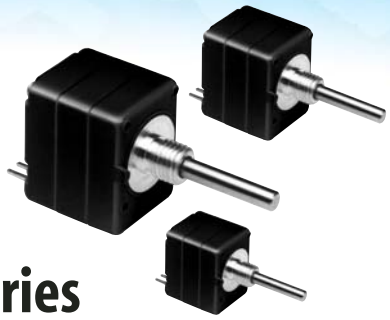
BOURNS®

# Product Update Memo

SENSORS & CONTROLS PRODUCTS

June, 2006

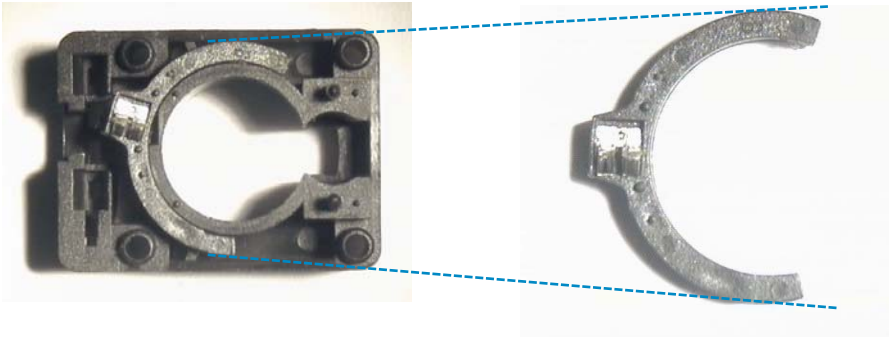
Bourns Manufacturers Representatives
Corporate Distributor Product Managers
Americas Sales Team
Asia Sales Team
Europe Sales Team



## Model EN Optical Encoder Series Material Change

Sensors and Controls Division will be changing the plastic material used in molding the LED trimming rotor of the Model EN Optical Encoder. A change will be made from Fortron 1140L4 to Thermocomp® OF-1008 due to phase out of Fortron material at our current supplier and lack of availability from other suppliers.

Thermocomp® material is equivalent to the Fortron material and has been qualified for use in the standard EN Series product. Please reference the attached photo identifying the rotor. There is no change in form, fit or function.



The transition to Thermocomp® material is currently in progress for standard catalog part numbers. Thermocomp® is a UL rated (V-0) engineering material. Attached you will find data sheets for both Fortron and Thermocomp® plastics for your review. The UL certification for Thermocomp is QMFZ2.E45195 and is available on the UL website at www.ul.com

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*Thermocomp® is a registered trademark of General Electric Custom Engineered Products Division.*

# FORTRON®

Polyphenylene Sulfide (PPS)

## Grade Compositions

POLYPLASTICS CO., LTD.

# FORTRON®
## Grade Compositions

**FORTRON® completely changed the industry's prior view of polyphenylene sulfide (PPS) as being a brittle material. FORTRON® is firmly establishing is base as a new type of PPS resin that overcomes this brittleness. This is because while traditional PPS has a partially cross linked molecular structure, FORTRON® possesses a non-cross linked linear structure. Needless to say, FORTRON® is superior in its heat resistance, flame retardance, and chemical resistance, and it also contains only very low levels of ionic impurities and exhibits superior solderability. These properties are seeing growth for FORTRON® continue centered on demanding electronic component applications.**

- Mechanical strength is exceedingly high, with flexural strength in particular exhibiting a high value, excellent elastic recovery is also possessed.
- Elongation and impact strength are high, and brittleness, a major drawback of traditional PPS, has been improved significantly.
- Can withstand immersion in 260°C solder bath for 10 s, making the resin more than able to cope with electronic component surface mount technologies.
- Ionic impurities are low, and application is possible in applications where strict electrical properties are demanded.
- Weld strength is high, and superior secondary processability (screws, insertion, etc.) is exhibited.

