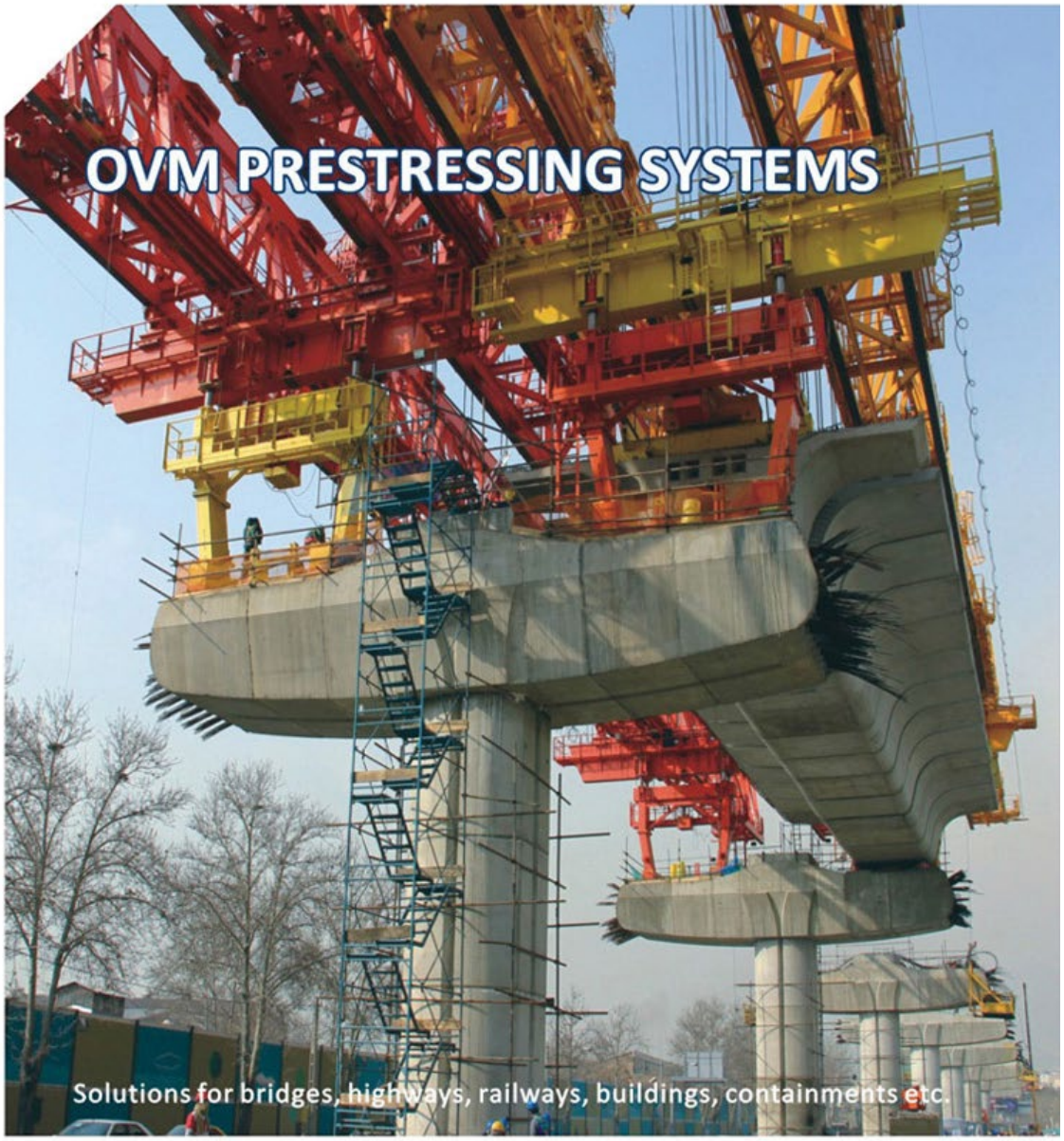
OVM

GROUTING SERVICES



GUANGXI LIUGONG GROUP CO., LTD.
LIUZHOU OVM MACHINERY CO., LTD.
www.ovm.cn

LiuGong

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

GROUTING SERVICES

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.

GROUTING SERVICES

Certifications of OVM

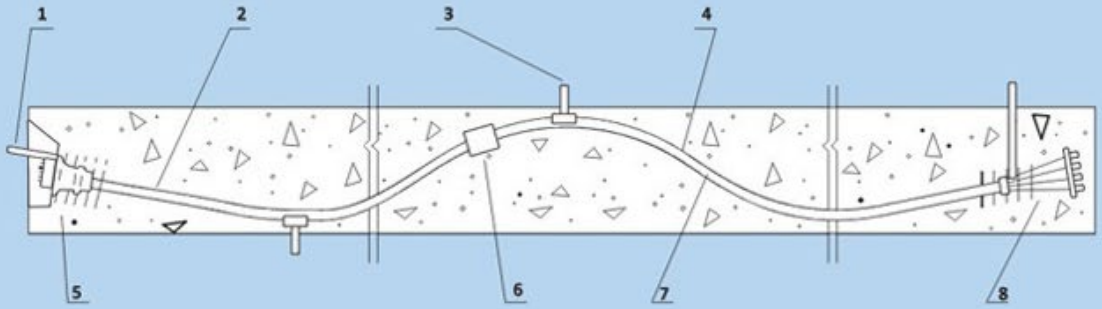
OVM PRESTRESSING SYSTEMS

GROUTING SERVICES

OVM POST-TENSIONING SYSTEMS

OVM PRESTRESSING SYSTEMS

OVM Post-tensioning System in Girder



1.Grout tube 2.Duct 3.Vent 4.Strand bundle 5.Stressing-end anchorage
6.Coupler 7.Grout 8.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: $\varepsilon_{apu} \geq 2.0\%$.

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

Turbiah Interchange Project
KSA 2009
Post Tensioned Girders: 35 meter Span
Main Contractor: Al Omier

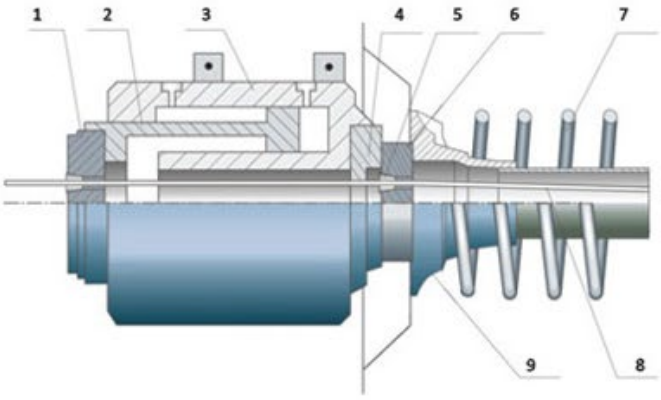
GROUTING SERVICES

OVM PRESTRESSING SYSTEMS

Integral Assembly of OVM Post-tensioning System

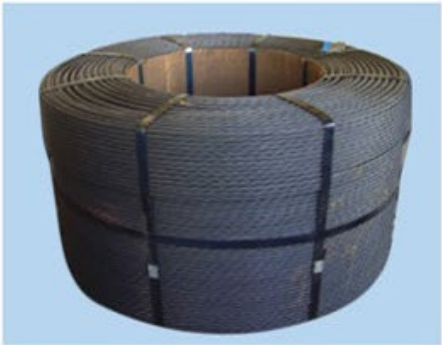
Stressing-end (Two-ends-stressing is available as per design) Dead-end: Type P

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

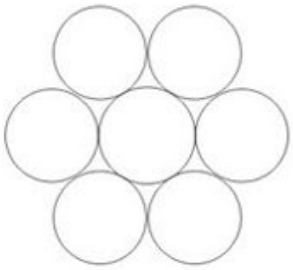


GROUTING SERVICES

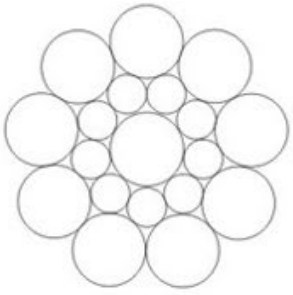
Strand



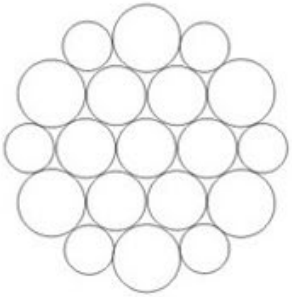
The strand to fit OVM Post-tensioning System should comply with ASTM416, GB/T 5224, prEN 10138 or JIS G3536. The strand could be bare, galvanized or epoxy-coated.



