CI/SfB (27) Xt6

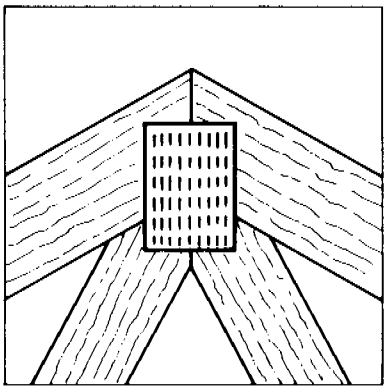
Gang-Nail Systems Ltd
Christy Estate
Ivy Road
Aldershot
Hants GU12 4XG
Tel: 0252 334691

Agrément Certificate No 90/2413

GANG-NAIL PUNCHED METAL PLATE TIMBER FASTENERS

Connecteurs métalliques pour charpentes en bois
Nagelplatten als Holzverbindungsmittel

Product



- *THIS CERTIFICATE RELATES TO GANG-NAIL PUNCHED METAL PLATE TIMBER FASTENERS.*
- *The fasteners are steel plates with integral nails, used to connect the members of internally used framed timber structural components (such as trusses) at any angle within the same plane.*
- *Timber joints are fabricated under factory conditions, and it is essential that the fabricator and the equipment for assembly are approved by the Certificate holder in accordance with the conditions set out in this Certificate.*

Building Regulations

1 The Building Regulations (England and Wales)

The Secretary of State has agreed with the British Board of Agrément the requirements of the Building Regulations to which punched metal plate timber fasteners can contribute in achieving compliance. In the opinion of the BBA, the position of Gang-Nail Punched Metal Plate Timber Fasteners under these Regulations, if used in accordance with the provisions of this Certificate, is as stated in Detail Sheet 1.

2 The Building Standards (Scotland) Regulations

In the opinion of the BBA, the position of Gang-Nail Punched Metal Plate Timber Fasteners under these Regulations, if used in accordance with the provisions of this Certificate, is as stated in Detail Sheet 1.

3 The Building Regulations (Northern Ireland)

In the opinion of the BBA, the position of Gang-Nail Punched Metal Plate Timber Fasteners under these Regulations, if used in accordance with the provisions of this Certificate, is as stated in Detail Sheet 1.

Design Data

4 General

4.1 Gang-Nail Punched Metal Plate Timber Fasteners have been assessed in accordance with the requirements of MOAT No 16 : 1979 *UEAtc Directive for the Assessment of Punched Metal Plate Timber Fasteners*. The fasteners are suitable for use in making joints in timber framed structures. The company's prescribed methods of applying the fasteners are considered satisfactory.

4.2 The framed structures incorporating the fasteners are designed using established engineering methods, including prototype testing carried out in accordance with

BS 5268 : Part 2 : 1988 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*, or where appropriate BS 5268 : Part 3 : 1985 *Code of practice for trussed rafter roofs.*

5 Structural performance

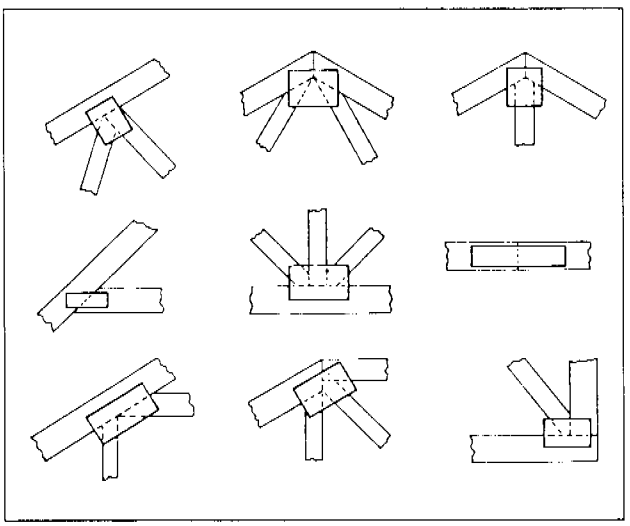
5.1 The strength of timber is influenced by the duration of loading. A similar effect applies to timber joints, except where the strength of the fastener is the limiting factor. In accordance with the procedures recommended in BS 5268 : Part 2 : 1988 or BS 5268 : Part 3 : 1985, four categories of load duration should be considered: long-, medium-, short- and very short-term loads.

5.2 In tension or compression, the strength of a joint is generally dependent upon the lateral resistance of the nails. However, the limiting tensile, compressive or shear strength of the net section of the plates must not be exceeded.

Joint assembly

5.3 Timber members to be connected may be in line or meet at any required angle in the same plane; typical joints are illustrated in Figure 1.

Figure 1 Examples of typical joints



5.4 The fasteners must be embedded in both faces of each abutting member using special equipment supplied or approved by the manufacturer.

5.5 Each fastener must be embedded to achieve complete penetration of the nails without pressing the plate into the timber for more than one-quarter of its thickness. There must be no significant gaps between the fastener and the timber.

6 Performance in relation to fire

When used in a structure subject to fire resistance requirements, an appropriate assessment or test, relating to that structure, must be carried out by a National Measurement Accreditation Service (NAMAS) accredited laboratory for the test concerned.

7 Timber treatments

Preservative

7.1 The timber may be preserved with copper/chrome/arsenic, boron compounds or organic solvent preservative applied in accordance with BS 5268 : Part 5 : 1977 *Preservative treatments for constructional timber.*

7.2 Where copper/chrome/arsenic preservative is used it is essential to allow sufficient time for the complete fixation of the preservative (about seven days) and to ensure that the timber is subsequently re-dried after fixation, before the fasteners are embedded.

7.3 When confined to the dry conditions specified in this Certificate the use of preservative-treated timber does not present a corrosion risk. In wetter conditions, however, the risk of premature corrosion of fasteners may be greater than with untreated timber. Risks associated with the various forms of treatment are described in the Building Research Establishment Information Sheet IS 11/77.

Fire retardants

7.4 Attention is drawn to Building Research Establishment Information Sheet IS 11/77 with respect to the risk of premature corrosion of fasteners used in timber treated with inorganic flame retardant salts.

8 Interpretation of test results

8.1 The permissible loads for the joints under long-term loading were derived from the test results using the following general equation (see section 8 of the relevant Detail Sheet). This ensures that the permissible loads are the estimated minimum joint strengths making allowance for the variations in maximum load, as shown by the test results and a further factor of safety:

$$W = (m - k\,\sigma)\,F^{-1}$$

where:

W = permissible load
m = average maximum load from test
σ = standard deviation of test results
k = 2.33
F = 2.25 (factor of safety).

8.2 The permissible stresses in compression, tension and shear for the plate net sections were obtained by applying a reduction factor of 2.5 to the ultimate stresses obtained from tests.

9 Conditions

9.1 The quality of materials and method of manufacture have been examined and found satisfactory by the BBA and must be maintained to this standard during the period of validity of this Certificate. This Certificate will remain valid for an unlimited period provided that:

(a) the specification of the product is unchanged, and

(b) the manufacturer continues to have the product checked by the BBA.

9.2 Where reference is made in this Certificate to any Act of Parliament, Regulation made thereunder, Statutory Instrument, Code of Practice, British Standard, manufacturer's instruction or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certificate.

9.3 In granting this Certificate, the BBA makes no representation as to the presence or absence of patent rights subsisting in the product and/or as to the legal right of Gang-Nail Systems Ltd to market, install or maintain the product.

9.4 It should be noted that any recommendations relating to the safe use of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to re-state the requirements of the Health and Safety at Work etc Act 1974, or of any other statutory or Common Law duties of care, or of any duty of care which may in the future exist; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any other present or future statutory or Common Law duties of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage incurred in respect of personal injury arising as a direct or indirect result of the use of the product.

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

In the opinion of the British Board of Agrément, Gang-Nail Punched Metal Plate Timber Fasteners are satisfactory if used as set out in this Certificate. Certificate No 90/2413 is accordingly awarded to Gang-Nail Systems Ltd.

