Sims
SINCE 1919

SIMSITE® STRUCTURAL COMPOSITES SIGNIFICANTLY REDUCE ENERGY CONSUMPTION

Today, there is a tremendous amount of effort being put forth to reduce energy consumption. The DOE (Department of Energy) and the Hydraulic Institute have been working together to reduce the energy consumption of pumps, motors, and pump systems. This is where SIMSITE® Structural Composites shine — they can significantly reduce energy consumption — in some cases as much as 20%, or more! It starts with the basic concept of Composites.

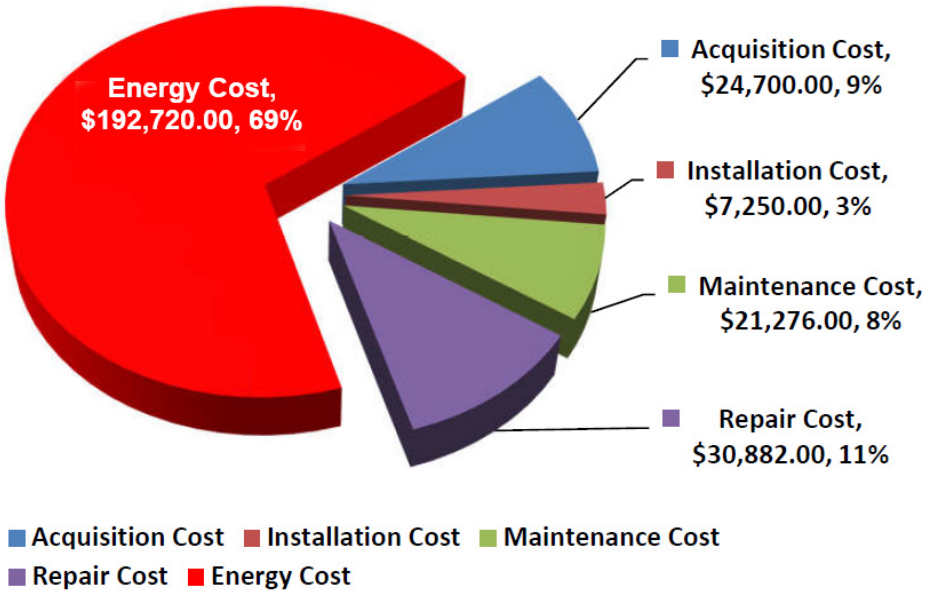
SIMSITE® Composite Components are Corrosion and Erosion Resistant

Corrosion, Erosion, Cavitation, Rotor Imbalance, and Leakage between the Wear Rings, Casing Rings, & Interstage Bushings are major contributors to the loss of Pump Efficiency Damage from Corrosion, Erosion, and Cavitation quickly destroys the metallic pump and pump parts which makes the pump inefficient and drastically increases energy consumption.

A METALLIC IMPELLER AFTER ONLY 3 MONTHS OF OPERATION IN FRESH WATER!

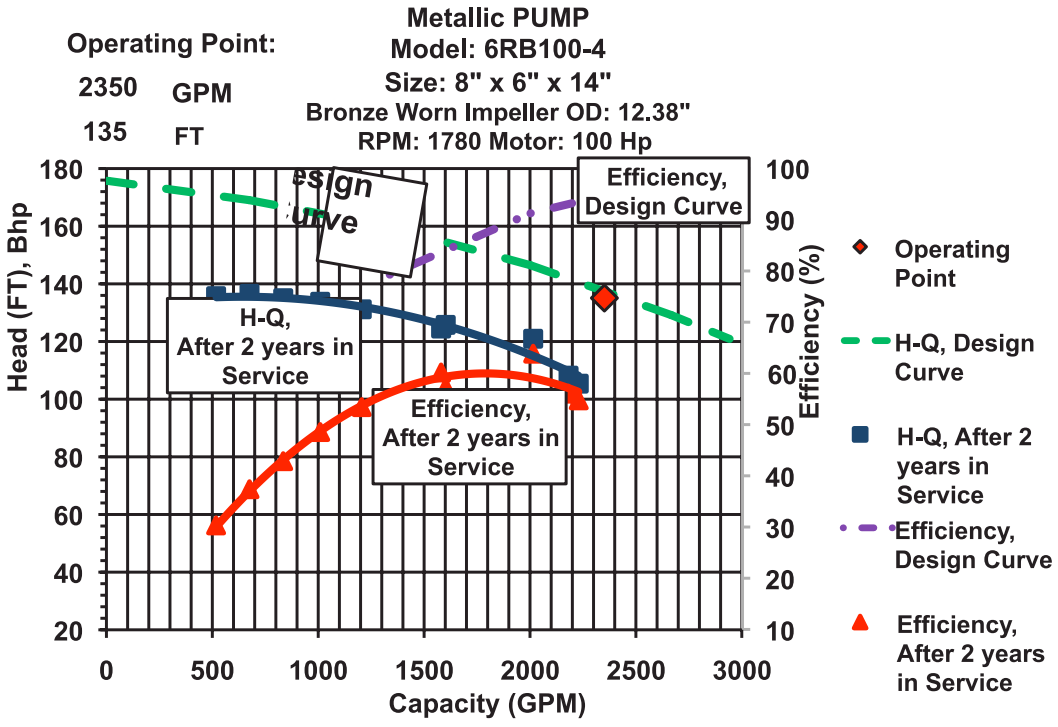
SIMSITE® STRUCTURAL GRAPHITE COMPOSITE PUMPS & IMPELLERS — LIGHT WEIGHT, CORROSION RESISTANT AND ENGINEERED FOR HIGH EFFICIENCY, AND LONGER LIFE

