

## A-850

### Strong Base Type I Acrylic Anion Exchange Resin

(For use in demineralization of water  
containing organic matter)

## Technical Data

### PRODUCT DESCRIPTION

**Purolite A-850** is a gel-type I strong base anion exchange resin with an acrylic matrix. The acrylic matrix ensures excellent removal of organic matter from a water supply in conjunction with its reversible removal upon regeneration. This resin is regenerated very efficiently with lower levels of sodium hydroxide than those required for a polystyrene based type I resin, and yet it

has a comparable ability to remove weaker acids including carbonic acid and silica. Its use in combination with a polystyrene based resin (for instance in a mixed bed positioned after the anion unit) can often result in the removal of a wider spectrum of organic compounds than either type of anion resin alone.

Typical Physical & Chemical Characteristics	
Polymer Matrix Structure	Crosslinked Gel Acrylic
Physical Form and Appearance	Transparent White Spherical Beads
Whole Bead Count	95% min.
Functional Groups	Quaternary Ammonium
Ionic Form, as shipped	Cl <sup>-</sup>
Shipping Weight (approx.)	720 g/l (45 lb/ft <sup>3</sup> )
Screen Size Range: - U.S. Standard Screen	16 - 50 mesh, wet
Particle Size Range	+1.2 mm <5%, -0.3 mm <1%
Moisture Retention, Cl <sup>-</sup> form	57 - 62%
Irreversible Swelling	10% max.
Reversible Swelling Cl <sup>-</sup> → OH <sup>-</sup>	15% max.
Specific Gravity, moist Cl <sup>-</sup> Form	1.08
Total Exchange Capacity, Cl <sup>-</sup> form,	1.25 eq/l min.
Operating Temperature, Cl <sup>-</sup> Form	40°C (100°F) max.
pH Range, Stability	No Limitations

Standard Operating Conditions (Co-Current Regeneration)				
Operation	Rate	Solution	Minutes	Amount
Service	8 - 24 BV/h 1 - 3 gpm/ft <sup>3</sup>	Decationized water	per design	per design
Backwash	Refer to Fig. 2	Decationized water 20°C (70°F)	5 - 20	1.5 - 6 BV 10 - 35 gal/ft <sup>3</sup>
Regeneration	4 - 8 BV/h 0.5 - 1 gpm/ft <sup>3</sup>	2 - 8% NaOH	30 - 45	50 - 150 g/l 4 - 10 lb/ft <sup>3</sup>
Rinse, (slow)	4 - 8 BV/h 0.5 - 1 gpm/ft <sup>3</sup>	Decationized water	60 approx.	2 - 4 BV 15 - 30 gal/ft <sup>3</sup>
Rinse, (fast)	8 - 24 BV/h 1 - 3 gpm/ft <sup>3</sup>	Decationized water	15 - 40 To desired end point	3 - 6 BV 25 - 45 gal/ft <sup>3</sup>
Backwash Expansion 50% to 75% Design Rising Space 100% Minimum bed depth 700 mm (27.5 in) "Gallons" refer to U.S. Gallon = 3.785 litres				

## REGENERATION

**Purolite A-850** is supplied in the chloride form and before use must be regenerated with a good grade of sodium hydroxide. A double regeneration is recommended for the first cycle. The conditions for standard regeneration are given in the table above. Where the silica content is high it is recommended that the tempera-

ture and (if necessary) the quantity of sodium hydroxide are elevated, in order to prevent build-up of silica. However the maximum operating temperature given under "Product Description" should not be exceeded. Operation at a temperature of 5°C below the maximum is usually adequate to ensure efficient silica removal.

Standard Operating Conditions (Counter Current Regeneration)				
Operation	Rate	Solution	Minutes	Amount
Service	8 - 40 BV/h 1 - 5 gpm/ft <sup>3</sup>	Decationized water	per design	per design
Regeneration (CCR)	Refer to Fig. 2	2 - 4% NaOH	30 - 60	48 - 104 g/l 3 - 6.5 lb/ft <sup>3</sup>
Rinse, (slow) (CCR)	2 - 4 BV/h 0.25 - 0.5 gpm/ft <sup>3</sup>	Decationized water	30 - 60	2 - 4 BV 15 - 30 gal/ft <sup>3</sup>
Rinse, (fast) (service flow)	10 - 40 BV/h 1.25 - 5 gpm/ft <sup>3</sup>	Decationized water	20 - 40	8 - 10 BV 60 - 75 gal/ft <sup>3</sup>
Backwash Expansion 50% to 75% Design Rising Space 100% Minimum bed depth 1200 mm (48 in) "Gallons" refer to U.S. Gallon = 3.785 litres				

## OPERATING CAPACITY

The Operating Capacity of **Purolite A-850** is a function of a number of variables including the quantity and temperature of regenerant, the percentage of sulphate to total anions, the silica to total anions in the feed solution, the flow rate and the mode of regeneration (co-current or counter current).

