A-BEAM W®

Erection Manual

Version 11/2021

CE

A-BEAM W®

A-BEAM® is a concrete-filled steel beam developed by Anstar Oy for placement inside a floor system. Thanks to a powerful composite effect, long span lengths and modifiable space solutions can be achieved affordably. In addition to hollow-core slabs, the beam can also be used for supporting thin-shell slabs, composite slabs and cast-in-place concrete slabs. The composite structures can be designed up to fire resistance class R120 without any additional protection on the site.

Saving space
Located inside the intermediate floor, the beam places no limitations on the use of space in the building.

Load-bearing capacity
The steel box beam and concrete produce a powerful composite effect, allowing for long span lengths.

Moisture control
The composite beam can be equipped with heating cables for quicker removal of moisture from inside the beam.

Connection technology
Anstar's experience as a professional in connections and fastenings ensures that the beam connections are quick to install and durable.

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Revision G. 26 Nowember 2021

The W beam structure and beam selection have been redesigned.
The standard beam range has also been expanded to composite column frames.
The beam's application range has been extended to thin-shell slab structures.
The connection range has been supplemented and renewed.

Revision F. 31 May 2018

Minor corrections to the text. English version published.

Revision E. 26 June 2017

The user manual has been rewritten.
The design instructions have been separated into their own manual.
The name of the old A-Beam has been changed. The new name is A-BEAM W.
A new A-Beam type has also been developed: A-BEAM S. Separate design and erection manuals have been prepared for the beam.
The beam's product approval has been changed. The new product approval is CE marking according to EN 1090-1.
The design instructions for the beam have been updated.
The quick desing software for the beam has been updated.
The new software version, ABeam 4.7, was published on 31 May 2018.

1 A-BEAM W

The W beam is designed as a load-bearing structure for intermediate floors and roofs. The beam is used with hollow-core slabs in structures where a flat beam frees the space beneath the slab for building services. The W beam has also been developed into a new application for continuous thin-shell slab floor structures. The W beam is a sister product to the Anstar S beam.

The W beam is particularly well suited to winter construction as the beam housing is already filled with concrete at the machine shop, thus eliminating the need for difficult winter pouring. Concrete grouting of the housing at the machine shop can be done more reliably and economically than in winter conditions at the site.

In the W beam, the concrete dries and water evaporates from inside the beam in a favourable direction, i.e. through the grouting openings of the upper flange, and drying already begins in the machine shop immediately after the casting. The beam is erected when the concrete of the housing reaches sufficient strength and dryness level. This speeds up the construction process, as there is no need to wait for the concrete in the housing to dry on site. Construction of the floor surface structures can be started earlier, and no excess moisture is left inside the beam.

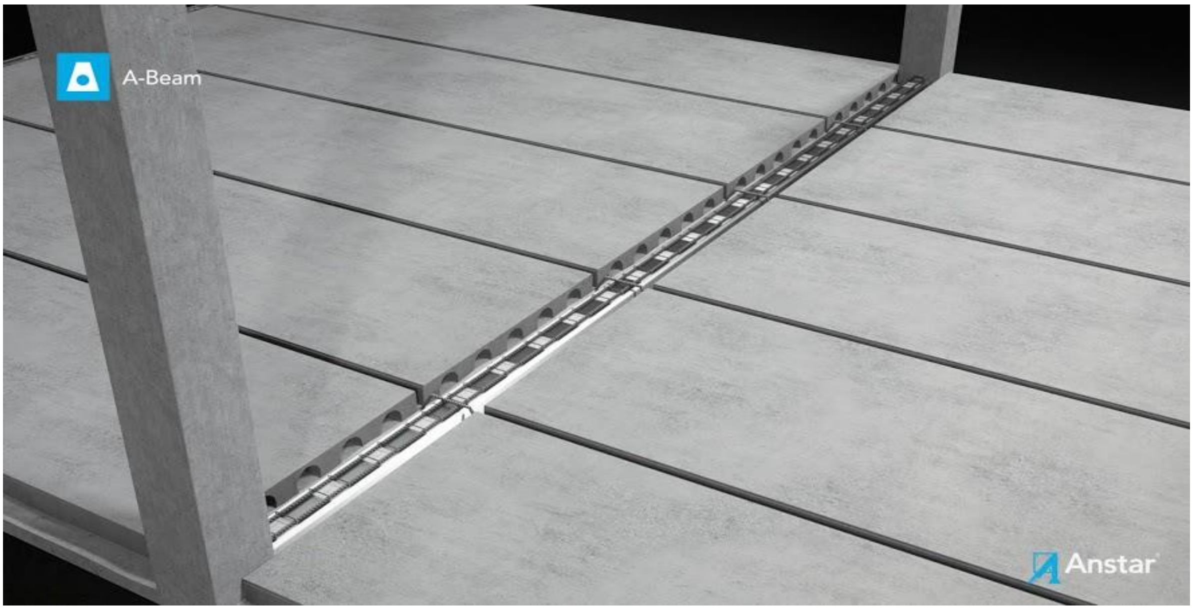


Figure 1. A-BEAM W composite beam on a concrete element frame

1.1 Standards to be followed in erection work

General	The W beam is CE-marked according to EN 1090-1, with CE marking certificate 0416-CRP-7247-03. Erection work is carried out according to the following standards:
SFS-EN 1090-1	Execution of steel structures. Part 1: Requirements for conformity assessment of structural components.[1]
SFS-EN 1090-2:2018	Execution of steel structures. Part 2: Technical requirements for steel structures. Execution classes EXC2 and EXC3. [2]
SFS-EN 13670	Execution of concrete structures. Execution class 2 or 3. [17]
SFS-EN 13225	Precast concrete products. Beams and columns. [18]
SFS-EN 13369	Common rules for precast concrete products. [19]
SFS-EN ISO 5817	Welding. Fusion-welded joints in steel, nickel, titanium and their alloys. Weld classes. [11]
SFS-EN 17760-1	Welding. Welding of reinforcing steel. Part 1: Load-bearing welded joints. [16]
SFS-EN 1992-1	Design of concrete structures. General rules and rules for buildings. [6]
SFS-EN 1993-1-1	Design of steel structures. General rules and rules for buildings. [8]

1. Reference standards	- The erection also follows the reference standards (SFS-EN ISO) specified in SFS-EN 1090-2:2018 for material acquisitions, work performance, welding, surface treatment and inspections.
2. Execution class	- The execution class (EXC) determines the level of quality inspection for the erection. The execution class is indicated in the erection drawings. - For the traceability of steel materials, screws and other products, it is enough to have a CE certificate according to the product approval in execution class EXC2 and EXC3. - Full traceability is not required unless the project specifically requires this. - Hollow-core slabs are erected according to SFS-EN 13670.

1.2 Structural plans to be followed in erection work

1. General	- The frame erection contractor prepares a project-specific installation plan for the frame in accordance with SFS-EN 1090-2:2018 and SFS-EN 13670. - This W beam erection manual is intended as a complement to the contractor's erection plan. - The following plans and instructions prepared for the project are followed in the erection work:
2. Implementation breakdown Quality plan	- Concrete and steel structure implementation breakdowns prepared for the project. - Quality inspection plan prepared for the project and site.
3. Drawings	- Erection drawings prepared by the frame designer with beam codes. - Structure sections and erection details prepared by the frame designer. - Beam erection details. - Beam manufacturing drawings.
4. Design and erection instructions for products	- A-BEAM W design instructions [23] - Project-specific erection instructions - AEP Bracket User Manual [20] - AEL Bracket User Manual [22]

2 DELIVERY OF THE BEAMS

2.1 CE marking and identification

1. General	- Each beam is equipped with the product approval CE marking according to EN 1090-1. - In addition, each beam has an identification code and an indication of the direction of erection. Figure 2.
2. Beam identification	see figure below

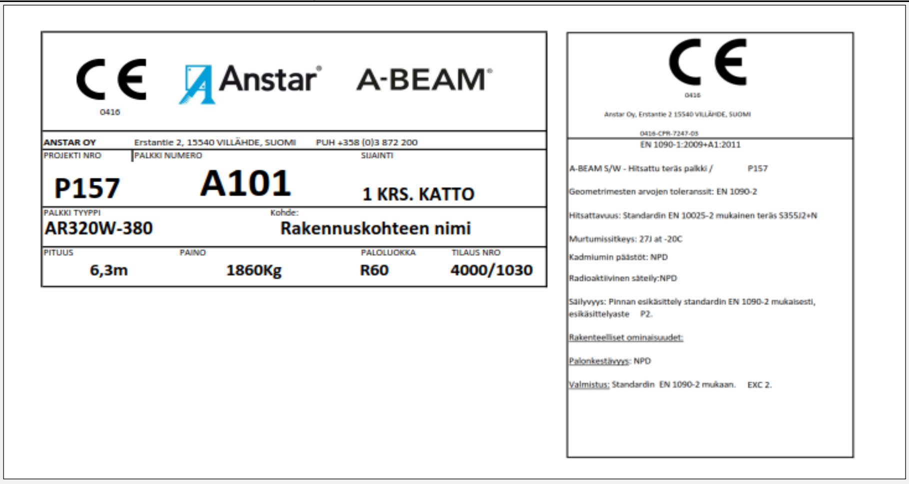
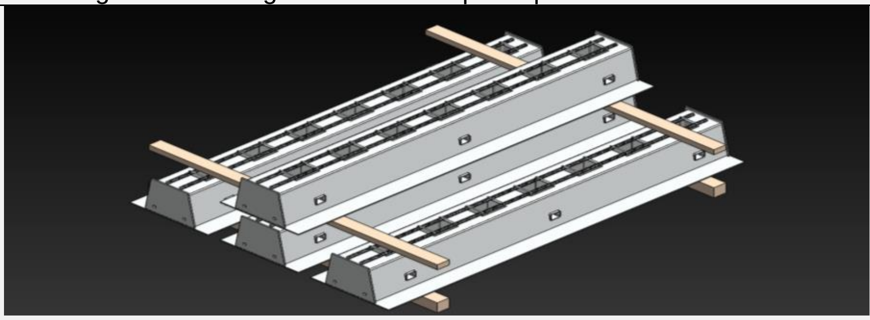
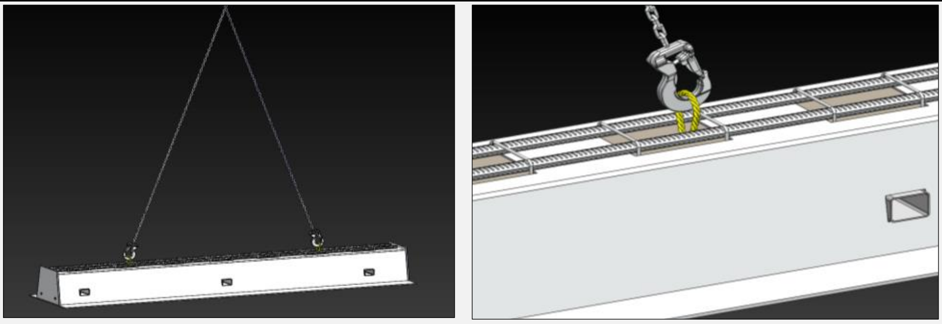


