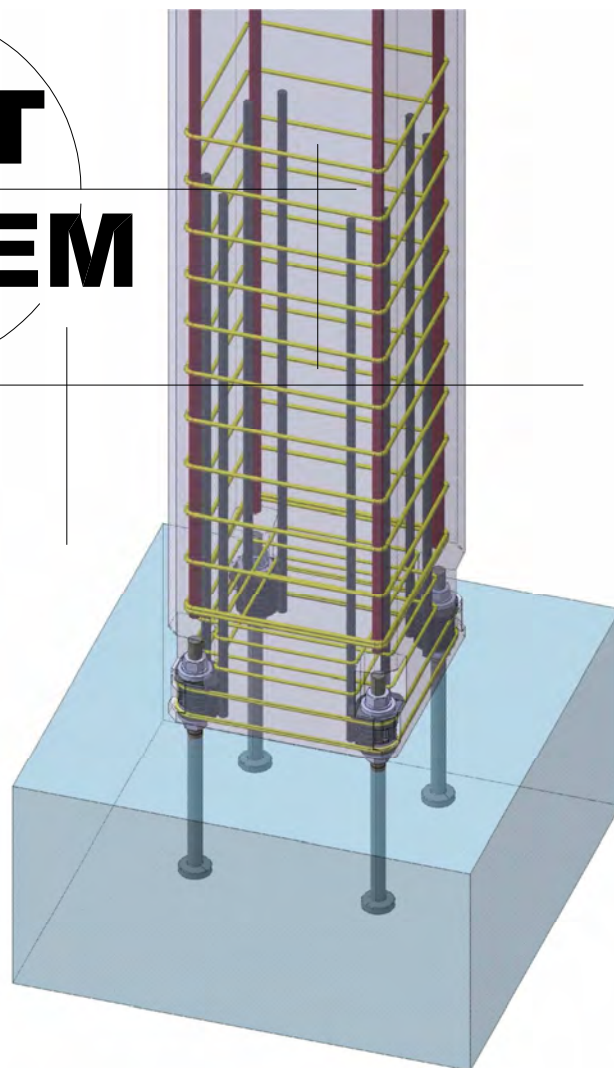


BELT SYSTEM



User manual **2021** BS ITALIA - BELT Manual ENG Rev. 0/2021

REVISIONE	DATA	DESCRIPTION
0	January 2021	First emission

PLEASE READ CAREFULLY THE INFORMATION AND REQUIREMENTS CONTAINED IN THIS USER MANUAL BEFORE USING ANY COMPONENT OF THE CONNECTION BELT SYSTEM, COVERED BY AN INTERNATIONAL PATENT.

For any doubt regarding the correct use of the components described in this manual, contact B.S. Italy:

B.S. Italia S.P.A. - 24050 Zanica (BG) - Via Stezzano, 16 - tel +39 035 670 569 - fax +39 035 671 854 www.bstaliagroup.com - infobsitalia@styl-comp.it

B.S. Italia S.P.A. is a company ISO 9001 certified and the system **BELT CONNECTION** is designed and build in accordance with :

Certifications B.S. Italia



Set of rules of reference:
Eurocodes EC2,EC3,EC8.

D.M. 17/01/2018 "
Technical standards for constructions.
Specification CENT/TS 1992-4-1:2009
Specification CENT/TS 1992-4-2:2009

For the general parts: Eurocodes and state of art .

For materials and surface treatments: Standards ISO, EN,DIN,UNI.

For material checks:
for accredited laboratories ACCREDIA;
ACCREDIA is part of the EA (European accreditation).

for quality system :
ISO 9001 della IGQ, (certify entity Accredia):
IGQ is part of the CISQ, which is part of the IQNet;
reg. B.S.Italia Nr. IT-0188

Validation of the finite element calculations of the system carried out by "Soluciones para el proyecto y diseno de estructuras, S.L. SP.Y D.E. S.L" in collaboration with the engineering mechanics department of the University of Zaragoza.

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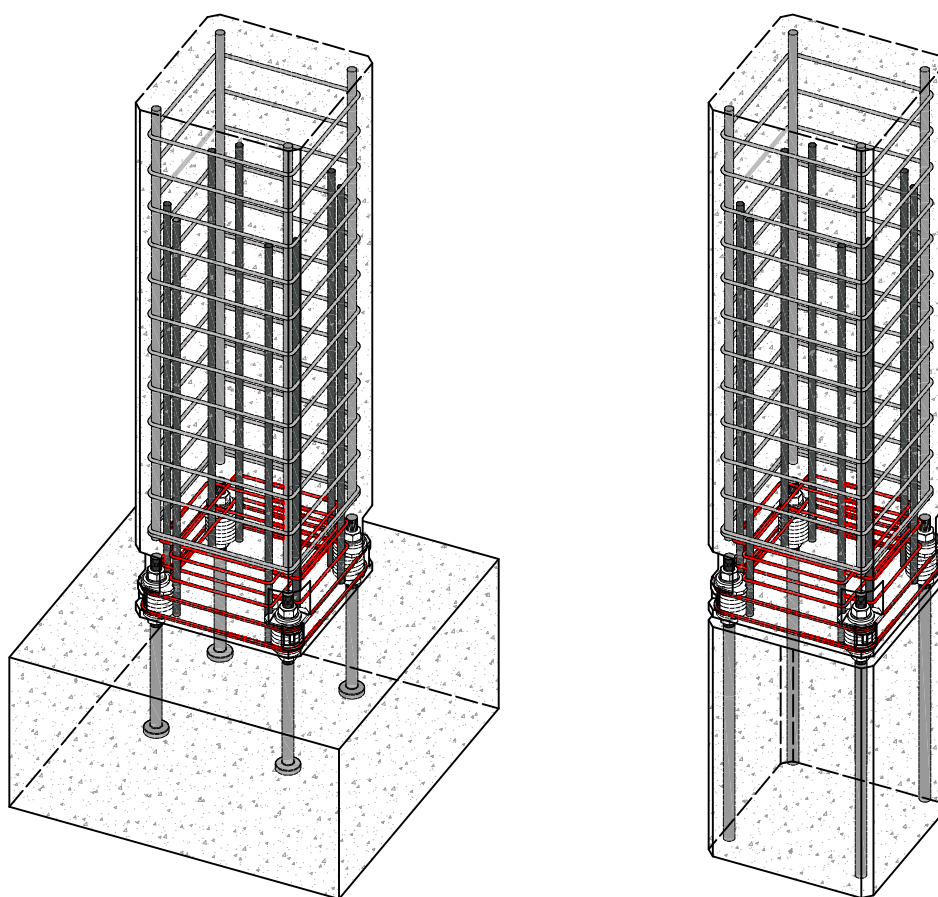
The drawings shown in the following User Manual are indicative

TECHNICAL-ECONOMIC SOLUTION TO CONNECT PRECAST CONCRETE COLUMNS

B.S.Italia always remains tied to its corporate philosophy based on technological innovation and improvement logic. It is offered to the market with the new connection system for prefabricated columns, called **BELT**, maintaining all the advantages of the current systems on the market, such as RAPIDITY of assembly in production and assembly on site, as well as assembly TOLERANCES and CAPACITY 'to bear the expected loads immediately, thus avoiding the use of additional supports.

B.S.Italia, however, introduces technical concepts with the **BELT** system, solving those defects present in current systems :

- Greater mounting tolerance
- Elimination of vertical iron plates, which create a total separation from the main concrete body.
- Interface of the overlapping rebar in accordance with NTC 2018
- Confinement and reinforcement with stirrups in the base of the column and also in the area where the section of the column is reduced.
- Grout filling of the through hole of the AB anchor bolt, thus solving both the shear forces and the weather protection



FEATURES OF THE SYSTEM

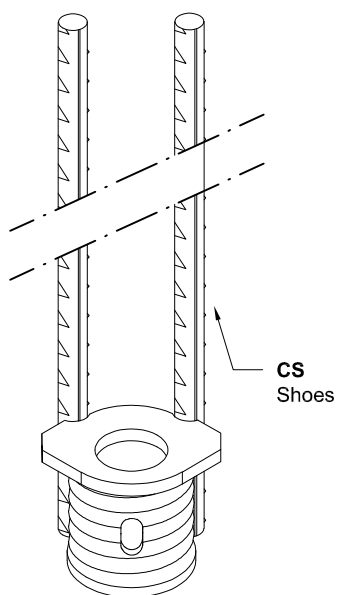
BELT column systems are available in different standard models .this multiplicity of solutions allows to adapt to the great variety of cases which can occur either in the connections between prefabricated columns and foundations in sito and in the connections of precast concrete elements.

Each model is composed of three elements:

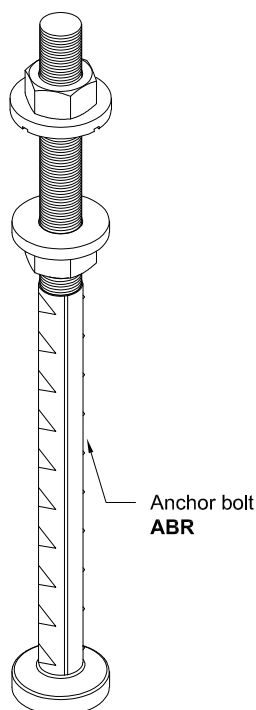
CS shoes arranged at the base of the prefabricated columns ;
Anchor bolts AB arranged in the foundation or in the head of the column with the use of templates;
Forms for the creation of the voids at the base of the columns.

During assembly these elements will be connected by nuts, then the empty spaces will be completely filled with high strength grout with compensated shrinkage.

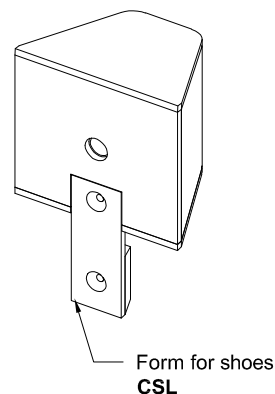
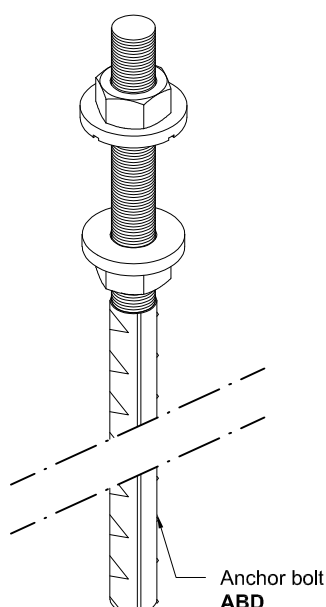
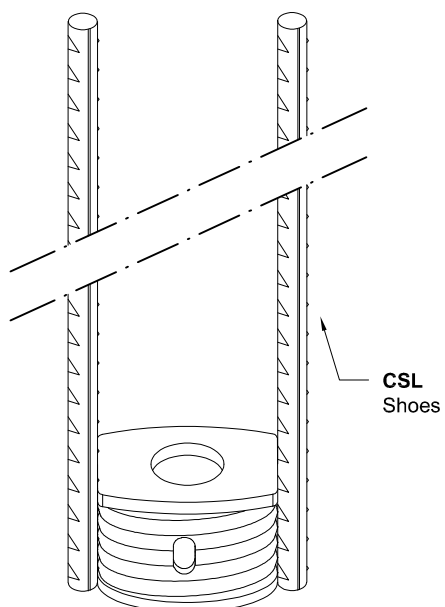
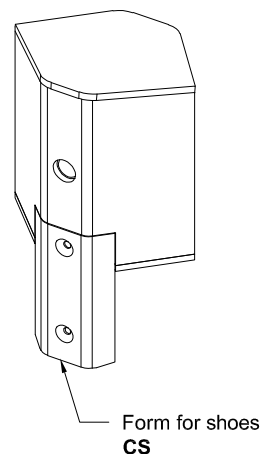
SHOES FOR COLUMNS **CS**



ANCHOR BOLT **AB**



FORMS



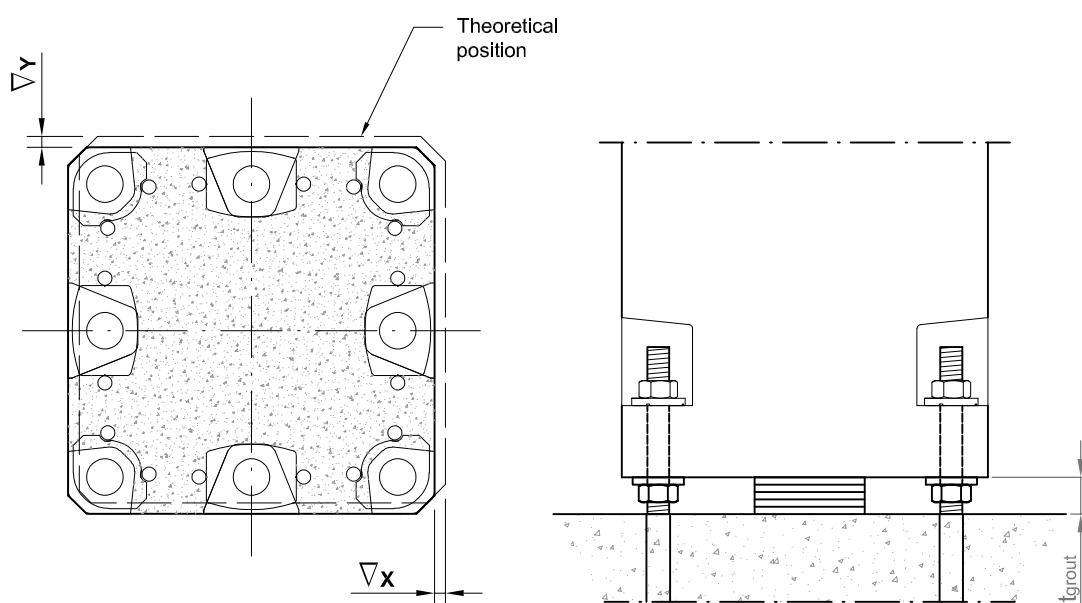
C ONDITION OF USE AND INSTALLATION TOLERANCES

The standard **BELT** column shoes are designed to be used according to the conditions shown in the following paragraph. If these conditions are not met, you can contact **B.S.Italia** technical support for a customized project of the connection **BELT** system .