SIMSITE® Composites Reduce Energy Consumption Because They Do Not Corrode



The chart on the left clearly shows that Energy Costs dwarf any other expenses. In this case the Acquisition Cost is only 9% of the total Life Cycle Cost of just one pump. This is why the Department of Energy, Europump, and the Hydraulic Institute have recently focused on Pump Life Cycle Costs. SIMSITE® Composite Upgrades can not only reduce **maintenance and repair costs,** but they also can drastically reduce **Energy Costs!**

The performance curve below clearly shows the huge drop in efficiency (Over 35%) when the bronze impeller cavitated, and corroded over a two year period in this pump, which operated in chlorinated water. Although the starting efficiency of the pump is good when the pump was new, this test clearly shows the rapid deterioration of the efficiency and performance as the pump continued to operate more and more inefficiently. The heavy losses of efficiency and performance could have been avoided by installing an Engineered Structural Composite Impeller and Rings, which would not corrode and would be cavitation resistant. The inefficiency of this pump contributed heavily to increasing the Energy, Maintenance, and Repair Costs of operating this pump!



Trouble Free Performance

SIMSITE® Structural Composite Impellers and Casing Rings offer tremendous advantages over traditional products cast from metal, because they do not corrode, are light weight, can run with tighter clearances, are designed for high efficiency, and are not subject to casting defects or imperfections. SIMSITE® Structural Composite Impellers and Casing Rings also offer perfect balance, both mechanically and hydraulically, tremendous mechanical strength, and corrosion, erosion & cavitation resistance. Many of these Impellers and Casing Rings have been used successfully since 1955, in the Marine, Navy, Waste Water, Industrial & Chemical markets. Structural Composite Impellers, like SIMSITE® Impellers, have outlasted and outperformed products manufactured from bronze, stainless steel, duplex steel, monel, and even titanium.

SIMSITE® Composite Wear Components and Surface Finish

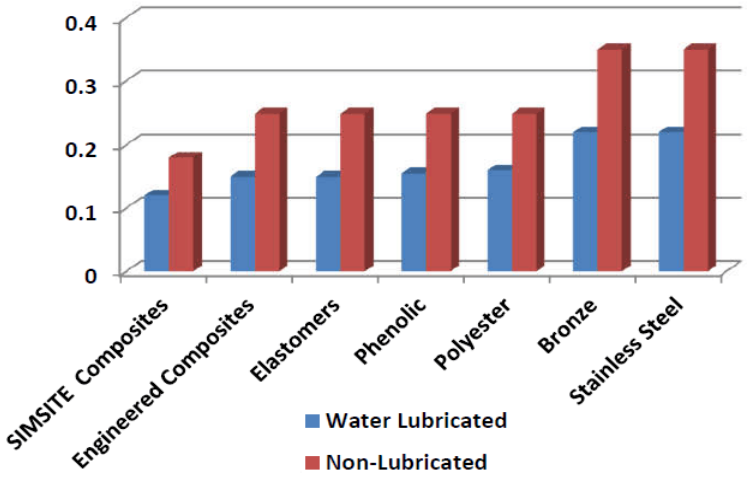
Wear between the rings and bushings create large clearances, which result in substantial decreases in pump efficiency, as well as huge increases in the energy consumed to operate the pump. Historically, most pump companies, and repair facilities have used metallic parts for Wear Rings, Casing Rings, Sleeves, Bushings, and Guide Bearings. These metallic parts have the potential to gall and seize, and therefore, require larger clearances between the parts. Compounding the issue is that these metallic parts do not have self lubricating qualities like many composites, and metallic parts are always subject to corrosion which further increases clearances and energy consumption.

