GETs are specially designed sacrificial pieces of metal that have two main purposes – increasing machine productivity and protecting the more expensive structural components from wear. The term covers components such as teeth, shrouds and cutting edges that are used on a range of mining machinery, such as excavators, wheel loaders, draglines, dozers and rope shovels. They are usually made of a harder or higher wear-resistant material than the rest of the machine.

GETs protect the exposed areas of machinery that are subject to the greatest force and wear, such as buckets or blades. For example, GETs are used on the leading edge of bucket lips and on the underside of buckets. “The lip of the bucket is the area most prone to wear,” explains Paul Schild, global product line manager at Sandvik. “Traditionally these lips were cut from plate steel. Due to the restrictions of quenching plate steel, the hardness and wear characteristics of a bare steel lip are not as robust as the cast GET product, so they have a reduced wear life compared with GETs.”

Craig Turner, GET marketing – customer services support at Caterpillar, adds: “Using GETs to shield base edges and sidebars from impact and abrasion helps extend their lives. This sacrificial iron is often mechanically attached, which enables faster replacement than cutting and welding.”

Matching GET products to the machine and its application increases productivity by reducing cycle times. For example, using a sharper tooth design to penetrate hard material better enables the loading machine to load more trucks per hour, increasing production and reducing downtime.

Brant York, national accounts manager at H-E Parts Distribution, notes: “With the correct GETs on the bucket or blade, the job of digging or pushing material is made easier. Good sharp GET products allow buckets to cycle through material more easily, reducing wear and tear on the bucket or blade, as well as reducing the fuel consumption of the machine.”

Joan Cesar Galobardes, product manager at MTG, says: “I would conclude that the more aggressive the work you are using a machine for, the more you need to have high-quality GETs.”

GETs are very important; operating without them would increase the wear on the bucket or blade system, so its lifetime would be reduced dramatically. “Operating without GETs would destroy the bucket or blade system, driving up operating cost per tonne or cost per operating hour,” cautions Turner. “Imagine throwing out your whole razor every week instead of just changing the razor blade.”

Swann Blaise, marketing manager at Liebherr, says: “No repairs would be possible, and users would probably have to change the complete bucket every week or month depending on the material’s abrasiveness. Users would have to bear a tremendous cost due to consequential damages and frequent bucket change-out.”

Turner explains: “The mechanical stresses would be transferred to and cause damage to other components, such as loader lifting arms, shovel stick and boom and hydraulic systems. Operating costs and downtime would increase further.”

York agrees: “Bucket teeth need to be changed before you wear into the pocket of a tooth, and bolt-on blades changed before they wear into the base edge of the bucket.”

Cesar adds: “GETs are essential in
buckets. The cost of the bucket is much higher than the cost of the pieces protecting it, so it makes sense not only to use them, but also to invest in high-quality GETs to maximise the life of the bucket.”

Without GETs, the penetration performance of the bucket or blade would also reduce markedly, making it an ineffective digging tool and lessening the machine’s ability to penetrate and produce.

Doug Pierce, global product manager for mining and GET at ESCO, says: “Without GETs, machine production would go down, first from less penetration and secondly from additional downtime for welding repairs.”

Finally, if such a machine did not have GETs, it would need to work much harder, so the fuel consumption of the machine would significantly rise. Cesar states: “One of the most important operating costs of the machinery is fuel, and it is unquestionable that GETs are indispensable to improve productivity and reduce production costs.”

**WEAR LIFE**

Although GETs are designed to be durable, they do wear out and have to be replaced. Regular inspections are important to identify any wear or cracks. GET replacement frequency varies by each site and sometimes even within a site. Schild says: “Machine hours can vary in range from 400 hours to 4,000 hours for a complete set of GETs on the lip of a bucket.”

The companies that MM spoke to unanimously agreed that while there are some GET products that can be recycled in other applications, generally it does not make sense to rebuild GETs, as the costs of doing so would be much higher than simply replacing them for new ones.

