



Design Solutions Guide

 **BASF**
The Chemical Company

Table of Contents

<i>Topic</i>	<i>Part/Page</i>
Welcome!	I
Overview.	I-2
BASF Product Line	I-2
Recycling	I-3
Design Assistance	I-3
CAD/CAE Capabilities	I-3
Safety	I-3
Design Considerations for Injection Molded Parts	II
Parting Lines	II-2
Draft Angles	II-3
Wall Thickness	II-3
Fillets and Radii	II-3
Bosses	II-4
Ribs	II-4
Openings	II-5
Shrinkage	II-5
Gating	II-5
Vents	II-6
Potential Knit Lines	II-6
Structural Design	III
Stress	III-2
Stress-Strain	III-2
Normal Stress	III-3
Shear Stress	III-3
Torsional Stress	III-4
Bending Stress	III-5
Section Properties of Various Cross-Sections	III-6
Explanation of Variables	III-6
Beam Sections	III-6
Formulas for Common Beams in Bending	III-7
Formulas for Torsional Deformation and Stress	III-8
I, T and L Sections	III-9
Formulas for Flat Plates	III-10
Flat Plate Equations	III-10
Pressure Vessels	III-11
Thermal Expansion and Stress	III-12
Impact Stresses	III-13
Stress Concentrations	III-14
Rib Design	III-15
Design for Equivalent Stiffness	III-18



Topic	Part/Page
Design Examples .....	.IV
Cruise Control Bracket .....	.IV-2
Cover Cap .....	.IV-4
Assembly .....	.V
Snap-Fit Assembly .....	.V-2
Snap-Fit Design .....	.V-2
Cantilever vs. Cylindrical .....	.V-2
Tapered Cantilever .....	.V-2
Short Cantilever Design .....	.V-3
New Formulas .....	.V-4
Snap-Fit Design Example .....	.V-4
Press-Fit Assembly .....	.V-5
Adhesive Bonding .....	.V-6
Bolts, Nuts, and Machine Screws .....	.V-8
Molded-in Threads .....	.V-9
Self-Tapping Screws .....	.V-10
Inserts .....	.V-11
Ultrasonic Welding .....	.V-12
Shear Joint .....	.V-12
Energy Director .....	.V-13
Vibration Welding .....	.V-14
Other Assembly Techniques .....	.V-15
Thermoplastic Staking .....	.V-15
Spin Welding .....	.V-15
Electromagnetic Welding .....	.V-16
Plastic Materials .....	.VI
Classification of Plastic Materials .....	.VI-2
Molecular Weight Distribution .....	.VI-4
Physical Properties .....	.VI-5
Density .....	.VI-5
Thermal Expansion .....	.VI-5
Thermal Conductivity .....	.VI-6
Physical Properties .....	.VII
The Mechanical Properties of Plastics .....	.VII-2
Short-Term Properties .....	.VII-2
Notches .....	.VII-2
Rate of Loading .....	.VII-2
Temperature .....	.VII-4
Thermal Aging .....	.VII-4
Moisture .....	.VII-5
Dimensional Considerations (Moisture Absorption) .....	.VII-6

Topic	Part/Page
Effects of Moisture	VII-6
Dimensional Changes	VII-6
Accelerated Moisture Conditioning	VII-6
Process Induced Property Variations	VII-7
Additives (Color)	VII-8
Ultraviolet (UV) Light	VII-8
Chemicals	VII-8
Long-Term Properties—Creep, Stress Relaxation and Service Life ...	VII-9
Coefficient of Friction	VII-11
Design Considerations for Gas Assist Molding	VIII
Hollow Molding	VIII-2
Short Shot Molding	VIII-3
Full Shot Molding	VIII-3
Finishing	IX
Electroplating	IX-2
Painting	IX-2
Printing/Hot Stamping	IX-2
Machining	IX-3
Surface Treatment	IX-3
Appendix I: Physical Properties and Terminology	A1
Anisotropy	A1-2
Brittleness	A1-2
Density	A1-2
Ductility	A1-2
Elasticity	A1-2
Friction and Wear	A1-2
Hardness	A1-2
Isotropy	A1-2
Lubricity	A1-2
Mold Shrinkage	A1-3
Notch Sensitivity	A1-3
Plasticity	A1-3
Specific Gravity (Relative Density)	A1-3
Toughness	A1-3
Warpage	A1-3
Water Absorption	A1-3
Appendix II: ISO and ASTM Test Methods	A2
	A2-2
Bibliography	B1
	B1-2



Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.