Cross-section of 13/15/18mm strand



Cross-section of 22mm strand

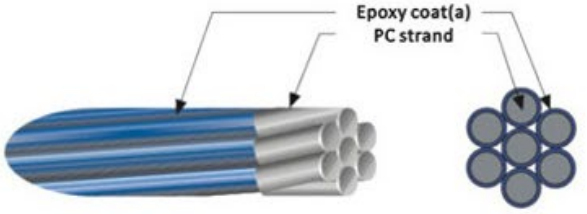


Cross-section of 28mm strand

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



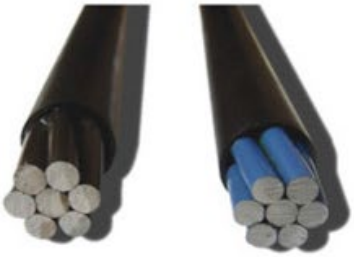
- ☐ With excellent anti-corrosion property
- ☐ UV resistance
- ☐ Same strength and mechanical property as bare strand
- ☐ Reduce the extra cost of corrosion protection
- ☐ Extended service life of the strand

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	

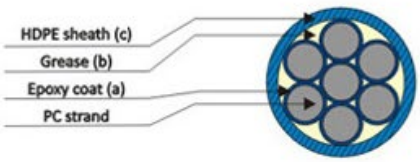
Unbonded Strand

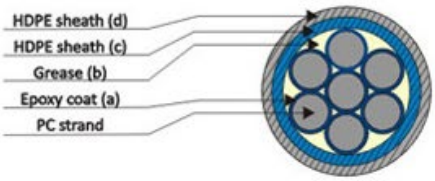


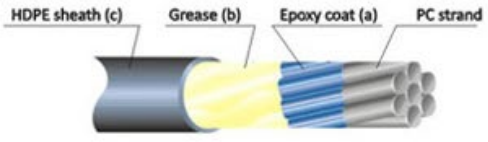
Bare Unbonded Strand

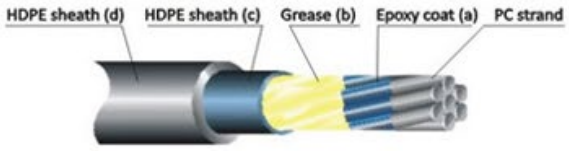
Epoxy-coated Unbonded Strand

Epoxy-Coated Unbonded Strand









Single Layer PE Sheathed

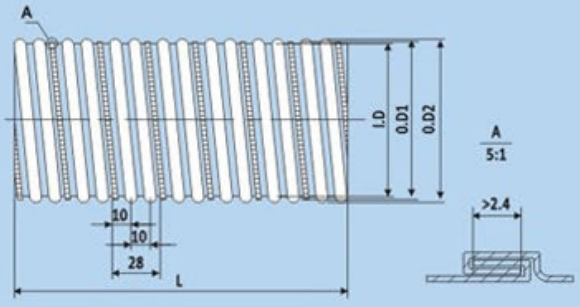
Type	PC strand		UPS13E/15E							
	Spec. (mm)	Unit weight (g/m)	External dia. (mm)	Unit weight (g/m)	Thickness (mm)		Weight of grease (g/m)	Material		
					a	c	b	a	b	c
UPS13E	12.7	775	⩾15.6	887	0.13-0.30	⩾1.0	⩾43	Epoxy	Grease	HDPE
UPS15E	15.2	1102	⩾18.1	1235	0.13-0.30	⩾1.0	⩾50			

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



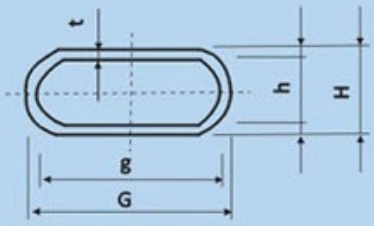
Main Data

Unit:mm

Specs	Duct			Coupler of duct			
	I.D	O.D1	O.D2	I.D	O.D1	O.D2	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

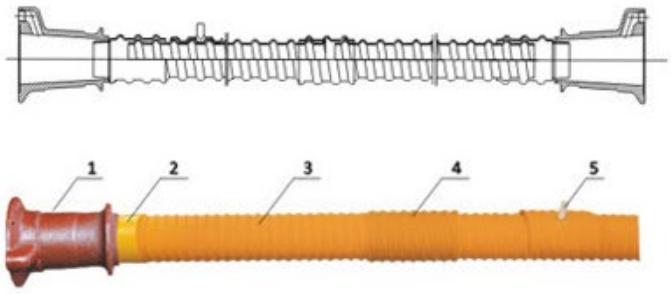
I. One-class-bigger duct can be used as the coupler. II. Special duct can be supplied on request.

Plastic Duct

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

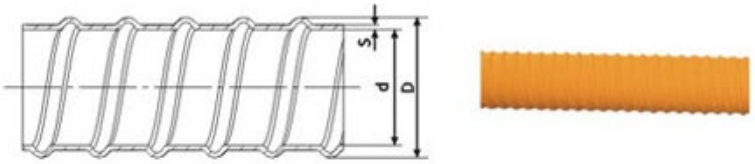
- Lower friction
- Excellent sealing property
- Better anti-corrosion performance
- More flexibility

Plastic Duct Assembly



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

Round Plastic Duct

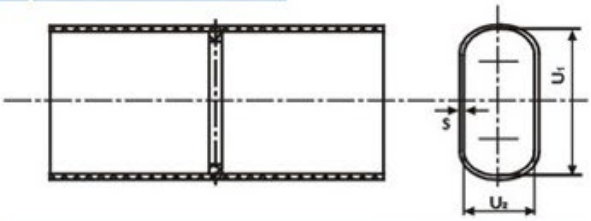


Main Data (Round Duct)

Unit:mm

Designation	d	D	s	Anchorage adapted
SBG-50	ϕ50	ϕ65	2.5	OVM.M15-2~3 OVM.M13-2~5
SBG-55	ϕ55	ϕ70	2.5	OVM.M15(13)-4~5
SBG-60	ϕ60	ϕ75	2.5	OVM.M13-6~7
SBG-65	ϕ65	ϕ80	2.5	As coupler of SBG55
SBG-70	ϕ70	ϕ86	2.5	OVM.M15-6~7 OVM.M13-8~9
SBG-75	ϕ75	ϕ92	2.5	
SBG-80	ϕ80	ϕ97	2.5	OVM.M15-8~9 OVM.M13-10~12
SBG-85	ϕ85	ϕ102	2.5	OVM.M15-10~12 OVM.M13-13~19
SBG-90	ϕ90	ϕ106	2.5	OVM.M15-13~17 OVM.M13-20~22
SBG-95	ϕ95	ϕ112	2.5	As coupler of SBG85
SBG-100	ϕ100	ϕ122	2.5	OVM.M15-18~19 OVM.M13-23~31
SBG-110	ϕ110	ϕ132	3	As coupler of SBG100
SBG-120	ϕ120	ϕ142	3	OVM.M15-20~27 OVM.M13-32~37
SBG-130	ϕ130	ϕ154	3	OVM.M15-28~31 OVM.M13-38~55
SBG-140	ϕ140	ϕ164	3	OVM.M15-32~37 OVM.M13-45~55

