

# DECKFORM® ZINC-COATED STRUCTURAL STEEL

## TECHNICAL BULLETIN TB-29

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This issue supersedes all previous issues

### INTRODUCTION

For over 40 years concrete slab design has utilised various proprietary profiled steel sheeting systems that can act as both formwork and tensile reinforcement. BlueScope Steel Limited manufactures DECKFORM® zinc-coated structural steel, a specifically designed steel product for use in structural formwork applications.

BlueScope Steel's standard DECKFORM® steel product has a Z350 zinc coating, which is designed to provide superior corrosion protection in structural formwork applications. An optional Z450 zinc coating is available and provides further corrosion protection when required.

This bulletin provides general information regarding the use of DECKFORM® steel and is not a substitute for professional advice. BlueScope Steel recommends that you seek specific advice regarding the needs of your project.

### BACKGROUND

Profiled, structural steel sheeting has been used since the mid 1960s. Today it is commonplace for structural elements to consist of composite steel and concrete. The compressive strength of concrete and the tensile strength of steel form a highly efficient and versatile system.

Proper design, installation and care of DECKFORM® steel will ensure many years of effective service. The following guidelines are provided to assist in gaining effective use of DECKFORM® steel.

### APPLICATIONS

Since 1986 BlueScope Steel has been intensively researching the behaviour of composite slabs and formwork.

Extensive testing of full-scale composite slabs has been performed and as a result, it has been possible to gain a sound understanding of their physical behaviour. This information, coupled with wide ranging corrosion studies of metallic coated products, enables BlueScope Steel to confidently recommend DECKFORM® steel for a wide range of formwork and composite slab applications.

DECKFORM® steel is suitable for domestic applications such as home units and town houses, as well as commercial and industrial buildings.

### DESIGN AND DURABILITY

The performance of DECKFORM® steel, as with all methods of construction, is a function of good design, detailing, construction and maintenance. The terms "design life" and "warranty" have distinct meanings and should not be used interchangeably. The design life of a structure is not usually the same as the durability of components within a structure or the warranty period. This point is made in AS/NZS 2312:2002 Clause 1.6, where it is noted that the protection offered by coating systems is usually shorter than the design life of the structure. This means that in order to achieve a nominated design life, due consideration must be given to maintenance or renewal requirements at the planning and design stage. When components of the structure are not accessible for maintenance after assembly, the corrosion protection system must remain effective for the design life of the structure.

### Concrete Requirements

When using DECKFORM® steel, as with traditionally formed concrete suspended floors, the upper surfaces must comply with conditions stipulated in AS3600: 2001, which prescribes detailing such as concrete cover thickness, deflection limits, crack prevention and specified concrete quality and strength. All these elements are vital to prevent moisture ingress and protect the reinforcement and structural performance of any suspended floor. Conformance to AS3600: 2001 and prevention of water or corrosive media penetration from the top surface, is a condition of the DECKFORM® steel warranty. It is recommended that the designing structural engineer follow AS3600: 2001, Section 4 in their assessment of design for durability.

### Beam Support Requirements

When DECKFORM® steel is used in a steel composite slab construction, the sheeting is placed on top of steel beams. If the steel beam is uncoated, a neutral protective barrier (*for example by pre-painting the beam\**) must be used to insulate the sheeting from the steel beam to avoid setting up a corrosion couple, which can promote attack of the zinc coating (*see Figure 1*). In the case of steel composite decking, steel studs are then placed on top of the sheeting and welded through the sheeting, to the underlying beam, by using a proprietary stud-welding gun.

The provision of a neutral protective barrier between uncoated steel beams or timber formwork is a condition of the DECKFORM<sup>®</sup> steel Warranty.

*\*Prepainting - refer to Stud Welding DECKFORM<sup>®</sup> steel section.*

### DECKFORM<sup>®</sup> steel Bottom Surface Considerations

While the top surface of DECKFORM<sup>®</sup> steel is encased in concrete, the reverse (usually unpainted) side is left exposed to the environment. This exposure and environment must be taken into account when specifying a DECKFORM<sup>®</sup> steel product. The appropriate coating class should be selected. Additional corrosion protection, such as post painting, may be necessary in exposed applications within more severe environments. Effective inspections are the starting point to assured durability. If the underside is periodically inspected and recorded as stipulated in AS/NZS2312: 2002 section 10.1, any potential issues can be addressed in the early stages. Regular inspections and early detection of issues is a condition of the DECKFORM<sup>®</sup> steel warranty.

Prepainted DECKFORM<sup>®</sup> steel is an option whereby the underside of the material is supplied in a BRITEWHITE<sup>™</sup> colour finish. This painted finish is essentially an aesthetic feature and is not a substitute for effective barrier systems in corrosive environments. It should also be noted that DECKFORM<sup>®</sup> steel with a BRITEWHITE<sup>™</sup> finish is supplied with a temporary protective film known as CORSTRIP<sup>®</sup> which needs to be removed in-situ.

Your nearest BlueScope Steel Sales Office should be contacted for specific advice on coating mass specification.

### STUD WELDING DECKFORM<sup>®</sup> STEEL

The steel beams are often painted with zinc-phosphate containing paints, for example 25-50µms in coating thickness. The thickness of both zinc and paint, and the type of paint will affect the required current, time and plunge settings of the welding gun.

