

WALITECHNICAL
RESOURCE

INDUSTRIAL BLADE MATERIAL SELECTION GUIDE

A practical framework for balancing wear resistance, toughness, edge stability and operating cost.

How to use this guide

Start with the processed material and actual failure mode - not with hardness alone. Use the decision steps below to identify a suitable material family, then confirm the exact grade, heat treatment, hardness, dimensions and inspection requirements with WALI before production.

IMPORTANT

This guide supports preliminary selection only. Final performance depends on steel quality, heat treatment, section size, edge geometry, blade clearance, mounting accuracy, feedstock contamination and machine condition. Grade names and hardness ranges are indicative, not contractual specifications.

The five-step selection process

Step	Question	Why it matters	Typical evidence to provide
1. Feedstock	What is being cut or shredded?	Abrasive fillers, sand, glass, metal contamination and fiber content can dominate wear.	Material name, photographs, density, moisture, contamination
2. Loading	Is the cut stable or impact-heavy?	Shock loading changes the priority from maximum wear resistance to toughness and crack resistance.	Machine type, rotor speed, throughput, motor power, cutting gap
3. Failure	How does the current blade fail?	Wear, chipping, cracking, rolling and corrosion require different corrections.	Used-blade photographs, service hours, current grade and hardness
4. Geometry	How thin and sharp is the edge?	Thin edges need better chipping resistance; thick sections need reliable through-hardening.	Drawing, edge angle, thickness, hole pattern, tolerances
5. Economics	What is the real cost target?	The best choice minimizes downtime and cost per processed ton, not simply purchase price.	Changeover time, regrinding plan, target life, annual quantity

1. Understand the performance trade-off

Industrial blade material selection is a balance. Raising alloy content or hardness can improve wear resistance and edge retention, but may reduce resistance to chipping and gross fracture. A tougher steel at a controlled hardness often outperforms a harder wear grade in contaminated or impact-heavy service.

Performance factor	When it should be prioritized	What usually improves it	Risk if over-prioritized
Abrasive wear resistance	Mineral-filled plastics, sand, glass fiber, dry wood, dirty recyclables	Carbide-rich cold-work steel, PM tool steel, suitable coating	Chipping, difficult grinding, higher cost
Toughness	Metal contamination, variable feed, shock, large blades, demolition or heavy shredding	Tougher cold-work/hot-work steel, lower working hardness, generous edge support	Faster wear or edge deformation
Edge stability	Thin edges, precision slitting, paper, film, textile and fine granulation	Fine, clean microstructure; HSS/PM grades; controlled heat treatment and grinding	Higher material and processing cost
Corrosion resistance	Wet feedstock, wash lines, food-contact or corrosive environments	Martensitic stainless grade, corrosion-resistant coating, better storage	Lower toughness or wear performance than a specialized tool steel
Hot hardness	Hot shearing, sustained frictional heat or thermal cycling	Hot-work or high-speed steel family	Unnecessary cost for cold applications

Hardness is a system setting, not a quality score

Observed condition	Likely direction	Checks before changing the material
Rapid smooth wear	Increase wear resistance or improve surface engineering.	Verify feedstock abrasiveness, heat treatment, grinding burn, blade clearance and lubrication.
Small edge chips	Improve chipping resistance; consider a tougher grade or lower hardness.	Check edge angle, micro-cracks, cutting gap, fastener torque and hard contamination.
Gross crack or breakage	Prioritize toughness and crack resistance.	Stop and review overload, mounting, bolt holes, section transitions and heat-treatment integrity.
Rolled or dented edge	Increase strength/hardness or improve edge support.	Check whether impact is excessive and whether the edge is too thin.
Rust or staining	Consider stainless material, coating or storage/process changes.	Confirm chemical exposure, moisture, cleaning agent and required hygiene standard.

2. Material family comparison

Material family	Representative grades	Relative profile	Best starting conditions	Key cautions
High-carbon cold-work tool steel	D2 / 1.2379 / SKD11 family; Cr12Mo1V1	High wear; moderate-to-low impact tolerance	Granulator knives, fixed knives, clean recycling streams, shear and slitting blades	Large carbides and excessive hardness can increase chipping; heat treatment and section size matter.
High-toughness cold-work tool steel	DC53 and other proprietary 8% Cr or matrix-type grades	Better wear/toughness balance than conventional D2-type choices	Shredder and granulator blades with moderate impact or recurring edge chipping	Proprietary grades are not automatic national-grade equivalents; use the producer's datasheet.
Shock-resistant / tough alloy tool steel	6CrW2Si, S1-type or supplier-selected tough grades	High impact resistance; moderate wear	Heavy-impact shearing, contaminated feedstock, thick sections and supported cutting edges	May wear faster in highly abrasive service; hardness must not be maximized blindly.
Hot-work tool steel	H11 / 1.2343; H13 / 1.2344	Good toughness, hot strength and thermal-fatigue resistance	Hot cutting, thermal cycling and impact-loaded tools	Often not the most wear-resistant choice for clean, cold abrasive cutting.
High-speed steel	M2 / 1.3343 / SKH51; selected cobalt HSS	Very high edge retention and hot hardness	Fine edges, high cutting speed, precision slitting and demanding granulation	Higher cost; demanding heat treatment and grinding; lower tolerance for misuse.
Powder-metallurgy tool steel	Supplier-specific PM cold-work or PM HSS grades	Excellent carbide uniformity and wear/edge stability combinations	Severe abrasive wear, premium life targets, thin precision edges	Premium cost and longer sourcing; exact grade selection must use manufacturer data.
Martensitic stainless steel	420-type / 1.4034; selected high-carbon stainless grades	Corrosion resistance with useful hardness	Wet, hygiene-sensitive or corrosion-prone service	Corrosion resistance, toughness and wear vary widely within the family.
Tough support / alloy steel	42CrMo / 1.7225 / 4140 family	High toughness and structural reliability; lower edge wear resistance	Knife bodies, holders, backing parts and some very heavy low-speed cutters	Usually unsuitable for a fine, long-life cutting edge without hardfacing or inserts.
Carbide / carbide-tipped solution	Tungsten-carbide grades selected by supplier	Maximum wear resistance; limited impact tolerance	Clean, stable, highly abrasive or precision cutting	Brittle under shock, expensive to repair and highly dependent on joint/support design.

