



MODERN METHODS OF MASONRY REPAIR



PRODUCT AND APPLICATION SOLUTIONS

The Wykamol Group

For over 70 years Wykamol has been the market leader in the fields of property repair and renovation.

Established in 1934 to develop a chemical treatment for insect infestations in timber, Wykamol now produces the broadest range of property repair and renovation solutions in the UK.

Thor Helical Remedial is the Specialist Structural Repair division of the Wykamol Group dealing in masonry repair principals, products and applications throughout the UK and Ireland.

As head distributors of Thor Helical products and pioneers of their concealed, non-disruptive application techniques, Wykamol have developed an array of standard and bespoke repair solutions that are widely used in preserving British and Irish heritage buildings.

This includes structural renovation of national housing stock and bridges to strengthening listed buildings and heritage structures such as churches, castles and monuments, Thor Helical retro fitted masonry reinforcement is widely recognised as a sustainable option of property repair and refurbishment that reduces costs, adds value and minimises environmental impact.



The Thor Helical Remedial division has a team of in-house engineers able to offer advice on project-specific solutions. The engineering team can provide approved CPD seminars for Architects, Structural Engineers, Surveyors and Building Professionals covering:

- Benefits of using helical reinforcement to strengthen masonry structures
- Crack stitching applications
- Formation of load-carrying masonry beams
- Remedial ties, pins and lateral restraints
- Non-disruptive installation techniques
- The advantage of using Thor Helical products over those of similar design or function

Thor Helical Remedial also offer contractor training in structural repair principals and product applications. A nationwide network of Approved Installers has been developed to provide property owners and managers with the confidence that from start to finish their project will be handled expertly by specialists trained in the field of structural masonry repair.



Our Process

Structural repairs carried out by Thor Helical Remedial Approved Installers are controlled by Wykamol's stringent Quality Management System.

Granted 'Approved' status for high standards of workmanship and customer service, Approved Installers are part of an elite group of quality contractors who enjoy a close relationship with Thor Helical Remedial.

Through a comprehensive programme of on-site and classroom learning, they have extensive practical and theoretical knowledge of Thor

Helical Remedial repair solutions, and the latest industry developments - regularly updated with supplementary training sessions.

Approved Installers' work is certificated by Construction Guarantee Services' (CGS) 10 year Guarantee Protection Insurance, offering property owners long-term peace of mind, even in the unlikely event that the Approved Installer were to stop trading.



Wykamol's 5 Steps to success

Survey

A detailed initial inspection is carried out to identify defects and weaknesses in a building and any external factors that might have an effect on the structure.

Diagnosis

An informed conclusion reached on the nature and cause of the defects identified from data collected at the survey stage. Correct diagnosis of the exact causes of the faults is vital if the appropriate remedial action is to be prescribed.

Design & Specification

Wykamol's Engineering Team have a wide range of standard repair details to suit most situations. Where something bespoke is needed then the Engineers are able to design project-specific specifications and work instructions.

Installation

Our UK network of Thor Helical Remedial Approved Installers are trained in all aspects of product installation and in-process testing. All aspects of the application are recorded for the Project Quality File and Guarantee.

Guarantees

CGS supports its members' guarantees by arranging for them to be insured for 10 years by Guarantee Protection Insurance Ltd, a UK based insurance company authorised by the Prudential Regulation Authority and Regulated by the Financial Conduct Authority.

1 2 3 4 5

Technical support and advice throughout every stage

Structural Repair Principles

Throughout the world, where masonry is used, the super-structure of a building is susceptible to the types of movement that may result in structural defects, such as the cracking, buckling, leaning or rotation of sections of wall.

The origins of such disturbance often include;

- **Unstable ground at foundation level** (settlement/ subsidence/ heave/ land slip, etc.)
- **Expansion/ shrinkage of materials due to variations in temperature and/or moisture content**
- **Faulty construction and/or faulty alterations**
- **Inadequate design resulting in overloading/over-stressing**
- **Chemical reactions within masonry walls/corrosive expansion of embedded metals**

Over recent decades, methods have been developed to introduce hidden strength into a structure by discretely retro-fitting ties and reinforcement into existing buildings. This improves the tensile and flexural strength of the masonry, transfers applied loads to the parts of a building most able to withstand them and creates smaller box structures within a structure to improve strength and resilience.

