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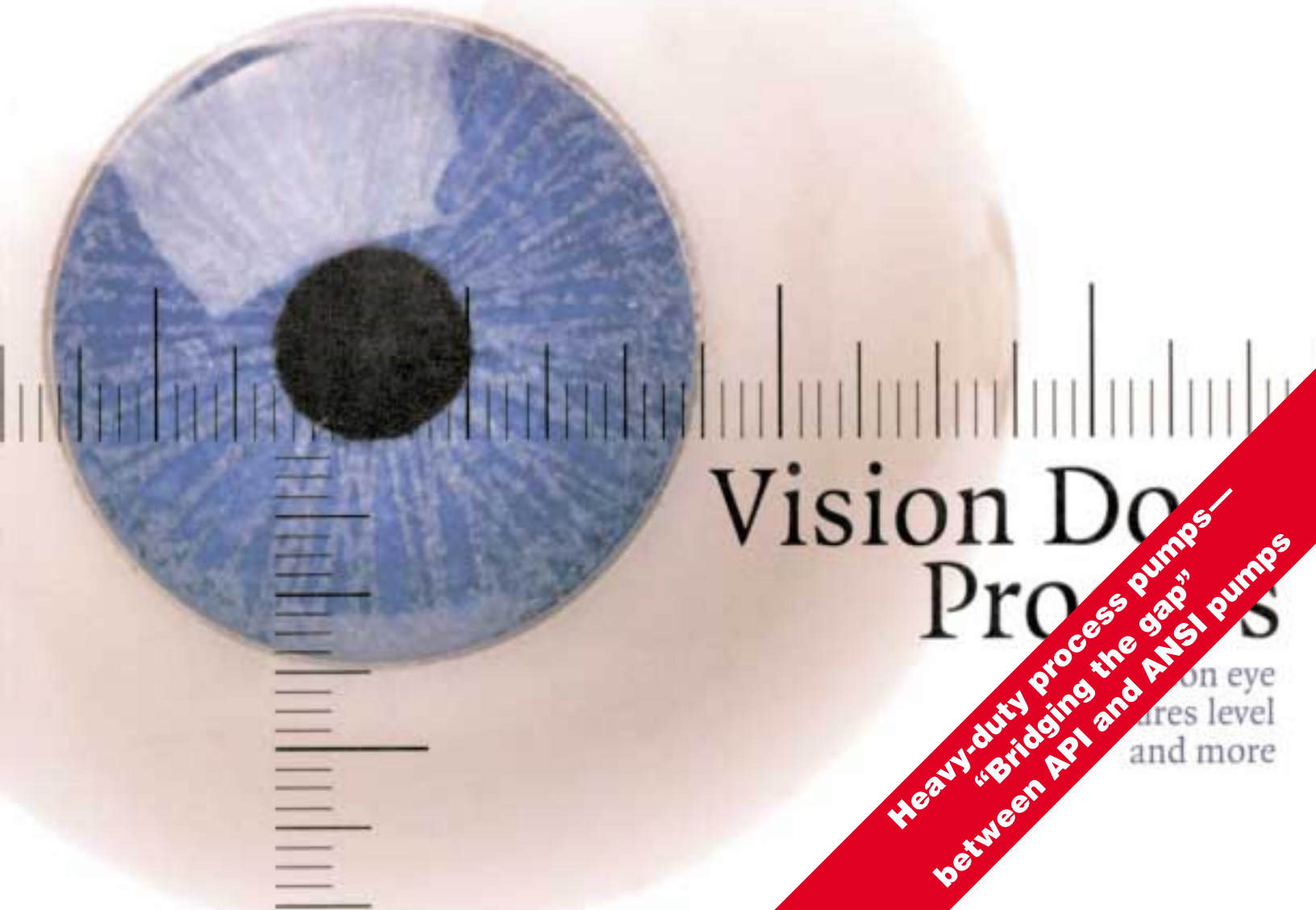

