The Patt Extrusion Alloy

Engineered longevity, with no compromises
Forged block material

Data sheet for preliminary disclosure updated 04/11/2025 (supersedes all previous editions)

PATT Extrusion Alloy (PEA) is the result of a focused, iterative development process born directly from the extreme demands of industrial plastic extrusion and extrusion tooling. A tool steel with the corrosion resistance of an austenitic stainless was needed, that did not carry any of the drawbacks or compromises of traditional super alloys; which are expensive, difficult to machine and also difficult to heat treat.
Through controlled melting (VIM-VAR), advanced forging, and rigorous modeling, PEA matured into a stainless tool steel that delivers high hardness, wear resistance, dimensional control, and corrosion performance without coatings or exotic processing equipment.
It is supplied solution-treated, nitridable, and ready to machine, with a metallurgical profile that allows it to be:

-Heat treated and nitride simultaneously in conventional plasma nitriding furnaces
-Machined with tools suitable for tool steels

All while delivering temper resistance rivaling high carbide pm grades and corrosion performance rivaling austenitic grades like 316L, but with the wear performance of a nitrided tool and die steel.

Applications

PATT Extrusion Alloy is ideal for high-performance tooling in plastic and polymer processing environments where conventional materials fall short. Its combination of hardness, dimensional control, and corrosion resistance makes it particularly well-suited for:

-Extrusion screws operating under pressure and wear from filled or abrasive polymers
-Die plates and breaker plates requiring polishable, nitrided surfaces, resistant to rigorous high-temperature cleaning cycles
-Tooling in halogenated polymer processing (PVC, PTFE, fluoropolymers) where resistance to corrosive offgassing is critical
-Barrels, mixers, and inserts exposed to thermal cycling and chemical cleaning agents
-Precision wear components where coatings are prone to failure

By eliminating the need for secondary coatings, or non-standard processing, PEA simplifies tooling production while expanding performance in the most demanding extrusion environments

Corrosion Resistance

Unlike conventional high-strength steels, PEA makes no compromises on corrosion resistance. Its carefully balanced chemistry, combined with very low sulfur and phosphorus levels, allows it to resist the following:

-Halogen offgassing from PVC/CPVC, and other fluoropolymers

-Acidic cleaning agents and caustic plant washdowns

-Moisture cycling and high-humidity storage

Where H13 and 4140 would pit or scale, PEA maintains structural and surface integrity with performance surpassing 316L stainless, yet without austenite loss of nitridability.