Retrofit Masonry Beams

It is common to find walls that have become distressed due to localised foundation failure or lintel failure. Cavity walls for example often have “physical” lintels in the inner leaf that support imposed floor and/or roof loads but in the lighter-loaded external leaf, only a flat or shallow arch provides the support for the brickwork above. Often such openings perform acceptably because the original timber or steel window/door frame acts as a fortuitous lintel. Deterioration of the window/door frame or its replacement with a U-PVC unit undermines this ‘fortuitous lintel’ support and can lead to failure of the brickwork above such openings.



Solid walls may also suffer from such problems as flat or shallow arches over openings are sensitive to small movements of the buttressing masonry either side of the opening.

The strength of the brickwork may be reinstated and reconsolidated by installing multiple retrofit lengths of Thor Helical reinforcement in the masonry panels above the windows or areas of localised foundation failure.



This technique generates an in situ reinforced, deep masonry beam. In order for the reinforced beam zone to accommodate the imposed flexural forces, it is necessary to repoint loose mortar joints and to deep-resin-inject cracks with an appropriate resin or grout.

Where lintel arches are failing, it is often necessary to put vertical ties up from the arch into the reinforced zone to complete the repair. Some additional localised crack stitching may also be required.

Crack Repair

Once the cause of a crack in a wall has been identified and resolved, it is necessary to reinstate the structural integrity of the cracked masonry. This can be done simply by introducing high tensile helical reinforcement bars across the crack to tie the masonry panels together. Thor Helical reinforcement bars set in non-shrink grout maximise bonding characteristics, combining excellent compressive resistance and great axial strength to provide resilience against further cracking.

Ties that Add Lateral Restraint

It is common for a façade wall to buckle, bow or lean due to the imposition of unwanted loads and the lack of restraint with which to resist them. For example, roof spread may result in roof loads being transferred from the inner leaf of a cavity wall to the outer leaf, causing it to buckle at mid-height. Lateral restraint is easily

provided to arrest this movement with special ties designed to secure the façade to the structural floor diaphragms or to timber dividing walls, forming smaller and stronger box structures within the span of the wall. In addition, remedial wall ties can be used in conjunction with lateral restraint systems, distributing loads evenly through the wall to prevent separation.



Applications

Wykamol strive to source the best quality products on the market to ensure that clients get the best possible repair, whatever the application.

As UK distributing partners of Thor Helical, Wykamol brings to market "second generation" building reinforcement products that have been continuously developed and improved by the inventors of the first helical wall ties and bars, which were launched under an older brand name in 1984.

The engineered improvements make the Thor products more versatile and reliable than earlier products that, to the non-trained production engineer, appear to be similar in design and function.

REMEDIAL TIES AND PINS

Self-tapping, hammer-in connectors use an interlocking undercut screw thread to grip into a wide variety of building materials. With patented perfect-pitch twisting technology Thor Helical wall ties offer a distinct performance advantage when tying together cavity walls, delaminating solid walls or separating partition walls. The smart and low-cost insertion tool is easy to use with the all new and patented Thor Helical CD Tie, making driving long-ties into arches and cross-walls a quick, clean and reliable process.

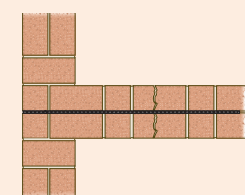
BED JOINT REINFORCEMENT & CRACK STITCHING

Helical reinforcement bars are ideal for stitching cracks in brickwork, reconnecting walls either side of the fracture and dissipating load along the length of the helix. The twisted Thor Helical bars can also be used as bed joint reinforcement to form deep masonry beams that carry and transfer imposed loads. The perfect pitch twisting process delivers lengths of bar that are not only consistent in pitch but also consistent in tensile strength, something that cannot be achieved by older wire-spinning techniques that are used to form our competitors' products.