On behalf of the British Board of Agrément

Date of issue: 27th February 1990 **Director**

British Board of Agrément
P O Box No 195, Bucknalls Lane
Garston, Watford, Herts WD2 7NG
Fax: 0923 662133

For information about
Agrément Certificates
telephone:
Hotline: 0923 662900

CI/SfB (27) Xt6

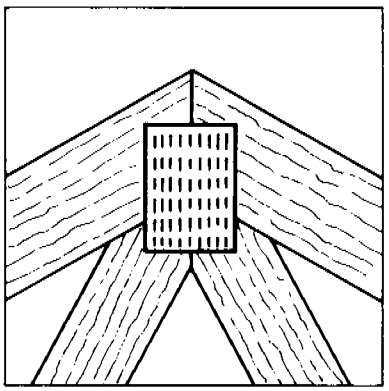
Certificate No 90/2413

Gang-Nail Systems Ltd

DETAIL SHEET 2

GANG-NAIL 14 GAUGE PUNCHED METAL PLATE TIMBER FASTENERS

Product



- *THIS DETAIL SHEET REPLACES CERTIFICATE No 80/746 AND RELATES TO GANG-NAIL 14 GAUGE ZINC COATED PUNCHED METAL PLATE TIMBER FASTENERS.*

This Detail Sheet must be read in conjunction with the Front Sheet and Detail Sheet 1, which give Conditions of Certification, details common to all Gang-Nail certificated fasteners and the product's position regarding the Building Regulations respectively.

Technical Specification

1 Description

1.1 Gang-Nail 14 Gauge Punched Metal Plate Timber Fasteners are galvanized mild steel plates having rows of integral nails pressed out to project at approximately right-angles to one face of the plates (see Figure 1). The slots so formed define the length direction of the fastener. One nail is formed from each slot, and alternate rows of nails face in opposite directions. The nails are formed with a slightly dished cross-section.

1.2 The fasteners are manufactured from material designation Z2 G275 to BS 2989 : 1982 *Specification for continuously hot-dip zinc coated and iron-zinc alloy coated steel : wide strip, sheet/plate and slit wide strip.* An upper limit on ultimate tensile strength is additionally imposed to ensure suitability for pressing. Reference should be made to BBA Information No 9 *Punched Metal Plate Timber Fasteners : Specification for Hot-Dip Zinc Coated Steel and Quality Control Guidance Notes.*

1.3 The dimensions and spacing of the nails are shown in Figure 2. The thickness of the plate including zinc coating is nominally 2 mm.

2 Sizes

The standard sizes of fastener are given in Table 1.

3 Identification

The fasteners are stamped with the manufacturer's identification mark, 'Gang-Nail', and are packed in boxes bearing the BBA identification mark incorporating the number of this Certificate.

Figure 1 Typical Gang-Nail 14 Gauge Punched Metal Plate Timber Fastener

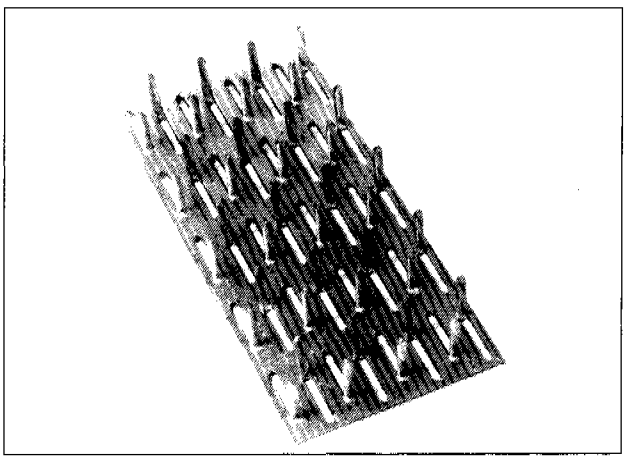


Figure 2 Details of a typical fastener

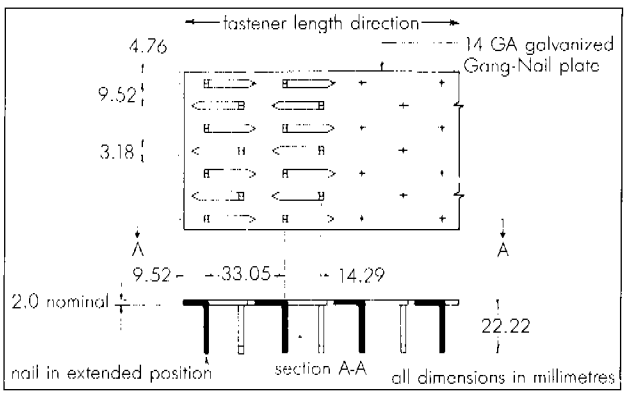


Table 1 Range of standard fastener sizes

Width (mm)	Length (mm) 100.1	133.3	166.6	200.0	233.5	266.5	333.5	400.0	467.0	533.0	633.0	700.0	766
38.1	1	1	1	0	1	0	0	0	0	0	0	0	0
76.2	1	1	1	1	1	1	1	1	1	1	0	0	0
66.8	1	1	1	1	1	1	1	1	1	1	0	0	0
114.3	1	1	1	1	1	1	1	1	1	1	0	0	0
133.4	1	1	1	1	1	1	1	1	1	1	0	0	0
152.4	0	0	1	1	1	1	1	1	1	1	1	1	0
190	0	0	0	1	1	1	1	1	1	1	1	1	1
228	0	0	0	1	1	1	1	1	1	1	1	1	1

1 denotes fastener size covered by this Certificate.

0 denotes fastener size not covered by this Certificate.

Design Data

4 Timber species

This Detail Sheet covers the use of Gang-Nail 14 Gauge Punched Metal Plate Timber Fasteners in sawn or planed, treated or untreated, stress graded timber of minimum specified thickness of 44 mm, −0 +1 mm divergence throughout a member (when measured at 20% moisture content) of the following species:

European whitewood
commercial western hemlock
European redwood
hem-fir
Eastern Canadian spruce (princess spruce)
spruce-pine-fir.

5 Structural performance

Lateral resistance

5.1 The lateral resistance of a fastener depends upon:

number of effective nails in the joint
species of timber and its moisture content
duration of load
direction of bearing of the nail with respect to the grain of the timber
angle of load to the fastener.

5.2 The number of effective nails in the joint shall be determined by omitting:

nails nearer than 6 mm to the edge of the timber,
nails nearer than 6 mm from the end of the timber member in compression, and
nails nearer than 13 mm from the end of the timber member in tension measured parallel to the grain.

5.3 The permissible lateral load per effective nail for the fasteners under long-term loading for the softwood species included in this assessment is given in Table 2. The permissible loads are specified for 15° increments of angle of load to the grain and nail orientation, as indicated in Figure 3.

Table 2 Permissible loads (Newtons) per nail for Gang-Nail 14 Gauge fasteners in planed/sawn timber

Angle of load to fastener length direction (°)	Angle of load to grain of member 0°	15°	30°	45°	60°	75°	90°
Long-term loading							
Commercial western hemlock							
0–25	307	293	260	225	199	183	178
>25	values as for European redwood						
European redwood and whitewood, hem-fir							
0–25	254	247	229	209	192	182	178
30	249	242	226	208	192	181	178
45	234	229	217	202	189	181	178
60	218	215	206	196	187	180	178
75	203	201	196	190	184	179	178
90	187	186	185	182	180	179	178
Western white spruce, Eastern Canadian spruce, spruce-pine-fir							
0–25	203	197	184	167	154	145	142
30	199	194	181	166	153	145	142
45	187	183	175	162	151	145	142
60	174	172	165	157	149	144	142
75	162	161	157	152	147	144	142
90	150	149	148	146	144	143	142

5.4 The permissible lateral load for medium-, short- and very short-term duration of load should be obtained in accordance with BS 5268 : Part 2 : 1988 by modifying the long-term permissible loads given in Table 2 by the following factors:

Medium-term (eg dead + snow, dead + temporary imposed)	1.12
Short-term (eg dead + imposed + wind*, dead + imposed + snow + wind*)	1.25
Very short-term (eg dead + imposed + wind†)	1.25

*For wind, *short-term* category applies to class C (15 s gust) as defined in BS Code of Practice CP 3 : Chapter V : Part 2 : 1972 *Code of basic data for the design of Buildings : Loading : Wind loads.*

†For wind, *very short-term* category applies to classes A and B (3 s or 5 s gust) as defined in CP 3 : Chapter V : Part 2.

