HIGH PENETRATION DRILLING: what you need to know

Our featured solutions:

- GEN3SYS® XT Pro
- GEN3SYS® XT

01 Using proper coolant
02 Avoiding edge build-up
03 Reducing heat

REPLACEABLE INSERT DRILLS VS SOLID CARBIDE DRILLS

Allied Machine offers a wide range of drilling, boring, reaming, burnishing, and threading tools to lower your cost per hole.
Increase your productivity

You need high productivity. You need hole quality. You need speed.

When you’re drilling a hole, the tool path will stay the same no matter the speed. The problem is that when speed and feed rates increase, you also see a magnification of any problems that were occurring at the slower speed.

A common challenge you might experience is the removal of heat and chips throughout the drilling process.

How do you overcome these challenges? If you can increase your penetration rates, you can increase your productivity. Higher productivity equates to higher throughput. Increased throughput drives an increase in revenue and, typically, profit.

And you like it when profits grow.

Get What You Need

When you increase your speeds and feeds, you need to ensure there is sufficient coolant to maximize the performance of your tooling. The new challenges to combat in high penetration drilling are increases in heat and chip creation. The tool is now making more heat and more chips, which must be overcome using coolant.

Coolant aids the removal of chips, which if not removed properly can cause chip packing. Increasing penetration rates also increases the heat created in the hole, leading to shorter tool life unless properly dissipated.

Tooling designed to create and effectively evacuate small chips will help you achieve the higher penetration rates you need. And an increase in strategically placed coolant ports allows for optimal heat dissipation and extended tool life. Proper tool coatings can increase heat resistance, also allowing the tool to last much longer.

Keep Your Cool(ant)

Keep chips away from cutting edges. Your tool’s cutting edge has microscopic crevices along its surface, and fresh, soft chips will fill in those crevices if they come into contact.

Edge build-up physically changes the cutting edge, causing changes in the tool’s performance. This can lead to tool failure, which will lead to machine downtime, which will lead to decreased production.

You need tooling designed to prevent that contact and to help mitigate material adhesion.

Chips and Edge Build-up
Check out these real life results

Geometry Matters

A customer manufactures transmission parts for the automotive industry. Because they needed to increase production to accommodate for additional orders, tool life became an issue.

<table>
<thead>
<tr>
<th>TEST 1</th>
<th>Previous Tooling</th>
<th>GEN3SYS® XT (standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool Life</td>
<td>1,500 parts</td>
<td>1,500 parts</td>
</tr>
</tbody>
</table>

With a raised eyebrow, the customer expressed his disappointment with the results. However, a simple change of geometry told a completely different story.

<table>
<thead>
<tr>
<th>TEST 2</th>
<th>Previous Tooling</th>
<th>GEN3SYS® XT (CI Geometry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool Life</td>
<td>1,500 parts</td>
<td>10,400 parts</td>
</tr>
</tbody>
</table>

By testing a different geometry on the XT insert, the customer achieved nearly 7x the tool life of their previous tooling.

Cater to Your Machine Like a PRO

The customer drills medium carbon tube sheets. Unsatisfied with the tool life and surface finish of their tooling, the customer needed an improved solution. The hang-up was their machine, which was limited to 1250 RPM.

The high penetration capabilities of the GEN3SYS XT Pro solved this problem, performing impressively under the customer’s machine limitations.

| RPM | 1250 |
| SFM | 245  |
| IPM | 15   |

Results:
- Superior surface finish
- 3x increase in tool life

This application illustrates the versatility of the XT Pro when you’re faced with machine limitations. The XT Pro is designed to be run at higher feeds, so you don’t have to live with the poor results your other tooling delivers.

Toss it out, grab an XT Pro, and improve both your parts and your productivity.

Find Success Where None Was Found Before

The customer tried different options to drill a 23mm diameter hole anywhere from 1” - 2.5” DOC, including replaceable insert drills, high penetration replaceable insert drills, IC drills, and even solid carbide drills. None of these options could exceed 100 SFM without catastrophic failure, and no drill finished more than two holes before problems arose.