11 give corrections applicable to both regeneration modes.

An example of how to use the curves:

Figures 3 through 6 give curves for the calculation of operating capacity and silica leakage using co-current regeneration, and Figures 7 through 10 give similar curves for counter-current regeneration. Figures 10 and

If the regeneration mode, level and service flow rate are known, the capacity and leakage curves with their correction factors may be used directly to determine the operating capacity of the resin in the unit and the silica residual in the treated water.

INFLUENT WATER ANALYSIS	TREATMENT																												
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="text-align: center; width: 25%;">ppm as CaCO<sub>3</sub></th> <th style="text-align: center; width: 20%;">Total Anions %</th> </tr> </thead> <tbody> <tr> <td>Cl</td> <td style="text-align: center;">50</td> <td style="text-align: center;">45</td> </tr> <tr> <td>SO<sub>4</sub></td> <td style="text-align: center;">50</td> <td style="text-align: center;">45</td> </tr> <tr> <td>HCO<sub>3</sub></td> <td style="text-align: center;">5</td> <td style="text-align: center;">5</td> </tr> <tr> <td>SiO<sub>2</sub></td> <td style="text-align: center;">5</td> <td style="text-align: center;">5</td> </tr> <tr> <td>Total</td> <td style="text-align: center;">110</td> <td style="text-align: center;">100</td> </tr> </tbody> </table>		ppm as CaCO <sub>3</sub>	Total Anions %	Cl	50	45	SO <sub>4</sub>	50	45	HCO <sub>3</sub>	5	5	SiO <sub>2</sub>	5	5	Total	110	100	<table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 70%;">Regeneration with NaOH at</td> <td style="text-align: right;">: 96 g/l</td> </tr> <tr> <td>Countercurrent flow at temperature</td> <td style="text-align: right;">: 30°C (86°F)</td> </tr> <tr> <td>Flow rate</td> <td style="text-align: right;">: 16 BV/h</td> </tr> <tr> <td>Sodium leakage</td> <td style="text-align: right;">: 40 ppb</td> </tr> <tr> <td>End point SiO<sub>2</sub> leakage</td> <td style="text-align: right;">: 100 ppb</td> </tr> </tbody> </table>	Regeneration with NaOH at	: 96 g/l	Countercurrent flow at temperature	: 30°C (86°F)	Flow rate	: 16 BV/h	Sodium leakage	: 40 ppb	End point SiO <sub>2</sub> leakage	: 100 ppb
	ppm as CaCO <sub>3</sub>	Total Anions %																											
Cl	50	45																											
SO <sub>4</sub>	50	45																											
HCO <sub>3</sub>	5	5																											
SiO <sub>2</sub>	5	5																											
Total	110	100																											
Regeneration with NaOH at	: 96 g/l																												
Countercurrent flow at temperature	: 30°C (86°F)																												
Flow rate	: 16 BV/h																												
Sodium leakage	: 40 ppb																												
End point SiO <sub>2</sub> leakage	: 100 ppb																												
<p><b>CAPACITY CALCULATION</b></p> <p>For regeneration level of 96 g/l NaOH at 45% SO<sub>4</sub>, base capacity (C<sub>B</sub>) = 0.89 eq/l (counter-current, Fig. 7)</p> <p>Correction factor for regeneration temperature (with reference to % silica to total anions Fig. 9)</p> $C_1 = 0.96$ <p>Correction factor for silica end-point leakage of 100 ppb, (Fig. 11)</p> $C_2 = 0.97$ <p>Hence operating capacity</p> $= C_B \times C_1 \times C_2$ $0.89 \times 0.98 \times 0.97 = 0.85 \text{ eq/l}$ <p>Applying the customary engineering design factor of 0.9, the operating capacity obtainable</p> $= 0.85 \times 0.9 = 0.77 \text{ eq/l}$	<p><b>SILICA LEAKAGE</b></p> <p>Base silica leakage Bs for 96 g NaOH/l at 5% SiO<sub>2</sub>/Total Anions</p> $= 3 \text{ ppb (Fig. 8)}$ <p>Correction factor for Na leakage</p> $K_1 = 0.98 \text{ (Fig. 10)}$ <p>Correction factor for regeneration temperature</p> $K_2 = 0.88 \text{ (Fig. 12)}$ <p>Operational silica leakage (Ts)</p> $= Bs / (K_1 \times K_2) = 3 / (0.98 \times 0.88)$ $= 3.5 \text{ ppb}$																												

## PLANT DESIGN

If the operating capacity for throughput purposes depends upon the required silica leakage, the base silica leakage Bs should first be calculated by correcting the total silica leakage Ts using the correction factors K<sub>1</sub> for sodium leakage of the cation unit from Fig. 6 (co-current) or Fig 10 (counter-current) and K<sub>2</sub> for temperature of regeneration (Fig. 12).

$$Bs = Ts \times K_1 \times K_2$$

From Fig. 4 or Fig. 8, as appropriate, the quantity of regenerant needed to achieve the required silica leakage

Bs may be determined. The capacity obtainable at the given regeneration level is then found from Figs. 3 or 7 respectively. Resin volume should be calculated in order that the flow rate and the cycle time are satisfactory. The matching of the cation and anion plant may be done in the usual way.

