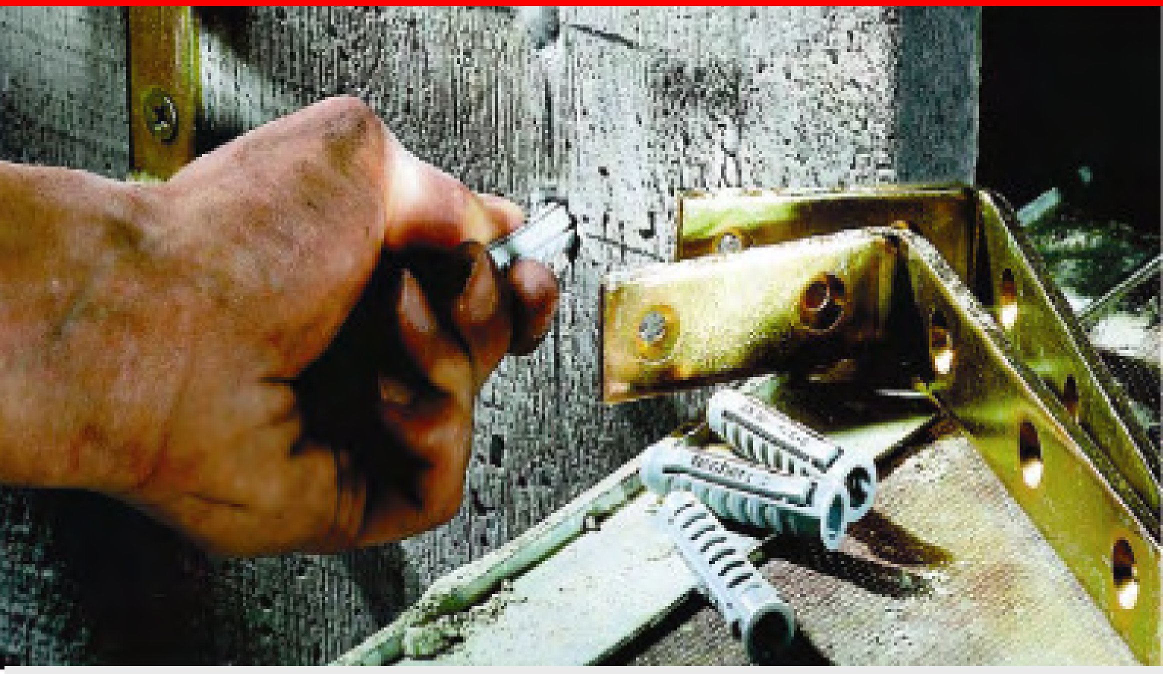
fischer Test Report



Fixing Tests for
Fastfloor and Hollowcore Units

Tarmac

fischer FIXING SYSTEMS

Topfloor

Your Reference:
Our Reference: DJH/djh

Tarmac Topfloor Limited
Weston Underwood
Ashbourne
Derbyshire DE6 4PH

Tel 01332 868 400
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Ashley Quarterman
Technical Advisor
Artur Fischer (UK) Limited
Hithercroft Road
Wallingford
Oxon
OX10 9AT

16th July 2003

Dear Sirs

Re: Fixings Into Standard Hollowcore and Fastfloor Products

We would like to take this opportunity to confirm that the report submitted to Tarmac for approval is in accordance with the testing completed at our Ashbourne works in January 1999, July 1999 and March 2003 as part of our on going testing regime.

With this in mind, we can confirm that all fixings indicated within your report are suitable for use into our standard products.

Kind regards,
Tarmac Topfloor Limited

Danny Hoskins
Engineer

RECEIVED
17 JUL 2003

Fixings into units

As part of a continued project looking at the use of fixings within Tarmac Topfloor Limited standard products the following units have been tested and the results collected for the inclusion in the Fischer Fixings Systems test report for Tarmac Topfloor.

Before using any of these fixings, ensure that an adequate Loading has been allowed for in all calculations to allow for the additional weight of the ceilings or services required. In the case fo class 3 designs, i.e. 0.1mm crack widths, please contact Fischer Fixings and Tarmac Topfloor regarding further design consideration.

If any tendons are cut or severed and have not already been allowed for by Tarmac Topfloor, please inform the Technical Department immediately on the numbers below.

Units Tested

- 150DBT Fastfloor Joist
- 150DBW Fastfloor Joist
- 150EST Fastfloor Joist
- 175EST Fastfloor Joist
- 225EST Fastfloor Joist
- 225DBT Fastfloor Joist (1 Hour)
- 150 "M" Series Hollowcore Unit
- 150 Spiroll Hollowcore Unit
- 320 IHE Hollowcore Unit

Where fixings are required into the soffit of hollowcore units to support lightweight services and decorative finishes it is not possible to use the same design loadings as with solid concrete, all required loadings for the fixings are available from Fischer Fixings Systems or from Tarmac Topfloor Limited's technical library on request. Any loads will be calculated in conjunction with testing into our standard hollowcore and Fastfloor products using the following method statement.

Method Statement

1. Ensure that all factory safety precautions are taken, for example all relevant PPE is worn.
2. A competent person should lift the units onto the stands using a forklift truck, taking care to ensure that the unit rests on its designed bearing points with no cantilevered overhang greater than the unit depth.
3. Once the unit is stable, drilling can be carried out from the underside using air-powered drilling equipment.

4. The relevant fixings should then be fixed in accordance with the manufacturers recommendations on a 600 x 300 grid, in the case of fixings that breach the core ensure that the hole drilled is located on the centre line of the second core.

5. Time should be given to allow the fixings to cure or bed in depending upon type and requirements as described by the manufacturer.

6. The manufacturers agent should then complete the pull out tests on the fixings, after completion of the tests the unit is to be lifted and removed in a safe manor by a competent forklift driver.

Type One Fixings

These fixings include:

- Fischer Nylon SX Plug
- Fischer FNS Nail
- Fischer FFS Frame Fixing Screw
- Fischer FBS Concrete Screw
- Fischer FNA Nail Anchor
- Fischer N Hammerfix

Type one fixings are classified as fixings for use in all hollowcore fixing zones and all Fastfloor joists, as indicated on the drawings enclosed.

The capacities of these fixings are such that they are generally considered as lightweight short embedment depth fixing.

None of the fixings shown above should be used within the first 100mm from the bearing support, as the area is hard to gain access to and can result in a fixing failure.

The fixing grid to be used is 300 x 300mm to prevent cracking between fixings and spalling to the soffit of the units and in case of a failure reducing the capacity of fixings within the cone of failure area.

The embedment depth for these fixings in the single hatched area, indicated on the attached drawings, is 35mm to avoid encroaching on the tendon positions and too any depth in the double-hatched area. However, after the core has been breached no additional strength can be gained by increasing the length of fixing in the core.

Type Two Fixings

- Fischer Nylon M Unit
- Fischer FIS V 360 S Hybrid Vinyl Ester Resin with FIP 18x85 net and M10 Rod
- Fischer FDA-R Drop-in Anchor with Rim
- Fischer FHY Hollow Ceiling Anchor & Gripple Hangfast
- Fischer FHY Hollow Ceiling Anchor

Type two fixings are to be fixed on the centre line of the core only to ensure that the fixings sit correctly in the core and therefore achieve a higher loadings, these types of fixings cannot be used with our Fastfloor products as there is not enough room between wire positions to fit these fixings.

None of the fixings shown above should be used within the first 100mm from the bearing support, as the area is hard to gain access to and can result in a fixing failure.

The fixing area to be used is 300mm down the length of the core and in adjacent cores across the width of the units to prevent cracking between fixings and spalling to the soffit of the units.

These fixings all require the core to be breached and therefore there is no minimum or maximum embedment depth requirements, however, drilling should not encroach on the tendons under any circumstances.

Fischer Fixings Systems contact details:

Artur Fischer U.K. Ltd
Hithercroft Road
Wallingford
Oxfordshire
OX10 9AT

Free Phone: **0800 328 2630**
www.fischer.co.uk

Tarmac Topfloor Limited contact details:

Tarmac Topfloor Limited
Technical Department
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Derbyshire
DE6 4PH

Tel: 01332 868 503
Fax: 01332 868 504

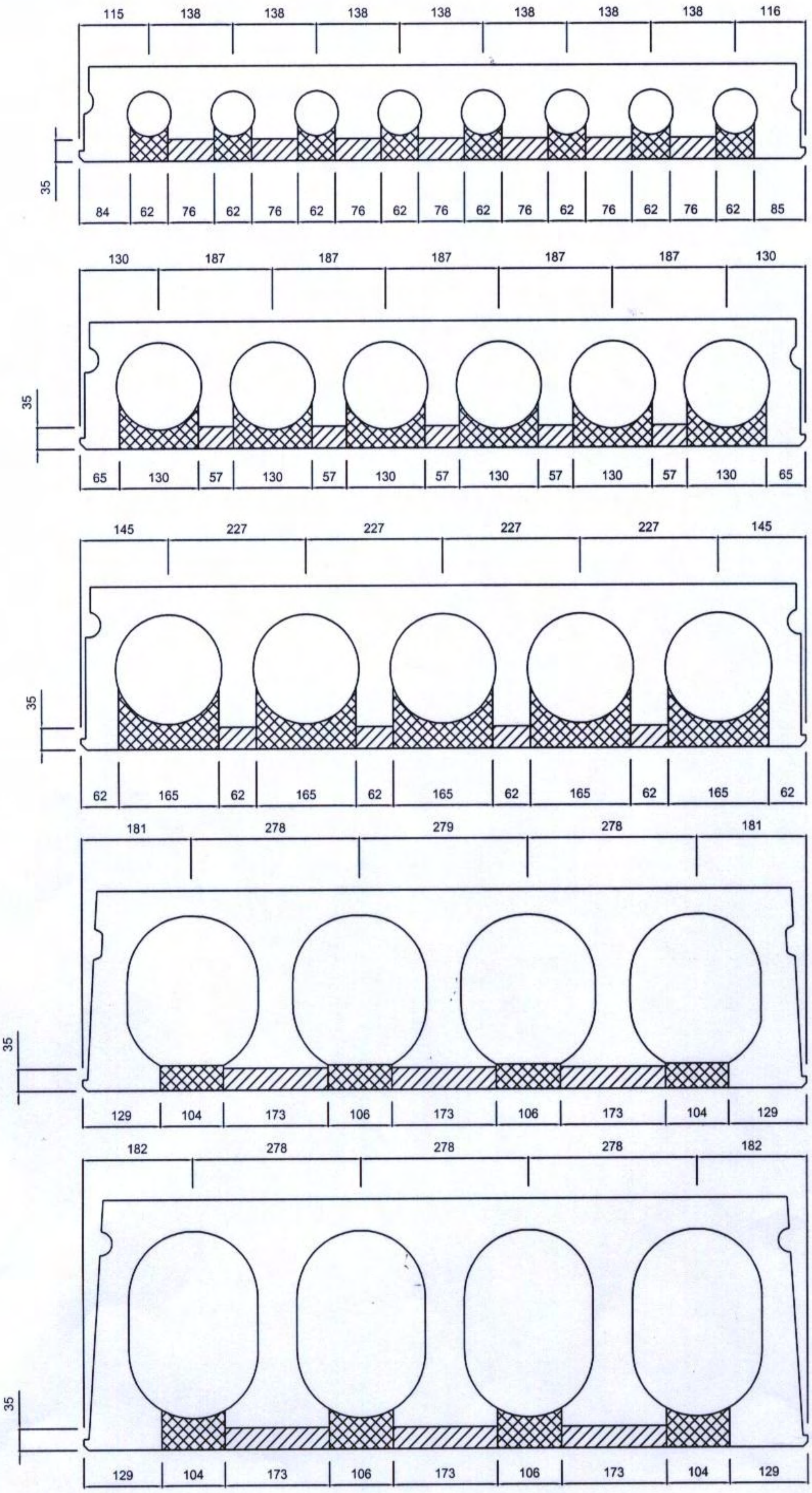
Important Notice

- The information and recommendations given herein are believed to be correct at the time of writing. The data has been obtained from tests done under laboratory or other controlled conditions and it is the user's responsibility to use the data given in the light of conditions on site and taking account of the intended use of the products concerned.

