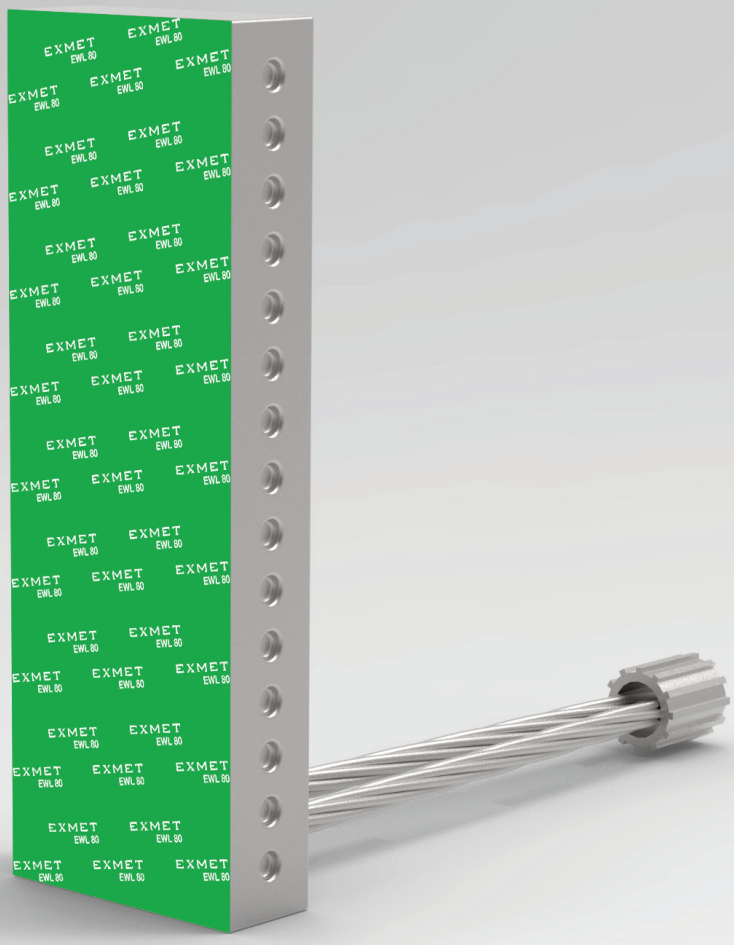
EXMET
PRECAST ACCESSORIES



EWL SINGLE WIRE LOOP
(WIRE LOOP BOX)

TECHNICAL MANUAL

RIGHTS TO CHANGES AND ERRORS RESERVED

EXM-EWL-DC-1003
R0 - 14.12.2021

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EWL SINGLE WIRE LOOP

1. INTRODUCTION

EWL wire loops are primarily used in precast concrete elements to easily and effectively form joints with other concrete elements. The joints with EWL wire loops are primarily meant to transfer shear forces.

1.1 Product Description

EWL wire loop consists of a steel box, a single wire rope per box and an anchorage sleeve.

