Anstar®

AOK® support

User manual

Version 8/2025

CE

AOK® support

- AOK Support is used in a hollow core slab openings as load bearing structure.
- Support will be used together ABEAM S and W beams.
- Standard support for full width of slab 1200 mm and 2400 mm.
- Custom support according to customer order. Span from 600 mm to 4800 mm.
- Load bearing resistance is highest in the market.
- Fire resistance class 60 minutes and for special order up to 120 minutes
- Standard connections for hollow core slab and for load bearing wall.
- Quick and easy erection in all site conditions.
- New components for Tekla Structures software and blocks for AutoCAD software.
- CE marking according to EN 1090-1
- AOK support has the patent FI 127374B2.

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Revision G - 22 August 2025
AOK220 table dimensions corrected and Appendix 1 removed.

Revision F - 28 May 2023
AOK order code has been updated in standard/Custom Support.
Updated order form appendix 1.
Added new joint type for thin shell slab.
Added new AOK220 support.
Published new AOK Hollow Code Slab Hanger Tools for Tekla Structure software.
Chapter 5.4 standard connections has been rewritten.
Minor text corrections.

Revision E – 11 October 2018
Minor text corrections

Revision D – 31 May 2018
The AOK support for hollow-core slabs has been redesigned.
The support has been designed according to the structural principles of the ABEAM S composite beam.
The application range has been extended significantly.
The span length range is 400–4800 mm, and the load-bearing capacity has been increased.
The fire resistance is standard support 60 min. and special support 120 min.
A new user manual has been prepared for the AOK support.
The AOK support's product approval is CE marking according to EN 1090-1.
Manufacture and sales of the old AOK support will be discontinued.

This user manual only applies to designing and using Anstar Oy products included in this document.
The manual or parts of it cannot be adapted or applied to designing or manufacturing other manufacturers' support products or using them in hollow-core slab floor openings.

1 AOK SUPPORT

The support is used in a hollow-core slab floor opening as the load-bearing structure for the end of the slab. The housing is made of steel plate, and its bending resistance is adjusted by means of plate thickness and supplementary reinforcement. During the erection stage, the support works without concrete on the inside, and housing grouting is performed on the site. During the final stage, the support works as a composite structure with the slab and the housing grouting. The support works without separate fire design up to fire resistance class 60 minutes. Standard connections have been designed for the support to the edge of the slab and to the top of the element beam and wall.

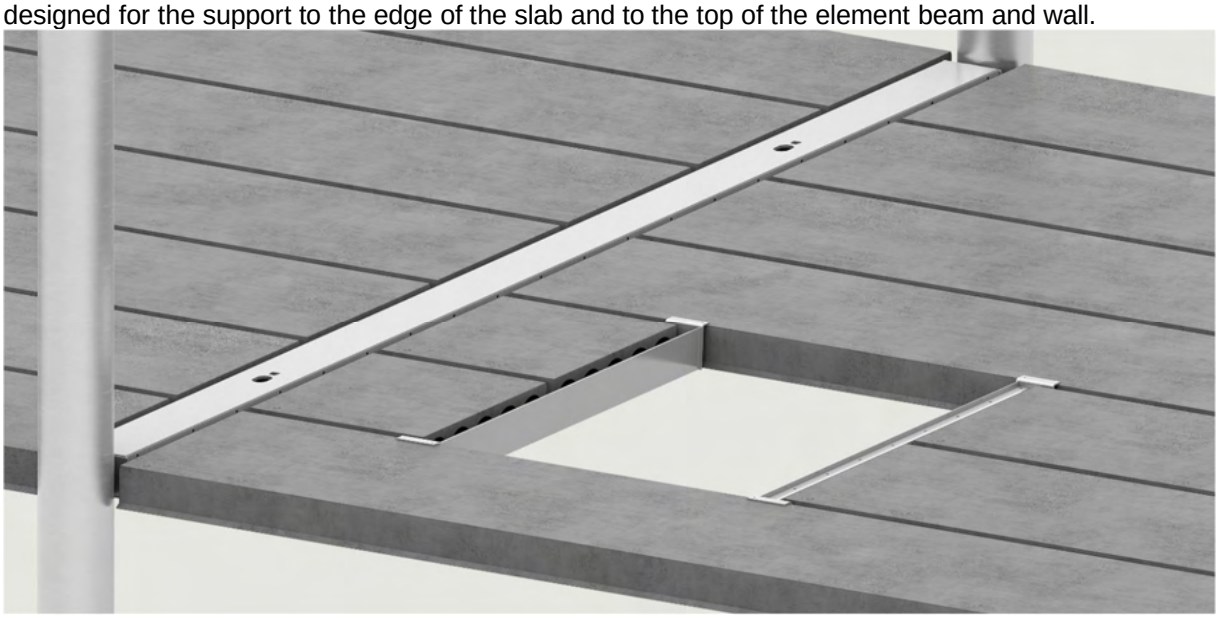


Figure 1. AOK support in a hollow-core slab opening.

2 USING THE SUPPORT

2.1 Structure

AOK supports are manufactured according to the following principles:

Hollow-core slab	Supports are manufactured for six hollow core slabs. High 200–500 mm.
Standard support	The length of standard supports is 1200 mm and 2400 mm for the 200–500 mm hollow core slabs.
Custom-made support	Custom-made supports are designed and manufactured according to the customer's order.
Load range	The support is used to transfer the floor loads in the standard load range of the slabs.
Design-and-build deal	The supports are also delivered as part of the design-and-build deal for ABEAM composite beams.

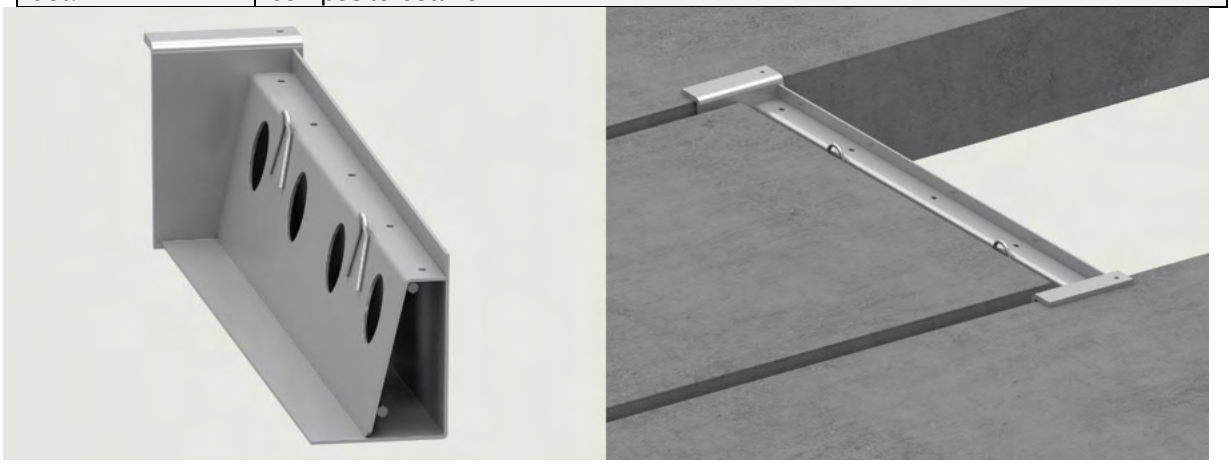


Figure 2. Typical structure of the AOK support

2.2 Forms of delivery

AOK supports are delivered according to the following principles:

1. **Standard supports.**
   Supports are delivered for applications requiring a support beam in a hollow-core slab floor opening. The length of standard supports are 1200 mm and 2400 mm, and the other dimensions are provided in Table 1 and the allowable application and loading range in tables 4–7.

   Standard supports are ordered with an order code. Example: **AOK320-2400**
   Additional information according to the specifications in Section 2.4.

2. **Custom-made supports designed according to the customer's dimensions and loads.**
   Custom-made supports are delivered by special order for applications where the support's dimensions or loads differ from those of standard supports. The supports are designed and manufactured according to information provided by the customer. The length range of custom-made supports is 600–4800 mm, and the other dimensions of the product are provided in Table 2. Supports are preselected in the design phase according to tables 4–7.

   Custom-made supports are ordered with an order code.
   Example: **AOK265C-L-<*parameters*>-ID-code** The order form is provided in Appendix 1 and is also available on our website at www.anstar.fi/tuotteet..
   Additional information from parameters according to the specifications in Section 2.5.

3. **Delivery as part of a design-and-build deal for composite beams**
   AOK supports may be added to the turnkey delivery of beams as part of a design-and-build deal for Anstar Oy's composite beams, in which case they need not be ordered separately. The supports are used for hollow-core slab floors implemented using ABEAM composite beams of the W and S type, and Anstar designs and delivers them in connection with the beam delivery. Supports are preselected in the reference design phase according to tables 4–7. In structural plan drawings, the supports must have ID codes similar to those of the beams.

2.3 Applications for the supports

1. *Support in an opening in the middle of a slab*	The support is used to form an opening in the floor, cutting 1–4 slabs. - This means that the width of the opening is 600–4800 mm. - The support may also rest on slabs of different heights, and the width of the opening may differ from the hollow core slab width. - The application and load range of the support is only limited by the point load resistance of the edge of the hollow-core slab.
2. *Support in an opening at the edge of a slab*	The support is used to form an opening at the edge of the floor, next to a beam or wall supporting the floor. - The support rests on the slab at one end and on a concrete wall or beam at the other end. - The support may also rest on slabs of different heights or on a wall. - If necessary, Anstar will design a special support solution.
3. *Steel stair lead-through opening in a floor*	The support is used to form a lead-through opening in a floor for steel stairs between floors. - The width of the opening is 1200–1500 mm, and its length is approx. 3600–4800 mm according to the stairs. Figure 3. - The steel stairs can also be fastened to the support beam welded to the support's front plate.
4. *Piping lead-through opening in a floor*	The support is used to form a lead-through opening in a floor, providing a load-bearing point for a piping lead-through. - In the opening, a concrete slab is cast, for example, supported by an L steel profile welded to the support's front plate. - The lead-through opening can also be designed as a fire area limit and used to support piping loads. - The opening can also be used for lead-throughs for other technology and for constructing a firestop. Figure 4. - The support is ordered using the order form provided in Appendix 1. -

5. *Special applications for the support's edge and support connection*	If necessary, brackets supporting other technology can be welded to the support's front plate. - The length of the support may differ from the standard slab width, and the top surfaces of the slabs may have different elevations. - The front plate of the support can be extended all the way to the top surface of the surface slab, forming a mould for grouting.
6. *Special applications*	The support can also be used to support short thin-shell and composite slab structures if concrete casting of the floor surface results in a composite effect with the steel parts of the support. - The load-bearing capacity is preliminarily determined according to load tables 4–7. - The supports are ordered using the form provided in Appendix 1.

