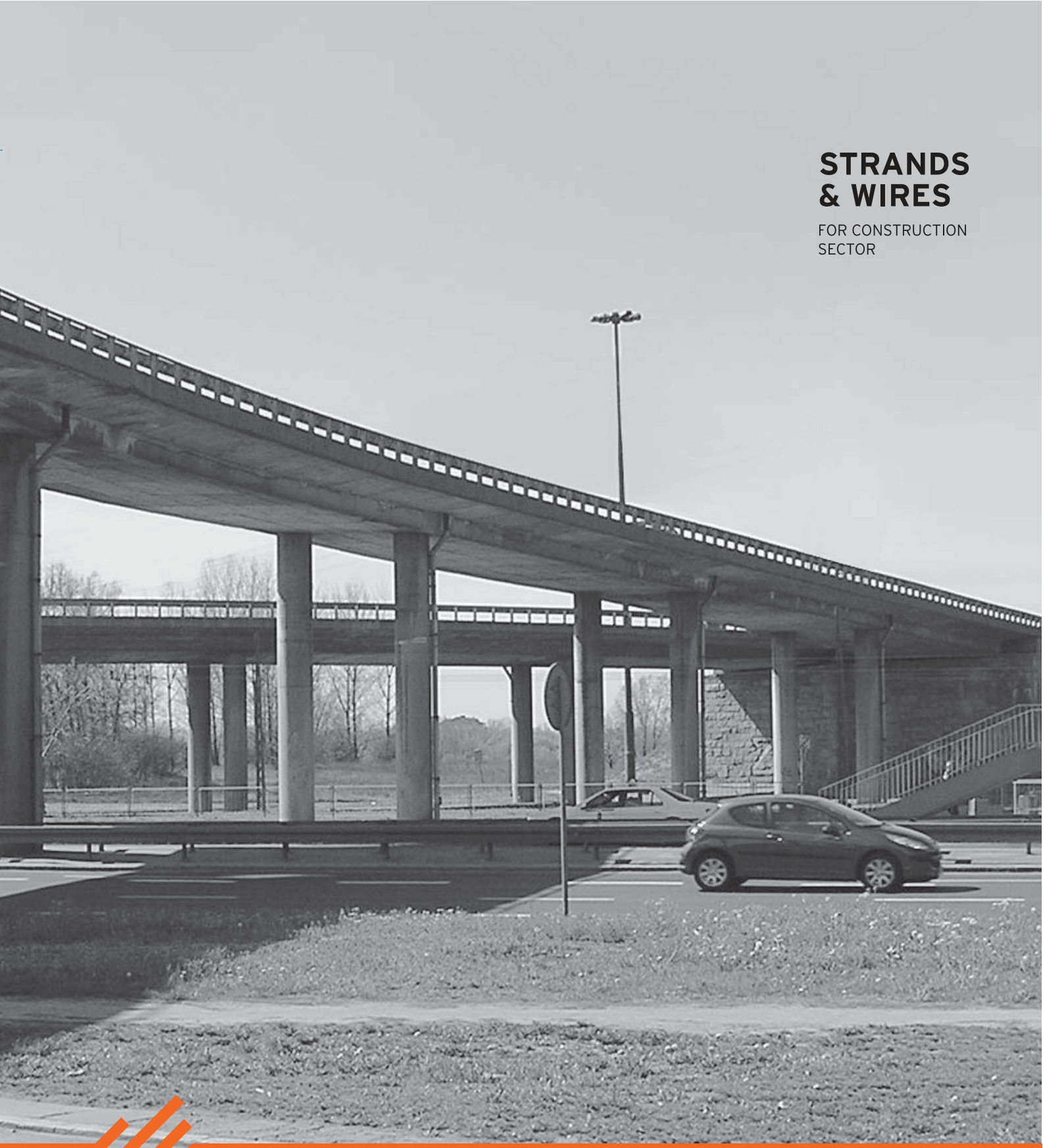
STRANDS & WIRES

FOR CONSTRUCTION SECTOR



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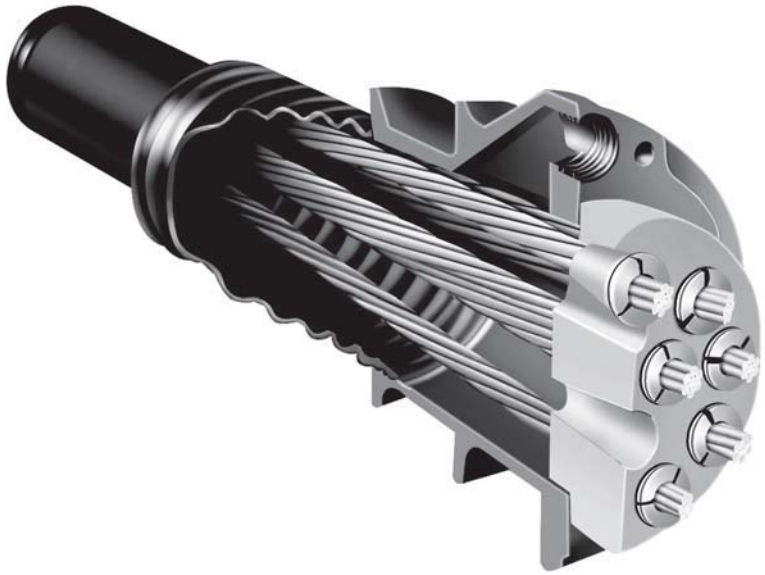
LRPC STRANDS-CONSTRUCTION PRODUCTS

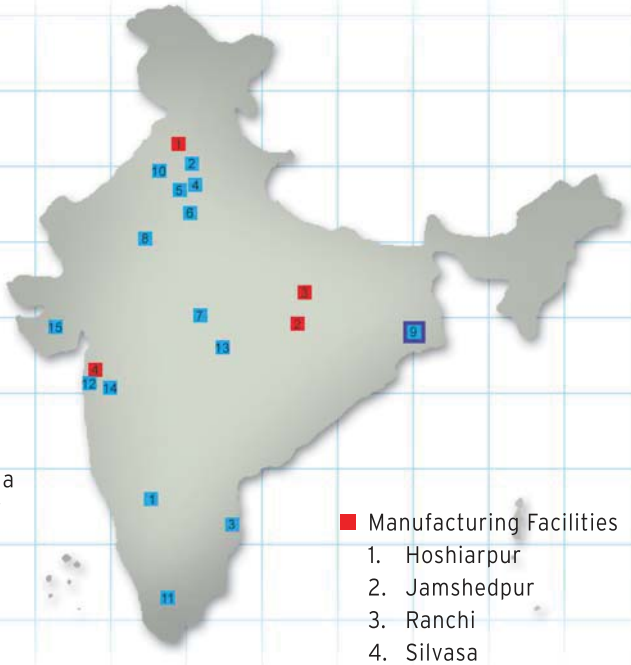
Usha Martin's continued investment in technology and equipment consistently push products to the highest quality standards. Years of engineering excellence, demonstrates our commitment to our customers in the construction industry. To keep pace with new concepts and constructional revolutions, Usha Martin product basket encompasses a comprehensive range of LRPC strands, namely:

- Bright Low relaxation (LRPC)/Normal relaxation (NRPC) Strand
- Galvanized LRPC Strand
- Polymer Coated*Galvanized*/Bright LRPC Strand
  - Grease/Wax Filled - Un-bonded LRPC Strand.
  - Bonded LRPC Strand
- Plain, Indented & Ribbed high tensile steel wire for Prestressed concrete.

*LRPC Strands of all available sizes and grades can be polymer sheathed & galvanized in conformance to all national and international specifications.