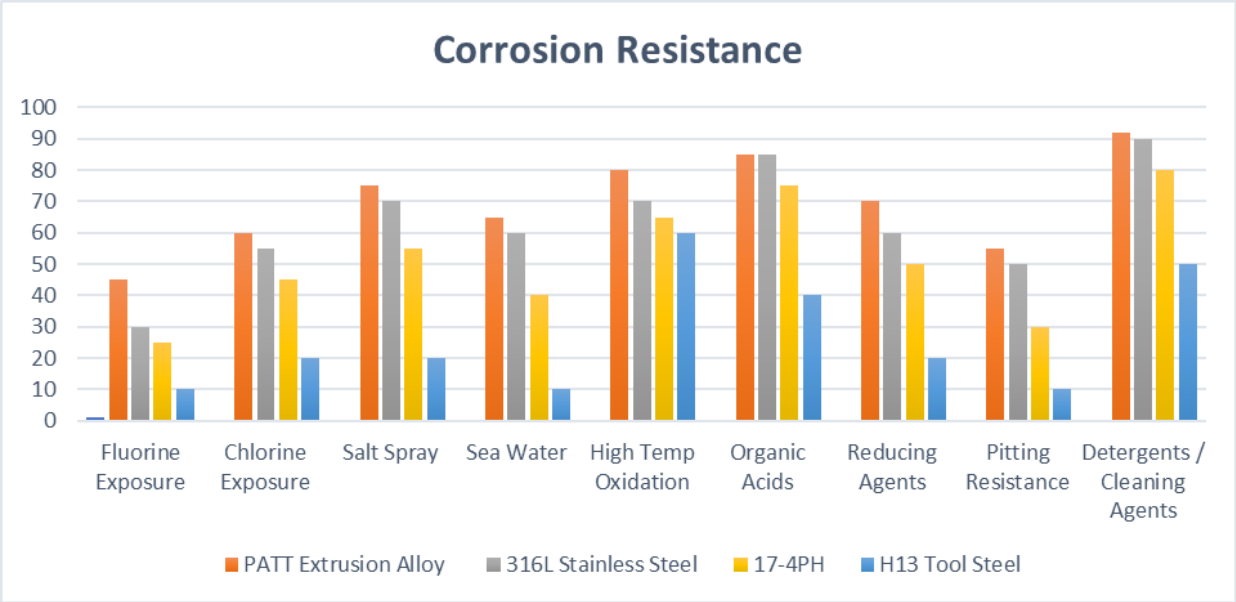


Figure 1: Modelled behaviour based on ASTM G85, ASTM B117, ASTM G111, ASTM G31, ASTM G28 Method A, using Inconel 625 as the baseline for this normalized corrosion index.

Wear Resistance

PEA delivers wear resistance beyond what is typically available in corrosion-capable tool steels.

-In its nitrided condition, it offers surface performance comparable to Vanadis 10, particularly in slid ing and galling-prone interfaces.

Even without nitriding, its 48–52 HRC core hardness and fine percipitate distribution make it superior to 17-4 PH, 4140, or H13 in uncoated wear zones.
It excels in:

-Abrasive contact with filled or reinforced polymers

-Reciprocating dies and shear edges

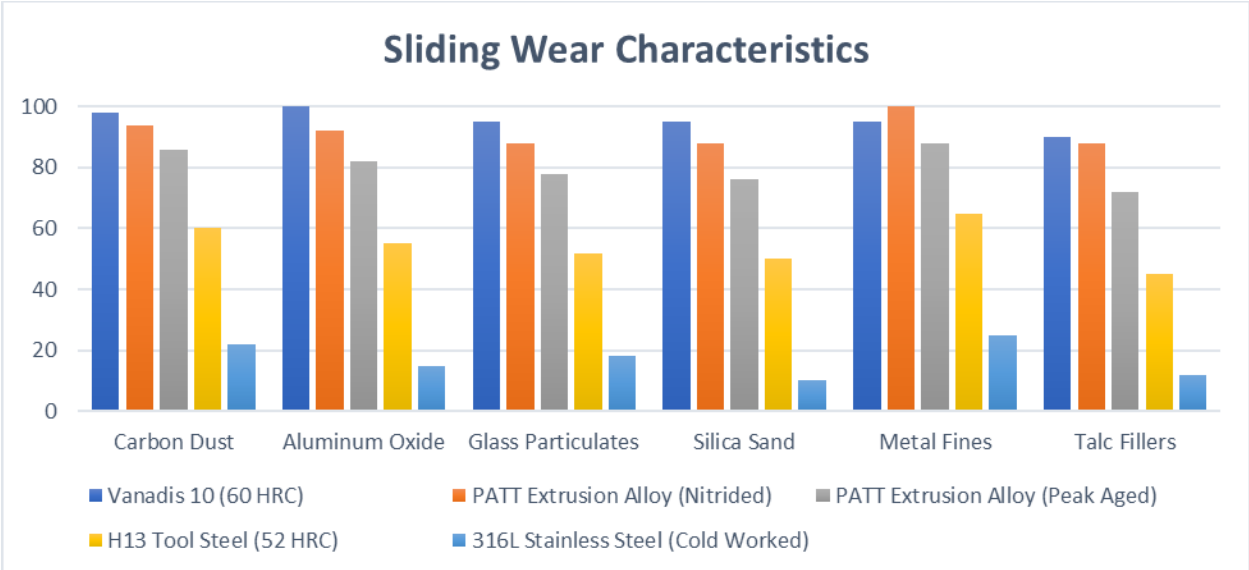
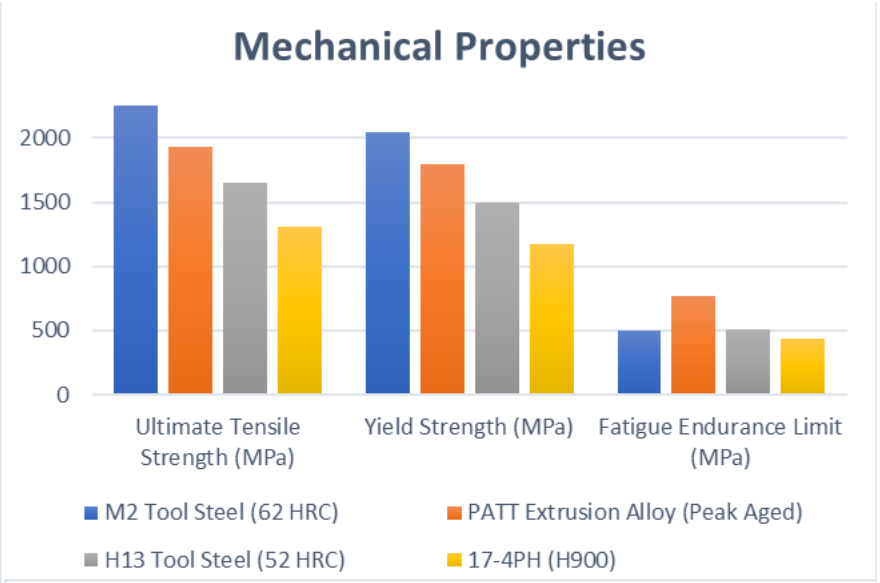


