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BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

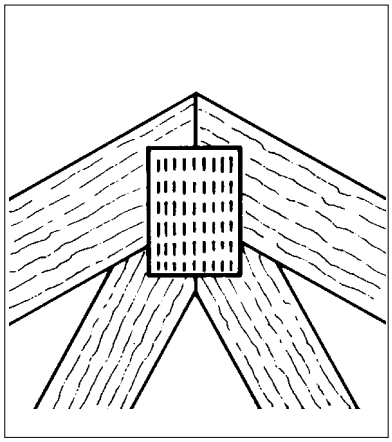
Alpine Automation Ltd

ALPINE A13 PUNCHED METAL PLATE TIMBER FASTENERS

Certificate No 05/4288

DETAIL SHEET 3

Product



- *THIS DETAIL SHEET RELATES TO ALPINE A13 PUNCHED METAL PLATE TIMBER FASTENERS.*

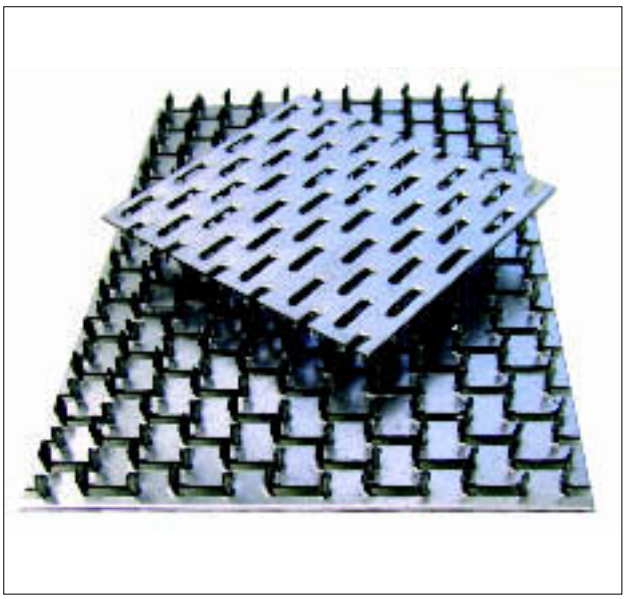
This Detail Sheet must be read in conjunction with the Front Sheets, which give Conditions of Certification, *details common to all Alpine's certificated fasteners and the product's position regarding the Building Regulations respectively.*

Technical Specification

1 Description

1.1 Alpine A13 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. Two nails are formed from each slot.

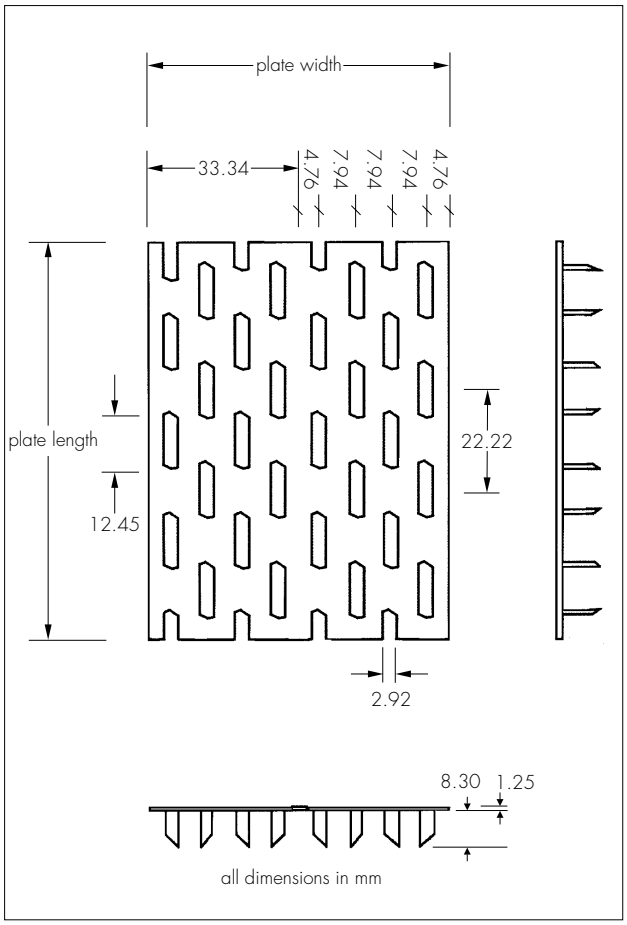
Figure 1 Typical Alpine A13 fastener



1.2 The fasteners are manufactured from material designation EN 10326 — S350GD + Z275 — N to BS EN 10326 : 2004 with additional limits on tensile properties.

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.

Figure 2 Dimensions and arrangement of nails



2 Sizes

The standard sizes of fastener are given in Table 1[1].

