Ion Exchange Resins for Industrial Water Treatment

Product Summary Table

DuPont has been a partner to the water treatment industry and plant owners for decades, with a history of application development, technical service, and product innovations in ion exchange technologies that have driven key improvements in reliability, productivity, efficiency, and safety. Combined with extensive performance testing and world-class application experience, the new AmberLite™ Ion Exchange Resin portfolio for industrial water will help you maximize the performance of our products in your hands and provide the quality and reliability you need on a daily basis.

Contact your DuPont representative to help address your ion exchange resin needs and find the best-suited products for your situation. Together, we'll work to create solutions to address the evolving demands of the industry, ultimately to better serve you.

Ion Exchange Resins for Industrial Water Treatment Make-up Water Demineralization, Softening, Polishing, and Scavenging

AmberLite™	Type	Matrix	Copolymer	Application					System Design					Recommended Uses
				Softening	Demineralization	Dealkalization	Scavenging	Mixed Bed Polishing	Co-current	Counter-current/ Hold-down Systems	Layered Beds	Packed Beds	Mixed Beds	
High Performance Cations														
HPR1100 Na	SAC	G	S	●					●	●		●		Softening resin with excellent physical stability and low rinse profile.
HPR1200 H	SAC	G	S		●			●	●	●		●	●	Designed to be the go-to, high-quality SAC resin. Compatible with all system technologies.
HPR1200 Na	SAC	G	S	●	o				●	●		●	o	Available for industrial softening or demineralization applications when the sodium-form is preferred by the user.
HPR1300 H	SAC	G	S		●			●	●	●	●	●	●	High-strength resin. Good for layered beds and mixed beds for polishing and pure water applications when very low sodium leakage and conductivity is a chief concern. Compatible with all system technologies and bed configurations including layered beds.
HPR1300 Na	SAC	G	S	●	o				●	●	●	●	o	Available for industrial softening or demineralization applications when the sodium-form is preferred by the user.
HPR650 H	SAC	G	S		●			●	●	●	●	●	●	High-solids SAC ideally suited for use in polishing mixed beds when highest resin purity and water quality are required.
HPR2900 H	SAC	M	S		●				●	●		●		High physical stability for harsh applications such as appreciable oxidative potential or high temperatures.
HPR2900 Na	SAC	M	S	●	o				●	●		●		High physical stability for harsh applications such as hot process softeners, sodium-cycle or amine-cycle condensate treatment, and other systems involving appreciable oxidative potential or high temperatures.
HPR2800 H	SAC	M	S		●			●	●	●	●	●	●	High physical stability for harsh applications such as demineralization systems involving appreciable oxidative potential or high temperatures. Allows low pressure drop in high-velocity operations and optimized for separability in mixed beds.
HPR8300 H	WAC‡	M	A	●	●	●			●	●	●	●		High-capacity dealkalization and softening resin with demonstrated improved operating capacity versus other WACs available in both H- and Na-form operation.
HPR8400 H	WAC‡	M	A	●	●	●			●	●		●		High-capacity dealkalization and softening resin allowing low pressure drop in high-velocity operations.
High Performance Anions														
HPR4200 Cl	SBA	G	S		●			o	●	●	●	●	o	Designed to be the go-to, high-quality SBA resin. Good balance of capacity, strength, and silica leakage. Compatible with all system technologies and bed configurations including layered beds, allowing users to inventory only one strong base anion resin for their demineralization needs.
HPR4200 OH	SBA	G	S		●			●	●	●	●	●	●	Designed to be the go-to, high-quality SBA resin. Good balance of capacity, strength, and silica leakage. OH-form offers a quick start-up in a single bed, layered bed, and mixed bed systems.
HPR4700 Cl	SBA	G	S		●			o	●	●		●	o	Available for fossil condensate polishing or post-RO mixed bed when the chloride-form is preferred by the user.
HPR4700 OH	SBA	G	S		●			●	●	●		●	●	High-capacity, high-solids SBA resin with rapid kinetics. Excellent selectivity for silica makes it an ideal choice for post-RO mixed bed. OH-form offers a quick start-up in a single bed and mixed bed systems.
HPR550 OH	SBA	G	S		●			●	●	●		●	●	High-capacity, high-solids SBA resin with rapid kinetics designed specifically for use in condensate polishing and mixed beds. Excellent selectivity for silica makes it an ideal choice for post-RO mixed bed. OH-form offers a quick start-up in a single bed and mixed bed systems.

