peikko group 50 years 1965-2015

Customer Magazine

CONCRETE CONNECTIONS

2/2015

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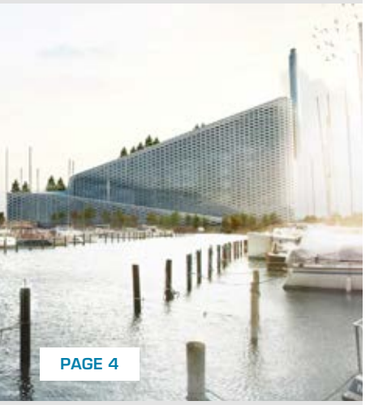

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ON THE COVER:
Amager Resource Center in Copenhagen, Denmark, combines innovative technology, recreational activity and local acceptance, and is consequently a great example how a power plant can be welcome to people's backyards.
© BIG Architects

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Jalo and Topi Paananen at Peikko's 50-year anniversary event at the Sibelius Hall, Lahti, Finland.

At your service,

Topi Paananen
CEO, Peikko Group Corp.
topi.paananen@peikko.com

THE VERY FIRST CUSTOMER

The most important person ever for Peikko is a man called Pentti Kunttu. Pentti never worked for Peikko. He did not develop or sell Peikko's products, and he did not finance the company. Nevertheless, one could easily say that without this individual Peikko would have never existed. So who is Pentti?

In the spring of 1965, my father **Jalo Paananen** was 26 years old. He had an idea to start his own company, and so he did with some of his friends. **Pentti Kunttu** from a company called Mattinen & Niemelä was Peikko's first customer - buying a set of 500 Diagonal Ties for sandwich wall panels.

Have you ever been the very first customer of a company? Pentti did not trust Jalo because of his age or experience. Neither did he place the order because he was dealing with an established, trusted player of the industry. Pentti did not buy the ties because of good references or reputation of the company, as those simply did not exist. Peikko did not have an office, logo or even a paper printed with the company name. Peikko did not even have a telephone number. But still, Pentti bought the ties and was happy. Why did he do such a thing, why did he decide to become the first customer of a start-up company?

The answer is simple. Because Peikko's products provided an immediate benefit for his work – making his own precast element production process easier, faster and more reliable, and because Pentti could calculate the direct benefits of buying a finished product instead of making the ties himself. He made the order because he trusted the 26-year-old youngster who – at the end of the day – did have some experience in steel business. And because Pentti knew that if Peikko could not deliver the products, as a back-up plan, he could still make something with his own team. But Pentti never needed to resort to that plan.

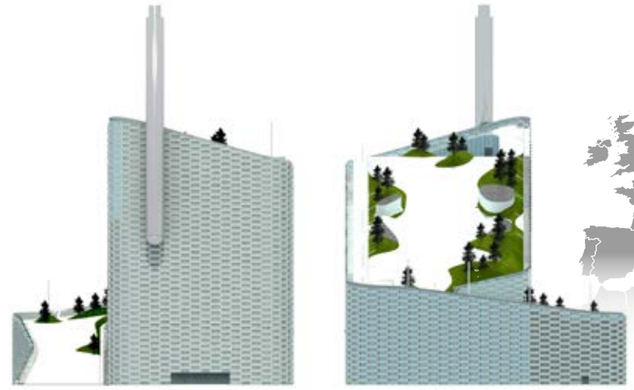
Still today, after having operated for 50 years and served thousands of customers over the years, Peikko keeps on convincing new customers, serving and keeping its promises to all of them every day, whether they are called Pentti or something else. We would thus like to thank you for being our customers - we promise to do our very best to serve you also in the future! ■

WASTE-TO-ENERGY PLANT WITH RECREATIONAL QUALITIES

AMAGER RESOURCE CENTER – ARC

Text: Inka Emich
Visualizations: BIG Architects

The Amager Resource Center, ARC, will be a role model in many ways. The new landmark will merge the industrial area on the island of Amager with the urban structure and society of the neighbouring city. Copenhagen's state of the art waste-to-energy plant will not only be one of the best performing European plants in terms of energy production, waste treatment capacity and environmental efficiency, but also in terms of visuality and local acceptance.



View of from East and West. © BIG Architects

It combines innovative technology, recreational activity and integration to society by creative architecture, and is consequently a great example of how a power plant can be welcome to people's backyards. Thus, the architects of the Bjarke Ingels Group (BIG) succeed in creating a new class of power plant.

For the first time, a waste-to-energy plant has been designed as an attraction: The extensive roof area of approximately 32,000 square meters (38,000 sq yd) is designed as a winding, inclined surface, serving as a ski slope with several levels of difficulty. The new building is situated in an area which has long been utilized by extreme sports athletes for their recreational activities. Now its role as popular destination of the Copenhagen population is to be established and expanded.

The new facility with state-of-the-art, eco-friendly disposal technology is built right next to the obsolete 45-year old plant which will be closed after the ARC has been commissioned.

OPEN SPACE PROVIDED BY USING DELTABEAM®

The design by the architects required long spans of the slabs for a column-free interior design. In addition, increased snow loads for the planned ski slope on the roof of the building had to be considered. DELTABEAM® Composite Beams meet all these requirements perfectly.

Oliver Beckmann, R&D Manager for Composite Structures at Peikko Germany, was responsible for the design of approximately 160 DELTABEAM® Composite Beams with a combined total length of nearly 1 kilometer (0.6 miles) in the ceilings and about 80 beams with roughly 400 meters (1,300 ft) in the roof area for this extraordinary project.

Both in terms of production quality and monitoring as well as with respect to corrosion protection, high demands were made, which were accomplished in close cooperation with the participating companies. In addition to DELTABEAM®, further concrete connection products of Peikko were utilized in the project as well.

THE CONCRETE–STEEL CONNECTION

Peikko's PCs Corbels provide the connection between the DELTABEAM® and precast concrete columns and walls. The hidden corbel substitutes concrete corbels. Its practical handling in the

»

DELTABEAM® Composite Beams were used in the slabs for long spans with slim structures

precast plant and on the construction site ensures neat connections with a pleasing appearance after completion of the building. Specially modified PCs Corbels enable the DELTABEAM® to be positioned particularly close to the upper edge of the precast elements.

Several connections and bearings of DELTABEAM® Composite Beams on beams and precast walls were executed using modified Fastening Plates. Peikko's customer engineering developed the necessary connection details. The highly stressed, partly rigid end plate connections were designed at Peikko by FEM-calculations.

The specifications of execution class EXC3, execution of quality class Z and ultrasonic tests on the steel plates as well as the high requirements placed on surface preparation and corrosion protection placed high demands on Peikko's production facilities.

CONNECTIONS BETWEEN PRECAST AND IN-SITU CONCRETE STRUCTURES

Peikko's MODIX® Rebar Couplers were installed by the precast plant in filigree walls. This means that on the building site a connection is available for the reinforcement of the adjacent in-situ concrete structures. By inserting the MODIX® Couplers the rebars are "extended" and in-situ concrete walls may be cast in place in their formwork on site.

In the joints between precast concrete units and the in situ concrete a stirrup reinforcement is used. Since the reinforcement of the connection cannot be screwed, the MODIX® Couplers allow connection of straight or bent rebars, if neither of the two bars can be rotated.

The MODIX® Rebar Coupling System is designed to be the most safe and flexible rebar splicing system. The assembly team and the site supervisors are conviced: "MODIX® is much faster to install compared to similar products where you need to use a torque wrench to check if they are tighten with enough moment."

The connections between the precast and in-situ concrete walls are made with the MODIX® Rebar Coupling System.

The roof area of the building will be used as ski slopes with different levels of difficulty.

