand cast and vacuum casting uses. The cured parts have excellent toughness and durability.

PT8917, PT8918 and PT8919

PT8917, PT8918 & PT8919 are very low viscosity, modified polyurethane systems that provide tough cured parts with excellent heat resistance. They have easy-to-measure, 1 to 1 mix ratios for convenient use in dispensing machines or hand-packed cartridges. These products are identical, except for color, for casting versatility: The clean white color of PT8919 and the translucent natural color of PT8918 provide attractive castings, and they are very easy to dye or pigment for a wide variety of colored parts. PT8917 is black in color, and parts made with it have a rich, opaque, deep black appearance. These products have a fast, 60 second gel time, which allows quick demolding of the parts, and more production in a day. Their very low mixed viscosity allows complete mold filling, even though they have a fast setting time.

PT8959

PT8959 is a fast gelling fire retardant system for machine or cartridge dispensing uses. It has a low mixed viscosity that allows easy filling of thin mold areas. This system allows fast demold times for quick mold turnaround and more cycles per day. PT8959 is UL Listed for UL 94 V-0 at 0.12" thickness (UL File No. E238713).

PT8970

PT8970 is a Shore D-70 urethane system that has a high degree of toughness, and excellent stability for this hardness range. It is a good material for various types of tools and fixtures. Panels and parts made with PT8970 have high impact strength and resistance to cracking, for long, durable service. Part B hardener is more suited to hand casting larger parts, and Part B1 is intended for machine and cartridge dispensing. Black versions of both hardeners are available.

PRODUCT SPECIFICATIONS and TYPICAL MECHANICAL PROPERTIES

Note: For full specifications and properties with all of the available hardeners, including recommended curing cycles, refer to the individual product bulletins in the next section of this booklet.

	PT8902	PT8907	PT8908	PT8925	PT8917, PT8918 & PT8919	PT8959	PT8970
Viscosity-Resin	80 - 100 cps	200 cps	200 cps	400 cps	100 cps	200 cps	1250 cps
Viscosity-Hardener	650 cps	1800 cps	1800 cps	1440 cps	2600 cps	1800 cps	1150 cps
Cured Hardness	85 Shore D	79 Shore D	75 Shore D	80 - 85 Shore D	85 Shore D	86 Shore D	70 Shore D
Specific Gravity	1.15	1.143	1.08	1.14	1.16	1.18	1.108
Izod Impact	2.1	1.1	1.13	0.75	0.82	0.68	4.4
Tensile Strength	10,010 psi	5,805 psi	5,407 psi	10,080 psi	8,420 psi	9,030 psi	5,314 psi
Flexural Strength	15,575 psi	8,300 psi	6,759 psi	13,576 psi	11,212 psi	14,401 psi	4,869 psi
Tg (Method)	213°F (DMA)	326°F (DMA)	298°F (DMA)	166°F (TMA)	259°F (DMA)	227°F (DMA)	300°F (DMA)



EPOXY ADHESIVES

PRODUCT LINE DESCRIPTION

We manufacture a wide variety of structural adhesives for industrial applications. Listed here are a number of stock products that include a broad range of properties. Many of our adhesives are tailored to specific uses and individual applications. If you have a requirement that cannot be fulfilled by these standard products, let us select or design a high performance adhesive that works for you.

PRODUCTS

ES6209

A translucent, straw colored adhesive with a controlled flow viscosity for good surface wetting, yet minimum run-out from the joint.

ES6210

A clear system with optical clarity in thin or thick cross sections. A good choice when minimum bond line appearance is desired. ES6210 has a long open time for casting and embedding uses as well as bonding.

ES6220

A fast setting green liquid adhesive with good adhesion to a variety of surfaces. Useful for bench assembly or quick repairs. Ideally suited for bonding situations where a fast cure at room temperature and good cures at low temperature are required.

ES6228

A gray thin paste high strength metal bonding adhesive. ES6228 adhesive is capable of bonding to slightly oily surfaces, which is useful in bonding metal parts in situations where complete removal of mill oil is not practical.

ES6238

A gray, aluminum filled paste adhesive for metal repair and bonding and many other uses. It has excellent adhesion to metal, glass and wood. ES6238 is easily machined when cured.

PRODUCT SPECIFICATIONS and TYPICAL MECHANICAL PROPERTIES

NOTE: For full specifications and properties, including recommended curing cycles, refer to the individual product bulletins available on our web site at www.ptm-w.com.

