

SigmaJoint®

Metallic “Leave-In-Place” Contraction & Day Joints
for **INDUSTRIAL CONCRETE FLOORS**



TYPE - “D”

TYPE - “O”

**The Ultimate Joint Armouring &
Load Transfer Systems**

PROPEX
CONCRETE SYSTEMS

SigmaJoint®

Introduction

“Joints are unavoidable elements in all concrete floors and their design and construction require careful attention because they can be a significant potential source of problems. The edges of slab panels are vulnerable to damage caused by the passage of material handling equipment, with wider joints being more susceptible.”

The above statement, taken from the UK Concrete Society Technical Report No. 34, is clear evidence that joints in concrete floors should be given careful consideration in their design and positioning. Most engineers will concur that the majority of problems on concrete floors tend to be associated with joints, particularly free-movement or day-joints.

A concrete floor has to be subdivided into smaller areas for two basic reasons:

- 1) To relieve tensile stresses due primarily to drying shrinkage and temperature changes
- 2) For convenience during construction and to meet the capability of plant/ labour and concrete supply.

All joints must be capable of transferring load from one bay to another and of limiting vertical differential movement, so that a step does not form in the floor surface. In an age when new warehouse racking systems are reaching skywards and material handling equipment is exerting greater and greater dynamic loadings, it is clear that high-performance joints are now a necessary requirement to achieve trouble free floors.

The Ultimate Joint Armouring and Load Transfer Systems

Product Description

SigmaJoint®, is a metallic “leave-in-place” contraction and day-joint designed specifically for industrial concrete floors on ground or suspended on piles.

It is the result of many years of research and development and is designed to give enhanced load transfer between concrete slabs as well as protection to joint arrises.

SigmaJoint®, manufactured to ISO-9001 Quality Assured Standards, is available in two basic types to suit different market requirements and personal preferences.

These are:

- Type D - Continuous plate dowel system
- Type O - Tongue-and-groove plate system

SigmaJoints have been successfully used throughout Europe since 1990 by many specialist flooring contractors.



Features & Benefits

- Leave-In-Place
- No Formwork Stripping
- Superior vertical load transfer for static & dynamic loads
- Free horizontal movement
- Joint opening up to 20mm
- Resistance to fatigue and impact
- Superior joint arris protection
- Reduced joint maintenance

Applications

- Ground bearing concrete floors
- Suspended slabs on piles
- External roads/ pavements
- General raft foundations

Usage

The metallic “leave-in-place” **SigmaJoint®** must be installed in accordance with the manufacturer’s recommendations. (Available on Request)

SigmaJoint® - Type O

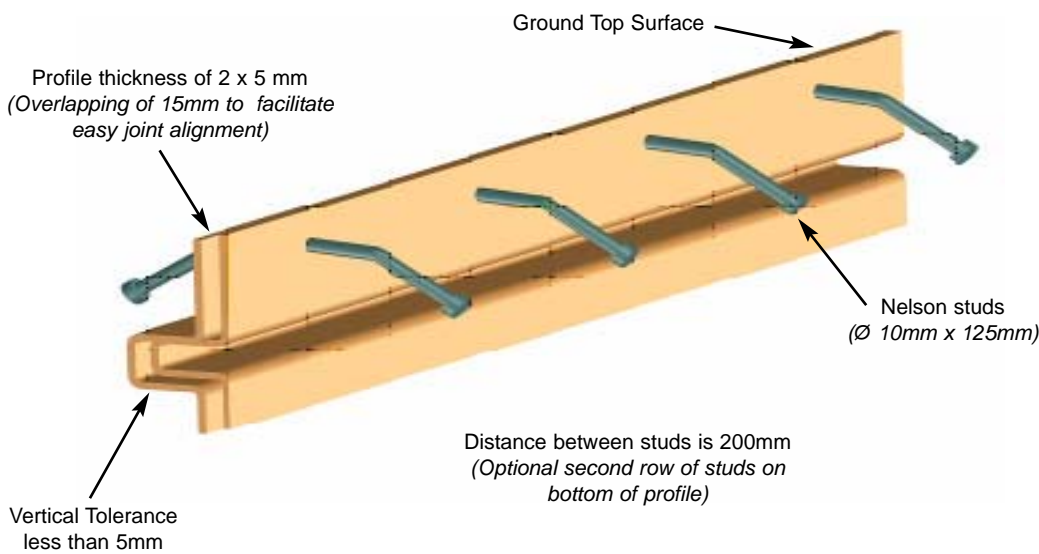
Tongue-and-groove plate system

Description

The Type “O” joint is a high performance “leave-in-place” joint system that provides heavy duty aris protection as well as excellent load transfer capability in industrial floor environments where clients and operators are looking for long term durability and low maintenance movement joints.