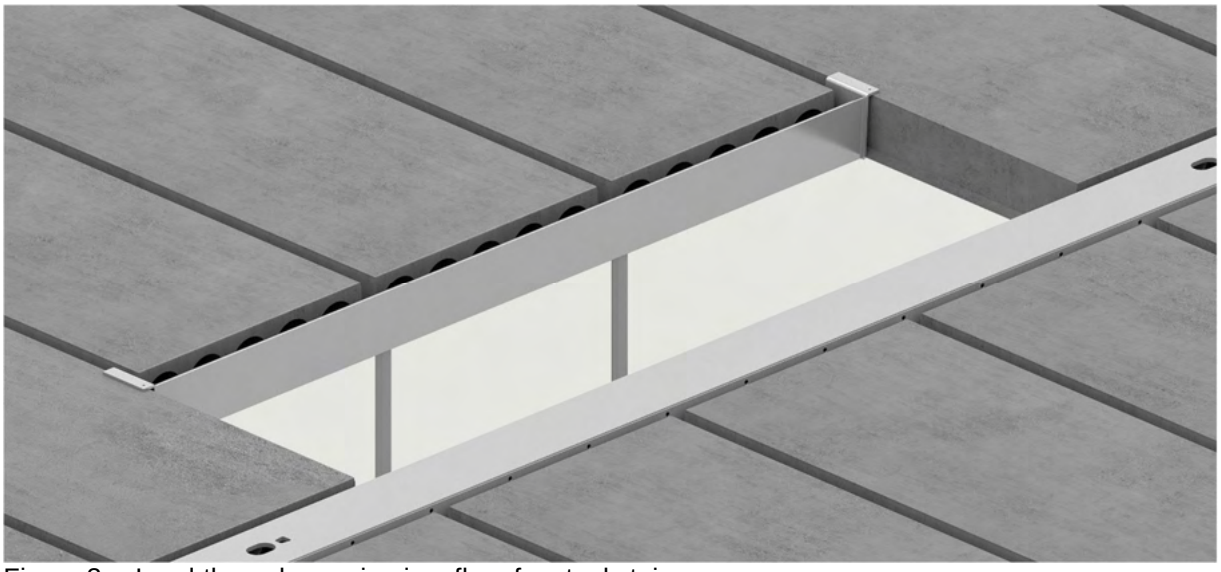


Figure 3. Lead-through opening in a floor for steel stairs

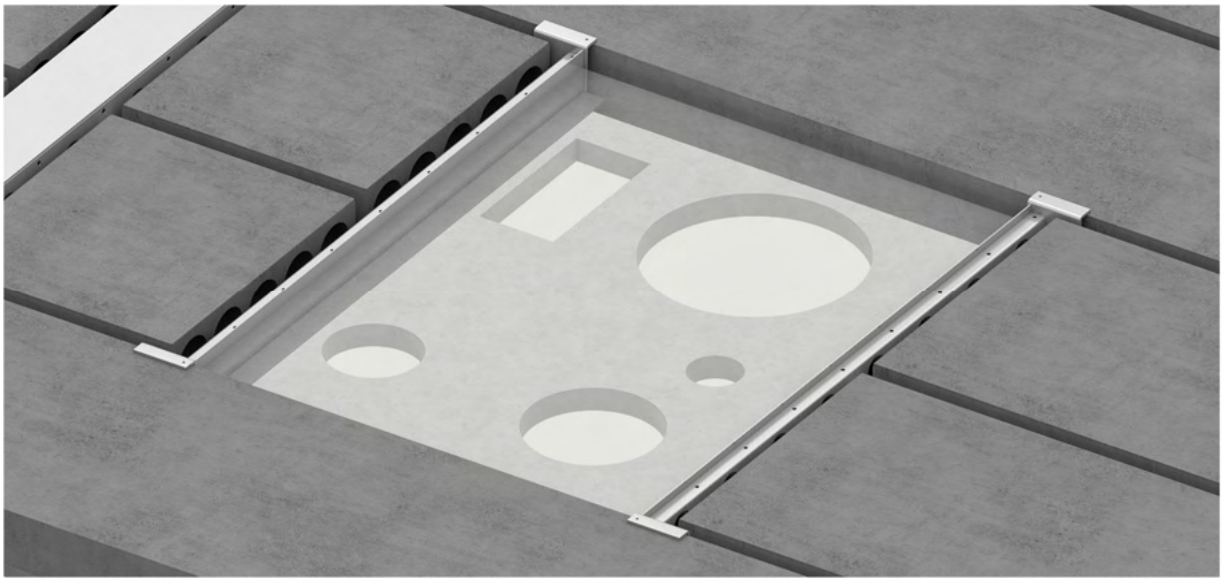


Figure 4. Lead-through opening in a floor for piping

2.4 AOK standard support

1. Application	Standard support (stock order) is used as an edge beam for openings in the floor to support slabs ending against the adjacent, intact slabs. Standard supports are ordered with an order code in accordance with the design criteria.
2. Order code	**Code: AOK265-L** - The width of the opening (= support length **L**) is either 1200 mm or 2400 mm. - Execution class is EXC2 and fire resistance class 60 min. - Standard delivery is primer 60 µ. - Long Support 2400 requires torsional steel. Delivery Site Contractor. - Support has standard joints type J1 for hollow core slab. See chapter 5.4.1 - The distance between the end of the hollow-core slab and the front edge of the support is fitting length M in Table 1.
3. Loads	The allowable loading for the hollow-core slab to be supported is in tables 4–7. - In the load tables, the self-weights of the support and slab are not included in the design loads for hollow-core slabs. - The customer is responsible for checking/designing the resistance of the adjacent hollow-core slab to the load transferred by the support.
4. Example of an order: (Code only)	The order code, such as **AOK320-2400**, means the following: - Support AOK320 is used for openings in OL320 mm high slabs, and support length **L = 2400** mm (= two-slab opening). - Support has standard joints J1 for slab OL320. - Fire resistance time is 60 min. The painting is primer 60 µ. - Torsional steel requires hole.

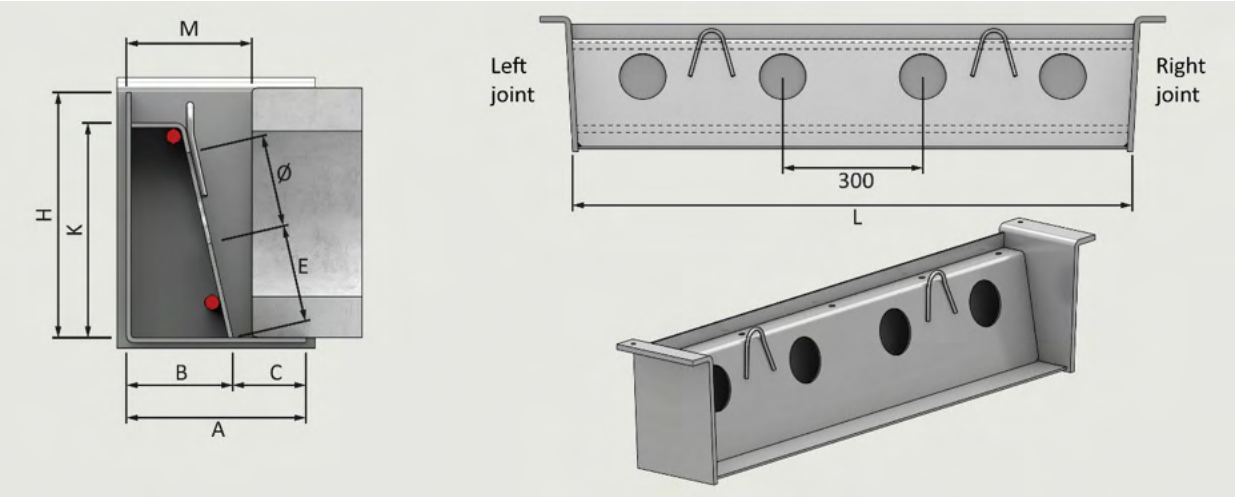


Figure 5. Structure of a standard support

Table 1. Dimensions of a standard support (stock order)

Order code	Standard length L (mm)	H mm	K mm	A mm	B mm	C mm	E mm	Ø mm	Fitting length M mm
AOK200-L	1200, 2400	200	180	170	80	90	55	90	90
AOK220-L	1200, 2400	220	200	170	80	90	55	90	90
AOK265-L	1200, 2400	265	230	190	100	90	75	110	110
AOK320-L	1200, 2400	320	280	200	110	90	100	125	120
AOK370-L	1200, 2400	370	330	240	120	120	125	150	130
AOK400-L	1200, 2400	400	360	255	135	120	145	170	145
AOK500-L	1200, 2400	500	460	270	150	120	215	190	160

Legend:

L = Order length of support H = Slab height = front plate height K = Housing height A = Overall width	B = Web width at bottom C = Flange projection width E = Hole Ø distance from lower flange R = Torsional steel required
M = Fitting length. The distance between the end of the hollow-core slab and the outer edge of the support's front plate.	

