



Sandvik LH203 LHD after a full Aramine reman

Rebuild and go electric

Electric traction drive specialist **Saminco Inc** has nearly 30 years of experience supplying AC and DC traction drives as well as VFDs to the mining industry, initially mainly in the underground US coal mining market but now increasingly in hard rock (now 20% of its business) and with customers now from around the world. Its products are widely used in factory delivered OEM models across the big players, but it also has considerable experience in taking on the electrical aspect of equipment rebuilds – which includes motor replacements and overhauls, but in this age of electrification it is increasingly being called upon to convert tethered equipment to battery and to convert diesel powered machines to battery. Facilities and authorised representatives are located in South Africa, Poland, India, Australia and the USA. All its rebuilds for the USA are MSHA approved with ATEX approval elsewhere. Milestones for Saminco include developing in 2014 a first of its kind (LHD) with Smart Battery (Sodium Nickel) and charger for hard rock mining; then in 2017 introducing a hydrostatic electric eLHD system with Smart Battery. Saminco commissioned their first battery powered LHDs in 2008 using DC drive systems in conjunction with lead acid batteries for use in tunnelling and hard rock backfilling operations.

The customers for the rebuilds can be the OEM itself, the OEM dealer or in some parts of the world a mid tier rebuilder carrying out the work for the mine operator and which contract Saminco to carry out the electrical aspect of the work. In the USA for example these independent companies include the likes of Highland Machinery Corp and Phillips Machine, both in West Virginia, which both are major rebuilders as well as supplying their own OEM models and selling used and rebuilt machines. They send motors, drives, displays and other electrical components to Saminco for rebuild or replacement. But conversions to battery are becoming more common – for Highland Saminco recently converted a diesel 2 yd³ LHD to battery as an example. One of the company's strengths is its experience across all the main battery chemistries. It is a distributor for FZSoNick molten salt batteries, but with experience in Li-ion, Li-phosphate, Nickel Manganese Cobalt, lead acid and other types.

Saminco's Kenny Boles, VP Market Development told **IM**: "We are seeing conversion to battery, either from tethered or diesel, becoming much more common, especially as older mines look to upgrade existing fleets during rebuilds. In some cases they will buy one new battery machine to prove its performance in their

Rebuilding, remanufacturing and upgrading are all options for older equipment. Paul Moore spoke to four distinct companies in this market

There are a variety of companies in the market offering rebuilds, but not all are made equal. Aix-en-Provence, France-based **Aramine** is a true rebuilds specialist in that it only focuses on remanufacturing or "reman" of its own machines or those of Epiroc or Sandvik. Arnaud Paul, Aramine Equipment Sales Director told **IM** that this is because at the reman level it operates at, which includes total disassembly rather than just a refurb, it has to know the equipment at a detailed level, which it does having been an Epiroc dealer in France and Francophone Africa going back to Wagner days, and having supplied Sandvik parts for Sandvik equipment for many years. In fact the company has been conducting remans for over 30 years now in tandem with its Epiroc dealership business as well as its other business since 2005 of supplying its own Aramine brand "small gallery" equipment. These Aramine machines have now been around long enough to be suitable for rebuilding themselves; in 2019 Aramine carried out full remans on five of its own narrow vein LHDs. That year other reman models supplied included a Sandvik LH203 and LH410 as well as Epiroc ST1030 and other machines. The reman process typically takes four or five months.

The Aramine reman process involves stripping right down to the bare frame, and sandblasting it to locate any defects or weaknesses. All components are repaired or if they have to be replaced are sourced direct from the OEM but never replaced by adaptable parts. The warranties on its reman machines include six months on the powertrain, engine and hydraulics/hoses and a year for the chassis/frame. All remans are done "on the books" as Aramine calls it, ie following exact specifications from the OEM equipment manuals and guides. Nothing is altered in designs or part types. The

idea being that the full reman machine be as if it was ex-OEM factory. "There are only a handful of companies doing full remans at the level we are, and that includes the global OEMs themselves," said Arnaud Paul.

