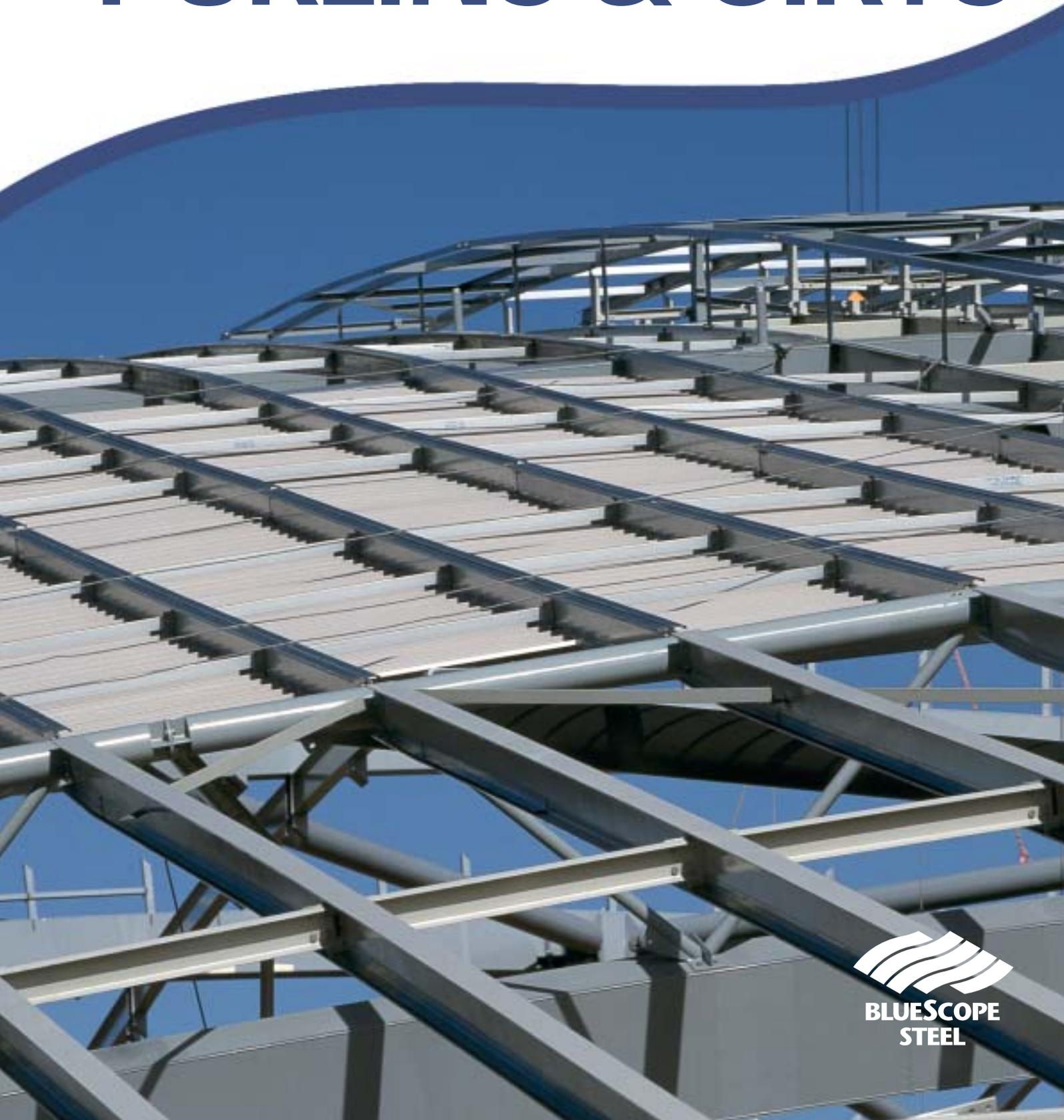


Galvaspan[®]

Made Only By BlueScope Steel

A GUIDE TO USING

PURLINS & GIRTS



PROVEN PERFOR



When it comes to purlins and girts, few can match the strength, weight, useability and durability of those made from GALVSPAN® steel.