VISIBLE ENERGY EFFICIENCY

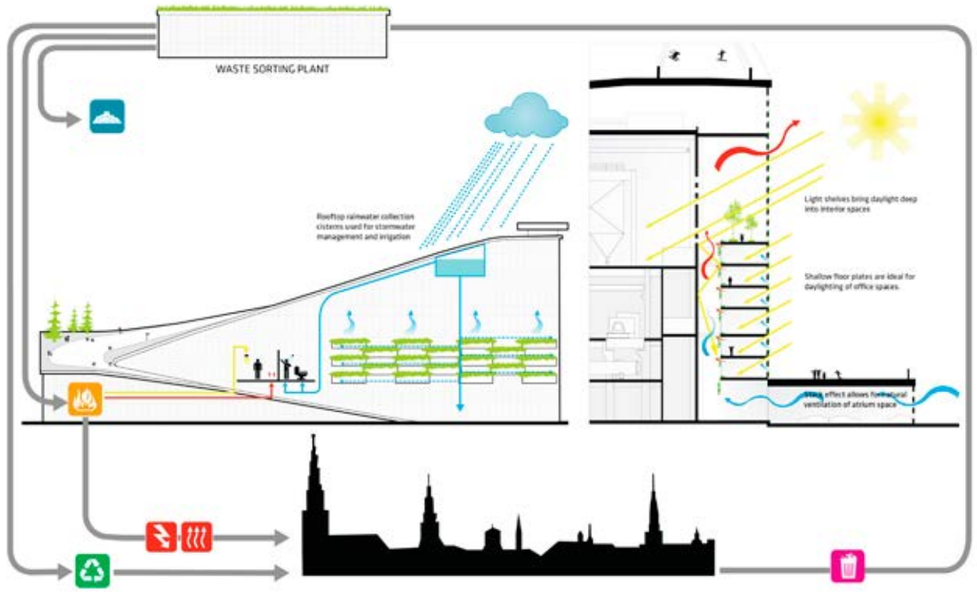
After commissioning in 2017, the ARC will provide heating to 160,000 households and electricity for about 62,500 residential buildings. The owners, five Danish municipalities, expect the plant to burns 2 x 35 tons (40 US Tons) of waste per hour.

From a 124-meter-high (407 ft) stack steam rings with a diameter of 25 meters (82 ft) are ejected. BIG explains: "Does anyone know what a ton of CO_2 looks like? We propose to modify the chimney so that a steam ring is released when one tonne of CO_2 has accumulated. These serve as a visible reminder of the impact of energy consumption." ■

ARC IN A NUTSHELL

Developer:	Amagerforbraending, Copenhagen
Architect:	BIG Architects, Copenhagen
Structural Engineering:	AKT, MOE
Constructor:	NCC Construction A/S Ed. Züblin AG, Hosena
Floor Space:	approx. 95,000 m^2 (114,000 sq yd)
Landscape Area:	approx. 90,000 m^2 (108,000 sq yd)
Roof and Ski Slope:	approx. 32,000 m^2 (38,000 sq yd)
Construction Period:	2015–2016

The new waste-to-energy plant pursues a consistent strategy of sustainability, ranging from the selection of construction methods and systems to its role as a communication platform in the urban and social environment.



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DELTABEAM® EXCELS IN A RESIDENTIAL HIGHRISE

Text: Timo Vennonen

The Winnipeg skyline will get a new landmark when the 21-storey GlassHouse is completed in 2016. DELTABEAM® has played an important role in meeting the needs of the architect, structural designer and constructor alike in this ambitious Canadian project.

One of the tallest steel structures in the Manitoba region, GlassHouse is in Winnipeg's rapidly growing sports, hospitality and entertainment district (SHED). Downtown Winnipeg has seen brisk development in recent years, and GlassHouse is seen as a trendsetting example of the new wave of sustainable accommodations in the area.

With its 196 high-end condominiums and urban appearance, GlassHouse can also be described as "chic", and is truly unlike anything Winnipeg has ever seen before. The first residents to move in by spring 2016 will experience floor to ceiling glass and life in a loft-like space achieved through the use of structural steel.

"The architects were looking for a solution that would incorporate a slab thickness of 9 to 10 inches (22 to 25 cm). DELTABEAM® was the perfect solution, offering what the architectural expression needed while making life easier for the structural designer and contractor alike," explains Peikko Canada's Managing Director **Dominic Lemieux**. As an interesting interior detail, the underside of the beams are exposed and painted black – in contrast to the exposed concrete hollowcore slabs and hardwood floors. GlassHouse also boasts more than 2,000 panes of floor to ceiling glass and a room height of 9 feet (2.7 m).

TECHNOLOGY FOR OPEN SPACES

"DELTABEAM® is a slim-floor steel structure that lets you build architecturally interesting open spaces," Lemieux says, continuing: "and the best thing is that the simple assembly process of DELTABEAM® helps to keep large projects like this one right on schedule."

The beauty of structural steel is that almost all components can be prefabricated to speed up the building process. This means that the building has been added to the Winnipeg skyline at an astounding pace since the cornerstone was laid in November 2014.

"You don't need to weld when installing these beams. This makes for safety on site and swift frame erection," Dominic Lemieux points out. DELTABEAM®s are connected to the columns using Peikko's modular PCs Corbels, which are factory-welded to the steel columns to provide lego-like ease of installation.

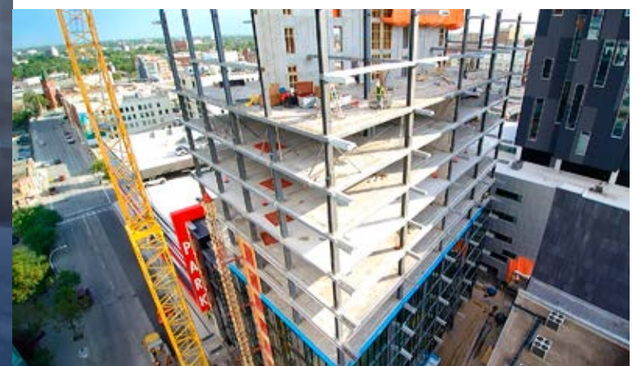
ALSO BENEFITING INVESTORS

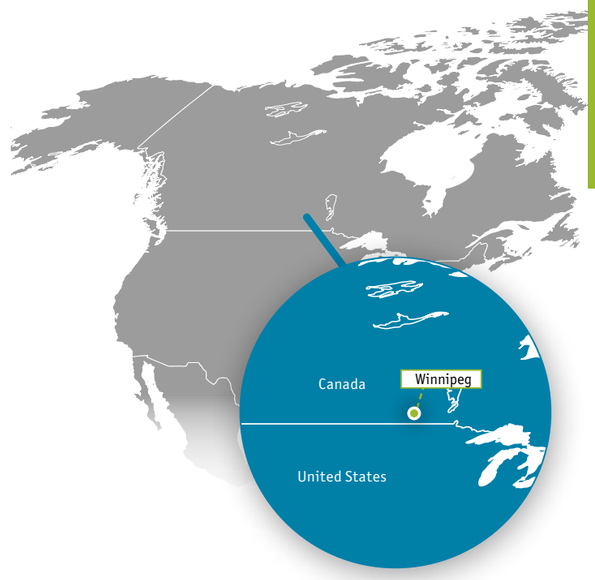
"Choosing DELTABEAM® means more profit for investors, because our slim floor technology allows you to build more floors for a given overall height. On the other hand, constructors are happy when the chosen technical solution is quick to assemble," Lemieux explains. DELTABEAM® reduced the structural depth of each floor by a whopping 16 inches (40 cm), which translates into 2 extra floors compared to conventional structural technology. Flat ceilings also mean straightforward HVAC installations that further reduce building time.