2.5 AOK custom-made support

1. Application	Custom-made supports are ordered using an order code. The information specified in Appendix 1 shall also be added to the order.
2. Order code	**Code: AOK265C-L-<*parameters*>-ID-code** - The code **AOK265C-L** defines type and length of the support. Width of hole = length of support **L**. It can be 600 – 4800 mm. **ID-code** defines identification name of support in construction drawing. With <***parameters***> can be defined following information: - <J1-J4> Left joint. (See joint specification in chapter 5.4) - <J1-J4> Right joint. (See joint specification in chapter 5.4) - <R90> Fire resistance class R90/R120. If it is not standard R60 min. - <L80> Additional profile on the web. Standard profiles are L80 and L100. - <HDG> Hot dip galvanizing. If it is not standard painting 60µ. - <EXC3> Execution class. If it is not standard EXC2. Add only those parameters which differ from standard delivery.
3. Loads	The allowable load range for the slab to be supported is in tables 4–7. - In the load tables, the self-weights of the support and slab are not included in the design loads for hollow-core slabs. - The party ordering the support is responsible for designing the resistance of the adjacent hollow-core slab to the load transferred by the support. - Special loads may also be specified for the floor to be supported.
4. Example of an order: Code	The order code as **AOK265C-3000-J1-320J2-R90-L100-HDG-A204** means the following: - Support AOK265C (C=custom) is used for openings with OL265mm slabs, and support length **L** = 3000 mm. - Left end standard joint is type **J1** for slab 265. See chapter 5.4. - Right end special joint for slab high 320 is type **320J2**. See chapter 5.4. - Fire resistance class is **R90** min and surface finishing are **HDG** and additional profile on web is **L100**. - The **ID code** of support in the drawing is A204.

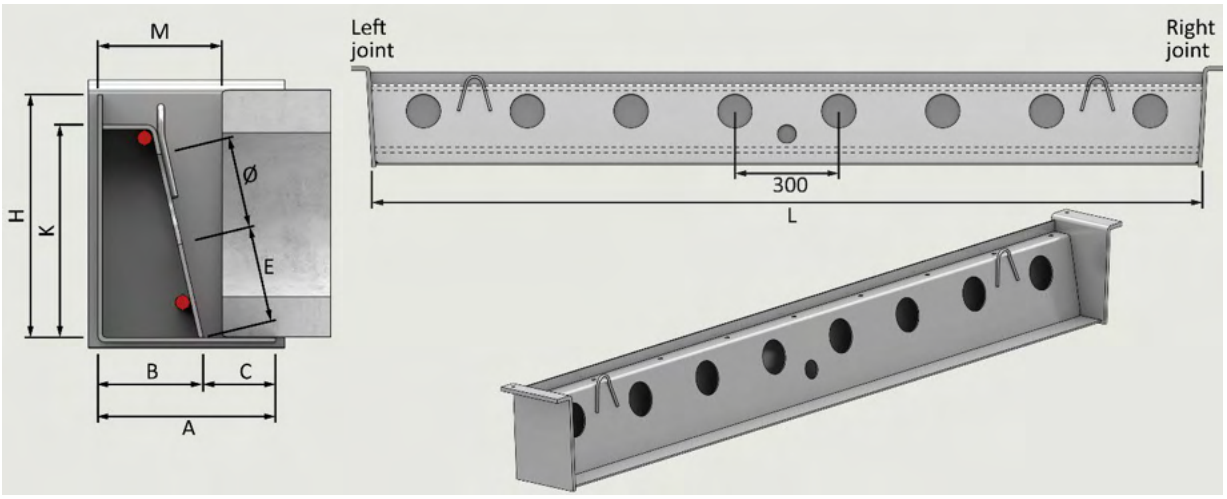


Figure 6. Structure of a custom-made support

Table 2. Dimensions of a custom-made support

Order code	Order length L L(mm)	H mm	K mm	A mm	B mm	C mm	E mm	θ mm	Fitting length M mm
AOK200C-L-<param>-ID	600–3600	200	180	170	80	90	55	90	90
AOK220C-L-<param>-ID	600–3600	220	200	170	80	90	55	90	90
AOK265C-L-<param>-ID	600–4800	265	230	190	100	90	75	110	110
AOK320C-L-<param>-ID	600–4800	320	280	200	110	90	100	125	120
AOK370C-L-<param>-ID	600–4800	370	330	240	120	120	125	150	130
AOK400C-L-<param>-ID	600–4800	400	360	255	135	120	145	170	145
AOK500C-L-<param>-ID	600–4800	500	460	270	150	120	215	190	160

Legend: See chapter 2.4

3 MANUFACTURING

1. *General*	ANSTAR Oy has entered into a quality control agreement with KIWA Inspecta Oy regarding the manufacture of steel parts for composite beam products. Manufacture according to SFS-EN 1090-2 in execution class EXC2 or EXC3 and according to SFS-EN 1090-1 for a CE marking.
2. *Manufacturing markings*	The supports feature manufacturing markings: - CE marking according to SFS-EN 1090-1 for steel parts.[1] - ANSTAR Oy's code as well as product code and weight
3. *Materials*	The manufacturing materials used meet the following SFS-EN standards: - Web and flange plates SFS-EN 10025 S355J2+N - Reinforcement EN 10080 B500B - Concrete grouting inside the housing minimum C25/30 class 2
4. *Manufacturing method*	- Beams are manufactured according to SFS-EN 1090-2 in execution class EXC2. By special order, they can be manufactured in execution class EXC3. [2] - Welding class C, SFS-EN ISO 5817. [11] - Rebar welding SFS-EN 17760-1. [16]
5. *Surface treatment*	Standard support: - Painting: SFS-EN ISO 12944-5 A40 workshop priming – FeSa2. [12] - By special order, hot-dip galvanization according to SFS-EN ISO 1461. [13] Custom-made support: - Surface treatment is specified upon order in Appendix 1.
6. *Traceability*	Based on order number.
7. *Product approval and quality control*	- Manufacture according to SFS-EN 1090-2:2018 in execution class EXC2 or EXC3. - Manufacture CE marking according to standard EN 1090-1. CE marking certificate: 0416-CPR-7247-03.

4 DESIGN CRITERIA

4.1 Design and manufacturing standards

1. Finnish European standards:

SFS-EN 1991-1+NA	Actions on structures. Part 1-1: General actions. [5]
SFS-EN 1992-1+NA	Design of concrete structures. Part 1-1: General rules and rules for buildings. [6]
SFS-EN 1993-1-1+NA	Design of steel structures. Part 1-1: General rules and rules for buildings. [7]
Concrete Code Card	No. 18EC (EN 1992-1-1) 31 July 2012. Designing a hollow-core slab supported by a beam. [20]

2. Other countries in the European Standards area

Basic Eurocode	EN-1992-1-1:2004/AC:2010
Sweden	SS-EN 1992-1-1:2005/AC:2010+A1/2014
Germany	DIN-EN 1992-1 +NA/2013-04

3. Manufacture

SFS-EN 1090-1	Execution of steel structures. Part 1: Requirements for conformity assessment of structural components. [1]
SFS-EN 1090-2	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 ISO 5817	Welding. Fusion-welded joints in steel, nickel, titanium and their alloys.
SFS-EN 17760-1	Welding. Welding of reinforcing steel. Part 1: Load-bearing welded joints. [16]

4.2 Structural function of the support

4.2.1 Functional cross-section

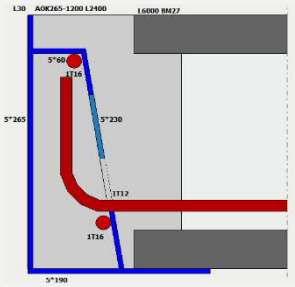
AOK supports are used as edge beams in floor openings in the frames of office, commercial, public and industrial buildings as well as multi-storey car parks.

- They are used to support slabs ending at the edge of the opening against the adjacent, intact slabs.
- There may be a structurally reinforced concrete on top of the slab, or the surface may be created using filler or without a surface structure.
- If necessary, the surface structure can also be used as part of the support's load-bearing structure.

1. Functional cross-section of standard supports.

Parts belonging to the functional cross-section of the support:

- Housing structure and reinforcement
- Concrete grouting inside the housing
- Joint grouting and casting of the flange top surface
- The surface slab is not included in calculating the structural function of the support even if there is one.
- Filling of the hollow core is not included in calculating the functional cross-section.
- No torsional reinforcement for L < 1800 mm supports.



2. Functional cross-section of custom-made supports.

Parts belonging to the functional cross-section of the support:

- Housing structure and reinforcement
- Concrete grouting inside joint and top surface.
- If necessary, the surface slab can be included in calculating the structural function of the support.
- Filling of the hollow core is not included in calculating the functional cross-section.
- No torsional reinforcement for L < 1800 mm supports.
- The support can also be delivered with the front plate extended all the way to the top surface of the surface slab.

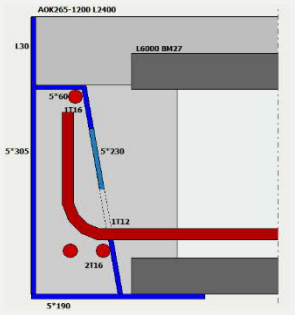


Figure 7. Functional cross-section of a support connection

4.2.2 Design principles

1. General	- The resistance values of the structure are calculated taking into account the development of the load history from erection to the final stage. - It is also taken into account that structures are connected to the load-bearing cross-section at different times. - The nominal loads and load combination are specified according to the following principles:
2. Consequence class and execution classes	- In the design, the consequence class and reliability class are the same as for the building frame, and the manufacture execution classes are accordingly determined as follows: Table 3. Consequence and reliability classes as well as exec classes

Consequence class/ reliability class	Steel structure's execution class SFS-EN 1090-2	Concrete structure's execution class SFS-EN 13670
CC1/RC1	EXC2	Execution class 2
CC2/RC2	EXC2	Execution class 2
CC3/RC3	EXC3	Execution class 3

