www.endura.ee

THREADED LIFTING SYSTEM

TECHNICAL MANUAL

END/TLA/DC/001-

R0 - 03.09.2026

Threaded Lifting System

A threaded lifting system is an engineered interface incorporated into precast concrete elements to facilitate their handling during manufacturing, storage, transportation, and erection. The arrangement provides a controlled means of transferring forces generated by lifting equipment into the concrete component through a mechanically engaged threaded c onnection. Threaded lifting systems are used for lifting precast concrete elements.

The advantages of Threaded Lifting System are as follows:

- Fast, repeatable installation
- Minimal extra reinforcement
- Lower long-term project cost
- Easier inspection
- Safe, simple, and very efficient system for lifting and transporting elements.
- Available in various load ranges from 5 kN to 125 kN
- Ideal for beam or wall elements.

Table of Content

1. INTRODUCTION

Threaded Lifting Anchors are designed for lifting precast concrete elements and have a load range from 5kN to 125kN, depending on the type of lifting used. The various types of lifting anchors, lifting devices, and accessories under this system are shown in figure 1, figure 2, and figure 3, respectively.

EH EST EWTL EWTS ECP

Figure 1. Threaded Lifting Anchors

The EH configuration comprises the threaded socket alone, without a supplementary anchoring element. Load transfer into the concrete is achieved through a necked profile with a knurled or hatched surface texture.

The ETS configuration incorporates a straight deformed reinforcing bar (tail) rigidly connected to the socket base, typically by crimping, forging, or resistance welding. Load transfer occurs primarily through bond stress distributed along the development length of the bar, governed by the bar diameter.

The EWTL and EWTS configurations replace the straight tail with a waved bar profile, increasing the effective anchorage length and introducing a mechanical bearing component at each wave crest, in addition to conventional bond stress. This composite bond-plus-bearing mechanism yields a higher pull-out resistance per unit embedment depth relative to an equivalent straight-tail detail, effectively improving the load-to-depth efficiency ratio.

EWTL denotes the long-wave-length variant, applied where sufficient embedment depth is available to develop the full wave geometry, while EWTS denotes the short-wave-length variant, optimized for shallow structural members (thin slabs, panels) where embedment depth is constrained but higher capacity than a straight tail is still required.

The ECP configuration substitutes the bar tail with a straight shank terminating in an enlarged bearing element (plate head). Anchorage in this case is governed predominantly by end-bearing resistance of the enlarged foot against the concrete, rather than bond stress along a bar length, analogous to the load-transfer mechanism of a headed stud or headed anchor.

EFS EBA ELR ECFA

Figure 2. Threaded Lifting Anchors

The EFS anchor consists of a short threaded socket mounted directly onto a flat, wide bearing plate at its base. Load transfer is governed almost entirely by end-bearing of the plate against the concrete. These anchor systems are generally suitable for slabs and the thinnest elements.
The EBA is a threaded lifting insert incorporating a high-strength bolt (class 8.8) for anchorage. Different bolt lengths can be selected to suit the required embedment and component geometry.
The ELR is a threaded lifting insert extended with ribbed reinforcement to provide a longer anchorage zone and effective force transfer through the surrounding concrete.
The ECFA is a threaded lifting insert with an enlarged anchorage foot that develops resistance through mechanical bearing within the concrete.
The ELL loop is fabricated from multi-strand steel wire rope formed into a closed-loop configuration, with both rope ends cold-pressed into a common threaded steel end fitting. The ELL loop is for axial pulls up to 45° from vertical and is not intended for tilting or turning operations.

ELL

Figure 3. Threaded Lifting Device

Safety Features

Where concrete-side failure is the governing consideration, the system carries a built-in margin of 2.5 times the concrete's characteristic strength value (5% fractile).

Colour coding System

Each thread size is assigned a specific colour code to facilitate quick and easy identification of the corresponding anchor.

Table 1. Colour codes for threaded lifting system

Lifting Insert Type	Colour
Rd 12	Pale Green
Rd 14	Light Coral
Rd 16	Baby Blue
Rd 18	Plum
Rd 20	Khaki
Rd 24	Lucky Orange
Rd 30	Antique Steel
Rd 36	Burly Wood
Rd 42	Steel Blue
Rd 52	Tyrolite Blue-green

2. PRODUCT SPECIFICATIONS

2.1 Dimensions

2.1.1 EH Lifting Insert Dimensions

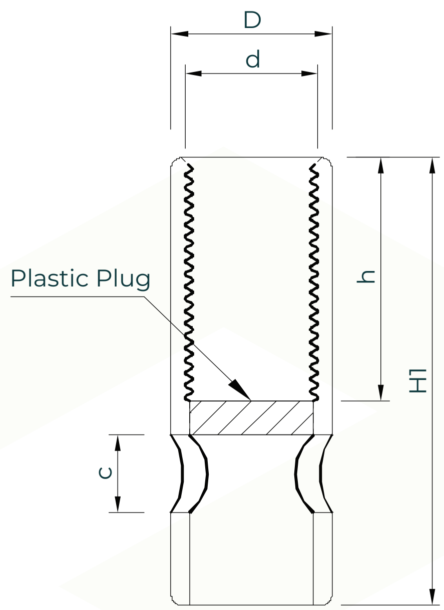


Figure 4. EH Lifting Insert

Table 2. EH Lifting Insert dimensions

Lifting Socket	D [mm]	d [mm]
EH 12	15	Rd12
EH 16	21	Rd16
EH 20	27	Rd20
EH 24	31	Rd24
EH 30	40	Rd30
EH 36	47	Rd36
EH 42	54	Rd42
EH 52	67	Rd52

2.1.2 ETS Lifting Insert Dimensions

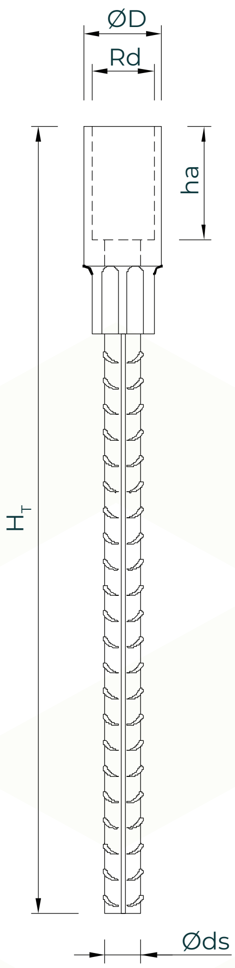


Figure 5. ETS Lifting Insert

Table 3. ETS Lifting Insert dimensions

Lifting Insert	H [mm]	ØD [mm]	Rd [mm]	Øds [mm]	h1 [mm]
ETS - 12	190	15	12	8	22
ETS - 14	235	18	14	10	25
ETS - 16	270	21	16	12	27
ETS - 20	350	27	20	14	35
ETS - 24	400	31	24	16	43
ETS - 30	505	40	30	20	56
ETS - 36	680	47	36	25	68
ETS - 42	790	54	42	28	80
ETS - 52	900	67	52	32	100

2.1.3 EWTL Lifting Insert Dimensions

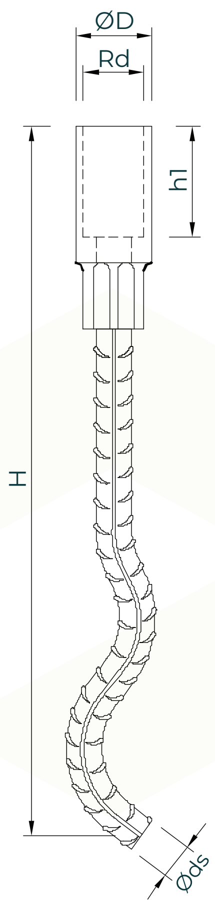


Figure 6. EWTL Lifting Insert

Table 4. EWTL Lifting Insert dimensions

Lifting Insert	H [mm]	ØD [mm]	Rd [mm]	Øds [mm]	h1 [mm]
EWTL - 12	137	15	12	8	22
EWTL - 14	170	18	14	10	25
EWTL - 16	216	21	16	12	27
EWTL - 20	257	27	20	14	35
EWTL - 24	350	31	24	16	43
EWTL - 30	450	40	30	20	56
EWTL - 36	570	47	36	25	68
EWTL - 42	620	54	42	28	80
EWTL - 52	880	67	52	32	100

2.1.4 EWTS Lifting Insert Dimensions

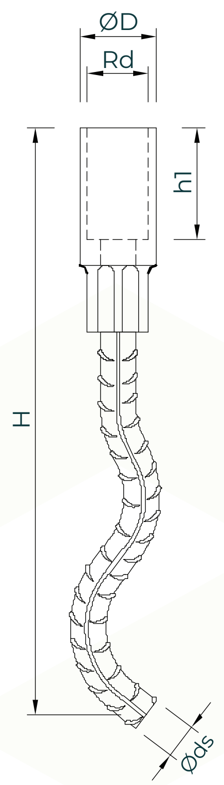


Figure 7. EWTS Lifting Insert

Table 5. EWTS Lifting Insert dimensions

Lifting Insert	H [mm]	ØD [mm]	Rd [mm]	Øds [mm]	h1 [mm]
EWTS -12	108	15	12	8	22
EWTS - 14	130	18	14	10	25
EWTS - 16	167	21	16	12	27
EWTS - 20	187	27	20	14	35
EWTS - 24	240	31	24	16	43
EWTS - 30	300	40	30	20	56
EWTS - 36	380	47	36	25	68
EWTS - 42	450	54	42	28	80

2.1.5 ECP Lifting Insert Dimensions

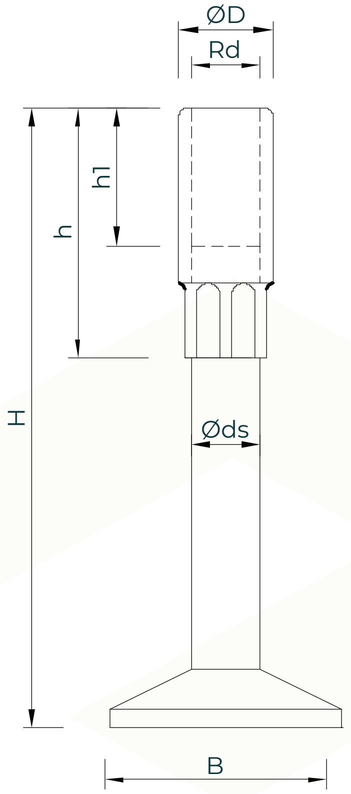


Figure 8. ECP Lifting Insert

Table 6. ECP Lifting Insert dimensions

Lifting Anchor	H [mm]	ØD [mm]	Rd [mm]	Øds [mm]	B [mm]	h [mm]	h1 [mm]
ECP-16	100	22	16	16	42	45	29
ECP-20	115	28	20	20	54	60	40
ECP-24	130	32	24	24	63	70	46
ECP-30	175	40	30	30	78	90	60
ECP-36	225	48	36	36	99	105	69