It is designed for use in both ground supported concrete floors and suspended slabs on piles.

The Type “O” joint consists of two roll formed steel plates which are precisely engineered to fit perfectly together as a tongue & groove joint. It is designed to achieve maximum load transfer and completely free horizontal movement.



Technical specifications:

Profile Thickness:	2mm x 5mm
Available heights:	120mm to 300mm Special designs are available for heights above 300mm
Anchorage:	Metal studs 10mm diameter x 125mm length
Steel Quality:	S235JRG2
Standard Length:	3 metres



With the introduction of a new production process the quality of the SigmaJoint® Type “O” has been improved significantly

Roll forming of the steel profiles has led to a significant reduction in the tolerance between the two plate sections. This means that the load transfer capacity of the joint has been further improved, even with joint openings up to 20mm.

Anchorage

The Nelson-type 10mm diameter studs, with industry proven performance, are automatically welded to the steel profiles to guarantee strong anchorage into the surrounding concrete.

Surface grinding

After assembly of the “O” joint, the top surface of the profiles are ground down to ensure that the arises of the steel are completely level when installed.

SigmaJoint® - Type O

Technical Performance

The SigmaJoint® Type “O” has been extensively tested at the University of Ghent (Belgium) where it has proved its’ ability to transfer very high loads. Different depths of joints have been tested up to the concrete rupture.



Testing at the Magnel Laboratory
University of Ghent, Belgium

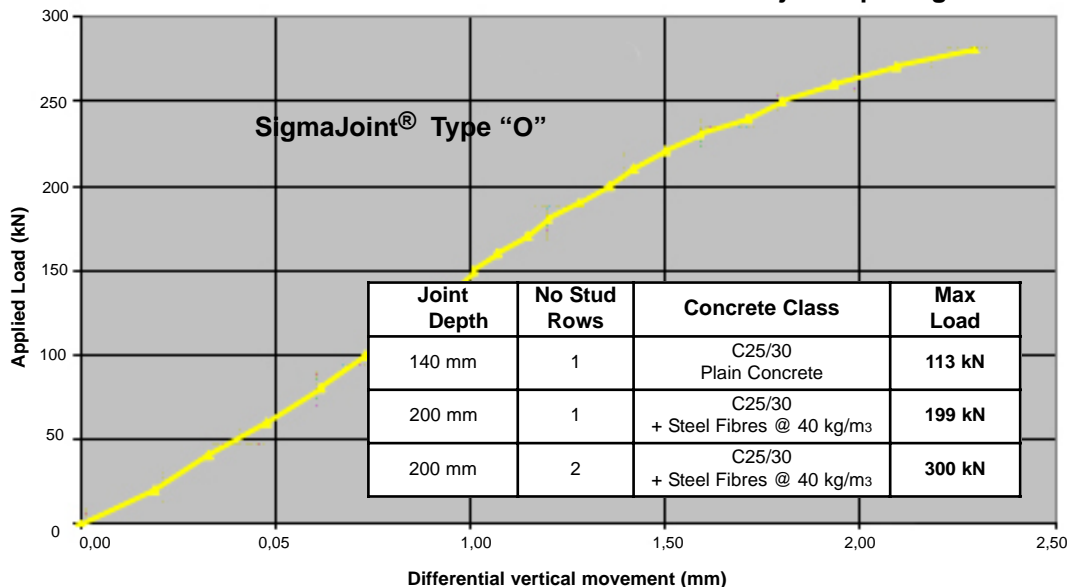
Concrete floors in industrial warehouses and logistic units are subjected to intense forklift traffic. Since 1990, the SigmaJoint® Type “O” has proven its practical ability to support heavy loads.