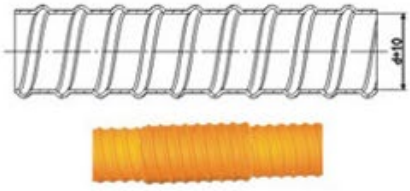
Flat Plastic Duct



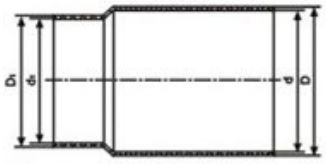
Main Data (Flat Duct) Unit:mm

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

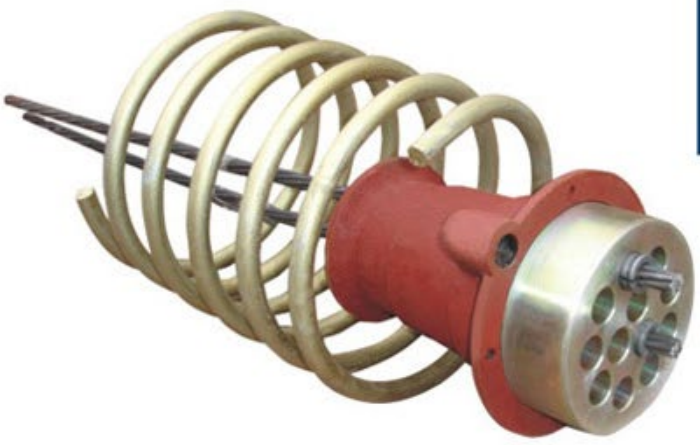
Main Data of OLG & OLT Unit:mm

Designation	D	d	d_1	D_1	L
OLG-50	ϕ75	ϕ60			More than 250mm or as per request
OLG-60	ϕ86	ϕ70			
OLG-70	ϕ97	ϕ80			
OLG-80	ϕ106	ϕ90			
OLG-85	ϕ112	ϕ95			
OLG-90	ϕ122	ϕ100			
OLG-100	ϕ132	ϕ110			
OLG-120	ϕ154	ϕ130			
OLG-130	ϕ164	ϕ140			
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	

OVM POST-TENSIONING SYSTEMS

OVM PRESTRESSING SYSTEMS

Stressing-end Anchorage



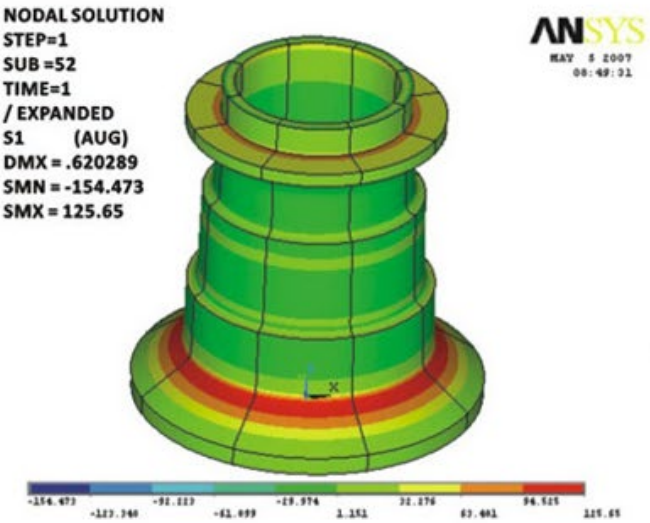
OVM.M15A Series
OVM.M13A Series

Round bearing plate obtains better load transfer property.

"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).

GROUTING SERVICES



Finite Element Model of Bearing Plate

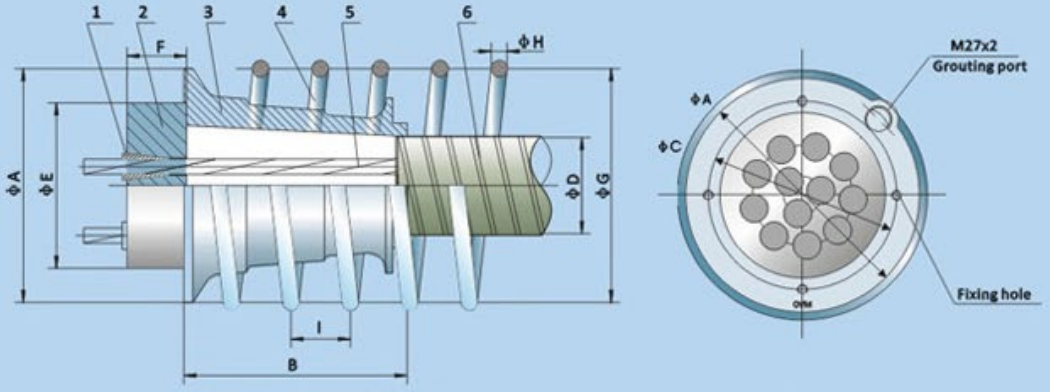
OVM working anchor head and wedges

GROUTING SERVICES

OVM POST-TENSIONING SYSTEMS

OVM PRESTRESSING SYSTEMS

Stressing-end Anchorage OVM.M15A



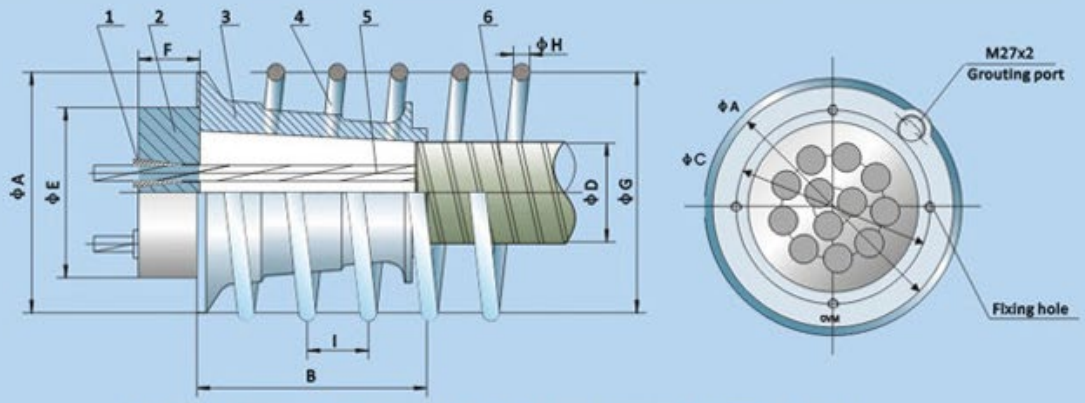
1.Wedge 2.Anchor head 3.Bearing plate 4. Spiral reinforcement 5. Strand 6.Duct

