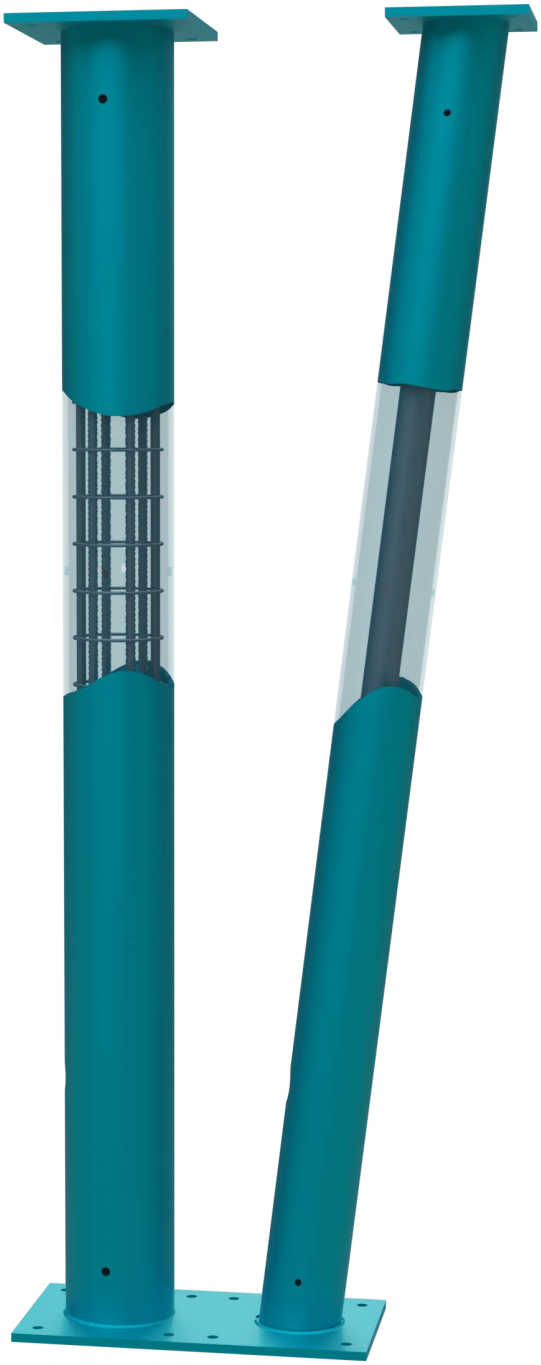
TECHNICAL MANUAL



ATLANT® and ATLANT® Strong

Slender ATLANT® and close to invisible ATLANT® Strong composite columns

Version PEIKKO GROUP 05/2024

peikko®

ATLANT® and ATLANT® Strong

Slender ATLANT® and close to invisible ATLANT® Strong composite columns

The ATLANT® Family contains two products: ATLANT® and ATLANT® Strong composite columns. The close to invisible ATLANT® Strong composite columns provide the highest resistance and slenderness, while the ATLANT® composite columns enable effective optimization. Both, ATLANT® and ATLANT® Strong are available in three cross-section shapes: circular, square, and rectangular, all in a wide range of sizes.

- More slender than other same resistance columns.
- Strong columns capable of maintaining constant outer cross-section dimensions throughout floors.
- Integrated fire proofing.
- Quick and easy installation.
- Architectural flexibility and more open interior space.
- Compatible with beam systems for precast, cast-in-situ, timber, hybrid, and other common slabs.
- Optimal design and support provided by client's language speaking Peikko specialists.
- Eurocode 4 based design and local approvals.
- Certified production in state-of-the-art factories.

The ATLANT® Family composite columns enable construction flexibility, architectural freedom, and maximize the space for people. Our experienced engineers and other specialists will design and offer an optimal solution for your building. According to the construction process, the columns can be delivered as a complete product or, if desired, certain processes can be finished on site, such as concreting or painting.

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CONTENTS

1. Product properties

ATLANT® and ATLANT® Strong composite columns are manufactured from hollow steel sections provided with internal reinforcement, consisting of a circular, square, or rectangular rebar cage in the case of ATLANT® or a single steel core in the case of ATLANT® Strong (*Figure 1*). The columns are filled with concrete either at Peikko's factory or at the construction site. As the name implies ATLANT® Strong can achieve higher capacity than ATLANT® while also reducing the cross-section size.

