

Delrin® Delivers in Healthcare

Greater design freedom for medical product engineers.
Lasting device performance for patients. Delrin is here to make
a material difference in care.



Material of Choice in the Healthcare Industry

Delrin® acetal homopolymer is a high-performance material for medical components in the most demanding applications.

Wide portfolio of options

Delrin is available in a broad range of Special Control (SC) and Premium Control (PC) grades—differentiated by degrees of testing, manufacturing control, global availability and regulatory support—to suit your project's unique requirements.

Delrin® Renewable Attributed (RA) options are produced from certified sustainable sources. These materials can help manufacturers reduce the carbon footprint of their healthcare products and achieve sustainability goals.

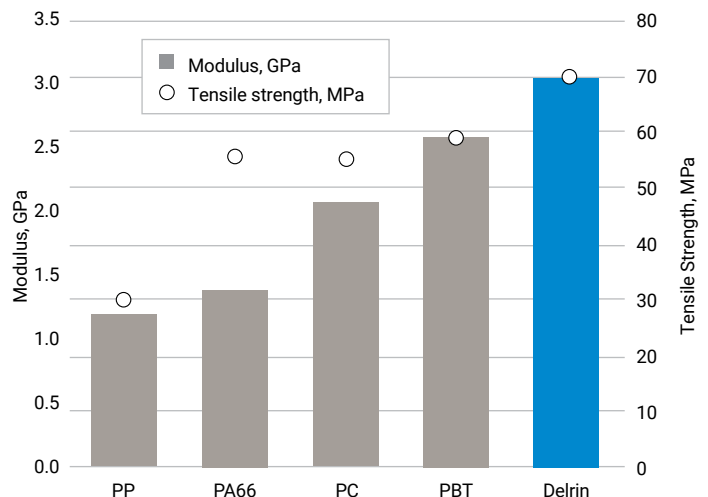


Superior design flexibility—and performance

Strength, stiffness and toughness

Delrin behaves more like metal than other unreinforced plastics due to its very high crystallinity (Figure 1). It's the first choice for designers seeking an optimum balance of strength, stiffness and toughness with excellent molding characteristics. This balance is key to designing components for maximum reliability, safety and manufacturability.

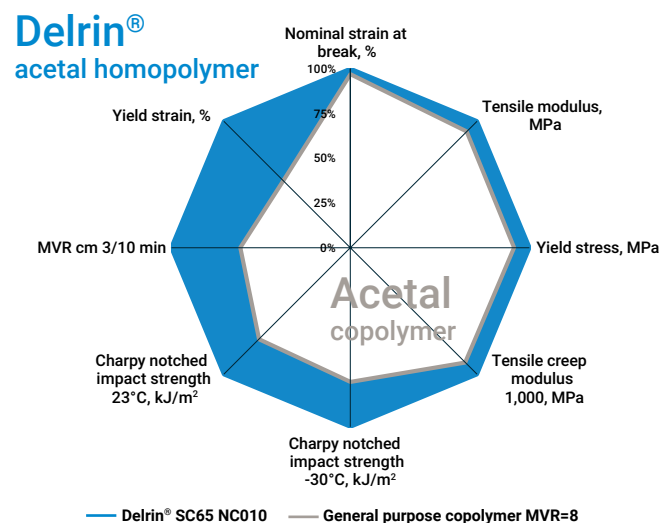
Figure 1. Comparison of mechanical properties



Source: Delrin

Compared to acetal copolymer, Delrin acetal homopolymer offers improved tensile strength, stiffness, creep and fatigue resistance, and significantly higher impact resistance (Figure 2). The combination of these mechanical properties in a single material allows for thinner, lighter-weight parts and shorter molding cycles with potential cost reductions.

