

## **MPC** Conductive Rollers/Belts for Printers and Paper Transport

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MPC's specialty product lines, semi-conductive urethane parts, have volume resistivity in semi-conducting ranges of 5E5 to 5E10 at a hardness of 5 to 85 Shore A for solid urethanes and 20 Shore OO to 70 Shore A for foam. Our patented formulations and process for conductive urethane products include Durethane Conductive Solid (DCS), Durethane Conductive Microcellular (DCM) and Durethane Conductive Foam (DCF). These unique products cover both charge management and electrostatic charge dissipation (ESD), or antistatic, applications.

First, **charge management** controls the specific charge density on the roller or belt surface to pick up specified amounts of dry or liquid toner on conductive urethane surfaces, or to transfer toner onto paper/film surfaces for further image fixing.

Among urethane components made for charge management application are:

- Developer, charge, and toner adder rollers for laser printers and copier cartridges using dry, monochrome, or color toners, including developer rolls for high-resolution color printers. The rollers can have single- or multilayer coatings. Image transfer belts can also be produced for these applications.
- Bias transport rollers for toner transfer to paper or film in image fixing for laser printers and copiers as well as the film transport roller for X-ray film imaging.
- Conductive endless or seamless solid and foam belts with or without a linen core, having multiple layers of coating or made from composites.

Volume resistivity ranges from 5E5 to 5E8 ohm-cm.

Second, the **electrostatic dissipation** (ESD) or **antistatic** application dissipates the tribocharge accumulated on the material surface to eliminate fire hazard and prevent paper/film jam during medium transport. In general, tribocharge builds up on the surface when two different substances collide against each other, causing electrons to transfer from one surface to another. This leaves equal positive and negative charges on opposite sides of the materials.

Tribocharge more readily accumulates on the material surface and rises to a higher voltage if the material is insulated, especially in cold and dry environments. When the voltage reaches a high level, it can discharge, potentially causing fires or damaging surrounding electronic components. Therefore, in many cases, the electronic product or carrying case will require semi-conductive materials to protect electrical components.



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Examples for [electrostatic dissipation](#) (ESD) or [antistatic](#) applications:

Paper-handling rollers for office machines including laser printers, inkjet printers copiers, mail system machines, inserters, cash and bar code registers, thermal printers, fax machines, packing, conveyer belts, textile rollers, conductive textile fibers for clothing, high speed wheels, cash/credit card registers, conductive wheels for industrial vehicles, and so forth.

Conveyer belts for clean room environments to prevent charged dust particles from depositing on electronic components during manufacture.

Semi-conductive endless or seamless conveyer belts, belts with or without a linen core, having an integral skin foam and solid, and single or multiple layers of coating.

In general, volume resistivity for ESD or antistatic applications is in the range of  $5E8$  ohm-cm to  $5E10$  ohm-cm. By using antistatic urethane, one can eliminate the additional cost of a carbon black or metallic brush commonly used for ESD in medium transport systems.

## Superior MPC castable, conductive urethanes

MPC begins manufacturing the cast conductive urethane by uniformly mixing proprietary conductive additives into the liquid phase of precursor materials, including prepolymers, curatives and extenders. The chemicals then react to form cross-linked thermoset urethanes.

There are several advantages to cast conductive urethanes:

- Tooling is usually less expensive than injection mold tooling.
- There is a high degree of cross-linking during polymerization in casting, which provides much greater physical and mechanical strength compared to other elastomers at a similar hardness. These material properties include tensile strength, tear strength, elongation, compression modulus, tensile modulus abrasion resistance, compression set resistance, and a high coefficient of friction (COF).
- Because MPC adds its conductive chemicals to the precursors during the liquid phase, the product has a uniform conductivity throughout. Other manufacturers control conductivity by adding high concentrations of carbon black or metal powders (20-80 percent by weight). Due to the large particle size of the carbon black and the high weight of the metallic powders, they do not disperse uniformly inside the urethane matrix. Therefore their conductivity is uneven, and the migration of the carbon black and metal powder to the surface causes dark marking on the paper and results in low wear resistance. In MPC



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conductive urethane, each urethane molecule carries current in three dimensions evenly throughout the bulk urethane.

- Only very low concentrations (0.01-2 percent) of conductive additives are needed to effectively increase conductivity by thousands or millions of times. Because the charge weight of the conductive additives is so low, the physical and mechanical properties are almost untouched.
- The high weight concentrations of carbon black or metal powders and fibers needed to enhance conductivity significantly diminish the physical and mechanical properties of the conductive products.
- MPC conductive additives provide more stable conductivity and a smaller change in conductive properties than carbon black or metal powder in a high humidity/high temperature and low humidity/low temperature environments.
- Varying conductive ranges, different hardnesses, solid or open cells and closed foam as well as single and multiple layer urethane coating and composites are all available. There are also multiple color choices: colors can be red, green, yellow, blue and white—unlike the carbon black additive in rubber and plastics which limits the materials to being black or gray. (Also, migration of carbon black to the surface of components after abrasion wear will stain the transported medium.)

## **MPC delivers unique and consistent quality products**

At MPC, we manufacture our patented conductive formulation with state-of-the-art compounding and fabrication equipment to produce customized urethanes. We are constantly creating specialty formulations and processes in our Research and Development Lab to provide customer solutions with urethane having the desired conductivity, specified surface rheology including surface energy, coefficient of friction, surface roughness, compression set resistance, compression module, patented tension force, and abrasion wear resistance.

We apply computerized 3-4 stream metering machines for compounding and automatic pouring in continuous or shot-by-shot processes. The computer monitors and precisely controls process parameters such as flow rate, temperature, flow pressure, degree of vacuum and charge weight for the mold.

Operators control the chemical reaction rate by adjusting the catalyst level to obtain consistent gel and demolding times, post-cure time and oven temperature. Following these processes, the urethane forms a consistent hardness and stable conductivity, which provides a superior quality



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for electronic printing and medium transport applications. Other equipment and processes such as spin casting, centrifuging and transfer molding as well as B-stage casting and multiple-layer casting, are also applied for porosity-free urethanes used in various industries.

Our quality assurance technicians monitor and update the isocyanate radical (NCO) of the diisocyanate prepolymers many times per day in order to ensure the precise ratios of the flow for the compounding. After compounding, the urethane is cured and fabricated through CNC grinding and surface finishing equipment. Quality Control also measures and inspects the finished parts according to ISO 9002 standards and customer specifications. By applying statistical process control and continuous improvement, we deliver cost-effective, high-quality products on time.

### MPC manufactures cost-effective parts in both high and low volumes

MPC has various types of machines and tooling for producing both high- and low-volume parts. Our production runs vary from hundreds to millions of pieces a year. We provide customers with solutions through engineering, research and development, continuous improvement, and supplier involvement early in the design phase. Customer satisfaction is our job!

### Contact

**Sale personnel:** Mary W. McLaughlin, Director of Sales & Marketing. Ext. 3074

**Address:** 16 Western Industrial Drive, Cranston, RI 02921-3405, USA

**Phone:** 401-946-4400

**Fax:** 401-943-8210

**Homepage:** [mearthane.com](http://mearthane.com)

**E-mail:** [mmclaughlin@mearthane.com](mailto:mmclaughlin@mearthane.com)