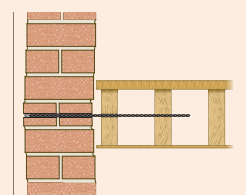
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Reconnection of partition walls



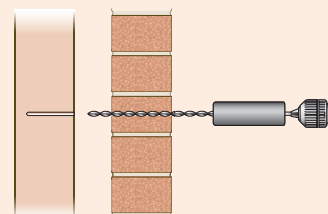
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Lateral restraints



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Restraining bowed walls



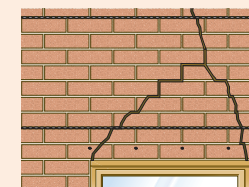
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Arch lintels



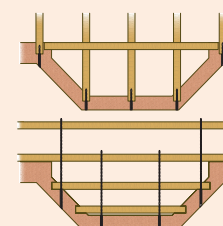
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Lintel repairs



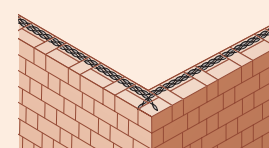
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Bay Window Repairs



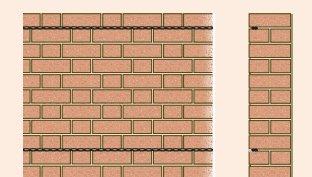
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Cracks near corners of buildings



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Masonry beam creation



Crack Stitching

Masonry crack repair systems utilise crack stitching bars to enhance the tensile, flexural and shear capacity of cracked walls.

Cracks in walls are the direct result of movement beyond that which can be accommodated by the construction materials. Typically wall cracks where masonry is overstressed and least restrained, such as at window and door openings or at corners. The movement that results in cracked walls is usually caused by variations in the moisture content of the masonry, or in the ground that supports it, temperature variations or by chemical reactions. Some movements are cyclic and reversible, many are permanent.

Wall cracks in masonry can be divided into three categories:

- **ACTIVE** - (a crack which is increasing in width and/or length)
- **PASSIVE** - (a crack which is no longer increasing in width or length)
- **CYCLIC** - (a crack in a wall which opens and closes seasonally)

Unless the history of the building is known and the cracks can be classified into the passive or cyclic categories, ascertaining the type and cause of cracks can be difficult and may need the input of a structural engineer. Monitoring of the cracked brickwork over an extended period of time may be required before an appropriate masonry repair strategy can be determined

Generally, wall cracks that are passive or cyclic can be reinforced by simple crack stitching and masonry repair techniques that improve the tensile and flexural strength of cracked walls such as to accommodate small and/or cyclic movements.

Bed joint reinforcement bars are bonded into mortar joints, at regular intervals, usually 300mm to 450mm apart, to tie the masonry on each side of the crack.

Mortar joints are simply raked out to form slots that extend 500mm either side of the wall cracks. Each slot is thoroughly wetted prior to the application of a proprietary cementitious bonding agent. A crack repair bar is pushed into the bonding agent such as to fully embed the rod and implement crack stitch repairs without costly rebuilding work and with minimum inconvenience to the occupants.

This effective system of masonry crack repairs fully restores the integrity of cracked walls to their pre-cracked state and allows the masonry to behave as a reinforced non-fractured unit.



CRACK STITCHING PRODUCTS

Stainless steel crack stitching bars are roll profiled and cold worked to an ultimate tensile strength that is twice that of rebar, four times that of epoxy glass-fibre rods and seven times that of flat twisted plate [ref: BRE GBG 62].

Having a helical configuration the high tensile crack repair rods physically interlock with the bonding agent, exhibiting a unique and resilient torsional spring-like quality that allows small amounts of cyclic movement and recovery to occur without brittle failures.

The angular faces of the helix redistribute tensile forces over the reinforced area to stabilise the wall structure, making the walls tougher, stronger in flexure and tension and less likely to crack.

Cementitious masonry repair grouts are the preferred bonding agents for retrospective masonry crack repairs and reinforcement. The use of resins for structural repairs by crack stitching is discouraged unless the load potential on the rod is wholly axial (parallel to the helical rod).