- Whilst Tarmac Topfloor Limited can give general guidance and advice, the nature of these fixing products means that the ultimate responsibility for selecting the correct product for a particular application must lie with the customer.

- All products must be used, handled and applied in accordance with current instructions for use published by Fischer Fixings Limited.

- Tarmac Topfloor Limited policy is one of continuous development. We, therefore, reserve the right to alter specifications etc. without notice.



Designed By:	Checked By:	Approved Signature:	
D J Hoskins	S J Copeland		Spiroll and IHE Units

Tarmac

Tarmac Topfloor Limited
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Derbyshire
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Telephone: 01332 868400
Facsimile: 01332 868401

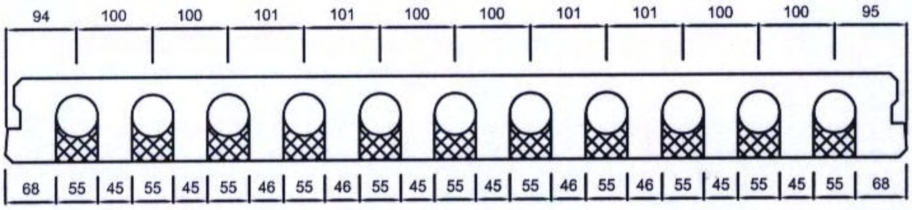
Title: Fixings Zones

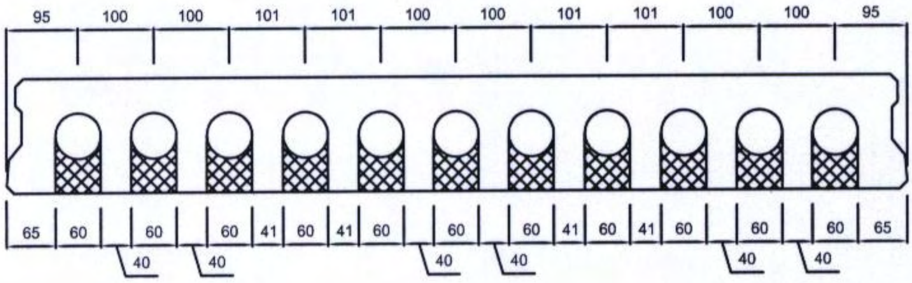
Scale: 1:10

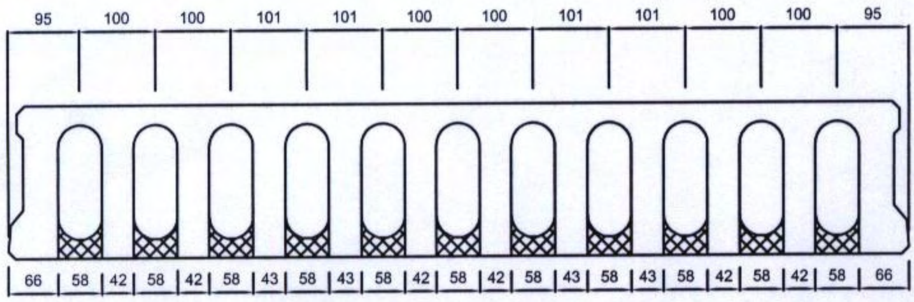
Revision: A

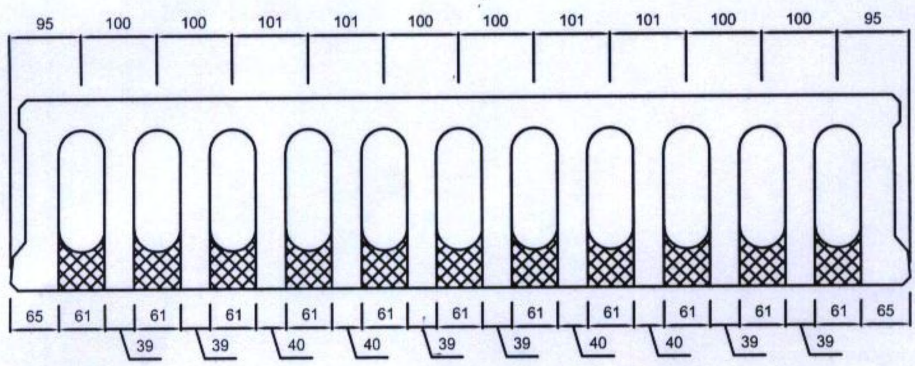
Sheet: 5 of 8

Filename: Fixing Zones Into Tarmac Products









Designed By:	Checked By:	Approved Signature:	
D J Hoskins	S J Copeland		"M" Series Units

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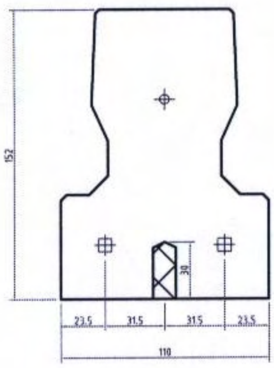

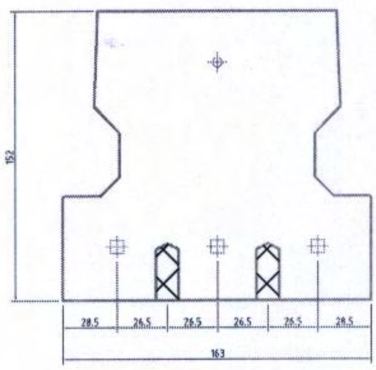

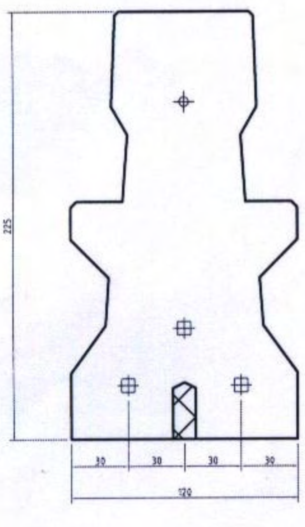

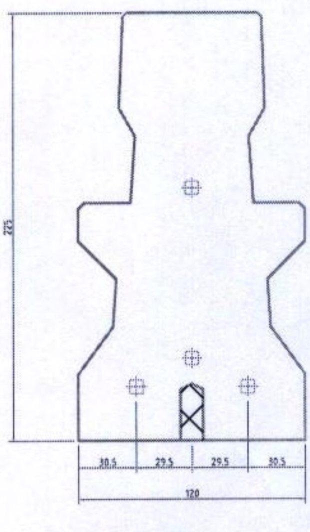

Designed By:	Checked By:	Approved Signature:	
D J Hoskins	S J Copeland		DBT Fastfloor Joists

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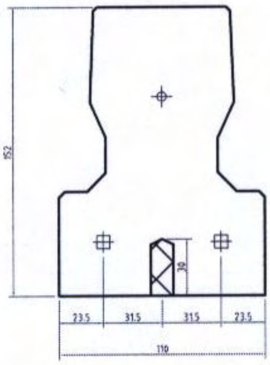
Title: Fixings Zones

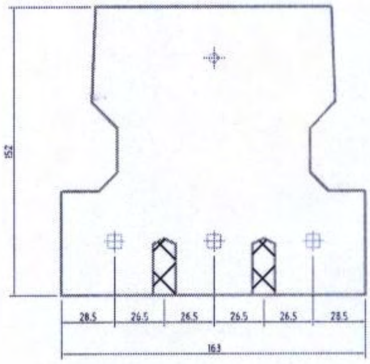
Scale: 1:4

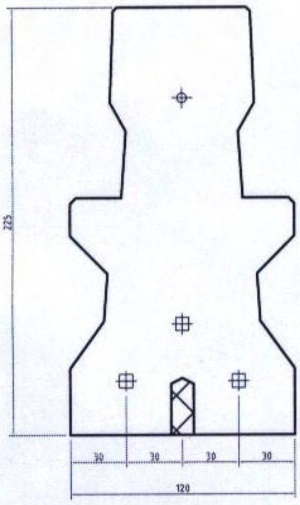
Revision: A

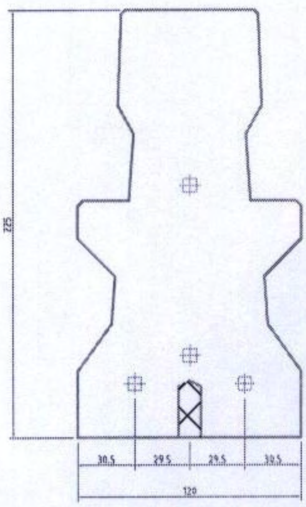
Sheet: 7 of 8

Filename: Fixings Zones Into Tarmac Products









Designed By:	Checked By:	Approved Signature:	
D J Hoskins	S J Copeland		EST Fastfloor Joists

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Scale: 1:4

Revision: A

Filename: Fixings Zones Into Tarmac Products

CONTENTS

1. Test Parameters

1.1 January 1999

The fixings were tested into a sample of the 150mm deep precast hollowcore floor slab, at intervals such that any resulting conical breakout of the fixings when tested in tension could not affect the performance of adjacent anchors. All tests were carried out in tension using a calibrated hydraulic load meter.

A single sample of each fixing was tested in tension to failure to establish the typical stress cone diameter at failure so that subsequent anchors could be installed at twice this dimension.

The hollowcore slab was tested at 1day post-production, and was assumed to have a design strength at 40-45 N/mm^2. After consultation with Richard Lees Ltd, it was apparent that the strength would reach a minimum specification of $50N/mm^2$. This in turn would increase the loading performance of all fixings tested within the contents of this report.

The web thickness was measured on all hollowcores for the test slab and results recorded. The web thickness was found to vary between 25mm min. and 30mm max. These dimensions were taken in order to establish fixing products that would function within these parameters.

1.2 July 1999

Two different types of floor decking units were tested. The 150 mm deep precast hollowcore spiroll floor slab was tested at the Ashbourne site and the 150 mm deep precast hollowcore M unit floor slab was tested at the Lound site. All tests were carried out in tension using a calibrated hydraulic load meter.

Six tests were conducted on each type of fixing, ensuring that stress cones did not intersect.
Following consultation with Richard Lees Ltd the hollowcore slab that was tested at Ashbourne was assumed to have a design strength of 60 N/mm^2 and the hollowcore slab that was tested at Lound was assumed to have a design strength of 50 N/mm^2

The web thickness was measured on all hollowcores for the test slabs. The web thickness was found to vary between 25mm min. and 30mm max. These dimensions were taken in order to establish fixing products that would function within these parameters.

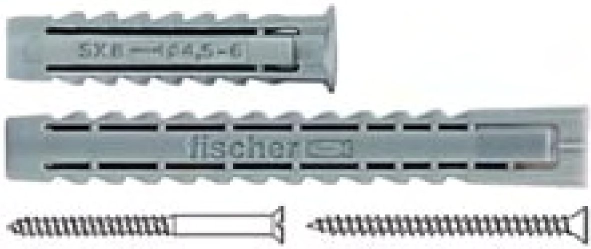
1.3 March 2003

The fixings were tested into various samples. Two sizes of Hollow core units and five sizes of beam units. All tests were carried out in tension using a calibrated hydraulic load test meter.

Six tests were carried out on each fixing unless it was found that the failure of the fixing or tensile slippage was the decisive factor, these details have been noted in the test result tables.