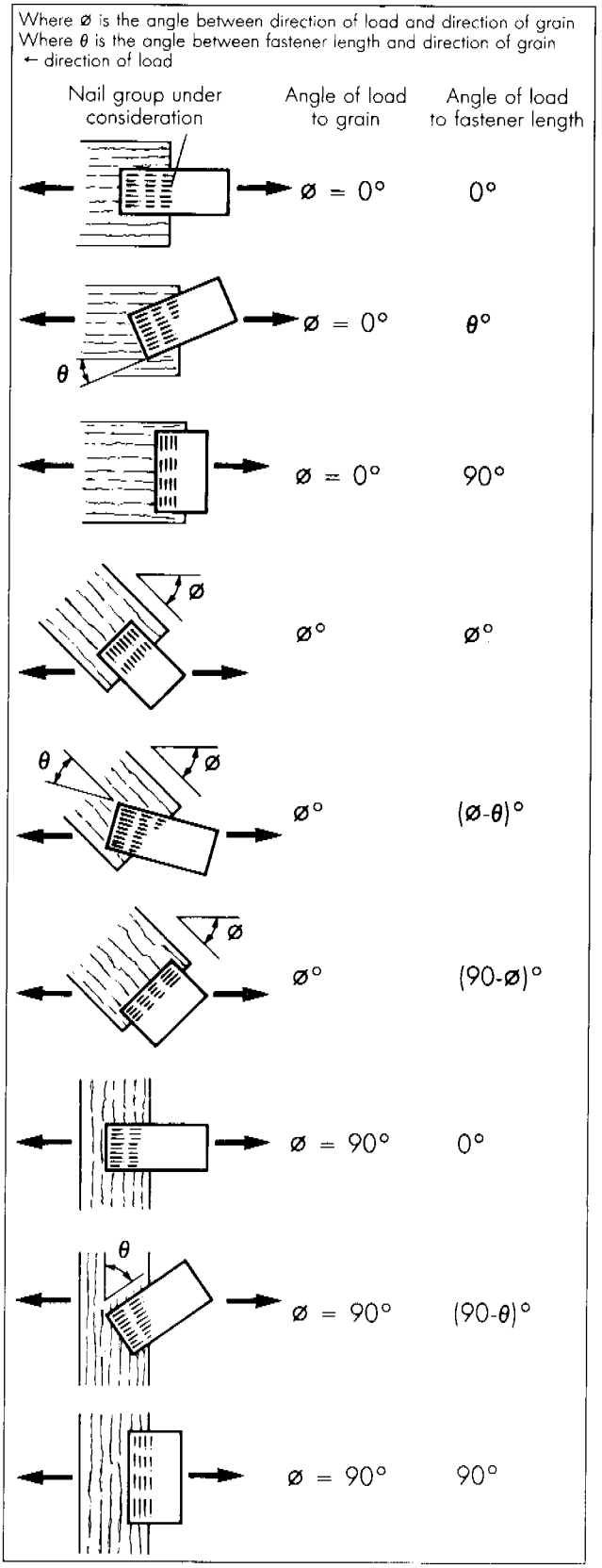
Tensile strength

5.5 The maximum tensile force acting on the fasteners, for all four categories of load duration, must not exceed the following:

force acting in direction of fastener length — 171 Nmm^{-1} of fastener width;

force acting in direction of fastener width — 65 Nmm^{-1} of fastener length.

Figure 3 Angle of load to grain and nail orientation



Compressive strength

5.6 The maximum compressive force acting on the fasteners, for all four categories of load duration, must not exceed the following:

force acting in direction of fastener length — 100 Nmm^{-1} of fastener width;

force acting in direction of fastener width — 56 Nmm^{-1} of fastener length.

5.7 The loads given in section 5.6 were derived from tests and are based on a typical factor of safety for general use. Where failure of the fastener will result in forces being taken in end bearing, and the joint will not be subject to stress reversal, the permissible values for compressive force may be modified by multiplying by 1.5. A suitably qualified engineer shall be responsible for considering the merits of each application and deciding upon the appropriate permissible value.

Shear strength

5.8 The maximum shear force acting on a fastener, for all four categories of load duration, must not exceed the value given in Table 3 for the angle α, the angle between the fastener length direction and the direction in which the load is acting.

*Table 3 Maximum shear forces**

Angle α	Nmm^{-1} of shear line
0 - 50	70
60	85
70 – 80	100
90	70

*Values for intermediate angles can be interpolated.

5.9 The values are limited to angle α up to and including 90°, as required by conventional UK practice. The requirements relating to shear given in MOAT No 16 : 1979 *UEAtc Directive for the Assessment of Punched Metal Plate Timber Fasteners* include values for angle α from 0° to 180°. An assessment will therefore be necessary in each particular case where values for shear angle α greater than 90° are required.

6 Practicability of installation

The fasteners are easy to embed using the commercial platen press equipment normally employed for truss fabrication.

7 Durability

The fasteners have a zinc coating (see section 1.2 of this Detail Sheet), which will give adequate protection against corrosion in normal internal domestic situations, where the moisture content of the timber does not exceed 18% for any significant period and does not exceed 22% at any time.

3

The following is a summary of the technical investigations carried out on Gang-Nail 14 Gauge Punched Metal Plate Timber Fasteners.

8 Tests

8.1 As part of the assessment leading to the issue of the previous Certificate:

(1) The results of tests on 116 full-size structural joints, assembled using the commercial equipment normally employed, were assessed to determine the permissible loads and stresses for the fasteners. Additional data, obtained for reports in tests carried out at the Technischem Hochschule Karlsruhe, Germany, were also considered. The results of tests on a further 68 joints, including 30 made using sawn timber, were also assessed.

(2) Five species of timber, commercial western hemlock, European redwood, European whitewood, Eastern Canadian spruce and Western white spruce, were used in the test joints. Existing data on the relative strength of species were used to derive values for use with other species. The tests examined:

variations in strength within species
effects of surface finish
effects of fastener orientation
tensile and shear properties of fasteners.

8.2 Sample joints were subjected to load-cycling tests, including some 60,000 applications and relaxations of load up to the maximum permissible load level for the plates, with no significant creep or loss in strength.

9 Other investigations

9.1 As part of the assessment leading to the issue of previous Certificate No 80/746 the following investigations were made:

(1) The permissible loads were compared with the estimated maximum loads to cause a joint slip of 0.8 mm. These latter load values, however, were consistently higher than those based on maximum load values except for joints in commercial western hemlock, with the load acting at 0° to the nails. In general, the maximum initial slip in joints in tension, at the permissible long-term loads, will not be greater than 0.6 mm (or 0.75 mm for joints of commercial western hemlock with load acting parallel to the grain) and the average initial slip not greater than 0.25 mm.

(2) Existing data on the durability of punched metal plate timber fasteners were examined.

(3) Existing data relating to cyclic loading on fasteners in dwellings and similar structures were examined and the effects found to be insignificant.

(4) An assessment was made on the practicability of joint assembly.

(5) The test data on which the previous Certificate was based were re-examined and analysed in accordance with BBA MOAT 16 : 1979, and compared with related comparative research data. The analysis established that the design data previously derived remain valid.

(6) The manufacturing process was examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

9.2 As part of the assessment leading to the issue of this Certificate, the following investigations were made:

(1) A re-examination was made of the data and investigations on which the previous Certificate was based.

(2) The strength of joints in compression was investigated.

