ION EXCHANGE
Refreshing the Planet

INDION® 790

Hydrochloric acid Regeneration

Description

INDION 790 is a macroporous strong acid cation exchange resin containing sulphonic acid groups. It is supplied in wet form as dark grey spherical beads. A proper mix of high cross linkage and porosity gives this product outstanding physical stability and makes it extremely resistant to breakdowns by osmotic, mechanical and thermal shock. INDION 790 can be used directly in aqueous systems such as condensate water treatment or in organic media after conditioning with a water miscible solvent. It is also used for chemical processing applications to remove impurities (metal ions) and basic organic compounds (amines etc.) from aqueous and non aqueous systems (appropriate pretreatment is required).

Characteristics

Appearance	:	Opaque dark grey beads
Matrix	:	Styrene divinylbenzene copolymer
Functional Group	:	Sulphonic acid
Ionic form as supplied	:	Hydrogen, H^+
Total exchange capacity in Na form	:	1.9 meq/ml, minimum
Moisture holding capacity	:	51- 55 %
Shipping weight *	:	740 kg/m^3 approximately
Particle size range	:	0.3 to 1.2 mm
> 1.2 mm	:	5.0%, maximum
< 0.355 mm	:	1.0%, maximum
Uniformity co-efficient	:	1.7, maximum
Effective size	:	0.45 to 0.60 mm
Maximum operating temperature	:	120^0 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 & draining.

Applications

De-ionising

INDION 790 in hydrogen form is used as a first step in de-ionising. Technical data for counter current regeneration is given in this literature.

Two stage de-ionising

Two stage de-ionising uses two units in series - the first containing INDION 790 as cation exchanger and second containing strong base anion exchanger Type I resins such as INDION FFIP/GS 300/810 or Type II resins such as INDION NIP/GS 400/820.

Mixed bed de-ionsing

When treated water of highest possible quality is required, INDION 790 strong acid cation exchange resin is used with INDION FFIP in a mixed bed unit. A mixed bed is often operated as the last unit in a de-ionising stream to act as a polisher for producing water of highest quality.

Typical operating data

Two stage/multiple stage de-ionising

	Counter Current regeneration
Minimum bed depth	1.0 m
Treatment flowrate	45 $m^3/h\ m^2$, maximum
Pressure loss	Refer Figure 7
Bed expansion	Refer Figure 6
Backwash.....	9 $m^3/h\ m^2$ till effluent is clear*
Regenerant	Hydrochloric acid (2.5 to 5.0% w/v)
Regenerant flowrate	3 - 18 $m^3/h\ m^2$
Regenerant injection time	20 minutes, minimum
Slow rinse	2-3m^3/m^3 at injection flowrate
Final rinse.....	For 5 minutes at treatment flowrate

* After a set number of regenerations

Operating Exchange capacity

Operating exchange capacity of INDION 790 in counter current mode depends on :

- Regeneration level
- Alkaline content of feed water
- Sodium content of feed water
- Active bed-depth

Figures 1, 2, 3 and 4 give operating exchange capacity and correction factor of INDION 790 in counter current regeneration mode.

Regeneration

Counter current regeneration

The concentration of hydrochloric acid used in regeneration is 2.5 to 5 % w/v. For acid dilution and rinsing, decationised water must be used.

To prevent the disturbance of the resin bed during upward acid injection and uprinse, use of down flow of water is employed. Alternatively, a downward air pressure can also be used for the same purpose. Backwashing of complete bed, during every regeneration is not desirable and only subsurface wash must be employed.

Whenever the counter current unit is backwashed, higher than the normal quantity of regenerant has to be used in subsequent injection operation.

Thoroughfare regeneration

When the alkaline hardness is high, use of INDION 236 weak acid cation exchanger preceding INDION 790 is recommended.

