

Development and application of new seals

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Abstract: The new seal adopts a special structure design to realize the easy-pull opening mode, ensuring that the seal is opened quickly, conveniently and safely, and can be used as a credential to prevent users from opening privately. Eliminate the personal and equipment safety hazards that exist during the use of the current seal. Improve the efficiency of metrological verification personnel and electricity information collection personnel.

1. Introduction

In order to meet the development needs of the smart grid, power companies installed and operated a large number of smart meters and collection terminals on the power client to collect user power information, control and monitor user power consumption. With the increase in smart meter coverage, the workload of metrology verification and operation and maintenance has also increased significantly. When the metering personnel install, verify, troubleshoot and process the smart meter, you need to install or turn on the smart meter seal.

According to statistics, the measurement department of A Power Supply Company is responsible for the verification, maintenance and troubleshooting of more than 1.3 million smart meters in its jurisdiction. In 2018, about 130,000 smart watches were verified and maintained, accounting for 10% of the total number of smart watches in the A region. Three seals were installed on each smart watch, and about 390,000 seals need to be opened and installed. The amount of smart table seal opening per year is shown in Figure 1.

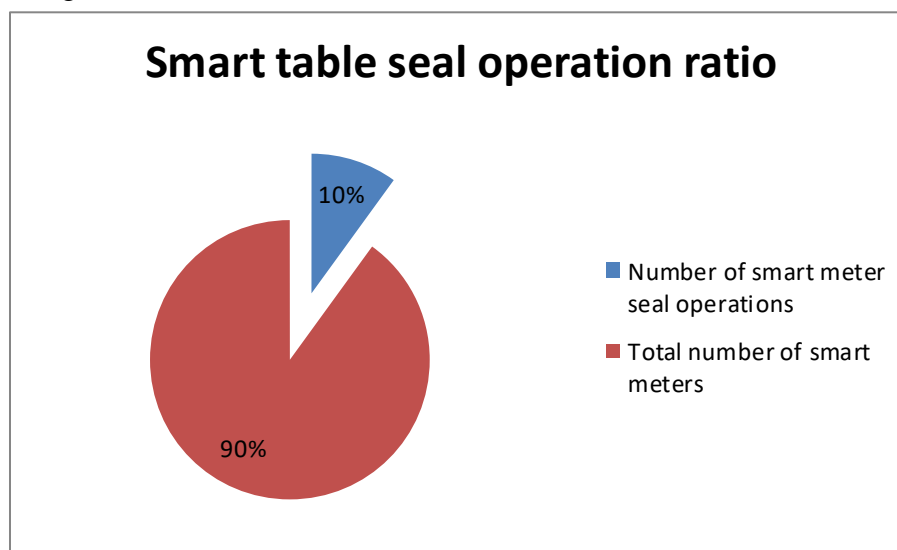


Figure 1. Smart table seal operation ratio

At present, the smart meter and the collection terminal use a snap-on plastic seal and a seal-type seal. Opening the snap-on seal must use the awl to repeatedly pierce the seal surface until it is destroyed to remove it. In this process, it is easy to cause damage to the meter, damage to the module, injury to the operator, etc., and there is a problem that the opening is unsafe and takes a long time; Installation of the sealing wire seal requires the use of multiple strands of copper strands through the small holes of the terminal pins to connect the seal to the smart meter. There are problems such as difficulty in threading, easy handling, copper consumption, and long time. As shown in Figure 2.

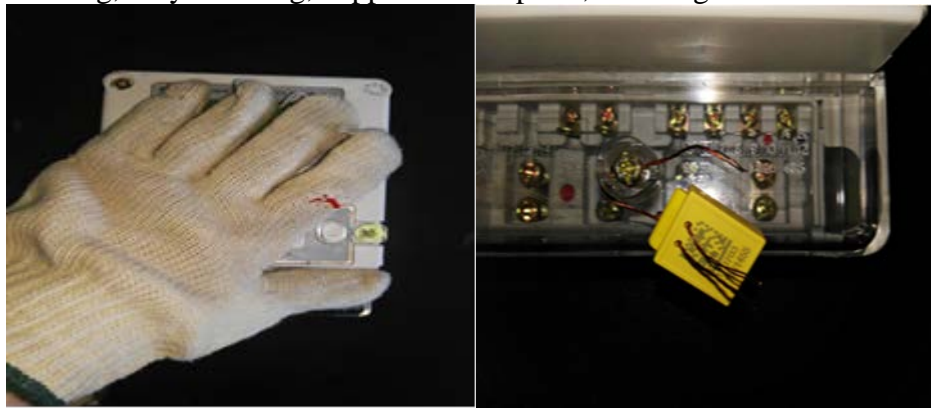


Figure 2. snap-on seals and sealing seals installed on the metering device

It can be seen from the above analysis that in the process of using the smart watch seal, there is a large workload, a long operation time and a certain security risk. A seal must be developed to eliminate the personal and equipment safety hazards that exist when the current seal is used, and to improve the efficiency of seal installation and opening.