Figure 2. CE marking and beam identifying information

2.2 Delivery and storage of the beams

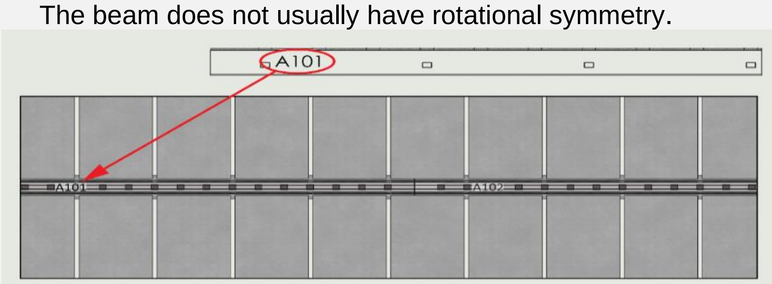
1. Delivery	- Beams are delivered to the site loaded in the vehicle in the order of erection. - However, long beams are always loaded lowermost. - Erection is performed directly from the vehicle, so intermediate storage is not necessary.
2. Storage	- If necessary, the beams can be stored on the site by placing them on wooden supports on a level surface. - Longer-term storage on the site requires protection from rain.
3. Principle	 Figure 3. Transport support and storage on the site

2.3 Lifting and moving the beams

1. Lifting point	- Lifting lugs have been cast on the top surface of the beam and can be used for lifting with slings. - The maximum allowable lifting angle of the slings must be taken into account when lifting. Use CE-marked or type-approved lifting equipment only. - Pieces of rebar welded to the upper flange must not be used for lifting or moving the beam.
2. Lifting	 Figure 4. Lifting points in the upper flange and lifting.

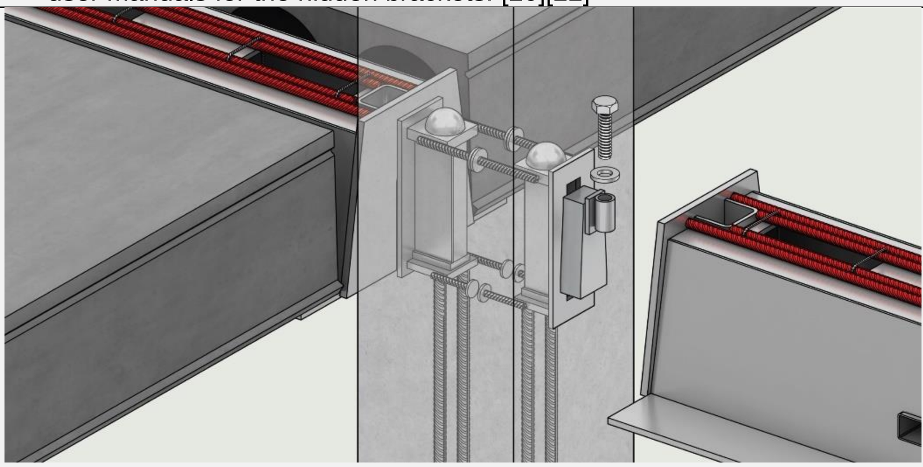
3 ERECTING THE BEAMS

3.1 Erection order and stability

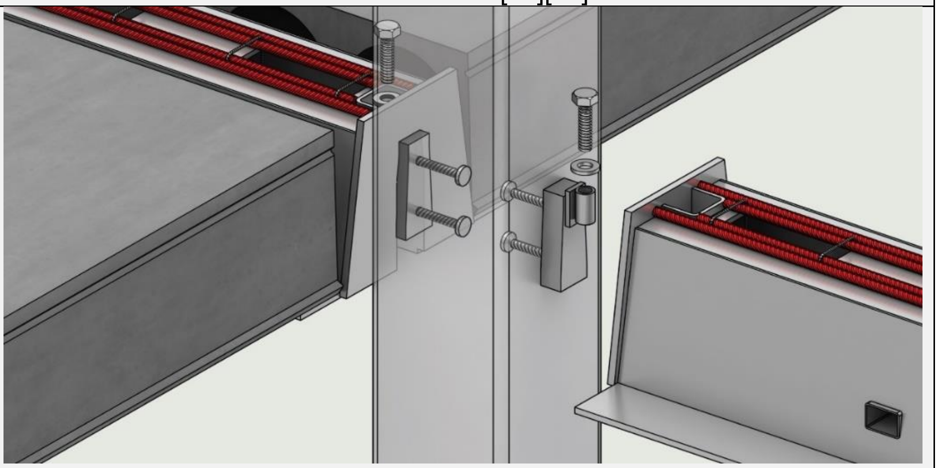
1. Erection readiness	- Before erection, it must be ensured that the column structures are ready according to the erection plan and the necessary connection pieces are in accordance with the plans.
2. Erection order	- The beams are erected such that the code at the left end of the beam can be read in the same direction as the code in the erection drawing. The beam does not usually have rotational symmetry.  Figure 5. Beam code and direction of erection

3.2 Installing the connection

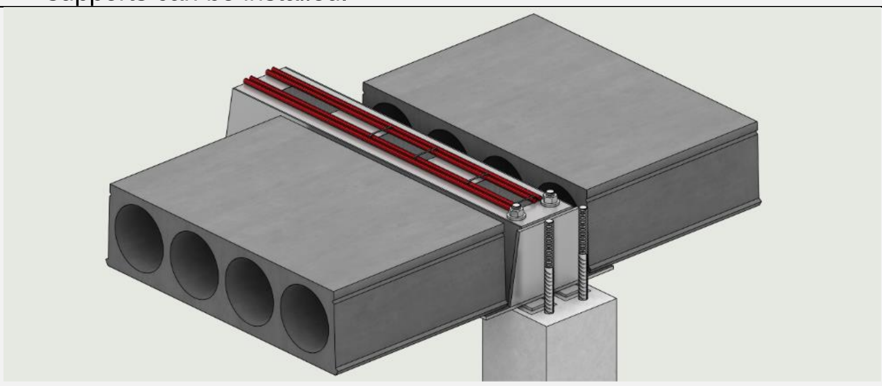
3.2.1 AEP-C hidden bracket to a concrete column

1. General	The W beam's standard hidden bracket for concrete columns and walls is AEP-C. - The resistance values and design instructions for the brackets are provided in the user manual for AEP-C hidden brackets. (*The new user manual will be published at the end of 2021 and, until then, the old AEP bracket will be in use.*) **Virhe. Viitteen lähdettä ei löytynyt.** - The bracket provides a torsionally stiff joint for the W beam and a swivel joint for the bending moment to the concrete column surface. - The AEP hidden bracket is designed for the R120 fire resistance class and for the W beam's ultimate limit and accident limit states.
2. Placement of the bracket	- The bracket is placed on the side of a concrete column such that the connection is usually centred on the column. - The elevation of the AEP-C bracket's column component's bottom surface is determined by the bottom surface of the hollow-core slab (= top surface of the lower flange). For more information, refer to the user manual for the AEP bracket. - The structure of the bracket's tongue part is suitable for both concrete and composite beams.
3. Design of the bracket	- Anstar provides instructions for the placement of the connection and for the design of the supplementary reinforcement for the column. - The choice of bracket size is the responsibility of the main structural designer. - Anstar delivers the final design loads (Vd, Td) for the connection's erection and ultimate limit states.
4. Delivery of the bracket	- Anstar manufactures the AEP-C brackets and delivers their column and tongue components to the prefabrication factory that manufactures the column. - All the required bracket connection pieces are manufactured for the W beam.
5. Erecting the beam on the bracket	- Lift the beam on top of the tongue of the hidden bracket and lower it onto the bracket using the slot in the beam end plate. - Adjust the theoretical clearance between the end plate and the column, 20 mm, such that it is the same at both ends. - Lock the AEP connection into place using the locking screw of the bracket's tongue part. - The screw joint locks the connection into place, after which the erection supports can be installed. - More specific instructions for installing the connection are provided in the user manuals for the hidden brackets. [20][22]
6. Principle drawing of the connection	 Figure 6. AEP bracket connection to a concrete column