NO EXTRA FIREPROOFING NEEDED

Structural steel needs to have the required fire rating. Intumescent paint is the standard industry procedure if the steel is exposed, but this has to be done on site. It can also take some time, as you need a primer, base coat and decorative topcoat. None of this is needed with DELTABEAM®, as the beam is cast in concrete. DELTABEAM® is supplied in a pre-painted form, and it's not going to be a crucial issue if it happens to get scratched at the worksite or corroded after a while due to exposure to the elements. "Crews can repaint these beams the way they like without the need for further inspection, whereas on other jobs you'd have to re-coat the beam in intumescent paint," explains Lemieux. "This has also been a clear bonus at the GlassHouse building site."

To prove the point, DELTABEAM® is UL-tested to achieve 2-hour, 3-hour and 4-hour ratings with no additional fire protection on the beam. ■





GLASSHOUSE WINNIPEG

Owned by Urban Capital, the GlassHouse was designed by Stantec Architecture Winnipeg. The structural design engineers were Crosier Kilgour & Partners and the main contractor is Bockstael Construction. To date, GlassHouse is the tallest steel frame structure realized with DELTABEAM®.

For further details visit **www.glasshousewinnipeg.com**

NEW HYPERMARKET IN CENTRAL FINLAND BUILT USING

METAFORM FREE MOVEMENT JOINTS

Text: Reeta Paakkinen

In the spring of 2016, Finnish hypermarket chain Prisma will open new premises in Jyväskylä, Central Finland. Peikko's METAFORM Free Movement Joint System is being used in the construction of the parking hall of the market, as well as in the retail premises. The project is the first extensive one where Peikko is using METAFORM in Finland. METAFORM was included in Peikko's product range in 2014, after Peikko acquired UK-based flooring product specialist company Metalscreed UK Ltd.

AN EASY-TO-ASSEMBLE PRODUCT

At Jyväskylä, in total 1.5 kilometres (0.9 miles) of METAFORM Free Movement Joints were used in the construction of the new hypermarket. This consisted of 1.1 kilometres (0.7 miles) of METAFORM DUO and 400 metres (1,300 ft) of METAFORM. The products cover 4,000 square metres (5,000 sq yd) of the total 13,000 square meters (16,000 sq yd) of the premises', and were used in the parking area of the complex as well as its retail area.

Prisma chain has currently some 64 stores in Finland. In addition to Finland, the chain has stores also in Estonia, Latvia, Lithuania and Russia. The main constructor of the hypermarket chain's new store in Jyväskylä is Lehto Oy and the floors are being constructed by Megalattiat Oy.

Jukka Lintulahti, responsible for the project at Lehto Oy, said: "METAFORM Free Movement Joint System is very simple and therefore easy to assembly from the viewpoint of functionality and in terms of its assembly technology. Simplicity makes it a good product to use. With Peikko we have a long history of cooperation and we will definitely use METAFORM later. This project has proceeded in an excellent manner."

A COST-EFFECTIVE SYSTEM

METAFORM is prefabricated, multi-purpose, leave-in-place Free Movement Joint System with integrated load transfer system, designed for medium to heavy-duty concrete floors. It was originally a product developed by Metalscreed Ltd, which became part of Peikko's product range when Peikko acquired Metalscreed in 2013.

Janne Saarivirta, Sales Manager of Flooring Products at Peikko Finland, noted METAFORM can be used to form either expansion or contraction free movement joints in ground-bearing and pile-supported concrete floors. "It also provides a number of modular variants based on the METAFORM base rail, which provides effective wrap-around joint arris armoring."

"Compared to Peikko's older products LS1 and LS2 Expansion Joints, METAFORM Joints are shorter and straighter, and provide technically better anchoring mechanism and are not sensitive to break," notes **Toni Metsi**, Sales Manager at Peikko Finland. "Our older product LS2 Joint was six meters long, but METAFORM is just three meters which improves the straightness of the joint. Tolerances of +- 0.5 mm/m are particularly suitable for high-class floors. METAFORM is also easy to modify for different kind of loads. The dowels are 5, 6 or 8 mm (3/16 in, 1/4 in or 5/16 in) and dowel centers c/c 600 mm (24 in) or 300 mm (12 in), which maximize load transfer capacity. Pricewise METAFORM is also more economic than our older models," Metsi explained.

THE BEGINNING LOOKS PROMISING

Jari Räty, who oversees the assembly process of the hypermarket floors at Megalattiat Oy, said after getting used to the new product and mastering its finer details, assembly of floors at Jyväskylä building site has proceeded smoothly. "The floors have already started settling, which is a good sign. We are beyond halfway of the project and will see the completed result in about four months. It already looks very promising," Räty said.

The construction in Jyväskylä kicked off in early 2015, and the building is expected to be complete by spring 2016. It is the first major project where METAFORM joints have been used in Finland. "However, we are already in discussions of using it in new projects next year – these are commercial premises elsewhere in Finland. It's obvious this product suits the Nordic market very well," Peikko's Metsi concluded. ■


Image: SOK

NEW OPTIMAJOINT

FLOORING TECHNOLOGY: MORE BENEFITS AND ECONOMY

Text: Timo Vennonen

Added benefits often mean a more expensive product, but not with the OPTIMAJOINT, Peikko's new Free Movement Joint.

Flooring contractors are usually under constant pressure from customers to find more economical solutions without sacrificing any of the benefits of a heavy-duty concrete floor joint. Peikko has responded to this challenge by developing a comprehensive top performer that meets the needs of your most exacting customers for technical and functional capacity, cost and sustainability.

"We have focused on economic efficiency while adding benefits for contractors and consumers alike," says product manager **Milan Ďurčovič**. "And I'm happy to report that we succeeded!"

GREENER AND FASTER

Designed to reduce the carbon footprint of concrete floors, OPTIMAJOINT is 30 per cent lighter than competing free movement heavy-duty joints. "Besides these green credentials, lightness translates into swift installation, as crews can handle and fix the rails with ease," says industry veteran and OPTIMAJOINT designer **Pat Eve**.

Assembling this new heavy-duty joint is actually so simple that no special equipment or experience is needed. OPTIMAJOINT can be installed in various ways using round bar pins, removable timber formwork, or Peikko's new dedicated adjustable height system, Speedfix.

Manufacturing was also considered during the research and development phase. Top rails are now made by pressing, instead of jig welding together from various profiles. This process saves a great deal of energy and labor.

REDUCED WEAR AND TEAR ON MHE WHEELS

Forklift tires take a continual pounding from the sharp inner edges of the steel top bars cast into a conventional joint. "Think about a hammer and chisel. That's the kind of impact MHE (Mechanical Handling Equipment) wheels take every time you drive over a joint," Pat Eve explains.

OPTIMAJOINT minimizes this problem with rounded inner edges on the top steel bars. This significantly reduces the wear on tires, leading to lower maintenance costs. "It also means more pleasant working conditions for truck drivers, as it softens the jolts caused by joints," Eve adds. Softer impacts also considerably reduce damage to concrete. Contractors will likewise approve the sharp outer edges of the OPTIMAJOINT top rail, which butts firmly and securely onto the poured and finished concrete.

IMPROVED FAILURE RESISTANCE

The anchor tangs of OPTIMAJOINT are pressed out of the parent material. This provides a bigger anchoring surface that is less easily dislodged from the concrete slab.

As a continuous part of the parent material, these anchor tangs eliminate the failure potential found in conventional welded shear studs. This unique solution to the problem of fastening anchor tangs to the joint not only improves anchoring resistance, but also reduces the costs involved in complex welding work. And when filled with concrete, the holes left by the anchor tangs form keys that hold the rails in position and improve resistance to shear and compressive loads on the joint. "Compressive loads are also managed by using virtually the entire slab thickness, as OPTIMAJOINT protrudes only 4 millimeters (5/32 in). into the slab at the joint face," Pat Eve explains. "The rails have an offset tag that locates behind the rail at the time of connection. This tag locks the rails together, preventing separation when the joint gap opens."