LOADING AND ENVIRONMENTAL CONDITIONS

The **BELT** column shoes are designed to bear **static loads**. In the case of dynamic, fatigue or seismic loads, a customized project must be made.

The systems of connection for columns **BELT** are designed to be used indoors and in dry conditions. When has to be used in different conditions, surface treatments, concrete covers or raw materials prepared for the entire useful life of the structure can be evaluated.



Measures in mm						
	BELT 20	BELT 24	BELT 30	BELT 33	BELT 36	BELT 39
MAXIMUM INSTALLATION TOLERANCE IN PLANT Δ_x e Δ_y	±9	±7	±8	±6,5	±9,5	±8,0
MAXIMUM INSTALLATION TOLERANCE AT HEIGHT	$t_{grout} 50^{+30}_{-28}$	$t_{grout} 50^{+30}_{-23}$	$t_{grout} 50^{+36}_{-16}$	$t_{grout} 50^{+32}_{-12}$	$t_{grout} 50^{+44}_{-16}$	$t_{grout} 50^{+42}_{-14}$

SHOES "CS & CSL"

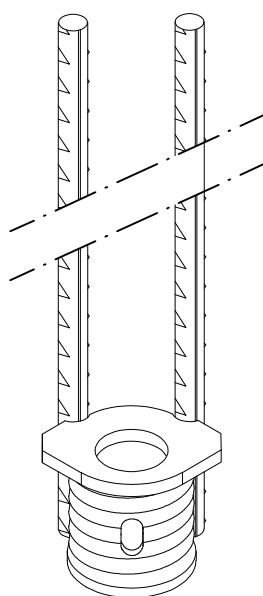
CS shoes are inserts to be placed at the foot of prefabricated columns and which allow to connect structural and non-structural elements to concrete in any type of building.

The shoes are available in different standard types which are suitable for different applications, load conditions and sections. The shoes allow to transfer the loads of the structure to the foundations in place.

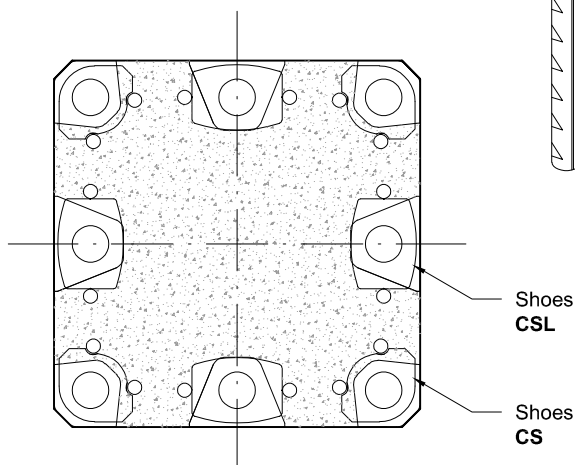
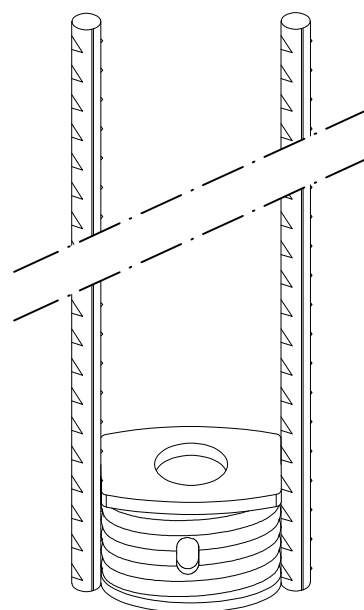
The shoes are divided into two standard types:

- a) **CS** Shoes arranged in the corners of the columns
- b) **CSL** Shoes arranged on the sides of the columns

SHOES **CS**



SHOES **CSL**

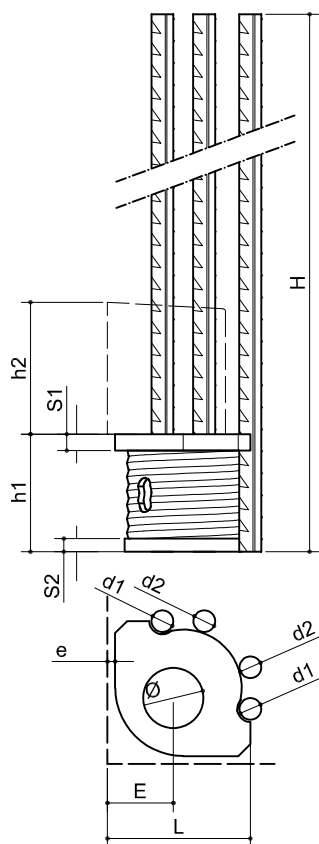


CS and **CSL** shoes allow the creation of a rigid connection between the elements. They effectively and efficiently transmit actions both during assembly and during steady stay operation. The efforts developed are transmitted to the foundation through the ABR and ABD anchor bolts.

COMPONENTS	MATERIAL	REFERENCE STANDARD
Corrugate tube ,top plate and bottom plate	S355J2	EN 10025-2
Rebar with improved pull -out strength	B500B	EN 10080

SHOES "CS & CSL" DIMENSIONS

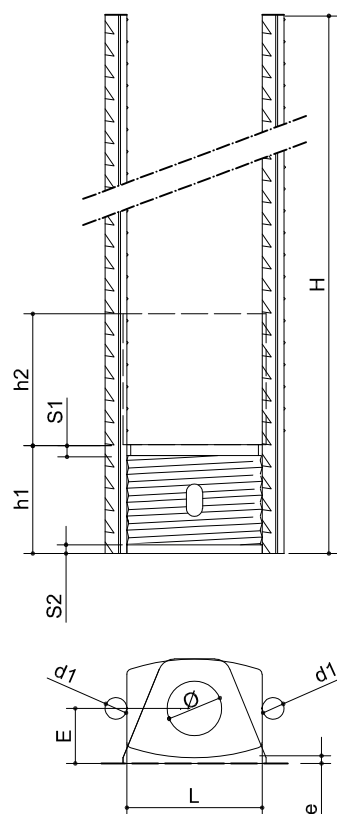
SHOE OF CONNECTION CORNER OF THE COLUMN



Measures in mm

TYPOLOGY OF CS						
	CS20	CS24	CS30	CS33	CS36	CS39
h1	96	96	98	98	107	107
h2	120	120	120	120	150	150
H	1050	1125	1320	1430	1145/1340	1340
S1	8	8	10	10	15	15
S2	6	6	8	8	12	12
L	93,4	93,4	108,4	108,4	130	130
E	45,5	45,5	50	50	60	60
e	10	10	8,5	8,5	7	7
Ø	38	38	46	46	55	55
d1	14	16	20	22	16	20
d2	/	/	/	/	20	20
Weight (Kg)	3,617	4,634	8,246	10,270	13,509	16,505
Marking	CS20	CS24	CS30	CS33	CS36	CS39

SHOE OF CONNECTION SIDE OF THE COLUMN



Measures in mm

TYPOLOGY OF CSL				
	CSL20	CSL24	CSL30	CSL33
h1	95	95	99	99
h2	120	120	120	120
H	1050	1125	1320	1430
S1	8	8	10	10
S2	6	6	8	8
L	112	112	112	112
E	50	50	50	50
e	5	5	5	5
Ø	38	38	46	46
d1	14	16	20	22
Weight (Kg)	4,201	5,215	8,308	10,332
Marking	CSL20	CSL24	CSL30	CSL33

The length of the overlap rebar of the anchor rebar is defined for a C30 / 37 concrete in conditions of poor adhesion.

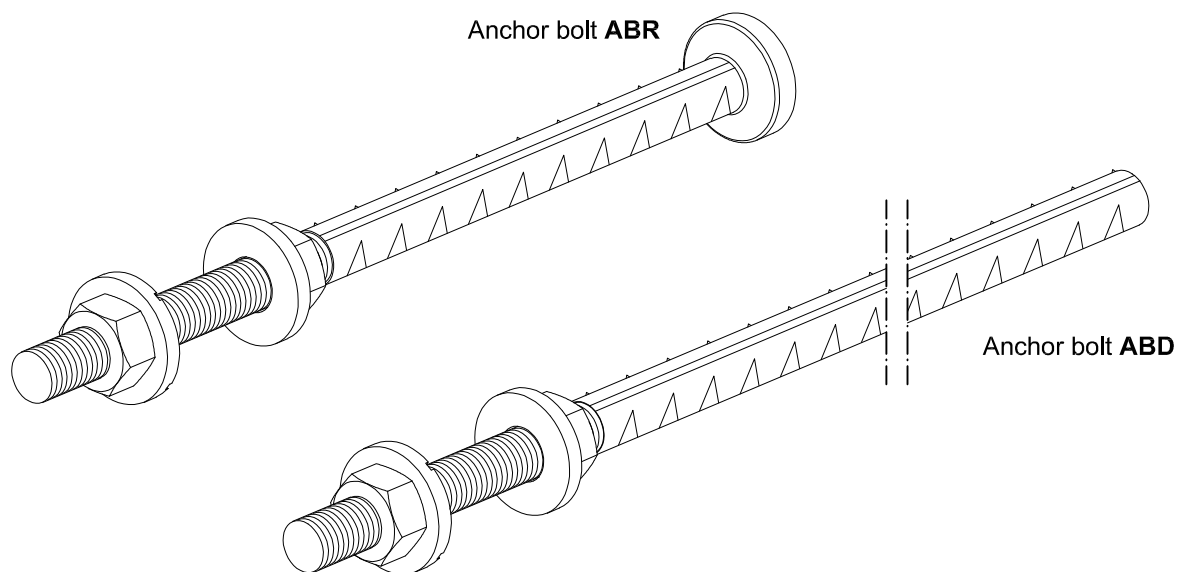
ANCHOR BOLT "AB"

The **AB** anchor bolts are anchors that laid in the castings in place allow to connect structural and non-structural elements to concrete in any type of building.

AB anchor bolts are available in different standard types which are suitable for different applications, load conditions and sections. The anchor bolts are inserted into the concrete and transfer the loads from the fixed structure to the base structure.

AB anchor bolts are divided into two standard types:

- a) **ABR** Anchor bolt with terminal protrusion
- b) **ABD** Anchor bolt with straight bar



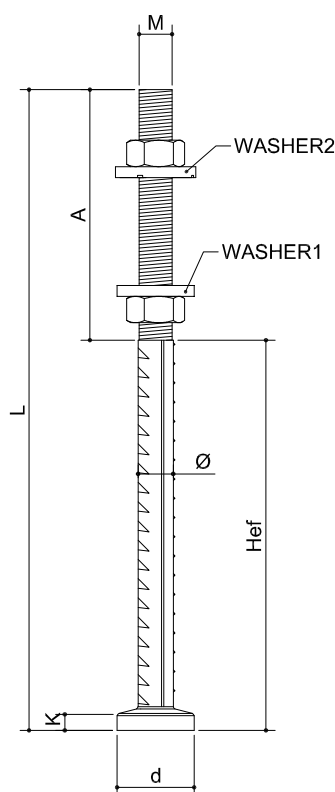
In **ABR** type anchor bolts, anchoring is obtained thanks to the end part with protrusion. the loads are transferred thanks to the pressure of the protrusion terminal against the hardened concrete. Thanks to their small size, the **ABR** anchor bolts are inserted in structures of limited thickness such as foundations, beams and slabs.