2.1.6 EFS Lifting Insert Dimensions

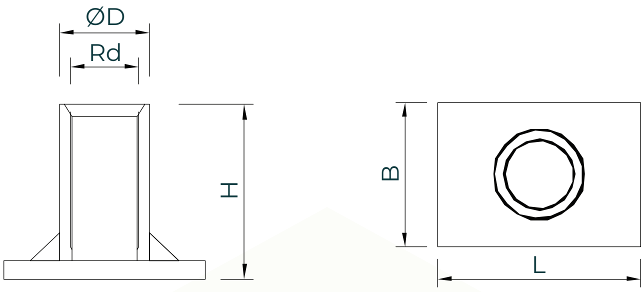


Figure 9. EFS Lifting Insert

Table 7. EFS Lifting Insert dimensions

Lifting Anchor	H [mm]	ØD [mm]	Rd [mm]	L [mm]	B [mm]
EFS-12	30	15	12	35	25
EFS-14	33	18	14	35	35
EFS-16	35	21	16	50	35
EFS-20	47	27	20	60	60
EFS-24	54	31	24	80	60
EFS-30	72	40	30	100	80
EFS-36	84	47	36	130	100
EFS-42	98	54	42	130	130
EFS-52	117	67	52	150	130

2.1.7 EBA Lifting Insert Dimensions

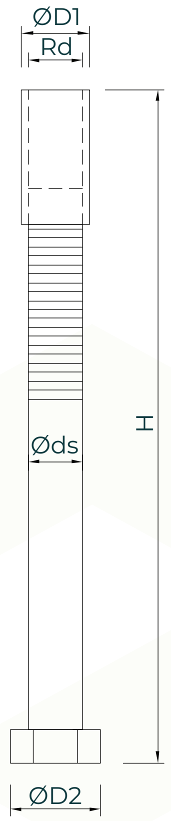


Figure 10. EBA Lifting Insert

Table 8. EBA Lifting Insert dimensions

Lifting Anchor	H [mm]	ØD1 [mm]	Rd [mm]	h [mm]	Part(2) (bolt size) [mm]
EBA-12	150	15	12	30	M12x120
EBA-16	220	21	16	45	M16x180
EBA-20	180	27	20	60	M20x130
EBA-20	270	27	20	60	M20x220
EBA-24	320	31	24	70	M24x260
EBA-30	380	40	30	90	M30x300
EBA-36	300	47	36	105	M36x300
EBA-36	420	47	36	105	M36x320
EBA-42	300	54	42	120	M42x200
EBA-42	460	54	42	120	M42x360

2.1.8 ELR Lifting Insert Dimensions

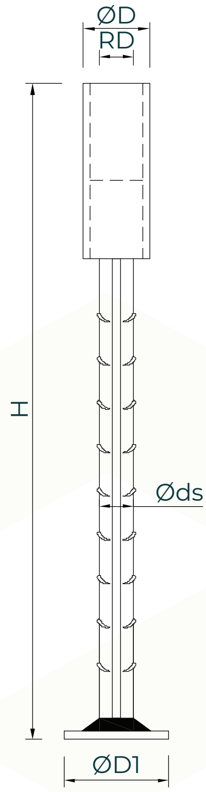


Figure 11. ELR Lifting Insert

Table 9. ELR Lifting Insert dimensions

Lifting Anchor	H [mm]	ØD [mm]	Rd [mm]	ØD1 [mm]	Øds [mm]
ELR-12	150	15	12	24	8
ELR-14	155	18	14	30	10
ELR-16	175	21	16	36	12
ELR-18	225	24	18	42	14
ELR-20	250	27	20	42	14
ELR-24	275	31	24	48	16
ELR-30	350	40	30	60	20
ELR-36	450	47	36	75	25
ELR-42	500	54	42	84	28
ELR-52	700	67	52	96	32

2.1.9 ECFA Lifting Insert Dimensions

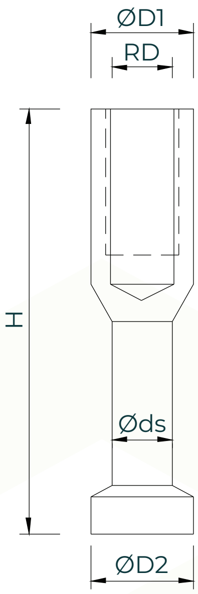


Figure 12. ECFA Lifting Insert

Table 10. ECFA Lifting Insert dimensions

Lifting Anchor	H [mm]	ØD1 [mm]	Rd [mm]	ØD2 [mm]	Øds [mm]
ECFA-12	60	17	12	17	10
ECFA-14	70	19	14	19	10
ECFA-16	80	21	16	21	12
ECFA-20	100	27	20	27	15
ECFA-24	115	31	24	31	18
ECFA-30	150	40	30	40	20

2.1.10 ELL Dimensions

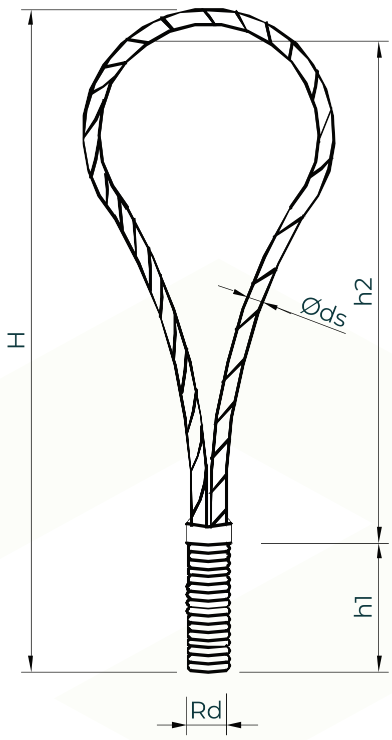


Figure 13. ELL Lifting Insert

Table 11. ELL Lifting Insert dimensions

Lifting Anchor	H [mm]	Rd [mm]	Øds [mm]	h1 [mm]	h2 [mm]	Wire type
ELL-12	155	12 x 1.75	6	22	133	6x19 IWRC
ELL-14	155	14 x 2.00	7	25	130	6x19 IWRC
ELL-16	155	16 x 2.00	8	27	128	6x19 IWRC
ELL-18	190	18 x 2.50	9	34	156	6x19 IWRC
ELL-20	215	20 x 2.50	10	35	180	6x19 IWRC
ELL-24	255	24 x 3.00	12	43	212	6x19 IWRC
ELL-30	300	30 x 3.50	16	56	244	6x36 IWRC
ELL-36	340	36 x 4.00	18	67	273	6x36 IWRC
ELL-42	425	42 x 4.50	20	80	345	6x36 IWRC
ELL-52	510	52 x 5.00	26	97	433	6x36 IWRC

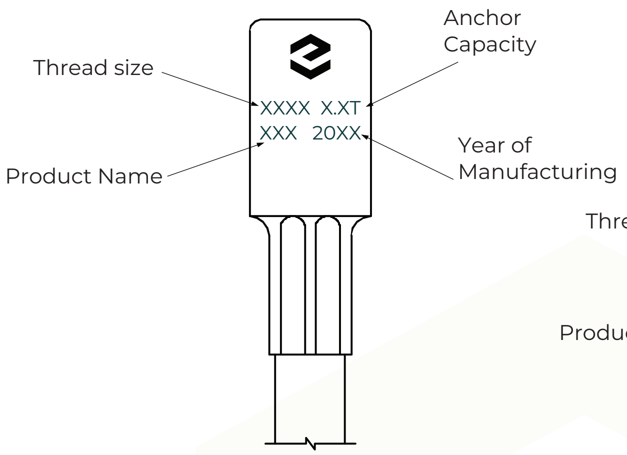
2.2 Materials

Table 12. Lifting Anchors are available in the following materials

Lifting	Material	Material Type	Standard
EH, EBA ETS, EWTL, EWTS, ECP, ELR, ECFA EFS	S355J0 S235JR+AR S355J2+N	Electro-Zinced	EN 10025
EHs, ETSs, EWTLs, EWTSs, ECPs, EFSs, ELRs, ECFAs	1.4301	Stainless Steel	EN 10088
EHa, ETSa, EWTLa, EWTSa, ECPa, ECFAa	1.4401	Acid Resistant Steel	EN 10088
EFS, EBA	1.4571	Stainless Steel	EN 10088
ETS, EWTL, EWTS, ELR	B500B	Ribbed Reinforcement	SFS 1300
EBA (BOLT)	Grade 8.8	Medium Carbon Steel	ISO 898-1
ELL (Wire)		High Strength Steel Wire	EN 12385-4
ELL (Ferrule)		Metal	

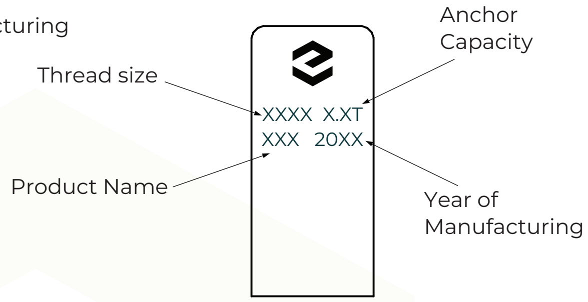
2.3 Markings

Each product is marked with the Thread Size, Load Class, Product Name, and manufacturing date as shown in Figures 14.1, 14.2, 14.3, 14.4, and 14.5.



