

Technical Bulletin # 970C

Product Description

A properly applied glass-reinforced epoxy laminate will provide the most effective long wearing, corrosion protection for water-borne main propulsion propeller shafting and other metal surfaces exposed to severe marine environments.

The three basic requirements for satisfactory shaft protection

1. Use of a qualified materials system
2. Correct surface preparation
3. Proper application technique

Use & Benefits

PHILLYCLAD 1775/620TS was developed to exceed the requirements of Navy, Coast Guard and commercial shaft coating specifications. It is the most generally used shaft coating in the world. Meeting NATO requirements and those of most other navies and Classification Societies. It is also in use on U.S., Canadian and Russian icebreakers. In particular, it meets the U.S. Navy's present MIL-R-23461 (Ships) and the proposed new specification.

Materials Estimation

1. Determine the amount of Fiberglass Tape required using the formula:

$$L = \frac{3.5DH}{W}$$

Where:

L = Length of glass tape in millimeters (inches) per layer

D = Diameter of shaft in millimeters (inches) Length of shaft to be covered, millimeters (inches)

W = Width in millimeters (inches) of glass tape

Small shafts under 150 mm (6") in diameter should use 75 mm (3") wide glass tape. Larger shafts should use 150 mm (6") wide glass tape. All shafts require 4 layers. Woven edge 150 mm (6") or 75 mm (3") wide. All rolls are 40 m (150') long.

2. Determine the amount of Phillyclad 1775/620TS Resin required:

- To determine the quantity of resin required per coat, find the number of square millimeters (sq ft) to be covered. (3.5 x diameter x length.) One liter covers 2 square meters. (One gallon covers 80 sq ft)
- Phillyclad 1775/620TS resin comes in a 3.785 liter (1 gallon) unit.
- Four layers of tape require 5 coats of Resin.

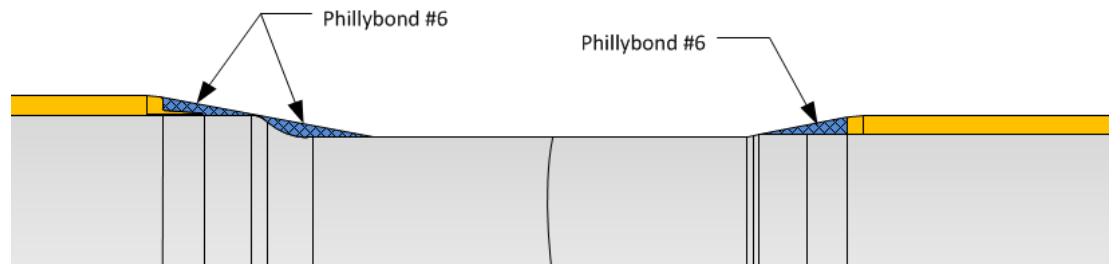
3. Determine the amount of additional materials required:

- PHILLYBOND No. 6 0.454 kg (1 lb) kit. 267 cc (16.3 in³) MIL-R-17882C
- Jiffy Mixer Blade Or equivalent to be driven by an electric drill at no more than 300 RPM. <http://www.jiffymixer.com/>
- PRT 59 Solvent 3.785 liter (1 gallon) cans or 18.925 liter (5 gallon) pails.

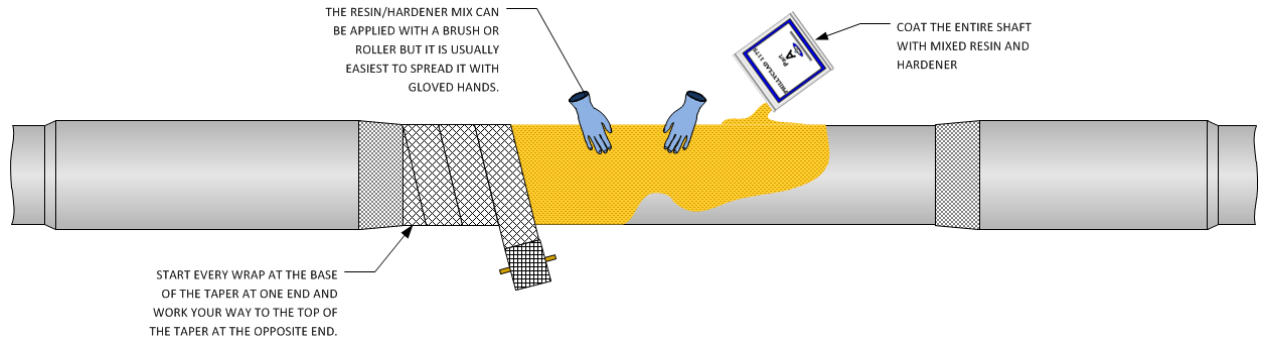
Quantity of solvent to wash shaft will vary but usually two wash-downs are needed to obtain oil and dirt free surface. Figure on 19 liters (4 gallons) per 6 meters (20.) of shaft. PRT-59 is also useful for cleaning mixing tools, etc.

