



Works: _____

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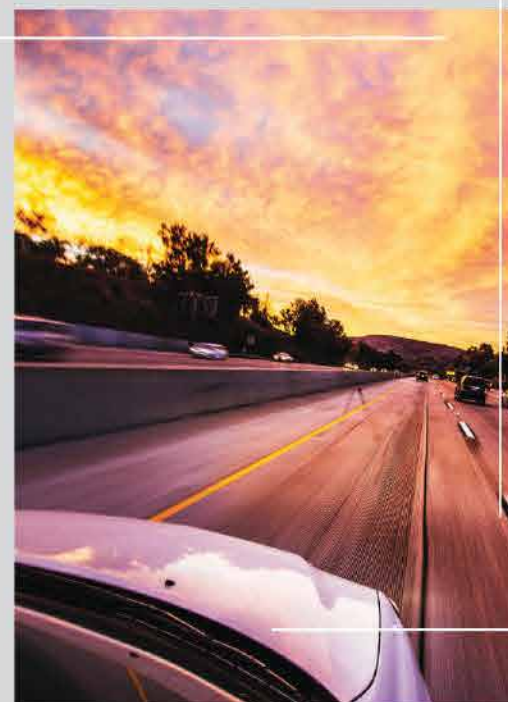
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Powering **Possibilities** with



**Passion. Precision.
Perfection.**



**Best In Class High Quality Oil Hardened
and Tempered Steel Wires**

Introduction:

PENGG USHA MARTIN

THE LAST WORD IN HIGH QUALITY OIL
HARDENED AND TEMPERED STEEL WIRES.



Pengg Usha Martin has successfully adopted and incorporated the vast experience and considerable expertise of its parent companies, Joh Pengg and Usha Martin and hence delivering excellence to customers every step of the way.



A company specialized in the manufacture of wire for use in a variety of products and applications, Pengg Usha Martin has achieved international recognition within the fields of automobile and mechanical engineering.

What sets us apart? The highest degree of dimensional accuracy, precision in mechanical properties, a thorough knowledge of the metallurgical processes involved, a close working relationship with our customers and focused attention to their requirements.

These qualities represent at the same time, our motto and our standards. The foundation of these standards has been laid with the help of our collaborator Joh Pengg, Austria who have many years of metal working experience, originating in the mid-13th century and continued to the present day by their skill and technical competence.



OUR PRESENCE



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Product Offering

OIL TEMPERED WIRES

The continuous oil-tempering process optimizes wire properties and results in a stress-relieved, homogenous wire structure with no deformation texture. Our customers appreciate the durability of these wires, their excellent fatigue life, the reliability when subjected to elevated operating temperatures and high resistance against relaxation.

Application examples:

Engine valve springs, clutch springs, springs for fuel injection systems, damper springs, etc.



CERTIFIED QUALITY MANAGEMENT SYSTEMS

Our wires undergo tough quality tests, including eddy testing to ensure that only the best products of the highest quality reach our customers.

Our quality management system has been designed and are managed in accordance with IATF 16949/ISO 9001

PENTHOR FROM PENG USHA MARTIN

A COMPLETE RANGE OF SPECIALIZED OIL
HARDENED & TEMPERED STEEL WIRES
FOR SPRING MANUFACTURING



PRODUCT	DESCRIPTION	SIMILAR GRADES	APPLICATION
Penthor 1064	Oil tempered SiCrV+Ni alloyed valve spring wire from shaved wire rod, with dia $\geq 2.50\text{mm}$ 40 μm -continuous surface inspected.	NA	For high dynamic stresses e.g. valve springs.
Penthor 964	Oil tempered SiCrV alloyed valve spring wire from shaved wire rod, with dia $\geq 2.50\text{mm}$ 40 μm -continuous surface inspected.	• VDSiCrV according to EN 10270-2 : 2011 • ASTM A877/877M Grade B • SWOSC-VHV	For high dynamic stresses e.g. valve springs.
Penthor 943	Oil tempered SiCrV alloyed spring wire with dia $\geq 2.5\text{mm}$ 60 μm -continuous surface inspected.	• TDSiCrV according to EN 10270-2 : 2011 • ASTM A1000 Grade D	For moderate dynamic stresses e.g. clutch springs
Penthor 911 HT	Oil tempered SiCrV alloyed spring wire with dia $\geq 2.5\text{mm}$ 60 μm -continuous surface inspected.	NA	For moderate dynamic stresses e.g. trunk springs
Penthor 911	Oil tempered SiCrV alloyed spring wire.	• FDSiCrV according to EN 10270-2 : 2011	For statically stressed springs e.g. suspension springs
Penthor 864	Oil tempered SiCr alloyed valve spring wire from shaved wire rod with diameters $\geq 2.5\text{ mm}$ 40 μm -continuous surface inspected.	• VDSiCr according to EN 10270-2 : 2011 • ASTM A877/877M Grade A • JIS G3561 SWOSC-V • VDSiCr according to IS 4454 Part 2	For high dynamic stresses e.g. valve springs
Penthor 844S	Oil tempered SiCr alloyed spring wire spring wire from shaved wire with diameters $\geq 2.5\text{ mm}$ 40 μm -continuous surface inspected.	• TDSiCr according to EN 10270-2 : 2011 • ASTM A1000 Grade A • JIS G3560 SWOSC-B • TDSiCr according to IS 4454 Part 2	For dynamic stresses
Penthor 842/843	Oil tempered SiCr alloyed spring wire with diameters $\geq 2.5\text{ mm}$ 60 μm -continuous surface inspected.	• TDSiCr according to EN 10270-2 : 2011 • ASTM A1000 Grade A • JIS G3560 SWOSC-B • TDSiCr according to IS 4454 Part 2	For moderate dynamic stresses e.g. clutch springs
Penthor 811	Oil tempered SiCr alloyed spring wire.	• FDSiCr according to EN 10270-2 : 2011 • ASTM A401/A401M • JIS G3560 SWOSC-B • FDSiCr according to IS 4454 Part 2	For statically stressed springs e.g. suspension springs
Penthor 111	Oil tempered unalloyed spring wire.	• FDC according to EN 10270-2 : 2011 • ASTM A229/A229M • JIS G3560 SWO-A • FDC according to IS 4454 Part 2	For statically stressed springs e.g. garage springs, car seat springs.