AmberLite™	Type	Matrix	Copolymer	Application					System Design					Recommended Uses
				Softening	Demineralization	Dealkalization	Scavenging	Mixed Bed Polishing	Co-current	Counter-current/ Hold-down Systems	Layered Beds	Packed Beds	Mixed Beds	
High Performance Anions (continued)														
HPR550 Cl	SBA	G	S		●			o	●	●		●	o	Available for fossil condensate polishing or post-RO mixed bed when the chloride-form is preferred by the user.
HPR4580 Cl	SBA‡	G	A		●				●	●	●	●		High operating capacity, good physical stability and organic fouling-resistant acrylic SBA.
HPR4780 Cl	SBA‡	G	A		●				●	●		●		Dual Functional (WBA+SBA) resin with extremely high operating capacity, efficiency and organic fouling resistance.
HPR4800 Cl	SBA	G	S		●			o	●	●		●	o	High-quality SBA resin with excellent capacity and rinse characteristics, while reducing chemical regenerant and rinse water usage. Compatible with all system technologies.
HPR4800 OH	SBA	G	S		●			●	●	●		●	●	OH-form offers a quick start-up in a single bed and mixed bed systems.
HPR4811 Cl	SBA	G	S		●		o		●	●		●		High capacity porous gel SBA resin for use with high organic waters without the temperature limitations of acrylic resins.
HPR9200 Cl	SBA	M	S		●			o	●	●		●	o	Exceptional physical stability, resistance to osmotic shock, and well-suited for use in demineralization of high organic waters.
HPR9000 OH	SBA	M	S		●			●	●	●		●	●	Specifically designed for use in regenerable mixed beds when highest resin purity and water quality are required. Exceptional resistance to surface fouling as well as physical, osmotic, and oxidative stresses, which allows increased resin lifetime in operation.
HPR9000 SO_4	SBA	M	S		●			●	●	●		●	●	Available in the SO_4-form when preferred by the user for enhanced storage stability and reduced shipment volume compared to the OH-form.
HPR4100 Cl	SBA II	G	S		●	●			●	●		●		The go-to, uniform, Type II SBA resin.
HPR9100 Cl	SBA II	M	S		●	●			●	●		●		High resistance to organic fouling and physical stresses with improved operating capacity compared to Type I macro SBA and increased resin lifetime in operation compared to a gel Type II resin.
HPR6700	WBA‡	G	A		●				●	●		●		Very high-capacity WBA with exceptional physical stability and organic fouling resistance.
HPR7000	WBA‡	G	A		●				●	●		●		High-capacity WBA with exceptional physical stability, organic fouling resistance, and good rinse-down characteristics.
HPR9500	WBA	M	S		●				●	●	●	●		Displays excellent thermal stability, good organic fouling resistance, and high kinetics yielding good operating capacity even in low-temperature operations. Offers a quick start-up in a single bed or when paired with an OH-form strong base anion in layered bed systems.
HPR9600	WBA	M	S		●				●	●	●	●		Combines excellent physical and thermal stability, good organic fouling resistance, and high kinetics yielding good operating capacity even in low-temperature operations.
HPR9700	WBA‡	M	S		●				●	●		●		Combines excellent physical and thermal stability, good organic fouling resistance, and allows low pressure drop in high-velocity operations.

G = Gel resins M = Macro resins S = Styrenic A = Acrylic PE = Polyethylene* PP = Polypropylene*

● = Recommended o = Alternative

All resins listed are uniform particle size except those marked with ‡. These are specially graded resins optimized for use in packed beds.

For anion resins listed in both Cl^- and OH^- form, OH^- form offers a quick start-up in a single bed and mixed bed systems.

For cation resins listed in both H^+ and Na^+ form, Na^+ form is mainly intended for softening applications whilst it is available for demineralization when Na^+ form is preferred by the user. However, Na^+ form resins are never recommended in mixed bed operations.

* This is a polymer, not a copolymer.

Ion Exchange Resins for Industrial Water Treatment Make-up Water Demineralization, Softening, Polishing and Scavenging (cont.)

