

# GRAVEX®

## High Performance Water Treatment for Power Generation

### Gravex® Nuclear Grade Resins

GR-1-9 NG, GR-2-0 NG, GR-3-9 NG, GR-4-9 NG

Gravex Nuclear Grade Ion exchange resins are high capacity, polystyrene, gel type resins. They have been regenerated and processed to provide the highest possible performance in nuclear applications. GR-1-9 NG and GR-2-0 NG are fully tested and certified. Our unique blending process creates the less separable GR-3-9 NG mixed bed. It is the most uniformly blended product available and has the same consistent cation to anion ratio in every package. The mixed bed version with  ${}^7\text{Li}^+$  form cation is GR-4-9 NG.

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

boron level toward the end of a fuel cycle. It is a low chloride anion exchanger that effectively removes chloride and sulfate from the reactor water as well as radionuclides, including isotopes of iodine. GR-2-0 NG is used to remove  ${}^7\text{Li}$  when necessary to control reactor pH and is effective for reduction of corrosion products. The GR-3-9 NG  $\text{H}^+/\text{OH}^-$  mixed bed also removes  ${}^7\text{Li}$ , corrosion products, soluble radionuclides and can remove boron as needed especially in the BTRS or Boron Recycle System. The GR-4-9 NG  ${}^7\text{Li}^+/\text{OH}^-$  mixed bed removes soluble radionuclides and other impurities while maintaining



${}^7\text{Li}$  Lithium Hydroxide concentration and reactor pH. The cation component is converted to the  ${}^7\text{Li}^+$  form using highly enriched and pure  ${}^7\text{LiOH}$  certified to meet nuclear requirements. Each of these mixed beds contains the GR-1-9 NG anion.

**Other** – The GR-1-9 NG, GR-2-0 NG, and GR-3-9 NG products are also useful for treating liquid radwaste streams, spent fuel pools, and for any other high purity applications.

#### Recommended Operating Conditions

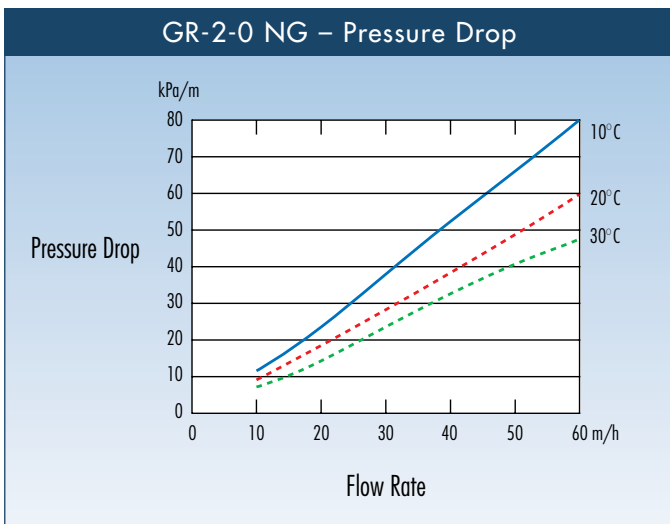
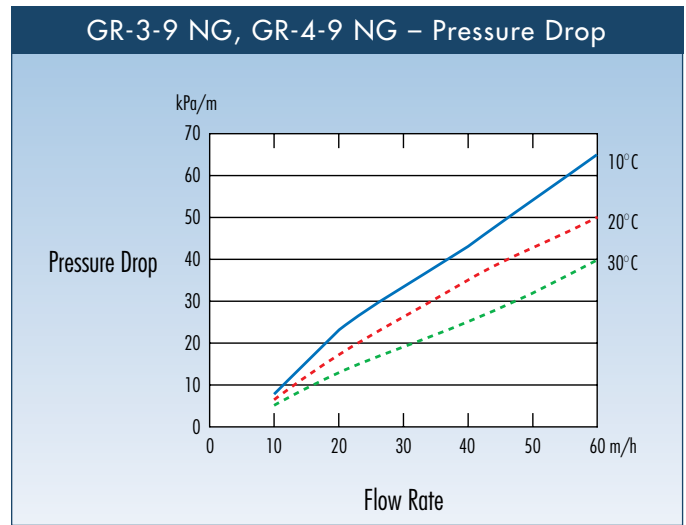
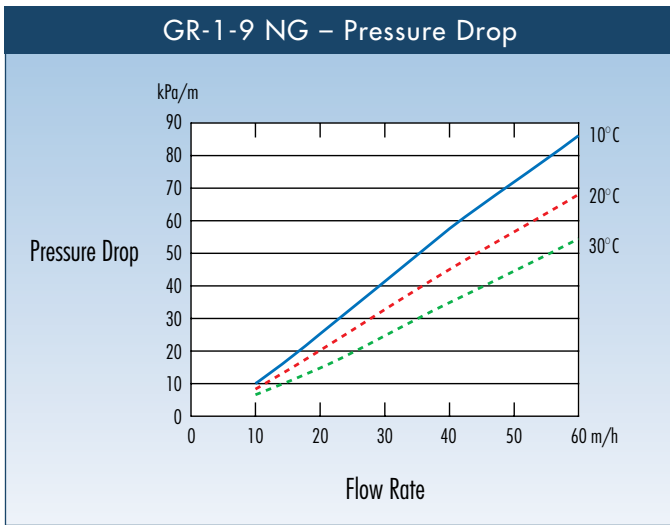
<b>Maximum Operating Temperature</b>	120°C (250°F) Cation 60°C (140°F) Anion
<b>Minimum Bed Depth</b>	800 mm (2.6 ft)
<b>Linear Flow Rate</b>	5 – 125 m / hr (2 – 50 gpm/ft <sup>2</sup> )
<b>Volume Flow Rate</b>	8 – 50 BV / hr (1 – 6 gpm/ft <sup>2</sup> )

