# PRODUCT INFORMATION

## Shallow Shell™ SSTC60 Resin for Softening

This Product Information brochure details the advantages of SSTC60 high-performance gel strong acid cation resin for potable and non-potable softening applications.

Purolite®

## SHALLOW SHELL™ SSTC60 RESIN FOR SOFTENING

This Product Information brochure explains the functionality, advantages and applications for Purolite Shallow Shell SSTC60 resin. For more detailed information on this product or to find a product for an application not mentioned, please go to www.purolite.com or contact the closest Purolite regional office to you as listed on the back cover.

### INTRODUCTION

Founded in 1981, Purolite is a leading manufacturer of ion exchange, catalyst, adsorbent and specialty resins. With global headquarters in the United States, Purolite is the only company that focuses 100% of its resources on the development and production of resin technology.

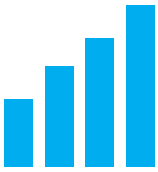
Responding to the needs of our customers, Purolite has built the largest technical sales force in the industry, the widest variety of products and five strategically located Research and Development groups. Our ISO 9001 certified manufacturing facilities in the U.S.A, Romania and China combined with more than 40 sales offices in 30 countries ensure complete worldwide coverage.

### PREMIER PRODUCTS

The quality and consistency of our products is fundamental to our performance. Throughout all Purolite plants, production is carefully controlled to ensure that our products meet the most stringent criteria, regardless of where they are produced.

### RELIABLE SERVICE

We are technical experts and problem solvers. Reliable and well trained, we understand the urgency required to keep businesses operating smoothly. Purolite employs the largest technical sales organization in the industry.



### INNOVATIVE SOLUTIONS

Our continued investment in research & development means we are always perfecting and discovering innovative uses for ion exchange resins and adsorbents. We strive to make the impossible possible.

Shallow Shell™ SSTC60 is a very different polystyrenic gel strong acid cation exchange resin used in potable and non-potable water softening applications. It is supplied in the sodium form as SSTC60 or hydrogen form as SSTC60H.

Each resin bead in the Purolite Shallow Shell Technology (SST®) family of high-efficiency softening resins has an inert core and uniform depth of functionality. During the manufacturing process, each bead is functionalized (or activated) to the same degree. This means that they have a shorter diffusion path that results in more rapid softening than tradition ion exchange resin. This is particularly advantageous during regeneration since reducing the depth of penetration required to clean the resin allows for a more complete regeneration and provides higher, more efficient utilization of the regenerant. The SST resins have unsurpassed salt efficiency, lower leakage, and reduced rinse water requirements. Compared to conventional softening resins, regenerant reductions of 2 – 4 lb/ft$^3$ (32 – 64 g/l) of resin per regeneration, are possible without sacrificing capacity or increasing leakages. This translates to a salt savings of 700 – 1,400 lb/ft$^3$ (318 – 636 kg) per year based on daily regenerations.

**Figure 1 – SST resin beads**

Under a microscope, Purolite SST resin looks different because each bead has an inert core that resists fouling and enables more thorough regeneration of the bead.

## Technical data

**Table 1 – Typical physical and chemical characteristics**

| | |
|---|---|
| Polymer structure | Gel polystyrene crosslinked with divinylbenzene |
| Physical form | Spherical beads |
| Functional Groups | Sulfonic acid |
| Whole bead count functional groups | 90% min. |
| Ionic form, as shipped | $Na^+$ |
| Total capacity, $Na^+$ form | 3.8 eq/kg |
| Moisture retention, $Na^+$ form | 36 – 46% meq/g |
| Particle Size range | 300 – 1200 µm |
| < 300 µm (max.) | 1 % |
| Uniformity coefficient (max.) | 1.7 |
| Reversible swelling, $Na^+ \rightarrow H^+$ (max.) | 6% |
| Specific gravity, $Na^+$ form | 1.20 |
| Shipping weight | 775 – 825 g/l (48.4 – 51.6 lb/ft$^3$) |
| Maximum temperature limit | 60°C (140°F) |

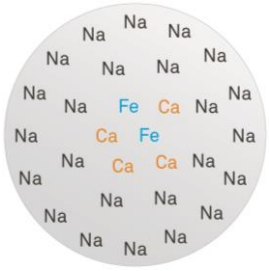
## Kinetics and efficiency

As regenerant is consumed, the force of the reaction diminishes. Because of this, the core of standard resins remains unregenerated at the end of the regeneration cycle. As calcium, magnesium, iron and other elements accumulate, beads becomes fouled, leakage occurs, and excessive amounts of expensive chemical are required. The unique core of SST resin helps solve these problems, making the resin much more efficient by eliminating the sites that take the longest to exchange, are the most difficult to regenerate and are the most susceptible to fouling.

