INSTRUCTION FOR BONDING TECHNOLOGY Fibermarine® / Fibermarine HighLine®

GRE and GRVE Pipe and Fitting

© by TPR Fiberdur GmbH & Co. KG 2014

TPR Fiberdur GmbH & Co. KG.
Industriepark Emil-Mayrisch, Galileo-Allee 6, D-52457 Aldenhoven, Germany
Tel.: 0049 (0) 24 64 9 72-0. eMail: fibermarine@fiberdur.com

1.1 WORKING PROCEDURE

Thorough preparation before starting bonding operations will ensure that the work can proceed smoothly. Make sure that all pipes and fittings required, together with a sufficient quantity of adhesive, are at hand before starting work.

CUTTING PIPES

Pipes can be cut into lengths by hand using a metal-cutting saw. Make the cut at right-angles to the pipe axis. When cutting manually it is useful to mark the pipe before cutting.

IMPORTANT

Cut pipes all the way through, supporting the free ends as required. This avoids the pipe breaking off before cutting is completed.

SURFACE PREPARATION

Good bonding depends on good adhesion between the adhesive and the materials being bonded. The bonding surfaces of the pipe and bonded socket ends must thefore be prepared for the adhesive in the correct manner.

CYLINDRICAL BONDING

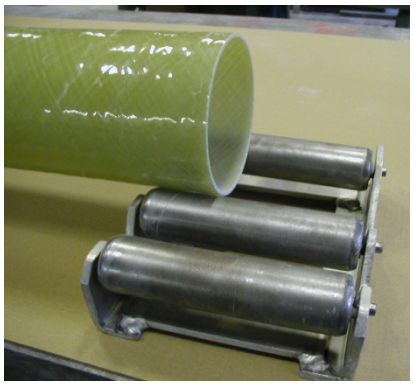
Part of the Fiberdur pipes and fittings are bonded using cylindrical socket ends. This kind of bonding is easy and no special tools are required. Pipe ends are uniformly and thoroughly emerized under dry conditions (over bonding length +10mm). This procedure is also applied to the inside and leading edge of the bonded socket end of the fitting.

TPR Fiberdur GmbH & Co. KG.
Industriepark Emil-Mayrisch, Galileo-Allee 6, D-52457 Aldenhoven, Germany
Tel.: 0049 (0) 24 64 9 72-0. eMail: fibermarine@fiberdur.com

After emerizing bonding surfaces should be free of shiny areas. The surfaces are evenly worked and should be free of large pits. It should be possible to slide fittings onto pipe ends easily without them becoming jammed. Symmetrically round components can be emerized on a dolly. This ensures a uniformly emerized surface. The procedure is easier and faster.

Changes in the manufacturing method of some fittings result in a simplified technique while handling these fittings for bonding.
In the process of technical development the manufacturing procedure for some fittings are being changed. Affected are the following fittings:

- Elbows
- Reducers (DN 100 and larger)
- T-pieces



The changes affect the manufacturing of the socket area. The inner layer is now being produced by applying a pull-out-tissue. This pull-out-tissue is marked by a red thread, so that a clearly visible marking is achieved and it is impossible to mistake this socket for a normal one.
Because of the pull-out-tissue it is not necessary any longer to grind the inner surface of the socket before the bonding. Only the pull-out-tissue has to be removed from the socket. There is a tongue on the inside for easy removal.
Due to the change it can happen occasionally, that the fittings in one shipment are fabricated with different methods (with and without pull-out-tissue). The distinction is guaranteed by the red thread in the pull-out-tissue, which is very obviously noticed.

TPR Fiberdur GmbH & Co. KG.
Industriepark Emil-Mayrisch, Galileo-Allee 6, D-52457 Aldenhoven, Germany
Tel.: 0049 (0) 24 64 9 72-0. eMail: fibermarine@fiberdur.com

CONCIAL BONDING

Filament wound pipes can be pre-fabricated to include a conical bell end and conically shaved spigot end.
Bonding on site requires the following preparation:

- Manually emerize all bonding surfaces to ensure that any dirt is removed.
- Inspect and prepare the bonding surfaces as required as previously described.