We also manufacture multiarc/oval shaped wires across all grades. (Pls refer shaped wire page)

PENTHOR 1064

OIL TEMPERED SILICON/CHROMIUM/ VANADIUM + NICKEL
ALLOYED VALVE SPRING WIRE FROM SHAVED WIRE ROD



EXTERNAL STANDARD:

NA

FURTHER SIMILAR STANDARDS:

NA

APPLICATIONS:

Especially suitable for coil springs subjected to high dynamic stresses requiring good fatigue resistance (eg valve springs), as well as for springs which require high tensile strength and excellent relaxation properties at moderately elevated working temperatures (up to approx. 250 °C).

RANGE OF DIAMETERS:

1.30 to 7.00 mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %	V %	Ni %
0.50-0.70	1.80-2.20	0.30-1.00	0.020	0.020	0.06	0.85-1.05	0.05-0.25	0.20-0.40

RAW MATERIAL:

Wire rod made of Si-killed steel according to in-house specifications.

The wire rod is shaved to eliminate surface defects such as seams, cracks and decarburization.

CLEANLINESS ACC. TO MAX. T-METHOD:

Number of non-metallic inclusions in the surface area detected on end samples of the wire rod.

Size of inclusions	5-10	>10-15	>15 ¹⁾	µm
Max.number/1000mm ²	50	7	0	

1) As stated by IVSWMA* it is likely to find occasional inclusions in valve spring quality steel of a size large than 15 µm IVSWMA: International Valve Spring Wire Manufacturers Association

MECHANICAL PROPERTIES: PENTHOR 1064

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	MINIMUM NO. OF TORSIONS min. Nos.	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40	± 0.020	2280 to 2380	-	5	MAX 0.5 % OF THE WIRE DIAMETER	
>1.40 to 1.60		2230 to 2360				
>1.60 to 2.00		2230 to 2330				
>2.00 to 2.50		2180 to 2280				
>2.50 to 2.70		2130 to 2230				
>2.70 to 3.00		2130 to 2230				
>3.00 to 3.20		2130 to 2230	45			
>3.20 to 3.50	2080 to 2180	4				
>3.50 to 4.00	2080 to 2180					
>4.00 to 4.20	2030 to 2130		40	3		
>4.20 to 4.50	2030 to 2130					
>4.50 to 4.70	2030 to 2130					
>4.70 to 5.00	2030 to 2130	35	-			
>5.00 to 5.60	± 0.030			1980 to 2080		
>5.60 to 6.00	± 0.035			1980 to 2080		
>6.00 to 7.00	± 0.040	1960 to 2060				

- Range of tensile strength within one coil max. 60 MPa
 - Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
 - Yield point (0.2% limit) at least 90% of the tensile strength
 - Modulus of elasticity E = 206.000 MPa (Standard)
 - Shear Modulus G = 79.500 MPa (Standard)
 - Torsion tests are carried out according to EN 10218-1
- 1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.5 to 6.5 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects.

Testing of wires <2.5 mm can be agreed upon separately.

Defect ≥40µm are recorded and marked.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380° – 425°C, with a holding time of 30 minutes at temperature.

After shot peening, the springs must be stress relieved at approx. 240°C for 30 minutes.

SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 964

OIL TEMPERED SILICON/CHROMIUM/ VANADIUM ALLOYED
VALVE SPRING WIRE FROM SHAVED WIRE ROD



EXTERNAL STANDARD:

The material confirms to VDSiCrV according to EN 10270 – 2: 2011

FURTHER SIMILAR STANDARDS:

ASTM A877/877M Grade B and SWOSC-VHV

APPLICATIONS:

Especially suitable for coil springs subjected to high dynamic stresses requiring good fatigue resistance (e.g. valve springs), as well as for springs which require high tensile strength and excellent relaxation properties at moderately elevated working temperatures (up to approx. 250° C)

RANGE OF DIAMETERS:

1.30 to 10.00mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %	V %
0.50-0.70	1.20-1.65	0.40-0.90	0.020	0.020	0.060	0.50-1.00	0.10-0.25

RAW MATERIAL:

Wire rod made of Si-killed steel according to in-house specifications.