Fortunately, today there are excellent solutions to these problems. Structural Composite like SIMSITE® — manufactured by SIMS PUMP COMPANY — have the mechanical strength of metal, and have self-lubricating qualities embedded in the composite eliminating the risk for seizing and galling. Furthermore, SIMSITE® Structural Composites do not corrode in Seawater, Waste Water, Sewage, or Chlorinated Water and they are excellent with most chemicals. SIMSITE® Engineered Structural Composites have extremely smooth surfaces with an excellent surface finish and a low coefficient of friction on all surfaces, which increases efficiency and reduces energy consumption.

SIMSITE® Structural Composite Rings are corrosion resistant and wear better than metallic rings. Because they will not seize, or gall like metallic rings, they run with tighter clearances, which increase efficiency and decreases energy consumption.

SIMSITE® Engineered Structural Composite Sleeves, Guide Bearings and Bushings have self-lubricating qualities and are not subject to corrosion.

COEFFICIENTS OF FRICTION



SIMSITE® Composites are Corrosion and Erosion Resistant

Since many composites are impervious to different corrosive environments, these composite wear components will not corrode, or erode like metallic components. Although composite wear components will reduce energy consumption for all pumps, including all fresh water services, the greatest savings will occur in corrosive environments such as salt water, waste water, chlorinated water, and chemical process, because the composites are corrosion resistant and in many cases will not corrode at all.

When the metallic pump parts begin to wear from corrosion, pump efficiency drops drastically. This drop in efficiency not only has a significant impact on Energy consumption, but it also significantly increases the cost of maintenance, repairs, and overhauls. The life cycle of the pump is often reduced to months instead of years.

SIMSITE® Composites Have a Low Coefficient of Friction

As you can see in the graph to the left, most composites have a lower coefficient of friction than the traditional metallic materials; (Bronze & Stainless Steel) that have been used in pumps. However, SIMSITE® Structural Composites have the lowest coefficient of friction — lubricated or non-lubricated. The low coefficient of friction reduces the friction losses of the liquid being pumped, which allows for an increase in efficiency and a reduction in energy consumption.

Composite Coatings have been used to coat pump casings, which not only protects the casings against corrosion and erosion, but also smoothes the rough surfaces, which reduces friction and thus increases efficiency. Some studies have shown that efficiency can be improved by as much as 2% to 3% by using Composite Rings, Guide Bearings, and Coatings.

CORROSION RESISTANCE CHART

	Salt Water	Waste Water	Hydrochloric Acid	Sulfuric Acid
Bronze	3	3	5	5
Stainless Steel	2	2	5	5
SIMSITE® Composites	1 No Corrosion	1 No Corrosion	1	1

Corrosion Resistance: 1 — excellent, 2 — good, 3 — OK, 4 — be careful, 5 — not usable

SIMSITE® Engineered Composite Impellers

Engineered Structural Composite SIMSITE® Impellers offer an even greater potential to reduce energy consumption. Because of their corrosion, erosion, & cavitation resistance, light weight, smooth vane passageway surfaces, and anti-galling & seizing characteristics, composite impellers are able to operate at significantly higher efficiencies than metallic impellers reducing energy costs and consumption.

Structural Engineered Composite Impellers, like SIMSITE® Impellers & Rings, offer even greater savings, because they are machined as opposed to being cast or molded. Machining enables the composite impeller to be optimized hydraulically for the service in which the pump is running. Machining allows for perfect balance, both mechanically and hydraulically, because of the accuracy of the vane passages. Since these impellers are corrosion resistant to most liquids, they do not go into an imbalance even after years of service! This reduction in vibration translates into higher efficiency and a reduction in energy consumption.