Figure 2. Comparison of mechanical properties



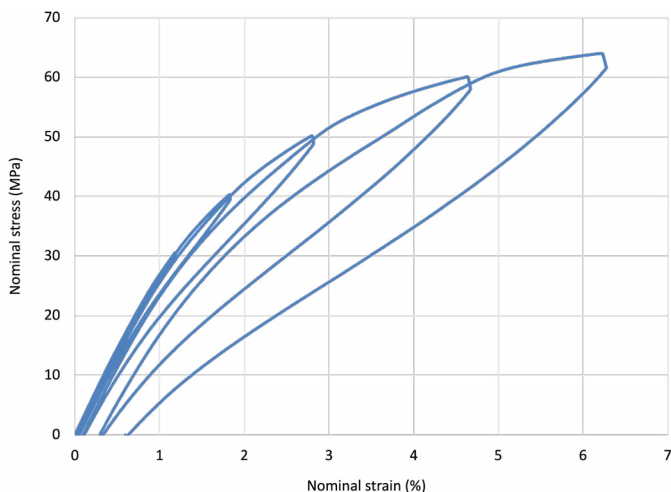
Source: Delrin

Spring performance

Delrin® is an excellent choice for functional parts in drug delivery devices, clips and connector components due to its spring performance. As demonstrated by cyclic loading at different strain levels (Figure 3), Delrin shows a spring-like flexibility beyond the linear portion of the stress-strain curve and strong recovery when the load is removed.

This allows designers to create snap fits or springs that return closer to their original position for more predictable and reliable device performance.

Figure 3. Cyclic tensile test Delrin at 23°C

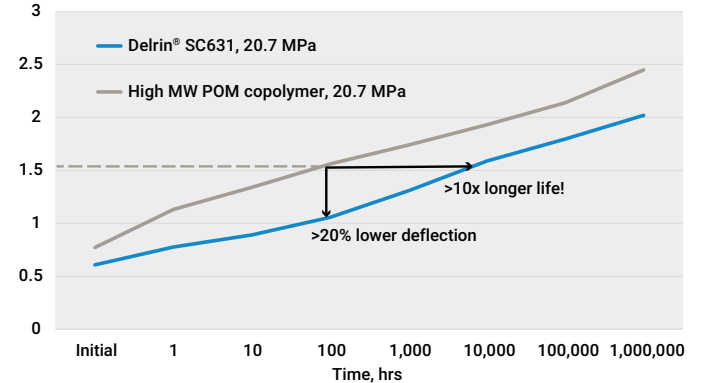


Source: Delrin

Creep resistance

In many healthcare applications, the accurate function of a device depends on components that hold their shape after long-term loading. One such example is a spring-loaded auto-injector. As drugs have become more complex, larger springs are being used to deliver formulations, increasing stress on internal parts. Delrin offers the best creep resistance of all unreinforced engineering polymer types including acetal copolymers (Figure 4). Design engineers can be confident in its performance without the need for glass-reinforced alternatives, which can compromise impact performance and dimensional stability.

Figure 4. Comparison of creep performance



Accelerated Flexural Creep at 23°C using DMA. For reference purposes only.

Source: Delrin

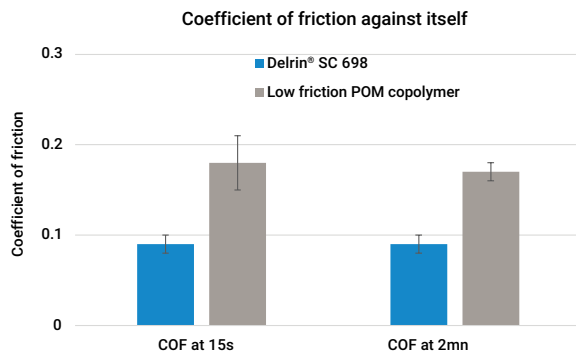


Delrin® acetal homopolymer offers extended lifetime performance in components like auto injectors.

Low friction

In a tribological system—whenever two surfaces rub against each other—careful material selection matters. The right materials help ensure predictable performance and avoid excessive or variable friction, stick-slip effects, squeaking and failure. Delrin® is an inherently low-friction material that can be further enhanced with low-friction additives, making it an easy choice in applications where sliding performance and wear resistance are critical (Figure 5).

