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Contents in this brochure are subject to review and amendment without further notice.

May, 2011 Edition 6

美高美设计 0772-2818124

LIUGONG 柳工

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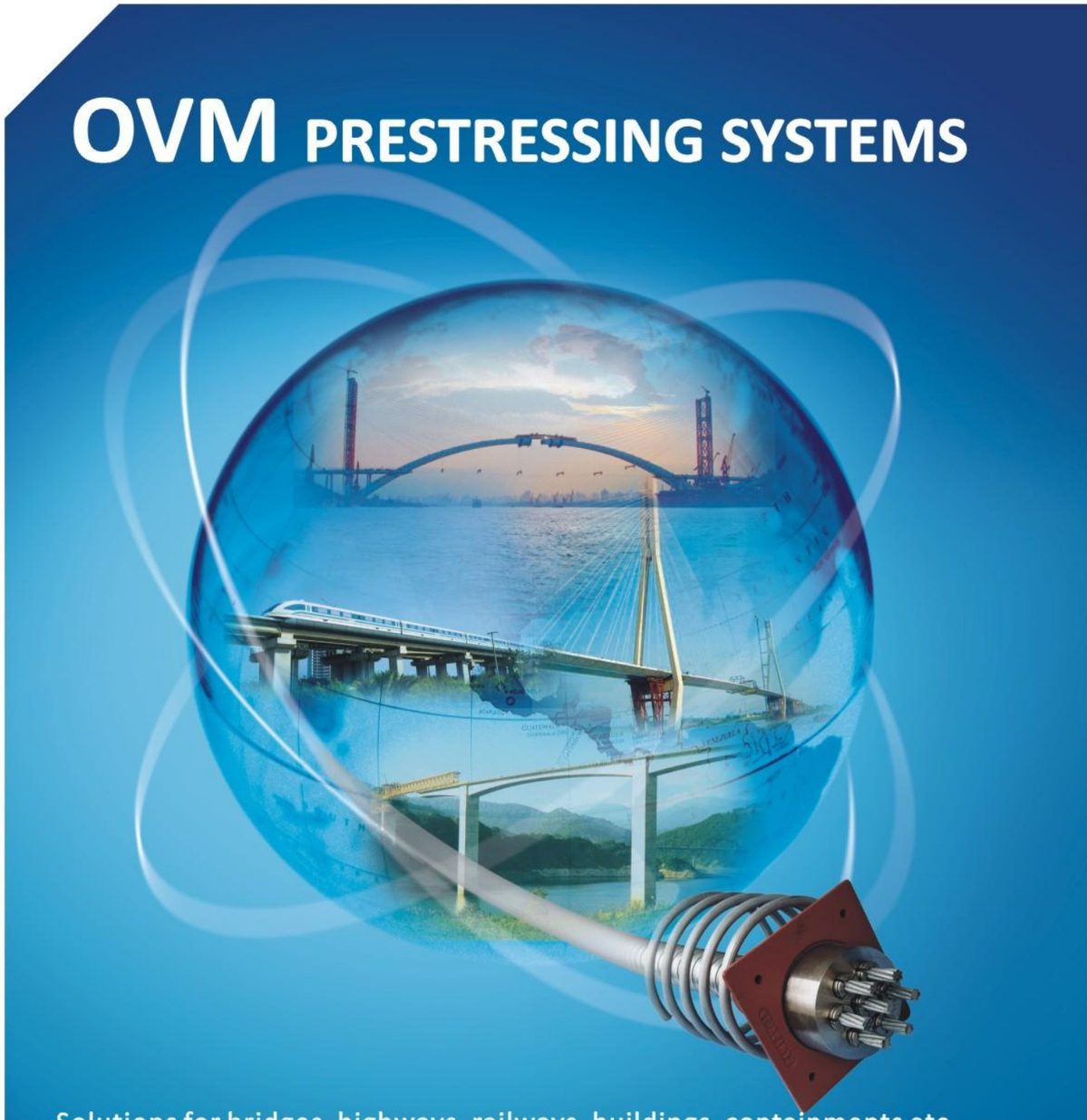
# OVM PRESTRESSING SYSTEMS



Solutions for bridges, highways, railways, buildings, containments etc.

GUANGXI LIUGONG GROUP CO., LTD.
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OVM®

■ **OVM PRESTRESSING SYSTEMS**

- ☐ OVM MONITORING SYSTEMS
- ☐ OVM CABLE SYSTEMS
  (for Cable-stayed Bridge, Arch Bridge & Suspension Bridge)
- ☐ OVM GROUND ANCHOR SYSTEMS
- ☐ OVM BEARINGS & EXPANSION JOINTS
- ☐ OVM ENGINEERING SOLUTIONS
  (Heavy Lifting / Turning / Incremental Launching )
- ☐ OVM COMPANY BROCHURE

# OVM BRIEF

OVM PRESTRESSING SYSTEMS



+ With plenty of experience in prestressing field
+ Abundant in technical research & development
+ With ISO9001-2008 quality management system
+Products complying with AASHTO, ASTM, BS, ETA, FIP, GB, JIS
+ETA certificate ETA-10/0307


**OVM tops the Chinese prestressing industry**

Thanks to 40 years of experience, OVM is now a leading product supplier and specialist contractor in China in the field of prestressing and other special construction techniques. With a strong reputation for reliability, professionalism and innovation, OVM systems have successfully worked on numerous projects, including bridges, highways, high-speed railways, buildings, dams, nuclear power plants, and in doing so have achieved worldwide acknowledgement.

**Sufficient R&D**

As a basic company strategy, more than 5% annual turnover would be invested in the R&D. OVM has a national technology center and a postdoctoral research workstation in cooperation with renowned universities and institutions etc. OVM owns 390 technical patents by 2010, which guarantee the multiple efficient solutions to the clients.

**Full range of products**

OVM focuses on developing outstanding prestressing technology and building up renowned brand in civil engineering field. As the biggest supplier in China, OVM provides full range of prestressing system including 5 categories, 30 series and more than 420 types of products:

I. OVM Post-tensioning Systems
II. OVM Cable Systems (for cable-stayed bridge, arch bridge and suspension bridge)
III. OVM Construction Solutions (Incremental Launching, turning and heavy lifting)
IV. OVM Bearings & Expansion Joints
V. OVM Monitoring Systems

**Certified management and products**

The lasting and reliable OVM products are guaranteed by outstanding management.
OVM is certified with ISO9001-2008 Quality Management System by BSI and CQC. Each process of production from raw material purchasing to delivery is strictly under the control of management system. OVM products meet the requirements of major standards: AASHITO,ASTM, BS, EN, ETA, FIP, GB, JIS, PTI etc. Meanwhile, OVM works closely with external, independent institutions for testing and improvement of all products.

**Yours truly dependable partner**

With worldwide network, OVM strives continually to provide high quality services to clients and is seeking partnerships in areas of prestressing design for structural engineering projects, provision of prestressing systems, and contracting of special structures.

# Certifications of OVM

OVM PRESTRESSING SYSTEMS








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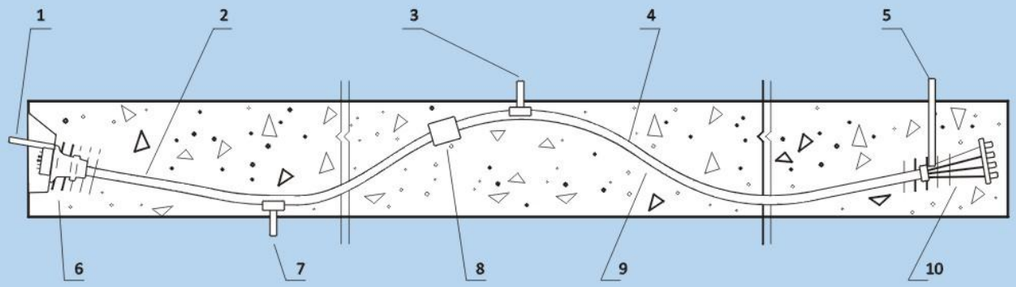
Shanghai Yangtze River Bridge, China

# OVM Post-tensioning System in the Girder




1.Grout tube 2.Duct 3.Vent 4.Strand bundle 5.Grout tube 6.Stressing-end anchorage
7.Drain port 8.Coupler 9.Grout 10.Dead-end anchorage Type P (alternatively)

OVM Post-tensioning System consists of anchor age (stressing-end, dead-end), coupler, strand and duct. OVM post-tensioning systems mating strands with various diameters: OVM13 for strand dia. 12.5/12.7/12.9mm, OVM15 for strand dia. 15.24/15.3 /15.7mm, OVM22 for strand dia. 21.8mm, OVM28 for strand dia. 28.6mm, which feature:

■ Adaptable for strand with various strength such as 1570/1670/1770/1860/2000MPa and various diameters.

■ Full range of tendon sizes are available (1~ 55 strands and larger sizes are available on request).

■No need to accurately determine strand length in advance.

■ High anchoring coefficient, reliable and stable.

* For OVM post-tensioning System:

+ Anchor coefficient: $\eta_a \geq 0.95$;

+ Total strain at ultimate tensile force: $\varepsilon_{ap\mu} \geq 2.0\%$.

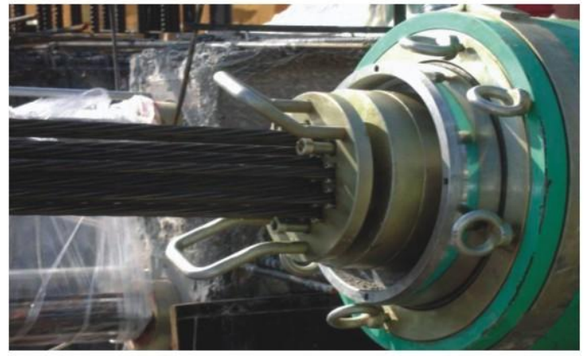
■Simple and reliable equipment for installation, tensioning and grouting.



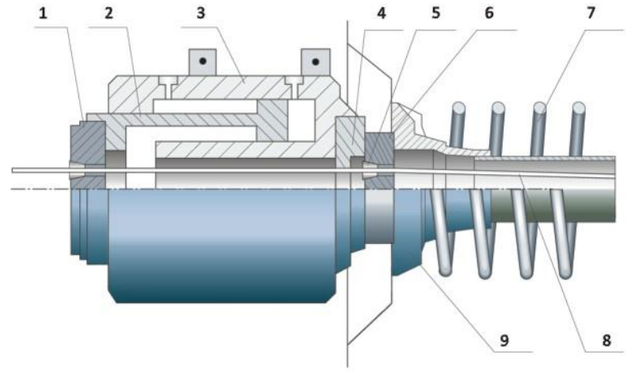



# Integral Assembly of OVM Post-tensioning System

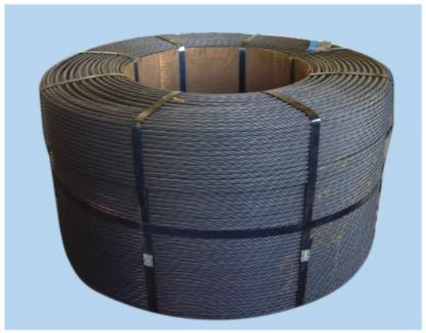
Stressing-end (Two-ends-stressing is available as per design) Dead-end: Type P



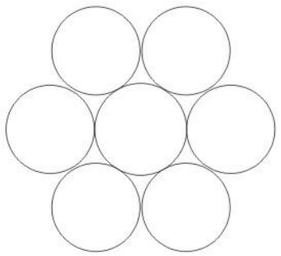
1. Tool anchorage
2. Piston
3. Cylinder
4. Spacer
5. Wedge
6. Anchor head
7. Spiral reinforcement
8. Strand
9. Bearing plate



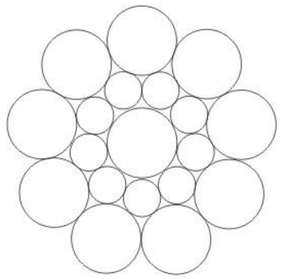
# Strand



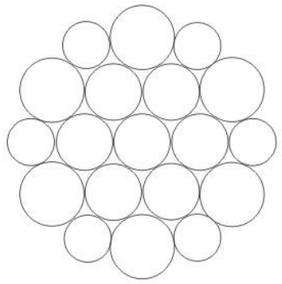
The strand to fit OVM Post-tensioning System should comply with ASTM416, GB/T 5224, prEN 10138 or JIS G3536. The strand could be bare, galvanized or epoxy-coated.



Cross-section of 13/15/18mm strand



Cross-section of 22mm strand



Cross-section of 28mm strand

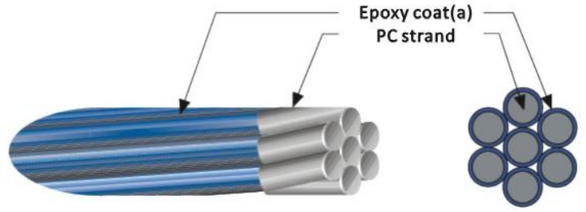
## Main Data

| Type | 13mm (0.5") | | | | 15mm (0.6") | | | | 18mm | 22mm | 28mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Designation | prEN 10138-3 (2006) Y1860S7 | | ASTM416-06 Grade 270 | GB/T 5224-2003 | prEN 10138-3 (2006) Y1860S7 | | ASTM416-06 Grade 270 | GB/T 5224-2003 | JIS G3536 -2008 | JIS G3536 -2008 | JIS G3536 -2008 |
| Nom. Dia. (mm) | 12.5 | 12.9 | 12.7 | 12.7 | 15.3 | 15.7 | 15.24 | 15.2 | 17.8 | 21.8 | 28.6 |
| Nom. Cross Section ($mm^2$) | 93 | 100 | 98.7 | 98.7 | 140 | 150 | 140 | 140 | 208.4 | 312.9 | 532.4 |
| Nom. Mass (Kg/m) | 0.726 | 0.781 | 0.775 | 0.775 | 1.093 | 1.172 | 1.102 | 1.101 | 1.652 | 2.482 | 4.229 |
| Nom. Yield Strength (MPa) | 1634 | 1640 | 1675 | | 1636 | 1640 | 1676 | | | | |
| Nom. Tensile Strength (MPa) | 1860 | 1860 | 1860 | 1860 | 1860 | 1860 | 1860 | 1860 | | | |
| Min. Breaking Load (kN) | 173 | 186 | 183.7 | 184 | 260 | 279 | 260.7 | 260 | 387 | 573 | 949 |
| Young's Modulus (Gpa) | Approx. 195 | | | | | | | | | | |
| Relaxation after 1,000h at 20° C at 70% breaking load | Max. 2.5 | | | | | | | | | | |





## Epoxy-Coated PC Strand



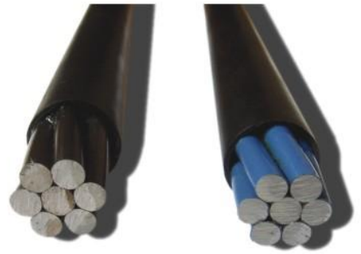

- ☐ With excellent anti-corrosion property
- ☐ UV resistance
- ☐ Same strength and mechanical property as bare strand
- ☐ Reduce the extra cost of corrosion protection
- ☐ Extended service life of the strand

In recent years, Epoxy-coated Strand (ECS) is widely applied to severe environments such as marine structures or structures in salt damage area.

## Epoxy-Coated PC Strand

| Type | PC strand | | OVMECS13/ECS15 | | | | |
|---|---|---|---|---|---|---|---|
| | Spec. (mm) | Unit weight (g/m) | External dia.(mm) | Unit weight (g/m) | Coating thickness on Single wire (mm) | Unit weight of coating (g/m) | Material |
| OVMECS13 | 12.7 | 775 | 13.5 | 789 | 0.13-0.30 | 14.9 | Epoxy |
| OVMECS15 | 15.2 | 1102 | 16.0 | 1119 | 0.13-0.30 | 17.7 | |

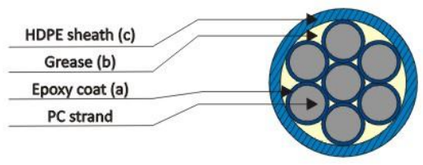
## Unbonded Strand

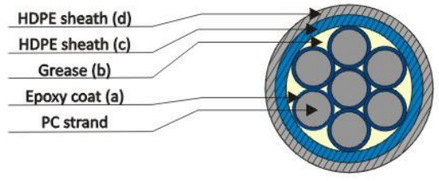


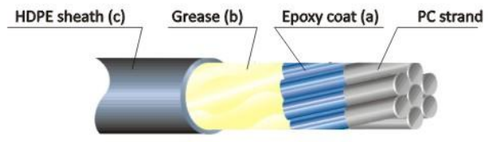
Bare Unbonded Strand

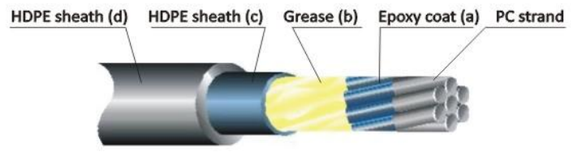
Epoxy-coated Unbonded Strand

## Epoxy-Coated Unbonded Strand



## Single Layer PE Sheathed

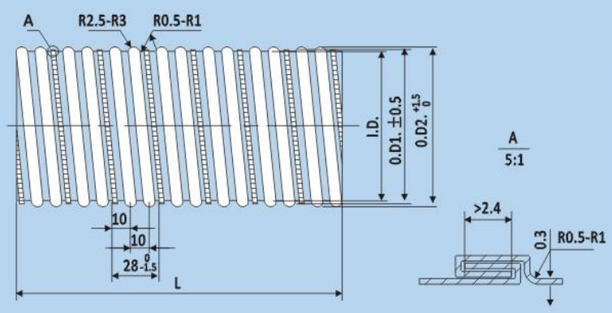
| Type | PC strand | | UPS13E/15E | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Spec. (mm) | Unit weight (g/m) | External dia. (mm) | Unit weight (g/m) | Thickness (mm) | | Weight of grease (g/m) | Material | | |
| | | | | | a | c | b | a | b | c |
| UPS13E | 12.7 | 775 | ⩾15.6 | 887 | 0.13-0.30 | ⩾1.0 | ⩾43 | Epoxy | Grease | HDPE |
| UPS15E | 15.2 | 1102 | ⩾18.1 | 1235 | 0.13-0.30 | ⩾1.0 | ⩾50 | | | |

## Double-layer PE Sheathed

| Type | PC strand | | UPS13E2/15E2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spec. (mm) | Unit weight (g/m) | External dia. (mm) | Unit weight (g/m) | Thickness (mm) | | | Weight of grease (g/m) | Material | | | |
| | | | | | a | c | d | b | a | b | c | d |
| UPS13E2 | 12.7 | 775 | ⩾16.9 | 912 | 0.13-0.30 | ⩾1.0 | 0.8-1.0 | ⩾43 | Epoxy | Grease | HDPE | HDPE |
| UPS15E2 | 15.2 | 1102 | ⩾19.7 | 1270 | 0.13-0.30 | ⩾1.0 | 0.8-1.0 | ⩾50 | | | | |