AmberLite™	Type	Matrix	Copolymer	Application					System Design					Recommended Uses
				Softening	Demineralization	Dealkalization	Scavenging	Mixed Bed Polishing	Co-current	Counter-current/ Hold-down Systems	Layered Beds	Packed Beds	Mixed Beds	
Gaussian Cations for Co-Flow Regenerated Systems														
IRC120 H	SAC	G	S		●				●					General-purpose demineralization resin with a long-established track record of reliable performance in the industry. Offers a good balance of capacity and strength resulting in long lifetime.
IRC120 Na	SAC	G	S	●	o				●					Available for industrial softening or demineralization applications when the sodium-form is preferred by the user.
IRC200 Na	SAC	M	S	●					●					Highest physical stability for harsh applications such as hot process softeners, sodium-cycle or amine-cycle condensate treatment, and other systems involving appreciable oxidative potential or high temperatures.
IRC83 H	WAC	M	A	●	●	●			●					General-purpose, high-capacity dealkalization and softening resin with improved operating capacity demonstrated in high-TDS Na-form operation.
Gaussian Anions for Co-Flow Regenerated Systems														
IRA402 Cl	SBA	G	S		●				●					This industry-staple resin is designed to provide excellent balance of properties for capacity, strength, silica selectivity, and a long lifetime.
IRA458 Cl	SBA	G	A		●				●					Offers a good balance of high capacity and high strength.
IRA410 Cl	SBA II	G	S		●	●			●					General-purpose Type II SBA used for general demineralization where high operating capacity is needed.
IRA67	WBA	G	A		●				●					Very high-capacity WBA with exceptional physical stability and organic fouling resistance. Effectively removes mineral acids as well as carbon dioxide and organics, reducing the ionic load on the SBA resin and also protecting it from organic fouling.
IRA900 Cl	SBA	M	S		●		o		●					Industry-staple macro SBA resin designed to provide a long lifetime when resistance to organic fouling and physical stress is needed.
IRA910 Cl	SBA II	M	S		●	●			●					High resistance to organic fouling and physical stresses with improved operating capacity compared to Type I macro SBA and increased resin lifetime in operation compared to a gel Type II resin.
IRA96	WBA	M	S		●				●					General-purpose WBA combining excellent physical and thermal stability, good organic fouling resistance.
Organic Scavengers														
SCAV1		G	A				●		●					Removal of hydrophobic and hydrophilic NOM species for high free mineral acidity (FMA) waters at acidic pH. Best used with waters with medium to high TDS when the ratio of TOC to sulfate (ppm C / meq/L SO_4) is less than 3.
SCAV2		M	A				●		●					Removal of high-load hydrophilic and hydrophobic NOM for low free mineral acidity waters at acidic pH. Best used with waters with low to medium TDS when the ratio of TOC to sulfate (ppm C / meq/L SO_4) is greater than 3.
SCAV3 Cl		M	S		o		●		●					Removal of large, complex, hydrophobic NOM and color species (such as humic and fulvic components) and general polishing of organics remaining after bulk removal at neutral to alkaline pH.
SCAV4 Cl		M	A		o		●		●					Removal of high-load hydrophilic and hydrophobic NOM at neutral to alkaline pH, with excellent resin lifetime and long, stable performance even under challenging operational conditions. It is the go-to organic scavenger for the bulk removal of NOM, and especially useful as RO pretreatment.

AmberLite™	Type	Matrix	Copolymer	Application					System Design					Recommended Uses
				Softening	Demineralization	Dealkalization	Scavenging	Mixed Bed Polishing	Co-current	Counter-current/ Hold-down Systems	Layered Beds	Packed Beds	Mixed Beds	
Inerts														
14i	Inert	–	PP		o					o	o	●		Floating inert resin specifically designed for use as an upper layer in down-flow regenerated ion exchange systems, such as floating beds.
62i	Inert	–	PE	●	●					o	o	●		Floating inert resin with properties specifically designed for use as an upper layer in up-flow regenerated ion exchange systems, such as Upcore™ Packed Bed Systems.
600BB	Inert		A					o					o	Non-functionalized bead designed to create an inert zone between the functional resins in mixed beds. Used in high-purity mixed bed systems when the use of inert is preferred.
Fully Regenerated Ready-To-Use Gaussian Mixed Beds														
MB9L H/OH	SAC/ SBA	G	S					●					●	Non-regenerable, pre-mixed resin characterized by a highly cationic exchange capacity. The light color enables visualization upon exhaustion. The reference mixed bed for electro-erosion applications.
MB20 H/OH	SAC/ SBA	G	S					●					●	Pre-mixed resin developed for the production of high-purity water in general-purpose polishing applications. The reference mixed bed for service deionization.
MB6113 H/OH	SAC/ SBA	G	S					●					●	Non-regenerable, pre-mixed resin developed for the production of high-purity water. A color indicator allows easy visualization of the exhaustion point of the resin. The reference mixed bed for the production of demineralized water in small cartridge systems.

