



INNOVATIVE PLASTICS

RESISTANCE+ DURABILITY

Chemical Resistance Performance Testing
for Healthcare Materials



CHEMISTRY THAT MATTERS™

INTRODUCTION

HARSH DISINFECTION AND STERILIZATION ENVIRONMENTS...

With patient safety at the forefront, the healthcare industry is mobilizing to address the concerns of increasing patient infections associated with medical care, known as HCAs (healthcare associated infections). To help meet this challenge, medical equipment and high touch surfaces in patient care settings are repeatedly wiped down with increasingly aggressive chemical disinfectants.

...REQUIRE A HIGH PERFORMANCE SOLUTION

Materials used to manufacture medical device enclosures must withstand ever increasing in-service demands due to chemical resistance needs, complex designs and performance requirements. SABIC's portfolio of enclosure materials has been created to help the industry meet a broad range of potential device requirements (see Figure 1).

ESCR TESTING

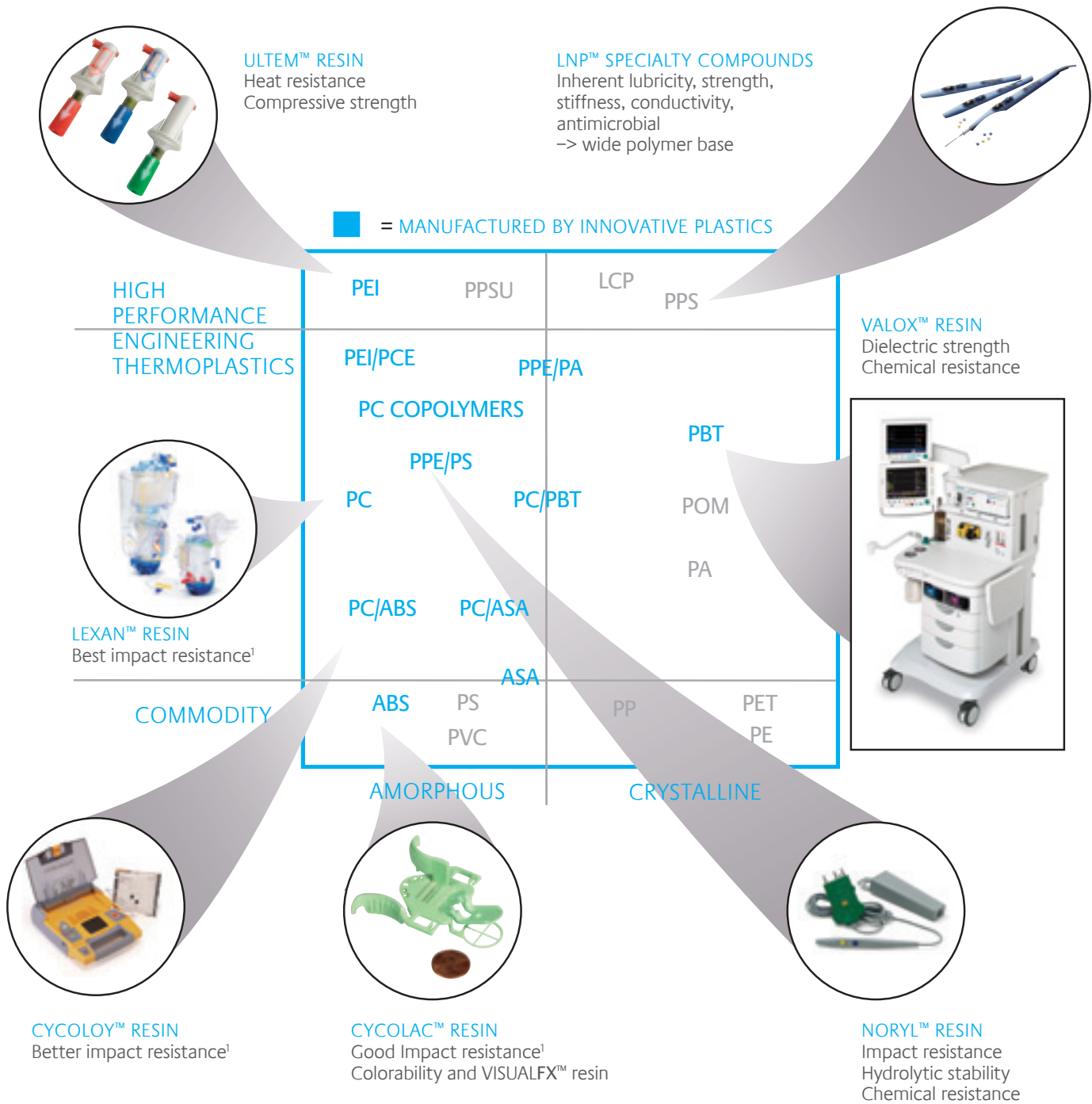
CHEMICAL RESISTANCE PERFORMANCE TESTING

SABIC has provided chemical resistance performance test results for a broad portfolio of both amorphous and semi-crystalline materials to aid medical equipment manufacturers in selecting materials for their device requirements (see Table 1). To supplement this test data, SABIC has performed an environmental stress cracking resistance (ESCR) study of common flame retardant medical enclosure materials with newer chemical disinfectants (see Table 2 and Table 3).

Environmental stress cracking in medical devices can be related to many factors including polymer morphology, chemical concentration and residual stress in molded components. This ESCR study looks at compatibility of common flame resistant medical enclosure materials tested with Alcohol/Quaternary Ammonium Compound (QAC) based disinfectants and Alcohol Free/QAC based disinfectants at various strain levels to determine chemical resistance performance. This study was performed with two chemical exposure conditions, saturation and wipe. In an effort to simulate end use conditions in a patient care setting where a device would be wiped down frequently, the first application method looked at wiping the samples with the disinfectant 15 times over a period of three days (see Table 2). The second application method, saturation, can be useful in predicting long term chemical resistance performance (see Table 3).

