



**THERMOPLASTIC ELASTOMERS • STRUCTURAL • WEAR
CONDUCTIVE • COLOR • FLAME RETARDANT**



Hospital Cleaner Resistant Plastic Technology

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Overview

YOUR GLOBAL COMPOUNDER OF CUSTOM ENGINEERED THERMOPLASTICS

- **Problem Statement**
- Flame Retardants 101
- Chemical Resistance Test Methodology
- Development Process
- Results
- Conclusion / Case Study



Problem Statement

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- **Hospital Acquired Infections**
 - 2,000,000 new cases per year (USA)
 - 100,000 deaths per year (USA)
 - \$11 Billion additional cost (USA)
 - Global trend
- **Costs have been driven back to healthcare providers**



Problem Statement

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- **Added costs have led to an increase in cleaner usage and frequency**
- **Harsh chemicals causing failures in plastic housings**



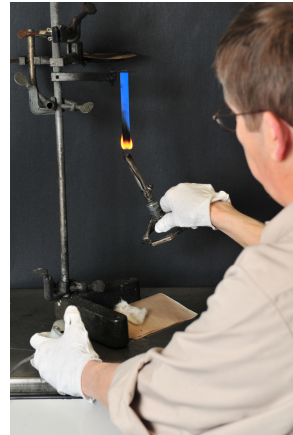


Rising to the Challenge

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Product Development Criteria

- Increased chemical resistance to healthcare cleaners vs. traditional housing materials
 - PC/ABS, PC/PBT, ABS, PC, PC/ASA
- High Impact/Ductility
- Good dimensional stability with shrinkage similar to PC/ABS
- Colorable
- Flame retardant grade for electronic housings



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Flame Retardant (FR) Materials

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Definition

Materials that do not ignite readily or propagate flames under small to moderate fire exposures

- Materials are combustible
- Fire retardants reduce the intensity and spread of fire
- Reduces smoke and toxic by-products of combustion.



Fire Triangle



Goals of Flame Retardant Compounds

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- Increase Resistance to Ignition
- Reduce Rate of Flame Spread
- Reduce Rate of Heat Release
- Reduce Smoke Emission

End Goal

- Meet FR Specifications
- Make the World a Safer Place!



Thermoplastic Resin Flammability

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Flammable

- Polyolefins
- Nylons
- Polycarbonate
- Polyesters
- Styrenics
- TPE'S

Inherently Flame Resistant

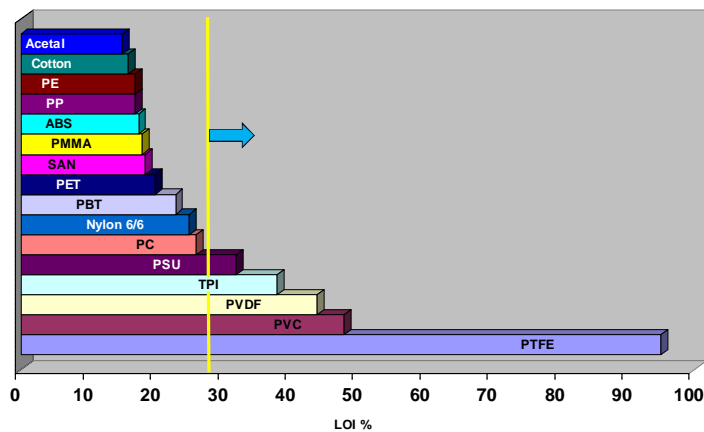
- Polyphenylene Sulfide
- Polyetheretherketone
- Polyetherimide
- Fluoropolymers



Challenges of Flame Retarding Plastics

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Limiting Oxygen Index





Electrical and Electronics (E&E)

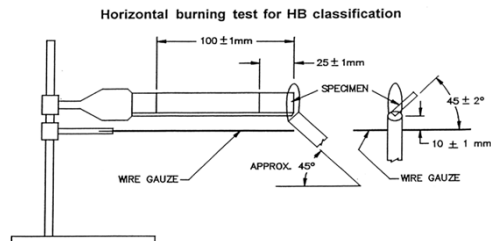
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- Appliances, Connectors, Housings, etc..
- UL 94
 - V, 5V, HB
- UL 746
 - HAI, HWI, CTI



UL94 HB

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Classification Criterion

3.0 mm to 13.0 mm thickness

- slower than 40 mm/minute or...
- combustion ceases prematurely

< 3.0 mm thickness

- slower than 75 mm/minute or...
- combustion ceases prematurely

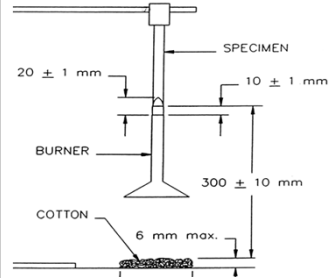
** In general most thermoplastics meet this criteria**



