TECHNICAL BULLETIN
INDION® ISR (IRON SPECIFIC RESIN)

ION EXCHANGE (I)Ltd
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INTRODUCTION

Iron is a common metallic element found in nature. Water percolating through soil and rocks dissolves iron present in it, which subsequently enters into ground water bodies. In deep wells and springs, where both oxygen and pH content tend to be low, water containing dissolved iron appears colorless. When the same water is exposed to air, the dissolved iron reacts with atmospheric oxygen and converts to yellow colored suspended particles which finally forms a reddish brown residue. High concentration of iron cause reddish brown stains on laundry and household fixtures, sometimes clogs water distribution pipes and imparts a bittersweet or metallic taste to drinking water.

The following types of iron can be found in potable water supplies:
- Sequestering iron
- Organic Iron - “Heme Iron”
- Iron Bacteria
- Ferric Hydroxide or Red Water Iron
- Ferrous Bicarbonate or Clear Water Iron

We see that iron is found in many different forms. There is a problem for the removal of iron from water as treatment methods for removal of iron differ for each type of iron. In India there is an acute problem of iron in water. The concentration of iron ranges from 1 - 20 ppm in areas such as West Bengal, Assam, Tripura, Chhattisgarh and in the east coast (Chennai and surrounding areas). This problem is faced in countries like Bangladesh, Malaysia and Kenya as well as in some part of United State.
CONVENTIONAL IRON REMOVAL METHODS

1. Oxidation & Chemical Precipitation Methods
Aeration, chlorine and ozone are generally used to precipitate iron in a retention tank. Supernatant water is then passed through sand filter to get iron free water.

Demerits: This requires large space and continuous monitoring. Precipitated iron may cause clogging and rusting of pipes which affects the treatment cost.

2. Use of Green Sand
Naturally occurring green sand coated with manganese results in purple-black media and acts as catalyst to precipitate iron and manganese.

Demerits: As density of media is $> 1.5$, the required backwash pressure and flow is high. Continuous regeneration increases the chemical and operating cost of the unit.

3. Ion exchange water softener
Can treat low level iron concentration. ($< 1 - 5$ ppm)

Demerits: Cleaning of resin is difficult. Oxidized iron may reduce the operating capacity of softener resin.
INDION® ISR

INDION® ISR*(Iron Specific Resin) is based on ion exchange resin technology and has manganese dioxide as a catalytic moiety. It works as a catalyst to promote iron oxidation. Basically, iron and oxygen are attracted to manganese dioxide, which enhances the oxidation of dissolved iron and converts the soluble iron (Fe++) into insoluble ferric (Fe+++), which can be filtered through the media that acts as catalyst in this process and does not get consumed. In this reaction, manganese dioxide is reduced to manganese oxide and ferric hydroxide is precipitated. During backwash, the surface of this material is scoured, converting it to MnO₂, which is further used to oxidise the iron. Simple backwash regenerates manganese dioxide. No chemicals are required to regenerate the resin.

*-indion® ISR is a product of Ion Exchange and has been patented

UNIQUE FEATURES

The media size ranges from 0.3 to 1.2 mm therefore it also acts as filter media, apart from iron precipitation.

The media is not getting consumed in the process of iron removal; as a result media has longer life.

The media can be easily backwashed for removal of filtered iron from the bed, and does not require regeneration.

The catalytic oxidation by the media requires less contact time and hence less bed depth.

Negligible labor and operational cost.

Due to spherical beads, media undergoes less compaction.

Increased Service velocity at lower feed iron content, resulting in cost reduction.

Operable in a wide range of temperature (20-45° C)

Operates with high TDS (up to 2500ppm) and lower alkalinity level.