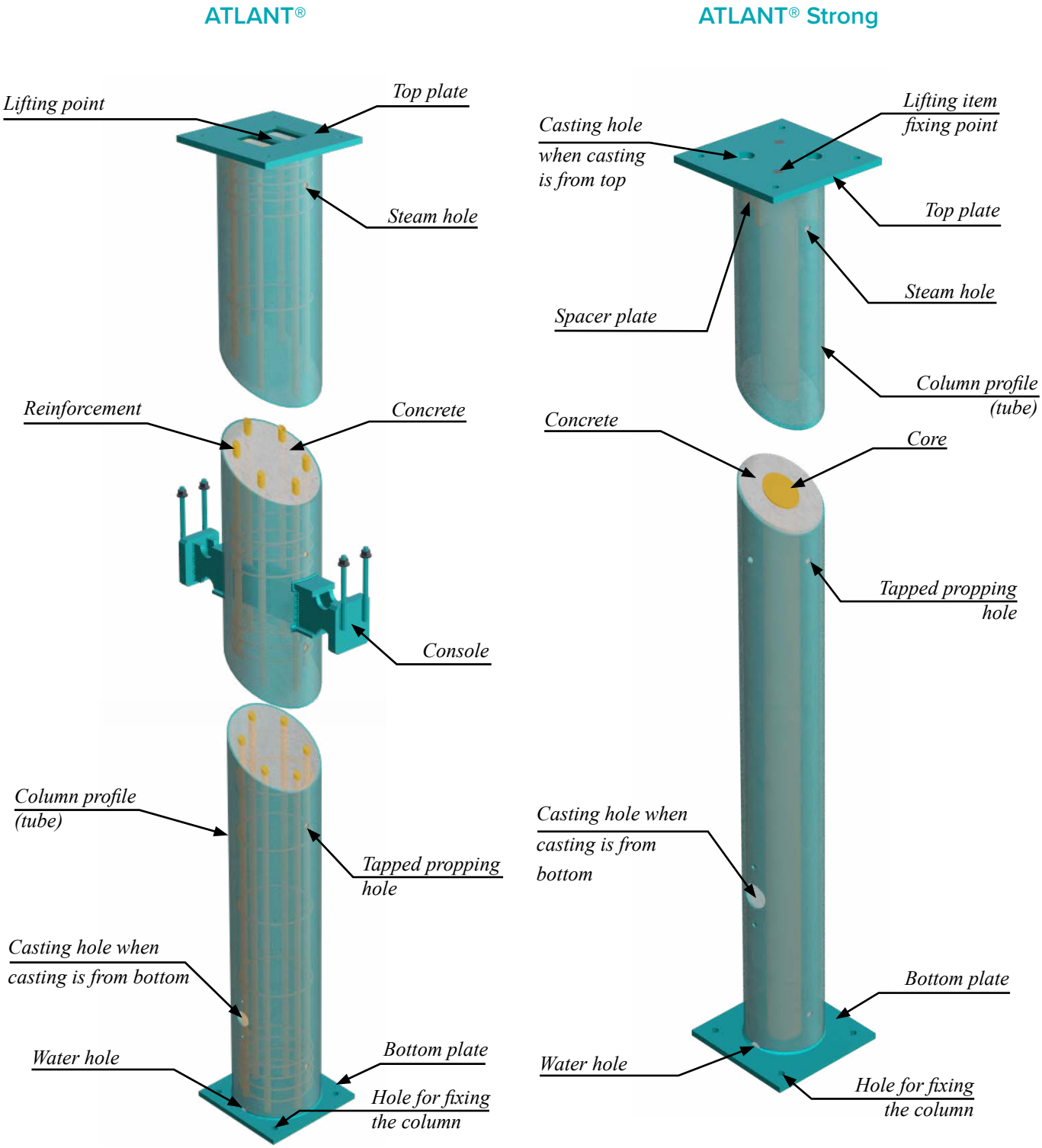
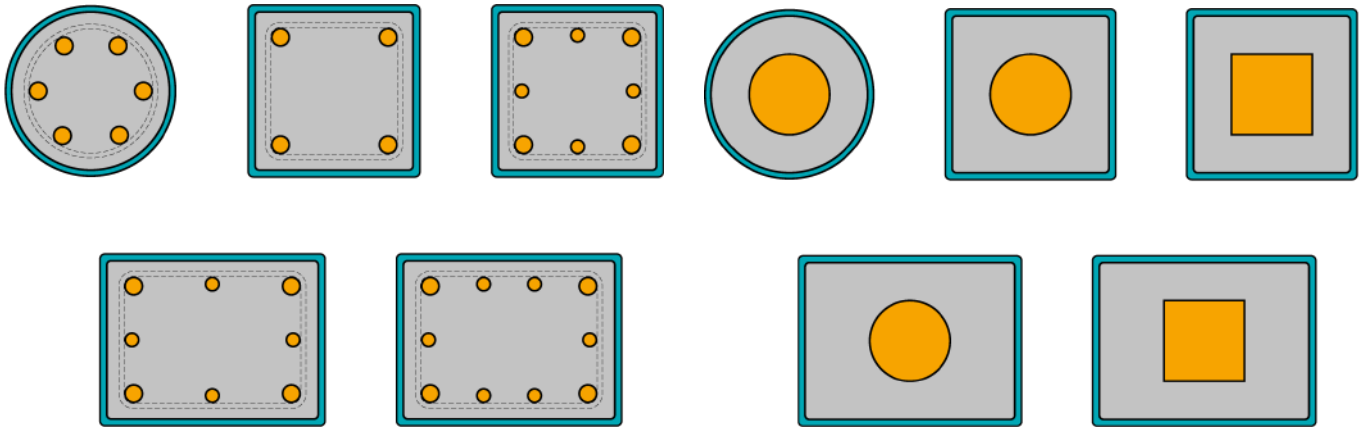


Figure 1. ATLANT® and ATLANT® Strong detail examples.