Conical surfaces may only be emerized manually. Careful use of grinding machines is permitted, but only if the pipes are installed on rollers and able to rotate.

IMPORTANT

Remove all excess emery powder using a brush. Protect prepared surfaces from dirt, humidity, etc. Grease, oil, or human perspiration act as parting agents and prevent adhesion.

Do not use solvents to clean bonding surfaces. Bonding surfaces should be prepared immediately before bonding is carried out.

1.2 HANDLING ADHESIVE

ADHESIVE EP 220 (Epoxy resin)

Quantity per charge: 560 gr
Resin (Component A): 380 gr
Hardener (Component B): 180 gr.

Take note of shelf-life indicated, max. 2 years.
For adhesive EP 220, always mix the total quantities for each charge. Alternative mixing proportions are not permitted.
The hardener is added to the resin and both components thoroughly mixed in the container. The adhesive is ready for use when mixture is of a uniform consistency. No streaks should be visible. At low ambient temperatures (less than 15°C) the resin (component A) should be gently heated since it is otherwise too viscous. At ambient temperatures under 10°C bonding requires heating (e.g. using electric heating elements for dryers).

IMPORTANT

Make sure to obtain a good mix also at the bottom and in the corners of the container. Store adhesive in a dry place.
When mixing and using adhesives, observe the safety instructions (see adhesive container or DIN safety information sheet).

NUMBER OF CONNECTIONS USING ADHESIVE EP 220
The following table shows the number of bondings which can be carried out for the various nominal diameters using one charge of adhesive:

- EP 220 (560 g)

The calculation of the quantity of adhesive used assumes that the total quantity of adhesive is used within the specified pot-life. This requires preparation of a corresponding number of bonding locations. Since the number of possible bonded connections is very large in the case of small nominal diameters, it is recommended to make provision for various nominal diameters at the planning stage.

Number of bonded connections

Nominal Diameter		**CONNECTIONS WITH ONE UNIT EP 220 (560 GRAMM)**	**TIME FOR ONE BONDING IN MINUTES**
DN 25	1"	25	20
DN 40	1 ½"	19	20
DN 50	2"	12	20
DN 65	2 ½"	10	25
DN 80	3"	8	27
DN 100	4"	5	33
DN 125	5"	5	40
DN 150	6"	4	45
DN 200	8"	3	50
DN 250	10"	2	60
DN 300	12"	1	80
DN 350	14"	0,5	100
DN 400	16"	0,5	120
DN 450	18"	0,4	140
DN 500	20"	0,3	165

UTILIZATION LIMITS (POT-LIFE)

The period in which adhesive can be used (pot-life) and the curing period of mixed adhesive depends on temperature according to the following table.

IMPORTANT

If the shelf life (pot-life) is exceeded, the adhesive becomes very viscous and lumpy. Adhesion of bonded components is then no longer ensure. Therefore, make sure that the pot-life of adhesives has not been exceeded. Bonded components may only be aligned within the pot-life.

Tempe-rature (°C)	**Pot-Life (Minutes)**	**Curing period (Hours)**
	EP 220	**EP 220**
5	60	60 [1)]
10	50	45 [1)]
20	25	20[1)]
30	20	10[1)]
40	10	5[1)]
60	5	3
80	--	2
100	--	1
120	--	1

1.)
At these ambient temperatures complete curing is no longer possible. Optimum properties of strength and anti-corrosion do not apply. Hot curing or hot after curing is necessary (see above)

ADHESIVE APPLICATION

The adhesive mixture is applied to the sections of pipe and fitting which have been emerized. First, rub in a thin coat of adhesive using pressure. This is followed by a thicker coat. The thickness of adhesive on the pipe end should fill the bonding gap between pipe and fitting. Depending on nominal diameter, a thickness of 2-4 mm should be sufficient.
The cut edges of the pipe should be sized with a thin coat of adhesive. A thin coating of adhesive is also rubbed in at the socket end of the fitting using pressure. This is followed by the application of a coating of adhesive approx.
1 mm thick.