The SigmaJoint® Type “O” works as a construction- and day joint. The joint is designed not only to accommodate horizontal movement due to the natural shrinkage of the concrete but also to provide a high degree of joint arris protection.

The SigmaJoint® Type “O” is also designed to effectively transfer vertical load from one slab to another and to ensure that a step does not occur in the slab surface.

The continuity of the steel profiles in the SigmaJoint® Type “O” helps to stiffen the concrete slab edges and distribute point loads..

Test results: 200mm slab thickness and 10mm joint opening



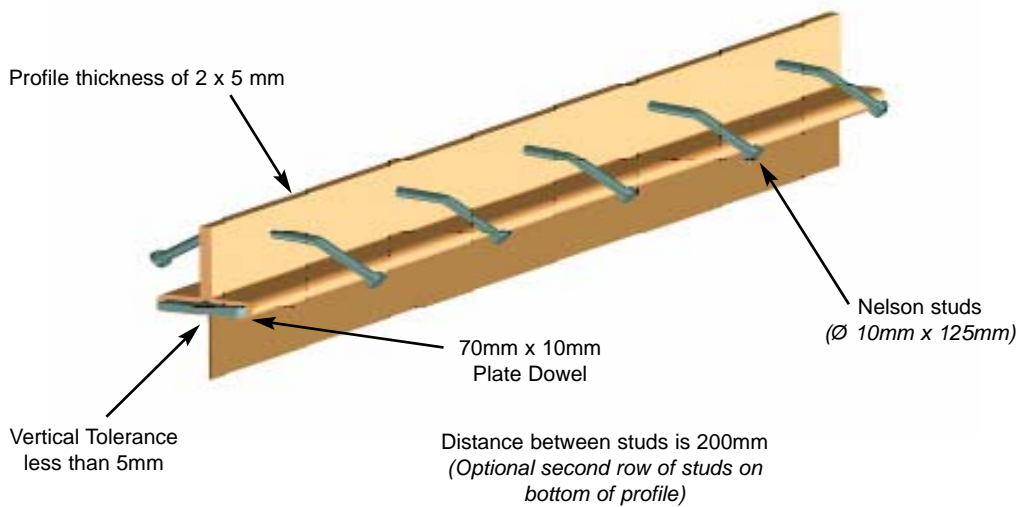
SigmaJoint® - Type D

Continuous plate dowel system

Description

The Type “D” joint is also a high performance “leave-in-place” joint system that provides heavy duty arris protection as well as excellent load transfer capability in industrial floor environments. It is designed for both ground supported concrete floors and suspended slabs on piles.

The Type “D” joint consists of a double flange profile and a continuous 10mm thick high strength steel dowel plate designed to achieve maximum load transfer and complete free horizontal movement.



Technical specifications:

Profile Thickness:	2mm x 5mm
Available heights:	95mm to 300mm Special designs are available for heights above 300mm
Plate Dowel:	70mm x 10mm
Anchorage:	Metal studs 10mm diameter x 125mm length
Steel Quality:	S235JRG2
Standard Length:	3 metres



With the introduction of a new production process the quality of the SigmaJoint Type “D” has been improved significantly

Roll forming of the steel profiles has led to a significant reduction in the tolerance between the two plate sections.

The dowel shape has also been optimized in order to further improve the load transfer capacity, even with openings up to 20 mm.

Anchorage

The Nelson-type 10mm diameter studs, with industry proven performance, are automatically welded to the steel profiles to guarantee strong anchorage into the surrounding concrete.

Symmetry

As the 2 profiles are identical, the top surface of the steel profiles will always be levelled at the placement

SigmaJoint® - Type D

Technical Performance

The SigmaJoint® Type “D” has also been extensively tested at the University of Ghent (Belgium) where it has proved its’ ability to transfer very high loads. Different depths of joints have been tested up to the concrete rupture.