The wire rod is shaved to eliminate surface defects such as seams, cracks and decarburization.

CLEANLINESS ACC. TO MAX. T-METHOD:

Number of non-metallic inclusions in the surface area detected on end samples of the wire rod.

Size of inclusions	5-10	>10-15	>15 ¹⁾	µm
Max.number/1000mm²	50	7	0	

1) As stated by IVSWMA* it is likely to find occasional inclusions in valve spring quality steel of a size large than 15 µm IVSWMA: International Valve Spring Wire Manufacturers Association

MECHANICAL PROPERTIES: PENTHOR 964

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	MINIMUM NO. OF TORSIONS Nos.	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	±0.020	2230 to 2360 2210 to 2360	50	5	MAX 0.50 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	±0.025	2160 to 2310 2100 to 2250 2060 to 2210				
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	±0.030	2060 to 2210 2060 to 2210 2010 to 2160 2010 to 2160	45	4		
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	±0.035	1960 to 2110 1960 to 2110 1960 to 2110 1960 to 2110 1910 to 2060	40	3		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	±0.040	1910 to 2060 1910 to 2060 1860 to 2010	35			
>7.00 to 8.00 >8.00 to 9.00	±0.045	1860 to 2010 1810 to 1960				
>9.00 to 10.00	±0.050	1810 to 1960				

- Range of tensile strength within one coil max. 50 MPa
- Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
- Yield point (0.2% limit) at least 90% of the tensile strength
- Modulus of elasticity E = 206.000 MPa (Standard)
- Shear Modulus G = 79.500 MPa (Standard)
- Torsion tests are carried out according to EN 10218-1

1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.5 to 6.5 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects. Testing of wires <2.50 mm can be agreed upon separately. Defects ≥ 40 µm are recorded and marked.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380°–425°C, with a holding time of 30 minutes at temperature.

After shot peening, the springs must be stress relieved at approx. 240°C for 30 minutes.

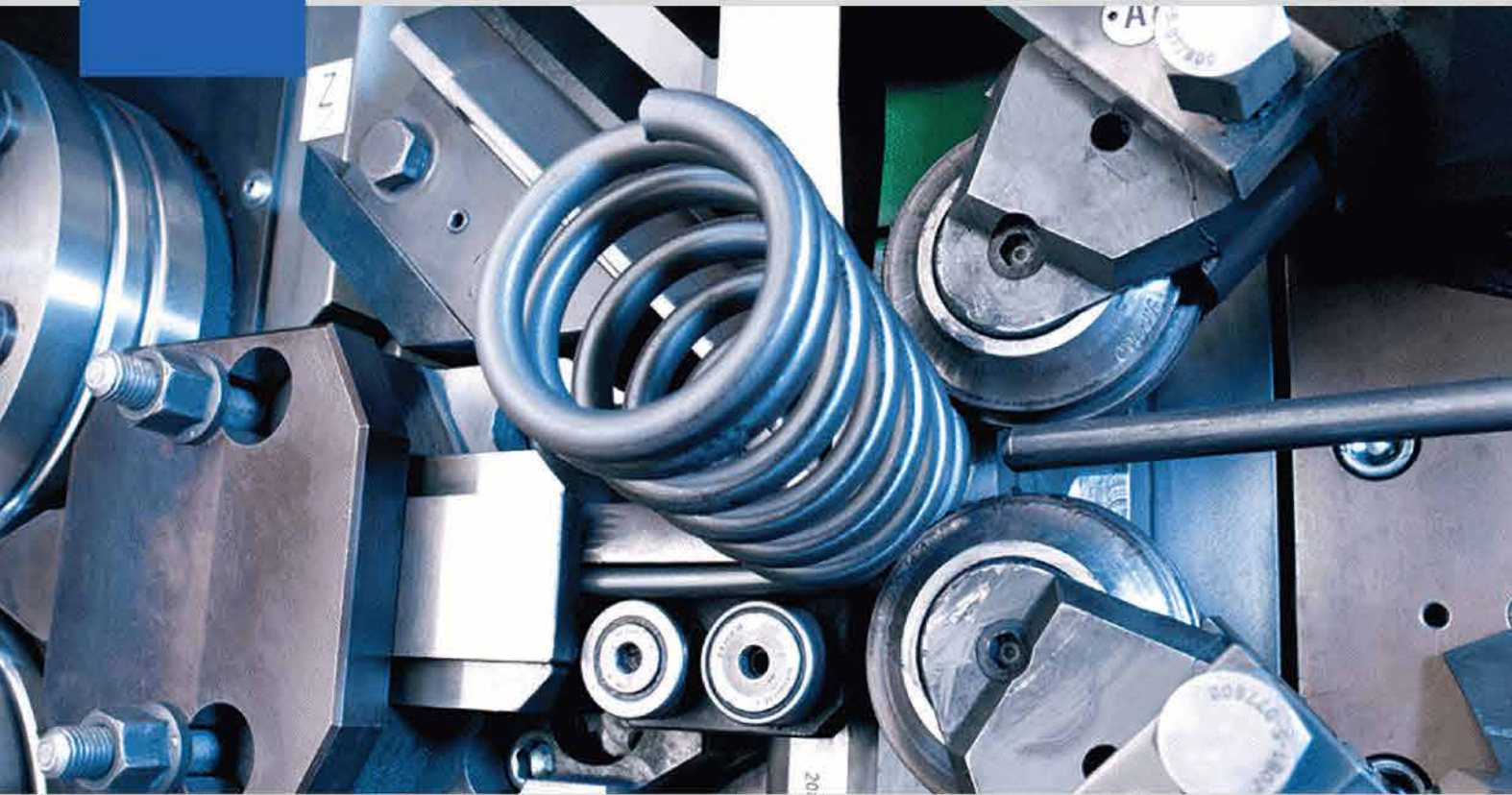
SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 943