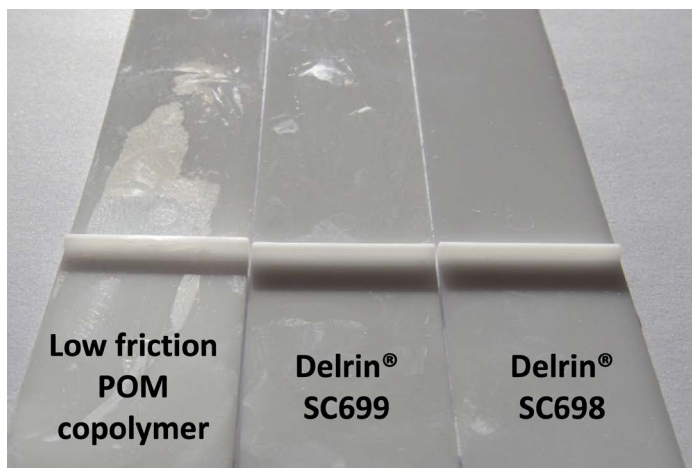
Figure 5. Typical dynamic coefficient of friction



Source: Delrin

Featuring the lowest coefficient of friction (COF) in the portfolio, Delrin® SC698 provides smooth, easy actuation for drug delivery devices like inhalers, injectors and pumps, eliminating the need for external lubrication of components. Patients can benefit from reduced effort, increased comfort, improved dosing accuracy and consistent operation. Designers and manufacturers can depend on Delrin® SC698 for a smooth surface, good colorability and improved aesthetics over other friction-modified acetals (Figure 6).

Figure 6. Improved surface finish with Delrin® SC698



Sterilization and chemical resistance

Frequent cleaning and sterilization are critical to stem the spread of disease in healthcare settings. The materials that make up medical devices, whether single-use or multi-use, must continue to perform through these processes.

A semi-crystalline polymer, Delrin withstands many chemicals commonly used in the healthcare industry for analysis, cleaning and disinfection (Figure 7), or as drug carriers or conserving agents. Delrin also withstands common sterilization processes, such as ethylene oxide (EtO) and a number of repeat autoclave cycles.

Figure 7. Chemical resistance testing of Delrin

Tensile strength after 96-hour exposure (>80% retention)



2.5% Bleach solution
3% Peroxide solution
Ethanol Quaternary ammonium solution Clorox® Healthcare Bleach Spray Lysol® Mold and Mildew Sani-HyPerCide® Germicide Sani-Cloth® AF3 Wipes Virex® Tb*

* Trademark of its respective company

Factors such as temperature, chemical concentration, exposure time, part surface-to-weight ratio and stress level can all affect performance. For this reason, it is highly recommended to conduct a realistic end-use test to determine suitability for a particular application.



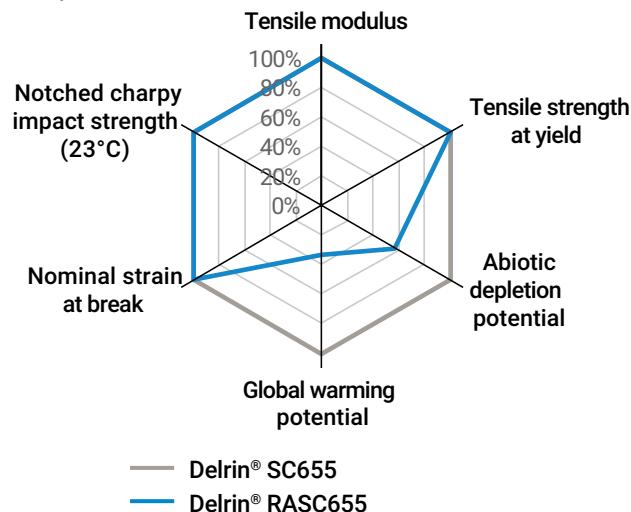
Sustainability

Delrin® presents an important opportunity to reduce the global warming potential of medical device components. While standard Delrin grades already have a low carbon footprint compared to many other polymer types, further gains can be made by switching to Delrin® Renewable Attributed—its base polymer is produced using 100% bio-feedstock from waste in accordance with ISCC mass balance certification. In addition, this material is manufactured with 100% certified renewable electricity.



Two commercial grades are available for healthcare applications. Delrin® RASC655 and Delrin® RASC698 offer mechanical properties and regulatory approvals identical to those of the existing Special Control versions*, but with up to 75% lower carbon footprint—a market-leading sustainability benefit (Figure 8).

