The One & Only Original Glass Banding Tape

RES-I-GLAS® by Fibertek is known throughout the rotating electrical equipment industry as the trade name of choice for glass banding tapes. Over all competitors, the original RES-I-GLAS® is superior in tensile strength, durability, insulation value, ease of application, and storage shelf life, due to the uncompromised use of highest grade raw materials and consistent manufacturing process. No wonder leading electric motor manufacturers and service centers world wide always insist on the one and only original RES-I-GLAS® banding tape by Fibertek.

RES-I-GLAS® Banding Tape is constructed of high tensile electrical grade glass yarns laid parallel and bonded with fully catalyzed thermosetting resins. It is not a woven tape; thus it utilizes the full tensile strength of the glass. This results in a high tensile, high modulus, low elongation, high impact strength band. Because RES-I-GLAS® tape is itself an insulation, it requires no underlying insulation pad. It thus eliminates insulation and

creepage problems experienced with steel wire banding.

RES-I-GLAS® tape is supplied semi-cured (B-Stage) in a soft well balanced flat ribbon form and this assures that each yarn bears an equal share of the load. The B-Stage resin isolates the individual glass yarns, thereby preventing cutting and shearing of these yarns. These thermosetting resins have been rigorously checked through laboratory tests and extensive and continuous service usage for many years.

In the completely cured (C-Stage)

stage, RES-I-GLAS® tape is stiff, hard and springy. During the early stages of curing, the resins flow. This flow fills all the voids and air spaces in the band, welding the laminate into a homogenous mass and greatly improving the heat dissipation factor. This flow of the resin also penetrates between coil openings, anchoring the coils against side movement and actually adding insulation between coils. In effect, the RES-I-GLAS® tape band molds to coil configuration and in operation is practically part of the coil system, greatly adding to it's stability under all conditions. RES-I-GLAS® tape bands have a very high arc resistance and

(continued)

attempts to induce flashover failure in 20 cycles have failed. Steel bands, on the other hand, usually fail in two or three cycles. Many instances have been recorded where severe coil burnouts underneath RES-I-GLAS® tape bands have destroyed as much as two thirds of the band, yet the remnant has held the coils in place. RES-I-GLAS® tape has gone far in eliminating the extreme damage caused by lashing wire and lifting armature coils experienced when steel bands break. Bands of RES-I-GLAS® tape also result in cooler coils than the steel system affords.

RES-I-GLAS® tape bands have successfully replaced steel wire on all types of armatures including traction, large generator, motor generator, power shovel, steel mill and diesel locomotive traction motors and generators. RES-I-GLAS® tape is very popular with winders because of its ease of application and because it eliminates the hazards present in the breaking and lashing of stressed steel. Application is fast and, depending on the size, armatures are banded in 10-60 minutes.

Why Different Types Of RES-I-GLAS®

RES-I-GLAS® is offered from stock in four standards, Type R,G,F and M. Type F RES-I-GLAS® is for use on motors of temperature ranges up to and including Class H Plus (220°C). Type F RES-I-GLAS® has a resin system with a nominal resin content of 27%. As can be readily seen from the technical data in the following pages, Type F represents a significant improvement in quality. Not only can Class H motors be glass banded, but motors of lower thermal ratings will obtain indefinite protection from aging or thermal degradation. Type F RES-I-GLAS® has excellent resin flow characteristics. Armatures can be banded with this tape either hot or cold because of the superior flow characteristics that it possesses. This resin flow also results in greater prestress retention, thereby minimizing coil movement.

Types R and G are for use on Class F motors (155°C). Except for the content of resin, types R and G are identical. Type G is for use when hot armature banding and contains a nominal 27% resin. Type R has a

TABLE I

STOCK RES-I-GLAS® SIZES

PART#	WIDTH (IN.)	THICKNESS (IN.)
B-0122-F,G,R,M	.125	.015
B-0022-F,G,R,M	.187	.015
B-0222-F,G,R,M	.250	.015
B-0322-F,G,R,M	.375	.015
B-0422-F,G,R,M	.500	.015
B-0622-F,G,R,M	.750	.015
B-0822-F,R,G,M	1.000	.015
B-1222-F,R,G,M	1.500	.015
B-1622-F,R,G,M	2.000	.015
B-2422-F,R,G,M	3.000	.015

NOTE: Custom widths and lengths available per required specifications.

