

### Gravex® High Capacity Nuclear Grade Resins

GR-1-9 NG, GR-2-16 NG, GR-3-16 NG, GR-7-16 NG, GR-4-7 NG

These Gravex Nuclear Grade Ion exchange resins are very high capacity polystyrene, gel type resins. They have been regenerated and processed to provide the highest possible performance in nuclear applications. The Gravex cation is specially processed to minimize leachable sulfonic acids. Its high capacity and oxidative stability help achieve optimal performance. Gravex mixed beds are the most uniformly blended products available and have the same consistent cation to anion ratio in every package. Our unique blending process creates the less separable GR-3-16 NG stoichiometric mixed bed. A <sup>7</sup>Li<sup>+</sup> form cation is available as GR-7-16 NG and in the GR-4-7 NG mixed bed.

#### Applications – Reactor Coolant Treatment (CVCS, chemical and volume control system)

The series of higher crosslinked Gravex cation exchange resins is designed to increase the run times of the cation and mixed beds because the cation capacity is up to 30% higher than standard cations. The longer bed life helps to reduce radwaste disposal volumes. The cation GR-2-16 NG by itself and as a



component of the mixed beds, is also selective for the soluble species of radionuclide metals. Each product continues to perform the normal functions of reactor water treatment and pH control. The GR-7-16 NG, <sup>7</sup>Li<sup>+</sup> form cation may be used in place of the GR-4-7 NG or the standard GR-4-9 NG to extend the bed life.

**Other** – The very high capacities of GR-2-16 NG and GR-3-16 NG make these Gravex products highly suitable for steam generator blowdown demineralizer systems and very useful for selective radionuclide removal from liquid radwaste.

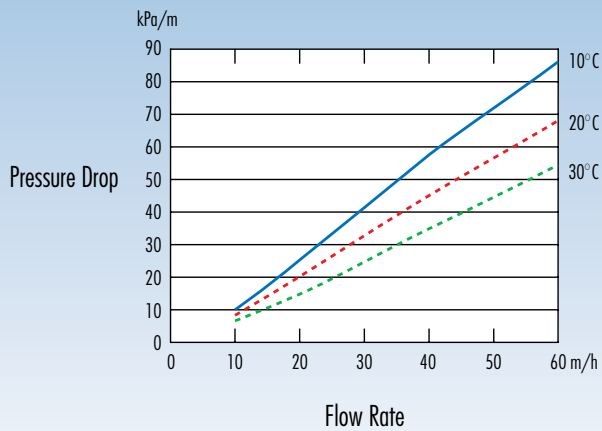
**Spent Fuel Pools** – GR-3-16 NG is chemically and physically resistant to the aggressive environment in spent fuel pools. The particle size of the GR-2-16 NG cation component further enhances resistance to separation, limiting the potential for a bottom layer of cation exchange resin in the vessel.

Typical Properties				
PRODUCTS	GR-1-9 NG	GR-2-16 NG, GR-7-16 NG ( <sup>7</sup> Li form)	GR-3-16 NG	GR-4-7 NG
Type	SBA Type 1	SAC	SAC/SBA	SAC/SBA
Matrix	Styrene DVB Gel	Styrene DVB Gel	Styrene DVB Gel	Styrene DVB Gel
Functional Group	Quaternary Ammonium	Sulfonic Acid	Sulfonic Acid, Quaternary Ammonium	Sulfonic Acid, Quaternary Ammonium
Ionic Form	OH <sup>-</sup>	H <sup>+</sup>	H <sup>+</sup> /OH <sup>-</sup>	<sup>7</sup> Li <sup>+</sup> /OH <sup>-</sup>
Total Exchange Capacity (meq/mL)	1.2 (min)	2.4 (min)	2.4 / 1.2	2.4 / 1.2
Ionic Conversion	97% OH (min) 3% CO <sub>3</sub> (max) 0.1% Cl (max) 0.1% SO <sub>4</sub> (max)	99% H / <sup>7</sup> Li <sup>+</sup>	99% / 97% (min) 3% CO <sub>3</sub> (max) 0.1% Cl (max) 0.1% SO <sub>4</sub> (max)	99% / 97% (min) 3% CO <sub>3</sub> (max) 0.1% Cl (max) 0.1% SO <sub>4</sub> (max)
Water Retention Capacity	54 – 60%	37 – 43%	37 – 43% / 54 – 60%	37 – 43% / 54 – 60%
Particle Size	>1,190 μm <300 μm	2% (max) 0.2% (max)	2% (max) 0.2% (max)	2% (max) 0.2% (max)
Friability	Average g/bead >200 g/bead	350 (min) 95% (min)	500 (min) 95% (min)	500 / 350 (min) 95% (min)
Whole Bead	95% (min)	95% (min)	95% (min)	95% (min)
Harmonic Mean Size	670 ± 50 μm	525 ± 50 μm	525 / 670 ± 50 / 50 μm	525 / 670 ± 50 / 50 μm