# Galvanized Steel Duct

## Round Duct







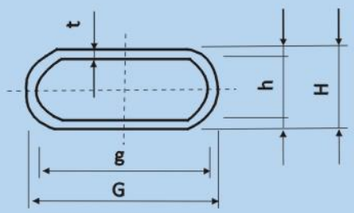

## Main Data

Unit:mm

| Specs | Duct | | | Coupler of duct | | | |
|---|---|---|---|---|---|---|---|
| | I.D. | O.D.1 | O.D.2 | I.D. | O.D.1 | O.D.2 | Length |
| 2B40(Zn) | 40 | 42.5 | 45.5 | 45 | 47.5 | 50.5 | 200~300 |
| 2B45(Zn) | 45 | 47.5 | 50.5 | 50 | 52.5 | 55.5 | 200~300 |
| 2B50(Zn) | 50 | 52.5 | 55.5 | 55 | 57.5 | 60.5 | 200~300 |
| 2B55(Zn) | 55 | 57.5 | 60.5 | 60 | 62.5 | 65.5 | 200~300 |
| 2B60(Zn) | 60 | 62.5 | 65.5 | 65 | 67.5 | 70.5 | 200~300 |
| 2B65(Zn) | 65 | 67.5 | 70.5 | 70 | 72.5 | 75.5 | 200~300 |
| 2B70(Zn) | 70 | 72.5 | 75.5 | 75 | 77.5 | 80.5 | 200~300 |
| 2B75(Zn) | 75 | 77.5 | 80.5 | 80 | 82.5 | 85.5 | 200~300 |
| 2B80(Zn) | 80 | 82.5 | 85.5 | 85 | 87.5 | 90.5 | 200~300 |
| 2B85(Zn) | 85 | 87.5 | 90.5 | 90 | 92.5 | 95.5 | 200~300 |
| 2B90(Zn) | 90 | 92.5 | 95.5 | 95 | 97.5 | 100.5 | 200~300 |
| 2B95(Zn) | 95 | 97.5 | 100.5 | 100 | 102.5 | 105.5 | 200~300 |
| 2B100(Zn) | 100 | 102.5 | 105.5 | 105 | 107.5 | 110.5 | 200~300 |
| 2B105(Zn) | 105 | 107.5 | 110.5 | 110 | 112.5 | 115.5 | 200~300 |
| 2B110(Zn) | 110 | 112.5 | 115.5 | 115 | 117.5 | 120.5 | 200~300 |
| 2B115(Zn) | 115 | 117.5 | 120.5 | 120 | 122.5 | 125.5 | 200~300 |
| 2B120(Zn) | 120 | 122.5 | 125.5 | 125 | 127.5 | 130.5 | 200~300 |
| 2B125(Zn) | 125 | 127.5 | 130.5 | 130 | 132.5 | 135.5 | 200~300 |
| 2B130(Zn) | 130 | 132.5 | 135.5 | 135 | 137.5 | 140.5 | 200~300 |
| 2B135(Zn) | 135 | 137.5 | 140.5 | 140 | 142.5 | 145.5 | 200~300 |
| 2B140(Zn) | 140 | 142.5 | 145.5 | 145 | 147.5 | 150.5 | 200~300 |
| 2B145(Zn) | 145 | 147.5 | 150.5 | 150 | 152.5 | 155.5 | 200~300 |
| 2B150(Zn) | 150 | 152.5 | 155.5 | 155 | 157.5 | 160.5 | 200~300 |
| 2B155(Zn) | 155 | 157.5 | 160.5 | 160 | 162.5 | 165.5 | 200~300 |
| 2B165(Zn) | 160 | 162.5 | 165.5 | 165 | 167.5 | 170.5 | 200~300 |

I. One-class-bigger duct can be used as the coupler. II. Special duct can be supplied on request.

## Flat Duct




## Main Data

Unit:mm

| Specs | Duct | | | | | Coupler of duct | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | g | G | h | H | t | g | G | h | H | t | Length |
| 2B50B(Zn) | 50 | 56 | 19 | 25 | 3 | 57 | 62 | 25 | 30 | 2.5 | 200~300 |
| 2B60B(Zn) | 60 | 66 | 19 | 25 | 3 | 67 | 72 | 25 | 30 | 2.5 | 200~300 |
| 2B70B(Zn) | 70 | 76 | 19 | 25 | 3 | 77 | 82 | 25 | 30 | 2.5 | 200~300 |
| 2B90B(Zn) | 90 | 96 | 19 | 25 | 3 | 97 | 102 | 25 | 30 | 2.5 | 200~300 |

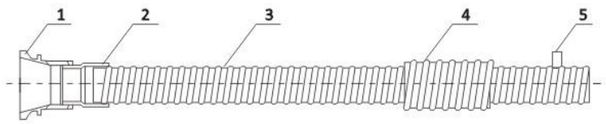
I. One-class-bigger duct can be used as the coupler. II. Special duct can be supplied on request.

# Plastic Duct

Equipped with OVM Post-tensioning System, made of HDPE material, compared to steel duct, its advantages as follow:

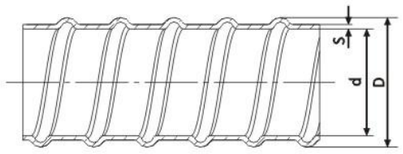
- Lower friction
- Excellent sealing property
- Better anti-corrosion performance
- More flexibility

## Plastic Duct Assembly




1.Bearing plate 2.OLT coupler 3.Plastic duct 4.OLG coupler 5.Vent

## Round Plastic Duct



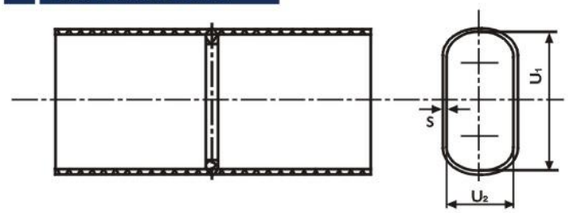

**Main Data (Round Duct)** Unit:mm

| Designation | d | D | s | Anchorage adapted |
|---|---|---|---|---|
| SBG-50 | ϕ50 | ϕ63 | 2.5 | OVM.M15-2~3 OVM.M13-2~5 |
| SBG-55 | ϕ55 | ϕ68 | 2.5 | OVM.M15(13)-4~5 |
| SBG-60 | ϕ60 | ϕ73 | 2.5 | OVM.M13-6~7 |
| SBG-65 | ϕ65 | ϕ73 | 2.5 | As coupler of SBG55 |
| SBG-70 | ϕ70 | ϕ83 | 2.5 | OVM.M15-6~7 OVM.M13-8~9 |
| SBG-75 | ϕ75 | ϕ88 | 2.5 | |
| SBG-80 | ϕ80 | ϕ93 | 2.5 | OVM.M15-8~9 OVM.M13-10~12 |
| SBG-85 | ϕ85 | ϕ98 | 2.5 | OVM.M15-10~12 OVM.M13-13~19 |
| SBG-90 | ϕ90 | ϕ104 | 2.5 | OVM.M15-13~17 OVM.M13-20~22 |
| SBG-95 | ϕ95 | ϕ108 | 2.5 | As coupler of SBG85 |
| SBG-100 | ϕ100 | ϕ114 | 2.5 | OVM.M15-18~19 OVM.M13-23~31 |
| SBG-110 | ϕ110 | ϕ123 | 2.5 | As coupler of SBG100 |
| SBG-120 | ϕ120 | ϕ134 | 3 | OVM.M15-20~27 OVM.M13-32~37 |
| SBG-130 | ϕ130 | ϕ144 | 3 | OVM.M15-28~31 OVM.M13-38~55 |
| SBG-140 | ϕ140 | ϕ154 | 3 | OVM.M15-32~37 OVM.M13-45~55 |





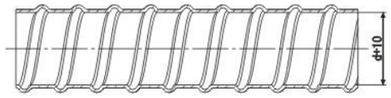
## Flat Plastic Duct



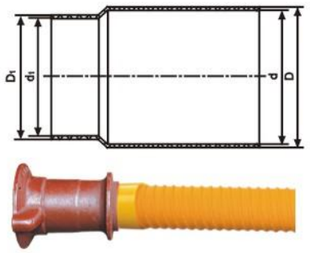

**Main Data (Flat Duct)** Unit:mm

| Designation | U1 | U2 | s | Anchorage adapted |
|---|---|---|---|---|
| OVMSBGB-41 | 41 | 22 | 2.5 | BM15(13)-2 |
| OVMSBGB-60 | 60 | 22 | 2.5 | BM15(13)-2~3 |
| OVMSBGB-72 | 72 | 23 | 2.5 | BM15(13)-4 |
| OVMSBGB-90 | 90 | 23 | 2.5 | BM15(13)-5 |

## Coupler (OLG)




OLG coupler

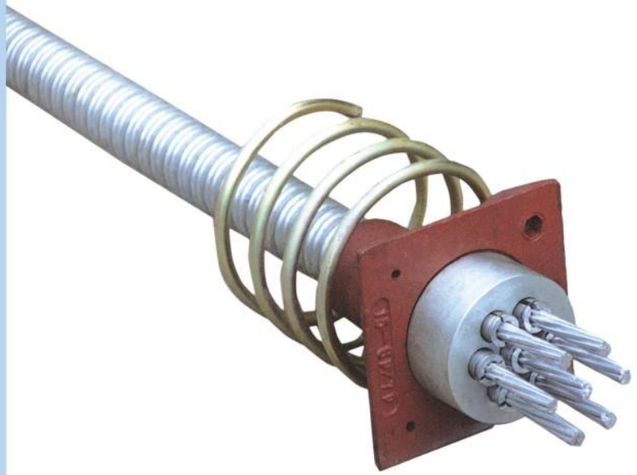



OLT coupler

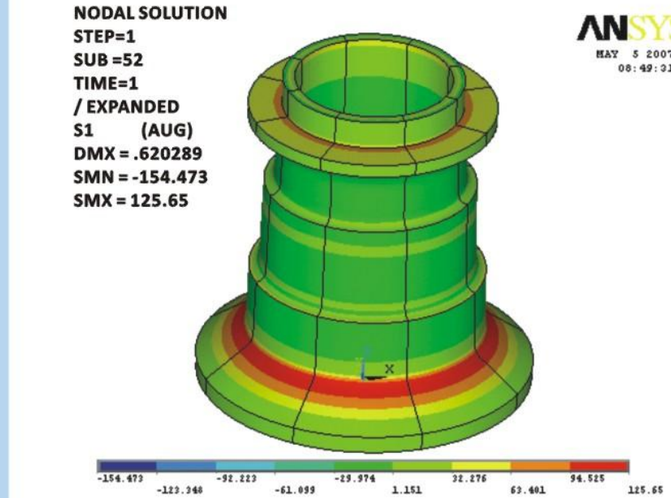
**Main Data of OLG & OLT** Unit:mm

| Designation | D | d | D1 | D1 | L |
|---|---|---|---|---|---|
| OLG-50 | (d+10)mm duct | | | | More than 250mm or as per request |
| OLG-60 | | | | | |
| OLG-70 | | | | | |
| OLG-80 | | | | | |
| OLG-85 | | | | | |
| OLG-90 | | | | | |
| OLG-100 | | | | | |
| OLG-115 | | | | | |
| OLG-130 | | | | | |
| OLT-(2~3) | ϕ64 | ϕ67 | ϕ52 | ϕ56 | 130 |
| OLT-(4~5) | ϕ64 | ϕ68 | ϕ57 | ϕ61 | |
| OLT-(6~7) | ϕ84 | ϕ88 | ϕ75 | ϕ78 | |
| OLT-(8~9) | ϕ95 | ϕ99 | ϕ85 | ϕ88 | |
| OLT-(10~12) | ϕ100 | ϕ104 | ϕ95 | ϕ98 | |
| OLT-(13~17) | ϕ105 | ϕ109 | ϕ95 | ϕ98 | |
| OLT-(18~19) | ϕ115 | ϕ119 | ϕ105 | ϕ108 | |
| OLT-(20~27) | ϕ135 | ϕ139 | ϕ124 | ϕ128 | 145 |
| OLT-(28~31) | ϕ145 | ϕ149 | ϕ134 | ϕ138 | |

# Stressing-end Anchorage



OVM.M15 Series
OVM.M13 Series




Finite Element Model of Bearing Plate

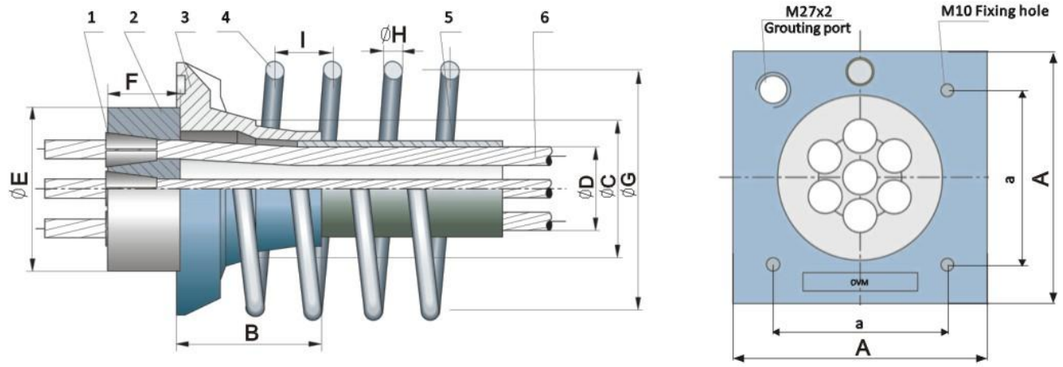
OVM.M15A Series
OVM.M13A Series

Round bearing plate obtains better load transfer property.

OVM working anchor head and wedges

"13" refers to strand diameter 0.5" (12.5/12.7/12.9mm).
"15" refers to strand diameter 0.6" (15.2/15.24/15.3/15.7mm).

# Stressing-end Anchorage OVM.M15




1.Wedge 2.Anchor head 3.Bearing plate 4. Spiral reinforcement 5. Duct 6.Strand

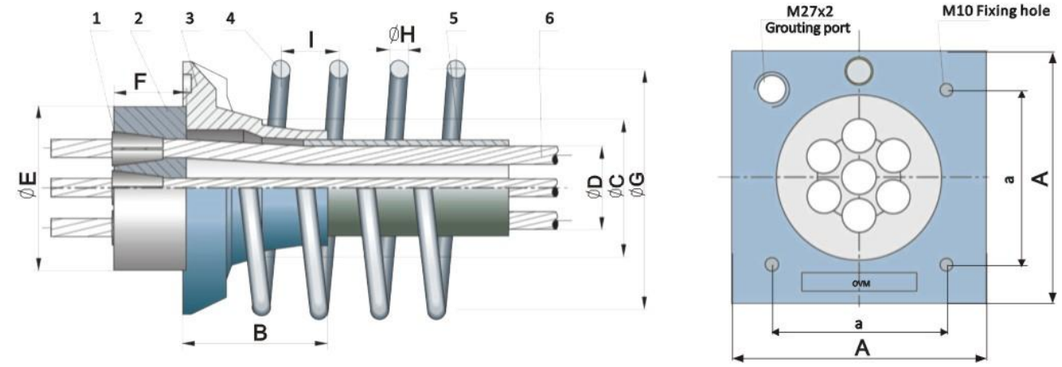
## Main Data

| Designation | Bearing plate | | Duct | Anchor head | Spiral reinforcement | | | | Stressing jack |
|---|---|---|---|---|---|---|---|---|---|
| | AxBx ϕ C | Bolt distance a | ϕ D. | ϕ ExF | ϕ G | ϕ H | I | N | |
| OVM.M15-2 | 115x100x ϕ 80 | 80 | 45 | ϕ 85x48 | ϕ 115 | ϕ 8 | 40 | 4 | YCW100B |
| OVM.M15-3 | 135x110x ϕ 83 | 95 | 45 | ϕ 85x48 | ϕ 130 | ϕ 10 | 50 | 4 | YCW100B |
| OVM.M15-4 | 165x120x ϕ 93 | 120 | 55 | ϕ 101x48 | ϕ 150 | ϕ 12 | 50 | 4 | YCW100B |
| OVM.M15-5 | 180x130x ϕ 93 | 135 | 55 | ϕ 116x48 | ϕ 170 | ϕ 12 | 50 | 4 | YCW100B/ YCW150B |
| OVM.M15-6 | 210x160x ϕ 108 | 145 | 70 | ϕ 126x48 | ϕ 200 | ϕ 12 | 50 | 4 | YCW150B |
| OVM.M15-7 | 210x160x ϕ 108 | 145 | 70 | ϕ 126x52 | ϕ 200 | ϕ 12 | 50 | 4 | YCW150B/ YCW250B |
| OVM.M15-8 | 220x160x ϕ 123 | 160 | 80 | ϕ 143x53 | ϕ 216 | ϕ 14 | 50 | 5 | YCW250B |
| OVM.M15-9 | 240x180x ϕ 125 | 180 | 80 | ϕ 152x53 | ϕ 240 | ϕ 14 | 50 | 5 | YCW250B |
| OVM.M15-10 | 270x210x ϕ 140 | 200 | 90 | ϕ 166x55 | ϕ 270 | ϕ 14 | 60 | 5 | YCW250B |
| OVM.M15-11 | 270x210x ϕ 140 | 200 | 90 | ϕ 166x57 | ϕ 270 | ϕ 16 | 60 | 5 | YCW250B |
| OVM.M15-12 | 270x210x ϕ 140 | 200 | 90 | ϕ 166x60 | ϕ 270 | ϕ 16 | 60 | 5 | YCW250B/ YCW350B |
| OVM.M15-13 | 270x210x ϕ 140 | 200 | 90 | ϕ 166x62 | ϕ 270 | ϕ 16 | 60 | 5 | YCW350B |
| OVM.M15-14 | 285x220x ϕ 152 | 210 | 90 | ϕ 175x62 | ϕ 285 | ϕ 16 | 60 | 5 | YCW350B |
| OVM.M15-15 | 300x240x ϕ 170 | 225 | 90 | ϕ 195x65 | ϕ 300 | ϕ 16 | 60 | 5 | YCW350B |
| OVM.M15-16 | 300x240x ϕ 170 | 225 | 90 | ϕ 195x65 | ϕ 300 | ϕ 18 | 60 | 5 | YCW350B/ YCW400B |
| OVM.M15-17 | 300x240x ϕ 170 | 225 | 90 | ϕ 195x70 | ϕ 300 | ϕ 18 | 60 | 5 | YCW350B/ YCW400B |
| OVM.M15-18 | 310x250x ϕ 174 | 230 | 100 | ϕ 205x70 | ϕ 310 | ϕ 18 | 60 | 6 | YCW400B |
| OVM.M15-19 | 310x250x ϕ 174 | 230 | 100 | ϕ 205x73 | ϕ 310 | ϕ 18 | 60 | 6 | YCW400B/ YCW500B |
| OVM.M15-20 | 320x260x ϕ 188 | 230 | 120 | ϕ 224x75 | ϕ 320 | ϕ 20 | 60 | 6 | YCW500B |
| OVM.M15-21/22 | 320x260x ϕ 188 | 230 | 120 | ϕ 224x78 | ϕ 320 | ϕ 20 | 60 | 6 | YCW500B |
| OVM.M15-23/24 | 350x295x ϕ 210 | 260 | 120 | ϕ 244x82 | ϕ 350 | ϕ 20 | 60 | 6 | YCW650A |
| OVM.M15-25/26/27 | 350x295x ϕ 210 | 260 | 120 | ϕ 244x85 | ϕ 350 | ϕ 20 | 60 | 6 | YCW650A |
| OVM.M15-28/29 | 390x346x ϕ 222 | 290 | 130 | ϕ 260x88 | ϕ 390 | ϕ 20 | 60 | 7 | YCW650A |
| OVM.M15-30/31 | 390x346x ϕ 222 | 290 | 130 | ϕ 260x90 | ϕ 390 | ϕ 20 | 60 | 7 | YCW650A |
| OVM.M15-32/33/34 | 465x390x ϕ 246 | 350 | 140 | ϕ 296x95 | ϕ 465 | ϕ 20 | 60 | 8 | YCW650A/ YCW900A |
| OVM.M15-35/36/37 | 465x390x ϕ 246 | 350 | 140 | ϕ 296x100 | ϕ 465 | ϕ 20 | 60 | 8 | YCW650A/ YCW900A |