The **ABD** anchor bolts are anchored by overlapping, where the anchor bolts overlap with the main reinforcement. The loads are transferred thanks to the ribs of the bars with improved pull-out strength. The main use of **ABD** anchor bolts is in structures of sufficient thickness such as base column and columns in general.

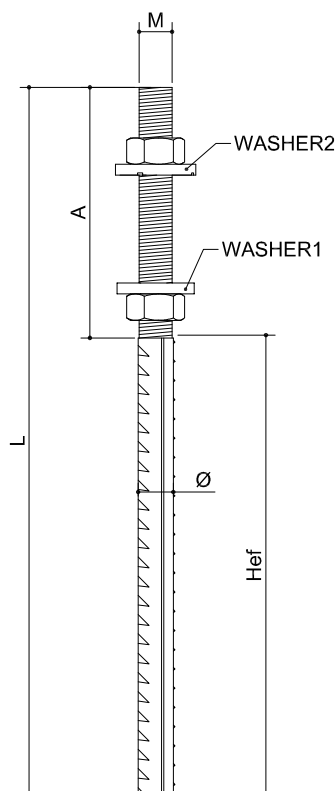
N.B.: All types of AB log bolts will be supplied with the relative nuts and washers necessary for assembly.

COMPONENTS	MATERIAL	REFERENCE STANDARD
Rebar with improved pull -out strength	B500B	EN 10080
Washers	S355J2	EN 10025-2
Nuts	Class 8	EN ISO 4032/EN24032

ANCHOR BOLT "ABR" e "ABD" DIMENSIONS



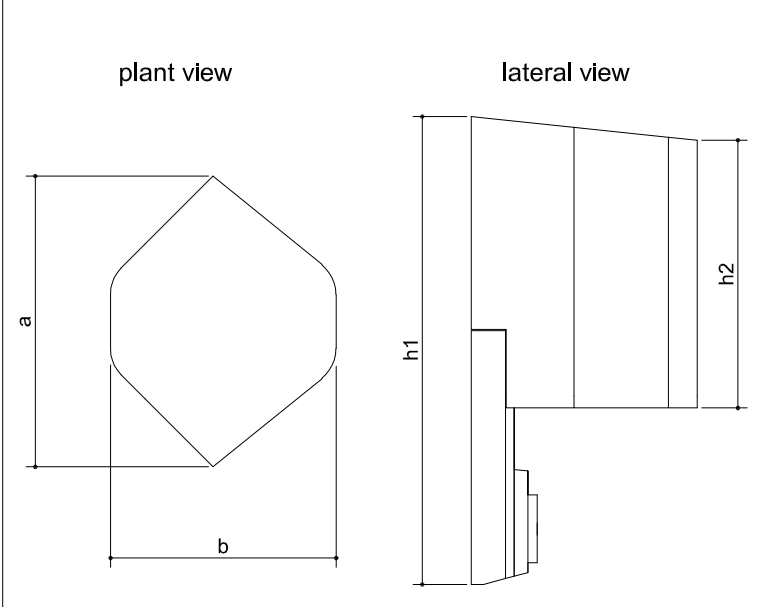
	Measures in mm					
TYOLOGY	ABR 20	ABR 24	ABR 30	ABR 33	ABR 36	ABR 39
M	M20	M24	M30	M33	M36	M39
A	203	208	223	223	260	260
NET AREA RESISTANT	245	352	561	647	817	976
Ø	20	25	32	34	40	40
L	443	513	578	628	735	780
WASHER1	Ø52-6	Ø52-8	Ø70-10	Ø70-12	Ø85-15	Ø85-15
WASHER2	Ø52-6	Ø52-8	Ø70-10	Ø70-12	Ø85-15	Ø85-15
Hef	245	310	360	410	480	525
K	12	13	15	15	18	18
d	46	55	70	75	90	90
Weight (Kg)	1,565	2,602	4,867	5,995	9,555	10,682
Marking	ABR 20	ABR 24	ABR 30	ABR 33	ABR 36	ABR 39



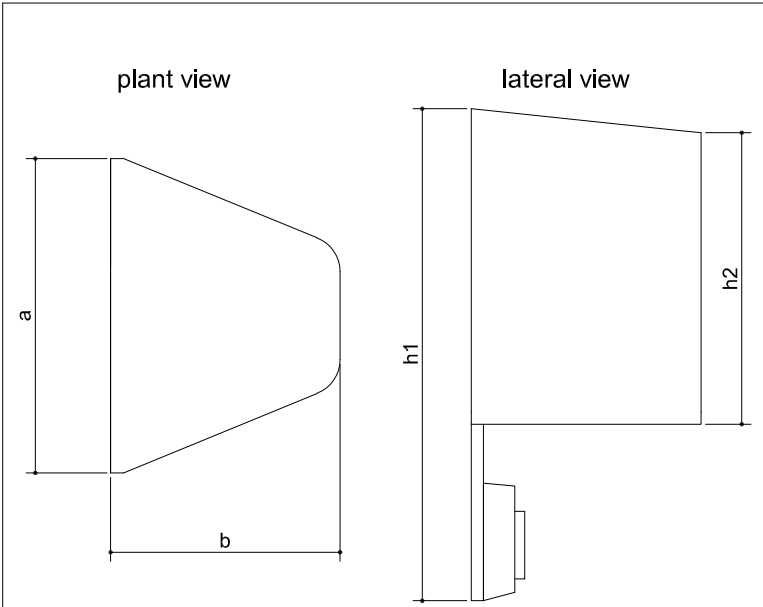
	Measures in mm					
TYOLOGY	ABD 20	ABD 24	ABD 30	ABD 33	ABD 36	ABD 39
M	M20	M24	M30	M33	M36	M39
A	203	208	223	223	260	260
NET AREA RESISTANT	245	352	561	647	817	976
Ø	20	25	32	34	40	40
L	1260	1440	1735	1875	2010	2030
WASHER1	Ø52-6	Ø52-8	Ø70-10	Ø70-12	Ø85-15	Ø85-15
WASHER2	Ø52-6	Ø52-8	Ø70-10	Ø70-12	Ø85-15	Ø85-15
Hef	1062	1237	1517	1657	1755	1775
Weight (Kg)	3,864	5,954	11,770	14,420	21,251	22,132
Marking	ABD 20	ABD 24	ABD 30	ABD33	ABD 36	ABD 39

The forms for the BELT systems that we will indicate in the tables below have been simplified into three typologies for CS shoe (due of its dimensions) and one for CSL shoe.

Main dimensions of **CS** forms

		Measures in mm			
		a	b	h1	h2
	CS20	107	82	193	110
	CS24				
	CS30	123	99	193	110
	CS33				
	CS36	150	120	228	140
	CS39				

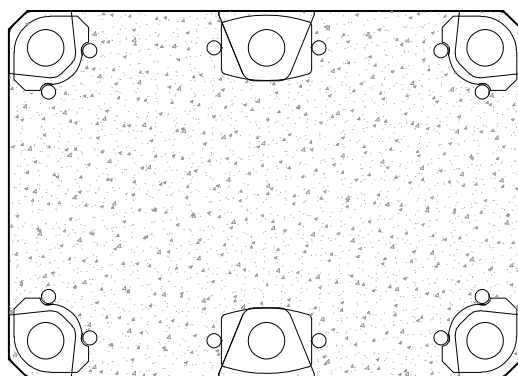
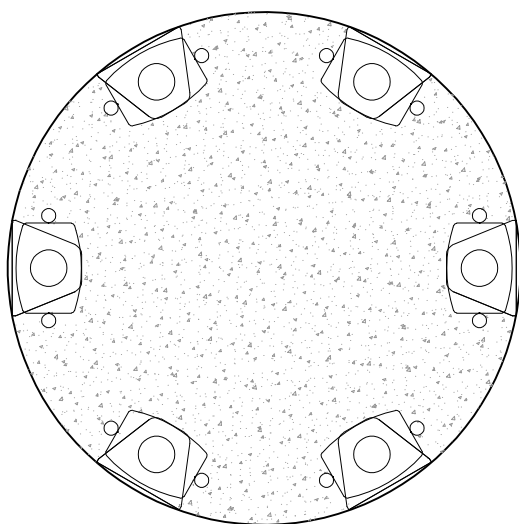
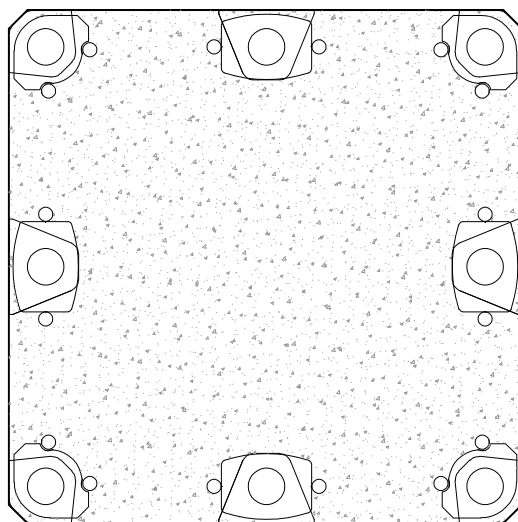
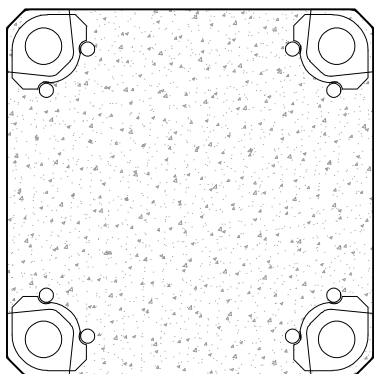
Main dimensions of **CSL** forms

		Measures in mm			
		a	b	h1	h2
	CSL20	130	95	193	110
	CSL24				
	CSL30				
	CSL33				

APPLICATION FIELDS

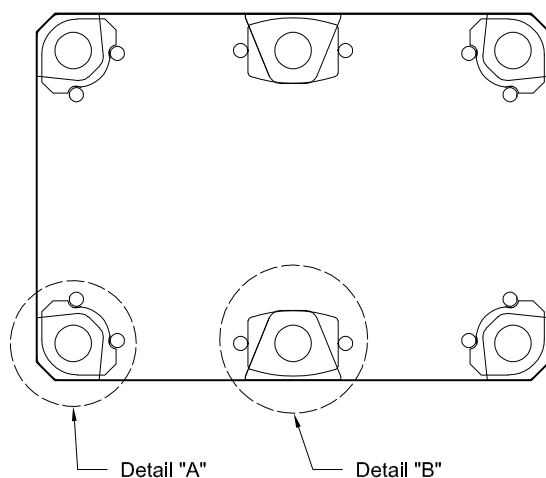
It is possible to use four or more shoes for column depending on the size of the same and the amount of effort to be transmitted.

Positioning of the CS and CSL **BELT** shoes in the different column sections.

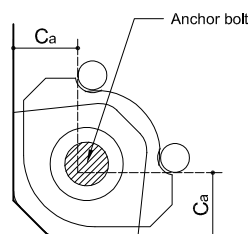


COVER REBAR

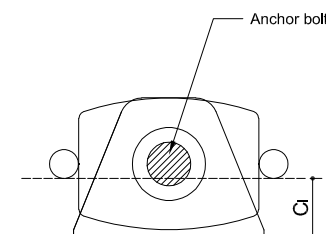
Plan view of the section of the column



DETAIL "A"
Corner positioning
of the column shoe



DETAIL "B"
Lateral positioning
of the column shoe

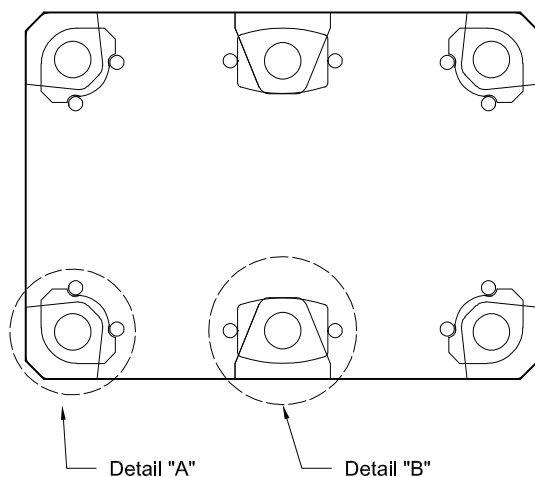


	Measures in mm					
	BELT 20	BELT 24	BELT 30	BELT 33	BELT 36	BELT 39
Corner cover rebar C_a	41	40	45	44	40	40
Lateral cover rebar C_l	43	42	40	39	/	/

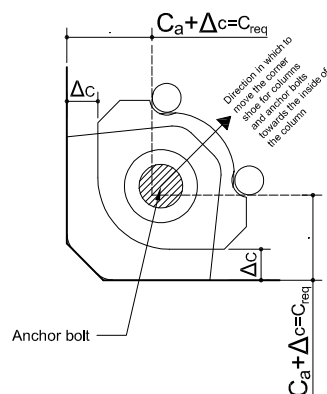
If higher cover rebar values are required ($C_{req} > C_a$ or $C_{req} > C_l$), the Belt column shoes must be moved towards the center of the column (see drawing below). To prevent the concrete from clogging the grooves of the shoes during the casting, it is possible to use sheet metal shapes. If the shoes for columns are positioned more internally than the perimeter of the column, special arrangements must be made to prevent the concrete from clogging the space Δ_c .