| Item | Unit | Testing Method | Unreinforced | Glass fibers filled | | | | | | | Glass fibers and Inorganic fillers filled | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0220A9 | 1130A64 | 1140A64 | 1150A64 | 1140A7 | 1140A6 | 1130A1 | 1140A1 | 6165A4 | 6165A6 | 6165A7 |
| | | | Toughness | Standard, Low flash | | Low warp, Low flash | Ultrahigh flow, Low flash | High strength | High toughness | | Dimensionally precise, Standard, Low flash | | Dimensionally precise, Low flash |
| | | | Unfilled | GF30% | GF40% | GF50% | GF40% | GF40% | GF30% | GF40% | GF/M65% | GF/M65% | GF/M60% |
| Density | g/cm³ | ISO 1183 | 1.35 | 1.57 | 1.66 | 1.75 | 1.66 | 1.66 | 1.57 | 1.66 | 1.98 | 1.98 | 1.89 |
| Water absorption (23˚C, 24hrs) | % | ISO 62 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Melt viscosity (310˚C, 1,000/sec) | Pa·s | ISO11443 | 500 | 240 | 240 | 260 | 160 | 260 | 350 | 380 | 400 | 300 | 300 |
| Mold Shrinkage (80×80×2mmt) Flow direction | % | | 1.1 | 0.4 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 |
| Mold Shrinkage (80×80×2mmt) Transverse direction | % | | 1.4 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 0.6 | 0.7 | 0.5 | 0.5 | 0.6 |
| Stress at yield | MPa | ISO527-1,2 | 90 | 170 | 200 | 145 | 170 | 210 | 170 | 185 | 130 | 130 | 155 |
| Strain at break | % | ISO527-1,2 | 15* | 1.9 | 1.8 | 1.2 | 1.4 | 1.9 | 2.0 | 1.8 | 1.1 | 1.1 | 1.2 |
| Flexural strength | MPa | ISO 178 | 140 | 230 | 280 | 215 | 240 | 290 | 245 | 260 | 190 | 190 | 220 |
| Flexural modulus | MPa | ISO 178 | 3,800 | 10,500 | 14,000 | 16,000 | 14,000 | 14,000 | 10,000 | 13,000 | 18,300 | 18,300 | 17,300 |
| Charpy notched impact strength | kJ/m² | ISO179/1eA | 3.3 | 7.0 | 9.5 | 5.0 | 9.0 | 11.0 | 10.0 | 10.0 | 4.5 | 4.5 | 5.5 |
| Temperature of deflection under load (1.8MPa) | ˚C | ISO 75-1 | 100 | 265 | 270 | 270 | 275 | 270 | 260 | 265 | 270 | 270 | 270 |
| Coefficient of linear thermal expansion Flow direction | ×10⁻⁵/˚C | ISO11359-2 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| Coefficient of linear thermal expansion Transverse direction | ×10⁻⁵/˚C | ISO11359-2 | 6 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 3 |
| Flammability | — | UL94 | V-0 | V-0 | V-0 | V-0 | V-0 | V-0 | V-0 | V-0 | V-0 | V-0 | V-0 |
| Dielectric constant (1KHz) | | IEC 60250 | 3.6 | 4.2 | 4.5 | 4.6 | 4.3 | 4.2 | 4.0 | 4.6 | 5.8 | 5.8 | 5.3 |
| Dielectric constant (1MHz) | | IEC 60250 | 3.6 | 4.2 | 4.5 | 4.7 | 4.3 | 4.2 | 4.0 | 4.6 | 5.8 | 5.8 | 5.4 |
| Dielectric loss tangent (1KHz) | | IEC 60250 | 0.0004 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 |
| Dielectric loss tangent (1MHz) | | IEC 60250 | 0.001 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Electric strength (Short-time test: 3mm) | kV/mm | IEC 60243-1 | 19 | 15 | 16 | 16 | 15 | 16 | 16 | 15 | 14 | 14 | 14 |
| Volume resistivity | Ω·cm | IEC 60093 | $2\times10^{16}$ | $8\times10^{15}$ | $4\times10^{16}$ | $2\times10^{16}$ | $4\times10^{15}$ | $4\times10^{16}$ | $3\times10^{16}$ | $1\times10^{16}$ | $8\times10^{15}$ | $8\times10^{15}$ | $2\times10^{15}$ |
| Surface resistivity | Ω | IEC 60093 | $7\times10^{16}$ | $8\times10^{16}$ | $3\times10^{17}$ | $3\times10^{17}$ | $1\times10^{15}$ | $3\times10^{17}$ | $2\times10^{17}$ | $8\times10^{16}$ | $9\times10^{15}$ | $9\times10^{15}$ | $8\times10^{16}$ |
| Tracking resistance | V | IEC 60112 | 125 | 125 | 150 | 125 | 125 | 150 | 150 | 150 | 200 | 200 | 175 |

*Nominal strain at break

- All figures in the table are the typical values of the material and not the minimum values of the material specifications.
- For qualified values of UL (Underwriters Laboratories Inc.) refer to the yellow card (File No.E 109088) issued by UL.

**Asterisked grades come under Item 5 (18) of Annex 1 of the Export Trade Control Order on the basis of the Foreign Exchange and Foreign Trade Law of Japan.
All other grades come under Item 16 of Annex 1 of the Export Trade Control Order of Japan.

