

**DESCRIPTION:** Poly-Optic® 14-Series Casting Resins are two-part, polyurethane systems formulated specifically for applications where optical clarity is required. Castings are clear like water; however, PolyColor dyes can be added to obtain clear, colored castings. Poly-Optic systems, with low viscosities and long pot-lives, provide for easy mixing, excellent detail penetration, and easy degassing, through vacuum or pressure casting techniques, for bubble-free castings.

**BEFORE USE:** Thoroughly read Safety Data Sheets, product labels and the "SAFETY" section in this Technical Bulletin.

Choose the Poly-Optic® product that's best for your application:

**Poly-Optic® 1410** cures to a hard, virtually unbreakable, plastic. Cure 1410 at room temperature and, for optimum physical properties, post cure at 150°F.

**Poly-Optic® 1411** is an easy 1A:1B, by volume, system that cures quickly to a super-strong, hard plastic. 1411 develops hardness and can be demolded more quickly than 1410. It also has a higher heat deflection temperature, which is useful in certain prototyping applications.

**Poly-Optic® 1411 ES7** a long pot-life (~7 hr) version of 1411, is used for large pours where extra working time or minimal shrinkage is required. 1411 ES7 Part B can be blended with 1411 Part B to shorten pot-life.

## PRODUCT LINE FEATURES

- Crystal clear
- Reproduces fine detail
- Can be machined, drilled and sanded
- Tough and hard, but not brittle
- Long working time
- Low shrinkage upon cure

**Poly-Optic® 1412** is a high-strength, heat-resistant, fast-curing, rapid-prototyping plastic designed for casting in heated molds.

**Poly-Optic® 1420** cures to a tough, impact- and heat-resistant plastic that can be polished and machined. For strong plastic, heat cure 1420 at 150-180°F. For brittle, glass-like castings, cure at room temperature.

**Poly-Optic® 14-70** is a firm rubber. Blend 1410 and 14-70 to achieve any hardness between Shore D85 and Shore A70.

**Poly-Optic® 1490** is a mercury-free formula with an easy 1A:1B mix ratio by volume (100A:90B by weight). Must be pressure cast or used with vacuum casting equipment (not degassing).

## PHYSICAL PROPERTIES

Product	Poly-Optic® 1410	Poly-Optic® 1411	Poly-Optic® 1411 ES7	Poly-Optic® 1412	Poly-Optic® 1420	Poly-Optic® 14-70	Poly-Optic® 1490 <sup>^</sup>
Mix Ratio by Volume	N/A	1A:1B	1A:1B	1A:1B	N/A	N/A	1A:1B
Mix Ratio by Weight	3A:2B	100A:90B	100A:90B	1A:1B	2A:1B	4A:5B	100A:90B
Shore Hardness	D80	D80	D80	D80	D85	A70	D80
Pot Life (1-lb mix)	15 min.	9 min.	420 min.	8 min.	15 min.	15 min.	9 min.
Demold Time* @ 73°F unless otherwise noted	2 hr. (1" thick)	30 min. (0.5" thick)	48-96 hr.	30 min. @ 175°F	8 hr. @ 150°F 30 min. @ 175°F	24-48 hr.	1 hr.
Cured Color	Water Clear	Water Clear	Water Clear	Water Clear	Water Clear	Water Clear	Water Clear
Mixed Viscosity (cP)	700	600	600	750	250	340	690
Specific Volume (in <sup>3</sup> /lb)	25.8	25.8	25.8	25.8	26.3	26.1	25.8
Specific Gravity	1.07	1.07	1.07	1.07	1.05	1.06	1.07
Linear Shrinkage (in/in)	ND	0.0018	N/A	0.0019	ND	0.0016	N/A
Elongation (%)	27	7	N/A	11.1	5.3	234	12
Max Exotherm (°F)	265	228	140	235	311	190	235
Heat Deflection Temp. (°F)	100	138	N/A	227	168	N/A	N/A
Tensile Strength (psi)	4,566	6,083	N/A	9,825	7,900	564	8,740
Elastic Modulus (psi)	96,830	133,956	N/A	179,886	171,500	N/A	128,800
Flexural Modulus (psi)	144,158	250,992	N/A	295,101	250,000	N/A	282,600
Flexural Strength, 5% Strain (psi)	4,893	8,478	N/A	12,261	12,600	N/A	10,800

\*Demold time varies with thickness of casting and the amount of accelerator used. <sup>^</sup>Poly-Optic 1490 must be pressure cast or used with vacuum casting equipment (not degassing).