3. Live load during erection	- The design load during the erection stage is the self-weight of the slab with joint grouting and a live load of 0.5 kN/m2. - Other loads during erection are possible, and information on these must be specified in the order form in Appendix 1. - The moment of design during the erection stage: The joints and housing of the slab have been grouted but the grout has not hardened.
4. Erection support	- Support during erection is provided according to the following principles: ***1. No erection supports.*** Short < 1800 mm supports are installed without erection support. The

	support and its connection withstand the loads coming from the slab during erection. **2. *Erection supports at the slab joints.*** In openings two or more slabs wide, the supports are supported during erection at the slab joints. The support eliminates bending during erection.
5. *Design for the final stage*	- The support acts as a composite structure for loads during the final stage. - The design takes into account that the various structures (including the surface slab) and loads are connected to the functional cross-section at different times. - The design is performed using software. Loads including dynamic effects are taken into account according to SFS-EN 1990-1, Section 4.1.5, with the corresponding increased partial safety factors for loads.
6. *Design for fire situations and torsional steel*	- The support is designed up to fire resistance class R60–R120 without fire protection of the lower flange and front plate. In a fire situation, the load-bearing structure is formed by the web of the inside of the housing, the pieces of rebar and the concrete grouting. - The lower flange and the front plate of the housing do not act in a fire situation. - The slab is tied against torsion and for fire situations using torsional steel going into the housing. The steel is located at the slab joint
7. *Design for accident situations*	- A design analysis for accident situations is performed according to SFS-EN 1992-1-1, Section 2.4.2.4, by using the partial safety factors in accident situations indicated in Table 2.1N of the standard to determine the resistance of the structure in exceptional situations. [6]
8. *Use at low temperatures.*	- The impact strength of standard materials is tested at –20 °C. - At operating temperatures lower than this, the material requirement must be increased in the reference plans.
9. *Ensuring the joint action of the slab and filling the hollow core*	- Shear analysis of the web of the slab is also performed for slabs resting on the support. - The design software designs the shear resistance of the slab's ribs according to Concrete Code Card 18EC. - The final resistance analysis of the slabs always belongs to the slab supplier. - The resistance of the support does not normally require additional filling of the hollow cores other than for the minimum length required by Concrete Code Card 18EC. - Additional filling of the hollow cores is required in order to increase the shear resistance of the slab's ribs; the slab designer provides instructions for this.
10. *Surface slab reinforcement*	- Reinforcing the surface slab significantly increases the bending resistance of the structure. - The surface slab is designed to produce a composite effect together with the rest of the structure when the slab thickness is at least 40 mm. - Transverse reinforcement is placed in the surface slab, also evening out the cracks in the surface slab and ensuring the composite effect. - The surface slab reinforcement significantly improves the shear resistance of the slab's ribs. - The standard supports have been designed without a surface slab.
11. *Removing moisture from inside the housing*	- After erection, the housing is grouted on the site such that it is filled with concrete, and moisture runs out through the web holes and the vent holes in the upper flange. - However, the final drying of the inner parts of the housing must be taken into account in scheduling the manufacture of the surface structures.
12. *Structure's service life and durability*	- Service life and durability design is performed according to the instructions in SFS-EN 1992-1.

5 DETAIL DESIGN

5.1 Selecting the support

1. *Standard support*	- Standard supports are selected using the design tables in Section 5.2. - The order is made using the order code specified for the support. - The support is manufactured according to the order code provided by the customer.
2. *Custom-made support*	- Custom-made supports are selected using the design tables in Section 5.2. - The additional information required for ordering the support is provided in Appendix 1. - An order code is formed for the support. - The support is designed and manufactured according to Appendix 1.

5.2 Support design criteria and load tables

1. *Design for the erection stage*	***Design criteria:*** - Design of the support for the erection stage has been specified for the self-weight of the seamed slab and for an erection load of 0.5 kN/m^2. - When the support length is ≥ 1800 mm, erection supports are used. - The graphs in tables 4–7 already include erection stage analysis.
2. *Design for the final stage*	***Design criteria:*** - Design standard SFS-EN 1992-1. - Partial safety factors for loads. Permanent γ_g = 1.15, live γ_q = 1.5) - Design of the support for the final stage has been specified for the self-weight of the seamed slab and for live loads (g2+q2) kN/m^2. - The self-weight of the slab on the support and the length of the load distribution area are calculated at the middle of the slab to be supported.
3. *Design for accident situations*	***Fire situation:*** - Accident situation analysis has been performed using software. - The standard fire resistance class in the tables is 60 min. - With custom-made supports, the fire resistance class may be 120 min.
4. *Design the connection.*	***Design criteria for an end connection:*** - Design tables 4–7 have been specified such that the support reaction of the end of the support on the adjacent support slab does not exceed the point load resistance of the slab's edge. The point load resistance has been calculated for the slab's concrete strength C50/55. - The slab's point load resistance is always ensured by the slab supplier.
5. *Design tables*	***Preparation criteria for tables 4–7:*** - The horizontal axis depicts the overall length L (m) of the slab to be supported by the support. *(Distance from the edge of the front plate to the centre line of the support beam) (= span length of the slab)* - The vertical axis depicts the nominal value (g2+q2) kN/m^2 of the uniform load on the slab. - The supports have been designed with the partial safety factor γ_q = 1.5 by assuming that the entire load (g2+q2) coming from the slab is a live load. - The following are included in calculating the load: g2 = slab's surface casting and other dead loads (kN/m^2) q2 = live loads on the slab (kN/m^2) - Point and line loads must be converted into uniform loads in the slab area. - *The dead weight of the seamed slab is not included in this load g2.*
6. *Selecting the support*	***Using the tables:*** - According to the length of the support, select the same or next higher standard-length dimension table as the design table. - Select the same height for the support according to the slab to be supported. - From the horizontal axis, select the overall length of the hollow-core slab to be supported = span length. - From the vertical axis, select the slab's specific load (g2+q2) kN/m^2. - The loading point must be left below the graph for the selected support.

Table 4. Support length L1200 mm. Dead and live load kN/m^2 allowed for the slab to be supported.

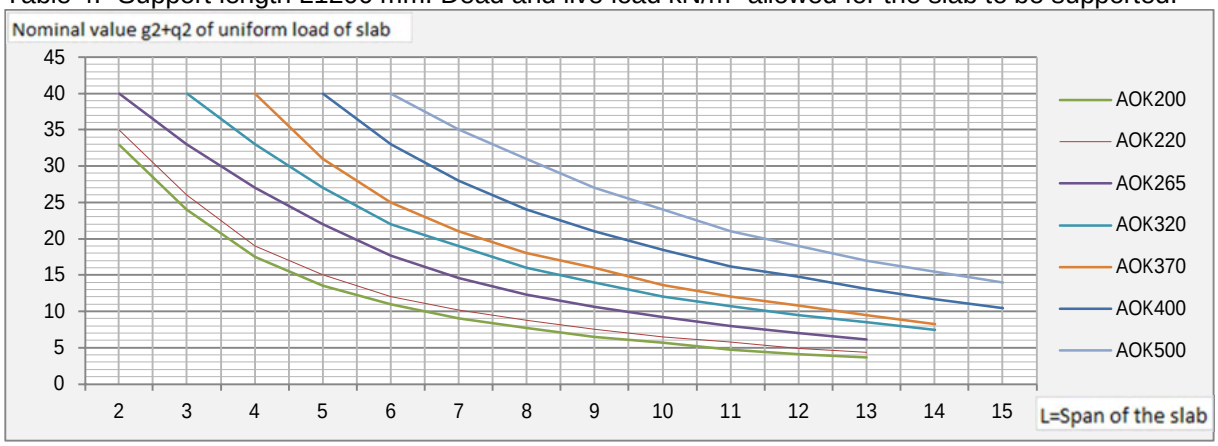


Table 5. Support length L2400 mm. Dead and live load kN/m^2 allowed for the slab to be supported.

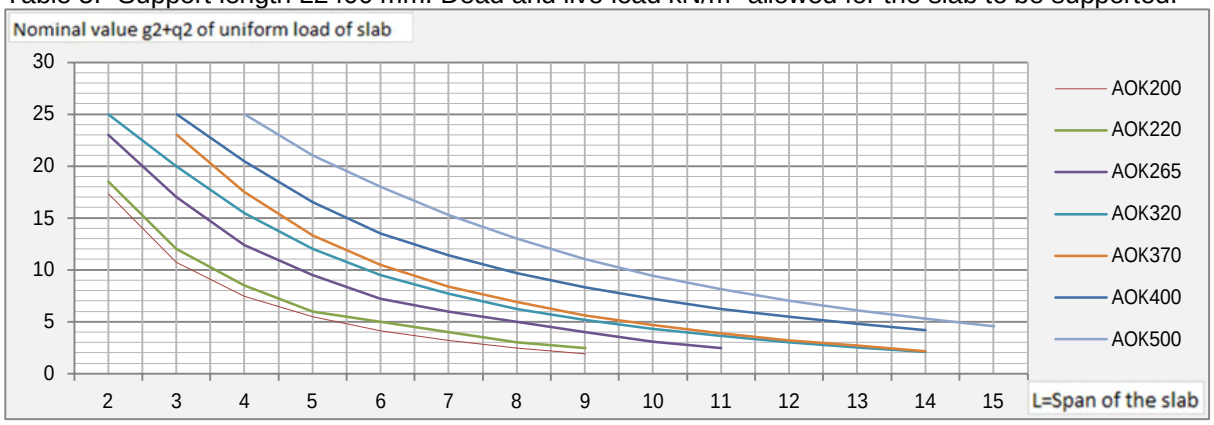


Table 6. Support length L3600 mm. Dead and live load kN/m^2 allowed for the slab to be supported.

