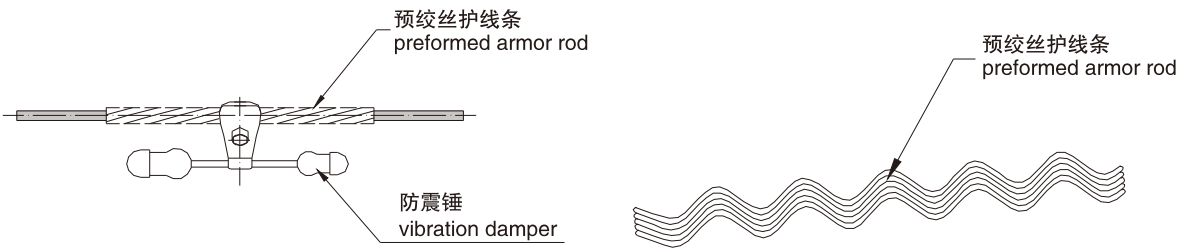


十一、防震锤、护线条Eleven. vibration damper and armor rod



中备公司提供的4D系列防振锤为斯托克布里奇音叉式设计，多共振音效减振装置，主要用于减弱和分散由于微风振动对光缆所产生的冲击能量。

The 4D series vibration damper provided by Zhongbei Company is a Stokebridge tuning fork design, multi-resonance sound damping device, which is mainly used to weaken and disperse the impact energy generated by the breeze vibration on the cable.

1、规格 Specifications

表11.1 Table 11.1

型号 Model	夹持直径范围(mm) Clamping Diameter Range (mm)	总 长(mm) Total length (mm)	线夹宽(mm) Clamping Diameter Range (mm)	重量(kg)Weight (kg)
4D-30-27.0	27.0-22.3	383	52	2.5
4D-30-23.4	23.4-19.5	383	52	2.5
4D-30-20.3	20.3-16.5	383	52	2.5
4D-30-18.0	18.0-15.0	383	52	2.5
4D-30-16.0	16.0-14.0	383	52	2.5
4D-30-14.0	14.0-12.2	383	52	2.5
4D-20-27.0	27.0-22.3	330	52	1.4
4D-20-23.4	23.4-19.5	330	52	1.4
4D-20-20.3	20.3-16.5	330	52	1.4
4D-20-18.0	18.0-15.0	330	52	1.4
4D-20-16.0	16.0-14.0	330	52	1.4
4D-20-14.0	14.0-12.2	330	52	1.4

2、配置 configuration:

常用于OPGW光缆的防震装置，也可用于ADSS光缆。

It is commonly used in the anti-shock device of OPGW cable, and can also be used in ADSS cable.

表11.2 OPGW防振锤安装数量的配置表

Table 11.2 Configuration Table of OPGW vibration damper Installation Quantity

光缆直径(mm) Cable diameter (mm)	档 距(m) gear(m)			
$d < 12$	100~300	300~600	600~900	
$12 \leq d < 22$	100~350	350~700	700~1000	1000~1200
防振锤数量(每档) Number of vibration dampers (per gear)	2	4	6	8

11.3 ADSS防振锤安装数量的配置参照表

11.3 ADSS vibration damper installation number configuration reference table

光缆直径(mm) Cable diameter (mm)	档 距(m) gear(m)			
$d < 12$	100~250	250~450	450~700	
$12 \leq d < 22$	100~250	250~500	500~800	800~1000
防振锤数量(每档) Number of vibration dampers (per gear)	1	2	6	8

注：在临界档距上，为安全起见，防振锤数量用多不用少。

Note: At the critical span, for safety reasons, the number of vibration dampers is used more not less.

3、选型 Selection:

选型时考虑两个因素，一是选择锤头，二是选择安装导线直径。综合考虑OPGW的光缆的主要技术参数，如张力、风速、地形等因素确定选用防振锤。

Two factors are considered in the selection, one is to select the damper head, and the other is to choose the diameter of the installation wire. Considering the main technical parameters of OPGW's optical cable, such as tension, wind speed, topography and other factors, the anti-vibration hammer is selected.

3.1重量的选择 weight selection:

理论公式： $Z = \sqrt{T \cdot M}$ Theoretical formula: $Z = \sqrt{T \cdot M}$

意义：Z为光缆的特征阻抗值，此数值决定防振的型号。

如果 $Z > 110$ ，则选用4D-30；如果 $Z \leq 110$ ，则选用4D-20。

注：T光缆额定抗拉强度的18%~25% (kN) M光缆单位重量kg/km

Meaning: Z is the characteristic impedance value of the cable. This value determines the type of anti-vibration.