Purlins and girts made from GALVSPAN® steel are proven performers, delivering cost effective, design-efficient, highly innovative building solutions.



Like the Dunc Grey Velodrome (shown on the cover and below left) – venue for the cycling events at the Sydney 2000 Olympic Games – where in a world's first, pairs of back-to-back curved purlins helped achieve the striking roof design.

PERFORMANCE

GALVSPAN® steel, made only by BlueScope Steel, is a special grade of high strength, hot-dipped galvanised steel strip. It's been specifically developed for purlins and girts, and is cold roll-formed into a wide range of sizes and thicknesses.

There's plenty of reasons why you should ask only for GALVSPAN® steel when specifying or ordering purlins and girts.

Readily available

GALVSPAN® steel is manufactured in Australia by BlueScope Steel. Our Australia-wide customer/distributor network is your best assurance of timely site delivery, no matter where you are.

Greater spanning capabilities

You can span further and potentially save on overall construction costs. GALVSPAN® steel is made from hi-tensile steel, which means it has a strength-to-weight ratio approximately 60% greater than hot rolled steel. In short, it's **strong** and **durable**.

Easier to handle

The higher strength-to-lower weight ratio means purlins made from GALVSPAN® steel are easier to transport and handle on site.

Cladding fixes easier and faster

Because of the relatively thin profile of purlins made from GALVSPAN® steel, fixing of roof and wall cladding is fast and easy with self-drilling, self-tapping screws.

Low maintenance costs

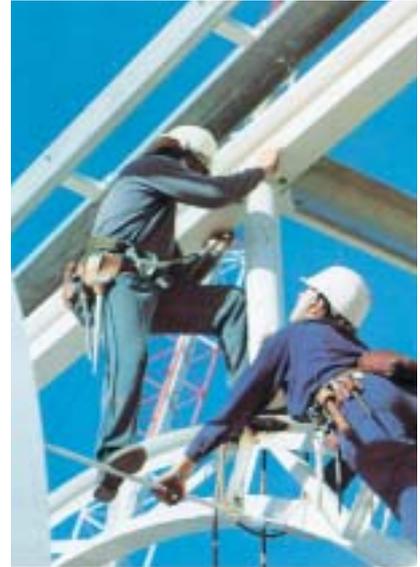
The continuously hot-dipped galvanised finish of GALVSPAN® steel is superior to post painting in terms of toughness, adhesion and corrosion resistance. This means it stands up better during handling, erection and over the life of the structure, reducing maintenance costs.

Backed by BlueScope Steel

Only BlueScope Steel makes GALVSPAN® steel. Genuine GALVSPAN® steel is warranted* and backed by BlueScope Steel.

Technical support when you need it

BlueScope Steel supports users of GALVSPAN® steel with project-specific advice and on-call technical assistance.



HI-TENSILE



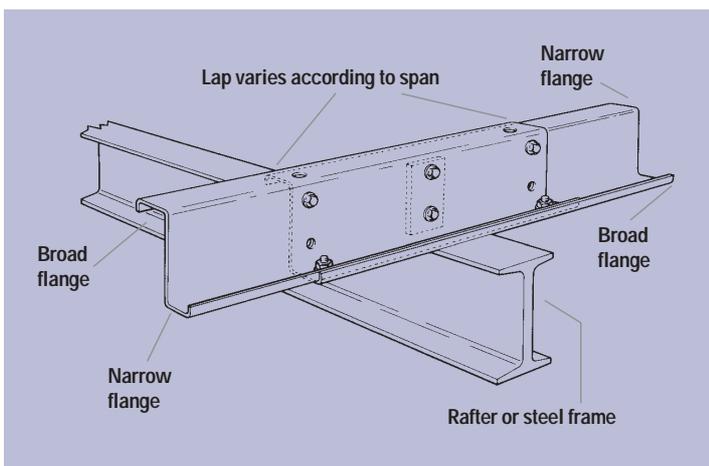
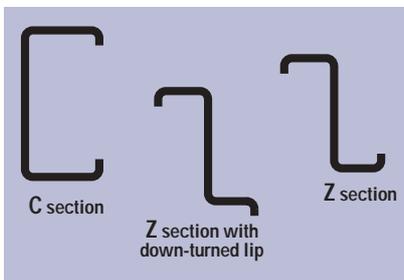
DURABILITY