GET components are often worn to destruction or failure, so components such as bucket teeth and cutting edges are used once and then discarded. In terms of cost efficiency, simply replacing the components also avoids lengthy machine downtime.

Pierce explains: “Rebuilding GETs is a case of diminishing returns, because heat from welding takes the heat-treating out of the parent steel.”

The time it takes to replace GET components can vary from five minutes to five weeks, depending on the size of the component and the manpower required.

There are several factors that affect the amount of wear on GET systems, such as the type and abrasiveness of material mined, the condition of the terrain, operator experience and technique, blasting technique and the material that the GET is made from.

The material being worked and its abrasiveness is one of the most important factors in how fast a GET component wears, and typically ores with a high quantity of silica, such as quartzite, are the most abrasive and so are tougher on bucket teeth and edges.

Blaise from Liebherr says: “We would classify mine-types from the least abrasive to the most abrasive as follows: coal, limestone, overburden, copper, iron ore, platinum, nickel and gold.”

There are various shapes or profiles of bucket teeth that have been designed to provide optimal penetration and performance for the machine in each application.

“Digging in tightly compacted abrasive conditions may require a tooth profile that is slimmer so that it will break out the material and allow the bucket to cycle quicker,” explains York.

“This results in less wear and tear on the bucket and less machine fuel consumption. This profile will not last as long as a heavier, thicker-profile tooth, but it does have the advantage of minimising wear and tear on the bucket.”

The quality of the steel can also impact wear life. Cesar from MTG says:

“Reaching the right balance between hardness and ductility, plus making sure that the steel is free of impurities, is key, not only to increase the wear life of the products but also to avoid breakages.”

Turner adds: “You have to balance abrasion resistance with material toughness. Of course, the challenge with a wear product is ensuring that the performance gains exceed the cost of delivering the special material.”

The operator can also influence the wear of GETs according to his or her way of operating the machinery. Turner remarks: “The best alloy and heat-treated product can be destroyed quickly by an inexperienced operator.”

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**You have to balance abrasion resistance with material toughness**

**Liebherr GETs being changed**
Extending the wear life of GETs typically increases productivity, because the machine has less downtime, the number of maintenance intervals is reduced and there is more time for production work. This also results in reduced costs.

Pierce warns: “However, the key is to extend wear life while assuring that the GET continues to penetrate at an effective rate so that production continues at a high rate. Blunt GETs that dig poorly increase the cost of production.”

Turner adds: “Ensuring the components wear as a system is key. For example, a longer-living tip is no good if the adapter or coupler fails before the tip wears out. On a motor-grader cutting edge, you can extend wear life by 50% by replacing a 6in (15cm) edge with an 8in (20cm) edge – as long as the edge wears evenly.”

Cesar says: “One of our clients works with a Komatsu PC3000 shovel at a gold mine in Mexico that experiences a high level of impact and a medium level of abrasion. They used to replace the GETs on average every 450 hours. Now with MTG tools and under the exact same application, they replace the GETs every 1,200 hours on average – that’s an increase of 266%.”

**OEM providers**

Some OEMs provide GETs for their equipment rather than relying on tools from other companies. Des Jarvis, product marketing manager, mechanical drive mining equipment at Komatsu America, says: “R&D and customer support are improved by controlling the development of new products, and it speeds up the communication process between the end user and factory.” Turner agrees: “When you engineer the entire machine, you work to optimise system performance. You can take a production focus rather than a component focus.”

**CATERPILLAR**

Caterpillar’s GETs are engineered and built to perform in tandem with its buckets and machines. The company says that each GET and bucket system is optimised for high productivity and low cost per tonne of material moved. Cat offers GET products and a customisation programme for Cat mining products, such as large wheel loaders, large track-type tractors, motor graders and underground loaders (LHDs). In addition, Caterpillar has been actively designing and testing GETs for surface extraction machines such as draglines, rope shovels and hydraulic shovels since Caterpillar acquired Bucyrus in 2011. GET components are engineered to a specific machine size and intended use. For example, Caterpillar offers a range of bucket tips designed for the Cat 994 wheel loader. “That range of tips is designed to endure the typical work that a machine in that size class performs,” explains Turner.

