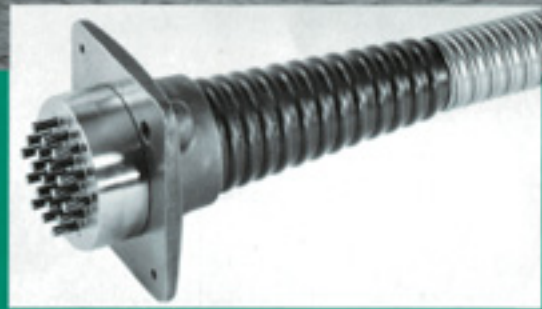
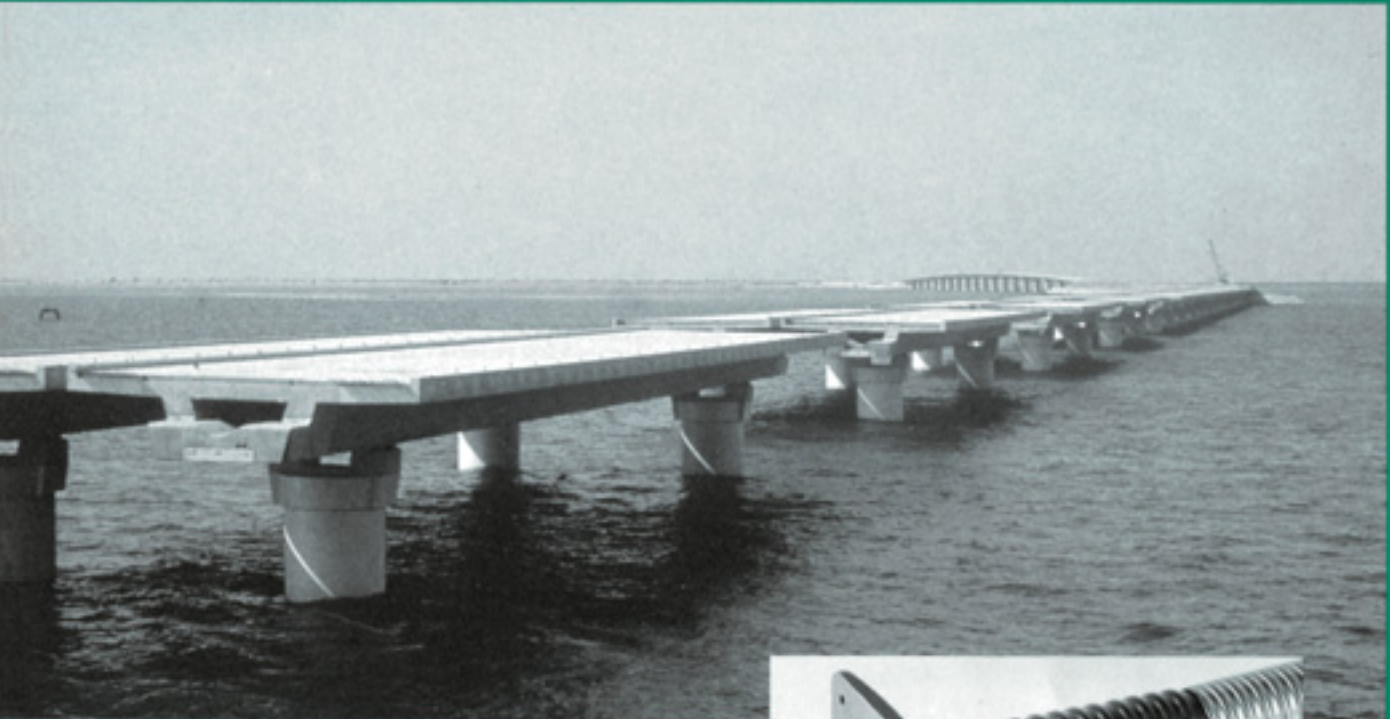


Prestressing System for Multi-Strands



BBR **CONA Compact**

CONA Compact® System

CONA Compact is a further development of the CONA Multi System, which has been applied since 1975. The tendons consist of a bundle of strands with a nominal diameter of 0.5" (13 mm) or 0.6" (15 mm): The tendons are installed in the structure by pushing individual strands or by pulling a precut bundle into conduits.

