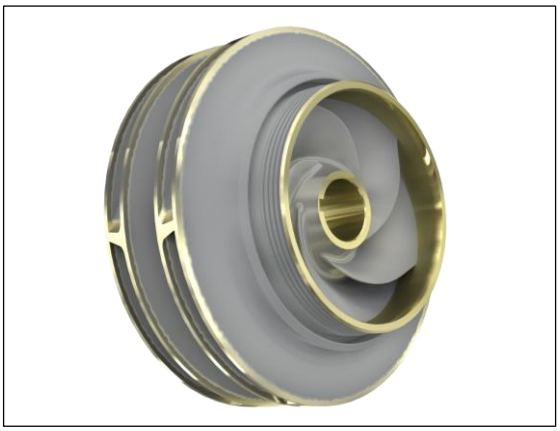
TALKING POINTS

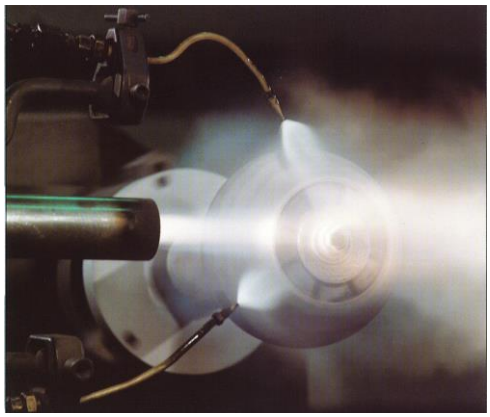
Flame-Plated Impellers

One of the major causes of worn, inefficient fire pumps is common sand. Types of sand causing this damage may range from coarse, sharp– edged, fast–cutting grains, down to fine, soft soap–like material that causes as much damage by clogging small passages as it does by direct wear. Any of these can cause major problems in the maintenance of fire pumps, with their extremely close tolerances used in impellers, wear rings, relief valves, pressure governors, gauges and other close–fitting parts.

Approximately 75% of pump wear due to pumping sand occurs on the impeller hubs. Impeller hubs are moving at a speed of 60 mph while wear rings are stationary. Sand impinges on the hubs at a much higher velocity than on the wear rings. For this wear problem, Waterous introduced an industry-exclusive flame plating process to the fire service more than 40 years ago. Flame-plating is available on several Waterous products but is standard on CMU and CSU Series Pumps.



The flame plating process consists of adding tungsten carbide to the surfaces to be protected from wear. This unique process produces extremely hard, well–bonded, wear–resistant coatings which consistently outwear hard chrome plating, tool steel and solid tungsten carbide.



A specially constructed gun is used to blast tiny particles of tungsten carbide onto and into the base metal. This gun resembles a large–caliber machine gun. When measured quantities of oxygen, acetylene and particles of coating material are metered into the firing chamber, a timed spark detonates the mixture. This creates a hot, high–speed gas stream which instantly heats the particles to a plastic state and hurls them at supersonic velocity (2500 fps) from the gun barrel. The near molten particles impinge onto the surface of the work piece where a microscopic welding action produces a tenacious bond. Rapid–fire detonations, during automatically controlled passes across the work piece, build up the coating to a specified thickness.

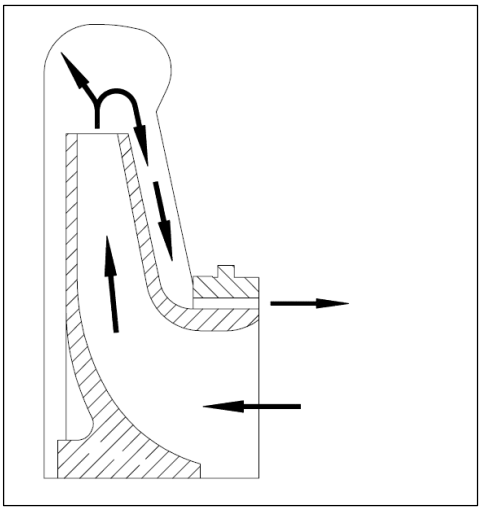
Although temperatures above 6,000°F are reached inside the gun, the work piece remains below 300°F. Thus, metallurgical properties of the base material are not changed during the coating process. Low temperatures in the substrate also eliminate the possibility of warpage, distortion or other physical change in precision parts. The impeller hub surface, when flame plated, is approximately twice the hardness of the hardest tool steel. An attempt to score the surface with a good metal file would prove harmful to the file, not the flame plated hub. This feature may be specified as follows - The impeller hubs to be flame plated with tungsten carbide to assure longer pump life and lower maintenance costs.