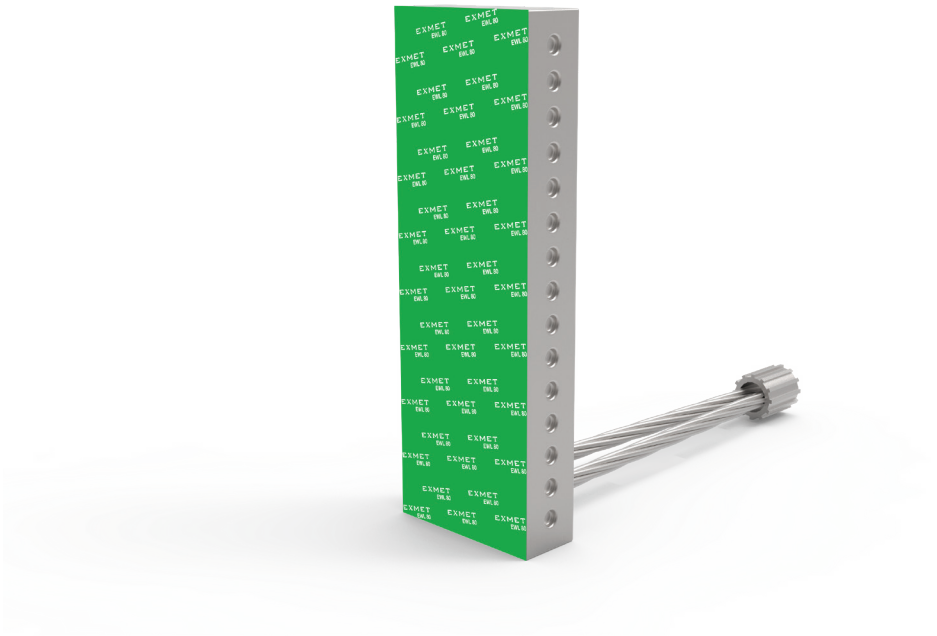

Figure 1. EWL Single Wire Loop Box

EWL wire loops are designed to primarily transfer vertical shear forces between precast concrete walls. Each part of the product has an important role in the transfer mechanism. The steel boxes form recesses in the concrete elements that act as shear keys. Overlapping wire loops in the connection form a confinement for the grout which after hardening allows passing tensile forces from one wire loop to the overlapping one. The tensile forces in the wire are anchored in the concrete element by the anchorage sleeve that is fixed to the ends of a wire rope. All together they create an ideal mechanism for transferring vertical shear forces between concrete elements.

2. TECHNICAL INFORMATION

2.1. Geometric Requirements for Concrete Elements

The geometric requirements for concrete elements are given in table 1.

Table 1. Geometric requirements for concrete elements (see also figure 1 for definition of symbols used in the table)

Wire Loop	Geometric Horizontal Requirements			Geometric Vertical Requirements		
	Wall Thickness [mm]	Joint Width [mm]	Wire Overlap [mm]	Top [mm]	Bottom [mm]	Spacing [mm]
EWL – 60	≥100	80	40	≥250	≥250	≥250 / ≤800
EWL – 80	≥100	100	60	≥250	≥250	≥250 / ≤800
EWL – 100	≥100	120	80	≥250	≥250	≥250 / ≤800
EWL – 120	≥100	140	100	≥250	≥250	≥250 / ≤800
EWL – 140	≥150	160	120	≥350	≥350	≥350 / ≤800

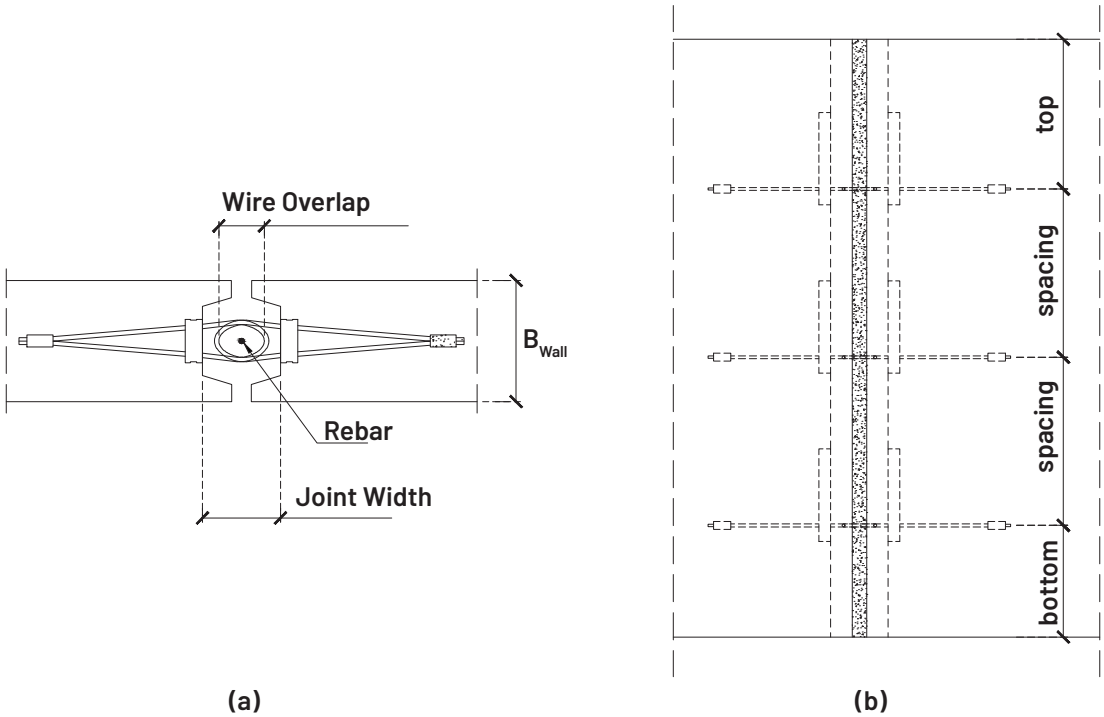

Figure 2. Symbols used to describe geometric requirements for concrete elements using EWL wire loops. Symbols for horizontal and vertical requirements are depicted in (a) and (b) respectively.

