Evaluating pump efficiency ratings

UNDERSTANDING TESTING PARAMETERS IS CRITICAL IN MAKING ACCURATE PUMP SELECTIONS

LOWARA
a xylem brand

Laws designed to bring about significant improvements in the energy efficiency of products are driving down overall energy consumption as the European Union moves closer to achieving targets outlined in its 2012 Energy Efficiency Directive.

With electricity accounting for nearly a quarter of overall energy consumption across the EU, high-demand electrical products – from household appliances to lighting to centrifugal pumps – remain a primary focus of regulators.

In the case of centrifugal water pumps, increasingly stringent efficiency standards have taken effect in the last few years under (EU) 547/2012. The corresponding effect on energy demand is twofold: Pumps that did not meet energy-efficiency thresholds are no longer on the market, resulting in a decline in energy demand as newer, more efficient pumps replace them.

Pump manufacturers are required to comply with specific testing procedures to determine efficiency and document the results as part of the published curves for each pump. Efficiency ratings are an important factor in the pump specification process, with every percentage point of efficiency having a tremendous impact on energy costs, particularly when large multistage pumps are being considered.

However, the efficiency rating is not the only number to look at in pump selection. The testing process itself must be reviewed, as it provides valuable information related to efficiency, also documented within the pump curve. Failure to review testing parameters can result in selecting a pump with higher energy

requirements and greater lifetime energy costs, wasting resources and money. In evaluating pump efficiency, there are two predominant guidelines, the Minimum Efficiency Index (MEI) and ISO standards (International Organization for Standardization). Each serves a different purpose in evaluating pump efficiency. Further, each requires more than a cursory review of the efficiency value in making accurate pump selections.

MEI

The Minimum Efficiency Index (MEI) specifies the parameters for a pump to be marketed in Europe. It is a numerical value that indicates how a pump's efficiency at certain conditions compares with other pumps on the market. The standard for water pump efficiency is ≥0,40, meaning the pumps that rank in the lowest 40 percent of efficiency must be eliminated from the market. An MEI of ≥0,70 is the benchmark for efficiency and reflects the best available technology on the market. Yet, a pump with MEI ≥ 0,6 can have a higher efficiency value than a pump with MEI ≥ 0,7 when the impeller is trimmed for the specific duty point or the best efficiency point (BEP) of the pump is not as close to the specific duty point in terms of flow. This underscores the importance of reviewing the efficiency value for the specific duty point to find the most efficient pump.

ISO and ANSI/HI acceptance

The MEI is only the first threshold to cross in evaluating efficiency. Testing and certification by the International Organization for Standardization (ISO) as well as ANSI/HI 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests, are intended to ascertain the performance of the pump and to compare this with the manufacturer's guarantee.

ISO 9906 specifies hydraulic performance acceptance tests for centrifugal pumps. A 2012 update specifies three levels of acceptance. The ANSI/HI 14.6 standard contains three grades of accuracy and tolerance bands for pump acceptance criteria, comparable to ISO 9906.

- Grades 1B, 1E and 1U with tight tolerances
- Grades 2B and 2U with broader tolerances
- Grade 3B with even broader tolerances

In industrial applications that call for multistage, multiport pumps, ISO 9906:2012 recommends grade 2B for testing, with a -5% efficiency tolerance.

The same pump, tested at the same flow, head, power and speed at grade 3B with a -7% tolerance will yield a higher efficiency rating. By using a lower test grade, efficiency skews higher due to the broader tolerance.

The ISO and ANSI/HI standards are acceptable at either test grade, but test grades cannot be compared similarly in assessing efficiency of competing products. *It is critical to look beyond the percentages to determine the actual efficiency of a multistage pump.*

Apples to apples

Let's illustrate this in a real-world scenario:

An industrial customer is seeking a multistage pump with a flow of 180 cubic meters per hour, head at 410 meters at a speed of 2950 RPM made of cast iron with stainless impellers. Two similar pumps are specified, although the efficiency values are listed at 78,8% and 80,0% respectively.

