Introduction:

To keep today’s ultra-efficient heat exchanger systems operating at peak efficiency, petrochemical and refining facilities must clean their tubes thoroughly and regularly to keep them clear of process-related deposits. Such deposits can drastically limit the system’s ability to transfer heat, driving operating costs substantially higher.

Adding indirect costs like downtime and compliance with safety and environmental regulations, the pressure on tight operations budgets’ becomes intense.

To meet this challenge, more and more companies today are cleaning tubes with Ultra-high-pressure (UHP) water jetting (20,000 to 40,000 psi, or 1,400 to 2,800 bar).

Water jetting has been widely used for product removal and industrial cleaning for some 40 years. It removes hardened deposits thoroughly and cost-effectively, often saving thousands of dollars/rands/pounds while significantly improving productivity.

Semi-automated systems, for example, can clean 100 tubes 75% faster than manual methods, depending on the size of the tube bundle and the material being cleaned out. Fully-automated systems can clean them 90% faster than manual.

A UHP tube cleaning system typically involves a small nozzle placed on the end of either a rigid tube (for straight line cleaning) or a small flexible hose (for tubes with bends). Water from a pump unit is fed through the tube or hose and exits the nozzle at a speed and pressure that removes even the hardest residues, rust and scale. The waste material is then flushed out of the tubes and rinsed away.
Traditional Manual Methods:

One of the most common and most economical methods for cleaning tubes is manual water blasting. There are a number of variations on this, but all generally require an operator to manually feed the nozzle into each tube that needs to be cleaned. Once the nozzle is positioned in the tube, the operator starts the flow of high-pressure water by depressing a foot pedal. This process, while effective, has drawbacks. First, it can be time-consuming. Second, holding on to a hose as high-pressure water rushes through can lead to operator fatigue over time. Third, the operator may not always feed the nozzle into the tube at the same speed, which can result in uneven cleaning.
Automated Systems:

Automated systems are a superior method for removing product build-up from heat transfer tubes. Not only do they save many hours compared to manual methods, but more importantly they eliminate the variables an operator brings to the process while removing him or her from the immediate vicinity of the high-pressure water.

Automated systems for cleaning tubes typically have multiple lances or hoses, a means of moving them across the face of the tube bundle, and a system for feeding them in and out of the tubes without manual labour. The operator typically controls the actions of the system from a remote position nearby. Hoses and lances are usually provided in different sizes to suit a variety of tube diameters; changeover should be simple to minimize downtime.

The Jetech model HE-30/40 heat exchanger cleaning system is engineered to clean and unplug heat exchanger tubes and pipe in a semi-automated process. After initial setup, the system requires only one operator who can control the rotation of the lances and the in/out motion of the lances for cleaning from the remote operators station.

- Standard unit has one rotating lance.
- Optional: 2, 3, or 4 rotating lances.
- Air driven rotation.
- Remote operation station with foot control valve and joystick in/out control of the lances.
- Effective cleaning length: 25 feet (7.68 m).
- Box style X-Y frame with attachment points to heat exchanger.
- Swing type level unit at rear at system to control level position of the lance track unit.
- Alum. Linear track system with slide carriage.
- Completely air motor driven.
- One 953RS Eddy-Jet seal per lance.
Productivity:

As the examples in Table 1 taken from a contractor’s study of the available methods & systems; demonstrate that semi-automated and fully automated water jetting systems require about half as much time per pass as manual water jetting, and this advantage increases as lances are added. A fully-automated 4-lance system can clean 100 tubes in a little over an hour, compared to 16 hours with the labour-intensive manual cleaning method. Actual cleaning times can vary greatly, depending on the length of the tubes and the type of material being removed.

<table>
<thead>
<tr>
<th>Tube Cleaning Method</th>
<th>Number of Lances</th>
<th>Number of Tubes to Clean</th>
<th>Time Per Cleaning Pass</th>
<th>Total Cleaning Time</th>
<th>Time Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Water Blasting</td>
<td>1</td>
<td>100</td>
<td>10 mins</td>
<td>16 Hours</td>
<td>NA</td>
</tr>
<tr>
<td>Semi Automated Dual Flex Lance System</td>
<td>2</td>
<td>100</td>
<td>5 mins</td>
<td>4 Hours</td>
<td>12 Hours</td>
</tr>
<tr>
<td>Semi-Automated Triple Flex Lance System</td>
<td>3</td>
<td>100</td>
<td>5 mins</td>
<td>2.75 Hours</td>
<td>13.25 Hours</td>
</tr>
<tr>
<td>Automated Quadruple Rigid Lance System HE-40*</td>
<td>4</td>
<td>100</td>
<td>4 mins</td>
<td>1.3 Hours</td>
<td>14.7 Hours</td>
</tr>
</tbody>
</table>

*Automated systems allow the operator to clean on both the in and out stroke of the cleaning lance.
In addition to increasing productivity, automated water jet systems can improve the quality and consistency of the cleaning process. The systems discussed in this white paper allow tubes to be cleaned both on the inward and outward passes, so more material is removed in less time. They also allow the operator to set the feed rate so that each tube will be cleaned in an even, repeatable manner.

**Safety and Ergonomics:**

Automated tube cleaning systems have benefits for operating personnel as well. Manual hose or lance feeding can be tiring over time and can expose operators to backspash and debris. With a semi-automated system, the operator has complete control without coming near the water blasting, using a remote (even wireless) control.

**Conclusion:**

Tube bundle cleaning plays a key role in maintaining heat exchanger efficiency, which is a critical factor in petrochemical quality and productivity. High-pressure water jetting is a proven method for keeping tubes clear of deposits, and today’s automated systems are more effective — and more operator-friendly — than ever before. They can reduce cleaning time by 75% to 90% vs. manual water jetting, and processors can choose from different levels of automation to suit their specific needs.