



**WATER TREATMENT AT POWER PLANT**

# Boiler Make-Up Water Product Recommendations

Boiler feedwater is generally the blend of returned steam condensate and fresh make-up water that is added to replace the volume escaping as steam or discharged as blowdown. Depending on technology preference, region, water source, and boiler type, a variety of technologies may be required to treat makeup water before it enters the steam loop. Dow has the widest range of products available to pretreat (UF), demineralize (RO and IX), and polish (IX) makeup water to protect your equipment from scaling and corrosion.

## Membrane Technologies

TECHNOLOGY	PRODUCT	APPLICATION	FEATURES AND RECOMMENDED USES	
<b>ULTRAFILTRATION MODULE AND SKID</b>	DOW IntegraFlux™ SFP-2880XP	Suspended Solids Removal	High permeability and high mechanical strength hollow fiber polyvinylidene fluoride (PVDF) membranes. The modules provide excellent performance, industry leading membrane area with low energy and chemical consumption. XP fiber provides up to 35% higher permeability than previous generation modules, improving operating efficiencies and productivity.	
	DOW™ Ultrafiltration SFP-2880		High mechanical strength hollow fiber PVDF membranes. The modules provide excellent performance with industry leading membrane area.	
	DOW IntegraPac™ IP-77XP		The skids are pre-engineered, standardized and ready to assemble. Comprising of DOW IntegraPac™ modules (standard and XP fiber), auxiliary parts and piping, the skids can significantly streamline design, assembly, and installation. Flexible sizing with 6-22 modules per skid.	
	DOW IntegraPac™ IP-77			
<b>NANOFILTRATION ELEMENTS</b>	DOW FILMTEC™ NF270-400/34	Softening	A product suitable for removal of a high percentage of total organic carbon (TOC) and with medium to high salt passage and medium hardness passage at very low operating pressures.	
	DOW FILMTEC™ NF90-400/34	Softening/ Partial Demineralization	A product suitable for high hardness removal and partial monovalent ion passage at low operating pressures.	
<b>REVERSE OSMOSIS ELEMENTS</b>	DOW FILMTEC™ ECO PRO-440	Demineralization from Controlled Feedwater Source (Municipal/High Quality/2 <sup>nd</sup> Pass RO)	State-of-the-art solution to deliver high salt rejection at low operating pressure reducing CAPEX and OPEX.	
	DOW FILMTEC™ BW30HR-440		Very high rejection proven at broad Total Dissolved Salts (TDS) range, coupled with reduced footprint installations.	
	DOW FILMTEC™ BW30HRLE-440		Delivers low operating pressure coupled with a good permeate purity	
	DOW FILMTEC™ BW30-400		Established industry reference product providing consistent, high performance and long element life with decades of proven performance	
	DOW FILMTEC™ FORTILIFE CR 100	Demineralization from Challenging Feedwater Source (Surface Water/Waste Water)	State-of-the-art solution to tackle tough fouling coupled with excellent salt rejection.	
	DOW FILMTEC™ ECO PRO-400		State-of-the-art solution to deliver high salt rejection at low operating pressure reducing CAPEX and OPEX.	
	DOW FILMTEC™ BW30XFR-400/34		Established high fouling resistance and fouling removal efficiency coupled with very high rejection proven at broad TDS range,	
	DOW FILMTEC™ BW30XFRLE-400/34		Improved fouling resistance as well as efficiency of element’s cleaning combined with low energy consumption and good water purity.	
	DOW FILMTEC™ BW30-400/34		Consistent and reliable high operational performance coupled with increased productivity comparing to BW30-365.	
	DOW FILMTEC™ BW30-365		Established industry reference product providing consistent, high performance and long element life with decades of proven performance	
	DOW FILMTEC™ SW30XHR-440		Seawater Desalination from Controlled Feedwater Source (well, UF pretreated)	Highest rejection seawater RO element enabling stringent water quality requirements.
	DOW FILMTEC™ SW30HRLE-440			High rejection at sustainable lower lifecycle cost for medium- and high-salinity feedwaters.
	DOW FILMTEC™ SW30XLE-440	Advanced combination of productivity and rejection resulting in a low energy seawater element, enabling lowest operation cost.		
	DOW FILMTEC™ SW30ULE-440	Medium salinity and medium temperature feed waters an advanced combination of high productivity and high rejection through extra-low energy consumption.		
	DOW FILMTEC™ SW30XHR-400	Seawater Desalination from Challenging Feedwater Source	Highest rejection seawater RO element enabling stringent water quality requirements.	
	DOW FILMTEC™ SW30HRLE-400		High rejection at sustainable lower lifecycle cost for medium- and high-salinity feedwaters.	
DOW FILMTEC™ SW30HRLE-370/34	Durable, high-rejection, high-productivity seawater element, helping to support smooth operations and low cost of water.			
DOW FILMTEC™ SW30XLE-400	Advanced combination of productivity and rejection resulting in a low energy seawater element, enabling lowest operation cost.			
DOW FILMTEC™ SW30ULE-400	Medium salinity and medium temperature feed waters provide an advanced combination of high productivity and high rejection through extra-low energy consumption.			