#### Typical Properties

PRODUCTS	GR-1-9 NG	GR-2-0 NG	GR-3-9 NG	GR-4-9 NG
<b>Type</b>	SBA Type 1	SAC	SAC/SBA	SAC/SBA
<b>Matrix</b>	Styrene DVB Gel	Styrene DVB Gel	Styrene DVB Gel	Styrene DVB Gel
<b>Functional Group</b>	Quaternary Ammonium	Sulfonic Acid	Sulfonic Acid, Quaternary Ammonium	Sulfonic Acid, Quaternary Ammonium
<b>Ionic Form</b>	$\text{OH}^-$	$\text{H}^+$	$\text{H}^+/\text{OH}^-$	${}^7\text{Li}^+/\text{OH}^-$
<b>Total Exchange Capacity (meq/mL)</b>	1.2 (min)	1.9 (min)	1.9 / 1.2	1.9 / 1.2
<b>Ionic Conversion</b>	97% $\text{OH}^-$ (min) 3% $\text{CO}_3$ (max) 0.1% $\text{Cl}^-$ (max) 0.1% $\text{SO}_4$ (max)	99% $\text{H}^+$ (min)	99% / 97% (min) 3% $\text{CO}_3$ (max) 0.1% $\text{Cl}^-$ (max) 0.1% $\text{SO}_4$ (max)	99% / 97% (min) 3% $\text{CO}_3$ (max) 0.1% $\text{Cl}^-$ (max) 0.1% $\text{SO}_4$ (max)
<b>Water Retention Capacity</b>	54 – 60%	46 – 54%	46 – 54% / 54 – 60%	46 – 54% / 54 – 60%
<b>Particle Size</b>	>1,190 $\mu\text{m}$ <300 $\mu\text{m}$	2% (max) 0.2% (max)	2% (max) 0.2% (max)	2% (max) 0.2% (max)
<b>Friability</b>	Average g/bead >200 g/bead	350 (min) 95% (min)	350 (min) 95% (min)	350 (min) 95% (min)
<b>Whole Bead</b>	95% (min)	95% (min)	95% (min)	95% (min)
<b>Harmonic Mean Size</b>	670 $\pm$ 50 $\mu\text{m}$	650 $\pm$ 50 $\mu\text{m}$	650 / 670 $\pm$ 50 $\mu\text{m}$	650 / 670 $\pm$ 50 $\mu\text{m}$

# Gravex® Nuclear Grade Resins

## GR-1-9 NG, GR-2-0 NG, GR-3-9 NG, GR-4-9 NG



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

Impurity mg/dry kg (max)	GR-1-9 NG	GR-2-0 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-3-9 NG and GR-4-9 NG same as components for each impurity.



**Graver Technologies**

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Nuclear Quality Assurance Program

10CFR50, Appendix B



A Marmon Water/Berkshire Hathaway Company

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