Where leakage of silica is not important, base operating capacity curves may be used directly. In doing so the maximum correction factor C<sub>2</sub> from Fig. 11 (1.05) should be used.

## REGENERATION COUNTER-CURRENT MODE

To obtain the lowest concentrations of silica in the treated water, **Purolite A-850** should be regenerated with sodium hydroxide of a good grade. To fully utilize the high capacity and prevent the build-up of any unwanted contaminants it is preferable to use at least 48 g NaOH/liter (3 lbs/ft<sup>3</sup>) of resin. Above this level the quantity is chosen according to the operating capacity required, as given in Fig. 7. The rinse at the slow flow rate performs a double function. As well as serving as the regenerant displace-

ment, it also ensures satisfactory elution of organic matter particularly if the period is extended to approximately one hour. This procedure can also improve the efficiency of the final rinse. Care should be taken that good quality deionized water is used for rinsing, thus avoiding the possibility of contamination of the freshly regenerated resin at the outlet of the bed. When using the correct procedures the rinse characteristics closely approach those of polystyrene resins.

## HYDRAULIC CHARACTERISTICS

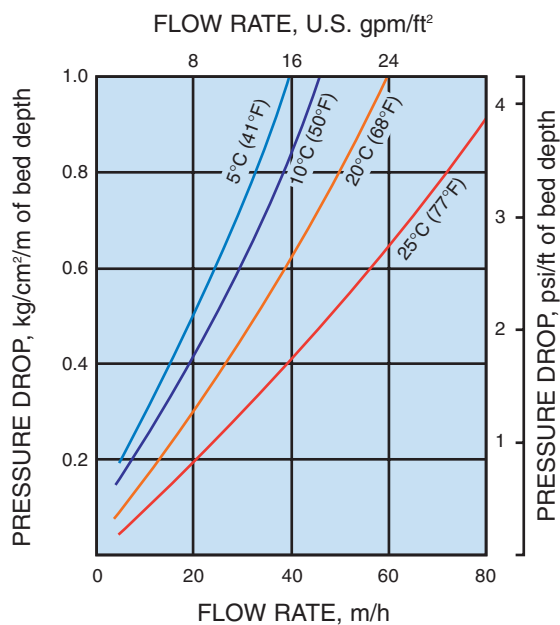
The pressure drop (or headloss) across a properly classified bed of ion exchange resin depends on the particle size distribution, bed depth, and void volume of the exchange material as well as on the flowrate and viscosity (and hence on the temperature) of the influent solution. Factors affecting any of these parameters, for example the presence of particulate matter filtered out by the bed, abnormal compressibility of the resin, Or the

incomplete classification of the bed will have an adverse effect and result in an increased headloss.

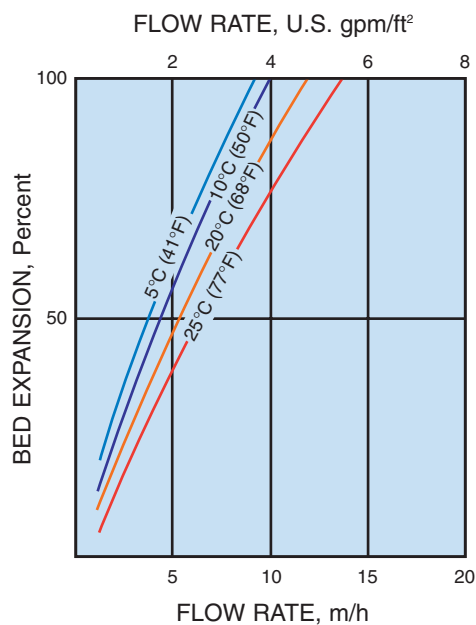
Depending on the quality of the influent water, the application and the design of the plant, service flow rates may vary from 8 - 40 bed volumes/hour.

Typical pressure drop data is given in Fig. 1.

