Fault Diagnosis and Precaution on Cracking of Suspension Clamp on Transmission Line

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Abstract. In order to fault diagnosis of suspension clamp, combined with the common faults and causes of suspension clamp, By macroscopic examination, metallurgical testing, hardness testing analyzes the failure of a certain overhead lines XGU-3 type U-shaped screw-type suspension clamp, the reason fo clamp fracture is in the long run process, for the effects of wind, the impact of span, the impact alignments, the terrain, the impact of surface features cause ear hanging plate friction between the shaft and trunnion gradual wear and tear, ultimately the critical strength insufficient lead to fracture. Finally, propose the suggestions to prevent the fault of suspension clamp.

Keywords: suspension clamp, Transmission Line, fault diagnosis, precaution.

1. Introduction

Suspension clamp used on overhead power lines hanging on cables, is gold with one set of power lines used in most products, it is carrying a guide, ground in a straight line towers, connected by fittings and insulator strings or tower crossarm, its performance directly affects the life of overhead lines and line losses [1].

The main cause of failure of the suspension clamp has two, namely the quality of the natural environment and themselves. Since the choice of overhead transmission lines and communication lines to consider factors such as arable land, and sometimes the path is unique, so choose the path needs to consider a variety of factors [2]. Therefore, to reduce the suspension clamp can start from failure to improve its texture and structure.

Suspension clamp placed on the natural environment exposed, directly affected by weather conditions and the environment under normal conditions, mainly bear vertical loads, wind loads and friction contact surface of the wire and under accident conditions (break) to withstand the wire tension [3]. Suspension clamp in the long run process of transmission lines, especially in strong winds, under adverse conditions, such as large span, suspension clamp hull axis badly worn (the most serious of more than 30%) and even rupture [4], which directly affects safe operation of the line of personal and property safety. Therefore, the suspension clamp fault diagnosis makes sense.

2. Accidents Overview

The main impact of the transmission line suspension clamp worn for two reasons. On the one hand is the suspension clamp own structure and material, different structure and material selection directly affect the performance suspension clamp; hand suspension clamp is running conditions, such as high winds, large span, long span and other harsh environments running continuously by alternating force and friction affect directly reduce the suspension clamp life.

Currently suspension clamp hull material is malleable iron, hanging panels made of ordinary steel, clamp affected working conditions during operation, the hull and the blade trunnion will inevitably produce friction, the more harsh conditions of their degree of wear more large, the hardness of the material or higher can be used in the conventional surface coating layer of wear-resistant material.

Weather conditions and geographical location have an important impact on the suspension clamp, located in the outlet air flow is usually flat or open terrain, especially in the complex geographical environment, consistent with the wind transmission line where the wind speed is unstable, it will lead to clamp swing and hull Turn the frequency and magnitude of the increase, and these factors are closely related with the clamp wear. In addition, the tower position on both sides of the span and height differences have important implications for the clamp wear, wear and vertical load is proportional to both sides of the span when the tower difference is large, the imbalance will produce tension clamps on both sides, will accelerate Clamps wear [5].

3. Literature References

3.1. Macroscopic Examination.

Measuring 3 to sample, its main dimensions conform to the relevant provisions of "electrical fittings Manual".

Tower timber fittings and harsh environments or improper fittings material in question will occur wear [6]. Trunnion conical hull with peg board phase at the trunnion diameter Φ16mm, replaced two clamp trunnion wear serious, but relatively minor wear sandwich boards.

42 on the left ear clip a shaft not wear off, wear depth 7mm (see Figure 2); another trunnion wear off, the fracture in two distinct parts: one severe corrosion for long-term wear and tear caused by outdated uniform fracture , wear depth 11mm, this part represents approximately 80% of the fracture area, another part of the final instantaneous fracture zone in the region remaining 5.0mm, about 20% of the fracture area (see Figure 3). # 42 on the right sides of the clip are significant wear of the trunnion, and the depth of wear was 4mm 6mm (Figure 4, Figure 5, Figure 6).