THE INNOVATIVE PLASTICS RESINS PORTFOLIO

FIGURE 1
THE INNOVATIVE PLASTICS RESINS PORTFOLIO



¹ based on a general performance comparison of ABS, PC/ABS and PC resins

CHEMICAL RESISTANCE PERFORMANCE TESTING

TABLE 1

CHEMICAL RESISTANCE PERFORMANCE TESTING - HEALTHCARE RESINS, STANDARD RESINS

PRODUCT FAMILY	GRADE/SERIES	Exposure time (days)	Bleach sodium hypochlorite solution, 50%	Cidex [®] glutaraldehyde based disinfectant	Methyl ethyl ketone (MEK)	Virex [®] organic ammonium chloride based disinfectant	Betadine [®] microbicide; povidone-iodine solution	Ethanol (ethyl alcohol)	Hydrogen peroxide 3%	Isopropanol (isopropyl alcohol; ipa) 70%	Saline 10%	Lipid hydrocarbon-containing organic compounds; fatty acid derivatives	DEHP diethylhexylphthalate
LEXAN PC RESINS													
Healthcare products													
	HP1R	3	+	+	■	●	+	●	+	+	+		
	HPS2R	3	+	+	■	●	+	+		+	+		
	HPS7	3	+	●	■	●	+	+	7 days +	+	+	●	5 days +
	HPX4	3	+	+	■	▲	+	+	+	+	+		
	HPH4404	3	+	+	■	+	+	+	+	+	+		
	HPH4704	3	+	+	■	+	+	+	+	+	+		
Standard products													
	925	7	+	●	■	●	+	+	+	+	+		
	945	7	+	▲	■	●	+	+	+	+	+		
	925A	7	+	●	■	+	+	+	+	+	+		
	945AU	7	+	+	■	+	+	+	+	+	+		
Standard Products — Enhanced flow / ductility resins													
	EXL1414	7	++	+	■	●	+	+	+	+	+		
	EXL9112	7	++	▲	■	●	+	+	+	+	+		
	EXL9330	7	++	+	■	+	+	+	+	+	+		
	EXL9335	7	+	+	■	+	+	+	+	+	+		
XYLEX™ PC/POLYESTER RESIN BLENDS													
Healthcare products													
	HX7409HP	3	+	+	■	●	+	+	+	+	+	●	
	HX8300HP	3	+	●	■	▲	+	■	+	+	+	■	
XENYO™ PC/POLYESTER RESIN BLENDS													
Healthcare products													
	HX5600HP	7	●	+	■	▲	+	+	+	●	+	●	
	HX6600HP	7	+	+	+	+	+	▲	+	+	+	+	+
CYCOLOY PC/ABS RESIN BLENDS													
Healthcare Products													
	HC1204HF	7	●	▲	■	▲	■	■	+	+	●		
Standard products													
	C2950	7	●	■	■	■	■	▲	●	●	▲		
	C6600	7	●	■	■	■	+	■	●	■	+		
	CX2244ME	7	●	■	■	■	+	■	+	●	+		
	CX2142ME	7	●	■	■	■	+	■	+	●	+		
CYCOLAC ABS RESINS													
Healthcare products													
	HMG47MD	7	++	●	■	●	■	■	▲	●	●		
	HMG94MD	7	++	■	■	■	■	■	+	■	●		
Standard products													
	MG37EPN	7	++	●	■	▲	●	■	+	■	+		
	XHMM1	7	++	▲	■	●	■	■	+	■	+		
	GRM2600L	7	++	●	■	+	●	■	+	●	+		