**Fig. 1 PRESSURE DROP VS FLOW RATE**



**Fig. 2 BACKWASH EXPANSION**



During upflow backwash, the resin bed should be expanded in volume by between 50 and 70%. This operation will free it from any particulate matter, clear the bed of bubbles and voids, and reclassify the resin particles, ensuring minimum

resistance to flow. Bed expansion increases with flow rate and decreases with temperature, as shown in Fig. 2 for the exhausted form of the resin. Care should always be taken to avoid resin loss by over-expansion of the bed.

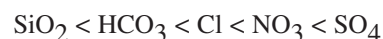
Conversion of Units	
1 m/h (cubic meters per square meter per hour)	= 0.341 gpm/ft <sup>2</sup> = 0.409 U.S. gpm/ft <sup>2</sup>
1 kg/cm <sup>2</sup> /m (kilograms per square cm per meter of bed)	= 4.33 psi/ft = 1.03 atmos/m = 10 ft H <sub>2</sub> O/ft

## PROPERTIES OF STRONGLY BASED ACRYLIC RESINS

**Purolite A-850** is particularly recommended where the water to be treated is high in organic matter. Many surface waters have high levels which are subject to seasonal variation. Such organic compounds require excess sodium hydroxide for their effective removal. Resins with a polystyrene matrix have a high selectivity for these contaminants and can eventually become irreversibly fouled and/or require frequent cleaning with alkaline brine solutions. Changes of regeneration level on a seasonal basis to cope with such difficulties are not often practical and operating performance can deteriorate prematurely. The acrylic matrix of **Purolite A-850** has excellent kinetics for the uptake of such organic matter, which adequately compensates for the lower selectivity. The advantage of the lower selectivity is found in the regeneration, where removal is more efficient and hence resin fouling is considerably reduced. Occasional cleaning with alkaline brine will ensure that performance is maintained even where seasonal variation in the organic matter content exists. The more flexible resin structure also provides for good efficiency of regeneration of the anions of salts

removed by demineralization. Indeed this removal is equal to that found for type 2 strong base anion (SBA) resins. Furthermore the uptake of weak acids such as carbonic acid and silica (as mentioned earlier) are comparable to that of conventional polystyrene type I SBA resins.

The typical order of selective uptake of these ions is as follows:



Also, the divalent sulphate ion is (as usual) more efficiently regenerated. Hence a correction to operating capacity has to be made for changing sulphate/total anions ratio in the feed. This is covered more fully later under operating performance.

Another benefit of **Purolite A-850** is its efficiency for silica removal (comparable to a conventional type I SBA resin). Hence low leakage levels can be combined with high operating capacity.

## APPLICATIONS

As can be seen from the above, the main use of **Purolite A-850** is in the demineralization of water high in organic matter when it is placed following a strong acid cation resin. As a result of its high regeneration efficiency it may be used to replace a conventional weak/strong base resin pair. The weak base resin would normally protect the conventional SBA resin from organic fouling. Such protection may no longer be a requirement. For the same reasons it is often possible to dispense with an organic trap resin as a pretreatment.

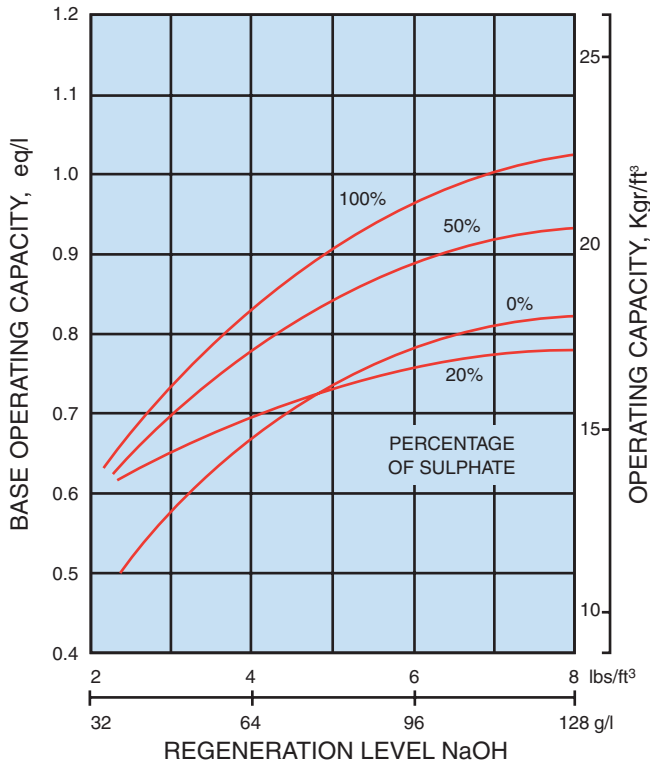
**Purolite A-850** may be used in conjunction with styrene resins which, for example may be placed in mixed beds

after the acrylic anion unit. In this way a wider spectrum of organics is removed and such systems provide a more consistent protection for the mixed bed over a longer period of operation.