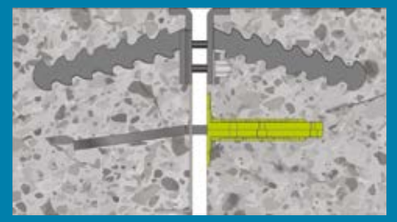
BE READY FOR A CHANGE

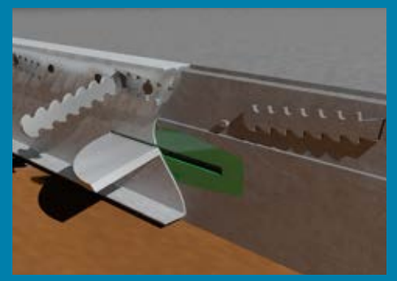
Even though this market is typically conservative and responds only slowly to change, initial trials of OPTIMAJOINT have been highly successful. "The joint has been welcomed by experienced contractors using it for the first time, and we are confident that OPTIMAJOINT will rapidly become a best-selling product," Milan Ďurčovič concludes.

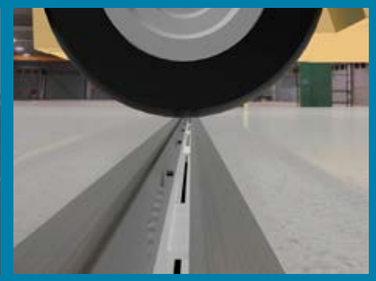
Both types of Peikko TERADOWEL and ULTRADOWEL load transfer systems can be used as an integral part of OPTIMAJOINT. Plain steel OPTIMAJOINT is designed for predominantly indoor use, and a Hot Dipped Galvanized version is available for outdoor or otherwise harsh conditions. ■

TECHNICAL BENEFITS OF OPTIMAJOINT

- Anchor tangs pressed out of the parent material provide a bigger anchoring surface that is less easily dislodged from the concrete
- Holes left by the anchor tangs fill with concrete and increase the shear resistance of the joint
- Rounded inner joint edges make the joint kinder to MHE wheels and reduce maintenance
- Use of the entire slab thickness improves resistance to compressive loads
- Load transfer system incorporates a selection of dowels
- Offset tags prevent movement at the connection point
- Efficient design uses less steel than conventional joints, delivering enhanced performance







WELDA® – WELD'S BEST FASTENING PLATE?

Text: Vesa Tompuri

A basic product that is good and well established can be made even better by paying close attention to customers' needs. Peikko's Fastening Plates are a good example of this. The result was WELDA® Fastening Plate family that is more cost efficient and easier for constructors, precast element factories, and designers to use.

Fastening plates are needed in construction whenever steel structures must be connected to concrete. Fastening plates have featured in Peikko's manufacturing program since just after Peikko was established 50 years ago. They are basic products, which were developed once and proved themselves to be good, remaining relatively unchanged well into this century. The WELDA® family of Fastening Plates, which has just been developed, is a great example of how good solutions can be refined into even better ones.

"The old products did their job well. However, we wanted to take the optimization of our solutions one step further as regards design and construction," says **Pekka Paavola**, Peikko Group's Product Manager in charge of Fastening Products.

Traditionally, designers have selected fastening plates using tables. The tables are still useable but even highly competent designers may find themselves selecting plate types that are slightly heavier than required when the numbers are analyzed more accurately. More precise calculation using a solution such as the Peikko Designer®, Peikko's free calculation software, enables slightly lighter plates to be used that still provide sufficient structural reliability.

"Furthermore, the table resistances of the former products were based on the materials and calculation methods that were used previously. It was not always possible to find an optimal plate in terms of dimensions and resistance for all use cases. Now, we are pleased to be able to offer our customers even more suitable solutions in all situations," says Paavola.

WELDA® FITS INTO TIGHT SPACES

Feedback was received from constructors, designers and precast element producers. When this feedback was analyzed, Peikko set itself the goal of making Fastening Plates lighter without reducing resistance. This feedback, coupled with the experience that Peikko has accumulated over the decades, led to a great success: WELDA® Fastening Plates, which replace the previous plates that had been on the market for some time, have even better mechanical properties despite being lighter than before.

"This is due to the plate dimensions better corresponding to the most common load cases and the more accurate dimensions produced by the Peikko Designer® software in comparison with the traditional table-based method," Paavola says.

Reducing the dimensions and weights of plates is also beneficial from the perspective of installing the plate because the "leaner" plate – that nonetheless has higher resistance and strength – is easier to fit into tight spaces around rebar.

"For example, corner locations in which beams and columns are densely reinforced are the best places for the new WELDA® Fastening Plates to be used. We already have plenty of positive experience with these on our industrial and commercial construction sites," says **Timo Noponen**, Purchasing Manager from Finnish precast element producer Betset Oy's Kyyjärvi factory.

Betset played an active part in specifying the needs of its production and construction sites. By paying close attention to these, Peikko's product development specialists developed a complete product family with nothing missing in terms of dimensions and mechanical properties. The product family contains an optimal solution for every structure and site.

From the perspective of structural design, Peikko's new product family also means that the Fastening Plates correspond more closely to the needs that arise in practical projects.

"The connecting points between column edges and cast-in-situ slabs and related vertical structures are particularly tight. Locations like this, with extensive reinforcement, demand fastening plates with large capacities, which has occasionally necessitated custom-manufactured plates. It is definitely a good thing that there is now a productized solution for these situations, which arise fairly often," says **Esa Ikäheimonen**, a structural designer from Ramboll Finland Ltd.

Ikäheimonen also considers it important that Peikko offers software that can make the job of design engineers easier and faster.

"Peikko has given me these software tools to use, including ones for designing fastening plate solutions. I am familiar with the products, which helps me to understand the logic of Peikko Designer®, which will then make design easier," he says.

RELIABILITY ABOVE ALL

WELDA® Fastening Plates do not deviate from Peikko's rule that optimized solutions should benefit the customer and the company's own production.

"WELDA® is a good example of how small details can be fine-tuned on old products to create valuable new products. The traditional fastening plate was a very well established product based on general guidelines published in the 1970s," Pekka Paavola says.

For this reason, several constructors are used to using unnecessarily heavy plates and related anchors.

"There has been some discussion in our production department about how thin the anchors are in relation to the old ones. There was no suspicion of problems, of course, as we trust Peikko, both technically and in terms of delivery reliability. We can always trust that our orders will be delivered on time. We are also grateful that the product warehouses are on Peikko's premises and not at our factory," says Timo Noponen.

A new production line has recently been built at Peikko's Lahti factory for the WELDA® products. In addition to Finnish markets, the new Fastening Plates have already stirred up significant interest in other Nordic countries and in the Baltic countries.

"The markets for WELDA® Fastening Plates are expected to be in these areas, where buildings are constructed and concrete products are manufactured in the same way as in Finland. In addition to the Nordic countries, this also applies to cast-in-situ construction in places such as Germany and Austria," says Pekka Paavola. ■

NEW AND UPDATED TOOLS FOR DESIGNERS

Tools for Designers is Peikko's toolbox for structural designers to make their work faster, easier, and more reliable. The toolbox includes design software, 3D components for modeling programs and technical manuals of Peikko's products.