Testing at the Magnel Laboratory
University of Ghent, Belgium

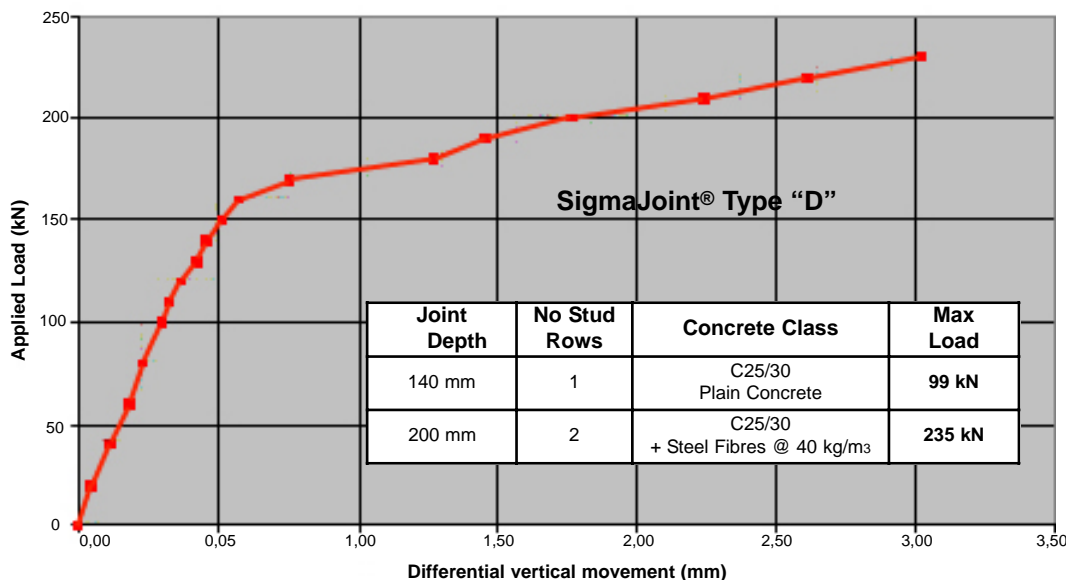
Concrete floors in industrial warehouses and logistic units are subjected to intense forklift traffic. Since 1990, the SigmaJoint® Type “D” has proven its practical ability to support heavy loads.

The SigmaJoint® Type “D” works as a construction- and day joint. The joint is designed not only accommodate horizontal movement due to the natural shrinkage of the concrete but also to provide a high degree of joint aris protection.

The SigmaJoint® Type “D” is also designed to effectively transfer vertical load from a one slab to anothe and to ensure that a step does not occur in the slab surface.

The continuity of the steel profiles in the SigmaJoint® Type “D” helps to stiffen the concrete slab edges and distributes point loads..

Test results: 200mm slab thickness and 10mm joint opening



Frequently Asked Questions (F.A.Q.)

Why use SigmaJoints?

- **SigmaJoints** combine the roles of both day-joints and contraction joints.
- The 5 mm-thick plate protects the concrete arris of the joint against impact and spalling damage.
- Provides high performance load transfer and ensures that no vertical movement occurs.
- The absence of horizontal restraint makes it perfect for the use in 'joint-free' floors where the edges of the slab move in the two directions.
- The SigmaJoint has been successfully used by specialist flooring contractors throughout Europe since 1990.

How to place SigmaJoints correctly?

- On sub-base generally. (See method of placement guidance sheets)
- Extra-care must be taken to ensure that the profiles are butt jointed and levelled (re-fixing can be sometimes necessary when the joint was affected during transport).
- On existing concrete, pin bars should be a smaller diameter and notched to prevent any restraint of the concrete floor.
- On insulation: special feet have been developed to prevent perforating the insulation board.



What are the necessary precautions during concrete pouring?

- The sub-base must be controlled under the joint (compaction and levelling) to avoid having a weaker slab along the edges.
- The concrete must be compacted with a poker vibrator to fill the void beneath the profiles.
- When using a coating (dry shake hardener, resin etc.), the finished floor level must be flush with the top of the profiles.
This will require extra attention to placement and correct compaction of the concrete surface.
- For a slab with induced saw-cut joints, it is not necessary to reflect the saw-cuts through the metallic joint.

What happens when the concrete shrinks?

