ION EXCHANGE
Refreshing the Planet

INDION® 225 Na

Softening Application

Description

INDION 225 is a strongly acidic, unifunctional, cation exchange resin containing sulphonic acid groups. It is based on cross linked polystyrene and has a gel structure. The resin is extremely robust and has excellent physical and chemical characteristics.

It is supplied moist in sodium form.

This literature gives information on the operation of INDION 225 for softening application by conventional co-flow and countercurrent regeneration with sodium chloride and salt recycle.

Characteristics

Appearance	:	Golden yellow beads
Matrix	:	Styrene divinylbenzene copolymer
Functional Group	:	Sulphonic acid
Ionic form as supplied	:	Sodium
Total exchange capacity	:	2.0 meq/ml, minimum
Moisture holding capacity	:	43 - 50 %
Shipping weight *	:	830 kg/m^3, approximately
Particle size range	:	0.3 to 1.2 mm
> 1.2 mm	:	5.0%, maximum
< 0.3 mm	:	1.0%, maximum
Uniformity co-efficient	:	1.7, maximum
Effective size	:	0.45 to 0.55 mm
Maximum operating temperature	:	140 ^{0}C
Operating pH range	:	0 to 14
Resistance to reducing agents	:	Good
Resistance to oxidizing agents	:	Generally good, chlorine should be absent

* Weight of resin, as supplied, occupying 1 m^3 in a unit after backwashing and draining.

Operating Capacity

Co-flow regeneration

The operating capacity of INDION 225 in water softening is obtained by multiplying the basic capacity value from Fig. 1/Table 1 by the correction factors A to C from Figs. 2 to 4/Tables 2 to 4.

Countercurrent regeneration (CCR)

The operating capacity of INDION 225 in water softening is obtained by multiplying the basic capacity value from Fig. 5/Table 5 by the correction factors D to F from Fig. 6 to 8/ Tables 6 to 8.

The exchange capacity indicated in the above mentioned figures/tables is for an injection time of 20 minutes. Higher capacity is realised with longer injection periods. A capacity gain of 10% is attained when salt solution is injected for one hour.

Treated Water Quality

The leakage of calcium and magnesium salts from INDION 225 operating as a sodium exchanger is independent of influent hardness upto 1200 mg/1 $CaCO_3$ and influent sodium.

The hardness leakage from INDION 225 is a follows:

Co-flow regeneration < 5 mg/l $CaCO_3$

Countercurrent regeneration < 1 mg/1 $CaCO_3$

When operating on waters beyond the conditions specified, it is recommended to establish accurate leakage data by practical experiment.

Typical operating data

	Co-Flow Regeneration	Counter Current regeneration
Bed depth	0.75 m, minimum	1.0 m, minimum
Treatment flowrate.....	45m^3/h m^2, maximum	45m^3/h m^2, maximum
Pressure loss.....	Refer Figure 9	Refer Figure 9
Bed expansion.....	Refer Figure10	Refer Figure 10
Backwash.....	9m^3/h m^2, for 5minutes or till effluent is clear.	9m^3/h m^2, till effluent is clear*.
Regenerant.....	Sodium chloride (10 - 15% w/v)	Sodium chloride (10 15% w/v)
Regenerant flowrate	2 - 4 bv/h	2 - 4 bv/h
Regenerant injection time.....	20 minutes, minimum	20 minutes, minimum
Slow rinse	1 to 2 bv at regeneration flowrate	1 to 2 bv at regeneration flowrate
Final rinse.....	3 - 4 bv at service flow rate	3 - 4 bv at service flow rate

* After set number of regeneration
1bv (bed volume) = 1 m^3 fluid/m^3 of resin

INDION® 225 Na Co-flow - Softening Data

Determination of Operating Exchange Capacity (Cap)

$$Cap = Cap^0 \times A \times B \times C$$

Table 1
Basic Exchange Capacity (Cap^0) at Different Regeneration Levels

Regeneration Level kg $NaCl/m^3$	Cap^0 kg $CaCO_3/m^3$
80	52.0
100	58.6
130	66.5
160	72.7