When used as a full length rod-bonding agent, for repairing cracked walls, resins do not cope well with shear forces (perpendicular to the rod) and their use for masonry crack repairs should be avoided where there is cross-plane movement.



Wall Ties and Cavity Wall Failure

Wall ties are an essential element for the stability of a cavity wall structure, tying its weather protecting masonry facade to the main body of the building at regular spacings.

An effective wall tie system transfers static and live loads across the cavity, enabling load-sharing by both inner and outer walls. Typically cavity wall ties are bedded in a mortar bed joint as a building is constructed.

Cavity wall tie failure can be a consequence of a construction defect; for example where the original 'built-in' cavity wall ties have been omitted, incorrectly fixed or fitted with masonry ties that are too short. Alternatively failure may be a result of a buildings ageing process, whereby wall tie corrosion may have compromised the load-sharing capacity of the wall structure.

Over time mortar joints, which host the wall ties, undergo a chemical change through carbonation. The mortar becomes aggressive to the base steel and its protective coatings, reducing the life expectancy of cavity tie systems to as little as 26 years. The design life of the building is typically much longer than this period and it therefore follows that at some point the installation of a wall tie replacement system may be necessary if the stability and load sharing capacity of the wall is to be maintained.

As wall tie corrosion sets in the steel wall ties generate a build up of iron oxide layers which occupy a greater volume than that of non-corroded steel. In most cases, particularly when wire wall ties have been used, the increase in volume is accommodated within the mortar bed as the cavity ties erode. In such cases there may be little sign that the outer facade is free-standing and the walls not supported, save that the wall may appear to bulge.

In other cases, particularly where sheet steel or vertical twist wall ties have been used in less forgiving mortars, replacement of sound steel with iron oxide build up may have the effect of lifting the masonry above a line of in situ masonry ties. If expansion is widespread along several rows of the corroding wall ties, a tell-tale pattern of horizontal cracks may be produced along each wall tie course.

Where any type of cavity tie failure has been established the walls should be immediately stabilised with new stainless steel remedial wall ties. Where each leaf is at least 90mm thick, installation of the replacement wall ties is, generally, undertaken at a density of 2.5 per sq. metre, tie centres measuring 900mm horizontally and 450mm vertically, in a staggered 'domino 5' pattern. Additional retrofit ties are installed adjacent to open reveals. Installation of wall tie replacement systems is a simple process that can be carried out by competent builders.

Where wall tie corrosion and expansion has resulted in horizontal cracks to a brick facade, a qualified engineer should be asked to assess the potential for continued expansive damage and to weigh this against the damage that could result from efforts to remove or isolate all the corroding wall ties. Remedial work to remove or isolate existing cavity ties is a separate and delicate task requiring extreme care if the masonry is not to be unduly damaged.



Replacement

There are a number of corrosion resistant stainless steel remedial wall ties that are designed specifically for cavity wall tie replacement in domestic housing and for ease of use. The most common retrofit brick tie types are:

Driven Helical Wall Ties - A profiled and twisted remedial wall tie that is driven into a pilot hole. Work hardened blades cut a spiral interlock into brick, block & concrete walls as the cavity ties are driven by a series of impacts. Tiny 6mm pilot holes enable extremely quick wall tie installation with minimal disruption to the facade or to cavity insulation. Use helical ties in all masonry types. A setting tool in a hammer drill facilitates the easiest and fastest retrofit wall tie replacement system available.

Resin Grouted Wall Ties - Remedial cavity wall ties that are pushed into resin or grout filled holes in one brick leaf before more bonding agent is pumped around the other end.

The resin or grout sets around, and keys to, major deformations located at each tie end. Grouted wall ties are well suited to domestic buildings having inconsistent or suspect quality masonry.



Masonry Beaming

Bed joint reinforcement, added during construction, is an accepted technique for making brick, block and stonework walls tougher, stronger in flexure and tension, and less likely to crack. It is also used with the masonry to generate load carrying beams or lintels within walls.

Retrofitting masonry reinforcement into existing wall structures is a relatively simple way of generating a deep beam within the masonry to repair sagging lintels and flat arches, develop arches or cantilevers within a wall to span over patches of subsidence, and increase the flexural strength (out of plane) and shear resistance of walls to combat wind and seismic loading.