OIL TEMPERED SILICON/CHROMIUM/ VANADIUM
ALLOYED SPRING WIRE



EXTERNAL STANDARD:

The material confirms to TDSiCrV according to EN 10270 – 2: 2011.

FURTHER SIMILAR STANDARDS:

ASTM A-1000 Grade D

APPLICATIONS:

For coil springs subjected to moderate dynamic stresses, such as clutch springs or springs requiring similar moderate fatigue resistance as well as high tensile strength and excellent relaxation properties at elevated temperatures (up to approx. 250°C).

RANGE OF DIAMETERS:

1.30 to 10.00 mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %	V %
0.50-0.70	1.20-1.65	0.40-0.90	0.020	0.020	0.10	0.50-1.00	0.10-0.25

RAW MATERIAL:

Wire rod according to in-house specifications.

CLEANLINESS ACC. TO DIN 50602, INCLUSIONS CHART 1:

Max. size 2 for all types of inclusions.

MECHANICAL PROPERTIES: PENTHOR 943

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	MINIMUM NO. OF TORSIONS min. Nos.	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	±0.020	2230 to 2360 2210 to 2360	50	5	MAX 1.30 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	±0.025	2160 to 2310 2100 to 2250 2060 to 2210				
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	±0.030	2060 to 2210 2060 to 2210 2010 to 2160 2010 to 2160	45	4		
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	±0.035	1960 to 2110 1960 to 2110 1960 to 2110 1960 to 2110 1910 to 2060		40		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	±0.040	1910 to 2060 1910 to 2060 1860 to 2010	35	-		
>7.00 to 8.00 >8.00 to 9.00	±0.045	1860 to 2010 1810 to 1960				
>9.00 to 10.00	±0.050	1810 to 1960				

- Range of tensile strength within one coil max. 60 MPa
- Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
- Yield point (0.2% limit) at least 90% of the tensile strength
- Modulus of elasticity E = 206.000 MPa (Standard)
- Shear Modulus G = 79.500 MPa (Standard)
- Torsion tests are carried out according to EN 10218-1

1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.5 to 6.5 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects. Testing of wires <2.5 mm can be agreed upon separately. Defect ≥60µm are recorded and marked.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380° – 425°C, with a holding time of 30 minutes at temperature.

After shot peening, the springs must be stress relieved at approx. 240°C for 30 minutes.

SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 911HT

OIL TEMPERED SILICON/CHROMIUM/ VANADIUM
ALLOYED SPRING WIRE



EXTERNAL STANDARD:

NA

FURTHER SIMILAR STANDARDS:

NA

APPLICATIONS:

For coil springs subjected to moderate dynamic stresses, such as clutch springs or springs requiring similar moderate fatigue resistance as well as high tensile strength and excellent relaxation properties at elevated temperatures (up to approx. 250°C).

RANGE OF DIAMETERS:

1.30 to 7.00 mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %	V %
0.50-0.70	1.20-1.65	0.40-0.90	0.020	0.020	0.10	0.50-1.00	0.10-0.25

RAW MATERIAL:

Wire rod according to in-house specifications.

CLEANLINESS ACC. TO DIN 50602, INCLUSIONS CHART 1:

Max. size 2 for all types of inclusions.

MECHANICAL PROPERTIES: PENTHOR 911HT

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	TORSION (MIN.) nos	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40	±0.020	2330 to 2430	45	4	MAX 1.30 % OF THE WIRE DIAMETER	
>1.40 to 1.60		2330 to 2430				
>1.60 to 2.00	2260 to 2360	40				
>2.00 to 2.50	2260 to 2360					
>2.50 to 2.70	2240 to 2340					
>2.70 to 3.00	2240 to 2340					
>3.00 to 3.20	2240 to 2340					
>3.20 to 3.50	2240 to 2340					
>3.50 to 4.00	2220 to 2320					
>4.00 to 4.20	±0.035	2220 to 2320	38	3		
>4.20 to 4.50		2220 to 2320				
>4.50 to 4.70		2200 to 2300				
>4.70 to 5.00		2200 to 2300				
>5.00 to 5.60		2200 to 2300				
>5.60 to 6.00	±0.040	2180 to 2280		NA		
>6.00 to 6.50		2180 to 2280				
>6.50 to 7.00		2180 to 2280				

- Range of tensile strength within one coil max. 60 MPa
 - Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
 - Yield point (0.2% limit) at least 90% of the tensile strength
 - Modulus of elasticity E = 206.000 MPa (Standard)
 - Shear Modulus G = 79.500 MPa (Standard)
 - Torsion tests are carried out according to EN 10218-1
- 1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.5 to 6.5 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects.