Easily adaptable.
CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Black</td>
</tr>
<tr>
<td>Physical Form</td>
<td>Beads</td>
</tr>
<tr>
<td>Wet screen grading</td>
<td>0.3-1.2mm</td>
</tr>
<tr>
<td>Osmotic Strength</td>
<td>Good</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>46-52%</td>
</tr>
<tr>
<td>Mechanical strength</td>
<td>Good</td>
</tr>
<tr>
<td>Voids</td>
<td>40% approximately</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>0.8 kg/lit</td>
</tr>
<tr>
<td>Particle Density (Wetted in water)</td>
<td>1.23 kg/lit</td>
</tr>
<tr>
<td>Uniform coefficient</td>
<td>1.7max</td>
</tr>
<tr>
<td>Effective size</td>
<td>0.45-0.5mm</td>
</tr>
<tr>
<td>Approximate shipping weight</td>
<td>760 kg/m³</td>
</tr>
</tbody>
</table>

RECOMMENDED INFLUENT LIMITATIONS

U.S. Environmental Protection Agency have listed iron and manganese in secondary drinking water standards, applicable to drinking water contaminants that cause offensive taste, odor, color, corrosion, foaming or staining problems. Secondary drinking water contaminants do not pose risks to humans at the levels usually found in natural water.

As per USEPA (June 2003) and WHO Guideline 2006, drinking water standard for iron is 0.3 ppm.
DESIGN GUIDELINES

- **pH**: >6.5
- **Dissolved Oxygen**: Greater than 15% of Iron Content
- **Alkalinity**: 100 ppm minimum
- **Hydrogen Sulfide**: Nil
- **Oil**: Nil
- **Free Chlorine**: Nil
- **Organic matter**: <1.0ppm
- **Total Dissolved solids**: 2500ppm max.
- **Total suspended solids**: 10 ppm max
- **Temperature range**: 15-45°C (59-113°F)

SUGGESTED OPERATING CONDITIONS

**Upto 10.0 ppm feed iron**
- **Bed depth**: 0.7 - 1.5 m minimum
- **Service velocity**: 15 m/h
- **Backwash velocity**: 26-30 m/h
- **Backwash bed expansion**: 40-50%
- **Backwash time**: 15-20mins
- **Backwash frequency**: 8-10 hrs or ΔP of 1.0kg/cm² whichever is earlier

**Upto 5.0 ppm feed iron**
- **Bed depth**: 0.5 - 1.5 m minimum
- **Service velocity**: 15-20 m/h
- **Backwash velocity**: 26-30 m/h
- **Bed wash bed expansion**: 40-50%
- **Backwash time**: 15-20mins
- **Backwash frequency**: once in 10-12 hr or ΔP of 1.0kg/cm² whichever is earlier
DESIGN GUIDELINES
SIZING OF DE-FERROUS UNIT

Check the raw water analysis thoroughly, so that it meets all limiting conditions. Provide necessary pretreatment to condition the water to meet feed water limiting conditions.

Note the iron content in feed water and select appropriate service velocity from the suggested operating conditions.

Calculate the diameter required for the selected velocity. If the standard FRP vessel is used, select nearest higher diameter and has height sufficient for required bed depth and expansion.

Select required bed depth based on iron content in feed water. Calculate quantity of media required.

Calculate HOS (height on straight) of the vessel considering 50-60% bed expansion. The media can be directly supported on strainer on plate system. Add 0.4 m in HOS, if underbed system is used for media support.

Calculate backwash flow rate at 24-30 m/h velocity. Provide adequate pump to cater backwash flow requirement. Provide a separate backwash water tank and pump for iron content of 8 ppm and above so as to carry out backwash with iron free water.
### TECHNICAL SUPERIORITY OF INDION ISR

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Characteristics</th>
<th>INDION® - ISR</th>
<th>Catalytic 1</th>
<th>Catalytic 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Color</td>
<td>Black</td>
<td>Black</td>
<td>Blackish grey</td>
</tr>
<tr>
<td></td>
<td>Shape</td>
<td>Beads</td>
<td>Granules/Pellets</td>
<td>Granules/Pellets</td>
</tr>
<tr>
<td></td>
<td>Size (mm)</td>
<td>0.3 to 1.2</td>
<td>0.1 to 0.25</td>
<td>0.5 to 1.5</td>
</tr>
<tr>
<td></td>
<td>Effective size</td>
<td>0.5 - 0.6 mm</td>
<td>0.6 - 0.66 mm</td>
<td>0.61 mm</td>
</tr>
<tr>
<td></td>
<td>True density (g/cc)</td>
<td>1.2</td>
<td>Not stated</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Bulk density (g/cc)</td>
<td>0.8</td>
<td>1.5</td>
<td>0.750</td>
</tr>
<tr>
<td></td>
<td>Uniform coefficient</td>
<td>1.5 to 1.7</td>
<td>1.4 to 1.7</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>Attrition loss per annum (%)</td>
<td>1-2</td>
<td>1 to 5</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

