



Emnor Mechanical Inc.
20 Depew Street
Hamilton, Ontario
L8L 7H8

Emnor Mechanical Manufacturing Process

In North America, there are many older pumping installations in place. It is not uncommon for centrifugal pumps commissioned in 1950's, 60's and 70's to still be in service.

As this equipment ages, spare parts and replacement pumps become obsolete. In cases where parts are available, prices can be extremely high, and deliveries prohibitively long. At times the original manufacturer no longer exists, making matters more difficult. When confronted with delivery and price problems, customers are forced to consider replacing the older pumps with current line offerings. This can be a costly option. In most situations, the new equipment will not have the same footprint as the existing. To install new pumps, baseplate, motor and couplings will also need to be purchased. Piping and concrete work are also required.

An alternative to outright replacement is to reverse engineer / duplicate the existing components. Major components or complete pumps can be manufactured this way. In business since 1977, companies such as Emnor Mechanical Inc. have a wealth of parts making experience.

In recent years there have been advances in technology that make the reverse engineering process more accurate than ever before. Portable co-ordinate measuring machines can be used to create 3D models of either new or worn cast parts. The photo below shows a probe type machine that Emnor is using to measure a sample.





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It has generated a 3D model of the impeller, as seen on the computer screen. Once the 3D model is done, it is checked for accuracy vs. the sample part. In the case of used parts, the model will be adjusted to accommodate for the wear. For pump impellers, the following steps are taken:

- 1) The solid model is used to determine hydraulic geometry and vane angles
- 2) Using the pump curve, inlet angles are calculated and compared to the solid model
- 3) Head calculation based on speed, design flow and impeller exit geometry are compared to actual head
- 4) The impeller solid model is then corrected for wear
- 5) In a similar manner, when casings are worn, inlet area and inlet angles are calculated, and the solid model adjusted for wear.

Emnor Mechanical also owns portable scanning equipment, as shown in the photo below:



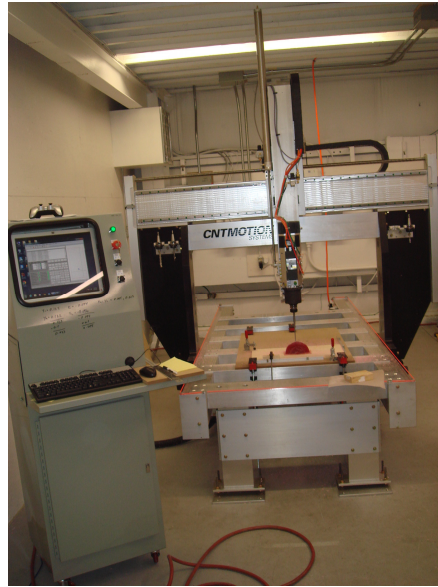
It can be used on its own or in conjunction with the probe device. The scanning equipment is a helpful when making site visits to measure parts that cannot be sent out. It speeds obtaining the cast profile shape.

Once the solid models are finalized, the manufacturing process can begin. Most parts produced by Emnor are cast in sand foundries, and require pattern tooling. The pattern is used to create a cavity in a sand mould, into which liquid metal can be poured. After being poured, the casting is cleaned and heat treated if required.



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The solid model of the part being manufactured is adjusted for foundry shrink, and machining allowance is added. Once this is done, the pattern tool can be designed. The tools are cut on CNC machines as shown in the photo below.



When the pattern is complete, it is inspected versus its solid model. Corrections are made if required.

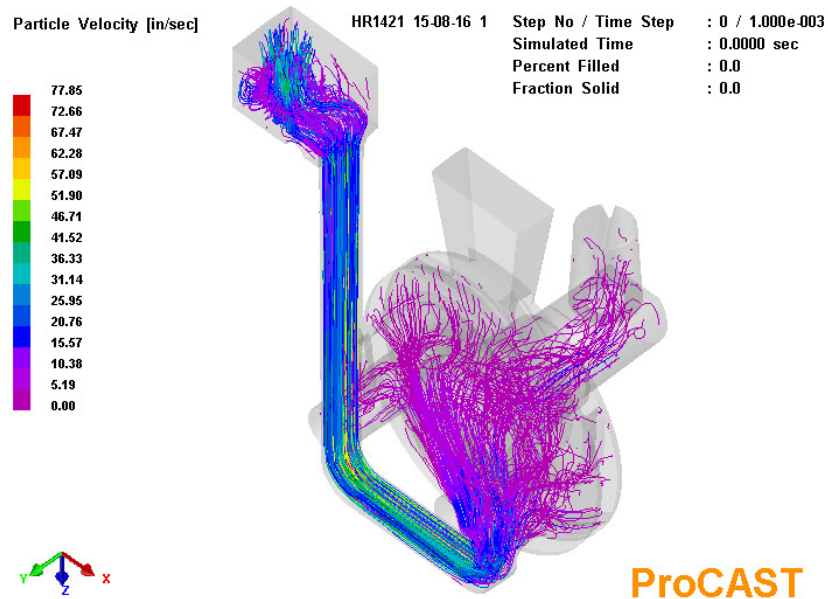
In cases where parts need to be made quickly, Emnor utilizes a combination of 3D printed sand cores and single use tooling. When using this process, our foundries can be working on moulds in one week. The photo below shows a typical 3D printed core:





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Whether using traditional or 3D core methods, Emnor uses melt simulation software as shown in the photo below:



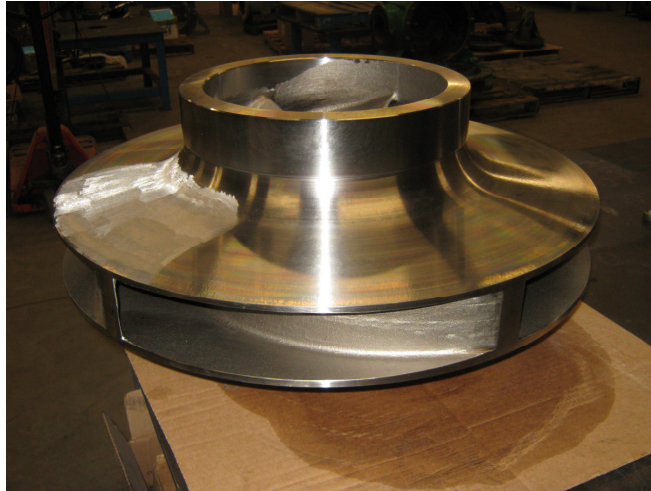
The programme uses algorithms to predict liquid metal behavior as it is poured into a mould. To detect and prevent possible casting flaws, velocity and solidification are checked. If problems are detected, the mould design is corrected. This technology helps eliminate common problems such as shrink and porosity.

An example of cost savings is shown in the photos below and on the following page:





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In this case, Emnor's customer was operating 2 large double suction pumps that had been in service since the 1960's. The casings were badly worn. The cost to replace the pumps with current offerings was prohibitive due to civil, piping and motor requirements. At significant savings, Emnor manufactured 2 new casings and impellers, that were drop in replacements.

The portable advanced technology used by Emnor Mechanical has made the reverse engineering process speedy, accurate, reliable and cost effective. When considering whether to replace older equipment, manufacturing drop in replacements is a viable option.