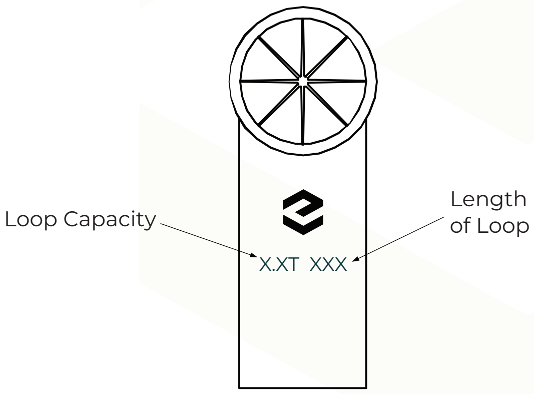
EST, EWTL, EWTS, ECP, ELR

Figure 14.1



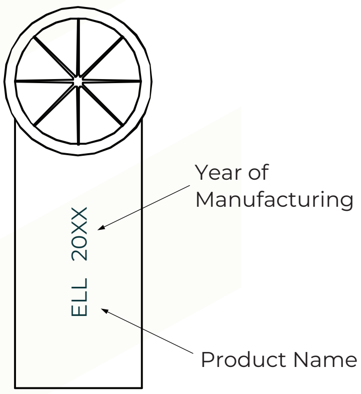
EFS, EBA, ECFA

Figure 14.2



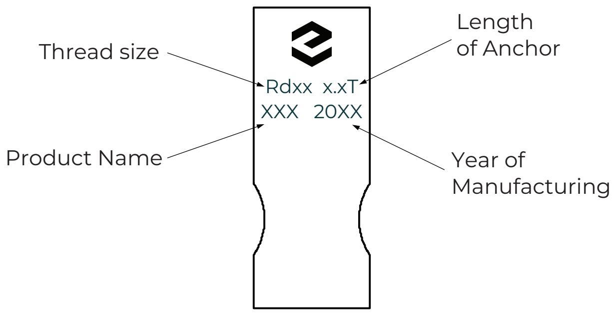
ELL

Figure 14.3



ELL

Figure 14.4



EH

Figure 14.5

3. DESIGN LOAD CAPACITY (SAFE WORKING LOADS)

The design of Lifting Anchors is in accordance with European standards. The applicable European standards are as follows – EN 1992, EN 1993, Machinery Directive 2006/42/EC, VDI/BV-BS 6205

The safety factors for failure modes are as follows:

Steel failure for solid sections	Concrete failure
$\gamma s = 3.0$	$\gamma c = 2.5$

3.1 Walls

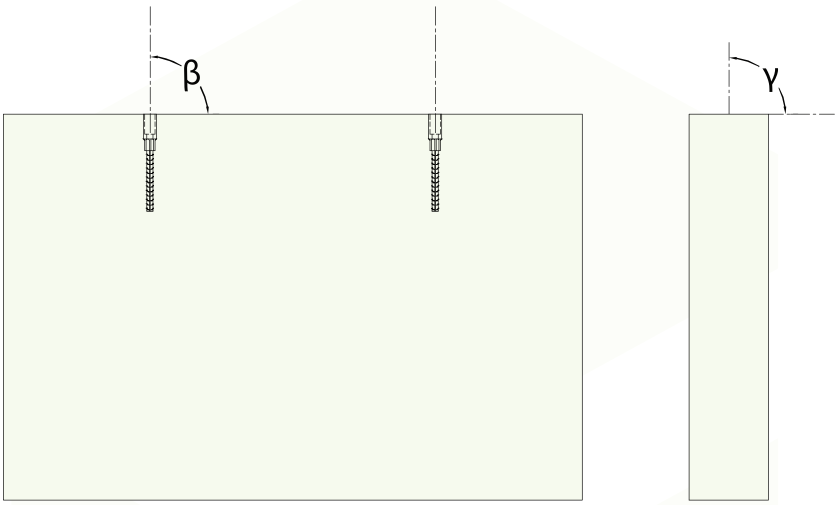


Figure 15

Table 13. Safe Working Load (SWL) for EH Lifting Insert

Lifting Anchor	Design Load Capacity (Safe Working Load), kN	
	β = 0° – 45°	γ = 0° – 90°
EH 12	5.0	2.5
EH 16	12.0	6.0
EH 20	20.0	10.0
EH 24	25.0	12.5
EH 30	40.0	20.0
EH 36	63.0	31.5
EH 42	80.0	40.0
EH 52	125.0	62.5

Table 14. Safe Working Load (SWL) for ETS Lifting Insert

Lifting Anchor	Design Load Capacity (Safe Working Load), kN	
	β = 0° – 45°	γ = 10° – 90°
ETS -12	5.0	2.5
ETS - 14	8.0	4.0
ETS - 16	12.0	6.0
ETS - 18	16.0	8.0
ETS - 20	20.0	10.0
ETS - 24	25.0	12.5
ETS - 30	40.0	20.0
ETS - 36	63.0	31.5
ETS - 42	80.0	40.0
ETS - 52	125.0	62.5

Table 15. Safe Working Load (SWL) for EWTL Lifting Insert

Lifting Anchor	Design Load Capacity (Safe Working Load), kN	
	β = 0° – 45°, γ = 0° – 10°	γ = 10° – 90°
EWTL - 12	5.0	5.0
EWTL - 14	8.0	8.0
EWTL - 16	12.0	12.0
EWTL - 18	16.0	16.0
EWTL - 20	20.0	20.0
EWTL - 24	25.0	25.0
EWTL - 30	40.0	40.0
EWTL - 36	63.0	63.0
EWTL - 42	80.0	80.0
EWTL - 52	125.0	125.0

Table 16. Safe Working Load (SWL) for EWTS Lifting Insert

Lifting Anchor	Design Load Capacity (Safe Working Load), kN	
	β = 0° – 45°, γ = 0° – 10°	γ = 10° – 90°
EWTS - 12	5.0	5.0
EWTS - 14	8.0	8.0
EWTS - 16	12.0	12.0
EWTS - 18	16.0	16.0
EWTS - 20	20.0	20.0
EWTS - 24	25.0	25.0
EWTS - 30	40.0	40.0
EWTS - 36	63.0	63.0
EWTS - 42	80.0	80.0

Table 17. Safe Working Load (SWL) for EBA Lifting Anchor in Wall Elements

Lifting Anchor	Wall Thickness, B [mm]	Design Load Capacity (Safe Working Load)							
		β = 0° – 45°				γ = 0° – 90°			
		C12/15	C16/20	C20/25	C28/35	C12/15	C16/20	C20/25	C28/35
EBA - 12	60	4.81	5.00	5.00	5.00	2.41	2.50	2.50	2.50
EBA - 16	80	5.95	7.93	9.91	12.00	2.97	3.97	4.96	6.00
EBA - 20	110	10.05	13.40	16.75	20.00	5.03	6.70	8.38	10.00
EBA - 20	110	10.05	13.40	16.75	20.00	5.03	6.70	8.38	10.00
EBA - 24	120	13.43	17.91	22.39	25.00	6.72	8.96	11.19	12.50
EBA - 30	140	22.65	30.20	37.74	40.00	11.32	15.10	18.87	20.00
EBA - 36	150	33.66	44.87	50.26	59.47	16.83	22.44	25.13	29.74
EBA - 36	150	33.66	44.87	50.26	59.47	16.83	22.44	25.13	29.74
EBA - 42	160	39.73	45.88	51.29	60.69	19.86	22.94	25.65	30.34
EBA - 52	160	45.58	57.21	63.97	75.68	22.79	28.61	31.98	37.84

Table 18. Safe Working Load (SWL) for ELR Lifting Anchor in Wall Elements

Lifting Anchor	Wall Thickness, B [mm]	Design Load Capacity (Safe Working Load)							
		β = 0° – 45°				γ = 0° – 90°			
		C12/15	C16/20	C20/25	C28/35	C12/15	C16/20	C20/25	C28/35
ELR - 12	60	5.00	5.00	5.00	5.00	2.50	2.50	2.50	2.50
ELR - 14	70	8.00	8.00	8.00	8.00	4.00	4.00	4.00	4.00
ELR - 16	80	12.00	12.00	12.00	12.00	6.00	6.00	6.00	6.00
ELR - 18	100	16.00	16.00	16.00	16.00	8.00	8.00	8.00	8.00
ELR - 20	110	20.00	20.00	20.00	20.00	10.00	10.00	10.00	10.00
ELR - 24	120	25.00	25.00	25.00	25.00	12.50	12.50	12.50	12.50
ELR - 30	140	26.62	35.50	40.00	40.00	13.31	17.75	20.00	20.00
ELR - 36	150	63.00	63.00	63.00	63.00	31.50	31.50	31.50	31.50
ELR - 42	160	35.22	46.96	58.70	80.00	17.61	23.48	29.35	40.00
ELR - 52	160	88.28	101.93	113.96	125.00	44.14	50.97	56.98	62.50

3.2 Slab

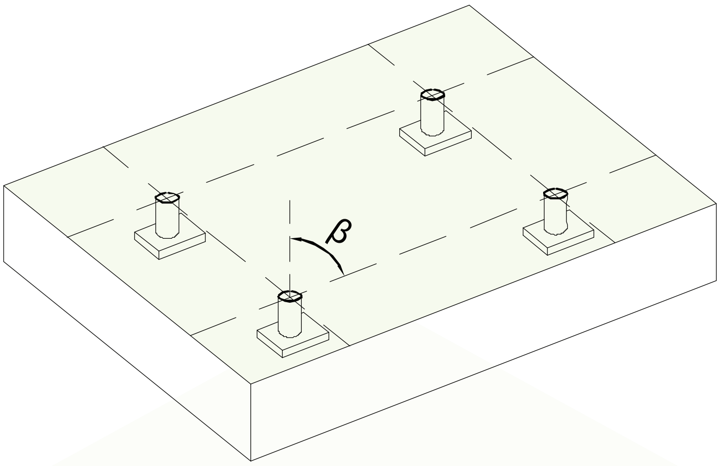


Figure 16

Table 19. Safe Working Load (SWL) for EFS Lifting Anchor in Slab Elements

Lifting Anchor	Slab Thickness, B [mm]	Design Load Capacity (Safe Working Load), kN			
		β = 0° – 45°			
		C12/15	C16/20	C20/25	C28/35
EFS - 12	70	5.00	5.00	5.00	5.00
EFS - 14	80	7.58	8.00	8.00	8.00
EFS - 16	85	9.44	10.90	12.00	12.00
EFS - 20	100	15.93	18.39	20.00	20.00
EFS - 24	115	21.33	24.64	25.00	25.00
EFS - 30	140	37.08	40.00	40.00	40.00
EFS - 36	160	51.49	59.46	63.00	63.00
EFS - 42	175	68.26	78.82	80.00	80.00
EFS - 52	215	102.57	118.44	125.00	125.00

Table 20. Safe Working Load (SWL) for ECP Lifting Anchor in Slab Elements

Lifting Anchor	Design Load Capacity (Safe Working Load), kN			
	β = 0° – 45°			
	C12/15	C16/20	C20/25	C28/35
ECP - 16	12.00	12.00	12.00	12.00
ECP - 20	20.00	20.00	20.00	20.00
ECP - 24	24.59	25.00	25.00	25.00
ECP - 30	38.66	40.00	40.00	40.00
ECP - 36	56.25	63.00	63.00	63.00

Table 21. Safe Working Load (SWL) for ECFA Lifting Anchor in Slab Elements

Lifting Anchor	Slab Thickness, B [mm]	Design Load Capacity (Safe Working Load), kN			
		β = 0° – 45°			
		C12/15	C16/20	C20/25	C28/35
ECFA - 12	80	5.00	5.00	5.00	5.00
ECFA - 14	90	8.87	10.40	11.63	12.00
ECFA - 16	100	10.98	12.67	14.17	16.77
ECFA - 20	120	15.53	17.93	20.05	23.72
ECFA - 24	135	19.20	22.18	24.79	29.34
ECFA - 30	170	29.15	33.66	37.63	44.53

Table 22. Safe Working Load (SWL) for ELL Lifting Anchor

Lifting Anchor	Design Load Capacity (Safe Working Loads)
ELL-12	5.0
ELL-14	8.0
ELL-16	12.0
ELL-18	16.0
ELL-20	20.0
ELL-24	25.0
ELL-30	40.0
ELL-36	63.0
ELL-42	80.0
ELL-52	125.0

4. MINIMUM ELEMENT THICKNESS AND SPACING OF ANCHORS

The minimum thickness of the element and edge distance of the lifting anchor are given in the tables below.