Interestingly, the majority of its reman market is not mining customers wanting to rebuild older machines in their fleet, though this does happen – most of the business involves companies looking to acquire machines of a certain size but wanting options outside of a completely new machine. As such, Aramine remans up to 35 underground LHDs and trucks every year, and sources some of the them from customers and some from the open market but even here always from known contacts that can provide the full working history of the machine in terms of how it was used. Equally important is understanding how the buyer will use the machine and what mining conditions it will work in. And machines are sourced for reman not just based on orders. Aramine says it can judge annual demand for these units well enough to be able to reman units for stock as well and in many cases such is the demand that these "stock" machines are sold during the reman itself.

The goal is that the reman machine be no more than 60% of the cost of the equivalent new machine so that these full reman units remain competitive, but to achieve this cut off means doing the reman as efficiently as possible, so all Aramine remans are done in its own facilities at the HQ not at customer sites or elsewhere.

In terms of a machine's life, Aramine in general recommends that a new machine be considered for a full reman after 10,000 hours, though a lot depends on the working conditions and some minor refurbishment may be needed before this. A second reman is possible after another 10,000 hours but this is the limit – two full remans for one machine life.



Before and After - images of an LHD rebuild where electric drives and battery electric specialist Saminco converted the machine from diesel to battery power for the lead rebuilder, client Highland Machinery

mining conditions but then opt to convert the rest. Of course any conversion is a challenge, especially when it comes to the resulting weight displacement and in space terms where to put the traction motors, hydraulic pump motors etc, but we have some of the broadest experience in the industry.”

Canada and Scandinavia are the hotspots currently, both for new battery machines and battery conversions, but interest in increasing in the rest of the world, including India and China. In China for example, Saminco has now converted numerous scoops to battery from diesel. While other global groups like Siemens, ABB, GE (Wabtec), Danfoss etc are also working on supplying battery propulsion solutions for mining equipment, including conversions, Saminco's depth of experience as well as its smaller size means it can take on smaller projects of just one or a few machines right up to whole fleets and also stands out in having experience that cuts across the coal and hard rock divide in mining.

Most recently, Saminco has signed a deal with two major underground hard rock mining equipment OEMs, one in the USA and one in South America, where it is exclusively carrying out work for them on both conversions to battery and the development of battery systems for new machines for these companies. The deals are expected to be announced at MINExpo 2020 later this year.

Comminution: Upgrading designs

Maintaining high equipment availability rates is crucial for any mine. For this reason, Codelco's

Division Andina copper operation needed to perform a crusher upgrade to their Symons crusher. This is the second upgrade by Metso for this customer – one of the most important mining sites in the region. To achieve the needed increase in availability, the equipment's setting time was reduced, as were its bowl removal time and its adjustment ring removal time. These various upgrades have reduced maintenance

times and, with it, injury risk – and have led to increased uptime.

Mining production rates have risen over the last few years, so it is necessary to maintain high equipment availability rates. In order to meet this challenge, it became important to upgrade the site's crushers.

Division Andina, Codelco's mining site in the mountain range of the Valparaiso Region, 80 km from Santiago, needed to increase its coefficient of performance in its tertiary and quaternary plants. Given this situation, there were two options: purchase new equipment or update the existing units.

The Symons 7' crushers working at the client's mining site belonged to the older generation of these machines, that is, machines installed prior to the 1980s. The main factors that affected the coefficient of performance of the mine's ageing Symons 7' crushers were:

- Stalling (mineral, iron, wood, etc caught in its crushing chamber) and the fact that the units had to go into maintenance for long periods of time without warning; these issues ultimately led to lower production.
- The time associated with operational adjustments to the equipment, such as its close setting, which had to be carried out at least twice every shift. This generated complications due to its older configuration, which involved a piston rack and, for each



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- ⚡ MSHA, ATEX and IECEx approvals
- ⚡ Introduced FIRST Smart Battery eLHD system (Sodium Nickel) and charger for hard rock mining in 2014.
- ⚡ Diesel & tethered system conversions to electric battery vehicles begun in 2011.



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Installing the upgraded Symons crusher at Codelco's Division Andina

adjustment made, caused a 30-minute interruption (on average) to the process. This interruption added up to two hours of lost time a day (corresponding to 8.3%). Today, after the upgrades were carried out, they are still adjusted twice per shift, but the daily impact is only 20 minutes a day, ie an increase of 7% in the equipment's usage.

- The third factor was the scheduled maintenance every 4,500 hours; it was time-consuming due to the fact that these older-generation Symons 7' units have an outdated spring system that doesn't allow for quick maintenance and the ready freeing of the crushing chamber.

