



# *AutoShift™ Combination Decoking Cutting Tool*

*Flowserve has pioneered many significant advancements in hydraulic decoking, transforming it into an increasingly safe, efficient and automated process.*



## **Revolutionizing Hydraulic Decoking**

*With more than 100 years of decoking experience through its Worthington, Pacific and IDP heritage brands, Flowserve is the undisputed global leader in hydraulic decoking systems. It has pioneered many significant advancements in hydraulic decoking, transforming it into an increasingly safe, efficient and automated process. Now, with its new AutoShift combination decoking tool, Flowserve is poised to revolutionize the industry.*

The patented AutoShift combination decoking tool makes remote operation feasible by removing the operator from the cutting deck. Mode shifting is accomplished automatically and remotely by water pressurization and depressurization, not manually as with other tools. As such, there is no personnel exposure to the following dangers:

- High pressure water
- Hot spots or steam eruptions
- Hydrogen sulfide (H<sub>2</sub>S) vapors
- Mechanical hazards

### **AutoShift Tool Benefits**

The AutoShift combination decoking cutting tool provides numerous benefits to hydraulic decoking operations, including:

- Improved operator safety
- Greater system automation
- Reduced cycle times
- Improved efficiency
- Easier maintenance
- Shifting flexibility to free “stuck” tools
- Manual shift feature



*Patented AutoShift decoking tool*

**Experience In Motion**

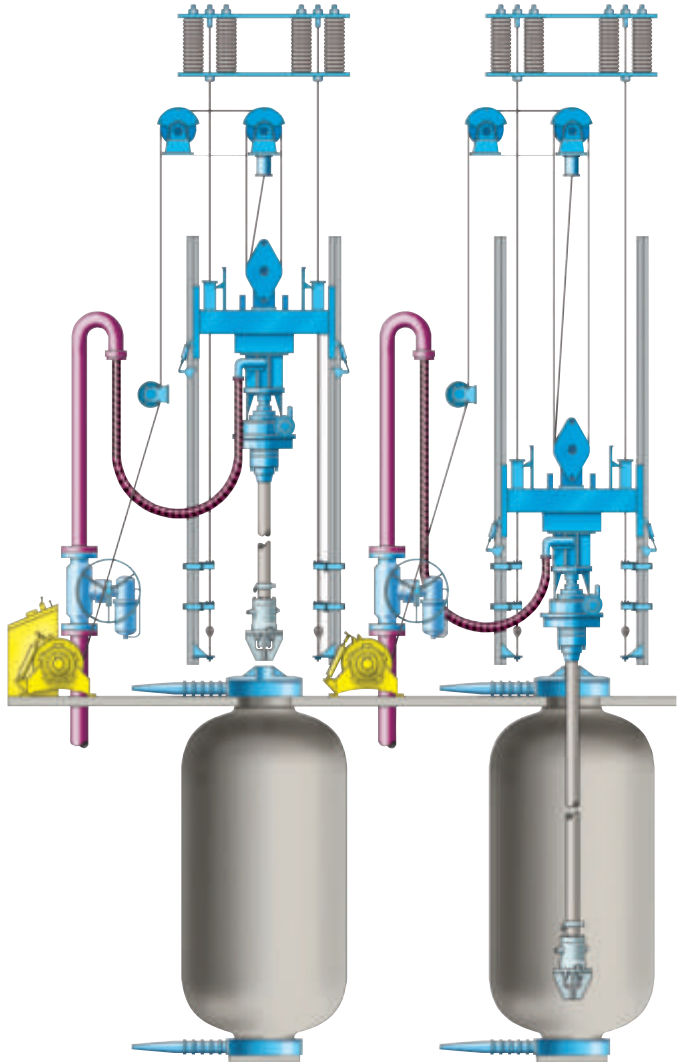
## Hydraulic Decoking Made Safer

With the patented\* AutoShift combination decoking cutting tool, hydraulic decoking is automated, simplified and, most importantly, safer.

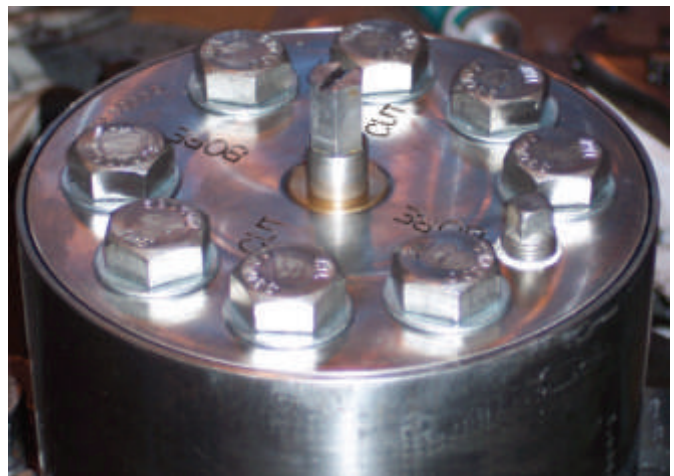
Traditional combination cutting tools require extensive handling to manually shift cutting modes. First, a pilot hole must be bored downward from the top of the drum through the coke bed using downward oriented nozzles of the decoking tool. Then, the tool must be raised to the top of the drum where either the entire tool or the operating mode of the combination decoking tool is changed to use side-oriented cutting nozzles. Finally, the tool must be rotated and moved vertically downward in the pilot hole, where the side-oriented nozzles cut the balance of the coke and flush it out the open bottom of the drum.