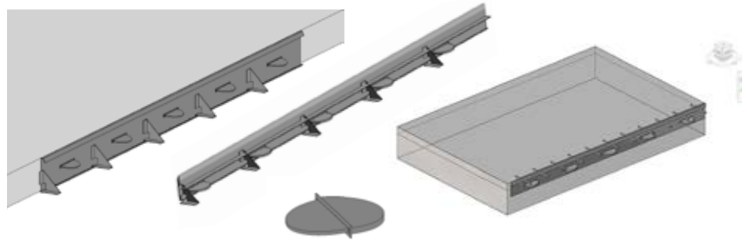
DESIGNING WELDA® FASTENING PLATES

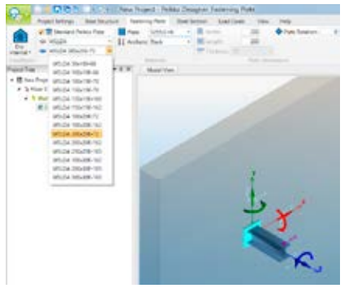
WELDA® Fastening Plates are now available in Peikko Designer®. You can design all standard Fastening Plates or make project specific WELDA® Modified Fastening Plates using Peikko Designer® Fastening Plate Module.

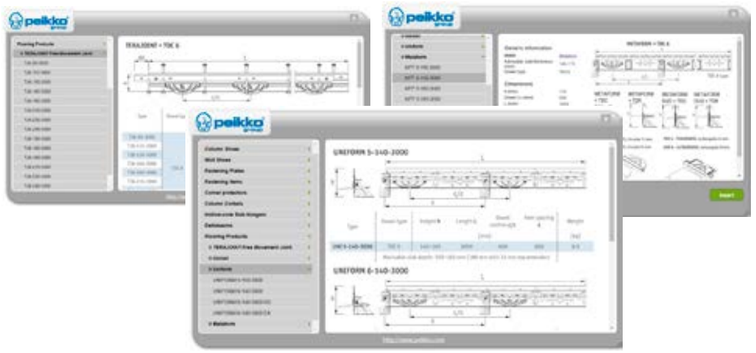
We have released a full tool set to model and add WELDA® Fastening Plates to structural plans. You can find AutoCAD blocks and Revit families in the Peikko Toolbox for Revit and AutoCAD, and Tekla Structures plugins from our data storage or Tekla Warehouse.

3D MODELING TOOLS

Flooring products for Revit and AutoCAD are now released. You can find Free Movement Joints, Screed Rails and Load Transfer Systems as Revit families and AutoCAD blocks from Peikko Toolbox for Revit and AutoCAD.



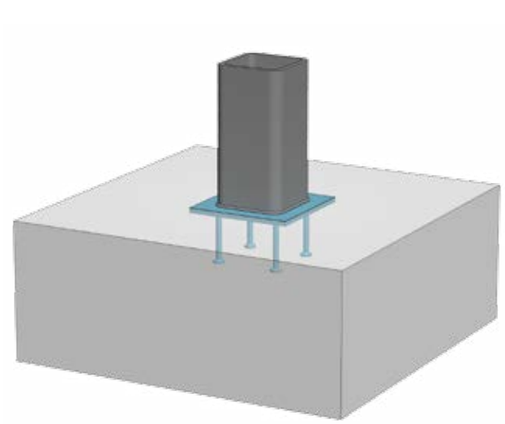


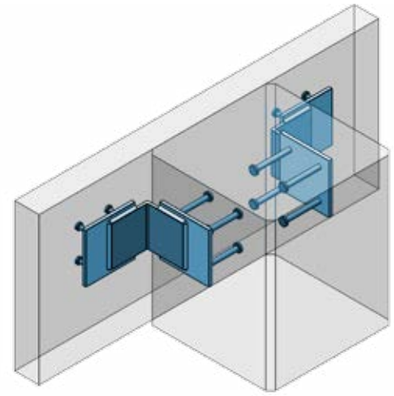


TOOLS FOR DESIGNERS

Peikko's design tools, plug-ins and components can be downloaded from our websites. In the Software download center you will find short introductions on the tools and instructions how to register and download them. With the help of Tools for Designers, Peikko's goal is to make designing and detailing faster, easier, and more reliable!

Software download center:
www.peikko.com/software





WELDA® FASTENING PLATES

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1. INTRODUCTION

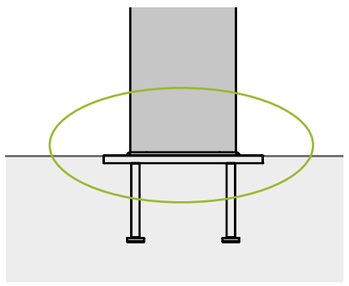
Peikko Group has launched a new family of WELDA® Fastening Plate products with resistances calculated on the basis of technical specifications CEN/TS 1992-4-1..2, as published by the European Committee for Standardization (CEN). WELDA® Fastening Plates can be dimensioned for structures based on Eurocodes. They replace Peikko's previous line of SBKL Fastening Plates, which corresponded to Finnish national norms (RakMk) and were standardized by the Finnish Concrete Association.

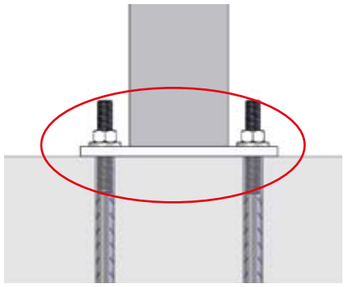
The transition to WELDA® Fastening Plates provided Peikko with an opportunity to improve its product range and to update the technical details of its products to ensure that they fulfill the needs of designers today. WELDA® Fastening Plates provide designers with products that are optimized for Eurocode design and a more extensive range of standard products, particularly for thin structures.

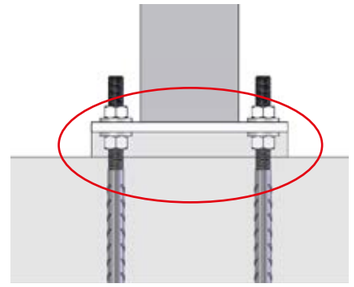
Peikko is setting its sights on European markets with the new WELDA® Fastening Plates. They have been approved for the Finnish market, where they have been in use for several months already. WELDA® Fastening Plates can also be used in other countries providing that the design is based on Eurocode standards and national annexes.

WELDA® Fastening Plates enable connections to be formed between steel and concrete structures. They also enable concrete elements to be joined together. Fastening plates do not protrude from the cast surface. Therefore, they enable connections to be less conspicuous than with post-anchoring and bolt connections.

This article details the structural behavior of WELDA® Fastening Plates, the inspections that must be made during dimensioning (Peikko Designer®) with regard to the tensile and shear forces that can act on anchors, and the potential for modifying WELDA® Fastening Plates.







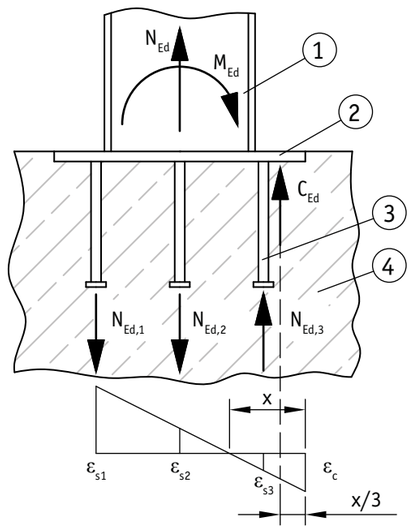
Benefits of WELDA® Fastening Plates for various parties in the construction process	
Architect	A visually less conspicuous solution with no parts protruding from the concrete surface that would otherwise be distracting or would need to be hidden
Structural Designer	The expanded range of standard products offers approved connection solutions to replace solutions that previously needed to be made using modified special steel parts
	A diverse selection of materials enables solutions to be found, even for highly challenging sites such as industrial buildings or maritime climates
	WELDA® Fastening Plates offer almost unlimited scope for modification, enabling optimal solutions to be created in terms of dimensions and resistance for challenging sites such as structures with large amounts of reinforcement
	Technical manuals, approval documentation, the Peikko Designer® software, 2D and 3D components speed up planning and product selection, making the process more efficient
Precast factory / construction site	Smaller and lighter than earlier products while being easier to install – even into dense reinforcement – ensuring that less time is consumed by manual work phases
	WELDA® Fastening Plates can be fastened into place without breaking molds
	An expanded range of products in stock enables faster delivery
Construction site	Extensive plate-axis installation tolerances: connecting structures can be installed and welded in exactly the right location

2. STRUCTURAL BEHAVIOR

WELDA® Fastening Plates include a steel plate to which headed anchors are welded and embedded into the concrete in the casting phase. WELDA® Fastening Plates are designed to transfer the loads caused by bending moments, normal forces, and shear forces into the concrete. The calculations presume that the steel plate is completely rigid and remains a plane in the loading. The steel plate transfers forces from the profile, which is welded on, to anchors in the concrete.