If the shoes for columns are to be moved towards the inside of the column, the anchor bolts must also be moved in the drawings relative to their positioning.

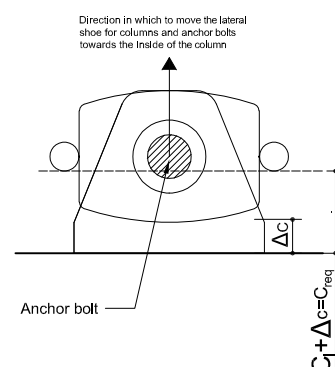
Plan view of the section of the column



DETAIL "A"
Corner positioning
of the column shoe



DETAIL "B"
Lateral positioning
of the column shoe



POSITIONING OF THE SHOES IN THE FORMWORK

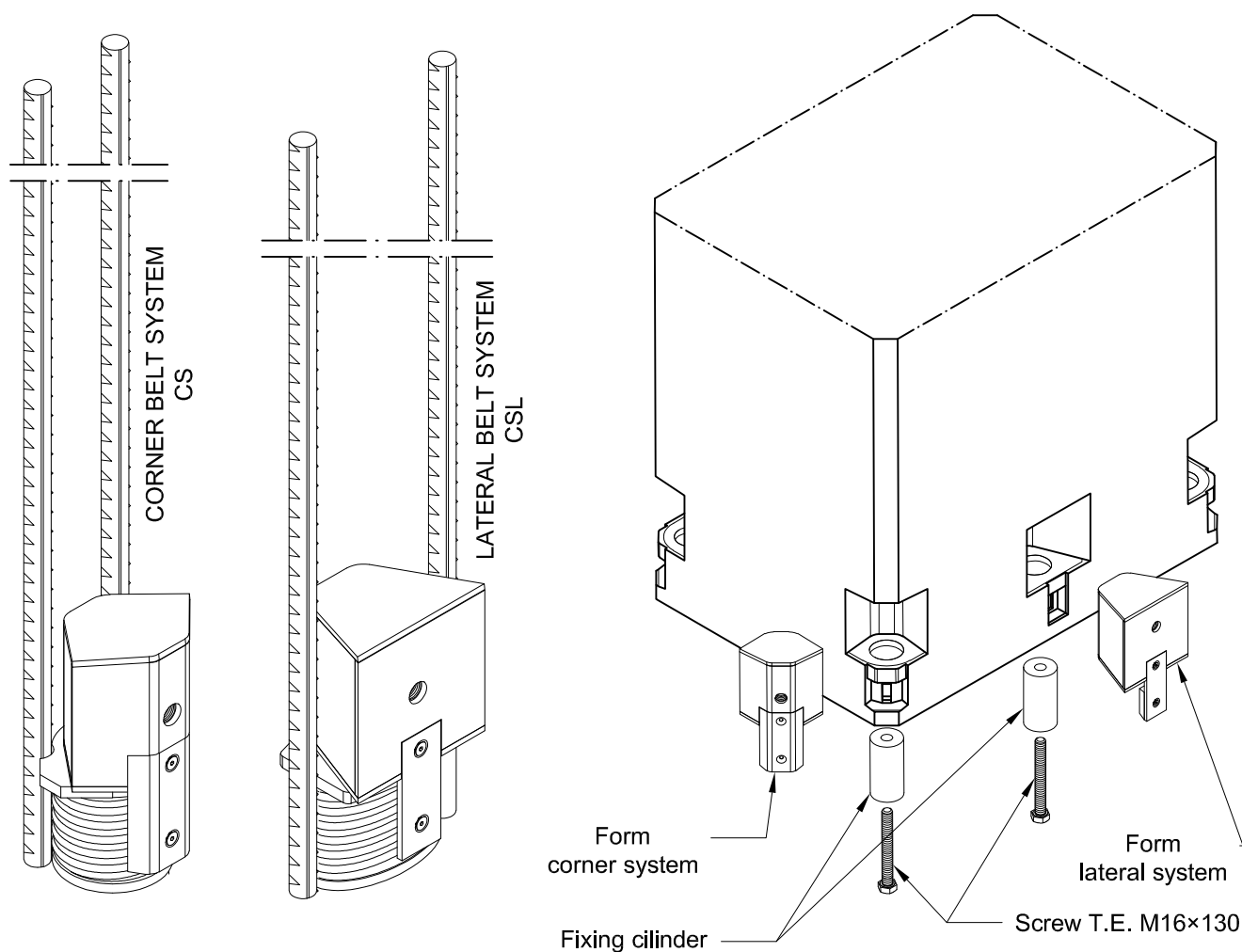
The shoes for columns are positioned in the reinforcement of the column and fixed to the head of the formwork through the relative forms and accessories of the same.

The forms in fact, combined with their cylindrical pins having a diameter equivalent to the hole of the plates and the bolt inserted in the pin, allow to fix and position the shoes at the head of the formwork with irrelevant tolerances, particular attention must be paid in the realization of the templates. The additional stirrups must be positioned as indicated on pages 24 and 25.

N.B: The hole closing block must be applied after positioning the integrative stirrups ①

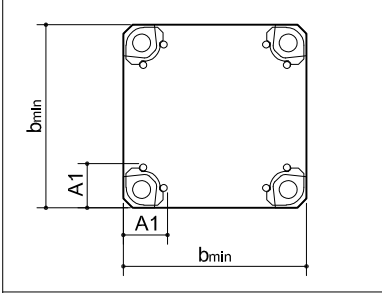
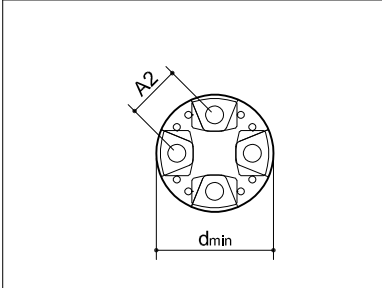
The forms has been designed for a minimum rebar cover of 2.5cm, if a larger rebar cover is required, shims must be inserted between the form and the formwork with adhesive strips/rigid thicknesses or, if a concrete cover is always required Greater, to create customized forms (to be checked with the BS Italia technical office).

The forms must be lubricated with release agents to facilitate removal after casting. It is always advisable that, after removing the form, the hole is inspected to verify that there is no concrete grout, if so, carefully remove it.



M INIMUM DIMENSION OF THE COLUMN

Belt column shoes are designed to be used in reinforced concrete columns of minimum dimensions as shown in the table below.

		Measures in mm					
		BELT 20	BELT 24	BELT 30	BELT 33	BELT 36	BELT 39
	A1	114,5	117	120,3	121,3	140	140
	b_{min}	250	260	270	270	320	320
		BELT 20	BELT 24	BELT 30	BELT 33		
	A2	146	146	146	146		
	d_{min}	350	350	350	350		

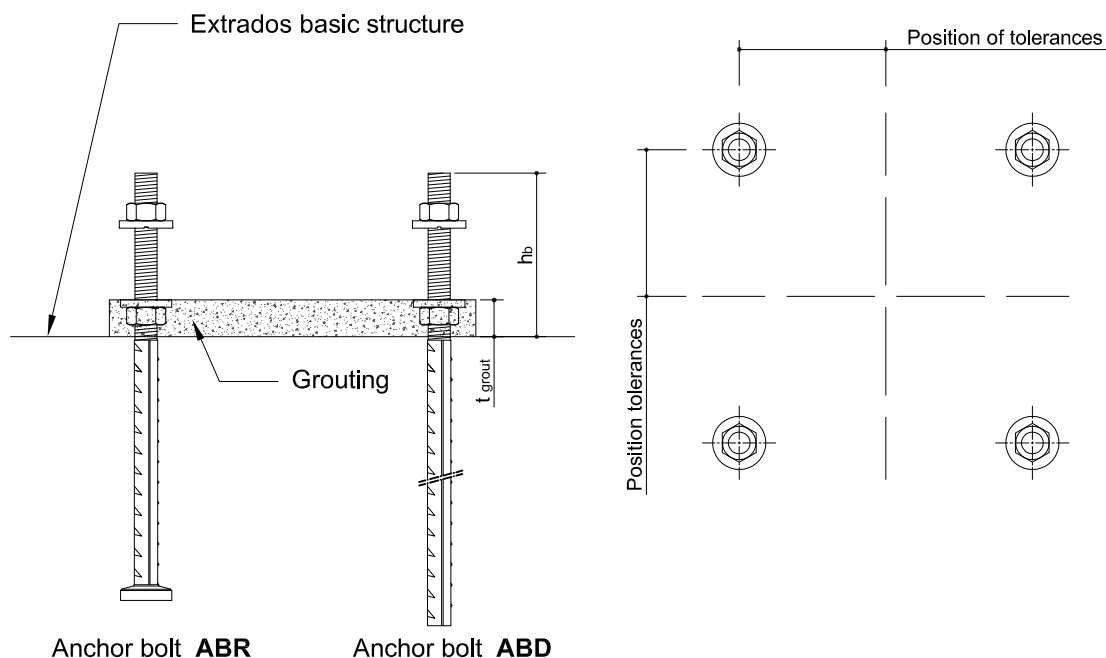
The characteristics of the standard **Belt** column shoes are guaranteed for use in reinforced concrete columns with class C30 /37 to C70/85 concrete. The strength of the grouting mortar must be at least equal to or greater than the strength of the concrete of the column.

The structural properties of the **Belt** column shoes are guaranteed if the supplementary reinforcement indicated on pages 24 and 25 is placed in the column. The supplementary reinforcement is to be considered as additional to the main reinforcement designed to bear the actions inside the column.

The cover of the main anchor bars of the column shoes is 40-47 when the **Belt** column shoes are positioned in the corners at the base of the column.

ANCHOR BOLT INSTALLATION "AB"

The anchor bolts are laid strictly with the template and project, respecting the "hb" dimension, indicated in the table below, by type of anchor bolt. The dimension measured from the concrete surface has a tolerance of ± 20 mm.



Anchor bolt	AB20	AB24	AB30	AB33	AB36	AB39
Thickness of grouting t _{grout} (mm)	50	50	50	50	60	60
Quote of the anchor bolt h _b (mm)	198	203	218	218	255	255
Position tollerances of the anchor bolt (mm)	± 3	± 3	± 3	± 3	± 3	± 3

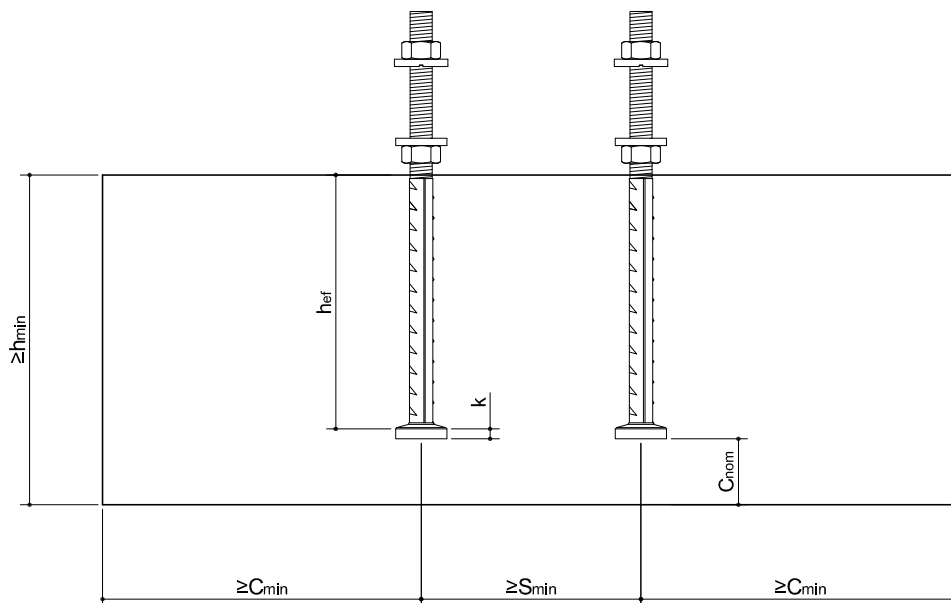
FOLDING BOLTS

The **AB** anchor bolts are produced from improved pull-out strength bars in B500B steel. Their folding must be done according to UNI-EN 1992-1-1.