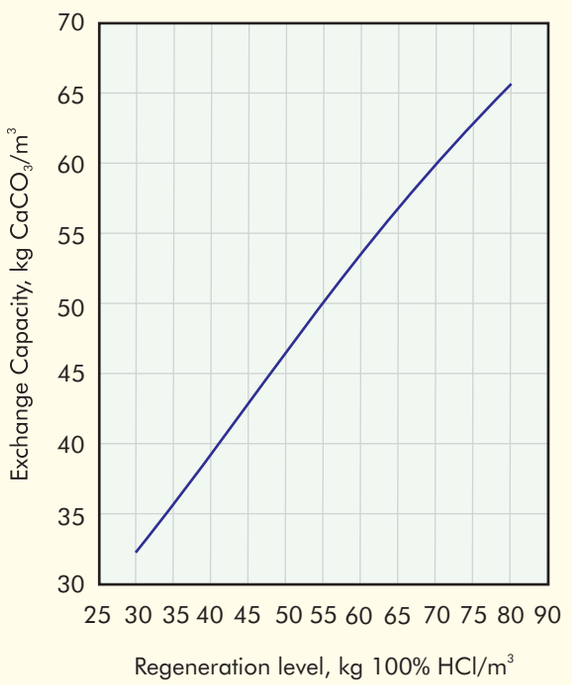
In such cases, the regeneration can be conducted first through strong acid cation exchanger, followed by weak acid cation exchanger. The waste acid from the strong acid cation exchanger is utilised to regenerate the weak acid cation exchanger. This process improves the utilisation of acid and minimises the effluent while obtaining highest quality treated water. This process is commonly referred to as thoroughfare regeneration.

Treated water quality

The exchange capacities of INDION 790 in counter current mode of regeneration are shown in Figure 1. These are based on end point of one ppm of sodium slip expressed as $CaCO_3$. For sodium slip less than one ppm, consult us.

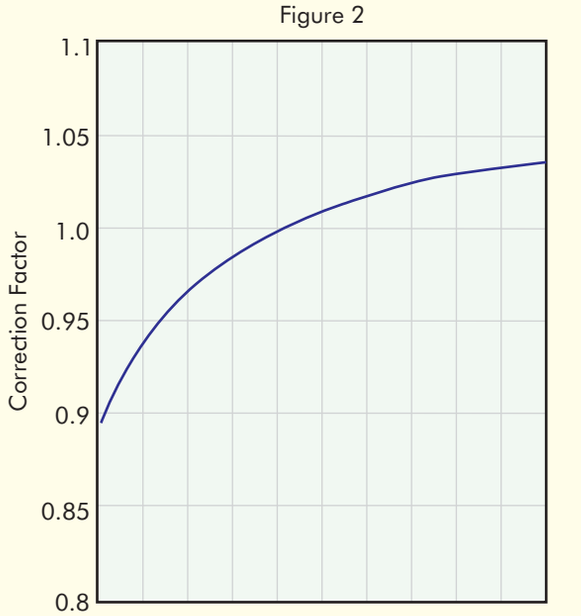
OPERATING EXCHANGE CAPACITY (CCR)

Figure 1



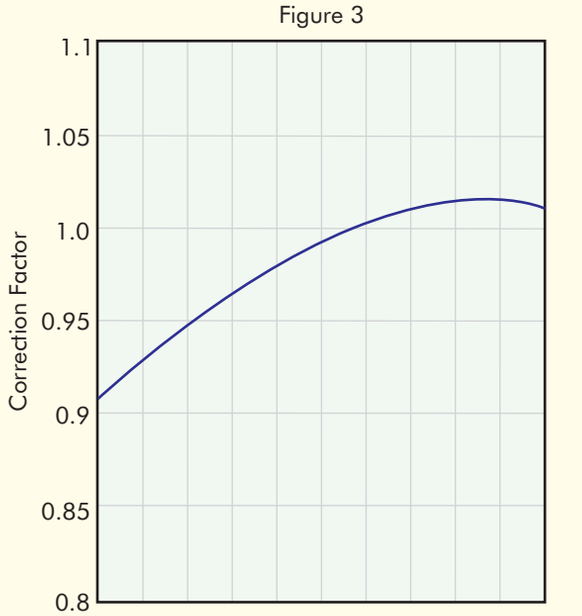
CORRECTION FACTOR FOR FEED SODIUM (CCR)