These types of problems are common to all mining plants with older-generation equipment. In Chile, there are more than 100 such units operating in different mining plants.

In light of the above challenges, Metso fully re-engineered and improved the equipment and installed cutting-edge components. "Starting in 2015, a project was carried out to modernise the famous and historic Symons equipment. Its mechanical components and adjustment system were updated, its springs replaced, and the ring adjustment operation automated, which led to the upgrade proposal for the current modernisation," Metso's Mining Crusher Screens Manager Nelson Mella pointed out.

For this particular Symons 7', modern systems to free up the crushing chamber were used; in terms of securing the chamber, the older Symons technology was upgraded to HP and MP technology.

"By doing this, the advantages include increased equipment availability, lower exposure to risk for the workers, and better product quality control, as the setting can be adjusted more accurately as a result of the motorised setting," Mella points out.


In addition, a new Hydraulic Power Unit with a PLC was installed, enabling Ethernet connectivity for the existing automation systems belonging to the client or through Metso automation systems (eg TC1000, TC2000). This makes it possible to adjust parameters remotely, optimising the equipment's efficiency.

The solution was installed by the client over

the course of one week in June 2018 under the guidance of Metso professionals. The results:

- A 31% increase in availability, thanks to less time needed to adjust the unit's bowl and Closed Side Settings.
- A reduction in maintenance time and, consequently, a reduced risk of injury. This

was achieved by replacing the spring system.

- The equipment's setting time was reduced (from 30 minutes to 5 minutes).
- The bowl removal time was reduced (from 3 hours to 25 minutes), and the adjustment ring removal time was reduced (from 10 hours to 3 hours). 

Paul Moore spoke to Martin Wallman, Product Manager at Epiroc, about its Midlife rebuild program and some of the options

Q Do you still divide your rebuild options into Midlife BASIC, Midlife PLUS and Midlife TECH+? Has the relative take up of different rebuild options changed ie are you seeing more companies opt for more advanced options towards Midlife TECH+ and if so why is this?

A Yes we are still following this concept. When the customer has decided to go for a more advanced option they generally would like to perform a Midlife at the same time the machine is upgraded to the next level. We can also see a trend in replacing completely major components on the machine when doing a Midlife. This plug and play model will shorten the overall lead time of a Midlife.



Q With more and more companies wanting to retrofit technology (and not just autonomy) onto older machines, to what extent is there overlap between "retrofit" and "rebuild" ie could you argue that a major retrofit that involves new digital hardware etc is a form of rebuild? Are these handled completely separately within Epiroc?

A Yes, we do offer different type of upgrades on older machines. There is as big step going from an older more traditional machine to a fully autonomous machine, and so there are customers who prefer to do this journey in steps. Then a technology upgrade can be an intermediate solution. We can have this included as part of a full Midlife but can also be offered this as a standalone product.

Q There are also a lot of independent companies local to mining markets offering rebuilds across all the main brands – are these sometimes competitive in price and quality to an "official" Epiroc rebuild?

A Here it is really important to see the total value. Epiroc always offers the best overall customer value by looking at the total TCO, of course we are then looking at customer value, price and quality. With our Midlives we aim for a second full life of the machine, we are not just adding a couple of additional thousand hours. Safety is another very important aspect during a Midlife. No one knows our machines better than us, and we know how to make sure that every Epiroc machine going through a Midlife will be safe to operate again.

Q There is more trading of used equipment (eg in online trades and auctions) as well as rental of equipment in the mining market than ever before – to what extent do rebuilds have a role to play here? Eg where a company or dealer performs a rebuild to ready an older machine for sale on the open market?

A We want to give our customer all possible different options, from a minor rebuild to a full Midlife and also the alternative in purchasing a new machine. We have many different price models to meet our customer demands. With this they can decide what is their best option, including performing a Midlife or ordering a new machine.

Q To what extent are scheduled rebuilds now factored into the TOC over the life of the machine at the point of sale today? For example when you sell a customer a new fleet today, do you already factor in a series of rebuilds at particular stages of its life and at recommended times in terms of hours it has worked?

A Yes, this is a clear trend, especially among our mining customers. They want to get the most out of their fleet and during the sales process for new equipment, a requirement in the RFQ is often to include at a detailed level the process around a Midlife.