**MOLD PREPARATION:** Poly-Optic products reproduce minute detail from a mold or pattern, but may stick or foam when poured on improperly prepared surfaces; ensure that the surface is moisture-free. Perform a trial casting on a surface similar to the final mold to avoid damaging a valuable mold. Polyethylene and silicone rubber (i.e., PlatSil® 71- and 73-Series) molds, do not require a release agent. [CAUTION: Condensation-cure silicones (i.e., TinSil® 70-Series) are not recommended for casting Poly-Optic since residual alcohol can inhibit cure or produce hazy castings.] Latex, polyurethane or metal molds must be dry and require a coat of a suitable release agent (i.e., Pol-Ease® 2300 Release Agent). For optically clear castings, use highly polished masters to create molds with excellent surface quality.

**MIXING:** Before mixing resins, be sure that both Parts A and B are at room temperature and that all tools and molds are ready to go! Use metal or plastic mixing vessels (i.e., polyethylene pail) and spatulas to avoid introducing moisture. Shake or stir Part B before use, if required. Carefully weigh or measure proper ratios of A and B into a mixing container. Mix immediately, thoroughly scraping sides and bottom. Vacuum degas mix and pour into the mold as quickly as possible. Using pre-heated molds (i.e., 150°F) reduces shrinkage and improves the surface quality of Poly-Optic parts. Pressure casting helps produce clear castings. A light spray of Pol-Ease 2300 Release Agent or quickly passing the flame of a torch over the back of the casting helps to break bubbles on the back of the pour. To produce bubble-free castings, vacuum degassing and pressure casting is necessary.

Once Part A and B containers are opened, use the product completely or reseal tightly since atmospheric moisture may cause foaming of the plastic. To lengthen shelf life, spray Poly Purge, a heavier-than-air dry gas, into the open containers before resealing. If containers collapse slightly over time, reopen containers and spray more Poly Purge to keep containers from further collapse.

**CURING:** Allow castings to remain in the mold until thoroughly cured. Parts demolded too soon may be subject to deformation. Use pre-warmed molds to hasten curing, and reduce shrinkage and improve overall quality of the casting. Low temperatures slow the cure and extend demold time.

Poly-Optic 1410, 1411, 14-70 and 1490 cure at room temperature. For plastic castings less than ¼-inch thick, 1411 is recommended because it can be demolded more quickly in thin sections. For thinner castings, or when using Poly-Optic 1410 for thin parts, add Part 14X Catalyst or heat cure (8 hr at 140-150°F). Castings greater than ½-in thick do not require heat or 14X, but the addition or use of either will speed up the curing process considerably.

Poly-Optic 1412 and 1420 are demoldable after 30 minutes at 175°F and, if desired, can be post cured for 16 hours at 150°F for optimum physical properties. To produce brittle, glass-like parts and props, cure 1420 at room temperature.

Wash mold release from surfaces prior to painting or bonding.

**ACCELERATING CURE SPEED:** Poly-Optic® 14 Part X Accelerator can be mixed into Part B prior to adding Part A to accelerate gel and cure times. For castings less than ½-in thick, Part X is recommended. Add 0.5% Part X to the total mix weight to speed the cure significantly (e.g, 0.5g Part X in a 100g mix of 1410 halves the pour and cure time). Exotherm (heat of reaction) and thus shrinkage on cooling is also increased. Experiment to determine the best amount of Part X to use, but do not use more than 1% Part X because final physical properties may be affected.

