

# VSL GC ANCHORAGE TECHNOLOGY



## GC ANCHORAGES

Technical Data  
Characteristics  
Applications

# VSL'S LATEST FOR POST-TENSIONING

Light components for easy handling and installation

Meets ETAG with proven materials

PT-PLUS<sup>®</sup> duct system for enhanced corrosion protection



VSL has developed a new anchorage designed to satisfy the increasing expectations of the construction industry. The VSL GC type anchorage is an evolution optimizing new requirements with well proven materials while maximizing cost effectiveness.

The result is:

- lighter components
- ease of handling and placing
- fatigue resistance according to international guidelines and standards

The challenge for the VSL R&D Department was to further develop the EC and SC anchorage systems and to enhance the market friendliness. VSL has a long tradition in developing post-tensioning: revolutionary in 1966 as the first with strands, later on, in 1974 and 1992 with the introduction of casting (EC) and

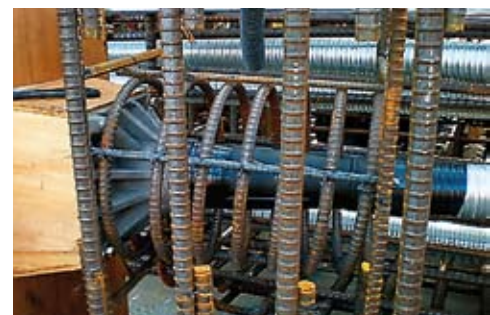
composite material (CS), and finally today with the GC System.

The GC consists of standardized anchorage units using up to thirty-seven 15 mm (0.6") diameter strands and can be used with both steel or plastic PT-PLUS<sup>®</sup> ducts. Equipped with an additional retainer plate, the GC anchorage can also be used as a dead-end anchorage. It can be used for couplers and external cables.

The VSL GC System is compatible with ETAG (European Technical Approval Guidelines) and other state approval requirements. It has also been tested at cryogenic temperatures for its use in LNG/LPG tanks.



Fixing of casting at recess former



Installed anchorage type GC 6-27

# Technical data and characteristics

## Strand properties

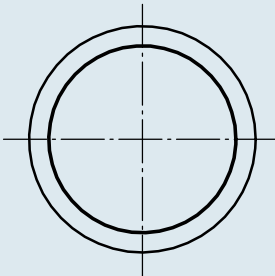
Strand type	15 mm (0.6")		
		prEN 10138 – 3 (2006) Y1770S7 / Y1860S7	ASTM A 416-06 Grade 270
Nominal diameter d	(mm)	15.7	15.2
Nominal cross section $A_p$	(mm <sup>2</sup> )	150	140
Nominal mass M	(kg/m)	1.17	1.10
Nominal yield strength $f_{p0,1k}$	(MPa)	1560 / 1640 <sup>1)</sup>	1676 <sup>2)</sup>
Nominal tensile strength $f_{pk}$	(MPa)	1770 / 1860	1860
Nominal breaking load $F_{pk}$	(kN)	265.5 / 279	260.7
Young's modulus	(GPa)	approx. 195	
Relaxation <sup>3)</sup> after 1000 h at 20 °C and 0.7 x $F_{pk}$	(%)	max. 2.5	

1) Characteristic value measured at 0.1 % permanent extension

2) Minimum load at 1 % extension for low-relaxation strand

3) Valid for relaxation class acc. to prEN 10138-3, or low-relaxation grade acc. to ASTM A 416-06

## Duct dimensions

Duct diameter for steel and PT-PLUS <sup>®</sup> duct	Tendon unit 0.6"	Steel duct <sup>1)</sup> minimum (mm) d/D	PT-PLUS <sup>®</sup> <sup>2)</sup> plastic duct (mm) d/D
 <p>Inside duct diameter: d Outside diameter: D</p>	6-3	40/45	-
	6-4	45/50	-
	6-7	55/62	58/63
	6-12	75/82	76/81
	6-19	90/97	100/106
	6-22	100/107	100/106
	6-27	110/117	115/121
	6-31	120/127	130/136
	6-37	130/137	130/136

1) The dimensions given are according our ETAG documents. Bigger diameters are possible

2) VSL PT-PLUS<sup>®</sup> ducts for 3 and 4 strands are not available

3) Dimensions are subject to modification

## Duct spacing and cover



Standard steel duct

In determining minimum spacings and concrete cover requirements, reference should be made to applicable standards and recommendations.



