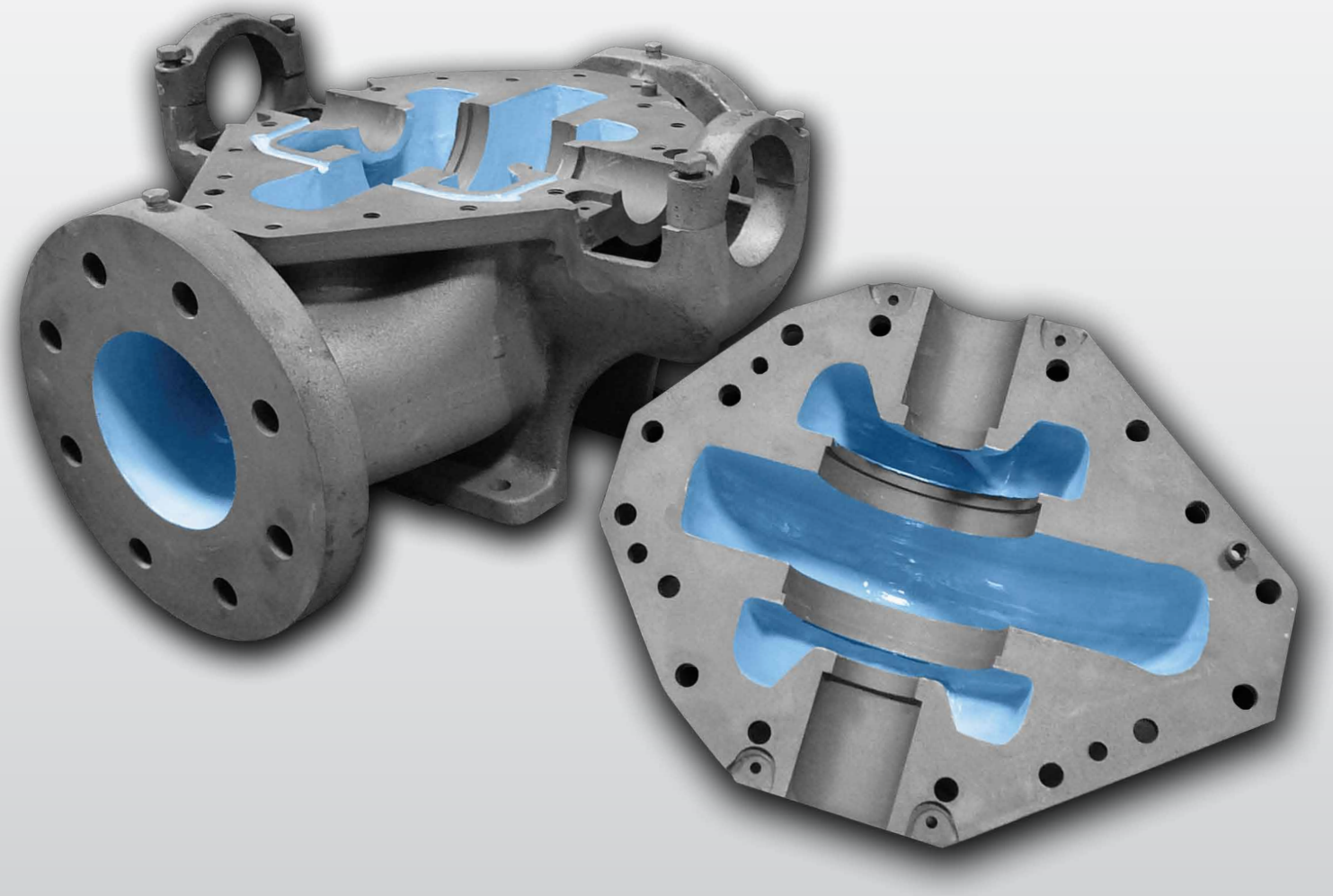
BELZONA®
Repair • Protect • Improve



PUMP EFFICIENCY IMPROVEMENT

The Cost Effective Approach to Maintaining Fluid Flow

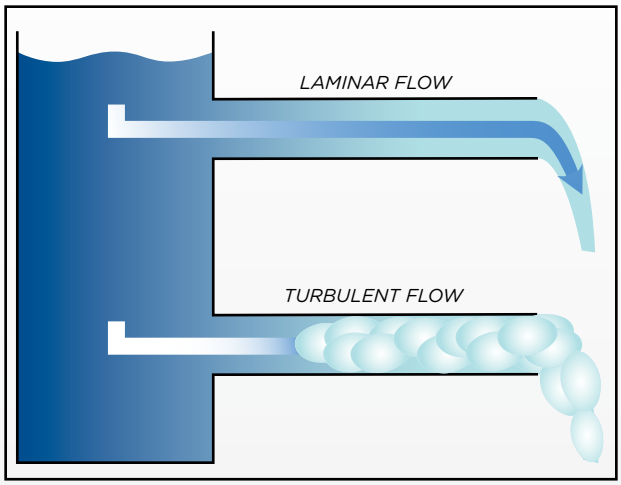


ENERGY LOSSES IN FLUID HANDLING SYSTEMS

The nature of a pump system presents engineers, planners, contractors and operation personnel with regular maintenance challenges including:

- Erosion of fluid flow passages
- Build up of corrosion deposits within the pump casing
- Loss of critical mechanical clearances

These complications consequently result in loss of pressure, reduced fluid flow rate, loss of efficiency, and ultimately, inflated system operational costs.



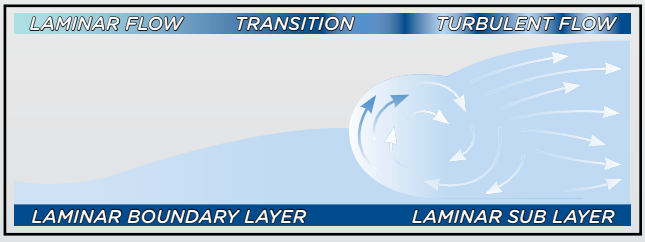
FLOW 101

A fluid passing through a hydraulic passage is subject to resistance caused by friction and viscosity. If the velocity of the fluid is low, it will flow in parallel layers to the sides of the passage, with no disruption between the layers. This regime is known as “laminar flow”. If the velocity of the fluid increases, at some point the fluid flow becomes chaotic, and unsteady eddies appear. This regime is opposed to the laminar flow and is known as “turbulent flow”.

Classical theory of Fluid Mechanics states that molecules of a fluid at the surface of the passage are stationary. As a result, a velocity gradient is established across the passage due to the fact that the fluid layers adjacent to the static molecules are slowed down. This effect becomes less intense as the distance from the passage wall increases. The resulting viscous shearing is known as “skin friction” or “boundary layer drag”, and accounts for pressure losses in passages operating under a laminar flow regime. The “boundary layer” is defined as the layer of fluid in the immediate vicinity of a bounding surface, which has its velocity affected by boundary shear.