BASIC EXCHANGE CAPACITY (Cap^0)

Figure 1

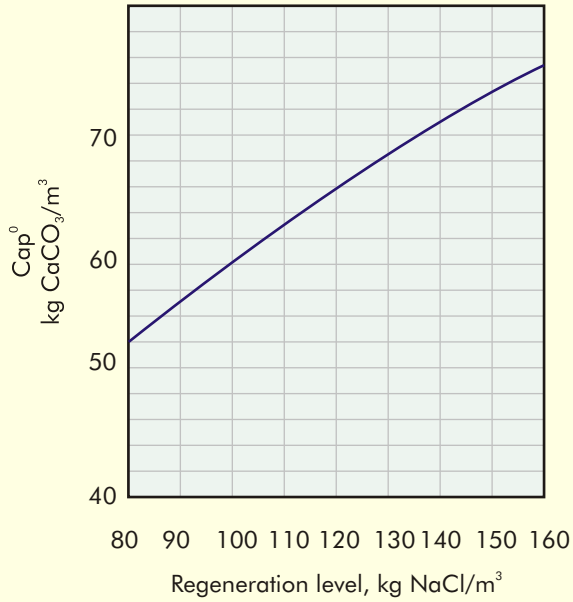
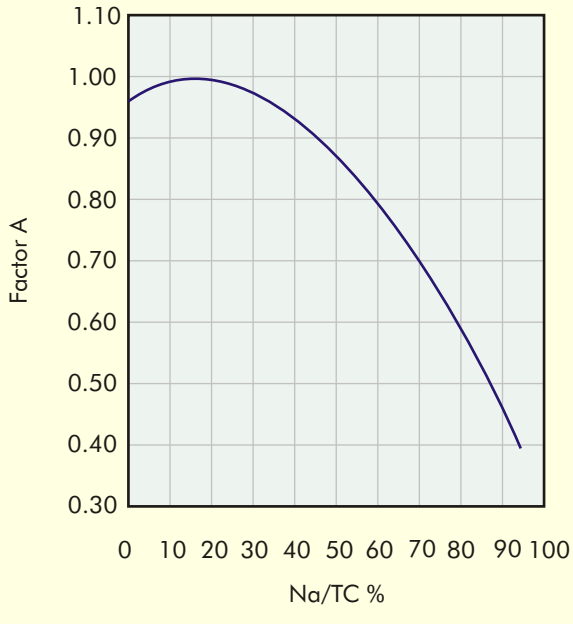


Table 2
Capacity Correction Factor A For Feed Sodium

Na/TC (%)	Factor A
0	0.96
20	1.00
40	0.92
60	0.80
80	0.61
95	0.39

FEED SODIUM

Figure 2



INDION® 225 Na Co-flow - Softening Data

Determination of Operating Exchange Capacity (Cap)