PT-PLUS<sup>®</sup> plastic duct with protection shell

VSL Protection Shells are recommended to be fixed on the duct at tendon supports for tendon radii  $R \leq 2 R_{min}$  (see next page).

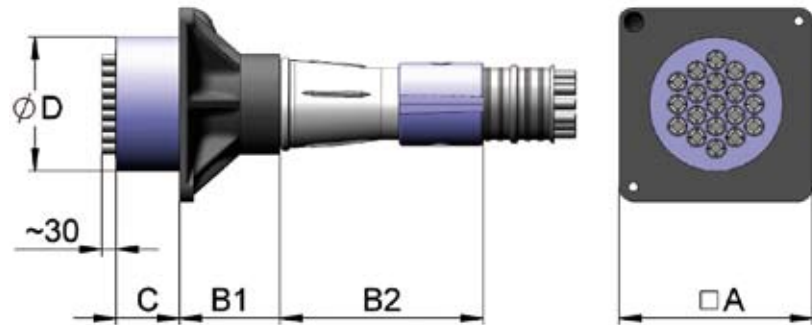


PT-PLUS<sup>®</sup> duct coupler  
– Half-shell  
– Clamp

# Technical data and characteristics

## Stressing anchorage VSL type GC

Grout and local zone reinforcement are not shown. Spirals and/or rectangular stirrups are, however, required to control local zone stresses. Please contact the nearest VSL representative.



## Main data

Tendon unit 0.6"	Dimensions 0.6"				
	A	B1	B2	C	D
6-3	130	120	-*	50	95
6-4	140	120	-*	55	110
6-7	180	135	-*	60	135
6-12	230	220	-*	75	170
6-19	290	150	300	95	200
6-22	325	150	490	100	220
6-27	350	170	450	110	240
6-31	375	170	410	120	260
6-37	410	170	600	135	280

Dimensions in mm

Subject to modification

\* These castings have no trumpet

Max. prestressing force may be applied when concrete reaches 80% of its nominal strength. Max. prestressing force is 75% of min. tendon breaking load (temporary overstressing to 80%).

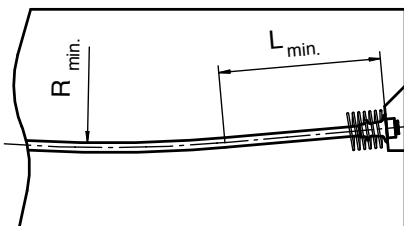
Where PT-PLUS® plastic ducts are used the trumpets for the GC have short, profiled extensions for PT-PLUS® coupling.

## Friction

The following values may be assumed when using the equation  $P_x = P_0 \cdot e^{-\mu(\alpha + \Delta\phi)}$

	Range	Recommended value
Steel duct	$\mu = 0.16$ to $0.20$ $\Delta\phi = 0.004$ to $0.008 \text{ m}^{-1}$	$\mu = 0.18$ $\Delta\phi = 0.006 \text{ m}^{-1}$
PT-PLUS® plastic duct	$\mu = 0.10$ to $0.14$ $\Delta\phi = 0.005$ to $0.012 \text{ m}^{-1}$	$\mu = 0.14$ $\Delta\phi = 0.007 \text{ m}^{-1}$

## Minimum radius of tendon curvature and minimum tangent length



$$R_{\min} = 3 \times \sqrt{F_{pk}} \{ \text{MN} \} \geq 2.5 \text{ m}$$

$$L_{\min} = 0.8 \text{ m for } F_{pk} \leq 2 \text{ MN}$$

$$= 1.0 \text{ m for } F_{pk} \geq 2 \text{ MN}$$

$$\leq 7 \text{ MN}$$

$$= 1.5 \text{ m for } F_{pk} \geq 7 \text{ MN}$$

FOR MORE





LNG Tank – Shanghai, PR China (2007-2009)

Suvarnabhumi Airport – Bangkok, Thailand (2008)

The GC anchorage system has gained worldwide acceptance for many projects. In addition to its ease of handling, customers particularly appreciate its compatibility with international standards and guidelines.