Application Instructions

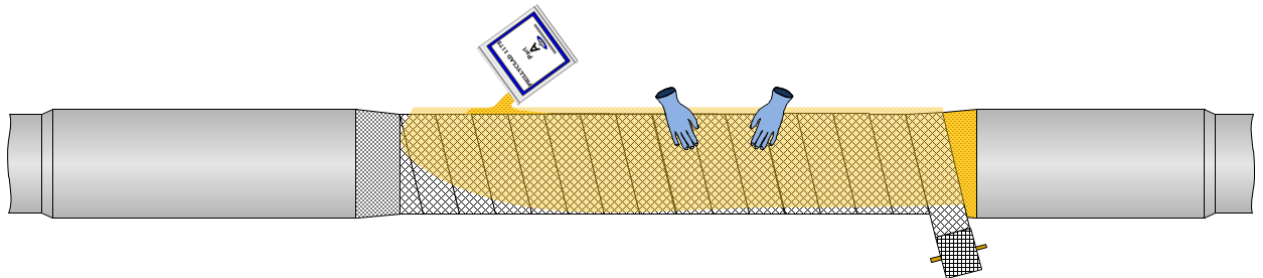
1. Do not prepare the shaft until it is ready to be coated. Sandblast to near white metal (SP10) using clean grit or sand. Meeting this standard requires a very thorough blast cleaning with mill scale, rust and foreign matter removed. Number 2 sand shot or ALOX is recommended with a minimum air pressure of 5.3 kg/cm² (75 psi). This is a cleanliness standard, not a standard for surface finish or roughness so, in addition, we also recommend a surface profile of 0.075 mm (0.003", 75 micron or 3mil). At a profile of 0.075 mm and with a near white metal blast we can guarantee excellent, long-lasting adhesion of Phillyclad 1775. Schedule the blasting so there is a minimum delay before the coating is applied. Wrapping the shaft with polyethylene sheet may protect the finish for up to 24 hours if there is unavoidable delay.
2. If the laminate finishes at a shrunk-on sleeve, the end of the sleeve should be faired from its top edge down to the shaft so there will not be a step in the laminating. Use PHILLYBOND No. 6 for this. It is a fast-curing, very tough epoxy paste. Use it also to fill any corrosion pits or other surface irregularities. Allow at least one hour for hardening.



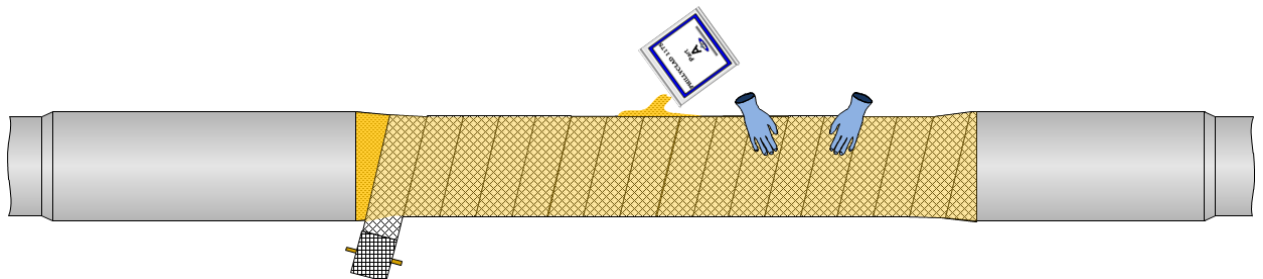
3. Rinse the shaft with PRT-59 Solvent, trichlorethane or other chlorinated solvent that removes oil, grease and dirt but does not leave any residue. Do not use hydrocarbon solvents. Pour ample solvent over the shaft so that it runs off. Do this twice. Do not use any cloth, paper or waste to dry it. Do not handle or contaminate the shaft in any way.
4. Temperature is important to the laminating process. The shaft and resin should not be below 20°C (68°F). 27°C (80°F) is desirable. Both the cure time and tape wet-out by the resin are significantly affected at low temperature.
5. Do not mix the resin and hardener until ready to start the application. Power-mix a pre-measured unit of resin and hardener with a Jiffy mixer blade at about 175 rpm. The mix must be thorough and complete, making sure the resin and hardener on the sides of the container are blended together thoroughly. Generally 3 to 4 minutes mixing time is sufficient. The resin and hardener temperature must be 22°C (72°F) or above. If the mixture turns milky upon mixing, it is too cold or the mixing RPM are too high.
6. Pour mixed resin on top of the shaft as it rotates in a lathe or on powered rollers. Spread it with gloved hands or roller to completely wet out the surface. (Use throw-away plastic gloves or clean re-usable rubber gloves.)



