NEMA MW 35-C or MW 73-C
Class 200 Copper - Round Conductors - Polyester/Polyamideimide coated magnet wire / winding wire.

APPLICATION
ULTRASHIELD® PLUS magnet wire, which is specifically designed for use in motors that may be subjected to higher voltage spikes present in inverter duty applications, has been enhanced for easy identification and differentiation. The enhanced product has exhibited increased resistance to partial discharges and improved abrasion resistance to repeated scrape. The combination of the modified polyester basecoat and polyamideimide topcoat provides an insulation system with outstanding toughness and excellent dielectric properties. ULTRASHIELD® PLUS magnet wire has improved voltage endurance and thermal properties, compared to standard NEMA MW 35-C magnet wire, while retaining superior chemical resistance to common solvents and refrigerants. ULTRASHIELD® PLUS conforms to all of the requirements of NEMA MW 35-C and MW 73-C.

ULTRASHIELD® PLUS is recommended but not limited to the following applications:
• Inverter Duty Drive Motors
• Rotating Machines
• Hermetic Motors
• DC Motors
• Power Tools
• Automotive Alternators and Generators
• Transformers, All Dry Types through Class 200
• Electronics, All Types of Coils through Class 200

ENGINEERING HIGHLIGHTS
1. THERMAL CLASSIFICATION
ULTRASHIELD® PLUS magnet wire on copper conductor is UL listed at Class 200, and is recommended for NEMA MW 35-C and MW 73-C wire applications with higher burnout requirements.

2. THERMOPLASTIC FLOW
ULTRASHIELD® PLUS magnet wire has excellent thermoplastic flow (cut-thru) properties, with typical test values of 300°C.

3. WINDABILITY
ULTRASHIELD® PLUS magnet wire has been extensively wound in various motor applications and has been highly commended for its superior windability performance.

4. ELECTRICAL
The electrical properties for ULTRASHIELD® PLUS have been measurably improved. Voltage endurance for the enhanced ULTRASHIELD® PLUS magnet wire at 3000V and room temperature increased by 20% and at 1000V and 200°C increased by 30%. Testing with sinusoidal and with inverter waveforms shows that ULTRASHIELD® PLUS magnet wire lasts many times longer than standard NEMA MW 35-C and MW 73-C insulation (see graph at lower left). While no standards for this type of testing have been universally accepted, our testing shows dramatic improvement in insulation life, especially under severe duty applications at higher temperatures.

5. CHEMICAL
ULTRASHIELD® PLUS magnet wire has been tested for resistance to R-22 refrigerant and the results show it to be compatible for hermetic systems.

Successful results are also seen with samples tested for 24 hours at room temperature in a wide variety of other solvents such as petroleum naphtha, toluene, ethanol, 5% sulfuric acid, 1% potassium hydroxide, butyl acetate, and acetone.

6. TERMINATION
Insulation piercing, mechanical stripping, and flame welding processes can all be used successfully with ULTRASHIELD® PLUS magnet wire. If the connection is to be soldered, it is recommended that mechanical stripping be used to remove the insulation prior to soldering.

7. NORMAL AVAILABILITY
• Round Copper Sizes:
  9 - 30 AWG, Heavy Build
Please consult Magnet Wire Marketing for additional size (including metric) and build information.
**THERMAL PROPERTIES**

**HEAT SHOCK RESISTANCE**
TYPICAL PERFORMANCE: No topcoat or basecoat cracks
REQUIRED PERFORMANCE: 20%, 3XD, no crack†

**THERMAL AGING**
TYPICAL PERFORMANCE: 215°C
REQUIRED PERFORMANCE: 200°C, minimum†

**THERMOPLASTIC FLOW**
TYPICAL PERFORMANCE: 390°C
REQUIRED PERFORMANCE: 300°C, minimum†

---

**18 AWG Heavy Build ULTRASHIELD® PLUS Thermal Aging**

---

**PHYSICAL PROPERTIES**

**ABRASION RESISTANCE: REPEATED SCRAPE**
TYPICAL PERFORMANCE: 496 strokes, avg.*

**ABRASION RESISTANCE: UNIDIRECTIONAL**
TYPICAL PERFORMANCE: 2100 g., avg.
REQUIRED PERFORMANCE: 980 g., minimum; 1150 g., minimum avg.†

---

**PHYSICAL PROPERTIES (cont’d)**

**ADHESION AND FLEXIBILITY**
TYPICAL PERFORMANCE: No topcoat or basecoat cracks
REQUIRED PERFORMANCE: 20%, 3XD, no crack†

