Development and Application of Universal Hanging line Fixtures for 66-220kV Pointed cross-head

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Abstract. For traditional fixtures, replace insulator string conductors as horizontal side hanging points in the linear pole tower of the transmission line. Its versatility is not strong, when using the wire rod and soft slings or carriages cannot be shared and other limitations. The development of a Universal Hanging line Fixtures for 66-220kV Pointed cross-head is proposed. First of all, the fixtures span can be adjusted by adjusting the bolts, so as to better avoid all kinds of cross-burden head bolts, and cross on the joint plate and the cross-load bolt. Makes it stable. Secondly, fitting the wire rod directly in the slot at the hanging points at both ends of the mount and lifting with a wire rod depends on the needs of the lifting wire. You can also install a pin rod in the trailer, the carriage set or tight-line soft sling hanging on the pin rod, with the carriage or soft sling lifting. Solved the problem when replacing the insulator with pointed cross-heads, the generality of the wire lifting is not good. And the wire rod and carriage set and soft sling between the lifting tool interchange.

1. Introduction
At present, in the domestic power system, when 66-220kV transmission lines pointed cross-head replaces the insulator stogis on the lifting wire with a live replacement, as a cross-burden hanging point of the card also has a lot of forms. But they don't have universality.[1-5] Often a card can only be used on a cross-stretcher[6-9]. The trolley or soft sling cannot be used with the wire rod's card. It has no universality and no promotional value.

In view of the above situation, it is necessary to develop a hanging line card suitable for a variety of pointed-tip-straight-line tower with live replacement overhang insulator string[10-11].

2. Development of Universal Hanging line Fixtures for 66-220kV Pointed cross-head
In existing technology, replacing insulator strings in transmission lines usually requires power outages to replace them, affecting production. There are also cards used as side hanging points to achieve live work. Such cards also have many forms in China, but none of them are universal[12]. Usually a card can only be used on a cross-stretcher, and it needs to be equipped with a variety of specifications[13]. A cord with a wire rod does not use a soft sling or carriage, and it does not have universality and increases maintenance costs.

66kV-220kV tip-to-head general purpose lifting line card, includes two opposite-interval boards, multiple bolts between the plates. There is a card slot in the middle of the bottom face of each card plate. The upper surface on both sides of the plate has grooves which have the bezels.

The screw lift sits in the groove between the plates. Screw lift including wire rod. There's a nut on the wire. Both ends of the nut have beams tied to grooves. The wire rod has a lift handle. The lower end of the wire rod has an mounting hole.
The card span can be adjusted by adjusting the bolts. So as to better avoid all kinds of cross-burden head bolts and cross on the joint plate and the cross-load bolt that makes it stable. It can also be based on the different needs of the lifting wire. Fit the wire rod directly in the slot at the hanging points at both ends of the mount. Lifting with a wire rod. You can also install a pin rod in the trailer. Hang the carriage set or tight-line soft sling on the pin bar. Lift with a carriage or a soft sling.

66kV-220kV tip-to-head universal suspension line card includes two relatively spaced card plate 1, card plate 1 is triangular. Card 1 is connected by six bolts 2. There is a card slot in the middle of the bottom side of each plate 1. The upper surface on the side of plate 1 has a groove 4. Groove 4 notch with bezel 5. The fender 5 is secured by screws. As shown in Figure 1.

![Figure 1](image1.png)

(a) Positive view  (b) Top view

Fig.1. 66kV-220kV tip-to-head cross-charge line card

The screw lift is a stand-alone component. When using, sit in the groove 4 between the card plate 1 that across between two card plates 1. The screw lift includes the wire rod 6. Silk rod 6 with nut 7. Nut 7 ends with crossbeams tied to groove 48. Wire rod 6 set with lift handle 9. Wire rod 6 lower end with line hole 10. As shown in Figure 2.

![Figure 2](image2.png)

Fig.2. Screw

Figure 3 shows the tip of the transmission line tower. The cross-burden 11 is made up of angle steel snaps 12 fixed between seven cross-load bolts. The rectangular dotted wire frame in the figure is the installation location for this card. Groove 4 card across the middle edge of the cross-burden. Due to the four cross-load bolts on the 11th of the cross-stretcher 12. It gets stuck on both sides of the bolt when the card is stuck. Different distances of bolt space arrangement on different cross-stretchers. Requires adjustable distance between card plate 1. So between the two plates 1 is connected by bolt 2 with a wire buckle at both ends. Meet on-site use requirements. Put this card on the cross-burden 11. Put on the screw lift, and connect the upper wires. Turn the lift handle 9. Realize the wire bar 6 up and down. Lifting conductors. Allows the insulator string to relax. Enable live replacement of insulator strings..
Fig. 3. The tip of the tower of the transmission line

3. Footnotes

66 to 220kV tip-to-head general-purpose suspension line save features the ability to adjust the card span by adjusting the bolts. It is better to avoid all kinds of cross-burden head bolts. and cross on the joint plate and the cross-load bolt that makes it stable. It can also be based on the different needs of the lifting wire. Fit the wire rod directly in the slot at the hanging points at both ends of the mount. Lifting with a wire rod. You can also install a pin rod in the trailer. Hang the carriage set or tight-line soft sling on the pin bar. Lifting with a carriage or a soft sling. Figure 4 is a sketch of the structure. Figure 5 is an instance diagram.

It have four advantages. First, it can be adjusted bolts to change the span, to meet a variety of pointed cross-load installation use. Second, its structure is simple, reasonable and safe to use. Third, it
provides a variety of tip straight-line cross-stretchers to replace the wire lifting points when replacing the insulators. Last, it can be used to install the plug-and-pin lever for the exchange of wire rods and carriage sets and lifting tools between soft slings, and it achieves the versatility of a card.

4. Conclusion
Because of the different structures of the electric tower in each region, the tools applied vary widely, and even the form of the tower applied in a region varies widely. It brings great waste and trouble to the power production[14-15]. Therefore, in the domestic power production can achieve universal tools have a very large promotion space.

Application of this tool for live work each time to reduce the power outage time comprehensive consideration by 5 hours. On average, 10 such operations are carried out by county and municipal power supply companies per year. The economic benefits it brings can be calculated according to the different local electricity price and line load conditions. It reduces the time of power failure, eliminates the hidden danger of equipment failure, and improves the reliability of power supply on social benefits.

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