The Wykamol Group distributes the Thor Helical® reinforcement system that involves retrospectively reinforcing the mortar beds of an existing masonry structure by removing part of the outer portion of a bed joint and inserting two 6mm diameter helically profiled Thor Helical bars encased in a strong grout. The high-fin/ low-trough helix maximizes bonding characteristics between the wire and the WHO-60® grout, providing excellent compressive and axial strength along the full length of the bonded composite.

Depending on the number and location of the beds reinforced in this way, either deep masonry beams can be created - or more general areas can be reinforced returning structural integrity to a cracked building - or localised reinforced areas can be produced - reinstating more localised areas of a structure.



The design principle is based on the formation of a deep beam within the brickwork by the insertion of two chords of reinforcement: the lower tension chord and the upper compression chord (formed by the combination of the grout encased wires and the surrounding masonry). The unreinforced courses between these two chords can be seen as the equivalent to the web of the beam.

The BRE have published a paper that proposes a design method - and loading tables - for use with 6mm diameter Thor Helical® bars, when they are encased in WHO-60® grout and used as a remedial technique for reinstating the structural integrity of buildings.

Copies of the BRE documentation are available to engineers on request.



Lateral Restraints

The Wykamol Group, under its Thor Remedial division, bring to market an engineered solution to enhancing lateral restraint through tying external walls to structural timbers and partition walls in a method that improves reliability, reduces cost and alleviates disruption to property owners or building occupiers.

Signs of bulging brickwork are often highlighted on houses where a middle section of a wall is pulling away from the main structure of the building.

The cause of such buckling walls is often due to the combination of excessive vertical loads and inadequate mechanical connection between perimeter walls and the main structure of the building, for example the timber joists, partition walls and party walls.

In older buildings that have no joist-hangers the timbers often sit into pockets in the masonry and rely purely upon friction to maintain their relative position to it.

When this frictional resistance is overcome by forces that encourage the wall outwards, the connection between the wall and the joist is lost, leaving the wall free standing and vulnerable.

In the past, means of arresting outward movement of the walls have included the insertion of intrusive heavy duty tie-bars and pattress plates.

Other methods of strengthening the walls connection with abutting structural timber include the utilisation of lateral restraint straps or angle irons, often held in place by

lightweight screws and plugs; both methods involve much internal upheaval and disruption as internal floorboards are lifted and plasterwork is disturbed.

Wykamol offer two types of lateral restraint products for reconnecting and strengthening bulging walls; one for tying perimeter walls to the more stable floor diaphragm structure or to stud walls and the other for strengthening the connection between the masonry façade and walls that run perpendicular to it, such as masonry partition walls and party walls.



The masonry to timber lateral restraint tie comprises of an 8mm threaded shaft and a timber drilling tip. A clearance hole is drilled through the facade up to first joist/stud and the tie is screwed through the required number of joists/studs. The drilling tip pilot holes the timber and the threaded section follows to provide a strong threaded connection with the timber section.

The outside end of the lateral restraint tie is then securely resin bonded into the masonry facade. The wall is securely held in position thus resisting further buckling.

Long Thor Helical tie bars can be used to tie facade walls back into masonry partitions and party walls. The heavy duty helical bars are generally fully embedded in Thor W60 grout. Alternatively, driven helical fixings can be used to connect directly into the end grain of floor joists or into pilot holes through thinner masonry sections for a quick and easy mechanical fixing solution.

Whichever lateral restraining technique is adopted the façade wall is fixed firmly in place relative to the main building and buckling loads are transferred and dissipated into the main structure.

This leaves a strong, durable and virtually invisible repair that utilises the existing structural elements to provide the necessary support and stability without major upheaval.



Technical Drawings

Thor Helical Remedial have an extensive library of masonry repair details for both cavity and solid walls using Thor Helical Remedial Heliforce Bars, HD Heliforce Bars and Grout Ties.

All are available to download from our website in PDF format or as NBS clauses for Architects and Engineers wishing to include the appropriate repair details within their specification.

