



Improving ECM Refrigeration Motors Performance with Advanced Plastics



Saving Generation for the Next Generation



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Extensive use of advanced plastics in electronically commutated (ECM) refrigeration motors improves resistance to moisture and extreme low temperatures, enhances safety and reduces motor noise.

Advanced plastics are being increasingly used in the motor industry, not only for insulation materials, replacing traditional materials such as papers or ceramics, but also for structural parts and enclosures, replacing metals such as steel and aluminum. Wellington is a world leader in the use of plastics in these applications. Wellington uses only high quality Du Pont™ Zytel® (nylon) and Rynite® (polyester) plastics in its ECR series of electronically commutated (ECM) refrigeration motors, and partners with Du Pont™ in developing the use of advanced plastics in its motors.

This white paper discusses the advantages of using plastics over traditional materials as structural parts and enclosures in ECM refrigeration motors.

1. Thermal Insulation

The major advantage of metals in traditional motors is their thermal properties. Metals are good thermal conductors. This makes them effective at transferring waste heat from the motor to the outside atmosphere. In low efficiency motors, or in high powered motors, this is an important property, as large amounts of waste heat must be dissipated. However, in a small energy saving ECM motor like Wellington's ECR, there is very little waste heat, so this property of metals is not important. In fact for motors of this type, rather than encouraging heat transfer, it can be preferable to minimise it. Using a plastic housing slows the heat transfer: this gives a more stable environment both inside the motor (protecting the bearings and electronics from thermal shocks and extreme low temperatures) and outside the motor (improving temperature control).

2. Low Temperature Tolerance

For low temperature applications, correct material selection is extremely important, as some metals (including most steels) and many plastics become brittle below about -10°C (14°F). The Zytel® and Rynite® grades used in Wellington's ECR motors are rated for low temperature use, retaining over 80% of their impact strength at -30°C (-22°F)¹. As discussed above, the thermal insulation properties of plastics are also helpful at low temperatures, as they allow the motor to warm up in operation, preventing it from being exposed to long periods of vibration while extremely cold.

3. High Temperature Tolerance

Most commonly used metals can tolerate temperatures far above what is encountered in motors. Only a few plastics are able to tolerate such extreme temperatures. However, a variety of advanced plastics are available which will tolerate the temperatures found in motors. For example, the highest internal temperature of Wellington's ECR motors is below 105°C or 221°F (Class A). But the Zytel® and Rynite® grades used in these motors are UL rated for normal operating temperatures up to 155°C or 311°F (Class F), so the safety margin for temperature is large.

4. Electrical Insulation

While aluminum and other metals conduct electricity, plastics are good electrical insulators. This is a major disadvantage of metals, as an earth connection is required to maintain safety when metal is used. This poses the risk that if the connection corrodes or is incorrectly fitted, the motor could become unsafe. Use of an advanced plastic housing and rotor hub allows Wellington's ECR series to meet double insulated standards, avoiding the need for an earth connection while keeping installation and maintenance personnel safe.

¹ Further information available at http://plastics.dupont.com/plastics/pdflit/americas/zytel/ZYTEL_Prod_Prop_02_2009.pdf and <http://plastics.dupont.com/plastics/pdflit/americas/rynite/H72128.pdf>

5. Corrosion

In the harsh environment of a refrigeration system, corrosion is a central issue, and a reason for motor failure. The combination of temperature changes with water and contaminants can cause corrosion even in normally non-corrosive metals such as aluminum. Corrosion is worsened by combining several metals, such as steel laminations and bearings with aluminum housings (electrolytic corrosion). Plastics do not corrode, and since they are electrical insulators they also prevent electrolytic corrosion between metal parts attached to them, avoiding motor failures.

6. Vibration and Sound Isolation

Plastics are less stiff than metals, and have some internal damping. This minimizes the transmission of motor-generated sound and vibration, particularly high frequency noises. It also helps protect internal components from shock and impact.

7. Flammability

Metals are non flammable. Some plastics are flammable. However, fire retardant grades are available for many engineering plastics. Several levels of fire retardance are defined by international standards, of which the highest are V-0 and 5-V. All advanced plastics used by Wellington in its ECR motors are V-0 or 5-V rated.

8. Strength

Metals are normally thought of as stronger than plastics. However, with modern engineering plastics, the difference is no longer large. For example, glass reinforced nylons can have a failure stress of over 200MPa, which is similar to the yield strength of common aluminum alloys and cast or wrought irons.

Figure 1. ECR ONE Motor



Figure 2. ECR ONE Advanced Plastic Components



Authors:

David Howell, *Chief Technical Officer*, Wellington Drive Technologies Limited.

About Wellington Drive Technologies Limited:

Wellington Drive Technologies is one of the world's leading suppliers of energy saving, electronically commutated (ECM) motors and fans for the refrigeration, ventilation and appliance industries. As an international supplier of energy saving solutions, Wellington has offices in the United States, Europe, Singapore, New Zealand and Central America. Wellington's advanced technology provides standard and custom solutions that lower energy consumption through design innovation and lower costs through reduced materials usage and electronics design. For more information, visit us at www.wdtd.com, or contact a Wellington office near you.



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USA

Wellington Drive Technologies US, Inc.
1407 Barclay Blvd
Buffalo Grove, IL 60089
USA
Phone: +1 (224) 588-8712
Toll Free: +1 (888) 786-4153
Email: sales@wdtl.com

MEXICO

Wellington Drive Technologies Mexico
PO Box 57
San Juan del Rio
Querétaro
Mexico 76800
Phone: +52 427 112 9101
Email: sales@wdtl.com

NEW ZEALAND

Wellington Drive Technologies Ltd
16-22 Omega Street, Rosedale
North Shore City 0632
New Zealand
Phone: +64 (0) 9 414 6590
Fax: +64 (0) 9 414 6591
Email: info@wdtl.com

ITALY

Wellington Italia Srl
Via Torino, 2
20123, Milan
Italy
Phone: +39 02 7254 6746
Fax: +39 02 7254 6412
Email: sales@wdtl.com

TURKEY

Wellington Motor Teknolojileri San Tic Ltd Sti
Bostanci Yolu Cad Keyap Sitesi, No:105
Yukari Dudullu, Umraniye 34775 Istanbul
Turkey
Phone: +90 (0) 216 420 1202
Fax: +90 (0) 216 420 1205
Email: sales@wdtl.com

SINGAPORE

Wellington Drive Technologies Pte Ltd
39 Tampines Street 92
#4-00
Singapore 528883
Phone: +65 6373 7200
Fax: +65 6373 7201
Email: sales@wdtl.com

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