NATIONAL PRESENCE



Sale Offices

1. Bangalore
2. Chandigarh
3. Chennai
4. Delhi
5. Faridabad
6. Ghaziabad
7. Indore
8. Jaipur
9. Kolkata
10. Ludhiana
11. Madurai
12. Mumbai
13. Nagpur
14. Pune
15. Rajkot

Manufacturing Facilities

1. Hoshiarpur
2. Jamshedpur
3. Ranchi
4. Silvasa

Head Office
Kolkata

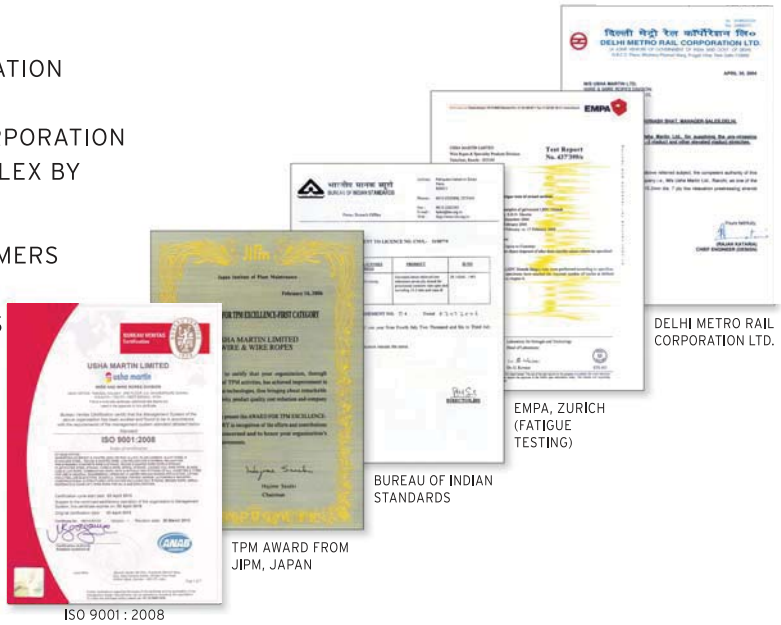
OUR VALUED CLIENTS

NATIONAL

- NATIONAL HIGHWAY AUTHORITY OF INDIA (NHAI)
- PUBLIC WORKS DIVISION (PWD)
- NUCLEAR POWER CORPORATION
- DELHI METRO RAILWAY CORPORATION
- KOLKATA METRO RAILWAYS
- NATIONAL THERMAL POWER CORPORATION
- IT PARKS & MULTISTORIED COMPLEX BY PRIVATE CONTRACTORS

INTERNATIONAL OVERSEAS CUSTOMERS SPREAD OVER

- GULF & MIDDLE EAST COUNTRIES
- PAPUA NEW GUINEA
- BANGLADESH
- SOUTH AFRICA
- AUSTRALIA



ISO 9001 : 2008

TPM AWARD FROM JIPM, JAPAN

BUREAU OF INDIAN STANDARDS

EMPA, ZURICH (FATIGUE TESTING)

DELHI METRO RAIL CORPORATION LTD.

HIGH TENSILE STEEL STRANDS

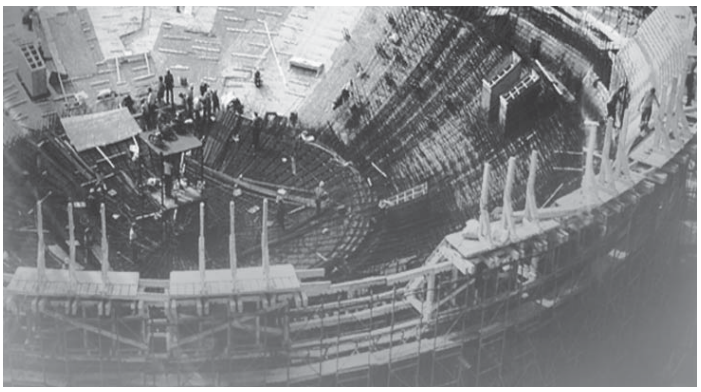
for Prestressed Concrete (Low Relaxation)

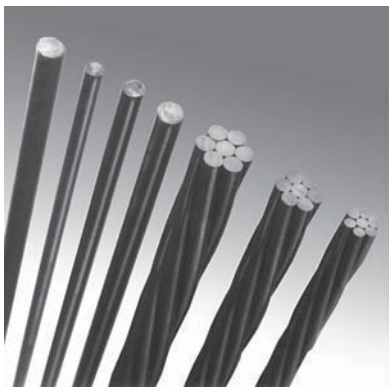
Why Low Relaxation Strands ?