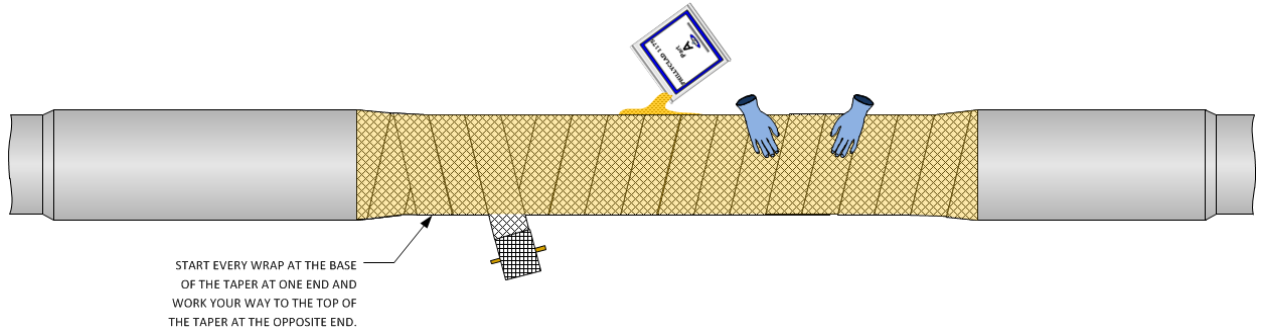
7. Two men can typically cover a shaft 500 mm (20") in diameter by 6 meters (20') long in 10 to 15 minutes. It is essential that there be no dry spots.
8. Two persons are required for the tape application. One holds the roll of tape on a horizontal axle, and feeds it on to the rotating shaft starting at the bottom of the taper at one end. The other stands by to help guide the tape, to press out any air bubbles and, with a large pair of scissors, to cut the tape at the end of the shaft.
9. When starting the layer of tape, wind one complete turn around the shaft to cover the tape end completely. Use moderate tension so the tape sinks in the resin but does not slip excessively. Once the turn is complete, apply more tension by braking the roll with the thumbs and lead off with decreasing tape overlap into an open helical wind. Take care not to create wrinkles, but also avoid unnecessary overlapped turns. **Once the helix is established the adjacent tape edges should be about 2 mm (1/8") apart.** Continue the helical winding until the other end of the shaft is approached. Start progressive overlapping and finish up at the top of the taper. Cut the tape without stopping the shaft rotation.