EFFECTS OF SURFACE ROUGHNESS

As the surface roughness of the passage increases, the “boundary layer” thickens. At some specific speed (known as critical velocity), this layer becomes unstable and the transition is made to turbulent flow. Under this regime discrete molecules of fluid behave as separate entities creating vortices and cross-currents. This results in energy losses in addition to those arising from skin friction or boundary layer drag.



In the case of relatively smooth surfaces, the thickness of the “boundary layer” can still be sufficient to cover surface projections, and the surface is said to be “hydraulically smooth”.

SURFACE ROUGHNESS AND THE EFFECTS OF EROSION - CORROSION

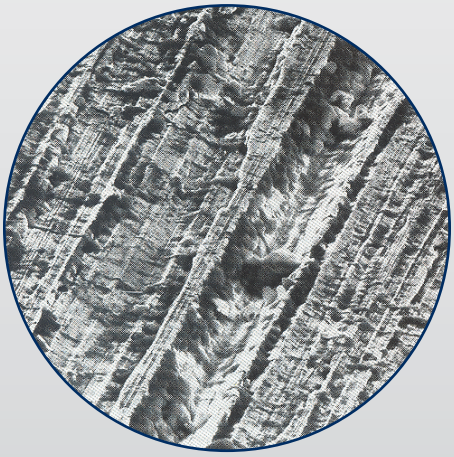
In case of equipment made of cast iron, surface roughness can be seen by the naked eye although is more clearly visible with the aid of a scanning electron microscope.

Even seemingly smooth metal surfaces are found to be relatively rough when examined under high magnification...

Turbulence in the liquid can lead to impingement, a situation where the turbulent action of the liquid bombards the surface of the equipment, thereby accelerating the erosion of the metal surface.

Turbulence also gives rise to cavitation as a result of the formation and implosion of fluid bubbles within the liquid. As these implode shock waves are generated, creating destructive forces of such magnitude that the metal is eaten away, resulting in a severely pitted surface.

These effects are further accentuated by corrosion and abrasion, thus leading to further reduction in efficiency of the system.