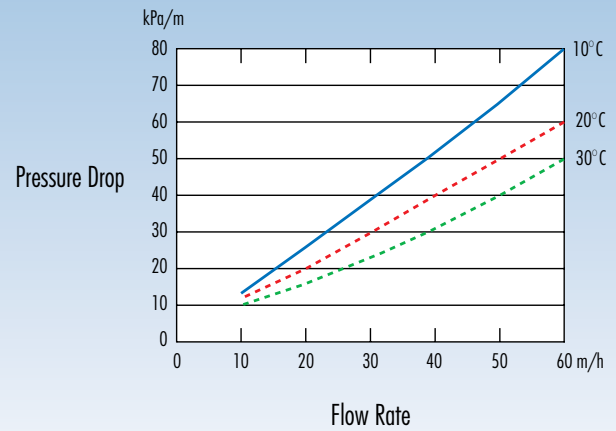
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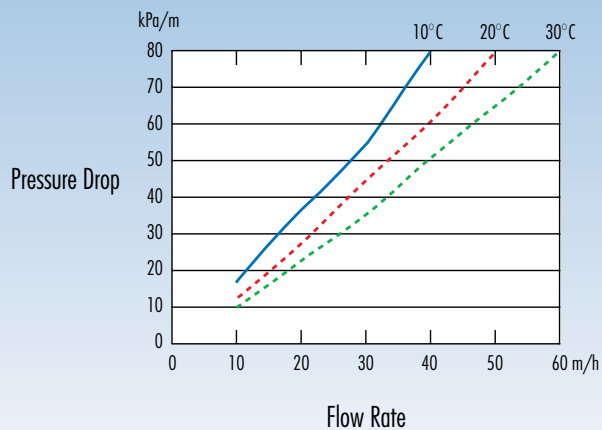
GR-1-9 NG – Pressure Drop



GR-3-16 NG, GR-4-7 NG – Pressure Drop



GR-2-16 NG, GR-7-16 NG – Pressure Drop



### Recommended Operating Conditions

<b>Maximum Operating Temperature</b>	120°C (250°F) Cation 60°C (140°F) Anion
<b>Minimum Bed Depth</b>	800 mm (2.6 ft)
<b>Linear Flow Rate</b>	5 – 125 m / hr (2 – 50 gpm/ft <sup>2</sup> )
<b>Volume Flow Rate</b>	8 – 50 BV / hr (1 – 6 gpm/ft <sup>2</sup> )

### Impurity - Mg/Dry Kg (max)

Impurity mg/dry kg (max)	GR-1-9 NG	GR-2-16 NG GR-7-16 NG
Na	20	50
Fe	50	50
Cu	10	10
Pb	10	10
Al	50	50
Ca	50	50
Mg	50	50
K	50	50
Zn	50	50
Co	30	30
Hg	20	20
SiO <sub>2</sub>	100	
Total Cl	500	
Total SO	600	

GR-3-16 NG and GR-4-7 NG same as components for each impurity.



**Graver Technologies**

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#### 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

#### Europe

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

#### India

**T** +(91) 9212.722.691

#### United States

#### IX Manufacturing



ISO 9001  
 FM 592082

#### 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

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