1.1 Standard ATLANT® Family cross-sections

The ATLANT® Family columns steel profile shapes can be circular, square, or rectangular depending on your project requirements. Joint components such as base plates and consoles are welded at the factory, the columns are ready to be assembled when they reach the construction site.

Cross section types



Standard cross section sizes

Circular	Square	Rectangular
152.0	150 × 150	200 × 150
159.0	160 × 160	250 × 150
168.3	180 × 180	260 × 180
177.8	200 × 200	300 × 150
193.7	220 × 220	300 × 200
219.1	250 × 250	400 × 200
244.5	260 × 260	400 × 300
273.0	300 × 300	500 × 200
323.9	350 × 350	500 × 300
355.6	400 × 400	600 × 400
406.4	500 × 500	
457.0		
508.0		
610.0		
711.0		

Note: Depending on project specifics and delivery terms, cross-section sizes that are not listed here may be available. Contact us for more information.

Standard cross section sizes

Circular	Square	Rectangular
101 .6	100 × 100	150 × 100
114.3	120 × 120	160 × 120
121.0	140 × 140	180 × 100
127.0	150 × 150	180 × 120
133.0	160 × 160	200 × 100
139.7	180 × 180	200 × 120
152.0	200 × 200	200 × 150
159.0	220 × 220	250 × 150
168.3	250 × 250	260 × 180
177.8	260 × 260	300 × 150
193.7	300 × 300	300 × 200
219.1	350 × 350	400 × 200
244.5	400 × 400	400 × 300
273.0	500 × 500	500 × 300
323.9		600 × 400
355.6		
406.4		
457.0		
508.0		
610.0		
711		

Figure 2. Selection of ATLANT® column cross-section types and sizes.

1.2 ATLANT® family columns with DELTABEAM® as a slim frame solution

ATLANT® Family columns work perfectly well with Peikko's DELTABEAM® composite beam forming a full composite slim frame solution (*Figure 3*), the advantage being that all the frame elements come from a single supplier, including all connection detailing, increasing speed of delivery and availability of technical support.

The JOINTS of the DELTABEAM® Frame consist of a standardized selection of:

- column-to-foundation joints
- column-to-column joints
- beam-to-column joints
- beam-to-beam joints

The ATLANT® Family columns can be offered as continuous or single-story solutions. For execution planning please contact Peikko's technical department.

A combination of ATLANT® and ATLANT® Strong can also be used in the same building, meaning you can have ATLANT® in one floor and transition to ATLANT® Strong in the next one while keeping the same cross-section dimensions.

