EASTMAN

Design device housings and hardware with **better chemical resistance and durability.**

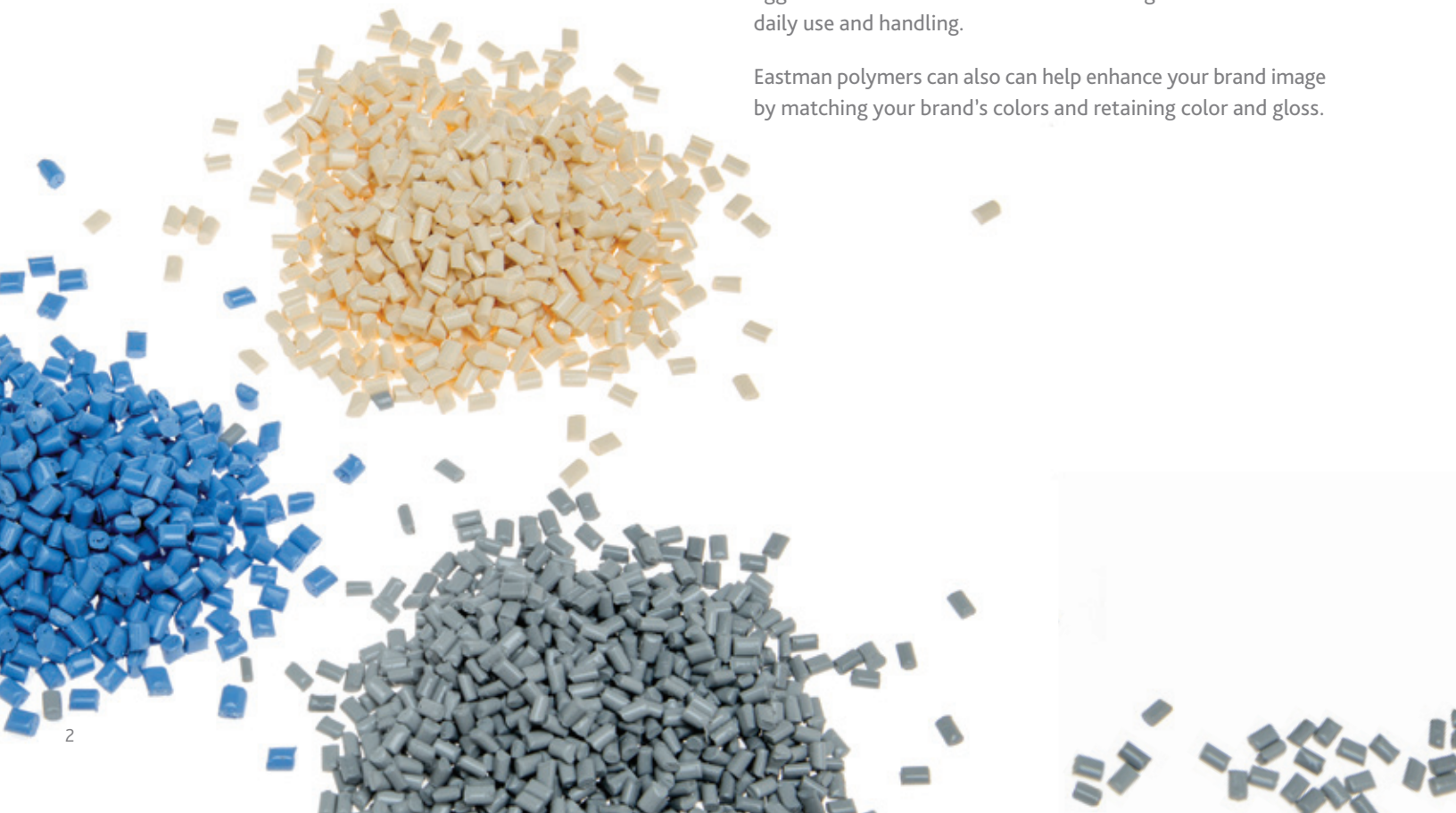
The market demands more from devices. **Now, you can deliver more.**

Eastman polymers for housings and hardware offer opaque and clear polymers that that have excellent chemical resistance and toughness, plus an Underwriters Laboratories (UL) 94 V-2 flammability rating.