LEGEND FOR SYMBOLS

- Compatible at 0.5% strain
- ⊕ Compatible at 1.0% strain
- ⊕⊕ Compatible at 1.5% strain
- ▲ Marginal for one or both measures at 0.5% strain
- ▲⊕ Marginal for one or both measures at 1.0% strain
- ▲⊕⊕ Marginal for one or both measures at 1.5% strain
- Not compatible

LAB BENCH COMPATIBILITY RATING:

Color rating	Retention tensile stress at yield, %	Retention tensile elongation at break, %
COMPATIBLE	≥ 90	80 - 139
MARGINAL	80 - 89	65 - 79
NOT COMPATIBLE	≤ 79	≤ 64 OR > 140

PRODUCT FAMILY	GRADE/SERIES	Exposure time (days)	Bleach sodium hypochlorite solution, 50%	Cidex ¹ glutaraldehyde based disinfectant	Methyl ethyl ketone (MEK)	Virex ¹ organic ammonium chloride based disinfectant	Betadine ¹ microbicide; povidone-iodine solution	Ethanol (ethyl alcohol)	Hydrogen peroxide 3%	Isopropanol (isopropyl alcohol; ipa) 70%	Saline 10%	Lipid hydrocarbon-containing organic compounds; fatty acid derivatives
ULTEM PEI RESINS												
Healthcare products												
	HU1010	7	+	+	+	+	+	+	+	+	+	+
	HU2300	7	+	+	+	+	+	+	+	+	+	+
NORYL MODIFIED PPE RESIN BLENDS												
Healthcare products												
	HN731E	7	+	+	+	+	+	+	+	+	+	+
	HNA033	7	+	+	+	+	+	+	+	+	+	+
	HNA055	7	+	+	+	+	+	+	+	+	+	+
Standard products												
	GFN2	3	+	+	+	+	+	+	+	+	+	+
VALOX PBT AND/OR PET RESINS AND BLENDS												
Healthcare products												
	HX215HPR	3	+	+	+	+	+	+	+	+	+	+
	HX420HP	3	+	+	+	+	+	+	+	+	+	+
Standard products												
	365	3	+	+	+	+	+	+	+	+	+	+
	855	3	+	+	+	+	+	+	+	+	+	+
LNP LUBRICOMP™ COMPOUNDS – Internally lubricated												
	AL003	7	+	+	+	+	+	+	+	+	+	+
	DFL36	3	+	+	+	+	+	+	+	+	+	+
	EL003	7	+	+	+	+	+	+	+	+	+	+
	RFL36	7	+	+	+	+	+	+	+	+	+	+
	WFL36	7	+	+	+	+	+	+	+	+	+	+
	ZFL36CCX	7	+	+	+	+	+	+	+	+	+	+
LNP THERMOCOMP™ COMPOUNDS – Internally reinforced												
	DF006ER	3	+	+	+	+	+	+	+	+	+	+
	EF006	7	+	+	+	+	+	+	+	+	+	+
	LF006	7	+	+	+	+	+	+	+	+	+	+
	RF006	7	+	+	+	+	+	+	+	+	+	+
	UF008	7	+	+	+	+	+	+	+	+	+	+
	WF006	7	+	+	+	+	+	+	+	+	+	+

CHEMICAL RESISTANCE TESTING ACCORDING TO ISO 4599 (DETERMINATION OF RESISTANCE TO ENVIRONMENTAL STRESS CRACKING (ESCR) – BENT STRIP METHOD) OR ASTM D543 (EVALUATING THE RESISTANCE OF PLASTICS TO CHEMICAL REAGENTS).

This information should be used as indicative only: Accurate chemical compatibility can only be determined under final application conditions. Therefore, extensive testing of the finished part is strongly recommended. The performance and interpretation of end-use testing are the end producers responsibility.