A steel member that is prestressed and embedded in concrete, loses the initially applied stress exponentially with the passage of time. The utmost important factor attributing to this loss in stress is the stress relaxation property of the steel itself. By treating the steel through a thermomechanical process known as stabilising, the propensity of the steel to "relax" under a stressed condition is controlled to a great extent. Some of the main advantages that our customers derive by using low relaxation strands are listed below :

- Upto 10% reduction in steel requirement is possible.
- Saving in number of anchorages, ducts, sheathings, wedges and labour resulting in overall reduction of project cost.
- Reduction in concrete requirement due to reduced size of structural members.
- Thermo-mechanical processing during manufacture of LRPC Strands produces a nearly straight strand, thereby eliminating necessity for extra post straightening treatment.

Applications : Prestressed concrete girders for road, river & railway bridges and flyovers, prestressed concrete domes, buildings, silos, hangars, aquaducts, viaducts & railway sleepers.





Product Specifications
Bright (Ungalvanized LRPC Strands)

INDIAN SPECIFICATIONS : IS-14268/1995

Class	Nominal Diameter of Strand	Tolerance	Nominal area of Strand	Minimum Breaking Strength of Strand		0.2 Proof load (90% of Breaking Strength)		Minimum % Elongation GL=600mm	Nominal Weight of Strand (Approx)	Relaxation Loss	Chemical Composition
	(mm)	(±mm)	(mm^2)	(kN)	(kg)	(kN)	(kg)		(kg/km)	(%)	(%)
11	9.5	+0.66 -0.15	54.8	102.3	10434	92.1	9394	3.5	432	2.5 max. at 70% of specified min. breaking load after 1000 hours OR 1.8 max. at 70% of specified min. breaking load after 100 hours	S = .04 max. P = .04 max.
	11.1	+0.6 6 -0.15	74.2	137.9	14065	124.1	12658		582		
	12.7	+0.66 -0.15	98.7	183.7	18737	165.3	16860		775		
	15.2	+0.66 -0.15	140.0	260.7	26592	234.6	23929		1102		

BRITISH SPECIFICATIONS : BS-5896 : 1980

Type of Strand	Nominal Diameter	Tolerance of		Nominal area of Strand	Nominal Tensile strength	Specified Characteristic breaking strength	Load at 1% Elongation	Relaxation			Minimum Elongation at max load	Nominal Mass
		dia	Cross Sectional areas & mass					Initial load (% of actual breaking load)	Maximum after 1000 hrs			
									Class 1	Class 2		
	(mm)	(±mm)		(mm^2)	(N/mm^2)	(kN)	(kN)		For all strands		(L_o≥500mm)	(kg/1000m)
7 Wire Standard	9.3	±0.30 -0.15	+4% -2%	52	1770	92	81				For all strands	408
	11.0			71	1770	125	110					557
	12.5	+0.40 -0.20		93	1770	164	144	60%	4.5%	1.0%		730
	15.2			139	1670	232	204	70%	8.0%	2.5%	3.5%	1090
7 Wire Super	9.6	+0.30 -0.15	+4% -2%	55	1860	102	90	80%	12%	4.5%		432
	11.3			75	1860	139	122					590
	12.9	+0.40 -0.20		100	1860	186	163					785
	15.7			150	1770	265	233					1180