## Ion Exchange Technology

Dow manufactures a wide array of premium ion exchange resins designed for the highest performance in the most sophisticated ion exchange systems including AMBERPACK™ and UPCORE™ Packed and Layered Beds, and polishing mixed beds. All of these resins have a low uniformity coefficient and are sized for their promoted use. They have exceptional stability, capacity, and contaminant removal capability. The table below lists Dow's premium ion exchange resins for Industrial Water Treatment along with their recommended uses. Use this table as a guideline to select the best ion exchange resins the industry has to offer.

AMBERLITE™ RESIN PRODUCTS	APPLICATION	TYPE	PARTICLE SIZE DISTRIBUTION	MORPHOLOGY	MATRIX	SYSTEM DESIGN					FEATURES AND RECOMMENDED USES
						CO-CURRENT	COUNTER-CURRENT	LAYERED BEDS	PACKED BED	MIXED BEDS	
<b>HIGH PERFORMANCE RESINS</b>											
HPR1100 Na	Softening	SAC	UPS	G	S	●	●				Softening resin with excellent physical stability and low rinse profile.
HPR1200 H	Deminerlization Mixed Bed Polishing	SAC	UPS	G	S	●	●		●	●	Designed to be the go-to, high-quality SAC resin.
HPR1200 Na	Softening	SAC	UPS	G	S	●	●		●	○	
HPR1300 H	Deminerlization Mixed Bed Polishing	SAC	UPS	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.
HPR1300 Na	Softening	SAC	UPS	G	S	●	●	●	●	○	
HPR650 H	Deminerlization Mixed Bed Polishing	SAC	UPS	G	S	●	●	●	●	●	High-solids SAC ideally suited for use in polishing mixed beds when highest resin purity and water quality are required.
HPR4200 Cl	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●	●	●	○	Designed to be the go-to, high-quality SBA resin. Good balance of capacity, strength and silica leakage.
HPR4200 OH	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●	●	●	●	
HPR4700 OH	Deminerlization Mixed Bed Polishing	SBA	UPS	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.
HPR4700 Cl	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●		●	○	
HPR550 OH	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●		●	●	High-capacity, high solids SBA resin with rapid kinetics designed specifically for use in polishing mixed beds when highest resin purity and water quality are required. Excellent selectivity for silica makes it an ideal choice for post-RO mixed bed.
HPR550 Cl	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●		●	○	
HPR4580 Cl	Deminerlization	SBA	Graded	G	A	●	●	●	●		High operating capacity, good physical stability and organic fouling-resistant acrylic SBA.
HPR4780 Cl	Deminerlization	SBA	Graded	G	A	●	●		●		Dual Functional (WBA+SBA) resin with extremely high operating capacity, efficiency and organic fouling resistance.
HPR4800 Cl	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●		●	○	High-quality SBA resin with excellent capacity and rinse characteristics.
HPR4800 OH	Deminerlization Mixed Bed Polishing	SBA	UPS	G	S	●	●		●	●	
HPR4811 Cl	Deminerlization Scavenging	SBA	UPS	G	S	●	●		●		High capacity gel SBA resin for use with high organic waters without the temperature limitations of acrylic resins.
HPR4100 Cl	Deminerlization Dealkalization	SBA II	UPS	G	S	●	●		●		The go-to uniform Type II SBA resin.
HPR6700	Deminerlization	WBA	Graded	G	A	●	●		●		Very high-capacity WBA with exceptional physical stability and organic fouling resistance.
HPR7000	Deminerlization	WBA	Graded	G	A	●	●		●		High-capacity WBA with exceptional physical stability, organic fouling resistance, and good rinse down characteristics.
HPR2900 H	Deminerlization	SAC	UPS	M	S	●	●		●		High physical stability for harsh applications such as appreciable oxidative potential or high temperatures.
HPR2900 Na	Softening	SAC	UPS	M	S	●	●		●		