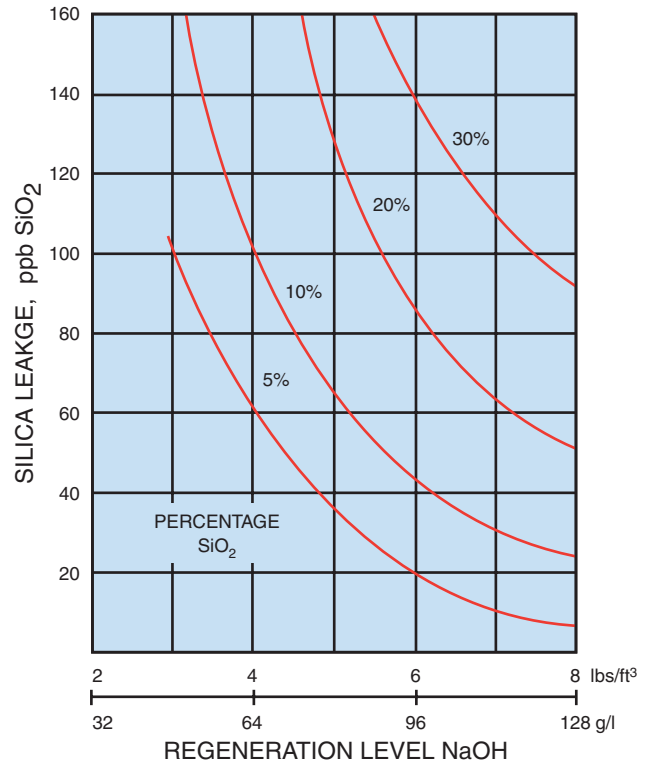
Color removal from various solutions may also be achieved using **Purolite A-850**, however the macroporous counterpart **Purolite A-860** is generally recommended where colour bodies including ones of high molecular weight are present, as for example in the refining of sugar solutions.