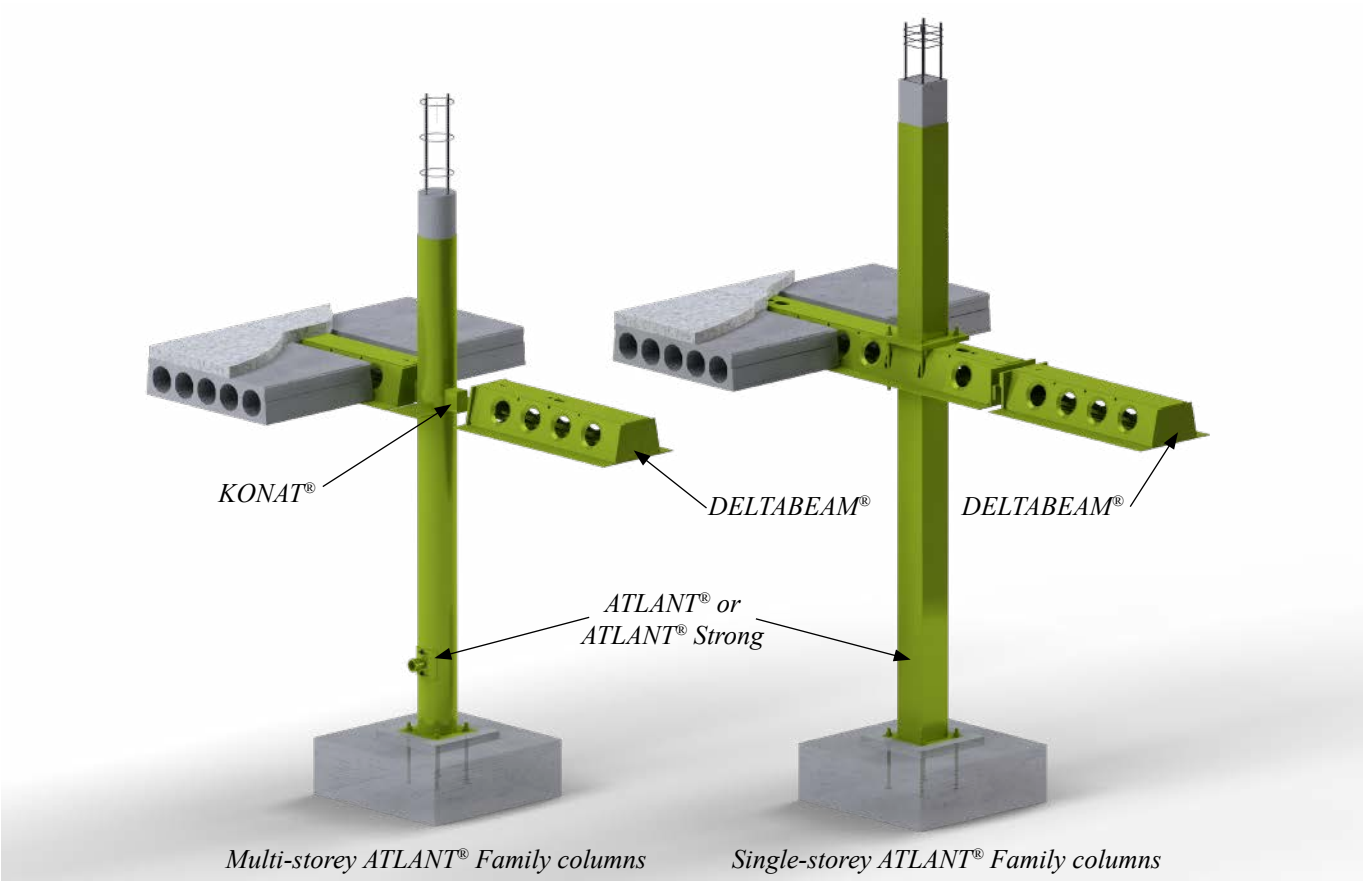


Figure 3. Peikko's DELTABEAM® Frame.

1.3 Wide range of possible uses and applications

ATLANT® Strong composite support with load hook and mandrel

- Welded load hook on the top plate.
- Quickly attach and detach the support from the crane.
- Save valuable crane time during assembly.

ATLANT® Strong composite support with load distribution plate

- Load distribution plate on the column head with increased load capacity.
- For introducing particularly high loads.

ATLANT® Strong composite support with load transmission

- The steel core of the column runs through the ceiling structure.
- Loads from floors above are transmitted through the ceiling.

ATLANT® Strong composite support with CUBO

- For high punching loads, e.g. with many floors in multi-story buildings
- CUBO and ATLANT® delivered combined as a system.

ATLANT® Strong composite column with PSB PLUS® punching shear reinforcement system

- Heavy-duty construction made of supports and slim ceilings.
- One of the most effective punching shear reinforcement systems.
- Low weight, high load capacities.

ATLANT® Strong composite column + DELTABEAM ® composite beam

- ATLANT® Strong composite column + DELTABEAM® composite beam.
- Perfectly coordinated prefabricated, standardized connections.
- Fire protection integrated.
- Easy transport and assembly thanks to its low weight.

Figure 4. Possible applicationsfor ATLANT® Family columns.

2. Structural behavior

ATLANT® Family columns behavior has been extensively tested with full-scale tests. Full-scale and small-scall tests have been compared with sophisticated finite element analysis (FEA) models. The design method has been calibrated based on these results.

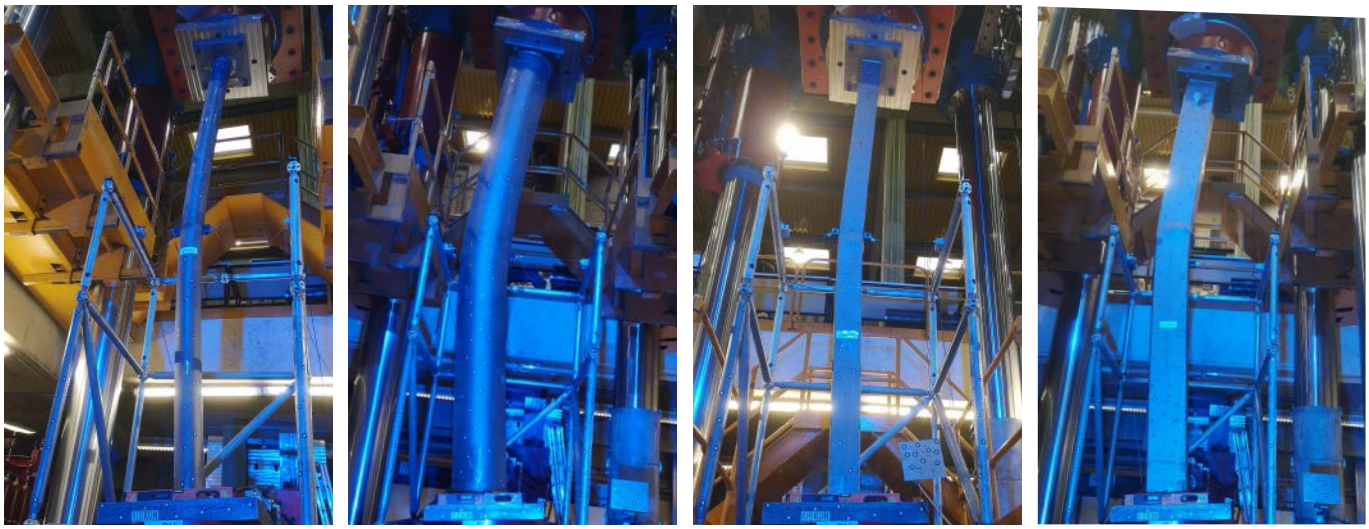


Figure 5. Full-scale tests in Ruhr University Bochum, Germany.

