Remedial Tie Selection

The problem of wall instability and tie failure

Wall ties are an important structural component ensuring the stability of the outer leaf of a cavity wall against wind loads. The condition and number of ties in the structure are important and where corrosion has set in or wall ties are missing or broken, then remedial ties will be required. Solid masonry may also delaminate through broken headers or deteriorated mortar, requiring remedial tying to ensure future stability.

Wall tie failure

Corrosion of galvanised metal cavity wall ties is a widespread problem and has been well documented in Australia since the Newcastle earthquake in 1989. The earthquake resulted in 13 deaths and over 150 injured. Many buildings collapsed and many lost large portions of their external cavity brick walls which were found to be unsupported, largely due to corroded wall ties. The event alerted building owners and professionals to the problems and risk associated with wall tie failure in cavity brick buildings.

Since 1990, codes and practices have been changed requiring the use of stainless steel and other non-corrosive materials for cavity wall ties in coastal zones where corrosion risks are greatest. However, many older buildings continue to suffer brickwork collapses during strong winds as a result of corroded wall ties. Most cavity brick buildings in Australia built before 1990 contain wall ties made from galvanised mild steel. Unexpected wall collapse can be extremely dangerous and require costly repairs.

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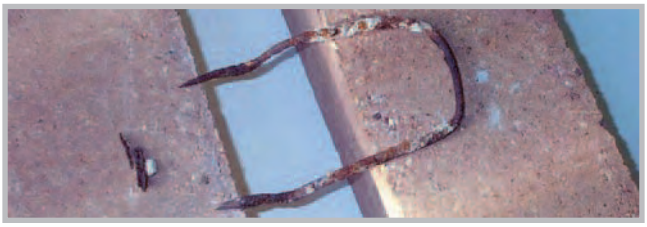

The majority of wall tie corrosion occurs within the bed joints of the external leaf

Brickwork collapse from a residential appartment block in Sydney, resulting from wall tie failure

Bowed brickwork is a strong indicator of wall tie failure

Indicators of wall tie failure

The majority of wall tie corrosion occurs within the bed joints of the external leaf, and not in the cavity itself, as is commonly suggested. This means that the extent of the problem of wall tie failure can be difficult to ascertain. The most assured method of correctly diagnosing the problem is to use a tie locator or metal detector to locate and mark a number of ties in each elevation, to then remove one or more bricks in the external skin and to then visually inspect the portion of the tie end embedded in the mortar joint. Other indicators include:

- Out of plumb, bowed, cracked or collapsed brickwork
- Corroded arch bars and lintels
- Rust stains in the walls
- Gaps between timber reveals and brickwork at openings
- The age and location of the building and known problems with other similar buildings in the area

Remedial Tie Selection

The solution to wall instability and tie failure

Helifix remedial ties are the solution to the problem of wall instability and tie failure. All Helifix ties are stainless steel, corrosion resistant and flexible to accommodate natural building movement. All ties are easy to install and test in the building under repair, leaving nothing to chance.

The following notes and tables provide some general guidelines on how to choose and install the appropriate Helifix wall tie solution. Table 1 indicates the most appropriate tie for situations involving standard cavity wall constructions with differing cavity widths. Table 2 matches different wall tie systems to a selection of different wall constructions and remedial situations, while Table 3 outlines tie size specifications. Table 4 details tie penetration and pilot hole requirements for different substrates. Note that in some situations, a full site survey conducted by an engineer or building professional may be required to produce an accurate specification. Note further that full installation details for each product are presented in the following few pages and in the Repair Details section at the end of this catalogue.

Ties, substrates and cavity width

Included among the Helifix range of remedial ties are BowTies, Cemties, RetroTies, ResiTies and DryFix ties. Typically, the composition of the wall requiring repair, and the size of the cavity involved, will dictate which particular Helifix product will be required to provide a strong and durable solution. Commonly, problems involving large cavities will require a ResiTie or RetroTie solution, while problems involving rubble-filled or deep masonry walls will require a CemTie solution. Problems involving the reconnection of bowed or bulging walls to floor joists will regularly require a BowTie solution. Most often, however, the DryFix system for wall tie replacement will provide the most suitable solution to the problem of wall instability and tie failure.

DryFix ties are 8mm in diameter and are available in a number of different standard lengths to accommodate a large range of problem situations and cavity widths. The standard DryFix lengths include 155, 170, 195, 220, 245, 270 and 295mm. The standard pack size is 100 ties. DryFix ties are easily installed into a variety of different materials to provide an extremely strong and durable mechanical connection.

Drilling guide

For all remedial ties it is important to use the correct drilling technique to avoid excessive spalling of the near leaf as the drill breaks through into the cavity and to ensure the accuracy of the hole's diameter.