*Below are guidelines regarding installation. You must ensure that you comply with all relevant Occupational Health & Safety and Building codes legislation and regulations before*

*attempting to install DECKFORM<sup>®</sup> steel. Duly qualified installers must be employed to install the product. The following is a recommended guide only and is not a substitute for professional advice. Professional advice should be obtained prior to commencing any building or construction work. Note: a suitable P2 respirator should be used, particularly in a still air environment in order to prevent inhalation of welding fumes.*

1. Studs should be dry and clean.
2. The surface of the beam should be dry and clean.
3. The DECKFORM<sup>®</sup> steel should lie on the top surface of the beam without any gap.
4. Adjust the gun to suit the length of the stud.
5. Adjust the weld parameters on the generator. The length of lead has an effect.
6. Inspect the flash around the base of the stud after welding. Generally, a good weld is one that has a uniform flash around the whole circumference of the base of the stud (see Figure 2). If there is any doubt, test the weld and replace the stud if necessary. (Remember that a "current shunting" effect can be generated due to studs being placed too close together. Weld quality can also be affected by positioning studs too close to beam edges. The best position for studs is directly over the web of the beam).

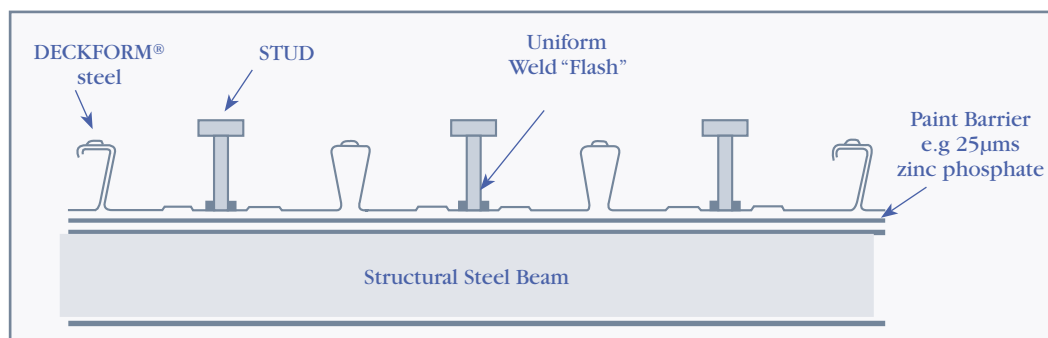
### ON-SITE TESTING

Stud weld qualification tests should be conducted in accordance with AS/NZS 1554.2: 2003 Structural Steel Welding Part 2: Stud Welding (steel studs to steel).

**Figure 2:** Example of 360° Flash.



**Figure 1:** DECKFORM<sup>®</sup> steel fixed prior to concrete pour.



## MAINTENANCE REQUIREMENTS

Structural steel decking is used in a wide range of environments. In order to assess the effectiveness of a steel corrosion protection system, it is necessary to inspect the system at regular intervals. The maintenance requirements for DECKFORM® steel will vary depending on the environment and whether the application is internal or external.

**Internal Environments** - are deemed for the purpose of this guide to be controlled atmospheric environments such as air-conditioned commercial buildings. Internal environments are generally less corrosive and typically require maintenance at a lower frequency than with external environments.

**External Environments** - where DECKFORM® steel decking is exposed to the surrounding environment. The underside of the deck is exposed to long term unwashed conditions and the affects of a changing environment.

An “Unwashed” area is an area that can come into contact with dust, salts and other airborne contaminants (detritus) and is not regularly washed by rain. This allows a build up of contaminants against the metallic coating that, in turn, becomes moist with condensed

water vapour from night air. This situation accelerates corrosion of the metallic coating. Long Term exposure of unwashed areas to the environment can affect the performance of DECKFORM® steel. In some cases additional corrosion protection measures should be taken as a safeguard. These additional measures typically involve the application of a suitable barrier system (Refer AS/NZS2312: 2002) to the exposed surface of the DECKFORM® steel in order to ensure that the material meets the design life of the structure. This can be applied either at the time of construction or at some later time dependent upon ongoing maintenance inspection.

In all cases, the life of DECKFORM® steel can be significantly extended through a regular maintenance and cleaning regime.

For maintenance guidelines see Table 1. These guidelines aim to prolong the life of the DECKFORM® steel corrosion protection system and avoid premature corrosion issues. Application of a barrier system and/or adherence to maintenance routines does not negate the need for proper specification, installation and good detailing practice to prevent corrosion from within the slab.

**Table 1:** Care and Maintenance Principles

Element	Why Important?	Guiding Principle
Inspect for detritus material	Detritus material accelerates corrosion due to increased time of wetness or increased electrolytic potential.	Determine frequency of contaminant build-up on product (eg. salt, dirt debris, pollutants) Prevent and remove all contaminants regularly.
Inspect for moisture or signs of corrosion	Moisture is a key driver of corrosion. The longer the time of wetness, the faster the corrosion rate.	Inspect for moisture on all surfaces, which is frequent, constant or cyclic in nature. Pay special attention to: - Crevices and edge detailing - Around penetrations and plumbing - White corrosion powder (Zinc oxides) indicates corrosion is underway and should be addressed immediately. - Dry all moist areas promptly and ensure adequate ventilation.
Care and Maintenance	Removal of detritus material will reduce the corrosion rate of product and reduce risk of white corrosion buildup.	Detritus should be removed regularly to prevent constant build-up. If frequency of build-up is higher than can be practicably removed, a barrier coating should be used.
Maintenance Records	Retaining records enables assessment and understanding of maintenance requirements for a site. They are also useful for confirming compliance to warranty terms and conditions in event of a claim	Retain records of: - Inspection observations - Care and maintenance regime - Results of work carried out

## REFERENCES

Australian Standard AS 1554.2-1993 steel welding Part 2: Stud welding (Steel studs to steel)

Australian/New Zealand Standard AS/NZS 2312.2 2002

Australian Standard AS 3600: 2001

## ACKNOWLEDGMENT

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The information and advice contained in this Bulletin is of a general nature only, and has not been prepared with your specific needs in mind. You should always obtain specialist advice to ensure that the materials, approach and techniques referred to in this Bulletin meet your specific requirements.

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