IMPORTANT

All emerized sections of pipe and fittings must be sized with adhesive. The quantity of adhesive on fittings is sufficient when pushing the pipe forward produces a bead of adhesive. Excess adhesive in the socket end of the fitting is forced inwards and reduces the cross-section area. Therefore, the bead should be kept to a minimum. Excess adhesive must be removed.

1.3 JOINING PIPES AND FITTINGS

CYLINDRICAL BONDING

The fitting is inserted onto the pipe (previously coated with adhesive) and pushed fully home. Next, the excess adhesive at the out edge between socket end and pipe is so removed that a fillet-type filling remains. This bead serves as corner reinforcement.

Any excess adhesive on the inside of the fitting must be removed. If accessible, a spatula or similar tool is used. At locations impossible to access, excess and not yet hardened adhesive must be distributed over or removed from the pipe using a pig drawn

through the pipe. The pig can be made of foam rubber or rubber, preferably wrapped around with a felt or fabric rag. When using the pig, care must be taken not to disturb the bonded connection by movement or pulling apart.

On completion of fitting alignment, care must be taken to prevent any movement of components during the curing process.

1.4 HOT CURING / AFTER CURING

The mechanical strength and chemical resistance to corrosion of an adhesive depends on the degree of cure obtained. The more complete the cure, the higher the values. If curing takes place at room temperature tempering for after cure is required, in particular for the epoxy resin adhesive EP 220, in order to ensure a bonded connection of high quality. It is therefore appropriate that bonded connections are cured at high temperatures. FIBERDUR heating elements meet these requirements and are adjusted to curing temperatures.

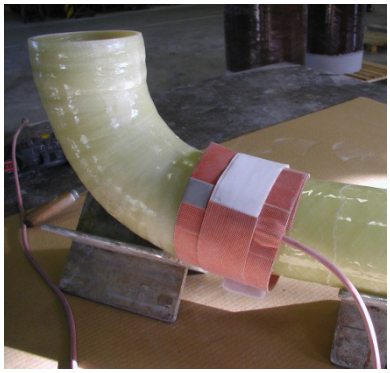
The following table shows recommended temperature and curing periods for hot or after cures when using FIBERDUR heating elements.

ADHESIVE	CURING TEMPERATURE	CURING PERIOD
EP 220	70-80° C	60 min

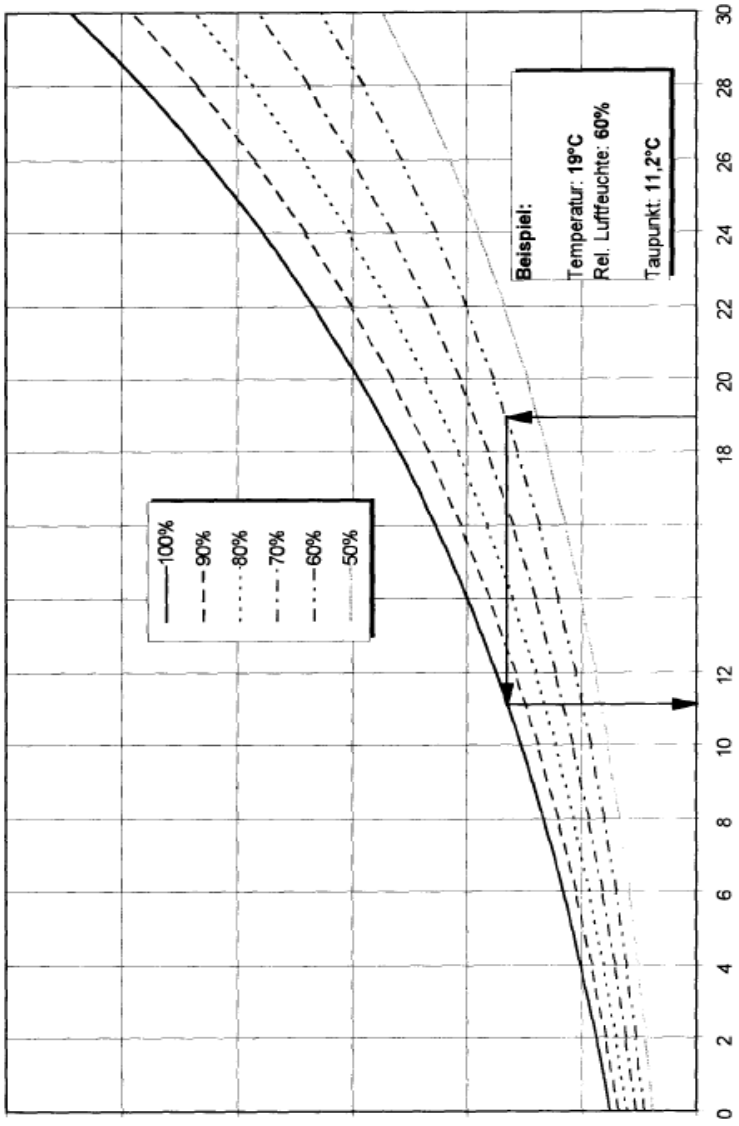
FOR HIGHER TG-VALUES THE FOLLOWING CURING TEMPERATURES AND CURING TIMES ARE NECESSARY:

ADHESIVE	CURING TEMPERATURE	CURING PERIOD (soak and curing)
EP 220 Tg ≥100° C	100° C	60 min + 60 min

Heat can also be provided using electric radiating heaters or hot air blowers. Depending on their output, these items should be installed at approx. 300 mm from the bonded pipe components. This avoids excessive heating.



WATER CONTENT OF AIR IN RELATION TO RELATIVE HUMIDITY



TPR Fiberdur GmbH & Co. KG.
Industriepark Emil-Mayrisch, Galileo-Allee 6, D-52457 Aldenhoven, Germany
Tel.: 0049 (0) 24 64 9 72-0. eMail: fibermarine@fiberdur.com

1.5 SPECIAL NOTES ABOUT ENVIRONMENTAL EFFECTS

EFFECTS OF HUMIDITY

Care must be taken that the components to be bonded are protected from humidity (rain, mist, dew, snow, etc.) during both preparation and assembly. This can be achieved by using an assembly tent or a tarpaulin.
Even when direct humidity, such as rain or mist, is not observable, local climatic conditions may be such that a film of humidity forms on the components to be bonded trough condensation. This occurs when the temperature remains under dew-point.
The following diagram can be used to determine whether at given local climatic conditions, undershooting the dew-point is possible or not. Ambient conditions are measured.

The basic values are:

Ambient temperature	T_1
Relative humidity	PHI
Component temperature	T_2

On the basis of the input data T_1 and PHI, the dew-point temperature T_t is calculated using the diagram. The calculated values allow the following situation analysis:

$T_2 > T_t$:	condensation is not possible
$T_2 \leq T_t$:	condensation may form. Workpieces must be warmed to approx. 5° C above T_t.

When processing the components care must generally be taken to maintain a safety margin in relation to the dew-point temperature. If a workpiece is heated, care must be taken that on cooling while in use its temperature does not fall below dew-point.

EFFECTS OF AMBIENT TEMPERATURE

The effects of ambient temperature on the pot-life and curing period of adhesives has already been described above. Attention is drawn at this point to the dependency of adhesive viscosity on temperature.

EP 220

At temperatures under 15° C it is a good idea to heat the resin slightly before using it. Otherwise, viscosity is very high, the resin is very viscous and difficult to use. It will not be possible to obtain a thorough mix. Also, it is not possible to rub the adhesive into the surface sufficiently well. It must also be remembered that the temperature of the pipe affects the viscosity of the adhesive. If, for example, pre-heated adhesive is applied at temperatures under approx. 10° C, the coating of adhesive will cool very rapidly, resulting in high viscosity. Pre-heating the pipe ends provides a solution, but it must be remembered that the increased pipe temperature effects the pot-life of the applied adhesive. At ambient temperature below 10° C, we recommend carrying out the work in a heated tent or workshop. Heating pipe ends, the socket ends of fittings and adhesive is an option, but not always the recommended one.