2. Development of new seals

(1) Structural design features

The upper surface of the seal is designed as an easy-pull structure. The new seal is snap-fit type, plastic material, easy-opening type, and one-time opening and breaking type. The edge of the upper surface 1 of the seal is provided with an annular tearable indentation 2, and the annular tearable indentation 2 is provided with an inscribed slot 4, and the periphery of the inscribed slot 4 is a tearable indentation 5. The center position of the upper surface 1 of the seal is additionally printed with a two-dimensional code 3 on which the unit information of the seal is recorded. The length of the indented slot 4 and the tip of the screwdriver Corresponding to the width so that the tip of the screwdriver protrudes into the in-line slot 4.

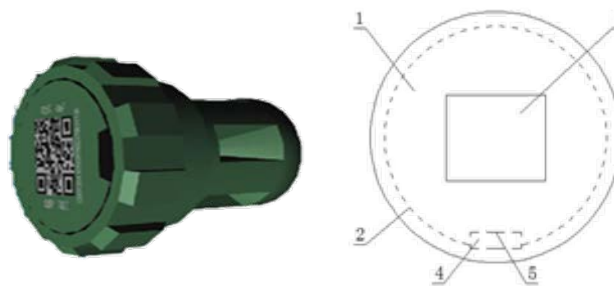


Figure 3. Easy pull structure

Seal is designed to be pressed. a cavity is arranged in the middle of the sealing seat, and a second card hole is arranged at a corresponding position of the cavity and each of the first card holes, a spring sleeve is also nested in the cavity, and a plurality of obliquely inverted cards are arranged on the spring sleeve. Each of the diagonally inverted cards penetrates the first card hole and the second card hole of the corresponding position, so that the sealing seat and the upper cover of the electric meter cannot be separated, and the sealing is completed as shown in Figure 4.

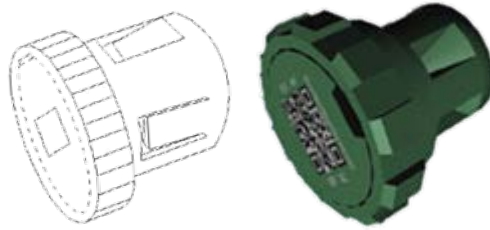


Figure 4. Push structure

Design seal opening slot. For the problem that the seal is opened without professional tools, a slot opening slot is designed, and the length and width of the opening slot on the seal are the same as the length and width of the ordinary slotted screwdriver. When it is opened, the screwdriver can be pressed down at the opening slot without any effort, and it will not cause damage to the hands, gauges, modules, etc., thus achieving the goal of “one-time” rapid and safe opening. As shown in Figure 5

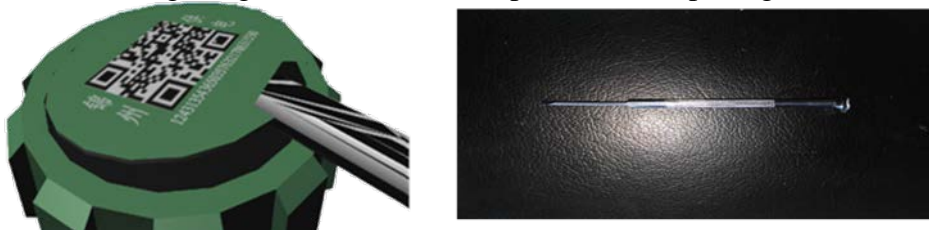


Figure 5. Sealed slot opening slot

(2) Structural design purpose

The upper end surface of the snap-on seal is a flat surface. When opening, it is necessary to poke a gap on the upper end surface thereof, and it is necessary to try to puncture the gap. It is better to tear the upper end surface to facilitate the fixing screws hidden under the end surface. Therefore, when removing the snap-on seal, the operator must repeatedly poke the upper end face with sharp gas. Moreover, the upper end surface area is small, and the operator has to use force when poking. When the landing point is not accurate or the force is insufficient, the sharp device will slide away from the upper end surface of the snap-on seal, and it is very easy to injure the operator or the meter at this time. . The upper surface of the new seal is designed with a rectangular and circular hole for the purpose of making the seal upper plate easy to be uncovered, and the exposed end face is complete, which does not hinder the screwing of the hidden fixing nail under the seal. The opening of the seal is both labor-saving and fast and safe.

