QUALITY ENDORSED

TECHNICAL DATA SHEET No.5

ON-SITE SPECIFICATION FOR EPOXY INJECTION
RECOMMENDED GUIDELINES ONLY

Technical Data Sheets

a) Introduction

This document will outline recommendations for on-site injection of epoxy joints in Glulam. The process is to provide connections of two Glulam members by means of hidden steel dowels (usually threaded bar or reinforcing bar) placed in voids drilled into the Glulam and then injected with high strength epoxy to create a rigid joint with predictable mechanical properties. Joints made in end grain and perpendicular to the grain are covered.

b) Scope

The following recommendations will cover in broad terms the minimum requirements to create structural joints as described in a). Manufacturers and erectors should develop in detail their own on-site procedures as this document would not provide sufficient detail necessary to instruct and train operators.

c) Epoxy Specification

The type of epoxy system used shall be tested prior to use to ensure the following fundament requirements:

- Ability to achieve wood bond
- Resistance to heat
- Compressive strength
- Maintain ductility under compression

1) Wood Bond

As the wood bond required is achieved without pressure being applied, the tests established prior to use need to reflect this requirement.

2) Resistance to Heat

Most epoxies will become more ductile as temperature rises. A test should be used to ensure the proposed epoxy will maintain minimum compressive strength at temperatures up to 100 degrees celsius.

3) Compressive Strength

This is clearly the most important test for a structural joint and can be achieved in a modified block shear rig.

4) Ductility

Usually compressive strengths in structural epoxy is not a problem but the combination of ductility and high compressive strength is required. It mainly reflects the mix design ratio of hardener to resin is correct and within the manufacturer's limits. Specimens will shatter under compression with no ductility when 'mix' proportions are incorrect.

d) Mixing

Mixing may be batch or through a static mixer. Both methods will require a different approach to specimens needed.

1) Batch

Batch methods require accurate measurement of both parts. Measurement by volume is the most convenient on-site.

The volume mixed at any one time is important to avoid accelerating the chemical reaction. Small mixes are most efficient.

2) Static Mixing

The major problem with static mixing is the need to monitor the mix ratio. A system has to be devised to ensure the mix ratio is correct at all times.

Use of a static mixer will allow the use of fast hardeners and will assist when the ambient temperatures are low.

e) Injection

1) The joint to be injected must be adequately sealed to reduce the risk of epoxy loss. Voids in the timber need to be sealed.

2) An inspection point for injection in the horizontal position is a good idea and the level can then be monitored as the epoxy sets. This can be achieved by leaving the joint at the top unsealed.

3) In vertical joints where an inspection point is not practical, the joint needs to be observed for leaks post injection.

NB. The essential requirement for a good structured joint is to minimise voids, if not eliminate entirely.

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f) Testing On-Site

It is recommended that a minimum of four (4) tests be performed.

1. Compressive Strength

Test specimens should be taken and marked according to the injection plan. It is usually impractical to test these on-site so these become a QA record when tested later. The other quick test will provide information to ensure the epoxy is set and mixed correctly whilst the compressive test simply puts a number on the materials strength.

The frequency of the collection of these specimens will depend on the type of mixing. The minimum recommendations is as follows:

Batch: 1 specimen per batch.

Static: 2 per injection, ie. one at the start and one at the end.

2. Face Bond

This specimen is a simple test to ensure the adhesive has the required bond qualities to the timber use. Small blocks of the same specie as the Glulam are bonded without pressure and allowed to set. Each specimen needs to be identified.

The face bond is checked on-site by a dry cleavage method using one part only of each specimen. The other half is kept for further testing if the first fails due to inadequate setting time.

The frequency of the collection of the specimens will be governed again by the mixing method.

Batch: 1 specimen per batch

Static: 1 per injection - preferably taken midway through the process

3. Simulated Specimens

A specimen which matched the actual dowel bar, specie and hole size should be made for each joint. This can provide information as a quick site test and can be used to provide loads when tested in a modified block shear test rig.

The quick on-site test is simply destruction of the specimen by impact on the steel bar. This will provide shear failure in the surrounding timber and a visible inspection of the epoxy will confirm the adhesive is set and the frame or member can be lifted.

Whilst this is a subjective visual test, it is the most important site test. Brittle failure of the epoxy may occur and could indicate incorrect mix proportion. Extreme deformation of the epoxy when split can also indicate the adhesive is not set or the mix proportions are incorrect.

A good specimen will show clear shear failure in the wood and neat impressions of the steel in the epoxy.

The frequency of this test is as follows:

Batch: 1 specimen per batch

Static: 1 specimen per joint

4. Additional Tests

In the event that the face bond test and the simulated test specimen fail due to inadequate curing, the joint can be further tested by drilling a small diameter drill into the epoxy and inspecting the waste removed. Epoxy which is set will produce a powder when drilled by a HS steel drill bit.

g) Safety

Epoxy is generally a very safe material to handle however some personnel may have a reaction on their skin when direct contact is made. All personnel handling the material should be using protective clothing and eye protection.

The manufacturer's MSDS should be obtained and all personnel made aware of the materials properties prior to use.

h) Clean-Up

1) The manufacturer will recommend clean-up procedures for the equipment.

2) Concrete slabs etc should be protected during injection by disposable plastic to collect spillage.

3) Clean-up of excess material on joints should be cleaned off while the epoxy is fluid. Clean water will usually do this and save work after the epoxy is set.