**Key:** SBA = Strong Base Anion WBA = Weak Base Anion SAC = Strong Acid Cation

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

AMBERLITE™ RESIN PRODUCTS	APPLICATION	TYPE	PARTICLE SIZE DISTRIBUTION	MORPHOLOGY	MATRIX	SYSTEM DESIGN					FEATURES AND RECOMMENDED USES
						CO-CURRENT	COUNTER-CURRENT	LAYERED BEDS	PACKED BED	MIXED BEDS	
<b>HIGH PERFORMANCE RESINS</b>											
HPR8300 H	Softening Dealkalization Deminerlization	WAC	Graded	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	Softening Dealkalization Deminerlization	WAC	Graded	M	A	●	●		●		High-capacity dealkalization and softening resin allowing low pressure drop in high velocity operations.
HPR9200 CI	Deminerlization Mixed Bed Polishing	SBA	UPS	M	S	●	●		●	○	Exceptional physical stability, resistance to osmotic shock, and well-suited for use in deminerlization of high organic waters.
HPR9100 CI	Deminerlization	SBA II	UPS	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.
HPR9500	Deminerlization	WBA	UPS	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	Deminerlization	WBA	UPS	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	Deminerlization	WBA	Graded	M	S	●	●		●		Combines excellent physical and thermal stability, good organic fouling resistance, and allows low pressure drop in high velocity operations.
HPR2800 H	Deminerlization Mixed Bed Polishing	SAC	UPS	M	S	●	●	●	●	●	High physical stability for harsh applications such as deminerlization systems involving appreciable oxidative potential or high temperatures. Allows low pressure drop in high velocity operations and optimized for separability in mixed beds.
HPR9000 OH	Deminerlization Mixed Bed Polishing	SBA	UPS	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 <sub>4</sub>	Deminerlization Mixed Bed Polishing	SBA	UPS	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.
14i	Deminerlization	Inert	Gaussian	PP	PP		○	○	●		Floating inert resin specifically designed for use as an upper layer in down-flow regenerated ion exchange systems, such as floating beds.
62i	Softening Deminerlization	Inert	Gaussian	PE	PE		○	○	●		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.
600i	Mixed Bed Polishing	Inert	UPS	G	A					○	Non-functionalized bead designed to create an inert zone between the functional resins in mixed beds.
SCAV1	Scavenging		Gaussian	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 SO <sub>4</sub> ) is less than 3.
SCAV2	Scavenging		Gaussian	G	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 SO <sub>4</sub> ) is greater than 3.
SCAV3 CI	Scavenging Deminerlization		Gaussian	M	S	●					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 CI	Scavenging Deminerlization		Gaussian	M	A	●					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™ RESIN PRODUCTS	APPLICATION	TYPE	PARTICLE SIZE DISTRIBUTION	MORPHOLOGY	MATRIX	CO-CURRENT	COUNTER-CURRENT	LAYERED BEDS	PACKED BED	MIXED BEDS	FEATURES AND RECOMMENDED USES
<b>GENERAL PURPOSE RESINS</b>											
IRC120 H	Dem mineralization	SAC	Gaussian	G	S	●					General-purpose, durable resin offers a good balance of capacity and strength resulting in long lifetime for co-flow regenerated systems.
IRC120 Na	Softening	SAC	Gaussian	G	S	●					
IRA402 Cl	Dem mineralization	SBA	Gaussian	G	S	●					This industry-staple resin is designed to provide excellent balance of properties for capacity, strength, silica selectivity and a long lifetime for co-flow regenerated systems.
IRA458 Cl	Dem mineralization	SBA	Gaussian	G	A	●					Offers a good balance of high capacity and high strength for co-flow regenerated systems.
IRA410 Cl	Dem mineralization Dealkalization	SBA II	Gaussian	G	S	●					General-purpose Type II SBA used for general demineralization where high operating capacity is needed.
IRA67	Dem mineralization	WBA	Gaussian	G	A	●					Very high capacity WBA with exceptional physical stability and organic fouling resistance.
IRC200 Na	Softening	SAC	Gaussian	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	Softening Dealkalization Dem mineralization	WAC	Gaussian	M	A	●					General-purpose high-capacity dealkalization and softening resin with improved operating capacity demonstrated in high TDS Na form operation.
IRA900 Cl	Dem mineralization Scavenging	SBA	Gaussian	M	S	●					Industry staple macro SBA resin designed to provide a long lifetime for co-flow regenerated systems in variety of applications when resistance to organic fouling and physical stress is needed.
IRA910 Cl	Dem mineralization Dealkalization	SBA II	Gaussian	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	Dem mineralization	WBA	Gaussian	M	S	●					General-purpose WBA combining excellent physical and thermal stability, good organic fouling resistance.

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## Water & Process Solutions

7600 Metro Blvd.  
Edina, MN 55439

## For more information, contact our Customer Information Group:

Asia Pacific +86 21 3851 4988  
Europe, Middle East, Africa +31 115 672626  
Latin America +55 11 5184 8722  
North America 1-800-447-4369

[dowwaterandprocess.com](http://dowwaterandprocess.com)

WARNING: Oxidizing agents such as nitric acid attack organic ion exchange resins under certain conditions. This could lead to anything from slight resin degradation to a violent exothermic reaction (explosion). Before using strong oxidizing agents, consult sources knowledgeable in handling such materials.

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