Acetal vs. Nylon

A Guide to Choosing the Right Plastic

Properties

Acetal (POM) and nylon (polyamide) are both popular engineering plastics used for precision-machined parts (gears, bearings, bushings), with differing properties.

Strength & Stiffness

- Nylon offers higher peak tensile and flexural strength when dry. It handles shock well.
- Acetal maintains strength and stiffness regardless of humidity.

Moisture & Wear

- Acetal absorbs very little water & retains tight tolerances in humid or wet conditions.
- Nylon is hygroscopic - it absorbs water, which can cause swelling and reduce stiffness.
- In dry environments, nylon often outperforms acetal in wear resistance and can handle heavy loads.
- In wet or lubricated settings, acetal holds up better because it doesn't soften with moisture.

Machinability & Fabrication

- Acetal (especially Delrin®) machines cleanly, holds tight tolerances, and resists post-machining movement.
- Nylon can be more challenging to machine, as it is more gummy and stringy. Sharp tools, chip control, and heat management are required.

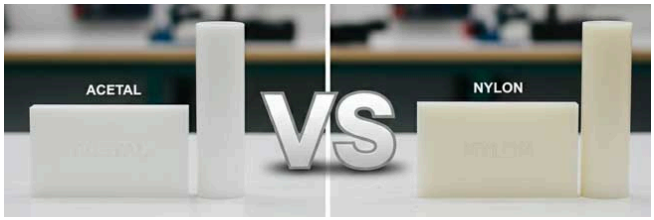
Thermal Properties

- Nylon and acetal soften below melt and perform in cold, but nylon is often the safer choice for components near persistent heat sources.

Chemical Resistance

- Acetal copolymer performs better in bases and hot water.
- Nylon holds up in fuels and oils better, but is attacked by strong acids and bases.
- Both resist fuels, oils, and many solvents.

Applications and Uses



Choose acetal when your application demands tight tolerances, low moisture absorption, and consistent performance. Choose nylon when you need higher strength and wear resistance in dry conditions, larger or more impact resistant parts, or a cost-effective solution for big shapes.

Acetal

- **Gears & Power Transmission:** Small precision gears, wet or humid settings.
- **Bushings & Bearings:** Wet or submerged bearings (zero water swell).
- **Wear Plates & Slides:** Not often used over other materials like UHMW-PE or PTFE.
- **Precision Components:** Tight tolerance or complex machining.
- **Automotive & Industrial:** Fuel system components, clips, and latches.
- **Food & Medical Equipment:** Food processing machinery, drug delivery device parts.

Nylon

- **Gears & Power Transmission:** Large or heavily loaded gears.
- **Bushings & Bearings:** Dry, high load bushings.
- **Wear Plates & Slides:** Dry sliding surfaces or wear strips along conveyor lines.
- **Precision Components:** Can be used, but only if benefits outweigh machining/stability challenges.
- **Automotive & Industrial:** Fans, intake manifolds, industrial equipment like rollers or cams.
- **Food & Medical Equipment:** Can be food-grade. Used in surgical instrument handles.

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Property Comparison Table

Property	Cast Nylon	Extruded Nylon	Acetal Copolymer	Delrin Homopolymer
Tensile Strength (psi)	10,000-13,500	12,400	9,800	10,000
Flexural Modulus (psi)	420,000-500,000	410,000	370,000	420,000
Izod Impact (Notched, ASTM D256, @ 73°F)	0.7-0.9 ft-lb/in.	1.2 ft-lb/in.	1 ft-lb/in.	1.5 ft-lb/in.
Heat Deflection Temp @ 264 psi (°F)	200-400	194	230	257
Max Continuous Service Temp in Air (°F)	230	210	195	185
Water Absorption (24 hr, %)	0.60-1.20	1.20	0.20	0.25
Wear Resistance (dry)	Excellent (dry, 4x acetal)	Excellent (dry)	Good	Good
Wear Resistance (wet)	Poor-Fair (softens when wet)	Fair (when moist)	Excellent (stable wet)	Excellent (but avoid hot water)
Machinability	Good (large parts, watch moisture)	Good (sharp tools needed)	Excellent (easy to machine)	Excellent (easy to machine)
Chemical Resistance	Good (not acids; OK hydrocarbons)	Good (slightly better acid resist)	Good-Excellent (strong base OK)	Good (avoid strong base/acid)
Cost	Low for large parts	Low-Medium	Medium (higher than nylon)	Medium-High (premium brand)