ASTM SPECIFICATIONS : A416

Grade	Nominal Diameter of Strand		Tolerance		Nominal area of Strand		Minimum Breaking Strength of Strand		Minimum load at 1% Extension		Nominal Weight of Strand (Approx)		1000 hrs Relaxation	Minimum % Extension GL 600 mm
	(Inch)	(mm)	(±Inch)	(±mm)	($Inch^2$)	(mm^2)	(lb)	(kN)	(lb)	(kN)	(lb/ 1000ft)	(kg/ 1000m)		
270	3/8	9.53			0.085	54.84	23000	102.30	20700	92.10	290	432	2.5% max. at 70% of specified min. breaking strength OR 3.5% max. at 80% of specified min. breaking strength.	3.5
	7/16	11.11	+0.026	+0.66	0.115	74.19	31000	137.90	27900	124.10	390	582		
	1/2	12.70	-0.006	-0.15	0.153	98.71	41300	183.70	37170	165.30	520	775		
	6/10	15.24			0.217	140.00	58600	260.70	52740	234.60	740	1102		

SPEC – prEN10138 – 3 : Dimension & Properties of Strands

Class	Steel Designation		Nominal [a*]				Specified			
	Steel Name	Steel Number	Diamater	Tensile Strength	Cross-Sectional Area [c*]	Mass	Permitted Deviation on Nominal Mass	Characteristic Value of Maximum Force	Maximum Value of Maximum Force	Characteristic Value of 0.1% Proof Force[d*]
				R_m [b*]		m		F_m	$F_{m\,max}$	$F_{p\,0.1}$
			(mm)	(Mpa)	(mm^2)	(g/m)	(%)	(kN)	(kN)	(kN)
A	Y1860S7	1.1366	9.0	1860	50	390	±2	93	106	80
			11.0		75	586		140	160	120
			12.5		93	726		173	198	149
			13.0		100	781		186	213	160
			15.2		140	1095		260	298	224
			16.0		150	1170		279	319	240
	Y1770S7	1.1365	15.2	1770	140	1095	±2	248	282	213
			16.0		150	1170		265	302	228

1 MPa = 1 N / mm^2

Notes :

a* The Nominal Modulus of Elasticity may be taken to be 195 GPa (kN/mm2)

b* The Nominal Tensile Strength is calculated from the Nominal Cross-Sectional Area and the specified characteristic Maximum Force, rounded to the nearest 10 MPa.

c* The Cross-Sectional Area is calculated from the Nominal Mass and Density of 7.81 kg/dm3

d* The specified characteristics 0.1% Proof Force is approximately 86% of the specifiedcharacteristic Maximum Force

SPEC – AS – 1311 : Dimension, Masses and Minimum Breaking Force of 7 Wire Strand

Nominal Diameter of strand	Nominal area	Calculated mass	Minimum Breaking Force	Grade
(mm)	(mm^2)	(kg / 1000 m)	(kN)	
9.3	52	410	94	REGULAR
10.9	71	555	125	
12.7	94	740	165	
15.2	139	1090	227	
9.3	55	430	102	SUPER
10.9	75	590	138	
12.7	100	785	184	
15.2	143	1125	250	
15.2	143	1125	261	EXTRA – HIGH TENSILE

SPEC – ISO 6934 – 4 : 1991 (E) : Dimension, Masses and Tensile Properties of 7 Wire Strand

Type of Strand [1*] / Diameter	Nominal Stand Diameter [1*]	Nominal Tensile Strength [1* 2*]	Nominal Cross-Sectional Area [2*]	Mass Per Length		Characteristic		
				Nominal	Permissible Deviation	Maximum Force [2* 3* 4*]	0.1% Proof Force [3* 4* 5*]	0.2% Proof Force [4* 5*]
(mm)	(mm)	(N/mm^2)	(mm^2)	(g/m)	(%)	(kN)	(kN)	(kN)
7-Wire Ordinary	9.5	1860	54.8	432.0	+4 -2	102.0	83.6	88.6
	10.8	1720	69.7	546.0		120.0	98.4	102.0
	11.1	1860	74.2	580.0		138.0	113.0	117.0
	12.4	1720	92.9	729.0		160.0	131.0	136.0
	12.7	1860	95.7	774.0		184.0	151.0	156.0
	15.2	1720	139.0	1101.0		239.0	196.0	203.0
	15.2	1860	139.0	1101.0		259.0	212.0	220.0

Notes :

1* The type of Strand, Nominal Diameter and Nominal Tensile Strength are for designation purposes only.