9.3 Regular factory inspections have been carried out to ensure that quality is being maintained.

9.4 No failure of the product in use has been reported to the BBA.

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

On behalf of the British Board of Agrément

P. C. Hewlett

Date of issue: 27th February 1990 **Director**

British Board of Agrément
P O Box No 195, Bucknalls Lane
Garston, Watford, Herts WD2 7NG
Fax: 0923 662133

For information about Agrément Certificates telephone:
Hotline: 0923 662900

CI/SfB
(27) Xt6

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

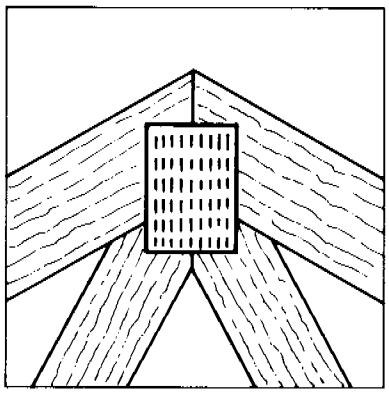
Certificate No 90/2413

Gang-Nail Systems Ltd

DETAIL SHEET 3

GANG-NAIL 18 GAUGE PUNCHED METAL PLATE TIMBER FASTENERS

Product



- *THIS DETAIL SHEET REPLACES CERTIFICATE No 80/747 AND RELATES TO GANG-NAIL 18 GAUGE MULTI-NAIL ZINC COATED PUNCHED METAL PLATE TIMBER FASTENERS.*

This Detail Sheet must be read in conjunction with the Front Sheet and Detail Sheet 1, which give Conditions of Certification, details common to all Gang-Nail certificated fasteners and the product's position regarding the Building Regulations respectively.

Technical Specification

1 Description

1.1 Gang-Nail 18 Gauge Punched Metal Plate Timber Fasteners are galvanized mild steel plates having rows of integral nails pressed out to project at approximately right-angles to one face of the plates (see Figure 1). The slots so formed define the length direction of the fastener. One nail is formed from each slot, and alternate rows of nails face in opposite directions. The nails are formed with a slightly dished cross-section.

1.2 The fasteners are manufactured from material designation Z2 G275 to BS 2989 : 1982 *Specification for continuously hot-dip zinc coated and iron-zinc alloy coated steel : wide strip, sheet/plate and slit wide strip*. An upper limit on ultimate tensile strength is additionally imposed to ensure suitability for pressing. Reference should be made to BBA Information No 9 *Punched Metal Plate Timber Fasteners : Specification for Hot-Dip Zinc Coated Steel and Quality Control Guidance Notes*.

1.3 The dimensions and spacing of the nails are shown in Figure 2. The thickness of the plate including zinc coating is nominally 1.25 mm.

2 Sizes

The standard sizes of fastener are given in Table 1.

3 Identification

The fasteners are stamped with the manufacturer's identification mark 'Gang-Nail', and are packed in boxes bearing the BBA identification mark incorporating the number of this Certificate.

Figure 1 A typical Gang-Nail 18 Gauge Punched Metal Plate Timber Fastener

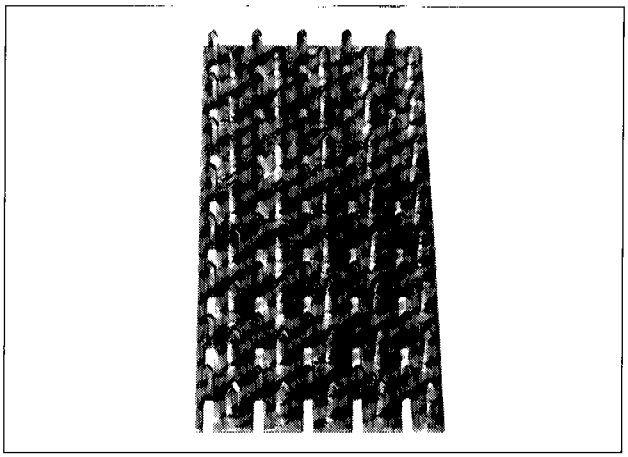


Figure 2 Dimensions and arrangement of nails

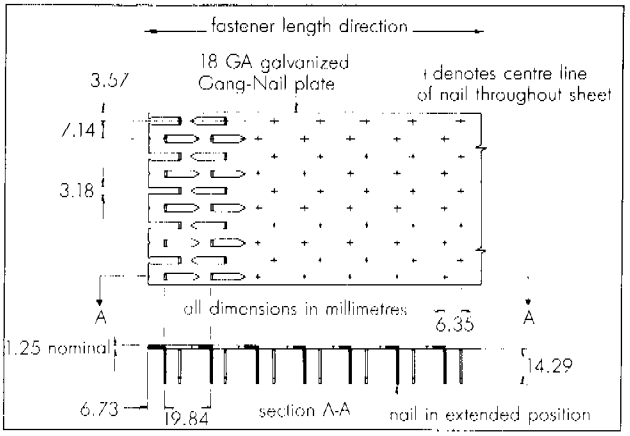


Table 1 Range of standard fastener sizes

Width (mm)	Length (mm)															
	59.4	79.5	99.4	119.1	139.0	158.7	178.0	198.2	218.0	238.3	278.0	317.5	337.0	357.0	397.0	476.0
35.8	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0
71.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
107.2	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	1
143.0	0	1	1	1	1	1	0	1	0	1	1	1	0	0	0	0

1 denotes fastener size covered by this Certificate.

0 denotes fastener size not covered by this Certificate.

Design Data

4 Timber species

This Detail Sheet covers the use of Gang-Nail 18 Gauge Punched Metal Plate Timber Fasteners in sawn or planed, treated or untreated, stress graded timber of minimum specified thickness of 35 mm, −0 +1 mm divergence throughout a member (when measured at 20% moisture content) of the following species:

European whitewood
European redwood
hem-fir
Western white spruce
Eastern Canadian spruce (princess spruce)
spruce-pine-fir.

5 Structural performance

Lateral resistance

5.1 The lateral resistance of a fastener depends upon:

number of effective nails in the joint
species of timber and its moisture content
duration of load
direction of bearing of the nail with respect to the grain of the timber
angle of load to the fastener.

5.2 The number of effective nails in the joint shall be determined by omitting:

nails nearer than 6 mm to the edge of the timber,
nails nearer than 6 mm from the end of the timber member in compression, and
nails nearer than 10 mm from the end of the timber member in tension measured parallel to the grain.

5.3 The permissible lateral load per effective nail for the fasteners under long-term loading for the softwood species included in this assessment is given in Table 2. The permissible loads are specified for 15° increments of angle of load to the grain and nail orientation, as indicated in Figure 3.

Table 2 Permissible loads (Newtons) per nail for Gang-Nail 18 Gauge fasteners in planed/sawn timber

Angle of load to fastener length direction (°)	Angle of load to grain of member						
	0°	15°	30°	45°	60°	75°	90°
Long-term loading							
European redwood and whitewood, hem-fir							
0–25	156	146	123	102	87	79	76
30	151	142	121	101	87	79	76
45	136	129	114	97	85	78	76
60	120	115	105	93	84	78	76
75	104	101	95	88	81	77	76
90	89	88	85	82	79	77	76
Western white spruce, Eastern Canadian spruce, spruce-pine-fir							
0 25	125	117	99	82	70	63	61
30	121	113	97	81	70	63	61
45	109	103	91	78	68	63	61
60	96	92	84	74	67	62	61
75	83	81	76	70	65	62	61
90	71	70	68	66	63	61	61

5.4 The permissible lateral load for medium-, short- and very short-term duration of load, should be obtained in accordance with BS 5268 : Part 2 : 1988 by modifying the long-term permissible loads given in Table 2 by the following factors:

Medium-term (eg dead + snow, dead + temporary imposed)	1.12
Short-term (eg dead + imposed + wind*, dead + imposed + snow + wind*)	1.25
Very short-term (eg dead + imposed + wind†)	1.25

*For wind, *short-term* category applies to class C (15 s gust) as defined in BS Code of Practice CP 3 : Chapter V : Part 2 : 1972 *Code of basic data for the design of buildings : Loading : Wind loads.*

†For wind, *very short-term* category applies to classes A and B (3 s or 5 s gust) as defined in CP 3 : Chapter V : Part 2.