The presumption of a rigid plate in the event of normal forces and moments requires the fastening area to be sufficiently large in relation to the surface of the plate. Special attention must be paid to this when calculations are made for long fastening plates. For long fastening plates, the calculating model should be a plate that is large enough to enable the steel profile to be connected within the relevant tolerances and that has no unnecessary rows of anchors with regard to the calculation. If necessary, additional supports can be used between the fastening plate and the steel profile to increase the fastening area. In such cases, the steel profile can be modeled in accordance with the external dimensions of the additional supports for the purpose of calculation.

Figure 1. Model of the distribution of forces when fastening plates are subject to moments and normal forces.



Explanation:
1. Connected steel profile or part
2. Steel plate
3. Headed anchor
4. Concrete structure

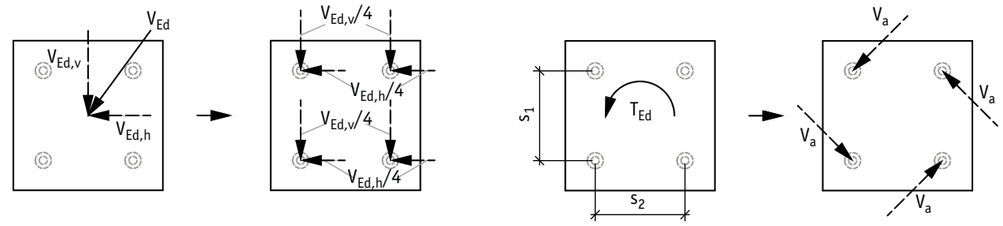
Parts 2 and 3 constitute the WELDA® Fastening Plate

The forces in the anchors (N) and concrete (C) are:

$$N_{Ed,i} = A_s \cdot \varepsilon_{s,i} \cdot E_s$$

$$C_{Ed} = 0.5 \cdot b \cdot x \cdot \varepsilon_c \cdot E_c$$

Figure 2. Defining shear forces for individual anchors when four anchors are subject to an inclinedshear force of V_{Ed} and a torque of T_{Ed}.

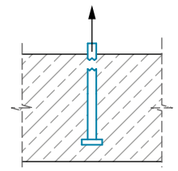
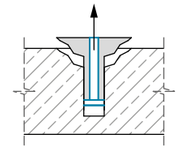
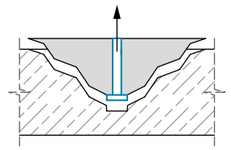
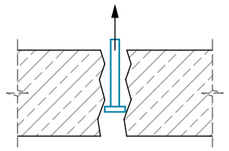
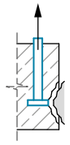


$$V_a = \frac{T_{Ed}}{I_p}\left[\left(\frac{s_1}{2}\right)^2 + \left(\frac{s_1}{2}\right)^2\right]^{0.5} \text{ and } I_p = {s_1}^2 + {s_2}^2$$

2.1 REQUIRED VERIFICATIONS FOR WELDA® HEADED ANCHORS LOADED IN TENSION

The verifications described below can be made using Peikko's own Peikko Designer® software.

Table 1. Required verifications for headed anchors loaded in tension.

Failure mode	Example	Most loaded anchor	Anchor group
Steel strength of anchor		$N_{Ed}^h \le N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{Ms}}$	
Pull-out strength of anchor		$N_{Ed}^h \le N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{Mp}}$	
Concrete cone strength [1]			$N_{Ed}^g \le N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{Mc}}$
Splitting strength [2]			$N_{Ed}^g \le N_{Rd,sp} = \frac{N_{Rk,sp}}{\gamma_{Msp}}$
Blow-out strength [3]			$N_{Ed}^g \le N_{Rd,cb} = \frac{N_{Rk,cb}}{\gamma_{Mc}}$

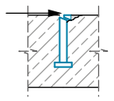
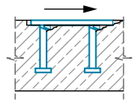
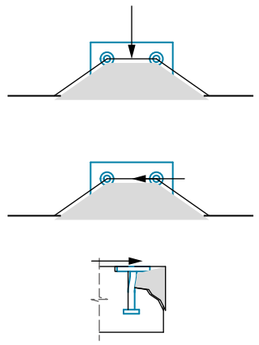
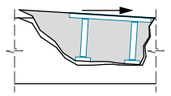
[1] Not required if supplementary reinforcement is provided according to Appendix A1
[2] Not required if the edge distance in all directions $c \ge 1{,}5\ h_{ef}$ for groups with one anchor and $c \ge 1{,}8\ h_{ef}$ for groups with more than one anchor or if supplementary reinforcement provided according to Appendix A2
[3] Not required if the edge distance in all directions $c \ge 0{,}5\ h_{ef}$

»

2.2 REQUIRED VERIFICATION FOR WELDA® HEADED ANCHORS LOADED IN SHEAR

The verifications described below can be made using Peikko's own Peikko Designer® software.

Table 2. Required verifications for headed anchors loaded in shear.

Failure mode	Example	Most loaded anchor	Anchor group
Steel strength of anchor		$V_{Ed}^{h} \leq V_{Rd,s} = \frac{V_{Rk,s}}{\gamma_{Ms}}$	
Concrete edge strength [1)] • Shear perpendicular to the edge • Shear parallel to the edge • Inclined shear		$V_{Ed}^{g} \leq V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{Mc}}$	
Concrete pry-out strength		$V_{Ed}^{g} \leq V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{Mc}}$	

[1)] Not required if the edge distances in all directions c ≥ min (10 h_{ef}; 60Ø) or if supplementary reinforcement is provided according to Appendix B1

2.3 COMBINED TENSILE AND SHEAR FORCES

When an anchor is subject to simultaneous tensile and shear forces, the interaction must satisfy the following equations for the various failure modes. The interaction of tensile and shear forces is easy to check using the Peikko Designer® Fastening Plate software.

VERIFICATIONS TO BE CARRIED OUT FOR STEEL PARTS

Headed anchors
When simultaneous tensile and shear forces are acting, every anchor must satisfy the following condition:

$$|\beta_N|^2 + |\beta_V|^2 \leq 1 \qquad \text{CEN/TS 1992-4-2, Eq. (46)}$$

where

$$\beta_N = \frac{|N^1_{Ed}|}{N_{Rd}} \leq 1 \text{ and } \beta_V = \frac{|V^1_{Ed}|}{V_{Rd}} \leq 1$$

where

N^1_{Ed} = axial tensile force in the anchor subject to greatest force
V^1_{Ed} = shear force in the anchor subject to greatest force
N_{Rd} = the anchor's tensile resistance
V_{Rd} = the anchor's shear resistance

VERIFICATIONS TO BE CARRIED OUT FOR CONCRETE

Anchors without supplementary reinforcement
When simultaneous tensile and shear forces are acting, the following condition must be satisfied:

$$|\beta_N|^{1.5} + |\beta_V|^{1.5} \leq 1 \qquad \text{CEN/TS 1992-4-2, Eq. (48)}$$

Anchors with supplementary reinforcement
When simultaneous tensile and shear forces are acting, the following condition must be satisfied:

$$|\beta_N|^{2/3} + |\beta_V|^{2/3} \leq 1 \qquad \text{CEN/TS 1992-4-2, Eq. (49)}$$

where

β_N = the largest degree of utilization from concrete verifications under tensile force
β_V = the largest degree of utilization from concrete verifications under shear force

NOTE: Failure modes β_N and β_V are those not covered by supplementary reinforcement

3. USAGE CONDITIONS

The resistances of fastening plates have been calculated for static forces. For dynamic or fatigue forces, higher safety factors must be used on a case-by-case basis.