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-1	-	-	-	Φ 50x48	Φ 80	Φ 6.5	30	4	YDC240QX
OVM.M15A-2	Φ 132x80	105	Φ 45	Φ 86x50	Φ 115	Φ 8	40	4	YCW100B
OVM.M15A-3	Φ 136x80	110	Φ 50	Φ 91x50	Φ 130	Φ 10	50	4	YCW100B
OVM.M15A-4	Φ 140x125	120	Φ 55	Φ 102x50	Φ 150	Φ 12	50	4	YCW100B
OVM.M15A-5	Φ 155x130	135	Φ 55	Φ 115x50	Φ 170	Φ 12	50	4	YCW100B/150B
OVM.M15A-6	Φ 165x160	145	Φ 70	Φ 126x52	Φ 200	Φ 12	50	4	YCW150B
OVM.M15A-7	Φ 172x170	145	Φ 70	Φ 126x53	Φ 200	Φ 12	50	4	YCW150B/250B
OVM.M15A-8	Φ 185x180	162	Φ 80	Φ 136x55	Φ 216	Φ 14	50	5	YCW250B
OVM.M15A-9	Φ 200x190	175	Φ 80	Φ 146x55	Φ 240	Φ 14	50	5	YCW250B
OVM.M15A-10	Φ 210x210	190	Φ 90	Φ 156x58	Φ 270	Φ 14	60	5	YCW250B
OVM.M15A-11	Φ 210x220	190	Φ 90	Φ 166x58	Φ 270	Φ 16	60	5	YCW250B
OVM.M15A-12	Φ 214x230	190	Φ 90	Φ 166x60	Φ 270	Φ 16	60	5	YCW250B/350B
OVM.M15A-13	Φ 224x230	190	Φ 90	Φ 170x63	Φ 270	Φ 16	60	5	YCW350B
OVM.M15A-14	Φ 233x260	200	Φ 90	Φ 176x65	Φ 285	Φ 16	60	5	YCW350B
OVM.M15A-15	Φ 246x290	220	Φ 90	Φ 186x68	Φ 300	Φ 16	60	5	YCW350B
OVM.M15A-16	Φ 246x330	220	Φ 90	Φ 196x70	Φ 300	Φ 18	60	5	YCW350B/400B
OVM.M15A-17	Φ 258x395	220	Φ 90	Φ 196x73	Φ 300	Φ 18	60	5	YCW350B/400B
OVM.M15A-18	Φ 272x325	230	Φ 100	Φ 206x75	Φ 310	Φ 18	60	6	YCW400B
OVM.M15A-19	Φ 272x325	230	Φ 100	Φ 206x75	Φ 310	Φ 18	60	6	YCW400B/500B
OVM.M15A-20	Φ 300x325	250	Φ 120	Φ 226x80	Φ 320	Φ 20	60	6	YCW500B
OVM.M15A-21/22	Φ 300x325	250	Φ 120	Φ 226x80	Φ 320	Φ 20	60	6	YCW500B
OVM.M15A-23/24	Φ 330x430	280	Φ 120	Φ 244x82	Φ 350	Φ 20	60	6	YCW650A
OVM.M15A-25/26/27	Φ 330x430	280	Φ 120	Φ 244x85	Φ 350	Φ 20	60	6	YCW650A
OVM.M15A-28/29	Φ 352x415	290	Φ 130	Φ 260x88	Φ 390	Φ 20	60	7	YCW650A
OVM.M15A-30/31	Φ 352x415	290	Φ 130	Φ 260x90	Φ 390	Φ 20	60	7	YCW650A
OVM.M15A-32/33/34	Φ 386x510	330	Φ 140	Φ 296x95	Φ 465	Φ 20	60	8	YCW650A/900A
OVM.M15A-35/36/37	Φ 394x510	330	Φ 140	Φ 296x100	Φ 465	Φ 20	60	8	YCW650A/900A

OVM PRESTRESSING SYSTEMS

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
	ΦAxB	Bolt distance ΦC	ΦD (I.D.)	ΦExF	ΦG	ΦH	I	N	
OVM.M13A-1	-	-	-	Φ40 x 40	Φ80	Φ6.5	30	3	YDC240QX
OVM.M13A-2	Φ125 x 60	105	Φ45	Φ75 x 45	Φ110	Φ6.5	30	3	YCW100B
OVM.M13A-3	Φ132 x 80	105	Φ45	Φ80 x 45	Φ120	Φ10	50	3	YCW100B
OVM.M13A-4	Φ136 x 102	105	Φ50	Φ85 x 48	Φ135	Φ10	50	3	YCW100B
OVM.M13A-5	Φ140 x 125	120	Φ50	Φ100 x 48	Φ145	Φ12	50	4	YCW100B
OVM.M13A-6	Φ155 x 130	135	Φ60	Φ105 x 48	Φ165	Φ12	50	4	YCW100B
OVM.M13A-7	Φ155 x 130	135	Φ60	Φ105 x 50	Φ165	Φ12	50	4	YCW150B
OVM.M13A-8	Φ170 x 160	140	Φ60	Φ116 x 52	Φ175	Φ12	50	4	YCW150B
OVM.M13A-9	Φ175 x 170	145	Φ70	Φ126 x 53	Φ190	Φ12	50	4	YCW150B
OVM.M13A-10/11	Φ200 x 190	162	Φ80	Φ136 x 53	Φ216	Φ14	50	4	YCW150B
OVM.M13A-12	Φ210 x 210	175	Φ80	Φ146 x 55	Φ216	Φ14	50	5	YCW250B
OVM.M13A-13	Φ210 x 210	175	Φ80	Φ146 x 55	Φ230	Φ14	50	5	YCW250B
OVM.M13A-14	Φ210 x 230	190	Φ80	Φ156 x 57	Φ230	Φ14	50	5	YCW250B
OVM.M13A-15	Φ214 x 230	190	Φ90	Φ166 x 60	Φ240	Φ16	50	5	YCW250B
OVM.M13A-16/17	Φ246 x 270	200	Φ90	Φ176 x 62	Φ265	Φ16	60	5	YCW250B
OVM.M13A-18/19	Φ246 x 270	200	Φ90	Φ176 x 65	Φ265	Φ16	60	5	YCW350B
OVM.M13A-20	Φ260 x 365	220	Φ90	Φ196 x 68	Φ290	Φ18	60	5	YCW350B
OVM.M13A-21/22	Φ260 x 365	220	Φ90	Φ196 x 70	Φ290	Φ18	60	5	YCW350B
OVM.M13A-23/24	Φ275 x 380	245	Φ100	Φ216 x 73	Φ310	Φ18	60	6	YCW400B
OVM.M13A-25/26/27	Φ275 x 380	245	Φ100	Φ216 x 75	Φ310	Φ18	60	6	YCW400B
OVM.M13A-28/29	Φ300 x 400	250	Φ105	Φ224 x 78	Φ315	Φ18	60	6	YCW400B
OVM.M13A-30/31	Φ300 x 400	250	Φ105	Φ224 x 80	Φ315	Φ18	60	6	YCW500B
OVM.M13A-32/33/34	Φ330 x 430	280	Φ120	Φ244 x 82	Φ370	Φ20	60	7	YCW500B
OVM.M13A-35/36	Φ330 x 430	280	Φ120	Φ244 x 85	Φ370	Φ20	60	7	YCW500B
OVM.M13A-37	Φ330 x 430	280	Φ120	Φ244 x 85	Φ370	Φ20	60	7	YCW650A

Dead-end Anchorage Type P OVM.P15/P13

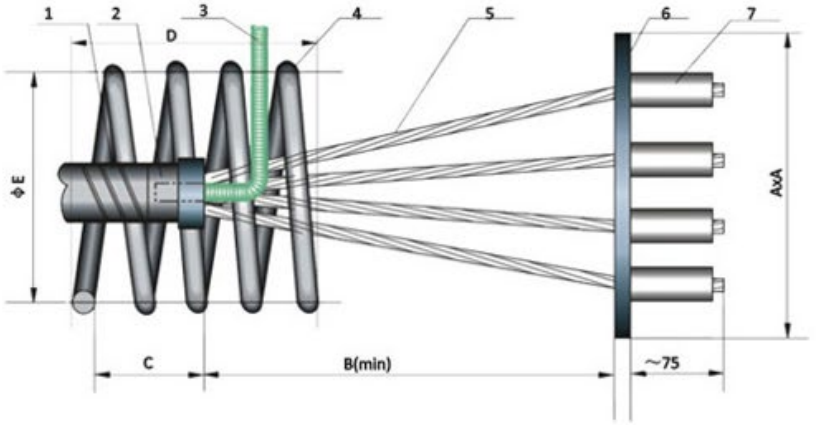
In case of transferring the post-tensioning force to the girder end directly, type P anchorage can be adopted. It is composed of the swaged end (swage socket and swage spring being extruded by GYJC50-150 swaging machine), anchor plate, spiral reinforcement, restraining ring, etc. ZB4-500 hydraulic pump 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	28~31	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)	320	350	390	465	465

The figures in brackets are for OVM.P13.