3.2.2 AEL-C hidden bracket to a concrete column

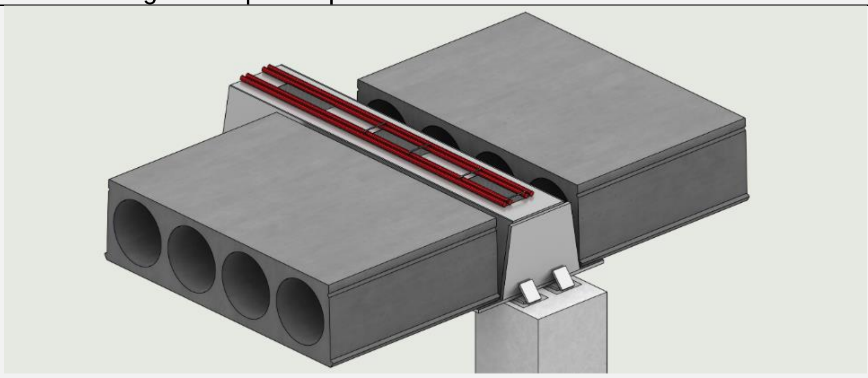
1. General	The W beam's standard hidden bracket for composite and steel columns is AEL-C. - The resistance values and more detailed design instructions for the brackets are provided in the user manual for AEL-C hidden brackets. (The *new user manual will be published at the end of 2021 and, until then, the old AEL bracket will be in use.*)**Virhe. Viitteen lähdettä ei löytynyt.** - The bracket provides a torsionally stiff joint for the W beam and a swivel joint for the bending moment to the composite column surface. - The AEL-C hidden bracket is designed for the R120 fire resistance class and for the W beam's ultimate limit and accident limit states.
2. Placement of the bracket	- The bracket is placed on the side of the composite column's steel tube such that the connection is usually centred on the composite column. - The elevation of the AEL-C bracket's column component's bottom surface is determined by the bottom surface of the hollow-core slab (= top surface of the lower flange). For more information, refer to the user manual for the AEL-C hidden bracket. - The structure of the bracket's tongue part is suitable for both a composite beam and the concrete beam's AEP-C bracket, allowing for free selection of the beam and column material.
3. Design of the bracket	- Anstar provides instructions for the placement of the connection and for the design of the weld fastening for the column. - The choice of bracket size is the responsibility of the main structural designer. - Anstar delivers the final design loads (Vd, Td) for the connection's erection and ultimate limit states.
4. Delivery of the bracket	- Anstar Oy manufactures the AEL-C bracket's column component and delivers it to the machine shop that manufactures the composite column, where the bracket is welded to the surface of the composite column. - The parts needed for the connection are manufactured for the W beam.
5. Erecting the beam on the bracket	- Lift the beam on top of the tongue of the hidden bracket and lower it onto the bracket using the slot in the beam end plate. - Adjust the theoretical clearance between the end plate and the column, 10 mm, such that it is the same at both ends. - Lock the AEL connection into place using the locking screw of the bracket's tongue. - The screw locks the connection into place, after which the erection supports can be installed. - More specific instructions for installing the connection are provided in the user manuals for the hidden brackets. [20][22]
6. Principle drawing of the connection	 Figure 7. AEL-C bracket connection to composite column

3.2.3 Bolt connection on top of a column or wall

1. General	The W beam's bolt connection on top of a column is made using AHP bolts [25] going through the beam and elevation parts. - The connection can be implemented with one or two bolts. - Only a two-bolt connection transfers the beam's torsion during the erection stage.
2. Bolt connection on top of a beam/wall	- The W beam can be connected on top of a column or wall using two AHP rebar bolts. - The location of the connection's vertical support reaction and the beam height are adjusted by placing a steel fitting plate on top of the mounting plate on the column. - The vertical support reaction of the beam is transferred from the end plate through the fitting plates to the mounting plate and then to the column. - The tensile force due to the torsional moment from the beam is transferred through the bolts to the column. - In an accident limit state, the horizontal shear force of the connection is transferred through the bolts' edge compression to the column. Alternatively, the beam can be welded to the mounting plate through the fitting piece.
3. Designing a connection	- The main structural designer designs the connection and all connection pieces in the column. - Anstar delivers the final design loads (Vd, Td) for the connection's erection and ultimate limit states.
4. Delivery of connection pieces	- Anstar delivers only the connection pieces that are integral to the beam. - The bolts for the column are part of the column delivery. - The fitting plates for the connection are part of the site acquisitions.
5. Erecting a beam on top of a column	- Check the height position of the connection and, if necessary, place fitting pieces of suitable thickness at the end of the column at a suitable height. - Lift the beam above the anchor bolts in the column and lower it such that the bolts go into the bolt holes at the end of the beam. - Lock the connection into place using the nuts. - The screws lock the connection into place, after which the erection supports can be installed.
6. Principle drawing of the connection	 Figure 8. Two-bolt connection of the W beam on top of a column or wall

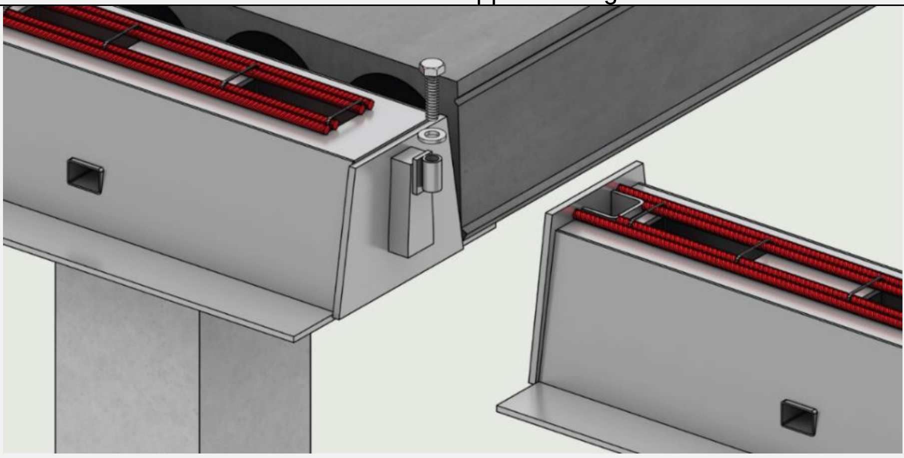
3.2.4 Welded connection on top of a column

1. General	A welded connection for the W beam on top of a column or wall can be made by welding its end plate to a mounting plate at the end of the column using mounting pieces. - The connection can be implemented with one or two mounting pieces. - The connection cannot transfer the torsional moment during the erection stage.
2. Mounting plate connection on top of a	- The location of the connection's vertical support reaction and the beam height are adjusted by welding two steel fitting plates on top of the mounting plate on the column. - The vertical support reaction of the beam is transferred through the

beam/wall	end plate to the mounting plate and then to the column. - The tensile force from the beam's torsional moment must be transferred by means of the erection supports.
3. Designing a connection	- The main structural designer designs the connection and all connection pieces in the column. - Anstar delivers the final design loads (Vd, Td) for the connection's erection and ultimate limit states.
4. Delivery of connection pieces	- Anstar delivers only the connection pieces that are integral to the beam. - The mounting plates for the column are part of the column delivery. - The fitting and welding plates for the connection are part of the site acquisitions.
5. Erecting a beam on top of a column	- Check the height position of the connection and, if necessary, place adjusting pieces at the end of the column at a suitable height. - Lift the beam above the column and lower it onto the mounting plate/adjusting pieces at the end of the beam. - The welding locks the connection into place, after which the erection supports can be installed. - Welding is carried out according to SFS-EN 1090-2:2018 in the execution class specified in the plans. - The welds are inspected in accordance with the quality inspection plan for the site before erecting the hollow-core slabs. - Welded connections must also be protected against corrosion according to a separate plan.
6. Principle drawing of the connection	 Figure 9. Welded connection of the W beam to a mounting plate on top of a column

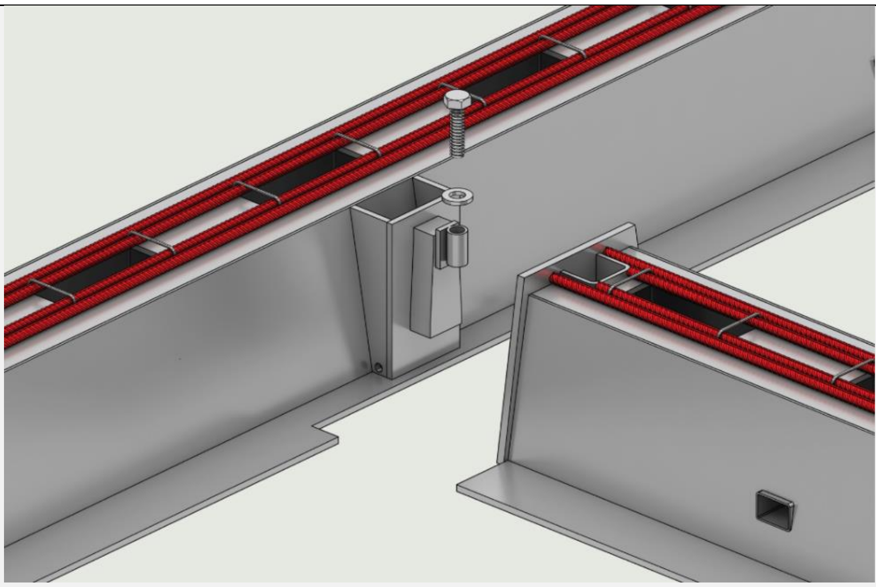
3.2.5 Beam coupler connection in the field

1. General	The W beam can be designed as a continuous structure going over the column in the roof, meaning that the coupler connection of the beam is located in the field at the origin of the bending moment. - The beam is designed as continuous. The coupler connection transfers the beam's shear force, torsional moment and longitudinal force. - The connection does not transfer the beam end's bending moment.
2. Beam coupler connection in the field	- The connection is made as a special application with the AEL hidden bracket. - The connection components come only about 10 mm outside the adjoining beam's web surface, with 10 mm of connection clearance. - The connection is torsionally stiff during erection, so erection support at the end of the beam is not necessary. - The connection is locked against vertical movement with one connection screw.
3. Designing a connection	- Anstar selects the size of the connection and designs all the necessary connection pieces.
4. Delivery of the connection	- Anstar manufactures and delivers all the necessary connection and mounting components fastened to the beams.
5. Coupling a beam	- Lift the beam on top of the hidden bracket on the beam protruding from the column and lower it onto the bracket using the slot in the beam end

	plate. - Adjust the theoretical clearance between the beam end plates, 10 mm, such that it is the same at both ends. - Lock the AEL connection into place using the locking screw of the bracket's tongue. - The screw locks the connection into place, after which the erection supports can be installed. - More specific instructions for installing the connection are provided in the user manuals for the hidden brackets. [20][22]
6. Installing the connection	- Remove the mounting screw provided with the connection (Figure 11). - Lower the beam to the bracket at the opening of the end plate. - Make the clearances of the beam end plates equal. - Lock the connection into place with a screw. - The connection withstands the torsion of the beam during erection, so the beam does not need torsional support during erection.
7. Principle drawing of the connection	 Figure 10. W beam coupler connection in the field. Gerber coupler.