Small-scale tests have been also performed in other laboratories, production tolerances were measured, hinge resistance, columns with and without steel core, material resistance and dissasembly were assessed as well. All the test results were used to confirm the structural behaviour from the real tests matched the numerical models.

Figure 6. Small-scale tests.

2.1 Temporary conditions

The ATLANT® family composite columns can be arranged to be delivered to site with or without concrete infill, the concrete grouting can be carried out on site, in these cases the steel tube columns have a low dead weight, which has a favorable effect on the assembly and transport costs. The base end of the column may be fixed and adjusted with a bolted connection to Peikko's anchor bolts or to a column in the lower level.

Figure 7. Installing ATLANT® Family columns on site.

Prior to concreting, the ATLANT® Family columns behave as pure steel members and are designed to carry the loads acting during the erection stage. Resistance of a pure steel member is considerably lower than the composite member in final stage, but enough to carry the construction stage loads. After concrete filling and reaching its design strength, composite columns can have fire rating as high as R180, usually without additional fire protection.

ATLANT® Design for erection stage is done according to EN 1993-1-1 or EN 1994-1-1.

ATLANT® Strong design is different from regular ATLANT®. For erection stage the design is based on EN 1993-1-1 for steel sections or EN 1994-1-1 if Peikko's production units fill with concrete before delivery to site.

2.2 Final conditions

ATLANT® Design for final stage is done according to EN 1994-1-1 *Simplified method of design*. ATLANT® Strong design for final stage is done according to EN 1994-1-1 *General method of design*. Elastoplastic column behavior is considered.

All the tree parts of the columns (tube, concrete, and core or reinforcement) act together as a composite element to allow proper **load transfer**. Depending on the connection detailing and the loads acting upon the column, additional parts like endplates, steel corbels or shear connectors are designed based on EN 1993-1-1 and EN 1994-1-1.

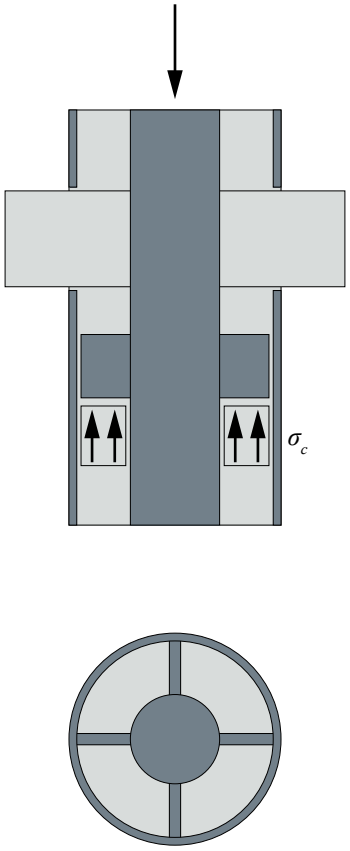


Figure 8. Spacer plates welded to the tube and core.

The **endplates and shear connectors** are verified during the design phase so that the imposed forces can be transferred to the column parts. Tensile stresses at the column ends are secured by the welds and designed according to EN 1993-1-1.

Horizontal shear forces are secured by welds with an effective weld length of $Lw = 2.d$ with d = column dimension in direction of the shear force x or y.

The **core joints are verified** in cases where two cores need to be joined, full penetration welding is not usually required. As with endplates any tension force must be secured by welding. Preparation of the contact surface is done according to EN 1090-2.

In case of dynamic, fatigue or seismic loads, individual design must be done.

2.3 Accidental Situation

Depending on the technical task, several accidental situations may be taken into account, such as design against progressive collapse, impact load and fire situation. The effective utilization of the steel and concrete components enable the ATLANT® composite columns to provide sufficient resistance during fire situations without additional fire proofing. This has been proven by real fire testing done in several columns with different dimensions and loading conditions and Finite Element Analysis as well.

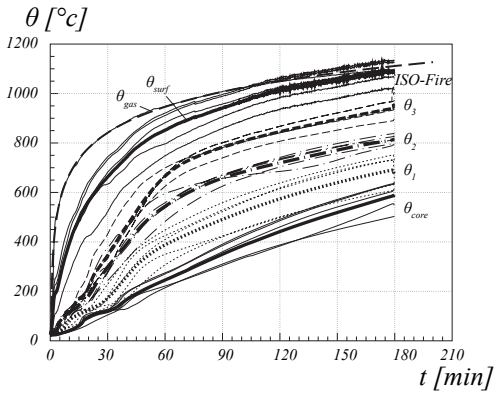


Figure 9. ATLANT® Strong fire tests, steel core protected by concrete.