<table>
<thead>
<tr>
<th>GEN3SYS® XT Pro: Steel (P) Geometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material: D2 Tool Steel (55 Rc)</td>
</tr>
<tr>
<td>Speed: 100 SFM</td>
</tr>
<tr>
<td>Feed: 0.007 IPR</td>
</tr>
<tr>
<td>Load Meter: 65% consistently</td>
</tr>
<tr>
<td>Tool Life: 18 total parts (some with 2 holes, some with 4 holes) = 40 total linear inches</td>
</tr>
<tr>
<td>Results: Spectacular chip control, minimal insert wear</td>
</tr>
</tbody>
</table>

The GEN3SYS XT Pro succeeded in an environment and application where no drills had succeeded before. The unique coating/geometry combinations provided new solutions to improve production and quality for the customer.

Improve Your Machine Usage

A customer manufactures parts for the automotive industry. Previously, they used a special solid carbide drill that required two machines to fulfill their order. Occupying two machines for this job left them shorthanded for other projects that also needed completed.

<table>
<thead>
<tr>
<th>Solid Carbide Drill</th>
<th>GEN3SYS® XT</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (RPM)</td>
<td>2,500</td>
</tr>
<tr>
<td>f (mm/min)</td>
<td>0.1 (250) mm/rev</td>
</tr>
<tr>
<td>Tool Life</td>
<td>12,800 holes (3 regrinds)</td>
</tr>
</tbody>
</table>

The GEN3SYS XT increased the penetration rate, which allowed the process to be performed on one machine instead of two. This freed up equipment and resources for other jobs and orders. Ultimately, by running the process 68% faster, the customer was able to get 68% more parts on the floor.

Call now to speak with a HOLEMAKING SPECIALIST. The Allied engineers are standing by, ready to help you make your application a success.
**Impacted Chips**

Increasing your penetration rates can complicate chip evacuation. Depending on the hole depth and material, the chip gullet inside the hole can become too tight for certain tooling to flush out the chips.

The GEN3SYS® XT Pro holder (see image below) is designed to increase the amount of coolant to the cutting edge. The drill contains 4 total coolant outlets (1 for each side outlet and 1 for each flute outlet), supplying more coolant to flush the chips and prevent them from packing. Also, the XT Pro features a wider flute, which increases the amount of space available for chip evacuation.

So if you’re dealing with chip evacuation problems, try the XT Pro holder. A slightly different tool design could make all the difference.

---

**High penetration application insiders**

**Radial Rake, AKA Speed**

Unlike traditional spade drills, high penetration tooling relies primarily on speed to achieve chip control. However, both speed and feed need to be adjusted in order to optimize chip formation and tool life for your application.

**Effects of Speed and Feed**

One key advantage that high penetration tools hold over traditional spade drills is that they can perform and achieve results at higher spindle speeds and lower feed rates.

**High Penetration Rates = High Coolant Demands**

High penetration drilling requires a high volume of coolant as well as high pressures in order to properly evacuate chips and keep heat from the cutting edge.

**The Right Coating Makes All the Difference**

Different coatings can help protect high penetration inserts from heat damage and edge build-up. Coatings designed for optimal performance in certain materials will help improve tool life drastically over general coating options.

---

**How to choose what’s right for you**

<table>
<thead>
<tr>
<th>GEN3SYS® XT</th>
<th>GEN3SYS® XT Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>Lower volume</td>
</tr>
<tr>
<td>Range of Parts/Jobs</td>
<td>Higher range (many different parts, low quantities)</td>
</tr>
<tr>
<td>Coating(s)</td>
<td>AM300®, AM420®, TiN</td>
</tr>
<tr>
<td>Geometries</td>
<td>Standard, Cast Iron, High Rake Stainless Steel</td>
</tr>
<tr>
<td>Diameters</td>
<td>11mm - 32mm</td>
</tr>
<tr>
<td>Holder Lengths</td>
<td>Stub, 3xD, 5xD, 7xD</td>
</tr>
<tr>
<td>Holder Styles</td>
<td>Drill/chamfer Straight flute Helical flute</td>
</tr>
</tbody>
</table>
**Production Facilities**

When demand for parts increases, high penetration tooling helps you push more finished parts out the door in shorter time - using the equipment you already have. You don’t need to purchase or utilize additional machines and equipment to meet the demand.