3.2.6 Connecting a secondary beam to the side of the W beam

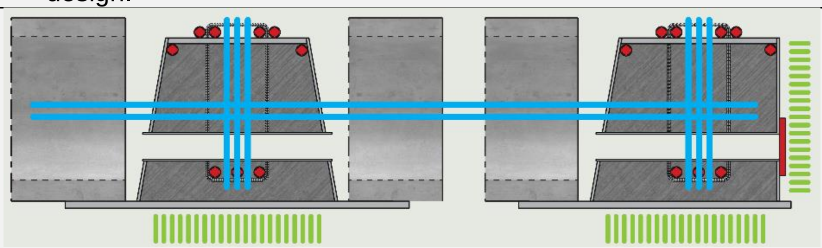
1. General	When the load-bearing direction of a hollow-core slab changes in the adjacent slab field, a secondary beam is connected to the side of another W beam. - The adjoining beams can also be S and W beams and also with elevation parts.
2. Secondary beam connection to a primary beam	- A secondary W beam is designed as a single-span structure, and the connection transfers the beam's shear force, torsional moment and longitudinal force. - The connection does not transfer the beam end's bending moment.
3. Designing a connection	- The connection is made as a special application with the AEL hidden bracket. - The connection components come only about 10 mm outside the adjoining beam's web surface, with 10 mm of connection clearance. - The connection is torsionally stiff during erection, so erection support at the end of the beam is not necessary. - The connection is locked permanently in all directions with one connection screw.
4. Delivery of the connection	- Anstar designs and delivers all the necessary connection pieces fastened to the beams.
5. Installing the connection	- Lift the secondary beam above the bracket on the primary beam and lower it into the slot in the beam end plate. - Adjust the theoretical clearance between the beam end plates, 10 mm, such that it is the same at both ends. - Lock the AEL connection into place using the locking screw of the bracket's tongue. - More specific instructions for installing the connection are provided in the user manuals for the hidden brackets. [20][22]

6. *Principle drawing of the connection*	 Figure 11. Connecting a secondary beam to the side of a primary beam

3.2.7 Edge beam formwork

The aim is always to prefabricate the edge formwork of the floor at the machine shop. The formwork can be welded onto the beam in advance and lifted into place with the beam. Edge formwork information must be delivered to the beam design unit early enough.

3.2.8 Additional fastenings to the beam on the site

1. *Beam lead-throughs*	- Small lead-throughs can be made in the blue areas of Figure 12. - However, the information must be delivered to the beam design unit in advance.
2. *Fastenings to the beam*	- Additional fastenings can be made to the beam on the site for installations required by building services. - Fastenings can be made to the bottom surface of the lower flange as well as to the vertical web (green hatched area). - However, heavy equipment suspensions must be designed separately to provide the beam with safe fastening points. - Weld fastenings must be checked and protected against corrosion according to SFS-EN 1090-2:2018.
3. *Handrail fastening*	- On edge beam lines, fasteners can be made on the beams for temporary handrails. - However, information about this must be delivered to detail design.
4. *Allowable fastening areas*	 Figure 12. Allowable fastening areas of the beam

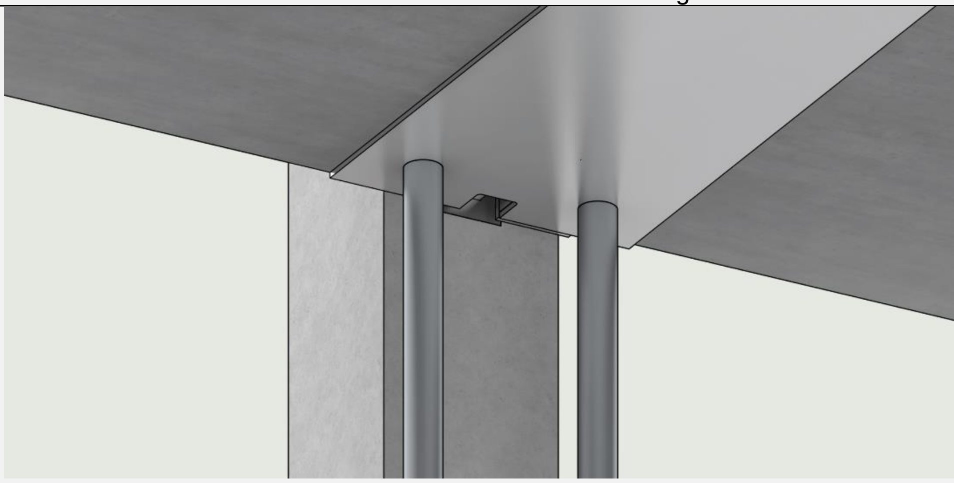
3.3 Erection supports for the W beam

1. Support planning

1. *Purpose of the supports*	**The purpose of the erection supports is as follows:** - The supports prevent deflection of the beam caused by loads during the erection stage. The pre-camber is used entirely for

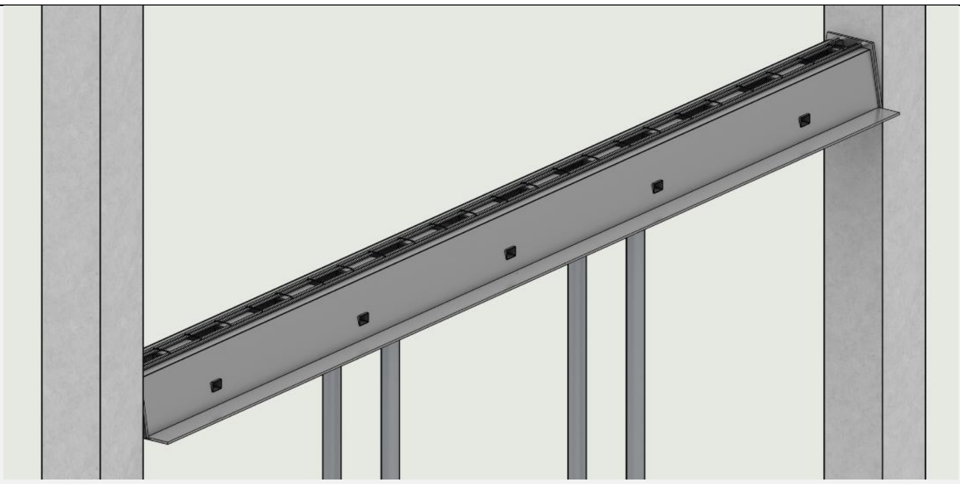
	payloads. - The supports eliminate the torsional moment to the connection at the end of the beam. - The supports eliminate the torsion of the slender beam created by the connection clearance and the torsion of the beam under an asymmetric load. - Two different methods of support can be used as appropriate.
2. Methods of support	**Method 1.** *<u>Erection supports at the end of the beam</u>.* - Erection supports (2 pcs) are placed at the end of the beam at a distance of approx. 100 mm from the connection, and the supports are mounted under both webs of the beam. Figure 13. - The supports eliminate the torsional moment to the connection at the end of the beam. - The supports also eliminate the torsion of the end of the beam created by the connection clearance and the torsion of the beam under an asymmetric load. - The support method does not affect the deflection of the beam during erection. **Method 2.** *<u>Erection supports at the third-points of the beam</u>.* - Erection supports (2 pcs) are placed at the third-points of the beam, and the supports are mounted under both webs of the beam. Figure 14. - The supports eliminate deflection of the beam caused by loads during the erection stage. - The supports also eliminate the torsion of the beam and reduce the torsional moment to the connection at the end of the beam. - The method is used for long and slender beams. - The lower structures must withstand the support forces coming from the supports. - The supports must not be placed too close to the beam end to prevent the connection from being subjected to a lifting force.
3. Support design	**<u>Anstar:</u>** - Anstar determines the preliminary need for supporting the beams and specifies the maximum load per erection support. - At this point, the final erection order of the hollow-core slabs is also specified. - If there is no information about the erection order of the slabs, the supports are designed for one-sided erection of the slabs. **<u>Site:</u>** - The site implements the supports according to Anstar's design, also taking into account possible changes in the erection order of the slabs.
4. Support period	- Erection support is provided after erecting the beams, before erecting the hollow-core or thin-shell slabs. - The supports must be removed when the joint grouting of the hollow-core slab and the screeding of the thin-shell slab have reached sufficient strength. - They must be removed before surface casting of the hollow-core slab or installation of other surface structures or additional loading of the hollow-core slab. - The supports of the thin-shell slab and its beam must be removed when the screeding of the slab has reached sufficient strength.
5. Permissible erection load of the floor	- The maximum allowable erection load for a hollow-core and thin-shell slab floor is 0.5 kN/m^2. - The supported floor must not be loaded with goods during the erection of the slabs and the hardening of the joint grouting. - If necessary, the erection load can be increased, but this must be done through the beam design unit.

2. Method 1. Erection supports at the end of the beam

1. Purpose of the supports	The purpose of using erection supports is to prevent torsion of the beam and the transfer of torsional moment to the connection during the erection stage. - The supports are always used for the building's edge beams and also for intermediate beams as necessary.
2. Placing the supports	- Erection supports are placed at the end of the beam, under the web, at a distance of 100 mm from the support. - In general, edge lines must always be supported. - On an intermediate line, the erection order of the hollow-core slabs can significantly influence the need for supports. - The slabs are erected alternately on both sides of the beam, allowing the supports to be replaced by a torsionally resistant end connection. - If the slabs on one side of the beam are installed first, the support is always placed under the web on this side. - When both supports are used, the erection order of the slabs can be selected.
3. Structure of the supports	- Each erection support consists of a vertical support placed under the web and tightened into place. If necessary, a dividing beam can be used between the support and the beam. When the support is tightened, the beam must not rise off the bracket or support. - This support prevents the torsion of the beam during erection and transfers the entire load of the beam down during erection, allowing the beam to bend. - The structure of the support is the same for the edge and intermediate lines. - The erection supports used must be CE-marked or type-approved for the purpose. - It must be ensured that the erection supports are properly fastened and cannot move. - Their foundations must withstand loads without sinking.
4. Principle of support	 Figure 13. Erection supports at the end of the beam.