Table 3
Capacity Correction Factor B For Feed Total Hardness

Feed Total Hardness mg/l $CaCO_3$	Factor B
500	1.00
800	0.96
1000	0.93
1200	0.89

FEED TOTAL HARDNESS

Figure 3

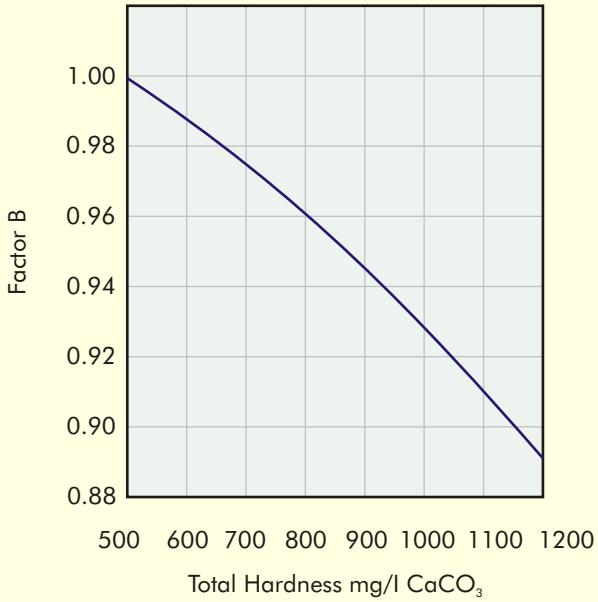
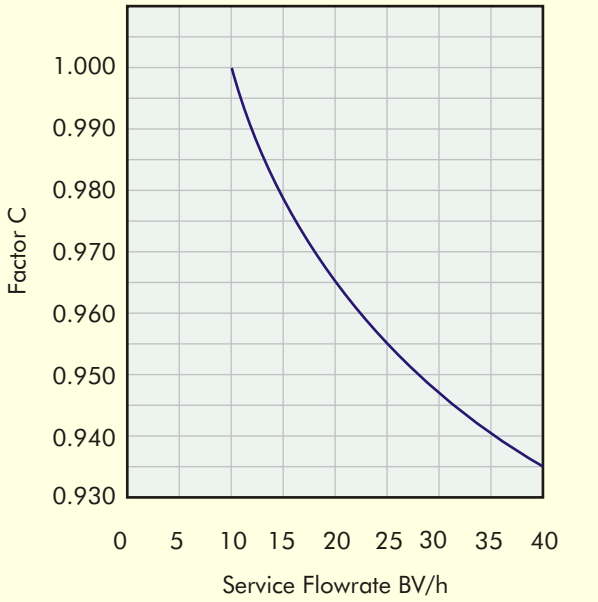


Table 4
Capacity Correction Factor C For Service Flowrate

Service Flowrate BV/h	Factor C
10	1.000
15	0.980
20	0.965
25	0.955
40	0.935

SERVICE FLOWRATE

Figure 4



INDION® 225 Na CCR - Softening Data

Determination of Operating Exchange Capacity (Cap)

$$Cap = Cap^0 \times D \times E \times F$$

Table5
Basic Exchange Capacity (Cap^0) at Different Regeneration Levels

Regeneration Level kg $NaCl/m^3$	Cap^0 kg $CaCO_3/m^3$
80	56.0
100	63.0
130	68.5
160	75.0

BASIC EXCHANGE CAPACITY Cap^0

Figure 5

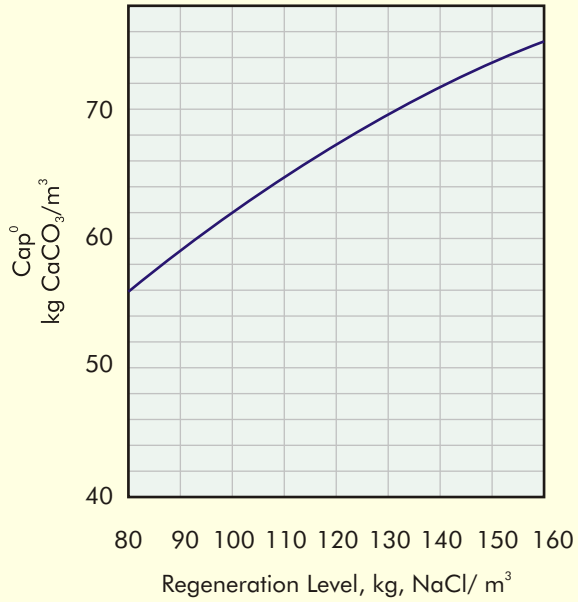
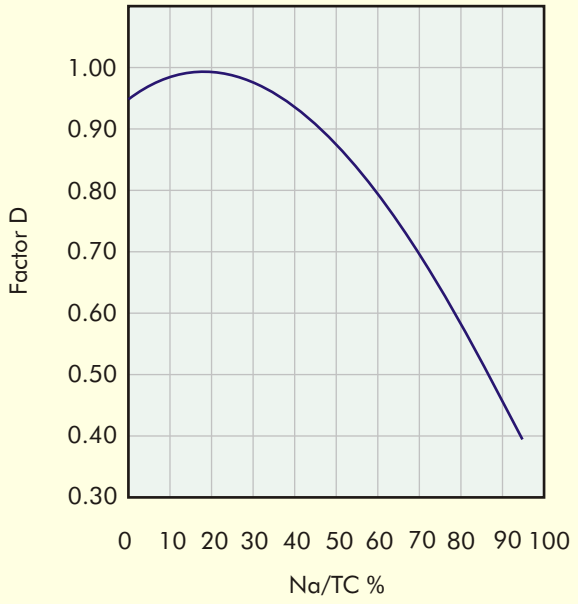