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http://www.polyplastics.com/en/product/

| Item | | Glass fibers and Inorganic fillers filled | | | | Special | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6465A62 | 6660A42 | 6565A6 | 6565A7 | 0220U9 | 1130T6 | 6150T6 | 6935A4 | 6345A4 | 3130A1 | **2130A1 | **7140A4 | 7340A4 |
| | | Low warp, Higher gloss, Cosmetic | Enhanced cosmetic, Low anisotropy | Low temperature mold, Adhesion-enhanced | | High impact | | | Low wear | | | Conductive, Low wear | | Conductive |
| | | GF/M60% | GF/M60% | GF/M65% | GF/M60% | Unfilled | GF30% | GF/M50% | GF/M20% PTFE | GF30% PTFE | Whiskers 30% | CF30% | CF30% PTFE | GF/M40% |
| Density | | 1.87 | 1.86 | 1.96 | 1.89 | 1.31 | 1.52 | 1.71 | 1.59 | 1.68 | 1.62 | 1.44 | 1.49 | 1.69 |
| Water absorption (23˚C, 24hrs) | | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.03 |
| Melt viscosity (310˚C, 1,000/sec) | | 200 | 320 | 280 | 200 | 500 | 400 | 240 | 260 | 220 | 200 | 380 | 280 | 340 |
| Mold Shrinkage (80×80×2mmt) | Flow direction | 0.4 | 0.7 | 0.3 | 0.3 | 1.1 | 0.3 | 0.2 | 0.6 | 0.3 | 0.4 | 0.1 | 0.1 | 0.3 |
| | Transverse direction | 0.7 | 0.7 | 0.5 | 0.5 | 1.6 | 0.7 | 0.6 | 0.7 | 0.7 | 1.0 | 0.6 | 0.5 | 0.7 |
| Stress at yield | | 140 | 90 | 125 | 130 | 75 | 155 | 155 | 120 | 155 | 125 | 215 | 180 | 135 |
| Strain at break | | 1.5 | 1.1 | 1.0 | 1.1 | 21* | 2.3 | 1.7 | 2.1 | 1.8 | 1.7 | 1.3 | 1.0 | 1.5 |
| Flexural strength | | 215 | 140 | 165 | 180 | 120 | 220 | 205 | 175 | 215 | 230 | 300 | 270 | 195 |
| Flexural modulus | | 14,400 | 13,200 | 18,200 | 17,800 | 3,400 | 8,800 | 11,200 | 7,500 | 10,300 | 11,500 | 21.200 | 22,800 | 12,000 |
| Charpy notched impact strength | | 6.0 | 2.8 | 4.5 | 5.0 | 7.0 | 12.0 | 8.0 | 4.5 | 8.5 | 2.5 | 5.5 | 4.5 | 5.0 |
| Temperature of deflection under load (1.8MPa) | | 270 | 260 | 275 | 275 | 95 | 255 | 265 | 250 | 265 | 210 | 265 | 270 | 265 |
| Coefficient of linear thermal expansion | Flow direction | 2 | 2 | 1 | 1 | 4 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 |
| | Transverse direction | 3 | 2 | 3 | 3 | 6 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 |
| Flammability | | V-0 | V-0 | V-0 | V-0 | — | V-2 | — | V-0 | V-0 | V-0 (3mm) | V-0 | V-0 | V-1 |
| Dielectric constant (1KHz) | | 4.9 | 5.3 | 5.4 | 4.9 | 3.5 | 3.9 | 4.5 | 3.7 | 4.2 | 7.6 | — | — | — |
| Dielectric constant (1MHz) | | 4.9 | 5.2 | 5.4 | 4.7 | 3.5 | 3.9 | 4.4 | 3.7 | 4.2 | 6.4 | — | — | — |
| Dielectric loss tangent (1KHz) | | 0.002 | 0.006 | 0.013 | 0.014 | 0.001 | 0.003 | 0.004 | 0.004 | 0.001 | 0.021 | — | — | — |
| Dielectric loss tangent (1MHz) | | 0.001 | 0.004 | 0.005 | 0.006 | 0.002 | 0.004 | 0.005 | 0.002 | 0.002 | 0.096 | — | — | — |
| Electric strength (Short-time test: 3mm) | | 20 | 13 | 19 | 14 | 18 | 18 | 16 | 18 | 20 | 9 | — | — | — |
| Volume resistivity | | $3\times10^{16}$ | $5\times10^{16}$ | $2\times10^{16}$ | $7\times10^{15}$ | $2\times10^{16}$ | $8\times10^{15}$ | $7\times10^{15}$ | $1\times10^{16}$ | $4\times10^{15}$ | $9\times10^{15}$ | $2\times10^{3}$ | $8\times10^{2}$ | $1\times10^{2}$ |
| Surface resistivity | | $1\times10^{16}$ | $1\times10^{16}$ | $2\times10^{16}$ | $1\times10^{17}$ | $8\times10^{15}$ | $4\times10^{16}$ | $1\times10^{17}$ | $1\times10^{17}$ | $8\times10^{15}$ | $1\times10^{16}$ | $2\times10^{2}$ | $2\times10^{2}$ | 9×10 |
| Tracking resistance | | 125 | 175 | 225 | 175 | 125 | 125 | 150 | 125 | 125 | 150 | — | — | — |