# Stressing-end Anchorage OVM.M13

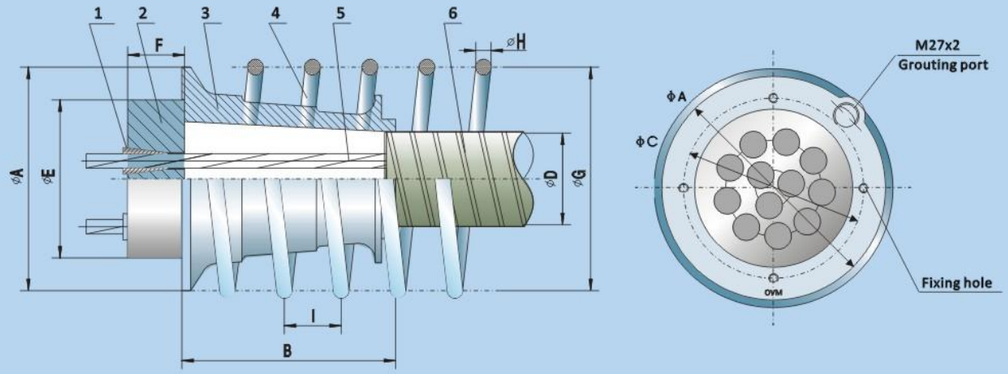



1.Wedge 2.Anchor head 3.Bearing plate 4. Spiral reinforcement 5. Duct 6.Strand

## Main Data

| Designation | Bearing plate | | Duct | Anchor head | Spiral reinforcement | | | | Stressing jack |
|---|---|---|---|---|---|---|---|---|---|
| | AxBx ϕ C | Bolt distance a | ϕ D. | ϕ ExF | ϕ G | ϕ H | I | N | |
| OVM.M13-2 | 115x100X ϕ 80 | 80 | 45 | ϕ 75x50 | ϕ 110 | ϕ 6 | 30 | 3 | YCW100B |
| OVM.M13-3 | 120x130X ϕ 80 | 85 | 45 | ϕ 80x50 | ϕ 120 | ϕ 10 | 50 | 3 | YCW100B |
| OVM.M13-4 | 135x130X ϕ 80 | 95 | 50 | ϕ 90x50 | ϕ 135 | ϕ 10 | 50 | 3 | YCW100B |
| OVM.M13-5 | 145x130X ϕ 80 | 105 | 50 | ϕ 100x55 | ϕ 145 | ϕ 12 | 50 | 4 | YCW100B |
| OVM.M13-6/7 | 165x130X ϕ 94 | 120 | 60 | ϕ 115x55 | ϕ 165 | ϕ 12 | 50 | 4 | YCW100B |
| OVM.M13-8 | 190x150X ϕ 100 | 135 | 60 | ϕ 130x55 | ϕ 175 | ϕ 12 | 50 | 4 | YCW150B |
| OVM.M13-9 | 190x150X ϕ 108 | 135 | 70 | ϕ 137x60 | ϕ 190 | ϕ 14 | 50 | 4 | YCW150B |
| OVM.M13-10/11 | 216x180X ϕ 134 | 160 | 80 | ϕ 157x60 | ϕ 216 | ϕ 14 | 50 | 5 | YCW150B |
| OVM.M13-12 | 216x180X ϕ 134 | 160 | 80 | ϕ 157x60 | ϕ 216 | ϕ 14 | 50 | 5 | YCW200B |
| OVM.M13-13 | 230x180X ϕ 136 | 190 | 80 | ϕ 157x60 | ϕ 230 | ϕ 16 | 60 | 5 | YCW250B |
| OVM.M13-14 | 230x180X ϕ 136 | 190 | 80 | ϕ 165x65 | ϕ 230 | ϕ 16 | 60 | 5 | YCW250B |
| OVM.M13-15/16 | 240x245X ϕ 140 | 200 | 90 | ϕ 195x70 | ϕ 240 | ϕ 16 | 60 | 5 | YCW250B |
| OVM.M13-17 | 240x245X ϕ 140 | 200 | 90 | ϕ 195x70 | ϕ 240 | ϕ 18 | 60 | 5 | YCW250B |
| OVM.M13-18/19 | 270x245X ϕ 154 | 200 | 90 | ϕ 195x70 | ϕ 265 | ϕ 16 | 60 | 5 | YCW350B |
| OVM.M13-20 | 290x340X ϕ 176 | 220 | 90 | ϕ 217x70 | ϕ 290 | ϕ 18 | 60 | 5 | YCW350B |
| OVM.M13-21/22 | 290x340X ϕ 176 | 220 | 90 | ϕ 217x80 | ϕ 290 | ϕ 18 | 60 | 5 | YCW350B |
| OVM.M13-23/24 | 300x355X ϕ 185 | 220 | 100 | ϕ 230x80 | ϕ 310 | ϕ 18 | 60 | 6 | YCW400B |
| OVM.M13-25/26 | 300x355X ϕ 185 | 220 | 100 | ϕ 230x85 | ϕ 310 | ϕ 18 | 60 | 6 | YCW400B |
| OVM.M13-27 | 300x355X ϕ 185 | 220 | 100 | ϕ 230x85 | ϕ 310 | ϕ 20 | 60 | 6 | YCW400B |
| OVM.M13-28/29 | 315x370X ϕ 190 | 230 | 105 | ϕ 245x85 | ϕ 315 | ϕ 20 | 60 | 6 | YCW400B |
| OVM.M13-30/31 | 315x370X ϕ 190 | 230 | 105 | ϕ 245x95 | ϕ 315 | ϕ 20 | 60 | 6 | YCW500B |
| OVM.M13-32/33 | 370x470X ϕ 216 | 280 | 120 | ϕ 270x110 | ϕ 370 | ϕ 20 | 60 | 7 | YCW500B |
| OVM.M13-34 | 370x470X ϕ 216 | 280 | 120 | ϕ 270x110 | ϕ 370 | ϕ 20 | 60 | 7 | YCW500B |
| OVM.M13-35/36 | 370x470X ϕ 216 | 280 | 120 | ϕ 270x110 | ϕ 370 | ϕ 20 | 60 | 7 | YCW500B |
| OVM.M13-37 | 370x470X ϕ 216 | 280 | 120 | ϕ 270x110 | ϕ 370 | ϕ 20 | 60 | 7 | YCW650A |

# Stressing-end Anchorage OVM.M15A




1.Wedge 2.Anchor head 3.Bearing plate 4. Spiral reinforcement 5. Strand 6.Duct

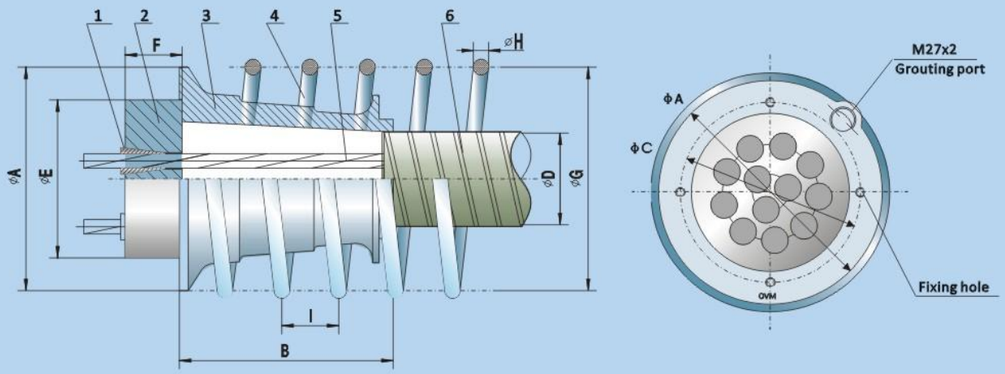
## Main Data

| Designation | Bearing plate | | Duct | Anchor head | Spiral reinforcement | | | | Stressing jack |
|---|---|---|---|---|---|---|---|---|---|
| | Φ AxB | Bolt distance Φ C | Φ D. | Φ ExF | Φ G | Φ H | I | N | |
| OVM.M15A-2 | 132x80 | 105 | 45 | Φ 86x50 | Φ 115 | Φ 8 | 40 | 4 | YCW100B |
| OVM.M15A-3 | 136x80 | 110 | 50 | Φ 91x50 | Φ 130 | Φ 10 | 50 | 4 | YCW100B |
| OVM.M15A-4 | 140x125 | 120 | 55 | Φ 102x50 | Φ 150 | Φ 12 | 50 | 4 | YCW100B |
| OVM.M15A-5 | 155x130 | 135 | 55 | Φ 115x50 | Φ 170 | Φ 12 | 50 | 4 | YCW100B/150B |
| OVM.M15A-6 | 165x160 | 145 | 70 | Φ 126x52 | Φ 200 | Φ 12 | 50 | 4 | YCW150B |
| OVM.M15A-7 | 172x170 | 145 | 70 | Φ 126x53 | Φ 200 | Φ 12 | 50 | 4 | YCW150B/250B |
| OVM.M15A-8 | 185x180 | 162 | 80 | Φ 136x55 | Φ 216 | Φ 14 | 50 | 5 | YCW250B |
| OVM.M15A-9 | 200x190 | 175 | 80 | Φ 146x55 | Φ 240 | Φ 14 | 50 | 5 | YCW250B |
| OVM.M15A-10 | 210x210 | 190 | 90 | Φ 156x58 | Φ 270 | Φ 14 | 60 | 5 | YCW250B |
| OVM.M15A-11 | 210x220 | 190 | 90 | Φ 166x58 | Φ 270 | Φ 16 | 60 | 5 | YCW250B |
| OVM.M15A-12 | 214x230 | 190 | 90 | Φ 166x60 | Φ 270 | Φ 16 | 60 | 5 | YCW250B/350B |
| OVM.M15A-13 | 224x230 | 190 | 90 | Φ 170x63 | Φ 270 | Φ 16 | 60 | 5 | YCW350B |
| OVM.M15A-14 | 233x260 | 200 | 90 | Φ 176x65 | Φ 285 | Φ 16 | 60 | 5 | YCW350B |
| OVM.M15A-15 | 233x260 | 220 | 90 | Φ 186x68 | Φ 300 | Φ 16 | 60 | 5 | YCW350B |
| OVM.M15A-16 | 246x330 | 220 | 90 | Φ 196x70 | Φ 300 | Φ 18 | 60 | 5 | YCW350B/400B |
| OVM.M15A-17 | 258x395 | 220 | 90 | Φ 196x73 | Φ 300 | Φ 18 | 60 | 5 | YCW350B/400B |
| OVM.M15A-18 | 272x325 | 230 | 100 | Φ 206x75 | Φ 310 | Φ 18 | 60 | 6 | YCW400B |
| OVM.M15A-19 | 272x325 | 230 | 100 | Φ 206x75 | Φ 310 | Φ 18 | 60 | 6 | YCW400B/500B |
| OVM.M15A-20 | 300x325 | 250 | 120 | Φ 226x80 | Φ 320 | Φ 20 | 60 | 6 | YCW500B |
| OVM.M15A-21/22 | 300x325 | 250 | 120 | Φ 226x80 | Φ 320 | Φ 20 | 60 | 6 | YCW500B |
| OVM.M15A-23/24 | 330x430 | 280 | 120 | Φ 244x82 | Φ 350 | Φ 20 | 60 | 6 | YCW650A |
| OVM.M15A-25/26/27 | 330x430 | 280 | 120 | Φ 244x85 | Φ 350 | Φ 20 | 60 | 6 | YCW650A |
| OVM.M15A-28/29 | 352x415 | 290 | 130 | Φ 260x88 | Φ 390 | Φ 20 | 60 | 7 | YCW650A |
| OVM.M15A-30/31 | 352x415 | 290 | 130 | Φ 260x90 | Φ 390 | Φ 20 | 60 | 7 | YCW650A |
| OVM.M15A-32/33/34 | 386x510 | 330 | 140 | Φ 296x95 | Φ 465 | Φ 20 | 60 | 8 | YCW650A/900A |
| OVM.M15A-35/36/37 | 394x510 | 330 | 140 | Φ 296x100 | Φ 465 | Φ 20 | 60 | 8 | YCW650A/900A |





# Stressing-end Anchorage OVM.M13A




1.Wedge 2.Anchor head 3.Bearing plate 4. Spiral reinforcement 5. Strand 6.Duct

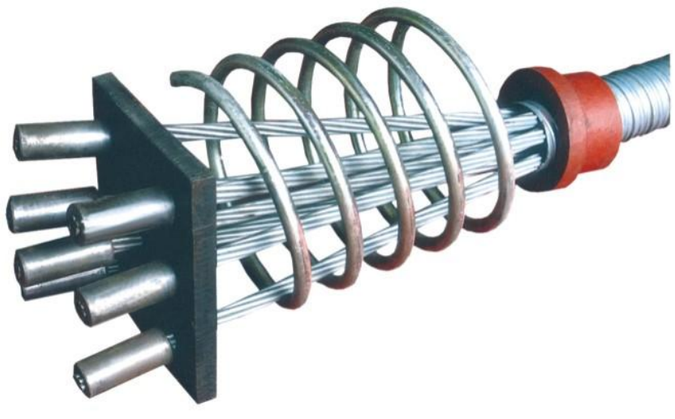
## Main Data

| Designation | Bearing plate | | Duct | Anchor head | Spiral reinforcement | | | | Stressing jack |
|---|---|---|---|---|---|---|---|---|---|
| | Φ AxB | Bolt distance Φ C | Φ D (I.D.) | Φ E * F | Φ G | Φ H | I | N | |
| OVM.M13A-2 | 125 x 60 | 105 | 45 | 75 x 45 | 110 | 6 | 30 | 3 | YCW100B |
| OVM.M13A-3 | 132 x 80 | 105 | 45 | 80 x 45 | 120 | 10 | 50 | 3 | YCW100B |
| OVM.M13A-4 | 136 x 102 | 105 | 50 | 85 x 48 | 135 | 10 | 50 | 3 | YCW100B |
| OVM.M13A-5 | 140 x 125 | 120 | 50 | 100 x 48 | 145 | 12 | 50 | 4 | YCW100B |
| OVM.M13A-6 | 155 x 130 | 135 | 60 | 105 x 48 | 165 | 12 | 50 | 4 | YCW100B |
| OVM.M13A-7 | 155 x 130 | 135 | 60 | 105 x 50 | 165 | 12 | 50 | 4 | YCW150B |
| OVM.M13A-8 | 170 x 160 | 140 | 60 | 116 x 52 | 175 | 12 | 50 | 4 | YCW150B |
| OVM.M13A-9 | 175 x 170 | 145 | 70 | 126 x 53 | 190 | 12 | 50 | 4 | YCW150B |
| OVM.M13A-10/11 | 200 x 190 | 162 | 80 | 136 x 53 | 216 | 14 | 50 | 4 | YCW150B |
| OVM.M13A-12 | 210 x 210 | 175 | 80 | 146 x 55 | 216 | 14 | 50 | 5 | YCW250B |
| OVM.M13A-13 | 210 x 210 | 175 | 80 | 146 x 55 | 230 | 14 | 50 | 5 | YCW250B |
| OVM.M13A-14 | 210 x 230 | 190 | 80 | 156 x 57 | 230 | 14 | 50 | 5 | YCW250B |
| OVM.M13A-15 | 214 x 230 | 190 | 90 | 166 x 60 | 240 | 16 | 50 | 5 | YCW250B |
| OVM.M13A-16/17 | 246 x 270 | 200 | 90 | 176 x 62 | 265 | 16 | 60 | 5 | YCW250B |
| OVM.M13A-18/19 | 246 x 270 | 200 | 90 | 176 x 65 | 265 | 16 | 60 | 5 | YCW350B |
| OVM.M13A-20 | 260 x 365 | 220 | 90 | 196 x 68 | 290 | 18 | 60 | 5 | YCW350B |
| OVM.M13A-21/22 | 260 x 365 | 220 | 90 | 196 x 70 | 290 | 18 | 60 | 5 | YCW350B |
| OVM.M13A-23/24 | 275 x 380 | 245 | 100 | 216 x 73 | 310 | 18 | 60 | 6 | YCW400B |
| OVM.M13A-25/26/27 | 275 x 380 | 245 | 100 | 216 x 75 | 310 | 18 | 60 | 6 | YCW400B |
| OVM.M13A-28/29 | 300 x 400 | 250 | 105 | 224 x 78 | 315 | 18 | 60 | 6 | YCW400B |
| OVM.M13A-30/31 | 300 x 400 | 250 | 105 | 224 x 80 | 315 | 18 | 60 | 6 | YCW500B |
| OVM.M13A-32/33/34 | 330 x 430 | 280 | 120 | 244 x 82 | 370 | 20 | 60 | 7 | YCW500B |
| OVM.M13A-35/36 | 330 x 430 | 280 | 120 | 244 x 85 | 370 | 20 | 60 | 7 | YCW500B |
| OVM.M13A-37 | 330 x 430 | 280 | 120 | 244 x 85 | 370 | 20 | 60 | 7 | YCW650A |

# Dead-end Anchorage Type P OVM.P15/P13

In case of transferring the post-tensioning force to the girder end directly, type P anchorage can be adopted. It is composed of the swaged end (swage socket and swage spring being extruded by GYJC50-150 swaging machine), anchor plate, spiral reinforcement, restraining ring, etc. ZB4-500 hydraulic pump serves the operation.