Testing of wires <2.5 mm can be agreed upon separately.

Defect ≥60µm are recorded and marked.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380° – 425°C, with a holding time of 30 minutes at temperature.

After shot peening, the springs must be stress relieved at approx. 240°C for 30 minutes.

SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 911

OIL TEMPERED SILICON/ CHROMIUM/VANADIUM
ALLOYED SPRING WIRE



EXTERNAL STANDARD:

The material confirms to FDSiCrV according to
EN 10270-2:2011

APPLICATIONS:

For statically stressed springs or springs working in the finite life range,
requiring strength at elevated temperatures (up to approx. 250°C).

RANGE OF DIAMETERS:

1.30 to 10.00 mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %	V %
0.50-0.70	1.20-1.65	0.40-0.90	0.030	0.025	0.12	0.50-1.00	0.10-0.25

RAW MATERIAL:

Wire rod according to in-house specifications.

MECHANICAL PROPERTIES: PENTHOR 911

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	± 0.020	2280 to 2410 2260 to 2410	45	MAX 1.50 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	± 0.025	2210 to 2360 2160 to 2310 2110 to 2260			
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	± 0.030	2110 to 2260 2110 to 2260 2110 to 2260 2060 to 2210	42		
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00	± 0.035	2060 to 2210 2060 to 2210 2010 to 2160 2010 to 2160	40		
>5.00 to 5.60 >5.60 to 6.00 >6.00 to 7.00	± 0.040	2010 to 2160 1960 to 2110 1960 to 2110	38		
>7.00 to 8.00 >8.00 to 8.50	± 0.045	1910 to 2050 1890 to 2030	35		
>8.50 to 10.00	± 0.050	1870 to 2010	32		

- Range of tensile strength within one coil max. 70 MPa
- Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
- Yield point (0.2% limit) at least 90% of the tensile strength
- Modulus of elasticity E = 206.000 MPa (Standard)
- Shear Modulus G = 79.500 MPa (Standard)
- Torsion tests are carried out according to EN 10218-1
 - 1) End samples

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380° – 425°C, with a holding time of 30 minutes at temperature.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 864

OIL TEMPERED SILICON/CHROMIUM ALLOYED VALVE SPRING WIRE FROM SHAVED WIRE ROD.



EXTERNAL STANDARD:

The material confirms to VDSiCr according to EN 10270 – 2: 2011 & IS 4454 Part 2:2001

FURTHER SIMILAR STANDARDS:

ASTM A877/877M Grade A JIS G3561 SWOSC – V

APPLICATIONS:

Especially suitable for coil springs subjected to high dynamic stresses requiring good fatigue resistance (eg. valve springs), as well as for springs which require high tensile strength and excellent relaxation properties at moderately elevated working temperatures (up to approx. 250°C).

RANGE OF DIAMETERS:

1.30 to 10.00mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %
0.50-0.60	1.20-1.60	0.50-0.90	0.025	0.020	0.06	0.50-0.80

RAW MATERIAL:

Wire rod made of Si-killed steel according to in-house specifications. The wire rod is shaved to eliminate surface defects such as seams, cracks and decarburization.

CLEANLINESS ACC. TO MAX. T-METHOD:

Number of non-metallic inclusions in the surface area detected on end samples of the wire rod

Size of inclusions	5-10	>10-15	>15 ¹⁾	µm
Max.number/1000mm ²	50	7	0	

1) As stated by IVSWMA* it is likely to find occasional inclusions in valve spring quality steel of a size large than 15µm * IVSWMA: International Valve Spring Wire Manufacturers Association.

MECHANICAL PROPERTIES: PENTHOR 864

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	MINIMUM NO. OF TORSIONS min. Nos.	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	± 0.020	2080 to 2210 2060 to 2210	50	5	MAX 0.5 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	± 0.025	2010 to 2160 1960 to 2060 1910 to 2010				
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	± 0.030	1910 to 2010 1910 to 2010 1910 to 2010 1860 to 1960				
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	± 0.035	1860 to 1960 1860 to 1960 1810 to 1910 1810 to 1910 1810 to 1910	45	4		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	± 0.040	1760 to 1860 1760 to 1860 1710 to 1810	40	3		
>7.00 to 8.00 >8.00 to 9.00	± 0.045	1710 to 1810 1670 to 1770				
>9.00 to 10.00	± 0.050	1670 to 1770	35	-		

- Range of tensile strength within one coil max. 50 MPa
- Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
- Yield point (0.2% limit) at least 90% of the tensile strength
- Modulus of elasticity E = 206.000 MPa (Standard)
- Shear Modulus G = 79.500 MPa (Standard)
- Torsion tests are carried out according to EN 10218-1

1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.5 to 6.5 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects. Testing of wires <2.50 mm can be agreed upon separately. Defects ≥ 40 µm are recorded and marked.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380° – 425°C, with a holding time of 30 minutes at temperature. After shot peening, the springs must be stress relieved at approx. 240°C for 30 minutes.

SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 844S

OIL TEMPERED SILICON/CHROMIUM ALLOYED SPRING WIRE
FROM SHAVED WIRE ROD



EXTERNAL STANDARD:

The material confirms with TDSiCr according to
EN 10270-2: 2011 & IS 4454 Part2:2001

FURTHER SIMILAR STANDARDS:

ASTM A-1000 Grade A, JIS 3560 SWOSC-B

APPLICATIONS:

For coil springs subjected to dynamic stresses requiring excellent
relaxation properties at elevated temperatures (up to approx. 250°C).

RANGE OF DIAMETERS:

1.30 to 10.00mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %
0.50-0.60	1.20-1.60	0.50-0.90	0.025	0.020	0.08	0.50-0.80

RAW MATERIAL:

Wire rod according to in-house specifications.

The wire rod is shaved to eliminate surface defects such as seams,
cracks and decarburization.

CLEANLINESS ACC. TO DIN 50602, INCLUSIONS CHART 1:

Max. size 2 for all types of inclusions.

MECHANICAL PROPERTIES: PENTHOR 844S

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	MINIMUM NO. OF TORSIONS min. Nos.	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	± 0.020	2080 to 2210 2060 to 2210	50	5	MAX 0.50 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	± 0.025	2010 to 2160 1960 to 2060 1910 to 2010				
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	± 0.030	1910 to 2010 1910 to 2010 1910 to 2010 1860 to 1960				
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	± 0.035	1860 to 1960 1860 to 1960 1810 to 1910 1810 to 1910 1810 to 1910	45	3		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	± 0.040	1760 to 1860 1760 to 1860 1710 to 1810	40			
>7.00 to 8.00 >8.00 to 9.00	± 0.045	1710 to 1810 1670 to 1770	35	-		
>9.00 to 10.00	± 0.050	1670 to 1770				

- Range of tensile strength within one coil max. 50 MPa
- Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
- Yield point (0.2% limit) at least 90% of the tensile strength
- Modulus of elasticity E = 206.000 MPa (Standard)
- Shear Modulus G = 79.500 MPa (Standard)
- Torsion tests are carried out according to EN 10218-1
1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.50 to 6.50 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects. Testing of wires <2.50 mm can be agreed upon separately. Defect >40µm are recorded and marked.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380°– 425°C, with a holding time of 30 minutes at temperature. After shot peening, the springs must be stress relieved at approx. 240° C for 30 minutes.

SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 843/842

OIL TEMPERED SILICON/CHROMIUM ALLOYED SPRING WIRE



EXTERNAL STANDARD:

The material confirms with TDSiCr according to EN 10270- 2: 2011 & IS 4454 Part 2:2001

FURTHER SIMILAR STANDARDS:

ASTM A-1000 Grade A, JIS 3560 SWOSC-B

APPLICATIONS:

For coil springs subjected to moderate dynamic stresses such as clutch springs or springs requiring similar moderate fatigue resistance as well as high tensile strength and excellent relaxation properties at elevated temperatures (up to approx. 250°C).

RANGE OF DIAMETERS:

1.30 to 10.00mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %
0.50-0.60	1.20-1.60	0.50-0.90	0.025	0.020	0.10	0.50-0.80

RAW MATERIAL:

Wire rod according to in-house specifications.

CLEANLINESS ACC. TO DIN 50602, INCLUSIONS CHART 1:

Max. size 2 for all types of inclusions.

MECHANICAL PROPERTIES: PENTHOR 843/842

WIRE DIAMETER mm	TOLERANCE mm	ULTIMATE TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	MINIMUM NO. OF TORSIONS min. Nos.	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	±0.020	2080 to 2210 2060 to 2210	50	5	MAX 1.3 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	±0.025	2010 to 2160 1960 to 2060 1910 to 2010				
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	±0.030	1910 to 2010 1910 to 2010 1910 to 2010 1860 to 1960				
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	±0.035	1860 to 1960 1860 to 1960 1810 to 1910 1810 to 1910 1810 to 1910	45	3		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	±0.040	1760 to 1860 1760 to 1860 1710 to 1810				
>7.00 to 8.00 >8.00 to 9.00	±0.045	1710 to 1810 1670 to 1770	35	-		
>9.00 to 10.00	±0.050	1670 to 1770				

- Range of tensile strength within one coil max. 60 MPa
 - Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
 - Yield point (0.2% limit) at least 90% of the tensile strength
 - Modulus of elasticity E = 206.000 MPa (Standard)
 - Shear Modulus G = 79.500 MPa (Standard)
 - Torsion tests are carried out according to EN 10218-1
 - Penthor 842 grade comes without eddy current testing
- 1) End samples

SURFACE INSPECTION:

Wires with diameters from 2.5 to 6.50 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects. Testing of wires <2.50 mm can be agreed upon separately.