**RETARDING CURE SPEED:** Poly-Optic® 14 Part R Retarder slows the cure of Poly-Optic systems. Slowing the cure also reduces exothermic heating, which can cause distortion, waviness and shrinkage especially in castings >½-inch thick. For every part of Part R added, an equal part of Part A must be added to the mix. Add 1.5% Part R to the total mix weight of 1410 to increase the pot-life from 15 to 70 minutes. Add 1% Part R to 1411 to double the working time from 9 to 18 minutes. Depending on the size and mass of the part, post curing 14-70 and 1410 parts in the mold at >140°F for 12 to 16 hours may be necessary. The extended pot-life creates a lower exotherm upon curing, allowing larger castings to be made without distortion. Never use more than 4% Part R since the system may not cure properly. For larger castings, consider Poly-Optic 1411 ES7 with a 7-hour pot-life and low exotherm.

**COLORS:** Add PolyColors to 14-Series Part B before mixing with Part A to create clear plastics of any color.

**EXTERIOR USES:** Although Poly-Optic 1410, 1411, 1411 ES7, 1412, 1420 and 1490 are non-yellowing formulas, they are not recommended for long-term exterior use. To improve durability for exterior applications, add 1% Poly UV Additive to the total mix weight of Poly-Optic to reduce the onset of chalking and pitting of the outside surface for ~2 years. Add 3% Poly UV Additive to achieve good exterior stability beyond 5 years.

**CLEAN UP:** Tools should be wiped clean before the plastic is hard. Denatured ethanol is a good cleaning solvent, but it must be handled with extreme caution owing to its flammability and health hazards. Work surfaces can be waxed or coated with Pol-Ease 2300 Release Agent so cured rubber can be removed.

**SAFETY:** Before use, thoroughly read Safety Data Sheets and product labels. Follow safety precautions and directions.

**Part A:** Keep out of reach of children. Avoid breathing fumes, vapors, mists, or spray. Use only outdoors or with adequate general or local exhaust ventilation to minimize exposure levels. If needed, a NIOSH-approved respirator with organic vapor cartridge may be used. If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory irritation, get medical attention. Wear impervious gloves, such as butyl rubber or nitrile rubber. Wash contaminated clothing before reuse. Wash skin thoroughly with soap and water after handling. If skin irritation or rash occurs, get medical attention. Wear eye protection, such as chemical safety glasses/goggles. If in eyes, rinse cautiously with water for several minutes, removing contact lenses if present and easy to do. Store in a well-ventilated place and keep container tightly closed.

**Part B:** Keep out of reach of children. Do not breathe fumes or vapors. Use with adequate general or local exhaust ventilation to minimize exposure levels. If needed, a NIOSH-approved respirator with organic vapor cartridge may be used. If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. Wear impervious gloves, such as butyl rubber or nitrile rubber. Wash skin thoroughly with soap and water after handling. Wear eye protection, such as chemical safety glasses/goggles. If in eyes, rinse cautiously with water for several minutes, removing contact lenses if present and easy to do. If spilled, avoid release to the environment.

**STORAGE LIFE:** Poly-Optic liquids can be stored for at least 6 months in unopened containers stored at room temperature. Poly-Optic Part As may crystallize slightly or become viscous during storage. If crystallization occurs warm the container to 100-120°F until crystals dissipate. Cool to room temperature before use.

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## ACCESSORIES

**Accelerator:**

Poly 14 Part X Accelerator

**Retarder:**

Poly 14 Part R Retarder

**Sealers & Release Agents:**

Pol-Ease® 2300 Release Agent

Pol-Ease® 2500 Release Agent

**Product Life Extender:**

PolyPurge Aerosol Dry Gas

**Colors:**

PolyColor Dyes

Black - Brown - Blue - Green - Red  
- Yellow - White - Fleshtone

**Fillers:**

Bronze Powder

**UV Stabilizers:**

UV Additive

**DESCRIPTION:** Poly-Optic® 17-Series Clear Urethane Resins are two-component, mercury-free, room temperature curing (RTV) systems that are formulated specifically for applications where optical clarity is a must. These polyurethane systems produce water-clear castings, but can be used in conjunction with PolyColor Dyes and dry fillers (e.g., fine metal powders) to create a myriad of effects.