INTEGRATIVE INDICATIONS FOR ANCHOR BOLT "ABR"

Anchor bolts AB are inserted into the concrete up to the quote as indicated in the previous paragraph.
Attention must be respected minimum distances caused of :

- a) l_{min} = Interax between anchor bolt
- b) B_{min} = Distance of the edge
- c) H_{min} = Thickness of the basic structure



	C_{min} (mm)	S_{min} (mm)	h_{min} (mm)	h_{ef} (mm)	k (mm)
ABR20	70	100	330	233	12
ABR24	70	100	395	297	13
ABR30	100	130	445	345	15
ABR33	110	130	500	395	15
ABR36	120	150	590	462	18
ABR39	130	150	610	507	18

REBAR REINFORCEMENT ANCHOR BOLT "ABR"

If the extraction resistances of the concrete cone (tensile), splitting (cracks), edge cone (shear) and punching (compression), are exceeded by the respective design forces, it is necessary to prepare the appropriate supplementary reinforcement.

To determine the correct integration reinforcement, contact the technical office of **B.S.Italia** indicating exactly:

- Dimensions of the artefacts
- Concrete resistance
- Project reinforcement already foreseen by the customer
- Value of forces

B.S.Italia will thus be able to provide the most suitable supplementary reinforcement.

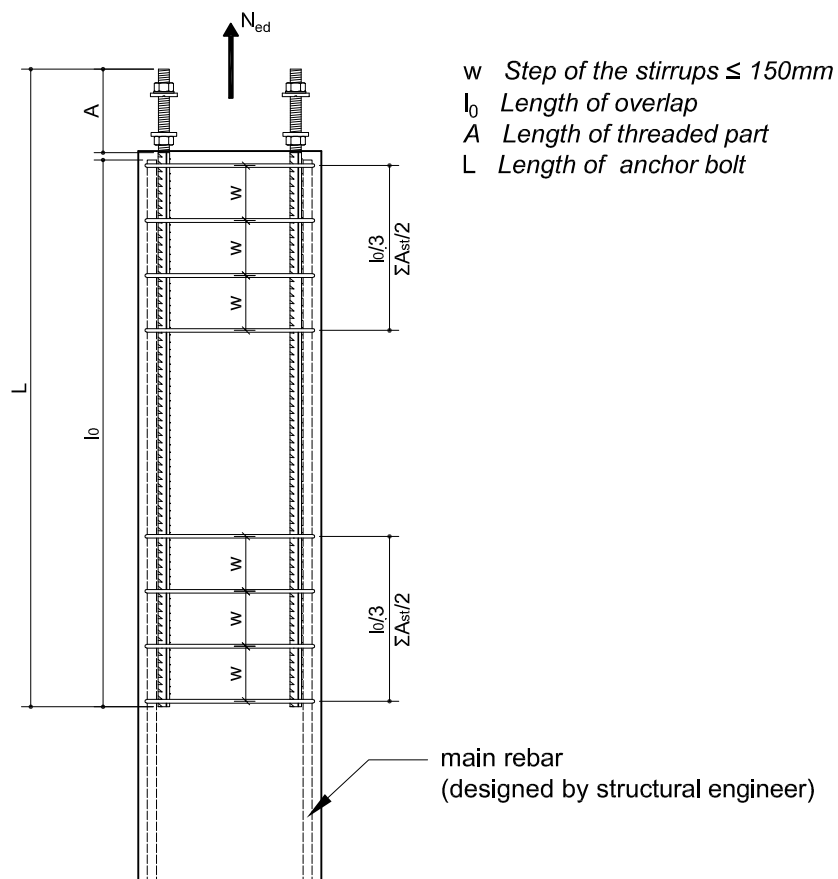
REBAR REINFORCEMENT ANCHOR BOLT "ABD"

ABD Long anchor bolts are designed for use in overlap with the main reinforcement of the base structure. The basic structure must be reinforced with longitudinal bars with an area equal to at least the anchor bolts. An adequate transversal reinforcement ΣA_{st} should be provided in the overlap area. The quantities of stirrups required are shown in the table below.

Anchor bolt	N° of total stirrups ①	L_0 (mm)
ABD 20	3+3 Ø8	1050
ABD 24	4+4 Ø8	1200
ABD 30	4+4 Ø10	1500
ABD 33	4+4 Ø10	1650
ABD 36	6+6 Ø14	1750
ABD 39	6+6 Ø14	1800

The reinforcement shown in the table can be directly applied if the following conditions exist:

- The concrete class of the base structure is equal to or greater than C25 / 30.
- The long anchor bolts are subject to tensile efforts.



The CS and CSL column shoes are designed to withstand at the tensile and compressive design efforts transmitted by the corresponding **AB** anchors bolts.

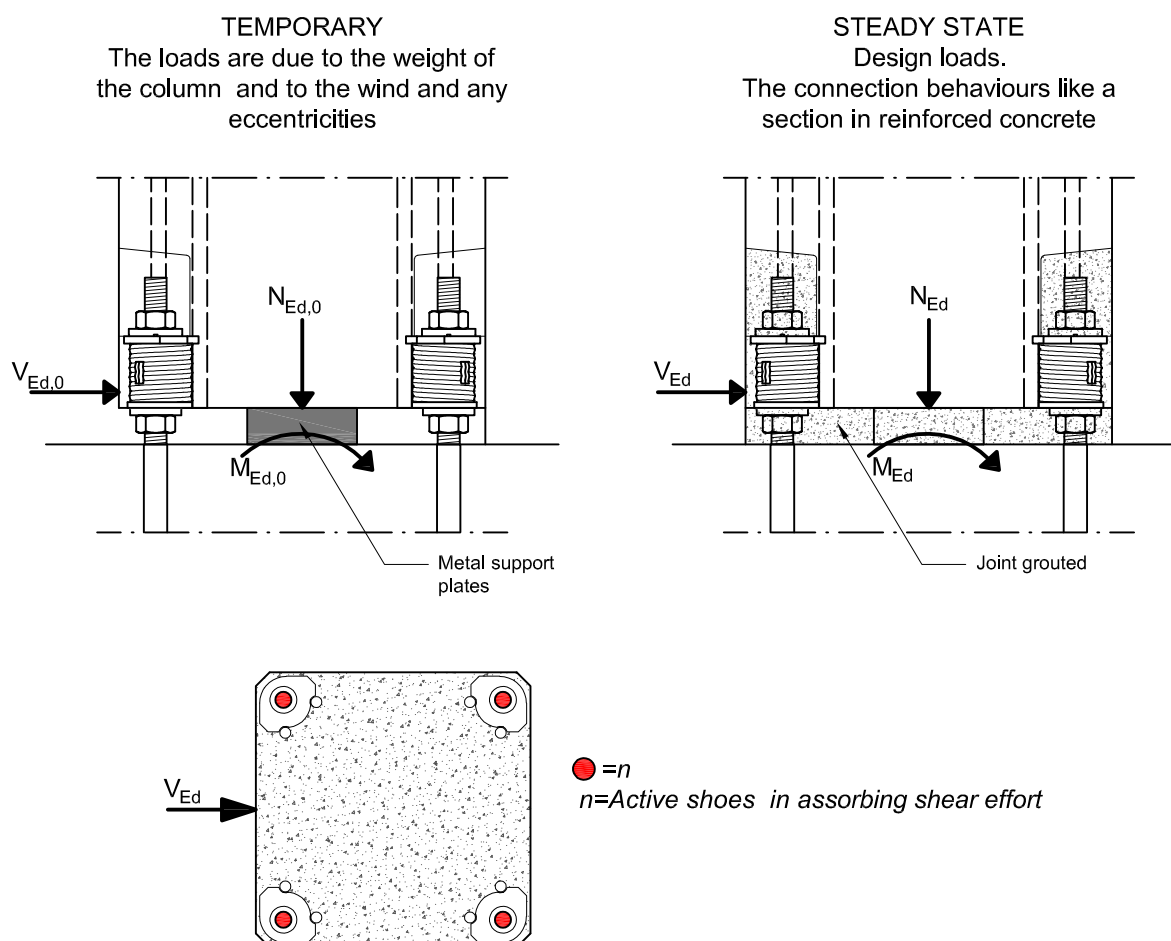
TEMPORARY SITUATION

During the column assembly phase, the stresses transmitted by the column (through the shoes) to the anchor bolts are mainly generated by the wind and by any eccentricities due to overhangs and/or brackets. The own weight of the column, on the other hand, is unloaded entirely on metal plates positioned in the center of the column. In this transitory situation, since the joint between the column and the base structure is not yet anchored, all the stresses transmitted by the shoes are supported only by the anchor bolts not yet made integral with the shoe. For each **BELT** system the values of tensile/compressive strength $N_{Rd,0}$ and shear $V_{Rd,0}$ are given in the table on page 21.

If the size of the log bolts is not sufficient to bear the acting loads, either the size or the number of log bolts and column shoes or both must be increased. **The joint below and the recesses must be grouted with non-shrink mortar and the hardening process of the mortar must be completed before the column is loaded by mounting other elements that insist on it.**

STEADY STATE

When the grouting design resistance is reached, the system is in a steady state operating as a section of reinforced concrete. The shoes for columns and the anchor bolts together with the grouting are in fact able to bear the project loads. For each **BELT** system the values of tensile/compressive strength N_{Rd} and shear V_{Rd} are given in the table on page 21. Unlike other connection systems, since the log bolts are completely embedded inside the CS and/or CSL, **all connection systems participate in the shear resistance of the section.**



LOAD CAPACITY OF THE BELT SYSTEM

The resistances of the BELT system are determined through calculations that refer to the standards mentioned on page 2.

TENSILE RESISTANCE

The following table shows the design loads for each type of system. The values refer to the steel side resistance of the anchor bolts. The verifications of the system on the concrete side of the foundation are left to the end user. The verifications to be carried out based on the type of system chosen are described on page 22.

SHEAR RESISTANCE

The following table shows the design loads for each type of system either during assembly and during operation. The values refer to the steel side resistance of the anchor bolts. The verifications of the system on the concrete side of the foundation are left to the end user. The verifications to be carried out based on the type of system chosen are described on page 23.

CORNER SHOES

SHOES CS	ANCHOR BOLT TO BE COMBINED		TENSILE DESIGN LOAD N_{Rd} (kN)	SHEAR TRANSITORY LOAD $V_{Rd,0}$ (kN)	SHEAR DESIGN LOAD V_{Rd} (kN)
	WITH PROTRUSION	BAR STREIGHT			
CS20	ABR 20	ABD 20	97,0	13,38	31,26
CS24	ABR 24	ABD 24	139,8	23,58	45,04
CS30	ABR 30	ABD 30	222,2	46,22	71,58
CS33	ABR 33	ABD 33	274,8	62,09	88,55
CS36	ABR 36	ABD 36	323,5	70,25	104,25
CS39	ABR 39	ABD 39	386,5	87,26	124,54

LATERAL SHOES

SHOES CSL	ANCHOR BOLT TO BE COMBINED		TENSILE DESIGN LOAD N_{Rd} (kN)	SHEAR TRANSITORY LOAD $V_{Rd,0}$ (kN)	SHEAR DESIGN LOAD V_{Rd} (kN)
	WITH PROTRUSION	BAR STREIGHT			
CSL20	ABR 20	ABD 20	97,0	13,38	31,26
CSL24	ABR 24	ABD 24	139,8	23,58	45,04
CSL30	ABR 30	ABD 30	222,2	46,22	71,58
CSL33	ABR 33	ABD 33	274,8	62,09	88,55

NOTE 1

The shear strength values shown in the previous tables, either transitory $V_{Rd,0}$ and in operation V_{Rd} , are valid for joint heights equal to t_{Grout} indicated in the table on page 16.

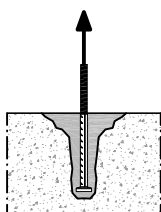
TENSILE VERIFICATIONS IN THE FOUNDATION

The following images show the verifications required in the foundation in place for the ABR and ABD anchor bolts submitted to tensile loads.

Depending on the type of anchor bolt used, some verifications must not be carried out as it is not applicable.