Table 6
Capacity Correction Factor D For Feed Sodium

Na/TC (%)	Factor D
0	0.96
20	1.00
40	0.92
60	0.80
80	0.61
95	0.39

FEED SODIUM

Figure 6



INDION® 225 Na CCR - Softening Data

Determination of Operating Exchange Capacity (Cap)

Table 7
Capacity Correction Factor E For Feed Total Hardness

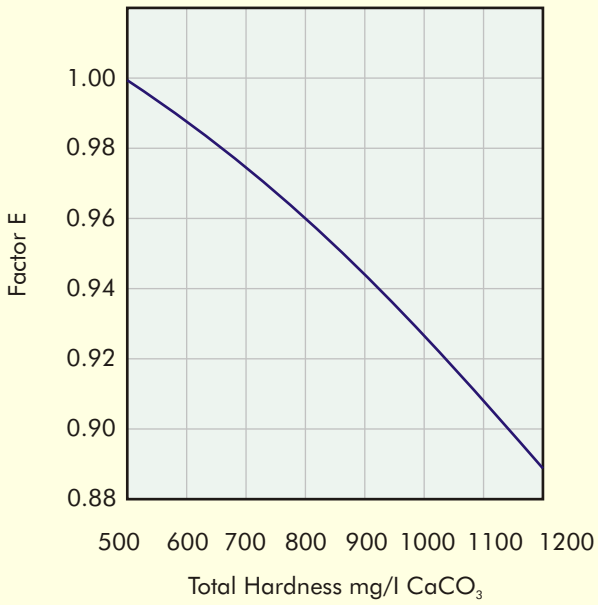
Feed Total Hardness mg/l $CaCO_3$	Factor E
500	1.00
800	0.96
1000	0.93
1200	0.89