“Knowing that there are extreme applications at both ends of the spectrum, we offer tips that place wear material in the most critical areas and offer speciality overlay products, such as tungsten carbide, that greatly extend the life of the base component.”

The Cat K-series tooth system has a lower tooth profile, which the company states provides better penetration and helps maintain sharpness for longer. In addition, the company says it can increase expected tooth life by up to 15%, and that the tips can be changed in roughly half the time of most other types of tip.

The K series features a twist-on procedure to make installation easier and quicker, and also reduces tip movement and allows the tip to grip the adapter tighter the harder it digs into tough materials. This reduces tip vibration and loosening.
material than usual is applied on the K-series tips for an increased wear life.

Tips are secured with a one-piece retainer that installs vertically in the tooth, rather than being hammered through holes in the sides.

Opposing sloped side rails and flanks help to keep the tip on the adapter nose when the retainer is installed and removed. On-site, the rails and flanks help to stabilise the tip and reduce the load on the retainer.

"Cat GETs are supported by experts who thoroughly understand machine functions and mine applications," comments Turner. "Cat dealers have the capabilities to rebuild each bucket system for the exact productivity and protection required. The Cat dealer network reaches even the most remote of mining sites and achieves the availability expectations of each mining operation."

GETs are currently in development for Caterpillar’s rope shovels, hydraulic shovels and draglines, and examples of these were shown at MINExpo International in September 2012. Caterpillar plans subsequently to offer GETs for all the mining machines in its range.

"You can find Cat GETs in most mines – even on competitors’ machines," says Turner. "Cat wheel loaders, tractors and other legacy machines are factory-equipped with Cat GETs, and development of GETs for the former Bucyrus machines is progressing quickly."

Komatsu offers GETs such as teeth, cutting edges, adapters, ripper shanks, edge segments, pins, wear plates and bars for excavators, wheel loaders, bulldozers and motor graders. Komatsu offers both Hensley and KVX GET systems, allowing customers to choose the most appropriate and cost-effective solution for their application.

The extreme service (XS) range features Hensley’s hammerless pinning system, which eliminates the need for heavy hammering and makes for safer tooth changeover and rotation. A conventional socket is all that is required to unlock and lock the pin fastener. Pins are also re-useable, further reducing costs. The hammerless pin system can drastically cut tooth changeover time, the company says.

KVX GETs are a system, where the lip and other GET components work together. They feature recessed bolt heads for better penetration and productivity, high-strength KVX bolts that enhance impact resistance, and flat-faced GET components that can be re-used as wear and impact liners elsewhere in the mining operation. Sagitta steel, a very hard and tough type of steel, may be used in extreme conditions to increase GET life.
LIEBHERR

Liebherr’s Z tooth system is compatible with its mining backhoes and face-shovels hydraulic excavators from R 9100 up to R 9400 models. The system is available in three tooth profiles (CL, CR and P) and in five sizes (Z90, Z100, Z110, Z120 and Z140), and can be used in a range of applications from well-blasted material to very hard ground.

The CL profile has a long-drawn pointed shape that provides a sharp cutting edge for penetration in rocky and blasted material up to medium compacted ground, while the wide, thick CR tooth delivers long service life in abrasive soils and blasted rock applications, making it ideal for a bottom dump bucket configuration. Liebherr says that the pointed shape of the P profile offers optimal penetration for very hard and compacted ground applications.

Liebherr buckets and GETs are designed to work in harmony to deliver an optimised, vertically integrated mining solution. To increase machine uptime and reduce the amount of tooling to one extraction tool, the teeth, shrouds and wing shrouds are equipped with a single locking system. In addition, the wear cap does not need a locking system as it slips onto the adaptor and is locked by the tooth.

Blaise says: “As a mining hydraulic excavator supplier, Liebherr’s main objective is to increase and master its machines’ productivity from heart to tip.”