**BEFORE USE:** Thoroughly read Safety Data Sheets, product labels and the “SAFETY” section in this Technical Bulletin.

Poly-Optic resins are the plastics of choice for mimicking glass and ice-like features and are widely used to create stunning prototypes (lenses, bottles, containers), as well as unique art, medical models, sculpture and display items. Vacuum and/or pressure casting techniques are recommended for bubble-free parts.

**MOLD PREPARATION:** Poly-Optic products reproduce minute detail from a mold or pattern, but may stick or foam when poured on improperly prepared surfaces; ensure that the surface is moisture-free. Perform a trial casting on a surface similar to the final mold to avoid damaging a valuable mold. Polyethylene and silicone rubber (i.e., PlatSil® 71- and 73-Series) molds, do not require a release agent. [CAUTION: Condensation-cure silicones (i.e., TinSil® 70-Series) are not recommended for casting Poly-Optic since residual alcohol can inhibit cure or produce hazy castings.] Latex, polyurethane or metal molds must be dry and require a coat of a suitable release agent (i.e., Pol-Ease® 2300 Release Agent). For optically clear castings, use highly polished

## PRODUCT LINE FEATURES

- Non-Mercury Formulas
- Water clear
- Reproduces fine detail
- Can be machined, drilled and sanded
- Low shrinkage upon cure
- Low Viscosity
- Easily accepts PolyColor Dyes and dry fillers

masters to create molds with excellent surface quality.

**MIXING:** Before mixing resins, be sure that both Parts A and B are at room temperature and that all tools and molds are ready to go. Use metal or plastic mixing vessels (i.e., polyethylene pail) and spatulas to avoid introducing moisture. Carefully weigh or measure proper ratios of A and B into a mixing container. Mix immediately, thoroughly scraping sides and bottom. Vacuum degas, mix and pour into the mold as quickly as possible. Using pre-heated molds (i.e., 150°F) reduces shrinkage and improves the surface quality of Poly-Optic parts. Pressure casting helps produce clear castings. A light spray of Pol-Ease 2300 Release Agent over the back of the casting helps to break bubbles on the back of the pour. To produce bubble-free castings, vacuum degassing and pressure casting is necessary.

## PHYSICAL PROPERTIES

Product	1730X	1730	1740
Mix Ratio by Weight or Volume	1A:1B	1A:1B	1A:1B
Shore Hardness*	D80	D80	D70
Pot Life (1 lb mix)	8 min.	15 min.	14 min.
Demold Time at 73°F †	1 hr.	1 hr.	1 hr.
Cured Color	Water Clear	Water Clear	Water Clear
Mixed Viscosity (cP)	450	400	400
Specific Volume (in <sup>3</sup> /lb)	28.8	28.8	28.5
Specific Gravity	1.04	1.04	1.03
Linear Shrinkage (in/in) <sup>^</sup> *	0.0015	0.0015	0.0015
Elongation (%)	6.7	7.4	12
Max Exotherm (°F)	235	235	210
Heat Deflection Temp. (°F)*	137	137	137
Tensile Strength (psi)*	5,670	5,480	3,180
Elastic Modulus (psi)	104,000	112,000	80,100
Flexural Modulus (psi)	213,000	201,000	91,000
Flexural Strength 5% Strain (psi)	7,920	7,350	3,560

\*All values measured after 7 days at 73°F/23°C. †Demold time varies with thickness of casting and the amount of accelerator used. ^Shrinkage is primarily caused by gelling while hot then cooling.

Once Part A and B containers are opened, use the product completely or reseal tightly since atmospheric moisture may cause foaming of the plastic. To lengthen shelf life, spray PolyPurge, a heavier-than-air dry gas, into the open containers before resealing. If containers collapse slightly over time, reopen containers and spray more Poly Purge to keep containers from further collapse.

**CURING:** Allow castings to remain in the mold until thoroughly cured. Parts demolded too soon may be subject to deformation. Use pre-warmed molds to hasten curing, reduce shrinkage and improve overall quality of the casting. Low temperatures slow the cure and extend demold time.