3. Method 2: Erection supports on the beam span at the third-points

1. Purpose of the supports	The purpose of erection support is to reduce beam deflection during erection by shortening the beam's span length. - The supports are used for long and slender beams. - The supports also eliminate the torsion of the beam during the erection stage. - Supports according to method 1 are not necessary in this case.
2. Placing the supports	- Two supporting points are placed symmetrically on the beam span. - The supports are usually located at the third-points of the beam.
3. Structure of the supports	- Each erection support consists of two vertical supports placed at least at the width of the webs or even wider, between which there is a horizontal support supporting the beam. - The supports prevent the torsion of the housing during erection and transfer the vertical load down. - The structure of the support is the same for the edge and intermediate lines.

4. Principle of support	 Figure 14. Erection supports on the beam span.

4. Removing the erection supports

1. Erection support removal	- The beam's erection supports are removed when the joint grouting of the hollow-core slab has reached sufficient strength. - At the latest, the supports must definitely be removed before casting the surface slab or installing other surface structures.
2. Erection supports for the thin-shell slab	- The thin-shell slab's erection supports are removed when the screeding of the thin-shell slab has reached sufficient strength. - The slab's supports are removed before removing the beam's supports.

5. Effect of the connections on the erection support

Connection type	Effect of the connection on the erection support
1. *General*	The need for erection support at the end of the beam must also be selected according to the type of connection used and its torsional resistance.
2. AEP bracket to a concrete column	- An edge beam is always supported at the end of the beam by method 1. - For intermediate beams, Anstar specifies the need for erection support in accordance with the hollow-core slab erection method and the resistance of the bracket. - The end of an intermediate beam is usually also supported.
3. AEL bracket to a composite column	- An edge beam is supported at the end of the beam, if necessary. - The AEL connection withstands torsion well and is non-torsional. - For intermediate beams, Anstar specifies the need for erection support in accordance with the hollow-core slab erection method and the torsion of the beam.
4. Secondary beam connection to a primary beam	- The secondary beam must not be supported at its end, as this will interfere with the deflection of the primary beam during the erection stage. - The AEL bracket withstands the erection stage loads from the beam without torsion. - If the secondary beam requires supports, they must only be provided at the third-points of the beam. - Anstar determines the need for support.
5. Bolt connection to a column	- The need for support is specified in the project-specific erection instructions. - The need for support is determined by the torsional resistance of the bolt connection. - Usually, the bolt connection is supported.
6. Welded connection to a column	- The need for support is specified in the project-specific erection instructions. - The need for support is determined by the torsional resistance of the connection. - Usually, the welded connection is supported.
7. Beam coupler	- A continuous beam's coupler connection in the field is not supported. - The AEL bracket withstands all the forces on the beam during the

connection in the field	erection stage. - The support required for the beam span is specified separately in the erection manual.
8. Other connections	- The need for support is specified in the project-specific erection instructions.

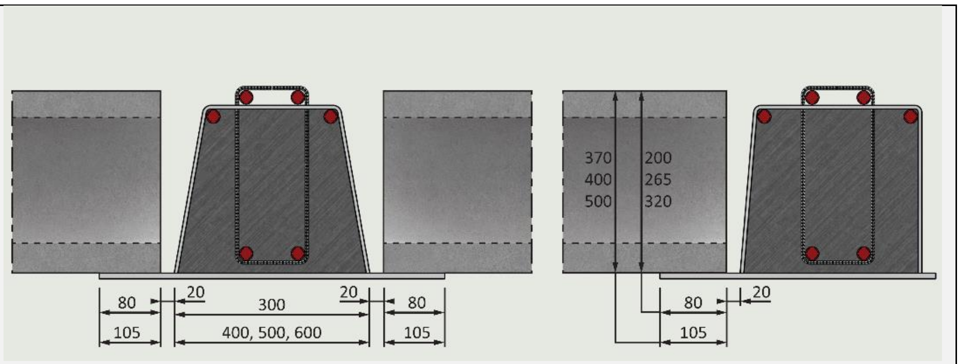
4 ERECTION OF A HOLLOW-CORE SLAB

4.1 Erection readiness of the floor

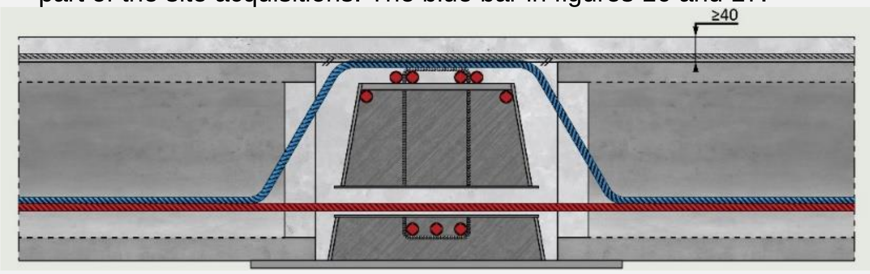
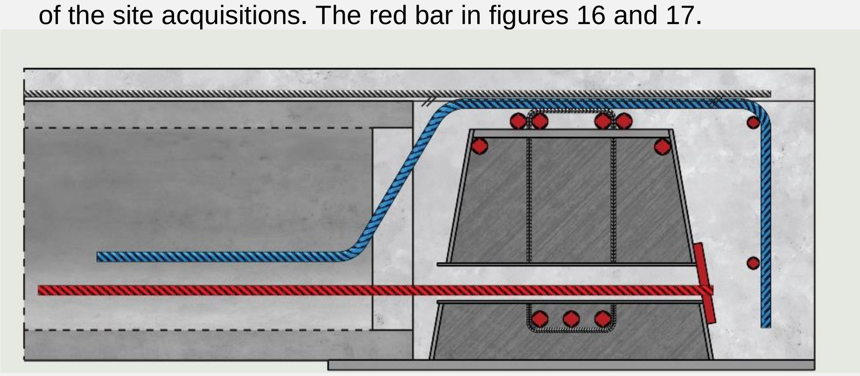
1. General	- Before erecting the slabs, a review must be carried out to confirm the erection readiness and stability of the structures. - Erection readiness for hollow-core slabs is reached when the following preparations and inspections have been made for the frame of the building:
2. Preparatory work	- The beams have been erected according to the plans and the connections locked. - The connections have been welded and inspected. - Anti-corrosion painting has been done for the welds. - Erection supports have been provided in accordance with the erection plan. - Column base plate casting and shoe housing grouting have been performed and have hardened. - The time at which grouting is to be performed is specified in the erection plan. - Any further measures specified in project-specific erection instructions have been taken.
3. Erection and stability	- Hollow-core slabs are always erected alternately on the jaw of the lower flange unless one-sided erection is accepted in the erection plan. - Ensure that the torsional steel hole is left at the joint of the hollow-core slab. - The width of the slab's support surface must not be below the minimum value. - The erection order must not be deviated from without the designer's permission. - The hollow-core slab is installed on the lower flange without neoprene.
4. Slab erection for a continuous beam	- For a continuous beam, the stability of the connecting beam located in the field must be ensured by the correct erection order of the slabs. - The slabs of a continuous beam's intact field must be erected before the connection field is erected to prevent the beam from "tipping".
5. Inspections	- A review must be conducted before erecting the slabs to confirm the erection readiness of the frame. - The results of the inspection are saved in the project's quality documentation.

4.2 Placing the slab on the beam's lower flange

1. General	- With W and S beams, the placement dimensions of both hollow-core and thin-shell slabs in the beam are all the same.
2. Minimum support surfaces	- The mounting clearance of a hollow-core and thin-shell slab from the bottom edge of the web is 20 mm. - In this case, the allowable support surfaces and erection tolerances for the slab are as follows: - For hollow-core slabs OL200–OL370, the support surface is 80 mm, minimum value 65 mm. - For hollow-core slabs OL400–OL500, the support surface is 105 mm, minimum value 85 mm. - Ensure that the torsional hole 50*70 mm in the housing is always placed at the joint of the hollow-core slab being erected. - Erection of the slabs must not be continued if there are deviations in these dimensions.

3. *Placement principle*	 Figure 15. Dimensions for placing the hollow-core slab on the lower flange

4.3 Installing supplementary reinforcement

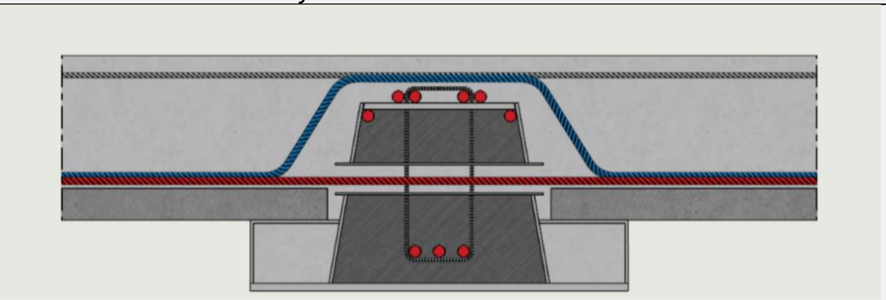
1. *General*	The structural function of the W beam requires installing the following additional pieces of steel for hollow-core slabs. - The additional pieces of steel shown in the following figures are installed at every hollow-core slab joint over the housing. The figures are indicative only. - More specific dimensions and reinforcement amounts are provided in the project-specific erection instructions.
2. *Suspension steel for the beam*	- In a fire situation, hollow-core slabs are suspended by pieces of suspension steel in the slab joint. - For intermediate beams, the pieces of steel go over the beam, and for edge beams, the steel is either taken behind the beam into the bay or anchored on top of the beam by bending in the direction of the beam. - These pieces of suspension steel are designed by Anstar and are part of the site acquisitions. The blue bar in figures 16 and 17.  Figure 16. Suspension and torsional reinforcement of the beam. Principle drawing of an intermediate beam
3. *Torsional steel for the beam*	- The torsional steel is used to tie the torsional moment caused by the hollow-core slab's eccentric support to the beam. The torsional steel is taken through the beam in the tube provided at the hollow-core slab's joint. For edge beams, the steel is anchored on the back surface of the beam with an end plate. - These pieces of torsional steel are designed by Anstar and are part of the site acquisitions. The red bar in figures 16 and 17.  Figure 17. Suspension and torsional reinforcement of the beam. Principle drawing of an edge beam

5 ERECTION OF A THIN-SHELL SLAB

5.1 Erection readiness of the floor

1. Placement of thin-shell slabs	- The theoretical clearance of the end of the thin-shell slab from the W beam web is 20 mm regardless of the width of the beam's lower flange projection and the height of the slab. - Also follow the instructions provided by the slab manufacturer for the minimum widths of the thin-shell slab's end support surfaces.
2. Slabs with elevation parts	- In the case of slab with elevation parts, the placement of the hollow-core/thin-shell slab's head is also determined by the beam web's lower edge. - On top of the elevation part, the clearance may therefore be slightly larger. - Therefore, the elevation part does not change the theoretical manufacturing length of the hollow-core/thin-shell slab.