The pre-calculated resistances (table 5) presume that the fastening plates are sufficiently far from the edges. In practice, lower edge distances can limit the resistances of fastening plates and require supplementary reinforcement.

The eccentricity due to manufacturing and installation tolerances (10% of the side length, max. 20 mm) is taken into consideration in the resistances. The largest eccentricities must be taken into consideration when designing connections. This can be done using the Peikko Designer® software, which can be downloaded from Peikko's website for free.

3.1 TAKING ENVIRONMENTAL CONDITIONS INTO CONSIDERATION

WELDA® Fastening Plates are design for use indoors in dry conditions. The design life of WELDA® Fastening Plates in dry, indoor conditions (environmental classification X0) is 50 years. When fastening plates are used in other conditions, the environmental classification and design life must be taken into consideration when the surface treatment or raw material is selected. Fastening plates are also manufactured from stainless steel materials.

WELDA® Fastening Plates are also available in other materials. Such products are known as modified fastening plates. Contact Peikko's sales team for more information.

Surface treatments of standard WELDA® Fastening Plates: protection paint 40 µm. Epoxy painting and galvanization upon request. Stainless steel WELDA R/Rr/A/Ar Fastening Plates are not painted.

Table 3. Materials of standard fastening plates.

Types	Plate material	Standard	Anchor material	Standard
WELDA	S355J2+N (carbon steel)	EN 10025-2	SD1 (carbon steel)	EN ISO 13918
WELDA R	1.4301 (rustproof)	EN 10088-2	SD1 (carbon steel)	EN ISO 13918
WELDA Rr	1.4301 (rustproof)	EN 10088-2	SD3 (stainless steel)	EN ISO 13918
WELDA A	1.4401 (acid-proof)	EN 10088-2	SD1 (carbon steel)	EN ISO 13918
WELDA Ar	1.4401 (acid-proof)	EN 10088-2	SD3 (stainless steel)	EN ISO 13918

SD1: $f_{yk} \geq 350$ N/mm2, $f_{uk} \geq 450$ N/mm^2, $A_5 \geq 15\%$; EN ISO 13918, carbon steel
SD3: $f_{p0.2} \geq 350$ N/mm2, $f_{uk} \geq 500$ N/mm^2, $A_5 \geq 25\%$; EN ISO 13918, stainless steel

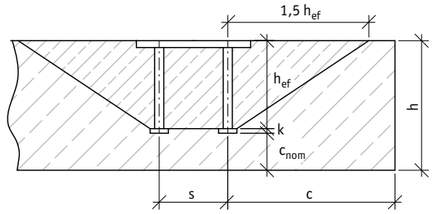
3.2 POSITIONING OF FASTENING PLATES

The precise position of fastening plates is shown on structural drawings. The plates must be fixed so that they are not able to move during casting. Fastening plates can be fixed to reinforcement or to the mold by nails, glue, double-sided tape, compression or magnets in steel molds. Upon request, holes can be made for nails to make the plate easier to fix in place.

Table 4. Installation parameters for headed anchors.

Nominal diameter [mm]		10	12	13	16	19	20
Minimum interval	s_{min} [mm]	50	70	70	80	100	100
Minimum edge distance	c_{min} [mm]	50	50	50	50	70	70
Minimum thickness of concrete structure	h_{min} [mm]	$h_{ef} + k + c_{nom} = H + c_{nom}$					
c_{nom} = Required thickness of concrete cover according to national regulations							

Figure 3. Parameters h_{ef}, k, c_{nom}, h, c, s.



3.3 MODIFIED WELDA® FASTENING PLATES

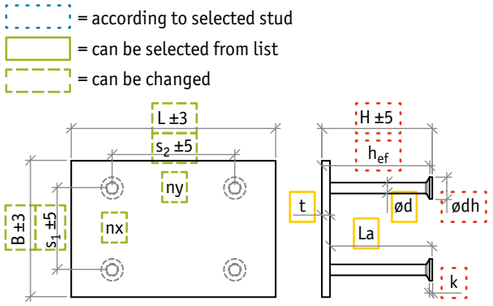
WELDA® Fastening Plates can be modified to ensure that they offer an optimal solution for different needs. The resistances of modified fastening plates can be verified using the Peikko Designer® software.

The properties that can be modified are as follows:
1) Plate dimensions:
- Thickness t: 8/10/12/15/20/25/30 mm
- Width B: 50–2000 mm
- Length L: 100–6000 mm

2) Headed anchors:
- Number and position of anchors
- Diameter Ød: 10/12/13/16/19/20(/22/25) mm
- Length La: 50–600 mm

3) Holes:
- Number and position of holes
- Diameter of holes

4) Steel quality (can be selected from steel qualities that are generally available)



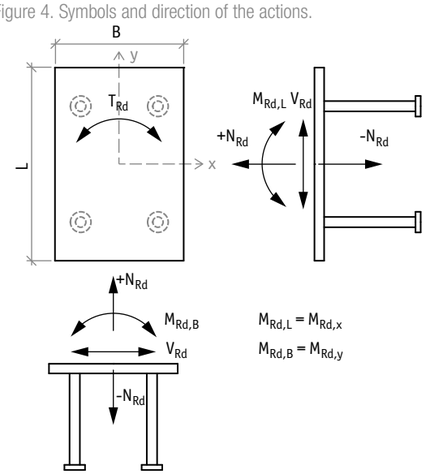
Modified WELDA® Fastening Plates must be named such that they cannot be confused with standard WELDA® Fastening Plates. Manufacturing drawings are required for production. The drawings must show the dimensions of the plate, the sizes and positions of the anchors, and the materials. Contact Peikko's sales team for more information about modifying WELDA® Fastening Plates.

Naming products: **WELDA MODIFIED**
[unique project number or name]

Examples:
WELDA MODIFIED 1234
WELDA MODIFIED 25x600x2000+30d16-150

4. RESISTANCES

Figure 4. Symbols and direction of the actions.



Assumptions for the resistances presented in table 5:

- Concrete strength C25/30. Concrete cracked, without supplementary reinforcement.
- The eccentricity due to manufacturing and installation tolerances (10% of the side length, max. 20mm) is taken into consideration in the resistances.
- The plate is far enough away from the edges so the edge does not fail.
- The calculations have been made for static loads in accordance with the instructions in CEN/TS 1992-4-1...2.
- The minimum fastening areas have been calculated for plate material S355J2+N.

In all cases, the resistances of fastening plates can be verified using the Peikko Designer® software. This is particularly recommended in the following circumstances:

- There are interactions of forces (shear forces, moments and normal forces)
- Edge distances may limit resistances
- Installation tolerances are greater than 10% of the length of the edge, max. 20 mm
- The fastening plate has been modified

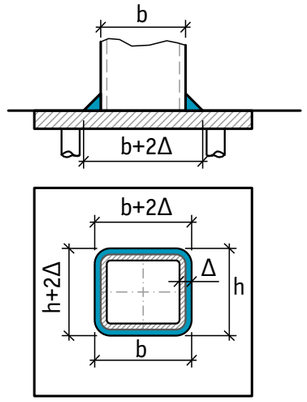
Table 5. Maximum tensile force N_{Rd}, shear force V_{Rd} [kN], bending moment M_{Rd} and torque resistance T_{Rd} [kNm] and minimum fastening area [mm^2] (kpa, calculated for moment M_{Rd}), when only one force applies.