## Assembly of AnchorageType P



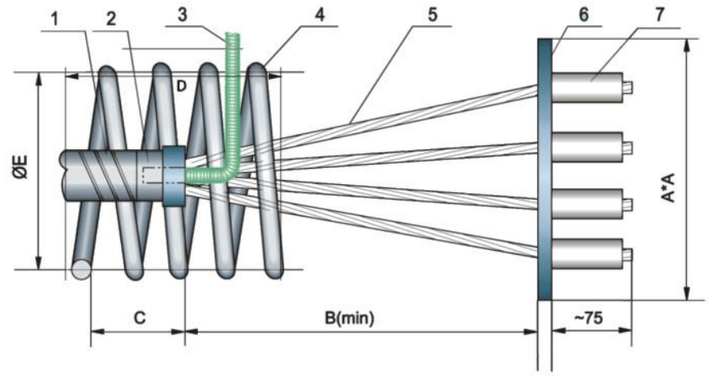
## GYJC50-150 Swaging Machine

## Swage Socket and Swage Spring





## Anchorage Type P




1.Duct
2.Restraining ring
3.Grout tube
4.Spiral reinforcement
5.Strand
6.Anchor plate
7.Swaged end

## Main Data

Unit:mm

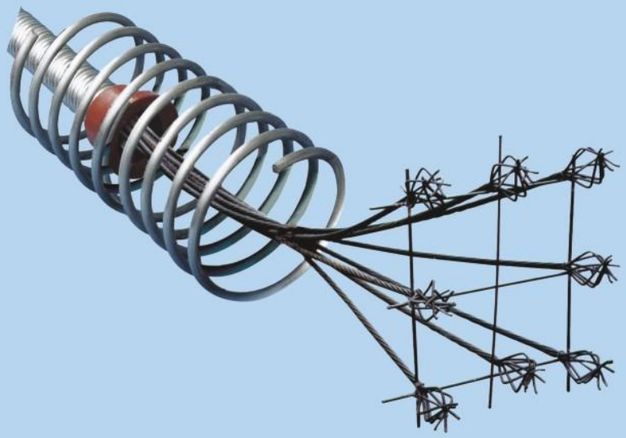
| Strand number | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18~19 | 20~22 | 23~27 | 28~30 | 32~34 | 35~37 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AxA | 100X80 (90X70) | 120 (100) | 140 (120) | 155 (140) | 170 (150) | 185 (170) | 195 (170) | 210 (220) | 220 (220) | 230 (220) | 240 (220) | 250 (250) | 260 (250) | 260 (250) | 260 (250) | 285 (250) | 300 (250) | 325 | 350 | 380 | 400 | 420 |
| B (min) | 180 (120) | 180 (120) | 240 (180) | 300 (180) | 380 (300) | 380 (380) | 440 (380) | 440 (440) | 500 (440) | 500 (440) | 500 (440) | 500 (500) | 560 (500) | 560 (500) | 560 (500) | 720 (500) | 720 (500) | 900 | 1000 | 1100 | 1100 | 1200 |
| C | 110 (85) | 110 (85) | 110 (110) | 110 (110) | 120 (110) | 120 (110) | 120 (110) | 120 (120) | 135 (120) | 135 (120) | 135 (120) | 135 (135) | 135 (135) | 135 (135) | 135 (135) | 135 (135) | 135 (135) | 135 | 135 | 135 | 135 | 135 |
| D | 160 (200) | 200 (200) | 200 (200) | 200 (200) | 200 (200) | 200 (200) | 200 (200) | 200 (250) | 250 (250) | 250 (250) | 250 (250) | 250 (250) | 275 (250) | 330 (250) | 330 (250) | 360 (250) | 360 (250) | 360 | 360 | 420 | 480 | 480 |
| ΦE | 115 (110) | 130 (120) | 150 (135) | 170 (145) | 200 (165) | 200 (165) | 216 (175) | 240 (190) | 270 (216) | 270 (216) | 270 (216) | 270 (230) | 285 (230) | 300 (240) | 300 (240) | 300 (240) | 310 (265) | 300 | 330 | 352 | 386 | 394 |

The figures in brackets are for OVM.P13.

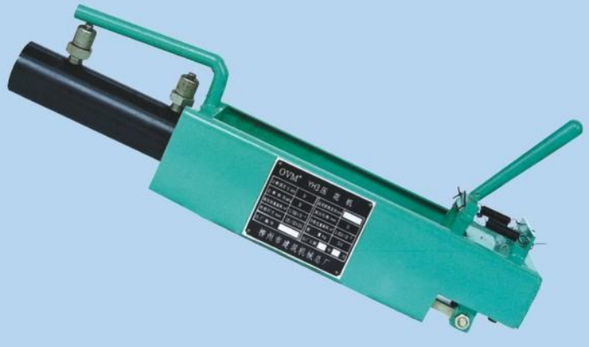
# Dead-end Anchorage Type H OVM.H15/H13

Type H anchorage is the most convenient fixed-end solution for on site operation. The prestressing force is transferred to the concrete partially by bond and partially by bulb formed by YH3 bulb machine. ZB4-500 hydraulic pump serves the operation.

## Assembly of Anchorage Type H



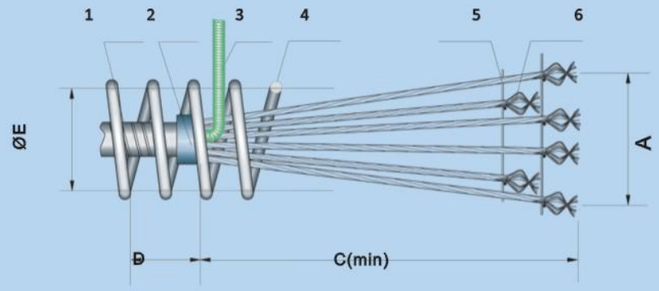
## YH3 Bulb Machine

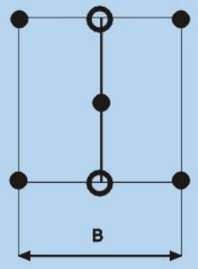






## Dead-end Anchorage Type H




1.Duct 2.Vent 3.Restraining ring 4.Spiral reinforcement 5.Spacer 6.Bulb

## Main Data

Unit:mm

| Designation | Qty of strand | A | B | C(min) | D | Φ E |
|---|---|---|---|---|---|---|
| OVM.H$^{15}_{13}$-3 | 3 | 190(130) | 90(70) | 950(650) | 145(145) | 130(120) |
| OVM.H$^{15}_{13}$-4 | 4 | 190(150) | 210(170) | 950(650) | 145(145) | 150(135) |
| OVM.H$^{15}_{13}$-5 | 5 | 200(160) | 220(180) | 950(650) | 145(145) | 170(145) |
| OVM.H$^{15}_{13}$-6/7 | 6/7 | 210(170) | 230(190) | 1300(850) | 155(155) | 200(165) |
| OVM.H$^{15}_{13}$-9 | 9 | 270(220) | 310(250) | 1300(850) | 155(155) | 240(190) |
| OVM.H$^{15}_{13}$-12 | 12 | 330(270) | 390(310) | 1300(850) | 155(155) | 270(216) |
| OVM.H$^{15}_{13}$-19 | 19 | 390(310) | 470(390) | 1300(950) | 155(155) | 310(265) |
| OVM.H$^{15}_{13}$-27 | 27 | 450(410) | 520(430) | 1700(1150) | 155(155) | 350(310) |
| OVM.H$^{15}_{13}$-31 | 31 | 510(430) | 570(470) | 1700(1150) | 165(155) | 390(315) |
| OVM.H$^{15}_{13}$-37 | 37 | 510(430) | 690(570) | 2000(1680) | 185(165) | 465(370) |
| OVM.H$^{15}_{13}$-43 | 43 | 550(560) | 750(580) | 2500(1680) | 210(185) | 500(390) |
| OVM.H$^{15}_{13}$-55 | 55 | 620(560) | 850(680) | 2500(1980) | 240(185) | 540(465) |

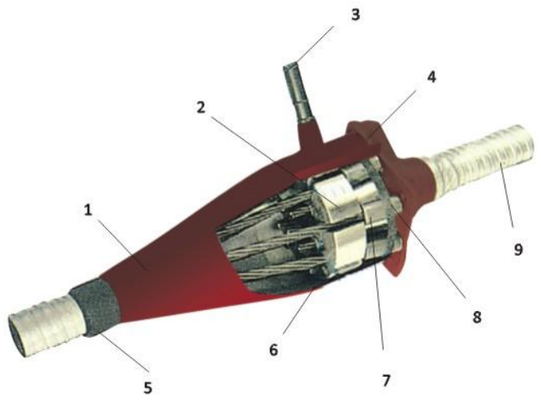
The figures in brackets are for OVM.H13.

# Coupler OVM.L15/L13

Couplers are used to elongate the tendons which due to their length or the construction method used in the project, cannot be installed or tensioned as one unit.

Coupler L15/L13 usually includes seven parts: coupler block, bearing plate, protective sleeve, restraining ring, spiral reinforcement, wedges and swaged ends. GYJC50-150 swaging machine and hydraulic pump ZB4-500 serve operation for extruding the swaged end.

## Multi-strand Coupler L15/L13



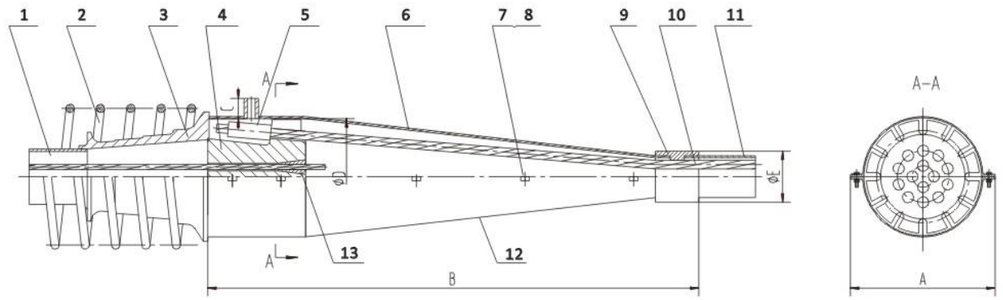

1.Protective cover 2.Coupler block 3.Grouting tube
4.Bearing plate 5.Restraining ring 6.Wedges
7.Swaged end 8.Omega ring 9.Duct

## Coupler Block





## Coupler L15/L13




1.Duct 2.Spiral reinforcement 3.Bearing plate 4.Coupler block 5.Swaged end 6.Protective cover I
7.Bolt 8.Nut 9.Restraining ring 10.Strand 11.Duct 12.Protective cover II 13.Wedge

### Main Data of Coupler OVM.L15

Unit:mm

| Designation | A | B | C | ϕD | ϕE |
|---|---|---|---|---|---|
| L15-2 | 191 | 599 | 40 | 148 | 80 |
| L15-3 | 195 | 617 | 40 | 152 | 80 |
| L15-4 | 207 | 669 | 40 | 164 | 85 |
| L15-5 | 219 | 722 | 40 | 176 | 85 |
| L15-(6~7) | 233 | 722 | 40 | 190 | 100 |
| L15-8 | 241 | 713 | 40 | 198 | 110 |
| L15-9 | 251 | 757 | 40 | 208 | 110 |
| L15-10 | 263 | 766 | 40 | 220 | 120 |
| L15-(11~12) | 273 | 810 | 40 | 230 | 120 |
| L15-13 | 277 | 837 | 40 | 234 | 120 |
| L15-14 | 283 | 822 | 40 | 240 | 120 |
| L15-15 | 295 | 877 | 40 | 252 | 120 |
| L15-(16~17) | 305 | 926 | 40 | 262 | 120 |
| L15-(18~19) | 311 | 955 | 40 | 268 | 140 |
| L15-(20~22) | 331 | 960 | 40 | 288 | 180 |
| L15-(23~27) | 361 | 1096 | 40 | 318 | 180 |
| L15-(28~31) | 409 | 1268 | 40 | 366 | 180 |

### Main Data of Coupler OVM.L13

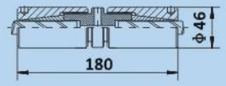
Unit:mm

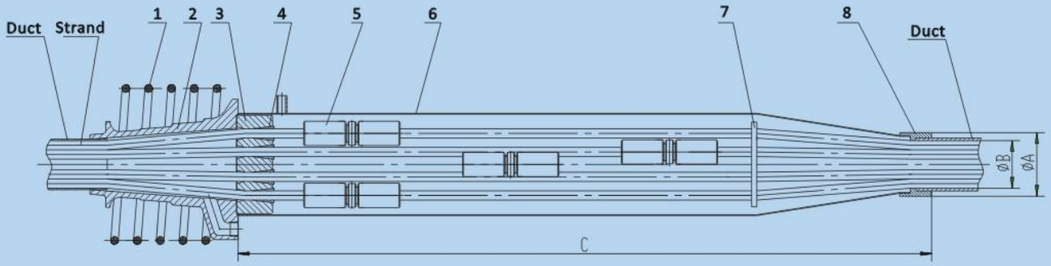
| Designation | A | B | C | ϕD | ϕE |
|---|---|---|---|---|---|
| L13-2 | 179 | 575 | 40 | 136 | 75 |
| L13-3 | 184 | 597 | 40 | 141 | 75 |
| L13-4 | 189 | 597 | 40 | 146 | 80 |
| L13-5 | 204 | 662 | 40 | 161 | 80 |
| L13-(6~7) | 209 | 640 | 40 | 166 | 90 |
| L13-8 | 220 | 689 | 40 | 177 | 90 |
| L13-9 | 230 | 689 | 40 | 187 | 100 |
| L13-(10~11) | 240 | 689 | 40 | 197 | 110 |
| L13-(12~13) | 250 | 734 | 40 | 207 | 110 |
| L13-14 | 260 | 780 | 40 | 217 | 110 |
| L13-15 | 270 | 783 | 40 | 227 | 120 |
| L13-(16~19) | 280 | 832 | 40 | 237 | 120 |
| L13-(20~22) | 315 | 991 | 40 | 272 | 120 |
| L13-(23~27) | 366 | 7716 | 40 | 323 | 130 |
| L13-(28~31) | 407 | 1338 | 40 | 364 | 140 |

# Coupler PD

This coupler ensures the connection of the second stage tendon to the first stage using mono-coupler.
It is composed of n (n-strand number) pieces of mono-couplers which are set parallelly in the protective sleeve, usually including seven parts : anchor head, bearing plate, spiral reinforcement, protective sleeve, restraining ring, wedges and mono-coupler.

## Coupler Type PD




1.Spiral reinforcement 2.Bearing plate 3.Working anchor head 4.Wedge
5.Mono-strand coupler 6.Protectine sleeve 7.Plate 8.Restraining ring

**Main Data**

Unit:mm

| Spec. / Size | OVM $^{15}_{13}$L-F-3 | OVM $^{15}_{13}$L-F-4 | OVM $^{15}_{13}$L-F-5 | OVM $^{15}_{13}$L-F-6 | OVM $^{15}_{13}$L-F-7 | OVM $^{15}_{13}$L-F-8 | OVM $^{15}_{13}$L-F-9 | OVM $^{15}_{13}$L-F-12 | OVM $^{15}_{13}$L-F-19 | OVM $^{15}_{13}$L-F-27 | OVM $^{15}_{13}$L-F-31 | OVM $^{15}_{13}$L-F-37 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ϕA | 80 (75) | 85 (80) | 85 (80) | 100 (90) | 100 (90) | 110 (90) | 100 (100) | 120 (110) | 140 (120) | 180 (140) | 180 (145) | 200 (170) |
| B | 58 (53) | 63 (58) | 63 (58) | 80 (68) | 80 (68) | 90 (68) | 90 (80) | 100 (90) | 110 (100) | 130 (110) | 140 (115) | 150 (130) |
| C | 840 (830) | 1080 (1060) | 1090 (1080) | 810 (790) | 1130 (1090) | 1450 (1420) | 1150 (1130) | 1200 (1180) | 1310 (1250) | 1420 (1360) | 1410 (1400) | 1560 (1430) |

The figures in brackets are for OVM.13L-F.

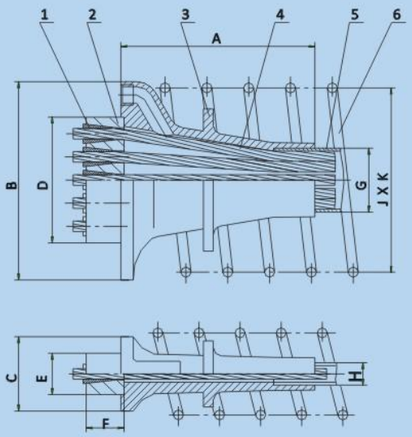




# Stressing-end Slab Anchorage BM13/15

Slab anchorage is widely used in high-rise buildings, which ensures greater span with reduced structural floor depth, proven to be a rapid and economical solution.