OTHER PROPERTIES

Ultimate Tensile Strength—p.s.i. (minimum) (Based on glass area, at elevated temperature, and after thorough cure) 240,000
Elastic limit—p.s.i. (minimum) (Based on glass area, at elevated temperature, and after thorough cure) 240,000
Elongation (%) 2-3
Recovery after elongation (%) 100
Volumetric shrinkage of resin during cure (approx. Percent) 8
Linear shrinkage of glass during cure 0
Percent resin (nominal)-
Type F 27
Type R 32
Type G 27
Type M 27
Net Weight of tape 1" width (approx. per M yds.) 30
Arc resistance after cure, seconds (minimum) 120

Conversion Tables (Steel Bands To Res-I-Glas® Tape)

These conversion tables are designed to assist in converting armature bands from tinned steel to RES-I-GLAS® tape in terms of equivalent tensile. Table II lists tensile strength of steel wires in terms of ultimate limit. The design strength of elastic limit is 35% less for the magnetic steel and 40% less for the non-magnetic stainless wire.

TABLE II

SIZE (AWG)	DIAMETER (IN.)	ULTIMATE TENSILE STRENGTH (LBS.) MAGNETIC STEEL GRADE C OR SPECIAL	NON-MAGNETIC STAINLESS STEEL
10	.1019	1957	1874
11	.0907	1551	•
12	.0808	1231	1171
13	.0720	977	932
14	.0641	774	738
15	.0571	615	535
16	.0508	486	•
17	.0453	387	368
18	.0403	306	•
19	.0359	243	•
20	.0320	193	•
21	.0285	133	147
22	.0253	121	•
23	.0226	88	•
24	.0201	76	•
25	.0179	60	•
26	.0159	47	•

The above data is based on American Steel & Wire Company bulletin titled, "Magnet Wire and Steel Armature Banding Wire", copyright 1949.

TABLE III

FOR USE UP TO 130°C

PART #	TENSILE STRENGTH
B-0322	590 lbs.
B-0622	1180 lbs.
B-0822	1580 lbs.

TABLE IV

FOR USE AT 150°C PLUS

PART #	TENSILE STRENGTH
B-0322	395 lbs.
B-0622	790 lbs.
B-0822	1055 lbs.

From above, conversion can easily be made by multiplying tensile strength of each wire by total number of wires to determine total steel tensile. Then select RES-I-GLAS tape and divide total steel strength by C Stage tensile to determine number of tape turns.

EXAMPLE OF CALCULATION

One wishes to replace a steel band on a motor known to operate at or about 150°C. The steel band at present is made of 30 turns of #13 wire (Grade C- special).

Table II shows this steel to have a tensile of 977 lbs. per turn.

30 x 977 = 29,310 lbs.

One wishes to use 3/4" RES-I-GLAS tape B-0622. The rated tensile strength for this temperature range is (Table IV) 790lbs. per turn.

29,310 lbs. = 37.2 turns
790 lbs./turn

Use 38 turns 3/4" RES-I-GLAS tape.

nominal 32% resin and is for use when banding cold armatures, though it can also be used on hot armatures - particularly when an extra good resin flow is desired on the tape surface. Top performance can be obtained with either R or G, but the application techniques appropriate to each RES-I-GLAS® tape used must be observed. Type R can be substituted for Type G without resulting in anything more serious than slightly higher costs. Type M is the moisture resistant high temperature RES-I-GLAS® containing a nominal 27% resin. It is for use in applications up to 220°C where excessive moisture and temperature are critical factors.

Armature Banding With RES-I-GLAS® Tape

Once the armature coils are seated, the function of the band is to hold them in that position under all operating conditions likely to be experienced. To do this the band must exert a restraining force greater at all times than the centrifugal forces generated by the revolving armature. The true test of a cured armature band, however, is the tensile strength it will possess under continuous centrifugal stress at its given operating temperature. Laboratory checks indicate that at 130°C the RES-I-GLAS® tape loses 20-23% of its room temperature strength. After 8 continuous months at 130°C, no further loss in tensile occurs. We, therefore recommend that for 130°C service the values shown in Table III should be used. They discount by 25% the values for freshly cured bands.

Many designers, however, feel that some armatures operating in the 150°C range at times run quite a bit hotter than this. Operating temperatures as high as 250°C can be reached (not continuous, of course) depending on maximum temperature tolerance or other insulations within the system. We therefore recommend, for 150°C service, the values of Table IV. These figures discount by 50% the values for freshly cured bands at room temperature.

If the maximum centrifugal force expected under all conditions is calculated for any given armature and a safety factor in accord with good engineering practices added, the required turns of RES-I-GLAS® tape can be determined by using values listed in Table III or Table IV (depending on operating temperatures).