Figure 8. Delrin® RASC655 and Delrin® SC655 properties comparison



Source: Delrin

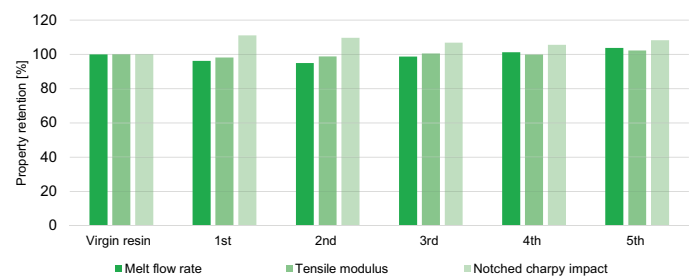
* Equivalency statements available upon request.

** Exact figures can be shared under NDA.

*** Data on POM from Plastics Europe. Data for Delrin and Delrin® Renewable Attributed from three panel peer reviewed LCA. Assumed redesigned weight savings is 10%.

In addition to the reduced carbon footprint achieved with Renewable Attributed grades, designers can take advantage of the superior properties of Delrin to make component sections thinner and integrate functional features into single molded parts, thus reducing overall material usage. Delrin also has the potential (if and where infrastructure exists) to be 100% recycled to support circularity initiatives.

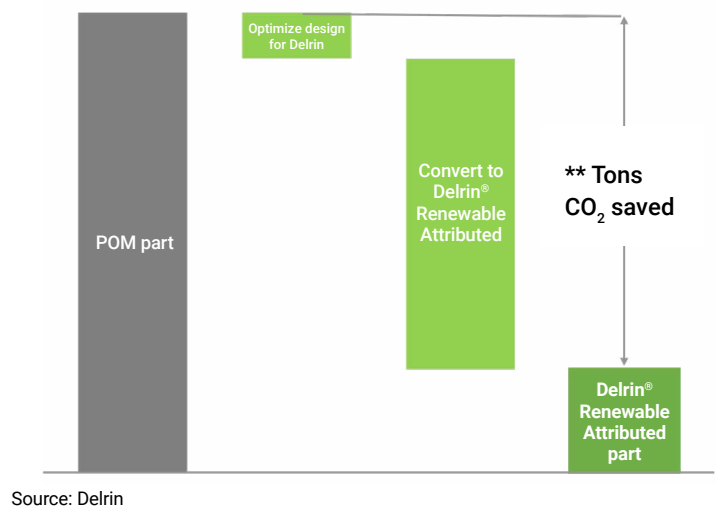
Figure 9. Delrin property retention after five passes of 100% reground



Source: Delrin

Planning on Delrin® Renewable Attributed from the early phases of a project can result in significant CO₂ savings throughout the lifetime of the application—with tangible benefits to end-users, patients and the environment (Figure 10).

Figure 10. Case study example of potential CO₂ savings (POM converted to Delrin® Renewable Attributed)***



Source: Delrin

Delrin® acetal homopolymer Special Control (SC) and Premium Control (PC) grades

These products are manufactured according to Good Manufacturing Practice (GMP) principles and generally accepted in food contact applications in Europe and the USA when meeting applicable use conditions. These products are also tested against ISO 10993-5 and -11 and selected parts of USP Class VI.

Details, individual compliance statements and complete data sheets are available from your Delrin representative. Table 1 is a condensed version.

The data contained herein reflects typical historical properties for our products and should not be used to establish specification limits.