Wear Rings

As it is impossible to avoid pumping water containing some sand or other abrasive material occasionally, it's a good idea to adopt as many measures as you can to minimize the effect of impeller hub wear on pump performance. Ordinary construction consists merely of a close running fit between the impeller hubs and the body bores; wear rings are commonly added to fit between an enlarged bore in the body and the hubs so that when wear occurs the original clearance can be restored by replacing the wear rings. The amount of leakage between the wear rings and the hubs depends mainly on three things: the pressure difference, the clearance and the leakage path. We can't do much about the pressure difference, but we can certainly do something about the clearance by rigidly supporting the impeller shaft and by flame plating the hubs to keep wear to a minimum and we can also do something about the leakage path. Every firefighter knows that the longer the hose the greater the friction loss and also that adding elbows to a piping system increases the friction loss through the system.

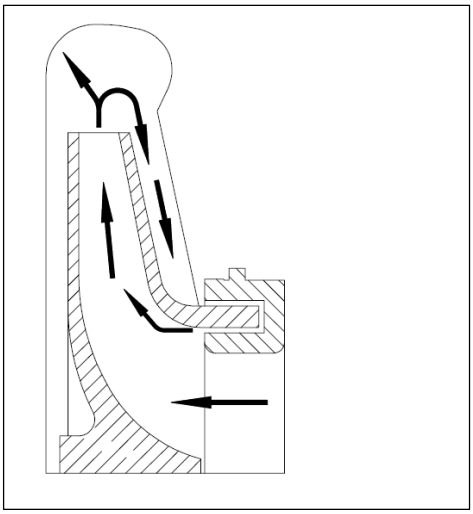
Plain Wear Rings

With ordinary wear rings the path is short and straight, so the friction loss is low and the leakage rate high. There are two ways to add to the length and to make the path crooked, one is called the “wrap–around” wear ring and the other is the “labyrinth” wear ring.



Wrap–Around Wear Rings

In the wrap–around design the wear ring extends into the eye of the impeller as well as fitting closely around the hub. With this design, water under discharge pressure in the volute tending to return to intake through the clearance between the wear ring and the impeller hub is forced to change direction and flow toward the impeller eye before it exits from the clearance; the leakage then flows with the water entering the impeller from intake.



Labyrinth Wear Rings

In the labyrinth reverse flow design, the wear ring extends into an annular groove just outside the hub. With this design, water under discharge pressure in the volute tending to return to intake is first forced to flow back toward the impeller, then forced to change direction again and flow outward away from the impeller as it exits from the clearance; the leakage then flows against the water entering the impeller from intake. Tests made with both designs indicate that with the same amount of radial clearance, the labyrinth design allowed less leakage. With the original close clearance, a pump will have pretty much the same efficiency even with plain, simple, old style wear rings as with either the wrap–around or labyrinth designs, but with the same amount of excessive clearance, as will result from operation with sandy water, the wrap–around design is better than the plain, but the labyrinth design is best, by an appreciable amount. Of course, with reduced leakage the wear will be less, so the impeller life will be increased in two ways, it will take longer for a given amount of wear to occur and there will be less leakage when the wear is the same. And, of course, if the hubs are flame-plated, it will take much, much longer for a given amount of wear to take place.