# PUROLITE A-850, CO-CURRENT REGENERATION

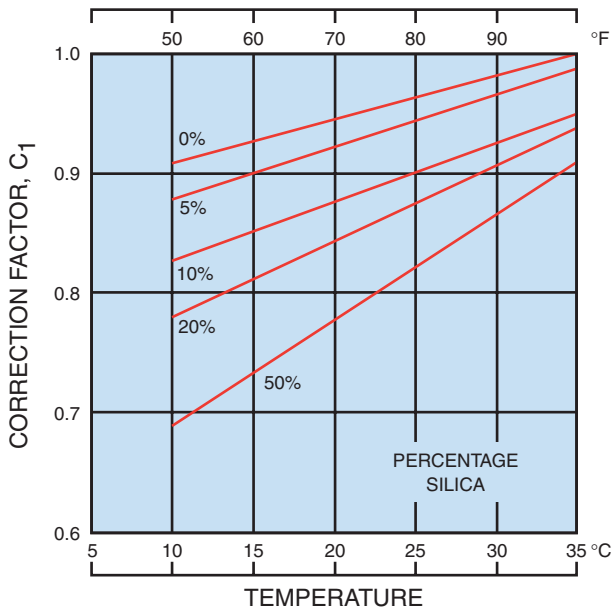
**Fig. 3 OPERATING CAPACITY**



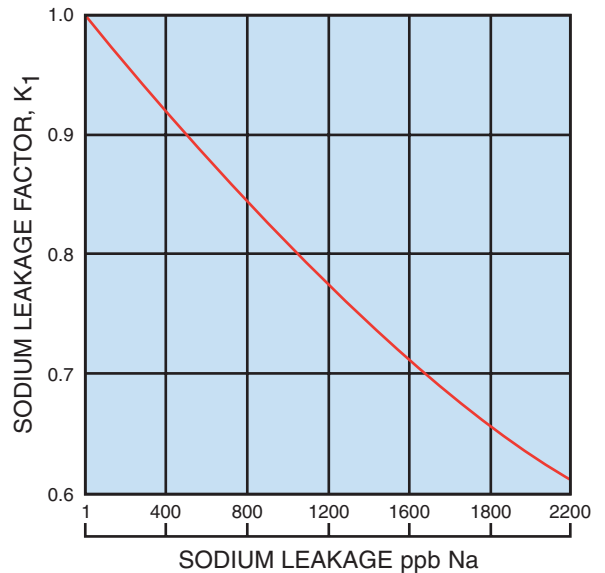
**Fig. 4 SILICA LEAKAGE**



**Fig. 5 CORRECTION FACTOR FOR TEMPERATURE OF REGENERANT**

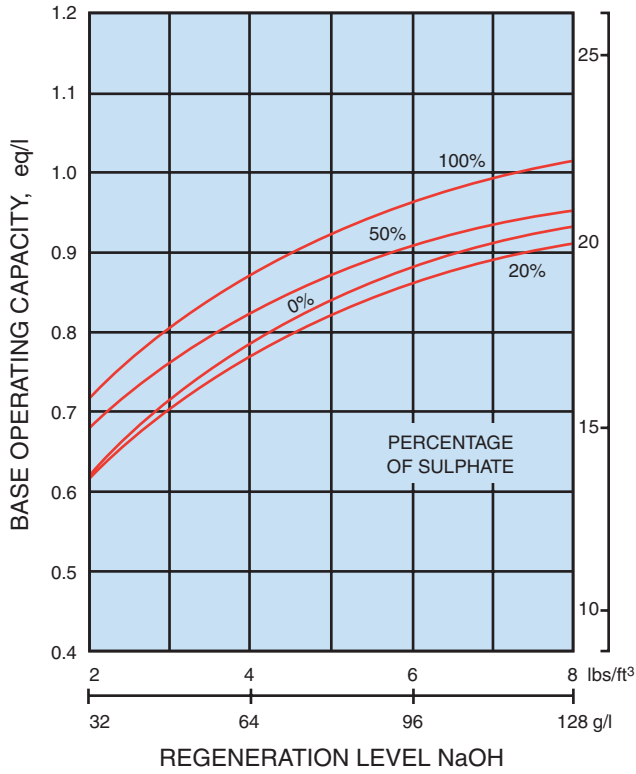


**Fig. 6 CORRECTION FACTOR FOR SODIUM LEAKAGE**

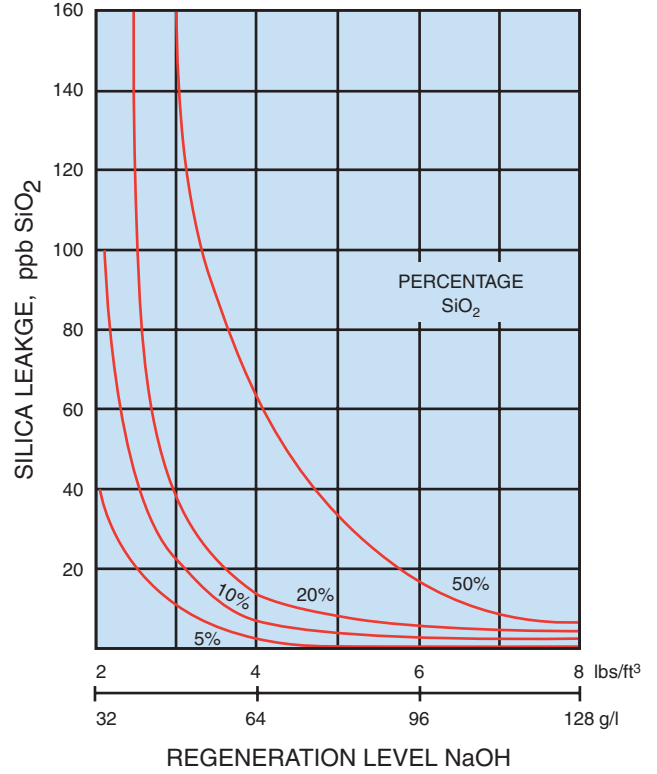


# PUROLITE A-850, COUNTER-CURRENT REGENERATION

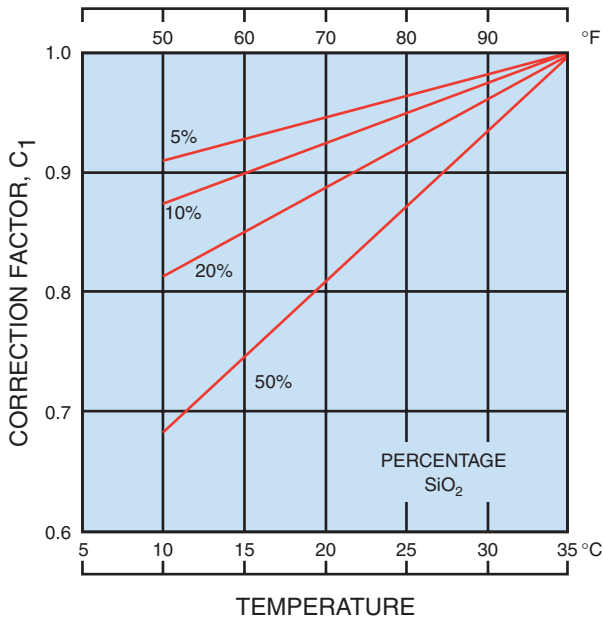
**Fig. 7 OPERATING CAPACITY**



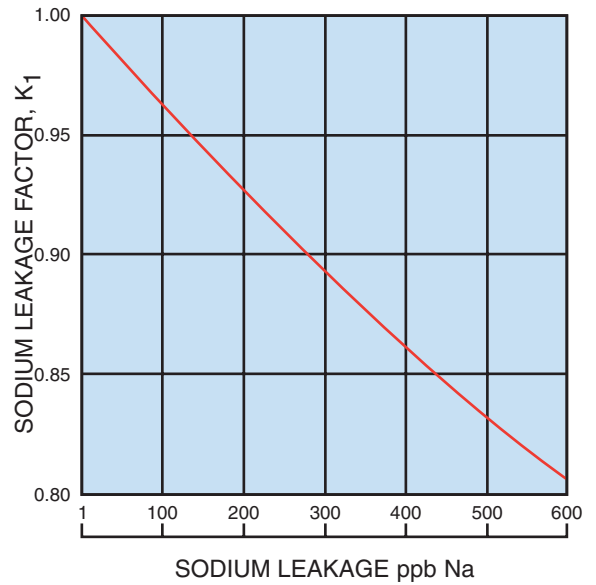
**Fig. 8 SILICA LEAKAGE**



**Fig. 9 CORRECTION FACTOR FOR TEMPERATURE OF REGENERANT**

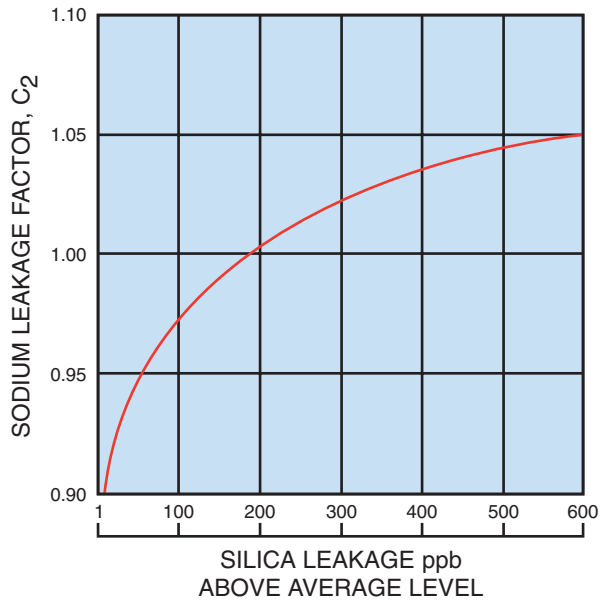