Table 1 Range of standard fastener sizes[1]

Length (mm)	Width (mm)													
	33	50	67	83	100	116	133	150	166	183	200	233	266	300
67	–	–	–	–	–	–	–	–	–	–	–	–	–	–
89	–	–	–	–	–	–	–	–	–	–	–	–	–	–
111	–	–	–	–	–	–	–	–	–	–	–	–	–	–
133	–	–	–	–	–	–	–	–	–	–	–	–	–	–
155	–	–	–	–	–	–	–	–	–	–	–	–	–	–
178	–	–	–	–	–	–	–	–	–	–	–	–	–	–
200	–	–	–	–	–	–	–	–	–	–	–	–	–	–
222	–	–	–	–	–	–	–	–	–	–	–	–	–	–
244	–	–	–	–	–	–	–	–	–	–	–	–	–	–
266	–	–	–	X	–	X	–	X	–	–	–	–	–	–
311	–	–	–	–	–	X	–	X	–	X	–	–	–	–
355	–	–	–	X	–	X	–	–	–	X	–	X	X	X
400	–	–	–	X	–	X	–	X	–	X	–	–	–	–
444	–	–	–	–	–	–	–	–	–	X	–	X	X	X

(1) X represents currently manufactured sizes, all other sizes available to order.

3 Identification

The fasteners are stamped with the manufacturer's identification mark *Alpine A13 or Alpine logo A13*, and are packed in boxes bearing the BBA identification mark incorporating the number of this Certificate.

Design Data

4 Timber species

This Detail Sheet covers the use of Alpine A13 Punched Metal Plate Timber Fasteners in planed, treated or untreated, stress graded timber of minimum specified thickness of 35 mm, –0.0 +1 mm divergence throughout a member (when measured at 20% moisture content) of the following species:

- European whitewood
- European redwood.

5 Structural performance

General

5.1 The anchorage strength of a fastener depends upon:

- the effective anchorage areas in the joint
- duration of load
- direction of bearing of the nail with respect to the grain of the timber
- angle of load to the fastener
- timber density
- timber moisture content.

5.2 The effective anchorage areas in the joint shall be determined by omitting:

- nails nearer than 5 mm to the edge of the timber
- nails nearer than 8 mm to the end of the timber member in tension or compression measured parallel to the grain.

In relation to BS 5268-2 : 2002

Anchorage strength

5.3 The permissible anchorage strengths per unit area for the fastener under long-term loading for the softwood species included in this assessment are given in Table 2. These are specified for 15° increments of angle of load to the grain and fastener length (see Figure 3).

5.4 The permissible anchorage strength for medium-, short- and very short-term duration of load should be obtained in accordance with BS 5268-2 : 2002 by modifying the long-term permissible anchorage strengths given in Table 2 by the following factors:

- medium term 1.12
- short term and very short term 1.25

Table 2 Permissible anchorage stresses (Nmm^{-2}) of Alpine A13 Nailplate

Angle of load to fastener length (α)	Angle of load to grain of member (β)						
	0°	15°	30°	45°	60°	75°	90°
0°	0.889	0.856	0.776	0.688	0.618	0.576	0.561
15°	0.887	0.854	0.775	0.688	0.618	0.576	0.561
30°	0.885	0.852	0.774	0.687	0.618	0.576	0.561
45°	0.832	0.806	0.742	0.670	0.611	0.574	0.561
60°	0.778	0.759	0.710	0.652	0.603	0.572	0.561
75°	0.771	0.752	0.705	0.650	0.602	0.572	0.561
90°	0.764	0.746	0.701	0.647	0.601	0.572	0.561

Anchorage stiffness

5.5 The initial slip in joints in tension, at the permissible long-term loads, was in the range of 0.13 mm to 0.18 mm (average 0.16 mm).

Tensile strength

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

- force acting in direction of fastener length — 193 Nmm^{-1} of fastener width
- force acting in direction of fastener width — 75 Nmm^{-1} of fastener length.

Compressive strength

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

- force acting in direction of fastener length — 72 Nmm^{-1} of fastener width
- force acting in direction of fastener width — 59 Nmm^{-1} of fastener length.

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 a, the angle between the fastener length direction and the direction in which the load is acting.

Table 3 Maximum shear forces(1)

Angle α	Nmm^{-1} of shear line
0	76
15	74
30	60
45	98
60	85
75	70
90	57
105	61
120	65
135	62
150	61
165	74

(1) Values for intermediate angles can be interpolated.

In relation to BS EN 1995-1-1 : 2004 (Eurocode 5)

Anchorage strength

5.9 The anchorage strength of the fastener may be determined in accordance with BS EN 1995-1-1 : 2004 using the anchorage properties given in Table 4 declared for strength class C27. These properties may be evaluated for other strength classes by modifying the values given in Table 4 by $(\rho_k/370)^{0.5}$ (where ρ_k is the characteristic density of the strength class concerned).