*Nominal strain at break

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## NOTES TO USERS

- All property values shown in this brochure are the typical values obtained under varying conditions prescribed by applicable standards and test methods.
- This brochure has been prepared based on our own experiences and laboratory test data, and therefore all data shown here are not always applicable to parts used under different conditions. We do not guarantee that these data are directly applicable to the application conditions of users and we ask each user to make his own decision on the application.
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- For safe handling of materials we supply, it is advised to refer to the Material Safety Data Sheet **"MSDS"** of the proper material.
- This brochure is edited based on reference literatures, information and data currently available to us. So the contents of this brochure are subject to change without notice due to new data.
- Please contact our office for any questions about products we supply, descriptive literatures or any description in this brochure.

∗ "FORTRON®" is a registered trademark of Kureha Chemical Industry Co., Ltd. in Japan and other countries, and is a trademark used by Polyplastics Co.,Ltd. with the owner's consent.


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Thursday

# Thermocomp® OF-1008

**LNP Engineering Plastics Inc. - *Polyphenylene Sulfide***

**Actions**

-- - ISO Data Sheet

**Product Characteristics**

| | |
|---|---|
| Material Status | • Commercial: Active |
| Availability | • North America |
| Test Standards Available | • ASTM |
| Filler/Reinforcement | • Glass fiber reinforcement |
| Forms | • Pellets |
| Processing Method | • Injection Molding |

## Properties [1]

| Physical | Nominal Values (English) | | Test Method |
|---|---|---|---|
| Density -Specific Gravity (Method A) | 1.70 | sp gr 23/23°C | ASTM D792 |
| Mold Shrink, Linear-Flow | 0.0030 | in/in | ASTM D955 |
| Mold Shrink, Linear-Trans | 0.010 | in/in | ASTM D955 |

| Mechanical | Nominal Values (English) | | Test Method |
|---|---|---|---|
| Tensile Strength @ Break | 23300 | psi | ASTM D638 |
| Tensile Elongation @ Brk | 1.5 | % | ASTM D638 |
| Flexural Modulus | 2060000 | psi | ASTM D790 |
| Flexural Strength | 34000 | psi | ASTM D790 |
| Coef. of Friction | | | ASTM D1894 |
| (vs. Steel - Dynamic) | 0.41 | | |
| (vs. Steel - Static) | 0.50 | | |
| Wear Factor (10^-10) (40 psi, 50 ft/min) | 373 | in^5-min/ft-lb-h | |

| Impact | Nominal Values (English) | | Test Method |
|---|---|---|---|
| Notched Izod Impact (0.125 in) | 1.80 | ft-lb/in | ASTM D256 |
| Unnotched Izod Impact (0.125 in) | 9.82 | ft-lb/in | ASTM D256 |

| Thermal | Nominal Values (English) | | Test Method |
|---|---|---|---|
| DTUL @264psi - Unannealed | 508 | °F | ASTM D648 |

**Additional Properties**

The values displayed above as Coef. of Friction and Wear Factor were tested in accordance with LNP WI-0687.
COEFFICIENT OF FRICTION vs. Steel, Dynamic @ 40 psi, 50 ft/min, LNP WI-0687: 0.41
COEFFICIENT OF FRICTION vs. Steel, Static @ 40 psi, 50 ft/min, LNP WI-0687: 0.5
WEAR FACTOR @ 40 psi, 50 ft/min, LNP WI-0687: 373 10^-10 in^5-min/ft-lb-hr

## Processing Information

| Injection Molding Parameters | Nominal Values (English) | | Test Method |
|---|---|---|---|
| Drying Temperature | 250 to 300 | °F | |
| Drying Time | 4.0 | hr | |
| Processing (Melt) Temp | 600 to 610 | °F | |
| Mold Temperature | 275 to 325 | °F | |
| Back Pressure | 25.0 to 50.0 | psi | |

## Notes

[1] Typical properties; not to be construed as specifications.

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