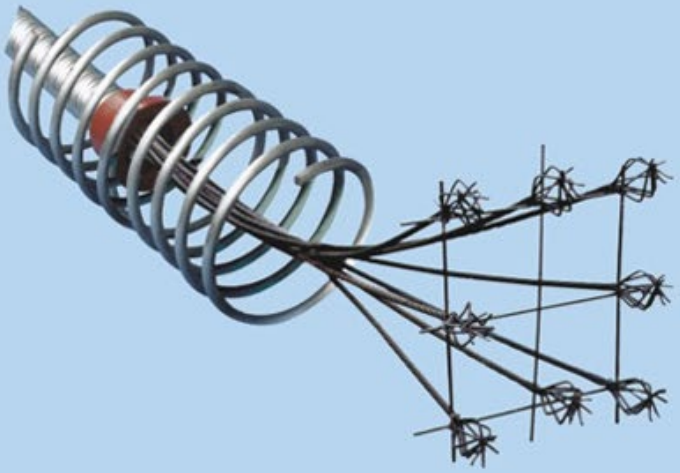
OVM POST-TENSIONING SYSTEMS

OVM PRESTRESSING SYSTEMS

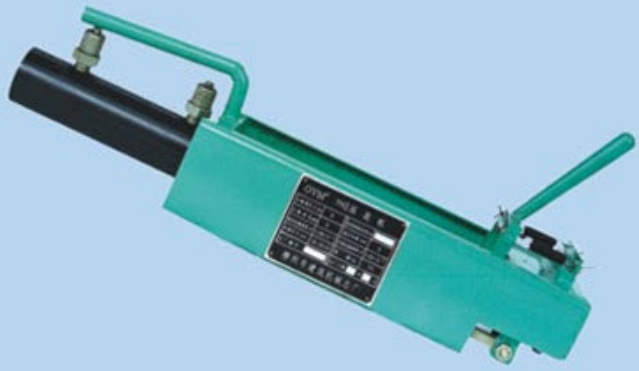
Dead-end Anchorage Type H OVM.H15/H13

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

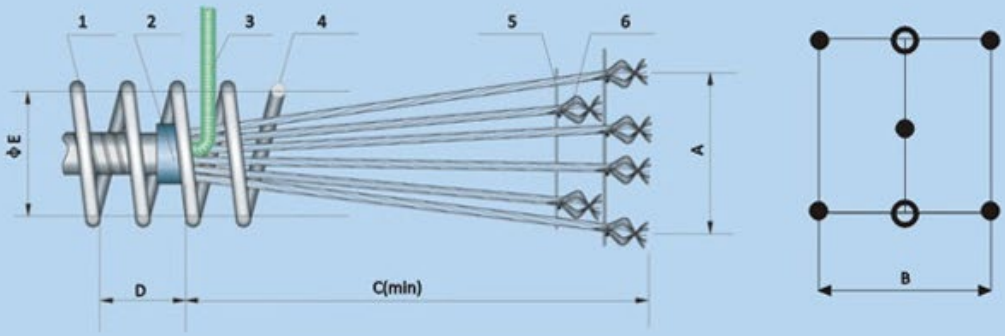


YH3 Bulb Machine



GROUTING SERVICES

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	ΦE
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)

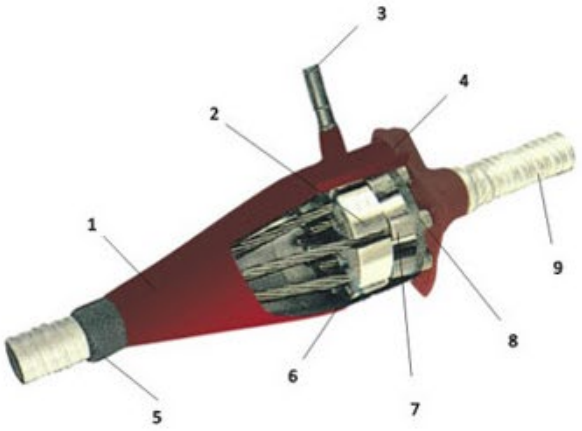
The figures in brackets are for OVM.H13.

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.

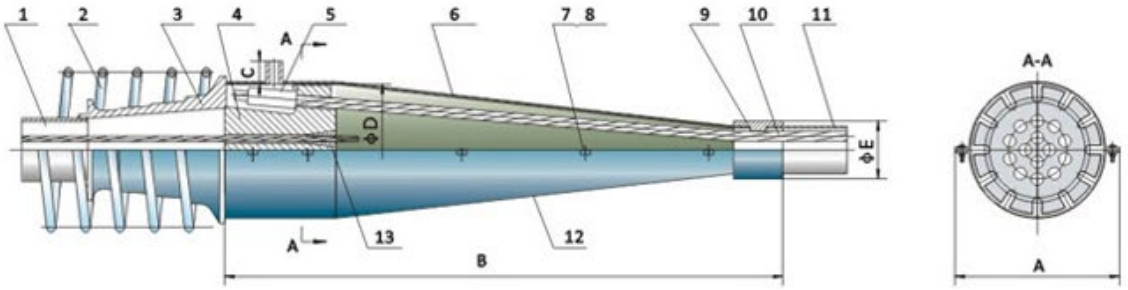
Multi-strand Coupler L15/L13



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

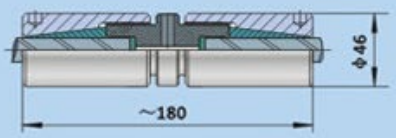
Unit:mm

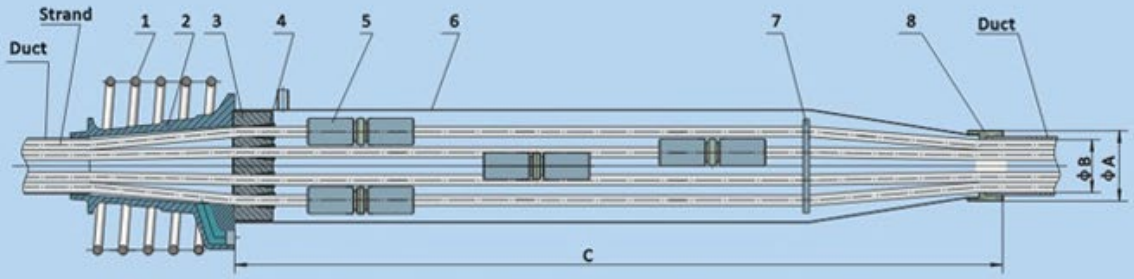
Designation	A	B	C	ΦD	ΦE
L13-2	179	575	40	136	75
L13-3	184	597	40	141	75
L13-4	189	597	40	146	80
L13-5	204	662	40	161	80
L13-(6~7)	209	640	40	166	90
L13-8	220	689	40	177	90
L13-9	230	689	40	187	100
L13-(10~11)	240	689	40	197	110
L13-(12~13)	250	734	40	207	110
L13-14	260	780	40	217	110
L13-15	270	783	40	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.

OVM PRESTRESSING SYSTEMS

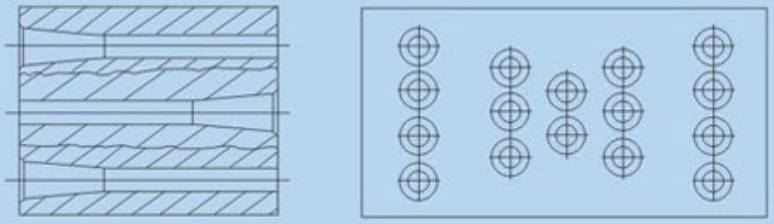
Ring Anchoring System OVM.HM

Application Field

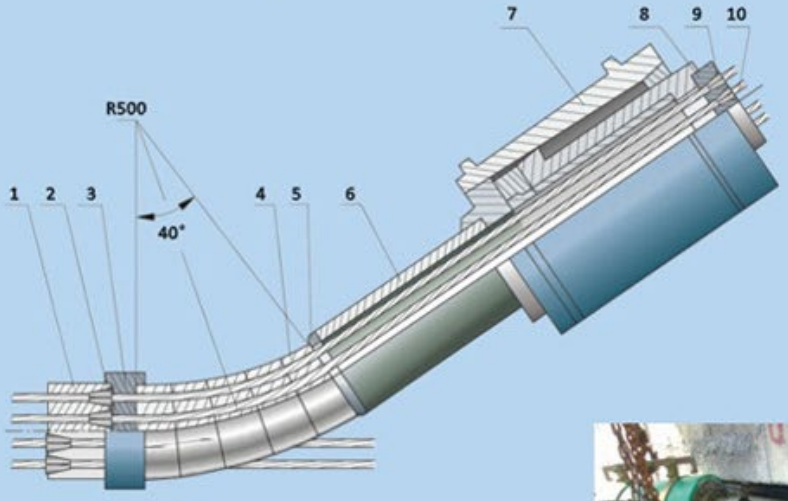
- Round PC storage tank, such as silo, liquid gas tank and sewage treatment tank
- PC containment of nuclear reactor
- PC Hydrodynamic tunnel and well
- Other similar round prestress concrete structure

