On site pull-off method

Reference standard: BS EN 1542:1999

Equipment required:
- Pull-off equipment (e.g. Hydrajaws)
- 25mm diameter steel dollies (metallic), 5 or more
- 50mm diameter (for concrete or timber), 5 or more
- Adhesive
- Spatula
- Bondline spacers – e.g. ballotini (glass spheres)
- Diamond-coated core drill (if required)

Procedure for preparing samples for pull-off testing:

1. Clean the steel dollies (degrease and gritblast unless otherwise stated)
   - This will help to prevent interfacial failures at the dolly interface
2. For concrete substrates drill through the repair system with diamond core drill at (90±1)° to the surface into the test surface by ~5mm or more
   - This ensures a consistent bond area and will therefore help reduce variations in the test results
3. Clean the substrate test surface as recommended by the manufacturer
4. Mix the adhesive as recommended by the adhesive supplier and add 1% by weight of ballotini (usually 0.5mm unless stated otherwise)
   - Adding ballotini will reduce alignment errors and therefore help reduce variations in the test results
5. Apply adhesive to steel dolly
6. Apply adhesive to substrate test surface
   - This ensures the adhesive wets out both surfaces and helps prevent interfacial failures
7. Press the steel dolly into the substrate test surface with a firm pressure
   - DO NOT 'seat' the dolly by twisting it into position. If the dolly is twisted into position it will increase the likelihood of interfacial failures.
8. Remove excess adhesive from around the edge of the dolly without disturbing its position
   - This ensures a consistent bond area and will therefore help reduce variations in the test results
9. If working on a vertical, or overhead surface, ensure the dollies are held firmly in position until the adhesive has cured.

Fig.1 Procedure for bonding steel dollies onto substrate
Procedure for performing pull-off tests:

- Set up the pull-off equipment so that the load is applied to the centre of the dolly and at an angle of $90^\circ \pm 1$ (Fig.2)
  - Excess misalignment will reduce pull-off strengths
- Secure equipment so that it does not move during testing
  - This will cause excess misalignment which will reduce pull-off strengths
- Apply a load at a continuous and even rate until failure.

![Fig.2 Test set-up](image)

- Record test temperature, failure load and failure mode (Fig.3)
  - (record mixed failure modes in percentages of bond area, i.e. 90% substrate failure, 10% cohesive failure)

![Fig.3 Possible modes of failure](image)

**IMPORTANT:**

A low reading WILL be obtained if:
- the pull-off tester is misaligned and not perpendicular to the specimen
- the specimen is misaligned and not perpendicular to the pull-off tester
- the bondline is not of uniform thickness (0.5mm)
- a sudden or erratic loading is applied.

**Note:** This sheet is for guidance only. Please also refer to adhesive manufacturer’s data and safety sheets.