

# High Performance Water Treatment for Power Generation

## Gravex® UPS Nuclear Grade and Condensate Resins

The UPS ion exchange products are high capacity, uniform size, polystyrene gel type resins. They are processed to achieve the best possible performance in nuclear plant applications. The Gravex® UPS GR-1-9 US NG anion is offered in the fully regenerated hydroxide form and the UPS GR-2-0 US NG cation in the hydrogen form. These resins are further processed to achieve soluble organics at the lowest possible levels. Excellent physical properties and high purity levels enable the UPS products to process PWR plant reactor coolant and all nuclear condensate waters to maintain the water quality needed in these systems for operational stability. These and other specialty Gravex products may be used in Steam Generator Blowdown Demineralizers to further enhance system operations.

The Gravex UPS anion is also available in the ultra-low-chloride version. The process was developed to produce anion at chloride levels significantly less than Nuclear Grade for special condensate treatment techniques. This enhanced quality level product and component of mixed beds is used for improved performance in primary side reactor coolant treatment.

In addition to the typical specification requirements, today's upgraded specifications limit the amount of leachable organic impurities present in high-quality condensate polishing ion exchange resins. The UPS condensate grade versions, GR-1-0 US CG and GR-2-0 US CG are processed to achieve these organic leachable and all requirements needed for optimal condensate polishing. The products are designed to separate easily to insure the best possible regeneration results and after remixing, attaining high-level condensate polishing performance.



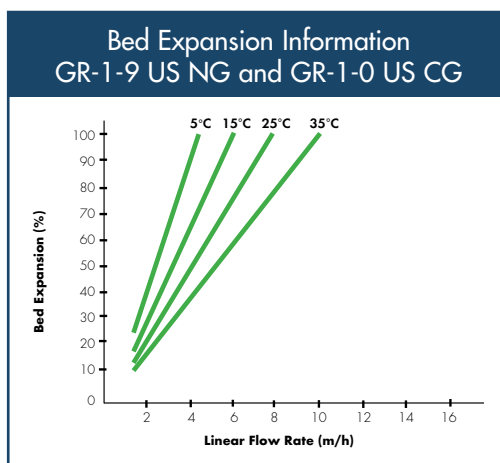
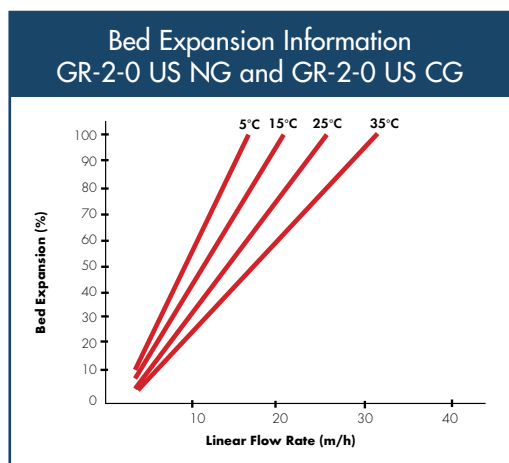
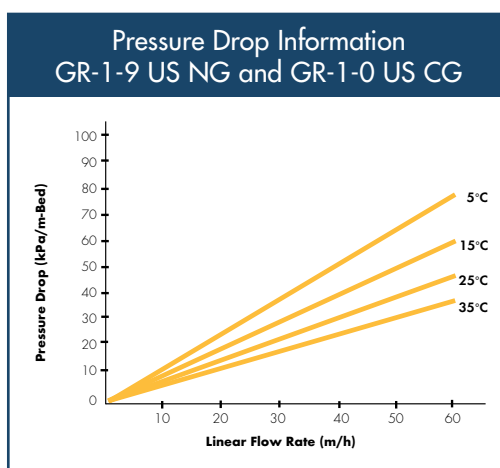
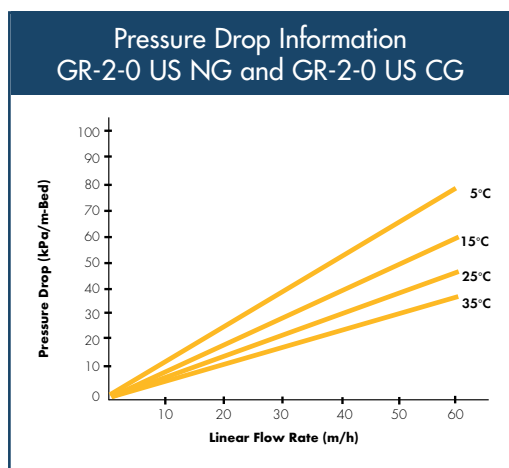
	NUCLEAR GRADE		CONDENSATE GRADE	
TYPICAL PROPERTIES	Gravex UPS GR-1-9 US NG	Gravex UPS GR-2-0 US NG	Gravex UPS GR-1-0-US CG	Gravex UPS GR-2-0 US CG
Type	Strongly basic type 1 gel	Strongly Acidic	Strongly basic type 1 gel	Strongly Acidic
Matrix	Styrene Divinylbenzene	Styrene Divinylbenzene	Styrene Divinylbenzene	Styrene Divinylbenzene
Functional Group	Trimethylammonium, A Quaternary Amine	Sulfonic Acid	Trimethylammonium, A Quaternary Amine	Sulfonic Acid
Ionic Form	Hydroxide	Hydrogen	Hydroxide	Hydrogen
Total Exchange Capacity	1.1 eq/L (min)	2 eq/L (min)	1.1 eq/L (min)	2 eq/L (min)
Ionic Conversion	95% Hydroxide (min)	99.7% Hydrogen (min)	95% Hydroxide (min)	99.7% Hydrogen (min)
	0.1% Chloride (max)		0.5% Chloride (max)	
	0.1% Sulfate (max)		0.1% Sulfate (max)	
Water Retention Capacity	55-65%	45-51%	55-65%	45-51%
Particle Size				
Mean Diameter	590 +/- 50 µm	660 +/- 50 µm	590 +/- 50 µm	660 +/- 50 µm
<850 µm			5% (max)	5% (max)
<300 µm	0.2% (max)	0.2% (max)	0.5% (max)	0.5% (max)
Uniformity Coefficient	1.2 (max)	1.2 (max)	1.1 (max)	1.1 (max)
Friability				
Average g/bead	350 (min)	500 (min)	350 (min)	500 (min)
>200 g/bead	95% (min)	95% (min)	95% (min)	95% (min)
Whole Uncracked Bead	95% (min)	95% (min)	95% (min)	95% (min)
Rinseable Organics				
Post UV Chloride			20 ppb (max)	20 ppb (max)
Post UV Sulfate			50 ppb (max)	50 ppb (max)
Trace Metals, mg/dry kg				
Aluminum	40	40	40	40
Calcium	50	50		
Cobalt	30	30		
Copper	10	10	10	10
Iron	50	50	50	50
Lead	10	10	10	10