5.2 Placing a thin-shell slab on the beam's lower flange

1. Erection support	- The thin-shell slab should always be shored for pouring loads using erection supports with 1–2 support lines. - Shoring reduces the stresses on the beam during the screeding of the slab.
2. Screeding of a thin-shell slab	- Casting can be done either on one side of the beam separately or on both sides. - The order of casting must be known during beam design. - The space for elevation parts is grouted full during screeding.
3. Thin-shell slab beams with elevated parts	- A thin-shell slab is usually so slender in height that the W beam always requires flange elevation parts for the thin-shell slab structure. - For continuity, the top surface reinforcement of the thin-shell slab is extended over the S beam. - A single-span thin-shell slab structure with a W beam is not possible because the composite effect connection between the beam and the concrete slab is completely broken and uncontrolled splitting will appear on the surface slab at the top corners of the beam due to slab torsion. - The structural height of the beam can be elevated by means of elevation parts for significant loads and span lengths. - The ABeam software includes standard thin-shell slab elevation parts for the most commonly used slab cases.
4. W beam structure with a thin-shell slab	 Figure 18. Principle drawing of the supplementary reinforcement of the thin-shell slab beam

5.3 Installing supplementary reinforcement

1. General	The structural function of the W beam requires installing the following additional pieces of steel for thin-shell slabs. - At each joint (c/c 1200 mm) of the thin-shell slab, additional pieces of steel are mounted over the housing as shown in Figure 18. The figures are indicative only. - More specific dimensions and reinforcement amounts are project-specific.
2. Suspension	- In a fire situation, the thin-shell slabs are suspended by pieces of

steel for the beam	suspension steel in the slab joint. For intermediate beams, the pieces of steel go over the beam, and for edge beams, the steel is either taken behind the beam into the bay or anchored on top of the beam by bending in the direction of the beam. - These pieces of suspension steel are designed by Anstar and are part of the site acquisitions. The blue bar in Figure 18.
3. *Torsional steel for the beam*	- The torsional steel is used to tie the torsional moment caused by the thin-shell slab's eccentric support to the beam. The torsional steel is taken through the beam in the tube provided at the thin-shell slab's joint. For edge beams, the steel is anchored on the back surface of the beam with an end plate. - These pieces of torsional steel are designed by Anstar and are part of the site acquisitions. The red bar in Figure 18.
4. *Main reinforcement of a thin-shell slab*	- The main pieces of rebar at the bottom surface of the screeding are anchored according to the standards to the lower flange of the W beam, to the edge of the beam. If necessary, additional pieces of steel can be passed through the beam via the torsion opening. - The steel at the top surface of the screeding is taken over the beam, thus ensuring slab continuity. These steels also form a composite effect connection according to the effective width of the W beam.

6 ACCIDENT LIMIT STATE

6.1 Circular steel for the floor

1. *Circular steel for the hollow-core slab floor*	- For the W beam, pieces of circular steel are installed above the pieces of suspension steel, in the joint grouting between the end of the hollow-core slab and the housing. - The beam end connections transfer horizontal forces before the hardening of the joint grouting, and they can be used to ensure the stability of the frame during erection. - During the final stage, all horizontal forces are transferred using these pieces of circular steel. - The pieces of circular steel are designed by the main structural designer and are part of the site acquisitions.

6.2 Additional steel against progressive frame collapse

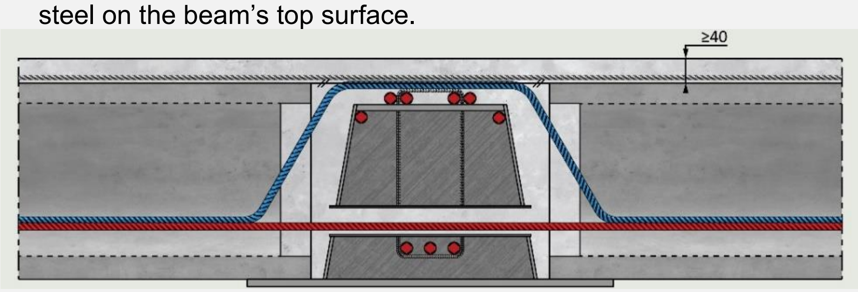
1. *General*	- For CC3 structures, the accident limit state design conditions according to SFS-EN 1991-1-7 must be ensured. - This has been taken into account in the structure of the redesigned W beam as follows:
2. *Hollow-core slab floor tying steel going through the beam*	- Transverse tying steel may be arranged as follows: - The housing of the new W beam is slightly lower than that of the old beam, so transverse steel can be placed over the beam. - Transverse steel can be placed at the joint of the hollow-core slab if there is no surface casting, or it can also be placed in the surface casting. - The necessary tying steel can also be placed in the tube of the W beam's torsional steel. - The design of these steels is the responsibility of the main structural designer and the procurement is the responsibility of the site.
3. *Tying steel against progressive column collapse parallel to the beam*	- Limiting progressive collapse can be managed in the accident limit state in which the load-bearing capacity of the column is lost. - W beams are tied to each other past the column by means of tying steel installed in the joint grouting. - These steels can only be positioned at the column and can be anchored to the composite effect steels of the top surface of the W beam, which can be provided with sufficient bond resistance for this design. - The design of these steels is the responsibility of the main structural designer and the procurement is the responsibility of the site.

7 GROUTING

7.1 Joint grouting of the hollow-core slab

1. *General*	To ensure that the hollow-core slab floor’s joints and the joint between the slab and the housing are ready for grouting, check that the following preparatory work has been performed.
2. *Preparatory work*	- Ensure that suspension torsional reinforcement has been installed. - Ensure that the pieces of circular steel for the hollow-core slab floor have been installed. - Ensure that the grouting protection for the slab’s hollow cores is in place. - Ensure that the formwork and casting protection for the hidden bracket connections have been made in accordance with the user manuals for the brackets. [20][22] - Ensure that the formwork for the other connections has been installed.
3. *Readiness for grouting*	- Use the concrete type and strength specified in the plan, taking into account the temperature during the hardening of the joint grouting. - All of the grouting is structural load-bearing concrete, which must not freeze during hardening. - The grouting is performed by following the quality control procedures for structural concrete.
4. *Performing the work*	- The inside of the housing has been filled with concrete at the machine shop. The grouting has reached sufficient strength by the erection stage. - Joint grouting of the hollow-core slab is performed once the additional steel in the structure has been installed. - The grouting is performed by grouting the hollow-core slab joints and the joint between the housing and slab up to the level of the top surface of the slab. (Changes to the old procedure.)
5. *Inspections*	- A review is carried out to confirm readiness for grouting, and the information is saved in the project’s quality documentation.

7.2 Surface casting of the hollow-core slab

1. *General*	Surface casting of the hollow-core slab floor is only performed after the joint grouting has hardened. Structurally, there are four different ways of performing the surface casting, and this influences the structural function of the beam. The surface casting options are:
2. *Reinforced surface casting ≥ 40 mm*	- Reinforced surface concrete meeting the quality requirements for structural concrete is applied on top of the slab. - Such structures include intermediate floor slabs of office and public buildings, where the span lengths are long and surface casting is applied to the floor surface structures. - Reinforcement is placed in the surface casting to even out cracks caused by deflection of the hollow-core slab. - In joint grouting, the top surface of the beam is cast to the hollow-core slab’s surface level. - The surface slab provides fire and corrosion protection for the pieces of steel on the beam’s top surface.  Figure 19. Joint grouting of the structure, structural reinforced surface slab
3. *Surface casting bay*	- A reinforced concrete topping bay can be used in the roofs of buildings to significantly increase the bending resistance of the structure.

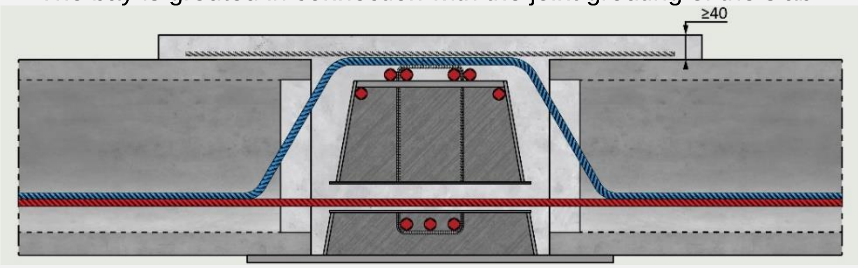
<table>
<tr><td>on top of the slab
≥ 40 mm</td><td>- The bay is located in the thermal insulation space of the structure, also protecting the upper flange of the beam against fire and corrosion.
- The bay is grouted in connection with the joint grouting of the slab.