The verifications are in accordance with the CEN / TS 1992-4-2: 2009 standard

PULL-OUT VERIFICATION



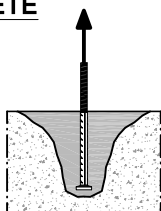
ANCHOR BOLD ABR

Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.2.4

ANCHOR BOLD ABD

Verification not applicable

VERIFICATION CONE BREKAGE CONCRETE



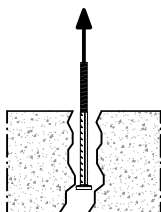
ANCHOR BOLD ABR

Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.2.5

ANCHOR BOLD ABD

Verification not applicable

VERIFICATION SPLITTING



ANCHOR BOLD ABR

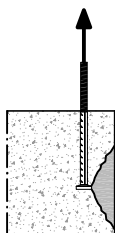
Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.2.6

ANCHOR BOLD ABD

Verification not applicable

Verificatio not applicable if the
distance to the edge , in evry
direction , is greater of $1,5 h_{ef}$

VERIFICATION BLOW-OUT



ANCHOR BOLD ABR

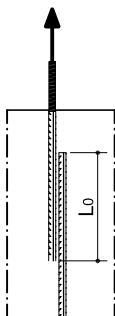
Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.2.7

ANCHOR BOLD ABD

Verification not applicable

Verificatio not applicable if the
distance to the edge , in evry
direction , is greater of $0,5 h_{ef}$

VERIFICATION LENGHT OF OVERLAPPING



ANCHOR BOLD ABR

Verification not applicable

ANCHOR BOLD ABD

Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.2.9

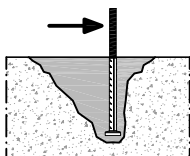
Shear Verifications in the Foundation

The following images show the verifications required in the foundation in place for the ABR and ABD log bolts subjects to shear loads.

Depending on the type of anchor bolt used, some verifications must not be carried out as it is not applicable.

The verifications are in accordance with the CEN / TS 1992-4-2: 2009 standard

VERIFICATION PRY-OUT



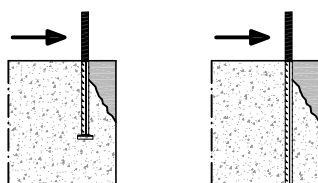
ANCHOR BOLD ABR

Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.3.5

ANCHOR BOLD ABD

Verification not applicable

VERIFICATION DISTANCE TO THE EDGE



ANCHOR BOLD ABR

Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.3.5

ANCHOR BOLD ABD

Verification in accordance
with standard CEN/TS
1992-4-2:2009
§ 6.3.5

Verification not applicable if the distance to the edge, in every direction, is greater of the minimum distance between $a: 10 \cdot h_{ef}$ o $60\varnothing$.

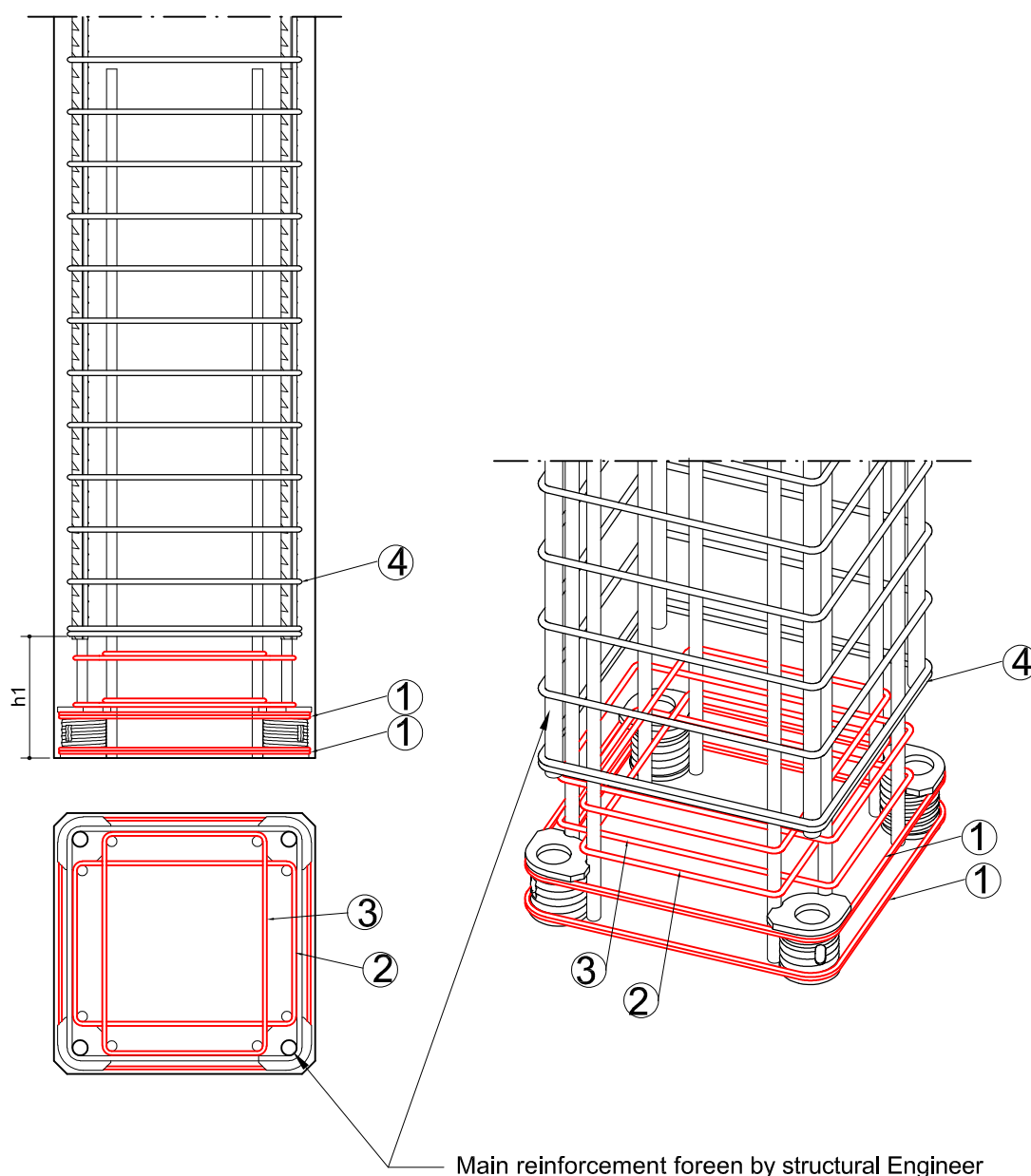
ATTENTION: make the verification both the shear effort acts in a direction parallel to the edge, perpendicular or inclined to it.

T RANSVERSAL REINFORCEMENT IN THE OVERLAP AREA AND INTEGRATIVE REINFORCEMENT

Details of the transversal reinforcement to be inserted in the overlap area and of the integrative reinforcement for shoes for CS columns are shown in the following figures. the number and dimensions of the stirrups required are indicated in the following table.

	CS20	CS24	CS30	CS33	CS36	CS39
Stirrups type①	2 Ø8	2 Ø8	2 Ø8	2 Ø8	4 Ø8	4 Ø8
Stirrups type②	2 Ø6	2 Ø6	2 Ø6	2 Ø6	4 Ø6	4 Ø6
Stirrups type③	2 Ø6	2 Ø6	2 Ø6	2 Ø6	4 Ø6	4 Ø6
Stirrups type④	Ø10	Ø10	Ø10	Ø10	Ø10	Ø10
h1	240	240	240	240	280	280

Measures in mm

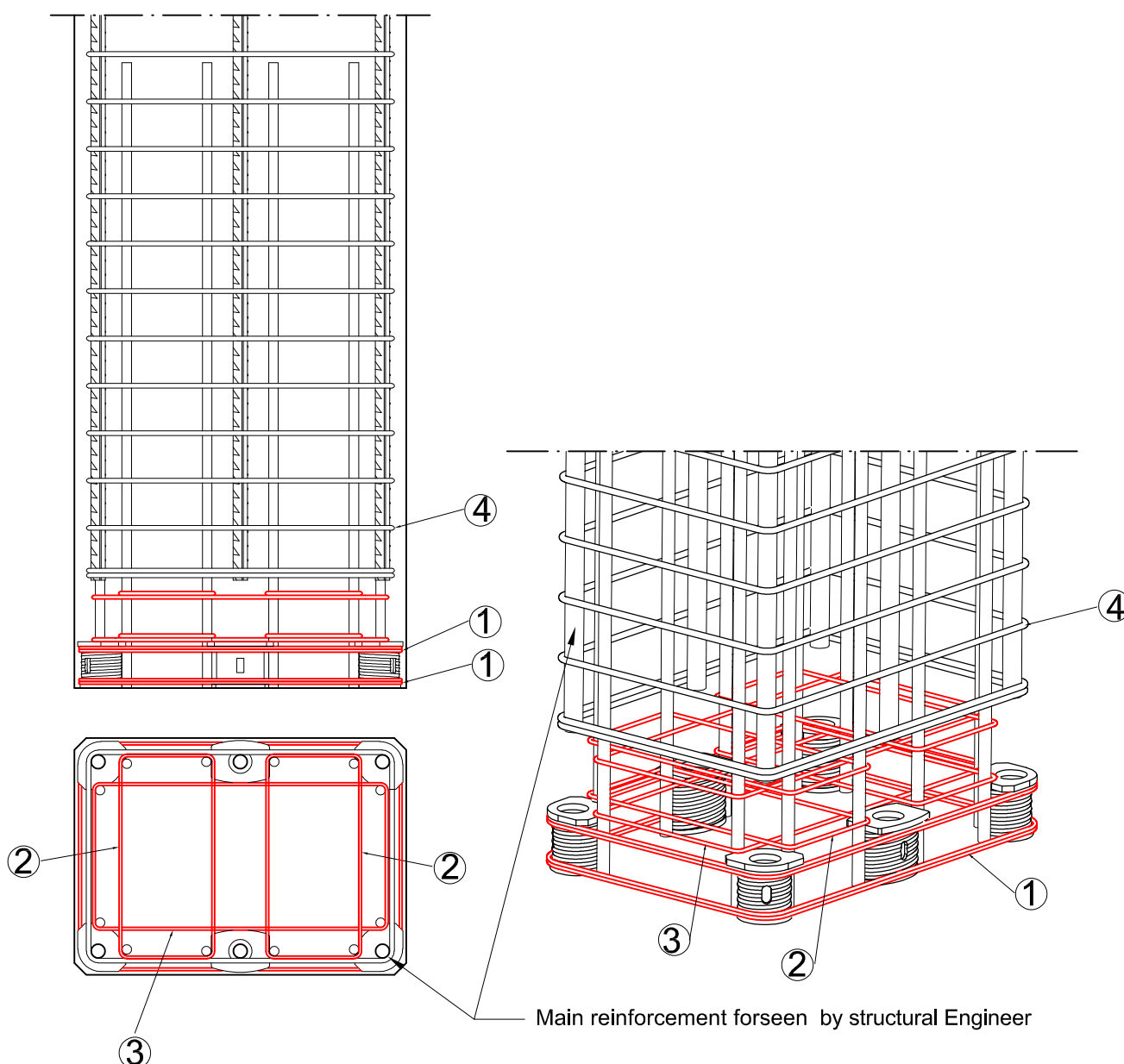


T RANSVERSAL REINFORCEMENT IN THE OVERLAP AREA AND INTEGRATIVE REINFORCEMENT

Details of the transverse reinforcement to be placed in the overlapping area and of the integrative reinforcement for the CS column shoes combined with the CSL shoes are shown in the following figures. The number and dimensions of the required stirrups are indicated in the following table.