2. Fixing Products Tested

2.1 Fischer Nylon SX Plug



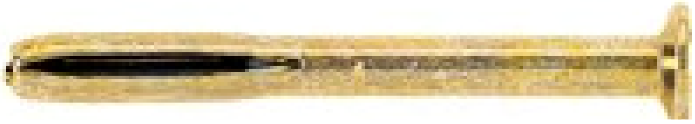
The SX plug is a nylon wall plug for the universal installation of machine screws or metric threaded studs.
It combines nylon with a 4-fold expansion of the fixing. This results in higher load bearing capacity in solid materials. Although it was developed with solid materials in mind, it shows a performance in hollow materials, which exceeds that of many universal fixings. The design of the SX permits "push-through" installation, thereby saving valuable time and energy. A "knock-in" lock effectively prevents the fixing from expanding prematurely.
All of these points mean that the Fischer SX plug is an ideal lightweight fixing for hollowcore floor slabs.

Typical Applications;

M&E Services Hangar Rods

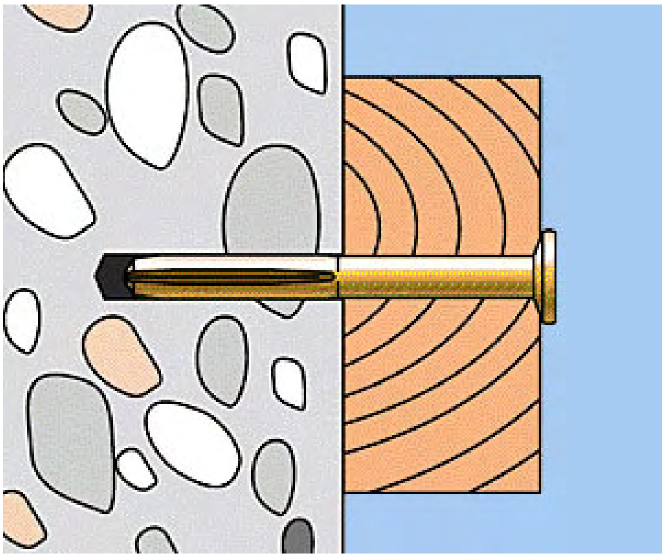
Bracketry for Suspended Ceilings

2.2 Fischer FNS Nail



The Fischer nail type FNS is a one-piece nail anchor made of electro galvanized steel. It is highly suitable for fast fixing due to its light hammerset assembly, and its variety of fixing thickness gives it great versatility.

Typical Application;

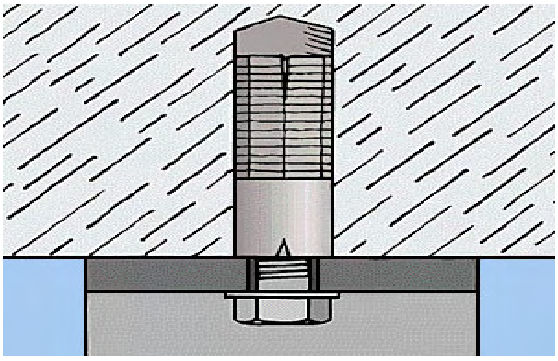


Typical Timber Batten Installation

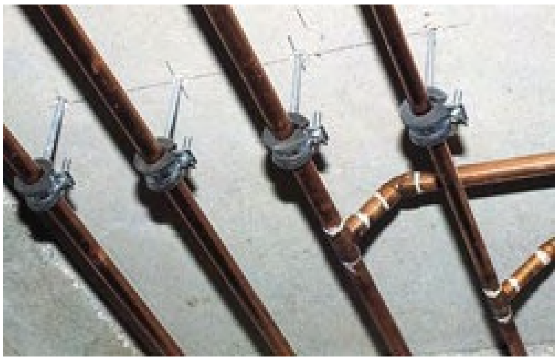
2.3 Fischer Nylon M Unit

The M unit is a glass fibre reinforced nylon expansion anchor with an integral internally threaded brass cone for the universal installation of machine screws or metric threaded studs (i.e. zinc plated, galvanized, stainless steel without bi-metallic action).
As a result of its high expansion capacity, the fixing can accommodate inaccuracies in the drill holes formed within the hollow cores. Typical hammer drilling action will create spalling of the concrete within the hollow and can effectively reduce the web thickness from 30mm to 15mm in the location of the fixing and more critically, the applied load.
Tightening torque is not relevant to this application, as the expansion segments can exert no compression to the surrounding base material. This fixing principle is known as "form-locking".

Typical Applications;



Installation Detail



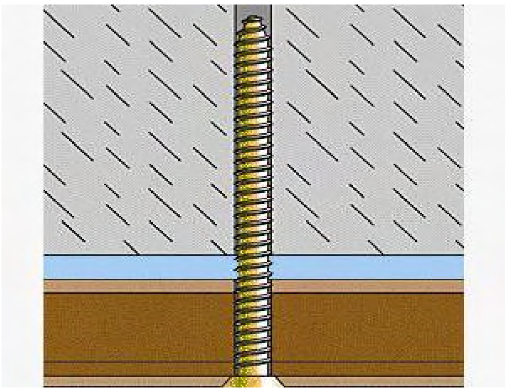
M&E Services Hangar Rod

Bracketry for Suspended Ceilings

2.4 Fischer FFS Frame Fixing Screw

The Fischer frame fixing screw type FFS allows a stress-free “through-fixing” whereby a 6mm diameter hole can be drilled through the assembly item and through the web of the floor slab, and the 7.5mm diameter screw subsequently installed through the item into the hollow of the slab. Providing the screw penetrates into the hollow, the maximum possible load capacity of the FFS is achieved. The screw itself has a tapered lead-in thread for easy attachment and an easy turning action due to a smooth-hardened screw surface and slim thread.

Typical Application;



Typical Timber batten installation detail

2.5 FIS V 360 S Hybrid Vinyl Ester Resin with FIS H 18x85 N net and M10 Rod

The Fischer Injection System FIS V 360 S contains a styrene free, quick-setting, high quality hybrid resin mortar, which is characterized by its universal suitability for many applications. It achieves maximum strength values in almost all building materials and anchors safely and without expansion pressure. The 2 components are mixed together inside the static mixer. A simple exchange of the static mixer allows the renewed use of cartridges after they have been opened.

Typical Applications;

Installation Detail

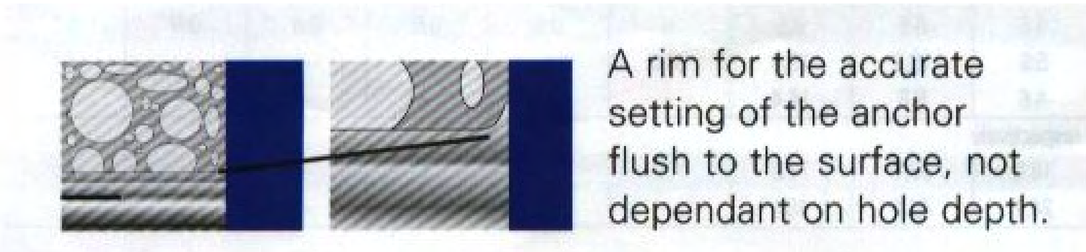
Suspended Ceiling Grids

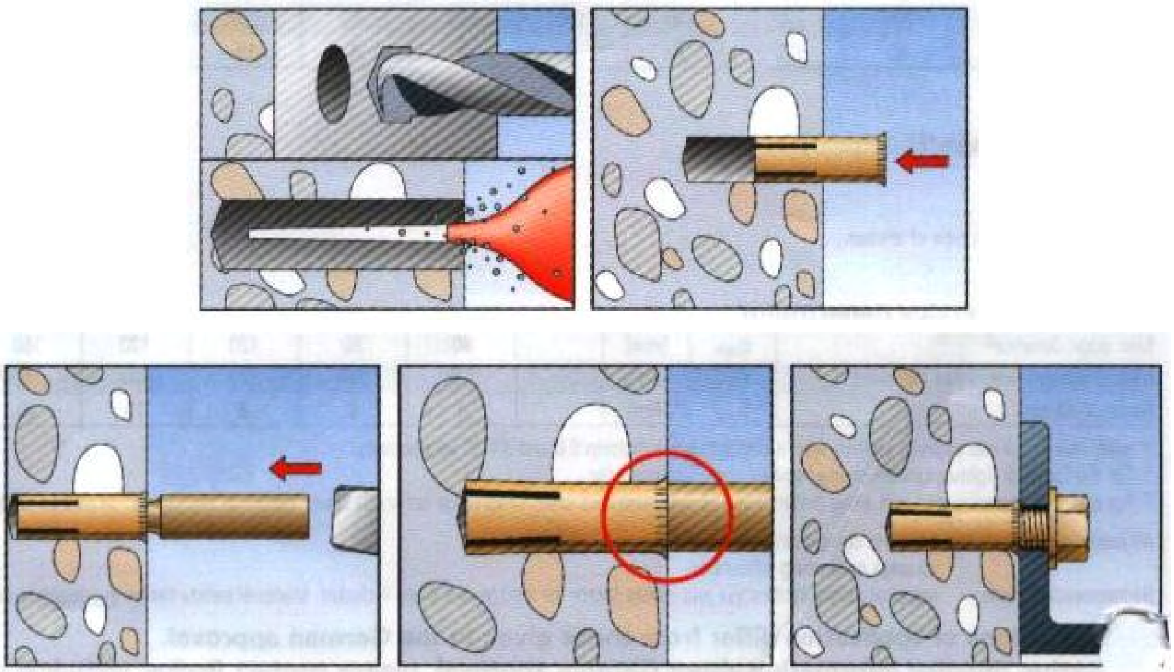
Building Services

2.6 Fischer FDA-R Drop In Anchor with Rim

A drop in anchor with rim so that the anchor always remains flush with the surface of the substrate. The drill hole can now be over depth without effecting the anchor.

Typical Applications;

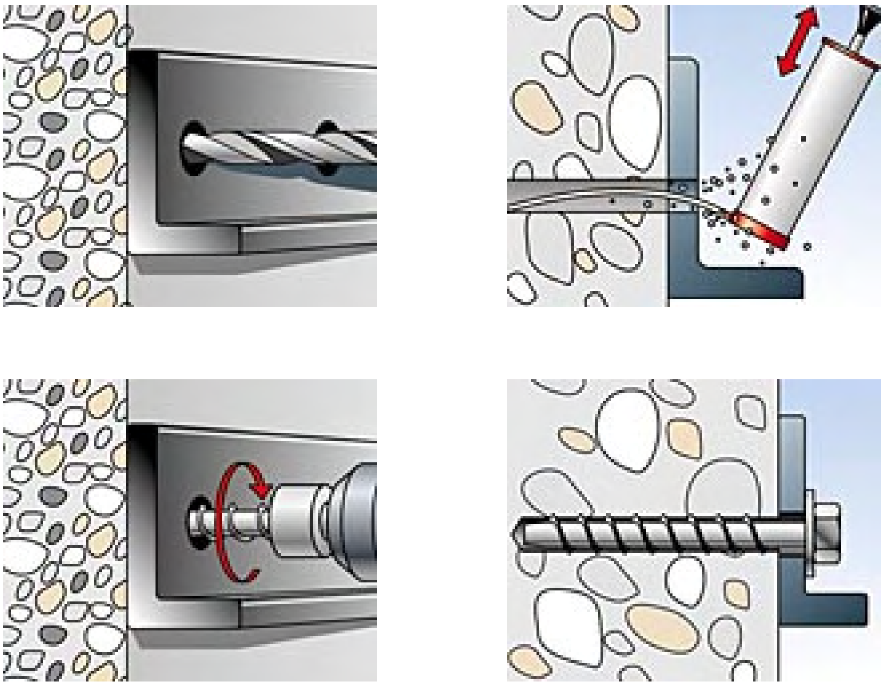




2.7 Fischer FBS Concrete Screw

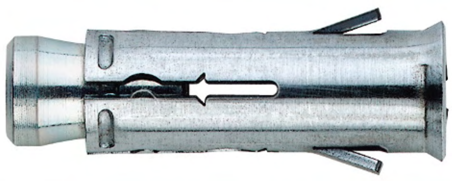
Fischer Concrete Screws have a special hardened thread. The lower turns of the thread also have teeth. The diameter of the hole and the thread of the screw are adapted to one another so that the special thread of the screw cuts into the concrete. The thread turns creating a fine undercut, thereby ensuring that a perfect form fit safely supports the load. The teeth allow the thread to cut into the concrete, thereby reducing the amount of energy required to insert the screw into its position.