To expedite the cure of thin castings (e.g., <1/2"), add Poly-Optic® 14 Part X Accelerator or heat cure (8 hr at 140-150°F). See "Accelerating Cure Speed" section below for additional instruction. If used, wash mold release from surfaces prior to painting or bonding.

**ACCELERATING CURE SPEED:** Poly-Optic® 14 Part X Accelerator can be mixed into Part B prior to adding Part A to accelerate cure times. For castings less than 1/2-in thick, Part X is recommended. Each addition of 1% Part X to the total mix weight will reduce the pot life by approximately 1 to 2 minutes. Exotherm (heat of reaction) and thus shrinkage on cooling is also increased. Experiment to determine the best amount of Part X to use, but do not use more than 5% Part X because final physical properties may be affected.

**COLORS:** Add PolyColor Dyes to 17-Series Part B before mixing with Part A to create clear plastics of any color. Add up to 0.5% PolyColor Dye of the total mixed weight when using PolyColor Black, Brown, Blue, Green, Red and Yellow. Add up to 2% PolyColor Dye of the total mixed weight when using PolyColor White and Fleshtone.

**EXTERIOR USES:** Although Poly-Optic products are non-yellowing formulas, they are not recommended for long-term exterior use. To improve durability for exterior applications, add 1% Poly UV Additive to the total mix weight of Poly-Optic to reduce the onset of chalking and pitting of the outside surface for ~2 years. Add 3% Poly UV Additive to achieve good exterior stability beyond 5 years.

**CLEAN UP:** Tools should be wiped clean before the plastic is hard. Denatured ethanol is a good cleaning solvent, but it must be handled with extreme caution owing to its flammability and health hazards. Work surfaces can be waxed or coated with Pol-Ease 2300 Release Agent so cured rubber can be removed.

**SAFETY:** Before use, thoroughly read Safety Data Sheets and product labels. Follow safety precautions and directions.

**Part A:** Keep out of reach of children. Do not breathe fumes, vapors or mists. Use only outdoors or in a well-ventilated area. Use with adequate general or local exhaust ventilation to minimize exposure levels. If needed, a NIOSH-approved respirator with organic vapor cartridge may be used. If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms, call a Poison Control center. Wear impervious gloves, such as butyl rubber or nitrile rubber. Take off contaminated clothing and wash it before reuse. Contaminated work clothing should not be allowed out of the workplace. Wash thoroughly with soap and water after handling. If skin irritation or rash occurs, get medical help. Wear eye protection, such as chemical safety glasses/goggles. If in eyes, rinse cautiously with water for several minutes, removing contact lenses if present and easy to do. If eye irritation persists, get medical help.

**Part B:** Keep out of reach of children. Avoid breathing fumes, vapors or mists. Use with adequate general or local exhaust ventilation to minimize exposure levels. If needed, a NIOSH-approved respirator with organic vapor cartridge may be used. Wear impervious gloves, such as butyl rubber or nitrile rubber. Take off contaminated work clothing and wash it before reuse. Contaminated work clothing should not be allowed out of the work area. Wash thoroughly with soap and water after handling. If skin irritation occurs, get medical help. Wear eye protection, such as safety glasses/goggles. If in eyes, rinse with water for several minutes, removing contact lenses if present and easy to do. If eye irritation occurs, get medical help.

**STORAGE LIFE:** For best results, store products in unopened containers at room temperature (60-90°F/15-32°C) and use products within six months from date of shipment.

Poly-Optic Part As may crystallize slightly or become viscous during storage. If crystallization occurs warm the container to 100-120°F until crystals dissipate. Cool to room temperature before use.

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## ACCESSORIES

**Accelerator:**

Poly-Optic® 14 Part X Accelerator

**Retarder:**

Poly-Optic® 14 Part R Retarder

**Sealers & Release Agents:**

Pol-Ease® 2300 Release Agent

Pol-Ease® 2500 Release Agent

**Product Life Extender:**

PolyPurge Aerosol Dry Gas

**Colors:**

PolyColor Dyes

Black - Brown - Blue - Green - Red - Yellow - White - Fleshtone

**Fillers:**

Bronze Powder

**UV Stabilizers:**

UV Additive