

# Plastic resin *identification.*

The seven recycling codes plus common engineering plastics — **chemical name, typical uses, temperature range, and recycling implications.** From PET water bottles to PEEK gears.

## The chart

CODE	RESIN	COMMON USES	MAX TEMP	NOTES
1 – PET / PETE	Polyethylene terephthalate	Water bottles, soda bottles, food packaging, polyester fiber	60 °C (140 °F)	<b>Recyclable.</b> Most common single-use bottle. Don
2 – HDPE	High-density polyethylene	Milk jugs, detergent bottles, pipes, plastic bags, lumber	120 °C (248 °F)	<b>Recyclable.</b> Stiffer than LDPE. Resistant to mo
3 – PVC / V	Polyvinyl chloride	Pipes (rigid), wire insulation, flooring, medical tubing	60-80 °C (140-176 °F)	<b>Hard to recycle.</b> Contains chlorine – releases
4 – LDPE	Low-density polyethylene	Plastic bags, squeeze bottles, film, food wrap	80 °C (176 °F)	Sometimes recyclable. Softer, flexible. Food-s
5 – PP	Polypropylene	Yogurt containers, bottle caps, automotive parts, fibers	120 °C (248 °F)	<b>Microwave-safe.</b> Generally regarded as safe; be
6 – PS	Polystyrene	Disposable cups, foam packaging, CD cases, plastic cutlery	70-90 °C (158-194 °F)	<b>Hard to recycle.</b> Brittle. Styrofoam is expande
7 – Other / 0	Mixed / specialty (PC, ABS, nylon, etc.)	Multi-resin laminates, BPA-containing plastics, specialty parts	Varies widely	Usually NOT recyclable curbside. Includes engi
ABS	Acrylonitrile butadiene styrene	LEGO, automotive trim, 3D printing, electronic housings	80 °C (176 °F)	Tough, machinable. The default 3D printing fil
PC	Polycarbonate	Eyeglass lenses, safety shields, CD/DVD discs, baby bottles (old)	120 °C (248 °F)	Strong, transparent. <b>BPA controversy</b> – many co
Acetal / POM (Delrin)	Polyoxymethylene	Gears, bearings, machined parts, precision mechanical	100 °C (212 °F)	<b>Self-lubricating.</b> Excellent machinability. Eng
Nylon (PA)	Polyamide (Nylon 6, 6/6, 11, 12)	Gears, bushings, cable ties, textiles, fishing line	100-150 °C (212-302 °F)	Tough, abrasion-resistant. <b>Absorbs water</b> – cha
PMMA (Acrylic / Plexiglass)	Polymethyl methacrylate	Aquariums, signs, optical lenses, displays	80 °C (176 °F)	<b>Transparent like glass, easier to machine.</b> UV
PTFE (Teflon)	Polytetrafluoroethylene	Non-stick cookware, chemical seals, plumbing tape, gaskets	260 °C (500 °F)	<b>Extremely chemically resistant.</b> Releases toxic
PLA	Polylactic acid	3D printing (standard filament), biodegradable packaging	60 °C (140 °F)	<b>Biodegradable</b> (industrial composting). Low tem
PEEK	Polyetheretherketone	Aerospace, medical implants, oil & gas seals, high-temp gears	250 °C (482 °F)	<b>High-temperature engineering plastic.</b> Very exp

**About the recycling code.** The chasing-arrow symbol with a number inside (1-7) is the **Resin Identification Code**, established by SPI in 1988. It identifies the resin — it does NOT mean the plastic is recyclable in your area. Local recycling varies wildly: most curbside programs accept 1 and 2; few accept 3, 6, or 7. Confirm with your local waste management.

