

PUMPS AND THEIR SYSTEMS—A CHANGING INDUSTRY

by

Robert J. Hart

Consultant

Robert J. Hart Enterprises, LLC

Newark, Delaware



Robert J. (Bob) Hart is an independent consultant and is the Senior Member of the consulting firm, Robert J. Hart Enterprises, LLC. He was previously employed by the Dupont Company (27 years) and retired as a Principal Consultant in the Rotating Machinery Group in the Engineering Department. His primary responsibilities were to define Corporate pumping system philosophy and procedures, provide technical guidance on special pumping applications, chaired the Pump Standards effort, chaired the Dupont Corporate Pump Committee, and provided technical leadership in the major Dupont Pump Supplier Alliance.

Mr. Hart is Chairman of the ANSI B73 Pump Committee and a former member of the Texas A&M Turbomachinery Laboratory's International Pump Users Symposium Advisory Committee. He was previously employed for 13 years in the Engineering Department of Cooper Bessemer and served four years in the U.S. Navy aboard various ships.

The following was delivered as the "Welcome Address" for the Eighteenth International Pump Users Symposium on March 6, 2001. It has received minimal editing.

I add my welcome to 2001 Texas A&M Symposium. The subject of my remarks this morning will be: "Pumps and Their Systems—A Changing Industry." I will be discussing:

- A "new" definition of cost
- Reemphasis of responsibility
- The future of standards
- Ownership versus pay for performance
- Certification

Past and current business conditions in the pump industry have set the stage for significant changes to take place in the future. We need to briefly acknowledge these conditions to understand the basis of the pending changes.

Pumping systems, either directly or indirectly, are an essential part of every business throughout the world. It has been estimated that nearly 20 percent of the energy generated globally is devoted to driving pumping systems.

Pumps are complex, technical pieces of equipment that require significant investments in facilities and personnel to manufacture and deliver (Figure 1).

Too frequently, the user community has not recognized the hidden cost of the broad range of administration, technical expertise, and customer support that has come to be expected as a part of the equipment that is delivered. Reliable sources have placed this indirect labor as high as 40 percent of the cost of the delivered pump (Figure 2).

The systems in which pumps are installed have a direct impact on pump reliability and maintenance. The systems can be of

Manufacturing Tasks

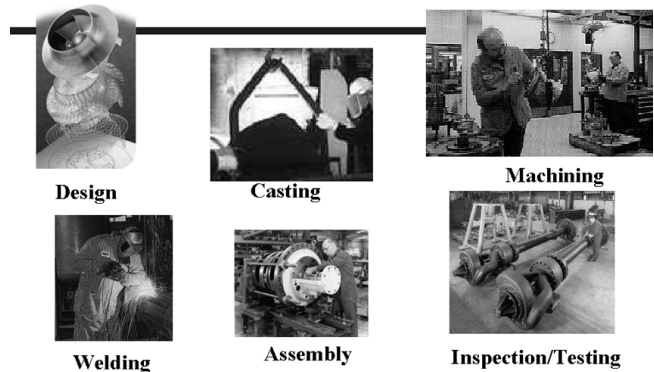


Figure 1. Manufacturing Tasks.

Cost of Pump Production

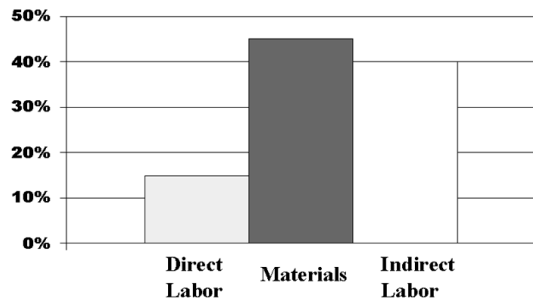


Figure 2. Cost of Pump Production.

varying degrees of complexity and are ever changing. Even if the systems are adequately designed and defined when the pump is initially selected and installed, they are too frequently altered to meet different conditions before or shortly after startup of the system (Figure 3).

Pumps are expected to move fluids under the most adverse conditions and abuse with no unexpected failures, and while requiring the minimum of maintenance.

There are two words that can be used to describe all pump industries throughout the world today. These words are "mature" and "competitive." The more mature an industry, the more competitive the business. The manufacturing of pumps is one of the most mature and competitive businesses in the equipment industry today.

It is important to recognize the pump industry participants include:

- The owners,
- The contractors, and
- The pump manufacturers and their suppliers.