The strands of the CONA Compact tendons are stressed simultaneously and anchored individually in an anchor head by means of wedges. The

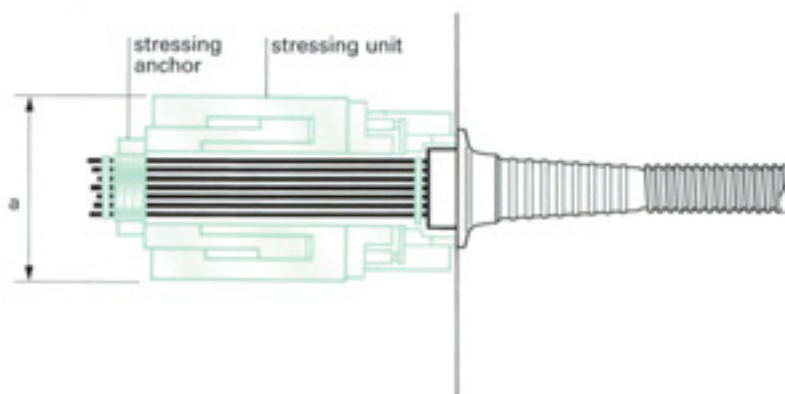
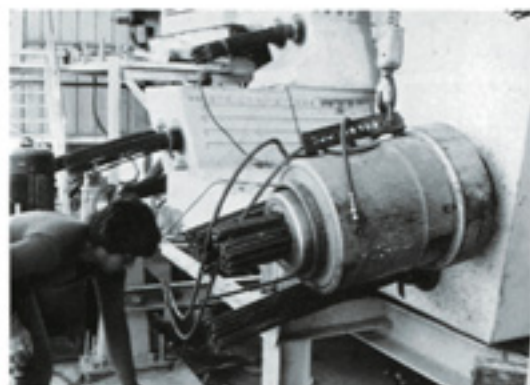
strand bundle projecting from the anchor head passes through the centre hole of a stressing unit and is fixed to the unit by a stressing head and special reusable wedges. This head can be observed during the stressing operation for correct gripping and the maintenance of the unit is easy and fast.

After the completion of the stressing operation, the tendon is anchored. The wedges in the anchor head are hydraulically seated by the stressing

unit for positive and equal gripping of all wedges.

For all anchor types, a special and adequate splitting reinforcement must be provided. Full prestressing is possible at a minimum concrete cube strength of 30 N/mm².

Because of differences in codes and available components, it is recommended to contact the local BBR representative for detailed information.



CONA Compact stressing units

| | | | | | | | |
|-----------------------------|----|--------|--------|--------|--------|--------|---------|
| Number of strands dia. 0.5" | | 7 | 12 | 19 | 31 | 42 | 61 |
| Number of strands dia. 0.6" | | 4 | 7 | 12 | 19 | 31 | 42 |
| Type of stressing unit | | CM 110 | CM 200 | CM 300 | CM 500 | CM 750 | CM 1000 |
| Max. jack force | kN | 1100 | 2000 | 3000 | 5000 | 7500 | 10000 |
| Jack type | | LP 110 | LP 200 | LP 300 | LP 500 | LP 750 | LP 1000 |
| Stressing unit weight | kg | 160 | 260 | 410 | 710 | 1240 | 1920 |
| Jack stroke | mm | 200 | 200 | 200 | 200 | 200 | 200 |
| Jack diameter a | mm | 270 | 330 | 400 | 500 | 635 | 730 |

Standard Tendons CONA Compact

| | | | | | | | |
|--------------------------------------|------|-------|-------|-------|-------|-------|--------|
| Number of strands dia. 0.5" | | 7 | 12 | 19 | 31 | 42 | 61 |
| Tendon type | | 705 | 1205 | 1905 | 3105 | 4205 | 6105 |
| Ultimate tensile force ¹⁾ | kN | *1302 | *2232 | *3534 | *5766 | *7812 | *11346 |
| Stressing force at 0.8 u.t.s. | kN | *1042 | *1786 | *2827 | *4613 | *6250 | *9077 |
| Weight of strand bundle | kg/m | 5.50 | 9.42 | 14.92 | 24.34 | 32.97 | 47.89 |
| Conduit I.D. pull through | mm | 55 | 70 | 85 | 105 | 120 | 145 |
| Conduit I.D. assembled | mm | 50 | 65 | 75 | 95 | 110 | 135 |