LNG Tank – Fujian, PR China (2007)



Flyover Palembang – South Sumatra, Indonesia (2008)

YOUR QUALITY PARTNER

# VSL LOCATIONS

## HEADQUARTER

VSL International Ltd.  
Scheibenstrasse 70 – Bern  
CH-3014 – Switzerland  
Phone: +41 58 456 30 30  
Fax: +41 32 613 30 55

## Americas

### ARGENTINA

VSL Sistemas Especiales de  
Construcción Argentina S.A.  
BUENOS AIRES  
Phone: +54 11 4 326 06 09  
Fax: +54 11 4 326 26 50

### BOLIVIA

Postensados de Bolivia  
SAN MIGUEL, LA PAZ  
Phone: +591 2 2770 338  
Fax: +591 2 2796 183

### CHILE

VSL Sistemas Especiales de  
Construcción S.A.  
SANTIAGO  
Phone: +56 2 571 6700  
Fax: +56 2 233 67 39

### COLOMBIA

Sistemas Especiales de  
Construcción Ltda.  
BOGOTA  
Phone: +57-1-620 96 34  
Fax: +57-1-620 58 16

### MEXICO

VSL Corporation Mexico S.A.  
de C.V.  
DISTRITO FEDERAL  
Phone: +52 53 96 86 21  
Fax: +52 53 96 84 88

### UNITED STATES

VStructural LLC  
BALTIMORE, MD  
Phone: +1 410 850 7000  
Fax: +1 410 850 4111

### VENEZUELA

Gestión de Obras y Construc-  
ciones C.A.  
CARACAS  
Phone: +58-212 941 86 75  
Fax: +58-212 941 86 75

## Middle East

### UNITED ARAB EMIRATES

VSL Middle East LLC  
DUBAI, UAE  
Phone: + 971 4 333 6262  
Fax: + 971 4 333 0008

## Africa

### EGYPT

Matrix Engineering Company  
CAIRO  
Phone: +20-2-344 19 00  
Fax: +20-2-346 04 57

### MOROCCO

Renfor-bat  
TANGER  
Phone: +212 39 95 80 87  
Fax: +212 39 95 80 85

### SOUTH AFRICA

Tsala-RMS Construction  
Solutions (Pty) Ltd  
JOHANNESBURG  
Phone: +27 11 878-6820  
Fax: +27 11 878-6821

## Europe

### AUSTRIA

Grund- Pfahl- und Sonderbau  
GmbH  
HIMBERG  
Phone: +43 2235 87 777  
Fax: +43 2235 86 561

### CZECH REPUBLIC

VSL Systemy (CZ), s.r.o.  
PRAGUE  
Phone: +420 2 51 09 16 80  
Fax: + 420 2 51 09 16 99

### FRANCE

VSL France S.A.  
LABEGE  
Phone: +33 05 61 00 96 59  
Fax : + +33 05 61 00 96 62

### GERMANY

VSL Systems GmbH  
BERLIN  
Phone: +49 30 53 01 35 32  
Fax +49 30 53 01 35 34

### GREAT BRITAIN

VSL Systems (UK) Ltd  
BEDFORDSHIRE  
Phone +41 58 456 30 30  
Fax +41 58 456 30 35

## NETHERLAND

Heijmans Beton en Waterbouw  
B.V.  
ROSMALEN  
Phone : +31 73 543 66 02  
Fax : + 31 73 543 66 11

## NORWAY

VSL Norge A/S  
STAVANGER  
Phone : +47 51 52 50 20  
Fax : + 47 51 56 27 21

## PORTUGAL

VSL Sistemas Portugal  
Pre-Esforço, Equipamento e  
Montagens SA  
S. DOMINGOS DE RANA  
Phone: +351 21 445 83 10  
Fax: +351 21 444 63 77