UL94 VB

YOUR GLOBAL COMPOUNDER OF CUSTOM ENGINEERED THERMOPLASTICS

Classification Criteria	V-0	V-1	V-2
Number of bar specimens	5	5	5
Maximum flame time per specimen per flame application, sec	10	30	30
Maximum total flame time 5 specimens, 2 ignitions, sec	50	250	250
Specimen drips, ignites cotton	No	No	Yes
Maximum afterglow time per specimen, sec	30	60	60
Burn to holding clamp	NO	NO	NO



Thickness dependent ratings



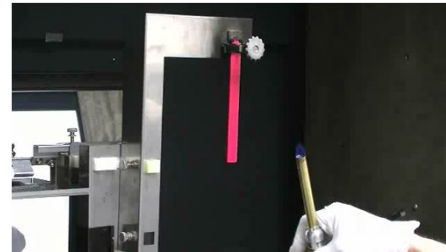
UL94 Vertical Burn Demo

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Flame Retardant – V-0



Non-Flame Retardant – No Rating





UL Certification

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- RTP Company has 500+ UL Yellowcards
 - Continuous expansion of UL listed products
- UL Certified Laboratory under Client Test Data Program (CTDP)
 - Short term properties to UL94
 - Long term thermal aging (RTI)
- RTP Company offers custom UL certifications to achieve full commercialization
 - Quick turnaround
 - **Compress your Time to Market!**



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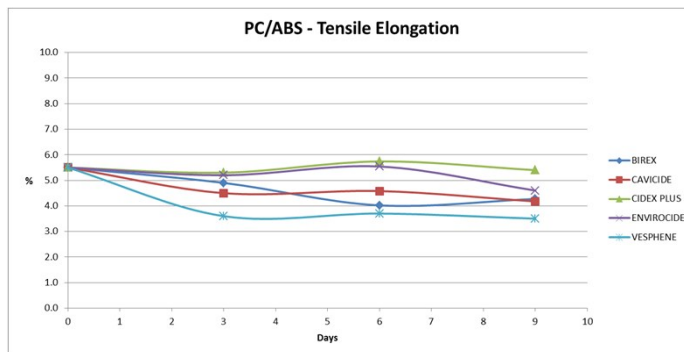
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Test Method Evaluation

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- Nine day soak test showed no change in physical properties
- Most field failures are seen in areas where stress is applied
- Need a test method that replicates field failures



Test Methodology

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- Exposure @ 1% Strain
- Patch Method
 - Saturate patch every 24 hours
 - Air dry
- Test tensile properties after exposure (96 hours)



Test replicated field failures and relative resistance



Chemical Classes

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- **Wide variety of chemical cleaners used to help avoid the spread of hospital acquired infections:**
 - Alcohols
 - Aldehydes
 - Quaternary compounds
 - Alkylamine derivatives
 - Chlorine releasing compounds
 - Acidic / Basic solutions
 - Etc..



Chemicals Tested

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Cleaning Agent	Base Chemical Class
Birex	Phenol
CaviCide 1	Isopropanol / Ethanol
Cidex Plus	Glutaraldehyde
Incides N	Propanol
Incidin Plus	Glucoprotamin / Ethanol
Incidin Pro	Alkylamine / Ethanol
Sani-Cloth Active	Quaternary compound
Sani-Cloth Bleach	Chlorine releasing compound
Sani-Cloth Plus	Isopropanol / Ethanol
Super Sani-Cloth	Isopropanol
T-Spray II	Alkylamine



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Target Properties

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Property	Targets for Housings
Healthcare Chemical Resistance	Excellent
Izod, Notched (ft-lbs/in)	>10
Tensile Strength (psi)	>4500
Tensile Elongation (%)	>10
Flexural Modulus (psi * 10 ⁶)	0.2 - 0.5
HDT @ 264 psi (° F)	>180
Mold Shrinkage (%)	0.6
UL 94	V-0 / 5VA

Similar Physicals to PC/ABS, Better Cleaner Resistance



Development

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- Numerous compositions screened for physical property and chemical resistance
 - Over a dozen polymers tested
 - Extensive alloy testing
- Proprietary polyester alloy was proven as best performer
- Alloy was optimized for physicals, chemical resistance and flame performance