Tensile strength

5.5 The maximum tensile force acting on the fasteners, for all four categories of load duration, must not exceed the following:

force acting in direction of fastener length — 94 Nmm^{-1} of fastener width;

force acting in direction of fastener width — 32 Nmm^{-1} of fastener length.

Compressive strength

5.6 The maximum compressive force acting on the fasteners, for all four categories of load duration, must not exceed the following:

force acting in direction of fastener length — 75 Nmm^{-1} of fastener width;

force acting in direction of fastener widths — 32 Nmm^{-1} of fastener length.

5.7 The loads given in section 5.6 were derived from tests and are based on a typical factor of safety for general use. Where failure of the fastener will result in forces being taken in end bearing, and the joint will not be subject to stress reversal, the permissible values for compressive force may be modified by multiplying by 1.5. A suitably qualified engineer shall be responsible for considering the merits of each application and deciding upon the appropriate permissible value.

Shear strength

5.8 The maximum shear force acting on a fastener, for all four categories of load duration, must not exceed the value given in Table 3 for the angle α, the angle between the fastener length direction and the direction in which the load is acting.

*Table 3 Maximum shear forces**

Angle α	Nmm^{-1} of shear line
0	34
10–50	40
70	60
80–90	47

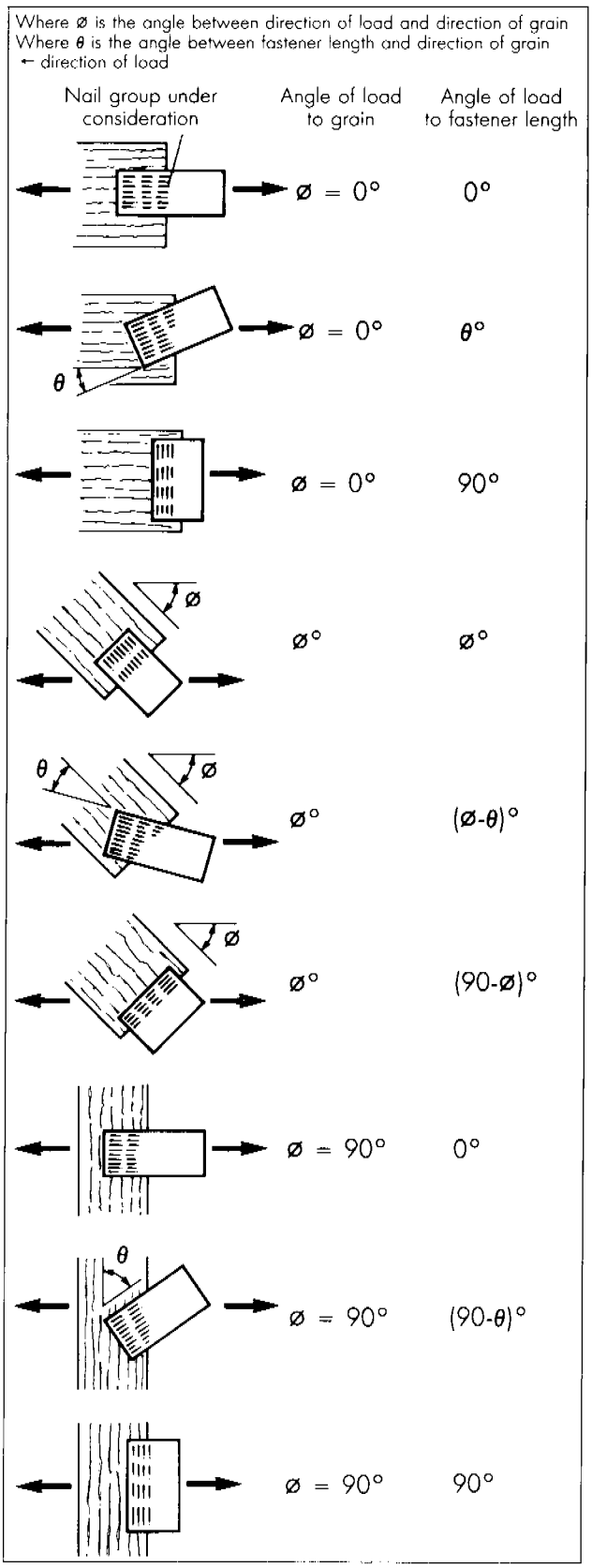
*Values for intermediate angles can be interpolated.

5.9 The values are limited to angle α up to and including 90°, as required by conventional UK practice. The requirements relating to shear given in MOAT No 16 : 1979 *UEAtc Directive for the Assessment of Punched Metal Plate Timber Fasteners* include values for angle α from 0° to 180°. An assessment will therefore be necessary in each particular case where values for shear angle α greater than 90° are required.

6 Practicability of installation

The fasteners are easy to embed using the commercial platen press equipment normally employed for truss fabrication.

Figure 3 Angle of load to grain and nail orientation



7 Durability

The fasteners have a zinc coating (see section 1.2 of this Detail Sheet), which will give adequate protection against corrosion in normal internal domestic situations, where the moisture content of the timber does not exceed 18% for any significant period and does not exceed 22% at any time.

3

Technical Investigations

The following is a summary of the technical investigations carried out on Gang-Nail 18 Gauge Punched Metal Plate Timber Fasteners.

8 Tests

8.1 As part of the assessment leading to the issue of the previous Certificate:

(1) The results of tests on 116 full-size structural joints, assembled using the commercial equipment normally employed, were assessed to determine the permissible loads and stresses for the fasteners. Additional data, obtained from reports on tests carried out at the Technischen Hochschule Karlsrohe, Germany, were also considered. The results of tests on a further 68 joints including 30 made using sawn timber, were also assessed.

(2) Five species of timber listed in section 4 were used in the test joints. Existing data on the relative strength of species were used to derive values for use with other species. The tests examined:

variations in strength within species
effects of surface finish
effects of direction and type of loading
effects of fastener orientation
tensile and shear properties of fasteners.

(3) Sample joints were subjected to load-cycling tests, including some 60,000 applications and relaxations of load up to the maximum permissible load level for the plates, with no significant creep or loss in strength.

(4) Tests were conducted to determine the thickness and quality of galvanizing.

9 Other investigations

9.1 As part of the assessment leading to the issue of previous Certificate No 80/747 the following investigations were made:

(1) The permissible loads, derived from the tests referred to above, were compared with the estimated maximum loads to cause a joint slip of 0.8 mm. These latter load values, however, were consistently higher than those based on maximum load values. In general, the maximum initial slip in joints in tension, at the permissible long-term loads, will not be greater than 0.5 mm and the average initial slip not greater than 0.3 mm.

(2) Existing data on the durability of punched metal plate timber fasteners were examined.

(3) Existing data relating to cyclic loading on fasteners in dwellings and similar structures were examined and the effects found to be insignificant.

(4) An assessment was made on the practicability of joint assembly.

(5) The test data on which the previous Certificate was based were re-examined and analysed in accordance with BBA MOAT No 16 : 1979, and compared with related comparative research data. The analysis established that the design data previously derived remain valid.

(6) The manufacturing process was examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

9.2 As part of the assessment leading to the issue of this Certificate, the following investigations were made:

(1) A re-examination was made of the data and investigations on which the previous Certificate was based.

(2) The strength of joints in compression was investigated.

