

## Portable Elbow Cable Joint Quick Release Tool

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### Abstract

In power cable lines, switching stations and junction boxes are commonly used. During the erection of cable lines, the construction and maintenance of elbow cable plugs is a very important link. However, during the construction, daily maintenance, and emergency repairs of our power cable lines, we will encounter the situation of long time-consuming construction of elbow cable plug insertion and removal. This article develops a portable hydraulic elbow cable connector quick disassembly tool to replace the original Some traditional methods relying solely on manpower have the advantages of convenient operation, safe and reliable during the installation and removal of elbow cable joints, reducing the labor intensity of the operators, and eliminating potential safety hazards in the construction, so as to shorten the operation time and ensure the work Personal safety in the process and easy to carry, improve the efficiency of on-site work.

### Keywords

Elbow cable connector; Hydraulic; Portable; Plugging aids.

### 1. Introduction

With the development of urbanization, the previously familiar high-voltage overhead lines in the sky are replaced with power cables (underground) power supply, electric poles are removed, the urban environment will be improved, and the space environment will be optimized. In power cable lines, switching stations and junction boxes will be widely used. In the process of erecting cable lines, the construction of elbow cable plugs is a very important link. Because our electric workers do not have special elbow-type cable plug disassembly tools, the construction time is long, which seriously affects the work efficiency of the team, and at the same time prolongs the power outage time, which affects the production and life of customers [1].

In power cable lines, switching stations and junction boxes will be widely used. In the process of erecting cable lines, the construction and maintenance of elbow cable plugs is a very important link. However, during the construction, daily maintenance, and emergency repairs of our power cable lines, we will encounter the situation of long time-consuming construction of elbow cable plug insertion and removal, which can be divided into the following three situations: 1) The newly installed elbow cable plug is not installed properly [2], There is a gap between the plug and the tapered insulating support; 2) After operation, the elbow cable plug will age and it will be very difficult to pull out; 3) The elbow cable plug is not accurately reserved, which causes the plug to be inserted multiple times during the installation process. pull. These construction methods are easy to damage other equipment and time-consuming, which seriously affects the work efficiency of the team, and at the same time prolongs the power outage time, which affects the production and life of customers [3].

When plugging and unplugging the cable line, the on-site construction workers consume a lot of time in the construction of the elbow cable plug. When installing or removing the elbow cable plug, we do not have special auxiliary equipment for disassembly and assembly. For a long time,

the elbow cable plug and the cone-shaped insulating support are tightly sealed, and there is no gap, which makes it difficult to pull out the plug head with bare hands. Our construction staff will use ropes for assistance, and use ropes to tie and fix the elbow cable plugs. Many people pull out together, but the staff often pull out the elbow-shaped cable head due to unbalanced force, and the direction of the force is not in line with the cable head, resulting in damage to the cable head and equipment connectors. Once the elbow cable plug is damaged, it cannot be used. It needs to be replaced and made again [4]. Cost and manpower. When the plug can not be pulled out with bare hands or with the help of a rope, sometimes it is also used to cut the insulation protection layer of the elbow cable plug and pull it out. Elbow cable plugs are easy to cause damage to other equipment [5].

Therefore, how to improve the traditional plug construction method and shorten the disassembly and assembly operation time of the elbow cable plug is a problem that needs to be studied urgently. It is necessary to develop a portable hydraulic elbow cable joint quick disassembly tool to replace the original manual method. It is convenient to operate, safe and reliable during the installation and removal of the elbow cable joint, and reduces the labor intensity of the operator. Eliminate the advantages of potential safety hazards in construction, so as to shorten the operation time, ensure personal safety in the work process, and be convenient to carry, and improve the efficiency of on-site work.

