The world of industrial process cooling equipment is one of extremes, with diverse and unique equipment required to complete processes that can have both high and low operating temperatures and with the handling of liquids of both high and low viscosities and various particulate levels. This need for versatility requires the plant’s process engineer to become adept in managing many different types of equipment, supplies and materials during the course of the process cooling operation.

One of the key pieces of equipment in process cooling is the industrial pump. Many different styles of pump can be used — gear, lobe, peristaltic (hose) and centrifugal, among others — but pumps that incorporate air-operated, double-diaphragm (AODD) technology have long been used by process cooling engineers. AODD pumps meet the needs of diverse process cooling applications because they have been designed to operate efficiently and reliably in a range of utilitarian, severe-duty pumping conditions.

One example of a process cooling operation within a severe-duty application is steel mills, where AODD pumps handle the coolant quench line. In order to roll steel into plates or coils, the steel slabs must be heated to 2,282°F (1,250°C). When the slab reaches that temperature, it is rolled back and forth in a roughing stand, which initially reduces its thickness to 1.2 inches (30 mm) while simultaneously increasing its length from 36 to 265 feet (11 to 80 m). Eventually, the steel slab will be reduced to a thickness of 0.08 inches (2 mm) and will grow to a length of 4,265 feet (1,300 m) — the equivalent of nearly one mile — before it is rolled into a coil for shipping or storage.

Facilitating this process are the rollers that flatten the extremely hot steel slab to the required thickness. As the hot steel is rolled through the roughing stand, it is sprayed with a light, oily coolant that is needed to cool and lubricate the

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Time-tested technology meets the needs of harsh operating conditions while improvements in airflow efficiency help optimize the bottom line.

By Tom Zuckett, Wilden Pumps
rollers during the quenching process. While this coolant is integral to the proper operation of the rollers, it must be removed from the steel at some point.

To remove the coolant from the steel, high pressure spray pumps are used. The coolant drains to a collection pit located beneath the rolling line. Also located in this coolant-collection pit are AODD pumps, which transfer the coolant from the collection pit through a filter and back to the coolant’s storage tank, where it is reused to spray the rollers.

AODD pumps are needed in the coolant recirculation process because the high pressure spray pumps that remove the coolant tend to also dislodge debris such as dirt, grit, steel fines and other impurities that are on the steel. These impurities find their way into the coolant-collection pit and must be removed from the coolant before it is recirculated. The AODD pump is well suited for the operation because it can handle liquids with solids or particulate matter.

The AODD pump is able to perform these difficult operations where other pump types fall short because of its design. AODD pumps are classified as reciprocating, positive-displacement pumps. The pump operates by displacing fluid from one of its two liquid chambers upon each stroke completion. To operate, the AODD pumps require a given amount of pressure — measured in pounds per square inch — and air volume — measured in cubic feet per minute — to deliver the

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proper amount of fluid. This simple design allows AODD pumps to provide efficient, reliable operation in many pumping situations.

The AODD pump design means that there are only a few dynamic, wetted parts: the two diaphragms, which are connected by a common shaft; the two inlet valve balls; and the two outlet valve balls. The diaphragms act as a separation membrane between the compressed air supply and the liquid. Driving the diaphragms with compressed air instead of the shaft balances the load on the diaphragm, which removes mechanical stress from the operation and extends diaphragm life. This also allows the valve balls to open and close on the valve seats, which direct liquid flow. This simple design and operation make it easy for the operator to find the correct pressures and flows to optimize operation.

Other operational characteristics of AODD pumps that make them a common choice in process cooling applications are:

- Portability.
- Dry-run capability.
- Sealless design.
- Deadhead capability.
- Shear-sensitivity.
- Self-priming feature.
- Submersibility.

While meeting production quotas has always been the main objective for the industrial facility manager, more and more that goal must be accomplished in the most cost effective and environmentally friendly manner possible. Tightening budgets and increased regulation regarding energy consumption and the size of a manufacturing operation’s carbon footprint mean that efficiency in all areas of the operation must be maximized.

Process cooling operations can be among the most severe in the industrial world. As a way to reliably optimize pumping requirements within these operations, process engineers have identified AODD pumps as a go-to technology. The consistency, reliability and ruggedness of AODD pumps in even the harshest operating conditions have provided peace of mind for process engineers for nearly six decades.

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