In addition, the Thor Helical Remedial Technical Team are available throughout the UK, to advise clients and contractors on the most appropriate repair techniques. Managers are spread across the UK and can attend site for training as well as carrying out cpds across the UK.

Thor Remedial understand the importance of correct diagnosis and the capabilities of using our extensive range of helical repair products. When using the Thor Helical bars for masonry beaming, for instance, the proper use of the installation guides is essential with clear instructions and drawings showing where and how these designs should be implemented.

The wall tie installation guides detail different connection strategies and positioning of wall ties for various construction types.

The crack stitching installation guides cover most common crackstitching applications from solid walls to cavity walls and rendered properties. Please contact us if you would like one of our technical detail CDs or as stated you can download all the drawings from our website.



Wall Ties

An effective brick tie system transfers static and live loads across the cavity, enabling load-sharing by both inner and outer walls.

Typically cavity wall ties are bedded in a mortar bed joint as a building is constructed.

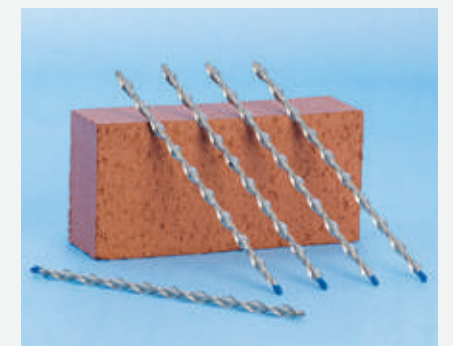
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Alternatively failure may be a result of a buildings ageing process, whereby wall tie corrosion may have compromised the wall's load-sharing capability.

Over time mortar joints, which host the wall ties, undergo a chemical change through carbonation.

The mortar becomes aggressive to the base steel and its protective coatings, reducing the life expectancy of cavity tie systems to as little as 26 years.

The design life of the building is typically much longer than this period and it therefore follows that at some point a remedial retrofit replacement of the brick ties may be necessary if the stability and load sharing capacity of the wall is to be maintained.



CD Tie - 9mm

The all New CD tie is the fastest fixing wall tie in the market today. The unique fixing tool is cost effective and enables the tie to be fixed very easily. Available in 6 sizes all 9mm diameter by 180mm, 205mm, 230mm, 255mm, 280mm and 305mm in length.



Stainless/neoprene expanding ties

For brick and softer host substrates, all ties are 10mm in width and come in five sizes 175mm, 200mm, 225mm, 250mm and 305mm.



Resin Bonded ties

Resin bonded ties fitted with stainless steel backstop nuts, available in three sizes all bars are 5mm thick and come in 175mm, 200mm and 225mm lengths.



PRP TIES

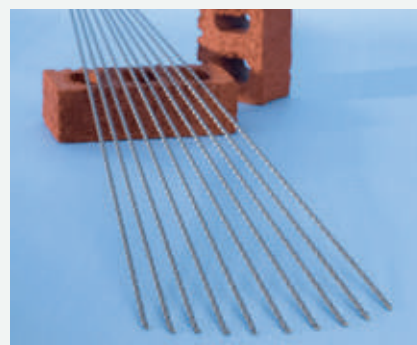
Resin bonded ties with self centring resin stop. Available in five sizes 175mm, 200mm, 225mm, 250mm and 305mm all ties are 5mm in width.

Crack Stitching



Thor Crack Kit

Masonry crack repair kit with everything needed for professional wall stitching repairs. Suitable for repairing cracks in brick, block and stone walls.



Crack Stitching Bars - 6MM

Thor crack stitch repair bars for masonry repairs. Available in five lengths 1000mm, 1200mm, 1500mm, 2000mm and 7000mm bars.



Heavy Duty 8-9mm crackstitching bars

Available in three lengths 1000mm, 1500mm and 2000mm (8mm also available in 7000mm) bars.

Thor crack stitch repair bars for masonry repairs and reinforcement of cracked walls.

Heavy duty helical bars (15kN+) are ideal for the masonry repair of wall cracks where shear strength is an issue. This 8mm or 9mm diameter crackstitching bar offers extra performance significantly increasing the shear, tensile and flexural strength of cracked masonry walls.

