DRILLING ALUMINUM

NOTES + COMMON PRACTICES

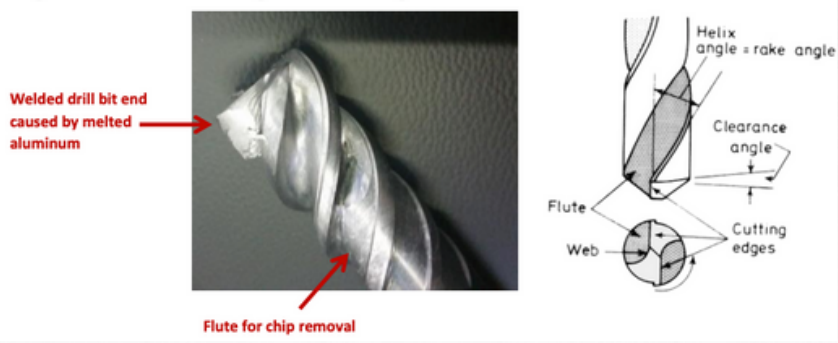
GREENCUT® ISN'T JUST A PRODUCT; IT'S A GAME-CHANGER, ENSURING EFFICIENCY, SAFETY, AND COST SAVINGS.

Drilling into aluminum often produces a strong squeaking noise, which becomes more pronounced with larger drill sizes and deeper holes. The holes drilled can sometimes be larger than intended and exhibit poor quality surfaces. Softer aluminum types, like EN AW-6060i and EN AW-2007, and even easily machined ones such as EN AW-5083, display a greater propensity to squeak.

This noise is indicative of aluminum tearing during the drilling process. When lubrication, feed rate, and speed are not properly balanced, direct contact between the metal surfaces can result in aluminum adhering to the drill bit, causing tearing. Though many operators rely on hazardous cutting oil additives for their cost-effectiveness and efficiency, these additives come with potential health risks and disposal concerns.

A contributing factor to this challenge with aluminum is its inherent softness and low melting point. During drilling, as the aluminum gets cut, it momentarily becomes stationary, and then tends to wrap around the drill bit's channels, leading to obstructions. This phenomenon intensifies the heat produced by the drill bit. It is a common issue with many materials due to the nature of drilling operations.

FIGURE 1. WELDED DRILL BIT DURING ALUMINUM DRILLING



When drilling into aluminum, if an operator aggressively forces the drill without considering the material's tendency to become entangled around the drill bit's channels, it can lead to increased heat, and consequently, more welding and tearing. This is primarily an issue with the feed rate. **To mitigate this:**

1. Opt for drill bits specifically designed for aluminum to remove debris effectively.
2. Slow down the drilling speed to decrease heat and prevent aluminum from adhering.
3. Implement the “Peck Drilling” method, which involves retracting the drill bit regularly to clear its channels. For smaller holes, this clearing should be done frequently.

Experienced machine operators are familiar with these challenges and often address them as standard procedures. Regarding the Drill Press and the VHM Reamer, there's a decision to make: either adjust the mix ratio of the "GreenCut Cutting Fluid" coolant to 15%-20% or modify the feed and speed rates to improve performance. Alternatively, one could stick with the current cutting oil, despite its safety and disposal concerns. This decision between costs and safety must be made by the client.

Such problems are unique to aluminum, due to its relatively low melting point when compared to other materials like steel, Inconel, titanium, and brass.

Metal	Melting Point	
	(°C)	(°F)
Aluminum	660	1220
Aluminum Alloy	463 - 671	865 - 1240
Brass, Red	1000	1832
Chromium	1860	3380
Cobalt	1495	2723
Copper	1084	1983
Hastelloy C	1320 - 1350	2410 - 2460
Inconel	1390 - 1425	2540 - 2600
Iron, Gray Cast	1127 - 1204	2060 - 2200
Magnesium	650	1200
Magnesium Alloy	349 - 649	660 - 1200
Nickel	1453	2647
Steel, Carbon	1425 - 1540	2600 - 2800
Steel, Stainless	1510	2750
Titanium	1670	3040
Tungsten	3400	6150
Zirconium	1854	3369

Table 1. Melting Points of Various Metals

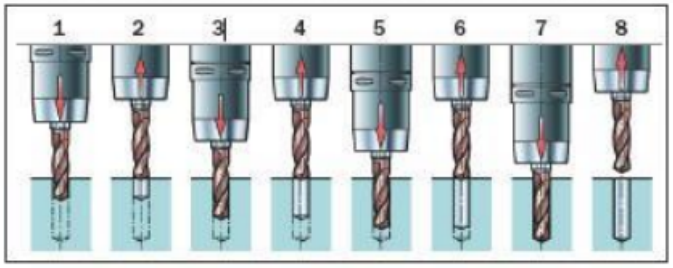
Peck Drilling

Peck drilling is a common technique where a drill goes down a short distance, retreats slightly, and then drills down further. This action resembles that of a woodpecker tapping on wood. The primary purpose of peck drilling is to remove the chips from the drilled hole. Re-drilling over these chips can reduce the lifespan of the tool.
In the bore, there's limited space for the chips to accumulate, and as the hole gets deeper, it becomes challenging to remove these chips. **Peck drilling offers two solutions:**

1. Even a small peck can break the chip, resulting in shorter and easier-to-remove chips.
2. Retracting the drill considerably reduces the length the chips have to travel up the drill's spiral.

However, it's essential to ensure that coolants or air/mist blasts don't push chips back into the hole during peck drilling. Therefore, the best peck drilling techniques don't fully retract the drill from the hole. Generally, the recommendation is to use peck drilling when drilling holes deeper than four times the drill's diameter.

FIGURE 2. PECK DRILLING



Source: SANDVIK Coromant

Milling Aluminum

When milling aluminum, there are fewer issues compared to drilling. This is because the factors of feed, speed, and lubrication are in sync. Unlike drilling, there's no risk of aluminum twisting and clogging the drill flutes because there's more open space and effective removal of chips during the milling process.