

Bucket maintenance basics

Properly kept excavator and backhoe buckets increase uptime, efficiency and safety while reducing unnecessary stress on the power unit.

BY CURT BENNINK

Froper bucket maintenance relies primarily on protecting the structure of the bucket from wear with the proper ground-engaging tools (GETs). But there is a lot of neglect in the field and wear items need to be carefully monitored.

Broken or excessively worn bucket teeth can damage adapters. Blunt teeth can reduce penetration forces, decreasing productivity while placing more stress on the power unit and increasing fuel consumption. In addition, small cracks that are not properly welded can open up into larger cracks that render the bucket unsafe or useless.

"If the sacrificial material is left unattended — in other words, the contractor has worn the protection components beyond 100% of their wear life — then you start getting into the structural components of the bucket," says Butch Guenther, senior product consultant, Caterpillar. "When you start wearing into the structural components of the bucket, a lot of things

can happen. We've seen components wear through and fall off."

It's more costly to repair a bucket in this condition than to do the proper maintenance on the bucket and keep things repaired.

"Poor maintenance procedures can ruin a bucket so you don't have anything to rebuild," says Doug Pierce, attachments marketing manager, ESCO.

Putting the bite into the bucket

Bucket teeth represent a reoccurring expense that can add up after time, so they should not be thrown away prematurely. However, they are wear items and need to be replaced when worn. A good measure of tooth life is the weight of the tooth at the time of disposal vs. the weight of the tooth when it was new.

"As a rule of thumb, it would be 35% of the weight of a new tooth," says Chuck Clendenning, engineering superintendent, H&L Tooth Co. "So you're looking at 65% of

the tooth being gone."

But optimum tooth life depends on the style of tooth. This percentage varies from manufacturer to manufacturer. Most GET manufacturers claim you should use at least 50% of the weight of the tooth if it is wearing properly.

As teeth wear, they can also become dull. Clendenning explains that teeth can be compared to a razor blade. A sharp blade will slice and penetrate. "With a dull tooth, you don't get any penetration at all," he notes. Often, operators don't notice the performance loss from dull teeth because it happens very gradually. But worn, dull teeth make the engine work harder to force the bucket into the dirt or rock, using more fuel and overstressing mechanical linkages.

Worn teeth also present other problems. If the teeth wear through, the adapters become exposed to wear. Since the pockets of the teeth that slide onto the adapters and the adapters themselves have closely matched toler-

ances, problems begin to arise.

"Once you wear into the adapter, the fit would be altered and maybe the pin would not fit properly," says Clendenning. "Then you end up replacing the adapter and that becomes expensive." This involves the labor-intensive process of using a cutting torch to remove the damaged adapters and welding new ones on, sometimes necessitating moving the bucket to a repair facility. For this reason, some equipment operators in remote locations prefer mechanically attached (non-welded) adapters.

"You want to replace the tooth just before it wears thin enough to go into the nosepiece of the adapter," says Don Bagwell, product manager, construction, at Hensley. "That's the optimum time to replace. That way you've gotten all you can get out of the tooth without damaging the nose of the adapter."

Matching the tool to the job

Selecting the right tooth for the job will dramatically impact whether or not you get optimum tooth life. Teeth concentrate force in a small area, which displaces the material in several directions and makes it easier for the bucket edge to finish the cut. By using the right bucket tooth, you reduce cutting edge wear and make it easier for the bucket to load.

There are literally hundreds of shapes and sizes of GETs. It's always a good idea to get advice from your GET supplier when selecting teeth, since choosing the correct teeth is always a balancing act.

"The GET is there to maximize the performance of the machine, not just to protect the bucket," explains Guenther. "What you have to realize with GET is that there are tradeoffs. You're always looking for the optimum situation in terms of wear life, penetration and cost."

He adds, "If you give up penetration, you're going to get longer life and lower cost. But when you give up penetration, you give up productivity. When you lean too far toward penetration, you give up tip life, you increase cost, and downtime of the machine may become more significant because you're changing tips more often. You're always looking for the optimum selection that's going to give you the best combination of penetration, durability and cost."

One note of caution: Never mix styles of teeth on the same bucket and never use a bucket with missing teeth. "The tooth that has the longest projection will always carry more load than the shorter projecting ones," explains Pierce. And missing teeth transfer more load to the remaining teeth. This situation could lead to failure.