Improved Life-Cycle

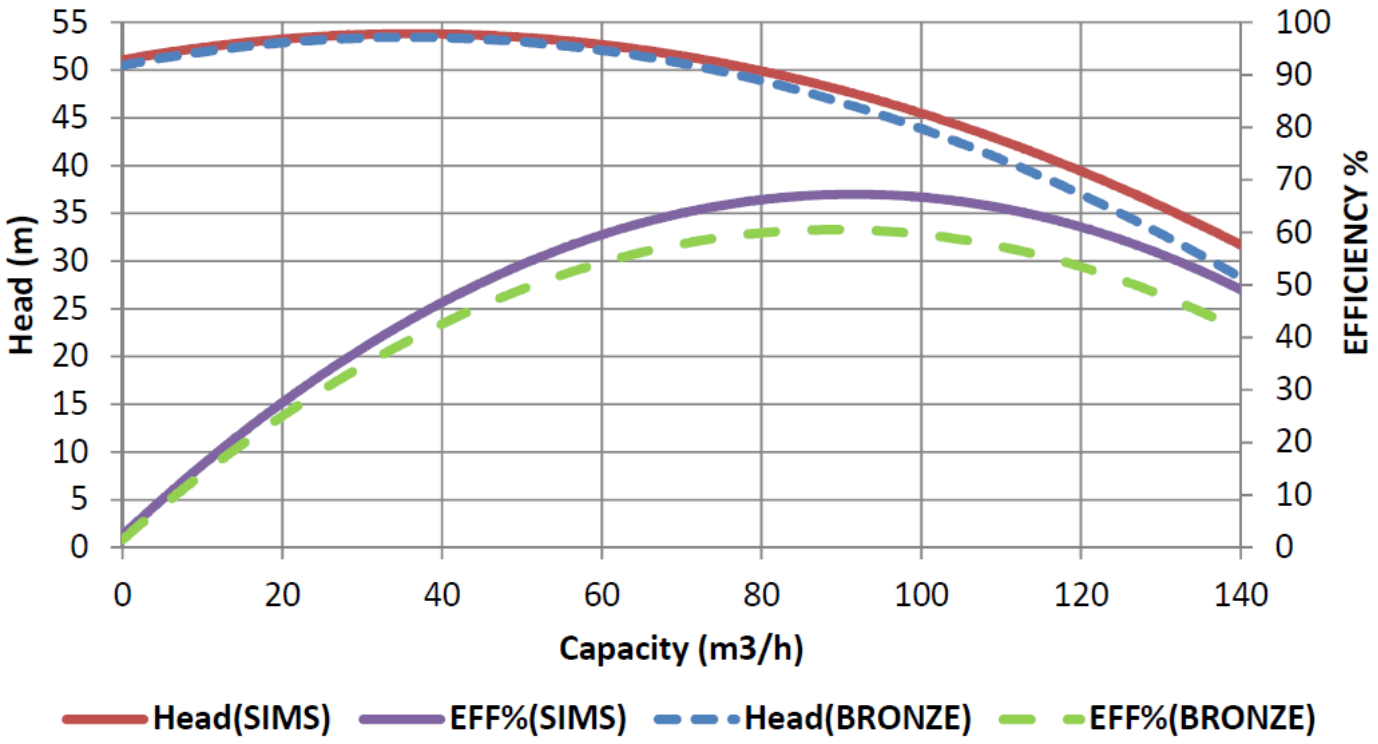
According to the U.S. Department of Energy (DOE), many centrifugal pumps may be less than 50% efficient — but have the potential to improve by 20–30% through various upgrades and system changes.

Pump Upgrades not only improve performance, maintenance and repair issues, but they also improve efficiency as well, so they will extend pump life and reliability. Pump Upgrades prevent expensive products from deteriorating; they can even prevent pump leaks that can result in costly cleanups and fines from regulatory agencies. In most cases, reduced downtime eliminated by the pump upgrade outweighs all other benefits.

In difficult times, it may be hard to allocate the funds for the upgrades, but the payback for doing pump upgrades is extremely quick. The resulting savings from the upgrades frees up funds that otherwise would have been wasted on energy, and more expensive repairs at a later date. In almost all cases, the incremental costs of upgrades are minimal when compared to the loss in downtime and expensive repairs.

Plant Outages, Ship Overhauls, Building New Vessels, Building New Manufacturing Plants, Plant Expansions, and New System Installations are good opportunities to specify pumps with upgraded efficiency and reliability features such as SIMSITE® Structural Graphite Composite Pump Internals (Impellers, Casing Rings, Sleeves, Bushings, Bearings, and Mechanical Seals).

SIMSITE® COMPOSITE IMPELLER VS. BRONZE IMPELLER
ALLWEILER PUMP NIM 65-315 EFFICIENCY AND HEAD



The above graph shows that changing the Bronze Impeller to a SIMSITE® Structural Composite Impeller increased efficiency 15.8% ! The efficiency on this 20 KW pump (26.8 HP) went from 57% with a metallic impeller to 66% with a structural composite impeller — an increase of 9 points or 15.8%! At 0.11 cents per kilowatt hour this translates into a yearly savings of **$2,218.00 per year, per pump!**

After only 1 year of service in a corrosive environment such as salt water, the metallic impeller, which was originally bronze, begins to corrode, which further reduces efficiency. Depending on the service, and the temperature of the salt water, and how the pump was operating, the efficiency will be reduced by as much as 5% to 7%, or more, resulting in additional energy costs! Upgrading to a SIMSITE® Structural Composite Impeller will not only increase efficiency 15.5% from the start, but will also prevent the losses in efficiency as a result of corrosion resulting in a total saving to the Customer of more than 20%! This results in a yearly savings of **$4,155.00 per year per pump!**