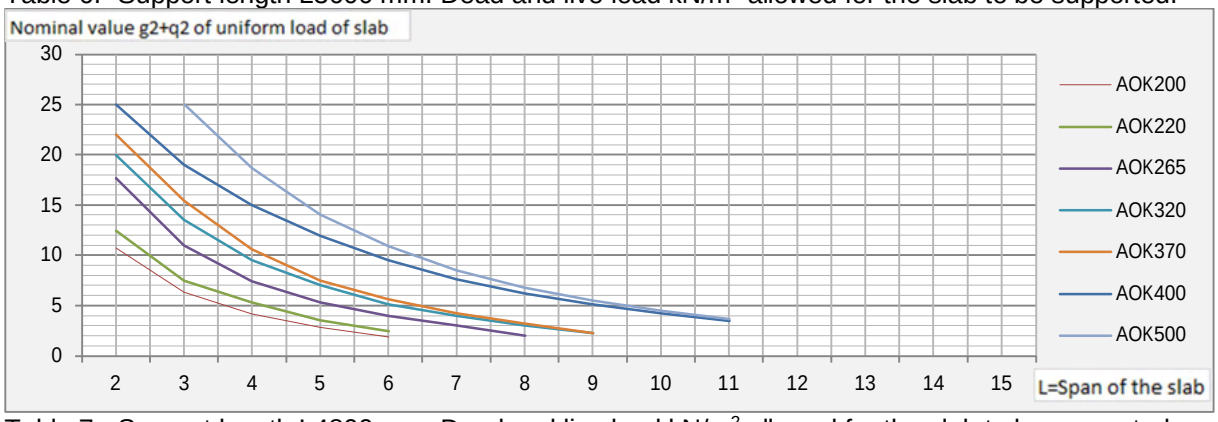
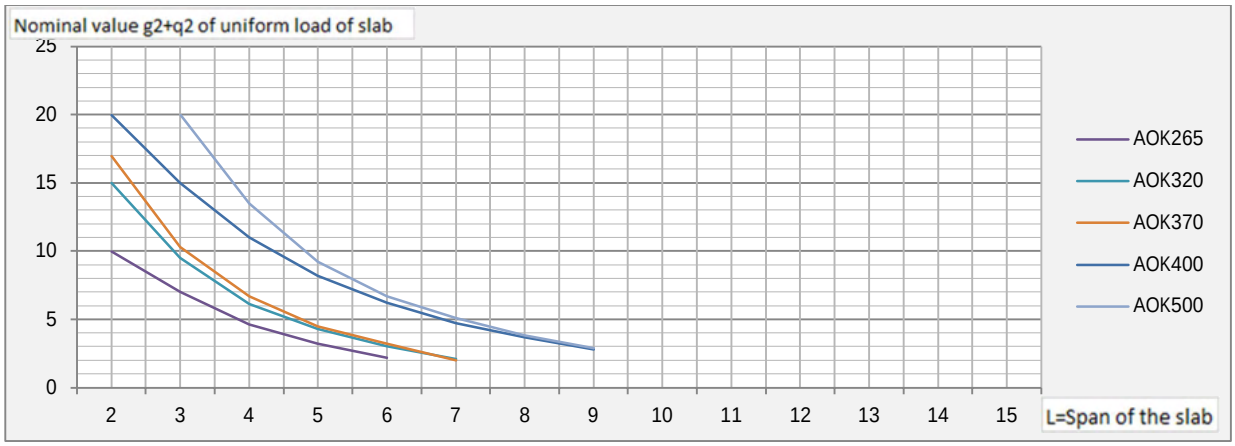


Table 7. Support length L4800 mm. Dead and live load kN/m^2 allowed for the slab to be supported.



5.3 Joint action of the support and hollow-core slab

5.3.1 Placement of the slab

1. General	The following must be taken into account in designing the connection between the support's housing and the slab:
2. Supporting the slab on the lower flange	The theoretical clearance of the end of the slab from the slanting web is 10 mm. The slab's support surface has the following values: - For slabs OL200-320, the support surface is 80 mm, minimum value 70 mm. - For slabs OL370–500, the support surface is 110 mm, minimum value 100 mm. - In the support surface width, the manufacturing tolerances of the slab length must be taken into account as a factor reducing the support surface
3. Concrete filling of the hollow cores and shear resistance of the ribs	- In terms of strength engineering, the functioning of the structure does not require concrete filling of the hollow cores for a length greater than the basic value indicated in the Concrete Code Card. - Additional filling is required when the shear resistance of the slab's concrete ribs is not sufficient in the joint action analysis in accordance with Concrete Code Card 18EC. - The shear resistance of the hollow-core slab's ribs is sufficient with the loads in accordance with the design table.

5.3.2 Additional steel in the structure

Torsional steel in accordance with Figure 8 is placed in the slab joints for the joint action of the housing and slab. These pieces of steel tie the torsional moment of the slab's eccentric support to the housing.

Torsional steel:
- For supports 1800–4800 mm long, the torsional steel is placed into the housing's torsional hole at the slab joint.
- The steel is slid into the beam through the opening at the lower edge of the housing.
- The order code specifies the delivery of torsional steel.

Circular reinforcement:
- If circular reinforcement is taken past the housing, it is placed at the joint between the housing and the end of the slab

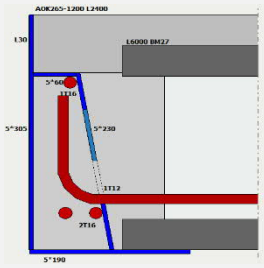


Figure 8. Torsional steel for the support

5.3.3 Grouting for the structure

1. General	The housing acts as a composite structure with the slab when the grout has hardened. The joint action of the housing profile and slab as a composite structure is influenced by the following grouting:
2. Grouting inside the housing	The housing is filled with concrete in connection with joint grouting of the slab. The housing grouting acts as part of the load-bearing structure, and quality control of the concrete must be carried out according to the requirements for structural concrete. The minimum strength is C25/30-2.
3. Grouting of the joint between the slab and housing	Grouting is performed by simultaneously grouting the housing, the longitudinal joints of the slab and the joint between the housing and slab up to the top surface of the floor.
4. Surface casting of the slab	The slab surface or filler casting is performed after the joint grout has dried.

5.3.4 AOK Support TS-Tools

1. General	Tekla Structures software has been implemented two tools to modelling hollow code slabs and AOK supports.
2. TS Tools	Two slab hanger modelling tools have been implemented for extending the capabilities of Tekla Structures software – locator tool "*AnstarAOKLocator*" and hanger designer tool "*AnstarAOK*". These tools are used together in following way: - *AnstarAOKLocator* is used to select slabs supporting the hanger, supported slabs and location of the hanger. - *AnstarAOKLocator* then uses *AnstarAOK* to model the slab hanger.

5.4 Joints

5.4.1 AOK support. Type of joints.

1. *General.*	AOK support has four joint types. - Standard support has always joint type J1 - Custom support has joint types J2-J4 which are defined in order.
2. *Standard joint to the edge of hollow core slab. Type J1.*	The standard support's connection to the edge of the slab is an end plate/suspended connection type J1, picture 9. - The connection is fastened to the top surface of the slab with a drop-in anchor to prevent the support from moving when installing the slabs.
3. *Special joint to the edge of hollow core slab. Type J2.*	The support's connection to the edge of the higher slab is an end plate/suspended connection type J2, picture 9. - The support is supported on the edge of the slab using the connection's end plate such that the support reaction is distributed onto two ribs of the hollow-core slab. - The connection is fastened to the top surface of the slab with a drop-in anchor to prevent the support from moving when installing the slabs. - Joint has additional fixing plate T2.
4. *Joint to the edge of thin shell. Type J3.*	The support's connection to the edge of the thin shell slab is an end plate/suspended connection type J3, picture 10. - The connection is fastened to the top surface of the slab with a drop-in anchor to prevent the support from moving when installing the slabs.
5. *Joint to top of wall and beam element. Type J4.*	Joint type J4 to the top of beam or wall element. - The connection is fastened to the top surface of the slab with a drop-in anchor to prevent the support from moving when installing the slabs.

5.4.2 Joint types J1 and J2 to the edge of hollow core slab

1. *General*	The standard support's connection to the edge of the slab is an end plate/suspended connection.
2. *Joint structure*	- The connection is fastened to the top surface of the slab with a drop-in anchor to prevent the support from moving when installing the slabs. - The support is supported on the edge of the slab using the connection's end plate such that the support reaction is distributed onto two ribs of the hollow-core slab. - During the final stage, the support has torsional reinforcement. The connection can be implemented with slabs of the same height or different heights. - Supports for slabs of different heights are ordered according to Appendix 1, where the connection type is specified.
3. *Load resistance of joint*	The resistance of the connection has been determined according to the point load resistance of the edge of the slab. The point load resistance corresponds to the standard-height slab of the support. The calculation theory is in accordance with SFS-EN 1168+A2, Section 4.3.3.2.4. The point load resistance of the edge of the hollow-core slab is calculated using the following formula: V_{Rd} = b_{eff} * h *f_{ctd} (1+0.3 α δ_{cp} / f_{ctd}) b_{eff} = Web width of the two outermost ribs (= b_{w2} + b_{w3}) h = Slab height α = l_x/l_{bpd} according to SFS-EN 1992-11:2004, Section 6.2.2 δ_{cp} = Compressive stress of the concrete on the central axis due to slab preload
4. *Edge of slab*	- The connection has been designed for standard slab edge shapes in accordance with Figure 1/1 of Concrete Code Card BY 18EC. - The edge inclination is 18–21 mm in relation to the bottom surface of the slab. - With non-standard edge shapes and slabs, the structure and point load resistance of the connection must be separately designed according to the slab used.
5. *Narrow slab*	- If a suspended connection is supported against a narrowed slab, the resistance of the connection's support area must be ensured on a case-specific basis. - Grouting must be used in the hollow cores of the slab, and the point load resistance of the supporting rib must always be determined case-specifically.

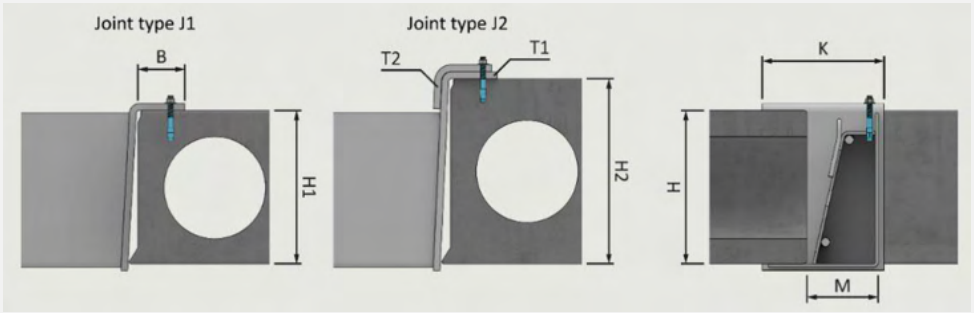
6. Resistance of joint	- The resistance of the connection has been specified for one standard suspended plate that is intended for a more lightly loaded support. - An additional plate T2 welded on top of the standard plate is used for custom-made supports
7. Picture	 Figure 9. Connection of support J1 to the edge of the slab and special connection J2 to a higher slab

Table 8. Suspended connection dimensions joints J1 and J2 and point load resistance.