**Attrition loss per annum % (depend on water condition and pressure)**

<table>
<thead>
<tr>
<th></th>
<th><strong>Operating conditions</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Water pH range</td>
<td>6.5 to 8.5</td>
<td>5.8 to 8.6</td>
<td>7.0 to 7.5</td>
</tr>
<tr>
<td></td>
<td>Feed Alkalinity, minimum ppm</td>
<td>100 ppm</td>
<td>-----</td>
<td>&gt;2 times EMA</td>
</tr>
<tr>
<td></td>
<td>Bed depth minimum (mm)</td>
<td>500 mm</td>
<td>600 mm</td>
<td>700 mm</td>
</tr>
<tr>
<td></td>
<td>Free board</td>
<td>40% of bed depth min.</td>
<td>40% of bed depth min.</td>
<td>40% of bed depth min.</td>
</tr>
<tr>
<td></td>
<td>Service</td>
<td>Downward</td>
<td>Continuous chlorination is required to remove iron</td>
<td>Downward</td>
</tr>
<tr>
<td></td>
<td>Regeneration</td>
<td>Not required</td>
<td>Not required</td>
<td>Not required</td>
</tr>
<tr>
<td></td>
<td>Activation of media</td>
<td>Only backwash</td>
<td>Sodium hypochlorite for iron and sodium hydroxide for manganese</td>
<td>Only backwash</td>
</tr>
<tr>
<td></td>
<td>Service flow rate (m/h)</td>
<td>10-25 m/h</td>
<td>1-30 m/h</td>
<td>10-15 m/h</td>
</tr>
<tr>
<td></td>
<td>Backwash flow rate (m/h)</td>
<td>24 - 30 m/h max.</td>
<td>Between 25-80 m/h</td>
<td>25 m/h</td>
</tr>
<tr>
<td></td>
<td>Pretreatment of water</td>
<td>None</td>
<td>Yes (media activation)</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Operating chemical cost</td>
<td>None</td>
<td>Yes</td>
<td>None</td>
</tr>
</tbody>
</table>
AVERAGE PRESSURE DROP STUDY
Service velocity = 10-15m/hr, Iron = 10 ppm, Number of cycles = 10

BACKWASH EFFICIENCY
APPLICATIONS OF INDION ISR

POU device (POU)
- Pre-treatment to drinking water systems
- Household applications like pretreatment to washing machines, bathroom showers
- Other Domestic Applications

HPA Unit
- Directly attach to Hand pump, Ideal for Rural communities
- Sturdy, Economical, No chemicals and Electricity required. Hence applicable in remote areas
- Drinking water for residential colonies and commercial complexes

Community Based units
- Suitable for Hospitals, Hotels, schools, college, corporate offices and other institutions

Industrial plants
- Pre-treatment for Industrial water treatment plants
- Beverage, Food processing and mineral water
- Pre-treatment to cooling towers
POUNTOF USE (POU) UNIT

- POU device is an online iron removal gravity filter that handles 90 litres per hour. In this mode, the knob should be in straight position.

- The raw water enters from the inlet port and passes through the resin bed in downward direction which facilitates the conversion of dissolved iron to insoluble iron.

- This precipitated iron settles down on the resin bed and water free of iron is then pushed through the bottom distributor through the riser pipe to the outlet port.

- The product water will be delivered through outlet port. In this mode drain port will not be active. In this way the unit delivers iron free water.

- In backwash mode, the knob should be turned anticlockwise. During backwash mode the flow of water is reversed.

- The incoming water passes through the riser pipe and flows upwards through the resin media. During this reverse flow, the resin bed is loosened and trapped dirt, precipitated iron is flushed through the drain port. There will be no water at the outlet port.
HAND PUMP ATTACHMENT (HPA) UNIT

UNIQUE FEATURES

• Sturdy
• Economical
• Does not require Electricity.
• Simple to operate
• No chemicals required
• Ideal for rural applications
• Long Life
• Flow of Unit is 8-10 lpm
POINT OF ENTRY (POE) DEVICE

- De-ferrous POE is a complete house water conditioning plant, which will be primarily connected to direct source of ground water.