Shapes and sections: which one?

Purlins made from GALVSPAN® steel are roll-formed into two standard shapes – C and Z sections. Both perform effectively, and in many instances the choice comes down to personal preference.

When to use C sections

Generally, C sections are used for simple span construction, with the purlins butted at internal supports. In cases where deflection is a design limitation and the building is of a suitable size, single C sections can be used over two or more bays.



When to use Z sections

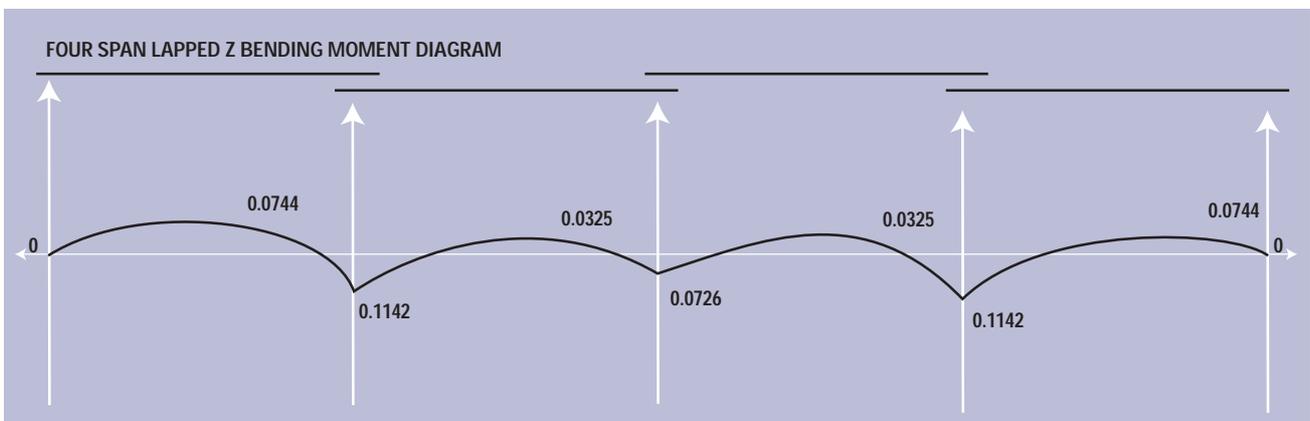
Z sections with one broad and one narrow flange are designed to nest neatly, and are intended for lapping at the internal supports. This produces structurally continuous lines of purlins for the length of the building.

Structural continuity results in improved rigidity, but lapping also doubles the thickness of purlin over supports where the bending moments are greatest. This results in a saving of up to 50 per cent – but typically 30 to 40 per cent – of the steel in the purlins, compared with simple span C sections.

Where additional strength is required from the purlins – for example in end bays, or where additional loads are applied locally – Z sections of the same depth but greater thickness can be lapped as required.

Special applications

In some applications, such as grain or coal handling facilities or wood machining factories, the upturned lip of conventional and C section purlins may form a trap for dust and debris. For this reason, Z sections are also available with downturned bottom lips. These sections are normally only used over simple spans with the ends butted rather than lapped.





Codes, standards and regulations

There are no Australian Standards specifically for purlins, but several are relevant.

AS/NZS4600, the SAA Cold formed steel structures code

This code is referred to in the Building Code of Australia and various state building regulations. Compliance with it is a requirement of the building codes.