Figure 2: Modeled behaviour of a pin on disk test with different polymer fillers as residues according to ASTM G99

Mechanical Properties

In its aged condition, PATT Extrusion Alloy achieves a unique combination of strength, hardness, and structural integrity that positions it among the most advanced precipitation-hardened and tool steels available. With a core hardness range of 48–52 HRC, the alloy delivers high yield strength exceeding 1650 MPa.

This internal structure provides outstanding compressive strength, elevated toughness, and long-term dimensional control — even under sustained thermal and mechanical load. Its temper resistance extends well beyond typical precipitation-hardened stainless steels, retaining its mechanical profile up to 420 °C without significant softening.



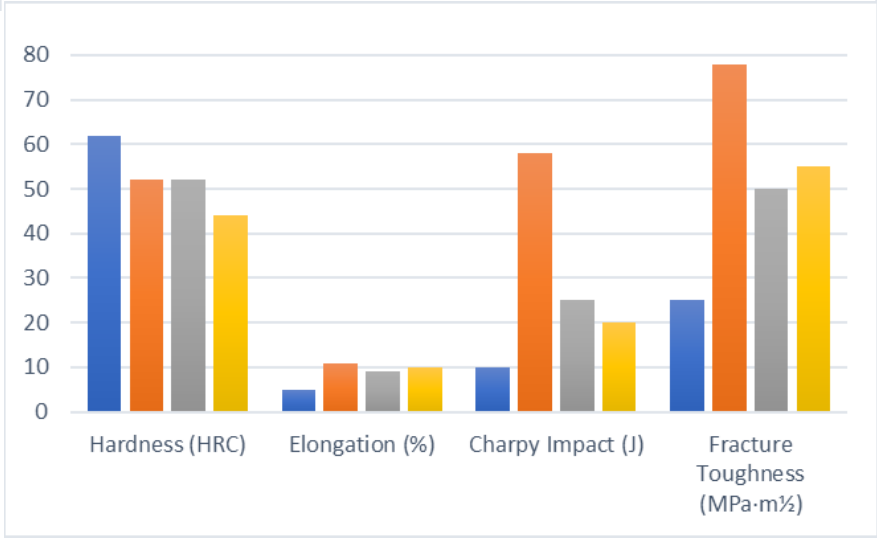


Figure 3 and 4: Present lab results of all four steel alloys in peak aged or hardened, low inclusion, remolten form in order to provide consistency between tested materials.