Sandvik

Sandvik’s GETs are specifically designed for underground loaders. However, there have been some fittings on surface stockpile loaders where a continuous lip system is used. All Sandvik GETs are made from quenched and tempered cast alloys, with a selection of raw materials such as steel, molybdenum and nickel chrome.

“The Sandvik mechanically attached GET is made from the company’s highest material specification to suit the most abrasive ground conditions,” says Schild. “We also supply a weld-on system with a slightly reduced spec that would suit less aggressive ground conditions.”

Sandvik GETs are fitted to about 2,200 loaders globally – on Sandvik machines as well as those of competitors. Sandvik currently factory-fits GETs on 55% of its new loaders each year.

The company has plans to trial a new mechanically attached heel shroud on one of its LH621 loaders in April at Xstrata’s Mount Isa mine in Australia.

Independent providers

There are also a number of independent GET manufacturers whose products are designed for, or can be adapted to fit, a range of machines. MM asked several of these providers about their product ranges.

COLUMBIA STEEL

Columbia Steel is a major manufacturer of wear parts for draglines and mining shovels globally. The company’s engineers work closely with maintenance supervisors to develop products, such as the R-Lock and Dynaclamp tooth/adapter system.

Columbia Steel says that the R-Lock device for securing teeth makes removal and replacement simple and efficient, as all that is needed is a hex socket and handle. The Dynaclamp system’s adapters can be safely installed and removed without heat or hammers.

COMBI WEAR PARTS

Combi manufactures wear parts for excavators and loaders, including its ProClaws system that can be used on machines from 25t to 250t. The system is designed to efficiently absorb the impact forces it is exposed to, so that the teeth maintain maximum sharpness while in operation. The system has a flat profile for optimal penetration. The coupling geometry has been simplified and strengthened, and the tooth slides into place with minimal effort.

The tooth, adapter and lock have all been equipped with a new wear indicator to signal when the part is no longer performing optimally and is due for a change. Combi states that utilising the wear indicators will prevent failure or breakage of parts, minimise downtime and improve safety.

The assembly is held in place by a vertical top-mounted locking device, which Combi says reflects the market demand and optimal design from an engineering standpoint. The company has applied for a patent on a new locking mechanism for ProClaws. The lock is made out of boron steel, which, after hardening, becomes very strong and extremely durable. The company explained that the advantage of the new locking mechanism is to ease the mounting and dismounting without the need for intricate tools or sledgehammers. Only a sleeve and a ratchet are needed, which makes it very user-friendly. The new locking mechanism, which is available via the company’s distribution network, can be reused several times and fits ProClaws installations that are already on the market.

The company has recently launched heavier ProClaws products for excavators in the 200-250t weight class. The range includes adapters, teeth and lip shrouds designed for cutting edges of 120mm thickness. They will be followed by the same parts for 140mm lip thickness. Two sizes are available – W40 and W50 – with teeth weighing between 60kg and 90kg.

Combi Wear Parts has mining customers in North and South America, Africa, Europe and Asia.

ESCO

ESCO offers complete GET packages for draglines, wheel loaders, rope shovels and excavators, including tooth equipment, shrouding, mechanical wear protection and weld-on wear protection. The company’s tools are made from several different alloys that are selected for each individual GET item. In addition to alloy selection by GET type, the company also offers a full complement of overlay products as options for much of its GETs, such as the ESCO E3 overlay for high-abrasion, low-impact applications.

“ESCO E3 overlays are applied during the GET manufacturing process to perform optimally and is due for a change. Combi states that utilising the wear indicators will prevent failure or breakage of parts, minimise downtime and improve safety.”

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prevent welding on a fully hardened casting, which can cause failures,” says Pierce. “We consult our customers to assure that when using one of our E3 overlays, we select the right overlay option and apply it in the correct pattern to optimise either penetration or wear life, or both.”

ESCO introduced the Nemisy system at MINExpo last year. Nemisy is a complete mining lip and GET system for 272-726 class hydraulic excavators, which won the Mining Magazine 2012 award for surface mining (soft rock).