AS/NZS4600 cites three material standards, namely:

- AS1397, Steel sheet and strip – Hot-dipped zinc-coated or aluminium zinc coated
- AS1594, Hot rolled steel flat products
- AS1595, Cold rolled unalloyed low carbon steel sheet and strip.

Purlins are normally rolled from steel manufactured in accordance with one of these standards.

Other steels are not excluded but their properties and suitability must be established by the purlin manufacturer by analysis, test or other means. It's then up to the design engineer to independently satisfy him or herself of the suitability of the steel.

Other relevant standards include:

- AS1170, the SAA Loading code. (Part 1: Dead and live loads and load combinations. Part 2: Wind forces.)
- AS4100, the SAA Steel structures code.

Design issues

Meeting the codes

The design of cold formed sections made from GALVSPAN® steel is subject to the requirements of AS/NZS4600, the SAA Cold formed steel structures code. The code contains the rules by which the physical design of the section should be carried out and its load capacities calculated. It is intended as a supplement to, and should be used in conjunction with, AS4100 (the SAA Steel structures code) to carry out the structural design.

Any part of a steel structure must be designed for loads laid down in a number of codes specified in AS4100. Purlin loads are generally established from AS1170, the SAA Loading code (Part 1: Dead and live loads, and Part 2: Wind forces). In practice, the loads are dead load, roof live load and wind load and, in some areas, snow load. The nett load effect may act inward or outward (often the latter under typical Australian wind conditions) and the purlins may need to be analysed for both cases.

Load tables

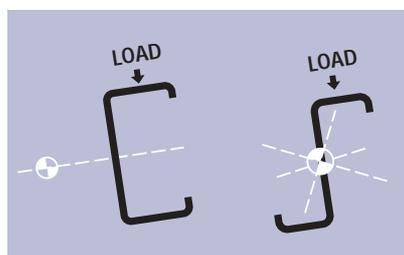
For design ease, some manufacturers provide detailed load tables that are either calculated in accordance with AS/NZS4600, or established by test (as permitted under the code).





Bridging

Light gauge cold formed purlins are capable of carrying loads over quite large spans in relation to their depth (commonly 40D and more). But because of this, they have a tendency to twist or buckle laterally. In the case of C sections, this is due to the shear centre lying outside the section; with Z sections, it's because the loading axes do not coincide with the principal axes.



This problem can be overcome by using lateral bracing (bridging). Running transverse to the purlins, bridging braces and stabilises the purlin webs, usually at mid span or approximately third points.

Boltless bridging systems

Some manufacturers provide bridging that is designed to hook into and lock the purlins in position quickly and easily, without the need for nuts, bolts or tie rods. These boltless bridging systems can reduce installation and construction costs, as well as increasing the safety for riggers installing the purlins.

Tolerances

Precision roll-forming of GALVSPAN® steel produces purlins to quite close dimensional tolerances. Typical tolerances are:

Depth \pm 1mm

Hole centres \pm 2mm

Flange width \pm 2mm

Camber 1 in 500

Overall length \pm 5mm

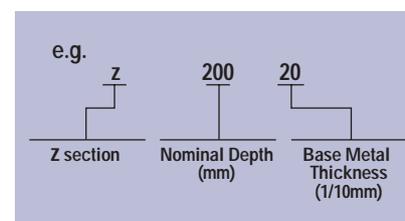
Bow 1 in 250

Tolerances for material thickness are nominated in AS1365: "Tolerances for hot rolled and cold rolled unalloyed low carbon steels (coils and cut lengths)."

Sizes and dimensions

There are no official standard sizes for purlins, but most purlins made from GALVSPAN® steel come in nominal depths of **100, 150, 200, 250, 300 and 350mm**. Not all sizes are available in both C and Z profiles.

Sections are generally designated by a code number signifying the nominal depth and material thickness, with a letter prefix to indicate the profile.



LOW MAINTENANCE

SIGN EFFICIENT



Metric or imperial?