Figure 2



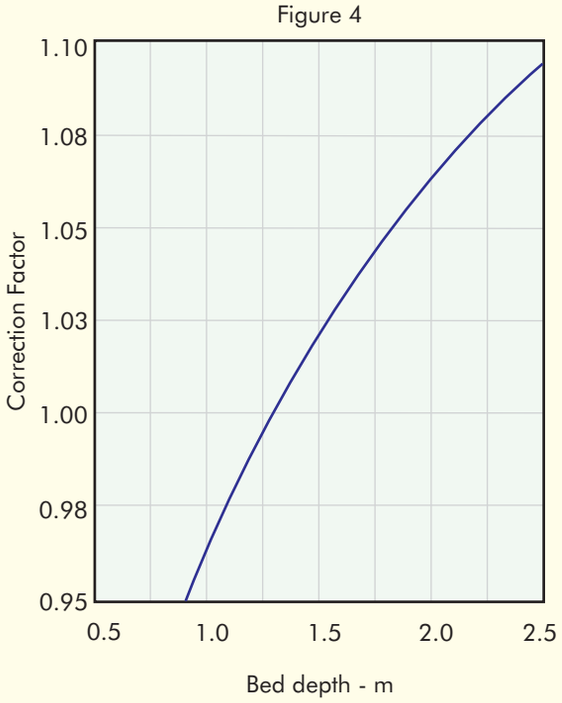
ALKALINE FACTOR FOR FEED ALKALINITY (CCR)

Figure 3



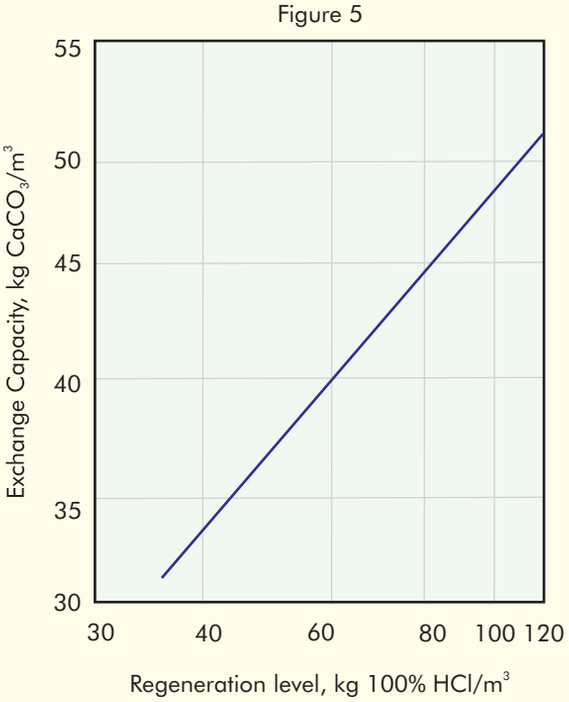
CORRECTION FACTOR FOR BED DEPTH (CCR)