STRAIN LEVEL <0.5%
Generally represents molded-in stress of actual part, when designed and molded in line with recommended guidelines

STRAIN LEVELS >0.5%
A material is generally more susceptible to chemical attack at higher strain levels. [e.g. chemically induced cracking will more readily occur at strain level 1.5% than at strain level 0.5%]

TEST TEMPERATURE: 23 °C (73 °F)

ESCR TEST RESULTS

TABLE 2

CHEMICAL RESISTANCE PERFORMANCE TESTING – COMMON RESINS USED FOR ENCLOSURES IN THE HEALTHCARE INDUSTRY

Chemical Application Method: Wipe (5x/day) Total Wipes: 15

Exposure Time: 3 Days

CHEMICALS	PDI Sani-Cloth [†] Plus Alcohol, QAC based disinfectant		PDI Super Sani-Cloth Alcohol Free, QAC based disinfectant		PDI Sani-Cloth AF III Alcohol Free, QAC based disinfectant	
	Yield Strength	Nominal Strain at Break	Yield Strength	Nominal Strain at Break	Yield Strength	Nominal Strain at Break
PRODUCT FAMILY/ GRADE						
CYCOLOY C6600 Resin	●	■	●	■	■	■
CYCOLOY CX2244ME Resin	■	■	●	■	■	■
VALOX 357U Resin	●	●	●	●	●	●
VALOX 364 Resin	●	●	●	●	●	■
VALOX V3900WX Resin	●	●	●	●	■	■
LEXAN EXL9330 Resin	●	●	●	●	■	■
LEXAN 945 Resin	●	▲	●	●	■	■
ULTEM ATX200 Resin	●	●	●	●	●	■

LEGEND FOR SYMBOLS

- Compatible at 0.5% strain
- ▲ Marginal for one or both measures at 0.5% strain
- Not compatible

LAB BENCH COMPATIBILITY RATING:

Color rating	Retention tensile stress at yield, %	Retention tensile elongation at break, %
COMPATIBLE	≥ 90	80 - 139
MARGINAL	80 - 89	65 - 79
NOT COMPATIBLE	≤ 79	≤ 64 OR > 140

TABLE 3

CHEMICAL RESISTANCE PERFORMANCE TESTING – COMMON RESINS USED FOR ENCLOSURES IN THE HEALTHCARE INDUSTRY

Chemical Application Method: Saturation

Exposure Time: 3 Days

CHEMICALS	PDI Sani-Cloth Plus Alcohol, QAC based disinfectant		PDI Super Sani-Cloth Alcohol, QAC based disinfectant		PDI Sani-Cloth AF III Alcohol Free, QAC based disinfectant	
	Yield Strength	Nominal Strain at Break	Yield Strength	Nominal Strain at Break	Yield Strength	Nominal Strain at Break
PRODUCT FAMILY/ GRADE						
CYCOLOY C6600 Resin	■	■	+	■	■	■
CYCOLOY CX2244ME Resin	■	■	●	■	■	■
VALOX 357U Resin	+	●⚠	+	●⚠	●	■
VALOX 364 Resin	+	+	+	+	●	■
VALOX V3900WX Resin	+	▲	●⚠	●	■	■
LEXAN EXL9330 Resin	+	●⚠	+	●	■	■
LEXAN 945 Resin	●	●	+	●	■	■
ULTEM ATX200 Resin	+	●⚠	+	+	■	■

LEGEND FOR SYMBOLS

- Compatible at 0.5% strain
- ⊕ Compatible at 1% strain
- ▲ Marginal for one or both measures at 0.5% strain
- ⚠ Marginal for one or both measures at 1% strain
- Not compatible

LAB BENCH COMPATIBILITY RATING:

Color rating	Retention tensile stress at yield, %	Retention tensile elongation at break, %
COMPATIBLE	≥ 90	80 - 139
MARGINAL	80 - 89	65 - 79
NOT COMPATIBLE	≤ 79	≤ 64 OR > 140

ESCR TEST METHODOLOGY

Chemical resistance testing according to ISO4599 (determination of resistance to ESCR – bent strip method) or ASTM D543 (evaluating the resistance of plastics to chemical reagents). This information should be used as indicative only; accurate compatibility can only be determined under final application conditions. Therefore, extensive testing of the finished part is strongly recommended. The performance and interpretation of end-use testing are the manufacturer’s responsibility. Note: ISO standard ISO4599 has been revised and replaced by ISO22088.

STRAIN LEVEL <0.5%

Generally represents molded in stress of an actual part, when designed and molded in line with recommended guidelines.

STRAIN LEVELS >0.5%

A material is generally more susceptible to chemical attack at higher strain levels (e.g. chemically induced cracking will more readily occur at strain level 1.5% than at strain level 0.5%)

TEST TEMPERATURE: 23 °C (73 °F)

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