Removal of the cutting tool from the drum, to either change it out or to change its cutting mode, is a cumbersome and hazardous operation. Raising the tool out of the vessel can be very dangerous if the proper control system is not in place to terminate the fluid cutting pressure to the cutting tool.

The AutoShift combination decoking cutting tool eliminates these dangers and reduces cycle times by shifting modes automatically and remotely in the drum. Moreover, its ability to remotely shift operating modes means that operating personnel do not need to be on the cutting deck, risking exposure to hot gasses and mechanical hazards. The time savings positively impacts the production capacity of the refinery by returning the decoked vessel to service quicker.



*Decoking tool assembly with AutoShift*



*AutoShift cartridge with center manual shift extension*

\* U.S. Patent No. 6,644,567 and select international equivalents

# ***AutoShift™ Combination Decoking Cutting Tool***

## **Available Retrofit Cartridge Assembly**

AutoShift is not just available as new equipment. Existing hydraulic decoking systems can upgrade to AutoShift technology. The complete AutoShift apparatus is assembled, tested and stocked as a cartridge and can be retrofitted quickly at an authorized Flowserve Service Center.

The AutoShift retrofit assembly can be used to:

- Upgrade existing Flowserve Pacific combination tools (axial and rotary types)
- Replace existing Flowserve Worthington tools
- Replace existing Flowserve Pacific non-combination tools
- Replace non-Flowserve cutting tools
- The retrofit includes a documentation package containing cross-sectional drawings, parts lists and updates to the original operating manual.

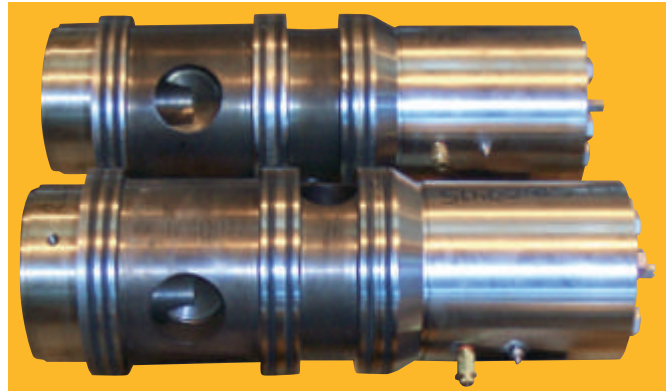
## **A History of Flowserve Innovation**

Flowserve has become the pre-eminent supplier of innovative decoking equipment and systems by listening to its customers and addressing their specific needs. As a result, Flowserve is able to produce safer, more efficient and less labor-intensive decoking tools and systems. The patented Flowserve AutoShift decoking tool exemplifies this industry leading innovation.

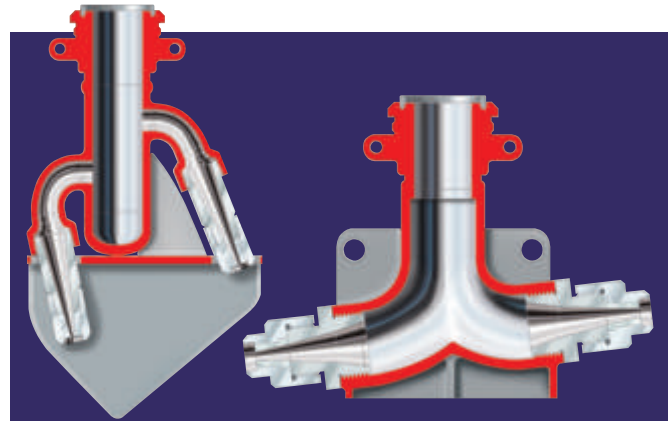
In 1938 Flowserve Worthington built a three-tool system (separate tools for boring, reaming and cutting) for the world's first hydraulic decoking installation. Each tool was manually removed and replaced for each of the operating modes. Further innovation produced a two-tool system that slightly reduced the overall cycle time of the system.

In 1979 Flowserve Pacific introduced a patented combination shifting tool that incorporated both boring and cutting nozzles within a single body. This “combo” design, termed axial shifting, was controlled by applying plant air to an internal piston and resulted in a significant reduction in system cycle time as well as increased operator safety. Recognizing the industry's need for higher pressure (above 275 bar [4000 psig]) decoking systems, Flowserve developed its patented rotary shifting tool in the late 1990s. This improved overall system throughput and productivity.

Sixty-five years after building the first hydraulic decoking tool, Flowserve produced and patented its AutoShift rotary actuated and remotely shifted combination tool in 2003. Mode shifting is accomplished automatically and remotely by water pressurization and depressurization. With this latest innovation, Flowserve has fulfilled the industry's need for a high-pressure decoking tool that significantly reduces system cycle time, virtually eliminates operator tool handling and maximizes operator safety.



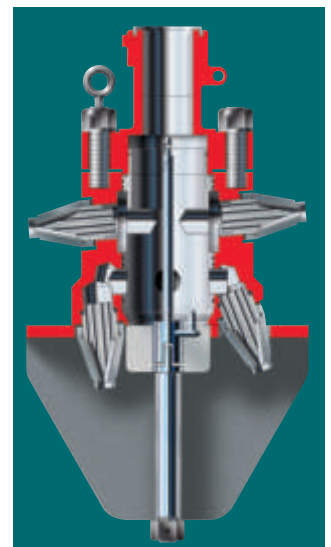
*Today's AutoShift cartridge assembly for new and retrofit cutting tools*



*Separate bore and cutting decoking tools (circa 1938)*



*Axial combination tool (1979)*



*Rotary combination tool (1998)*



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