4.1 Walls

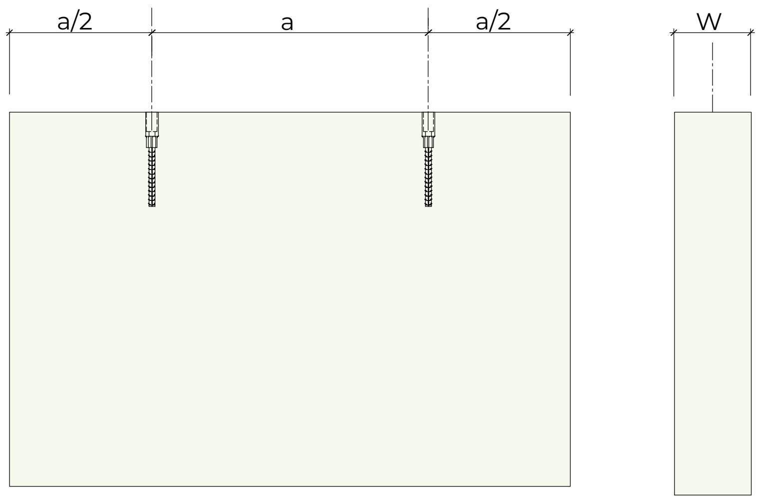


Figure 17: Minimum element thickness and minimum lifting insert spacing in wall elements

Table 23. Minimum element thickness and minimum lifting insert spacing in wall elements for EH Lifting Insert

Lifting Anchor	Wall Thickness, W [mm]	Minimum Edge Distance, a/2 [mm]	Minimum Centre to Centre Distance, a [mm]
EH - 12	60	150	300
EH - 16	80	200	400
EH - 20	100	275	550
EH - 24	120	300	600
EH - 30	140	325	650
EH - 36	200	400	800
EH - 42	240	500	1000
EH - 52	275	600	1200

Table 24. Minimum element thickness and minimum lifting insert spacing in wall elements for ETS Lifting Insert

Lifting Anchor	Wall Thickness, B [mm]	Minimum Edge Distance, X/2 [mm]	Minimum Centre to Centre Distance, X [mm]
ETS -12	60	140	280
ETS - 14	70	180	360
ETS - 16	80	180	360
ETS - 20	110	220	440
ETS - 24	120	250	500
ETS - 30	140	300	600
ETS - 36	150	400	800
ETS - 42	160	450	900
ETS - 52	230	500	1000

Table 25. Minimum element thickness and minimum lifting insert spacing in wall elements for EWTL Lifting Insert.

Lifting Anchor	Wall Thickness, B [mm]	Minimum Edge Distance, X/2 [mm]	Minimum Centre to Centre Distance, X [mm]
EWTL - 12	60	140	280
EWTL - 14	70	180	360
EWTL - 16	80	180	360
EWTL - 20	110	220	440
EWTL - 24	120	250	500
EWTL - 30	140	300	600
EWTL - 36	150	400	800
EWTL - 42	160	450	900
EWTL - 52	230	500	1000

Table 26. Minimum element thickness and minimum lifting insert spacing in wall elements for EWTS Lifting Insert

Lifting Anchor	Wall Thickness, B [mm]	Minimum Edge Distance, X/2 [mm]	Minimum Centre to Centre Distance, X [mm]
EWTS - 12	60	140	280
EWTS - 14	70	180	360
EWTS - 16	80	180	360
EWTS - 20	110	220	440
EWTS - 24	120	250	500
EWTS - 30	140	300	600
EWTS - 36	150	400	800
EWTS - 42	160	450	900

Table 27. Minimum element thickness and minimum lifting insert spacing in wall elements for EBA Lifting Insert

Lifting Anchor	Wall Thickness, B [mm]	Minimum Edge Distance, X/2 [mm]	Minimum Centre to Centre Distance, X [mm]
EBA-12	60	215	430
EBA-16	80	320	640
EBA-20	110	255	510
EBA-20	110	255	510
EBA-24	120	460	920
EBA-30	140	545	1090
EBA-36	150	420	840
EBA-36	150	420	840
EBA-42	160	415	830
EBA-52	160	655	1310

Table 28. Minimum element thickness and minimum lifting insert spacing in wall elements for ELR Lifting Insert

Lifting Anchor	Wall Thickness, B [mm]	Minimum Edge Distance, X/2 [mm]	Minimum Centre to Centre Distance, X [mm]
ELR-12	60	230	460
ELR-14	70	260	520
ELR-16	80	260	520
ELR-18	100	370	740
ELR-20	110	335	670
ELR-24	120	520	1040
ELR-30	140	370	740
ELR-36	150	735	1470
ELR-42	160	405	810
ELR-52	160	1035	2070

4.2 Slabs

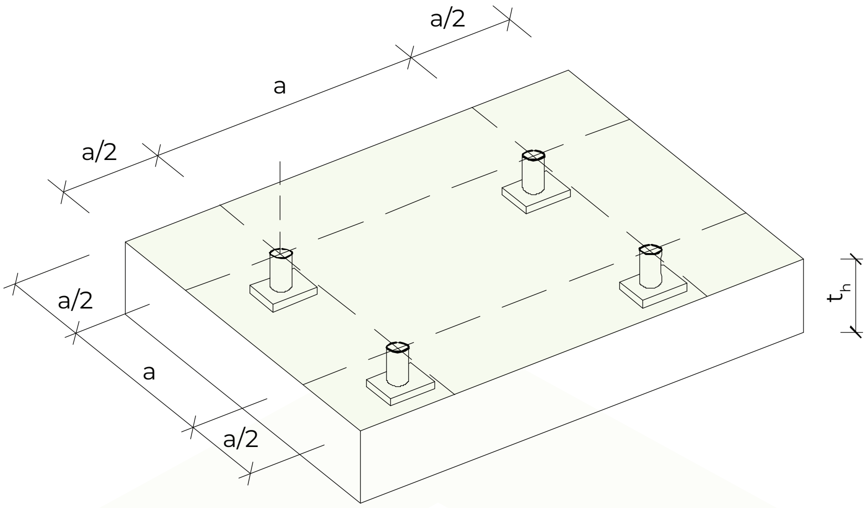


Figure 18: Minimum element thickness and minimum lifting insert spacing in slab elements :

Table 29. Minimum element thickness and minimum lifting insert spacing in slab elements for ECP Lifting Insert.

Lifting Anchor	Slab Thickness, t_h [mm]	Minimum Edge Distance, a/2 [mm]	Minimum Centre to Centre Distance, a [mm]
ECP - 16	120	150	300
ECP - 20	135	165	330
ECP - 24	150	190	380
ECP - 30	195	255	510
ECP - 36	245	330	660

Table 30. Minimum element thickness and minimum lifting insert spacing in slab elements for ECFA Lifting Insert.

Lifting Anchor	Slab Thickness, t_h [mm]	Minimum Edge Distance, a/2 [mm]	Minimum Centre to Centre Distance, a [mm]
ECFA-12	80	85	170
ECFA-14	90	100	200
ECFA-16	100	110	220
ECFA-20	120	140	280
ECFA-24	135	160	320
ECFA-30	170	210	420

Table 31. Minimum element thickness and minimum lifting insert spacing in slab elements for EFS Lifting Insert

Lifting Anchor	Slab Thickness, t_h [mm]	Minimum Edge Distance, a/2 [mm]	Minimum Centre to Centre Distance, a [mm]
EFS-12	70	175	350
EFS-14	80	175	350
EFS-16	85	250	500
EFS-20	100	300	600
EFS-24	115	400	800
EFS-30	140	500	1000
EFS-36	160	650	1300
EFS-42	175	650	1300
EFS-52	215	750	1500

5. REINFORCEMENT

Reinforcement for Lifting Anchors is based on the assumption that the angle of lifting (β) lies between 0° and 45°. Angles greater than 45° are not allowed. Reinforcement shall be provided based on the lifting anchor capacity, as specified in the tables below.

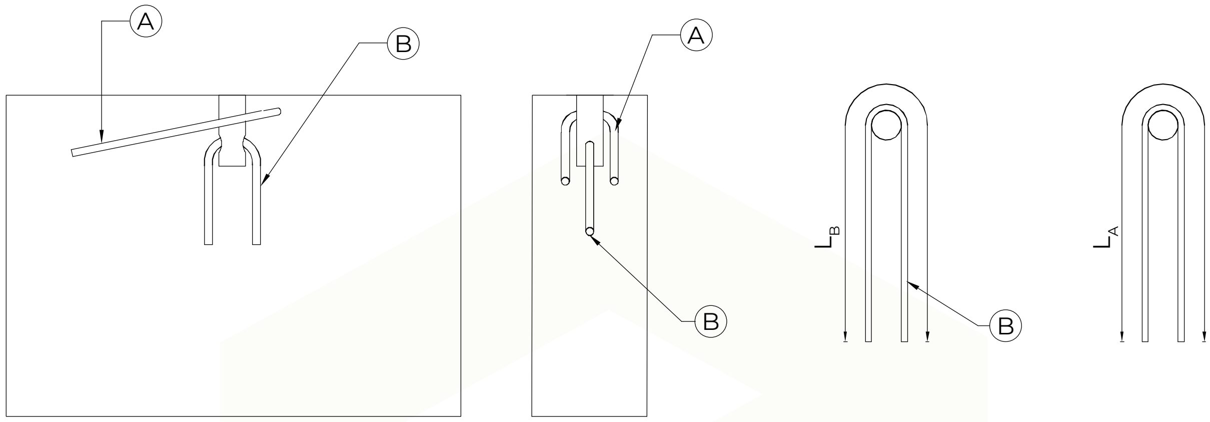


Figure: 19 Diagonal Reinforcement for EH lifting Anchor

Table: 32. Diagonal Reinforcement for EH lifting Anchor :

Lifting Anchor	Anchor Reinforcement, 1 (Ø – L1)	Diagonal pull Reinforcement, 3 (Ø – L2)
EH 12	6 – 240	6 – 300
EH 16	10 – 335	8 – 500
EH 20	12 – 465	8 – 700
EH 24	14 – 495	10 – 700
EH 30	16 – 690	12 – 800
EH 36	20 – 870	14 – 1200
EH 42	25 – 885	16 – 1300
EH 52	28 – 1235	20 – 1600

