

Essex® Bondable Products
Magnet Wire / Winding Wire

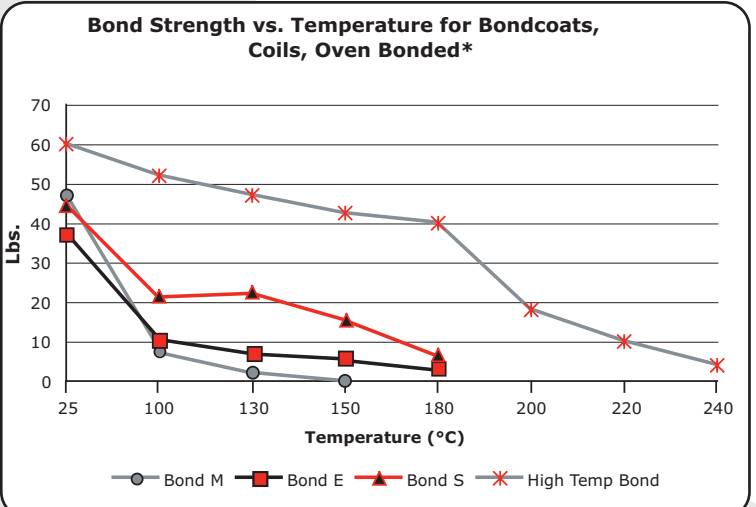
ESSEX BONDABLE PRODUCTS AND BONDING GUIDELINES

Essex bondable magnet wire products are described by the basecoat and topcoat materials. Polybondex® describes a number of possible constructions of bondable wire having a GP/MR-200® or Thermalex 200® base insulation with a thermoplastic bondcoat. For example, Polybondex® T indicates that the basecoat is Thermalex 200®. Polybondex® G indicates that the basecoat is GP/MR-200®. The bondcoat is designated by the letters M (Epoxy), S (Aromatic Polyamide), or E (Polyester).

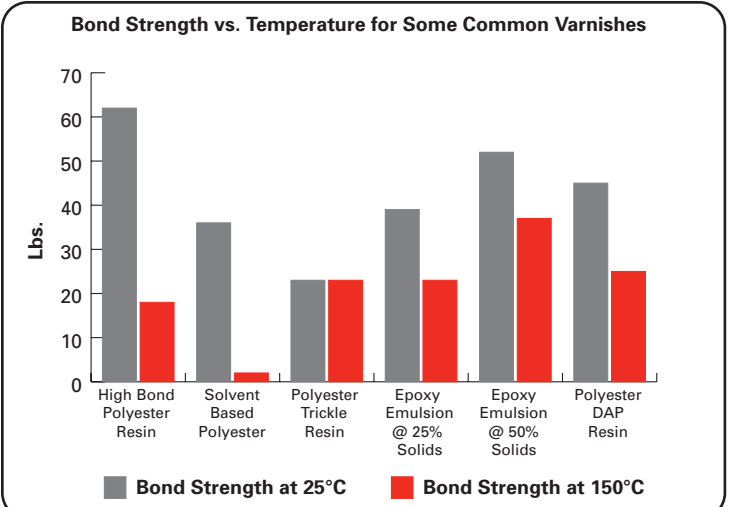
Bondable Product	Metal	Basecoat Polymer	Topcoat Polymer	Bondcoat Polymer	Temperature Rating (°C)	Bonding Temperature Guidelines (°C)	NEMA MW 102
Polybondex® G, Bond M	AL / CU	Polyester	Polyamide-imide	Epoxy	180	150-200	
Polybondex® G, Bond S	AL / CU	Polyester	Polyamide-imide	Aromatic Polyamide	180	210-230	x
Polybondex® G, Bond E	AL / CU	Polyester	Polyamide-imide	Polyester	180	180-200	x
Polybondex® T, Bond M	AL / CU	Polyester	N/A	Epoxy	180	150-200	
Polybondex® T, Bond S	AL / CU	Polyester	N/A	Aromatic Polyamide	180	210-230	
Polybondex® T, Bond E	AL / CU	Polyester	N/A	Polyester	180	210-230	
Soderbond® N/155	CU	Polyurethane	Nylon	Butvar	155	110-150	
Amide-Imide High Temp Bond	CU	Amide-Imide	N/A	Proprietary	N/A	275-300	
Amide-Imide Bond S	CU	Amide-Imide	-	Aromatic Polyamide	-	210-230	

