ENGINEERING RESINS

An Industrial Guide

by

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Preface

This volume describes more than 2,500 engineering resins which are currently available for industrial usage. The definition of engineering resins differs depending on whom one asks. The book contains those products which are termed "engineering plastics" as well as "upgraded commodity resins." The book will be of value to industrial technical and managerial personnel involved in the specification and use of these products. It has been compiled from information received from numerous industrial companies and other organizations.

The data included represent selections from manufacturers' descriptions made at no cost to, nor influence from, the makers or distributors of the materials.

Only the most recent information has been included. Products covered include blends, composites, alloys, and resins with superior impact resistance, heat or cold resistance, and/or stiffness. The products have been manufactured to meet high performance requirements in major end-use industries–automotive, packaging, electronics, computers and business equipment, aerospace and medical supplies. Many can be tailored to specific end-uses on request. It is believed that all of the products listed here are currently available, which will be of interest to readers concerned with product discontinuances.

Products are presented by company, and the companies are listed alphabetically. The table of contents is organized in such a way as to serve as a company index to the book. Also included is a Trade Name Index, for easy and rapid location of products by the reader. In addition, another section, which will be useful, contains the Suppliers' Addresses. It can be found immediately following the Product Information Section.

The book lists the following product information, as available, in the manufacturer's own words:

(1) Company name and product category.

(2) Trade name and product numbers.

(3) Product Description: a description of the product, as presented by the supplier.

My fullest appreciation is expressed to the companies and organizations who supplied the data included in this book.

Newburyport, Massachusetts
August 1988

Ernest W. Flick

NOTICE

To the best of our knowledge the information in this publication is accurate; however, the Publisher does not assume any responsibility for the accuracy or completeness of, or consequences arising from, such information. This Industrial Guide does not purport to contain detailed user instructions, and by its range and scope could not possibly do so. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Publisher.

Some engineering resins could be toxic, and therefore due caution should always be exercised in the use of potentially hazardous materials. Final determination of the suitability of any information or product for use contemplated by any user, and the manner of that use, is the sole responsibility of the user. We strongly recommend that users seek and adhere to a manufacturer's or supplier's current instructions for handling each material they use.

The Author and Publisher have used their best efforts to include only the most recent data available. The reader is cautioned to consult the supplier in case of questions regarding current availability.

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Product Information

ALLIED-SIGNAL INC.: CAPRON Nylon Copolymers for Molding and Extrusion:

CAPRON Nylon is based on type 6 polyamide resin, the most versatile and performance-proven of engineering thermoplastics.

CAPRON Copolymers:

Copolymerization of CAPRON Nylon results in a polymer structure exhibiting varying levels of toughness and flexibility, combined with the excellent thermal and chemical resistance properties provided by the polyamide backbone.

8253:
Injection molding and extrusion grade copolymer developed for applications requiring improved dry as molded toughness over nylon homopolymers, while maintaining excellent strength and stiffness.

8254:
Extrusion grade copolymer developed for tubing applications requiring a balance of performance properties including high flexibility, toughness, and abrasion resistance (Developed as CPN 1220)

8255:
Injection molding grade copolymer developed for applications requiring a high degree of flexibility and toughness. (Developed as CPN 1235)

8259:
Injection molding grade copolymer developed for fastener applications requiring resistance to abusive impact loading, combined with a high level of pullout strength (Developed as CPN 909A)

8350:
Injection molding and extrusion grade resin exhibiting the highest impact performance within the copolymer product line combined with an excellent balance of strength and stiffness. (Developed as CPN 1450)

Applications:
* Plugs, receptacles, flexible connector covers, weed trimmer components, clips, fasteners, flanges, key housings, and other high performance molding applications.

* Convoluted and emissions tubing, cable jacketing, automotive vacuum tubing, hydraulic and air conditioning hose, and other tubing and jacketing applications requiring heat, chemical and abrasion resistance.