WELDA® B x L – H	+N_{Rd} [kN]	V_{Rd} [kN]	$M_{Rd,L}$ [kNm]	$M_{Rd,B}$ [kNm]	T_{Rd} [kNm]	Min kpa [mm x mm]
WELDA 50x100-68	7.8	19.0	0.8	0.3	0.9	5x67
WELDA 100x100-68	17.2	30.5	1.1	1.1	1.8	48x48
WELDA 100x150-70	20.3	37.2	1.8	1.3	2.7	34x84
WELDA 100x200-72	23.9	46.0	2.5	1.6	4.0	20x105
WELDA 100x200-162	79.2	89.0	6.4	5.4	7.7	50x160
WELDA 100x300-162	90.1	94.9	11.0	5.4	10.3	46x260
WELDA 150x150-70	22.7	44.4	2.0	2.0	3.5	55x55
WELDA 150x150-160	62.9	52.8	4.8	4.8	4.2	116x116
WELDA 150x150-162	77.9	90.6	7.5	7.5	7.1	115x115
WELDA 200x200-72	28.5	58.4	3.1	3.1	5.8	40x40
WELDA 200x200-162	86.6	143.2	10.4	10.4	14.3	157x157
WELDA 200x300-165	97.6	145.7	15.9	12.0	18.3	108x217
WELDA 250x250-165	104.2	150.2	15.7	15.7	20.3	169x169
WELDA 300x300-165	107.5	151.1	18.2	18.2	21.5	201x201

Note:

- When many actions are active at the same time, interaction have to take into account.
- The minimum fastening area depends on the directions and magnitudes of the forces.
- Welds can be taken into consideration when the required fastening areas are calculated.
- The compression resistances of fastening plates can be calculated using Peikko Designer®.

Figure 5. Welds can be taken into consideration when calculating the minimum fastening areas.



The following factors must be taken into consideration in order to select the correct type of WELDA® Fastening Plate:

1. Type of loading and load cases: N_{Ed}, M_{xEd}, M_{yEd}, V_{xEd}, V_{yEd}, T_{Ed}. In the case of seismic, dynamic and fatigue loads, greater safety factors have to be used individually for each case.
2. Direction of loading
3. Dimensions of the steel profile
4. Eccentricity of the steel profile: ex, ey
5. Dimensions and edge distances of the concrete structure
6. Concrete grade
7. Cracked/uncracked concrete
8. Existing and supplementary reinforcement
9. Environmental conditions: dry internal/external atmospheric/other environment liable to corrosion

CONCLUSIONS

When structural design is based on Eurocodes and the CEN/TS 1992-4-1..2 specifications, ensuring the resistance of the selected fastening solution involves several different verifications with regard to different failure mechanisms. Often in such cases, it is not sufficient to ensure resistances on the basis of traditional resistance tables. To make the design of structural fastening details quick and reliable, it is recommended that the Peikko Designer® software be used to select WELDA® Fastening Plates. Peikko Designer® can be downloaded for free from Peikko's website.

The installation of WELDA® Fastening Plates into reinforced structures has been facilitated by updating the product's structural dimensions. The 2D and 3D design components can be used to check that the item will fit into the structure and openings in the reinforcement.

The optimal fastening solution is exactly the right size with regard to the surrounding structures and the structures to be fastened without giving rise to the need for supplementary localized reinforcement. The WELDA® product family has a larger range of standard products to help in identifying the optimal solution.

It should be noted that it is not always possible to find parts that are precisely suited for a particular purpose, even in such an extensive product range. As the size and dimensions of fastening plates are key factors, it is now also possible to design individual WELDA® MODIFIED Fastening Plates for specific purposes.

Peikko's transition to a new generation of fastening plates enables product development to correspond more closely to the requirements of different parties in the construction process. ■

REFERENCES

[1] WELDA® Fastening Plates, Technical Manual
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[3] CEN/TS 1992-4-2:2009, Design of fastenings for use in concrete. Part 4-2: Headed fasteners
[4] EN 1992-1-1:2004, Design of concrete structures: General rules and rules for buildings
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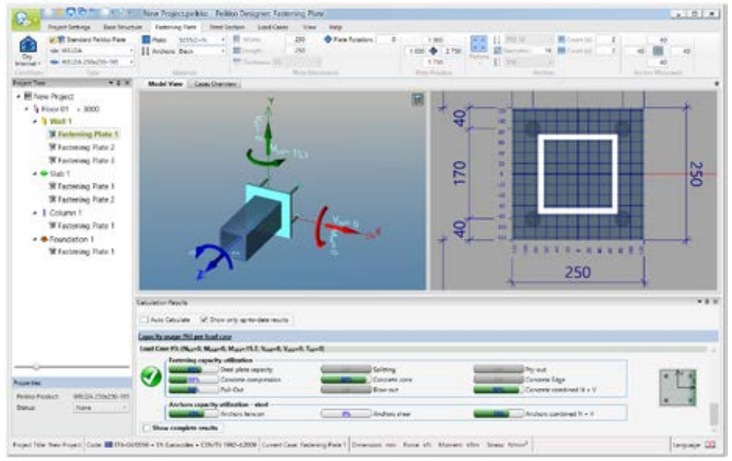
[6] EN 1993-1-8:2005, Design of steel structures. Part 1-8: Design of joints

Figure 6. Peikko Designer: Fastening Plate.



View WELDA® Fastening Plate animation on Youtube:

www.peikko.com/youtube

PEIKKO PROJECTS FROM AROUND THE WORLD

Peikko Lithuania delivered HDG and ECO Galvanized Anchor Bolts to the foundation connections of LitPol Link in Lithuania. LitPol Link is the first electricity interconnection between Lithuania and Poland, will connect the Baltic countries to the electricity infrastructure of Western Europe for the first time.

Peikko Russia delivered 1.3 kilometers (0.8 miles) DELTABEAM® Composite Beams to Tapiola residential project in St. Petersburg, Russia. The building will include 757 comfort-level apartments, 4,000 m² (43,000 sq ft) office space and 360 underground parking places.

Peikko Spain delivered 850 pcs Column Shoes and Anchor Bolts to the multi-national retail dealer CARREFOUR's logistics warehouse in Madrid, Spain. The total size of the warehouse will be 23,000 m² (250,000 sq ft).

Peikko Finland has received a substantial order for the steel frame structure of Ratina Shopping centre in Tampere, Finland. The delivery consists of 10 kilometers (6 miles) DELTABEAM© Composite Beams and 1,300 tons of other steel structures. The deliveries will start in early 2016 and continue until autumn. This project is the largest ever delivery of the Peikko Composite Frame in Finland.

Peikko Czech Republic delivered 5 kilometers (3 miles) of TERA-JOINT Free Movement Joints to AMAZON's warehouse in Prague, Czech Republic. The deliveries took place between December 2014 and April 2015.

Peikko Benelux delivered it's Wind Turbine Foundation Solution to a large wind park to be built near Lake Turkana in north-eastern Kenya. The delivery consisted of 365 pcs of Anchor Cages. The Anchor Cages are formed by Anchor Bolts, Anchor Rings and Template Rings, altogether about 750 tons of steel, equaling 41 pcs of 20 ft containers. The wind farm will be fully operational by 2017.

The large Lake Turkana 365-turbine wind farm will be Africa's largest so far constructed south of Sahara, and it is the largest single investment in Kenya's history. The Lake Turkana Wind Power (LTWP) project aims to provide 300 MW of reliable, low cost wind power to the Kenya national grid, equivalent to approximately 20% of the current installed electricity generating capacity. The wind farm site covers 162 km² (63 sq miles). The area has excellent wind conditions and the utilization rate of the turbines is estimated to rise to 55%, when the corresponding figure in Europe varies between 20 and 40%.