Systems Impact Pump Reliability & Maintenance

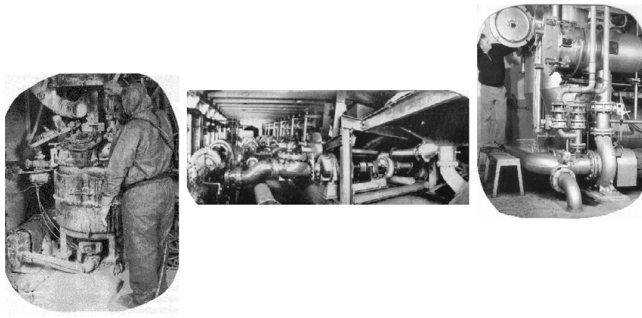


Figure 3. Systems Impact Pump Reliability and Maintenance.

Collectively it is the owners that establish the basis of conducting business and the business climate, as they are the source of capital. Success or failure of their companies, and frequently of their suppliers, rests with their perceptions and decisions, and they must be convinced any "change" is to their advantage.

For the past several years, pump manufacturers and their subsuppliers have been evaluated almost solely on the first cost of the equipment they supply.

Pump suppliers have responded by reducing costs and improving their productivity.

To further improve their cost picture, many pump companies have merged or have acquired less financially sound companies to broaden their product line, increase their market share, and reduce the percentage of fixed costs assigned to overhead. As a result, prices and the development of innovative products have remained relatively flat in the pump industry for several years.

Today, due mainly to this consolidation, it is estimated that of the several hundred pump manufacturers in the world; less than 10 major companies supply 50 percent of the value of the products shipped.

Changes in the products of a mature industry occur slowly unless influenced by external forces. Even then, such changes are limited by the number of customers that are willing to support the changes through industry standards such as API, ASME, HI, and PIP. Pumping equipment, being a product of a mature industry and serving very cost conscious customers has had little incentive to produce significant innovations in equipment design or procedures (Figure 4). This is a merely a historical state of the industry.

Equipment Designs Change Slowly in a Mature Industry

API - American Petroleum Institute

**ASME - American Society of
Mechanical Engineers**

HI - Hydraulic Institute

PIP - Process Industry Practices

Figure 4. Equipment Designs Change Slowly in a Mature Industry.

The future major changes in the pump industry will *not* be in hardware designs but in the methods of procurement, application,

maintenance, and ownership. The business conditions that will force these changes to occur will be the continued demands for lower owner production costs and final product prices.

The technology that will allow this to occur exists in current electronic tools, such as our computers and their associated software programs. The only impediment to be overcome is a commitment by the industry participants to the development of global, interactive, electronic systems that will allow the more rapid and accurate analysis, communication, data distribution, and record retention of pumping systems.

We have only begun the process. What lies ahead in the next five years and beyond?

First, there will be a continued and increasing demand by the *owners* for improvement in company profitability. However, owners and their contractor representatives will ultimately be required to recognize the negative impact of unique and conflicting specifications, unrealistic operating requirements, and the effect poor quotation and order administration has on their suppliers' prices and equipment performance. Suppliers' prices will reflect, directly or indirectly, the incurred costs of poorly engineered and administered projects and orders from the owners and their contractor representatives (Figure 5).

Responsibility

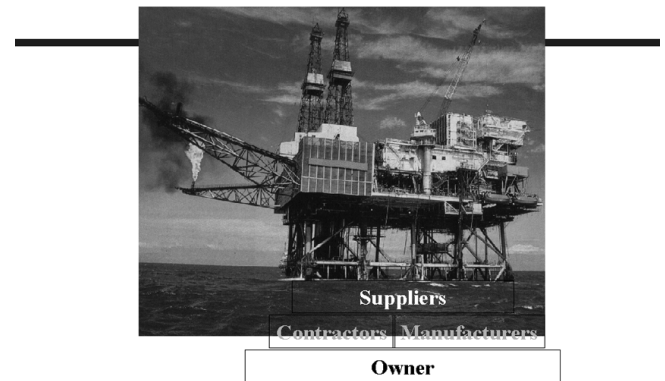


Figure 5. Responsibility.

Manufacturers will be expected to identify the origin of increased operating costs, and incorporate these data into their contract agreements where it is appropriate, rather than assign it as a flat percentage of overhead to all customers.

The suppliers' will, by necessity, become more assertive in expressing *their* needs to achieve the goals set forth by the owners, and, most properly, will expect to discuss, with the management of their customers, the problems their operations are creating.