Introducing *RTP 2000 HC* series



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Property Comparison

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Property	RTP 2000 HC	PC/ABS	RTP 2000 HC FR A	FR PC/ABS	FR PC/PBT
Tensile Strength (psi)	7000	7500	5750	8000	7250
Tensile Modulus (psi * 10 ⁶)	0.21	0.32	0.21	0.36	0.32
Tensile Elongation (%)	140%	65%	95%	15%	30%
Flex Strength (psi)	8750	12500	8500	15000	12750
Notched Impact (ft-lbs/in)	16.0	11.0	12.0	12.0	14.0
HDT @ 264 psi (° F)	200	205	190	210	220
Shrinkage (%)	0.5 -0.7	0.5-0.8	0.5-0.7	0.5-0.8	0.7-1.0
Specific Gravity	1.17	1.14	1.27	1.20	1.29
UL 94	HB	HB	V-0 / 5VA	V-0 / 5VA	V-0 / 5VA



Pass/Fail Criteria

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- **Tensile Strength**
 - 75% retention or greater
- **Tensile Elongation**
 - Minimum 10% tensile elongation





Tensile Strength

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Cleaner	RTP 2000 HC	PC/ABS	RTP 2000 HC FR A	FR PC/ABS	FR PC/PBT
T-Spray II	✓	✓	✓	✗	✓
Cidex Plus	✓	✗	✓	✗	✓
Incidin Plus	✓	✗	✓	✗	✗
Birex	✓	✓	✓	✓	✓
Sani-Cloth Active	✓	✓	✓	✗	✓
Sani-Cloth Bleach	✓	✓	✓	✓	✓
CaviCide 1	✓	✗	✓	✗	✗
Super Sani-Cloth	✓	✓	✓	✓	✓
Sani-Cloth Plus	✓	✗	✓	✗	✗
Incides N	✓	✓	✓	✓	✓
Incidin Pro	✓	✗	✓	✗	✗



Tensile Elongation

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Cleaner	RTP 2000 HC	PC/ABS	RTP 2000 HC FR A	FR PC/ABS	FR PC/PBT
T-Spray II	✓	✓	✓	✗	✓
Cidex Plus	✓	✗	✓	✗	✓
Incidin Plus	✓	✗	✓	✗	✗
Birex	✓	✓	✓	✓	✓
Sani-Cloth Active	✓	✗	✓	✗	✗
Sani-Cloth Bleach	✓	✓	✓	✓	✓
CaviCide 1	✓	✗	✓	✗	✗
Super Sani-Cloth	✓	✓	✓	✗	✓
Sani-Cloth Plus	✓	✗	✓	✗	✗
Incides N	✓	✓	✓	✗	✓
Incidin Pro	✓	✗	✓	✗	✗



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Case Study

YOUR GLOBAL COMPOUNDER OF CUSTOM ENGINEERED THERMOPLASTICS

Market: Medical

Application: Electrical control housing

Problem: Experiencing field failures and all commercially available housing materials were failing chemical testing

Solution: RTP 2000 HC FR A

Benefit: Provided required cleaner resistance, utilizing the existing tooling



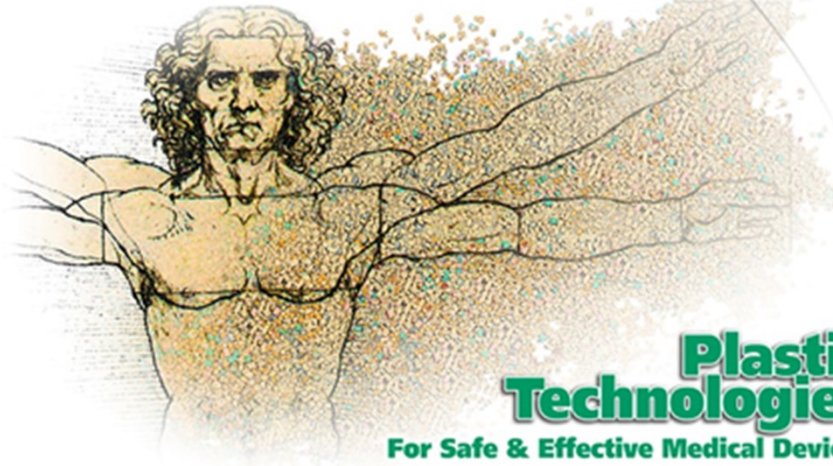
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Conclusions

- **RTP 2000 HC offers resistance to healthcare cleaners**
 - Available in UL94 V-0/5VA grade (RTP 2000 HC)
 - Physical properties well suited for housings
 - Dimensional stability
 - Similar molding conditions in existing tooling (PC/ABS, PC/PBT, ABS, PC, PC/ASA)
 - Fully colorable
- Available for immediate sampling/testing



Plastic Technologies
For Safe & Effective Medical Devices