The hi-fin design also makes the Thor Helical® products ideal for grouting into mortar beds to retrospectively reinforce distressed masonry and to control cracking by distributing forces back into the structure.



Resins and Grouts

Wykamol are able to offer an excellent range of resins and grouts to suit all applications in wall tie replacement and masonry reinforcement.

The range features the cement based Thor W60 grout which has been independently tested by the Building Research Establishment, for use in masonry reinforcement. features the cement based Thor W60 grout. (see tools & equipment) to use these products.



THOR REMEDIAL RESINS

We carry a large range of specialist resins from polyester through to pure epoxy and the widely used epoxy acrylate which along with the epoxy are ideal for use in damp substrates. Easy to extrude, short curing times and ideal for close edge and spacing applications.

We also stock a range of epoxy acrylate resins, these along with the epoxy are ideal for damp substrates.

Easy to extrude, short working and curing times, ideal for close edge and spacing applications.



THOR W60 FLEXI Grout

A high performance, non-shrink cementitious masonry repair grout. Used to bond helical masonry reinforcement into wall joints for the retrofitting of masonry reinforcement.

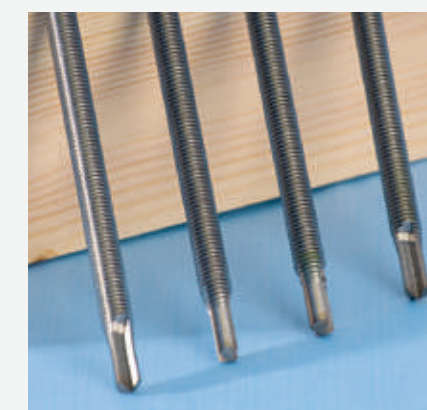
A 5kg cement grout/polymer blend consists of prebatched powder and liquid components which when mixed yields 3 litres of pumpable thixotropic masonry crack repair grout for bonding crack stitching components into concrete and masonry walls.

Lateral Restraints

Lateral restraint wall ties for restraining bulging walls. Walls should be tied back to two or more timber joists or studs using these 8mm diameter stainless steel ties.

Lateral restraint ties are fitted from outside the property with a minimum of disturbance - in most cases just lift a few floorboards to determine the position of the joists. Each restraint tie has a drill-like leading end for pilot holing the timber section. Using a drill on rotation only simply wind the lateral restraint tie through the timbers and then resin fix the outside end into the surrounding masonry.

Wykamol offer two types of lateral restraint products for reconnecting strengthening bulging walls; one for tying perimeter walls to the more stable floor diaphragm structure and to stud walls and the other for strengthening the abutment between the masonry façade and walls that run perpendicular to it.



Lateral Restraints

For tying masonry back to parallel grain structural timber members. Requires appropriate resin to bond outside end into masonry. 8mm diameter available in 4 lengths: 1000mm, 1200mm, 1500mm and 2000mm lengths.



Lateral Restraints setting tool

SDS setting tool necessary for installing Lateral Restraint Ties into the side of parallel floor joists etc. and countersinking the tie end beneath the surface of the wall to allow for subsequent resin fixing.

8 GOOD REASONS TO CHOOSE WYKAMOL

Wykamol has consistently pioneered new product developments and provided the very highest standards of customer service.

We supply a broad range of products direct to contractors and local authorities.

We are happy to advise architects, engineers, surveyors, builders and home owners concerning individual projects, priding ourselves on expertise in dealing with rising, penetrating and condensation damp, dry rot, woodworm infestations and structural repair.

DAMP PROOFING

TIMBER TREATMENTS

**STRUCTURAL
WATERPROOFING**

THOR HELICAL

ANTI-CONDENSATION

SURFACE TREATMENTS

TRAINING

GUARANTEES



Wykamol Group

Unit 3, Boran Court, Network 65 Business Park, Hapton,
Burnley, Lancashire BB11 5TH

t: +44 (0)845 400 6666 **f:** +44 (0)845 400 3333

www.thorremedial.com

www.Wykamol.com **e:** salesdepartment@Wykamol.com