G = Gel resins M = Macro resins S = Styrenic A = Acrylic PE = Polyethylene* PP = Polypropylene*

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For anion resins listed in both Cl^- and OH^- form, OH^- form offers a quick start-up in a single bed and mixed bed systems.

For cation resins listed in both H^+ and Na^+ form, Na^+ form is mainly intended for softening applications whilst it is available for demineralization when Na^+ form is preferred by the user. However, Na^+ form resins are never recommended in mixed bed operations.

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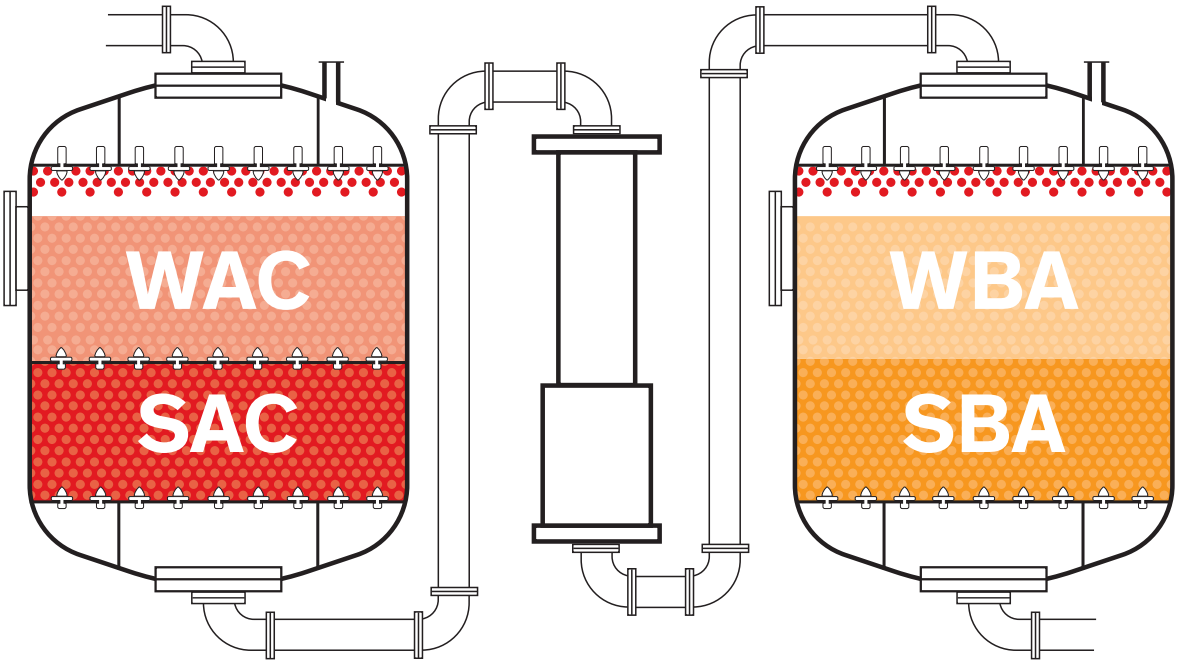
Layered Bed Systems in Industrial Water Treatment



Weak resins are well-suited for use with strong resins to improve overall efficiency and throughput of a demineralization system. Layered beds using weak and strong resins in a single vessel allows for significant capital cost and footprint savings compared to using the resins in two separate vessels.

Care must be taken in choosing the right ion exchange resins for layered beds as the concept is made possible by the density and particle size differences between the resins used. Upon exhaustion, the backwashing operation separates the resin layers that may have become partially mixed during service. In order for the full advantages of a layered bed to be realized, good resin separation is important.