The flat design of the upper end surface of the snap-on seal allows the seal to have no fixed force point when it is opened, and the sharp object naturally slides off the seal surface when opened. The upper surface of the new seal is designed with an opening groove that exactly matches the one-piece opening of the screwdriver. The purpose is to make the seal have a force point when it is opened. When opening, just use a suitable slotted screwdriver to press down slightly at the opening slot. The upper surface of the seal will first break at the opening groove, and will not slip off the upper surface, ensuring safe operation. The two seals are shown in Figure 6 and Figure 7.



Figure 6. snap-on seal opening effect chart

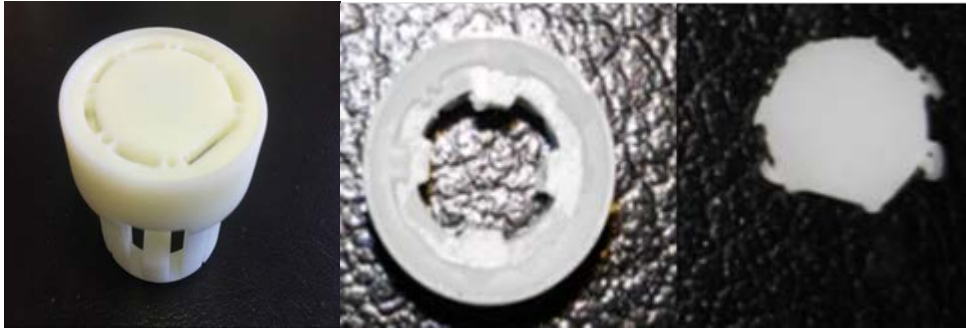


Figure7. New seal opening effect chart

In order to prevent the criminals from forging seals and opening the metering device privately, the two-dimensional code is designed on the upper surface of the new seal. The two-digit code is unique. The operator collects the two-dimensional code information after installing the seal and stores it in the customer's electronic file to make the new seal. With anti-counterfeiting, anti-stealing function. As shown in Figure 5.

When sealing the wire seal, it is necessary to pass the thin copper wire through the small hole of the nail and the small hole on the seal. Because the hole is small, the poor eyesight, hand shake, and unskillful operation will affect the installation speed of the seal, so the way of threading the seal is installed. It takes a long time and is inefficient. The new seal can be installed by pressing it on the fixing pegs in one second. As shown in Figure 8.

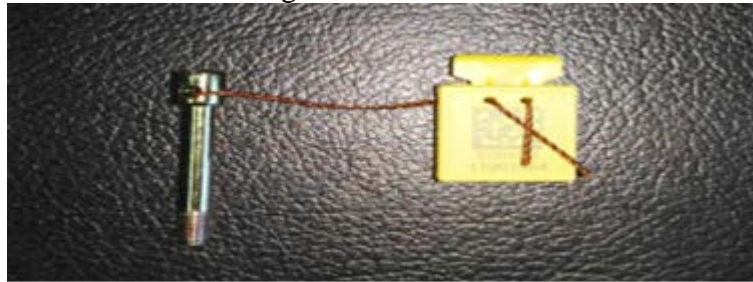


Figure 8. Installation diagram of sealing seal

3. Scope of application

The new seal is suitable for installation on all metering devices and power information collection devices.

4. Economic benefit

The price per new seal is less than 0.05 yuan for the snap-on seal, and the new seal does not require copper wire for installation. Therefore, the use of new seals shortens the installation and opening time of seals, reduces the consumption of manpower, material resources and financial resources, and saves costs. A power supply company installed and opened 390,000 seals due to failure in 2018, as shown in table 1.

Table 1. Cost comparison table before and after improvement

Compared	Cost category	Cost breakdown	Total cost (yuan)	Benefit
Before	Seal cost	$0.85 \text{ yuan / piece} \times 390000 = 331,500 \text{ yuan}$	448500	253500
	Copper cost	$5 \text{ yuan / group} \times 23400 \text{ group} = 117,000 \text{ yuan}$		
After	Seal cost	$0.5 \text{ yuan / piece} \times 390000 = 45,000 \text{ yuan}$	195000	
	Copper cost	0		

5. Conclusion

In summary, the new seal has obtained the national utility model patent. The unique structural design of the seal realizes push-type installation and easy-pull opening, which improves the working efficiency of the operator, ensures the safety of the person and equipment, saves the operation and maintenance cost of the electric energy metering device and the electricity information collecting device, and is subject to General recognition of power supply company operators.

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