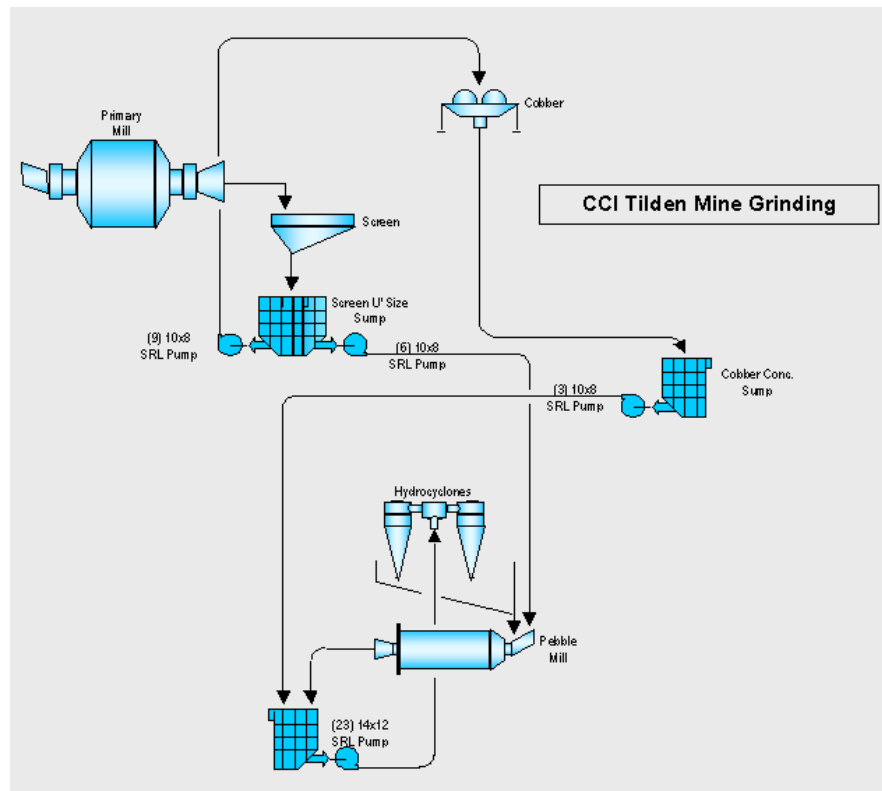


# Metso SRL-C Pump Upgrade at CCI's Tilden Mine



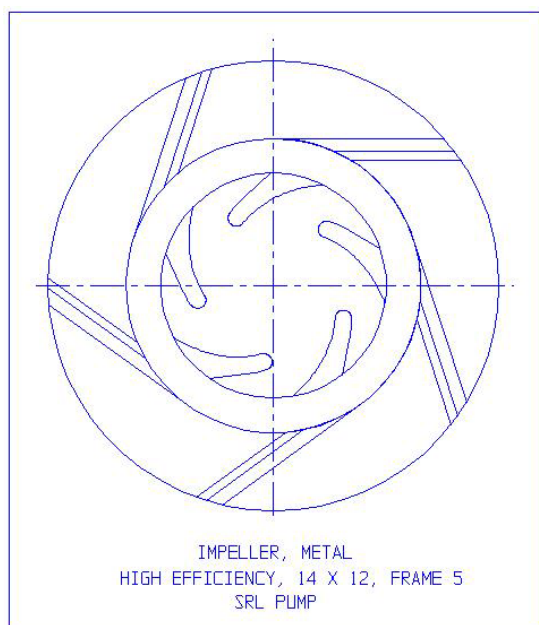
**Metso Minerals (MM) and their dealer, Champion Charter Sales & Service (CCSS) in Ishpeming, Michigan began a partnership with Cleveland Cliffs Tilden Mine (CCTM) to address concerns on SRL-C pump performance in their grinding circuit. CCTM is a large iron mining operation located in Ishpeming, Michigan. Larry Hermanson, Mechanical Engineer, CCTM took the lead on this program and is the primary champion for the upgrades.**

The SRL-C pumps went into operation in the mid 1970's and after 30 years of service, the mine was experiencing unacceptable downtime due to poor wear life and/or bearing assembly failures. The flow diagram above shows the SRL-C pumps affected in CCTM's grinding circuit.