Note that the vertical centre-to-centre distance between overlapping wires must be below 20mm (see figure 3).

2.2 Environmental Conditions

EWL wire loops can be used in both indoor and outdoor conditions if sufficient cover according to EN 1992-1-1 section 4.4.1 is provided.

2.3 Load Bearing Properties

EWL wire loops are designed in accordance with Eurocode series to transfer static loads. However, for accidental situations sudden load redistribution has also been accounted with. All of the load bearing properties given in this section apply for final stage – that is when the joint has been grouted and the strength of grout has reached its design value. Note that non-shrink grout must be used in the joint.

NB! Concrete elements using EWL wire loops must be sufficiently designed to transfer all of the necessary loads to wire loops.

NB! the product has not been designed to carry any load in erection stage so appropriate measures must be taken to assure the stability of concrete elements during the erection stage.

2.3.1 Parallel Shear Resistance

Design values of parallel shear resistances for persistent and transient design situations are given in table 4. Note that there must be at least 2 pairs of EWL wire-loops in each joint.

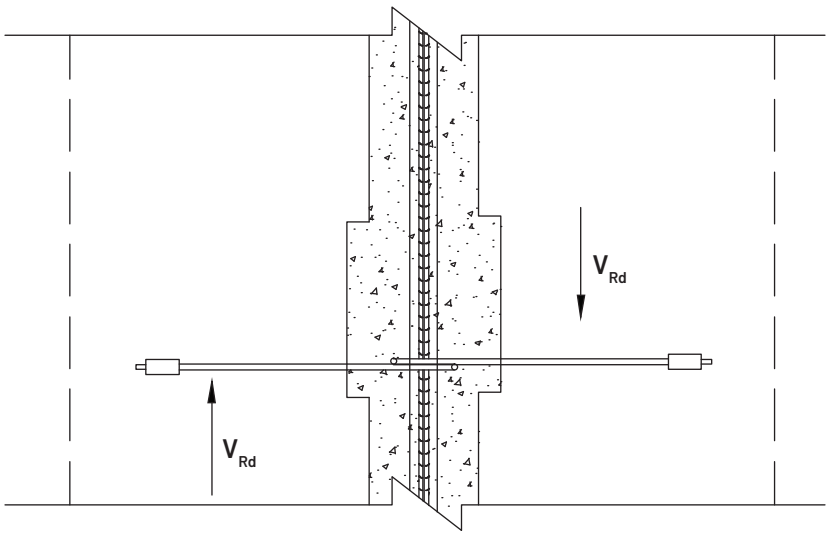

Figure 3. Depiction of Parallel Shear

Design values of parallel shear resistances for persistent and transient design situations are given in table 4 and for accidental design situations with sudden load redistribution are given in table 5. Note that there must be at least 2 pairs of EWL wire-loops in each joint.

Table 2. Parallel shear resistances for persistent and transient design situations

Number of Boxes	Shear Resistance of Joint with EWL – 60...120, [kN]					Shear Resistance of Joint with EWL – 140, [kN]				
	C30/37	C35/45	C40/50	C45/55	C50/60	C30/37	C35/45	C40/50	C45/55	C50/60
2	41.1	46.2	51.1	55.1	58.3	76.6	82.7	88.6	94.4	100.1
3	61.7	69.2	76.6	82.7	87.4	114.9	124.0	132.8	141.5	150.1
4	82.3	92.3	102.2	110.3	116.6	153.2	165.3	177.1	188.7	200.1
5	102.9	115.4	127.7	137.9	145.7	191.5	206.6	221.4	235.9	250.2
6	123.4	138.5	153.2	165.4	174.8	229.8	248.0	265.7	283.1	300.2
7	144.0	161.5	178.8	192.6	203.4	268.1	289.3	309.9	330.2	350.3
8	164.6	184.6	201.4	214.3	226.7	306.5	330.6	354.2	377.4	400.3
9	185.1	206.1	221.1	235.5	249.5	342.5	371.4	398.5	424.6	450.3
10	205.7	223.8	240.4	256.4	272.0	371.5	403.5	434.3	464.2	493.2