## 2. Tool Design and Implementation

### 2.1. Structure Design

In this section, we design the structure of portable hydraulic elbow cable joint quick disassembly tool. By analyzing the traditional method of replacing the elbow cable head, it was found that in practice the extraction of the cable head is time-consuming and labor-intensive, and that the cable head body is easily damaged during the extraction process. Is there a tool that can reduce the intensity of the work and ensure that the direction of force is in a straight line with the cable head? After much research and debate, it was decided to use a handle and a rotating screw to lengthen the force arm to achieve the effect of pulling out the elbow cable head with less effort; at the same time, the elbow cable head is supported by three support rods so that it is pulled out with a smooth force and in the same direction to avoid damage to the elbow cable head in the process of pulling out. The working principle is as follows: first adjust the position of the clamping block, then tighten the screw by means of a plum spanner, then adjust the support rod until it can be pressed against the fixed plane of the cable head, and finally rotate the handle through the threaded transmission between the drive screw and the support plate, and the cable head is gradually pulled out by using the pressure of the support rod on the fixing plane and the reaction force of the drive screw on the clamp block.

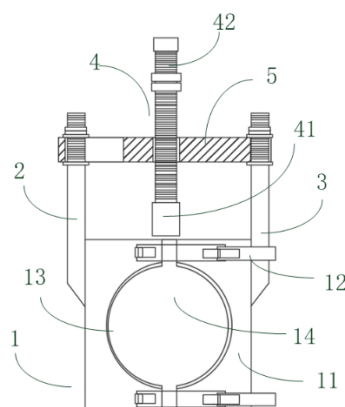


**Figure 1.** Structure design of portable hydraulic elbow cable joint quick disassembly tool

In the Figure, 1 is the connecting sleeve, 11 is the connecting collar, 12 is the buckle, 13 is the limiting groove, 14 is the limiting channel, 2 is the first connecting screw, 3 is the second connecting screw; 4 is the fastening component, 41 is the positioning head, 42 is the adjusting screw; 5 is the positioning plate,

## 2.2. Development of Automatic Locking Module

In order to further solve the problem that the moving mechanism cannot return to its actual position after one-way movement, this project adds a limiting strip in the storage tank, and the other end of the limiting strip penetrates the moving groove and extends outside the moving groove. When the gear rotates in the forward direction At this time, the magnet block will attract the elastic locking mechanism. At this time, by pulling the limiting strip outside the moving groove, the limiting strip will be inserted into the area of the magnet block so that the magnet block is fixed in the storage slot. At this time, when the gear rotates in the reverse direction, the elastic The locking mechanism will not lose the attraction of the magnet block, and the outer wheel and the rotating wheel will not be locked, so that the moving groove can be restored to the initial position. The end of the limiting strip located outside the moving groove is provided with an adjusting hand, which facilitates the insertion and extraction of the limiting strip by turning the adjusting hand.

## 2.3. Development of Hydraulic Rack and Pinion Mobile Module

This module includes racks, moving grooves, gears and handles to realize the external pull (disassembly) and internal pressure (installation) of the joint, so as to shorten the operation time, ensure personal safety during the work process, and be convenient to carry, and improve the efficiency of on-site work; As shown in Figure 2.

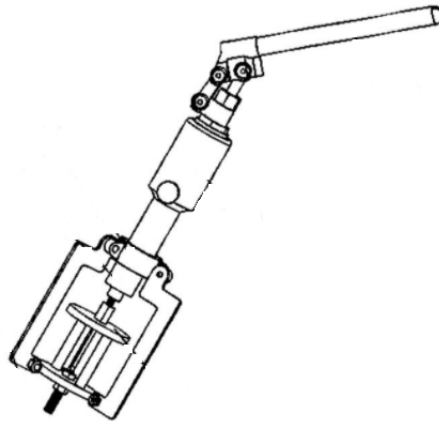


**Figure 2.** Hydraulic rack and pinion mobile module

When using the manual rack and pinion moving mechanism to separate or close the fixed holding cylinder and the movable holding cylinder, first pull the handle. At this time, because the handle is provided with a toggle block, and the end of the toggle block is against the gear. Therefore, when the handle is pulled forward, the gear will be driven to rotate. Since the gear includes the outer wheel, rotating wheel and axle wheel from outside to inside, when the handle rotates the gear, first the outer wheel will rotate, and the outer wheel will rotate with The friction between the wheels is relatively large, and because the elastic locking mechanism is locked with the locking groove, when the outer wheel rotates, it will drive the rotation of the rotating wheel. At this time, the limiting groove in the rotating wheel will also rotate. After the inner magnet block abuts on one side of the positioning groove, at this time, the rotating wheel will stop moving, and the magnet block will attract the elastic locking mechanism, so that the elastic locking mechanism is separated from the locking groove. At this time, the handle