...and further surface roughening can result from erosion-corrosion effects in service.

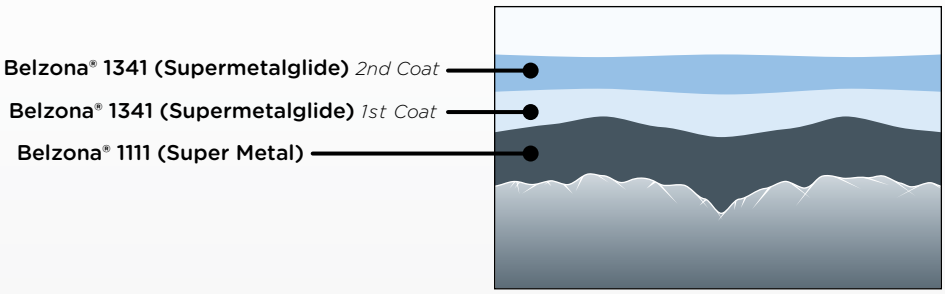
Typical effects of erosion-corrosion on a centrifugal pump cutwater.

THE BELZONA® SUPERMETALGLIDE SYSTEM

Energy losses due to the effects of viscous drag and surface roughness, accentuated by erosion-corrosion effects, can be reduced by the application of a protective coating to the surfaces of the fluid handling equipment.

Conventional coatings, however, have severe limitations:

- Many fail to give a smooth surface
- Poor rheology leads to excessive film thickness that can affect fluid flow characteristics
- They are insufficiently resistant to erosion-corrosion effects



NOW, THE TRUE SOLUTION: THE BELZONA® SUPER METAL/SUPERMETALGLIDE SYSTEM

Belzona provides solutions to minimize the effects of abrasion, erosion-corrosion, and cavitation on fluid handling equipment while simultaneously increasing performance. In addition, Belzona can also be used on new equipment to enhance efficiency and reduce electrical consumption. Its unique system provide gains in efficiency from 3% - 8% on new pumps as well as up to 20% on those already in service.

In fluid handling equipment which has previously been in service, any severely worn or pitted areas are first brought back to the original contours using Belzona® 1111 (Super Metal), a machinable, ceramic steel filled repair compound with outstanding adhesion to metal surfaces.

Then, application of the Belzona® 1341 (Supermetalglide) can be carried out. Two different colored coats (to ensure successful overlap) are applied by brush, applicator, or spray at a typical thickness of 10 mils per coat. This product has been formulated to ensure a perfectly smooth surface. The finish and coating thickness are critical factors behind the outstanding performance of the product as they reduce frictional drag without changing the fluid flow characteristics of the equipment.

Also important, is the unique chemistry of the Belzona® Supermetalglide coating. Water simply slides off it because of its hydrophobic nature and wear by abrasion is minimized by its encapsulated blend of lubricant agents and abrasion resistant fillers.

All this, coupled with resistance to impingement, cavitation, and corrosion, make Belzona® Supermetal-glide the material of choice for reducing energy consumption in fluid handling systems, particularly under aggressive conditions.

EFFICIENCY ENHANCEMENT PROVEN BY INDEPENDENT TESTING

For testing Belzona Supermetalglide, the test vehicle chosen was a single stage, end suction centrifugal pump with 10 inch suction and discharge branches.

The pump in uncoated condition, running at 1,300 rpm was found to deliver 5.55 MGD (875 m^3/hr) at 86.9 ft (26.5 m) head with overall peak efficiency of 83.5% (overall efficiency defined as the ratio of water power output to mechanical power input at the shaft).

TEST SET-UP

The pump tests were carried out using a typical closed-loop system with a series of flow/head/power readings taken across the full flow range from 10% to 125% to give an accurate performance curve using calibrated test instrumentation traceable to national standards.

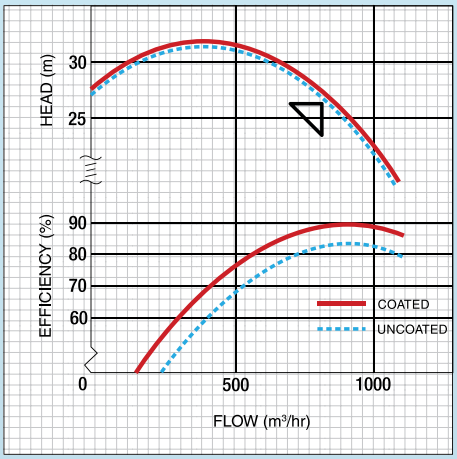
RESULTS

Testing of the Belzona Supermetalglide coated pump gave a maximum of 6% increase in the peak efficiency. Significantly, there was a little change to the pump head/flow characteristics with the peak efficiency duty coinciding with that of the uncoated pump.