Due to insulating effect of the concrete, part of concrete as well as the reinforcement and the core are in modest temperatures, and so both ATLANT® Family composite columns can withstand loads that are acting during the fire. Fire resistances as high as R180 can be achieved without additional fire protection.

For the fire situations both ATLANT® and ATLANT® Strong composite columns are designed according to EN 1994-1-2.

Simple or advanced calculation models according to EN 1994-1-2 are utilized for ATLANT® and ATLANT® Strong design respectively. The design models are calibrated with results of fire tests.

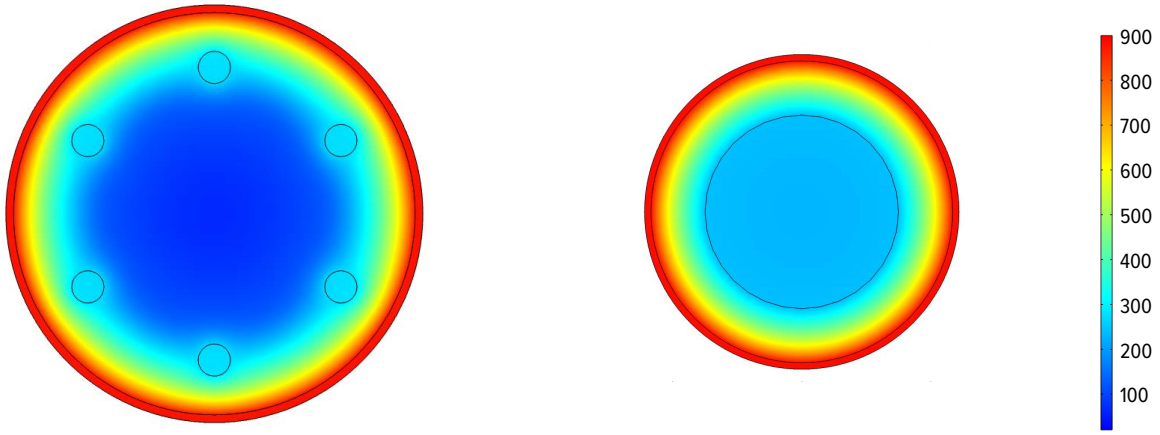


Figure 10. Temperature distribution of ATLANT® and ATLANT® Strong.

3. Materials

Materials used in the production of ATLANT® and ATLANT® Strong components follow the requirements provided in EN 1993, EN 1994, and other related standards, including local regulations of the country in which the construction of the building is executed. The steel tubes, plates, and cores are normally produced of S355 class steel, while other structural and 1.4301/1.4401/1.4571 stainless steels can be used in special cases (contact Peikko first).

The special case stainless steel possibility is possible. The commonly used rebars are produced of B500B or equivalent class steel. Strength and other parameters of the used concrete depend on project specifics and regulations of the country in which the columns are to be installed. In the case where columns are filled at Peikko, a self-compacting concrete is used.

Standard case materials:
Steel:

- S355 class steel for tubes
- S355 class steel for core
- S355 class for plates
- S355, S235 for lifting items (depending on country regulations)
- HDG and Stainless steel 1.4301/1.4401/1.4571 (contact Peikko first)
- Steel production (tolerances) according to EN 1090 (CE marked).

Concrete:

- Peikko concrete C45/55
- Self-compacting concrete
- Concrete production EN 206 or according to national standards
- Design according to Eurocodes.

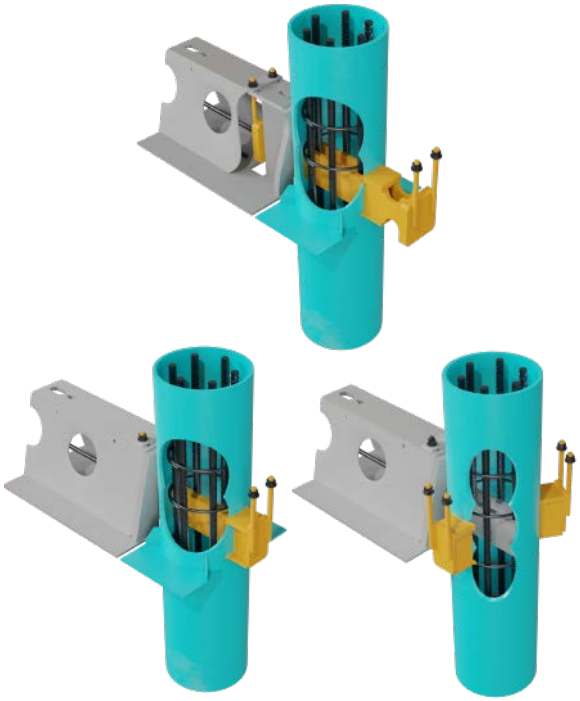
4. Compatibility with other Peikko solutions

Multiple Peikko products supplement ATLANT® Family composite columns, and together provide complete technical solutions. Such products are DELTABEAM® Composite Beams, KONAT™ Consoles, HPM® Rebar Anchor Bolts, PSB® Headed Anchors, CUBO Column Caps, BESISTA® Rod Systems, PETRA® Slab Hangers, THRELDA® Anchor Plates, SLADEX® Balcony Slab Connector and many more.