- De-Ferrous 500 has FRP vessel which contains filter media. The performance of the unit is controlled by semi-automatic valve, which is mounted on the tank.

- The iron contaminated water enters through the inlet of the valve, and passes through the filter media where dissolved ferrous iron is converted to ferric iron which is insoluble in water and gets trapped in the iron removal media.

- The treated water which comes out of the outlet, is devoid of excessive iron. After consistent use, the filter media gets clogged with the iron precipitate and the unit needs to be backwashed. In order to do this, the same inlet water is injected into the vessel under high pressure for 15 - 20 minutes.

- The filter media gets rubbed against each other thereby releasing the trapped iron precipitate which is washed out through the drain. Performance of De-ferrous depends entirely on the backwash. It is mandatory to do backwash regularly to ensure that you get iron free water at all times.

UNIQUE FEATURES

- Economical
- Sturdy
- Simple to operate
- Maintenance free
- Produces consistent quantity and quality of treated water.
- No Chemicals required for regeneration. Backwash is sufficient
- Ideal for rural, domestic, commercial and industrial applications
# STANDARD SYSTEMS FOR DOMESTIC AND INDUSTRIAL DESIGN

<table>
<thead>
<tr>
<th>Model</th>
<th>Flow Rate (m³/hr)</th>
<th>Applications</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STANDARD SYSTEMS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGIF 10</td>
<td>1.0</td>
<td>Domestic</td>
<td>• One vertical cylindrical mild steel pressure vessel with dished ends, rubber lined internally and protection coat externally</td>
</tr>
<tr>
<td>NGIF 20</td>
<td>2.0</td>
<td>Domestic</td>
<td>• One set of internal water distribution and collection system.</td>
</tr>
<tr>
<td>NGIF 50</td>
<td>5.0</td>
<td>Domestic</td>
<td>• One initial charge of under bed material and ISR resin</td>
</tr>
<tr>
<td>NGIF 75</td>
<td>7.5</td>
<td>Domestic</td>
<td>• One set of frontal pipework and valves</td>
</tr>
<tr>
<td>NGIF 100</td>
<td>10.0</td>
<td>Domestic</td>
<td>• Two pressure gauges to monitor headloss across the IRF system.</td>
</tr>
<tr>
<td><strong>INDUSTRIAL APPLICATIONS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRF 1200</td>
<td>17.0</td>
<td>Industrial</td>
<td>• One orifice board for indication; wash water flow to be fitted in drain sump</td>
</tr>
<tr>
<td>IRF 1400</td>
<td>23.0</td>
<td>Industrial</td>
<td>• Maximum/Minimum operating pressure will be 3.5 kg/cm²gm and 2.0 kg/cm²gm respectively</td>
</tr>
<tr>
<td>IRF 1600</td>
<td>30.0</td>
<td>Industrial</td>
<td>• INDION IRF systems are extended range upto 3000 mm diameters.</td>
</tr>
<tr>
<td>IRF 1800</td>
<td>38.0</td>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>IRF 2000</td>
<td>47.0</td>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>IRF 2200</td>
<td>57.0</td>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>IRF 2400</td>
<td>67.0</td>
<td>Industrial</td>
<td></td>
</tr>
</tbody>
</table>

* - INDION® New Generation Iron Filters (NGIF) are the first of their kind. Please contact our regional offices for detailed information and current product specifications.
PACKAGING, STORAGE AND SAFETY

Packing Specifications

The resin is supplied in 180 lit of mild steel with plastic liner or in plastic drum. It can also supplied in 50 lit bags.

Storage

INDION®-ISR requires proper care at all times. The media should not be stored in a dry condition. Always keep the resin drum in the shade. Recommended temperature is between 20° to 40° C
The INDION range of ion exchange resins are produced in the company's state-of-the-art ISO 9001 and ISO 14001 certified manufacturing facility at Ankleshwar, in the state of Gujarat in India. This datasheet [issues 03/2006] replaces previously issued datasheet.

To the best of our knowledge the information contained in this publication is accurate. Ion Exchange (India) Ltd. maintains a policy of continuous development and reserves the right to amend the information given herein without notice.

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