ALLIED-SIGNAL INC.: CAPRON Nylon Copolymers for Molding and Extrusion(Continued):

Properties of CAPRON Copolymers (73F, Dry as Molded):

8253:

Tensile Strength at Yield: psi: 9,500
Ultimate Elongation: %: 150
Flexural Strength: psi: 12,000
Flexural Modulus: psi: 320,000

8254:

Tensile Strength at Yield: psi: 5,300
Ultimate Elongation: %: 240
Flexural Strength: psi: 4,200
Flexural Modulus: psi: 110,000

8255:

Tensile Strength at Yield: psi: 5,000
Ultimate Elongation: %: 230
Flexural Strength: psi: 4,000
Flexural Modulus: psi: 120,000

8259:

Tensile Strength at Yield: psi: 8,500
Ultimate Elongation: %: 150
Flexural Strength: psi: 11,000
Flexural Modulus: psi: 300,000

8350:

Tensile Strength at Yield: psi: 8,000
Ultimate Elongation: %: 260
Flexural Strength: psi: 9,500
Flexural Modulus: psi: 260,000

ALLIED-SIGNAL INC.: CAPRON Nylon Homopolymers for Molding and Extrusion:

CAPRON Nylon is based on type 6 polyamide resin, the most versatile and performance-proven of engineering thermoplastics.

CAPRON Homopolymers:

CAPRON homopolymers are standard nylon 6 grades, used in a wide variety of molding and extrusion applications. These resins exhibit the combination of strength, stiffness, and toughness that is associated with nylon 6 as well as excellent chemical and abrasion resistance. There are three categories of CAPRON homopolymers: Standard, Alpha and Wire Jacketing Grades.

A. Standard Grades:

8200:
Medium viscosity injection molding grade exhibiting resistance to sink-mark formations in thick sections and improved toughness over conventional lower viscosity grades. Gears, mechanical components, fittings, handles, and wiring devices are produced from this grade.

8202:
Low viscosity injection molding grade for fast fill and thin sections. Clips and fasteners, fuel filters, electrical receptacles, connectors, and wire ties are typical end-uses.

8202L:
8202 type with excellent flow and mold release characteristics. Meets UL flammability requirements for 94 V-2 in sections as thin as 1/32 inch. UL regulated electrical applications include switches, plugs, and receptacles.

B. Alpha Grades:

Alpha grades differ from conventional type 6 materials in crystalline form. As a result, they offer an increase in strength, stiffness, and heat distortion temperature while improving the excellent processing properties normally associated with CAPRON Nylon. Alpha grades are denoted by the suffix "C", and include:

8202C:
Low viscosity, highly crystalline resin: fastest molding grade available. Gears, furniture casters, and electrical devices are among the numerous end-uses for this grade.

ALLIED-SIGNAL INC.: CAPRON Nylon Homopolymers for Molding and Extrusion(Continued):

B. Alpha Grades(Continued):

8202CL:
8202C type: meets UL flammability requirements for 94 V-2 in sections as thin as 1/32 inch.

8203C:
Intermediate viscosity, highly crystalline resin: exhibits fast set up for extrusion of tubing and cable liners.

C. Wire Jacketing Grades:

8220HS:
Medium viscosity heat stabilized extrusion grade for THHN, THWN building wire, shipboard cable, and non-metallic, sheath cable primary jacketing.

8221HS:
Medium viscosity heat stabilized, modified 8220. Utilized large diameter wire applications where increased flexibility required.