Support code	Joint type	Hollow core slab	Point load resistance V_{Rd} (kN)	H,H1 mm	K mm	T1,T2 mm	B mm	Fitting length M mm
AOK200C	J1, J2	200	36	200	190	10	80	90
AOK220C	J1, J2	220	46	220	190	10	80	90
AOK265C	J1, J2	265	58	265	210	12	80	110
AOK320C	J1, J2	320	70	320	220	15	80	120
AOK370C	J1, J2	370	80	370	260	15	100	130
AOK400C	J1, J2	400	110	400	275	18	100	145
AOK500C	J1, J2	500	130	500	290	18	100	160

Legend: V_{Rd} = Connection's point load resistance at the edge of the slab.
The resistance values have been calculated for the hollow-core slab's concrete strength C50/55.
The graphs in tables 4–7 have been calculated according to this resistance.
H = Connection height = front plate height
H1 = Joint type J1, standard high of slab
H2 = Joint type J2, Higher slab = given in order
K = Connection width
T1 = End plate thickness of standard connection
B = Connection plate width at top of slab
M = Fitting length. The distance between the end of the hollow-core slab and the outer surface of the front plate.

5.4.3 Joint type J3 to the thin shell edge.

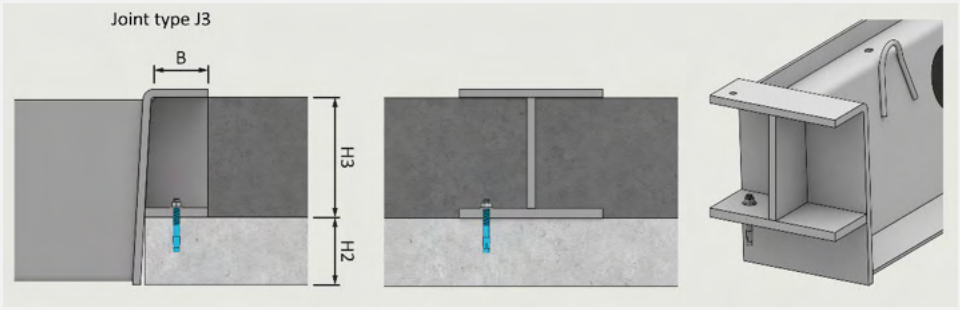
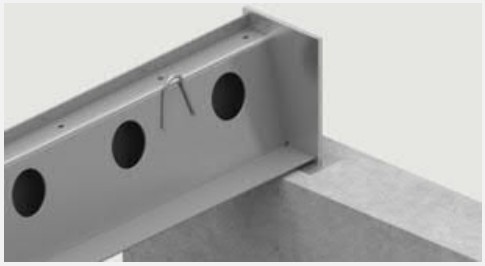
1. General	The joint type 3 to the edge of the thin shell slab is an end plate connection.
2. Structure of joint	- The support is supported on the edge of the thin shell slab using the connection's end plate such that the support reaction is distributed onto slab. - The connection is fastened to the top surface of the slab with a drop-in anchor to prevent the support from moving when installing the slabs.
3. Load resistance	- The resistance of the connection has been defined according to resistance of the edge of thin shell element.
4. Picture	

	Figure 10. Standard support of the joint J3 to the thin shell slab edge.

5.4.4 Joint type J4 on top of a concrete beam or wall

1. *Beam or wall at the bottom surface of the slab* - The support is connected on top of the supporting element with a normal end plate connection. - The end plate is welded to a mounting plate on top of the supporting element. - The connection must be designed for torsion from the support. - The connection type is ordered for custom-made supports according to Appendix 1.	
2. *Beam or wall at the top surface of the slab* - The support can be taken on top of a concrete beam using a direct end plate if the edge shape is suitable. - If necessary, some concrete can be removed from the corner of the concrete element as required by the rounding of the plate. - The connection type can be used for a standard support.	
3. *Other connection types for the custom-made support are designed according to the drawings attached to the order*	

5.5 Fire protection

1. *AOK Support*	The support and its connections are designed for the fire resistance class of the hollow-core slab floor. - The fire design of the support has been made for fire resistance class R60 using software. - In a fire situation, the load-bearing structure consists of the housing's upper flange and inner web, the concrete of the housing and joints as well as the rebar on the inside. - Fire design in the R60 class is also included in the design values of tables 4–7.
2. *Joint*	A suspended connection on top of the slab must be fire-protected when there will be no surface casting on the slab. - The protection is implemented using a fire protection plate or concrete grouting. - Structures on the roof floor can be used for protection. Connections on top of the beam or wall must be fire-protected if they are not inside the rest of the structure.

5.6 Service life design

1. *General*	Service life and durability design for concrete structures is performed according to the instructions in BY 65 Concrete Codes 2016, Section 2. The requirements of SFS-EN ISO 12944 are applied for steel structures [12]. If necessary, the analysis is performed separately for the top and bottom of the structure.
2. *Durability of concrete and rebar*	The pieces of rebar on the inside of the housing have sufficient protection in all exposure classes. At the upper flange, the nominal value of the housing's concrete cover is checked according to the exposure class.
3. *Durability of steel parts*	Surface treatment of the visible steel parts of the housing is carried out according to SFS-EN 12944-2 [12] by applying the instructions to the exposure classes of BY 65 Concrete Codes. The atmospheric corrosivity category according to SFS-EN 12944-2 and its requirements are taken into account in the surface treatment of the visible lower flange and front plate as well as the end connection. Non-standard surface treatment must be ordered as custom-made supports.
4. Nominal value	Table 9 shows the nominal value C_{nom} for the concrete cover of the

C_{nom} for the concrete cover	structure's supplementary reinforcement or steel parts by exposure class according to minimum value $C_{min,cur}$ in BY 65, Table 2.3. The nominal value for the concrete cover of the steel parts is $C_{nom} = C_{min,cur} + \Delta_{cdev}$ (= 10 mm). Table 9 also shows the recommended minimum surface treatments and protection methods in various exposure classes.

Table 9. Nominal value C_{nom} for the steel parts' concrete cover and surface treatment methods

Exposure class BY 65 Concrete Codes	50-year service life C_{nom} mm	100-year service life C_{nom} mm	Minimum requirement for surface treatment of the lower flange, front plate and end connection
X0	20	20	Workshop priming. Finish painting only for visible parts as necessary. Specified in the structural plans.
XC1	20	30	Workshop priming. Necessary finish painting specified in the structural plans.
XC3	35	45	Workshop priming. Necessary finish painting specified in the structural plans.
XD1–XD3	50	60	The support is hot-dip galvanized according to the standard [13]. Torsional reinforcement is hot-dip galvanized.
XS1–XS3 XA1–XA3 XF1–XF4	–	–	The supports can be used on the basis of site-specific special analyses. The surface treatment, protection methods and concrete cover's nominal value are specified according to the site requirements.

6 ORDERING AND DELIVERING THE SUPPORTS

6.1 Ordering custom-made supports using Appendix 1

The order is placed using the order form provided in Appendix 1, specifying the dimensions of the slab opening as well as the loads and connection information required for the design. The information needed in the order is shown in Figure 11:

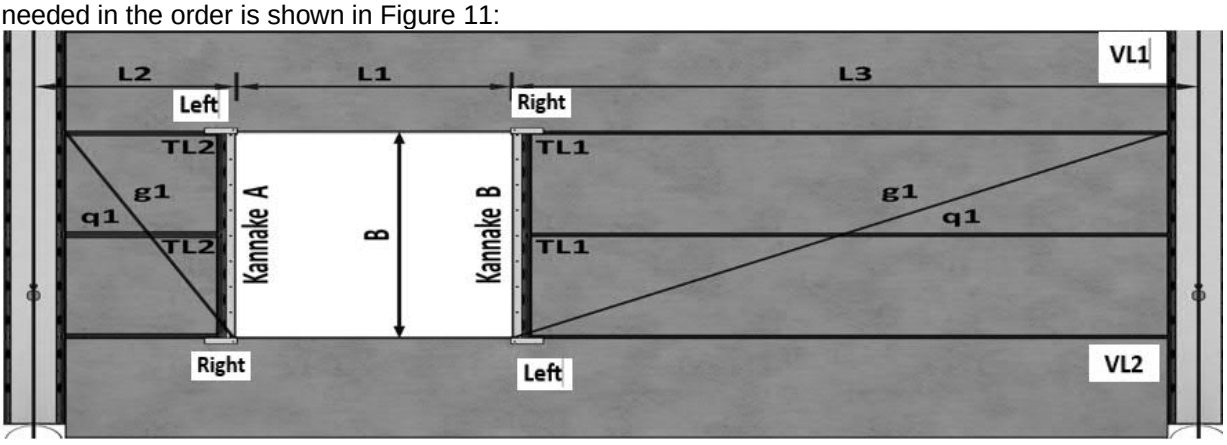
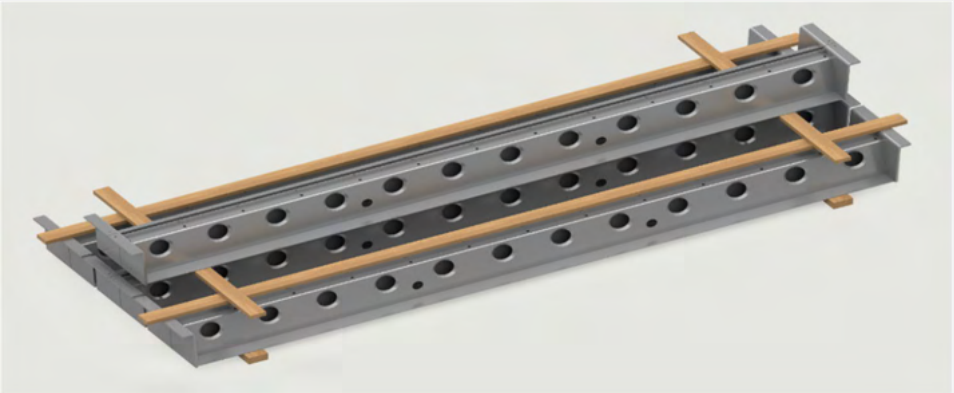


Figure 11. Dimensions for placing the support in the slab.