	CS20	CS24	CS30	CS33	CS36	CS39
Stirrups type①	2 Ø8	2 Ø8	2 Ø8	2 Ø8	4 Ø8	4 Ø8
Stirrups type②	2 Ø6	2 Ø6	2 Ø6	2 Ø6	4 Ø6	4 Ø6
Stirrups type③	2 Ø6	2 Ø6	2 Ø6	2 Ø6	4 Ø6	4 Ø6
Stirrups type④	Ø10	Ø10	Ø10	Ø10	Ø10	Ø10
h1	240	240	240	240	280	280

Measures in mm

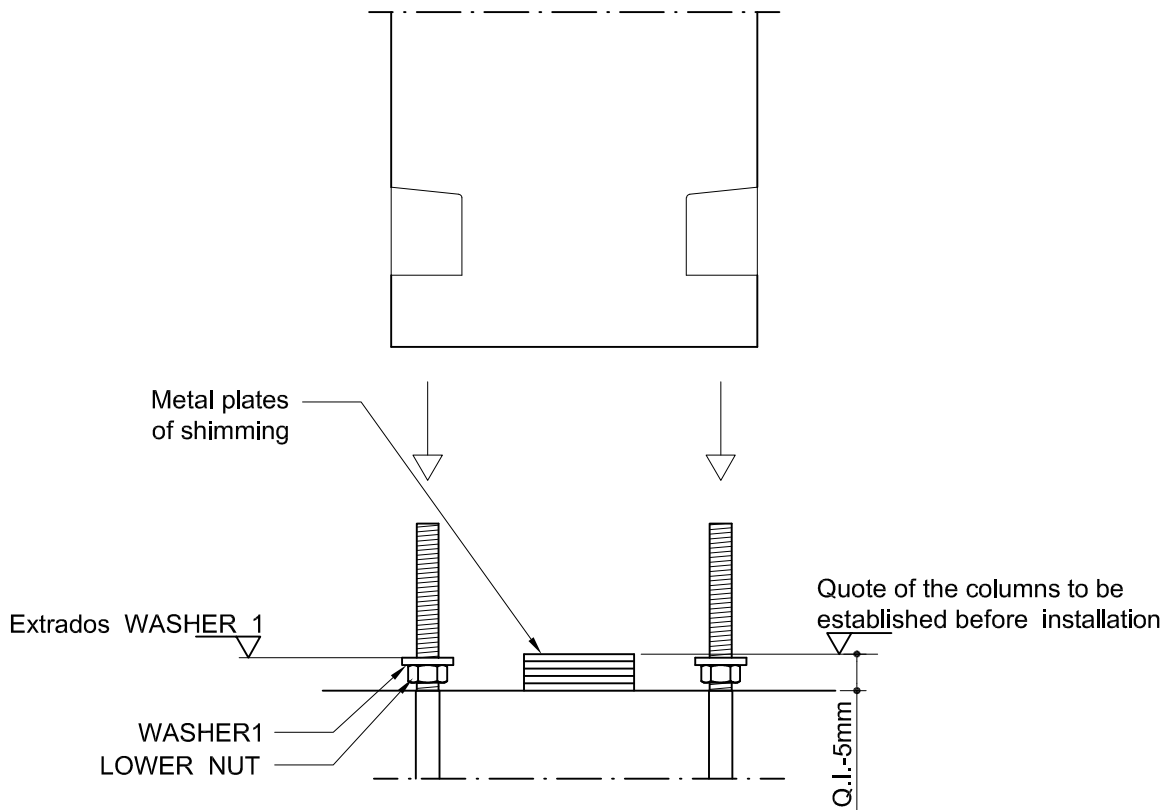


ERECTION OF THE COLUMN

SEQUENCE OF ERECTION OF THE BELT SYSTEM

Connection between column and foundation.

PREPARATION FOR THE INSTALLATION OF THE COLUMN



Before proceeding with the erection of the column, remove any dirt or rubble present on the foundation in the area corresponding to the location of the column and then position the metal shimming plates until reaching the quota of impost of the column.

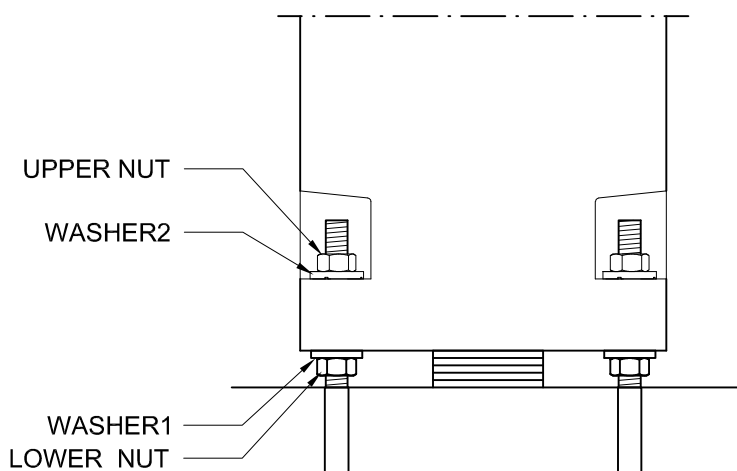
Remove the upper nuts, the vent washers (WASHER 2) and position the lower nuts and the respective washers (WASHER 1) at a height of -5mm from the impost quota determined by the plates of shimming.

ERECTION OF THE COLUMN

SEQUENCE OF ERECTION OF THE BELT SYSTEM

Connection between column and foundation.

PLACING AND VERTICALITY OF THE COLUMN



EXECUTIVES PHASES

1. Drop the column until it rests on the shimming plates;
2. Insert in the following sequence the vent washers (WASHER2), and the upper nuts;
3. Align the columns in the right position, taking advantage of the eccentric tolerances of the **Belt** system;
4. Unscrew the lower nuts until the lower washers (WASHER1) hits the lower edge of the CS shoes;
5. Operate on the lower nuts with a suitable key to adjust the verticality of the column;
6. Screw the upper nuts with a suitable torque wrench according to a tightening torque indicated in the table below.

	CS20	CS24	CS30	CS33	CS36	CS39
Tmin N·m	200	350	500	700	700	700
Tmax N·m	430	740	1400	2000	2500	3300

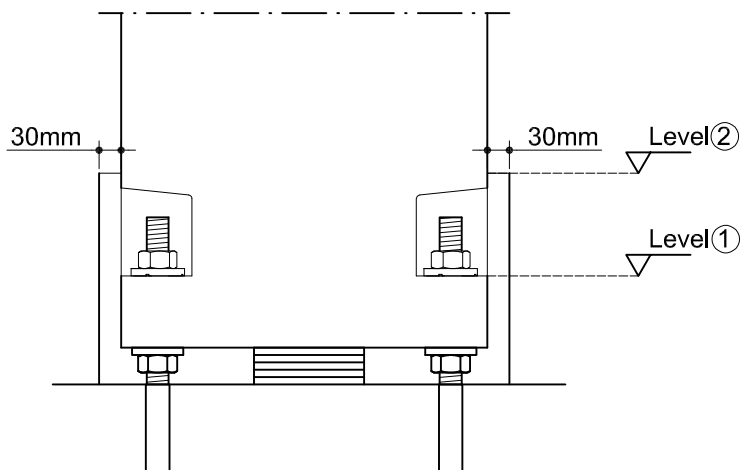
ATTENTION: IN ALL PREVIOUS PHASES THE COLUMN MUST BE LOCKED TO THE CRANE AND REST ON THE SHIMMING PLATES

ERECTION OF THE COLUMN

SEQUENCE OF ERECTION OF THE BELT SYSTEM

Connection between column and foundation.

GROUTING OF THE COLUMN



Substrate preparation

1. Clean and wet the substrate with water;
2. Prepare the formwork;
3. Prepare the grout in the manner indicated on the data sheet **B.S. Italia**;
4. Pour the grout keeping away from the empty created metal shapes to avoid blocking the vents of the vent washer;
5. Fill up to level ① and leave to rest for about 20 seconds, to ensure filling of the tube through the little window of **Belt** system
6. Proceed with filling up to level ②

CAUTION

Before installing the superstructures, the minimum recommended resistance for the grout must be 28 MPa (guaranteed value after about 24 hours at a temperature of 20°).

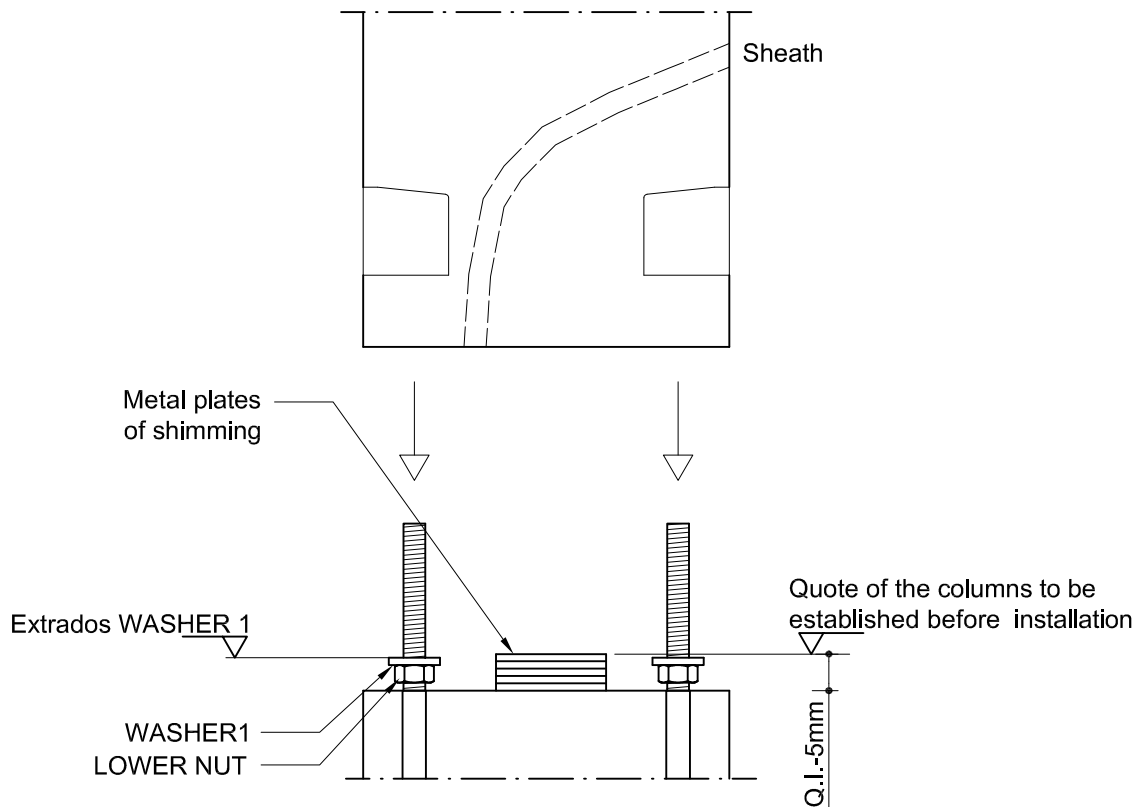
N.B.: It is not necessary to subject the casting to mechanical vibrations.

ERECTION OF THE COLUMN

SEQUENCE OF ERECTION OF THE BELT SYSTEM

Connection between column and column.

PREPARATION FOR THE INSTALLATION OF THE COLUMN



Before proceeding with the erection of the column, remove any dirt or rubble present on the foundation in the area corresponding to the location of the column and then position the metal shimming plates until reaching the quota of impost of the column.

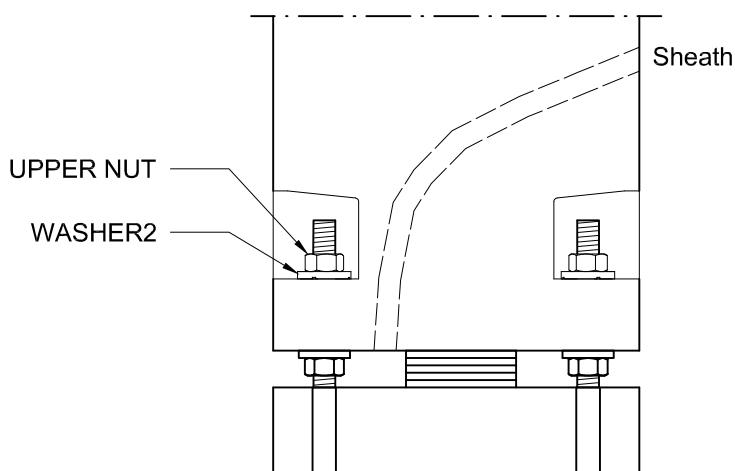
Remove the upper nuts, the vent washers (WASHER 2) and position the lower nuts and the respective washers (WASHER 1) at a height of -5mm from the impost quota determined by the plates of shimming.

ERECTION OF THE COLUMN

SEQUENCE OF ERECTION OF THE BELT SYSTEM

Connection between column and column.

PLACING AND VERTICALITY OF THE COLUMN



EXECUTIVES PHASES

1. Drop the column until it rests on the shimming plates;
2. Insert in the following sequence the vent washers (WASH2), and the upper nuts;
3. Align the columns in the right position, taking advantage of the eccentric tolerances of the **Belt** system;
4. Unscrew the lower nuts until the lower washers (WASH1) hits the lower edge of the CS shoes;
5. Operate on the lower nuts with a suitable key to adjust the verticality of the column;
6. Screw the upper nuts with a suitable torque wrench according to a tightening torque indicated in the table below.