While some manufacturers produce true metric-sized purlins, others produce to superseded imperial dimensions, which are then referred to by their soft metric conversions. Thus, a 200 series purlin could be 200mm or 203mm (eight inches) deep, depending on the manufacturer. While purlin depths are reasonably rationalised, the same cannot be said of other dimensions such as flange width, lip length or thickness.

Other variations between manufacturers

It's important to take into account the variations in detail between sections produced by different roll-formers when comparing their likely performance.

In particular, the effective section rules of AS/NZS4600 require careful attention, as variations in flange width, lip length and thickness can have a significant influence on the load capacity of the section.

Other variables can be material strength and thickness. GALVSPAN® steel from BlueScope Steel is a hi-tensile galvanised steel strip that conforms to AS1397-G450 (450MPa minimum yield stress); or for thicknesses less than 1.5mm, AS1397-G500. Clearly, lower strength materials from other steel producers will not deliver the same structural performance.

Steel thicknesses

Purlins made from GALVSPAN® steel are generally produced in thicknesses of **1.0, 1.2, 1.5, 1.9, 2.4, and 3.0**.

For design purposes, the relevant material thickness is the base steel thickness before galvanising or painting. Galvanised coatings, in particular, add appreciably to the thickness, but the zinc coating contributes little to strength and is not considered when calculating load capacities.

CORROSION PRO

Corrosion protection

AS/NZS4600 requires that cold formed sections must be adequately protected from corrosion attack.

The available protection options range from basic painting systems through to heavy galvanised coatings (like that used by BlueScope Steel for GALVSPAN® steel).

Before specifying what type of purlin, you need to consider:

- the structure, climatic or other local conditions
- maintenance provision, and
- the forming process used (in cases where the coating is applied before forming).

The zinc coating and quality-controlled galvanising process used by BlueScope Steel to make GALVSPAN® steel ensures a high standard of corrosion protection.

Coating classes

GALVSPAN® steel is available with two standards of corrosion protection.

These are:

- 350g/m² zinc coating weight
- 450g/m² zinc coating weight.

Both 300mm and 350mm purlin sizes are usually produced with 450g/m² zinc coating.

The zinc coating weight is the total weight of zinc on the base steel, and is usually referred to by the coating class, ie. 350g/m² of zinc is class Z350. The respective coating classes represent approximate coating thicknesses of:

- Z350 – 24µm
- Z450 – 31µm

of zinc on each side of the strip.

Base Metal Thickness	Coating Class	Total Coated Thickness (mm)
1.5	Z350	1.548
1.6	Z350	1.648
1.9	Z350	1.948
2.0	Z350	2.048
2.4	Z350	2.448
2.5	Z350	2.548
1.5	Z450	1.562
1.6	Z450	1.662
1.9	Z450	1.962
2.0	Z450	2.062
2.4	Z450	2.462
2.5	Z450	2.562
3.2	Z450	3.262

PROTECTION



The galvanising story

The galvanised finish on GALVSPAN® steel is applied by BlueScope Steel on a continuous galvanising line as part of the steel production process. (The base steels used are produced to AS1397.)

In conventional hot-dip galvanising, the clean steel surface is wetted by the molten zinc, producing zinc/iron alloy layers. With the continuous galvanised line process used by BlueScope Steel to produce GALVSPAN® steel, this alloying is controlled to ensure that the ductility of the coating matches that of the base steel.

Consequently, the molecular bond ensures that the zinc coating on GALVSPAN® steel:

- does not flake or peel during cold forming
- is highly resistant to damage during handling, transport and erection, and
- maintains its bright, attractive appearance.

In addition, the unique cathodic properties of GALVSPAN® steel – otherwise referred to as its in-built ‘cut edge protection’ – ensure that any cut edges, holes and minor coating damage are protected from subsequent corrosion by the sacrificial action of the surrounding zinc.