Condition	Hardness (HRC)	Yield Strength (MPa)	UTS (MPa)	Elongation (%)	Charpy (J)
Underaged	50	1720	1860	13	65
Peak Aged	52	1800	1930	11	58
Overaged	48	1670	1790	14	78

Table 1: The samples were first forged, then solutioned, before being cryogenically treated. They were then aged to three specific heat treat guidelines.

Thermal & Chemical Resistance to Fluidized Bed Cleaning

PEA is engineered to maintain structural and chemical integrity during repeated high-temperature cleaning cycles, including fluidized bed burnout and oxidative flame treatments. Unlike conventional tool steels that degrade or scale under these conditions, the alloy's finely tuned ensures outstanding resistance to oxidation, carburization, and halogen attack.

Its low-sulfur, low-phosphorus chemistry and tightly controlled microstructure eliminate weak grain

boundary phases, reducing susceptibility to cracking and spalling. The presence of aluminum, titanium, and silicone promotes a stable, adherent oxide film that defends against chlorine and hydrogen-rich environments generated during the decomposition of PVC, fluoropolymers, and other halogenated plastics.

Temperature (°C)	Patt Extrusion	H13	4140
400	100-180 cycles	30-60 cycles	2-4 cycles
420	80-150 cycles	20-50 cycles	1-2 cycles
440	60-120 cycles	15-40 cycles	1 cycle
460	45-90 cycles	10-20 cycles	1 cycle
480	30-75 cycles	<15 cycles	1 cycle
500	20-50 cycles	<10 cycles	0 cycles

Table 2: Modelled the behaviour of breaker plates made of three commonly used materials in fluidized bed cleaning across a temperature range of 400-500°C . Cycles were two hours long, and the decomposing polymer used was Nylon 6,6.