continues to move and the outer wheel continues Rotation, because the gear meshes with the rack and is connected with the moving groove through the axle wheel, the moving groove will move parallel to the rack, thereby driving the separation or closing of the movable holding cylinder and the fixed holding cylinder; when a wrench Pull to the bottom and need to pull back, the gear will also be driven to rotate back at this time, but due to the large friction between the outer wheel and the rotating wheel, the limited groove at this time will also occur with the rotation of the rotating wheel. At the same time, the magnet block will slowly leave the attraction position and abut against the other side of the positioning groove. After the elastic locking mechanism loses its attractive force, the elastic locking mechanism will cooperate with the locking groove to lock the outer wheel and the rotating wheel. After the outer wheel is locked, the gear does not rotate, so when the handle is pulled back, there will be no gear rotation, so the moving groove will not move back. When the handle is pulled back to the end, then pull it in the positive direction. At this time, the moving groove can move forward again. Repeatedly, the one-way movement of the moving groove on the rack is realized, thereby driving the separation or closing of the movable holding cylinder and the fixed holding cylinder.



**Figure 3.** Elbow Cable Head Removal Tool

### 3. Use of Tools

When disassembling and assembling the elbow-shaped cable joint, by rotating the fastening component, the fastening component is pressed against the elbow-shaped cable joint. At the same time, due to the synchronous and stable support of the two sets of connectors and the fastening components, the fastening components and the two sets of connectors are in position. On the same straight line, the elbow-shaped cable head can be pulled out smoothly and in the same direction of force to avoid damage to the elbow-shaped cable head during the removal process, and the external fastening component can be used to facilitate the staff in the external space. Rotating the external fastening component is accurate operation, which solves the problem of damage to the elbow cable connector when unplugging and the limited installation space when the traditional elbow cable connector is installed, and the operation is unchanged and time-consuming.

After rotating the adjusting screw to drive the positioning head against the elbow cable connector, by turning the adjusting nut to lock the adjusting screw on the positioning rod, the synchronous support of the adjusting screw and the two sets of connecting screws can be realized, which is convenient for stable force application. When using, adjust the position of the positioning block first, then tighten the screw with a torx wrench, then adjust the adjusting screw until it can be pressed to the fixed plane of the cable head, and finally rotate the handle

to adjust the screw or use hydraulic pressure, using two sets of connecting screws and adjusting screws To the reaction force of the positioning plate, pull out the cable head gradually.

#### 4. Conclusion

The portable hydraulic elbow cable head pulling and dismantling tool is mainly used in the daily maintenance work of the distribution network. The elbow cable head is smoothly drawn out using 10 components such as the transmission screw, bearing, and adjustment block, which saves time and effort, and can reduce the labor intensity of the construction personnel. At the same time, to avoid damage to the cable head and equipment connectors, the portable hydraulic elbow cable head extraction tool is cheap and easy to carry. The elbow cable head extraction tool for maintenance can effectively improve the efficiency of the elbow cable head extraction and removal, and reduce The labor intensity of the construction personnel to ensure the safety of construction has a wide range of social and economic benefits, which can be applied and promoted in various power supply stations. The portable elbow cable connector quick disassembly tool developed in this paper can effectively solve the situation of various cable elbow head methods and various elbow head types when disassembling the cable elbow head; it is portable and improves the manufacturing process of the cable elbow head. And time, thereby improving fast power recovery. During the installation and removal of the elbow cable joint, it has the advantages of convenient operation, safety and reliability, reducing the labor intensity of the operator, eliminating the hidden safety hazards in the construction, etc., so as to shorten the operation time, ensure the personal safety during the work, and be convenient to carry , Improve on-site work efficiency.

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