9.3 Regular factory inspections have been carried out to ensure that quality is being maintained.

9.4 No failure of the product in use has been reported to the BBA.

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

On behalf of the British Board of Agrément

P.C. Hewlett

Date of issue: 27th February 1990 **Director**

British Board of Agrément
P O Box No 195, Bucknalls Lane
Garston, Watford, Herts WD2 7NG
Fax: 0923 662133

For information about Agrément Certificates telephone:
Hotline: 0923 662900

CI/SfB
(27) Xt6
Certificate No 90/2413

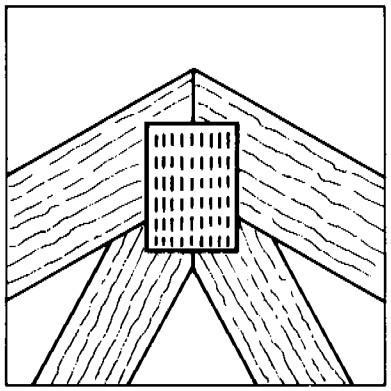
BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

Gang-Nail Systems Ltd

DETAIL SHEET 5

GANG-NAIL 20 GAUGE PUNCHED METAL PLATE TIMBER FASTENERS

Product



- *THIS DETAIL SHEET REPLACES DETAIL SHEET 4 AND RELATES TO GANG-NAIL 20 GAUGE ZINC COATED PUNCHED METAL PLATE TIMBER FASTENERS.*

This Detail Sheet must be read in conjunction with the Front Sheet and Detail Sheet 1, which give Conditions of Certification, *details common to all Gang-Nail certificated fasteners and the product's position regarding the Building Regulations respectively.*

Technical Specification

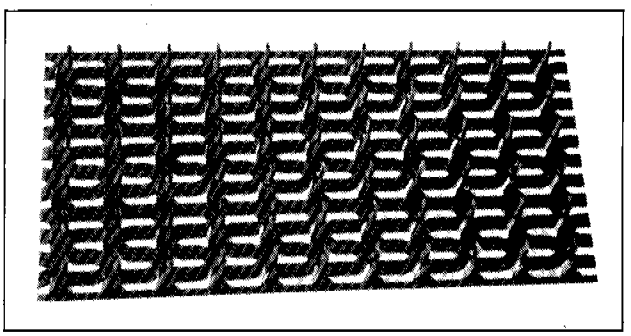
1 Description

1.1 Gang-Nail 20 Gauge Punched Metal Plate Timber Fasteners are galvanized mild steel plates having rows of integral nails pressed out to project at approximately right-angles to one face of the plates (see Figure 1). The slots so formed define the length direction of the fastener. One nail is formed from each slot, and alternate rows of nails face in opposite directions. The nails are formed with a slightly dished cross-section and a thickened root.

1.2 The fasteners are manufactured from material designation Z2 G275 to BS 2989 : 1982 *Specification for continuously hot-dip zinc coated and iron-zinc alloy coated steel : wide strip, sheet/plate and slit wide strip.* An upper limit on ultimate tensile strength is additionally imposed to ensure suitability for pressing. Reference should be made to BBA Information No 9 *Punched Metal Plate Timber Fasteners : Specification for Hot-Dip Zinc Coated Steel and Quality Control Guidance Notes.*

1.3 The dimensions and spacing of the nails are shown in Figure 2. The thickness of the plate including zinc coating is nominally 1 mm.

Figure 1 A typical Gang-Nail 20 Gauge Punched Metal Plate Timber Fastener



2 Sizes

The standard sizes of fastener are given in Table 1.

3 Identification

The fasteners are identified with the manufacturer's legend GN20 and are packed in boxes bearing the BBA identification mark incorporating the number of this Certificate.

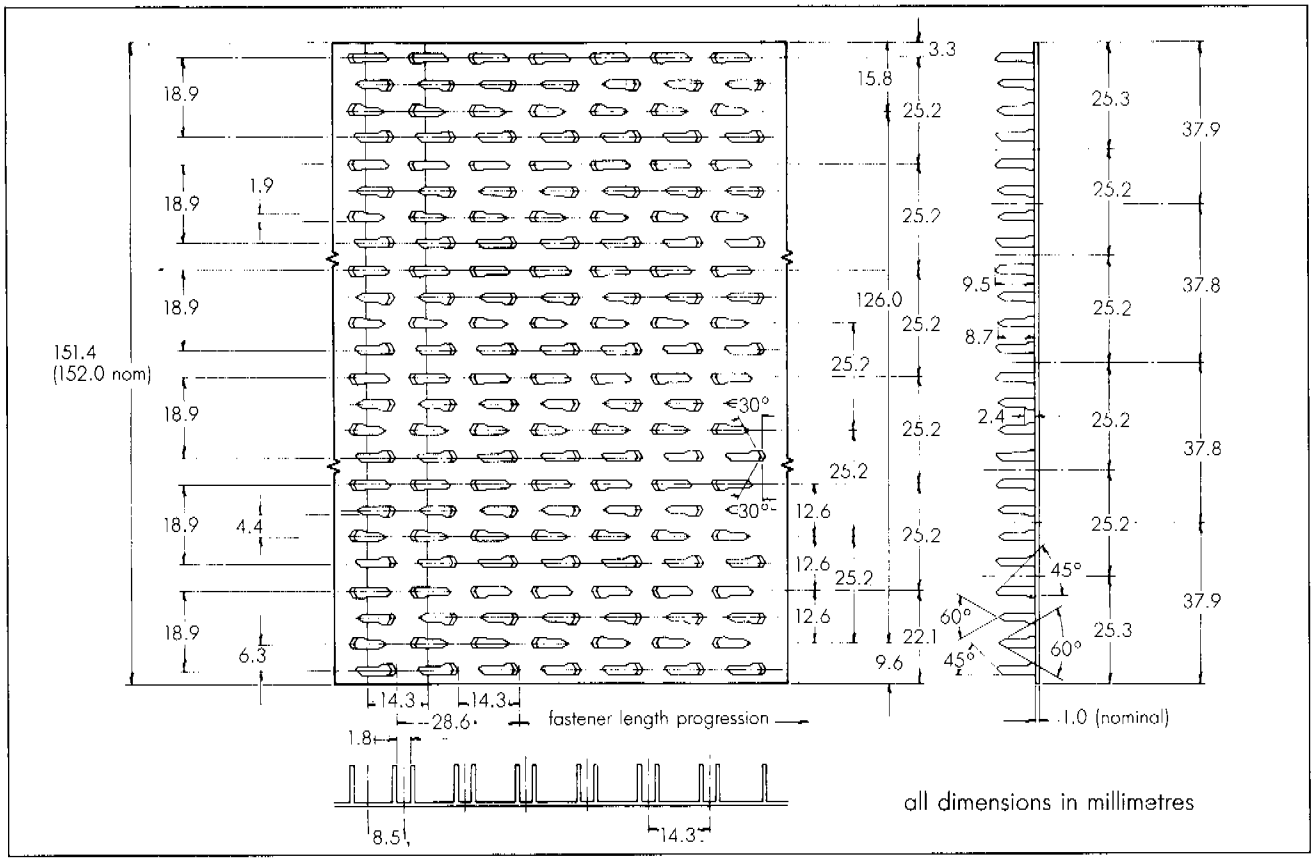
Table 1 Range of standard fastener sizes

Width (mm)	Length (mm)																		
	71.1	86.4	99.0	114.3	129.5	142.0	157.0	172.7	185.4	200.5	228.4	256.5	287.0	315.0	343.0	401.0	471.0	544.0	614.0
38.1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.8	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
63.0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0
76.2	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
101.6	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
127.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
152.4	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1

1 denotes fastener size covered by this Certificate.

0 denotes fastener size not covered by this Certificate.

Figure 2 Dimensions and arrangement of nails



4 Timber species

This Detail Sheet covers the use of Gang-Nail 20 Gauge Punched Metal Plate Timber Fasteners in sawn or planed, treated or untreated, stress graded timber of minimum specified thickness of at least 35 mm, −0 +1 mm divergence throughout a member (when measured at 20% moisture content) of the following species:

European whitewood
European redwood
hem-fir
Western white spruce
Eastern Canadian spruce (princess spruce)
spruce-pine-fir.

5 Structural performance

Lateral resistance

5.1 The lateral resistance of a fastener depends upon:

number of effective nails in the joint
species of timber and its moisture content
duration of load
direction of bearing of the nail with respect to the grain of the timber
angle of load to the fastener.

5.2 The number of effective nails in the joint shall be determined by omitting:

nails nearer than 6 mm to the edge of the timber, and
nails nearer than 6 mm from the end of the timber member measured parallel to the grain.