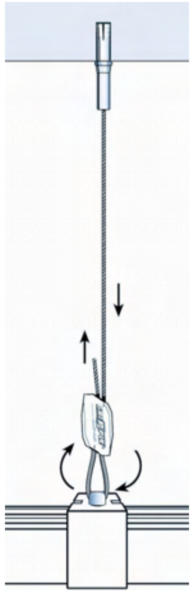
Typical Applications;



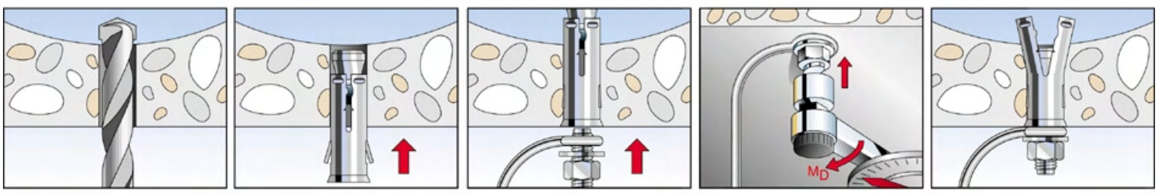
2.8 Fischer FHY Hollow Ceiling Anchor & Gripple Hangfast

Material: Metal, bright zinc plated or stainless steel
Range: M6 – M10

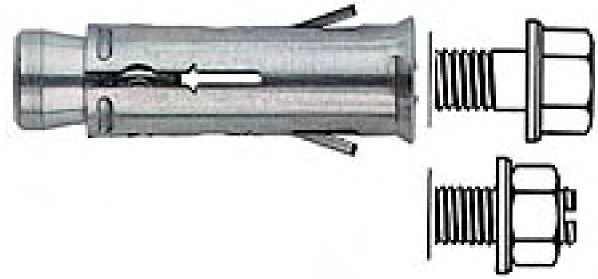




Fischer & Gripple Ltd has combined their unique products to offer a complete fixing solution for the Mechanical and Electrical market. The FHY is designed specifically for hollow core sections. The shield of the anchor is 40mm long with sections cut from the shield 21mm from the anchor collar allowing maximum expansion. It is at this point where the anchor is in contact with the concrete. The shield is divided into four segments so that the load is evenly distributed onto the walls of the hollow section within a hollowcore slab. It is with these characteristics that the anchor expands creating friction and form locking.
Gripple hangers consist of a high tensile steel wire rope with an adjustable self-locking grip for positioning and securing any M+E service. The hangers can be supplied with a 20mm long, 6.00mm dia. threaded stud which can be screwed directly into the FHY anchor to provide a fast, versatile, secure and cost effective alternative to threaded rod.
Gripple hangers with a stud end are available in size No1 (10kg SWL), No2 (45kg SWL). No3 (90kg SWL). All Gripple hangers incorporate a 5:1 safety factor.

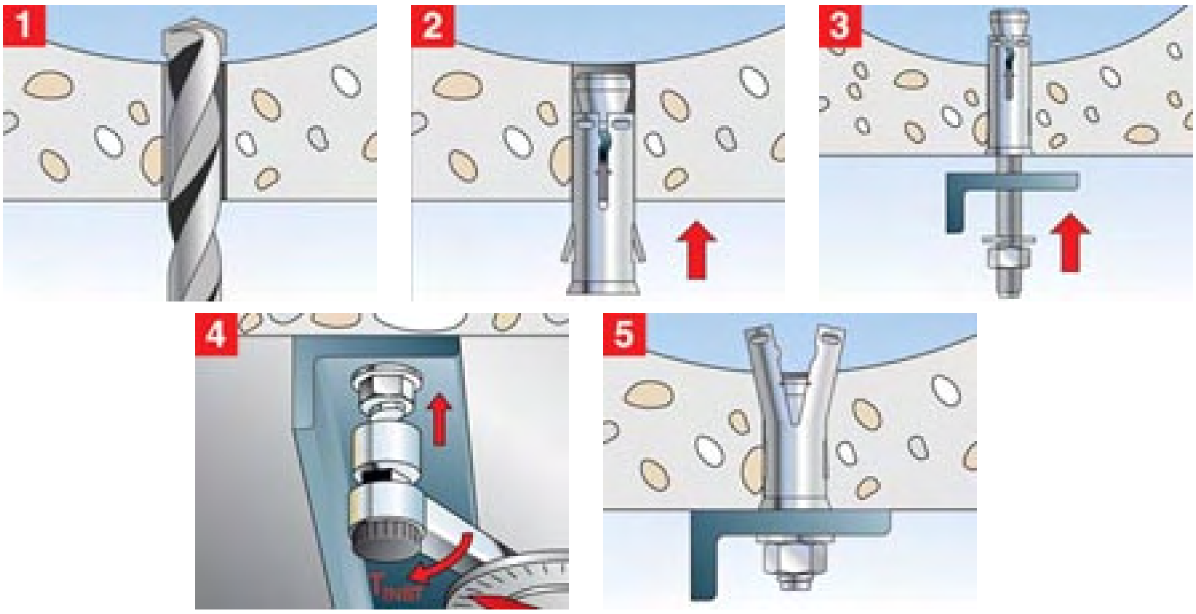


2.9 Fischer FHY Hollow Ceiling Anchor



The Fischer Hollow Ceiling Anchor FHY has been developed specially for fastenings in hollow-ceiling slabs of pre-stressed concrete. It is designed for use with standard bolts or threaded rods with metric threads from M6 to M10. The Hollow ceiling anchor FHY is installed flush with the concrete surface. When the bolt or the nut is tightened a tapered element is pulled into the sleeve, which presses this outward. In this way, the FHY presses against the sides of the hole, creating a friction fit. If the anchor encounters a cavity during installation, the expansion of the sleeve forms a Y shape. The holding power is now the result of a combination of expansion pressure and form fit. The Fischer hollow ceiling anchor FHY offers considerable scope in the location of attachment points. Unlike other competing products, it does not have to be located at the centre of the cavity axis, which is often very difficult to define. Instead, it can be located down to a minimum distance of 50mm from the pre-stressing steel.

Typical Applications;



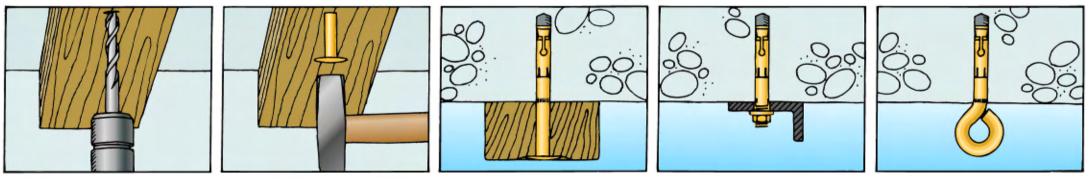
2.10 Fischer FNA Nail Anchor

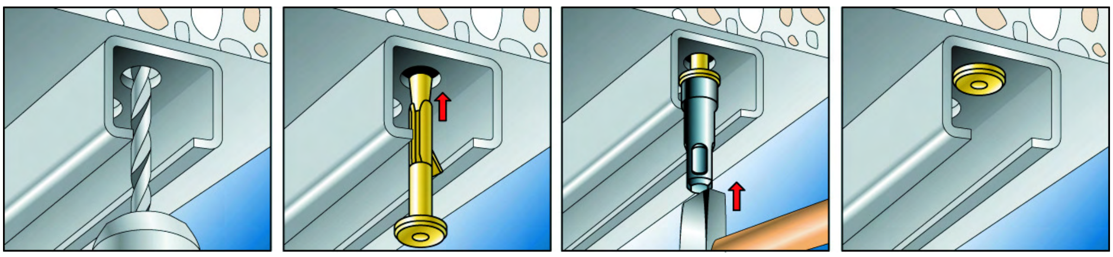
The Fischer Nail Anchor can be installed swiftly and smoothly, a real advantage for overhead work.

For battens and metal hangers, the nail head can be effortlessly sunk into timber with one blow. On metal parts, it covers a large surface area, giving a clean finish. Longer useful lengths bridge non-load bearing layers.

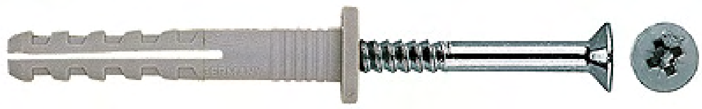
Typical Applications;