WALI RULE OF THUMB

When the current blade chips or cracks, do not solve the problem by specifying a harder grade. First restore toughness, edge support, clearance and mounting accuracy. When the blade wears smoothly without damage, a more wear-resistant family may be justified.

3. Application-oriented starting points

Application / feedstock	Typical loading	Practical starting material direction	What to verify with WALI
Plastic film, bags and soft polymers	Low-to-moderate impact; edge sharpness important	D2-type cold-work steel or a tougher proprietary cold-work grade	Film wrapping, contamination, edge angle, desired regrind interval
Rigid plastics (clean)	Moderate wear and intermittent impact	D2-type or DC53-type family	Resin type, wall thickness, throughput and cutting clearance
Glass/mineral-filled plastics	High abrasive wear	PM tool steel, HSS or optimized high-wear cold-work grade	Filler percentage, impact level, blade size and acceptable cost per ton
Tires and rubber	Tough, elastic feed; possible wire impact	High-toughness cold-work or shock-resistant family	Steel cord content, pre-shredding stage, edge chipping history
Wood and biomass	Abrasive dirt plus variable knots/impact	Tough cold-work or shock-resistant grade; wear upgrade if feed is clean	Sand, nails, moisture, chip size and rotor speed
RDF / municipal waste	Highly variable and contaminated	Toughness-first cold-work, hot-work or engineered composite solution	Metal contamination, overload events, reversible design and downtime cost
Paper and textile	Low impact; sharpness and edge stability dominate	D2-type, HSS or fine-structure premium grade	Cut quality, fiber type, adhesive contamination and blade straightness
Metal scrap / demolition shear	Very high load and shock	Supplier-selected high-toughness alloy/hot-work family	Material thickness and strength, shear geometry, machine force and crack history
Food, wet or corrosive service	Corrosion plus hygiene requirements	Martensitic stainless family or validated corrosion-resistant solution	Contact regulations, cleaning chemicals, temperature and surface finish

Selection shortcuts to avoid

Avoid	Use instead
'Use the hardest steel available.'	Define wear mode, impact, edge geometry and acceptable failure mode.
'D2 equivalent' with no standard.	State the governing standard, exact grade, required hardness and inspection documents.
Copying a competitor's grade only.	Compare chemistry, cleanliness, heat treatment, section size and real operating conditions.
Changing steel before checking the machine.	Inspect clearance, alignment, bolts, pockets, rotor condition and feed control.

4. Information required for a reliable recommendation

A material recommendation becomes much more reliable when it is linked to a drawing, operating data and the current failure mode. Send the following information with your RFQ:

Category	Required information	Preferred attachment
Machine	Manufacturer, model, rotor/shaft configuration, motor power, rotor speed	Nameplate and machine photographs
Blade	Drawing or sample, dimensions, hole pattern, edge angle, tolerances and quantity	PDF / DXF / DWG / STEP or measured sketch
Feedstock	Material type, size, moisture, fillers and expected contamination	Feedstock and contamination photographs
Current specification	Steel grade, hardness, heat treatment, coating and supplier certificate if available	Material certificate and hardness report
Performance	Service hours/tons, wear pattern, chipping, cracks, deformation and regrinding history	Close-up photographs of used blades
Target	Required life, cut quality, delivery date, inspection and traceability requirements	Approved inspection plan or sample report

CONTACT WALI

Send your blade drawing, machine model, feedstock, current grade/hardness and failure photographs. WALI can review material, heat treatment, hardness, geometry and inspection requirements as one engineered package.

Technical references

- [1] Daido Steel, DC53 and Cold Work Tool Steel product information - DC53 is described as an 8% Cr high-hardness, high-toughness cold-work steel; supplier data should govern proprietary grades.
<https://www.daido.co.jp/en/products/tool/cold/index.html>
- [2] Uddeholm, AISI A2 and cold-work tool steel product information - practical discussion of wear resistance, toughness, dimensional stability, shearing and industrial knife applications.
<https://www.uddeholm.com/us/en-us/products/aisi-a2/>
- [3] Uddeholm, Vanadis 8 SuperClean - powder-metallurgical tool steel positioned for high wear resistance, chipping resistance and industrial knife applications.
<https://www.uddeholm.com/us/en-us/products/uddeholm-vanadis-8-superclean/>
- [4] Uddeholm, Caldie - tool steel intended for applications requiring high chipping resistance, toughness and compressive strength, including shearing and industrial knives.
<https://www.uddeholm.com/us/en-us/products/uddeholm-caldie/>

DOCUMENT NOTICE

Material families and selection directions in this publication are general engineering guidance. The purchase order, approved drawing, current material standard, supplier datasheet and agreed inspection plan take precedence. WALI reserves the right to recommend an alternative after application review.

Suggested website description: A practical guide to selecting industrial blade materials based on wear, impact, toughness, edge stability, feedstock and operating conditions, with application-oriented recommendations and an RFQ checklist.