SIMSITE® COMPOSITE IMPELLER

$$\frac{GPM \times FT \times S.G.}{3960 \times Eff.} = \frac{440 \times 150 \times 1.03}{3960 \times .66}$$ = 26 HP × .746 = 19.4 KW × 8760 Hours × .11/hr = $18,697.00 per Year

METALLIC IMPELLER

$$\frac{GPM \times FT \times S.G.}{3960 \times Eff.} = \frac{440 \times 150 \times 1.03}{3960 \times .59}$$ = 29.1 HP × .746 = 21.7 KW × 8760 Hours × .11/hr = $20,916.00 per Year

METALLIC IMPELLER AFTER 1 YEAR IN SALT WATER

$$\frac{GPM \times FT \times S.G.}{3960 \times Eff.} = \frac{440 \times 150 \times 1.03}{3960 \times .54}$$ = 31.8 HP × .746 = 23.7 KW × 8760 Hours × .11/hr = $22,852.00 per Year

Lower Costs — Increased Performance

The new alternative composite solutions for Impellers and Rings are excellent for new, repair, or retrofit applications. They are light weight and virtually indestructible. Wear of other pump parts including the pump casing are greatly reduced, because of the Impeller's perfect balance, light weight, self-lubricating, sealing, and corrosion, erosion, & cavitation resistance. This means far less expense for replacement of parts, downtime, and years of trouble free performance. When you reduce or eliminate corrosion, erosion, and cavitation, you automatically increase efficiency and substantially reduce energy efficiency and costs.