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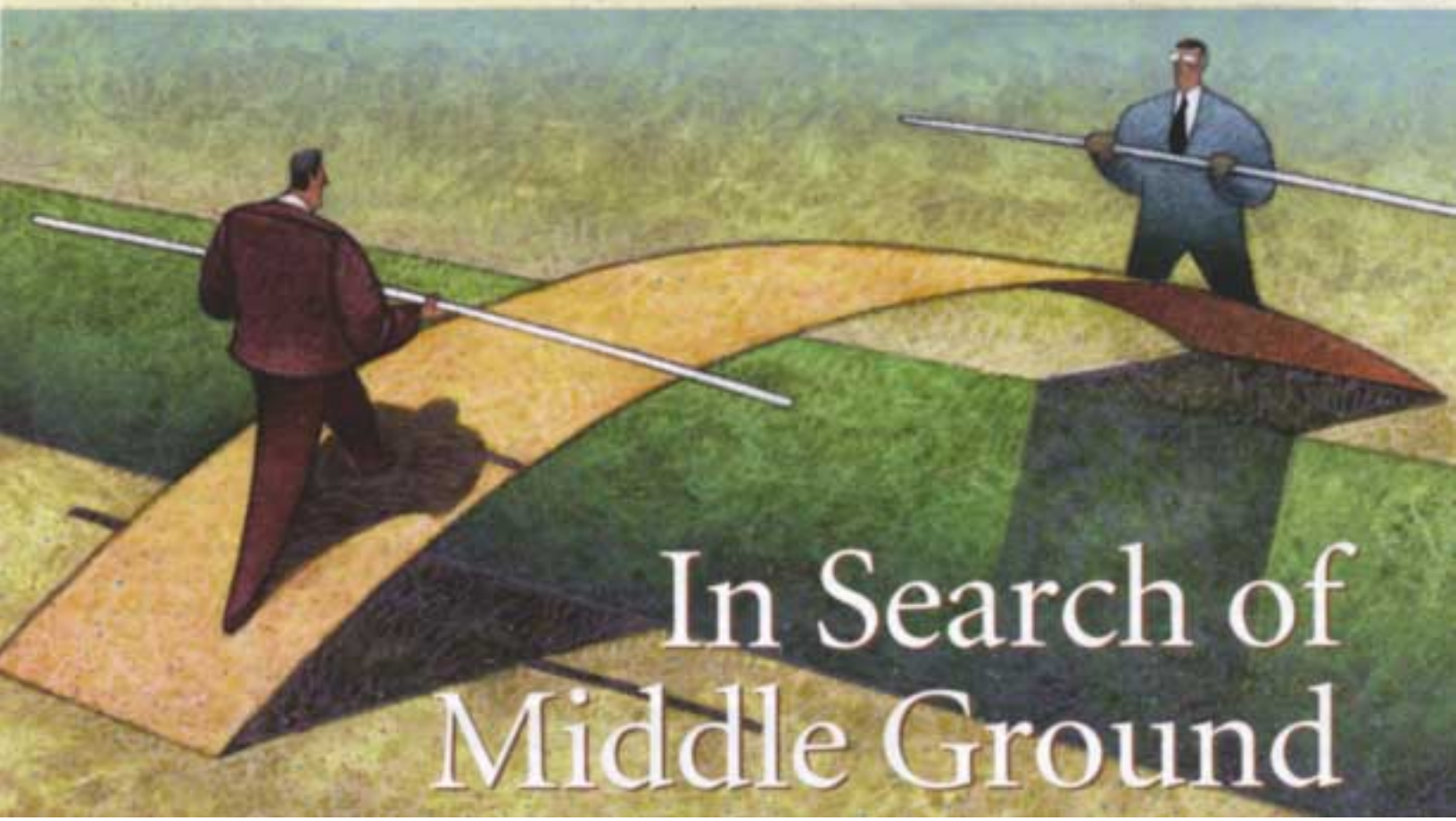
Heavy-duty process pumps—
"Bridging the gap"
between API and ANSI pumps

Intermediate heavy-duty process pumps bridge the gap between expensive API pumps and less-sophisticated ANSI pumps in many flammable and hazardous applications



In Search of Middle Ground

By Gennaro A. D'Alterio

Pumping high-temperature process liquids around the clock places extraordinary demands on most system components—particularly the chemical pumps. In many applications, catastrophic pump failure is seldom an option because it can lead to production down-time, wasted effort, added maintenance costs, ruined final product and personnel hazards.

Because pump performance and reliability are critical issues whenever — and wherever — high-temperature liquids are being transferred, the American Petroleum Institute (API) many years ago set forth rigid standards for the design, construction and performance of process pumps used for these applications. The original API standards were issued some 40 years ago for refinery services.

According to the text of API Standard 610, "API standards are published as an aid to procurement of standardized equipment and materials. These standards are not intended to inhibit purchasers or producers from purchasing or producing products made to other standards."

The intent was to minimize failure possibilities from known causes with appropriate pump design and construction materials. Most of these requirements are stated in API Standard 610.

Over the years, however, a number of revisions have been made to that standard as more experience was gained through high-temperature process pump use. The changes also reflect the significant improvements made in pump design and construction materials.