DELTABEAM® Composite Beams

HPM® Rebar Anchor Bolts

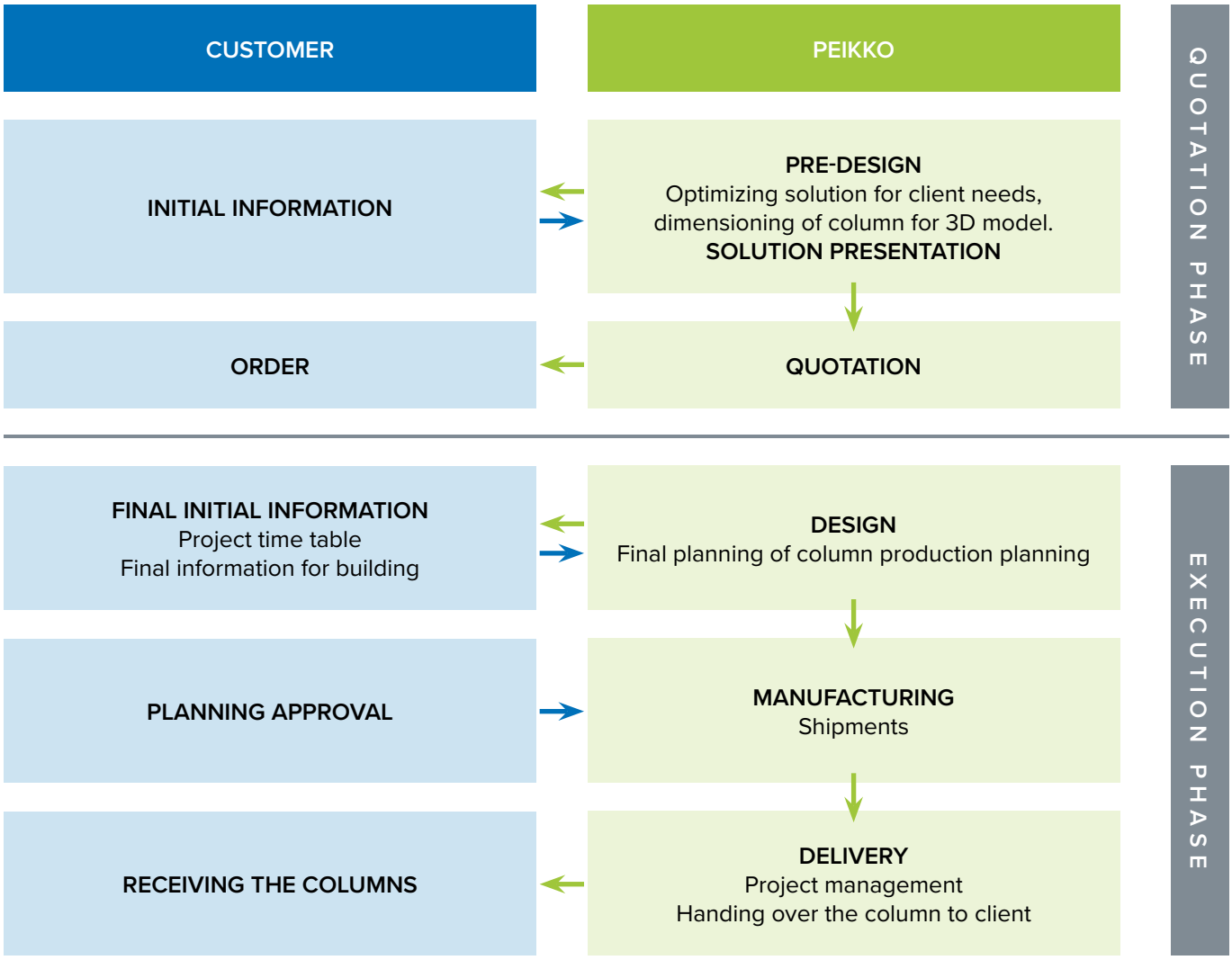
BESISTA® Rod Systems



KONAT™ Consoles

SLADEX® Balcony Slab Connector

Annex A – Design phase and delivery to site process



Installation of ATLANT® Family columns

On site, the ATLANT® family columns are easily handled, positioned, and fixed to the designed position according to Peikko provided installation instructions. When the columns are ordered without concrete, concreting on site is possible by pumping the columns from the bottom or filling it from top.

Fixing ATLANT® Family column on site with HPM® Anchor Bolts.

Temporary ATLANT® propping on site.

Concrete pumping on site from the bottom.