	ES6209 A/B	ES6210 A/B	ES6220 A/B	ES6228 A/B	ES6238 A/B
Color	Straw	Clear	Green	Gray	Gray
Mix Ratio, By Weight By Volume	100 : 100 1 : 1	100 : 50 2 : 1	100 : 100 1 : 1	100 : 100 1 : 1	100 : 100 1 : 1
Mixed Viscosity, cps	60,000 cps	500 cps	14,000 cps	Light Paste	Paste
Pot Life	60 - 90 min.	120 - 140 min.	4 minutes	2 hours	15 - 20 min.
Cured Hardness	85 Shore D	80 Shore D	82 Shore D	83 Shore D	86 Shore D
Specific Gravity, gms./cc	1.09	1.08	1.16	1.30	1.54
Operating Temperature	-50 - 150°F	-50 - 180°F	-50 - 125°F	-50 - 150°F	-50 - 250°F
Tensile Strength, psi	8,000 psi	7,500 psi	3,000 psi	9,500 psi	5,500 psi
Compressive Strength, psi	11,500 psi	10,000 psi	6,500 psi	12,000 psi	14,500 psi
Elongation	7 %	10 %	7 %	8 %	7 %
Tensile Lap Shear, @ 77°F @140°F	2700 psi 700 psi	2800 psi 800 psi	2500 psi 200 psi	3480 psi 3150 psi	2900 psi 1200 psi



EPOXY ADHESIVES

PRODUCTS

ES6249

A lightweight adhesive/patching/filler compound that is carvable when cured. It can be sanded in 2 to 3 hours, and is easily worked with hand tools.

ES6259

A dark brown high strength paste adhesive that cures well in the presence of water. Excellent in high humidity conditions, ES6259 will even cure underwater for special situations.

ES6265

A tan high strength paste adhesive with very good high temperature resistance. ES6265 is a good candidate for applications where bond lines are exposed to elevated temperatures.

ES6271, PT6272, & PT6279

A tough general purpose adhesive with excellent bonds to a wide variety of surfaces. ES6271 is Black, ES6272 is White, and ES6279 is the natural Tan version of this system. These are very versatile adhesives that combine ease of use with tough, high strength, impact resistant bonds for a broad range of applications.

ES6292

A tan paste epoxy adhesive intended for use in bonding composite parts and structural assemblies. ES6292 is a very tough adhesive, so it works well in applications where severe stresses and vibration are involved. It is not brittle when cured, and has very good resistance to peel forces. It has good thixotropy, and fills gaps in uneven bond lines without sagging or run out during cure. ES6292 performs well at both high and low temperatures, so it is useful for applications where the bonded structure is exposed to environmental extremes. This is a fire retardant system, and meets requirements of UL-94 Specification.

PRODUCT SPECIFICATIONS and TYPICAL MECHANICAL PROPERTIES

NOTE: For full specifications and properties, including recommended curing cycles, refer to the individual product bulletins available on our web site at www.ptm-w.com.

	ES6249 A/B	ES6259 A/B	ES6265 A/B	ES6271, ES6272 & ES6279 A/B	ES6292 A/B
Color	Tan	Dark Brown	Tan	Blk., Wh., Nat.	Tan
Mix Ratio By Weight By Volume	100 : 50 2 : 1	100 : 100 1 : 1	100 : 25 3 : 1	100 : 100 1 : 1	100 : 31.5 3.7 : 1
Mixed Viscosity, cps	Paste	Light Paste	Paste	Paste	Paste
Pot Life	25 - 30 min.	60 - 90 min.	20 - 25 min.	20 - 30 min.	40 min.
Cured Hardness	53 Shore D	84 Shore D	90 Shore D	90 Shore D	81 Shore D
Specific Gravity, gms./cc	.49	1.52	1.46	1.57	.98
Operating Temperature	-50 - 125°F	-50 - 150°F	-50 - 350°F	-50 - 150°F	-50 - 250°F
Tensile Strength, psi	1,800 psi	8,400 psi	6,500 psi	7,200 psi	7,643 (Flexural)
Compressive Strength, psi	2,156 psi	18,700 psi	13,600 psi	14,300 psi	7,482 psi
Elongation	4 %	7 %	8 %	6 %	8 %
Tensile Lap Shear, @77°F @140°F	1750 psi 160 psi	4810 psi 2400 psi	3810 psi 2840 psi	3480 psi 2000 psi	2800 psi 2325 psi



POLY FILLER RT and POLY FILLER HT

High Performance Polyester Filler Pastes

DESCRIPTION

The POLY FILLER products are two component polyester filler paste systems that provides the user both unique ease of handling and high performance characteristics when cured. The POLY FILLERS are formulated to provide a smooth creamy handling consistency and a dry tack-free surface when cured. A significant advantage of the POLY FILLER products over other materials of this type is their very low cured shrinkage. This feature allows faster application and repairs than with other filler pastes, which usually must be applied in several layers because of their high shrinkage rate! The creamy texture of POLY FILLER materials allows for easier application and spreading. POLY FILLERS can be troweled to a feather edge without rolling or skipping. They can be used to fill tiny pinholes without lifting. The dry, tack-free nature of the cured POLY FILLER paste provides for easier working with tools and prevents sandpaper from becoming gummy.