Table 8
Capacity Correction Factor F For Service Flowrate

Service Flowrate BV/h	Factor F
10	1.000
15	0.980
20	0.965
25	0.955
40	0.935

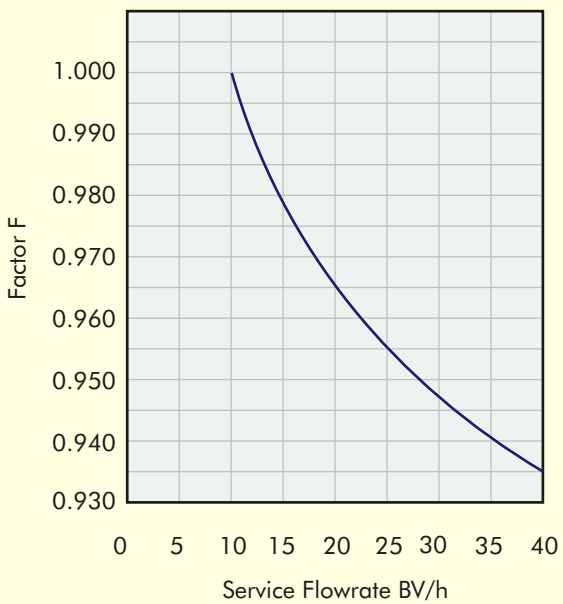
FEED TOTAL HARDNESS

Figure 7



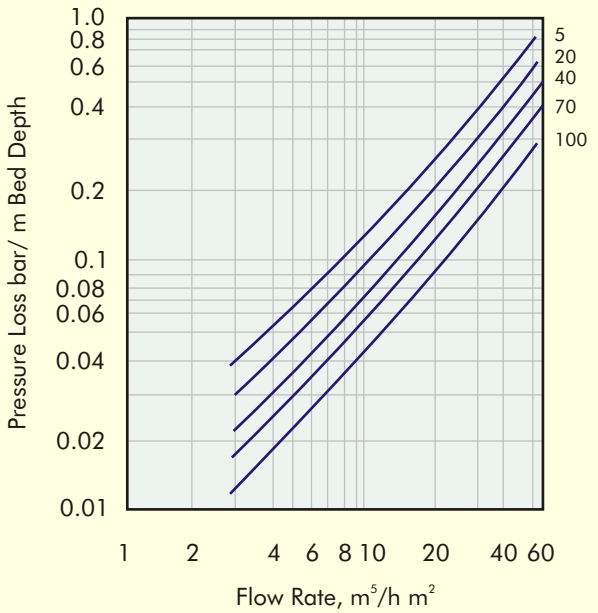
SERVICE FLOWRATE

Figure 8



PRESSURE LOSS

Figure 9



Salt Recycle

Operating conditions

Table 9 shows the effect of regeneration level on the operating exchange capacity. Table 10 gives the correction factors to be applied for feed sodium. These capacities refer to a hardness breakthrough of 5 mg/1 $CaCO_3$.

Table 9
Regeneration level V/s. Operating Exchange Capacity Initial Regeneration Level 130 Kg NaCl/m^3

Fresh Regeneration Level kg. NaCl/m^3	Operating Exchange Capacity kg. $CaCO_3$/m^3
60	42.0
77	53.9
90	60.2

Table 10
Capacity Correction Factor for Feed Sodium

Na/TC (%)	Correction factor
20	1.05
40	1.00
60	0.85
80	0.80

Table 11 give the recommended operating conditions for using INDION 225 in sodium cycle with salt recycle. The technique of salt recycling is employed primarily to improve the regeneration efficiency. Efficiency of upto 80% is easily achieved. The data presented are based on extensive tests using feed water having a total hardness of 275 mg/1 $CaCO_3$ and Na/TC of 40%. The runs were conducted at a flowrate of 12 bv/h.

Table 11
Recommended Operating Conditions

Bed depth	0.75 m, minimum
Treatment flowrate	45 m^3 /h m^2, maximum
Pressure loss	Refer Figure 9
Bed expansion	Refer Figure 10
Backwash	9 m^3/h $m^2$for 5 minutes or till effluent is clear
Regenerant	Sodium Chloride
Regenerant flowrate	2 to 4 bv/h
Rinse	3 bv at service flowrate

Recommended regeneration procedure

In order to obtain optimum results it is suggested that the following steps be followed:-

a) On exhaustion, backwash the unit with filtered water as indicated.

b) Inject the spent brine (collected during the previous regeneration in the spent brine tank) at a flowrate sufficient to give a minimum contact time of 20 minutes. The entire volume is drained.

c) Inject fresh salt sodium (at 10 to 15% w/v NaCl) at a flowrate sufficient to give a minimum contact time of 20 minutes. The initial 0.5 bv containing a low concentration of NaCl and a high concentration of hardness is drained.

d) Collect the balance quantity of regenerant effluent in the spent brine tank.

e) Rinse the unit with filtered water and collect the initial 0.5 bv of the rinse water in the spent brine tank. Drain the balance portion of rinse.

f) The unit is a now ready for the next service run.

BED EXPANSION
Figure 10