## Stressing-end Slab Anchorage



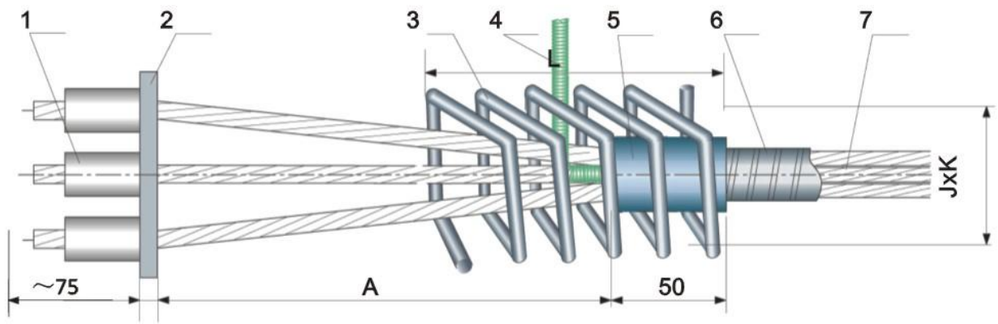

1.Wedge 2.Slab anchor head 3.Slab bearing plate
4.Strand 5.Steel flat duct 6.Spiral reinforcement

**Main Data**

Unit:mm

| Strand number | Bearing plate | | | Anchor head | | | Duct | | Spiral reinforcement |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | J x K |
| 2 | 120 | 150 | 70 | 80 | 48 | 50 | 50 | 19 | 130 x 100 |
| 3 | 150 | 180 | 70 | 115 | 48 | 50 | 60 | 19 | 170 x 100 |
| 4 | 210 | 220 | 70 | 150 | 48 | 50 | 70 | 19 | 210 x 100 |
| 5 | 250 | 260 | 70 | 185 | 48 | 50 | 90 | 19 | 250 x 100 |

# Dead-end Slab Anchorage Type BP




1.Swaged end 2.P-bearing plate 3.Spiral reinforcement
4.Vent 5.Restraining ring 6.Flat duct 7.Strand

## Main Data

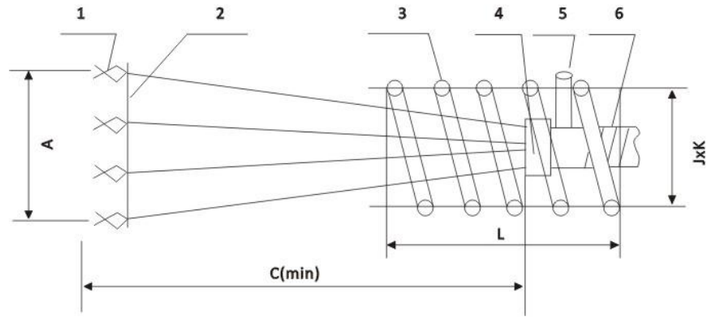
Unit:mm

| Strand number | Anchor plate | | Spiral reinforcement | Restraining ring | | Slab duct | | A Min |
|---|---|---|---|---|---|---|---|---|
| | Length | Width | L×J×K | Length | Width | Length | Width | |
| 2 | 140 | 70 | 180 ×130 × 100 | 90 | 50 | 50 | 19 | 190 |
| 3 | 180 | 70 | 180 × 170 × 100 | 90 | 50 | 60 | 19 | 250 |
| 4 | 220 | 70 | 180 × 210 × 100 | 100 | 50 | 70 | 19 | 320 |
| 5 | 260 | 70 | 225 × 250 × 100 | 100 | 50 | 90 | 19 | 400 |





# Dead-end Slab Anchorage Type BH




1.Bulb
2.Spacer
3.Spiral reinforcement
4.Restraining ring
5.Vent
6.Duct

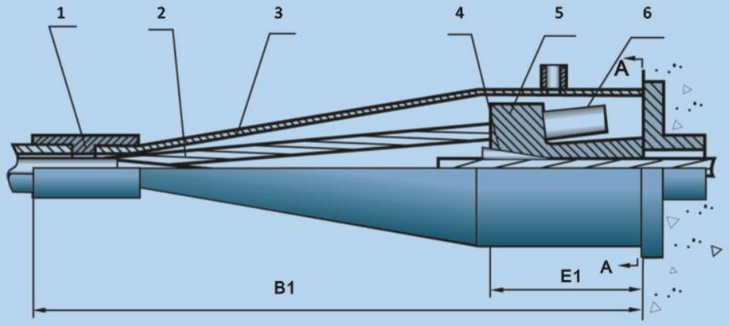
## Assembly of Dead-end Slab Anchorage

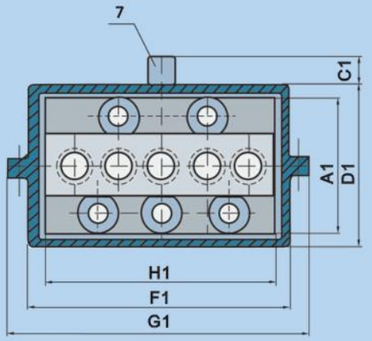

## Main Data

Unit:mm

| Strand number | A | C(min) | Spiral reinforcement L×J×K | Restraining ring | |
|---|---|---|---|---|---|
| | | | | Length | Width |
| 2 | 90 | 950 | 210 × 130 × 100 | 90 | 50 |
| 3 | 190 | 950 | 210 × 170 ×100 | 90 | 50 |
| 4 | 240 | 950 | 210× 210 ×100 | 100 | 50 |
| 5 | 270 | 950 | 260 × 250 × 100 | 100 | 50 |

# Coupler of Slab Anchorage Type BL




1 Restraining ring
2 Steel strand
3 Protective cover
4 Working wedge
5 Coupler block
6 Swaged end
7 Vent

## Main Data

Unit:mm

| Strand number | A1 | B1 | C1 | D1 | E1 | F1 | G1 | H1 |
|---|---|---|---|---|---|---|---|---|
| 2 | 100 | 700 | 25 | 118 | 135 | 90 | 130 | 80 |
| 3 | 100 | 700 | 25 | 118 | 135 | 125 | 165 | 115 |
| 4 | 100 | 750 | 25 | 118 | 135 | 160 | 200 | 150 |
| 5 | 100 | 750 | 25 | 118 | 135 | 195 | 235 | 185 |





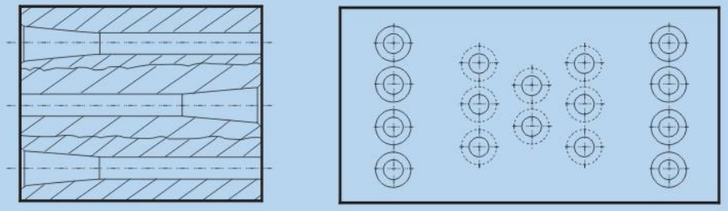
# Ring Anchoring System OVM.HM

## Application Field

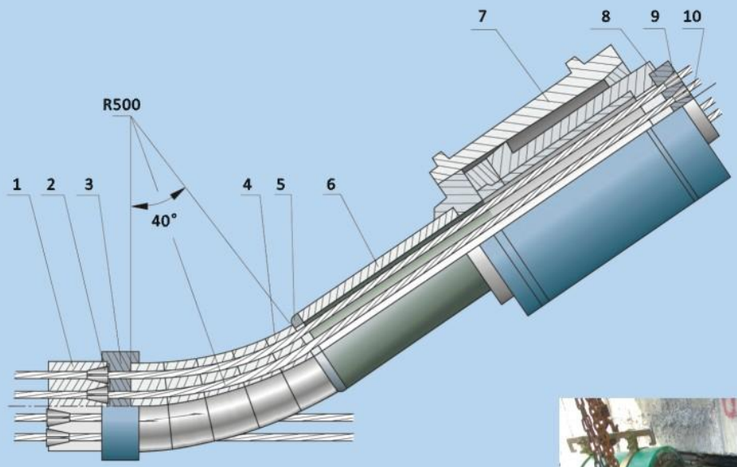
- Round PC storage tank, such as silo, liquid gas tank and sewage treatment tank
- PC containment of nuclear reactor
- PC Hydrodynamic tunnel and well
- Other similar round prestress concrete structure

When prestressing is applied to a ring structure, **OVM.HM** anchoring system is recommended. Both stressing end and dead end of ring prestressing tendon are overlapped and staggered at a same anchor head as a coupler. A special deviating device is required for tensioning tendons.

## Anchor Head of Ring Anchoring System

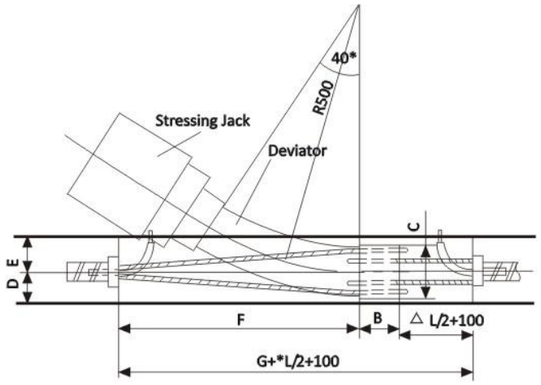


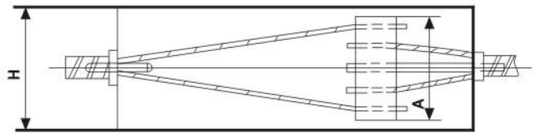
## OVM.HM Ring Anchoring System




1.HM.anchor head 2.Wedge 3.Spacer
4.Deviator 5.Transfer block 6.Stretch tube
7.Jack 8.Tool anchor head 9.Tool wedge
10.P.C.strand

## Structural Diagram of OVM.HM Anchoring System




**Main Data**

Unit:mm

| Designation | A | B | C | D | F | H |
|---|---|---|---|---|---|---|
| HM15-2 | 160 | 65 | 50 | 50 | 150 | 200 |
| HM15-4 | 160 | 80 | 90 | 65 | 800 | 200 |
| HM15-6 | 160 | 100 | 130 | 80 | 800 | 200 |
| HM15-8 | 210 | 120 | 160 | 100 | 800 | 250 |
| HM15-12 | 290 | 120 | 180 | 110 | 800 | 320 |
| HM15-14 | 320 | 125 | 180 | 110 | 1000 | 340 |

Parameter E and G would be determined according to actual engineering structure.



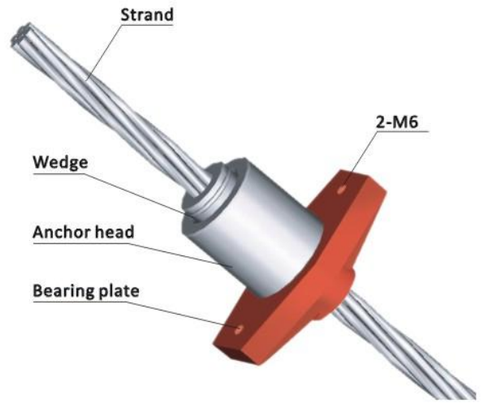


# Mono-strand Post-tensioning Systems

## Mono-strand Anchorage for Strand Dia.12.7/15.24/15.7/17.8/21.8/28.6mm

## Assembly of Mono-strand Anchorage

Mono-strand coupler

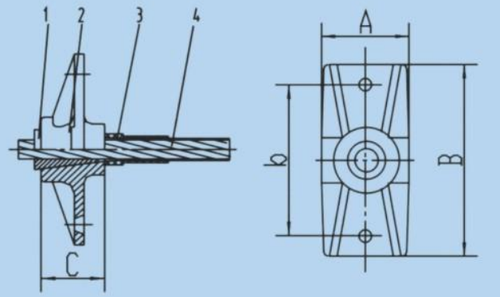



**Main Data**

Unit:mm

| Designation | Bearing plate | Anchor head | Spiral reinforcement | | | | Stressing jack |
|---|---|---|---|---|---|---|---|
| | AxBx ϕ C | ϕ ExF | ϕ G | ϕ H | I | N | |
| OVM.M15-1 | 80x80x ϕ 14 | ϕ 46x48 | ϕ 80 | ϕ 6 | 30 | 4 | YDC240QX |
| OVM.M13-1 | 80x80x ϕ 14 | ϕ 43x43 | ϕ 80 | ϕ 6 | 30 | 3 | YDC240QX |
| OVM.M15A-1 | | ϕ 50x48 | ϕ 80 | ϕ 6.5 | 30 | 4 | YDC240QX |
| OVM.M13A-1 | | ϕ 40 x 40 | ϕ 80 | ϕ 6.5 | 30 | 3 | YDC240QX |

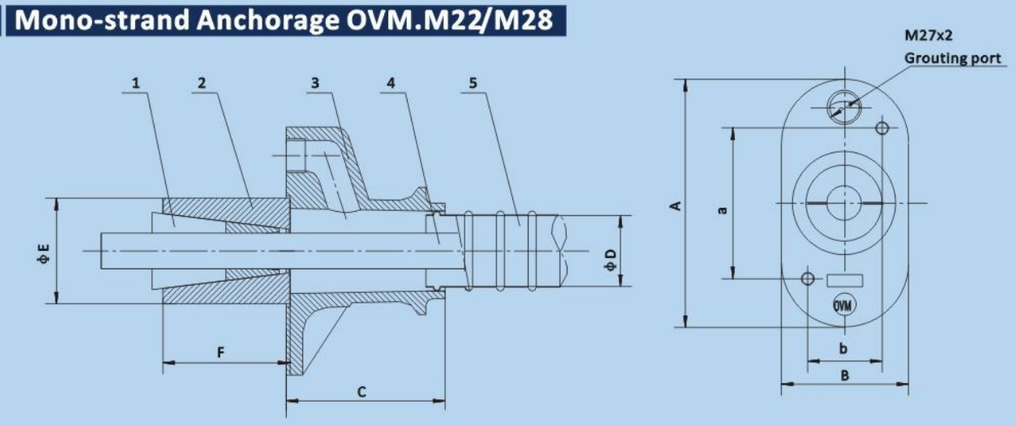
## Mono Unbonded Strand Anchorage OVM.ZM13/ZM15




1.Working wedge 2.Bearing plate 3.Casing 4.Unbonded strand

| Designation | Bearing plate | |
|---|---|---|
| | AxBxC | Installation distance b |
| OVM.ZM13-1 | 58x127x40 | 100 |
| OVM.ZM15-1 | 65x130x48 | 100 |

## Mono-strand Anchorage OVM.M22/M28




1.Working wedge 2.Working anchor head 3.Bearing plate 4.Strand 5.Plastic duct

### Main Data

Unit:mm

| Designation | Bearing plate | | Duct | Anchor head |
|---|---|---|---|---|
| | AxBxC | Installation distance a x b | (I.D) | ϕExF |
| OVM.M22-1 | 145x90x100 | 80x58 | ϕ30 | ϕ65x75 |
| OVM.M28-1 | 195x100x125 | 120x60 | ϕ40 | ϕ85x100 |

Jack YC75Q is used for stressing OVM.M28-1 and OVM.M22-1.Hydraulic pump ZB4-500 serves the operation.

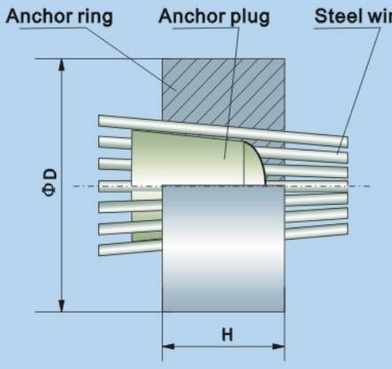




# Anchorage using wires

## GZ Anchorage

It is used to anchor Φ5 / Φ7 wires with strength 1570/1670MPa. YZ series jack equipped with ZB4-500 hydraulic pump serve the operation.




### Main Data

Unit:mm

| Designation | Wire | Nos | ΦD | H |
|---|---|---|---|---|
| GZ5-12 | Φ5 | 12 | 100 | 40 |
| GZ5-18 | Φ5 | 18 | 100 | 40 |
| GZ5-24 | Φ5 | 24 | 108 | 53 |
| GZ5-28 | Φ5 | 28 | 136 | 53 |
| GZ5-30 | Φ5 | 30 | 136 | 53 |
| GZ7-12 | Φ7 | 12 | 140 | 63 |
| GZ7-24 | Φ7 | 24 | 140 | 63 |

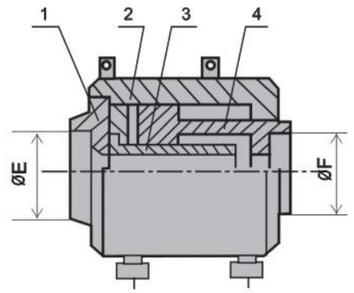
# YZ Series Jacks for GZ Anchorage

### Main Data

| Type | Nom. stress force (kN) | Nom. pressure (MPa) | Pressing force (kN) | Wedge release force (kN) | Stress piston area($m^2$) | Press piston area($m^2$) | Return piston area($m^2$) | Stroke (mm) | Pressing stroke (mm) | Mass (Kg) | Dimension (DxL mm) | Adapted pump |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YZ85-400 | 850 | 46 | 390 | 260 | $1.887x10^{-2}$ | $8.659x10^{-3}$ | $5.595x10^{-3}$ | 400 | 65 | 190 | ϕ326x990 | ZB4-500 |
| YZ150-300 | 1500 | 50 | 769 | 412 | $2.835x10^{-2}$ | $1.53x10^{-2}$ | $8.247x10^{-3}$ | 300 | 65 | 198 | ϕ363x1005 | ZB4-500 |

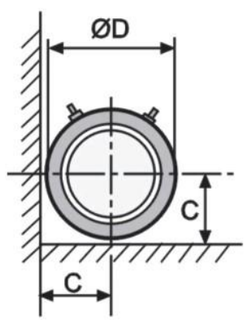
# Hydraulic Jack YCWA Series

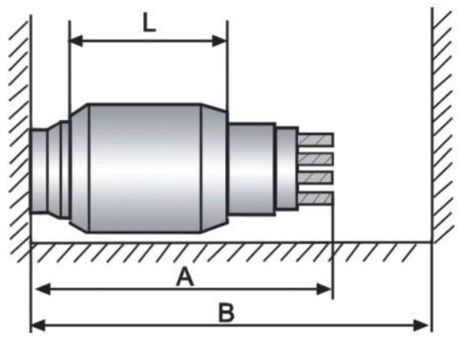

YCWA series hydraulic jack is widely applied to pre-tensioning and post-tensioning. When equipped with different accessories, it is able to tension OVM multi-strand anchorage, DM heading anchorage and stay cable anchorage etc.




1.Block 2.Cylinder 3. Cavity sleeve 4. Piston

## Min. Service Space




## Main Data

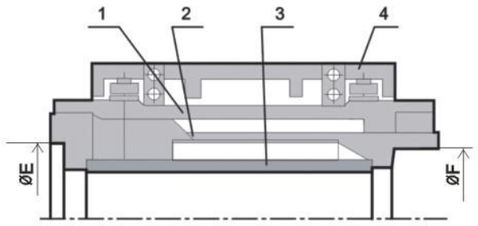
| Type | Nom. force (kN) | Nom. pressure (MPa) | Tension piston area($m^2$) | Return piston area($m^2$) | Return pressure (MPa) | Cavity aperture (mm) | Stroke (mm) | Mass (Kg) | Overall size (DxL mm) | Min. service space (mm) | Strand reserved length A (mm) | Installation size | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | ΦE | ΦF |
| YCW650A | 6500 | 49 | $1.35x10^{-1}$ | $7.07x10^{-2}$ | <20 | Φ240 | 200 | 960 | Φ610x640 | 2000x330 | 850 | Φ362 | Φ302 |
| YCW900A | 8952 | 54 | $1.6579x10^{-1}$ | $8.7258x10^{-2}$ | <25 | Φ280 | 200 | 1235 | Φ670x600 | 2200x450 | 1000 | Φ392 | Φ372 |
| YCW1200A | 11790 | 51 | $2.313x10^{-1}$ | $11.5375x10^{-2}$ | <25 | Φ275 | 200 | 1700 | Φ790x600 | 2400x500 | 1200 | Φ421 | Φ421 |





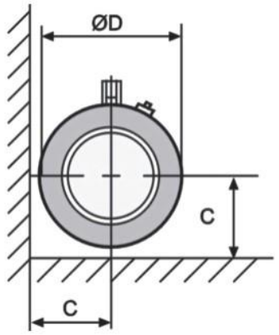
# Hydraulic Jack YCWB Series

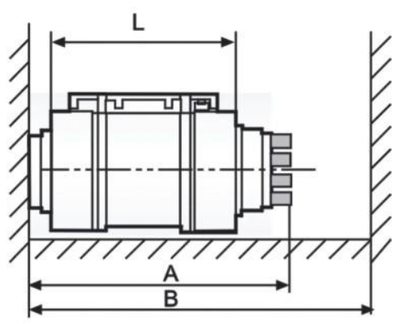

Based on the merit of YCWA series hydraulic jack, YCWB series lightweight hydraulic jack was invented.