* The effective forces depend on the national code requirements to be applied and the specifications of the strand to be used.

| | | | | | | | | |
|--------------------------------------|------|-------|-------|-------|-------|-------|-------|--------|
| Number of strands dia. 0.6" | | 4 | 7 | 12 | 19 | 22 | 31 | 42 |
| Tendon type | | 406 | 706 | 1206 | 1906 | 2206 | 3106 | 4206 |
| Ultimate tensile force ¹⁾ | kN | *1116 | *1953 | *3348 | *5301 | *6138 | *8649 | *11718 |
| Stressing force at 0.8 u.t.s. | kN | *893 | *1562 | *2678 | *4241 | *4910 | *6919 | *9374 |
| Weight of strand bundle | kg/m | 4.71 | 8.24 | 14.13 | 22.37 | 25.91 | 36.50 | 49.46 |
| Conduit I.D. pull through | mm | 50 | 65 | 80 | 100 | 110 | 130 | 150 |
| Conduit I.D. assembled | mm | 45 | 60 | 75 | 90 | 100 | 120 | 140 |

1) Based on Euronorm prEN 10138-1 1991, prestressing steels:

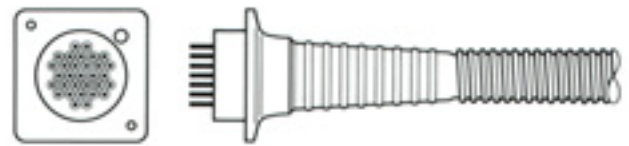
dia. 0.5": guaranteed u.t.s. 1860 N/mm², strand area 100 mm²,
dia. 0.6": guaranteed u.t.s. 1860 N/mm², strand area 150 mm².

Stressing Anchorage CONA Compact, Type M

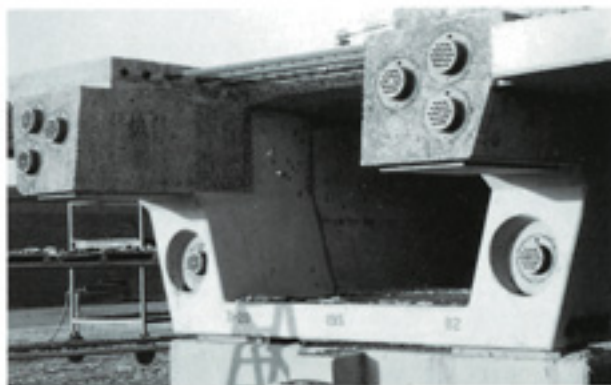
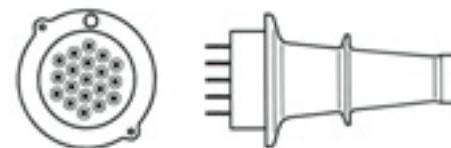
Dimensions of Bearing Plates, Trumpets and Reinforcing Steel Spirals



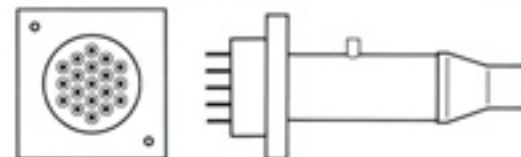
Bearing plate casting with PE trumpet type M1



Entire bearing plate casting type M2



Fabricated bearing plate type M3



The choice between the three types of bearing plates depends on structural requirements and availability of materials. The short casting with PE trumpet is very light and therefore easy to install. The fabricated assembly is

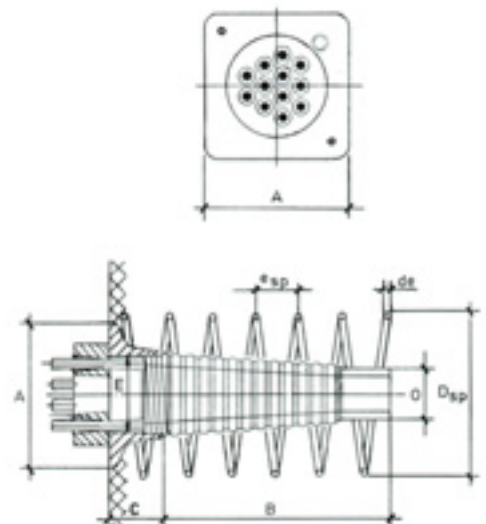
simple to manufacture and suitable where castings are not readily available.