5.3 The permissible lateral load per effective nail for the fasteners under long-term loading for the softwood species included in this assessment is given in Table 2. The permissible loads are specified for 15° increments of angle of load to the grain and nail orientation, as indicated in Figure 3.

5.4 The permissible lateral load for medium-, short- and very short-term duration of load should be obtained in accordance with BS 5268 : Part 2 : 1991 by modifying the long-term permissible loads given in Table 2 by the following factors:

Medium-term (eg dead + snow, dead + temporary imposed)	1.12
Short-term (eg dead + imposed + wind*, dead + imposed + snow + wind*)	1.25
Very short-term (eg dead + imposed + wind†)	1.25

*For wind, *short-term* category applies to class C (15 s gust) as defined in BS Code of Practice CP 3 : Chapter V : Part 2 : 1972 *Code of basic data for the design of buildings : Loading : Wind-loads.*

†For wind, *very short-term* category applies to classes A and B (3 s or 5 s gust) as defined in CP 3 : Chapter V : Part 2.

Tensile strength

5.5 The maximum tensile force acting on the fasteners, for all four categories of load duration, must not exceed the following:

force acting in direction of fastener length — 87 Nmm^{-1} of fastener width;

force acting in direction of fastener width — 43 Nmm^{-1} of fastener length.

*Table 2 Permissible loads (Newtons) per nail for Gang-Nail 20 Gauge fasteners in planed timber**

Angle of load to fastener length direction (°)	Angle of load to grain of member 0°	15°	30°	45°	60°	75°	90°
Long-term loading							
European redwood and whitewood, hem-fir							
0-45	84	80	70	60	53	48	47
60	78	75	67	59	52	48	47
75	72	69	64	57	52	48	47
90	67	65	60	55	51	48	47
Eastern Canadian spruce, Western white spruce, spruce-pine-fir							
0-45	79	75	68	59	52	48	47
60	73	71	64	57	52	48	47
75	68	66	61	56	51	48	47
90	63	62	58	54	50	48	47

*For sawn timber the permissible load values must be modified by multiplying by 0.85.

Compressive strength

5.6 The maximum compressive force acting on the fasteners, for all four categories of load duration, must not exceed the following:

force acting in direction of fastener length — 48 Nmm^{-1} of fastener width;

force acting in direction of fastener widths — 53 Nmm^{-1} of fastener length.

5.7 The loads given in section 5.6 were derived from tests and are based on a typical factor of safety for general use. Where failure of the fastener will result in forces being taken in end bearing, and the joint will not be subject to stress reversal, the permissible values for compressive force may be modified by multiplying by 1.5. A suitably qualified engineer shall be responsible for considering the merits of each application and deciding upon the appropriate permissible value.

Shear strength

5.8 The maximum shear force acting on a fastener, for all four categories of load, must not exceed:

(1) force acting in direction of fastener length — 30 Nmm^{-1} of fastener length;

(2) force acting in direction of fastener width — 26 Nmm^{-1} of fastener width;

(3) force acting at an angle α to fastener length direction is as given in Table 3, except where values of α and fastener width give a projection of the line of shear in the direction of the fastener length less than 14 mm (ie one module), when the limiting shear force is given by (2) above (see Figure 2 for width and length modules).

*Table 3 Maximum shear forces**

Angle α	Nmm^{-1} of shear line
10	31
15	33
20	35
25	37
30	40
35	42
40	45
50	50
60	55
$\leqslant 75 < 90$	59

*Values for intermediate angles can be interpolated.

5.9 The values are limited to angle α up to and including 90°, as required by conventional UK practice. The requirements relating to shear given in MOAT No 16 : 1979 *UEAtc Directive for the Assessment of Punched Metal Plate Timber Fasteners* include values for angle α from 0° to 180°. An assessment will therefore be necessary in each particular case where values for shear angle α greater than 90° are required.

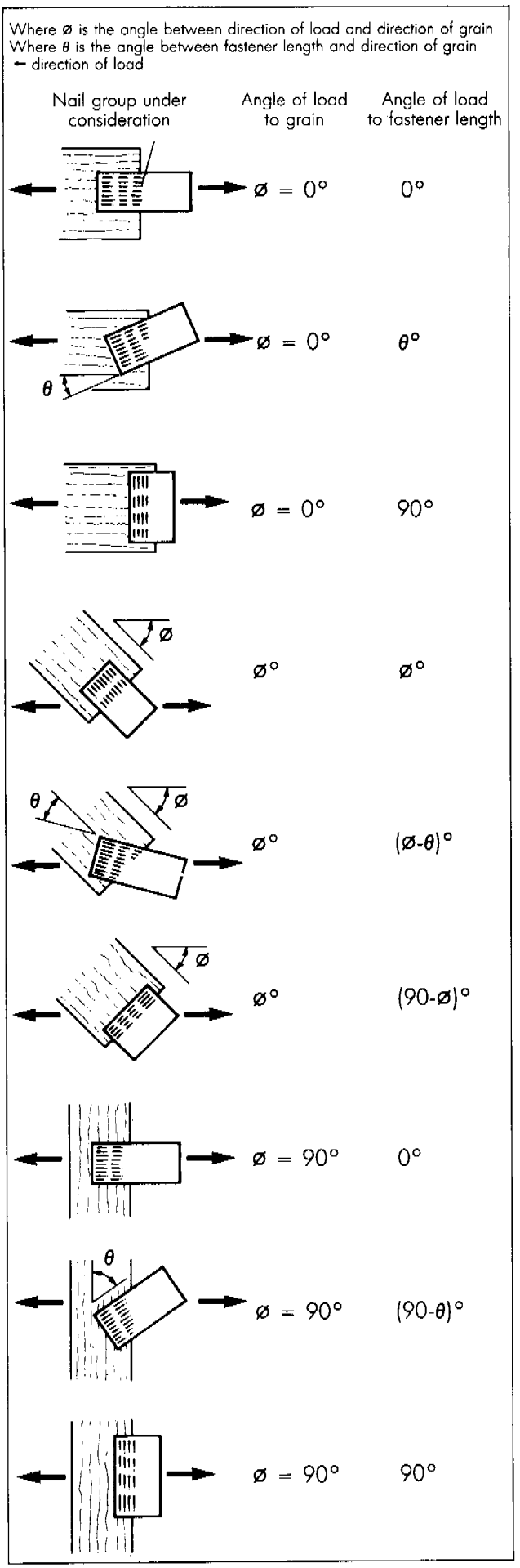
6 Practicability of installation

The fasteners are easy to embed using the commercial platen or roller press equipment normally employed for truss fabrication.

7 Durability

The fasteners have a zinc coating (see section 1.2 of this Detail Sheet), which will give adequate protection against corrosion in normal internal domestic situations, where the moisture content of the timber does not exceed 18% for any significant period and does not exceed 22% at any time.

Figure 3 Angle of load to grain and nail orientation



The following is a summary of the technical investigations carried out on Gang-Nail 20 Gauge Punched Metal Plate Timber Fasteners.

8 Tests

8.1 As part of the assessment leading to the issue of the previous Certificate:

(1) Tests were carried out on 120 full-size structural joints, assembled using the commercial equipment normally employed. The results were assessed to determine the permissible loads and stresses for the fasteners. Check tests on a further 36 joints, including 15 made using sawn timber, were also carried out.

(2) Three species of timber, European whitewood, Eastern Canadian spruce and Western white spruce, were used in the test joints. Existing data on the relative strength of species were used to derive values for use with other species. The tests examined:

variations in strength within species
effect of surface finish
effects of direction and type of loading
effects of fastener orientation
tensile and shear properties of fasteners.

(3) Sample joints were subjected to load-cycling tests, including some 60,000 applications and relaxations of load up to the maximum permissible load level for the plates, with no significant creep or loss in strength.

(4) Tests were conducted to determine the thickness and quality of galvanizing.

(5) Tests were conducted to investigate the strength of joints in compression.