## Uniform depth of functionality and diffusion path

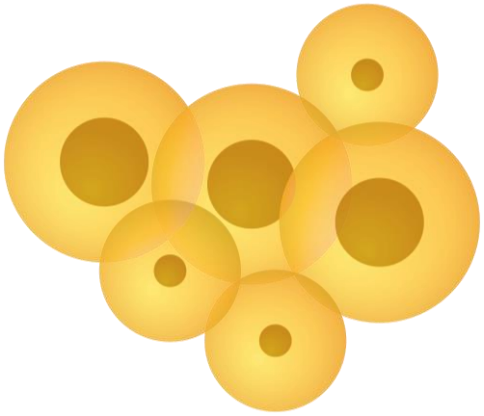
SST resins deliver better throughput with reduced chemical regenerant usage and minimal leakage. Each bead features a uniform depth of functionality so all beads react at the same rate for consistent performance. The Shallow Shell Technology structure shortens the diffusion path and creates more rapid ion exchange. The beads also exhibit superior toughness and durability and resist osmotic shock compared with conventional resin. This not only extends the life of the resin, but is important in industrial applications and portable exchange units where the resin experiences significant physical handling. These resins save water too. The shallow shell technology of Purolite SSTC60 regenerate with about 50% less water and rinse very quickly to quality.

## Figure 2 – Fouling of standard bead



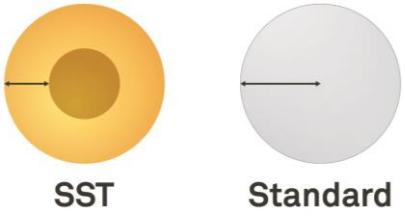

Standard resin beads are susceptible to fouling and leakage as the reaction force decreases as regenerant makes its way through the bead.

## Figure 3 – Uniform depth of functionality



SST beads feature uniform depth of functionality so every bead reacts at the same rate.

## Figure 4 – Diffusion path

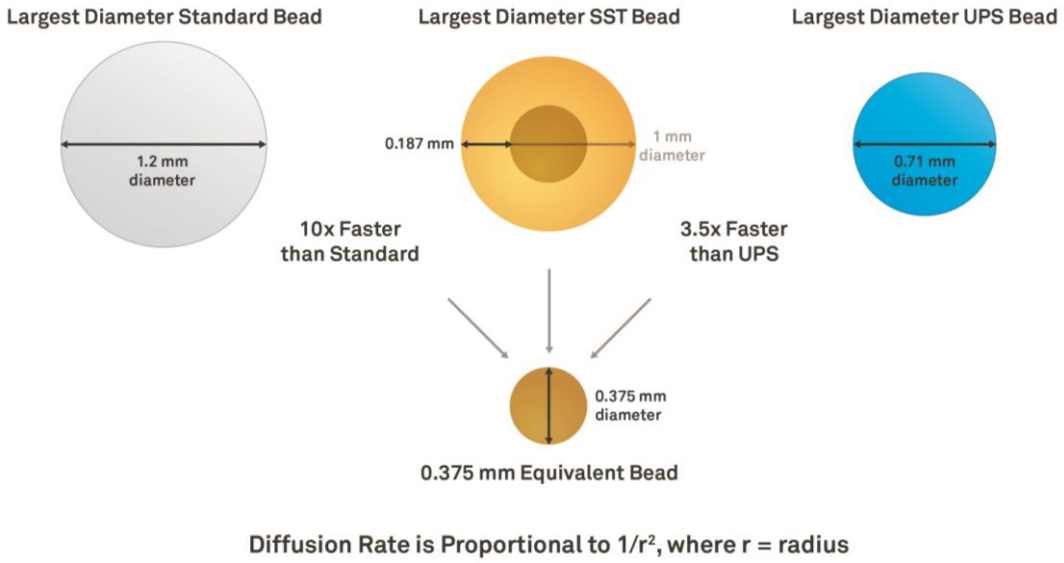



Where:
$\frac{S}{R}$ = Shell/Radius

| Shell Radius | .5 | .6 | .7 | .8 | .9 | 1.0 |
|---|---|---|---|---|---|---|
| Volume Ratio | 87.5% | 93.6% | 97.3% | 98.7% | 99.9% | 100% |

The diffusion path of SST beads is shorter, resulting in faster reactions and more efficient, thorough regeneration.