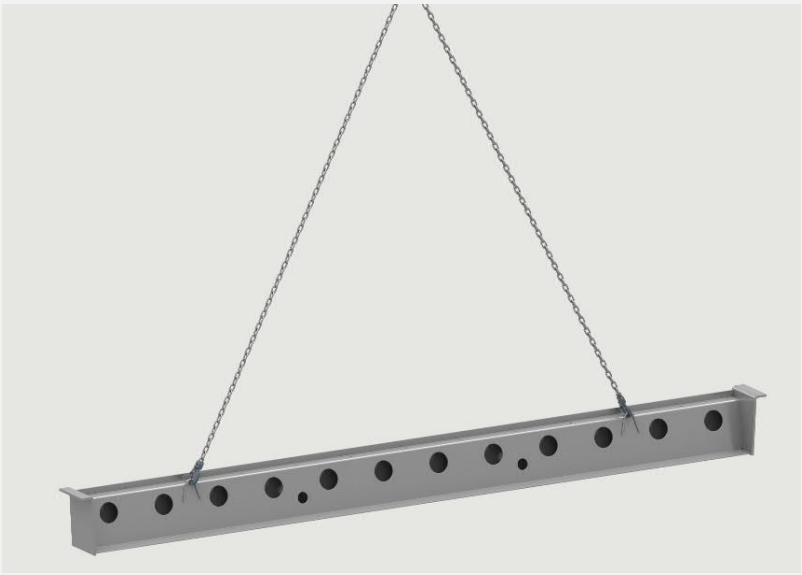
1. General	Dimensions to be specified in the order:
2. Order code	Both supports for the opening are ordered using the same form. - For asymmetrical cases, specify the order codes separately for each of the two supports for the opening. The support is viewed from inside the opening.
3. Location in the floor	Specify the location of the opening in the floor by providing the dimensions: - L1 = Free inside length of the opening = distance between the support front plates. - L2 = Distance from the edge of the opening to the middle of the left support beam. - L3 = Distance from the edge of the opening to the middle of the right support beam.

	- B = Free width of the opening to the edge of the adjoining slab (generally n*1200). Dimension B is the width of the opening and usually also support length L.
4. *Information on the hollow-core slab*	Provide the following information on the slabs: - Type of the slab to be supported, height information and seamed slab weight. - The support structure is symmetrical if the opening width is n*1200. - The support structure is asymmetrical in relation to the torsional steel opening when one of the slabs is narrower. The order must include a drawing showing the unusual placement and reduced dimensions of the slabs.
5. *Slab loads*	Specify the loads on slabs TL1 and TL2: - g1 = Permanent load on top of the slab (surface casting and other permanent loads). - q1 = Live load on the slab (live load on top of the slab). - The self-weight of the seamed slab is not included in the permanent load. - If the slab has special loads, a load chart must be provided.
6. *Slab connections*	The following connections are used for the support: - Standard suspended connection J1 to a slab of the same height. - Special connection to a higher slab J2 - Connection J3 to thin shell element - Connection J4 to the top of wall or beam. - Dimension information must be provided on special connections for designing the connection.
7. *Surface treatment*	- The standard treatment is painting, A60 workshop priming. - Hot-dip galvanization (with the order code HDG). - Special painting, adding the desired treatment combination.

6.2 Delivery and storage

1. *Delivery and storage*	Supports are delivered to the site loaded in the vehicle in the order of erection. - Long supports are always loaded lowermost. - The support must not rest on the vertical top edge of the front plate. The upper flange or end connection is suitable for supporting. - Erection is performed directly from the vehicle, so intermediate storage is usually not necessary. - If necessary, the supports can be stored on the site by placing them on wooden supports on a level surface. - The front plate top surface and end connection must be protected against damage during storage. - Longer-term storage requires protection from rain.
2. *Storage principle*	 Figure 12. Transport support and storage on the site

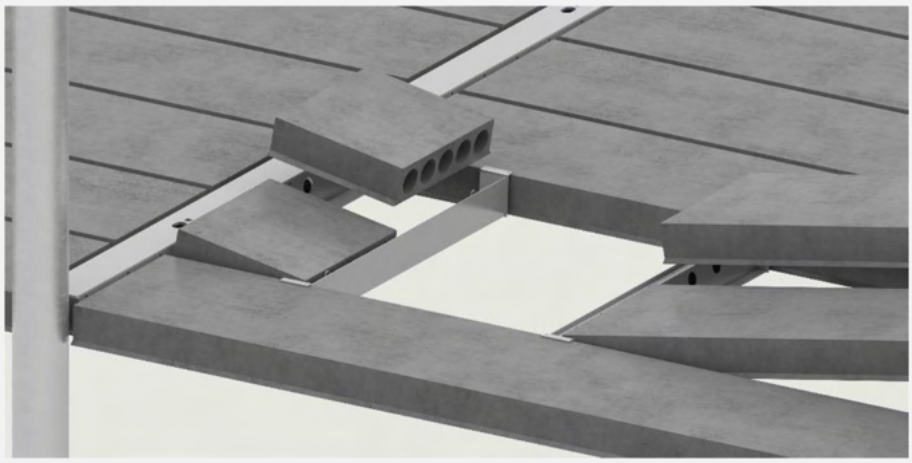
6.3 Lifting

1. Lifting	Lifting the support: - Lifting lugs have been welded to the surface of the slanting inner web for lifting using self-locking hooks. - The lifting point is located very close to the centre of gravity. - The maximum allowable lifting angle of the slings must be taken into account when lifting. - Use CE-marked or type-approved lifting equipment. The lifting lugs may be covered by grouting.
2. Lifting principle	 Figure 13. Lifting points and lifting

7 ERECTION

7.1 Erection order and erection

1. General	The supports and slabs for a floor opening are installed in the following order:
2. Hollow-core slabs	Start by selecting intact slabs at the edge of the opening such that the theoretical distance of the opening is within the planned tolerances.
3. Lifting	Lift the support so it rests on the edge of the slabs and adjust its location to correspond to the planned location of the opening and inner width of the opening.
4. Fastening	A suspended connection is fastened to the slab using a drop-in anchor M8*50. Other connections are fastened so that they cannot move.
5. Erection support	Erection supports are placed at the slab joints, under the lower flange, according to the instructions in Section 7.2. Erection supports are only used for supports whose length is L1800–L4800.
6. Installing the slabs	Install the hollow-core slabs onto the bottom flange of the support. - The theoretical erection clearance of the slab from the web surface is 10 mm. In this case, the allowable support surfaces and erection tolerances for the slab are: - For slabs OL200–OL320, the support surface is 80 mm, minimum value 70 mm. - For slabs OL370–OL500, the support surface is 110 mm, minimum is 100 mm.
7. Torsional reinforcement	Install torsional reinforcement for L1800–L4800 long supports. - Ensure that the torsional hole 55*80 mm in the housing is always placed at the joint of the slab being installed. - Erection of the slabs must not be continued if there are deviations from this. - At the joint of the slab, take the torsional steel in through the torsional hole

	in the housing's web. - The torsional steel for standard supports is T12. Delivery for Site Contractor.
8. *Circular steel for the slab*	- Any circular steel is installed above the torsional steel, in the joint grouting between the end of the slab and the housing. - The pieces of circular steel are designed by the main structural designer and are part of the site acquisitions.
9. *Housing grouting*	- Perform joint grouting of the housing and slabs.
10. *Supports*	- Remove the erection supports after the joint grout has hardened.
11. *Order of slabs*	 Figure 14. Erection order of the slabs

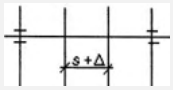
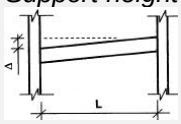
7.2 Erection support

The support is not supported during erection.	
1. *General*	- No erection supports are used for supports whose length is < L1800 mm. - Torsion from eccentric loads on the slab is transferred to the beam end connections.
Erection supports are placed on the span of the support.	
2. *General*	- The erection supports are placed under the jaw of the housing before installing the slabs. - 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.
3. *Need for erection supports*	- The purpose of erection support is to reduce bending during erection by shortening the span length. - Erection supports are used for supports L1800–L4800 mm long.
4. *Supporting point*	- The supporting points (1–3 pcs) are placed on the span, at the slab joint, under the lower flange.
5. *Structure of the erection supports*	- Each erection support consists of one vertical support at the web. - It prevents the housing from twisting during erection and transfers the entire load of the slab down.
6. *Removing the erection supports*	- The erection supports are removed after the grout of the slabs and housing has hardened, before casting the surface slab.
7. *Principle*	 Figure 15. Erection supports on the support span and their location.

7.3 Erection tolerances

1. *General*	- Erection tolerances according to SFS-EN 13670 are followed in installing a concrete element frame. Erection tolerances according to SFS-EN 1090-2 are followed in installing a composite column frame. The support and its connections allow for the following tolerance deviations in the location of the slabs

2. *Slab end clearance*	- The theoretical clearance of the end of the slab from the web is +10 mm.
	- The clearance from the web is allowed to vary within the range of 10–20 mm in the longitudinal direction of the slab.
	- The length tolerances of the slab must be evened out at the opposite end of the slab.
	- The width of the slab's support surface on top of the lower flange must not be below the minimum value.
	  - For slabs OL200-OL320, the support surface is 80 ± 10 mm.
	  - For slabs OL370–OL500, the support surface is 110 ± 10 mm.

3. *Slab distance* 	- The allowable deviation in the distance of adjacent support slabs is Δ = ± 10 mm from the theoretical slab distance (n*1200 mm). - The allowable deviation in the overall width of the slab opening is Δ = ± 20 mm from the theoretical.
4. *Support height* 	- Deviation in the elevation of the ends of the support (inclination). L = support length Δ = ± L/500, but no more than 10 mm. - Deviation in the relative elevation of adjacent slabs. L = support length Δ = ± L/500, but no more than 10 mm. - The level deviation of the support's general deviation is in accordance with the general tolerances for the frame.