Only Belzona® Supermetalglide, through independent testing, has proven to give ideal situation of "Across the Range" increases in pump efficiency while maintaining the original head/flow characteristics.

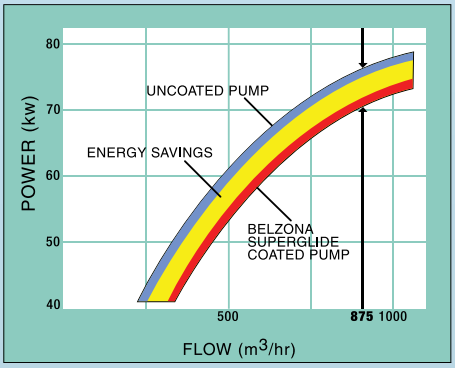
ENERGY SAVINGS IN PRACTICE

Fluid handling equipment consumes vast quantities of energy and, therefore, efficient operation of this equipment is essential to optimize operational costs. Any increase in fluid efficiency gives an immediate saving in power consumption, and provided that these pumps can be operated in excess of 5,000 hours per annum, these savings can be considerable.



Take, for instance, the pump tested N.E.L., a relative small unit consuming 75.7 kW at duty point. By application of Belzona® Supermetalglide system, the peak efficiency was raised by 6% giving power reduction of 5.1 kWh at duty point.

Assuming a 5,000 hour operating cycle/annum, the power savings over this period would amount to 25,400 kWh.



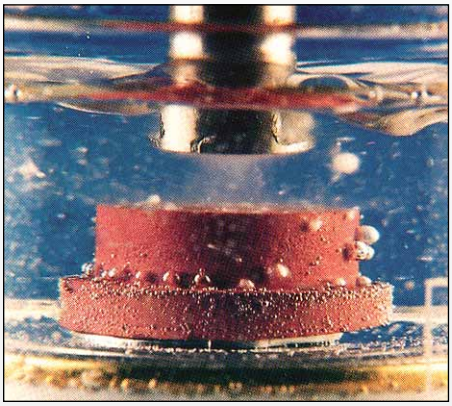
Repairing worn and damaged equipment with Belzona® Supermetalglide system, or coating original equipment with Belzona® Supermetalglide, will have an immediate effect on performance on operating costs giving many years of power savings in conjunction with high performance erosion/corrosion protection.

The testing of Belzona® Supermetalglide was carried out under strict independent laboratory conditions utilizing the most-up-to-date fluid flow test facilities of the National Engineering Laboratories (N.E.L.) who, as part of the U.K.'s department of Trade and Industry, represent the most comprehensive pump test facilities of their type available anywhere in the world.

PERFORMANCE RETENTION

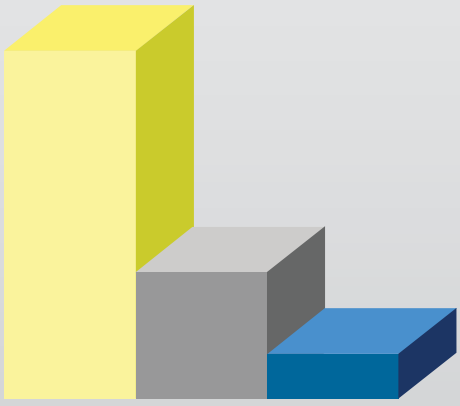
By careful consideration of all the parameters affecting the performance of fluid handling equipment, Belzona® Supermetalglide was developed to overcome and outperform conventional coating systems in the areas of:

CAVITATION



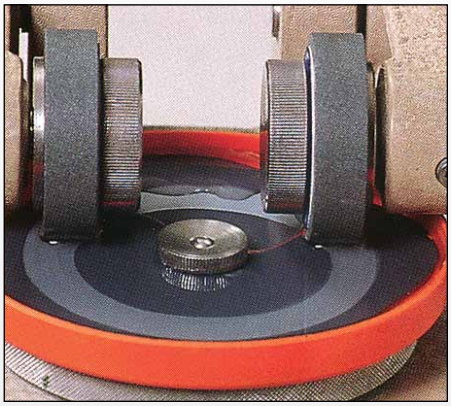
Cavitation can occur in any centrifugal, fluid handling equipment through service outside, normal operating conditions. And as such, any coating system must be capable of resisting breakdown under these circumstances.