- The contraction-joint will concentrate most of the shrinkage movement of the concrete floor.
- **SigmaJoints** are designed for a maximum opening of 20 mm.
- The metallic screws and nylon nuts, used during transportation, are designed to pull out when concrete shrinks. The estimated tension force caused by the shrinkage strain on these fixings is $F = e \times E \times A$ (e = shrinkage strain, E = concrete modulus, A = concrete section).
For a slab thickness of 150 mm and a shrinkage strain of 0.03%,
 $F = 0.0003 \times 30,000 \times 150,000 = 1,350 \text{ kN}$, i.e. 135 tonne on a single fixing.
- For example, the edges of a concrete panel of 50 m length can move of 8 mm (for a mean estimation of shrinkage strain of 0.03%) and an internal joint can open of 16 mm.
- This movement is accentuated by thermal effects, such as those found in freezer stores or external pavements etc. Extra care should be taken to limit the joint opening to 15-20 mm by a correct joint layout. Especially for external pavements, the joint should be open at the placement to allow for a concrete expansion.
- Differential shrinkage may cause edge curling of the floor. This phenomenon cannot always be avoided. However, **SigmaJoints** will maintain continuity across the joint.

What is the function of SigmaJoints?

- When used in **Ground Bearing Floors, SigmaJoints:**

- 1) Transfer load between concrete panels.
- 2) Limit vertical movement between panels.
- 3) Protect the joint arris.

The load transfer capacity of the joint has been tested on an existing floor by measuring the vertical displacement on both slabs. Accepting that there is a ± 0.5 mm tolerance between the metal profiles the adjacent concrete panels move in unison. Due to the continuity and longitudinal stiffness of the rails, the effect of a point load will be spread over a width 6 to 8 times the thickness of the floor. The **SigmaJoint** will ensure perfect armouring of the concrete arris when subjected to heavy traffic. The 10 mm stud connectors welded to the profile in the upper part of the joint will ensure sufficient anchorage

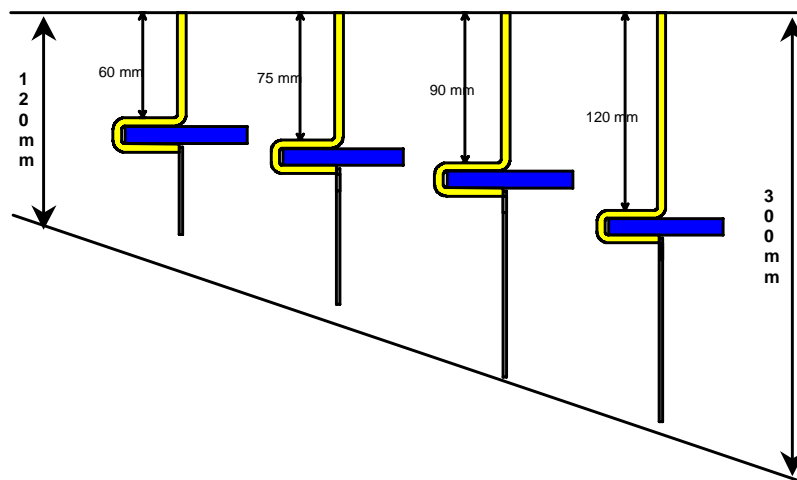
- When used in **Pile - Supported Floors, SigmaJoints:**

- 1 Resist shear loads imposed on the floor.
- 2 Limit the vertical movement between panels
- 3 Protect the joint arris.

The joints are usually placed at the point of contra-flexion where bending moments are minimal. Consequently, the slab will be cantilevered on one side and simply supported on the other side leading to high shear forces across the joint. Due to the high performance of the SigmaJoint under shear load conditions it is important to have the appropriate reinforcement adjacent to the joint profile. (40Kg per metre cube of Novocon steel fibres is the recommended minimum dosage.) The 10 mm stud connectors welded to the profile in the upper part of the joint will ensure sufficient anchorage

What size of SigmaJoint?

- The dowel plate/ tongue & groove toggle should be ideally located in the middle plane of the concrete slab. There are 4 available profiles to suit the floor depth from 120mm to 300mm+



- The height of the joint has to be approximately 10-20 mm less than the slab depth, in order to allow for the subbase level tolerance. Otherwise, the sub-base has to be dug out to place the joint at the right level.
- The **SigmaJoints** are designed with single row of top anchorage connectors as standard. However, bottom connectors are available as an option depending on application and loadings.
- For the food/ chemical industries and other sensitive applications SigmaJoints Type D & O are available in galvanised steel and Type O is also available in stainless steel.

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