**Fig. 10 CORRECTION FACTOR FOR SODIUM LEAKAGE**

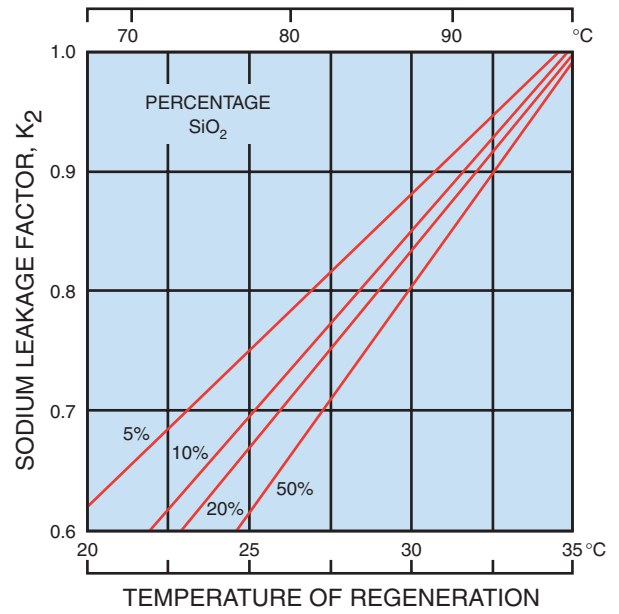


# PUROLITE A-850, CO- AND COUNTER-CURRENT REGENERATION

**Fig. 11 CORRECTION FACTOR FOR SILICA END-POINT LEAKAGE**



**Fig. 12 SILICA LEAKAGE CORRECTION FACTOR FOR TEMPERATURE OF REGENERANT**



## NOTES

**U.S.A.**

The Purolite Company  
150 Monument Road  
Bala Cynwyd, PA 19004  
Phone: (1) 610-668-9090  
Toll Free: 800-343-1500  
Telefax: (1) 610-668-8139  
Email: [sales@puroliteUSA.com](mailto:sales@puroliteUSA.com)

**TEXAS**

The Purolite Company  
1700 West Loop South  
Suite 740  
Houston, TX 77027  
Toll Free: 800-562-6488  
Telefax: (1) 713-627-7890