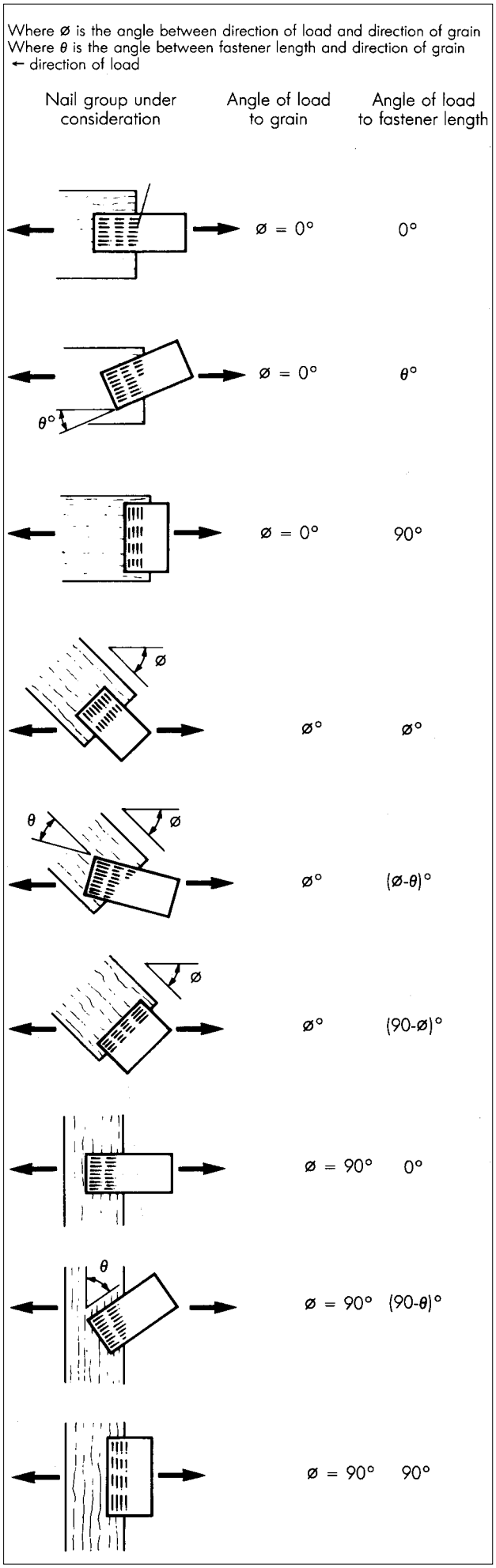
Table 4 Characteristic anchorage properties

Description (unit)	Symbol	Magnitude
Characteristic anchorage stress (Nmm^{-2})		
at 0° to grain and fastener length	$f_{a,0,0,k}$	2.20
at 90° to grain and fastener length	$f_{a,90,90,k}$	1.39
Constant	k_1	–0.267
	k_2	–0.057
	α_0	+1.047

Anchorage stiffness

5.10 The plate slip modulus per fastener per mm^2 of anchorage area is 9.2 $Nmm^{-1}mm^{-2}$.

Figure 3 Angle of load to grain and nail orientation



Steel plate strength

5.11 The steel plate strength of the fastener may be determined in accordance with the code using the properties of the steel plate given in Table 5.

Table 5 Characteristic plate properties

Description (unit)	Symbol	Magnitude
Characteristic plate tension strength (Nmm^{-1})		
at 0° to fastener length	$f_{t,0,k}$	338
at 90° to fastener length	$f_{t,90,k}$	120
Characteristic plate compression strength (Nmm^{-1})		
at 0° to fastener length	$f_{c,0,k}$	123
at 90° to fastener length	$f_{c,90,k}$	102
Characteristic plate shear strength (Nmm^{-1})		
at 0° to fastener length	$f_{v,0,k}$	120
at 90° to fastener length	$f_{v,90,k}$	99
Constant	γ_o	14° (0.244 rad)
	k_v	0.45

6 Practicability of installation

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

6.2 Precautions are necessary during handling and subsequent use due to sharp edges on the product. Care should be observed and gloves worn to avoid injury.

7 Durability

Alpine A13 fasteners have a zinc coating (see section 1.2), which will give adequate protection against corrosion in the Service Classes 1 and 2 defined in BS 5628-2 : 2002 and BS EN 1995-1.1 : 2004.

Technical Investigations

The following is a summary of the technical investigations carried out on Alpine A13 Punched Metal Plate Timber Fasteners.

8 Tests

8.1 The specimens were conditioned to constant weight before tests in accordance with BS EN 1075 : 2000 were carried out on full-size structural joints, assembled using the commercial equipment normally employed. The results were assessed to determine the permissible and characteristic stresses for the fasteners.

8.2 European whitewood was used in the test joints. The tests examined:

- variations in strength within species
- effects of direction and type of loading
- effects of fastener orientation
- compressive, tensile and shear properties of fasteners.

8.3 Tests were conducted to determine the mechanical properties of the steel and its thickness and quality of galvanizing.

9 Investigations

9.1 Existing data on the durability of punched metal plate timber fasteners were examined.

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

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

9.4 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.

Bibliography

BS 5268-2 : 2002 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*

BS EN 1075 : 2000 *Timber structures — Test methods — Joints made with punched metal plate fasteners*

BS EN 1995-1.1 : 2004 *Eurocode 5. Design of timber structures — General rules and rules for buildings*

BS EN 10326 : 2004 *Continuously hot-dip coated strip and sheet of structural steels — Technical delivery conditions*

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On behalf of the British Board of Agrément

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