It's a harsh reality. Heightened awareness of hospital-acquired infections (HAIs) has resulted in the increased use of aggressive medical disinfectants, such as bleach and alcohol, which can cause cracking, crazing, and hazing in certain plastics—and can lead to compromises in performance and safety of medical devices and diagnostic equipment.

Eastman polymers for housings and hardware provide an alternative to polycarbonate (PC), polycarbonate/acrylonitrile butadiene styrene (PC/ABS), polycarbonate/polyester terephthalate (PC/PET), and polycarbonate/polybutyl terephthalate (PC/PBT) that can stand up to today's aggressive disinfectants while withstanding the stresses of daily use and handling.

Eastman polymers can also can help enhance your brand image by matching your brand's colors and retaining color and gloss.



Eastman polymers for medical housings and hardware

Chemical resistance is just one of the many ways Eastman polymers for housings and hardware can add value to today's handheld and other medical diagnostic and electronic devices:

- **Flammability—**Eastman polymers for housing and hardware have received an all-color UL 94 FR V-2 rating.
- **Inherent toughness—**These polymers provide a high level of impact resistance and durability—enhanced by chemical resistance (see pages 4 and 5).
- **Safety and sustainability—**Eastman medical polymers provide toughness and durability without halogens, antimony, or *ortho*-phthalate plasticizers (see page 7).
- **True color match and retention—**The Eastman Color Technology Center provides world-class color matching technology and helps ensure your brand color and gloss are retained.

Chemical resistance—just the beginning of long-term performance

Chemical resistance is defined as the resistance to changes in aesthetic and mechanical properties after exposure to a chemical under a well-defined set of conditions. Pages 4 and 5 show the results of studies conducted to compare how the chemical resistance of Eastman polymers for housings and hardware can contribute to greater toughness and durability.

When it matters most

An expensive Echo-Screen III device like the one shown here represents a very small investment in plastic if made from PC/ABS. At a competitive manufacturing cost, Eastman polymers for housings and hardware can add significant value by reducing breakage from environmental stress cracking.

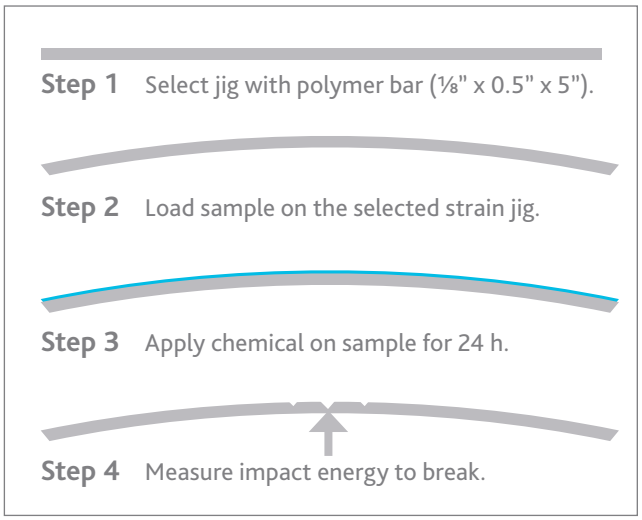
Chemical resistance and **durability** go hand in hand.

Chemical resistance can have a great impact on toughness—and other performance characteristics.

Understanding chemical resistance is complex because observations often are dependent on the nature of chemical contact (composition, time, and temperature) and the level and type of stress found in the part. For these reasons, testing of actual parts under realistic end-use conditions is always recommended. However, the tests presented here are useful for making material comparisons or screening different plastics against various commonly used disinfectants and cleansers.

Reverse side impact property retention test results

In these tests, a series of disinfectants were screened against Eastman medical polymers, polycarbonate alloys (PC/ABS, PC/PBT, and PC/polyester), and PVC using the reverse side impact test.