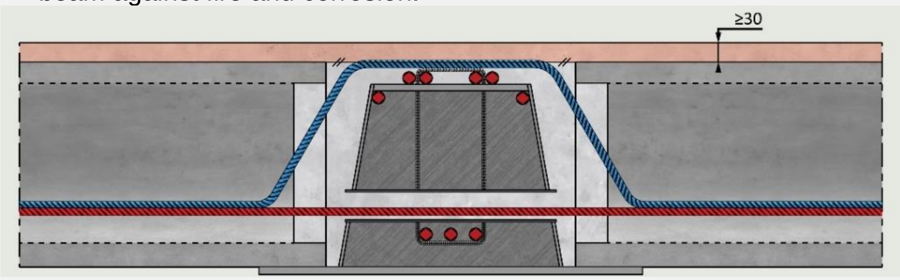
Figure 20. Joint grouting of the structure in the roof with a reinforced surface casting bay</td></tr>
<tr><td>4. Filler casting</td><td>- Such structures include intermediate floors of residential buildings and other structures only requiring a thin layer of filler on top of the slab.
- Light floor surface structures are placed on top of the filler.
- The filler must also protect the pieces of steel on the top surface of the beam against fire and corrosion.


Figure 21. Joint grouting of the structure in the intermediate floor with 10–30 mm surface filler</td></tr>
<tr><td>5. No surface casting</td><td>- Such structures include roofs and parking deck floors, where water and thermal insulation layers are placed on top of the slab.
- There must be a sufficient layer of protective concrete for corrosion and fire protection of the top surface rebar.
- In this case, a 20-mm high elevation part can be used to provide an adequate concrete layer on top of the beam.

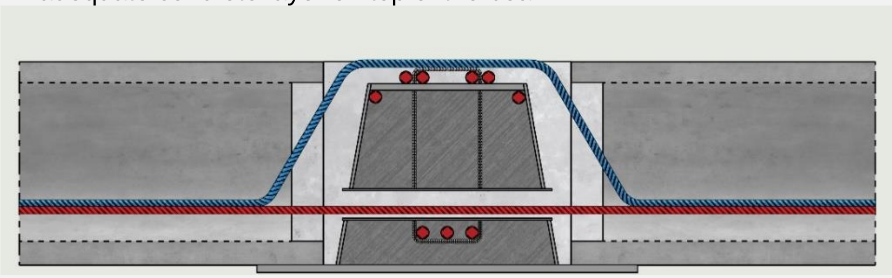



Figure 22. Joint grouting of the structure in the roof without a surface slab</td></tr>
<tr><td>6. Casting the floor's edge bays</td><td>- The floor's edge bays are cast in connection with the joint grouting, since they protect the housing against fire and act as a functional part of the edge beams' composite structure. The minimum concrete strength is C25/30.</td></tr>
</table>

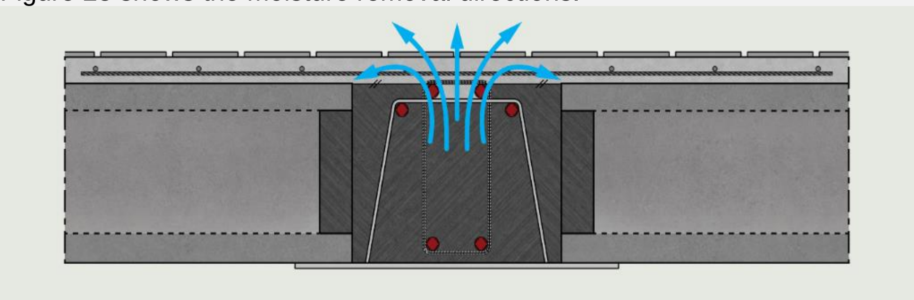
8 MOISTURE CONTROL

8.1 Measures during erection

<table>
<tr><td>1. General</td><td>The W beam is grouted at the machine shop, so the removal of moisture from the beam begins right after grouting. The beams are grouted and stored in warm indoor areas.
- The moisture is removed through the grouting openings in the top surface of the housing.
- The grouting openings of the new W beam have been enlarged to improve the removal of moisture.</td></tr>
</table>

	- Care must be taken to ensure that water does not accumulate in the beam when it rains.
2. *Work arrangements*	- After erection, protect the floor structures against getting wet or ensure water removal during the work from the installed floor. - Arrange good and sufficiently long drying conditions for the floor structures.

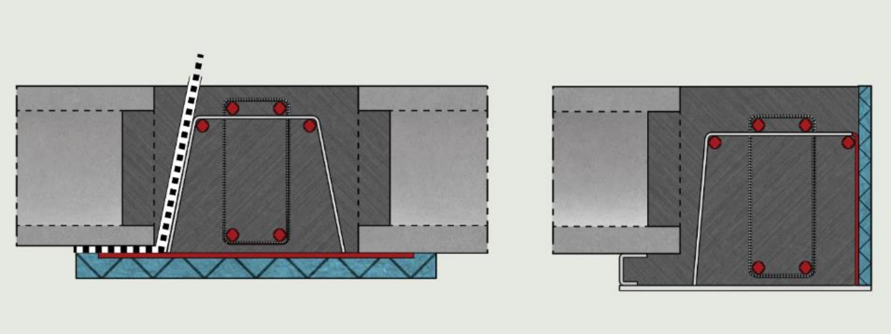
8.2 Situation after concrete grouting

1. *General*	In order for the surface structures of the floor to be installed, the concrete structures of the floor must have dried sufficiently. - The W beam is grouted at the machine shop, so the removal of moisture from the beam begins already there. - The moisture is removed through the grouting openings in the top surface of the housing.
2. *Work arrangements*	- Arrange good and sufficiently long drying conditions for the floor structures. - Prepare a schedule for the floor surfacing work, taking into account the drying time required by the housing and structures. - Measure the moisture of the structure, also at the housing's grouting openings.
3. *Removal of moisture*	Figure 23 shows the moisture removal directions.  Figure 23. Moisture removal directions from inside the housing

9 FIRE PROTECTION

9.1 Fire protection of the beam

1. *General*	- The W beam works without external fire protection up to fire resistance class R120. - This requires, however, that concrete grouting around the housing has been performed according to the plans. - In the following special cases, separate fire protection is required for all fire resistance classes.
2. *Edge beam web*	- The outer vertical web of an edge line must be fire-protected, unless an edge bay is cast for the floor and used for protection. - An exterior wall structure that meets the fire requirements also provides sufficient protection if the vertical web touches the surface of the fire-rated wall and if the wall material is sufficient for fire protection.
3. *Slab expansion joint*	- The lower flange of the beam located at the expansion joint of the hollow-core slab floor is protected, if necessary, using external plate protection or fire-resistant paint. The need for protection is always indicated by the beam design unit. - The scope and method of protection are always specified by a separate plan.
4. *Lower flange elevation parts*	- The lower flange elevation parts are filled with concrete in connection with the joint grouting. - The grouting provides the elevation part with sufficient fire protection, and no other protection is needed.
5. *Beam at the edge of an*	- At the edge of a floor opening, the visible web of the beam requires fire protection.

opening	- Edge bay casting is also sufficient for fire protection.
6. Fire protection of the upper flange	- Structural surface casting concrete provides the upper flange with sufficient fire protection. - With thin surface fillers, fire protection of the upper flange must always be considered separately. The filler must provide the upper flange with a sufficient protective layer for the required fire resistance class, and the filler material must have a fire endurance rating. - The surface casting bay can be used as separate fire protection in roofs in particular, in which case no other protection is needed.
7. Additional fire protection principle	 Figure 24. Beam's additional fire protection, expansion joint and exterior wall structure

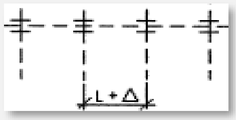
9.2 Fire protection of the connection

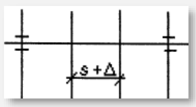
1. General	- The connections must be protected to a fire resistance class corresponding to the frame of the building. - Fire protection consists of the slab's grouting, but the following structural details must be taken into account for various connection types.
2. AEP bracket	- AEP bracket connections must always be protected to a fire resistance class corresponding to the frame. - The fire protection methods are presented in the user manual for AEP hidden brackets. [20] - The joint between the end plate and the column must not be grouted full.
3. AEL bracket	- AEL bracket connections must always be protected to a fire resistance class corresponding to the frame. The fire protection methods are presented in the user manual for AEL hidden brackets. [22] - The joint between the end plate and the column must not be grouted full.
4. Bolt connection	- A bolt connection to the top of a column does not require separate fire protection. - The mounting bolts are located such that they will be inside the beam housing, which provides sufficient protection.
5. Welded connection	- A welded connection to the top of a column does not require separate fire protection. - The weld is located such that it will be inside the housing's joint grouting, which provides sufficient protection.
6. Secondary beam connection	- The connection of a secondary beam to the side of a primary beam is protected from below the beam according to the instructions for the AEL hidden bracket. [22]
7. Connection in the field	- Beam coupler connections in the field are protected from below the beam according to the instructions for the AEL hidden bracket. [22]
8. Structures suspended from beams	- If maintenance platforms or supports for building service installations are suspended from the lower flange, the lower flange and the suspended structures need not be fire-protected unless these structures have fire resistance requirements. - If the equipment/platform requires fire-resistant suspension, the support structure must be designed separately, in which case fire-resistant suspension is arranged inside the housing or the lower flange

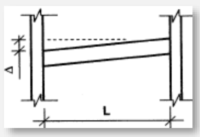
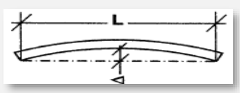
	is fire-protected.
9. Other connections	- The need for fire protection of other connection types is designed according to project-specific requirements.

10 ERECTION TOLERANCES

10.1 Erection tolerances for the beam

1. General	- Erection tolerances according to SFS-EN 13670 are followed in erecting a concrete element frame. - Erection tolerances according to SFS-EN 1090-2:2018 are followed in erecting a composite column frame. - However, the beam and its connections allow for the following tolerance deviations in the location of the columns and other vertical structures.
2. Column distance  	- An AEP bracket connection allows for displacement of ± 15 mm in the longitudinal direction of the beam. Accordingly, the clear distance between the columns may vary within Δ = ± 30 mm. - An AEL bracket connection allows for displacement of ± 10 mm in the longitudinal direction of the beam. Accordingly, the clear distance between the columns may vary within Δ = ± 20 mm. - Upon erection, this clearance must be made equal at both ends of the beam, and accumulation of clearances at the end of long beam lines must be prevented.