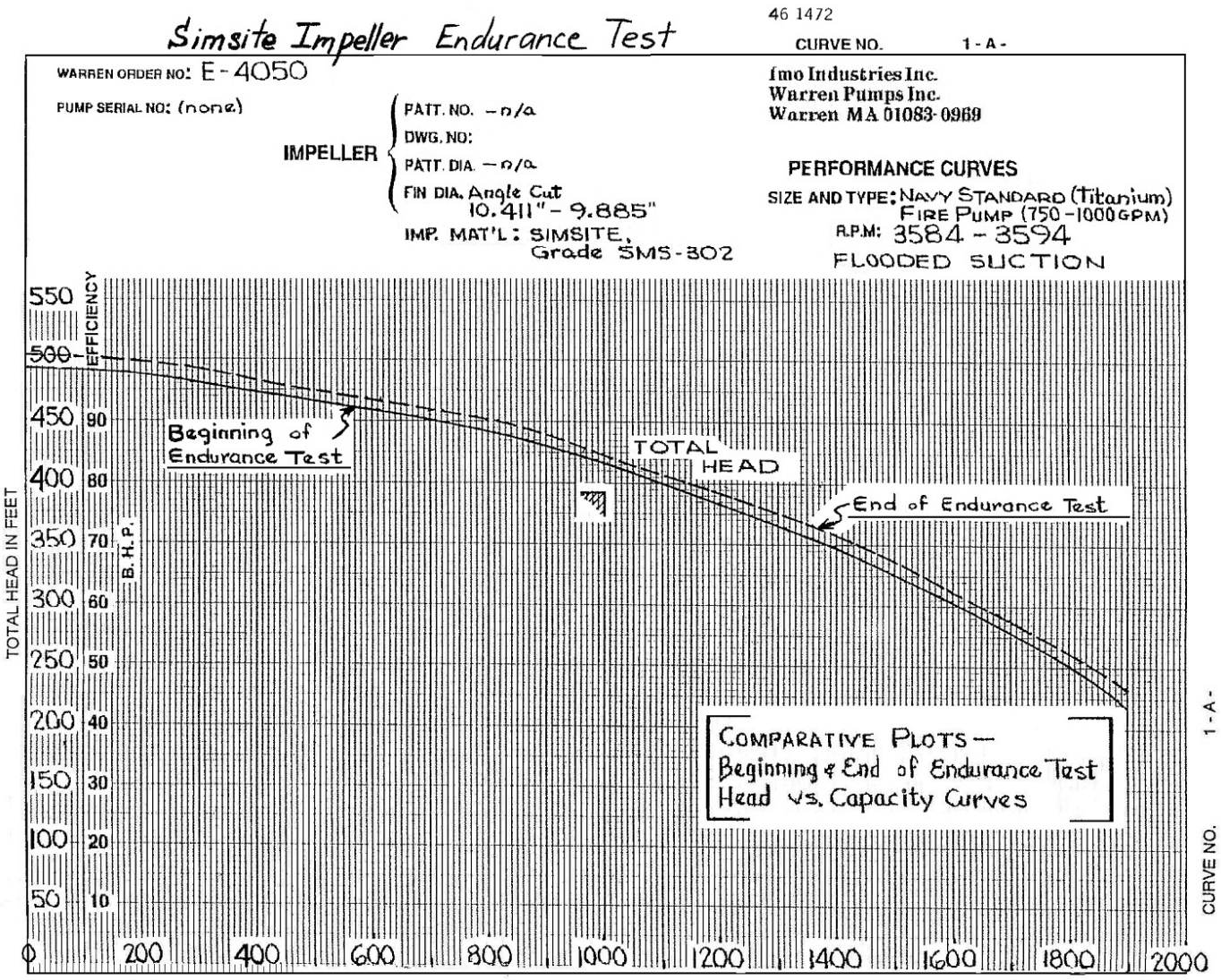
Optimization

It is an all too common problem — you purchased a pump for one specific performance and when you put the pump into service in your plant, or ship, the pump operatesat another point completely different from the original design point (BEP — best efficiency point) of the pump because of your system requirements. In addition to being very inefficient, when you operate the pump away from the original design point or BEP, it causes a multitude of problems. These problems include excessive noise & vibration of the pump, shaft oscillation, cavitation, premature wear and failure of the mechanical seals, bearings, rings, sleeves and impellers. In extreme cases, the pump shaft will break.

Fortunately, these problems can be easily resolved by installing SIMSITE® Alternative Solution Impellers & Rings, which have been re-engineered for your system requirements. Not only is the efficiency of the pump improved, but also the reliability and longevity of the complete pump is substantially improved.

SIMSITE® Composites Offer an Improvement over Time

Because of the self-lubricating characteristics of **SIMSITE® Structural Composite Pumps, Impellers and Casing Rings,** SIMSITE® composites do not wear, or corrode, like metallic pumps; therefore, the performance curve will actually increase over a period of time. The performance curve below shows a test performed by Warren Pumps on an actual US Navy Standard Fire Pump manufactured from Titanium with SIMSITE® Structural Composite Impellers and Casing Rings. After only 1000 hours, a performance test was performed with a SIMSITE® Engineered Structural Composite Impeller and Casing Rings. **The result clearly showed a substantial increase in the H-Q (Head-Capacity) Curve — 2.5% with the SIMSITE® Composite Impeller and Rings at the end of the 1000 hour Endurance Test.**



Simsite® Composite Impellers Will Improve Efficiency of Your Exsisting Pump

The Impeller is the heart of any Centrifugal Pump. Like a human heart, a pump impeller is the most loaded pump component, constantly stressed by hydrodynamic forces, fatigue, corrosion, erosion abrasion, chemical attack, and cavitation.

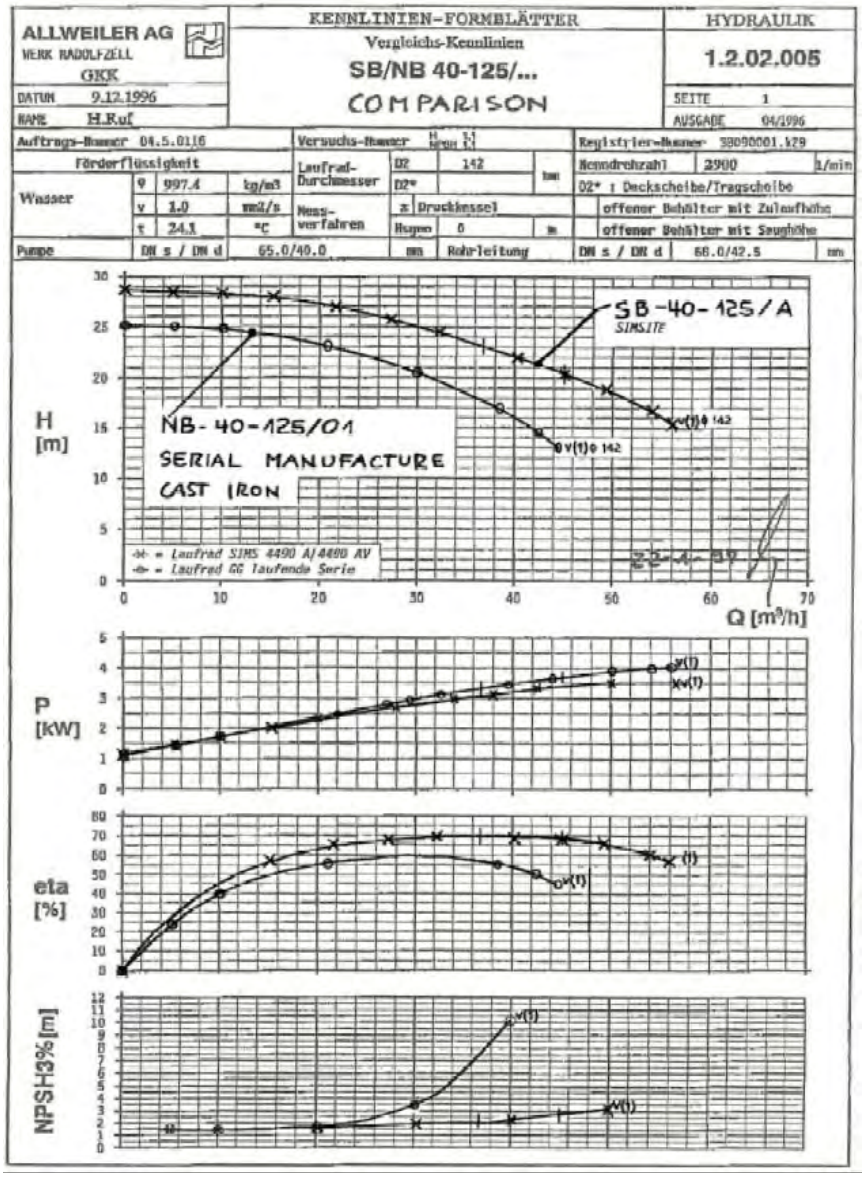
The overall Efficiency of a Centrifugal Pump is in direct correlation to the Efficiency of the Impeller. The Impeller's hydraulic design must correspond to the hydraulic design of the pump Casing and to the Operating Conditions of the pump in service (In the Plant) in order to maximize efficiency.