Rising costs spark alternatives

Some manufacturers of high-temperature heavy-duty process pumps have refined their products often to meet subsequent revisions to the orig-

Some manufacturers offer lower-cost pumps with many API- standard design and construction features by eliminating unnecessary documentation and testing.

inal standard. With each revision, the cost of API-type pumps continued to rise above that of other heavy-duty process pumps not meeting the API standard. Chemical pump users had little choice when selecting heavy-duty process pumps for many applications.

The American National Standards Institute (ANSI) eventually issued its own standards for chemical pumps. Those standards are not nearly as restrictive, nor as comprehensive, as API'S, particularly in the areas of testing, documentation and traceability requirements. Consequently, ANSI-type pumps cost substantially less than API-type pumps.

API vs. ANSI

ANSI-type pumps do not incorporate many of the design and construction features specifically mandated for the extreme service typically encountered by API service pumps (see the table). For example, centerline support structures in API-type pumps are not required in ANSI-type pumps. Without centerline support, however, shaft alignment could lose concentricity under continuous high-temperature use. Premature bearing, coupling and/or seal failure could result. Other design/construction differences include heavy-duty baseplates and steel bearing housings, all of which are required in API-type pumps but not in ANSI standard pumps.

To bridge the gap between high-end API-type pumps and lower-cost ANSI-type pumps, some manufacturers offer pumps that incorporate many of the design and construction features required by the API standard at a substantially lower cost. They can do so by eliminating the extensive documentation and testing requirements that might be deemed unnecessary for many applications.

Revision eliminates restrictions

According to API sources involved in the standard's development, API Standard 610, Ninth Edition was approved in January of this year. This newest revision specifically allows users to employ non-API-style pumps in services defined by parameters addressed in "Section 1 — Scope" of the standard. (Prior to this revision, users could employ a non-API pump in hazardous flammable operations, but the pump was not "approved" by API.) Although the API standard's Eighth Edition (Paragraph 1.1.4) includes these same service limits, it also specifies that the allowable services be "nonflammable and nonhazardous."

The Ninth Edition eliminates this restriction, permitting the use of non- API pumps in process and utility services, provided the stated criteria on performance and construction are met. As a result, many new and existing users of API-610 pumps now can take advantage of the lower costs offered by intermediate pumps for flammable and hazardous service without affecting performance, safety or reliability.

Like previous editions, the API-610 Ninth Edition also lists specific limits for process and utility services that allow the use of "pumps designed in compliance with other standards such as ISO 5199 or ANSI/American Society of Mechanical Engineers [ASME] B73.1M." In particular, the stated parameters mentioned are maximum discharge pressure (275 pounds per square inch gauge [psig]), maximum suction pressure (75 psig), maximum pumping temperature (300°F), maximum rotating speed (3,600 rotations per minute [rpm]), maximum rated total head (400 feet [ft]) and maximum impeller diameter (13 inches [in.]).

Non-API pumps in service

Although the decision to use non-API pumps in flammable and hazardous service must be determined on an individual basis, many organizations have been using alternative pumps for these applications on a routine basis.

"Basically, users who require the 'ultimate' pump for high-temperature hot oil requirements — the safest, heaviest possible pump — with cost as no object ... would specify an API-610 pump," emphasizes Will McKnight, a vice president with Process Equipment Co. in Fort Mills, S.C. He has been involved with applications engineering for high-temperature pumps in the chemical and petrochemical industries for many years. "On the other hand, if a user requires a pump for virtually the same service at a substantially less[er] cost, a non-API

API-610 and ANSI/ASME B73.1 Pump Comparison

Feature	API-610	ANSI/ASME B73.1
Service	Petroleum, heavy-duty chemical and gas	Chemical process
Flanges	Full faced or spot faced on back	Back at 3 degrees maximum on parallelism
Casing support	Centerline of casing	Foot under the casing
Bearing housing support	Not allowed	Yes
Bearing housing material	Steel for flammable or hazardous liquids	Cast iron
Bearings	Duplex, single row, angular contact	Not specified
Impeller mounting	Keyed	Keyed or threaded
Wearing rings	Casing and impeller	Not required
Seals	Per API 682	Not specified
Seal chamber throat bushing	Required	Not specified
Gland throttle bushing	Floating type required	Not required
Auxiliary connections	Sock weld, butt weld or flanged for flammable or hazardous liquids	Threaded NPT
Auxiliary piping	Minimum Schedule 160	Schedule 40

pump such as described here is quite suitable. In our experience, some engineers just have a 'mindset' on the use of API pumps," McKnight maintains.

Mitsubishi Polyester Film in Greer, S.C., has been using non-API heavy- duty, high-temperature process pumps successfully for many years. The pumps transfer Dowtherm glycol- water heat-transfer fluid through heat exchangers to stabilization systems for processing polyester-resin pellets. These pellets are sold to manufacturers that extrude them to produce plastic sheets for packaging applications.