The equipment manufacturer will also be required to meet schedules, and deliver a product that consistently achieves the advertised capability of the equipment, and inform the owner of the consequences the proposed applications will have on the equipment reliability and maintenance costs. This requires a greater knowledge of pump application by the pump representative and an understanding of the detrimental effects that a poor application will have on the product.

How cost is defined will change (Figure 6). The change will be driven by studies such as the life-cycle cost study now being completed by the Hydraulic Institute and Europump, which is currently scheduled to be released in the second quarter of 2001.

This study is the culmination of extensive cooperation between individuals in the manufacturing and the user community, and has been commissioned to assist the owner and application engineer in making better decisions that will define the true cost of a pumping system.

There are at least five fundamental costs in the development, installation, and operation of a pumping system. First cost is

The Cost Envelope

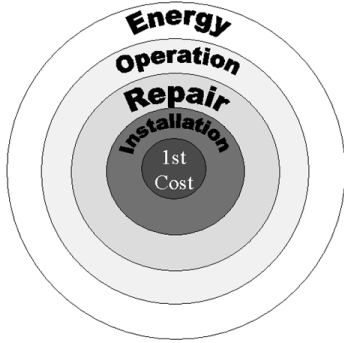


Figure 6. The Cost Envelope.

frequently the least of these expenses, but currently still tends to dominate the equipment selection process (Figure 7). The present tax legislation and resulting accounting systems drive this process and do not address the true cost of a total pumping system.

Typical Life Cycle Cost Distribution

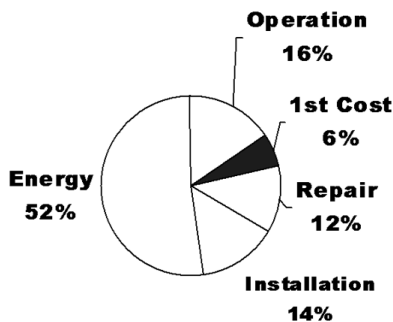


Figure 7. Typical Life-Cycle Cost Distribution.

When such information as the Hydraulic Institute and Europump study is applied to the development of pumping systems, along with recent technical additions to the HI Standards, it will be realized the total pumping system cost can be reduced and equipment reliability increased.

The equipment owner that embraces and implements this concept will drive the changes in the industry that will alter not only procurement and maintenance concepts, but accounting systems as well that will result in lower production costs and a “real” competitive international advantage.

Standards will become an increasingly important factor in conducting business in the pump industry. As pump manufacturers consolidate and structure their organizations for the lowest possible cost and rapid delivery, orders for equipment outside the recognized standards will be charged a premium, if they are available at all, on individual orders.

There are three successive levels of standards that exist. Their order of priority, as recognized by manufacturers, is first the national, second the industry, and, finally, the corporate standard (Figure 8). To achieve maximum benefit of these standards, the owner’s corporate standard will be expected to represent the consensus of the company and be written as an addendum to any existing national or industry standard. Unique specifications for the same application from different plants of the same corporation will pay a justifiable premium.

Standards

National - ANSI, ISO
Industry -- API, HI, PIP, ASME
Corporate -- Shell, DuPont, Union Carbide

Figure 8. Types of Standards.

The management of the companies of the more aggressive industry participants will support and provide leadership in the development of functional, national, and industry standards that address the needs of all the participants in the supply chain.

For owners’, the discipline required to implement a life-cycle cost analysis program, will drive the recognition of the advantages of developing and enforcing equipment and procedural standards within a company as standardization has a positive impact on cost and savings.

Communication is a major cost factor in developing a pumping system. These costs will be reduced for those that have adequately invested in the discipline, systems, and the electronic tools to do so.

Accurate and timely communication is essential between all of the industry participants. The current state of the communication process requires significant effort, is inefficient and prone to errors; all due largely to the lack of standardization in the task. Not only do the communication processes and administrative requirements vary between companies, but within the same company as well (Figure 9).

Communication

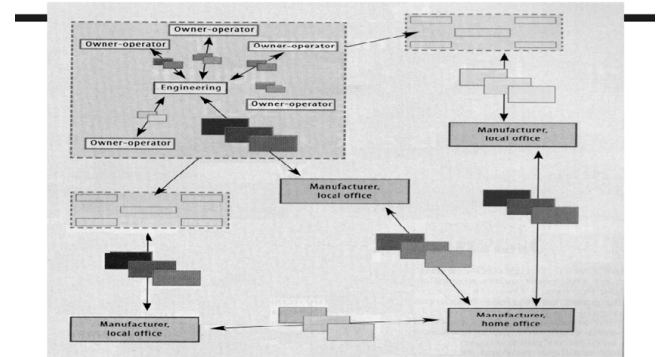


Figure 9. Communication Cost Factor.