Once applied and cured, the POLY FILLER materials will bond quite well to most surfaces such as aluminum, copper, fiberglass, epoxy, steel, plaster, graphite and kevlar laminates. They will also accept all types of enamel, epoxy, lacquer and paint stains as a surface finish.

The Poly Filler line consists of POLY FILLER RT, a product for room temperature applications; and POLY FILLER HT, which utilizes an excellent high temperature resin base, and therefore can be subjected to service temperatures in excess of 400°F.

APPLICATIONS

POLY FILLERS have been used with much success in very demanding industrial applications such as these:

- Aircraft High-Temp Bond Tools
- Bonding Inserts and Bushings
- Crack, Crevice and Hole Repair
- Core Box Repair
- Fiberglass Boat Repair
- Filling Porosity on Composites
- Filling Cloth Texture Impressions
- FRP Surface Patching
- Honeycomb Panel Edge Filling
- Pattern Repair and Filling
- RIM, BMC, SMC Surface Filling
- Router Fixture Repair
- Vacuum Form Mold Repair
- Urethane Mold Repair

HANDLING and PHYSICAL PROPERTIES

	POLY FILLER RT	POLY FILLER HT
Color	White	Available in Gray or Black Versions
Mixed Viscosity, centipoise	Smooth, Thixotropic Paste	
Mix Ratio, By Weight	100 Parts Resin : 2 Parts Cream Hardener, By Weight	
Pot Life @ 77°F	6 - 8 minutes	
Tack Free Time	10 Minutes After Gel	
Time Before Sanding	20 - 25 minutes After Gel	
Cured Hardness, Shore D	89 D	



REPLICAST

FAST-SETTING URETHANE SYSTEMS

PRODUCT LINE DESCRIPTION

The REPLICAST line of products consists of hard, rigid, fast setting general purpose urethane systems for the rapid production of temporary and short-run tooling, various jigs and fixtures, as well as rigid, durable shapes and parts.

PRODUCTS

REPLICAST Unfilled II

A low viscosity fast setting system for general casting uses. REPLICAST Unfilled II picks up fine detail quite well, and duplicates complicated surfaces easily.

REPLICAST 612 and REPLICAST 616

The REPLICAST 600 Series is a line of highly filler fast setting urethane tooling compounds. They have low shrinkage and good cured stability for a wide variety of general purpose industrial tooling applications. REPLICAST 616 has a faster setting time, and castings can be demolded a little sooner than with REPLICAST 612. REPLICAST 612 should be used for larger castings, and when the lowest shrinkage is required.

REPLICAST 112

A three component system consisting of a fast-setting resin and hardener and non-metallic bulk filler. The user can adjust the finished casting properties by varying the amount of the bulk filler that is incorporated into the mix.

PRODUCT SPECIFICATIONS and TYPICAL MECHANICAL PROPERTIES

NOTE: For full specifications and properties with all of the available hardeners, including recommended curing cycles, refer to the individual product bulletins available on our web site at www.ptm-w.com.

	REPLICAST Unfilled II	REPLICAST 112 A/B/Filler (1:1:2)	REPLICAST 612	REPLICAST 616
Color	Off-White	Cream	Metallic Gray	Metallic Gray
Mix Ratio, By Weight	100 : 100	100A to 100 B to 200 Filler	100 : 100	100 : 100
Viscosity, cps	300 cps	4,500 cps	2,600 cps	2,600 cps
Pot Life	3 - 4 minutes	11 minutes	10 minutes	6 minutes
Cured Hardness	75 Shore D	76 Shore D	84 Shore D	84 Shore D
Specific Gravity, gms./cc	1.07	1.48	1.71	1.71
Specific Volume, cu. in./lb.	25.8	18.2	16.19	16.19
Tensile Strength, psi	4,900 psi	3,000 psi	4,500 psi	4,500 psi
Elongation at Break, %	30 %	.95 %	2.0 %	2.0 %
Flexural Strength, psi	6,000 psi	7,160 psi	6,900 psi	6,900 psi



ACCESSORY PRODUCTS

PRODUCTS

PTM&W provides a variety of accessory tools and materials for tooling and production. They include:

RELEASE AGENTS

PA0801	Non-silicone paste wax for room temperature or elevated temperature applications. Easy to apply, it works equally well on metal or composite tooling. Can be used to release epoxies, polyurethanes, polyesters, and most adhesives based on those materials. Service temperature to 375° F
PA0810	A green water/alcohol solution of water soluble, film forming PVA for use as a parting agent for separation between polyester or epoxy resins and various mold surfaces. Used with PA0801 paste wax for easy, effective production release in a variety of applications.
PA0828	Rich silicone release for tooling or production uses. PA0828 is the best all purpose release for metal & plastic molds - easy release every time! Also an effective lubricant.
PA0868	Modified silicone release designed to provide glossy surface finish and easy release from the mold. PA0868 is especially effective for releasing thermosetting urethane elastomers from either epoxy or metal tooling. PA0868 can be removed from the parts easily with soap and water, thereby avoiding the use of potentially dangerous solvent cleanup.