The company plans to expand the Nemisy product line to dragline lips and surface mining (soft rock).

“Most mining operations around the world use ESCO products in some facet of their operations,” notes Pierce. “ESCO has excellent relationships with major OEMs supplying machines globally. ESCO also has distribution in growing mining markets around the world to support our products.”

MTG

MTG offers high-quality tooth-adapter systems designed to increase the productivity of machines such as excavators, loaders, shovels and dozers. MTG also offers other products such as lip and wing shrouds, and corner heel shrouds that can be used on loaders and excavators.

“MTG’s hammerless system is one of the biggest assets of our products,” says Cesar. “When you need to replace or remove the wear parts, it is much faster, easier and safer for the operator.”

In most of the cases, depending on the size of the GET, a single operator alone can reposition and replace them. This feature is useful in compacted terrain applications where changing the GET can be particularly complicated.

Cesar adds: “We have a case in Spain where a client works on a compacted terrain with high levels of humidity; it was so extreme that before using MTG’s hammerless system, the only way for the user to remove the GET was cutting them off with a blow torch. Using MTG products, they are now able to remove and replace the wear parts normally.”

The wear in the corners of a bucket tends to be higher than in the centre, since the corners are usually more exposed to abrasion; replacing the parts manually means that the machine operator can check the repositioning, meaning that the final wear process will be more uniform.

MTG uses different steels based on the product nature and in some cases, based on the application. “We are able to increase the productivity of the machines by combining different steel compositions with specialised designs that target specific applications,” explains Cesar. “In some applications and products, we use tungsten carbide and other materials to extend the life of teeth.”

MTG’s GETs may be factory-fitted or installed after sale, and the company claims that in either case they will give the same performance. MTG’s designs are optimised so that the tools continuously self-sharpen and most of the material wears out evenly.

The MTG Whisler adapter, which was presented for the first time at MINExpo, can be combined with the TMA500WH1 tooth for electric cable shovels. It has been used on P&H 4100 and Bucyrus 495 shovels at a mine in Sweden, where the material is medium-impact and highly abrasive. During the three-month test phase, the machines moved 476,000t of material.

Cesar comments: “MTG’s target for the next five years is completely focused on mining. We are expanding our current range of products and developing several new ones.”

Later this year, MTG will inaugurate a new factory in Spain that will exclusively produce the company’s range of GETs, with a particular focus on the larger sizes. There are also many product launches planned in 2013-15, including those for draglines, front shovels and electric cable shovels.

“We are able to increase the productivity of the machines by combining different steel compositions with specialised designs that target specific applications”

H-E Parts

H-E Parts offers the GETtuf line of high-performance wear parts, including:
- ripper teeth offered in long, intermediate and short profiles for different applications;
- ripper shanks and shank guards;
- bolt-on blades for rubber tyre loaders, motor graders and scrapers, with half-arrow profile wear segments and bolt-on edges that protect the loader bucket base edges rather than standard double-bevelled bolt-on edges; and
- bucket teeth of various profiles, including short, long, heavy-duty, penetration and abrasive teeth, as well as adapters and fasteners for support excavators and tracked excavators.

Many of the company’s GETtuf bucket teeth are designed with a specific profile, so that they start off sharp and continue to maintain a sharp profile as they wear. H-E Parts also offers GET products with tungsten carbide for extended wear life, which can be custom applied depending on wear patterns experienced in the tougher jobs.

“H-E Parts Distribution (HEPD) uses different steel specifications based on the use of each component,” explains York. “We use them for our complete range of bucket teeth, bolt-on adapters, weld-on adapters and ripper shanks.

“The difference is that a bucket tooth needs a higher hardness and impact resistance compared with an adapter that is welded onto the bucket with a lower hardness and needs to have some flex to reduce breakage.”

The company’s GETtuf cutting edges are running on Cat D10N dozers at a mine site in Elko, Nevada, US. They were installed as replacement components.

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