With the chemically exposed surface placed in tension, the energy required to break the flex bars was measured. In general, higher-percent retention in impact energy demonstrates better chemical resistance.

Chemical resistance—4-step test results

	Eastman MXF221 copolyester	PC/PBT	PC/ polyester 1	PC/ polyester 2	PC/ABS 1	PC/ABS 2	PVC
	% Retention of impact energy to break						
Control (joules)	5.2	5.3	5.5	5.8	6.8	6.6	4.5
Hydrogen peroxide	96 ± 1	100 ± 2	81 ± 36	40 ± 35	86 ± 11	12 ± 2	99 ± 1
IPA	85 ± 3	30 ± 3	47 ± 10	23 ± 3	16 ± 1	15 ± 1	11 ± 0
Clorox® Bleach (hypochlorite)	95 ± 3	95 ± 5	94 ± 3	65 ± 51	92 ± 1	100 ± 1	101 ± 2
Clorox Healthcare® Multi-Surface (IPA quat)	92 ± 3	57 ± 45	91 ± 12	27 ± 2	84 ± 13	64 ± 21	45 ± 36
Clorox Healthcare® Hydrogen Peroxide (H_2O_2 cleaner)	98 ± 1	94 ± 2	23 ± 1	79 ± 10	97 ± 2	69 ± 32	56 ± 32
Cidex® (aldehyde)	90 ± 3	89 ± 4	89 ± 1	81 ± 24	78 ± 33	7 ± 2	98 ± 2
Bleach (germicidal hypochlorite)	95 ± 2	98 ± 2	6 ± 2	43 ± 35	70 ± 21	102 ± 1	19 ± 0
Virex™ TB (ether, benzyl quat)	94 ± 2	8 ± 3	6 ± 1	11 ± 2	15 ± 1	Break on jig	19 ± 2
Wonder Woman™ Wipes (IPA)	99 ± 5	81 ± 22	6 ± 1	25 ± 5	12 ± 2	6 ± 2	81 ± 39
3M Neutral Quat	82 ± 3	87 ± 3	8 ± 3	73 ± 34	34 ± 6	Break on jig	97 ± 2
Wex-Cide® (RTU)	88 ± 4	96 ± 3	55 ± 52	20 ± 2	93 ± 1	58 ± 47	102 ± 1
Sani-Cloth® AFIII (benzyl quat, DPG ether)	93 ± 4	9 ± 2	5 ± 0	13 ± 1	20 ± 3	6 ± 1	46 ± 36
Sani-Cloth® HB (benzyl quat)	92 ± 2	97 ± 1	55 ± 48	95 ± 1	42 ± 3	48 ± 20	101 ± 1
Super Sani-Cloth® (IPA quat)	83 ± 1	91 ± 8	75 ± 28	26 ± 1	16 ± 1	42 ± 37	18 ± 2
Sani-Cloth Plus® (IPA benzyl quat)	96 ± 3	16 ± 2	8 ± 2	25 ± 1	71 ± 22	5 ± 0	100 ± 0
Sani-Cloth® Bleach (hypochlorite)	96 ± 1	99 ± 3	97 ± 2	93 ± 1	70 ± 8	96 ± 4	101 ± 1
Oxivir® TB Wipes (H_2O_2 cleaner)	99 ± 2	100 ± 2	88 ± 17	79 ± 35	95 ± 2	34 ± 38	33 ± 3
Clinell® Universal Wipes (quat)	95 ± 2	96 ± 2	97 ± 3	74 ± 39	91 ± 1	61 ± 43	101 ± 1
CaviCide® (IPA, ether)	93 ± 5	12 ± 5	7 ± 4	8 ± 2	21 ± 3	5 ± 0	100 ± 0
Envirocide® (IPA, ether)	97 ± 3	39 ± 42	6 ± 2	19 ± 12	28 ± 5	6 ± 2	100 ± 1

≥ 80% retention ≥ 60% retention < 60% retention

Summary

Eastman polymers for housings and hardware, based on Eastman Tritan™ copolyester, exhibit excellent chemical resistance properties against most screened medical disinfectants and medical disinfectant wipes. All PC alloys (PC/PBT, PC/ABS, and PC/polyester) show poor chemical resistance properties against most screened medical disinfectants and medical disinfectant wipes.