Properties of CAPRON Homopolymers(73F, Dry as Molded):

Standard Grades:

8200:
Tensile Strength at Yield: psi: 12,000
Ultimate Elongation: %: 150
Flexural Strength: psi: 16,000
Flexural Modulus: psi: 410,000

8202:
Tensile Strength at Yield: psi: 11,500
Ultimate Elongation: %: 70
Flexural Strength: psi: 15,700
Flexural Modulus: psi: 410,000

8202L:
Tensile Strength at Yield: psi: 11,500
Ultimate Elongation: %: 50
Flexural Strength: psi: 15,700
Flexural Modulus: psi: 410,000

ALLIED-SIGNAL INC.: CAPRON Nylon Homopolymers for Molding and Extrusion(Continued):

Properties of CAPRON Homopolymers (73F, Dry as Molded) (Continued):

Alpha Grades:

8202C:

Tensile Strength at Yield: psi: 13,000
Ultimate Elongation: %: 15
Flexural Strength: psi: 16,000
Flexural Modulus: 460,000

8202CL:

Tensile Strength at Yield: psi: 12,500
Ultimate Elongation: %: 10
Flexural Strength: psi: 17,000
Flexural Modulus: psi: 440,000

8203C:

Tensile Strength at Yield: psi: 12,000
Ultimate Elongation: %: 200
Flexural Strength: psi: 17,000
Flexural Modulus: psi: 460,000

Wire Jacketing Grades:

8220 HS:

Tensile Strength at Yield: psi: 12,000
Ultimate Elongation: %: 80
Flexural Strength: psi: 15,500
Flexural Modulus: psi: 410,000

8221 HS:

Tensile Strength at Yield: psi: 8,500
Ultimate Elongation: %: 200
Flexural Strength: psi: 10,000
Flexural Modulus: psi: 290,000

ALLIED-SIGNAL INC.: Mineral Reinforced CAPRON Nylon for Injection Molding:

CAPRON Nylon is based on type 6 polyamide resin, the most versatile and performance-proven of engineering thermoplastics.

Mineral Reinforced CAPRON Nylon:
The addition of mineral reinforcement enhances the performance characteristics of CAPRON Nylon molding compounds. Mineral reinforced CAPRON products exhibit high stiffness, dimensional stability, and performance at elevated temperatures combined with low warpage and resistance to sink mark formation.

8260:
40% mineral reinforced: excellent balance of engineering properties with the unique ability to be pigmented, painted, or chrome plated.

8360:
34% mineral reinforced: improved toughness and ductility combined with excellent procesability and surface aesthetics.

Applications:
* Marine hardware, brackets, fittings, bobbins, office furniture, appliance components, power tool housings.
* Automotive fuel filler pockets, door and window hardware, wheel hubs and covers, mirror housings, and interior lighting components.

Decorating Techniques:
* Colorability
* Painting
* Plating

Properties of CAPRON Mineral Reinforced Grades (73F, Dry as Molded):

8260:
Tensile Strength at Yield: psi: 13,000
Ultimate Elongation: %: 10
Flexural Strength: psi: 20,000
Flexural Modulus: psi: 800,000

8360:
Tensile Strength at Yield: psi: 13,000
Ultimate Elongation: %: 15
Flexural Strength: psi: 19,000
Flexural Modulus: psi: 725,000

ALLIED-SIGNAL INC.: Reinforced CAPRON Nylon for Injection Molding:

CAPRON Nylon is based on type 6 polyamide resin, the most versatile and performance-proven of engineering thermoplastics.

Reinforced CAPRON Nylon:
The addition of glass fiber or a combination of glass fiber and selected mineral reinforcement enhances the performance characteristics of CAPRON Nylon molding compounds. Glass reinforced CAPRON products exhibit high strength, stiffness, and performance at elevated temperatures. Mineral/Glass reinforced products offer a balance of engineering properties combined with low warpage and resistance to sink-mark formation.

A. Glass Reinforced:

8230G HS:
6% glass reinforced: improved stiffness and dimensional stability in thin sections.

8231G HS:
14% glass reinforced: improved mechanical properties with excellent processability and surface aesthetics.

8233G HS:
33% glass reinforced: high strength and rigidity combined with excellent dimensional stability, creep resistance and surface appearance.

8234G HS:
44% glass reinforced: the highest level of strength, rigidity, and mechanical performance.