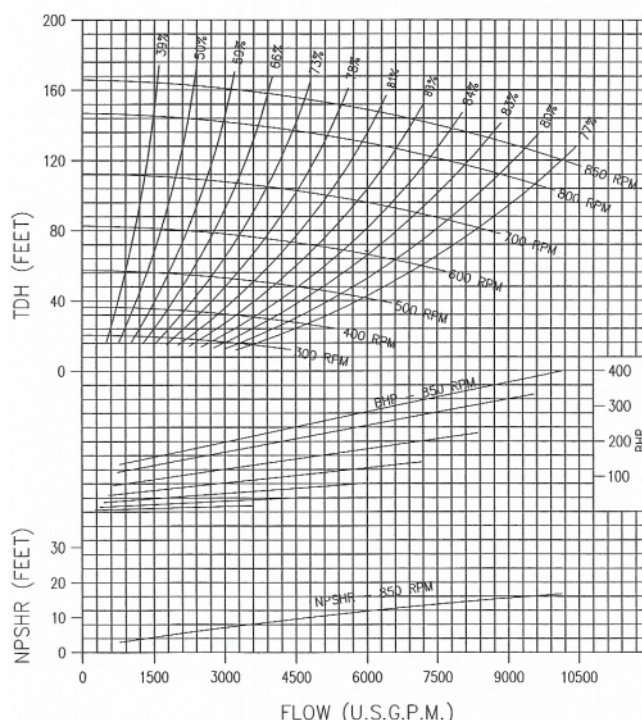
The primary concern was that of the (23) 14x12 SRL-C cyclone feed pumps. Bearing assembly failures were occurring on the drive ends on a frequent basis. CCTM was rebuilding bearing assemblies in house and sending a few of them to CCSS. Further investigation pointed to a few root cause failures including: age and condition of the bearing saddles on the pump pedestal, in house practices on repairing bearing assemblies and v-belt drive tensions. Bearing housing internal critical surface dimensions were being re-welded and machined back to size and the bearing caps securing the assembly to the pedestal were shimmed on some pumps indicating wear in the bearing location surfaces. A program to upgrade the pedestals on the worst pumps along with instructions on proper v-belt tensions and bearing housing oil levels has been successful. CCSS has begun a program on bearing assembly repair to OEM specifications that has also proven successful in extending bearing assembly life.

The next issue was the wear life on the pump parts. CCTM had not been using OEM pump parts for many years. Previous experience using natural rubber pump parts found that it worked on the hematite service but not in the magnetite. Urethane worked the best in magnetite. Therefore, CCTM standardized on urethane pump parts since some pumps worked in dual service. CCTM was using a third party parts replicator for the supply of urethane pump parts and Metso was losing the parts business. Of particular concern, was the wear life on the throat rings in the SRL-C cyclone feed pumps. The pumps were going off line every 2,000 hours to replace the throat rings and since the pump was down, they would change out all of the wear parts.

Metso's solution was to develop a high efficiency version of the 14x12 SRL-C impeller and produce it out of ASTM A-532 high chrome alloy. This involved adding a fifth vane and changing the vane shape to increase efficiency as shown in the curve and drawing below:



	PUMP MODEL	CURVE NBR.:	REV.: A
	14x12x26 SRL-HE	EFFECTIVE DATE :09/22/02	
	DISCHARGE # (in) :12	SUCTION # (in) :14	
	IMPELLER # (in) :26	NUMBER OF VANES :5	
	MAX. SOLIDS # (in) :...	PART NUMBER: 574322	
PERFORMANCE FOR CLEAR WATER @ 68F/20C AND 1.0 S.G. CORRECT FOR OTHER CONDITIONS AND/OR SOLIDS EFFECT			



A previous attempt by CCTM to use standard metal impellers was not successful. Metso convinced CCTM that a new design with better efficiencies would offer better hydraulic performance to the pump and minimize wear on the throat ring. Metso's hydraulic engineers design the 14x12 HE impeller and it was put into 11A Cyclone Feed Pump. The pump was monitored throughout the trial and after 3,200 hours the pump was opened for inspection. Not only had the throat ring wear improved, but CCTM was convinced they could have gotten another 400-500 hours on the pump. Another benefit of the 14x12 HE impeller was the savings in power. The following table shows the average comparisons between the standard urethane and HE impellers:

Impeller Type	Pump Speed	Motor Amps	Horsepower	\$\$/Hour Cost
Standard Urethane	740 rpm	41.0	356	\$8.85
HE High Chrome	680 rpm	37.0	321	\$7.99



Based on 6,500 hours/year of operation, the HE impellers would save CCTM \$5,265.00 on average per pump. CCTM made the decision to upgrade all 23 of the 14x12 SRL-C cyclone feed pumps with the new HE impellers which, as of the time of this article, has been done. CCSS has put together a stocking program to insure adequate supply to CCTM. Total yearly usage will be around 40-50 impellers and at a sell price of \$3,300.00, Metso and CCSS has won back \$130-160,000.00 in parts business. CCTM has already increased pump cycle times to 3,600 hours and believe they could probably get more. We recently added expeller vanes to the suction shroud to test further increases in wear life on both the impeller and throat liner.

The success of the cyclone feed pumps turned our attention towards the Screen Undersize, Cobber Feed and Cobber Concentrate pumps (see previous flow diagram). These circuits use a total of (18) 10x8 SRL-C pumps. We initially wanted to address the concerns over wear life of the existing third party urethane parts. Metso collaborated with Metso Skega in requesting molded rubber wear parts that would equal the life of urethane. The first set of this special rubber compound 61 40 040 code 140 was sent to CCTM and put into 9A Screen Undersize Pump. The urethane wear parts averaged 2,300 hours running ½ hematite and ½ magnetite slurry. The pump was opened after 2,050 hours and CCTM determined this special rubber compound would wear as long as urethane. The next step is to try and increase operating hours to equal the Georgia Iron Works 8LSA32 pumps also operating in these circuits. The GIW pumps are averaging 3,500-4,000 hours. Again, we called upon our hydraulic engineers to develop the HE version on the 10x8 SRL-C pump. These impellers are now in production and will be sent to CCTM in the next weeks.

Since the success of the special rubber compound in the 10x8 SRL-C pumps was promising, we had Skega mold a complete set of liners and throat ring for the 14x12 SRL-C cyclone feed pumps. The parts were installed along with a new HE impeller and put into service on August 3, 2004. The pump, as of this article, is still in operation and is scheduled for inspection the week of January 25, 2005.

This special rubber compound was also tested at QCM in Canada with similar results. A study is underway by Jan Lidin, Metso Minerals – Sweden, to produce a white paper on these results and further abrasion resistance testing in the lab should be conducted to prove the results are linear in other slurry applications. This would address the incomplete availability of urethane parts and expensive tooling for the new pump line as well as supply issues on the older pump lines.

The success of this program has gained considerable visibility at CCTM. The management at CCTM has brought this program to the attention of Cleveland Cliffs Corporate in Cleveland, Ohio.

We have presented blanket purchase order proposals to CCTM on the liners and HE impellers for both sizes of SRL-C pumps in this program. If the special rubber liners are successful in the cyclone feed pumps, then we will have set the stage for CCTM to switch over to Metso parts entirely. This would result in parts sales of \$350-400,000.00/year from a position dominated by a third party parts replicator.

In summary, we will continue to work with CCTM to improve performance on their SRL-C pumps. We may address future issues with new metal Metso Thomas wet ends to retrofit for higher capacities and continue to push the new HM/HR and XM/XR series. Further, our success at CCTM will be presented to Cleveland Cliffs Empire Mine to begin a similar program.

Currently, HE impellers increase efficiency by 9-10% and these impellers are available for the 10x8, 14x12, 16x14 and 20x18 SRL-C pumps. Curves have been published for the 8x6 and 12x10 HE impeller, but complete engineering review would need to be done before we can produce these sizes.

The program would not have been successful without the focused efforts of Metso Minerals, Champion Charter Sales & Service (Mr. Steve Wentarmini) and Cleveland Cliff's Tilden Mine (Mr. Larry Hermanson) working as partners to develop solutions to today's pumping requirements.

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