The clamp and the fracture was not observed significant manufacturing defects. Also in terms of grip strength, Preformed suspension clamp consists of two layers of aluminum alloy wire-cutter, housing, plastic tile pad and bag hoop components. Vertical intensity with ordinary suspension clamp same, but the standard does not specify twisted grip, manufacturers generally positioned as a wire pull-off force is calculated for 14% [7]. Here, the suspension clamp grip strength to meet the requirements.

Fig 2 Fracture # 42 suspension clamp Fig 3 # 42 bar suspension clamp fracture

Fig 4 # 42 on the right side suspension clamp

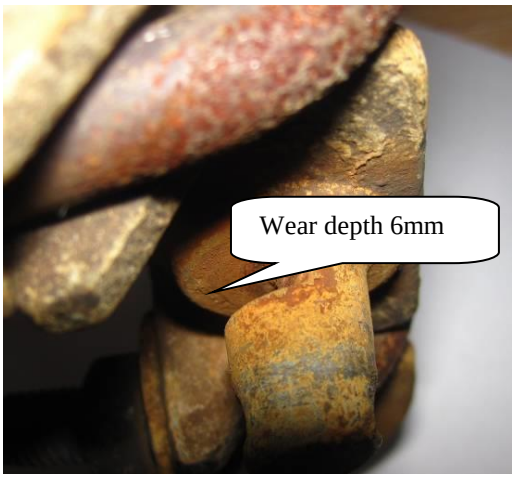

Fig 5 # 42 suspension clamp A trunnion Fig 6 # 42 suspension clamp B trunnion

3.2. Page Numbers.

Metallurgical testing is an important method to determine the merits of the extent of the material [8]. Suspension clamp material is an important reason for its influence convex shaft breakage, so after three clamp hull surface grinding to do metallurgical testing, both ferritic microstructure + floc graphite (see Figure 8 to 10), normal tissue for black heart malleable iron.

By DL / T 756-2009 "suspension clamp" provides suspension clamp available malleable iron manufacturing.