Tom Caudill, staff maintenance engineer at Mitsubishi, says Dowtherm liquid is circulated through the system at about 536°F. Mitsubishi has had 10 of these pumps in its stabilization unit for about six years, with five on-line simultaneously and five reserved for backup, according to Caudill.

As good as API

Although the pumps at Mitsubishi are not true API-style pumps, they have provided the company with performance comparable to that of API-610 pumps, at a substantially lower cost. Many factors are responsible for this successful track record, most of them focused on pump design and construction features that are similar to those of API-610 pumps.

> "The decision to use non-API pumps in flammable and hazardous service must be determined on an individual basis."

For the most part, their lower costs are directly attributable to the elimination of testing, documentation, software and traceability requirements on the part of pump manufacturers. The new API-610 Ninth Edition fundamentally minimizes many of these previous requirements for those pump users who do not actually need them.

More choices

The original API standards were intended to establish a minimum set of mechanical criteria for refineries to enhance operating safety and reliability through the design and construction of more rugged, reliable pumps. Although the Ninth Edition calls out specific performance standard requirements, it includes two key statements that now permit user discretion with regard to pump selection.

Specifically, "Section 1 — Scope" of the revised API standard ("centrifugal pumps for petroleum, heavy-duty chemical and gas industry services") — is technically equivalent to International Standard Organization (ISO) 13709 and contains the following statement:

"Process and utility services exist within most facilities that do not require pumps of the robustness and intrinsic reliability of those covered in this standard. For such services that do not exceed ANY of the following limits, i.e., less rigorous services, the user may want to consider pumps designed in compliance with other standards such as ISO 5199 or ANSI/ASME B73.1M."

Many other organizations also are applying non-API pumps in flammable and hazardous service successfully and have been doing so for years. A word of caution: In the author's opinion, when employing non-API pumps in traditional API services, users should not over-specify construction, performance and software requirements in an attempt to obtain a pump with API characteristics at a lower, non-API cost.

Conclusion

The API-610 Standard Ninth Edition — and the availability of many suitable pumps to meet its requirements — gives chemical pump users the option to consider lower-cost alternatives. The intermediate heavy-duty process pumps also offer design, construction and performance advantages over ANSI-type pumps for many applications — without the added expense of a virtually comparable API-610 pump. **CP**

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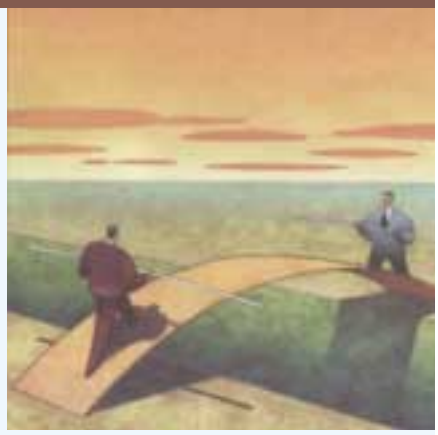
Designed for Performance



Because substantial differences exist between API- and ANSI-style pumps, the pumps in use at Mitsubishi's Polyester Film plant in Greer, S.C., bridge the gap between these two standards and offer advantages for use in applications governed by the Ninth Edition. For example, these pumps are of a configuration similar to that of API-610 pumps, with heavy-duty centerline-supported casings in a variety of materials, including carbon steel and 316 stainless steel. The pumps are capable of flows as great as 6,000 gallons per minute (gpm), heads to 800 ft, discharge pressures to 500 psig and temperatures to 500° F using ambient air cooling or 850°F with water cooling, actually exceeding the capabilities defined by API-610.

Other standard construction features of these pumps that permit their use for many API-610 applications include precision rabbetted casing and bearing housing joints, a confined casing gasket, a true back pull-out design, fully enclosed Francis vane impellers keyed to the pump shaft, ANSI Class 300# RF or RTJ flanges, casing wear rings and heavy-duty angular-contact thrust bearings.

A variety of mechanical seals can be employed, and cylindrical or tapered-bore stuffing boxes also can be specified to meet process requirements.

To help extend seal and bearing life, the pumps are available with seal-chamber cooling jackets and bearing-frame cooling coils to improve reliability and minimize downtime.

The pumps incorporate oversized shaft diameters to minimize shaft deflection, further enhancing bearing and seal life, major causes of premature pump failures. Typical construction details include standard pedestals for mounting on heavy-duty fabricated API-type baseplates; optional base mounting includes a yoke-mounted centerline support that fits on an existing ANSI standard baseplate.