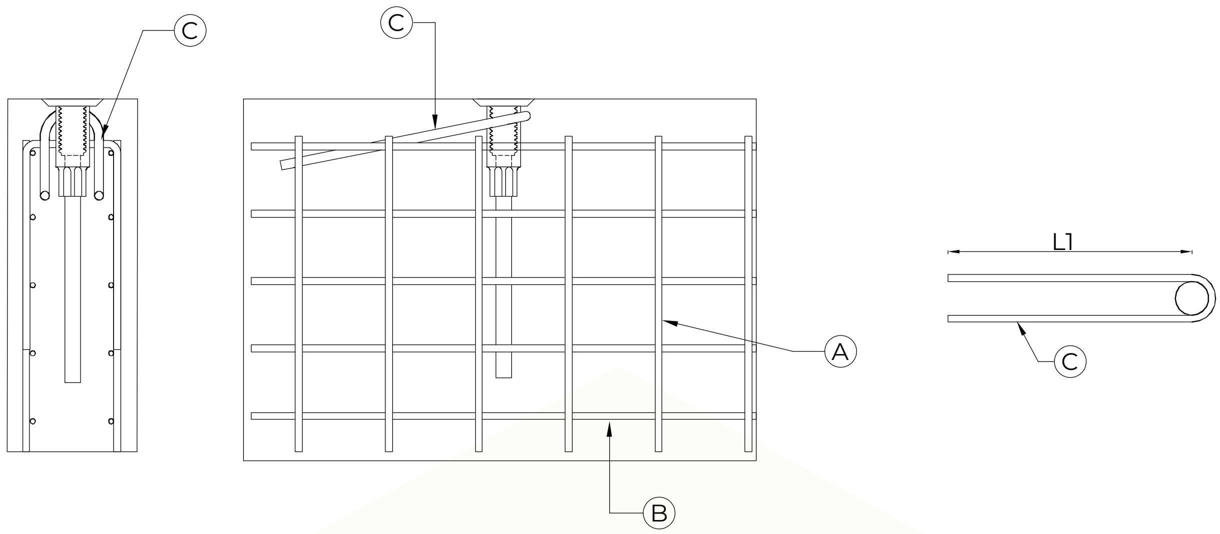


Figure: 20 Diagonal Reinforcement for ETS lifting Anchor :

Table: 33 Diagonal Reinforcement for ETS lifting Anchor :

Lifting Anchor	Mesh Reinforcement 1 [mm2/m]	Edge Reinforcement (both sides) 2	Diagonal pull Reinforcement, 3 (Ø – L2)
ETS -12	2 x 131	Ø8	6 – 160
ETS -14	2 x 131	Ø8	6 – 250
ETS - 16	2 x 188	Ø8	8 – 320
ETS - 20	2 x 188	Ø10	10 – 420
ETS - 24	2 x 188	Ø10	10 – 525
ETS - 30	2 x 188	Ø12	12 – 630
ETS - 36	2 x 188	Ø12	16 – 800
ETS - 42	2 x 188	Ø14	20 – 1000
ETS - 52	2 x 188	Ø20	20 – 1200

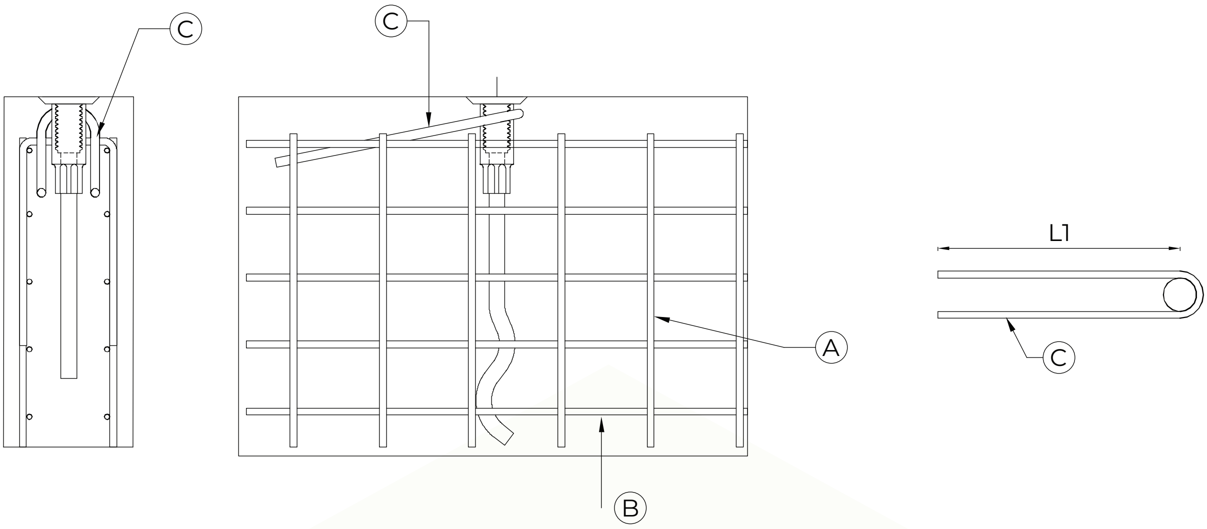


Figure: 21 Diagonal Reinforcement for EWTL lifting Anchor :

Table: 34. Diagonal Reinforcement for EWTL lifting Anchor :

Lifting Anchor	Mesh Reinforcement 1 [mm2/m]	Edge Reinforcement (both sides) 2	Diagonal pull Reinforcement, 3 (Ø – L2)
EWTL -12	2 x 131	Ø8	6 – 160
EWTL -14	2 x 131	Ø8	6 – 250
EWTL - 16	2 x 188	Ø8	8 – 320
EWTL - 20	2 x 188	Ø10	10 – 420
EWTL - 24	2 x 188	Ø10	10 – 525
EWTL - 30	2 x 188	Ø12	12 – 630
EWTL - 36	2 x 188	Ø12	16 – 800
EWTL - 42	2 x 188	Ø14	20 – 1000
EWTL - 52	2 x 188	Ø20	20 – 1200

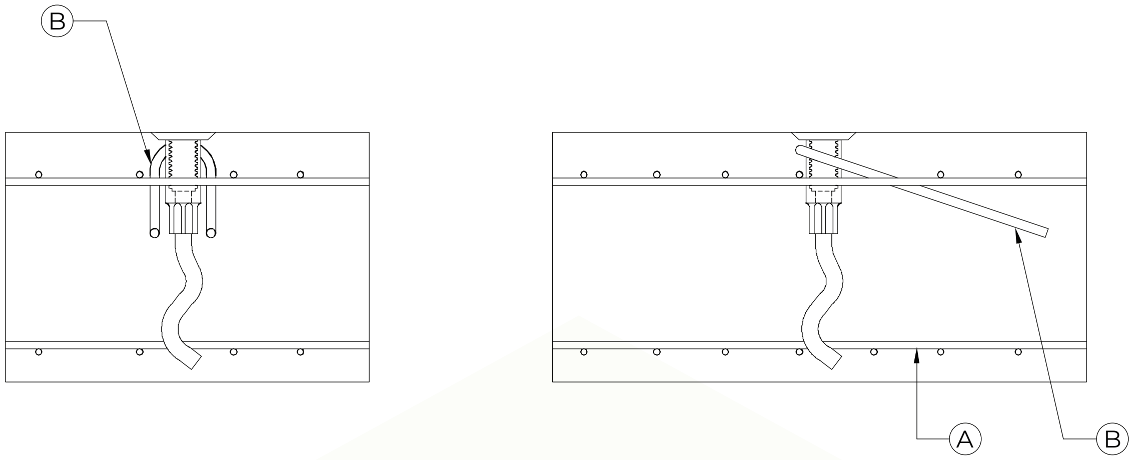


Figure: 22 Reinforcement for EWTS lifting Anchor :

Table: 35. Diagonal Reinforcement for EWTS lifting Anchor :

Lifting Anchor	2 Layers Mesh Reinforcement 2 [mm2/m]	Diagonal Reinforcement 1 [Ø - L]
EWTS -12	2 x 188	Ø6 - 320
EWTS -14	2 x 188	Ø8 -320
EWTS - 16	2 x 188	Ø8 - 420
EWTS - 20	2 x 188	Ø8 - 650
EWTS - 24	2 x 188	Ø10 - 650
EWTS - 30	2 x 188	Ø12 - 850
EWTS - 36	2 x 188	Ø14 -1200
EWTS - 42	2 x 188	Ø16 - 1250

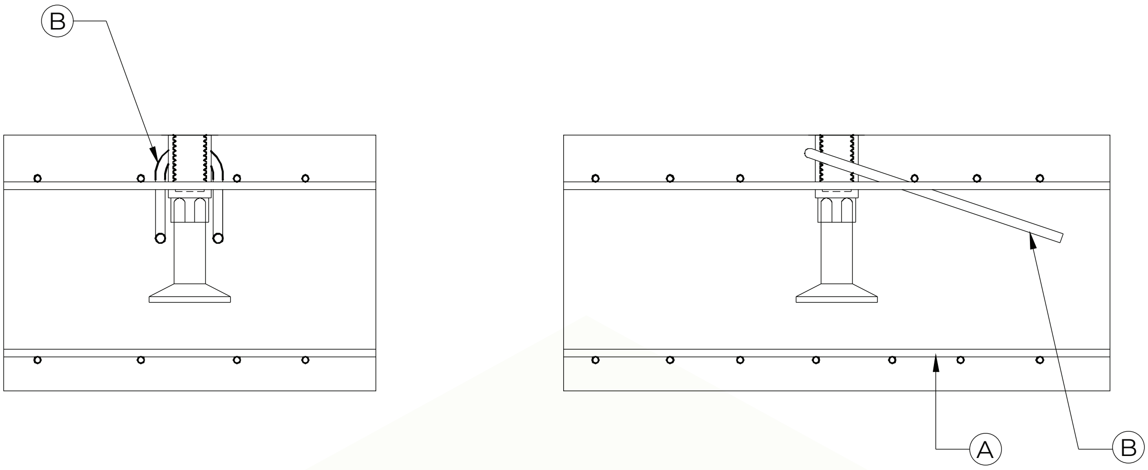


Figure 23. Reinforcement for ECP lifting anchor in slab :-

Table: 36 Diagonal Reinforcement for ECP lifting Anchor :

Lifting Anchor	Diagonal pull Reinforcement, 1 (Ø – L2)	2 Layers Mesh Reinforcement 2 [mm2/m]
ECP - 16	8 – 300	2 x 188
ECP - 20	8 – 400	2 x 188
ECP - 24	10 – 450	2 x 188
ECP - 30	12 – 550	2 x 188
ECP - 36	14 – 700	2 x 188