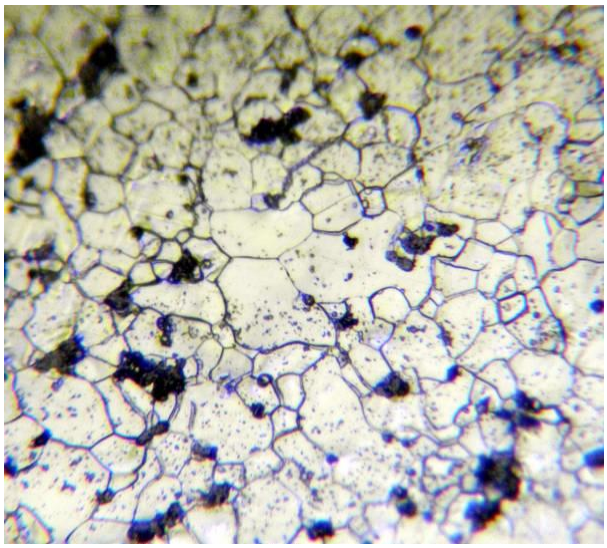

Fig 8 42 # bar on the left clip microstructure 300 ×

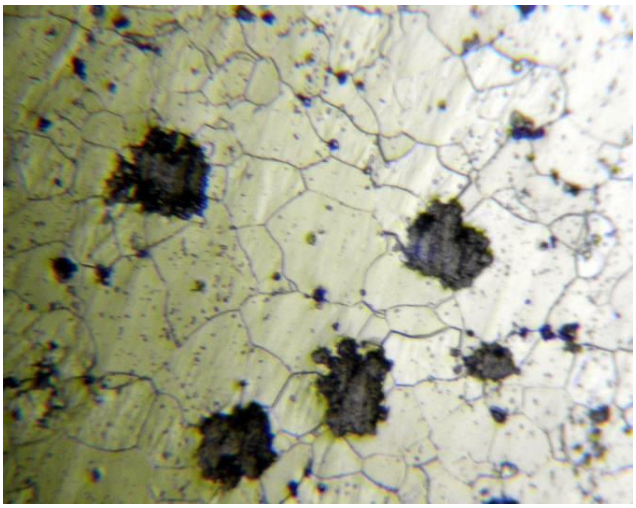

Fig 9 42 # bar on the right clip microstructure 300 ×

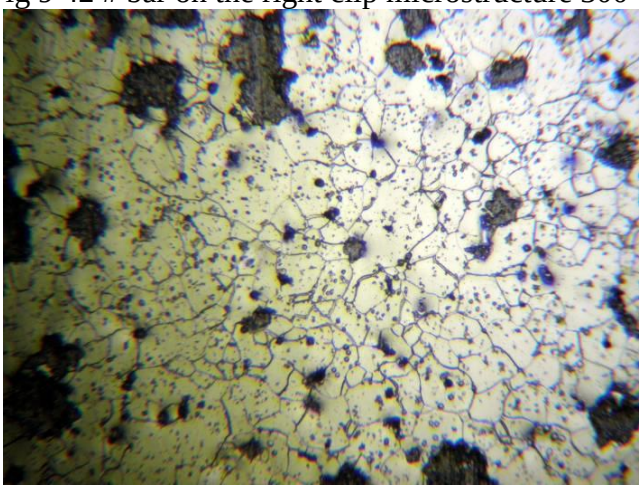

Fig 10 New clip microstructure 200 ×

3.3. Section Headings.

Hardness testing is one of the most simple and non-destructive testing, quick detection method for detecting less demanding environment, so as long as the correct analysis in the detection test results, and understand performance testing components such as clear, we can determine whether the part being inspected qualified parts [9]. Suspension clamp for three hulls were Brinell hardness testing, polished outer surface, sub 3:00 measure the hardness [10], the results are as follows Tab.1(HBW):

Table 1 The results of hardness test

	Measuring point 1	Measuring point 2	Measuring point 3	Average
Left	129	125	124	126
Right	136	140	139	138
New clip	130	129	132	130

DL / T 756-2009 "suspension clamp" provides that: "the parts and accessories suspension clamp the use of the material should meet the following requirements: a) malleable iron according to GB / T 9440 regulations, the tensile strength of not less than 330MPa elongation not less than 8%. "

GB / T 9440-1988 "Malleable Iron," to satisfy the conditions for black heart malleable cast iron hardness is HBW $\leqslant$ 150. Test the hardness values measured in line with GB / T 9440-1988 requirements.

4. The Proposal of Prevent the Failure

Dali Power Supply Bureau situation occurred in 2010 over 220kV line XGU-2-type U-shaped screw-type suspension clamp wear rupture, the situation is very similar to this, the running time close to 24 years. As such. Running time of over 20 years of transmission lines Clamp conduct a

comprehensive inspection, especially in the conduct audits under certain adverse operating conditions, severe wear should be replaced immediately.

Improve the structure of the process suspension clamp: Improved suspension clamp manufacturing materials, such as the application of high hardness materials, processing, or wear ear axis margin increased wear trunnion suspension clamp, increase siding with rotary clamp the friction area, the use of bag-type suspension clamp for suspension clamp plate and clamp body parts of slotting treatment [11]. Damping measures to strengthen the ground, effectively reduce wind-induced vibration on the ground suspension clamp and ground damage.

5. Conclusion

By macroscopic examination, metallurgical testing, hardness testing and other analyzes the reasons for a suspension clamp fracture is due to suspension clamp wind affected the process in the long run, the impact of span, the impact alignments, the topography, ground Suspension Clamp material impact in the long run the process, long-term fatigue wear of the trunnion and siding and continuous impact by alternating force, resulting clamp street strength can not withstand tensile and fracture lines, and propose prevention, clamp failure to reduce some of the recommendations on future troubleshooting suspension clamp is important..

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