Note: The information provided in this chart is provided for convenience only and is not intended to be a complete product listing. Please consult Magnet Wire Marketing for additional constructions and product information. The bond strength and melt temperatures required will define the proper bondcoat to use.

BOND STRENGTH COMPARISONS



* Polybondex® G bond strength was used for the graph.
Note: Helical coil bond strength, NEMA MW 1000-2008.



Note: Helical coil bond strength per ASTM D2519.

BOND COAT COMPARISONS

BOND COAT TYPE	BONDING METHODS	FEATURES	APPLICATIONS
Bond M	<ul style="list-style-type: none"> Solvent - Methylene ketone Heat bonding is recommended 	<ul style="list-style-type: none"> Use at temperatures not to exceed approximately 130°C 	<ul style="list-style-type: none"> Armatures Motor stators Sensors Small motors Transformers Transponders Various coil applications
Bond S	<ul style="list-style-type: none"> Heat activated 	<ul style="list-style-type: none"> Aromatic polyamide High bond strength at elevated temperatures 	<ul style="list-style-type: none"> Appliance motors Lift magnets Motor stators Sensors Small motors Solenoids
Bond E	<ul style="list-style-type: none"> Heat activated 	<ul style="list-style-type: none"> Requires minimal energy to effectively bond 	<ul style="list-style-type: none"> Appliance motors High temperature motors Sensors Solenoids Transformers
Soderbond® N/155	<ul style="list-style-type: none"> Denatured or isopropyl alcohol Heat activated 	<ul style="list-style-type: none"> High temperature applications where a solderable insulation is desired 	<ul style="list-style-type: none"> Solenoids Helical coils Toroidal coils
High Temp Bond	<ul style="list-style-type: none"> Heat activated 	<ul style="list-style-type: none"> Proprietary polymer High bond strength at elevated temperatures 	<ul style="list-style-type: none"> Suitable for applications requiring high thermal properties

THREE COMMON TYPES OF BONDING

SOLVENT BONDING
Some bondcoats can be activated by the application of certain solvents during or after coil winding. The solvent may be applied to the wire via a wick during the winding operation or the finished coils may be dipped in a bath of solvent after winding. In either case, the unit should be heated again to drive off residual solvent and to complete the bonding of the coils.

HEAT – OVEN BONDING
After the coils are formed, the unit is heated in an oven which causes the bondcoat to flow and bond the adjacent turns of wire together.

HEAT – RESISTANCE BONDING
Resistance heating is similar to oven heating, except that passing current through the formed coils supplies the heat. Time, voltage, and current are all unique to each application.



ESSEX GROUP®

FILM BUILDS ON BONDABLE WIRE

The addition of the bondcoat adds one overall build level to the wire dimension.

#0: Overall single build; half basecoat and half bondcoat - available in AWG 31 and larger. This film may not be a recommended choice for all AWG sizes. Please refer specific questions to Essex marketing and engineering personnel.

#1: Overall heavy build; single build film insulation plus single build bondcoat.

#2: Overall triple build; heavy build film insulation plus single build bondcoat.

Note: Since the bondcoat will be softened and displaced during bonding, it should be stressed that the bondcoat will not contribute to the electrical integrity of the film coating on the wire. The basecoat alone will determine the electrical properties of the wire.

In addition, product engineering should be aware of the additional space requirements necessary due to the additional build of the bondcoat. The turns density of the coil will be adversely affected with the addition of a bondcoat.