Table 3. Parallel shear resistances for accidental design situations with sudden load redistribution

Number of Boxes	Shear Resistance of Joint with EWL – 60...120, [kN]					Shear Resistance of Joint with EWL – 140, [kN]				
	C30/37	C35/45	C40/50	C45/55	C50/60	C30/37	C35/45	C40/50	C45/55	C50/60
2	36.5	41.0	44.9	47.8	50.6	66.1	71.5	76.8	82.1	87.2
3	54.7	61.5	67.4	71.7	75.9	99.1	107.2	115.2	123.1	130.8
4	72.9	82.0	89.9	95.6	101.2	132.1	143.0	153.6	164.1	174.4
5	91.2	102.5	112.3	119.5	126.5	165.2	178.7	192.0	205.2	218.0
6	109.4	122.9	134.8	143.4	151.8	198.2	241.5	230.4	246.2	261.6
7	127.6	143.4	156.0	165.9	175.4	231.2	250.2	268.8	287.2	305.1
8	145.9	162.0	173.6	184.9	195.8	264.3	286.0	307.3	328.3	348.7
9	164.1	177.7	190.8	203.4	215.7	295.0	320.2	344.5	368.0	390.8
10	178.0	193.1	207.7	221.7	235.3	320.4	348.4	375.3	401.4	426.8

2.3.2 Fire Resistance

In order to fulfil fire resistance requirements, the joint geometry should be designed according to EN 1992-1-2 such that the temperature in EWL wire loops would not exceed 350°C.

3. PRODUCT DESCRIPTION & PROPERTIES

3.1 Product Dimensions

The dimensions and tolerances of EWL wire loops are given in table 4.

Table 4. Dimensions and allowable tolerances of EWL wire loops

Wire Loop	L_{box} [mm]	L_{loop} [mm]	L_{tail} [mm]	B_{box} [mm]	t_{box} [mm]	$Ø_{wire}$ [mm]	Tape Colour
EWL – 60	160	60	190	55	20	6	Yellow
EWL – 80	160	80	190	55	20	6	Blue
EWL – 100	160	100	190	55	20	6	Red
EWL – 120	160	120	190	55	20	6	Orange
EWL – 140	200	140	350	75	30	8	Black
Tolerances	±2	±2	±2	±2	±2	–	

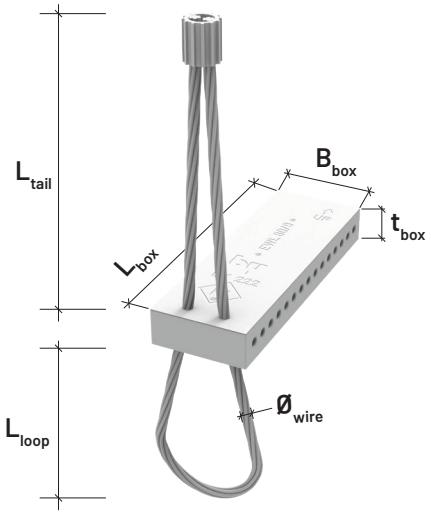

Figure 4. Product Dimension

3.2 Materials

EWL wire loop box are manufactured with the following materials which are shown below:

Table 5. Materials used in EWL wire loop box

Part	Material	Standard
Box	Galvanized Steel Plate 0.5 ... 0.7 mm	SFS – EN 10130 1.0330
Ferrule	Steel Compression Sleeve Ø12 – L25 or Ø18 – L40	SFS – EN 10025.10046
Wire Rope	Steel Wire Ø6 6x19 IWRC or Ø8 6x19 IWRC	SFS – EN 12385 SE – zn (1770 MPa)
Protective Tape	Duct Tape	

3.3 Markings, Manufacturing Method and Quality Control

3.3.1 Markings

Product package is equipped with an EXMET – sticker, which contains the following information: product type, product name, quantity, FI marking and product picture. Products are delivered in plywood boxes on a truck pallet. Plywood boxes are marked with FI and BY (Concrete Association of Finland) logo and the number of certified product declaration and the product name and type.