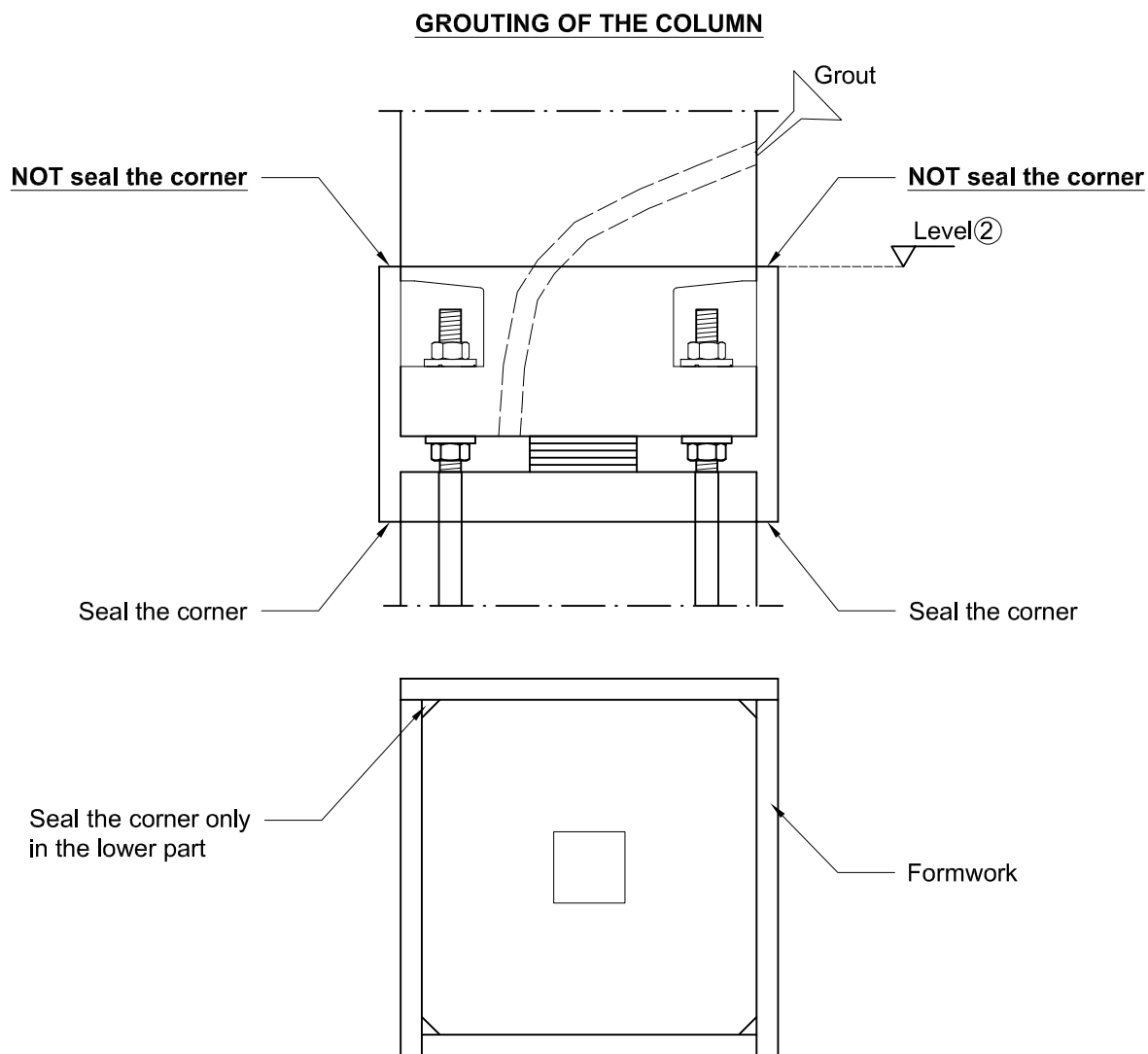
	CS20	CS24	CS30	CS33	CS36	CS39
Tmin N·m	200	350	500	700	700	700
Tmax N·m	430	740	1400	2000	2500	3300

ATTENTION: IN ALL PREVIOUS PHASES THE COLUMN MUST BE LOCKED TO THE CRANE AND REST ON THE SHIMMING PLATES

ERECTION OF THE COLUMN

SEQUENCE OF ERECTION OF THE BELT SYSTEM

Connection between column and column.



Preparation of the substrate

1. Clean and wet with water to saturation of the substrate;
2. Prepare the formwork and seal the corners in the lower part;
3. Prepare the grout as indicated on the data sheet of B.S. Italia Grout;
4. Fill with grout up to level 2 by pouring the grout through the sheath provided in the column;

ATTENTION

Before installing the superstructures, the minimum recommended resistance for the grout must be 28 MPa (guaranteed value after about 24 hours at a temperature of 20°).

N.B.: It is not necessary to subject the casting to mechanical vibrations.

For any doubt regarding the correct use of the components described in this manual, contact:

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tel +39 035 671746 fax +39 035 672265

www.bstaliagroup.com tecnico@bs-italia.191.it

WELDINGS OR MODIFICATIONS

Welding or modifications of the components of the **BELT** system are not allowed, which may cause a decrease of the capacity, a variation in the technical characteristics of the materials or induce dangerous working conditions.

B.S.Italia assumes no responsibility for damage of any kind in the event of changes to its products or individual components.

REPLACEMENT OR INTERCHANGE OF COMPONENTS

The products that B.S.Italia produces and supplies are designed as an inseparable system for the connection of precast/prestressed concrete elements. Replacement parts produced by others are therefore not authorized.

PROJECT CHANGES

B.S.Italia reserves the right to design changes relating to components and/or accessories and/or flow rates at any time, without notice.

THE CALCULATION

For the design of the inserts and the armature of the protection it is necessary to strictly follow the indications of this manual. However, it is the responsibility of the designer of the concrete products to choose the suitable component of the **BELT** system, related to the application in question and the actions involved.

For each project, according to legal obligations, to which total respect we refer, a safety manager must be appointed and a detailed mounting plan drawn up and followed. This manual must always be available at the place of use of the system and delivered to the relative managers: in production, storage and construction site.

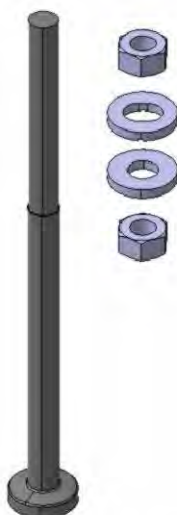
CORNER SYSTEM BELT CS20
Cod. 9120-01.E



LATERAL SYSTEM BELT CSL20
Cod. 9120-05.E



ANCHOR BOLD WITH PROTRUSION
L=468
Cod. 9120-02.E



ANCHOR BOLD WITH BAR
STRAIGHT L=1285
Cod. 9120-06.E



UPPER WASHER SLOTTED
Cod. 9120-03.E



MEDIUM NUT M20
Cod. 6000-20N



LOWER WASHER
Cod. 9120-04.E



CODES SYSTEM BELT 24

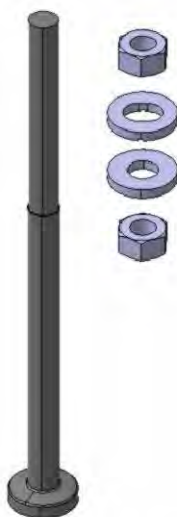
CORNER SYSTEM BELT CS24
Cod. 9124-01.E



LATERAL SYSTEM BELT CSL24
Cod. 9124-05.E



ANCHOR BOLD WITH PROTRUSION
L=533
Cod. 9124-02.E



ANCHOR BOLD WITH BAR
STRAIGHT L=1460
Cod. 9124-06.E



UPPER WASHER SLOTTED
Cod. 9124-03.E



MEDIUM NUT M24
Cod. 6000-24N



LOWER WASHER
Cod. 9124-04.E



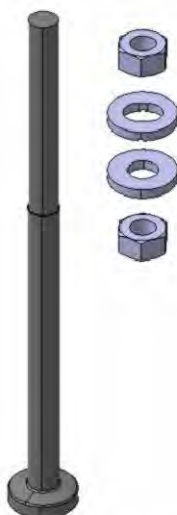
CORNER SYSTEM BELT CS30
Cod. 9130-01.E



LATERAL SYSTEM BELT CSL30
Cod. 9130-05.E



ANCHOR BOLD WITH PROTRUSION
L=583
Cod. 9130-02.E



ANCHOR BOLD WITH BAR
STRAIGHT L=1740
Cod. 9130-06.E



UPPER WASHER SLOTTED
Cod. 9130-03.E



MEDIUM NUT M30
Cod. 6000-30N



LOWER WASHER
Cod. 9130-04.E



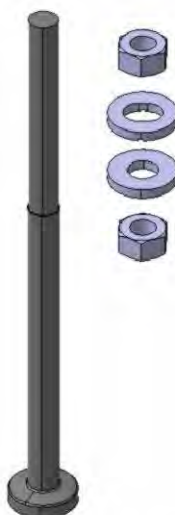
CORNER SYSTEM BELT CS33
Cod. 9133-01.E



LATERAL SYSTEM BELT CSL33
Cod. 9133-05.E



ANCHOR BOLD WITH PROTRUSION
L=633
Cod. 9133-02.E



ANCHOR BOLD WITH BAR
STRAIGHT L=1880
Cod. 9133-06.E



UPPER WASHER SLOTTED
Cod. 9133-03.E



MEDIUM NUT M33
Cod. 6000-33N



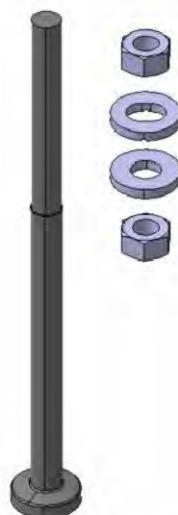
LOWER WASHER
Cod. 9133-04.E



CORNER SYSTEM BELT CS36
Cod. 9136-01.E



ANCHOR BOLD WITH PROTRUSION
L=755
Cod. 9136-02.E



ANCHOR BOLD WITH BAR
STRAIGHT L=2030
Cod. 9136-06.E



UPPER WASHER SLOTTED
Cod. 9136-03.E



MEDIUM NUT M36
Cod. 6000-36N

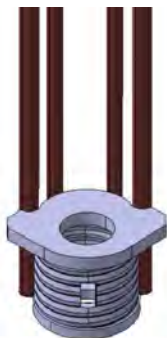


LOWER WASHER
Cod. 9136-04.E



CORNER SYSTEM BELT CS39

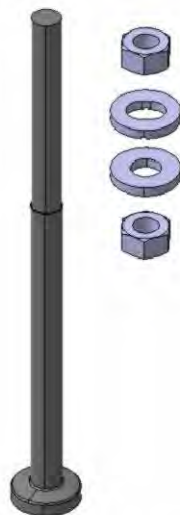
Cod. 9139-01.E



ANCHOR BOLD WITH PROTRUSION

L=800

Cod. 9139-02.E



ANCHOR BOLD WITH BAR

STRAIGHT L=2050

Cod. 9139-06.E



UPPER WASHER SLOTTED

Cod. 9139-03.E



MEDIUM NUT M39

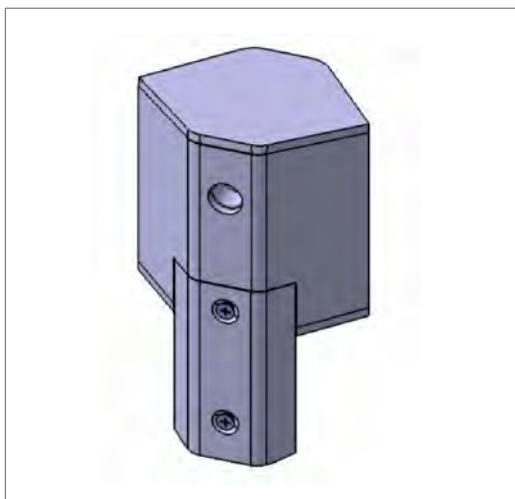
Cod. 6000-39N



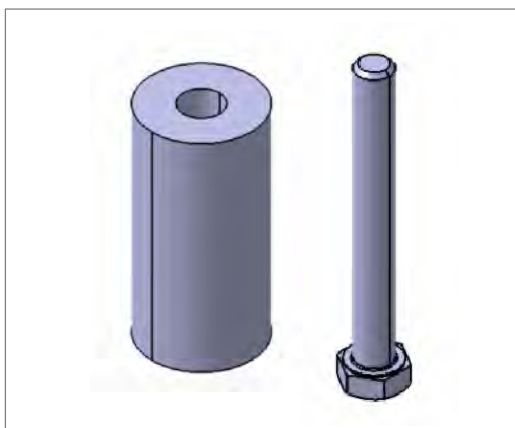
LOWER WASHER

Cod. 9139-04.E





DESCRIPTION	CODE
FORM FOR BELT SYSTEM	
FORM FOR CORNER BELT CS20-24	9124-10.N
FORM FOR CORNER BELT CS30-33	9133-10.N
FORM FOR CORNER BELT CS36-39	9139-10.N
FORM FOR LATERAL BELT CSL20-33	9133-12.N



FIXING CILINDER IN THE FORMWORK	
FIXING CILINDER FOR FORMWORK WITH SCREW CS20-24/CSL20-24	9120-08.E
FIXING CILINDER FOR FORMWORK WITH SCREW CS30-33/CSL30-33	9130-08.E
FIXING CILINDER FOR FORMWORK WITH SCREW CS36-39	9136-08.E