

TECHNICAL-ECONOMIC ANALYSIS BETWEEN ALUMINUM AND COPPER CONDUCTOR FOR MEDIUM VOLTAGE CABLES AND THE PRACTICE IN ZHEJIANG, CHINA POWER GRID

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ABSTRACT

The paper provides comprehensive comparisons between cables with aluminum conductor and copper conductor mainly on aspects of technology and economy. Due to high cost-efficient characters with aluminum cable, in a certain area, we are recommending to put aluminum conductor of cable into use, before we take aluminum as superiority, we shall also take conditions of tunnel as well as cable accessories into consideration upon a specific circuit. The paper provides principle of taking aluminum conductor instead of copper on similar current capacity basis, also involves difficulties to be faced and solutions to connect previous existed copper cable with aluminum one, and shows technical proposals for cable laying and installation. Zhejiang Power Grid has achieved notable benefit by largely putting aluminum conductor of cable into use from 2009 on.

KEYWORDS

MV XLPE cables, Technical-economic analysis, aluminum conductor, copper conductor.

INTRODUCTION

The Medium Voltage distribution networks in China mostly use three-core cables, with copper conductor, XLPE insulation and PVC sheath. By the end of 2009, as an example, around 17.9 million kilometers 10kV power cable is running with State Grid Corporation of China, it consume a large amount of copper. In south China, pipe laying are widely used, and normally the tube are synchronize with road construction, as a part of the city's infrastructure. To use large aluminum cables instead of copper cables, it is a point has to be considered.

This paper shows a comprehensive technical and economic comparison between copper conductor cable and aluminum conductor power cables, considering the cost-effectiveness of aluminum cable is higher, it should be actively advocated in some conditional region. For a certain line, the channel, accessories and other factors should be comprehensive considered, to decide whether to adopt aluminum cables as priority. Put forward based on approximate ampacity aluminum and copper alternative criterion, discusses aluminum cable line with copper aluminum transition cable line construction difficulties and solutions, as well as laying the sectors of construction and accessories technological requirements.

Through the demonstration, the following conclusions were got:

- Conductor allowed temperature, short-circuit temperature, bend radius are same between aluminum and copper conductor power cable, so we can replace copper cable with aluminum cable. But for specific engineering, to check if it is feasible, the

channels and attachments need to be involved into the detailed discussions.

- Under the same conditions, if the transportation ampacity are approximate, there should be two section level difference between aluminum cable and copper cable
- With an Investigation for the metals futures market since 2003, conductor cost can save 78%, after made cable, aluminum cable can save procurement costs for about 40-60 per cent. Than approximate ampacity copper cable.
- New tube diameter 175mm according to engineering appropriate consumers 10kV 250mm diameter, 20kV implementation.
- For already tube-build engineering, to purchase copper cable for aluminum conductor cable which is more than 500mm² trunk lines need to be introduced continuously, but not to rebuild exhaust pipe. For equal and below 500mm² section line, to choose aluminum core cable will be the priority for cost saving consideration.
- Cable conductor copper aluminum, change in annex production, copper aluminum docking aspects need to pay attention to some details, should seriously takeover the terminal copper aluminum transition qualified supplier certification, pressure meet PQR, formulate craft standard, and in the light of GB/T4315 defects as soon as making enterprise own terminals and hand-off order technical specifications.
- After change into aluminum cable, for newly-built whole aluminum cable line, the traction and bending radius control need to be carefully taken care of, to avoid broken stocks, influence cable carrying capacity.
- In the present technical conditions, it is not recommended to put copper and aluminum cable docking directly.

Zhejiang grid, which is one of subsidiary owned by State Grid Corporation of China, started made a mass popularize with cable aluminum cable in new medium voltage cable lines since August 2009, it contribute a notable economic benefit. According to the construction scale, about RMB 400 million can be saved within one year, and in the meanwhile, there's no apparent change with cable failure rate.

0 Foreword

In china, cables with copper conductor are largely put into use in Middle Voltage power grid, most of them are laid through pipes which are designed on basis of overall outer diameter of copper cable. Taking 10KV cable in State Grid for example, 179 thousands kilometers of cable with copper conductor are in operation which have consumed large quantity of copper.

It is well-known that China is a country lack of copper, and