In the table, the standard sizes of the stressing anchorage are listed. If intermediate capacity tendons are re-

quired, strands are omitted. The tendon can be restressed or entirely detensioned as long as the strand bundle projecting from the stressing anchorage has not been cut off.

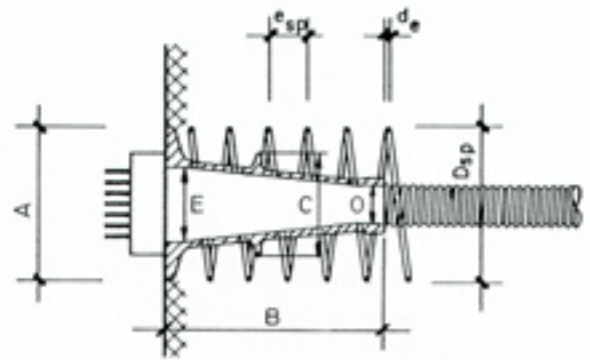
Anchor type M1

| | Number of strands | | | | | | | | |
|-----------|-------------------|-------|-----|-------|-----|-----|-----|-----|-----|
| Dia. 0.5" | 12 | 19 | - | 31 | - | - | - | - | 42 |
| Dia. 0.6" | 7 | 12 | 15 | 19 | 22 | 24 | 25 | 27 | 31 |
| AxA | 215 | 265 | 305 | 335 | 350 | 360 | 360 | 380 | 395 |
| B | 345 | 415 | 485 | 485 | 550 | 685 | 550 | 550 | 605 |
| C | 85 | 100 | 116 | 116 | 125 | 125 | 125 | 135 | 145 |
| Dia. E | 110 | 139 | 179 | 179 | 193 | 210 | 210 | 210 | 223 |
| Dia. O | 77 | 92 | 112 | 112 | 117 | 117 | 127 | 127 | 137 |
| de | 16 | 18/16 | 18 | 22/20 | 20 | 20 | 20 | 20 | 24 |
| esp | 50 | 50 | 50 | 50 | 60 | 60 | 60 | 60 | 60 |



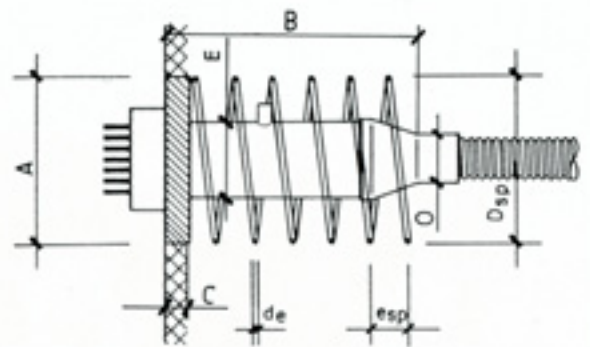
Anchor type M2

| | Number of strands | | | | | |
|-----------|-------------------|-----|-----|-----|-----|-----|
| | 7 | 12 | 19 | 31 | - | 42 |
| Dia. 0.5" | 7 | 12 | 19 | 31 | - | 42 |
| Dia. 0.6" | 4 | 7 | 12 | 19 | 22 | 31 |
| Dia. A | 175 | 230 | 285 | 345 | 370 | 440 |
| B | 250 | 400 | 475 | 502 | 625 | 700 |
| Dia. C | 135 | 170 | 220 | 260 | 280 | 330 |
| Dia. E | 78 | 110 | 139 | 179 | 193 | 223 |
| Dia. O | 55 | 70 | 85 | 105 | 110 | 130 |
| de | 12 | 14 | 16 | 20 | 20 | 20 |
| esp | 45 | 45 | 50 | 60 | 60 | 60 |



Anchor type M3

| | Number of strands | | | | | |
|-----------|-------------------|-----|-----|-----|-----|-----|
| | 7 | 12 | 19 | 31 | - | 42 |
| Dia. 0.5" | 7 | 12 | 19 | 31 | - | 42 |
| Dia. 0.6" | 4 | 7 | 12 | 19 | 22 | 31 |
| AxA | 175 | 220 | 270 | 345 | 375 | 440 |
| B | 220 | 435 | 545 | 785 | 820 | 910 |
| C | 20 | 30 | 40 | 55 | 60 | 70 |
| Dia. E | 76 | 109 | 138 | 178 | 193 | 222 |
| Dia. O | 55 | 66 | 84 | 100 | 110 | 130 |
| de | 12 | 14 | 16 | 20 | 22 | 24 |
| esp | 45 | 45 | 50 | 60 | 60 | 60 |