FNA 6x 30 / OE



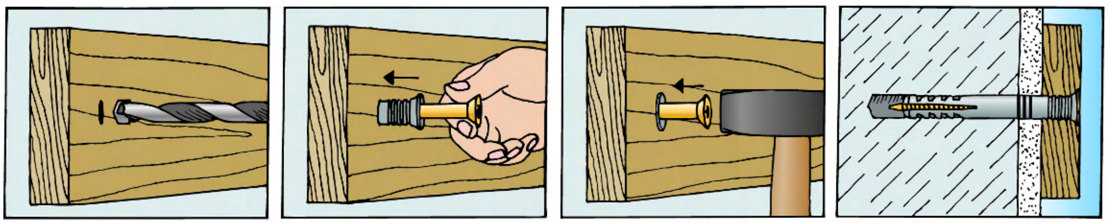


2.11 Fischer N Hammerfix



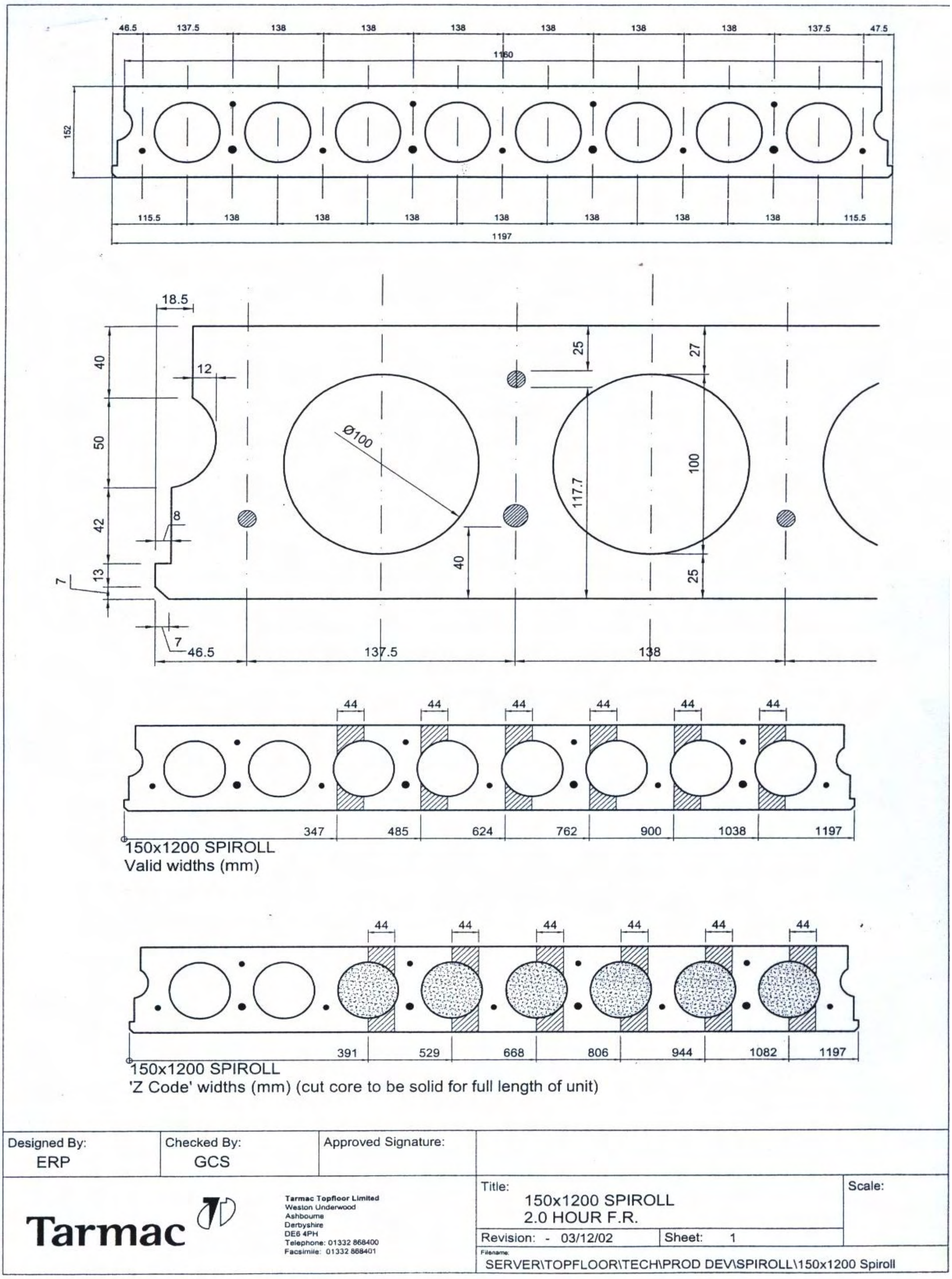
The Fischer N Hammerfix is simply tapped in with a hammer – DONE! Screwdrivers or electric screwdrivers are thus superfluous. This saves time and effort.
The fixing was developed for push through assembly as proven in practice and is supplied with pre-assembled nail screw – optionally with zinc plated, stainless steel or plastic nails. The cross drive recess enables loosening of the fixing for subsequent adjustment. To fix thin profiles and sheets, we recommend Fischer nail fixings with flat collars, in order to avoid damage or puncturing.
The fixings are manufactured from the same high grade and quality monitored polyamide (nylon), which is also used for the frame fixings with general building inspectorate approval. The material is temperature-resistant from –40 - +80 degrees C. As a result of the neat internal and external geometry in conjunction with the high-grade material and the special nail geometry, the Fischer Hammerfix guarantees constantly good pull out loads and installation results. Even in the case of assemblies through damp timber battens, the fixing will not expand prematurely.

Typical Applications;

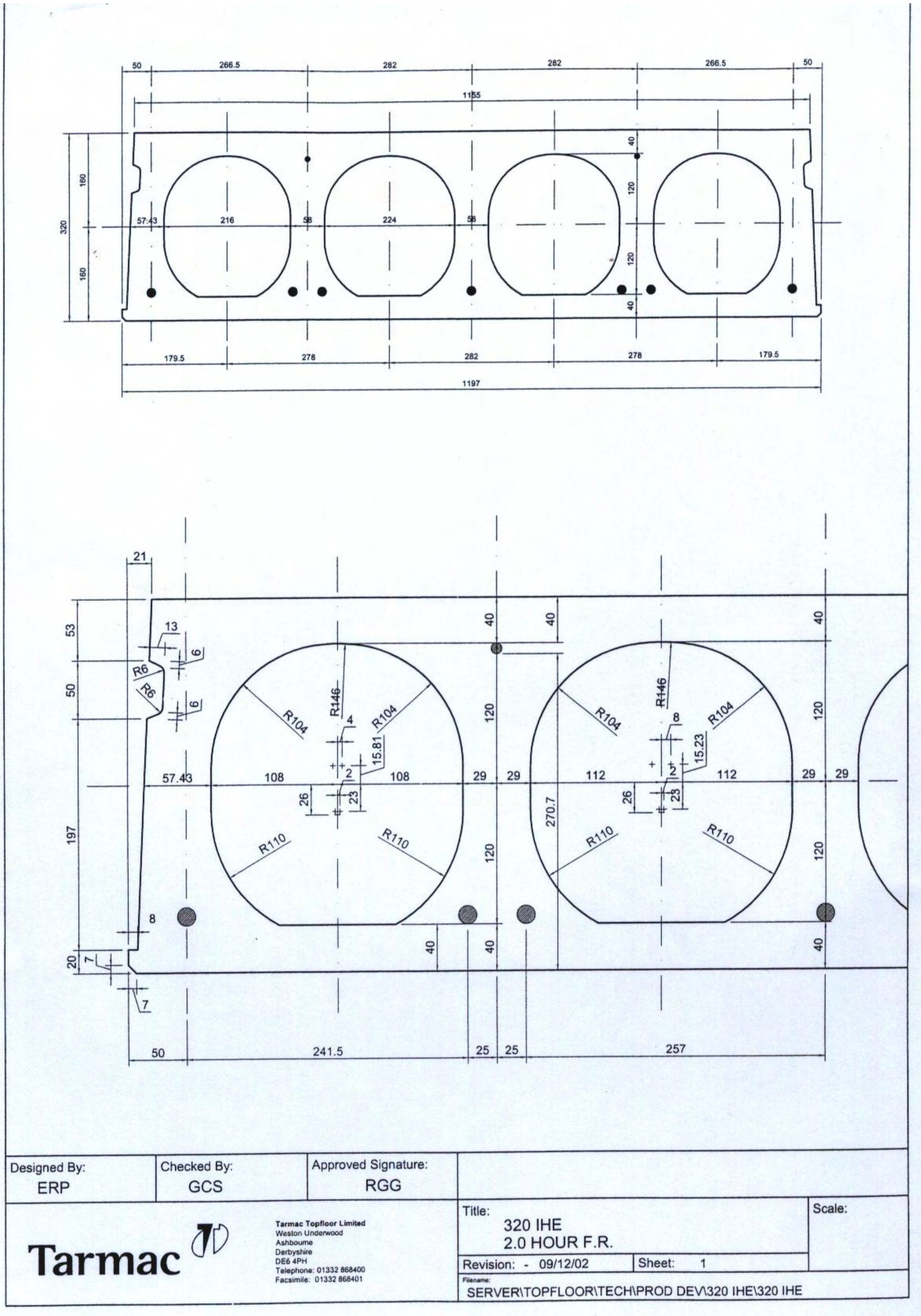


3. Substrates Tested

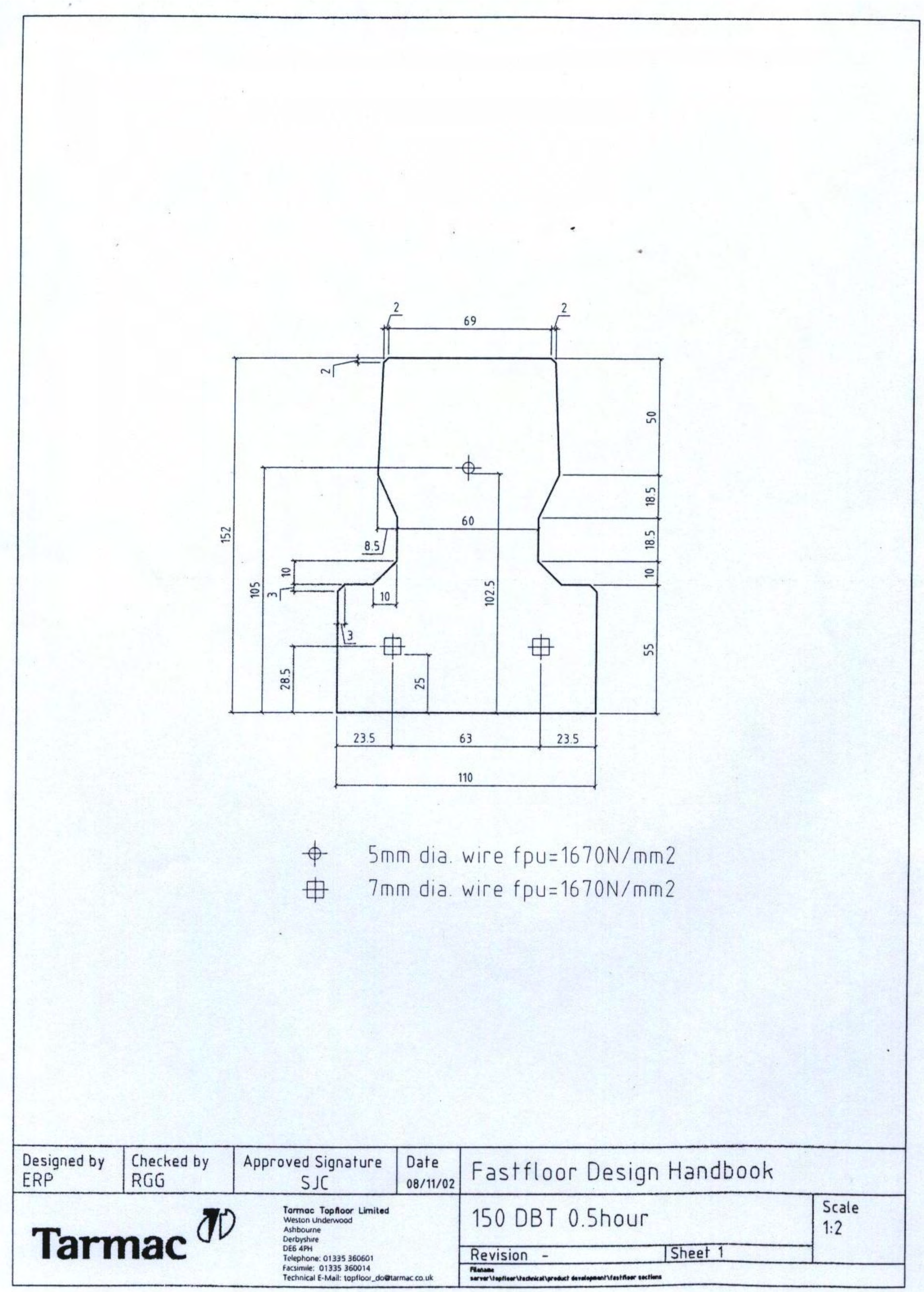
3.1 150 Spiroll Unit



3.2 320 IHE Unit



3.3 150 DBT Unit



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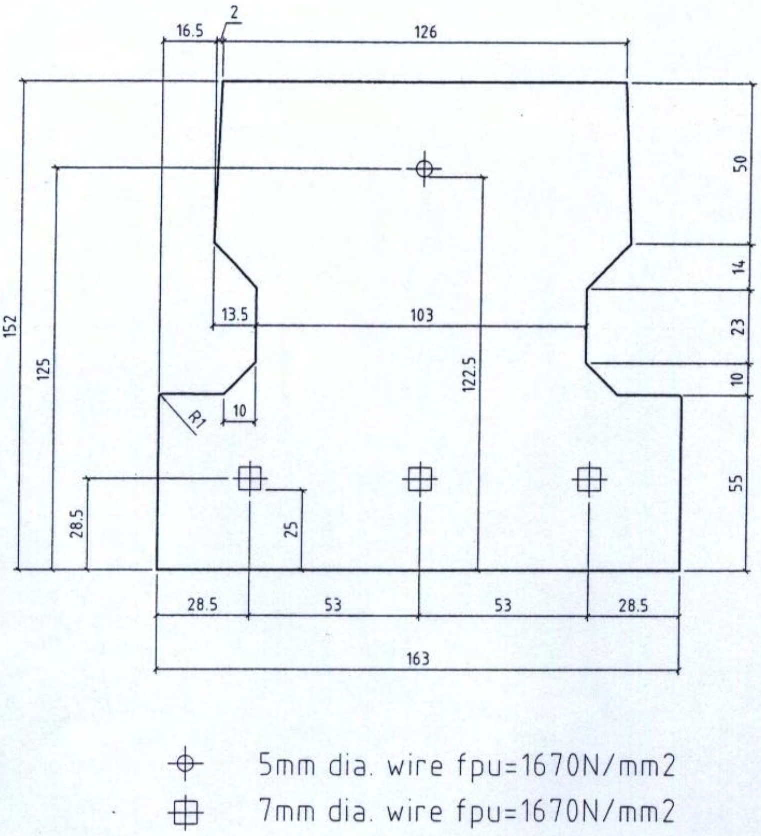