3. Beam distance

 	
	- The deviation in the distance between adjacent beams may vary within Δ = ± 30 mm.
	- The width of the hollow-core slab's support surface on top of the lower flange must not be below the minimum value.
	    - For hollow-core slabs OL200-370, the support surface is 80 ± 15 mm.
	    - For hollow-core slabs OL400–OL500, the support surface is 105 ± 15 mm.

4. Height of the beam  	- Deviation in the elevation of the ends of the beam (inclination) between the ends L. Δ = ± L/500, but no more than 10 mm. - Deviation in the relative elevation of adjacent beams. L = distance between beams. Δ = ± L/500, but no more than 10 mm. - The level deviation of the beam's general elevation is in accordance with the general tolerances for the frame.
5. Torsion of the beam	- The clearance of an AEP hidden bracket connection allows for a ± 1.5 degree twist in relation to the longitudinal axis. Upon erection, the beam can be wedged to the torsional position allowed for by this tolerance, enabling the erection or location tolerances of the other structures to be corrected during the erection. - The fit of the AEL hidden bracket is sufficiently tight, eliminating the torsion of the beam that would need to be taken into account separately. - When installing bolt and welded connections, the torsion of the beam can be adjusted as desired, so no other measures are needed.
6. Pre-camber of the beam  	- Pre-camber of the beam is made at the machine shop for the self-weight of the floor structure and for the floor's dead load with the tolerance Δ = –0, +15 mm. The beam is set straight or remains slightly curved upwards. - The standard dimension criterion of the beam's deflection limit for live loads is Δ = L/400.

10.2 Measures to be taken if erection tolerances are exceeded

1. General	- If tolerances are exceeded in the location of the vertical structures of the frame, the location of the beams can be corrected in a limited manner using the following methods.
2. Column distance	- Due to the structure of the bracket connection, the column distance cannot be exceeded other than by manufacturing a special tongue for this purpose. - The tongue part can be extended in a limited manner in the direction of the beam, but the resistance values of the connection must always be limited in this case. - For welded connections at the top of the column, the position of the beam can always be determined in accordance with the plans, provided that the beam stays in the area of the mounting plate on top of the column. - For bolt connections at the top of the column, the horizontal position of the beam cannot be corrected by more than the play allowed by the bolt's installation tube.
3. Beam distance	- The distance between beams cannot be corrected in bracket connections. - For bolt connections at the top of the column, the position of the beam cannot be corrected by more than the play allowed by the bolt's installation tube. - For welded connections at the top of the column, the position of the beam can always be determined in accordance with the plans.
4. Beam elevation	- The elevation position of the beam can be corrected using the following method. - If the hidden bracket is too high up the column, a maximum of 25 mm of material can be removed from the top surface of the tongue part. - If the tongue part is too low down the column, a special tongue must be manufactured in order to increase the elevation of the beam. - In this case, the torsional resistance of the hidden bracket must be limited and the beam must be erected using support. Anstar will design and manufacture any special tongues needed. - For bolt and welded connections, additional mounting plates can be used under the end of the beam to correct the elevation as necessary.

11 CORRECTIONS ALLOWED FOR THE BEAM

1. General	- In general, beam structures must not be modified without the manufacturer's permission. - Non-conformity reports must always be prepared for any modifications. - The changes must be documented in the project's quality documentation. - Below is a list of allowable and non-allowable modifications in a site installation.
2. Allowable corrective measure	- Fastening by welding is usually allowed on the lower flange or web. - However, the allowable welding areas must be confirmed with the beam design unit.
	- Welding must be performed according to Anstar's instructions, following the welding methods according to SFS-EN 1090- 2:2018 as well as quality control for welding class C and execution class EXC2.
3. Non-allowable corrective measure	- Cutting off pieces of the lower flange projection is not allowed. Any provisions needed must be approved by Anstar.
	- Holes must not be drilled through the housing on the site; all horizontal holes must be made through detail design.
	- Torsional and suspension reinforcement must not be modified or reduced.
	- The beam must not be welded to adjoining structures and connections in deviation of the plans.

12 SAFETY MEASURES

12.1 Information for preparing work safety instructions for the site

1. General	- Appointed by the developer, the project's work safety coordinator is responsible for ensuring work safety during the building work. - When preparing work safety instructions for the project, the following must be taken into account for erecting the composite beam:
2. Erection	- The erection is performed by following the working order in the erection plan and the requirement for frame stability during erection determined by the designer.
	- Falling of the beam as well as incorrect and excessive loading of the hollow-core slab floor during erection must be prevented.
	- Lifting the beam is only allowed using the appropriate lifting points.
	- The lifting equipment can be unhooked when the beam has been fastened into place and cannot fall.
	- The beam must never be left in place without fastening.
	- The width of the hollow-core slab's support surface on top of the lower flange must not be below the minimum value.
	- If it is necessary to remove the tongue part of the AEP hidden bracket from the column, this must be done using lifting equipment.

3. Stability	- The frame stability under exceptional natural loads is ensured at the end of the shift.
	- Erection of the hollow-core slabs must not begin before the beams have been finally fastened, erection supports have been placed and readiness for erection has been confirmed.
	- The erection order of the slabs must not be changed without the structural designer's permission.
	- The overall stability of a partially erected floor must be ensured.
	- The width of the hollow-core slab's support surface on the lower flange must not be below the minimum value.

4. Structure	- Supplementary reinforcement and joint grouting must be performed in accordance with the plans.
	- Fall protection has been made according to official requirements.
	- Erection supports are only removed after the joint grouting has hardened, but they must be removed before surface casting.
	- The commissioning permit and loading capacity of an installed and joint-grouted floor must be determined by means of a review.

12.2 Loading and commissioning the hollow-core slab floor during construction

1. General	- The beam acts as a composite structure together with the hollow-core slab, the grouting and possibly the surface casting. - Due to this, the hollow-core slab floor may only be loaded after the structural grouting has reached the design strength. - The following must be taken into account for loading the floor and using it for storing construction materials during the various construction phases:
2. Loading	- When erecting the hollow-core slabs, the maximum allowable load for the floor is 0.5 kN/m^2 before joint grouting. Storage of construction materials on the floor is not allowed then.
	- When joint grouting has hardened, the maximum allowable load for the floor is determined according to the structural function of the surface slab.
	- If there will only be surface filler or no filler on top of the hollow-core slabs, the normal, final load according to the plans is allowed for the floor when the housing and joint grouting has reached the

	design strength. - If there will be a structural surface slab on the floor, the final load according to the plans is only allowed for the floor after the surface slab has hardened. In this case, the loading capacity of the floor before casting the surface slab is specified separately.
3. Commissioning	- The hollow-core slab floor's readiness for commissioning and loading capacity must be determined by means of a review.

13 ERECTION QUALITY CONTROL

1. General	- Erection quality control for the structures is carried out in accordance with the quality control plan prepared for the site. - The structural and dimensional inspections specified in the implementation breakdown are performed on the erected frame. - The acceptance limits must meet the standard tolerance requirements of SFS-EN 1090-2:2018 in tolerance class 1. - For concrete structures, the standard to be followed is SFS-EN 13670.
2. Quality control reports	- An inspection report is always prepared for quality control and dimensional inspections and saved in the project's quality documentation. - The following inspection measures are performed for the floor structures:
3. Measures before erection	- Check that the beam is in accordance with the plan (type, code and dimensions) and has not been damaged during transport. - Ensure that the beam is erected in the right direction between the columns (line marking on the beam's web). - Check that the column is equipped with a bracket according to the plans. - Ensure that any snow and ice has been removed from the connection areas.
4. Measures before grouting	- Check that pieces of torsional steel have been installed in the hollow-core slab joints. - Check that casting protection has been installed in the hidden bracket. - Ensure that no extra load has been stored on the floor. - Ensure that the connections have been made according to the plans. - Ensure that reinforcement mesh has been installed in the surface casting.
5. Measures in the event of deviation	If the hollow-core slab floor installer deviates from the approved plans and documents in any of the following tasks: - lifting and moving - erection work and the materials used - structure tolerances and dimensional inspection of the frame - welding and welding methods - surface treatment and fire protection - quality control, required inspections and their documentation, the installer is obliged to start documenting the non-conformity upon observing the deviation from the plan and to have the client approve the resulting measures. Non-conformity reports are also saved in the project's quality documentation.

14 FINAL DOCUMENTATION OF QUALITY CONTROL

1. General	- When the work has been handed over, the inspection and quality control documentation created during the erection and grouting of the composite beams is delivered to the client.
2. Readiness inspection records	- Erection readiness inspection of the frame and beams for erecting the hollow-core slabs. - Grouting readiness inspection of the hollow-core slab floor and beams. - Loading capacity and commissioning inspection of the hollow-core slab floor.
3. Inspection records	- Inspection of the beam connection welds. - Inspection of the fire protection of the beams and connections.
4. Non-conformity	- Non-conformity reports prepared during the erection are handed over.

reports	
5. Product approval as-built	- CE marking certificates or corresponding product approval information for materials purchased for the site. - As-built documentation for changes made to the structure.

REFERENCES

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[4] *SFS-EN 1990, Eurocode. Basis of structural design.*
[5] *SFS-EN 1991-1, Eurocode 1. Actions on structures, parts 1–7.*
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[12] *SFS-EN ISO 12944, Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Part 1-7:*
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[21] *Anstar Oy. AEP Bracket User Manual.*
[22] *Anstar Oy. AEL Bracket User Manual*
[23] *Anstar Oy. A-BEAM W design instructions.*
[24] *Cancelled*
[25] *Anstar Oy. ATP Rebar Anchor Bolts*

PICTURES

Anstar Oy is a Finnish family business specialising in the sales and manufacture of concrete structure connections and composite beams. We are an international operator, and one of the pioneers in the field. Anstar will help you with all your questions relating to concrete connections. Anstar's specialists may also develop solutions to customer-specific connection problems.

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SMART STEEL.
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ANSTAR OY
Erstantie 2
FIN-15540 Villähde

Tel. +358 3 872 200
anstar@anstar.fi
www.anstar.fi