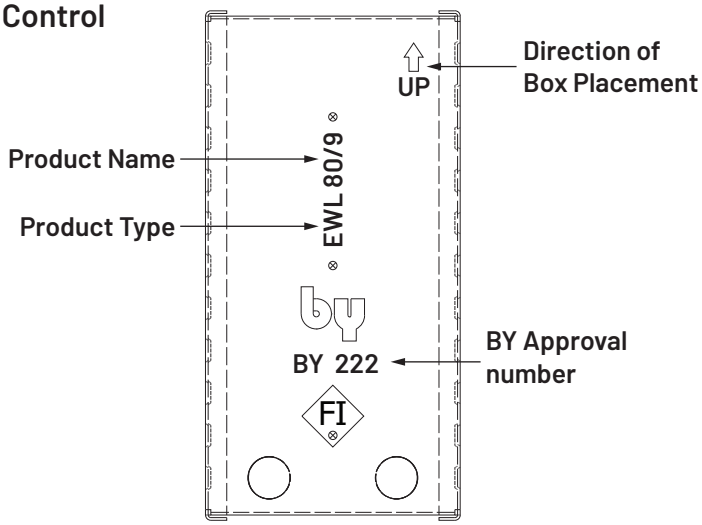

Figure 5. Markings

3.3.2 Manufacturing Method

The steel box is mechanically cut and bent to shape. The open wire rope is installed to the steel box and attached by the compression sleeve to form a loop. The wire rope is bent into the steel box and the open part of the steel box is closed by tape to protect from casting concrete.

3.3.3 Quality Control

Quality control of the wire rope loops is done according to EN 1090 – 2.
Exmet PA OÜ has a quality control contract with Inspecta Sertifiointi Oy.

4. ADDITIONAL REINFORCEMENT

Concrete elements that use EWL wire loops must be sufficiently designed to withstand all possible loading conditions and be able to transfer the necessary loads to EWL wire loops. In order to utilize the maximum load bearing capacity of EWL wire loops, reinforcement according to figure 3 must be present in the concrete element (this does not have to be additional reinforcement).

Note that the U-shaped stirrups must be placed as close to wire loop tails as possible and be sufficiently anchored in the concrete element.

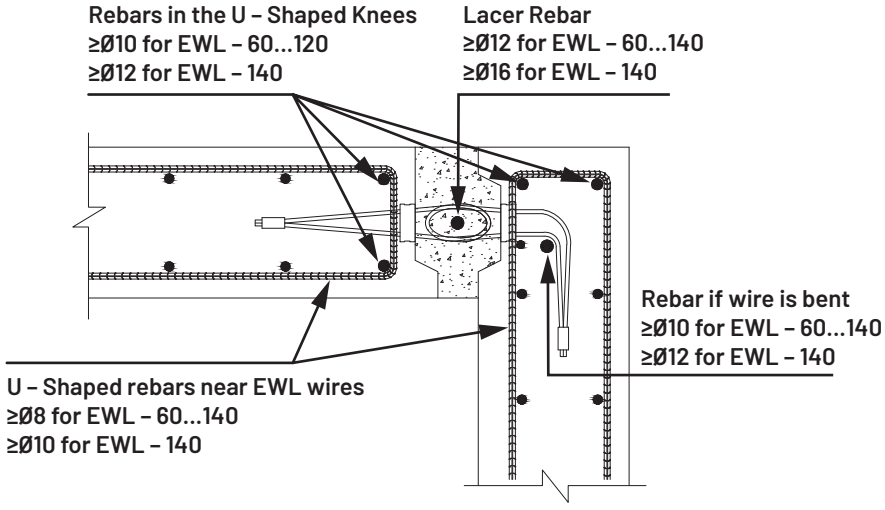

Figure 6. Required reinforcement to utilize maximum load bearing capacity of EWL wire loops

5. INSTALLATION REQUIREMENTS AND TOLERANCES

EWL wire loops must be placed into the formwork according to the installation drawings provided by the designer. The product can be fixed to the formwork by nails through the holes in boxes or by magnets. The reinforcement should be checked to fulfil requirements given in chapter 3.4 figure 3. Installation tolerances for EWL wire loops are given in figure 4. EWL wire loops are not designed to carry any load in erection stage so appropriate measures must be taken to assure the stability of concrete elements during the erection stage. Before grouting the joint, it must be made sure that the wire loops are perpendicular to the surface of the joint, the centre-to-centre distance between overlapping wire loops does not exceed 20 mm and the lacer rebar is placed through all of the wire loops in the joint (see figure 4).