NEMA MW 102-C*

APPLICATION

Essex bondable magnet wire products are an excellent choice for applications requiring the magnet wire to be a compact, self-supporting coil. Bondable wire consists of standard magnet wire insulations overcoated with a thermo-plastic polymer that can be temporarily softened by either heat or solvent, or both. The use of bondable magnet wire allows the coil to be self-supporting so that bobbins or additional varnishing is not necessary. Bondable magnet wire can also assist in reducing the work in progress and shortening the product assembly time; which can help lead to more efficient winding operations.

Depending on the desired application, Essex bondable magnet wire products offer a wide variety of bondcoat polymers and different bond strengths, along with excellent thermal properties and chemical resistance.

Bondable products are typically used, but not limited to the following applications:

- Armatures
- Bobbinless coils
- Clutch coils
- Ignition coils
- Lift magnets
- Motors
- Relays
- Sensors
- Solenoids
- Stators
- Transformers

*Not applicable to all bondcoats.

ENGINEERING HIGHLIGHTS

1. THERMAL CLASSIFICATION
Essex offers bondable products that can have a rating above and below an 180°C thermal class rating. Typical heat shock resistance passes 220°C with no cracks.

2. THERMOPLASTIC FLOW
Essex bondable magnet wire products have excellent thermoplastic flow (cut-thru) properties. Typical test values well exceed the 300°C requirement.

3. WINDABILITY
The flexibility and adhesion properties of Essex bondable products are excellent and suitable for most winding applications.