## Figure 5 – Diffusion path comparison of different resin bead types




## Advantages of SST resins for softening

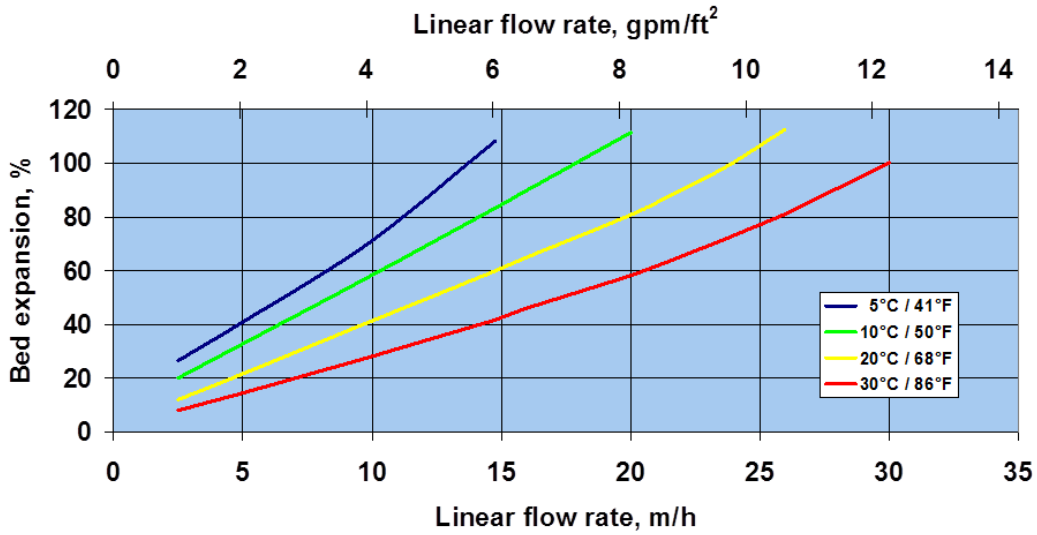
- Higher recovered capacity per pound (or kilogram) of salt
- Better iron removal
- Lower rinse requirements
- No equipment modifications needed; suitable for co-flow, counter-flow and packed bed systems
- Lower leakage at all regenerant levels
- Less susceptible to fouling
- Shorter regeneration cycles
- Excellent physical strength
- Non-solvent sulfonated
- More resistant to oxidation
- Meets NSF/ANSI-61 requirements for International Standard for Drinking Water Additives
- Supports ISO 9001:2004 initiatives toward environmental management and impact

## Table 2 – Standard operating conditions – Co-current water softening

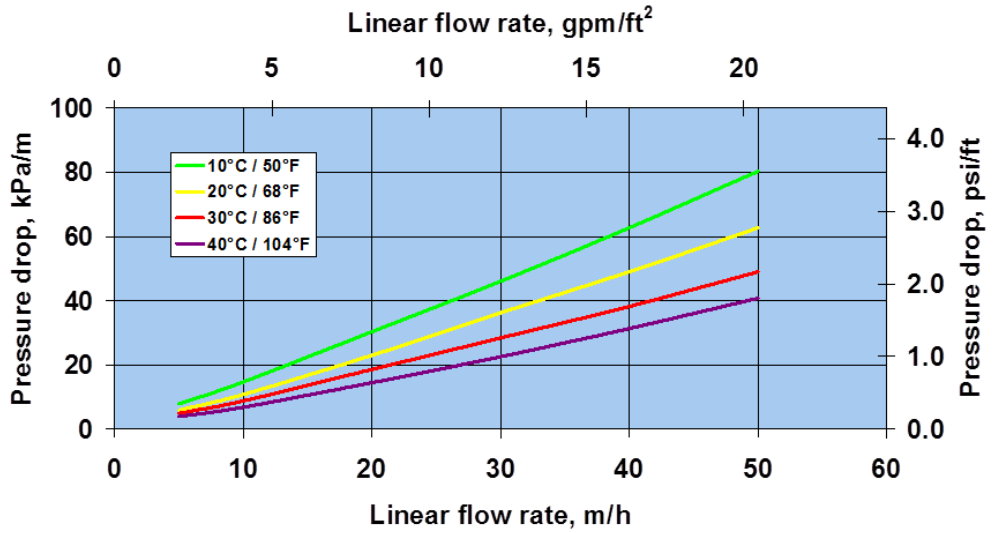
| Operation | Rate | Solution | Minutes | Amount |
|---|---|---|---|---|
| Service | 8 – 60 BV/h<br>1.0 – 7.5 gpm/ft$^3$ | Influent water | per design | per design |
| Backwash | Refer to Fig. 1 | Influent water<br>5° – 30°C<br>(40° – 80°F) | 5 – 20 | 1.5 – 4 BV<br>10 – 20 gal/ft$^3$ |
| Regeneration | 2 – 7 BV/h<br>0.25 – 0.9 gpm/ft$^3$ | 8 – 20% NaCl | 10 – 30 | 32 – 340 g/l<br>2 – 15 lb/ft$^3$ |
| Rinse, (slow) | 2 – 7 BV/h<br>0.25 – 0.90 gpm/ft$^3$ | Influent water | 12 – 60 | 1.5 – 2 BV<br>10 – 15 gal/ft$^3$ |
| Rinse, (fast) | 8 – 40 BV/h<br>1.0 – 5.0 gpm/ft$^3$ | Influent water | 6 – 30 | 1 – 5 BV<br>8 – 40 gal/ft$^3$ |
| Backwash expansion | 50% to 75% | | | |
| Design rising space | 100% | | | |

"Gallons" refers to U.S. Gallons = 3.785 liters

## Figure 1 – Backwash expansion




## Figure 2 – Pressure drop vs. flow rate




## Capacity

Users are referred to our PureDesign software for capacity and leakage evaluations. PureDesign software is available for download from our website at www.purolite.com.

To view a video showing how Shallow Shell Technology works, go to www.bit.ly/purolite.

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