Achieve lasting **color** and **gloss for your brand.**

Most brand owners who use opaque polymers require precise color matching and retention of aesthetics as key parts of brand identity. Eastman polymers for housings and hardware uses a dedicated resource, the Eastman Color Technology Center, to develop customer-specific color concentrate for the medical market. The Eastman Color Technology Center has been a leader in color theory and application since 1934 and can work with customers to match specific colors using Eastman polymers.

Provide **safety** and **sustainability for everyone.**

Increased focus on social and environmental issues facing the world continues to drive industry standards for safety and sustainability. Eastman polymers for housings and hardware help you meet these standards in several ways, including:

- Eastman medical polymers are made without halogens or *ortho*-phthalate plasticizers.
- Their toughness and durability can potentially increase product life and reduce waste.
- The flame-retardant additives used to make Eastman polymers do not contain antimony, bromine, or chlorine.
- These polymers are suitable for transducer housing applications that require contact with the skin.

Eastman polymers for housings and hardware are an excellent example of Eastman's widely recognized commitment to creating value through sustainability. Recent honors include:

- The American Chemistry Council recognized Eastman with Responsible Care® Energy Efficiency Awards for energy efficiency improvements 24 years in a row, receiving eight awards in 2016.
- The U.S. Environmental Protection Agency named Eastman a 2017 ENERGY STAR® Partner of the Year for the sixth consecutive year for continued leadership and superior energy efficiency achievements.
- In 2017, Eastman earned World's Most Ethical Companies designation by Ethisphere® Institute for the third year in a row.
- In 2016, Eastman topped the inaugural "JUST 100" List in the Chemical Industry, published by JUST Capital and Forbes.

Eastman is a world leader in polymer technology—with more than 70 years of experience and innovation in the medical market. For more information about how Eastman polymers for housings and hardware can help you bring innovative products to market, visit www.eastman.com/medical or call 800-EASTMAN (800-327-8626).

EASTMAN

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Safety Data Sheets providing safety precautions that should be observed when handling and storing Eastman Chemical Company ("Eastman") products are available online or by request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

It is the responsibility of the medical device manufacturer ("Manufacturer") to determine the suitability of all component parts and raw materials, including any Eastman product, used in its final product to ensure safety and compliance with requirements of the United States Food and Drug Administration (FDA) or other international regulatory agencies.

Eastman products have not been designed for nor are they promoted for end uses that would be categorized either by the United States FDA or by the International Standards Organization (ISO) as implant devices. Eastman products are not intended for use in the following applications: (1) in any bodily implant applications for greater than 30 days, based on FDA-Modified ISO-10993, Part 1, "Biological Evaluation of Medical Devices" tests (including any cosmetic, reconstructive, or reproductive implant applications); (2) in any cardiac prosthetic device application, regardless of the length of time involved, including, without limitation, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems, and ventricular bypass assisted devices; or (3) as any critical component in any medical device that supports or sustains human life.

For manufacturers of medical devices, biological evaluation of medical devices is performed to determine the potential toxicity resulting from contact of the component materials of the device with the body. The ranges of tests under FDA-Modified ISO-10993, Part 1, "Biological Evaluation of Medical Devices" include cytotoxicity, sensitization, irritation or intracutaneous reactivity, systemic toxicity (acute), subchronic toxicity (subacute), implantation, and hemocompatibility. For Eastman products offered for the medical market, limited testing information is available on request. The Manufacturer of the medical device is responsible for the biological evaluation of the finished medical device.

The suitability of an Eastman product in a given end-use environment is dependent on various conditions including, without limitation, chemical compatibility, temperature, part design, sterilization method, residual stresses, and external loads. It is the responsibility of the Manufacturer to evaluate its final product under actual end-use requirements and to adequately advise and warn purchasers and users thereof.

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