In repair work such calculations are rarely possible. Recourse can be made to the conversion tables and the recommended turns of RES-I-GLAS® tape required when converting from turns of steel wire used in the original banding. Let us point out that the use of these conversion tables introduces another factor of conservatism. The tensile values shown for steel wires are based on their ultimate tensile. Glass, unlike steel, does not "set" under stress. It does elongate 2-3%, but recovery is 100% as its elastic limit and ultimate tensile are identical. The elastic limit of steel is about 35% less and presumably the wire was originally calculated at its elastic limit rather than at its ultimate limit. If wire bands are calculated at the ultimate limit, rather than the elastic limit, loose bands will result and coil lift-off follows. Matching the ultimate values of steel in calculating the number of turns of RES-I-GLAS® tape results in a further "built in" safety factor.

The width of RES-I-GLAS® tape selected for any given unit will depend upon the surface or profile of the band area. To minimize the number of turns, the widest width tape should be used, but unless the band area is very flat and level a compromise will have to be made.

Terminating Res-I-Glas® Tape Bands

When cold banding with RES-I-GLAS® tape, the band must be terminated before the application tension is released. Use either a hot soldering iron or a hot air gun to fuse layer to layer and then snub the cut end under as in string banding.

When hot banding with RES-I-GLAS® tape (either hot armature or heated tape) the tension should be relaxed to about hand tension prior to cutting. If the armature is retained in the lathe for a few minutes, still under full tension, the hot tape band will fuse to a point where the maximum pre-stress will be retained after the tension is released and the tape cut. Many winders pull the cut end under several underlying layers to insure freedom from delamination.

(continued)

Curing Res-I-Glas® Tape Bands

Complete cure is effected after baking for 5 hours at 150°C (302° F). Higher temperatures will accelerate the cure and of course the reverse is true. Cure will not, however, take place regardless of the time cycle at temperatures lower than 110°C (230° F).

Normally the cure is accomplished during the varnish dip and bake cycle. However, phenolic varnishes can inhibit (but not prevent) the curing. This inhibiting effect can be offset by tightly covering the freshly wound bands with a layer of Fibertek RES-I-BAND Shrinkable Mylar Banding Film, (removed after the cure) or by a heat cycle, prior to the varnish dip and bake, of sufficient length to at least partly set up the RES-I-GLAS® tape bands.

The Recommended Procedure For Banding Armatures And Generators Using Res-I-Glas® Banding Tape

Before applying RES-I-GLAS® tape bands, the armature coils must be pulled down and well seated. The coil pull down may be effected in any acceptable and approved manner now employed.

Remove the RES-I-GLAS® banding tape from the cold storage area, allowing it to reach room temperature throughout before use. Place the RES-I-GLAS® banding tape on the tensioning mechanism of the lathe. Place Fibertek RES-I-STRAINT Tadpole Edging Tape edge restraint on the area to be banded. Edges should be accurately positioned so that the edge of the glass band will present a nearly perpendicular appearance to the armature axis. Terminate and pull tight with the aid of pressure sensitive tape, smoothing out the wrinkles as much as possible. Initiate the wind, using an acceptable level of prestress tension. The recommended prestress tension is 400 pounds per inch of tape width, although higher prestress tension is acceptable. Place the second turn over the first turn at a slight angle to prevent slippage. Low areas should be filled first to level the band and the succeeding turns half lapped back and forth. Wind the RES-I-GLAS® evenly and smoothly, traversing the width of the band. Maintain a near uniform cross section of the band, being careful not to create thin flange like edges. Maintain the wind angle as close to 90° to the armature shaft center line as possible in order to realize optimum tensile properties of the RES-I-GLAS® banding tape. Wind as many turns as required for the design operating temperature and the design centrifugal force, using an appropriate safety factor. The glass band should not extend to core iron. The resultant clearance allows the varnish to penetrate into the coils under the band. Terminate the band by heating the tape with a flat iron, soldering iron or industrial hot air gun while maintaining prestress tension. As the tape cools it will fuse to the adjacent layers of tape and the tension can be released and the tape cut. Wrap and cover the glass band with Fibertek RES-I-BAND Shrinkable Banding Film with release coating. Pull the film snug using hand tension and terminate using a pressure sensitive tape. This banding process incorporates the vital components of the Fibertek complete banding system.

FIBERTEK

P.O. Box 4000 • 305 Beasley Drive
Franklin, Tennessee 37065

Phone 615•794•1400
Fax 615•790•8289