Also, the increased tool life reduces machine downtime. With replaceable insert drills, you don’t need to change out an entire tool; you just swap out the insert and continue drilling.

**Scenario**

- Customer needs 50,000 parts in 10 days
- Your tooling can drill 400 parts per hour
- 400 parts/hr • 8 hrs/day • 5 days/wk • 2 weeks = 32,000 parts

**Where do the remaining 18,000 parts come from?**
- Do you pull a machine from another project to finish the job?
- Do you buy another machine to finish the job?
- Do you pay overtime to finish the parts?
- Do you outsource the rest of the job to someone else?

**Solution**

- Customer needs 50,000 parts in 10 days
- High penetration tooling can drill 650 parts per hour
- 650 parts/hr • 8 hrs/day • 5 days/wk • 2 weeks = 52,000 parts

**Meet the demand without increasing your costs**
- You don’t need additional machines or equipment
- You can meet the demand within the time frame
- You can reduce downtime by increasing tool life

---

**Job Shops**

If you’re working at an hourly rate, you need as much production as possible from every minute. High penetration tooling helps increase profits by speeding up current jobs so you can bring on new additional projects you couldn’t do before.

When you can produce current jobs faster, it allows you to earn more money with your time - and that money goes straight to your company’s bottom line.

**Scenario**

- First project takes one full hour (60 minutes) to complete
- The project is worth $100
- You have a second project that takes 25 minutes to complete
- The project is worth $100

**How can you get both projects done in the same hour?**
- Do you use an additional machine to run the first job?
- Do you buy another machine to run the second job?
- Do you forfeit the profits of the second job?

**Solution**

- High penetration tooling can finish the first project in 45 minutes
- You still earn the $100 like you did before
- Now you can finish the second project
- High penetration tooling can finish the second project in 15 minutes

**You add $100 to your bottom line that wasn’t there before**
- You don’t need additional machines or equipment
- You increase the number of jobs you can perform

---

**1 Hour of Machine Time with Standard Tooling**

- Job 1 = $100 profits

**1 Hour of Machine Time with High Penetration Tooling**

- Job 1
- Job 2
- Job 1 = $200 profits
**Versatility**
Each replaceable insert drill holder can accommodate a range of diameters. For example, a single 20 series GEN3SYS XT Pro holder will cover a diameter range of 20.00mm - 21.99mm.

**Reduced Downtime**
Did you wear out an insert? No problem; take it out, put in a new one, and keep drilling. You don’t need to change out the entire tool, which reduces the downtime in your production process. Also, there’s no need to reset your tool length.

**No Re grind Float**
Because the inserts are designed to be quickly replaced, there’s no need to send tools away for regrind. That means you don’t need to have a second round of tooling to cover the time while your first round is out for regrind.

**Limitations**
Each solid carbide drill is limited to one specific diameter. If different diameters are required, a new drill is needed for each different diameter, which increases tooling costs.

**Reduced Throughput**
When your tool breaks, you need to stop the entire operation to replace it. This takes time away from your production and ultimately reduces your throughput.

**Re grind Downfalls**
Because solid carbide tooling is so expensive, it’s not cost effective to buy a new one anytime you need it. You have to send tools away for regrind, which means you need back-up tooling to use while they’re gone. Plus, regrind tools rarely perform the same as new tools.

---

**What else do we offer?**
Allied Machine offers numerous holemaking and finishing products to help you improve your processes. From multiple drilling options to boring, reaming, burnishing, and threading, we have the answer for you.

---

**www.alliedmachine.com**

©️ 2019 Allied Machine & Engineering

**Literature Order Number**: SOL-HP

**Publish Date**: July 2019