Comparison of pump performance:

	PUMP A	PUMP B
Flow:	180m³/h	180m³/h
Head:	410m	410m
Efficiency:	80%	78,8%
Power:	251,4kW	255,2kW

The 1.2-point difference in efficiency is due to the defined test grade of ISO 9906:2012 and the material selection. Pump A performance is guaranteed at acceptance grade 3B with an efficiency tolerance of -7%. Pump B performance is guaranteed at acceptance grade 2B with an efficiency tolerance of -5%. Thus, this is not an apples-to-apples comparison between the two pumps.

	PUMP A	PUMP B
Test grade:	3B	2B
ETA tolerance:	-7%	-5%

In addition, the manufacturer's online selection tool for Pump B automatically adjusted the pump curve according to the selected test grade and material selection, where the selection tool curve for Pump A only provided the test grade provided in the published curve for the cast iron standard selection, and does not calculate variables that affect efficiency such as material selection.

In order to provide the most accurate comparison between pumps and account for variables, Pump A and Pump B need to be compared at the same guaranteed acceptance test grade and material selection, resulting in an efficiency value of 76,9% for Pump A and 78,8% for Pump B.

Comparison of pump performance at the same test grade 2B and same material selection:

	PUMP A	PUMP B
Flow:	180m³/h	180m³/h
Head:	410m	410m
Efficiency:	76,9%	78,8%
Power:	261,5kW	255,2kW
Operating hours:	4000 hours/year	4000 hours/year
Energy costs:	0,1 Euro/kWh	0,1 Euro/kWh
	104.598 Euro/year	102.076 Euro/year
Difference:	2.522 Euro/year	

The information about the guaranteed acceptance test grade and the degrading factors for different material selections is most of the times stated in a quotation or a catalog next to the curves. If it is not available, contact the supplier for the information.

Considering 4000 operation hours by year, equal motor and 0,1Euro by kWh, pump B has 2.522Euro less annual energy costs, even if it looked different at the first comparison. For high power pumps, every efficiency point counts.

When pump efficiency is compared on a level playing field, it becomes just one part of the equation. Price, product quality, reliability and technical support and education are other factors that influence purchasing decisions.

ISO 9906:2012 PUMP TOLERANCES						
Class:	1			2		3
Grade:	1E	1B	1U	2B	2U	3B
Tolerance:	E = Efficiency without negative tolerance	B = bilateral all tolerances + / -	U = unilateral total tolerances form + / - only applied in positive direction	B = bilateral all tolerances + / -	U = unilateral total tolerances form + / - only applied in positive direction	B = bilateral all tolerances + / -
Flow rate:	± 5%	± 5%	+ 10%	± 8%	+ 16%	± 9%
Pump total head:	± 3%	± 3%	+ 6%	± 5%	+ 10%	± 7%
Pump power:	± 4%	± 4%	+ 10%	± 8%	+ 16%	± 9%
Pump efficiency:	≥ 0%	- 3%	≥ 0%	- 5%	- 5%	- 7%
NPSHr:	without plus tolerance					
Speed:	50% to 120% of the rated speed for Q-H-P / 80% to 120% for the NPSH-test					

Review the facts

In order to make educated decisions in pump specification and like comparisons among manufacturers, include the following steps in the process:

- Consult the pump's technical catalog to determine which test grade is being used and if degrading factors for other test grades are provided.
- When using an online selection tool, determine if the program automatically adjusts curves according to the selected test grade and material selection.
- When reviewing pumps from different manufacturers, be sure to adjust to the same test grade levels for like comparisons.

In the EU, the industry sector accounts for nearly 26 percent of energy use, according to a 2014 analysis. A continued focus on efficiency to manage energy demand – particularly in industry – will positively impact broader goals to increase energy efficiency by 20 percent across the EU by 2020.

New products such as the Lowara e-MP Series by global water technology leader Xylem Inc. use advanced technologies that improve efficiency to reduce life cycle costs and energy demand. A fundamental shift in how manufacturers and consumers across the globe view the importance of energy efficiency will increase competitiveness and improve sustainability efforts, spotlighting the value of energy saved as a means to efficiency.