1.Cylinder 2.Piston 3.Cavity sleeve 4.Handle

## Min. Service Space

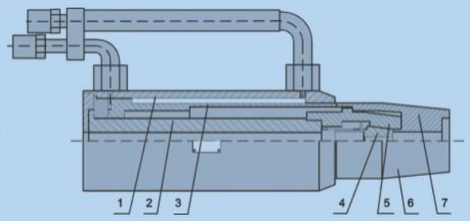



## Main Data

| Type | Nom. force (kN) | Nom. pressure (MPa) | Tension piston area($m^2$) | Return piston area($m^2$) | Return pressure (MPa) | Cavity aperture (mm) | Stroke (mm) | Mass (Kg) | Overall size (D*L mm) | Min. service space (mm)B*C | Strand reserved length A (mm) | Installation size | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Φ E | Φ F |
| YCW100B | 973 | 51 | $1.908x10^{-2}$ | $0.777x10^{-2}$ | <25 | Φ 78 | 200 | 65 | Φ214X370 | 1220X150 | 570 | Φ 151 | Φ 151 |
| YCW150B | 1492 | 50 | $2.98x10^{-2}$ | $1.38x10^{-2}$ | <25 | Φ 120 | 200 | 108 | Φ285X370 | 1250X190 | 570 | Φ 196 | Φ 176 |
| YCW250B | 2480 | 54 | $4.592x10^{-2}$ | $2.802x10^{-2}$ | <25 | Φ 140 | 200 | 164 | Φ344X380 | 1270X220 | 590 | Φ 210 | Φ 186 |
| YCW350B | 3497 | 54 | $6.476x10^{-2}$ | $3.462x10^{-2}$ | <25 | Φ 175 | 200 | 246 | Φ410X404 | 1320X250 | 620 | Φ 252 | Φ 252 |
| YCW400B | 3956 | 52 | $7.607x10^{-2}$ | $4.592x10^{-2}$ | <25 | Φ 175 | 200 | 270 | Φ432X400 | 1320X265 | 620 | Φ 252 | Φ 252 |
| YCW500B | 4924 | 49 | $10.05x10^{-2}$ | $4.773x10^{-2}$ | <25 | Φ 196 | 200 | 533 | Φ490X564 | 1960X310 | 750 | Φ 362 | Φ 302 |

# Mono-jack YDC240QX

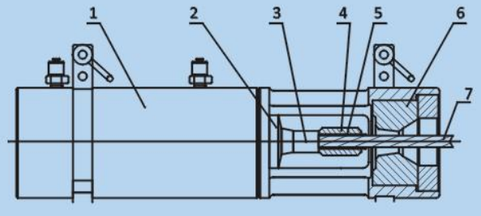



1.Cylinder 2.Cavity sleeve 3.Piston 4.Wedge
5.Anchor cup 6.Supporting sleeve 7.Supporting nut

## Main Data

| Type | Nom. force (kN) | Nom. pressure (MPa) | Tension piston area ($m^2$) | Return pressure (MPa) | Cavity aperture (mm) | Stroke (mm) | Mass (Kg) | Dimension DxL (mm) | Adapted strands |
|---|---|---|---|---|---|---|---|---|---|
| YCW240QX | 240 | 50 | $4.771x10^{-3}$ | <40 | Φ17 | 200 | 20.5 | Φ210x568 | Φ13 & Φ15 |

# Swaging Machine GYJC50-150




1.Cylinder 2.Piston 3.Swaging head 4. Swaged tube
5.Swaged spring 6.Swaging mould 7. Strand

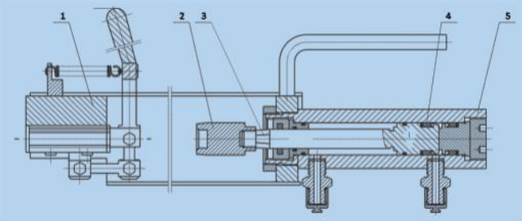
## Main Data

| Type | Nom. force (kN) | Nom. pressure (MPa) | Swaging piston area ($m^2$) | Return piston area ($m^2$) | Cavity aperture (mm) | Stroke (mm) | Mass (Kg) | Dimension DxL (mm) | Adapted pump |
|---|---|---|---|---|---|---|---|---|---|
| GYJC50-150 | 503 | 50 | $1.005x10^{-2}$ | $4.9485x10^{-3}$ | Φ30 | 150 | 48 | Φ150x565 | ZB4-500 |





# Bulb Machine YH3



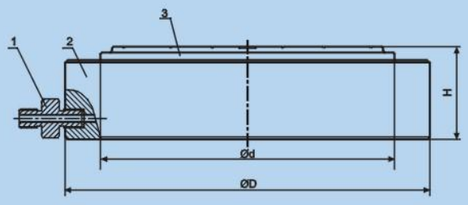

1.Engine body 2.Pushing head 3.Piston 4.Seal ring 5.Cylinder

## Main Data

| Type | Nom. Force (kN) | Nom. Pressure (MPa) | Tension piston area ($m^2$) | Return piston area ($m^2$) | Mass (Kg) | Dimension LxWxH (mm) | Diameter of bulb (Φ15mm strand) (mm) |
|---|---|---|---|---|---|---|---|
| YH3 | 34 | 50 | $7.068x10^{-4}$ | $4.524x10^{-4}$ | 13.6 | 535x150x224 | Φ90±5 |

# Flat Jack YBD Series

The compact design of YBD series flat jack perfectly fit the narrow space, especially for the replacement of bridge bearings and maintenance of large equipments.




1. Nozzle 2. Cylinder 3. Piston

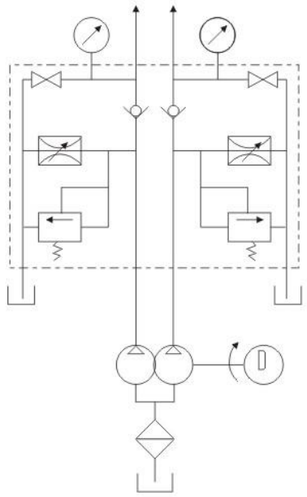
## Main Data

| Type | Nom. force (kN) | Nom. pressure(MPa) | Stroke (mm) | Dimension (mm) |
|---|---|---|---|---|
| YDB100-10 | 1000 | 50 | 10 | Φ220×50 |
| YDB100A-30 | 1000 | 50 | 30 | Φ220×80 |
| YDB250-18 | 2500 | 50 | 18 | Φ310×78 |
| YDB350-18 | 3500 | 49 | 18 | Φ380×107 |
| YDB400-18 | 4000 | 50 | 18 | Φ408×107 |

# Hydraulic Pump ZB4-500/500S/500SZ/500ZA

## ZB4-500 Hydraulic Pump


## Oil Circuit of ZB4-500 Pump

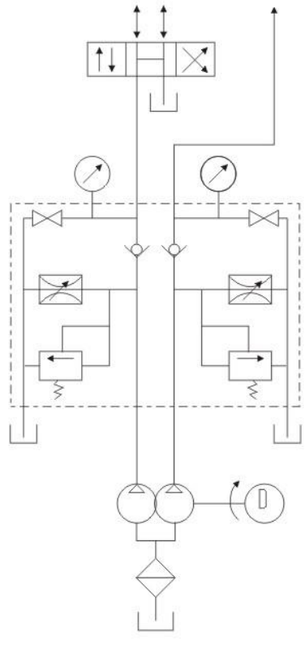


## ZB4-500S Hydraulic Pump





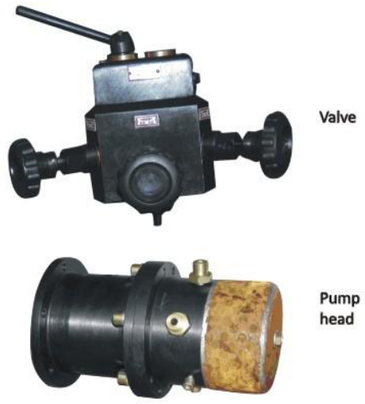
## Oil Circuit of ZB4-500S Pump







## ZB10/320-4/800B Hydraulic Pump

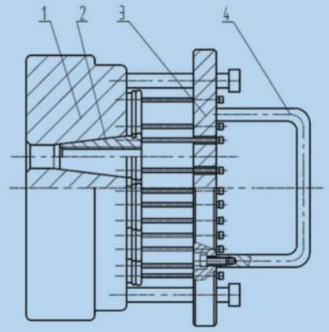

### Main Data

| Type | Nom. pressure (MPa) | Nom. flow (L/min.) | Mass (Kg) | Dimension LxWxH (mm) | Remarks |
|---|---|---|---|---|---|
| ZB4-500 | 50 | 2x2 | 120 | 745x494x1052 | To provide pressure oil for YCW, YZ85 and YC60 series jacks, as well as GYJC swaging machine etc. |
| ZB4-500S | 50 | 2x2 | 130 | 745x494x1052 | Three-way oil feeding, especially for jacks with pressing piston. It can also fulfill the function of ZB4-500 pump. |
| ZB10/320-4/800B | 32<br>80 | 10<br>4 | 270 | 1090x590x1120 | Two stage variable pump, for large tonnage, long stroke and rapid jacks. |
| ZB4-500ZA | 50 | 2x2 | 120 | 1020x530x950 | Modified ZB4-500 |
| ZB4-500SZ | 50 | 2x2 | 130 | 1020x530x950 | Modified ZB4-500S |

## Modified ZB4-500—ZB4-500ZA

## Modified ZB4-500S—ZB4-500SZ

# Tool Anchorage OVM15G/13G




1.Anchor head
2.Tool wedge
3.Holding plate
4. Handle

## Main Data

| Designation | Dimension of tool anchor head D*L (mm) | No. of tool wedge | Holding plate | Handle | Designation | Dimension of tool anchor head D*L (mm) | No. of tool wedge | Holding plate | Handle |
|---|---|---|---|---|---|---|---|---|---|
| OVM15G-1 | ϕ49*55 | 1 | N | N | OVM13G-1 | ϕ43*47 | 1 | N | N |
| OVM15G-2 | ϕ134*60 | 2 | N | N | OVM13G-3 | ϕ134*60 | 3 | N | N |
| OVM15G-3 | ϕ134*60 | 3 | N | N | OVM13G-4 | ϕ134*60 | 4 | N | N |
| OVM15G-4 | ϕ134*60 | 4 | N | N | OVM13G-5 | ϕ134*60 | 5 | N | N |
| OVM15G-5 | ϕ134*60 | 5 | N | N | OVM13G-6 | ϕ134*60 | 6 | N | N |
| OVM15G-6 | ϕ175*60 | 6 | N | N | OVM13G-7 | ϕ134*60 | 7 | Y/N | Y/N |
| OVM15G-7 | ϕ175*60 | 7 | Y/N | Y/N | OVM13G-8 | ϕ134*60 | 8 | Y | Y |
| OVM15G-8 | ϕ175*60 | 8 | Y | Y | OVM13G-9 | ϕ175*60 | 9 | Y | Y |
| OVM15G-9 | ϕ175*60 | 9 | Y | Y | OVM13G-12 | ϕ175*60 | 12 | Y | Y |
| OVM15G-10 | ϕ184*70 | 10 | Y | Y | OVM13G-13 | ϕ175*60 | 13 | Y | Y |
| OVM15G-11 | ϕ184*70 | 11 | Y | Y | OVM13G-15 | ϕ184*70 | 15 | Y | Y |
| OVM15G-12 | ϕ184*70 | 12 | Y | Y | OVM13G-16 | ϕ184*70 | 16 | Y | Y |
| OVM15G-13 | ϕ194*70 | 13 | Y | Y | OVM13G-17 | ϕ184*70 | 17 | Y | Y |
| OVM15G-14 | ϕ194*70 | 14 | Y | Y | OVM13G-19 | ϕ184*70 | 19 | Y | Y |
| OVM15G-15 | ϕ250*80 | 15 | Y | Y | OVM13G-21 | ϕ250*70 | 21 | Y | Y |
| OVM15G-16 | ϕ250*90 | 16 | Y | Y | OVM13G-22 | ϕ250*70 | 22 | Y | Y |
| OVM15G-17 | ϕ250*90 | 17 | Y | Y | OVM13G-27 | ϕ250*70 | 27 | Y | Y |
| OVM15G-18 | ϕ250*90 | 18 | Y | Y | OVM13G-31 | ϕ300*120 | 31 | Y | Y |
| OVM15G-19 | ϕ250*90 | 19 | Y | Y | OVM13G-43 | ϕ300*110 | 43 | Y | Y |
| OVM15G-21 | ϕ300*120 | 21 | Y | Y | | | | | |
| OVM15G-22 | ϕ300*100 | 22 | Y | Y | | | | | |
| OVM15G-25 | ϕ300*120 | 25 | Y | Y | | | | | |
| OVM15G-27 | ϕ300*120 | 27 | Y | Y | | | | | |
| OVM15G-31 | ϕ300*120 | 31 | Y | Y | | | | | |
| OVM15G-34 | ϕ370*140 | 34 | Y | Y | | | | | |
| OVM15G-37 | ϕ370*140 | 37 | Y | Y | | | | | |





# Grouting Machine

## Basic Type

## Mortar Pump UB3


| | | |
|---|---|---|
| Pumping capacity ($m^3$/h) | | 3 |
| Working pressure (MPa) | | 2 |
| Power of electromotor (kw) | | 4 |
| Rev of electromotor (r/min) | | 1440 |
| When water weight / concrete weight = 0.43 | Horizontal delivery capacity (m) | 400 |
| | Vertical delivery capacity (m) | 80 |
| Inner dia. of mortar Inlet (mm) | | 64 |
| Inner dia. of mortar outlet (mm) | | 38 |
| Mass (Kg) | | 250 |
| Dimension L*W*H (mm) | | 1033*474*940 |

## Grout Mixer JW180

| | |
|---|---|
| Nom. volume (L) | 180 |
| Mixing capability ($m^3$/h) | 6 |
| Power of electromotor (kw) | 2.2 |
| Inner dia. of mortar outlet (mm) | 70 |
| Mixing speed (r/min) | 64 |
| Loading height (mm) | 900 |
| Mass (Kg) | 200 |
| Dimension D*H (mm) | ϕ900*1146 |

## Advanced Type

# Grouting Machine MR-60

| Performance | |
|---|---|
| Max Pumping capacity at 200rpm | 53 liters/Min.- at 3 Bar |
| Max output pressure at 200 rpm | 60 Bar |
| Type of pump | Eccentric screw (Made in Germany) |
| Suction hose (Dia.) | 1" fast coupling |

| Mixer data | |
|---|---|
| Drive unit | Electric drive |
| Electric drive | 7.5HP 380V-3-5Hz 8.8A with IP54 |
| Drive speed | 1440 rpm |
| Capacity Dia x Height-Liters with Cover | ϕ 85 cm x 60 cm -135 liters Max |

| Agitator data | |
|---|---|
| Drive unit | Electric drive |
| Electric drive | 7.5HP 380V-3-50Hz 8.8A with IP 54 |
| Drive speed | 200 rpm |
| Capacity Dia x Height-Liters | ϕ 60 cm x 70 cm -170 liters Max |

| Water tank data | |
|---|---|
| Capacity L x W x H - Liters Max | 40 cm x 40 cm x 60 cm - 85 liters |
| **Electric data** | |
| Power input | 380V-3 phase-50Hz AC 5-Pin 6h, fuse 32A |
| **Grouting platform dimension & Mass** | |
| Length x Width x Height | 2,150 mm X 1,180 mm X 2,010 mm |
| Mass | 880 Kg |

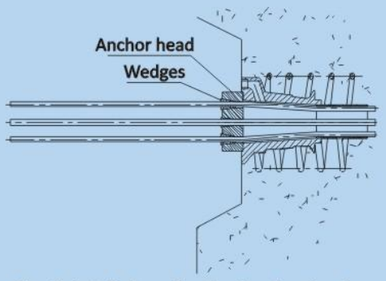




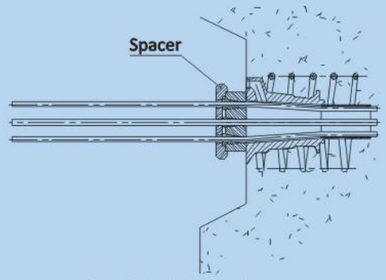
# 15HP / 30HP Strand Pushing Machine

| Horsepower | 15HP | 30HP |
|---|---|---|
| Electric data | 380 volts, 3 phases, 50 Hz | |
| | 220 volts, 3 phases, 60 Hz | |
| Fuse | >100A | >125A |
| Pushing capacity | 80 M/Min | 160M/Min |
| Rotational speed of motor | 940 RPM | 1450 RPM |
| Hydraulic pump max pressure | 210 Kg/cm² | 210 Kg/cm² |
| Overall dimension L*W*H | 1220*1280*1000mm | 1450*1550*1400mm |
| Mass | 480 Kg | 800 Kg |

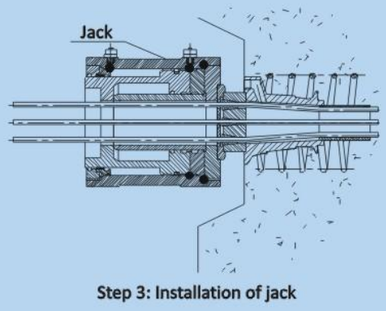
# Installation and Stressing



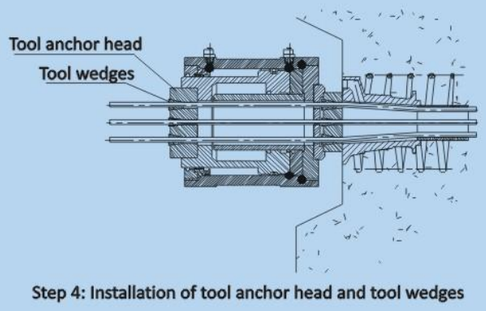

Step 1: Installation of anchor head and wedges



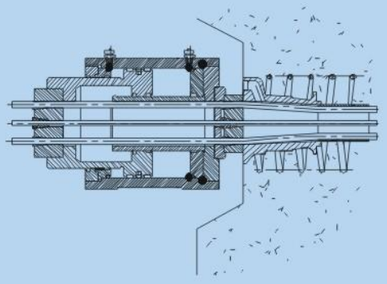

Step 2: Installation of spacer



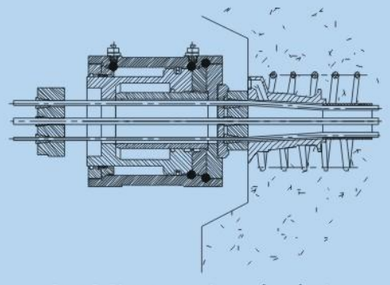

Step 3: Installation of jack



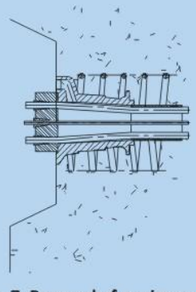

Step 4: Installation of tool anchor head and tool wedges



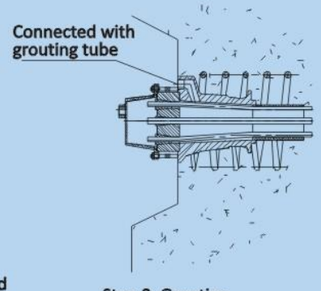
Step 5: Stressing



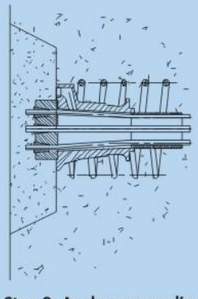
Step 6: Piston returning and anchoring



Step 7: Removal of equipment and cutting of extra strand




Step 8: Grouting



Step 9: Anchorage sealing





# Design Considerations

■ Friction losses in anchorage
The coefficient of friction is no more than 0.025.

