

GRAVEX® Nuclear Grades 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.

TYPICAL PROPERTIES

Product	GR-1-9 NG	GR-2-0 NG	GR-3-9 NG	GR-4-9 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^-	H^+	H^+ / OH^-	${}^7\text{Li}^+ / \text{OH}^-$
Total Exchange Capacity (meq/mL)	1.2 (min)	1.9 (min)	1.9 / 1.2	1.9 / 1.2
Ionic Conversion	97% OH (min)	99% H (min)	99% / 97% (min)	99% / 97% (min)
	3% CO_3 (max)		3% CO_3 (max)	3% CO_3 (max)
	0.1% Cl (max)		0.1% Cl (max)	0.1% Cl (max)
	0.1% SO_4 (max)		0.1% SO_4 (max)	0.1% SO_4 (max)
Water Retention	54–60%	46–54%	46–54% / 54–60%	46–54% / 54–60%
Whole Bead	95% (min)	95% (min)	95% (min)	95% (min)
Friability	average g/bead	350 (min)	350 (min)	350 (min)
	> 200 g/bead	95% (min)	95% (min)	95% (min)
Particle Size	> 1,190 μm	2% (max)	2% (max)	2% (max)
	< 300 μm	0.2% (max)	0.2% (max)	0.2% (max)
Harmonic Mean Size	670 \pm 50 μm	650 \pm 50 μm	650 / 670 \pm 50 μm	650 / 670 \pm 50 μm

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

Gravex GR-1-9 NG is used as a deborating bed to control the 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 H^+ / 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 ${}^7\text{Li}$ 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.

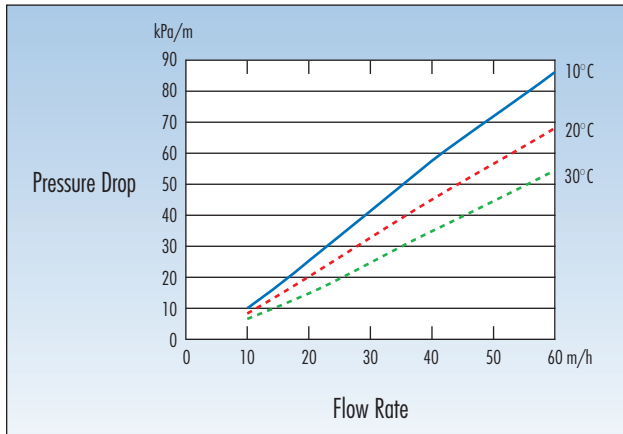
Other

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.

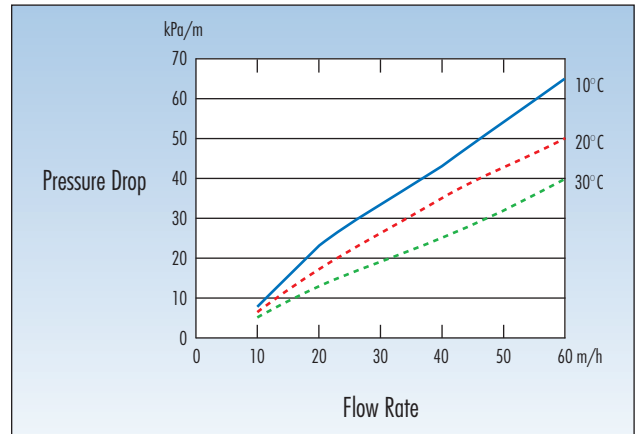
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GR-1-9 NG, GR-2-0 NG, GR-3-9 NG, GR-4-9 NG

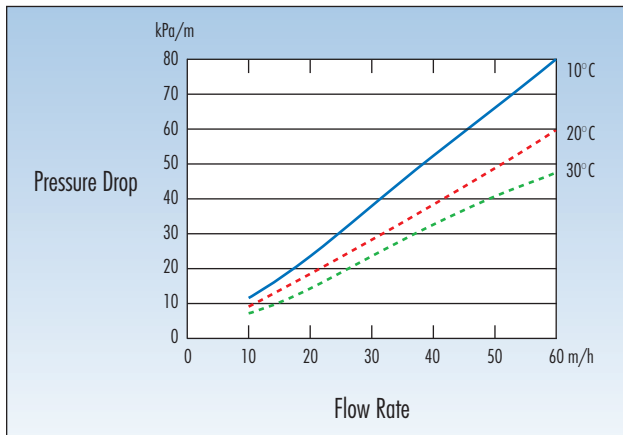
GR-1-9 NG – PRESSURE DROP



GR-3-9 NG, GR-4-9 NG – PRESSURE DROP



GR-2-0 NG – PRESSURE DROP



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 ₂	100	
Total Cl	500	
Total SO ₄	600	

RECOMMENDED OPERATING CONDITIONS

Max. Operating Temperature	120°C (250°F) Cation 60°C (140°F) Anion
Min. Bed Depth	800 mm (2.6 ft)
Linear Flow Rate	5 – 125 m/hr (2 – 50 gpm/ft ²)
Volume Flow Rate	8 – 50 BV/hr (1 – 6 gpm/ft ³)

GR-3-9 NG and GR-4-9 NG same as components for each impurity.

For more information

Graver Technologies
Customer Service:
800.533.6623
E-mail: info@gravertech.com
Website: www.gravertech.com

United States

Graver Technologies, LLC

200 Lake Drive
Glasgow, DE 19702 USA
800.533.6623
Phone: (302) 731.1700
Fax: (302) 731.1707

China

Graver Technologies, LLC

RM 16D, Bldg. B
No.1118, Changshou RD
Shanghai, China 200042
Phone: (86) 21.5238.6576.608
Fax: (86) 21.5238.6579

Europe

Graver Technologies, LLC

Koenigstrasse, 10c
D-70173 Stuttgart, Germany
Phone: (49) 711.3154.7160
Fax: (32) 61.32.9724



Graver Technologies

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**Nuclear
Quality
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Program**

10CFR50
Appendix B

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