The API, ASME, and PIP pump standards’ committees have collaborated to adopt standardized terminology and data sheets that will permit a universally accepted software program to exchange and maintain historical information throughout the inquiry, order entry, and maintenance phases of equipment sourcing and usage. The acceptance and implementation of this information will be dependent on the support of the ultimate equipment owner.

We are only beginning to see the vast potential the electronic tools will have on the communication and standardization effort in the pump industry. These tools are a necessary and vital part of every business but must become more effective and practical in the future. As present technical personnel move into management positions, there will be a demand for standardization to assure these tools are functional and capable of interacting as systems and across corporate boundaries.

As “owners” become more knowledgeable of the total cost of pumping systems and the basis of these costs, there will be

recognition that changes are required in the manner in which pumping systems are developed and maintained. Understanding the true complexity of developing reliable and low maintenance systems will lead to a different concept of pump and system ownership as has been done in the very competitive airline and railroad industries.

The effect system design has on the reliability and maintenance of the pumps and the associated cost will be identified and, where the economics warrant, long-term design and maintenance contracts will be established with organizations that have been trained for the specific task.

As pump manufacturers broaden their base of operation, they will be the logical contender to supply total pumping system services to either the engineering contractor or what is now the ultimate owner of such systems. For such a change to occur successfully, the supplier of the equipment and services must be brought into the project at an early phase of the system design, and adequately compensated for supplying these services.

Pumping systems are complex and their development requires a broad knowledge of many fields of technology. Pumping systems consume a large portion of the world's generated energy. They are expected to move hazardous materials reliably and without incident. We have environmental laws and legal and financial penalties if these systems fail. Too frequently what currently is lacking is a uniform understanding of the basic principles of developing a pumping system and an appreciation for the negative consequences resulting from this lack of understanding.

At some time in the future, owners and contractors will recognize the importance of certifying the individuals that have responsibility for developing these systems, and that they are grounded in the eight fundamental pumping principles before allowing them to make decisions on such systems. As business managers become more knowledgeable of the true cost and origin of errors, certification by a recognized independent and impartial authority will be a requirement of conducting business. A degree, professional registration, and "on the job training" are not adequate in today's fast-paced industry.

The constant demand for a lower first price on every item or service purchased has led to a state of near stagnation of new and innovative products and work processes, and has led to the reduction or even the elimination of some services. The responsibility for implementing change lies with the ultimate owner of the equipment. Manufacturers and contractors can only proceed with the agreement and support of their customers.

How quickly such change is implemented depends on those willing to take up the challenge to develop the administrative solutions that will reduce the system development and maintenance costs and improve reliability. This requires changes in the accounting and purchasing methods currently in place, and an understanding by all individuals involved of the negative effects

these current methods are having on the industry. Change will occur only when it is realized the current procedures will no longer achieve the goals of the industry.

There are new electronic "tools" in place to support a dramatic change in the pump industry that require changes in business procedures. Management of the individual company participants must provide the direction and support to assure such changes are accomplished to reap the benefits.

The present methods and definitions will be challenged as individuals compare alternatives. The rate such change will occur is dependent on individuals and companies willing to suffer some initial inconvenience and to adequately fund the training and education of people to effectively operate and use these concepts and tools.

For equipment manufacturers and contractors to continue to develop and support the goals of the owners, they must be given the opportunity to share in the savings generated with the innovative systems and technology they are expected to develop, either in the form of direct compensation or expanded services they can render (Figure 10).

Value & Return -- Key Elements

All industry participants must receive a reasonable return on their investment.

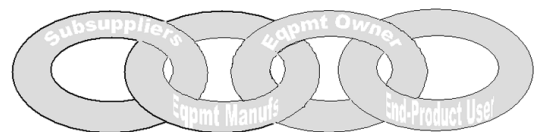


Figure 10. Value and Return.

Addressing the challenges being put forth by the business community for the continued high returns on investment has forced the beginning of change in the way business is conducted—not in perhaps the anticipated manner initially intended—but the resulting changes will be far more beneficial.

We all will be affected by the change.

I wish to acknowledge my colleague, Judy Hodgson, for her effort in the development and presentation of the slides that have supported these comments and the subsequent development of this publication copy. Thank you, Judy, for your patience with me in the many revisions I made throughout this process.

Thank you for your attention.