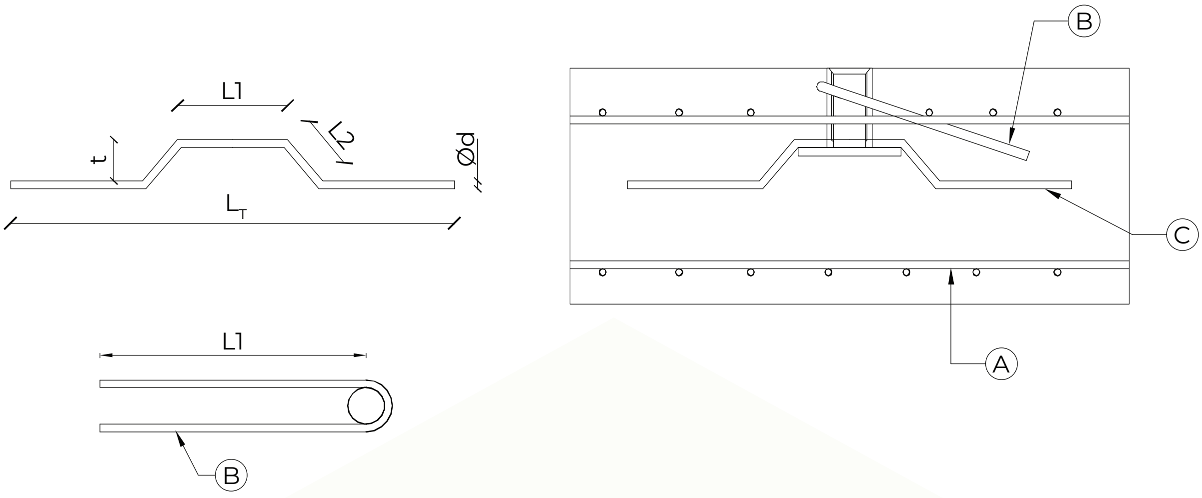


Figure: 24 Reinforcement for EFS lifting Anchor :

Table: 37 Diagonal Reinforcement for EFS lifting Anchor :

Lifting Anchor	2 Layers Mesh Reinforcement 2 [mm2/m]	Diagonal Reinforcement 1 [Ø - L]	Additional Reinforcement (3)				
			L	La	Lb	h	Øds
EFS-12	2 x 131	Ø6 - 160	250	60	60	30	6
EFS-14	2 x 131	Ø8 -160	360	60	70	30	8
EFS-16	2 x 131	Ø8 - 210	420	90	70	35	8
EFS-20	2 x 188	Ø8 - 320	640	90	80	40	10
EFS-24	2 x 188	Ø10 - 320	640	100	100	50	10
EFS-30	2 x 221	Ø12 - 425	850	110	110	55	12
EFS-36	2 x 221	Ø14 - 575	1150	140	120	60	14
EFS-42	2 x 513	Ø16 -625	1250	140	120	60	16
EFS-52	2 x 513	Ø20 - 800	1550	140	150	75	20

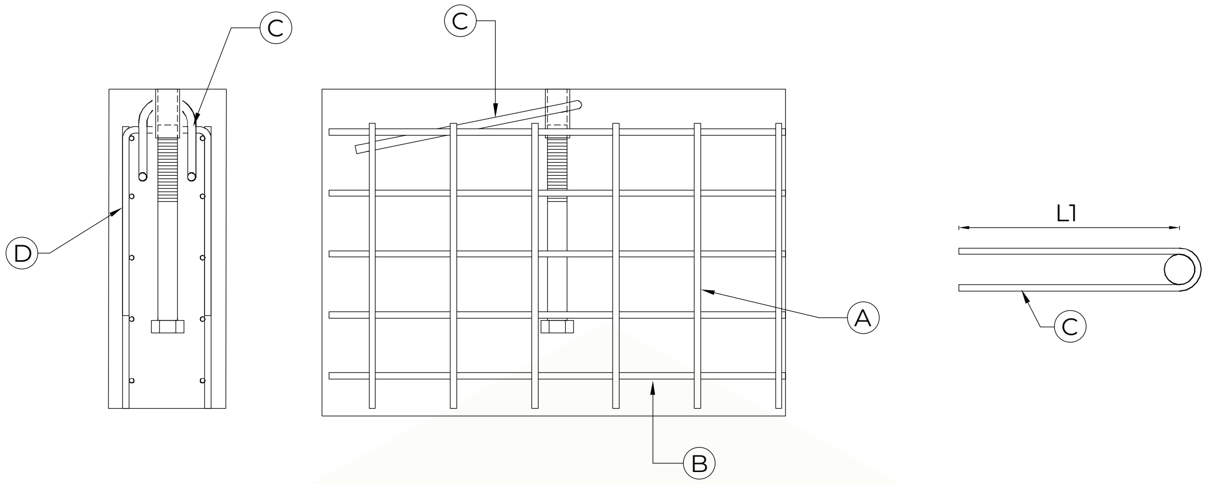


Figure: 25 Reinforcement for EBA lifting Anchor :

Table: 38 Diagonal Reinforcement for EBA lifting Anchor :

Lifting Anchor	2 Layers Mesh Reinforcement 3 [mm2/m]	Edge Reinforcement (both sides) 2	Diagonal pull Reinforcement, 1 (Ø – L2)	Stirrup Reinforcement, 4		
				Pcs.	Diameter [mm]	Length [mm]
EBA - 12	2 x 131	Ø8	6 – 160	2	6	350
EBA - 16	2 x 131	Ø8	8 – 320	2	6	350
EBA - 20	2 x 188	Ø10	10 – 420	2	8	450
EBA - 20	2 x 188	Ø10	10 – 420	2	8	450
EBA - 24	2 x 188	Ø10	10 – 525	2	8	450
EBA - 30	2 x 188	Ø12	12 – 630	2	10	600
EBA - 36	2 x 188	Ø12	16 – 800	4	10	650
EBA - 36	2 x 188	Ø12	16 – 800	4	10	650
EBA - 42	2 x 188	Ø14	20 – 1000	4	10	650
EBA - 52	2 x 188	Ø16	20 – 1200	4	10	700

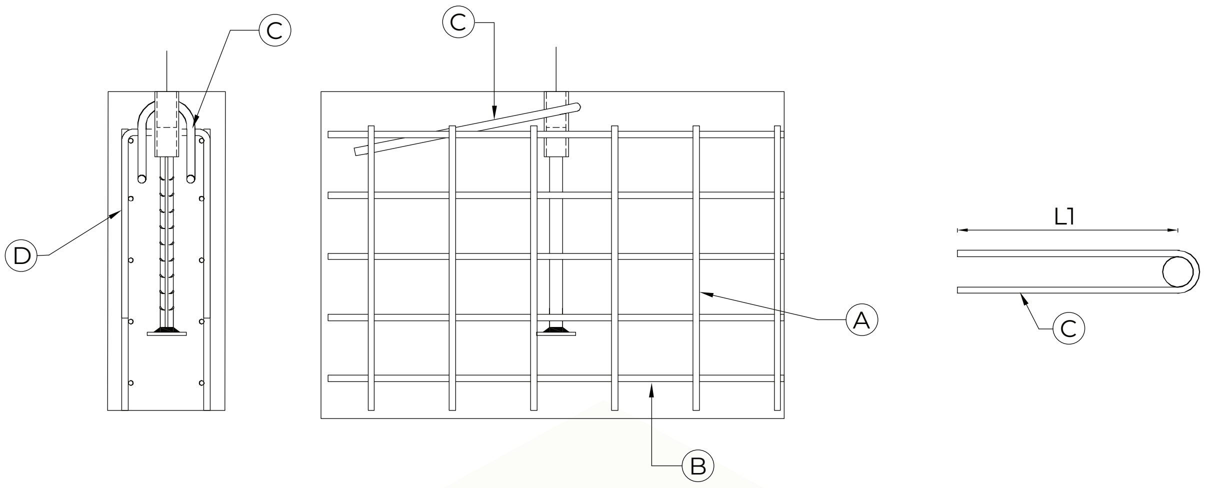


Figure: 26 Reinforcement for ELR lifting Anchor :

Table: 39 Diagonal Reinforcement for ELR lifting Anchor :

Lifting Anchor	Diagonal pull Reinforcement, 1 (Ø – L2)	Edge Reinforcement (both sides) 2	2 Layers Mesh Reinforcement 3 [mm2/m]
ELR-12	6 – 150	Ø8	2 x 131
ELR-14	6 – 200	Ø8	2 x 131
ELR-16	6 – 250	Ø10	2 x 131
ELR-18	8 – 200	Ø10	2 x 188
ELR-20	8 – 250	Ø10	2 x 188
ELR-24	8 – 300	Ø12	2 x 188
ELR-30	10 – 350	Ø12	2 x 188
ELR-36	12 – 450	Ø12	2 x 188
ELR-42	14 – 600	Ø14	2 x 188
ELR-52	16 – 750	Ø16	2 x 188

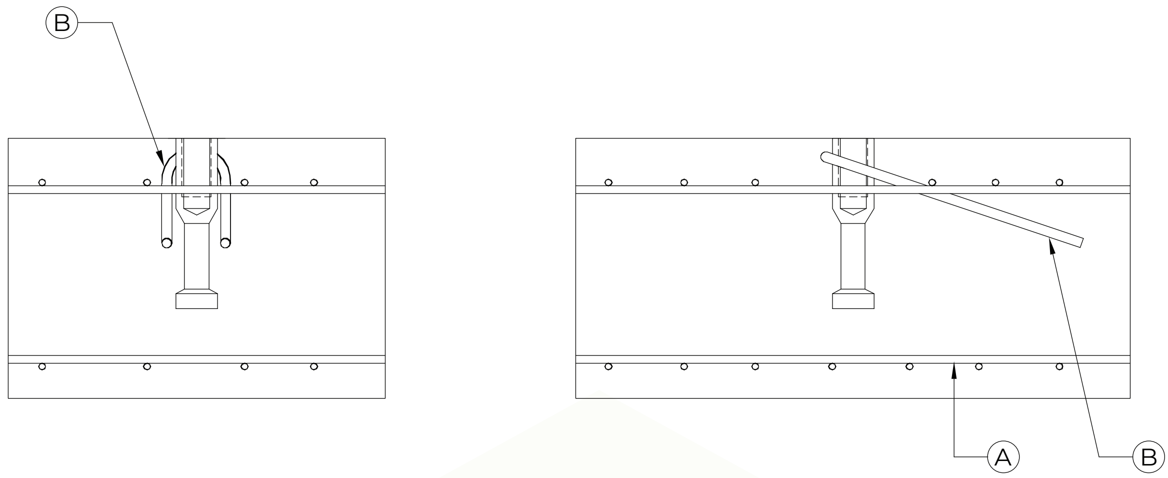


Figure: 27 Reinforcement for ECFA lifting Anchor :