■ Stress losses due to draw-in of wedges
The draw-in value of OVM anchorage is $\lambda \leqslant 5$mm, and $\lambda \leqslant 6$mm is recommended for calculation of the stress losses due to draw-in action.

■ Friction losses along tendon
Friction losses along the tendon are actually the stress losses due to the friction between tendon and duct, which can be determined with the following formula.

$$\sigma_{12} = \sigma_{con}\left(1 - \frac{1}{e^{kx+\mu\theta}}\right)$$

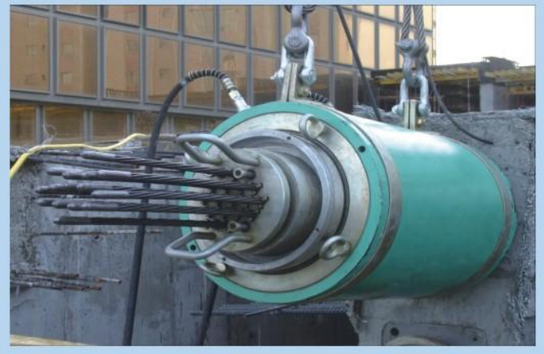
$\sigma_{12}$ --- prestress losses caused by friction between tendon and its duct (MPa)

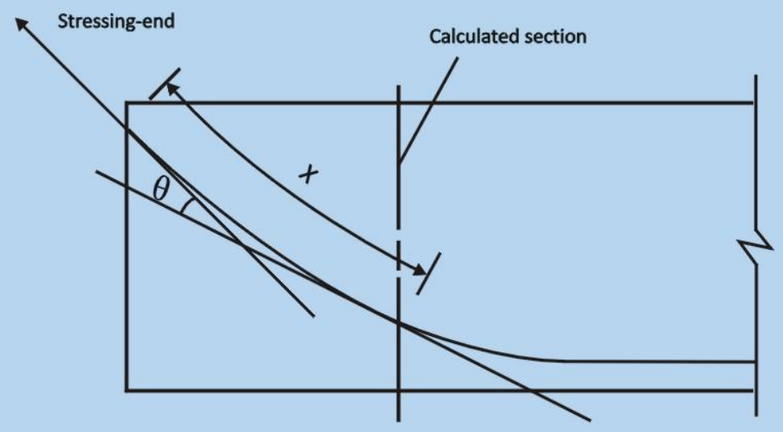
$\sigma_{con}$ --- Section stress without losses.

X---Duct length between stressing-end and calculated section (m)

$\theta$ --- Accumulated angle (rad)

$\mu$ , k --- friction coefficient, refers to Table 1 and 2.





## Table1: Coefficient when using strand and duct

| Duct mode | K | μ | |
|---|---|---|---|
| | | Wire, strand, bare steel bar | Deformed bar |
| Embedded Steel Pipe | 0.003 | 0.35 | 0.40 |
| Embedded Corrugated Pipe | 0.0015 | 0.25 | - |
| Core-Pulling Formed | 0.0015 | 0.55 | 0.60 |
| Plastic Corrugated Pipe | 0.001-0.003 | 0.14 | - |

When GZ anchorage or Similar anchorages are used, the anchoring port friction loss would be taken into consideration, which can be determined by the actual data measured.

## Table 2: Coefficient when using unbonded strand

| Unbonded prestressed tendon | K | μ |
|---|---|---|
| 7 Φ 5 carbon steel wire | 0.035 | 0.10 |
| Φ 15 Steel strand | 0.040 | 0.12 |

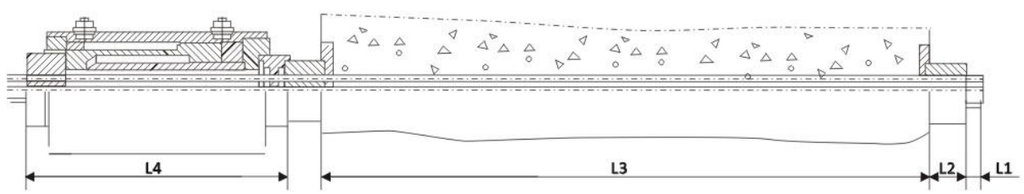
The friction coefficients of strands with other diameters refer to that of Φ15mm strand.

### Calculation of Strand length

● When using anchorage with wedges on both sides and tensioning on one side, as the diagram as follows, L (length of strand) can be determined with the formula: L= L1+2*L2+L3+L4+100~150mm

● When using anchorage with wedges on both sides and tensioning on both sides, L (length of strand) can be determined with the formula:
L= L3+2*(L2+L4)+200~300mm

● When using dead-end anchorage type P or type H on one side of tendon, the length of strand shall be considered up to the embedding position of anchorage.



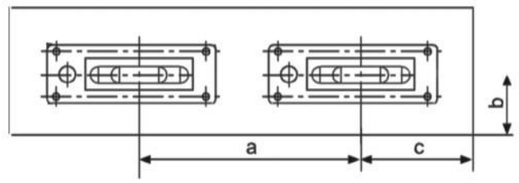

Calculation of length of strand (tensioning on one side)



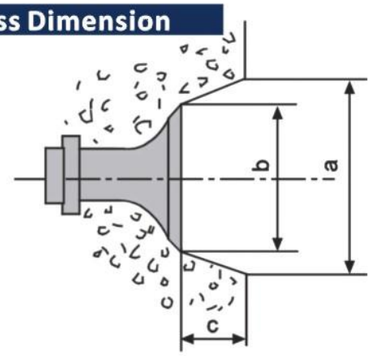


# Minimum Interval of Anchorage

### Slab Anchorage




### Recess Dimension




## Slab Anchorage

Unit:mm

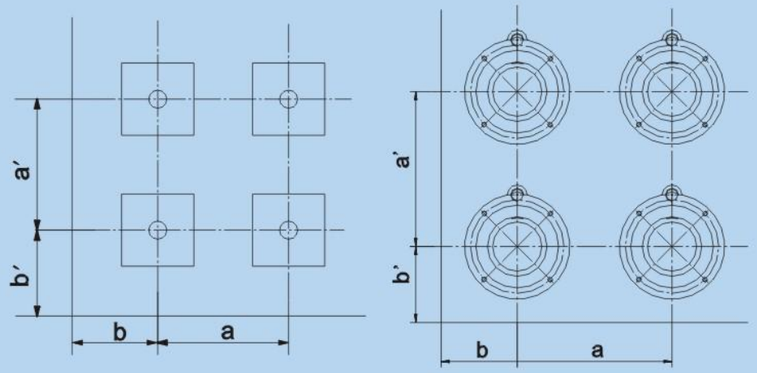
| Designation | Actual Concrete Strength (Cube Sample) | | | | | |
|---|---|---|---|---|---|---|
| | 40(MPa) | | | 50(MPa) | | |
| | a | b | c | a | b | c |
| BM15-2 | 230 | 75 | 115 | 220 | 70 | 110 |
| BM15-3 | 270 | 80 | 135 | 240 | 75 | 130 |
| BM15-4 | 340 | 95 | 170 | 330 | 90 | 165 |
| BM15-5 | 370 | 95 | 185 | 360 | 90 | 180 |

## Recess Dimension

| Designation | a(mm) | b(mm) | c(mm) |
|---|---|---|---|
| OVM.M15(13)-2~4 | 265(265) | 160(160) | 90(90) |
| OVM.M15(13)-5 | 335(265) | 230(160) | 90(90) |
| OVM.M15(13)-6~7 | 430(275) | 290(160) | 120(100) |
| OVM.M15(13)-8~11(8~12) | 430(370) | 290(220) | 120(130) |
| OVM.M15(13)-12~14 | 490 - | 340 - | 130 - |
| OVM.M15(13)-15~19(13~19) | 520(437) | 360(275) | 140(140) |
| OVM.M15(13)-20~22 | 575(500) | 400(330) | 150(150) |
| OVM.M15(13)-23~29(23~31) | 620(535) | 440(340) | 150(170) |
| OVM.M15(13)-30~37(32~37) | 710(600) | 510(385) | 170(190) |
| OVM.M15(13)-38~44 | 760(710) | 540(470) | 190(210) |
| OVM.M15(13)-45~55 | 860(775) | 620(520) | 210(220) |

## Conventional Anchorage

a,a` ⩾$a_o$; b,b`⩾$b_o$;
$a_o$——minimum interval between bearing plates
$b_o$——minimum distance between bearing plate centre and side face of concrete.




| Specs | Actual Concrete Strength of Anchored Area(Cube Sample) | | | | | |
|---|---|---|---|---|---|---|
| | 40(MPa) | | 50(MPa) | | 60(MPa) | |
| | $a_o$(mm) | $b_o$(mm) | $a_o$(mm) | $b_o$(mm) | $a_o$(mm) | $b_o$(mm) |
| OVM.M15(13)-2 | 140(120) | 90(85) | 135(120) | 85(85) | 130(120) | 85(85) |
| OVM.M15(13)-3 | 170(145) | 110(95) | 155(135) | 95(90) | 145(125) | 95(90) |
| OVM.M15(13)-4 | 198(180) | 120(115) | 176(150) | 110(100) | 168(140) | 107(100) |
| OVM.M15(13)-5 | 220(195) | 135(115) | 200(170) | 120(105) | 184(155) | 117(105) |
| OVM.M15(13)-6 | 240(200) | 155(125) | 224(180) | 135(115) | 224(180) | 132(115) |
| OVM.M15(13)-7 | 260(220) | 160(135) | 235(200) | 140(115) | 224(190) | 132(115) |
| OVM.M15(13)-8 | 275(235) | 165(140) | 250(210) | 150(120) | 246(200) | 147(120) |
| OVM.M15(13)-9 | 295(245) | 175(155) | 265(225) | 155(130) | 256(210) | 153(128) |
| OVM.M15(13)-10 | 310(260) | 180(155) | 280(235) | 170(141) | 290(232) | 170(141) |
| OVM.M15(13)-11 | 325(270) | 185(165) | 295(245) | 170(145) | 290(232) | 170(141) |
| OVM.M15(13)-12 | 340(285) | 190(180) | 310(260) | 170(150) | 290(245) | 170(141) |
| OVM.M15(13)-13 | 355(300) | 195(190) | 320(270) | 175(160) | 300(255) | 170(150) |
| OVM.M15(13)-14 | 365(310) | 210(195) | 330(280) | 180(165) | 320(255) | 178(150) |
| OVM.M15(13)-15 | 380(316) | 220(195) | 345(290) | 185(165) | 330(275) | 185(155) |
| OVM.M15(13)-16 | 390(330) | 235(200) | 355(300) | 195(170) | 335(285) | 185(155) |
| OVM.M15(13)-17 | 405(340) | 250(205) | 370(310) | 210(175) | 345(295) | 187(155) |
| OVM.M15(13)-18 | 445(350) | 255(205) | 380(315) | 215(175) | 355(300) | 190(170) |
| OVM.M15(13)-19 | 430(360) | 255(215) | 390(325) | 215(180) | 365(310) | 190(170) |
| OVM.M15(13)-21 | 455(380) | 268(225) | 410(345) | 223(190) | 390(325) | 205(180) |
| OVM.M15(13)-22 | 485(390) | 270(230) | 415(350) | 225(195) | 410(330) | 205(180) |
| OVM.M15(13)-25 | 500(410) | 285(240) | 450(375) | 235(200) | 425(350) | 220(190) |
| OVM.M15(13)-27 | 510(430) | 295(250) | 460(390) | 245(210) | 435(370) | 220(190) |
| OVM.M15(13)-37 | 600(500) | 350(285) | 545(460) | 295(250) | 510(430) | 270(221) |
| OVM.M15(13)-43 | 645(545) | 405(320) | 585(495) | 340(270) | 555(465) | 300(240) |
| OVM.M15(13)-55 | 730(610) | 440(360) | 660(555) | 370(300) | 620(520) | 330(270) |





# Features of OVM External Prestressing Systems

■Conform to the *Recommendations for the Acceptance of Post-tensioning Systems & External Prestressing Material and System* by the international FIP and Chinese National Standard of GB/T14370-2007 *Anchorage, Grip and Coupler for Prestressing Tendons*.

■ Durable, with excellent anti-corrosive and anti-fatigue property. Special damping device is equipped to reduce the tendon vibration.

■Easy to inspect, maintain and replace the tendon.

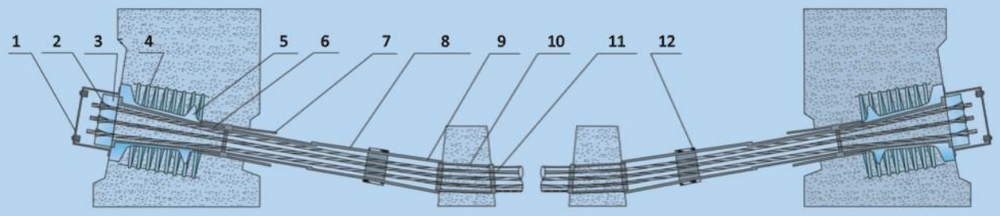
■ Low radius deviator, reduced stress concentration on deviating area.

# Basic Components of OVM External Prestressing Systems

The basic components of external prestressing system include:

- External cables, ducts and grouting materials
- Anchorage system
- Deviating device
- Anti-corrosion system
- Damping device

## OVM External Prestressing System

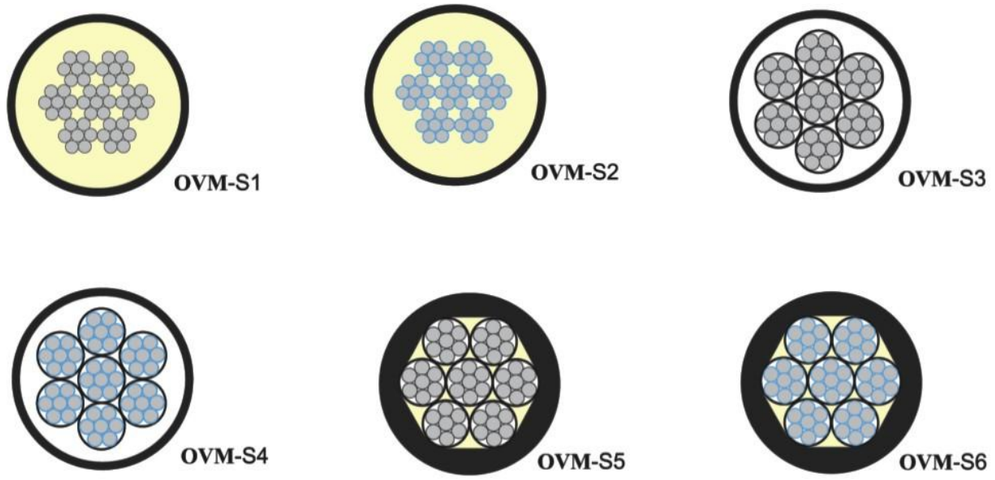



1.Protective cap 2.Working anchorage 3.Anchor head 4.Spiral reinforcement 5.Bearing plate 6.Bush
7.Duct 8.HDPE sheath 9.Connector 10.Deviator 11.Prestressing tendon 12.Damping device

# Anti-corrosion System of External Prestressing Cables

There are six types of OVM external prestressing cables:

OVM-S1, OVM-S2, OVM-S3, OVM-S4, OVM-S5 and OVM-S6.




## Basic components of external prestressing cables

| Type | OVM-S1 | OVM-S2 | OVM-S3 | OVM-S4 | OVM-S5 | OVM-S6 |
|---|---|---|---|---|---|---|
| Strand Type | Bare strand | Epoxy-coated strand | Unbonded strand | Epoxy-coated unbonded strand | Unbonded tendon | Expoxy-coated unbonded tendon |
| Duct | HDPE sheath | | HDPE sheath | | Hot extruded HDPE | |
| Grouting | Mortar,epoxy,grease | | No grout on free length | | No grout on free length | |

OVM-S3 and OVM-S4 is the type without grouting material. These 2 kinds of cables can be removed and replaced. The cables on free length can be inspected at any time. The cable is self-protective with each strand's anti-corrosion performance. The external HDPE sheath is to prevent internal unbonded tendons from being damaged by external factors. The HDPE sheath is made up of one big and one small retractable pipes.





# Deviating Device

Stress condition of strand will be better as the radius of deviator of external cable is increased. But bigger radius will result in bigger structural dimension and bigger deadweight of bridge. So a proper radius is needed on condition of essential safety. Additional stress created by installation and construction can be eliminated by smooth mouth of deviator, and would decrease the abrasion of HDPE sheath as well.

$$V_m = \frac{d}{2R} E$$

d---diameter of wire
R---bending radius
E---elastic modulus of strand

Fatigue strength of bending external prestressing cable is decreased to some extent because of additional flexural stress. So it is needed to check the strand stress plus flexural stress. It is difficult to accurately calculate the flexural stress of strands. But this can be done with the following formula if assuming no friction between steel wires.

## The minimum radius of deviator

| Strand Type | Min Radius(m) |
|---|---|
| 7-ϕ15.2 | 2.0 |
| 12-ϕ15.2 | 2.5 |
| 19-ϕ15.2 | 3.0 |
| 27-ϕ15.2 | 3.5 |
| 31-ϕ5.2 | 4 |

## Conventional Deviator

Stress loss due to friction between prestressing steels and ducts can be classified into 2 parts. One is due to friction between prestressing steels and ducts by vertical pressure of the curving section.

The other one is caused by warp and tough surfaces of ducts. The formula is shown below:

$$\sigma_{s1} = \sigma_k[1-e^{-(\mu\theta+kx)}]$$

$\mu$ : Friction coefficient between prestresing steel and duct.

K : Coefficient for local warp of every meter duct.

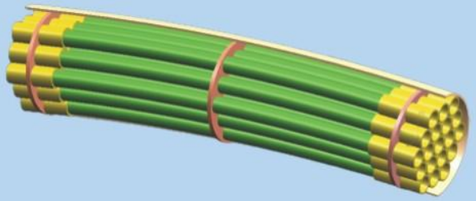
External prestressing cables are outside the concrete structures, made up of bending lines at deviator or anchor zones and straight lines between them. Friction effect due to warp of ducts is so weak on straight lines as to be ignored. Length of ducts on bending lines is short in general. So prestressing loss due to warp and tough surface of ducts can also be ignored

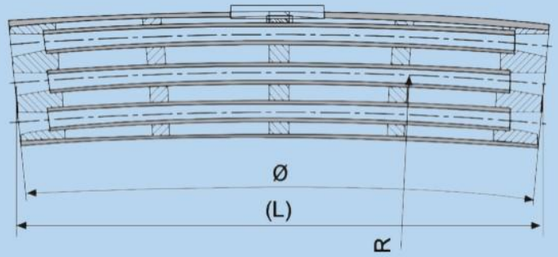
Assume k=0,

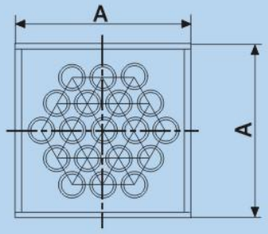
the formula above will be equal

to $\sigma_{s1} = \sigma_k(1-e^{-\mu\theta})$.