## Common applications

USE CASE	RECOMMENDED PLASTIC	WHY
3D printing – beginner	PLA	Low warp, easy to print, biodegradable
3D printing – durable	PETG or ABS	Tougher than PLA, higher temp resistance
3D printing – engineering	Nylon, PC, PEEK	Best mechanical properties
Outdoor / UV exposure	HDPE, ABS, PC	UV-stable. PVC + LDPE degrade in sun.
Food / drink containers	PP, HDPE, PET	Non-leaching. Avoid PC (BPA), PS (styrene).
Microwave-safe container	PP	Highest temperature tolerance among common food plastics
Machined gears or bearings	Acetal (Delrin), Nylon, PTFE	Self-lubricating, dimensionally stable
Chemical / acid resistance	PTFE, HDPE, PP	PTFE for severe; HDPE for moderate
Clear / optical	PMMA (acrylic) or PC	PMMA for UV; PC for impact
High temperature (>150 °C)	PTFE, PEEK, PI	Standard plastics deform

## Common pitfalls

- **Recycling symbol ≠ recyclable.** The number tells you the resin. It does NOT mean your recycler accepts it. Most communities accept only 1 and 2 from curbside collection. Some specialty programs accept others.
- **'BPA-free' doesn't mean safer.** Many 'BPA-free' replacements use BPS or BPF — chemically similar with similar concerns. The safest food contact plastics for hot use are PP (5) and silicone (not coded — it's not a plastic in this sense).
- **Plastics degrade in sunlight (UV) and heat.** Don't expect outdoor longevity from indoor-rated plastics. Black plastics (with carbon black additive) last much longer outdoors than clear ones because carbon absorbs UV.
- **Plastic IDs aren't unique.** Two products both marked '5 / PP' may have very different additives, fillers, and impact modifiers, leading to very different properties. The code identifies the base polymer only.
- **Nylon and PA absorb water.** Nylon 6 can absorb up to 10% of its weight in water at equilibrium with humid air, causing it to swell ~3% and lose stiffness. For dimensional stability, use moisture-stable nylon grades (PA 12) or alternatives (acetal).
- **Thermoset vs thermoplastic isn't shown.** All resins in this chart are thermoplastics — they can be remelted. Thermosets (epoxy, polyester, vulcanized rubber) once cured can't be remelted and aren't typically labeled with these codes.

## Common questions

### What do the recycling numbers mean?

Numbers 1-7 inside the recycling triangle identify the plastic resin. 1 = PET (water bottles), 2 = HDPE (milk jugs), 3 = PVC (pipes), 4 = LDPE (plastic bags), 5 = PP (yogurt containers), 6 = PS (foam), 7 = Other (PC, PLA, mixed). They don't mean the plastic IS recyclable in your area — they just identify the material.

### Is PLA actually biodegradable?

Only under industrial composting conditions: 50-60°C, controlled humidity, microbial environment. In a backyard compost or landfill, PLA can persist for decades — similar to other plastics. So '100% biodegradable' on a PLA cup is technically true only if you ship it to an industrial composter, which most municipalities don't accept.

### Which plastics are food-safe?

PET, HDPE, LDPE, and PP are FDA-approved for food contact. PVC and PS are food-safe in some forms but can leach plasticizers under heat or with oily foods — avoid for hot or fatty foods. PC contains BPA and is generally avoided for food storage. PLA is food-safe and increasingly common in disposable cups.

### Why does ABS smell when 3D printed?

ABS releases styrene and other volatile organic compounds when heated to printing temperature (220-250°C). The smell isn't just unpleasant — sustained exposure has health implications. Print ABS in a ventilated area or enclosed printer with filtered exhaust. PLA prints with much less fume and is the safer hobby option.

### What plastic can I use for high temperatures?

For continuous exposure above 100°C, you need engineered plastics: PEEK (260°C), PPS (220°C), PTFE/Teflon (260°C), or fiberglass-reinforced PA (130°C). Consumer plastics like PP and HDPE soften above 100-120°C. For hot food applications (dishwasher, microwave), PP is OK; for boiling oil or steam, you need engineered grades.

## Sources

- **Resin identification codes:** ASTM D7611 — Standard Practice for Coding Plastic Manufactured Articles for Resin Identification.
- **Plastic properties:** Manufacturer datasheets; *Modern Plastics Handbook* (McGraw-Hill).
- **Food contact safety:** US FDA 21 CFR Part 177 (Indirect food contact substances).
- **3D printing materials:** Manufacturer datasheets (PLA, ABS, PETG, nylon).

**Disclaimer.** Plastic selection depends on temperature, chemical exposure, mechanical load, UV exposure, and regulatory requirements (food contact, medical, electrical). Confirm with manufacturer datasheets for any critical application.