Key benefits of a layered resin bed include:

- Significant capital cost and footprint savings compared to using the weak and strong resins in two separate vessels
- Higher throughput capacity versus a single bed strong base anion (SBA) or strong acid cation (SAC) because the weak base anion (WBA) or weak acid cation (WAC) has a higher capacity and better regeneration efficiency than the SBA or SAC
- Efficient use of the same chemicals to regenerate both the SBA/SAC, then the WBA/WAC
- Lower operating costs compared to a single SBA/SAC bed
- WBA resins remove organic matter more efficiently, protecting the SBA and maintaining system performance

Recommended AmberLite™ Ion Exchange Resin Pairs for Layered Beds

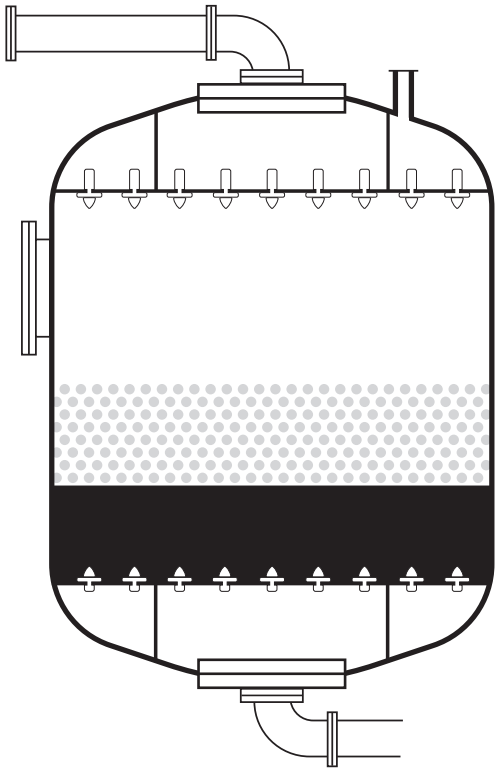
Product	AmberLite™ HPR1300 H	AmberLite™ HPR1300 Na	AmberLite™ HPR2800 H	AmberLite™ HPR4200 Cl	AmberLite™ HPR4200 OH	AmberLite™ HPR4580 Cl
AmberLite™ HPR8300 H	P	A	P			
AmberLite™ HPR9600				P	P	P
AmberLite™ HPR9500				P	P	P

P = Preferred A = Acceptable

Use of an inert resin may be required depending on system design.

Regenerable Working or Polishing Mixed Beds in Industrial Water Treatment

Mixed beds are primarily used for polishing demineralized water. The mixed bed produces very high-purity water from a single unit that contains cation and anion resin in an intimate mixture. This intimate mixture of resin minimizes sodium leakage because the dilute acid formed in the cation exchange process is immediately neutralizd by the anion resin. Care must be taken in choosing the right ion exchange resin for mixed beds as the concept is made possible by the density and particle size differences between the resins used. Upon exhaustion, the mixed bed must be backwash separated into distinct layers prior to regeneration. In order for the full advantages of a mixed bed to be realized, good resin separation is imperative. The following resin pairs have been engineered for maximum resin separability.



Key benefits of a mixed resin bed include:

- High-quality effluent water
- Ease of operation
- Lower capital cost

Recommended AmberLite™ Ion Exchange Resin Pairs for Mixed Beds

Product	AmberLite™ HPR650 H	AmberLite™ HPR1300 H	AmberLite™ HPR1200 H	AmberLite™ HPR2800 H	AmberLite™ HPR252 H	AmberLite™ HPR2900 H
AmberLite™ HPR550 OH	P					
AmberLite™ HPR4700 OH		P	A			
AmberLite™ HPR4200 OH		P	P			
AmberLite™ HPR4800 OH		P	P			
AmberLite™ HPR9000 OH	P			P		
AmberLite™ HPR900 OH		P		P	P	
AmberLite™ HPR9200 Cl		A		A		A

P = Preferred A = Acceptable

Buffer beads are not necessary with these recommended resin pairs as the resins are tailored for maximum separability. If the use of buffer beads is preferred for certain systems, the recommended product is AmberLite™ 600BB Inert Resin.

For the anion resins listed in OH^- form, either Cl^- or SO_4^- form is available if preferred by the user. Please refer to the product data sheets for detailed availability.

For cation resins listed in the H^+ form, Na^+ form is available if preferred by the user. However, Na^+ form resins are never recommended in mixed bed operations.

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