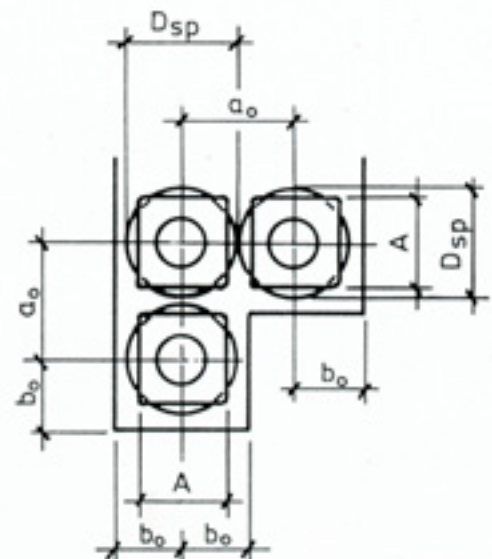


The Minimum Distances of the Bearing Plates to Concrete Edges and to Adjacent Plates

The minimum required distance of the bearing plates to concrete edges and to adjacent bearing plates depends in general on:

- the post-tensioning force to be transmitted
- the concrete strength
- the bearing plate dimensions
- the reinforcing steel behind the bearing plate
- structural requirements

a_o = min. distance between axis of two anchorages
 b_o = min. distance from concrete edge to anchorage axis
 D_{sp} = outside diameter of reinforcing steel spirals
 f_c = nominal concrete cylinder strength



Prestressing force can be applied at 80% of nominal concrete cylinder strength.

| fc min. (N/mm ²) | | Number of strands dia. 0.5" | | | | | Number of strands dia. 0.6" | | | | | | | | |
|---------------------------------|-----|-----------------------------|-----|-----|-----|-----|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| | | 7 | 12 | 19 | 31 | 42 | 4 | 7 | 12 | 15 | 19 | 22 | 27 | 31 | 42 |
| 23 | ao | 265 | 350 | 440 | 560 | 650 | 245 | 325 | 425 | 475 | 535 | 580 | 640 | 685 | 800 |
| | bo | 140 | 175 | 220 | 280 | 325 | 130 | 165 | 215 | 240 | 270 | 290 | 320 | 345 | 400 |
| | Dsp | 220 | 285 | 370 | 490 | 560 | 200 | 260 | 350 | 370 | 460 | 495 | 530 | 600 | 660 |
| 28 | ao | 240 | 315 | 395 | 505 | 590 | 225 | 295 | 385 | 430 | 485 | 525 | 580 | 620 | 725 |
| | bo | 135 | 165 | 200 | 255 | 295 | 120 | 150 | 195 | 215 | 245 | 265 | 290 | 310 | 365 |
| | Dsp | 210 | 270 | 340 | 440 | 510 | 180 | 240 | 320 | 340 | 420 | 450 | 495 | 540 | 620 |
| 33 | ao | 220 | 290 | 365 | 465 | 545 | 205 | 270 | 355 | 400 | 450 | 480 | 535 | 570 | 665 |
| | bo | 130 | 155 | 190 | 235 | 275 | 120 | 145 | 180 | 200 | 225 | 240 | 270 | 285 | 335 |
| | Dsp | 200 | 250 | 320 | 410 | 480 | 180 | 230 | 300 | 320 | 390 | 425 | 470 | 520 | 590 |
| 38 | ao | 205 | 270 | 340 | 435 | 505 | 200 | 255 | 330 | 370 | 420 | 450 | 500 | 535 | 620 |
| | bo | 125 | 150 | 185 | 225 | 260 | 120 | 145 | 175 | 185 | 215 | 230 | 255 | 275 | 310 |
| | Dsp | 190 | 240 | 310 | 390 | 460 | 180 | 230 | 290 | 310 | 370 | 400 | 445 | 490 | 560 |
| 43 | ao | 195 | 255 | 320 | 410 | 475 | 200 | 250 | 310 | 350 | 395 | 420 | 470 | 500 | 585 |
| | bo | 120 | 145 | 180 | 220 | 250 | 120 | 145 | 175 | 180 | 210 | 225 | 245 | 265 | 300 |
| | Dsp | 180 | 230 | 300 | 380 | 440 | 180 | 230 | 290 | 300 | 360 | 390 | 430 | 470 | 540 |