Table: 40 Diagonal Reinforcement for ECFA lifting Anchor :

Lifting Anchor	Diagonal pull Reinforcement, 1 (Ø – L2)	2 Layers Mesh Reinforcement 2 [mm2/m]
ECFA-12	8 – 150	2 x 131
ECFA-14	8 – 200	2 x 131
ECFA-16	8 – 200	2 x 131
ECFA-20	12 – 300	2 x 188
ECFA-24	12 – 300	2 x 188
ECFA-30	12 – 400	2 x 211

Reinforcement for lateral pull (Tilting Reinforcement):

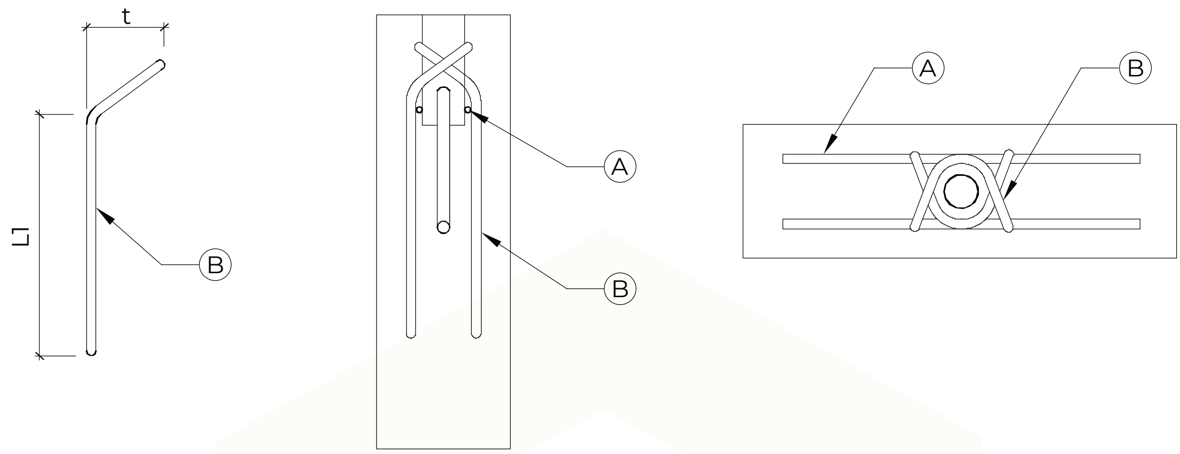
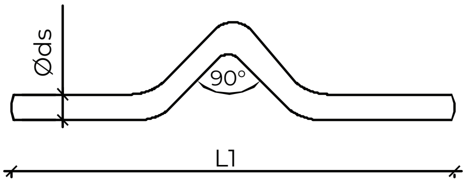


Figure 28 Reinforcement for EH:

Table: 41 Lateral Reinforcement for EH lifting Anchor :

Lifting Anchor	Anchor Reinforcement, 3 (Ø – L)	Angle Pull Reinforcement, 4	
		(Ø – L)	h
EH 12	8 – 400	6 – 300	35
EH 16	10 – 500	8 – 425	50
EH 20	12 – 600	12 – 500	65
EH 24	12 – 600	12 – 600	75
EH 30	16 – 700	16 – 750	95
EH 36	20 – 800	20 – 850	120
EH 42	20 – 850	20 – 950	145
EH 52	20 – 1000	25 – 1000	175



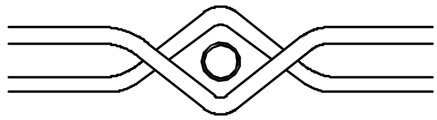


Figure 29. Reinforcement for ETS, EWTL :

Table: 42 Lateral Reinforcement for ETS, EWTL lifting Anchor :

Lifting Anchor	Diameter of bar (Øds)	Tilting Reinforcement, (L)
ETS, EWTL -12	6	270
ETS, EWTL -14	6	350
ETS, EWTL - 16	8	420
ETS, EWTL - 20	10	490
ETS, EWTL - 24	12	520
ETS, EWTL - 30	12	570
ETS, EWTL - 36	14	690
ETS, EWTL - 42	16	830
ETS, EWTL - 52	20	930

Table: 43 Lateral Reinforcement for EBA lifting Anchor :

Lifting Anchor	Diameter of bar (Øds)	Tilting Reinforcement, (L)
EBA - 12	6	270
EBA - 16	8	420
EBA - 20	10	500
EBA - 20	10	500
EBA - 24	12	520
EBA - 30	12	570
EBA - 36	14	700
EBA - 36	14	700
EBA - 42	16	830
EBA - 52	16	900

Table: 44 Lateral Reinforcement for ELR lifting Anchor :

Lifting Anchor	Diameter of bar (Øds)	Tilting Reinforcement, (L)
ELR-12	8	550
ELR-14	10	600
ELR-16	12	750
ELR-18	12	800
ELR-20	16	900
ELR-24	16	1100
ELR-30	20	1300
ELR-36	20	1700
ELR-42	25	1650
ELR-52	25	1950

6. ACTIONS ON LIFTING ANCHOR

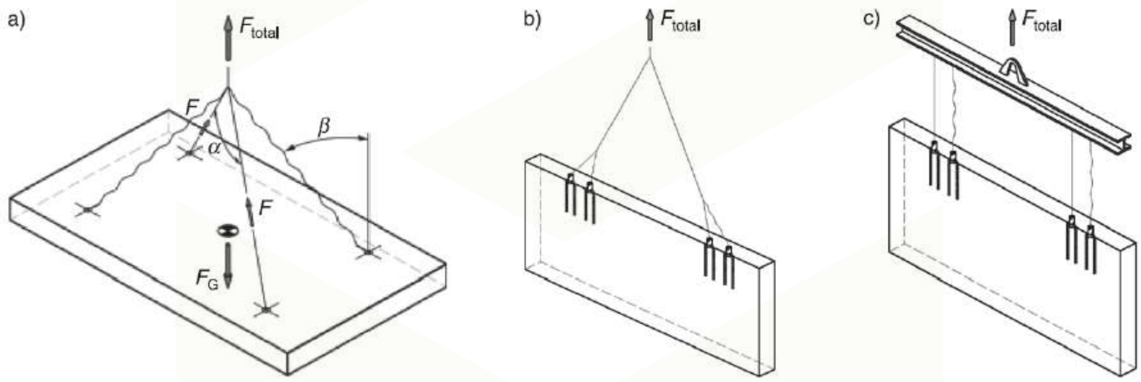
6.1 General

The loads acting on a lifting insert shall be determined considering the following factors:

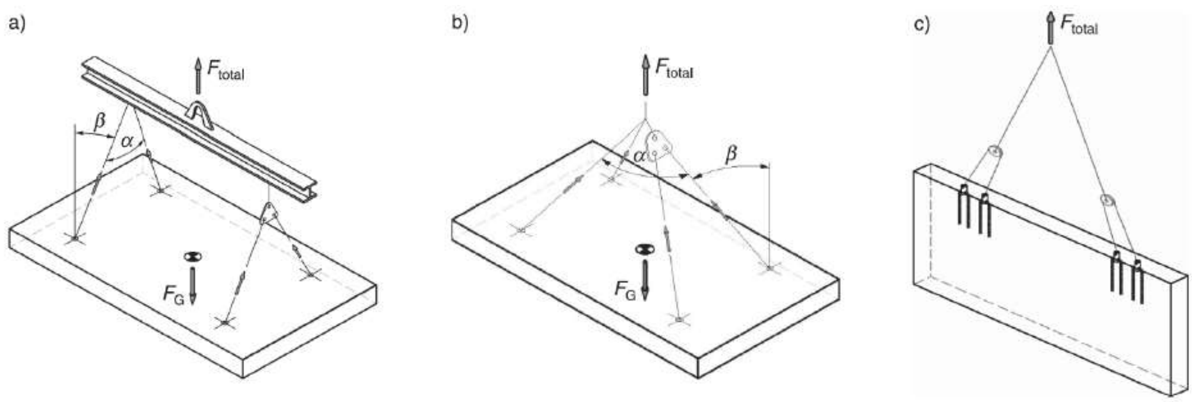
- Statical system
- Element self-weight
- Adhesion and form friction
- Dynamic effects
- Position and number of lifting inserts and type of lifting equipment

6.2 Statical System

The lifting equipment shall allow a statically determinate load distribution to all present lifting inserts and lifting insert systems. Figures below give examples of statically indeterminate systems where only two lifting inserts carry the load. The load distribution is not clearly defined in these applications. Therefore, statically indeterminate systems shall be avoided.

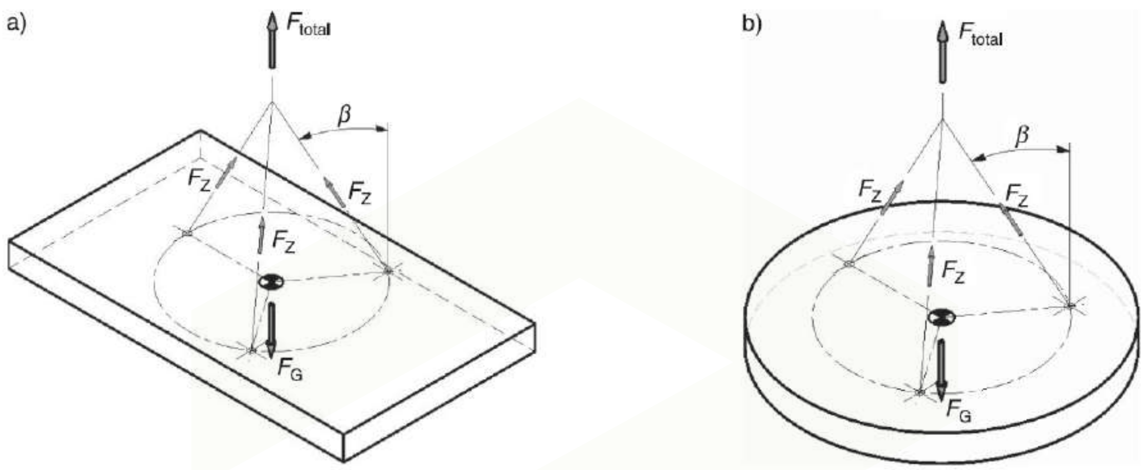


To ensure a statically determinate system and that all lifting inserts carry their required part of the load in case of applications with more than two lifting inserts transport aids such as sliding or rolling couplings or balancing beams shall be used. The figures below illustrate additional transport aids for slabs and wall elements are illustrated.



In case of inclined lifting slings the lifting inserts are loaded by combined tension and shear loads. The inclination β according to the figure on the previous page governs the level of combined tension and shear loads to be taken into account in the design.