FAQs: Acetal vs. Nylon

Is Delrin® the same as acetal, or what's the difference?
When looking at Delrin vs acetal, note that Delrin is a trade name for acetal homopolymer (POM-H). "Acetal" generically refers to the family of POM plastics, including both homopolymer (Delrin) and copolymer types. The main differences are that Delrin (homopolymer) has a more uniform crystalline structure giving it slightly higher strength and hardness, while acetal copolymers have co-monomers that improve stability and chemical resistance. In practice, Delrin is a bit stronger and more wear-resistant, whereas copolymer acetal is more resistant to thermal degradation, hot water, and caustics. They are otherwise very comparable and often interchangeable; if a project calls for "acetal," you could typically use Delrin or copolymer grades depending on the specific needs.

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Which is stronger, acetal or nylon?
Nylon is generally stronger in terms of tensile strength. Unreinforced nylon 6 or 6/6 usually has higher tensile strength than unfilled acetal. Cast nylon can be even stronger. That said, both materials are strong and often either will be sufficient. Nylon also maintains better strength at higher temperatures. If pure strength is the priority and the environment is dry, nylon has the edge. If the part is small and needs absolute rigidity (no moisture effect), acetal might perform more consistently.

Does nylon have better wear resistance than acetal?
It depends on the conditions. In dry conditions, nylon tends to have better wear and abrasion resistance - it often outlasts acetal in dry sliding tests. In wet or lubricated conditions, acetal tends to wear better since nylon softens with moisture and loses some wear performance. Nylon is often used for very high-load wear parts (especially with fillers) and has excellent fatigue endurance in cyclic wear. Acetal has very low friction and does well in more moderate load/speed scenarios or where moisture is present. Both materials also come in special bearing grades (lubricated formulations) to improve their wear life. So neither is universally "better" — nylon is superior for dry heavy-duty wear, acetal for wet or precision low-friction wear.

Which plastic is more stable and precise, acetal or nylon?
Acetal is more dimensionally stable and holds precision better than nylon in varying environmental conditions. Acetal's low moisture absorption means it won't swell or change much over time, so it's preferred for high-precision parts that must maintain tight tolerances. Nylon can change dimensions as it absorbs moisture and also tends to have higher mold shrinkage when molded. Additionally, acetal machines to very tight tolerances more easily than nylon (nylon might see slight warp as it equilibrates). So for precision components — think of something like a small valve spool or a gear with fine pitch - acetal is usually the better choice for stability. Nylon is stable enough for many applications, but for metrology-grade stability, acetal wins.

Is acetal more expensive than nylon?
Acetal typically costs slightly more per pound than nylon. The price difference can grow for larger stock shapes — large diameter acetal rod or thick plate can be considerably more expensive than an equivalent cast nylon shape. This is due to manufacturing economics: nylon can be cast into big blanks cheaply, whereas acetal is usually extruded or molded in smaller sizes. There are also proprietary grades and brand names (Delrin often costs more than generic acetal, and certain nylon grades can cost more depending on fillers). But in general, if budget is tight and both materials would work, nylon might be the more cost-effective option, especially for big parts. Always compare current prices from suppliers, as market conditions can shift costs.

Can I replace a nylon part with acetal (or vice versa) in my design?
It's possible in many cases, but you should evaluate the differences. If the nylon part's design accounted for moisture growth or relied on nylon's slight flexibility, switching to acetal could cause fit or performance issues (acetal will stay stiffer and won't swell). Conversely, replacing acetal with nylon could risk dimensional changes or reduced precision. Consider the function: for a low-friction bushing in a wet environment, replacing nylon with acetal is likely an upgrade (no swelling). For a high-load gear, replacing acetal with nylon could improve life if the gear can handle some moisture variation. It's best to check the critical requirements (strength, stiffness, environment) — as detailed above, each material has its niches. Often designers will test the alternate material in a prototype to ensure it meets expectations before a wholesale switch.

How does moisture affect nylon tensile strength, and what does that mean for part performance?
Nylon tensile strength is highest when the material is dry, but it decreases as nylon absorbs moisture. This is because water acts as a plasticizer, reducing stiffness while making the material more ductile. In practice, this means designers need to account for changes in nylon tensile strength if parts will operate in humid or wet environments, balancing the trade-off between lower strength and improved toughness.

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