Dimensions in millimetres

Fixed Anchorages CONA Compact, Type F and FC

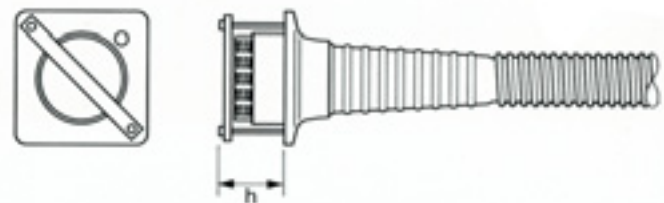
The fixed anchorage type F is accessible during stressing operations and is identical to the above stressing anchorage type M.

The fixed anchorage type FC is

cast in the concrete before stressing and the strands are anchored by means of wedges which are secured by springs. A cap fastened to the bearing plate precludes intrusion of

cement slurry into the anchorage. Dimensions are identical to the stressing anchorage type M.

Type FC



| Number of strands | Strand dia. 0.5" | | | | | | Strand dia. 0.6" | | | | | | | | | | |
|-------------------|------------------|----|-----|-----|-----|-----|------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 7 | 12 | 19 | 31 | 42 | 61 | 4 | 7 | 12 | 15 | 19 | 22 | 24 | 25 | 27 | 31 | 42 |
| Cap length h | 90 | 95 | 105 | 120 | 137 | 155 | 90 | 95 | 105 | 120 | 120 | 120 | 137 | 137 | 137 | 137 | 155 |

Dimensions in millimetres

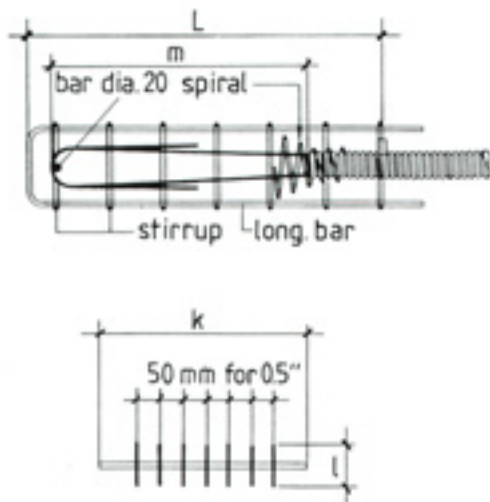
Fixed Loop Anchorages CONA Compact, Type E

Each strand of the loop anchorage is provided with an individual short loop. As bending of the loops only requires a light and compact tool, this anchorage can easily be assembled on the construction site at the end of a strand bundle which is already installed in the conduit.

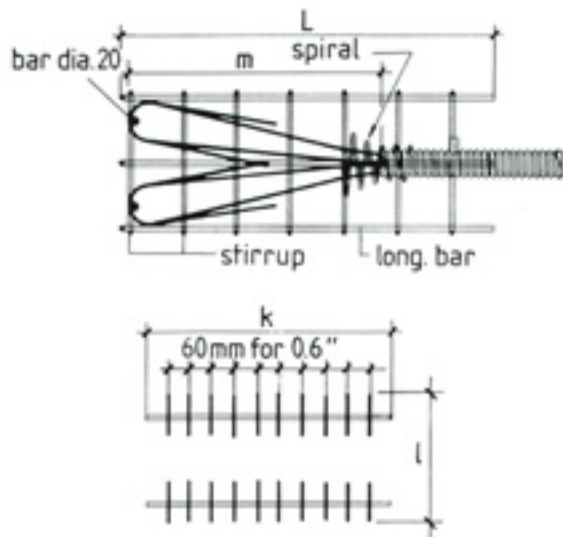


Additional reinforcing steel for the fixed loop anchorages:

Anchorage with up to 7 strands



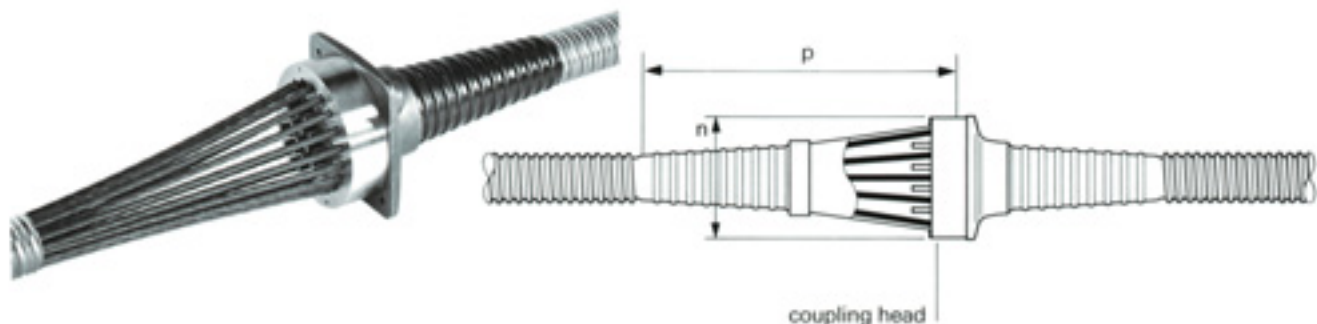
Anchorage with 8 to 19 strands



| | | Strand dia. 0.5" | | | Strand dia. 0.6" | | |
|-------------------|----|------------------|-----|------|------------------|------|------|
| Number of strands | | 7 | 12 | 19 | 4 | 7 | 12 |
| k | mm | 400 | 350 | 550 | 300 | 480 | 400 |
| l | mm | 125 | 330 | 330 | 155 | 155 | 400 |
| m | mm | 700 | 700 | 900 | 900 | 900 | 900 |
| Stirrup dia. | mm | 12 | 14 | 16 | 10 | 12 | 16 |
| Numbers | | 8 | 8 | 10 | 10 | 10 | 10 |
| Length L | mm | 800 | 800 | 1000 | 1000 | 1000 | 1000 |
| Long. bar dia. | mm | 10 | 10 | 12 | 10 | 10 | 12 |
| Spiral dia. | mm | 10 | 12 | 14 | 10 | 12 | 14 |
| Pitch | mm | 50 | 50 | 50 | 50 | 50 | 50 |
| Turns | | 6 | 6 | 6 | 6 | 6 | 6 |

Loop anchorages of larger capacities, exceeding 19 dia. 0.5" or 12 dia. 0.6" strands are available for particular applications upon consultation with Bureau BBR Ltd.

Coupling CONA Compact, Type K



| | | Strand dia. 0.5" | | | | Strand dia. 0.6" | | | | | | | |
|-------------------|--------|------------------|------|------|------|------------------|-----|------|------|------|------|------|------|
| Number of strands | | 7 | 12 | 19 | 31 | 4 | 7 | 12 | 15 | 19 | 22 | 24 | 31 |
| Fixed coupling | type K | 705 | 1205 | 1905 | 3105 | 406 | 706 | 1206 | 1506 | 1906 | 2206 | 2406 | 3106 |
| Diameter | n | 168 | 208 | 258 | 328 | 168 | 208 | 258 | 290 | 328 | 328 | 335 | 405 |
| Trumpet length | p | 530 | 575 | 610 | 780 | 550 | 575 | 610 | 880 | 780 | 895 | 1010 | 1075 |

Dimensions in millimetres

With the fixed coupling, a further tendon can be connected at a construction joint to an already stressed tendon

which is anchored in a coupling head. The strands to be coupled are pushed into the coupling head pre-

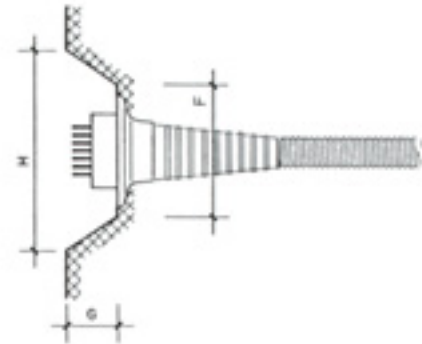
assembled in the factory with wedges and springs.

