A return to the tried and tested

Searching for the optimum pump material for grit trap pumps

Grit trap pumps with different material designs (hard chrome, ceramic coating, rubber coating, chrome-molybdenum chilled casting) compete in a comparative test under hard and real conditions to cope with the abrasive medium of a "grit / water mixture".

Signs of wear on the impeller and casings prompted the Saar Disposal Association (Entsorgungsverband Saar), operator of the Saarbrücken-Brebach waste water treatment plant to carry out comparative tests with grit trap pumps. The pumps used were made of hard chrome (1.4313, hardness < 320 HB) and did not have a satisfactory service life at a pump speed of 2,900 rpm. Ceramic coatings also did not achieve satisfactory results. The material originally required by the Disposal Association for abrasive media containing sand was chrome molybdenum chilled casting but it was not used when building the plant due to reasons of price. Instead hard chrome material (1.4313) made of chrome chilled casting was used - a fatal mistake! The selected speed of 2,900 rpm is also unusual for these applications with abrasive media.

Figure 1 Hard chrome (1.4313 / <320HB = 34HRC) is not hard enough

Figure 2 Also not GG with ceramic coating!

In 2006 a rubber-lined pump with a pump speed of 1,450 rpm was installed at the Saarbrücken-Brebach waste water treatment plant for testing. However after 1½ years the first signs of wear on the impeller vanes appeared. What can be done?

It should be remembered that pumps from the Emile Egger Company made of highly wear-resistant chilled casting (Vautid) were used or are still in use at many grit trap plants of the Disposal Association. A comparison with the rubber-lined pump already used is urged for!

In the meantime the Vautid chilled casting was replaced by a highly wear-resistant chrome molybdenum chilled casting (HG25.3) with a hardness of 600-700HV (55-60HRC) for Emile Egger. This material was completely through-hardened by heat treatment; therefore not just one boundary layer in the surface region is formed. Due to the high proportion of chromium, HG25.3 is ideally suited for abrasive media as well as corrosive media.

Now it was a case of carrying out a long-term test under the same conditions. For this purpose, the double grit trap with twin scrapers was ideal in Saarbrücken-Brebach. At the start of the test on 12.6.2007, two new pumps (one with rubber-lining and one made of HG25.3) with exactly the same design data were installed. The new rubber-lined pump was also provided with a high quality rubber compound by the manufacturer to achieve the best possible wear protection.

Translation from German Media Report: „Geringer Verschleiss bei Sandfangpumpen aus Chrom-Molybdän-Hartguss“, Industriepumpen+Kompressoren Heft 1/2014 S-45-47

The operating hours, flow of the waste water treatment plant as well as sand quantities were recorded and documented at the start of the test. The pumps were opened every year to also document the development of wear.

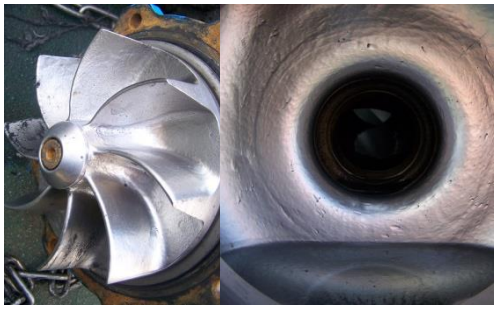
Jahr	Betriebsstunden Laufzeit gesamt [Bh]	Durchlauf Kläranlage [m³]	entsorgte Sandmenge [m³]
2007	Start 12.6.2007		
2008	2000	11,3 Mio	224
2009	4000	10,7 Mio	210
2010	6000	12,1 Mio	231
2011	8500	10,4 Mio	168
2012	11000	10,9 Mio	315
2013	13600		

Table 1 **Documented operating hours and sand quantities**

Pump made of chrome molybdenum chilled casting
Figure 3 **Start of test 06/2007**

After 3 years, openings on the impeller edge and the casing wall on the suction side could be found. The non-rubber-lined area behind the impeller showed clear signs of wear.
In contrast the pump made of chrome molybdenum chilled casting HG25.3 showed uniform surface erosion. The back vanes and casing cover were almost in the original condition.

Impeller and casing of pump with rubber-lining casting

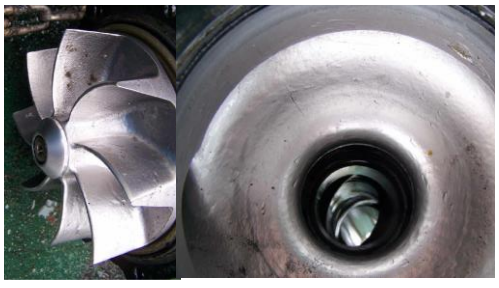


Pump made of chrome molybdenum chilled

After an additional year of running time, extensive erosion of the rubber lining and the cast formed for the rubber-lined pump and clear signs of wear appeared on the front vane edges.

In contrast the pump made of chrome molybdenum chilled casting remained almost unchanged.

Impeller and casing of pump with rubber lining casting



Pump made of chrome molybdenum chilled

Appraisal after 6 years

After exactly 6 years, the long-term test was completed with the following result:

The casing of the rubber-lined pump is almost destroyed due to wear, and reveals wall openings. The rubber coating of the impeller has eroded down to the raw material in .GG. Continuing operation of the pump is no longer possible.

The pump made of chrome molybdenum chilled casting remains dimensionally stable and does not show any impending failure features. The outer diameter is also protected by the retracted impeller in the separate impeller chamber so that no reduction in performance due to wear can result.

The performance data of the Egger Turo® vortex pump is the same after 6 years of continual use in the grit trap as the day when it ways commissioned. Based on the wear pattern, it is assumed that the pump will continue to be in service properly for another 4 years.

Impeller and casing of pump with rubber lining casting

Pump made of chrome molybdenum chilled

Energy-focused consideration of the long-term test

The long-term test also highlighted a clear difference in the energy requirement of both pumps. The difference in efficiency for the rubber-lined pump is approx. 10 percentage points due to the optimised Turo® vortex hydraulic system with patented axial spiral and the distinctive impeller design. If the efficiency and cos phi of the small submersible motors are also considered, this results in a saving of 6,350 kWh (approx. 1,600 Euros for 25 ct/kWh – and counting) for the 13,500 operating hours in service.

Another advantage of the pump made of chrome molybdenum chilled casting is that the desired optimum duty point is reached by turning precisely to the millimetre. Unnecessarily high flow rate jumps caused by only a few available standard diameters are avoided. The additional costs for purchase are also worthwhile when considering this energy aspect.

In conclusion, the operating personnel also benefit from the high plant availability and low maintenance pump solution. The time gained can be used for the actual tasks of waster water treatment operation.

Authors: Andreas Flögel, Thomas Bleif, Remo Biegert

Translation from German Media Report: „Geringer Verschleiss bei Sandfangpumpen aus Chrom-Molybdän-Hartguss“, Industriepumpen+Kompressoren Heft 1/2014 S-45-47