Designed by	Checked by	Approved Signature	Date	
ERP	RGG	SJC	08/11/02	Fastfloor Design Handbook

Tarmac

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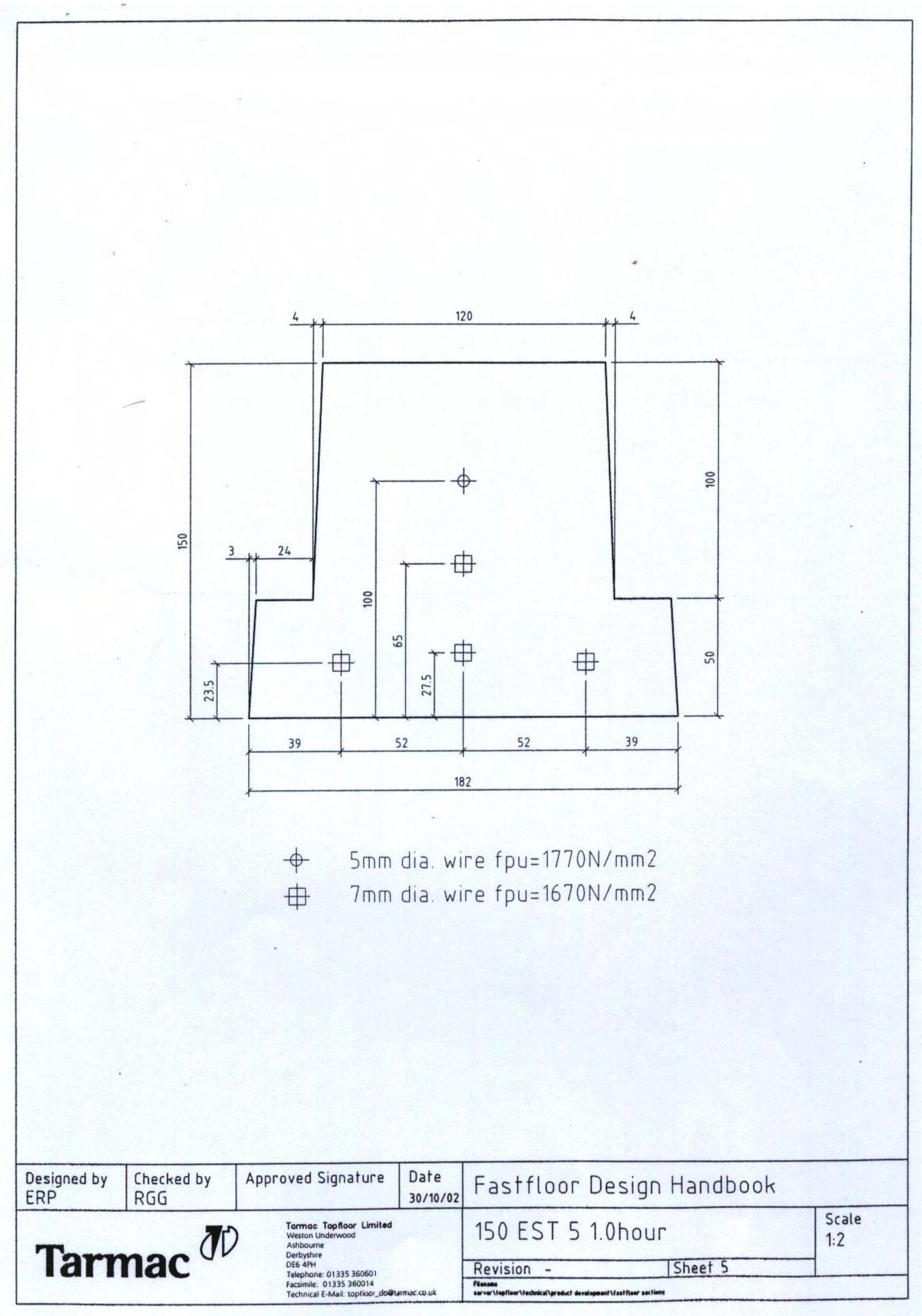
150 DBW 1.0hour