Anchorage Recesses

Recesses of stressable or accessible fixed anchorages M and F shall have the following minimum dimensions:

| | Number of strands | | | | | | |
|---------------|-------------------|-----|-----|-----|-----|-----|-----|
| | 7 | 12 | 19 | 31 | - | 42 | 61 |
| Dia. 0.5" | 7 | 12 | 19 | 31 | - | 42 | 61 |
| Dia. 0.6" | 4 | 7 | 12 | 19 | 22 | 31 | 42 |
| Recess size F | 230 | 270 | 340 | 420 | 420 | 460 | 560 |
| Depth G | 140 | 140 | 150 | 165 | 165 | 185 | 200 |
| Recess size H | 310 | 370 | 400 | 510 | 510 | 560 | 660 |

Dimensions in millimetres



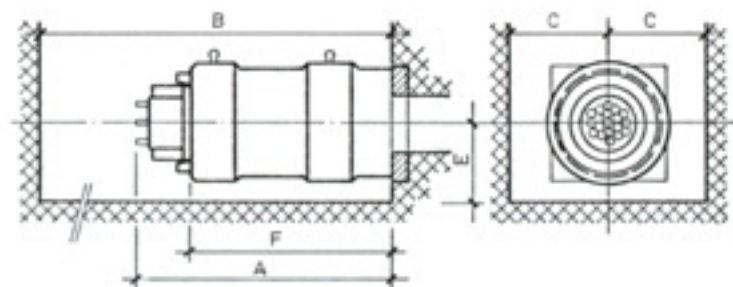
Recesses (dimensions F and H) may be square or round. The dimensions G result in a concrete cover above the strands of 50 mm. For special appli-

cations or the use of e.g. rectangular bearing plates, the above dimensions must be adapted individually. The above recess dimensions are only

valid for the new CONA COMPACT and not for CONA MULTI wedge seating devices.

Space Requirements for Stressing Units

The dimensions of the space requirements given below are based on the use of the CONA stressing jacks type LP with a stroke of 200 mm.



| | | Number of strands | | | | | | |
|-----------------|----|-------------------|--------|--------|--------|--------|--------|---------|
| | | 7 | 12 | 19 | 31 | - | 42 | 61 |
| Dia. 0.5" | | 7 | 12 | 19 | 31 | - | 42 | 61 |
| Dia. 0.6" | | 4 | 7 | 12 | 19 | 22 | 31 | 42 |
| Stressing unit | | CC 110 | CC 200 | CC 300 | CC 500 | CC 500 | CC 750 | CC 1000 |
| Strand length A | mm | 710 | 750 | 810 | 890 | 890 | 1060 | 1130 |
| Unit length F | mm | 595 | 620 | 675 | 740 | 740 | 900 | 950 |
| Distance B | mm | 1400 | 1500 | 1600 | 1750 | 1750 | 2150 | 2300 |
| Distance C | mm | 250 | 300 | 330 | 400 | 400 | 470 | 550 |
| Distance E | mm | 200 | 230 | 260 | 330 | 330 | 370 | 420 |

Tendon Curvature

A straight portion L adjacent to the anchorage must be observed to limit the screw pull of the strand bundle against the anchorage.



Number of strands

| | | | | | | | |
|-------------------------|---|-----|-----|-----|-----|------|-----|
| Dia. 0.5" | 7 | 12 | 19 | 31 | - | 42 | 61 |
| Dia. 0.6" | 4 | 7 | 12 | 19 | 22 | 31 | 42 |
| Radius R min. | m | 4 | 4.5 | 5 | 6 | 6.5 | 8 |
| Straight portion L min. | m | 0.8 | 0.9 | 1.0 | 1.1 | 1.15 | 1.3 |

Friction Losses

Experience and tests have shown that the friction coefficients μ and k - using the formula $V_x = V_0 \cdot e^{-(\mu x + kx)}$ - considerably scatter.

In the case of good workmanship, following friction coefficients μ and k can realistically be taken into account in

the design for use with plain corrugated sheet metal ducts:

| | μ | k |
|--|-------------|-----------------|
| - Clean new strands in clean new ducts | 0.18 - 0.22 | 0.0009 - 0.0011 |
| - Clean new strands in corroded ducts | 0.24 - 0.30 | 0.0012 - 0.0015 |
| - Corroded strands in corroded ducts | 0.30 - 0.40 | 0.0015 - 0.0020 |

- It is recommended for the design to check the influence of the friction by using min. and max. friction coefficients.
- The spacing of the tendon supports shall not exceed 1.3 m.
- To reduce excessive friction, it is possible to flush the tendon with water or water soluble oil.



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