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NUCLEAR GRADE			CONDENSATE GRADE	
TYPICAL PROPERTIES	Gravex UPS GR-1-9 US NG	Gravex UPS GR-2-0 US NG	Gravex UPS GR-1-0-US CG	Gravex UPS GR-2-0 US CG
Magnesium	50	50		
Mercury	20	20		
Potassium	40	40		
Sodium	20	25	50	50
Zinc	50	50		
Other impurities, mg/dry kg				
Total Chloride	500			
Total Sulfate	600			
Total Silica	100			
Swelling			23% (Cl <sup>-</sup> to OH <sup>-</sup> )	8% (Na <sup>+</sup> to H <sup>+</sup> )
Particle Density	1.07 g/mL	1.22 g/mL	1.07 g/mL	1.22 g/mL
Approximate Shipping Weight	41 lbs/ft <sup>3</sup> (655 - 660 g/L)	50 lbs/ft <sup>3</sup> (800 g/L)	41 lbs/ft <sup>3</sup> (655 - 660 g/L)	50 lbs/ft <sup>3</sup> (800 g/L)

**RECOMMENDED OPERATING CONDITIONS**

NUCLEAR GRADE			CONDENSATE GRADE	
	Gravex UPS GR-1-9 US NG	Gravex UPS GR-2-0 US NG	Gravex UPS GR-1-0-US CG	Gravex UPS GR-2-0 US CG
Operating Temperature (max)	60°C (140°F)	130°C (265°F)	60°C (140°F)	130°C (265°F)
pH Range	0 - 14	0 - 14	0 - 14	0 - 14
Bed Depth (min)	800 mm (2.6 ft)	800 mm (2.6 ft)	450 mm (1.5 ft)	450 mm (1.5 ft)
Service Rate	5 - 60 m/h (2 - 24 gpm/ft <sup>2</sup> )	5 - 60 m/h (2 - 24 gpm/ft <sup>2</sup> )	40 - 150 m/h (16 - 60 gpm/ft <sup>2</sup> )	40 - 150 m/h (16 - 60 gpm/ft <sup>2</sup> )
Regenerant	N/A	N/A	4 - 8 % NaOH	2 - 10 % H <sub>2</sub> SO <sub>4</sub> 4 - 8% HCl
Regeneration Rate	N/A	N/A	2 - 10 m/h (0.8-4 gpm/ft <sup>2</sup> )	2 - 10 m/h (0.8-4 gpm/ft <sup>2</sup> )
Total Rinse Requirement	N/A	N/A	2 - 10 BV	2 - 10 BV



Graver Technologies

**Graver Technologies, LLC**  
 200 Lake Drive, Glasgow, DE 19702  
**T** 800.533.6623  
**T** 302.731.1700  
**F** 302.731.1707  
 info@gravertech.com  
 gravertech.com

**China**  
 RM 16D, Building B  
 No.1118, Changshou Road  
 Shanghai, China 200042  
**T** +(86) 21.5238.6576  
**F** +(86) 21.5238.6579

**India**  
**T** +(91) 9212.722.691

**Europe**  
 Koenigstrasse, 10c. D-70173  
 Stuttgart Germany  
**T** +33 (6) 1933.1110

**United States**  
 IX Manufacturing



**Nuclear QA and ISO Certified**  
 72 Lockwood Street, Newark, NJ 07105  
**T** 800.533.6623

Nuclear Quality Assurance Program  
 10CFR50, Appendix B



A Marmon Water/Berkshire Hathaway Company