Belzona® Supermetalglide has, in tests using ultra-sonic cavitation simulation equipment, giving outstanding performance compared to conventional coatings such as metal filled epoxies and polyester glass flake systems.



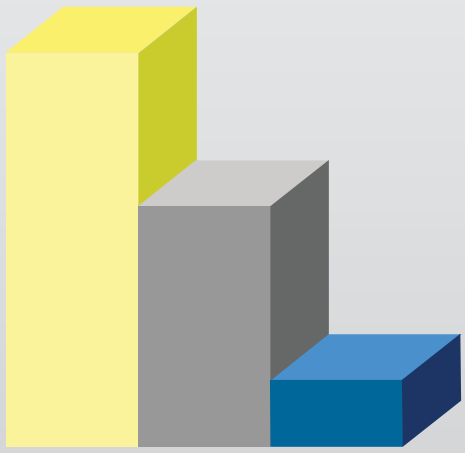
COMPARATIVE VOLUME LOSS PER UNIT TIME TESTED AT 20,000 CPS AND 50 AMPLITUDE

ENTRAINMENT



Particles in suspension in any fluid system can lead to rapid deterioration of a protective coating.

Belzona® Supermetalglide was engineered to meet these aggressive “entrainment” conditions. Its excellent wet abrasion resistance, illustrated here against metal filled epoxies and glass flake linings using wet abrasion testing, widens its scope of application to include those involving entrained solids.



COMPARATIVE VOLUME LOSS PER UNIT TIME TESTED AT 1,000 CYCLES USING WET TABER ABRASER TEST

BELZONA PROTECTIVE COATINGS

REPAIR

ELIMINATE ADDITIONAL COST

Belzona provides solutions for repairing pumps rather than disposing the equipment, which in turn reduces the cost of downtime and eliminates expenses for new pump purchases.

Entrained solids and cavitation can cause severe damage, as noted by the holes and pitting on runner vanes.

Replacement of the runner would result in a several million dollar investment. Therefore, rebuilding and protecting with Belzona is the most cost effective option.

PROTECT

EXTEND PUMP LIFE

Belzona offers a durable corrosion resistant protective layer to protect the internal and external areas of the pump from the effects of erosion and corrosion.

Output of the pump was drastically reduced due to corrosion and cavitation damage.

After coating the pump with Belzona, performance drastically increased. Four years later, the pump was still 9% more efficient than its previous condition, prolonging the life of the pump.

IMPROVE

INCREASE PUMP EFFICIENCY

By using Belzona, pump systems receive a smooth surface finish, which then creates better flow to increase pump efficiency.

Old, worn pump casings that are pitted and covered with scale can reduce pump efficiency by as much as 20%.

By addressing erosion-corrosion problems, Belzona creates a smooth surface finish which increases efficiency of the pump better than OEM provided.

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Belzona is not just a product, but a complete service to industry.

About Belzona

Established in Elland, West Yorkshire England in 1952 by specializing in the flame spraying of steel with zinc to provide corrosion protection, Belzona has become a leader in providing industrial protective coatings and repair composites. Belzona's products are used for rebuilding, repairing, and maintaining machinery, equipment, buildings, and structures,

With significant investments in research and development, Belzona continuously evaluates and enhances our product range to ensure that market-driven solutions to problems are continuously developed to exceed the ever-increasing industry demands.

Technology and Support

Belzona's zinc-rich epoxy coatings have developed into a technologically advanced product range that is renowned for being at the forefront of advanced polymer systems and engineering maintenance.

At Belzona we have made it our business to be an indispensable asset to our customers. We recognize that top quality products are only effective with a support mechanism to ensure that they are used properly. Identifying this need, we offer uncompromising support unmatched by anyone in the industry.

Local Service, Global Reach

Worldwide, authorized Belzona Distributors have their own trained Belzona Technical Consultants to serve local Industry.

A Belzona Technical Consultant will provide:

- Diagnosis of your maintenance problem
- Recommended solution
- Working specification
- On the spot advice and training of maintenance staff, or contractor's crew

QUALITY PRODUCTS – TECHNICAL SUPPORT
Belzona® products are manufactured through stringent quality and environmental control guidelines complying with the internationally recognized requirements of **ISO 9001:2000** and **ISO 14001:2004**.
Belzona® has a global distribution network of over 140 Distributors operating in 120 countries. Local support is provided by trained Technical Consultants who will diagnose the problem, recommend the solution and provide 24 hour on-site application supervision and advice.

BSI
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