**COEFFICIENT OF FRICTION**
TYPICAL PERFORMANCE: Dry Lube: 0.02 - 0.06*†

**ELONGATION**
TYPICAL PERFORMANCE: 38%
REQUIRED PERFORMANCE: 32%, minimum†

**SPRINGBACK**
TYPICAL PERFORMANCE: 48 degrees
REQUIRED PERFORMANCE: 58 degrees, maximum†

---

**ELECTRICAL PROPERTIES**

**CONTINUITY**
TYPICAL PERFORMANCE: ≤ 1 fault/100 ft.
REQUIRED PERFORMANCE: 5 faults/100 ft., maximum†

**DIELECTRIC BREAKDOWN VOLTAGE**

**ROOM TEMPERATURE**
TYPICAL PERFORMANCE: 12,900 volts, avg.
REQUIRED PERFORMANCE: 5,700 volts, minimum†

**RATED TEMPERATURE**
TYPICAL PERFORMANCE: 10,982 volts, avg.
REQUIRED PERFORMANCE: 4,275 volts, minimum†

---

**CHEMICAL PROPERTIES**

**REFRIGERANT RESISTANCE (R-22)**

**EXTRACTION**
TYPICAL PERFORMANCE: 0.02%
REQUIRED PERFORMANCE: 0.25%, maximum†

**DIELECTRIC BREAKDOWN VOLTAGE**
TYPICAL PERFORMANCE: 11,686 volts
REQUIRED PERFORMANCE: 5,700 volts, minimum†

**SOLUBILITY**
TYPICAL PERFORMANCE: Passes
REQUIRED PERFORMANCE: 580 g. scrape, minimum†

* Tests not indicated as NEMA are Essex® Standards.
** The values shown represent typical average results and are not intended to be used as design data or specification limits.
*** Data obtained from standard 18 AWG twisted pairs tested at 150°C, with a 575 volt drive and motor (phase-to-phase).
† Requirements of NEMA MW 1000; Section MW 35-C or MW 73-C, as applicable.

All sales are subject to Essex® Standard Terms and Conditions as posted on www.superioressex.com. Copies are available upon request.

---

Essex Group, Inc.
1601 Wall Street
Fort Wayne, IN 46802
260.461.4000

© Essex Group, Inc. 2008
NEMA MW 36-C
Class 200 Copper - Rectangular Conductors - Polyester/Polyamideimide Coated Magnet Wire / Winding Wire.

APPLICATION
ULTRASHIELD® PLUS rectangular magnet wire is designed specifically for use in motors & generators that may be subjected to higher voltage spikes present in inverter applications. ULTRASHIELD® PLUS rectangular magnet wire provides significant resistance to abrasion while maintaining flexibility. The combination of a modified polyester basecoat and polyamideimide topcoat provides an insulation system with outstanding toughness and excellent dielectric properties. ULTRASHIELD® PLUS conforms to all of the requirements of NEMA MW 36-C.

ULTRASHIELD® PLUS magnet wire is recommended but not limited to the following applications:
- Motors and Generators for Hybrid and Electric Vehicles
- Wind Generators
- Inverter Duty Drive Motors
- Low, Medium & High Voltage Rotating Machines
- Hermetic Motors
- Large Industrial Motors in Corona Applications

ENGINEERING HIGHLIGHTS
1. THERMAL CLASSIFICATION
ULTRASHIELD® PLUS magnet wire on copper conductor is UL listed at Class 200, and is recommended for NEMA MW 36-C wire applications with higher burnout requirements.

2. THERMOPLASTIC FLOW
ULTRASHIELD® PLUS magnet wire has excellent thermoplastic flow (cut-thru) properties, with typical test values of 405°C.

3. ELECTRICAL
The electrical properties of ULTRASHIELD® PLUS are one of the superior attributes of this product. Overall product quality was key in the development of this product. Due to the design of the insulation system and manufacturing process, AC dielectric breakdown values consistently average 6,000V. Inverter life testing of the rectangular ULTRASHIELD® PLUS insulation system shows a 24X increase in life over the standard MW 36-C insulation system when tested at 200°C on a 575V inverter. While no standards for this type of testing have been universally accepted, our testing shows dramatic improvement in insulation life, especially under severe duty applications at higher temperatures.

4. CHEMICAL
ULTRASHIELD® PLUS magnet wire has been tested for resistance to R-22 refrigerant and the results show it to be compatible for hermetic systems. Successful results are also seen with samples tested for 24 hours at room temperature in a wide variety of other solvents such as petroleum naphtha, toluene, ethanol, 5% sulfuric acid, 1% potassium hydroxide, butyl acetate, and acetone.