Scale 1:2

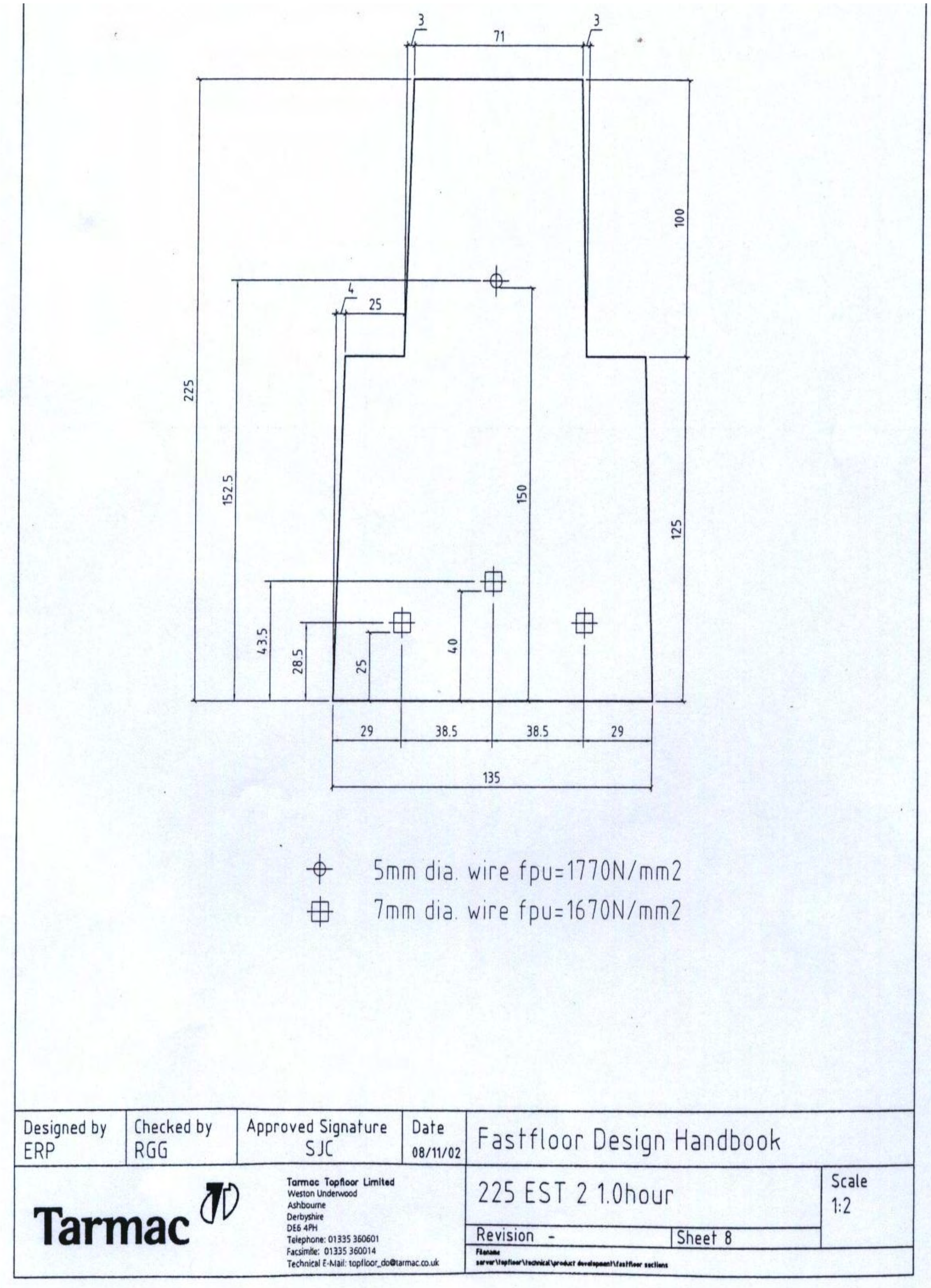
Revision - | Sheet 2

Filename
server\topfloor\technical\product development\fastfloor sections

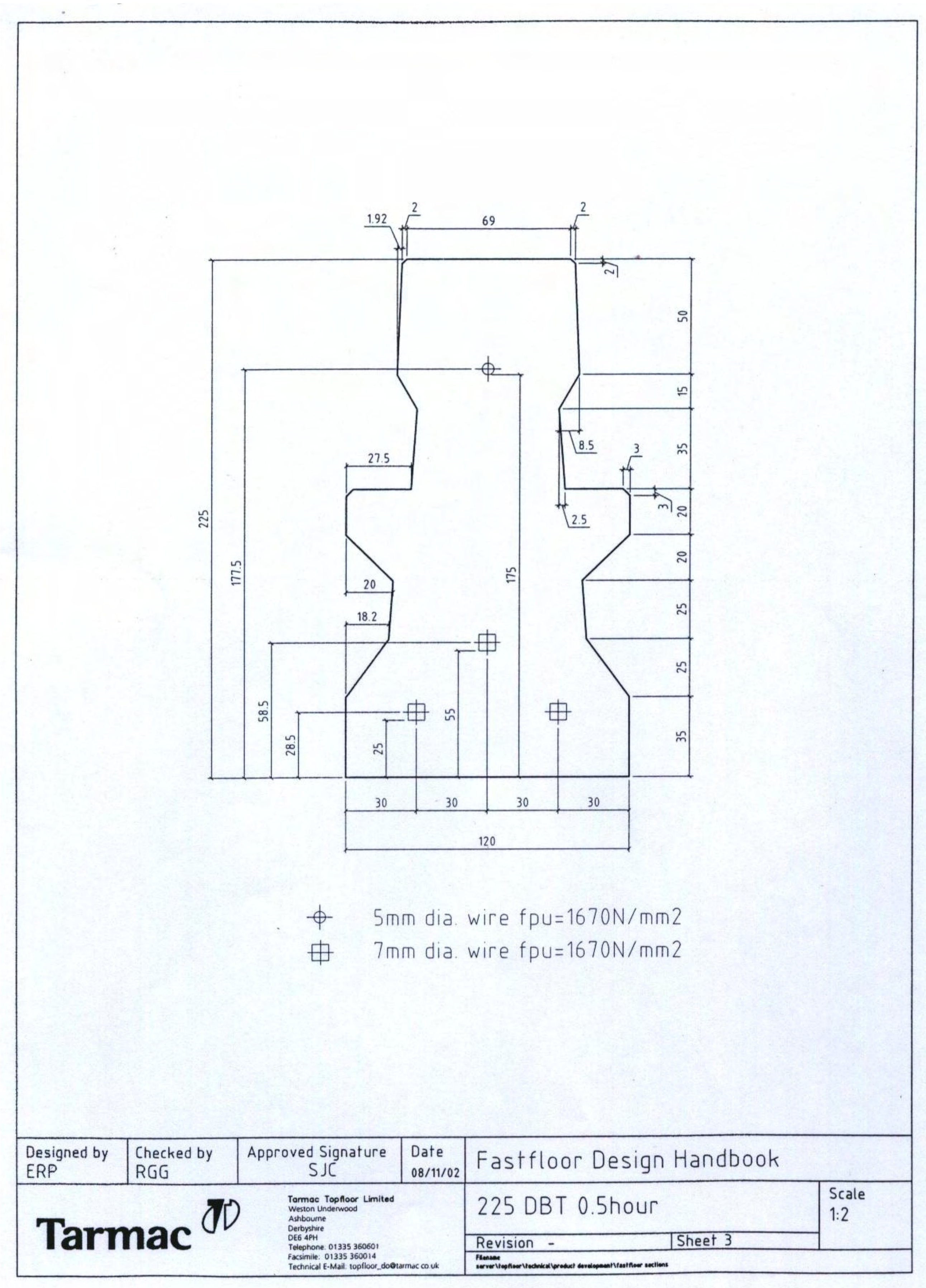
3.5 150 EST Wide Unit



3.6 225 EST Unit



3.7 225 DBT Unit



4. Test Results

4.1 Fischer Nylon SX Plug (July 1999)

Test No	Load in kN	Mode of Failure
Ashbourne Spiroll Unit		
1	5	Anchor Pull Through
2	5.5	Anchor Pull Through
3	5	Anchor Pull Through
4	5.5	Anchor Pull Through
5	5.5	Anchor Pull Through
6	5.5	Anchor Pull Through
Lound M Unit		
1	4	Anchor Pull Through
2	3.5	Anchor Pull Through
3	4	Anchor Pull Through
4	3	Anchor Pull Through
5	3	Anchor Pull Through
6	4	Anchor Pull Through

Ashbourne Average Ultimate Tensile Load = **5.3kN**
Using a global safety factor of 7, safe working load in tension = **0.8kN**

Lound Average Ultimate Tensile Load = **3.6kN**
Using a global safety factor of 7, safe working load in tension = **0.5kN**

NB: We would recommend a minimum axial spacing of 100mm for nylon SX plug size M10, based on the stress cone diameters experienced during load tests to failure. This would ensure that overlapping of stress cones for pairs or series of anchors when loaded simultaneously does not occur, and the safe working load as quoted above would not have to be reduced accordingly.

4.2 Fischer Nylon SX Plug (March 2003)

Test No	Load in kN	Mode of Failure
SX6 225 DBT Unit		
1	2.5	Tensile Slip
2	3.5	Tensile Slip
3	2.5	Tensile Slip
4	3.0	Tensile Slip
5	2.5	Tensile Slip
6	3.0	Tensile Slip
SX6 150 EST Unit		
1	2.5	Tensile Slip
2	2.5	Tensile Slip
3	2.5	Tensile Slip
4	2.5	Tensile Slip
5	2.0	Tensile Slip
6	2.0	Tensile Slip
SX8 150 DBW Unit		
1	4	Tensile Slip
2	4	Tensile Slip
3	4	Tensile Slip
4	4	Tensile Slip
5	4	Tensile Slip
6	4	Tensile Slip

As tensile slip was decisive it was apparent that no advantage or disadvantage to be gained for larger or smaller beam sections.

225 DBT Unit Average Ultimate Tensile Load = **2.83kN**
Using a global safety factor of 7, safe working load in tension = **0.41kN**

150 EST Unit Average Ultimate Tensile Load = **2.33kN**
Using a global safety factor of 7, safe working load in tension = **0.33kN**

150 DBW Unit Average Ultimate Tensile Load = **4.0kN**
Using a global safety factor of 7, safe working load in tension = **0.57kN**

4.3 Fischer FNS Nail (July 1999)

Test No	Load in kN	Mode of Failure
Ashbourne Spiroll Unit		
1	3	Anchor Pull Through
2	3	Anchor Pull Through
3	4	Anchor Pull Through
4	3	Anchor Pull Through
5	3.5	Anchor Pull Through
6	3.5	Anchor Pull Through
Lound M Unit		
1	2.5	Anchor Pull Through
2	3.5	Anchor Pull Through
3	2.5	Anchor Pull Through
4	4	Anchor Pull Through
5	2.5	Anchor Pull Through
6	3.5	Anchor Pull Through

Ashbourne Average Ultimate Tensile Load = **3.3kN**
Using a global Safety Factor of 4, safe working load in tension = **0.8kN**

Lound Average Ultimate Tensile Load = **3.1kN**
Using a global safety factor of 4, safe working load in tension = **0.8kN**

NB: We would recommend a minimum axial spacing of 100mm for FNS frame fixing screws 7.5mm diameter, based on the stress cone diameters experienced during load tests to failure. This would ensure that overlapping of stress cones for pairs or series of anchors when loaded simultaneously does not occur, and safe working load as quoted above would not have to be reduced accordingly.

4.4 Fischer Nylon M Unit M10 (January 1999)

Test No	Load in kN	Mode of Failure
1	9	Concrete Failure (Tensile Pull Out)
2	12	Concrete Failure (Tensile Pull Out)
3	11	Concrete Failure (Tensile Pull Out)
4	12	Concrete Failure (Tensile Pull Out)
5	6*	Anchor Pull Through
6	12	Concrete Failure (Tensile Pull Out)
7	15	Concrete Failure (Tensile Pull Out)
8	13	Concrete Failure (Tensile Pull Out)
9	13	Concrete Failure (Tensile Pull Out)
10	14	Concrete Failure (Tensile Pull Out)

* This load is lower due to the fact that the anchor was not expanded sufficiently behind the web.

Average Ultimate Tensile Load (Discarding test No 5) = **12kN**
Using a global safety factor of 4, safe working load in tension = **3kN**

NB: We would recommend a minimum axial spacing of 100mm for nylon M Unit size M10, based on the stress cone diameters experienced during load tests to failure. This would ensure that overlapping of stress cones for pairs or series of anchors when loaded simultaneously does not occur, and the safe working load as quoted above would not have to be reduced accordingly.

4.5 Fischer FFS Fixing Screw (January 1999)

Test No	Load in kN	Mode of Failure
1	4.5	Concrete Failure (Tensile Pull Out)
2	5.0	Concrete Failure (Tensile Pull Out)
3	5.0	Concrete Failure (Tensile Pull Out)
4	5.0	Concrete Failure (Tensile Pull Out)
5	4.5	Concrete Failure (Tensile Pull Out)
6	4.5	Concrete Failure (Tensile Pull Out)
7	6.0	Concrete Failure (Tensile Pull Out)
8	5.5	Concrete Failure (Tensile Pull Out)
9	5.0	Concrete Failure (Tensile Pull Out)
10	6.0	Concrete Failure (Tensile Pull Out)

Average Ultimate Tensile Load = **5.1kN**
Using a global safety factor of 4, safe working load in tension = **1.2kN**

NB: We would recommend a minimum axial spacing of 50mm for FFS frame fixing screws 7.5mm diameter, based on the stress cones for pairs of anchors when loaded simultaneously does not occur, and the safe working load as quoted above would not have to be reduced accordingly.

4.6 FIS V 360 S Hybrid Vinyl Ester Resin with FIP 18x85 net and M10 Rod (July 1999)

Test No	Load in kN	Mode of Failure
Ashbourne Spiroll Unit		
1	20+	No Failure
2	20+	No Failure
3	20+	No Failure
4	20+	No Failure
5	20+	No Failure
6	20+	No Failure
Lound M Unit		
1	20+	No Failure
2	20+	No Failure
3	20+	No Failure
4	20+	No Failure
5	20+	No Failure
6	20+	No Failure

Ashbourne Average Ultimate Tensile Load = **20+kN**
Using a global safety factor of 4, safe working load in tension = **5kN**

Lound Average Ultimate Tensile Load = **20+kN**
Using a global safety factor of 4, safe working load in tension = **5kN**

NB: We would recommend a minimum axial spacing of 100mm for resin sleeve size 18x85 with M10 connecting rod, based on the stress cone diameters experienced during load tests to failure. This would ensure that overlapping of stress cones for pairs or series of anchors when loaded simultaneously does not occur, and the safe working load as quoted above would not have to be reduced.

4.7 Fischer Drop In Anchor with Rim FDA-R (March 2003)

Test No	Load in kN	Mode of Failure
M8 Spiroll Unit		
1	16	Concrete Failure
2	14	Concrete Failure
3	14.5	Concrete Failure
4	14	Concrete Failure
5	12	Concrete Failure
6	12	Concrete Failure
M8 320 IHE Unit		
1	17.5	Anchor Failure
2	18	Anchor Failure
3	17	Concrete Failure
4	17.5	Anchor Failure
5	17.5	Concrete Failure
6	12	Concrete Failure
M10 Spiroll Unit		
1	19.5	Anchor Failure
2	15	Concrete Failure
3	14	Concrete Failure
4	18	Concrete Failure
5	20	No Failure
6	15	Concrete Failure
M10 320 IHE Unit		
1	20	No Failure
2	20	No Failure
3	20	No Failure
4	20	Tensile Slip
5	18	Tensile Slip
6	16	Tensile Slip

FDA-R M8 in Spiroll Unit
Average Ultimate Tensile Load = **13.75kN**
Using a global safety factor of 4, safe working load in tension = **3.44kN**

FDA-R M8 in 320 IHE Unit
Average Ultimate Tensile Load = **16.58kN**
Using a global safety factor of 4, safe working load in tension = **4.15kN**

FDA-R M10 in Spiroll Unit
Average Ultimate Tensile Load = **16.92kN**
Using a global safety factor of 4, safe working load in tension = **4.23kN**

FDA-R M10 in 320 IHE Unit
Average Ultimate Tensile Load = **19.0kN**
Using a global safety factor of 4, safe working load in tension = **4.75kN**

4.8 Fischer Concrete Screw FBS (March 2003)

Test No	Load in kN	Mode of Failure
FBS6 Spiroll Unit		
1	7.5	Anchor Pull Through
2	9	Anchor Pull Through
3	8.5	Anchor Pull Through
4	10.5	Anchor Pull Through
5	6	Anchor Pull Through
6	6.5	Anchor Pull Through
FBS6 320 IHE Unit		
1	8	Anchor Pull Through
2	19	Anchor Pull Through
3	14	Anchor Pull Through
4	8	Anchor Pull Through
5	10	Anchor Pull Through
6	18	Anchor Pull Through
FBS8 Spiroll Unit		
1	9	Anchor Pull Through
2	9	Anchor Pull Through
3	6	Anchor Pull Through
4	8	Anchor Pull Through
5	7	Anchor Pull Through
6	8	Anchor Pull Through
FBS8 320 IHE Unit		
1	18	Anchor Pull Through
2	20	No Failure
3	20	No Failure
4	20	Anchor Pull Through
5	20	No Failure
6	19.5	Anchor Pull Through

FBS 6 in Spiroll Unit
Average Ultimate Tensile Load = **8.0kN**
Using a global safety factor of 4, safe working load in tension = **2.0kN**

FBS 6 M8 in 320 IHE Unit
Average Ultimate Tensile Load = **12.83kN**
Using a global safety factor of 4, safe working load in tension = **3.21kN**

FBS 8 in Spiroll Unit
Average Ultimate Tensile Load = **7.83kN**
Using a global safety factor of 4, safe working load in tension = **1.96kN**

FBS 8 in 320 IHE Unit
Average Ultimate Tensile Load = **19.58kN**
Using a global safety factor of 4, safe working load in tension = **4.90kN**

4.9 Fischer FHY Hollow Ceiling Anchor & Gripple Hangfast (March 2003)

Test No	Load in kN	Mode of Failure
Spiroll Unit		
1	2.8	Wire Failure
2	2.5	Wire Failure
3	2.5	Wire Failure
4	2.7	Wire Failure
5	2.5	Wire Failure
6	2.6	Wire Failure

It was decided not to test into the 320 IHE Unit due to the fact that the wire failure was the decisive factor and by going into a larger unit no advantage would be gained. The figures for this unit we would expect to be the same as for the 150 Spiroll Unit.