Painted purlins do not offer this inbuilt corrosion protection. They are prone to coating damage during handling and erection, which in turn may lead to corrosion and higher maintenance costs over time. For this reason, painted purlins have been largely superseded by galvanised purlins.

Compatibility with other steel products

The zinc coating on purlins made from GALVSPAN® steel is fully compatible with the zinc and aluminium/zinc coatings used on roof and wall sheeting made from other quality BlueScope Steel products.

If minor damage occurs to the purlin coating, the base steel is protected by its own surrounding coating. Furthermore, the protective coating on the sheeting is not corroded by an unprotected base steel nearby.

Specifying for corrosive environments

Z450 purlins should be specified for environments requiring additional corrosion protection. Talk to your local BlueScope Steel office, or call BlueScope Steel Direct on 1800 022 999, for assistance in detailing purlin specifications for severe exposure environments.

A more complete guide to coating class recommendations is also provided in our Technical Bulletin No. 17 – “Selection Guide For Galvanised Steel Purlin Products.”

LONG-LIFE



STRUCTURAL PE

Storage and handling

Like other building materials, purlins made from GALVSPAN® steel require care during storage and handling on site. Follow these recommendations:

- ideally, deliveries should be arranged so that the period between delivery and installation is minimised
- if the purlins aren't required for immediate use, the bundles should be stacked clear of the ground and, if in the open, protected with waterproof covers
- if the bundles do become wet, the purlins should be separated, wiped dry and covered. (Any moisture that gets between bundled purlins cannot easily evaporate, and may cause unsightly coating damage that can reduce the life of the product), and
- bolts and nuts should be kept clean, dry and free of dirt or dust to prevent difficulties when tightening.

It's important to take care when lifting bundles of purlins. Long lengths should be lifted using a spreader bar and fabric slings. Take special care to prevent damage at the lifting points.



Installation

Purlins are bolted to the primary frame by cleats welded to the rafters or columns by the steel fabricator.

The cleats and the associated hole geometry have been standardised in the AISC Standardised Structural Connections. (Most manufacturers comply with the standard and the hole centres, as shown in the diagram below.)

Bolts

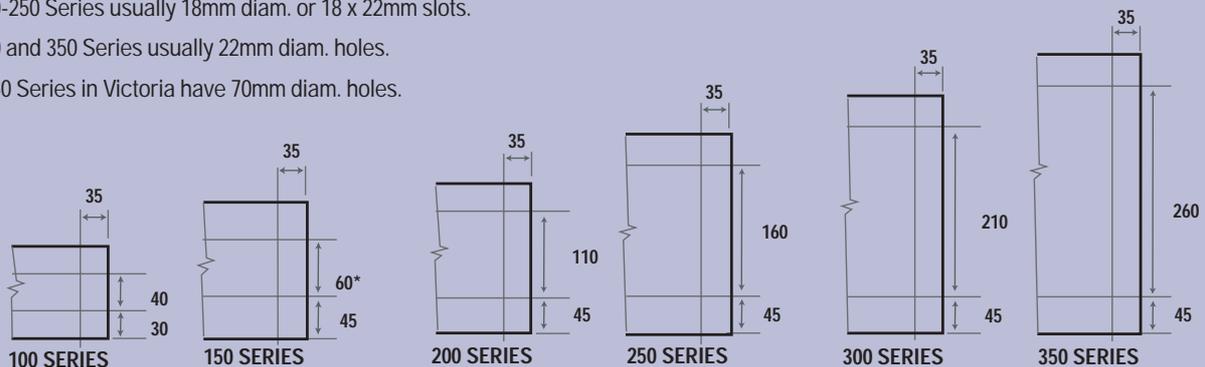
Bolts are usually M12 Grade 4.6 requiring snug tightening to make an effective connection. These can be ordered from purlin manufacturers, some of whom supply special types, such as bolts with short 16mm plain shanks and M12 threads, nuts and bolts with integral washer faces, etc.