7.4 Measures to be taken if erection tolerances are exceeded.

1. *General*	- If tolerances are exceeded in the location of the slabs, the location of the supports can be corrected in a limited manner using the following methods.
2. *Distance between support slabs*	- If the distance tolerance of support slabs exceeds +20 mm, the support connection must be corrected to ensure that the forces are transferred as planned. The support must not be installed in an opening wider than L + 20 mm without correcting the support connection. - If the distance is short, some concrete may be removed from the edge of the slab, taking into account the load-bearing capacity of the slab. The support must not be modified.
3. *Location and distance of the opening*	- The location of the opening can be corrected as needed. The load-bearing capacity and structure of the support do not prevent this. If the distance of the opening is changed, the minimum requirement for the slab's support surface on the lower flange must be taken into account.
4. *Slab location on the lower flange*	- The end of the slab may be placed so that it touches the surface of the slanting inner web by removing the stop plate from the web surface. - The clearance of the slab end from the web must not exceed 20 mm. The location of the slab must be corrected.

7.5 Allowable corrections on the site

1. *General*	- In general, 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 erection.
2. *Allowable corrective measure*	- Fastening by welding is usually allowed on the lower flange or vertical web. However, the allowable welding areas and loads must be confirmed with Anstar's beam design unit.
	- Welding must be performed according to Anstar's instructions, following the welding methods according to SFS-EN 1090-2 as well as quality control for welding class C and execution class EXC2.
	- Building services erections may usually be taken through the grouting holes

	in the web. Similarly, small holes for lead-throughs may be made in the vertical plate at the front edge. - However, the size and location of the erections must be approved by Anstar.
3. *Non-allowable corrective measure*	- Cutting off pieces of the lower flange projection is not allowed. Any provisions needed must be approved by Anstar. - Grouting holes in the web must not be reamed. - Torsional reinforcement must not be modified or reduced. - The support must not be welded to adjoining structures in deviation of the plans.

8 PERFORMING THE GROUTING

8.1 Checking that the housing and joints are ready for grouting.

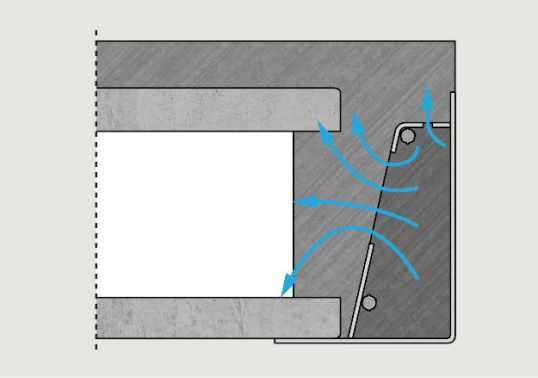
1. *General*	- To ensure that the slab joints and inside of the housing are ready for grouting, check that the following preparatory work has been performed.
2. *Preparatory work*	- Ensure that torsional reinforcement has been installed. - Ensure that circular reinforcement (if any) has been installed. - Ensure that the grouting protection for the slab's hollow cores is in place.
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 grout. - All of the housing and joint grouting is structural load-bearing concrete, which must not freeze during hardening. If necessary, the housing must be equipped with heating cables. - The grouting is performed by following the quality control procedures for structural concrete.
4. *Inspections*	- A review is carried out to confirm readiness for grouting, and the information is saved in the project's quality documentation.

8.2 Grouting of the housing and slab

1. *General*	Dimensioning of the floor during erection takes into account the self-weight of the slabs and the live load during erection. - Before the joint grout hardens, the floor must not be loaded otherwise, for example, by using it for intermediate storage of construction materials. - The support starts acting as a composite structure with the slab once the joint grout has hardened. - The joint action of the housing and slab as a composite structure is influenced by the following concrete grouting:
2. *Grouting inside the housing*	- The housing is filled with concrete during joint grouting, and the grout acts as part of the load-bearing structure. - The entire housing must be filled with concrete. - Start the grouting by filling the housing through its grouting openings, starting from both ends of the housing at the same time. - When the housing has been filled up to the top edge of the grouting openings, fill the joint between the slab housing up to the surface of the floor. - Ensure that the housing is filled up to the upper flange. - You can also see that the housing is full when concrete comes out of all the vent holes in the top surface of the housing. - The amount of free water in the concrete mix should be kept as small as possible in order for the structures to dry more quickly. - When the water/cement ratio is kept low, plasticisers should be used to ensure that the housing is filled with concrete. - The strength of the concrete of the housing is specified in the structural plans.
3. *Joint grouting of the slab and housing*	Joint grouting of the slab is performed once the additional steel in the structure has been installed. - The grouting is performed by grouting the slab joints and the joint between the housing and slab up to the level of the top surface of the

	slab. - The grouting is performed at the same time as filling the housing.
4. Inspection	The erection supports are removed when the grout has hardened. - Before removing the erection supports, you must check that the housing has been filled with concrete up to the upper flange by knocking on it. - If the housing has not been filled completely, the empty parts must be filled by injecting through the vent holes in the housing's upper flange.

8.3 Removing moisture from inside the housing

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 moisture is removed through the housing's grouting openings and vent holes. - The following factors must be taken into account in moisture control of the floor during construction:
2. Actions	Take care of moisture control as follows: - Grout the housing and the slab joints using concrete with a low water/cement ratio. - 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. - 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.
3. Principle	 Figure 16. Moisture removal directions from inside the housing

9 FIRE PROTECTION

1. General	- The support is designed without external fire protection for fire resistance class R60–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. Web and lower flange	- The web and lower flange do not usually require fire protection. Fire design is often the most critical point, and fire protection of these parts can significantly increase the resistance of the support.
3. Suspended connection on top of the slab	- If there will be no surface casting or surface structures on the slab floor, the support connection must be fire-protected on top of the slab. - The scope and method of protection are always specified by a separate plan.
4. Fire protection of the upper flange	- Structural surface casting concrete provides the upper flange with sufficient fire protection. - Without surface casting, the sufficiency of the concrete cover of the upper flange must always be reviewed separately in spaces with a risk of fire.

10 SAFETY MEASURES

10.1 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 installing the support:
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 support as well as incorrect and excessive loading of the floor during erection must be prevented. - Lifting is only allowed using the appropriate lifting points. - The lifting equipment can be unhooked when the support has been fastened into place and cannot fall. - The support must never be left in place without fastening. - The width of the slab's support surface on top of the lower flange must not be below the minimum value.

3. *Stability*	- Erection of the slabs must not begin before each support has been fastened to the adjacent slab, 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 installed floor must be ensured. - The width of the 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 joint grout has hardened, but they must be removed before surface casting. - The commissioning permit for a joint-grouted floor must be determined by means of a review.

10.2 Loading and commissioning the floor during construction

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

11 QUALITY CONTROL AND FINAL DOCUMENTATION

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 design inspections specified in the implementation breakdown are performed on the structures. The acceptance limits must follow the standard tolerances of SFS-EN 1090-2 in tolerance class 1. For concrete structures, the instructions provided in SFS-EN 13670 are followed. The following inspection measures are performed for the support:
2. *Measures before erection*	- Check that the support is in accordance with the plan (type, code and dimensions) and has not been damaged during transport. - Ensure that the support is installed in the correct location on top of the slab and fastened to the slab. - Check that the distance between slabs is in accordance with the plans. - Ensure that any snow and ice has been removed from the connection areas. - Check that the erection supports have been provided.
3. *Measures before grouting*	- Check that pieces of torsional steel have been installed in the slab joints. - 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 is installed in the surface casting according to the plans.
4. *Measures in the event of deviation*	If the 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 - 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.

1. *General*	- When the work has been handed over, the inspection and quality control documentation created during the erection and grouting of the supports and composite beams is delivered to the client.
2. *Readiness inspection records*	- Erection readiness inspection of the frame and beams for installing the slabs. - Grouting readiness inspection of the floor and supports. - Loading capacity and commissioning inspection of the floor.
3. *Inspection records*	- Inspection of the housing grout filling. - Inspection of the fastening of connections. - Inspection of the fire protection of the supports and connections.
4. *Non-conformity reports*	- Non-conformity reports prepared during the erection are handed over.
5. *Product approval as-built*	- CE marking certificates for materials purchased for the site. - As-built documentation for changes made to the structure.

REFERENCES

[1] *SFS-EN 1090-1 Execution of steel structures and aluminium structures. Part 1: Requirements for conformity assessment of structural components.*
[2] *SFS-EN 1090-2, Execution of steel structures and aluminium structures. Part 2: Technical requirements for steel structures.*
[3] *SFS-EN ISO 3834. Quality requirements for fusion welding of metallic materials. Part 1: Criteria for the selection of the appropriate level of quality requirements, and parts 2–5.*
[4] *SFS-EN 1990, Eurocode. Basis of structural design.*
[5] *SFS-EN 1991-1, Eurocode 1. Actions on structures, parts 1–7.*
[6] *SFS-EN 1992-1-1, Eurocode 2. Design of concrete structures. Part 1-1: General rules and rules for buildings.*
[7] *SFS-EN 1992-1-2, Eurocode 2. Design of concrete structures. Part 1-2: General rules. Structural fire design.*
[8] *SFS-EN 1993-1, Eurocode 3. Design of steel structures. Part 1-10: General rules and rules for buildings.*
[9] *CEN/TS 1992-4-1 Design of fasteners in concrete – Part 4-1: General.*
[10] *CEN/TS 1992-4-2 Design of fasteners use in concrete – Part 4-2: Headed Fasteners.*
[11] *SFS-EN ISO 5817, Welding. Fusion-welded joints in steel, nickel, titanium and their alloys. Weld classes.*
[12] *SFS-EN ISO 12944, Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Part 1: General, and parts 2–7.*
[13] *SFS-EN ISO 1461. Hot dip galvanized coatings on fabricated iron and steel articles.*
[14] *SFS-EN 10025, Hot rolled products of structural steels. Part 1: General technical delivery conditions.*
[15] *SFS-EN ISO 1684 Fasteners. Hot dip galvanized coating.*
[16] *SFS-EN 17760-1 Welding. Welding of reinforcing steel. Part 1: Load-bearing welded joints.*
[17] *SFS-EN 13670 Execution of concrete structures.*
[18] *SFS-EN 13225 Precast concrete products. Column and beam elements.*
[19] *SFS-EN 13369 Common rules for precast concrete products.*
[20] *No. 18EC (EN 1992-1-1) 31.7.2012 Designing hollow-core slabs supported on beams with design example.*
[21] *Anstar Oy. ABEAM S Design Instructions.*
[22] *Anstar Oy. ABEAM S Erection Instructions.*

LIST OF TABLES

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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