The drilling machine should be small (around 650 to 750w) and the operator must not lean or push heavily on the drill during operation as this will reduce the effectiveness of the hammer and increase the likelihood of spalling the back face of the brick. Rotary hammer drill bits (SDS type), used appropriately, will satisfy most common drilling requirements. However, when drilling into very soft masonry or hollow concrete blocks, rotary percussion drilling with 3-jaw-chuck type drills should be used. This may increase drilling time but will minimise spalling.

Ties may be installed directly into the mortar bed in situations where drilling through the brick/block face is not acceptable. This will be satisfactory where the mortar is strong and in good condition. Angled drilling through the masonry may also be used in some circumstances.

Testing and spacing

Testing can be included as a routine part of tie installation. A random number of ties may be tested at different levels and elevations to determine the pull-out load from both the near and far leaves. In most typical situations, a tensile proof load of 1kN will be sufficient to satisfy SAA Masonry Code requirements, with ties spaced at 600mm centres on unbroken brickfaces and 300mm centres around openings.

Pull-out tests on ties can be easily and accurately conducted on site using the Helifix Load Test Unit.

TABLE 1*–Tie Systems for Standard Cavity Walls (e.g. Brick Cavity and Brick Veneer)

Cavity Width	DryFix	RetroTie	ResiTie (8mm)	ResiTie (10mm)
< 40mm	✔			
40mm-60mm (standard)	✔ (DryFix 8x220)			
< 90mm	✔			
90mm-140mm		✔ (if >1000 ties)	✔ (if <1000 ties)	
140-200mm				✔
> 200mm				✔ (Increased density required to achieve compressive strength)

*To be used as a guide only. For technical support, product availability and general specifications please contact Helifix on 1300 66 70 71.

Remedial Tie Selection

TABLE 2*–Tie Systems for Other Common Wall Types and Remedial Situations

Wall Type/Situation	DryFix	RetroTie	ResiTie (8/10mm)	CemTie	BowTie
Solid Masonry	✔		✔	✔	
Brick / Cavity / Concrete	✔	✔	✔		
Brick / Cavity / Concrete Block	✔	✔	✔		
Block / Cavity / Block	✔	✔	✔		
Rubble-filled, parapet and party walls				✔	
Bowed Brickwork / Timber					✔

TABLE 3*–Tie Size

	Diameter	Length	Masonry Clearance Hole	
Bow Tie	8mm	Parallel joists: Sufficient to drive 50mm into or through the second joist	12mm	
	8mm	Perpendicular joists: Sufficient to drive 75mm into joist end grain	14mm	
CemTie	8mm & 10mm	50mm less than all the materials being tied	12–14mm	(for 8mm Ø tie < 450mm in length)
			16mm	(for 8mm Ø tie > 450mm in length)
			16mm	(for 10mm Ø tie < 450mm in length)
			18mm	(for 10mm Ø tie > 450mm in length)
RetroTie	8mm	Minimum 3/4 of near leaf thickness + cavity width + far leaf penetration (see Table 4)	10–12mm	(near leaf only. See Table 4 for RetroTie pilot hole requirements.)
DryFix	8mm	Near leaf thickness less 10mm+ cavity width + far leaf penetration (see Table 4)	Not applicable	(but pilot hole required. See Table 4 for DryFix pilot hole requirements.)
ResiTie	8mm & 10mm	Minimum 3/4 of near leaf thickness + cavity width + 55mm far leaf penetration	10–12mm	(for 8mm Ø tie < 450mm)
			12–14mm	(for 10mm Ø tie < 450mm)

TABLE 4*– Tie Penetrations and Pilot Hole Requirements for Different Substrates

Far Leaf Material	Penetration (mm)	Recommended Tie	Pilot Hole
AAC/Aerated concrete blocks & panels <4.0 MPa	95	8mm DryFix	Not required
		8mm RetroTie	Not required
Standard brick/Natural stone	60-70	8mm DryFix	5mm/6mm
Hollow concrete block 5-20 MPa		8mm RetroTie	5mm/6mm (Percussion drill)
Hard brick/Extruded brick	45	8mm DryFix	6mm/6.5mm
		8mm RetroTie	6mm/6.5mm
High strength reinforced vibrated concrete	35	8mm DryFix	6.5mm
		8mm RetroTie	6.5mm
Timber frame	45	8mm DryFix	Not required (5mm optional in hard wood)
		8mm RetroTie	Not required (5mm optional in hard wood)
Floor joist - side grain	45-70	8mm BowTie	Not required (5mm optional in hard wood)
- end grain	70	8mm BowTie	Not required (5mm optional in hard wood)

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