Standard hole geometry

100-250 Series usually 18mm diam. or 18 x 22mm slots.

300 and 350 Series usually 22mm diam. holes.

*150 Series in Victoria have 70mm diam. holes.



PERFORMANCE



Clearance holes

To allow for minor variations in frame alignment, purlins made from GALVSPAN® steel generally have quite large clearance holes; typically 18mm diameter holed for 12mm diameter bolts. Some manufacturers produce 18mm x 22mm slots for greater adjustment. These generous clearances make for easier assembly, but won't affect structural performance.

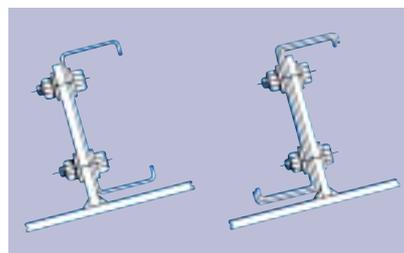
When Z purlins are lapped, additional holes are provided to ensure structural continuity. It's here that the extra clearances are especially useful. Purlins are usually engineered for M12 bolts and in these cases, M16 should not be used. In fact, with lapped Z purlins in some of the thicker gauges, the holes cover one another sufficiently to prevent assembly with M16 bolts unless they are forced.

Top flange facing up

Purlins should always be installed with the top flange facing up the slope from the cleat, ie:

- C sections should be fitted on the high side of the cleat, open face facing up the slope
- Z sections should be fitted with the web on the low side of the cleat, with the top flange above it.

This is to minimise the tendency of the sections to rotate between supports or bridgings.

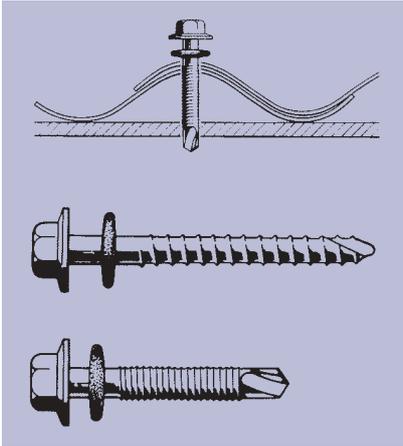


Fitting the bridging and cladding

While purlin fixing is quite straightforward, the sections are very flexible until they become part of the total sheeted system. The aim, therefore, should be to maintain a stable framework by fitting the bridging as the purlins are attached.

Ideally, the cladding should also be progressively fixed, although this isn't always practical if the jobs are handled by different sub-contractors.

Bundles of roof sheeting **should not** be placed on unsheeted purlins, as this can cause overloading and result in permanent deformation of the sections.



Cladding

A major benefit of cold formed purlins made from GALVSPAN® steel is the ease with which cladding can be fixed. The relatively thin material of the purlin flange means that drilling and fixing is one simple operation, using self-drilling, self-tapping screws with preassembled seals.

Non-cyclonic areas

In non-cyclonic areas, fixing may be through the crests or valleys of the sheets. On roofs, valley-fixing introduces some risk of leakage, but on walls it is the usual practice. Check with BlueScope Steel or your sheeting manufacturer/supplier for the recommended fixing method for the sheeting product you're using.

Cyclonic areas

In cyclonic areas, some claddings should only be crest-fixed. With the cyclic nature of the loading, thin hi-tensile claddings can fatigue quickly due to a lack of flexibility around the valley fixing. The sheeting fails by cracking around the screw heads. (Again, check with BlueScope Steel or your sheeting supplier on the appropriate fixing method.)

Secret-fixed decks

These types of cladding are attached to clips screwed to the purlins.

From a structural viewpoint, steel cladding properly fixed will always provide adequate lateral restraint for the top flange. However, the same cannot be said of other metals or brittle sheeting materials.