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



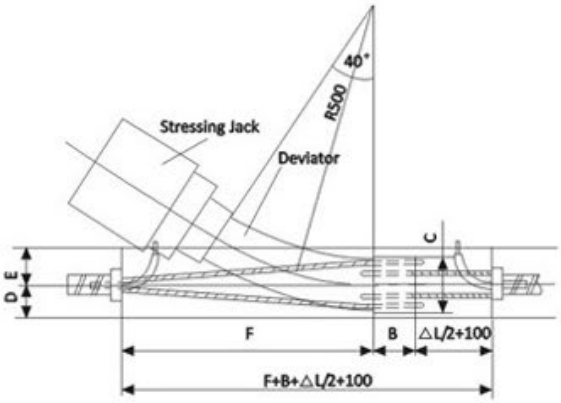
OVM.HM Ring Anchoring System

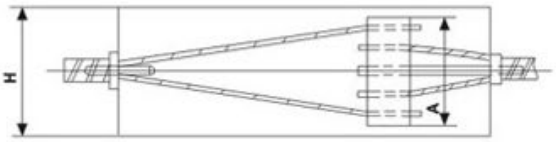


1.HM.anchor head 2.Wedge 3.Spacer
4.Deviator 5.Transfer block 6.Stretch tube
7.Jack 8.Tool anchor head 9.Tool wedge
10.P.C.strand

GROUTING SERVICES

Structural Diagram of OVM.HM Anchoring System

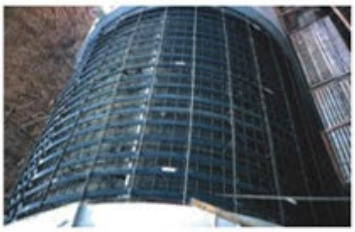




Main Data Unit:mm

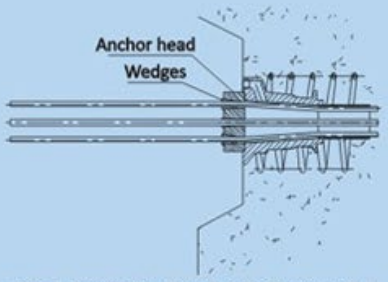
Designation	A	B	C	D	F	H
HM15-2	160	48	60	45	700	200
HM15-4	196	80	90	65	800	240
HM15-6	210	90	130	85	800	250
HM15-8	230	100	148	100	800	270
HM15-12	290	100	160	110	800	320
HM15-14	320	120	180	110	1000	340

1.Parameter E would be determined according to actual engineering structure.

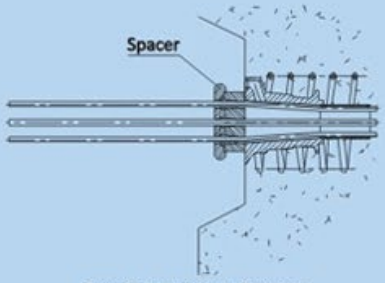


GROUTING SERVICES

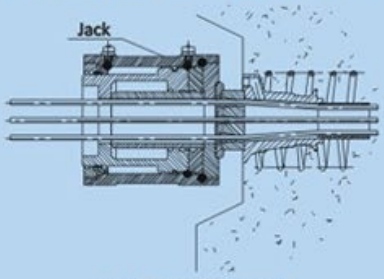
Installation and Stressing



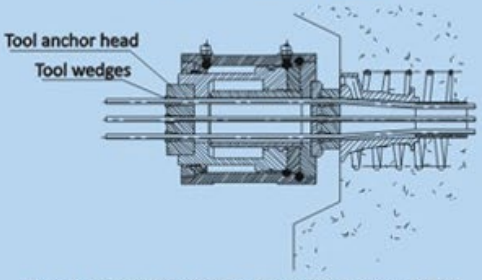
Step 1: Installation of anchor head and wedges



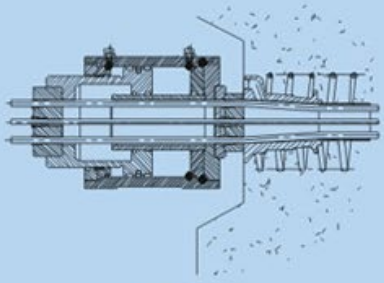
Step 2: Installation of spacer



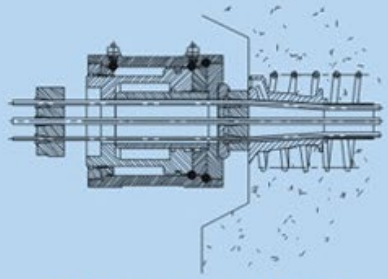
Step 3: Installation of jack



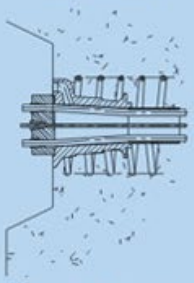
Step 4: Installation of tool anchor head and tool wedges



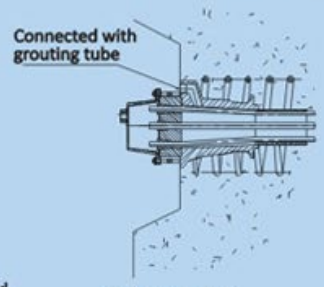
Step 5: Stressing



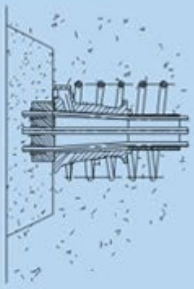
Step 6: Piston returning and anchoring



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.

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

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

σ_{con} --- Section stress without losses.

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

θ --- Accumulated angle (rad)

μ , k --- friction coefficient, refers to Table 1 and 2.

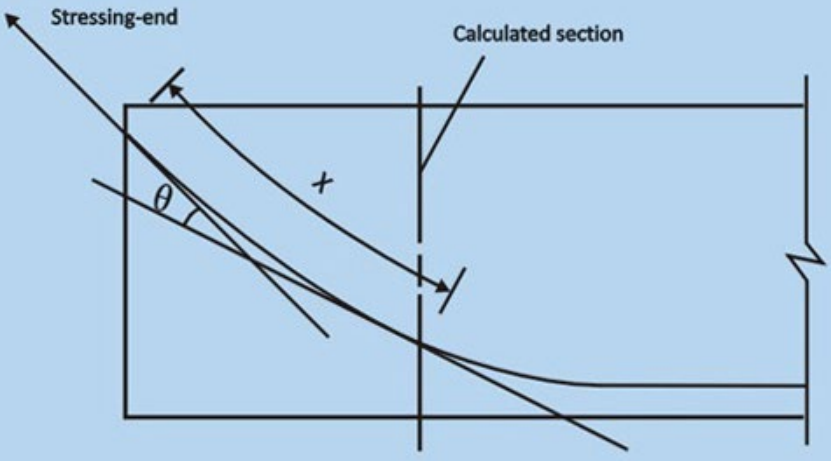


Table1: Coefficient when using strand and duct

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
ϕ 15 Steel strand	0.040	0.12

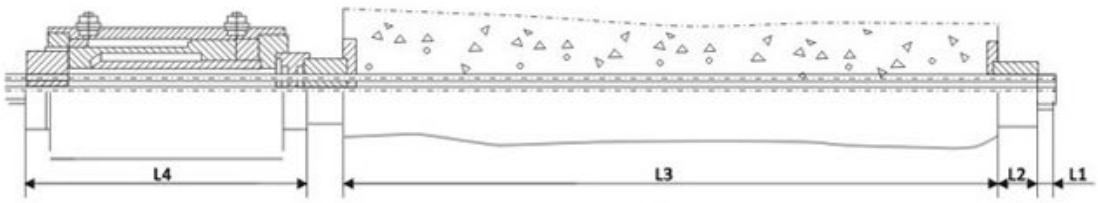
The friction coefficients of strands with other diameters refer to that of ϕ15mm strand.