**CANADA**

The Purolite Company  
625 Wabanaki Drive  
Unit #2  
Kitchener, Ontario N2C 2G3  
Toll Free: 800-461-1500  
or (1) 519-896-6674  
Telefax: (1) 519-896-6679

**UNITED KINGDOM**

Purolite International Limited  
Kershaw House  
Great West Road  
Junction with Lampton Road  
Hounslow, TW5 OBU  
Sales Phone: (44) 181-570-4454  
Telefax: (44) 181-572-7726  
  
European Marketing  
Phone: (44) 181-577-1222  
Telefax: (44) 181-577-1136

**GERMANY**

Purolite Deutschland GmbH  
Harkort Strasse 25  
40880 Ratingen  
Phone: (49) 2102-46033  
Telefax: (49) 2102-443663

**FRANCE**

Purolite International SARL  
34 Avenue Matignon  
75008 Paris  
Phone: (33) 1-4256-4563  
Telex: 648856  
Telefax: (33) 1-4563-3826

**SPAIN**

Purolite Iberica S.A.  
Parc Tecnologic del Valles  
Centre Empreses Noves Technologies  
08290 Cerdanyola del Valles (Barcelona)  
Phone: (34) 3-582-0266  
Telefax: (34) 3-582-0268

**EGYPT**

Purolite International Middle East  
Cairo Liaison Office  
12 Obour Gardens  
Fifth Floor, App. No. 55  
Salah Salem Street  
Nasr City, Cairo  
Phone: (20) 2-4021477  
Telefax: (20) 2-4021478

**ITALY**

Purolite International S.r.l.  
Viale Coni Zugna 29  
20144 Milan  
Phone: (39) 02-481-8145  
Telefax: (39) 02-4801-2359

**ROMANIA**

Purolite Romania  
International Business Center Modern  
B-dul Carol I No. 34-36  
5th Floor  
Bucharest, Sector 2  
Phone: (40) 1-250-5053/5028  
Telefax: (40) 1-250-5999

**POLAND**

Head Office  
Radus Spolka z o.o.  
ul Przebendowskich 33  
81-543 Gdynia  
Phone/Fax: (48) 58-6248118

**GLIWICE**

Radus Spolka z o.o.  
ul Górnych Wałów 25  
44-100 Gliwice  
Phone: (48) 32-315-931  
Telefax: (48) 32-315-931

**SLASK**

Radus Spolka z o.o.  
ul 3 Maja 3/33  
32-600 Oswiecim  
Phone: (48) 33-425-603  
Telefax: (48) 33-425-603

**CZECH & SLOVAK REPUBLICS**

Purolite International  
Nad Mazankou 17  
182 00 Prague 8  
Phone: (420) 2-688-1086  
Telefax: (420) 2-688-1086

**RUSSIA**

Head Office  
Purolite International  
10th Floor  
36 Lyusinovskaya Street  
Moscow  
Phone: (7) 095-564-8120  
Telefax: (7) 095-564-8121

**ST. PETERSBURG**

Purolite International Limited  
12 Building A Tambovskaya St.  
St. Petersburg  
192007 Russian Federation  
Phone: (7) 812-327-8530  
Telefax: (7) 812-327-9079

**KAZAKHSTAN**

Purolite RH Limited  
Office 205  
240 Dostyk AV.  
Almaty 480051  
Phone: (7) 3272-641-234  
Telefax: (7) 3272-641-234

**SINGAPORE**

Purolite International (Singapore)  
PTE Limited  
32-04 The Concourse  
300 Beach Road, 199555  
Phone: (65) 297-0889  
297-1453  
Telefax: (65) 297-1986

**CHINA**

Head office  
Purolite (China) Company, Ltd.  
Chengguan Town  
Deqing County  
Zhejiang Province 313200  
Phone: (86) 572-842-2908  
Telefax: (86) 572-842-3954

**TAIWAN**

Purolite International  
16F-2, No. 191  
Fu-hsing N. Road, Taipei  
Phone: (886) 2-546-7078  
Telefax: (886) 2-546-7069

**MEXICO**

Purolite International, S.A. De C.V.  
World Trade Center  
Montecito 38, Piso 33, Oficina-19  
Mexico D.F. 03810  
Phone: (52) 5-488-0904  
Telefax: (52) 5-488-0906

**UKRAINE**

Purolite International Limited  
2 Korolenko Street.  
Dnepropetrovsk 320070  
Phone: (38) 0562-320-065  
0562-320-066  
Telefax: (38) 0562-320-067

**KOREA**

Purolite International (Korea) LLC  
Dae Yeon Bldg., Suite 403  
943-30 Daechi-dong  
Kangnam-gu, Seoul  
Phone: (82) 2-3453-7062/7063  
Telefax: (82) 2-3453-7064