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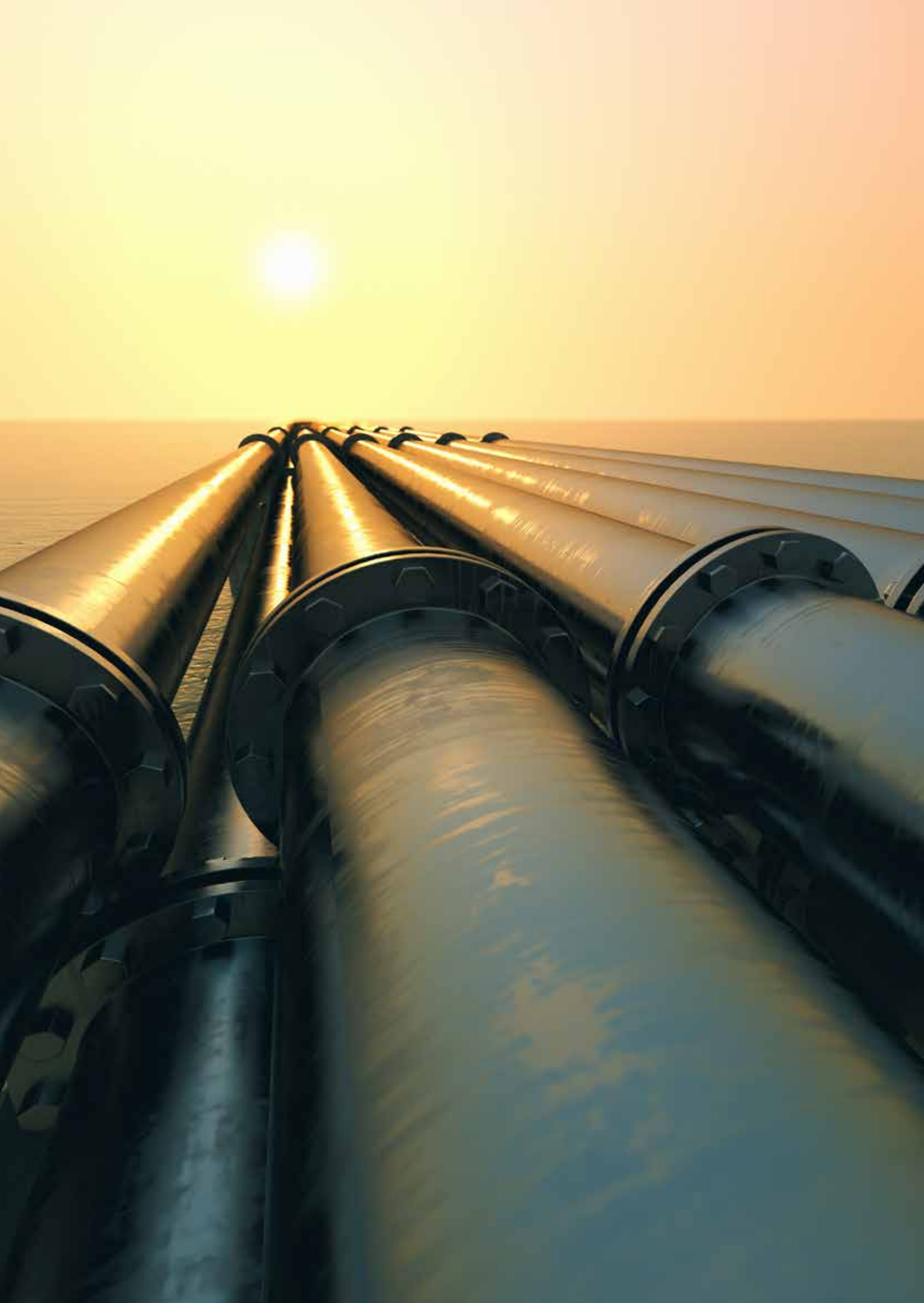

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1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services, and agricultural settings. With its October 2016 acquisition of Sensus, Xylem added smart metering, network technologies and advanced data analytics for water, gas and electric utilities to its portfolio of solutions. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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