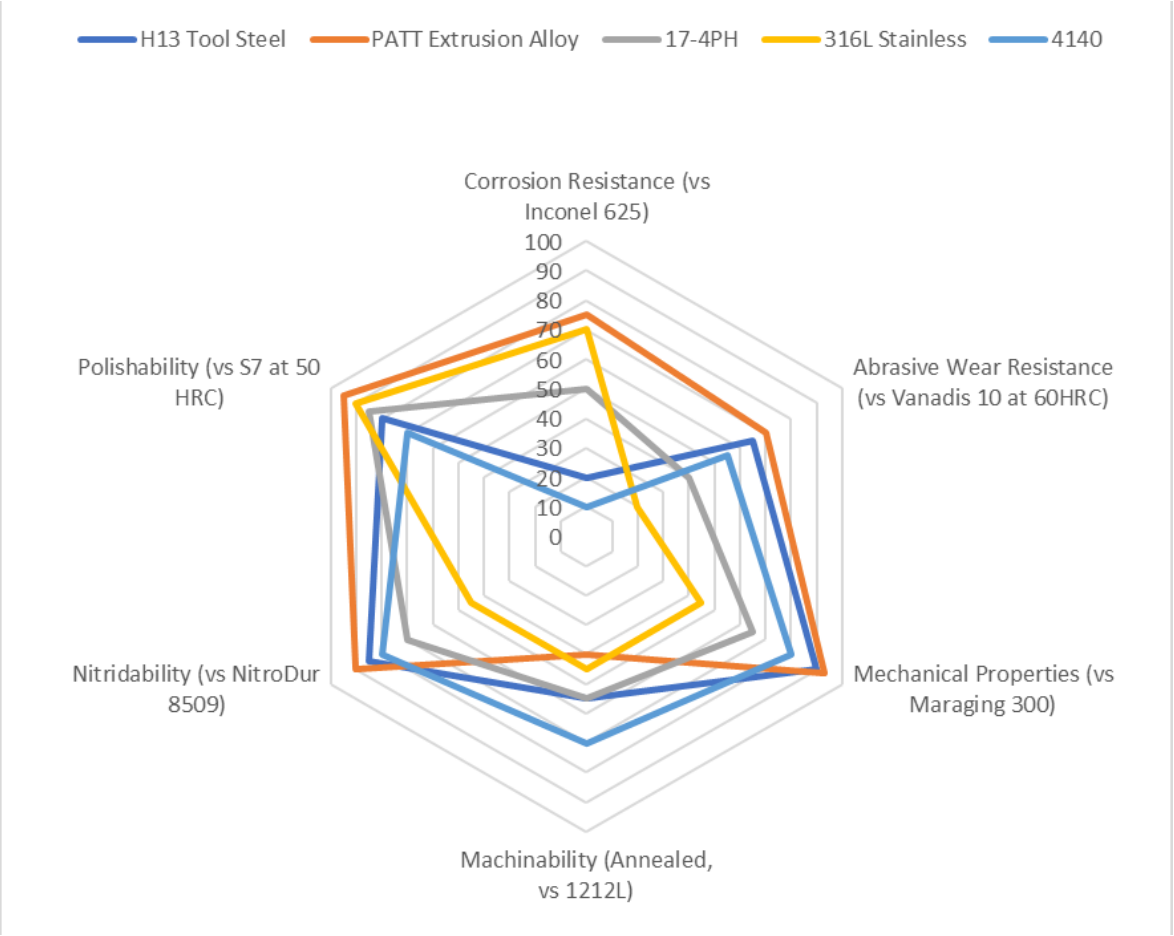
Processing & Machining

The PATT Extrusion Alloy is engineered for production simplicity without sacrificing performance. Its thermal and mechanical behavior has been finely tuned to eliminate common processing challenges seen in high-strength or corrosion-resistant materials.

The alloy undergoes a single-step aging process that simultaneously delivers peak mechanical performance and enables vacuum plasma nitriding in the same cycle, significantly reducing process time and distortion risk. In contrast to traditional tool steels, PEA exhibits exceptionally low distortion during heat treatment, even in large cross-sections, making it ideal for tight-tolerance parts such as extrusion disks and die components.

Machining is straightforward and reliable. Despite its high-strength structure, the alloy maintains tool-friendly behavior in the solution-annealed state and remains fully machinable without requiring ceramic or ultra-hard tooling. After finishing, PATT Alloy also accepts mirror-level polishing, with surface responses comparable to premium tool steels like S7 or P20+Nickel.
Altogether, the alloy bridges the gap between high-performance metallurgy and everyday manufacturability, requiring no specialized heat treat equipment, no post-processing coatings, and no compromise in surface finish or dimensional precision.

Figure 5: Radar chart of normalized indexes of important properties and characteristics of commonly used materials in the plastic extrusion and die tooling industries. Well known class leading materials were used as the 100 score baseline for each category. The rest of the materials were then compared to that baseline. All materials were classed in their hardest form, whether that is achieved through ageing, standard heat treatment or cold working. The indexes are approximate and cover a vast range of environments and possibilities.



Nitridability

PATT Extrusion Alloy offers exceptional nitriding response thanks to its balanced levels of chromium, molybdenum, vanadium, and aluminum. The alloy develops a uniform, hard, and adherent diffusion layer without compromising core toughness. Its low sulfur and clean microstructure promote consistent nitrogen uptake, while its precipitation-hardened matrix resists distortion during treatment. This makes PATT Extrusion Alloy ideal for components requiring enhanced surface hardness and wear resistance, with minimal dimensional change.

That's the PATT advantage.

PATT TECHNOLOGIES

For More Information or Purchasing Inquiries
Please contact us directly at:

450-689-2497

450-473-4888

sales@patt-tech.com

www.patt-technologies.com