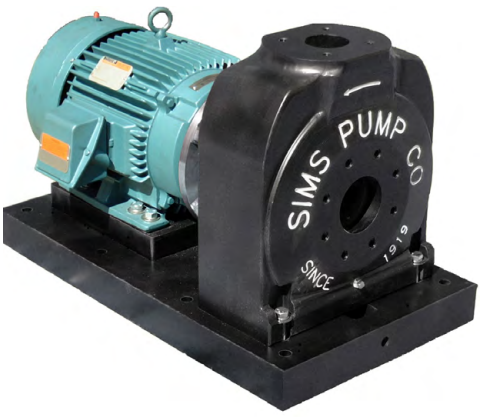
Companies like SIMS in Hoboken, N.J. specialize in the designing, engineering, and the manufacturing of Premium Efficiency Structural Composite SIMSITE® Impellers, and Pumps. Any Centrifugal Pump fit with the Premium Efficiency SIMSITE® Structural Composite Impeller will save a tremendous amount of money for the Pump Owner and Operator in **Repair and Maintenance Costs** as well as in **Energy Consumption.** This saving comes from Electrical Saving, (a higher efficiency pump consumes less energy), and from Saving on Maintenance and Repair (the pump fitted with a SIMSITE® Impeller will have a much longer life and a smoother run time), because the Structural Composite Impellers will never corrode.

Simsiteo Composite Impellers are Designed for Superior Hydraulic Performance

Because the new alternative SIMSITE® structural composite Impellers are computer engineered, designed, and precision machined, the impeller vane geometry can be engineered utilizing CFD (Computerized Fluid Dynamics) techniques and programs to maximize efficiency and performance. Problems such as recirculation, radial thrust, and cavitation can be minimized, or eliminated, by using structural composite impellers instead of the traditional metallic ones. Impeller vane shapes can easily be modified to provide the best vane shape for specific applications and performance requests.

In this comparison test performed by the Allweiler Corporation, the SIMSITE® Structural Composite Impeller, manufactured by the SIMS Pump Company had an efficiency of **70%** while the metallic impeller manufactured by Allweiler Ag had an efficiency of only **60%.** Notice the reduction in the NPSH required by the composite impeller. The difference is over 8 meters (26 feet)!





Simsite Composite Impellers are Light Weight & Reduce Shaft Deflection

Another critical area where composites significantly help in the reduction of Energy Consumption and Repair and Maintenance is in the area of shaft deflection. Structural Composites Impellers & Casing Rings like SIMSITE®, manufactured by SIMS, are only 15% the weight of traditional metallic materials. The lower weight not only reduces start-up load, but also reduces shaft deflection, which allows the rotating element to run with tighter clearances between the rings and the impeller. The tighter ring clearance reduces leakage, which increases efficiency and reduces energy consumption. The reduction in shaft deflection reduces vibration, and increases efficiency. The reduction in shaft deflection enables bearings, sleeves, mechanical seals, and rings to last much longer which saves on repair and maintenance costs.