Table 1. Special Control and Premium Control grades for healthcare applications

Product Family	Grade (Natural Color)	Description	Property	Tensile	Yield Stress	Yield Strain	Strain at Break	Charpy Impact (notched)		Density	Mass Flow Rate	Temperature of Deflection under Load	Melt Temperature
			Unit	(Mpa)	(Mpa)	(%)	(%)	(kJ/m²)	(kJ/m²)	(g/cm³)	(g/10 min)	(°C)	(°C)
			Test Condition	23°C	23°C	23°C	23°C	23°C	-30°C		2.16 kg	1.8 MPa	10°C/min
			Test Standard	ISO 527-1/-2	ISO 527-1/-2	ISO 527-1/-2	ISO 527-1/-2	ISO 179/1eA	ISO 179/1eA	ISO 1183	ISO 1133	ISO 75-1/-2	ISO 11357-1/-3
Delrin® POM	SC631	Low/medium flow		3300	74	15	35	9	8	1.42	7	103	178
	PC650	Medium flow		3100	71	17	20	9	8	1.42	15	95	178
	PC652	Medium flow, advanced lubricant		3000	65	11	23	7	6	1.39	14	97	178
	SC655	Medium flow		3100	71	17	30	9	8	1.42	15	95	178
	RASC655	Renewable Attributed. Medium flow.		3100	71	17	30	9	8	1.42	15	95	178
	SC690/PC690	High flow		3300	71	12	23	8	7	1.42	25	94	178
	SC698	High flow, low friction, superior surface		3100	65	11		4	4	1.44	21	97	178
	RASC698	Renewable Attributed. High flow, low friction, superior surface		3100	65	11		4	4	1.44	21	97	178

Source: Delrin

Contact your Delrin representative for Material Safety Data Sheets, general guides and/or information about ventilation, handling, purging, drying, etc. ISO mechanical properties are measured at 4 mm and all ASTM properties are measured at 3.2 mm.

Special Control* grades

- Manufactured according to GMP principles
- Food contact statements (EU/FDA)
- Tested against selected parts USP Class VI
- Tested against relevant parts ISO 10993
- Sterilization data
- Global availability

Products

- Delrin® SC631 NC010, medium flow, nucleated, POM homopolymer
- Delrin® SC655 NC010, medium flow POM homopolymer
- Delrin® SC690 NC010, high flow POM homopolymer
- Delrin® SC698 NC010, high flow, lubricated POM homopolymer for superior surface quality
- Delrin® RASC655 NC010, Renewable Attributed medium flow POM homopolymer
- Delrin® RASC698 NC010, Renewable Attributed high flow, lubricated POM homopolymer for superior surface finish

Premium Control grades

- Manufactured according to GMP principles
- Food contact statements (EU/FDA)
- Tested against selected parts of USP Class VI
- Tested against relevant parts of ISO 10993
- Sterilization data
- Global availability
- FDA drug master files available (DMF)
- Extended change notification

Products

- Delrin® PC650 NC010, medium flow POM homopolymer
- Delrin® PC652 NC010, medium flow, lubricated, POM homopolymer
- Delrin® PC690 NC010, high flow POM homopolymer

The use of Delrin® POM homopolymer in healthcare applications

With a variety of grade options available, and diverse performance characteristics, Delrin® grades may be considered for a wide range of medical applications. However, Delrin reserves the right not to sell into selected applications. As a principle, the Delrin business expressively requests that Delrin materials are not used in medical applications involving implantation in the human body or contact with internal body fluids or tissues unless the material has been provided from Delrin under a written contract that is consistent with the Delrin policy regarding medical applications and expressly acknowledges the contemplated use. For further information, please contact your Delrin representative.

Customer applications

- Clamps, clips and connectors
- Fluid and gas handling
- Safety devices for syringes
- Diagnostics
- Pen injectors
- Surgical instruments
- Dry powder inhalers
- Prosthetics
- Valves and pumps

To learn more, contact your Delrin representative or visit [Delrin.com](https://www.Delrin.com).



The information and recommendations contained herein are offered as a service to our customers but are not intended to relieve the user from its responsibility to investigate and understand other pertinent sources of information and to comply with all laws and procedures applicable to the safe handling and use of these materials. The information and recommendations provided herein were believed by Delrin to be accurate at the time of preparation or obtained from sources believed to be generally reliable. However, Delrin® makes no warranty concerning their accuracy and Delrin® will not be liable for claims resulting from any party's use of or reliance on information or recommendations contained herein regardless of whether it is claimed that the information or recommendations are inaccurate, incomplete or otherwise misleading.

Delrin is an industry-leading premium industrial polymer business. Grounded in strong innovation, Delrin is a category creator with a longstanding reputation for quality, reliability, supply and product performance. The iconic Delrin brand, coupled with proprietary technology and deep application expertise make us a leader in the high-end engineering polymer market. Delrin has exciting growth prospects from exposure to automation, actuation, healthcare, mobility and consumer applications.