If $Z > 110$, choose 4D-30; if $Z \leq 110$, choose 4D-20.

Note: 18%~25% (kN) of the rated tensile strength of T-fiber cable M cable weight per kg/km

3.2夹持直径的选择 Selection of clamping diameter:

夹持直径指光缆直径与耐张线夹（或悬垂线夹）内绞丝两倍直径之和。如安装在护线条时，夹持直径则为光缆直径加护线条的两倍直径。

The clamping diameter refers to the sum of the diameter of the cable and the double diameter of the skein in the tension clamp (or suspension clamp). If installed in the retaining line, the clamping diameter is twice the diameter of the cable diameter plus the armor rod.

4.1安装位置的确定 Determination of the installation location

理想状态防振锤应装在振幅最大的波腹点，但任何一个档距上的波节和波腹都是由频率决定的，由于风速的不同，波腹的位置也随之变化。防震锤安装位置对某种频率就不一定令人满意。由于4D型防振锤对很小的振幅也会做出敏感的反应。可在波中间任何位置都可获得满意的效果，故在工程上为简化计算，计算公式如下：

The ideal state vibration damper should be installed at the anti-node of the largest amplitude, but the nodes and anti-nodes of any one of the spans are determined by the frequency. The position of the anti-node is also changed due to the different wind speeds. The installation position of the vibration damper is not necessarily satisfactory for a certain frequency. Because the 4D anti-vibration hammer responds sensitively to small amplitudes. Satisfactory results can be obtained at any position in the middle of the wave, so in engineering to simplify the calculation, the formula is as follows:

a. 第一个防振锤安装位置可按下列公式计算

$$L1=0.5/f*(T/M)^{1/2} \text{ 其中: } f=0.185V/D$$

V-风速, 取6-7m/s.

D-光缆外径 (m)

T-光缆每日运行张力 (N) (无每日运行张力可按光缆RTS的20%取值)

M-光缆的单位重量 (kg/m)

第二只、第三只防振锤安装位置为: $L2=L1+0.58m$; $L3=L2+0.58m$,

其它挂点依次类推。

a. The first anti-vibration hammer installation position can be calculated according to the following formula

$$L1=0.5/f*(T/M)^{1/2} \text{ where: } f=0.185V/D$$

V-wind speed, take 6-7m/s.

D-fiber outer diameter (m)

T-fiber cable daily running tension (N) (no daily running tension can be taken as 20% of cable RTS)

M-fiber cable unit weight (kg/m)

The installation position of the second and third anti-vibration hammers is: $L2=L1+0.58m$; $L3=L2+0.58m$,

Other hanging points are analogous.

b. 采用等距安装第二、第三只防振锤, 间隔0.6米一只, 即 $L2=L3=0.6m$, 其他挂点依次类推。

b. Install the second and third vibration dampers equidistantly, with an interval of 0.6 meters, that is, $L2=L3=0.6m$, and other hanging points are analogized.

注意事项:

①根据计算,若防振锤计算安装的位置落在内绞丝上, 则直接安装即可。

②如果防振锤计算安装位置落在OPGW光缆上或落在外绞丝上, 考虑到安装方便, 推荐第一只防振锤装在内绞丝上, 且防振锤中心距离内绞丝末端为50-80mm.

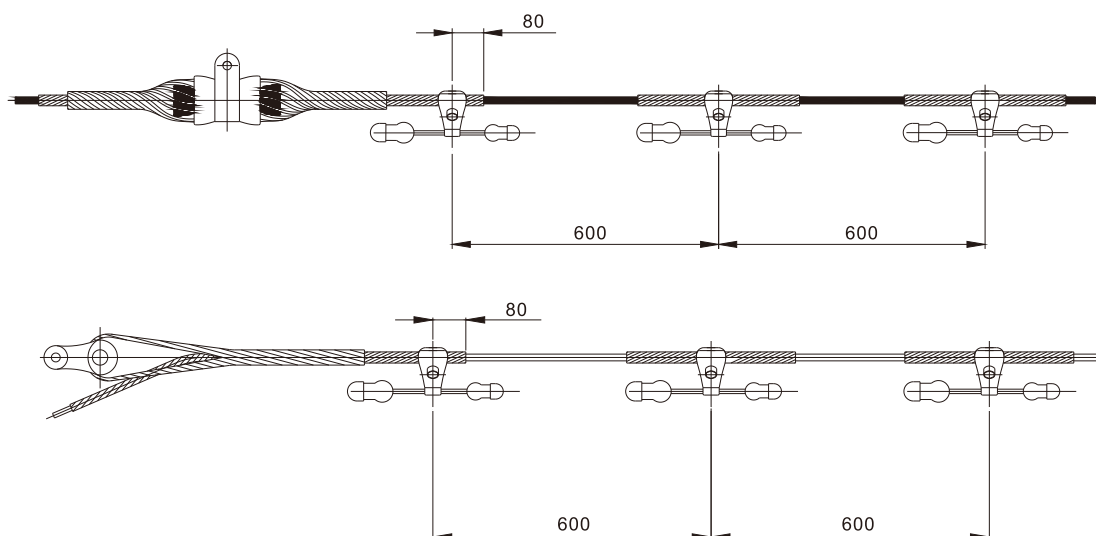
具体安装方式参见以下附图:

Precautions:

1 According to the calculation, if the position of the vibration damper calculation installation falls on the inner skein, it can be directly installed.

2 If the vibration damper calculation installation position falls on the OPGW cable or falls on the outer skein, considering the installation convenience, it is recommended to install the first vibration damper on the inner skein, and the center of the vibration damper is at the end of the skein. 50-80mm.

See the following figure for specific installation methods:



4.2 防振锤安装方向 Anti-vibration hammer installation direction

防振锤的锤头朝向与防振性能无关，也无相关标准规定。根据我国多年习惯装法，一般都将防振锤的大锤头朝向铁塔方向。

The damper head of the vibration damper has nothing to do with the vibration performance, and there is no relevant standard. According to the customary installation method in China for many years, the damper head of the vibration damper is generally oriented toward the tower.

5、护线条 Armor rod

表11.4 规格 Table 11.4 Specifications

规格 Specifications	适用缆径(mm) Applicable cable diameter (mm)	材料Material	长度(mm)L length (mm) L	重量(kg) Weight (kg)	规格 Specifications	适用缆径(mm) Applicable cable diameter (mm)	材料Material	长度(mm)L length (mm) L	重量(kg) Weight (kg)
TFH0800	7.4-8.0	防锈铝合金 Anti-rust aluminum alloy	400	0.12	TFH 1410	13.7-14.1	防锈铝合金 Anti-rust aluminum alloy	500	0.23
TFH0880	8.1-8.8	防锈铝合金 Anti-rust aluminum alloy	400	0.12	TFH 1430	14.2-14.3	防锈铝合金 Anti-rust aluminum alloy	500	0.23
TFH0960	9.0-9.6	防锈铝合金 Anti-rust aluminum alloy	450	0.15	TFH 1450	14.4-14.5	防锈铝合金 Anti-rust aluminum alloy	500	0.23
TFH1010	9.7-10.1	防锈铝合金 Anti-rust aluminum alloy	450	0.15	TFH 1510	14.6-15.1	防锈铝合金 Anti-rust aluminum alloy	500	0.25
TFH1060	10.2-10.6	防锈铝合金 Anti-rust aluminum alloy	450	0.17	TFH 1580	15.2-15.8	防锈铝合金 Anti-rust aluminum alloy	550	0.28
TFH1110	10.7-11.1	防锈铝合金 Anti-rust aluminum alloy	450	0.17	TFH 1600	15.9-16.0	防锈铝合金 Anti-rust aluminum alloy	550	0.30
TFH1160	11.2-11.6	防锈铝合金 Anti-rust aluminum alloy	500	0.19	TFH 1690	16.1-16.9	防锈铝合金 Anti-rust aluminum alloy	550	0.30
TFH1170	11.7-11.7	防锈铝合金 Anti-rust aluminum alloy	500	0.21	TFH 1730	17.0-17.3	防锈铝合金 Anti-rust aluminum alloy	550	0.30
TFH1200	11.8-12.0	防锈铝合金 Anti-rust aluminum alloy	500	0.21	TFH 1800	17.4-18.0	防锈铝合金 Anti-rust aluminum alloy	550	0.33
TFH1270	12.1-12.7	防锈铝合金 Anti-rust aluminum alloy	500	0.21	TFH 1840	18.1-18.4	防锈铝合金 Anti-rust aluminum alloy	550	0.33
TFH1290	12.8-12.9	防锈铝合金 Anti-rust aluminum alloy	500	0.23	TFH 1880	18.5-18.8	防锈铝合金 Anti-rust aluminum alloy	550	0.35
TFH1360	13.0-13.6	防锈铝合金 Anti-rust aluminum alloy	500	0.23					