Manage wear

Record keeping can be an important tool in maximizing tooth life. Operator technique, proper selection and maintenance all impact tooth life. Often a change in any one of these will impact tooth life. Contractors can measure that by keeping track of the machine hours and change intervals.

It's also important to note the corner teeth of a bucket wear faster than the inside teeth. "The reason is the material flow is changing directions at the corners more than it is anywhere else on the

bucket," Guenther explains.

By inverting and rotating the position of the teeth on the bucket, contractors can extend tooth life. "The ones in the middle should be moved out to the corners," says Guenther. Teeth also wear faster on the bottom of the bucket, so if the teeth are center-line type teeth (symmetrical), then you can invert them for more even wear. It is best to invert the tips and rotate their position at the same time.

"We wish that more contractors would rotate tips," Guenther states. "They have a lot of work to do and sometimes they don't feel they have the time to devote to bucket maintenance. We really feel there is good value in maintaining the bucket."

Teeth should also fit snug to the adapters. Make sure the retaining system is within tolerance to avoid losing tips. The bearing area between the teeth pockets and the adapters holds the teeth on the bucket.

ESCO's Pierce explains that as the bucket is curled, the digging forces pry down on the tip of the tooth. "The tooth is wanting to pull off that adapter nose," he explains. But the bearing area holds the tooth in place. "If you don't have good bearing area, then you can pull it right off."

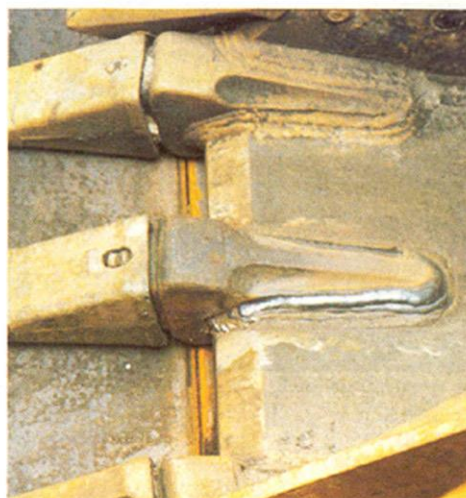
The retaining pin for the teeth is not meant as a load bearing device. "The fastener is designed only to hold the tooth in place," says Bagwell. "If the adapter nose-piece is worn and allows the tooth to move around, the fastener is not designed to withstand that. Fastener failure is usually caused by adapter nose wear."

Loose teeth and misaligned teeth are signs of worn out adapters. "I just saw a bucket that had worn out adapters on it," says Guenther. "The tips were sitting at various angles. If you got down and looked across the bucket in line with the tips, you would see that some tips were raised, some tips were low. They were not on the same plane."

Also check adapters for cracks. If the adapter is cracked, replace it. If the weld is cracking, gouge and reweld.

Maximizing bucket life

Simply adding wear plates and protectors to maximize life may not be the best solution. Every pound of weight added to the bucket reduces production and increases stress on the machine.



Top: Tooth blunting creates drag when trying to penetrate the digging bank. This requires greater machine power and accelerates hydraulic system and attachment bushing wear. Center: Note the attachment of the corner tooth instead of the pin and retainer as designed. Left: Poor welding can cause early failures and replacement.

Careful attention needs to be paid to optimize bucket life vs. production.

Base edges and side plates need to be regularly inspected for cracking. Wear plates on buckets should be checked periodically, and replaced if they wear close to the bucket's structure.

Also be sure to check the bottom of the bucket as well as the top. "Many times a customer will inspect the top of the bucket and forget to raise the bucket and look at the bottom side," says Guenther. "Really, the bottom side probably gets 80% of the wear. First thing in the morning, the operator should

elevate the bucket, rack the bucket back and look at the bottom side for weld cracking or components that are worn out."

When repairs are warranted, proper precautions must be made before welding. Many buckets are constructed of more than one type of steel and feature some type of hardened steel on the lips, which requires preheating and slow cooling to prevent damage to the steel's hard and brittle characteristics. Contact your bucket supplier prior to welding for specific instructions on your particular bucket. ■