9 Other investigations

9.1 As part of the assessment leading to the issue of previous Certificate No 80/748, the following investigations were made:

(1) The permissible loads, derived from the tests referred to above, were compared with the estimated maximum loads to cause a joint slip of 0.8 mm. These latter load values, however, were consistently higher than those based on maximum load values. In general, the maximum initial slip in joints in tension, at the permissible long-term loads, will not be greater than 0.4 mm and the average initial slip not greater than 0.2 mm.

(2) Existing data on the durability of punched metal plate timber fasteners were examined.

(3) Existing data relating to cyclic loading on fasteners in dwellings and similar structures were examined and the effects found to be insignificant.

(4) An assessment was made on the practicability of joint assembly.

(5) The test data on which the previous Certificate was based were re-examined and analysed in accordance with BBA MOAT 16 : 1979, and compared with related comparative research data. The analysis established that the design data previously derived remain valid.

(6) The manufacturing process was examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

9.2 As part of the assessment leading to the issue of this Certificate, an investigation was made of the strength of joints assembled using roller press equipment.

9.3 Regular factory inspections have been carried out to ensure that quality is being maintained.

9.4 No failure of the product in use has been reported to the BBA.

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

On behalf of the British Board of Agrément

Date of issue: 3rd October 1991 **Director**

British Board of Agrément
P O Box No 195, Bucknalls Lane
Garston, Watford, Herts WD2 7NG
Fax: 0923 662133

For information about
Agrément Certificates
telephone:
Hotline: 0923 662900

CI/SfB (27) Xt6

Certificate No 90/2413

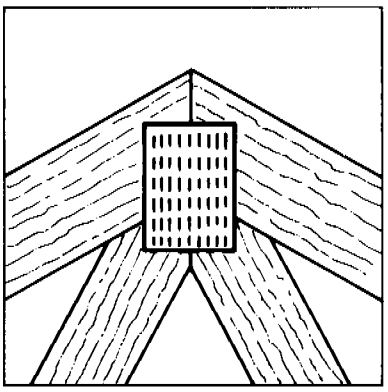
BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

Gang-Nail Systems Ltd

DETAIL SHEET 6

NEW ZEALAND RADIATA PINE FOR USE WITH GANG-NAIL PUNCHED METAL PLATE TIMBER FASTENERS

Product



- *THIS DETAIL SHEET RELATES TO THE USE OF MACHINE STRESS GRADED NEW ZEALAND RADIATA PINE WITH THE PUNCHED METAL PLATE TIMBER FASTENERS DESCRIBED IN THE ACCOMPANYING DETAIL SHEETS.*

This Detail Sheet must be read in conjunction with the Front Sheet, Detail Sheet 1 and the appropriate Detail Sheet for the particular fastener design. The Front Sheet gives the Conditions of Certification *and Detail Sheet 1 gives the product's position under the Building Regulations.*

Technical Specification

1 Description

1.1 New Zealand Radiata Pine is machine stress graded in accordance with BS 4978 : 1988 *Specification for softwood grades for structural use,* which calls for stress grading machines to be approved and controlled by a machine controlled system.

Design Data

2 General

This Detail Sheet is for use only in conjunction with the accompanying Detail Sheets to supplement the information therein.

3 Structural performance

3.1 New Zealand Radiata Pine is suitable for use with the punched metal plate timber fasteners described in the appropriate Detail Sheet.

3.2 The permissible lateral load per effective nail for fasteners in Radiata pine should be taken as equivalent to that given for European whitewood.

3.3 In accordance with the requirements of BS 5268 : Part 2 : 1991 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship,* all Radiata pine for structural work should be stress graded by an approved stress grading machine operated in accordance with the requirements of BS 4978 : 1988.

4 Practicability of installation

Fasteners are easy to embed in New Zealand Radiata Pine using the commercial equipment normally employed for truss fabrication as detailed in the appropriate Detail Sheet.

Technical Investigations

The following is a summary of the technical investigations carried out on New Zealand Radiata Pine:

5 Tests

5.1 Tests were carried out with selected fasteners on full-size structural joints of New Zealand Radiata Pine, controlled by a BSI kitemark quality assurance scheme as required by BS 4978 : 1988. The joints were assembled using the commercial equipment normally employed and tests were conducted in accordance with BBA MOAT 16 : 1979 *Directive for the Assessment of Punched Metal Plate Timber Fasteners.*

5.2 Existing data on the relative strength of species were examined.

5.3 An assessment was made on the practicability of joint assembly.

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

On behalf of the British Board of Agrément

Date of issue: 7th January 1992 **Director**

British Board of Agrément
P O Box No 195, Bucknalls Lane
Garston, Watford, Herts WD2 7NG
Fax: 0923 662133

For information about Agrément Certificates telephone:
Hotline: 0923 662900

CI/SfB
(27) Xt6

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

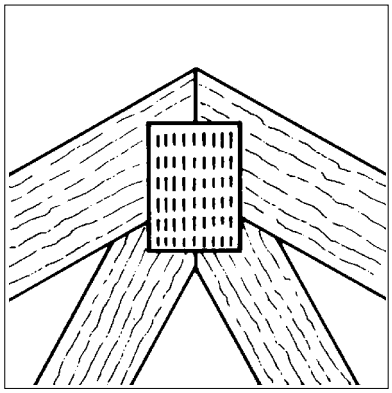
Gang Nail Systems Ltd

Certificate No 90/2413

DETAIL SHEET 7

BRITISH SITKA SPRUCE FOR USE WITH GANG NAIL PUNCHED METAL PLATE TIMBER FASTENERS

Product



- *THIS DETAIL SHEET RELATES TO THE USE OF STRENGTH GRADED BRITISH SITKA SPRUCE WITH THE PUNCHED METAL PLATE TIMBER FASTENERS DESCRIBED IN THE ACCOMPANYING DETAIL SHEETS.*

This Detail Sheet must be read in conjunction with the Front Sheet, Detail Sheet 1 and the appropriate Detail Sheet for the particular fastener design. The Front Sheet gives the Conditions of Certification *and Detail Sheet 1 gives the product's position under the Building Regulations.*

Technical Specification

1 Description

British sitka spruce must be strength graded in accordance with BS EN 518 : 1995 or BS EN 519 : 1995.

Design Data

2 General

This Detail Sheet is for use only in conjunction with the accompanying Detail Sheets to supplement the information therein.

3 Structural performance

3.1 British sitka spruce is suitable for use with the punched metal plate timber fasteners described in the appropriate Detail Sheet.

3.2 The permissible lateral load per effective nail for fasteners in British sitka spruce should be taken as equivalent to that given for European whitewood.

3.3 In accordance with the requirements of BS 5268 : Part 2 : 1996 all British sitka spruce for structural work should be strength graded in accordance with the requirements of BS EN 518 : 1995 or BS EN 519 : 1995.

4 Practicability of installation

Fasteners are easy to embed in British sitka spruce using the commercial equipment normally employed for truss fabrication as detailed in the appropriate Detail Sheet.

Technical Investigations

The following is a summary of the technical investigations carried out on British sitka spruce.

5 Tests

5.1 Tests were carried out with selected fasteners on full-size structural joints of British sitka spruce. The joints were assembled using the commercial equipment normally employed and tests were conducted in accordance with prEN 1075.

5.2 Existing data on the relative strength of species were examined.

5.3 An assessment was made on the practicability of joint assembly.

Bibliography

BS 5268 *Structural use of timber*
Part 2 : 1996 *Code of practice for permissible stress design, materials and workmanship*

BS EN 518 : 1995 *Structural timber. Grading. Requirements for visual strength grading standards*

BS EN 519 : 1995 *Structural timber. Grading. Requirements for machine strength graded timber and grading machines*

prEN 1075 *Timber structures — Test methods — Joints made with punched metal plate fasteners*

On behalf of the British Board of Agrément

Date of issue: 16th March 2000

Chief Executive

British Board of Agrément
P O Box No 195, Bucknalls Lane
Garston, Watford, Herts WD2 7NG
Fax: 01923 665301

e-mail: mail@bba.star.co.uk
http://www.bbacerts.co.uk

For technical or additional information, tel: 01923 665300.
For information about Agrément Certificate validity and scope, tel:
Hotline: 01923 665400