## Individual Strand Deviator






Individual strand deviator can make strands parallel and replaceable, every strand bears individual forces, ensures little abrasions existed between strands and de viator. Each guiding duct connects each other through the linked plates. Cement grout can separate external tendons, fix guiding ducts and bear the pressure be tween strands due to un-simultaneous tensioning. Guiding ducts can be reshaped horizontally and verti cally for requirements from different directions and bending radius. At both ends of each guiding duct, there is a compensating device with a trumpet to offset the an gular deviation in constructi

Sutong Bridge, China

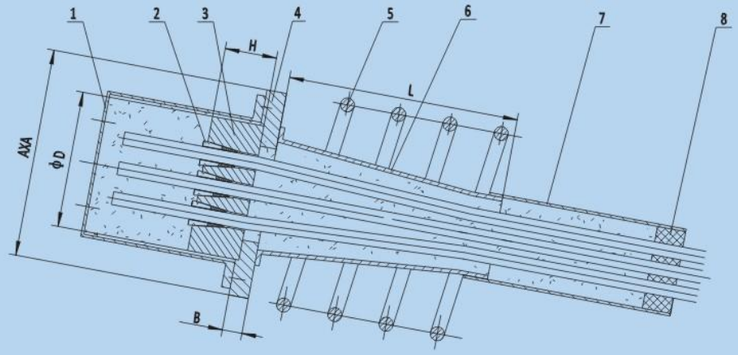




# OVM External Prestressing Anchorages

Stress amplitude of prestressing tendons is a very important parameter to the design of prestressing anchorage on the condition of live load. External tendons are individual members relative to the whole structure. They are bonded with concrete only at anchoring zone and the deviator outside the structure. Therefore the stress amplitude of the prestressing tendon depends on the deformation of the whole structure. Based on the developed OVM anchoring technology, several kinds of external prestressing anchorages are designed to meet some special requirements of different projects.

## Type OVM.A



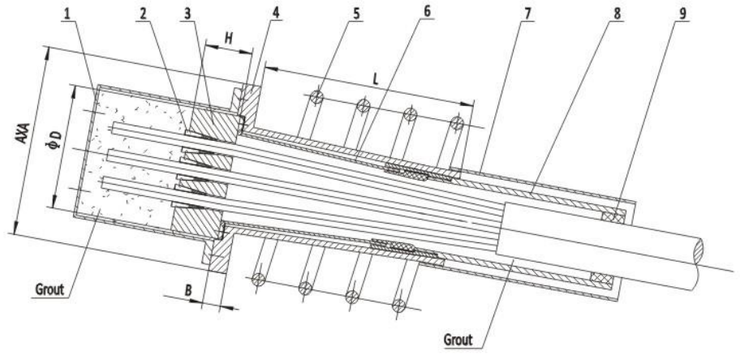

1.Protective cover 2.Working wedge 3.Working anchor head 4.Bearing plate
5.Spiral reinforcement 6.Trumpet 7.Embedded pipe 8.Sealing device

**Main Data** Unit:mm

| Designation | ϕD | H | AxAxB | L |
|---|---|---|---|---|
| OVM.A15-7 | ϕ135 | 60 | 240x240x45 | 265 |
| OVM.A15-12 | ϕ175 | 70 | 300x300x45 | 301 |
| OVM.A15-19 | ϕ240 | 90 | 370x370x60 | 555 |
| OVM.A15-27 | ϕ260 | 110 | 420x420x60 | 630 |
| OVM.A15-31 | ϕ275 | 130 | 470x470x75 | 765 |

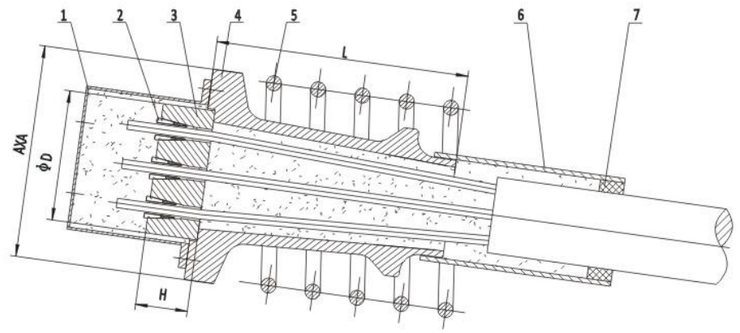
## Type OVM.AT

OVM.AT anchorage is derived from OVM.A anchorage by adding a insulating equipment to trumpet. If tendon needs to be replaced, the whole anchorage can be removed from the end. The structural form is shown below and dimensions are the same as that of OVM.A.




1.Protective cover
2.Working wedge
3.Working anchor head
4.Bearing plate
5.Spiral reinforcement
6.Bush
7.Embedded pipe
8.Sealing chamber
9.Sealing device

## Type OVM.TS




1.Protective cover
2.Working wedge
3.Working anchor head
4.Bearing plate
5.Spiral reinforcement
6.Embedded pipe
7.Sealing device

**Main Data** Unit:mm

| Designation | ϕD | H | AxAxL |
|---|---|---|---|
| OVM.TS15-7 | ϕ157 | 60 | 240x240x290 |
| OVM.TS15-12 | ϕ175 | 70 | 285x285x340 |
| OVM.TS15-19 | ϕ240 | 90 | 350x350x470 |
| OVM.TS15-27 | ϕ260 | 110 | 410x410x495 |
| OVM.TS15-31 | ϕ275 | 130 | 465x465x565 |

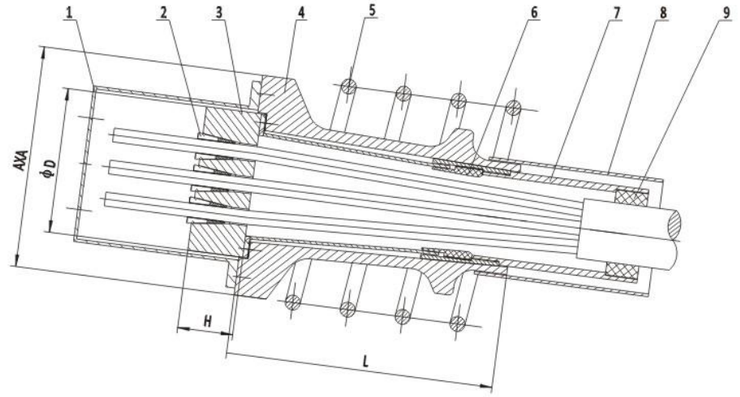




# OVM External Prestressing Anchorages

## Type OVM.TT

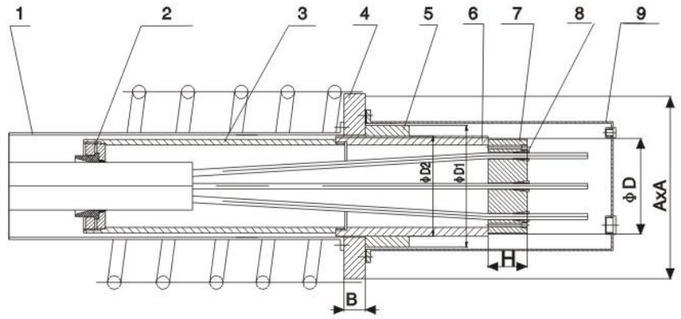
The structural form is shown below and dimensions are the same as OVM.TS.




1.Protective cover
2.Working wedge
3.Working anchor head
4.Bearing plate
5.Spiral reinforcement
6.Isolating device
7.Sealing chamber
8.Embedded pipe
9.Sealing device

## Type OVM.TSK

The tendon is replaceable and the tendon force can be adjusted when OVM.TSK anchorage is employed.




1.Embedded pipe
2.Sealing device
3.Sealing chamber
4.Bearing plate
5.Nut
6.Socket
7.Working anchor head
8.Working wedge
9.Protective cover

**Main Data** Unit:mm

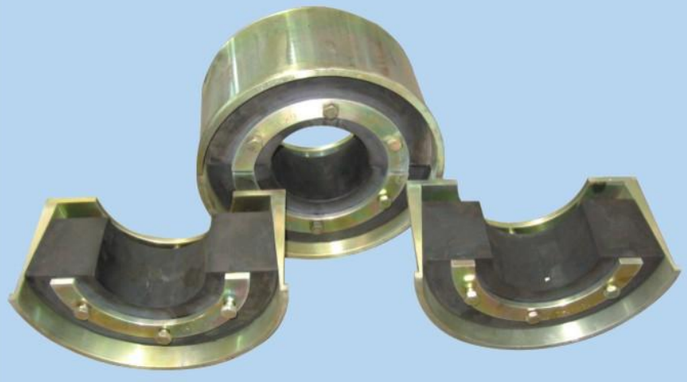
| Designation | ϕD | H | AxAxB | ϕD1 | ϕD2 |
|---|---|---|---|---|---|
| OVM.TSK15-7 | ϕ150 | 70 | 285x285x30 | ϕ210 | ϕ160 |
| OVM.TSK15-12 | ϕ205 | 80 | 360x360x40 | ϕ270 | ϕ220 |
| OVM.TSK15-19 | ϕ230 | 100 | 420x420x50 | ϕ305 | ϕ245 |
| OVM.TSK15-27 | ϕ270 | 100 | 490x490x60 | ϕ340 | ϕ285 |
| OVM.TSK15-31 | ϕ270 | 110 | 500x500x65 | ϕ340 | ϕ285 |

**OVM external prestressing anchorage can be properly selected according to design requirements.**

| Anchorage Type | Cable Type | Grouting Material | Deviator Type | Characteristics |
|---|---|---|---|---|
| OVM.A<br>OVM.TS | OVM-S1 OVM-S2 | Grease | Individual strand deviation | Mono-strand replaceable |
| | OVM-S3 OVM-S4 | Grease in anchor, no grouting on free length. | Individual strand deviation | Mono-strand replaceable |
| | OVM-S5 OVM-S6 | Grease in anchor | Spindly deviation | Replaceable in total |
| OVM.AT<br>OVM.TT | OVM-S1 OVM-S2 | Grease | Individual strand deviation | Mono-strand replaceable |
| | OVM-S3 OVM-S4 | Grease in anchor, no grouting on free length. | Individual strand deviation | Mono-strand replaceable |
| | OVM-S1 OVM-S2 | Cement or epoxy grout | Individual strand deviation | Replaceable in total |
| | OVM-S3 OVM-S4 | Grease in anchor, no grouting on free length. | Spindly deviation | Replaceable in total |
| | OVM-S5 OVM-S6 | Grease in anchor, no grouting on free length. | Spindly deviation | Replaceable in total |
| OVM.TSK | OVM-S5 OVM-S6 | Grease in anchor, no grouting on free length. | Spindly deviation | Replaceable and adjustable in total |

## Damping Device

Traffic loads bring the vibration to the structures and cables. If natural frequency of the cable is close to that of the structure, damage will be caused by resonance. In order to vary the natural frequency of the cable, damping devices should be properly installed on free length of tendon to shorten vibration zone.



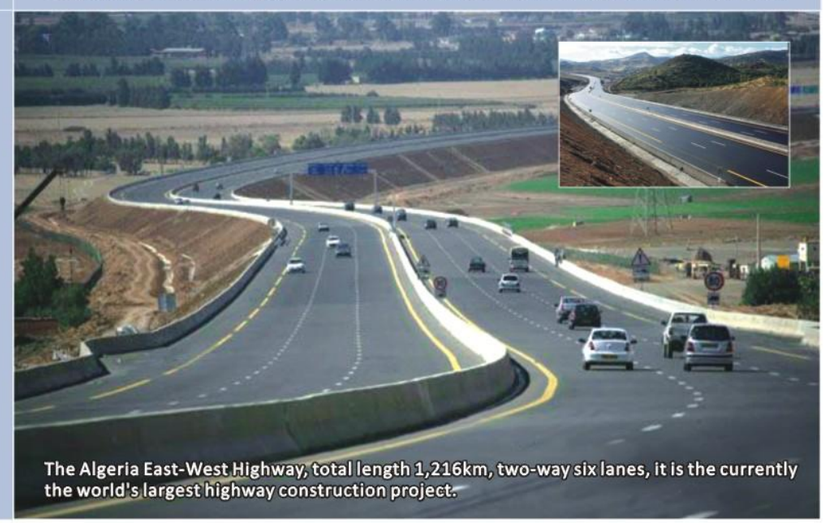




| Project Name | Shanghai Yangzte River Bridge | Client / Contractor | Shanghai Foundation Engineering Co., Ltd. |
|---|---|---|---|
| Style | Cable-stayed Bridge | Work | 2006 |
| Contract Amount | USD 1,900,000 | Location | China |
| OVM Scope | Supply of external prestressing systems (epoxy-coated cable 580 tons) | | |
| Project Brief |  Total length 16.5km, main span 730m, steel box girder width 51.5m, service speed 100km/h. It was opened on 2009. | | |

| Project Name | Incheon Grand Bridge | Client / Contractor | SAMSUNG Joint Venture |
|---|---|---|---|
| Style | Cable-stayed Bridge | Work | 2007 |
| Main Span | 800m | Location | South Korea |
| OVM Scope | Supply of post-tensioning systems and equipments (OVM.M15-12~M15-37) | | |
| Project Brief |  The Incheon Bridge (also called the Incheon Grand Bridge) is a newly-constructed bridge in South Korea. At its opening in October 2009, it became the second connection between Yeongjong Island and the mainland of Incheon. The 21.38km long highway project consisted of government-built sections at three ends and a 12.34km section in the middle build with private capital, the bridge section is 18,384m long. | | |

| Project Name | Qingdao Bay Bridge | Client / Contractor | Shandong Highway Group - Qingdao Highway Co., Ltd. |
|---|---|---|---|
| Style | Bay Bridge | Work | 2007 |
| Contract Amount | USD 4,800,000 | Location | China |
| OVM Scope | Supply of post-tensioning systems (OVM.M15-13~M15-27) | | |
| Project Brief | Total length 41.58km, main span 482m, deck width 35m, two cable-stayed bridges with rare cables and one self-anchored suspension bridge as the navigation channels, the rest of the bridge is continuous girder bridge. It will be opened on 2011.   | | |

| Project Name | Algeria East-West Highway | Client / Contractor | CITIC-CRCC |
|---|---|---|---|
| Style | Highway | Work | 2007~2009 |
| Contract Amount | USD 3,900,000 | Location | Algeria |
| OVM Scope | Supply of post-tensioning systems for Section Middle and West (OVM.BM15-4~M15-19) | | |
| Project Brief |  The Algeria East-West Highway, total length 1,216km, two-way six lanes, it is the currently the world's largest highway construction project. | | |





| Project Name | Fujian Fuqing Nuclear Power Plant | Client / Contractor | China Nuclear Industry 24th Construction Co., Ltd. |
|---|---|---|---|
| Style | Nuclear Plant | Work | 2008 |
| Contract Amount | USD 1,350,000 | Location | China |
| OVM Scope | Supply of post-tensioning systems (OVM15R-19K and OVM15R-37K) | | |
| Project Brief | | | |


OVM is the first and only Chinese prestressing products manufacturer which enters nuclear field. Fuqing Nuclear Power Plant consists of 6 sets of million KW grade nuclear units, OVM post-tensioning systems was successfully applied to the containment.

| Project Name | Beijing-Shanghai High-speed Railway | Client / Contractor | Jinghu High-speed Railway Co., Ltd. |
|---|---|---|---|
| Style | High-speed Railway | Work | 2008~2009 |
| Contract Amount | USD 13,200,000 | Location | China |
| OVM Scope | Supply of post-tensioning systems (OVM.M15-3~M15-22) | | |

**Project Brief**

With a total length of 1,318km, Beijing-Shanghai High-speed Railway is the longest high-speed railway with greatest investment (USD 33 Billion) and highest standard by 2010. Its operating speed will be 350km/h.





| Project Name | ISA Town Gate Interchange | Client / Contractor | SUNGWON Corporation / NASS Contracting |
|---|---|---|---|
| Style | Interchange | Work | 2008~2010 |
| Contract Amount | USD 1,200,000 | Location | Bahrain |
| OVM Scope | Supply of post-tensioning systems, equipments and external prestressing systems (OVM.M15-12~M15-19, OVM.TT15-27BL) | | |

**Project Brief**

The Project involves upgrading of the existing roundabout into three levels grade-separated interchange. The major works consist of the construction of dual two lane carriageway flyovers, dual three lanes carriageway underpass, at-grade Bridge and the new Isa Town Gate monument.

| Project Name | Zhejiang Jiashao Bridge | Client / Contractor | Zhejiang Jiashao Bridge Investment & Development Co., Ltd. |
|---|---|---|---|
| Style | Cable-stayed Bridge | Work | 2009 |
| Contract Amount | USD 1,800,000 | Location | China |
| OVM Scope | Supply of post-tensioning systems and equipments (OVM.M15-12~M15-22) | | |

**Project Brief**

Total length 10km, main span 482m, deck width 55.6m, it is a cable-stayed bridge with 6 pylons, it will be opened on 2012.

| Project Name | Boubyan Seaport Project (Phase 1-Stage 1) | Client / Contractor | China Harbour Engineering Company Ltd. |
|---|---|---|---|
| Style | Seaport | Work | 2009~2010 |
| Contract Amount | USD 2,250,000 | Location | Boubyan Island, Kuwait |
| OVM Scope | Supply of post-tensioning systems, equipments and bearings (OVM.M15-6~M15-14) | | |
| Project Brief |  Boubyan, Kuwait's largest island, is located in the north eastern part of the country and is separated from the mainland by the Subbiya Channel. Plans to turn the island in to a burgeoning sea port. When completed, the port will have 16 piers stretching 1,600m into the sea. Depth at the basins of the port are projected at 16.5 metres, and navigation channels will be 14.5m deep. The Phase 1- Stage 1 includes soft foundation treatment, route and 3 bridges. | | |

| Project Name | Libya Railway (Tripoli - Ras Ejder ) | Client / Contractor | China Civil Engineering Construction Corporation |
|---|---|---|---|
| Style | Railway | Work | 2010~2011 |
| Length | 172KM | Location | Libya |
| OVM Scope | Supply of post-tensioning systems and bearings (OVM.BM15-4~M15-15) | | |
| Project Brief |  With a total length of 172km, the double-track railway extends from Tripoli, Libya's capital and largest port, to Ras Jedeir in the west. The construction period lasts 54 months. | | |





| Al Maskar Commercial Mall, Kuwait |
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| 50,000 ㎡ of PT bonded slabs, span 16m, slab thickness 35mm/50mm, 400MT of strands were installed in 6 moths. |
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| Fowa Bridge over Nile, Egypt |
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| OVM supplies anchorages and stressing equipments for the bridge. |
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