TECHNICAL ADVICE

WARRANTY

Specifying and ordering

In the absence of specific product standards, designers have several options when specifying purlins:

- nominate the purlins by size and specific manufacturer, to the exclusion of all others
- specify by size and manufacturer and allow equivalent manufacturers, or
- specify the major dimensions and properties, ie:
 - depth
 - flange width
 - base metal thickness
 - yield strength
 - protective coating
 - mass of section

and leave the choice of manufacturer to the contractor.

To make sure your product is genuine GALVSPAN® steel by BlueScope Steel, it's important to **nominate the use of GALVSPAN® steel**.

Selection of the correct coating weight – Z350 or Z450 – is also critical. The choice is dependant on the environment in which the purlin is to be used. Z350 will suit most applications that are not subject to unusually corrosive conditions. In more corrosive applications, Z450 coating class may be appropriate.

Again, be sure to consider any minor detail differences between different products from different manufacturers to ensure they meet the design requirements.



Ordering to length

Purlins made from GALVSPAN® steel are normally produced to order for each project. They are usually:

- custom-cut to precise lengths,
- pre-punched with all necessary fixing and bracing holes, and
- delivered to site, ready to erect, with bridging, bolts and all other accessories.

Length limits for purlins are about 12m for the smaller sizes, increasing to about 20m for the larger. Most manufacturers will look at going beyond these limits on a job-to-job basis. But ultimately, maximum lengths will be determined by local transport regulations and practical handling issues.

BlueScope Steel's vast customer/distributor network helps to ensure on-time delivery to site. However, orders should still be placed early to allow for manufacture and delivery to meet the construction program.

Getting the order list right

Take care in preparing an order list. The order forms provided by most roll-formers will help.

Remember, too, that manufacturers offer a wide range of purlins and accessories, and the same purlin reference number alone does not necessarily mean the same load capacity or durability.

Again, make sure you are getting 'the genuine article'. Only BlueScope Steel makes GALVSPAN® steel, and only GALVSPAN® steel is covered by a BlueScope Steel warranty*.



A guide to selecting and using purlins and girts

A specifying checklist

When specifying **purlins**, include:

- catalogue number (identifying section, shape, size, thickness, protective coating and material grade)
- length (calculated by the detailer, taking into account frame spacing, end laps, clearances and overhangs as required)
- hole details (for end connections and bridging). Additional holes may be specified for fly bracing, etc. Where possible, standard gauge lines and hole dimensions should be specified to speed delivery
- number required, and
- special markings to facilitate erection.

When specifying **bridging**, include:

- catalogue number
- purlin spacing centre to centre, and
- number required.

Fascia bridging and adjustable ridge ties are ordered in the same way.

Accessories

Components such as bolts, brackets, etc. are usually ordered by catalogue number and number required.

The precise ordering procedure and the range of accessories offered may vary slightly from manufacturer to manufacturer, but the principles are generally the same.

A complete system

Purlins made from GALVSPAN® steel are part of an economical building system that promises good service for years to come. You should make the fullest possible use of the complete system and its accessories, such as ridge ties, raking girts, girt hangers, fascia purlins and multi-purpose angle connectors.

Inspection

Inspection of purlin systems normally requires only measuring and visual checking.

- **ensure the purlins meet the specification.** This should be done soon after delivery and before installation, and
- **visually check** that bolts are correctly fitted, all bridging correctly installed and the whole system is neat and true.

BACKED BY BLUESCOPE STEEL



Galvaspan®



BLUESCOPE STEEL



This simple checklist is your guarantee of the superior BlueScope Steel difference:

- Made only by BlueScope Steel in Australia for Australian conditions
- Meets Australian building standards
- Product performance is field-tested
- Supported by a BlueScope Steel warranty*
- Durable, strong and lightweight

To make sure your product is from BlueScope Steel, look for the GALVASPAN® steel brand mark.

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*Warranty terms and conditions apply. Ask your supplier for details. Clemenger/BHC0053/November 03 (P76)



DURABILITY



DESIGN
FLEXIBILITY



ENVIRONMENTALLY
FRIENDLY



WARRANTY



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