- 1/6 the Weight of Bronze, or Stainless Steel Impellers & Rings.
- Less Shaft Deflection F = M * Ac
- Less Start Up Load $y = WL^2 / CEI$

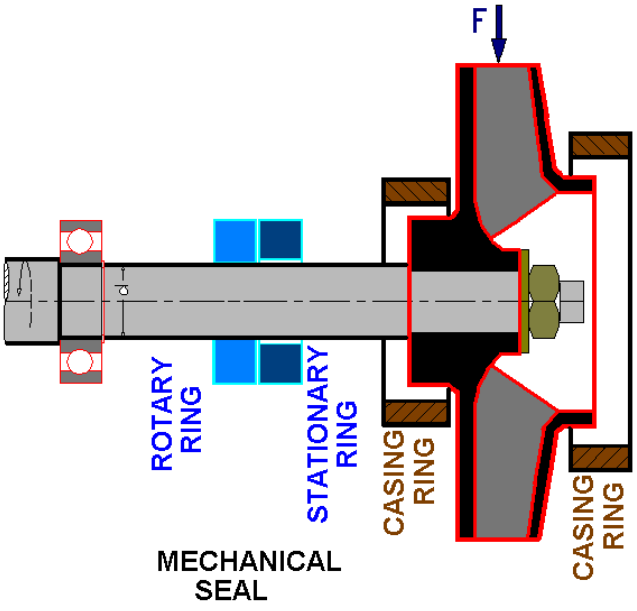
y = deflection, in; W = weight of rotating element, lb; L = shaft span, in;

A = acceleration;

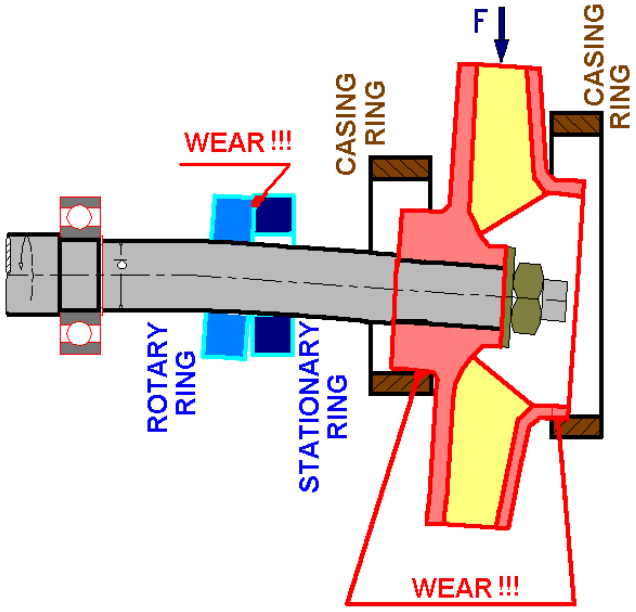
C = coefficient depending on shaft-support method and loading;

E = modulus of elasticity of shaft material, lb/in^2;

I = moment of inertia ($pD^4/64$), in^4.



SIMSITE IMPELLER — 20 Lb



BRONZE IMPELLER — 120 Lb

Advantage of Simsite® Structural Composite Impeller	Cause of Advantage	Most pronounced effect in
No Corrosion	Impellers machined from Simsite® Structural Composite, **never** corrode in salt water, waste water, chlorinated water, and many chemicals	Salt Water, Brine, Reverse Osmosis, Waste Water and other corrosive applications
No Electrolysis	Simsite® Structural Composite Impellers are Non-Conductive and will **not** support Galvanic Corrosion	Salt Water, Brine, and Reverse Osmosis.
Less Frictional Losses	Simsite® Composite Impellers have machined vane surfaces, which results in much smoother surface finishes. The Impellers have a low coefficient of friction with selflubricating characteristics	Low Specific Speed Impellers
Less Volumetric Losses	Simsite® Composite Impellers run on Tighter Ring Clearances	Mixed Flow Impellers
Less Mechanical Losses	Simsite® Structural Composite Impellers are 4–6 times lighter than Metallic Impellers	All Pumps
Less Vibration	Simsite® Composite Impellers are perfectly balanced, both hydraulically and mechanically.They remain balanced throughout the life of the pump	All Pumps
No Efficiency Degradation	Simsite® Structural Composite Impellers will not corrode; therefore there is no reduction in Efficiency and Performance	Sea Water, Chemicals Applications
Longer Life	Simsite® Structural Composite Impellers are Corrosion, Erosion, and Cavitation resistant. They are perfectly balanced and light weight. The average Life Cycle is 5 to 7 times longer than metallic impellers!	Salt Water, Brine, Reverse Osmosis, Waste Water and other corrosive applications
Average Expected Pump Efficiency Gain	Depends on Existing Pump Conditions, Operating Conditions, Temperature, and the Corrosive Nature of the Fluid Being Pumped	10–25%

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