In the special case of three lifting inserts located in a slab and arranged in a star pattern with the same distance to the centre of gravity with equal inclinations of 120° it is ensured that all three lifting inserts experience the same load.



6.3 Self-Weight

The weight FG of precast elements shall be determined as given by equation below

$F_G = V \cdot \rho_G$

where,

F_G Weight of the precast element, in kN

V Volume of the precast element, in m^3

ρ_G Density of the concrete, in kN/m^3

6.4 Adhesion and Form Friction

Adhesion and form friction are assumed to act simultaneously during the lifting of the precast element from the formwork. The actions for demoulding situations shall be determined from equation below

$F_{adh} = q_{adh} \cdot A_f$

where,

F_{adh} Action due to adhesion and form friction, in kN

q_{adh} Basic value of combined adhesion and form friction as per Table below, in kN/m^2

A_f Contact area between concrete and formwork, in m^2

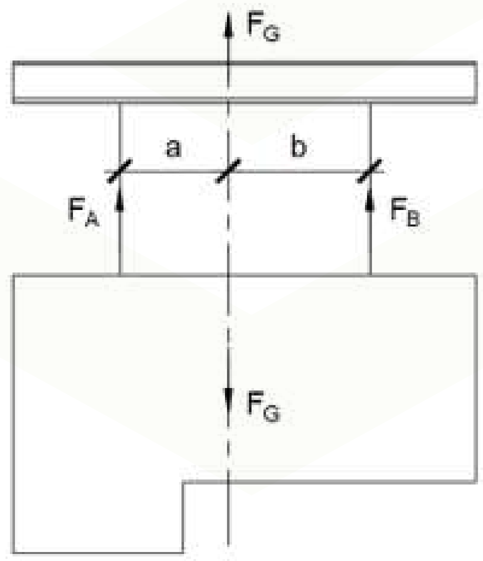
6.5 Dynamic Actions

During lifting and handling of the precast elements, the lifting devices are subjected to dynamic actions. The magnitude of the dynamic actions depends on the type of lifting machinery. Dynamic effects shall be taken into account by the dynamic factor ψ_{dyn}. For further guidance values of ψ_{dyn} depending on the lifting machinery and characteristics of the terrain are given in table below.

Condition	Dynamic Factor ψ_{dyn}
Tower crane, portal crane, mobile crane	1.3
Lifting and moving on flat terrain	2.5
Lifting and moving on rough terrain	≥ 4

Note: Other values of ψ_{dyn} than given in Table above based on reproducible tests or verified experience can be used in the design. In case of other lifting and handling conditions than reported in Table above the factor ψ_{dyn} shall be determined on the basis of tests or engineering judgement.

6.6 Distribution of Load for Non-symmetrical Elements



For non-symmetrical installation of lifting anchors (using spreader beam only), the load distribution is as in the equations below.

$F_A = F_G \, . \, b \, / \, (a + b)$

$F_B = F_G \, . \, a \, / \, (a + b)$

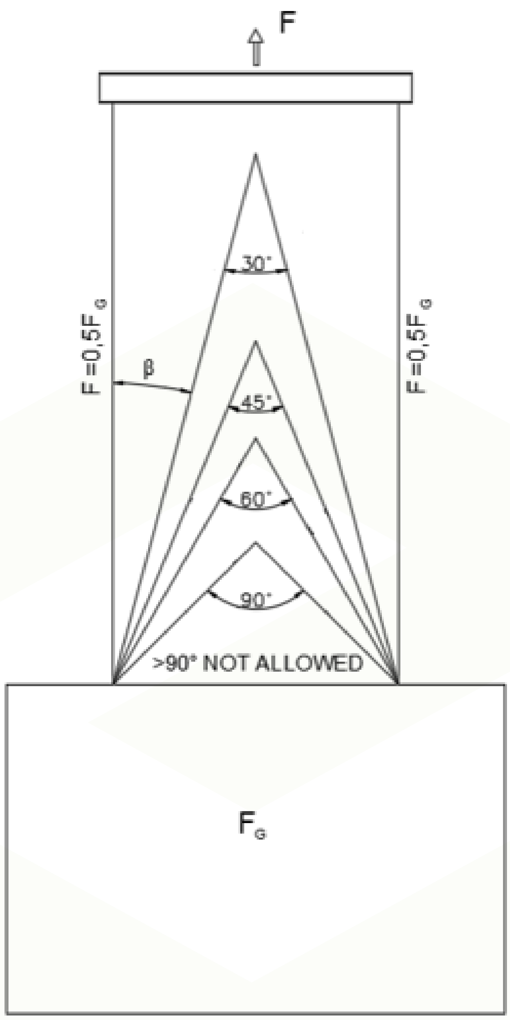
where,

F_G Weight of the pre-cast element, in kN

a Distance from insert to centre of gravity, in m

b Distance from insert to centre of gravity, in m

6.7 Spread Angle

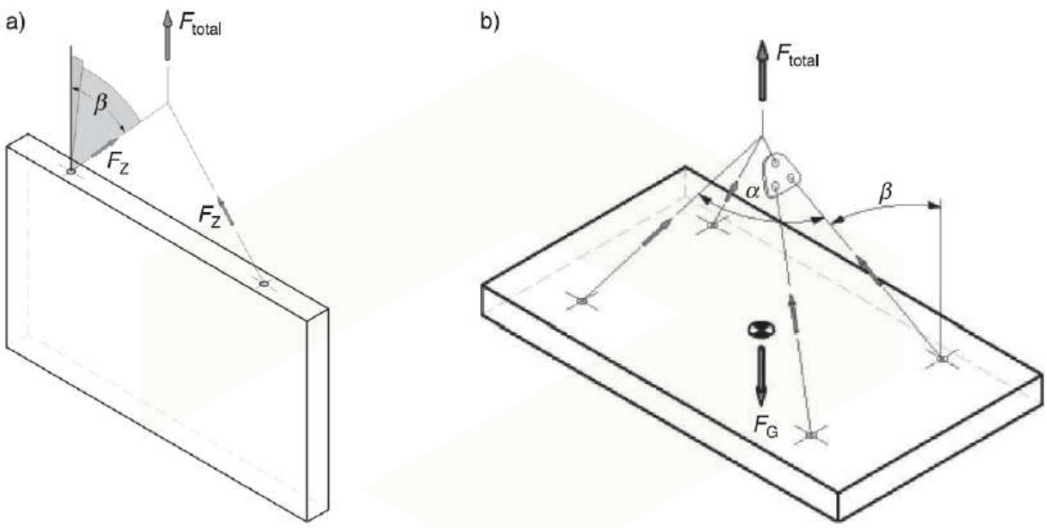


Cable Angle β	Spread Angle α	Load Factor z
0°	-	1.00
7.5°	15°	1.01
15°	30°	1.04
22.5°	45°	1.08
30°	60°	1.15
37.5°	75°	1.26
45°	90°	1.41

6.8 Number and Actions of Lifting Anchors

The number of load-bearing lifting inserts and the load acting on the lifting inserts shall be determined corresponding with the individual lifting situations in accordance with Equations given in the different situations below. The most unfavorable relation from action to resistance resulting from these equations governs the design.

6.8.1 Load condition “erection in combination with adhesion and form friction”



It is assumed that the precast element does not rest on one side of the form. Then the action FQ is:

$F_Q = (F_G + F_{adh}) \cdot z/n$

where,

- F_Q Load acting on the lifting insert, in kN
- F_G Weight of the precast element
- F_{adh} Action due to adhesion and form friction
- z Factor for combined tension and shear, z = 1/cos β
  In case of tension: z = 1.
- n Number of load carrying lifting inserts

6.8.2 Load condition “erection”

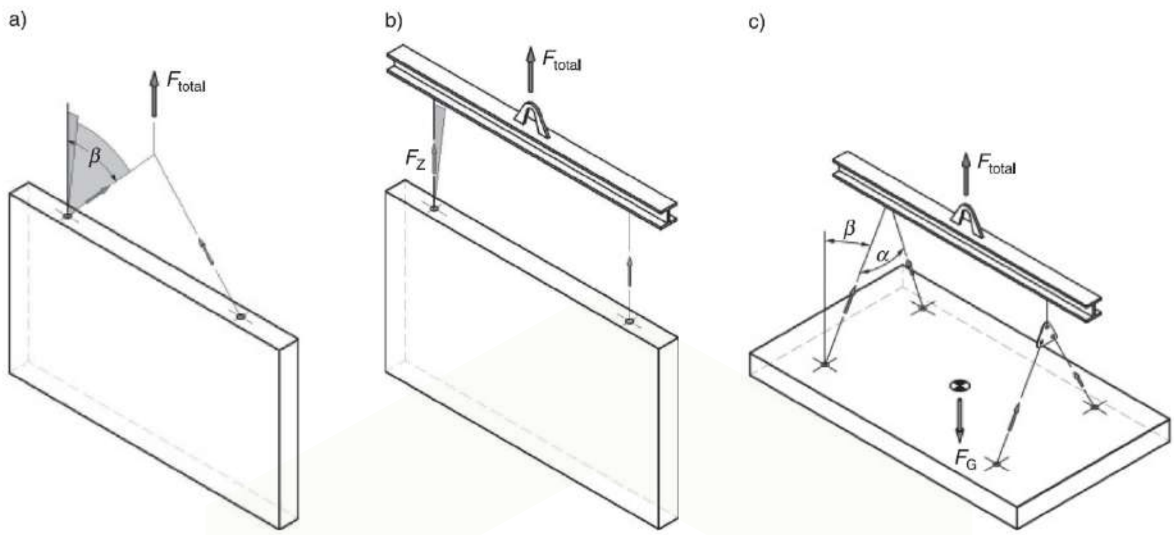
It is assumed that the precast element rests on one side of the form. Then the action FQ is:

$F_Q = (F_G / 2) \cdot \psi_{dyn} /n$

where,

- F_Q Shear load acting on the lifting insert (shear) directed perpendicular to the longitudinal axis of the concrete component
- F_G Weight of the precast element
- Ψ_{dyn} Dynamic factor
- n Number of load carrying lifting inserts

6.8.3 Load condition “lifting and handling under combined tension and shear”



The load condition is shown in the figure below. The action FZ is:

$F_Z = F_G \cdot \psi_{dyn} \cdot z/n$

where,

FZ Load acting on the lifting insert in direction of the sling axis, in kN

FG Weight of the precast element

Ψ_{dyn} Dynamic factor as per Table 2

z Factor for combined tension and shear, z = 1/cos β

In case of tension: z = 1.

n Number of load carrying lifting inserts

ENDURA

CONTACT US

Endura Global Private Limited

1008, 10th Floor, Graphix 2, Sector 62, Noida, UP 201309

+91 988 831 0093

info@endura.ee

www.endura.ee