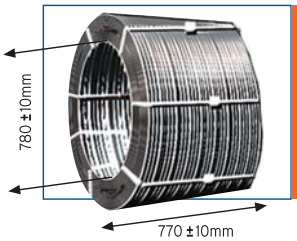
2* The nominal Tensile Strength is calculated from the nominal cross sectional area and the specified characteristic maximum force (see footnote 5*).

3* No single test result shall be less than 85% of the specified characteristic value.

4* Considering the small tolerance on mass per length, characteristic forces have been specified rather than stresses.

5* The 0.1% Proof Force is mandatory and the 0.2% Proof Force is for information only (see ISO 6934 - 1), except when otherwise agreed.

Packing :



In palletised cheese coil

Additional Specifications

PC strands as per following can also be supplied in case of specific demands

- ISI4268, Class 1
- ASTM A416, Grade 250
- JIS G 3536, Grade SW PR7AL, SWPR7BL
- Normal Relaxation PC Strands as per IS6006

INTRODUCING FOR THE FIRST TIME IN INDIA

Galvanised LRPC Strands :

Apart from Bright LRPC Strands, for some application, particularly in the case of extreme corrosive environment, Usha Martin's Galvanized LRPC Strands provides the additional protection required, and can be manufactured to customer requirements.

The physical and mechanical properties of the galvanized strands manufactured from hot - dip galvanized wires are at par with the bright strands for that particular diameter. Galvanization increases the resistance to corrosion led fatigue thereby resulting in enhanced service life.

Zinc coating weight can be supplied as per the customer requirements, varying from 190 - 340 gm/sq m.

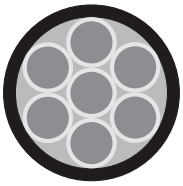
Polymer Coated Galvanized / Bright LRPC Strand :

The extruded thermoplastic coating becomes an integral part of the strand and is highly recommended for construction industry. The coating seals out contaminants, cushions the strands, resists abrasion and increases the life cycle capability of the structure.

Usha Martin's extensive background in cable sheathing technology and extrusion capability facilitates products with smooth, uniform and concentric coating of Polymer with premium quality. Usha Martin offers a selection of choices of types (family), thickness and colours (UV stabilized) of Polymers suitable for LRPC strand sheathing.

Grease Filled - Un-bonded LRPC Strand-For Post Tensioning

This speciality LRPC Strand may be bright or galvanized depending upon the environment, is coated with a corrosion resistant / water repellent - high temperature grease / wax to fill the interstices between the wires followed by a co-extrusion of an UV stabilized Polymer layer with thickness (min 0.5 mm, max as per customer's requirement). Usha Martin's Galvanized Un-bonded LRPC strands has an excellent durability and provides perfect protection against corrosion through tri-complimentary nested barrier formed by (1) galvanization followed by (2) anti-corrosive, water repellent - grease / wax coating in the interstices (3) UV stabilized polymer sheath, This particular arrangement also enables monitoring of strands, by replacing a post-tensioned strand at regular interval.



Zinc coating

Anti-corrosion High Temperature Grease

UV Stabilised Polymer

Bonded LRPC Strand (Galvanized/ Bright) - For Stay Cables

Bonding implies adhesion of the polymer sheath with the steel surface of the LRPC Strand. Bonded LRPC Strands exhibits a strong bonding strength and conforms to the requirement of the customers. The state of art sheathing lines and stringent control parameters during manufacture, particularly with regard to diametrical concentricity of sheathing, consents Bridge Designers to bundle Usha Martin strands with confidence.

Properties of Sheathed Galvanized/Bright LRPC Strand Post Tensioning /Stay Applications

Application	LRPC Variants	Sheathing Thickness(mm)		Polymer Type (UV Stabilized)**	Zinc Coating weight
		Min	Max		g/m^2
Post Tensioning	Unbonded (Grease Filled)	0.5	As per Customer's Requirement	PP-Standard Colour Orange OR PE-Standard Colour Black	190-340
Stay Cables	Bonded				

Note:

PP : POLYPROPYLENE , PE : POLYETHYLENE

** Apart from the standard colours shown in the table, other colours can also be supplied as per customers requirement

HIGH TENSILE STEEL WIRES

for Pre-stressed Concrete (Plain, Indented, Ribbed)

Applications : Concrete poles, Railway sleepers, Hume pipes, Bridges.