B. Mineral/Glass Reinforced:

8266G HS:
40% mineral/glass reinforced: an excellent balance of mechanical properties combined with good sink mark and warp resistance.

8267G HS:
40% mineral/glass reinforced: similar to 8266G HS but specifically formulated to improve surface appearance when pigmentation is required.

ALLIED-SIGNAL INC.: Reinforced CAPRON Nylon for Injection Molding(Continued):

Applications:

* Handles and housings for power tools, chain saws, lawn and garden equipment.
* Automotive under-hood components including cooling fans and shrouds, timing chain covers, and vacuum reservoirs.
* Painted exterior automotive body parts, door and window hardware, gears, connectors, and many other similar applications.

Properties of CAPRON Reinforced Grades (73F, Dry as Molded):

Glass-Reinforced Grades:

8230G HS:
Tensile Strength at Yield: psi: 12,000
Ultimate Elongation: %: 5.0
Flexural Strength: psi: 18,000
Flexural Modulus: psi: 580,000

8231G HS:
Tensile Strength at Yield: psi: 18,000
Ultimate Elongation: %: 3.5
Flexural Strength: psi: 25,000
Flexural Modulus: psi: 800,000

8233G HS:
Tensile Strength at Yield: psi: 29,000
Ultimate Elongation: %: 3.0
Flexural Strength: psi: 40,000
Flexural Modulus: psi: 1,360,000

8234G HS:
Tensile Strength at Yield: psi: 33,000
Ultimate Elongation: %: 2.0
Flexural Strength: psi: 41,000
Flexural Modulus: psi: 1,720,000

Mineral/Glass Grades:

8266G HS:
Tensile Strength at Yield: psi: 19,000
Ultimate Elongation: %: 4.0
Flexural Strength: psi: 27,500
Flexural Modulus: psi: 1,330,000

8267G HS:
Tensile Strength at Yield: psi: 20,000
Ultimate Elongation: %: 4.0
Flexural Strength: psi: 30,000
Flexural Modulus: psi: 1,110,000

ALLIED-SIGNAL, INC.: NYPEL Nylon Injection Molding Compounds:

NYPEL Nylon injection molding compounds are based on selected type 6 nylon feedstocks and are specifically formulated to combine quality, performance, and processability at a lower cost.

NYPEL Homopolymers:

NYPEL unreinforced resins are standard nylon 6 homopolymers used in a wide variety of molding applications. These resins possess an overall balance of strength, stiffness and toughness combined with excellent chemical and abrasion resistance.

2314:

Low viscosity injection molding grade for fast fill and thin sections. Fittings, cord reels, connectors, gears, pulleys, and washers are typical end uses.

2314 FCAT:

Low viscosity injection molding compound possessing a modified crystalline structure for increased performance and faster cycles. Bushings, fittings, wall plugs and tension rollers are among the numerous end uses.

NYPEL Reinforced Grades:

Glass fiber, mineral reinforcement, or a combination of glass fiber and mineral reinforcement, strengthen the performance characteristics of NYPEL molding compounds. Glass reinforced NYPEL products combine high strength, stiffness and performance at elevated temperatures. Mineral reinforced products possess rigidity and dimensional stability. Mineral/glass reinforced products offer a combination of engineering properties with low warpage and resistance to sink mark formation.

2360:

40% mineral reinforced: high stiffness, dimensional stability, and heat resistance combined with excellent processability and the ability to be painted. Applications include fuel filler pockets, wheel covers and supports, and housings. (Developed as NPN 1519)

2365G:

36% mineral and glass reinforced: offers excellent mechanical properties with good sink mark and warp resistance. Fans, shrouds, brackets and wheel hubs are some of the numerous applications.

6033G:

33% glass reinforced: high strength and rigidity combined with excellent creep resistance and dimensional stability. Bolts, switch components, gears and pressure regulators are typical applications.