■ 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

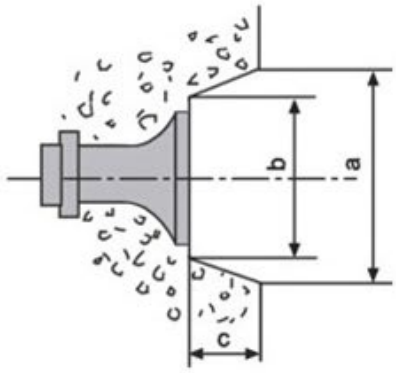
● When using dead-end anchorage type P or type H on one side of tendon, the length of strand shall be considered up to the embedding position of anchorage.



Calculation of length of strand (tensioning on one side)

Minimum Interval of Anchorage

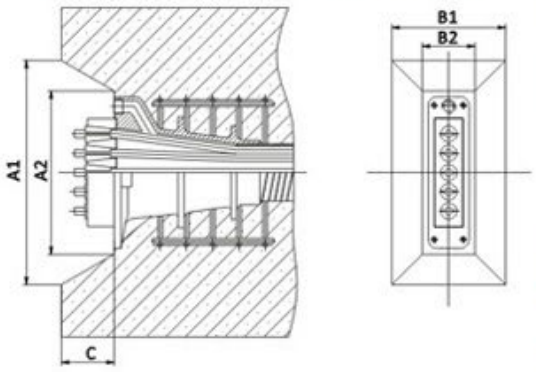
Recess Dimension



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)

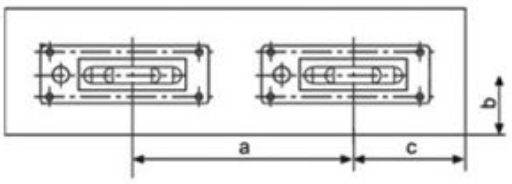
Recess dimension (slab tendon 0°)



Recess dimension (slab tendon 0°)

Designation	A1	A2	B1	B2	C
BM15-2	275	170	195	90	90
BM15-3	305	200	195	90	90
BM15-4	345	240	195	90	90
BM15-5	385	280	195	90	90

Slab Anchorage

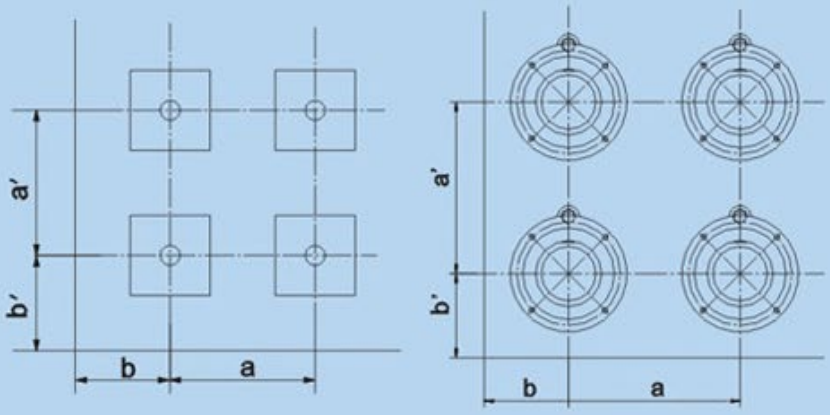


Slab Anchorage Unit:mm

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

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.

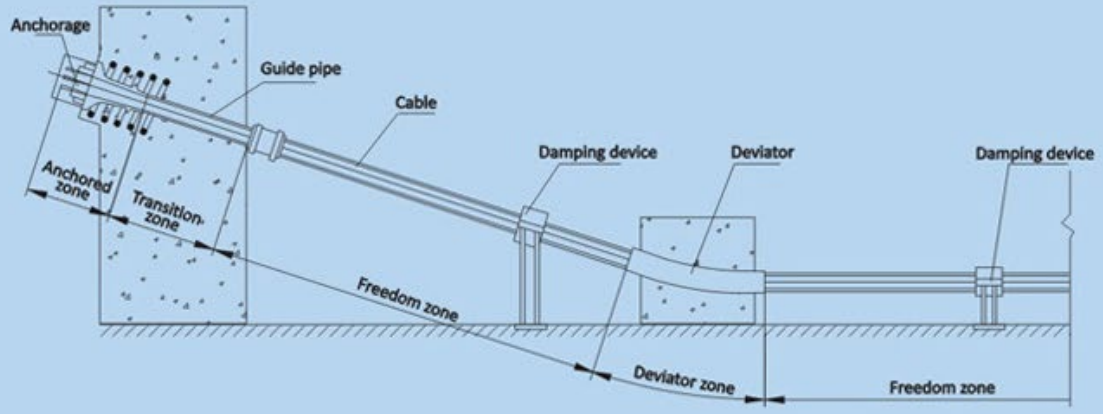
■ Low radius deviator, reduced stress concentration on deviating area.

Basic Components of OVM External Prestressing Systems

The basic components of external prestressing system include:

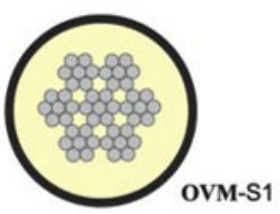
- External cables, ducts and grouting materials
- Anchorage system
- Deviating device
- Anti-corrosion system
- Damping device

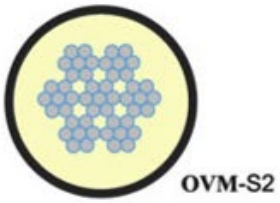
OVM External Prestressing System



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.


OVM-S1


OVM-S2


OVM-S3


OVM-S4


OVM-S5


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

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:

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

μ : Friction coefficient between prestresing steel and duct.

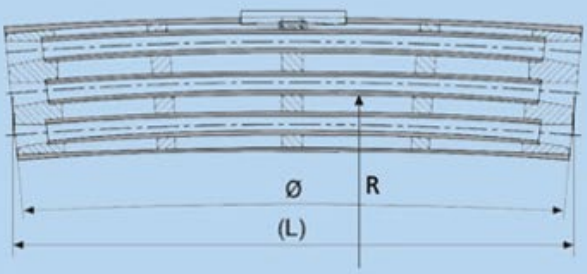
K : Coefficient for local warp of every meter duct.

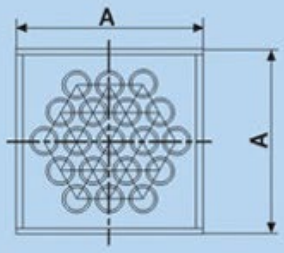
External prestressing cables are outside the concrete structures, made up of bending lines at deviator or anchor zones and straight lines between them. Friction effect due to warp of ducts is so weak on straight lines as to be ignored. Length of ducts on bending lines is short in general. So prestressing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

Assume k=0,
the formula above will be equal to $\sigma_{s1} = \sigma_k (1 - e^{-\mu\theta})$.

Intergrated Deviator (Conventional Deviator)

Distributed Deviator (Individual Strand Deviator)





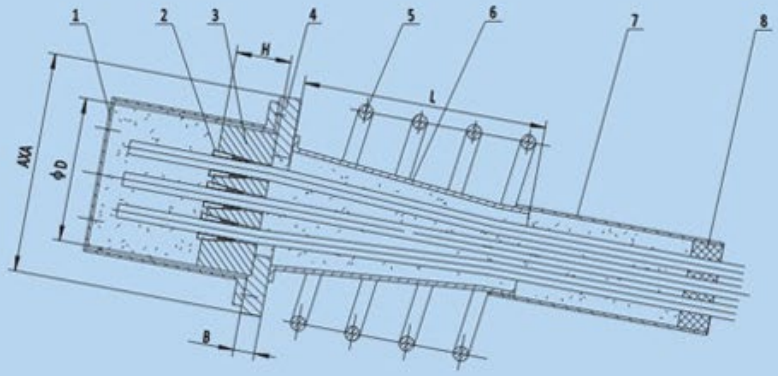
Individual strand deviator can make strands parallel and replaceable, every strand bears individual forces, ensures little abrasions existed between strands and de viator. Each guiding duct connects each other through the linked plates. Cement grout can separate external tendons, fix guiding ducts and 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 construction process.