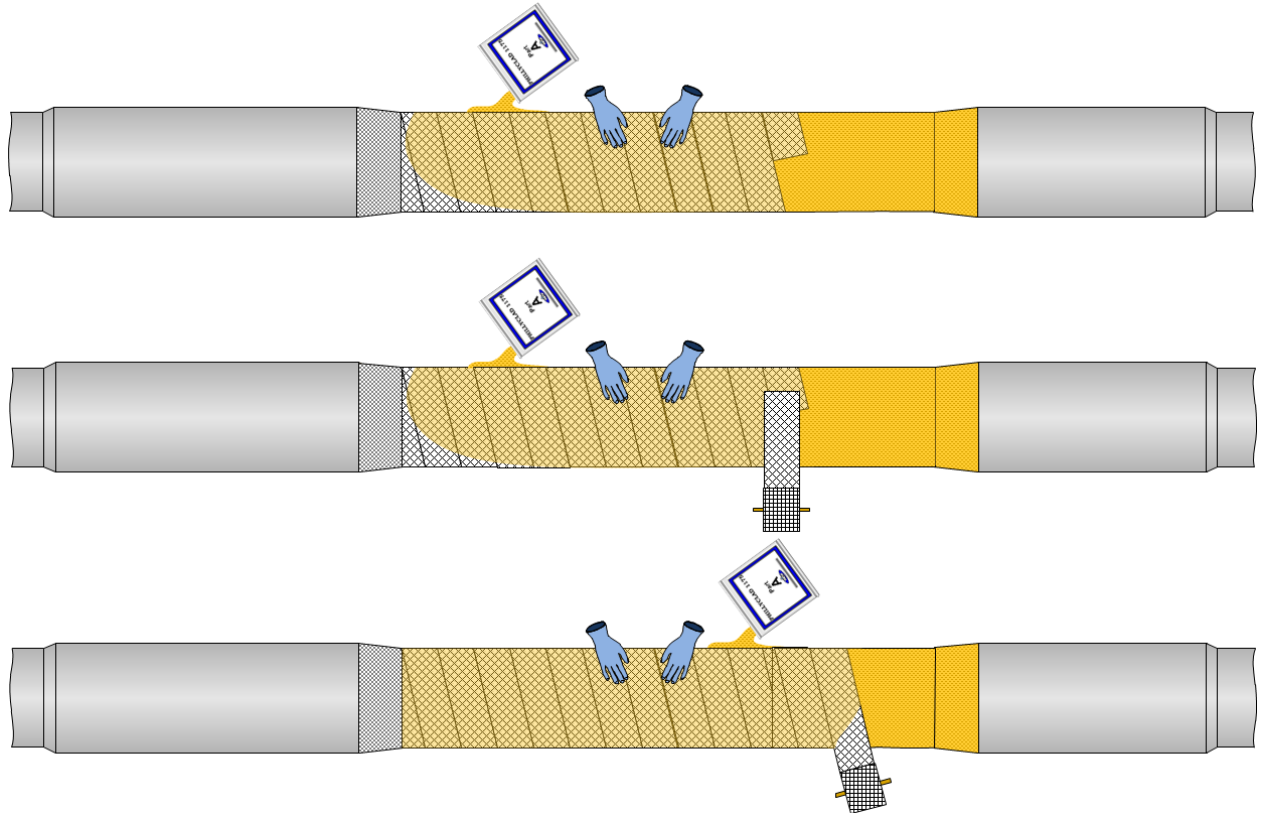
10. Allow the resin to soak through the tape completely, it may take 15 minutes. When it has, apply a second layer of mixed resin. Wind on a second layer of tape, starting at the end where the first layer finished. Allow this to soak through and repeat the procedure until four alternating layers of tape have been put on the shaft.



11. When the fourth layer of tape has soaked through thoroughly, apply a generous fifth coat of resin. Keep the shaft rotating slowly until the resin has hardened. Excessive speed at this stage may cause ridges in the resin mat.



12. Do not use short left-over pieces of tape if they will cause extra joints. When a tape roll ends part way along a shaft, overlap its end with the new tape and put a complete turn around the shaft. Progress out to a helix as normal.



13. Wrinkles and bubbles should be pressed out. If too large, cut the fold with the scissors and press it flat. A large fold may require a narrow triangle to be cut out.
14. Long tapers, whether to a coupling or to a sleeve, should always be wrapped going up the taper. When the general winding direction of a layer is in the contrary direction make a separate winding for the taper. Start along the shaft sufficient distance so that the complete starting turns of these two sections of the layer do not overlap each other.

Application Notes

1. Rotational speed: Determine a convenient per minute surface speed range for wrapping shafts with tape 14.5 meters to 25.5 meters (48' to 84'). If the shaft's diameter is d , the turning speed range in revolutions per minute will be:

$$\frac{4650}{d} \text{ to } \frac{8150}{d} \text{ rpm when } d \text{ is in millimeters.}$$

$$\frac{183}{d} \text{ to } \frac{321}{d} \text{ rpm when } d \text{ is in inches.}$$

2. **Cure Time:** The shaft may be handled after 8 hours at 24°C (75°F). It will cure faster at higher temperatures. Allow 18-24 hours at 1 18°C (65°F) and below.
3. **Pin Hole Repair:** Shafts already coated and in for repairs or inspection which show pin holes must be repaired as follows:
 - a. Mechanically sand area in and around pin hole and fill hole with PHILLYBOND No. 6 Paste.
 - b. Sand flush.
 - c. Apply one coat of Phillyclad 1775/620TS epoxy resin
 - d. More extensive repairs can utilize glass tape and resin.
4. **When Rotation is not Possible:** Whenever possible PHILLYCLAD 1775/620TS should be applied while the shaft is rotating because it gives a smoother finish and is also transparent. However, when the shaft cannot be rotated during the application of Phillyclad 1775/620TS or a section has to be repaired when installed in the ship, then additional ingredients can be added to PHILLYCLAD 1775/620TS resin/ hardener system to make it much more viscous and less likely to drip off. The following is a non-sagging version of PHILLYCLAD 1775/620TS but otherwise identical. Add the following to one (1) unit of PHILLYCLAD 1775 resin:

Fumed Silica	2.1	Quarts	2.2	Liters
Glycerin	1.45	Tablespoons (US)	1.4	Tablespoons (UK)

Reference Technical Bulletin 950 Phillyclad 1775/620TS

Date May 2018

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