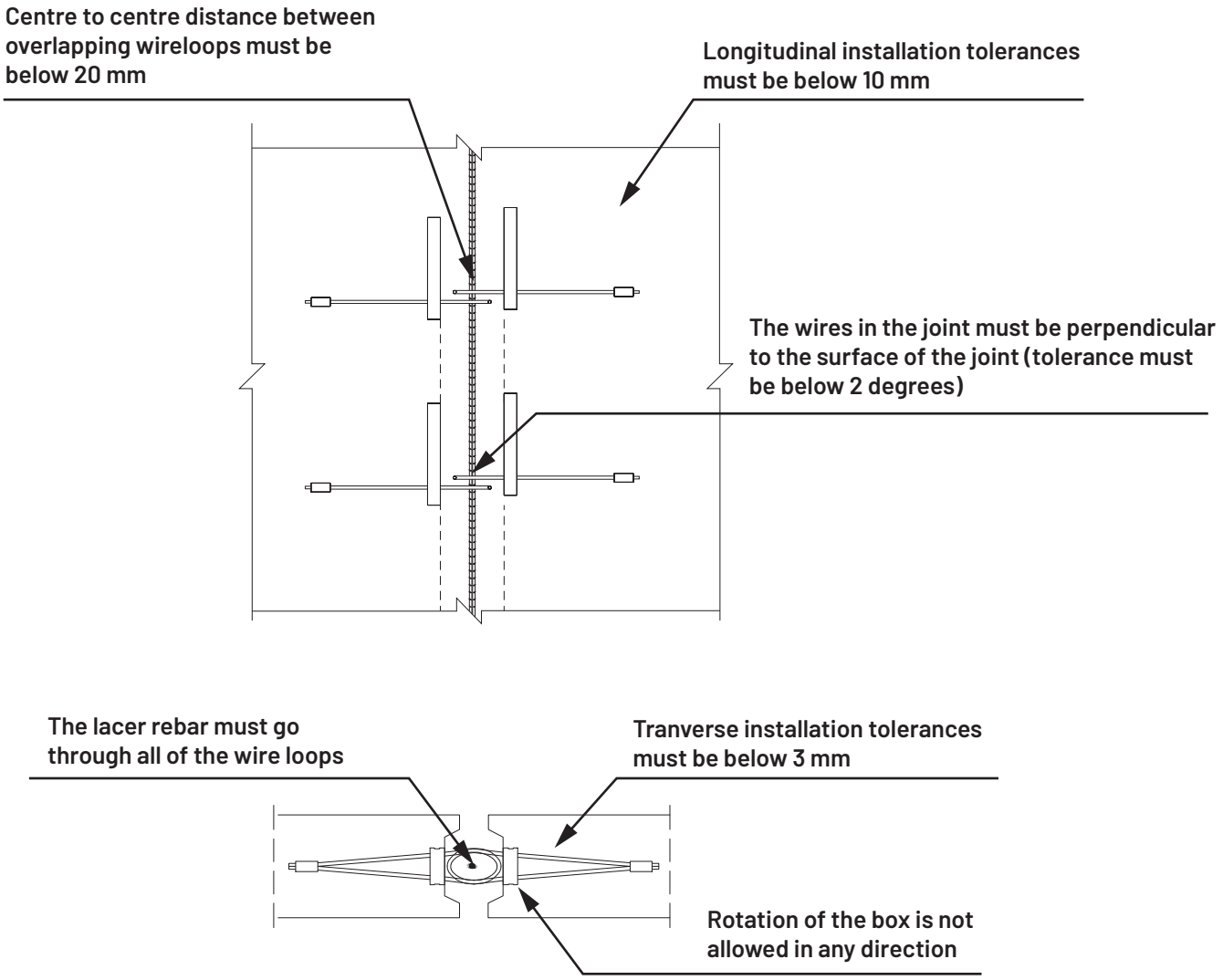

Figure 7. Installation requirements and tolerances for EWL wire loops

5.1 Supervision of Installation

Before Casting:
- do visual checking for EWL-wire loop, it has to be in good condition
- EWL-wire loop is according to designs (assembled to right place)
- check that the neccesary reinforcement is assambled

Casting:
- EWL-wire loop has to stay perfectly and in the right place
- concrete has to be vibrated around the EWL-wire loop

After Casting:
- the situation of the EWL-wire loop is according to designs
- remove tape covering after the concrete is hardened, so the construction site installation is faster more effective

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