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

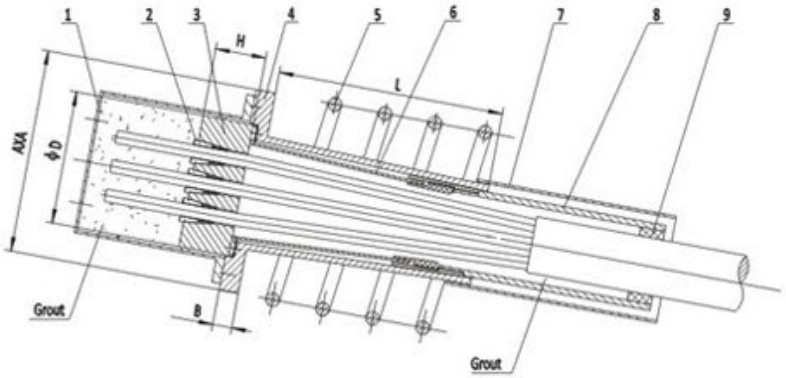
Main Data

Unit:mm

Designation	ϕD	H	AxAxB	L
OVM.A15-7	ϕ157	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

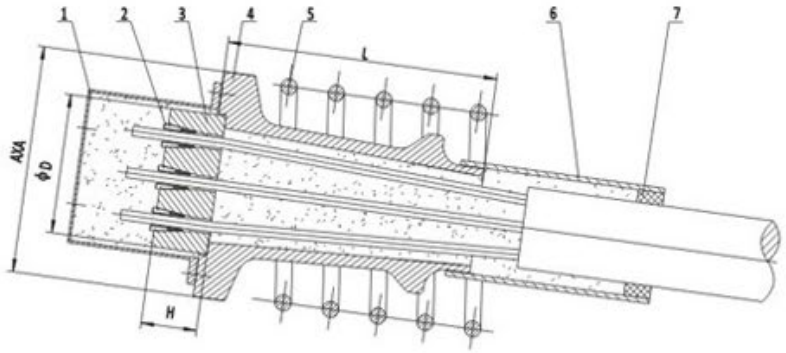
Type OVM.TA

OVM.TA 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

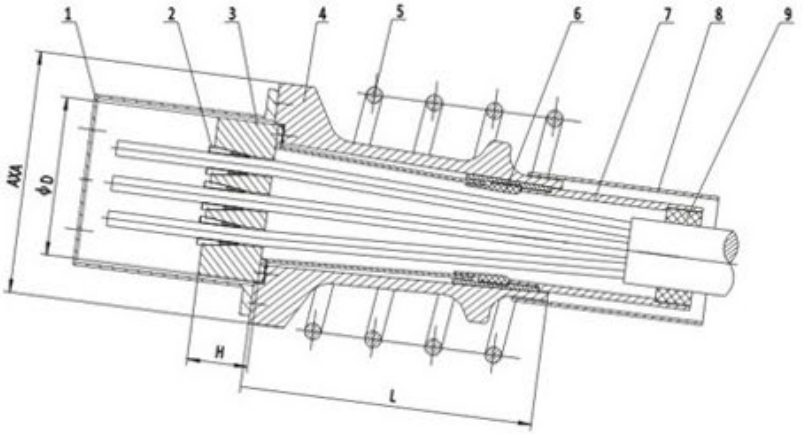
Main Data Unit:mm

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

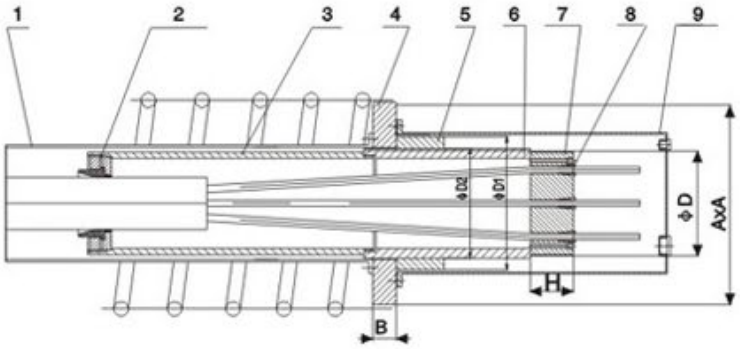
The structural form is shown below and dimensions are the same as OVM.TS.



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 SYSTEMS

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

Anchorage Type	Cable Type	Grouting Material	Deviator Type	Characteristics
OVM.A 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 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.

Grouting Services NZ Limited

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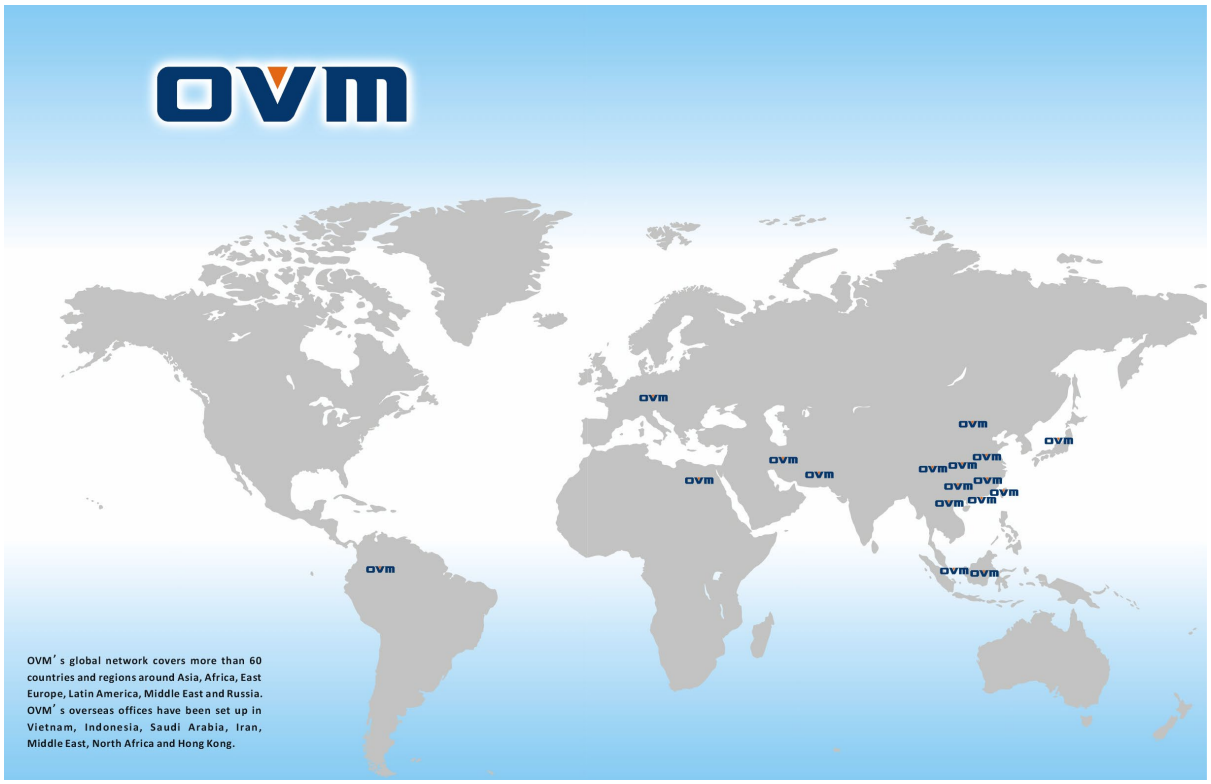

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