Defect ≥60µm are recorded and marked. Penthor 842 wire are not subjected to inline surface inspection.

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible at 380° – 425°C, with a holding time of 30 minutes at temperature.

After shot peening, the springs must be stress relieved at approx 240°C for 30 minutes.

SHOT PEENING:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs. Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 811

OIL TEMPERED SILICON/CHROMIUM ALLOYED SPRING WIRE



EXTERNAL STANDARD:

The material confirms with FDSiCr according to EN 10270-2: 2011 & IS 4454 part 2:2001.

FURTHER SIMILAR STANDARDS:

ASTM A401/A401M JIS 3560 SWOSC- B

APPLICATIONS:

For statically stressed springs or springs working in the finite life range, requiring strength at elevated temperatures up to approx. 250°C.

RANGE OF DIAMETERS:

1.30 to 12.50mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %	Cr %
0.50-0.60	1.20-1.60	0.50-0.90	0.030	0.025	0.12	0.50-0.80

RAW MATERIAL:

Wire rod according to in-house specifications.

MECHANICAL PROPERTIES: PENTHOR 811

WIRE DIAMETER mm	TOLERANCE mm	TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	± 0.020	2070 to 2250 2040 to 2220	45	MAX 1.5 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	± 0.025	2000 to 2180 1970 to 2140 1950 to 2120			
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	± 0.030	1930 to 2100 1910 to 2080 1900 to 2060 1870 to 2030			
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	± 0.035	1860 to 2020 1850 to 2000 1840 to 1990 1830 to 1980 1800 to 1950	40		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	± 0.040	1780 to 1930 1760 to 1910 1740 to 1890	38		
>7.00 to 8.00 >8.00 to 8.50	± 0.045	1710 to 1860 1700 to 1850	35		
>8.50 to 10.00	± 0.050	1660 to 1810	32		
>10.00 to 12.00	± 0.070	1620 to 1770	30		
>12.00 to 12.50	± 0.080	1580 to 1730			

- Range of tensile strength within one coil max. 70 MPa
 - Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
 - Yield point (0.2% limit) at least 90% of the tensile strength
 - Modulus of elasticity E = 206.000 MPa (Standard)
 - Shear Modulus G = 79.500 MPa (Standard)
 - Torsion tests are carried out according to EN 10218-1
- 1) End samples

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible.

Please inquire for special tolerances, tensile, sections, etc.

PENTHOR 111

OIL TEMPERED UNALLOYED SPRING WIRE



EXTERNAL STANDARD:

The material confirms with FDC acc. to EN 10270-2: 2011.

FURTHER SIMILAR STANDARDS:

ASTM A229/A229M JIS G3560 SWO - A

APPLICATIONS:

For statically stressed springs and springs working in the finite life range

RANGE OF DIAMETERS:

1.30 to 12.50mm Ø

CHEMICAL COMPOSITION (HEAT ANALYSIS):

C %	Si %	Mn %	P Max %	S Max %	Cu Max %
0.60-0.75	0.15-0.35	0.50-1.20	0.030	0.025	0.120

RAW MATERIAL:

Wire rod according to in-house specifications.

MECHANICAL PROPERTIES: PENTHOR 111

WIRE DIAMETER mm	TOLERANCE mm	TENSILE STRENGTH MPa	MINIMUM REDUCTION AREA %	PERMISSIBLE DEPTH OF SURF. DEFECTS 1) %	PERMISSIBLE PART DECARBURIZATION DEPTH 1) %
1.30 to 1.40 >1.40 to 1.60	± 0.020	1810 to 1970 1760 to 1940	45	MAX 1.0 % OF THE WIRE DIAMETER	
>1.60 to 2.00 >2.00 to 2.50 >2.50 to 2.70	± 0.025	1720 to 1890 1670 to 1820 1640 to 1790			
>2.70 to 3.00 >3.00 to 3.20 >3.20 to 3.50 >3.50 to 4.00	± 0.030	1620 to 1770 1600 to 1750 1580 to 1730 1550 to 1700			
>4.00 to 4.20 >4.20 to 4.50 >4.50 to 4.70 >4.70 to 5.00 >5.00 to 5.60	± 0.035	1540 to 1690 1520 to 1670 1510 to 1660 1500 to 1650 1470 to 1620	40		
>5.60 to 6.00 >6.00 to 6.50 >6.50 to 7.00	± 0.040	1460 to 1610 1440 to 1590 1430 to 1580	38		
>7.00 to 8.00 >8.00 to 8.50	± 0.045	1400 to 1550 1380 to 1530	35		
>8.50 to 10.00	± 0.050	1360 to 1510	32		
>10.00 to 12.00	± 0.070	1320 to 1470	30		
>12.00 to 12.50	± 0.080	1280 to 1430			

- Range of tensile strength within one coil max. 70 MPa
 - Ovality: Difference between the largest and smallest diameter of a cross section does not exceed 50% of the diameter tolerance.
 - Yield point (0.2% limit) at least 90% of the tensile strength
 - Modulus of elasticity E = 206.000 MPa (Standard)
 - Shear Modulus G = 79.500 MPa (Standard)
 - Torsion tests are carried out according to EN 10218-1
- 1) End samples

HEAT TREATMENT:

After coiling, the springs should be stress relieved as soon as possible.