## VSL GEO

Sistemas de Aplicação em  
Geotecnia SA  
S. DOMINGOS DE RANA  
Phone: +351 21 445 83 10  
Fax: + 351 21 445 83 28

## SPAIN

CTT Stronghold  
BARCELONA  
Phone: +34 93 289 23 30  
Fax: +34 93 289 23 31

## VSL-SPAM, S.A.

BARCELONA  
Phone: +34 93 846 70 07  
Fax: +34 93 846 51 97

## SWEDEN

Internordisk Spännarmring  
AB  
VÄSTERHANINGE  
Phone: +46 8-500 738 20  
Fax: +46 8 753 49 73

## SWITZERLAND

VSL (Switzerland) Ltd.  
SUBINGEN  
Phone: +41 58 456 30 30  
Fax: +41 58 456 30 15

## VSL (Suisse) SA

ST-LEGIER  
Phone: +41 58 456 30 00  
Fax: +41 58 456 30 95

## TURKEY

MEGA YAPI Construction &  
Trade Co. Ltd.  
ANKARA  
Phone : +90.312.490 90 66  
Fax : +90.312.490 90 55

## Asia

### BRUNEI

VSL Systems (B) Sdn. Bhd.  
BRUNEI DARUSSALAM  
Phone: +6732380153/381 827  
Fax: +673 2 381 954

### CHINA PRC

VSL (China) Engineering  
Corp. Ltd.  
HEFEI  
Phone: +86 551 382 29 18  
Fax: +86 551 382 28 78

### HONG KONG

VSL Hong Kong Ltd.  
CHAI WAN  
Phone: +852 2590 2288  
Fax: +852 2590 0290

### Intrafor Hong Kong Ltd.

CHAI WAN  
Phone : +852 2836 3112  
Fax : +852 2591 6139

### FT Laboratories Ltd

PING CHE  
Phone: +852 2758 4861  
Fax: +852 2758 8962

### INDIA

VSL India Private Ltd.  
CHENNAI  
Phone: +91 44 4225 11 11  
Fax: +91 44 4225 10 10

### INDONESIA

PT VSL Indonesia  
JAKARTA  
Phone: +62 21 570 0786  
Fax: +62 21 573 1217

### JAPAN

VSL Japan Corporation  
TOKYO  
Phone: +81 3 3346 8913  
Fax: + 81 3 3345 9153

### KOREA

VSL Korea Co. Ltd.  
SEOUL  
Phone: +82 2 553 82 00  
Fax: +82 2 553 82 55

### MALAYSIA

VSL Engineers (M) Sdn. Bhd.  
KUALA LUMPUR  
Phone: +60 3 7981 4742  
Fax: +60 3 7981 8422

## PHILIPPINES

VSL Philippines Inc.  
PASIG City  
Phone: +632 672 1703  
Fax: +632 672 1395

## SINGAPORE

VSL Singapore Pte. Ltd.  
SINGAPORE  
Phone: +65 6559 1222  
Fax: +65 6257 7751

## TAIWAN

VSL Taiwan Ltd.  
TAIPEI  
phone : +886 2 2759 6819  
Fax: +886 2 2759 6821

## THAILAND

VSL (Thailand) Co. Ltd.  
BANGKOK  
Phone: +66 2 679 76 15-19  
Fax: +66 2 679 76 45

## VIETNAM

VSL Vietnam Ltd.  
HANOI  
Phone: +844 9 76 50 88  
Fax: +844 9 76 50 89

## HO CHI MINH CITY

Phone : +84 88 106 817  
Fax : +84 8 9102 596

## Australia/Pacific

### AUSTRALIA

VSL Australia Pty Ltd

### NEW SOUTH WALES

Phone: +61 2 9 484 5944  
Fax: +61 2 9 875 3894

### QUEENSLAND

Phone: +61 7 3265 64 00  
Fax +61 7 3265 75 34

### VICTORIA and SOUTHERN

Phone: +61 3 979 503 66  
Fax: +61 3 979 505 47

FOR MORE