4. ELECTRICAL
Essex bondable products exhibit high dielectric strength.

5. NORMAL AVAILABILITY
Please consult Essex Magnet Wire Marketing for size (including metric) and build information.

Essex® Bondable Products
Magnet Wire / Winding Wire

	18 Polybondex® T #2 Bond S		18 Polybondex® T #2 Bond E		18 Polybondex® T #2 Bond M		18 Polybondex® G #2 Bond S		18 Polybondex® G #2 Bond E		18 Polybondex® G #2 Bond M	
	Typical Performance	Required Performance	Typical Performance	Required Performance	Typical Performance	Required Performance	Typical Performance	Required Performance†	Typical Performance	Required Performance†	Typical Performance	Required Performance
PHYSICAL PROPERTIES												
CONDUCTOR ELONGATION	38%	32%, minimum	38%	32%, minimum	38%	32%, minimum	38%	32%, minimum	38%	32%, minimum	38%	32%, minimum
SPRINGBACK	54°	62°, maximum	54°	62°, maximum	54°	62°, maximum	54°	62°, maximum	54°	62°, maximum	54°	62°, maximum
FLEXIBILITY	Pass	20%, 3XD, No exposed bare	Pass	20%, 3XD, No exposed bare	Pass	20%, 3XD, No exposed bare	Pass	20%, 3XD, No exposed bare	Pass	20%, 3XD, No exposed bare	Pass	20%, 3XD, No exposed bare
ABRASION RESISTANCE: REPEATED SCRAPE	42 avg. strokes	No Requirement Established	109 avg. strokes	No Requirement Established	87 avg. strokes	No Requirement Established	120 avg. strokes	No Requirement Established	159 avg. strokes	No Requirement Established	99 avg. strokes	No Requirement Established
ABRASION RESISTANCE: UNILATERAL SCRAPE	2448 2568	Actual Performance Avg. Performance	3060 3145	Actual Performance Avg. Performance	2513 2563	Actual Performance Avg. Performance	2700 2760	Actual Performance Avg. Performance	3195 3240	Actual Performance Avg. Performance	2100 2175	Actual Performance Avg. Performance
COEFFICIENT OF FRICTION	.02 - .06	No Requirement Established	.02 - .06	No Requirement Established	.02 - .06	No Requirement Established	.02 - .06	No Requirement Established	.02 - .06	No Requirement Established	.02 - .06	No Requirement Established
CHEMICAL PROPERTIES												
SOLUBILITY (Xylene)	Pass	Xylene, No exposed bare	Pass	Xylene, No exposed bare	Pass	Xylene, No exposed bare	Pass	Xylene, No exposed bare	Pass	Xylene, No exposed bare	Pass	Xylene, No exposed bare
SOLUBILITY (Xylene/Butyl)	Pass	Xylene/butyl cellosolve, No exposed bare	Pass	Xylene/butyl cellosolve, No exposed bare	Pass	Xylene/butyl cellosolve, No exposed bare	Pass	Xylene/butyl cellosolve, No exposed bare	Pass	Xylene/butyl cellosolve, No exposed bare	Pass	Xylene/butyl cellosolve, No exposed bare
THERMAL PROPERTIES												
HEAT SHOCK RESISTANCE	Pass	20%, 3XD @ 200° No exposed bare	Pass	20%, 3XD @ 200° No exposed bare	Pass	20%, 3XD @ 200° No exposed bare	Pass	20%, 3XD @ 200° No exposed bare	Pass	20%, 3XD @ 200° No exposed bare	Pass	20%, 3XD @ 200° No exposed bare
THERMOPLASTIC FLOW	> 350°C	Median min. 300°C	> 350°C	Median min. 300°C	> 350°C	Median min. 300°C	> 375°C	Median min. 300°C	> 375°C	Median min. 300°C	> 375°C	Median min. 300°C
ELECTRICAL PROPERTIES												
DIELECTRIC BREAKDOWN VOLTAGE ROOM TEMPERATURE	12,200 volts, avg.	5,700 volts, minimum	12,200 volts, avg.	5,700 volts, minimum	12,200 volts, avg.	5,700 volts, minimum	12,200 volts, avg.	5,700 volts, minimum	12,200 volts, avg.	5,700 volts, minimum	12,200 volts, avg.	5,700 volts, minimum
DIELECTRIC BREAKDOWN VOLTAGE RATED TEMPERATURE	10,300 volts, avg.	4,275 volts, minimum	10,300 volts, avg.	4,275 volts, minimum	10,300 volts, avg.	4,275 volts, minimum	10,300 volts, avg.	4,275 volts, minimum	10,333 volts, avg.	4,275 volts, minimum	10,333 volts, avg.	4,275 volts, minimum
CONTINUITY @ 1,500 VOLTS	≤ 1 faults/100 ft.	5 faults/100 ft.	≤ 1 faults/100 ft.	5 faults/100 ft.	≤ 1 faults/100 ft.	5 faults/100 ft.	≤ 1 faults/100 ft.	5 faults/100 ft.	≤ 1 faults/100 ft.	5 faults/100 ft.	≤ 1 faults/100 ft.	5 faults/100 ft.
BOND STRENGTH @ ROOM TEMPERATURE Bond M and E Bonded @ 200°C - 1 hour Bond S Bonded @ 220°C - 1 hour	34.35	No specification	30.38	No specification	33.92	No specification	45.41	30 lbs. - min.	38.49	30 lbs. - min.	47.00	No specification
BOND STRENGTH @ 100°C	27.79	No specification	11.95	No specification	10.38	No specification	24.31	No specification	10.57	No specification	8.78	No specification
BOND STRENGTH @ 130°C	25.42	No specification	9.58	No specification	3.30	No specification	22.05	No specification	8.46	No specification	2.18	No specification
BOND STRENGTH @ 150°C	20.78	No specification	7.47	No specification	No Bond Strength	No specification	16.51	No specification	7.14	No specification	No Bond Strength	No specification
BOND STRENGTH @ 180°C	6.51	No specification	4.29	No specification	-	-	7.37	3 lbs. - min.†	4.24	3 lbs. - min.†	-	-

Note: The values shown represent typical average results and are not intended to be used as design data or specification limits.
† Requirements of NEMA MW 1000; Section MW 102. Typical performance of base coat.

For customized or engineered bondable constructions, please consult Essex Magnet Wire Marketing.

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