Please inquire for special tolerances, tensile, sections, etc.

SHAPED WIRE

APPLICABLE SPECIFICATION:
Material according to EN 10270 - 2 as well as other international standards and customers specifications.

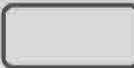
TYPES OF MATERIAL:
Oil-tempered wires across all grades served by Pengg Group.

RAW MATERIAL:
wire rod according to in-house specifications

MECHANICAL PROPERTIES:
Tensile and hardness according to customer requirements

SHAPES:
square, rectangular, flat, oval, two side flat. special shapes on request according to customer requirements.

APPLICATIONS:
Engine valve, Automotive transmission electrical connector parts, Automotive door hinges, conveyer screws, piston rings, and other engineering applications.



DIMENSIONAL RANGE AND TOLERANCES

SHAPED WIRE:
Min. size: 1.50 *1.50 mm
corner configuration min. 0.30 mm

SIZE	TOLERANCES
>1.50 mm - 3.00 mm	+/-0.020 mm
>3.00 mm - 5.00 mm	+/-0.030 mm
>5.00 mm - 6.00 mm	+/- 0.040mm

Other dimensions and tolerances on special request

FLAT WIRE:
Thickness: min 1.40 mm
w/t max. 3

NOMINAL WIDTH	TOLERANCES	THICKNESS	TOLERANCES
1.50 mm - 3.00 mm	+/-0.050 mm	1.00 mm - 2.00 mm	+/-0.015 mm
3.00 mm - 5.00 mm	+/-0.070 mm	2.00 mm - 4.00 mm	+/-0.020 mm

Other dimensions and tolerances on special request

DELIVERY FORMS

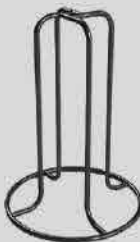
TYPE 1 CATCH-WEIGHT COILS

WIRE DIAMETER	COIL DIAMETER (MM)		MAXIMUM COIL WEIGHT KG
	INSIDE	OUTSIDE	
1.30-2.50	800	1100	550
2.51-6.99	1100	1400	1000
7.00-10.00	1400	1700	1000
10.01-12.50	1800	2100	1200



TYPE 2 CARRIERS

WIRE DIAMETER	COIL DIAMETER (MM)		MAXIMUM WEIGHT/ CARRIER KG	MAXIMUM CARRIER HEIGHT MM
	INSIDE	OUTSIDE		
1.30-2.50	800	1100	2500	1500
2.51-6.99	1100	1400	2500	1000
7.00-10.00	1400	1700	2500	1200



TYPE 3 WOODEN BOX AND PALLET



Material: Carrier made of steel tubes
Packaging: For packaging, the materials used are only those which can be recycled 100% such as paper or LPDE (low density polyethylene)

SAFETY; HANDLING AND STORAGE INFORMATION



- Oil hardened and tempered wires are very high tensile wires. Due to straight cast and very high springiness these wires have a tendency to get opened very swiftly with a very high force while cutting the steel/plastic straps used for binding the coils which may result in an accident. Hence during cutting the steel straps used for binding these coils, ensure that, (i) Few rings in the coil are bound together with cable tie (ii) While cutting cable ties, free end is tied with former or pay off arm carefully to avoid accidents.
- Be attentive while running the coils of oil hardened and tempered wires, since more springiness action of these wires may result in fatal accidents. If possible, use safety ring on the top of the coil or a cross bar.
- While cutting the steel strap of oil hardened and tempered wires, please ensure that wire is not damaged mechanically. Any mechanical damage may result in the problem of breakage during subsequent coiling operation.
- During the usage of oil hardened and tempered wires; if a certain portion of coil is left after coiling the required number of springs, then in that case, apply rust preventive oil to the left over portion of the coil, pack the leftover coil properly and then shift the same to storage area after proper identification.
- If the wires are received in wet condition at the time of receipt, please intimate us immediately for further actions.
- Handle the wires carefully to avoid mechanical damage. Mechanical damage on wire surface may result in the problem of breakage during coiling operation.

- Please store these wires in proper conducive storage conditions, preferably in a horizontal manner on dry wooden planks. During storage of these wires, please ensure that wires do not come in contact with water and moisture to avoid the problem of rust.
- To protect the wires from atmospheric influences and hence to avoid the problem of rust; ensure that wires are stored in proper packed condition.
- If the wires are not stored properly in proper storage conditions and wire gets rusted due to poor storage conditions; Pengg Usha will not be liable for such cases.
- Ensure that oil hardened and tempered wires are used within six months after the receipt.
- The springs coiled from defective portion of eddy tested wires which is painted with yellow / white paint have to be discarded. Ensure that such springs are not mixed with OK springs.
- Avoid metal to metal and metal to concrete floor contact during storage, handling and usage of these wires.