5. TERMINATION
Mechanical stripping and flame welding processes can be used for removing the insulation prior to termination.

6. NORMAL AVAILABILITY
- Rectangular Copper Size Ranges:
  - Thickness (inches): 0.081-0.257
  - Width (inches): 0.091-0.300

Please consult Magnet Wire Marketing for additional sizes (including metric) and product availability.
**Performance data below is representative of 0.102" x 0.204" heavy build copper.**

### THERMAL PROPERTIES

**HEAT SHOCK RESISTANCE**
- **TYPICAL PERFORMANCE:** No cracks
- **REQUIRED PERFORMANCE:** 220°C 30 min, 15%, no crack

**THERMOPLASTIC FLOW**
- **TYPICAL PERFORMANCE:** 405°C

### PHYSICAL PROPERTIES

**ADHERENCE AND FLEXIBILITY**
- **TYPICAL PERFORMANCE:** No topcoat or basecoat cracks
- **REQUIRED PERFORMANCE:** 30%, no crack

### ELECTRICAL PROPERTIES

**DIELECTRIC BREAKDOWN VOLTAGE – NEMA**
- **TYPICAL PERFORMANCE:** 6,000V
- **REQUIRED PERFORMANCE:** 10%, Flat & Edge Bend Foil Method: 1500V, minimum, Any 3 of 4 values; 500V, minimum, 4th Value

**DIELECTRIC BREAKDOWN VOLTAGE – SHOTBOX**
- **TYPICAL PERFORMANCE:** 6,000V*, 10%, Flat & Edge Bend

### THERMAL PROPERTIES

**HEAT SHOCK RESISTANCE**
- **TYPICAL PERFORMANCE:** No cracks
- **REQUIRED PERFORMANCE:** 20%, 3XD, no cracks

**THERMAL AGING**
- **TYPICAL PERFORMANCE:** 215°C
- **REQUIRED PERFORMANCE:** 200°C, minimum

**THERMOPLASTIC FLOW**
- **TYPICAL PERFORMANCE:** 381°C
- **REQUIRED PERFORMANCE:** 300°C, minimum

### PHYSICAL PROPERTIES

**ABRASION RESISTANCE: REPEATED SCRAPE**
- **TYPICAL PERFORMANCE:** 300 strokes, avg.

**ABRASION RESISTANCE: UNIDIRECTIONAL**
- **TYPICAL PERFORMANCE:** 2,100 g., avg.
- **REQUIRED PERFORMANCE:** 980 g., minimum; 1,150 g., minimum avg.

**ADHESION AND FLEXIBILITY**
- **TYPICAL PERFORMANCE:** No cracks
- **REQUIRED PERFORMANCE:** 20%, 3XD, no cracks

### ELECTRICAL PROPERTIES

**DIELECTRIC BREAKDOWN VOLTAGE**
- **ROOM TEMPERATURE**
  - **TYPICAL PERFORMANCE:** 12,900 volts, avg.
  - **REQUIRED PERFORMANCE:** 5,700 volts, minimum
- **RATED TEMPERATURE**
  - **TYPICAL PERFORMANCE:** 10,982 volts, avg.
  - **REQUIRED PERFORMANCE:** 4,275 volts, minimum

**CHEMICAL PROPERTIES**

**REFRIGERANT RESISTANCE (R-22)**
- **EXTRACTION**
  - **TYPICAL PERFORMANCE:** 0.02%
  - **REQUIRED PERFORMANCE:** 0.25%, maximum
- **DIELECTRIC BREAKDOWN VOLTAGE**
  - **TYPICAL PERFORMANCE:** 11,686 volts
  - **REQUIRED PERFORMANCE:** 5,700 volts, minimum

**SOLUBILITY**
- **TYPICAL PERFORMANCE:** Passes
- **REQUIRED PERFORMANCE:** 580 g. scrape, minimum

---

*Data obtained from standard 18 AWG twisted pairs tested at 200°C, with a 575 volt drive and motor (phase-to-phase).*

*Data from 18 AWG ULTRASHIELD® PLUS is included in this document to provide material characteristics & properties related to the enamel insulation system for tests that are not typically performed or cannot be performed on rectangular magnet wire.*

*Tests not indicated as NEMA are Essex® Standards.*

† Requirements of NEMA MW 1000; Section MW 35-C, as applicable.

‡ Requirements of NEMA MW 1000; Section MW 35-C, as applicable.

All Sales are subject to Essex Standard Terms and Conditions as posted on www.superioressex.com.