Checklist for casted on site columns:

1. Before concreting

- ☐ Ensure that the column is free of dirt and water/ice (abrasive after cleaning).
- ☐ Ensure that the column is installed in correct and vertical position.
- ☐ Ensure that the steam holes are closed with plastic plug.
- ☐ Ensure that there's a large enough opening at the top of the column to control the filling (discuss in advance during planning phase).
- ☐ Ensure that the propping (if required) is intact.
- ☐ Ensure that the ordered concrete (grade, aggregate size, consistency) fulfills the planned requirements
- ☐ With pumping from the bottom method ensure that the suitable hose input joint is available and it fits to the column and to the concreting hose.
- ☐ Have a shaft or form vibrator ready for compacting (if not using self-compacting concrete).

Figure 11. ATLANT® on site.

2. Receiving the concrete

- ☐ Self-compacting concrete: verify the consistency and temperature of each batch.
- ☐ Regular concrete: check each batch visually.
- ☐ Air-entrained concrete: measure the air content of concrete of each batch.

3. Concreting - Pumping from the bottom

- ☐ Align the pump hose avoiding sharp bends and steep climbs.
- ☐ Before concreting, pump the possible inadequate concrete to concrete waste dump.
- ☐ Attach the hose to the input joint.
- ☐ Start filling the column (recommended filling speed is 1 m/min).
- ☐ If the filling is blocked and the concrete pressure starts to raise do not try to open the blockage by increasing the pump pressure.
- ☐ When the concrete level reaches the top of the column continue pumping as long there is segregated concrete coming out.
- ☐ Take extra care by vibrating the last 1.5 m from the top of the column.
- ☐ Close the hose input joint by sliding the joint.
- ☐ Remove the concreting hose and connect it to the next column.
- ☐ Wipe off the external concrete splatters from column.
- ☐ After 30 minutes from the end of concreting check the level of concrete at the top of the column.
- ☐ If the concrete level has dropped top up the column with additional concrete and vibrate the top section as long as there is air bubbles coming up.
  NOTE: With self-compacting concrete, vibrate according to the guidance given by the concrete supplier. Optionally the top end can be filled by grouting. (If using self-compacting concrete no additional vibrating is required).
- ☐ When the concrete has hardened enough remove the input joint.

Figure 12. Concreting from bottom, revision of proper filling must be done at top end.

4. Concreting - Filling from the top

- ☐ Align the pump hose avoiding sharp bends and steep climbs.
- ☐ Before concreting, pump the possible inadequate concrete to concrete waste dump.
- ☐ Lower the vibrator to bottom of the column.
- ☐ Start filling the column (recommended filling speed is 1 m/min).
- ☐ Take extra care by vibrating the last 1.5 m from the top of the column.
- ☐ Wipe off the external concrete splatters from column.
- ☐ After 30 minutes from the end of concreting check the level of concrete at the top of the column.
- ☐ If the concrete level has dropped top up the column with additional concrete and vibrate the top section as long as there is air bubbles coming up.

5. Concreting in cold temperatures

When the air temperature is below +5 °C during the casting or two days after, cold weather concreting plan has to be prepared. Precautions should be taken when daily average temperatures remain below +10 °C. Use of rapid strength concrete is recommended. Also the use of higher strength concrete, cold weather concrete or hot concrete may be considered. Columns can be equipped with internal heating cables.

- ☐ Remove all snow and ice which may be built inside the column.
- ☐ Ensure that the heating cables are intact (if applicable).
- ☐ Wrap the column in insulation material.
- ☐ Follow and record the temperature development during the hardening process.

Installation of columns cast with concrete in the factory:

Preparation:

- ☐ Ensure the construction site is prepared for column installation, including clearing debris and verifying the foundation's readiness.

Transportation and Handling:

- ☐ Carefully transport the precast columns to the installation site using appropriate lifting equipment and secure them in place to prevent damage.

Placement:

- ☐ Position the precast columns onto their designated foundation points, ensuring proper alignment and orientation according to the project plans.

Anchoring:

- ☐ Securely anchor the precast columns to the foundation using approved methods such as anchor bolts or grout, following engineering specifications.
- ☐ Place and properly fix temporary props, if applicable.

Connection (if applicable):

- ☐ If required, connect adjacent columns using approved methods such as welding or bolting as per engineering specifications.

Inspection:

- ☐ Conduct a thorough inspection of the installed columns to verify compliance with project standards and specifications.

Documentation:

- ☐ Document the installation process, including photographs, measurements, and any deviations from the original plan, for future reference and quality assurance purposes.

NOTES

Revisions

Version: PEIKKO GROUP 05/2024. Revision: 001

- First publication

Resources

DESIGN TOOLS

Use our powerful software every day to make your work faster, easier, and more reliable. Peikko design tools include design software, 3D components for modeling programs, installation instructions, technical manuals, and product approvals of Peikko's products.

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TECHNICAL SUPPORT

Our technical support teams around the world are available to assist you with all of your questions regarding design, installation etc.

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APPROVALS

Approvals, certificates, and documents related to CE-marking (DoP, DoC) can be found on our websites under each products' product page.

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EPDS AND MANAGEMENT SYSTEM CERTIFICATES

Environmental Product Declarations and management system certificates can be found at the quality section of our websites.

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