Spiroll Unit
Average Ultimate Tensile Load = **2.47kN**
Using a global safety factor of 4, safe working load in tension **= 0.62kN**

4.10 Fischer Hollow Ceiling Anchor FHY (March 2003)

Test No	Load in kN	Mode of Failure
FHY M10 Spiroll Unit		
1	17	Concrete Failure
2	14	Concrete Failure
3	13	Concrete Failure
4	13	Concrete Failure
5	14	Concrete Failure
6	14	Concrete Failure
FHY M10 320 IHE Unit		
1	20	No Failure
2	20	No Failure
3	20	No Failure
4	20	No Failure
5	20	No Failure
6	20	No Failure
FHY M8 Spiroll Unit		
1	9	Concrete Failure
2	13.5	Concrete Failure
3	11.5	Concrete Failure
4	13.5	Concrete Failure
5	12.5	Concrete Failure
6	11	Concrete Failure
FHY M8 320 IHE Unit		
1	20	No Failure
2	20	No Failure
3	20	No Failure
4	17	No Failure
5	20	No Failure
6	20	No Failure

FHY M8 into Spiroll Unit
Average Ultimate Tensile Load = **11.83kN**
Using a global safety factor of 4, safe working load in tension = **2.96kN**

FHY M10 into Spiroll Unit
Average Ultimate Tensile Load = **14.17kN**
Using a global safety factor of 4, safe working load in tension = **3.54kN**

FHY M8 into 320 IHE Unit
Average Ultimate Tensile Load = **19.5kN**
Using a global safety factor of 4, safe working load in tension = **4.88kN**

At approximately 14kN there was some movement but the fixing stayed secure. This could only be put down to the expansion cone being drawn further into the fixing.

FHY M10 into 320 IHE Unit
Average Ultimate Tensile Load = **20kN**
Using a global safety factor of 4, safe working load in tension = **5.0kN**

At approximately 16kN there was some movement but the fixing stayed secure. This could only be put down to the expansion cone being drawn further into the fixing.

4.11 Fischer Nail Anchor FNA (March 2003)

Test No	Load in kN	Mode of Failure
150DBT Unit		
FNA 6 M8		
1	6.5	Anchor Failure
2	6.5	Anchor Failure
150DBW Unit		
FNA 6 M8		
1	6.5	Anchor Failure
2	7	Anchor Failure
150EST Unit		
FNA 6 M8		
1	6.5	Anchor Failure
2	6.5	Anchor Failure
225EST Unit		
FNA 6 M8		
1	6.5	Anchor Failure
2	7	Anchor Failure

As anchor failure was decisive we went for few fixings into various beam sections to ensure that this was consistent, it remained that way so no advantage or disadvantage from larger or smaller beam sections.

150 DBT Unit
Average Ultimate Tensile Load = **6.5kN**
Using a global safety factor of 4, safe working load in tension = **1.63kN**

150 DBW Unit
Average Ultimate Tensile Load = **6.75kN**
Using a global safety factor of 4, safe working load in tension = **1.69kN**

150 EST Unit
Average Ultimate Tensile Load = **6.5kN**
Using a global safety factor of 4, safe working load in tension = **1.63kN**

225 EST Unit
Average Ultimate Tensile Load = **6.75kN**
Using a global safety factor of 4, safe working load in tension = **1.69kN**

4.12 Fischer N Hammerfix (March 2003)

Test No	Load in kN	Mode of Failure
225DBT Unit		
N8 Hammerfix		
1	2.5	Tensile Slip
2	3.0	Tensile Slip
3	3.0	Tensile Slip
4	2.5	Tensile Slip
5	2.5	Tensile Slip
6	3.0	Tensile Slip
225EST Unit		
N6 Hammerfix		
1	1.5	Tensile Slip
2	1.5	Tensile Slip
3	1.5	Tensile Slip
4	1.5	Tensile Slip
5	1.5	Tensile Slip
6	1.5	Tensile Slip

As tensile slip was decisive it was apparent that no advantage or disadvantage was to be gained for larger or smaller beam sections.

225 DBT Unit
N8 Hammerfix
Average Ultimate Tensile Load = **2.75kN**
Using a global safety factor of 4, safe working load in tension = **0.69kN**

225 EST Unit
N6 Hammerfix
Average Ultimate Tensile Load = **1.5kN**
Using a global safety factor of 4, safe working load in tension = **0.38kN**

5. Conclusion

5.1 Testing January 1999

In conclusion, it is our opinion, that the 2 fixing types tested in conjunction with Richard Lees precast hollowcore floors are highly suitable for fixing applications such as fixing M&E Services via hanger rods, or timber batten installations for MDF ceilings.
As the tests were conducted into the most slender of the manufactured slabs (150mm o/all depth), it is also our opinion that the fixings would also be suitable for the thicker slab sections (200mm and 250mm) with web thickness greater than 25-30mm.
The slabs were tested in an inverted condition for easier access and testing. The slabs would, however be laid in-situ with the reinforcement in the bottom face (i.e. tensile zone). For a class 3 design of floor slab, it is possible for cracks of up to 2 mm to be present when the slab is in service*.
*Information received from Richard Lees.
As there is no current research into precast hollowcore flooring concerning reductions in fixing load performance for crack widths of up to 0.2mm, we can apply the principles of fixings for cracked concrete with a solid structure.
In general terms, we apply an average reduction factor of 0.6 to the working loads of anchors installed into concrete compression zones (i.e. non-cracked concrete) in order to assess the working load performance of anchors approved for use in cracked concrete. This reduction factor is based on crack widths up to 0.4mm. Using simple linear interpolation, we can estimate that a reduction factor of 0.8 (or 20% reduction) applies to the loads achieved during the tests.
We can therefore conclude the load performances in section 5 for our fixings installed to Richard Lees hollowcore floor slabs in-situ. The factored loads are applicable to Class 3 floor slabs and the unfactored loads are applicable to the remaining classes.

5.2 Testing July 1999

In conclusion, it is our opinion, that the 3 fixing types tested in conjunction with Richard Lees precast hollowcore floors are highly suitable for fixing applications such as fixing M&E Services via hanger rods, or timber batten installations for MDF ceilings.
As the tests were conducted into the most slender of the manufactured slabs (150mm overall depth), it is also our opinion that the fixings would also be suitable for the thicker slab sections (200mm and 250mm) with web thickness greater than 25-30mm.
The difference in readings between the two types of slab when using the SX plug is not expected. Therefore we propose to confirm these test results at a later date by means of further testing.
The slabs were tested in an inverted condition for easier access and testing. The slabs would, however be laid in-situ with the reinforcement in the bottom face (i.e. tensile zone). For a class 3 design of floor slab, it is possible for cracks of up to 2 mm to be present when the slab is in service*.
*Information received from Richard Lees.
As there is no current research into precast hollowcore flooring concerning reductions in fixing load performance for crack widths of up to 0.2mm, we can apply the principles of fixings for cracked concrete with a solid structure.
In general terms, we apply an average reduction factor of 0.6 to the working loads of anchors installed into concrete compression zones (i.e. non-cracked concrete) in order to assess the working load performance of anchors approved for use in cracked concrete. This reduction factor is based on crack widths up to 0.4mm. Using simple linear interpolation, we can estimate that a reduction factor of 0.8 (or 20% reduction) applies to the loads achieved during the tests.
We can therefore conclude the load performances in section 5 for our fixings installed to Richard Lees hollowcore floor slabs in-situ. The factored loads are applicable to Class 3 floor slabs and the unfactored loads are applicable to the remaining classes.

5.3 Testing March 2003

All the beam sections that were tested into are pre-stressed. The wires within the beam section provide the integrity for this stress, when drilling into these units for any fixing purpose it is necessary to avoid these wires to ensure that the integrity remains intact.

In conclusion, it is our opinion, that the fixings tested in conjunction with Tarmac Topfloor hollow core & beam units of various sizes are highly suitable for applications various types e.g. M&E services, timber batten systems & suspended ceilings.

The tests were carried out on units suspended at either end to simulate a real in-situ application. However they were not subjected to any loads so any possible tensile cracks would not be present or be less than in normal service, these would possibly have an adverse effect on the loads of the fixing.

6. Results Summary

6.1 Testing January 1999

Fixing	Safe Working Tensile Load Unfactored (kN) Class 1,2	Reduction Factor	Safe Working Tensile Load (kN)
Nylon M Unit	3.0	0.8	2.4
Fischer FFS Screw	1.20	0.8	0.96

6.2 Testing July 1999

Fixing	Safe Working Tensile Load Unfactored (kN) Class 1,2	Reduction Factor	Safe Working Tensile Load (kN)
150 Spiroll Unit			
Fischer SX10	0.8	0.8	0.64
FIS V 360 S Hybrid Vinylester resin & FIP18x85 and M10 rod	5.0	0.8	4.0
FNS Fischer Nail	0.8	0.8	0.64
M Unit Floor Slab			
Fischer SX10	0.5	0.8	0.4
FIS V 360 S Hybrid Vinylester resin & FIP18x85 and M10 rod	5.0	0.8	4.0
FNS Fischer Nail	0.8	0.8	0.64

6.3 Testing March 2003

Fixing	Safe Working Tensile Load Unfactored (kN) Class 1,2	Reduction Factor	Safe Working Tensile Load (kN)
225 DBT Unit			
Fischer SX 6	0.41	0.8	0.33
Fischer N8 Hammerfix	0.69	0.8	0.55
150 Spiroll Unit			
Fischer FDA-R M8	3.44	0.8	2.75
Fischer FDA-R M10	4.23	0.8	3.38
Fischer FBS 6	2.0	0.8	1.6
Fischer FBS 8	1.96	0.8	1.57
Fischer FHY Ceiling Anchor & Gripple Hangfast	0.62	0.8	0.50
Fischer FHY M10	3.54	0.8	2.83
Fischer FHY M8	2.96	0.8	2.37
150 EST Unit			
Fischer SX 6	0.33	0.8	0.26
Fischer FNA 6 M8	1.63	0.8	1.30

Fixing	Safe Working Tensile Load Unfactored (kN) Class 1,2	Reduction Factor	Safe Working Tensile Load (kN)

225 EST Unit			
Fischer N6 Hammerfix	0.38	0.8	0.30
Fischer FNA 6 M8	1.69	0.8	1.35
320 IHE Unit			
Fischer FHY M8	4.88	0.8	3.90
Fischer FHY M10	5.0	0.8	4.0
Fischer FBS 6 M8	3.21	0.8	2.57
Fischer FBS 8	4.90	0.8	3.92
Fischer FDA-R M8	4.15	0.8	3.32
Fischer FDA-R M10	4.75	0.8	3.80
150 DBW Unit			
Fischer SX 8	0.57	0.8	0.46
Fischer FNA 6 M8	1.69	0.8	1.35

Fixing	Safe Working Tensile Load Unfactored (kN) Class 1,2	Reduction Factor	Safe Working Tensile Load (kN)
150 DBT Unit			
Fischer FNA 6 M8	1.63	0.8	1.30