Figure 4



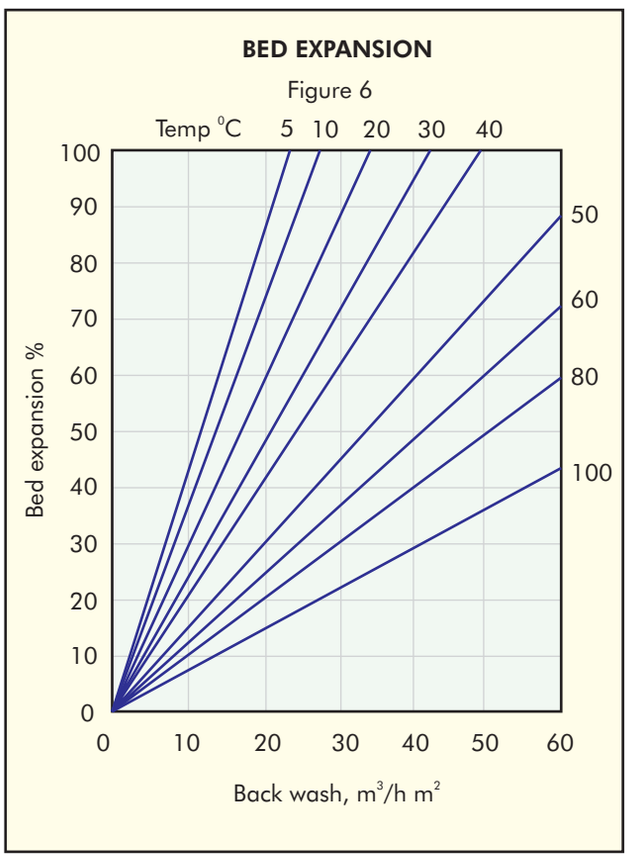
OPERATING EXCHANGE CAPACITY MIX BED DE-IONISING

Figure 5



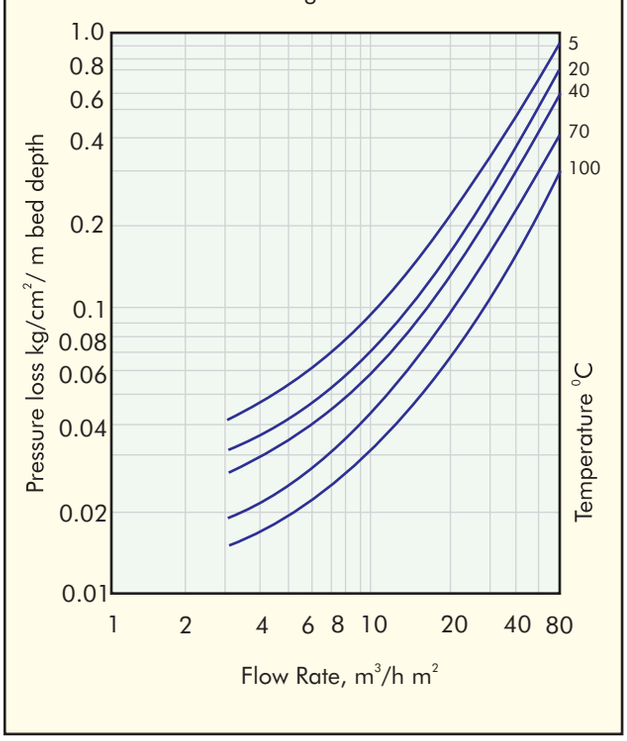
BED EXPANSION

Figure 6



PRESSURE LOSS

Figure 7



Mixed bed de-ionsing

When used as the cation exchanger in a mixed bed unit, variation with feed water composition in operating exchange capacity is less than that, in two stage deionising. For practical purposes, feed water may be classified as

- Ion exchange softened or demineralised
- Low ionic load influent.

In both cases, INDION 790 may be regenerated with hydrochloric acid of 5% concentration.

Figure 5 gives operating exchange capacity when used in a mixed bed unit.

Typical operating data

Mixed bed de-ionising

Total Bed depth	1.2 2.4 m using INDION 790 and INDION FFIP
Rising space	75% of bed depth
Treatment flowrate	60 $m^3/h\ m^2$, maximum
Pressure loss.....	1.2 kg/cm^2, maximum when using INDION 790 & INDION FFIP
Bed separation	9 $m^3/h\ m^2$ for 10 minutes
Bed settlement	Allow 5 minutes for separation before commencing injection of regenerants
Acid injection rate	3-18 $m^3/h\ m^2$ for 6-10 minutes with 3-5% w/v concentration
Downflow	1.5 $m^3/h\ m^2$
Acid rinse	2 m^3/m^3 in 10-15 minutes
Unit drain down	Before remixing the resins, the water level should be lowered to approximatly 0.4 m above the bed
Bed re-mixed	2 m^3/minute m^2 oil free air at 0.4 kg/cm^2 pressure for 10 minutes
Settle bed, refill unit, ... final rinse	These operations should be carried out in such a way to avoid separation of the two resins. Final rinse to satisfactory water quality should be effected at the treatment flowrate, or at 24 $m^3/h\ m^2$, whichever is greater. Total time required is normally about 5-10 minutes depending upon end point conductivity required.

Use of good quality regenerants

All ion exchange resins are subject to fouling and blockage of active groups by precipitated iron. Hence the iron content in the feed water should be low and the regenerant must be essentially free from iron and heavy metals. All resins are prone to oxidative attack, resulting in problems such as loss of physical strength. Therefore, the regenerant should have as low chlorine content as possible. Good quality regenerant of technically or chemically pure grade should be used to obtain best results.

Packing

HDPE lined bags	25/50 lts	LDPE bags	1cft/25 lts
Super sack	1000 lts	Super sack	35 cft
MS drums with liner bags	180 lts	Fiber drums with liner bags	7 cft

Storage

Ion exchange resins require proper care at all times. The resin must never be allowed to become dry. Regularly open the plastic bags and check the condition of the resin when in storage. If not moist, add enough clean demineralised water and keep it in completely moist condition. Always keep the resin drum in the shade. Recommended storage temperature is between 20^0 C and 40^0 C.

Safety

Acid and alkali solutions are corrosive and should be handled in a manner that will prevent eye and skin contact. If any oxidising agents are used, necessary safety precautions should be observed to avoid accidents and damage to the resin.

INDION range of Ion Exchange resins are produced in a state-of-the-art ISO 9001 and ISO 14001 certified manufacturing facilities at Ankleshwar, in the state of Gujarat in India.

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