BULK FILLER

PA0738	Hydrated alumina bulk filler for use with epoxy and polyurethane casting resins. Economical, it provides lower overall cost castings. Generally, the addition of PA0738 lowers the exotherm of the casting and thereby lowers the cured shrinkage. Castings made with a high content of PA0738 are very easy to machine or work with hand tools.
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ACCESSORY PRODUCTS

Tooling Brushes	2-Inch Wooden handle brushes with 3/4" blunt-cut solvent resistant bristles designed specifically for hand laminating and surface coat application. The 100% Pure China bristles have excellent chemical resistance, so the brushes can be used with solvent-containing systems if desired. The bristles are firmly locked into the ferrule, so they will not pull out during use and contaminate the material being applied.
Squeegees	Durable 3" x 5" plastic squeegees for spreading thick resins and for laminating. The high density plastic composition allows easy cleanup in common shop solvents. Cured resin pops off the flexible squeegees. Dual tapered sides and rounded corners allow use with thin fabrics with minimum snags. These squeegees are equally useful for graphics applications or other projects.
Epoxy Color Dispersions	Epoxy-based, opaque color pastes for pigmenting epoxies and some urethanes. PA0501 - Black PA0502 - White PA0503 - Red PA0504 - Green PA0505 - Blue PA0506 - Yellow PA0507 - Orange PA0508 - Brown
Urethane Color Pastes	Opaque color pastes made with urethane compatible raw materials and additives to minimize moisture contamination when used with urethanes: PA0511 - Black PA0512 - White PA0513 - Red PA0514 - Green PA0515 - Blue PA0516 - Yellow PA0517 - Orange PA0518 - Brown



ASTM Test Methods Used To Derive Material Properties

GENERAL PROPERTIES		
TEST	ASTM METHOD	VALUE REPORTED
Viscosity	D2393	Poise or Centipoise (cps) @ 77°F
Pot Life	D2471	Time Of A Specified Mass to Gel @ 77°F
Cured Hardness	D2240	Indentation Hardness as Measured By Shore Durometer
Shrinkage	D2566	Linear Shrinkage During Cure Reported as inch/inch, or inch/foot
Specific Gravity	D1475	Specific Gravity (Relative Density) Measured By Displacement as grams/cubic centimeter
Density	D792	Pounds/Cubic Inch
Specific Volume	D792	Cubic Inches / Pound of Material
Tensile Strength	D638	Force to Break Specimen Reported in Pounds/ Square Inch (psi)
Elongation	D638	Percent Of Elongation of The Specimen At Break
Tensile Modulus	D638	Pounds/ Square Inch (psi)
Flexural Strength	D790	Force to Break Specimen Reported in Pounds/ Square Inch (psi)
Flexural Modulus	D790	Pounds/ Square Inch (psi)
Compressive Strength	D695	Force to Break Specimen Reported in Pounds/ Square Inch (psi)
Compressive Modulus	D695	Pounds/ Square Inch (psi)
Izod Impact Strength	D256	Izod Pendulum Impact Resistance of A Notched Specimen Reported in Foot Pounds/Inch of Notch
Glass Transition Temperature (Tg): By DSC Method By TMA Method By DMA Method	D3418 D3386 D4065	Transition Temperature of A Specimen Reported in °F or °C : Measured By Differential Scanning Calorimetry, Measured By Thermomechanical Analyzer, or Measured By Dynamic Mechanical Analyzer
Coefficient of Thermal Expansion	D696	Coefficient of Expansion of A Specimen over A Defined Temperature Range Is Reported
Heat Deflection Temperature (HDT)	D648	The Deflection Temperature of A Specimen At A Load of 66 psi and/or 264 psi is Reported in °F or °C
URETHANE-SPECIFIC PROPERTIES		
TEST	ASTM METHOD	VALUE REPORTED
Modulus	D412	Modulus Value in Pounds/Square Inch At Various Percentages of Elongation Is Reported
Tear Strength, Die C	D624	Force To Tear A Specimen Is Reported In Pounds Per Lineal Inch
Compression Set	D395	Percent of Compression Set Is Reported
Bashore Rebound	D2632	Percent Of Vertical Rebound Of A Dropped Specimen is Reported
Taber Abrasion	D4060	Milligrams of Weight Loss Is Reported





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