BRITISH SPECIFICATIONS : BS-5896:1980

Nominal Diameter	Tolerance	Nominal UTS	Minimum Spec. Characteristics 0.1% Proof Load	Minimum load at 1% Elongation	Minimum Elongation % GL 200 mm	Reverse Bend	
						Minimum Number	Radius of Bend
(mm)	(±mm)	(kg/mm^2)	(kN)	(kN)	(%)	(nos.)	(mm)
7.0	0.05	160	50.1	51.3	3.5	4 for	20
6.0	0.05	170	39.3	40.2	-do-	smooth	15
6.0	0.05	180	41.6	42.6	-do-	wires	15
5.0	0.05	170	27.2	21.8	-do-	3 for	15
5.0	0.05	180	28.8	29.5	-do-	indented	15
4.5	0.05	165	21.4	21.9	-do-	wires	15
4.0	0.04	170	17.5	17.9	-do-		10
4.0	0.04	180	18.5	19.0	-do-		10

Notes :

- Maximum relaxation values after 100 hrs. as per Class 1 of BS specification
- Coil weights and IDs shall be as per table below

INDIAN SPECIFICATIONS : IS-1785 Part-1 (Stress Relieved)

Nominal Diameter	Tolerance	Nominal UTS	Minimum Elongation GL=200 mm	Bend Minimum Value	Bend Radius	Minimum 0.2% Proof Stress	Coil I.D.	Coil weights for stress relieved wires
(mm)	(±mm)	(kg/mm^2)	(%)	(nos.)	(mm)		(metre)	(kg)
2.5	0.025	205	2.5	3	7.5	85% of min.	1.5	200-300
3.0	0.04	190	2.5	3	10.0	Tensile	1.5	200-300
4.0	0.05	175	3.0	3	12.5	Strength for	1.5	300-500
5.0	0.05	160	4.0	3	15.0	all wires.	1.5	300-500
7.0	0.05	150	4.0	3	20.0		2.0	300-600
8.0	0.05	140	4.0	3	25.0		2.0	300-600

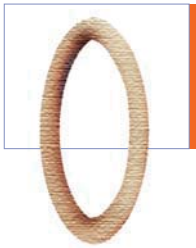
INDIAN SPECIFICATIONS : IS-6003 (Stress Relieved & indented)

Nominal Diameter	Tolerance	Nominal UTS	Minimum Elongation GL=200 mm	Bend Minimum Value	Bend Radius	Minimum 0.2% Proof Stress	Coil I.D.	Coil weights for stress relieved wires
(mm)	(±mm)	(kg/mm^2)	(%)	(nos.)	(mm)		(metre)	(kg)
3.0	0.05	190	2.5	3	10.0	85% of minimum	1.5	200-300
4.0	0.05	175	3.0	3	12.5	specified UTS	1.5 - 2.0	300-500
5.0	0.05	160	4.0	3	15.0	for all wires.	1.5 - 2.0	300-500

Notes :

- Apart from plain wires, we can also produce two side/ indented wires and ribbed wires
- In sizes 7.00 and 8.00mm stress relieved wire we can also manufacture 160 kg/mm2 minimum tensile.
- Relaxation values at initial stress 70% of min. UTS for all wires are 5% max. after 1000 hrs. or 3.5% max. after 100 hrs.
- Wires can be supplied in unoiled condition or can be coated with water soluble rust preventive oil
- We can also produce wires in higher sizes conforming to the above specifications.
- We can also manufacture High tensile Steel Wires as per other standards.
- Wires of higher diameters can also be produced as per customers requirement.

Packing :



In coils wrapped with Polythene and Hessian or Polycoated Hessian or as per customer's requirement.