Measure p: Optimize Heat Transfer

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Cables transmitting electricity are placed underground for safety reasons. Overhead cables can be knocked over easily, and could create a potential difference across the cables causing sparks to fly. Cables buried underground eliminate this issue, but also present their own unique challenges. Heat must be carried away from the buried electrical cable for an efficient operation. The air dissipates thermal energy for overhead lines. The soils in and around the trench do this for underground lines. Soil is used as a thermally conductive material to carry heat away from buried electrical transmission cables. Ampacity is the maximum electrical current a cable can safely sustain. The underground cables generate a lot of heat, drying surrounding soils. In soils with acceptable thermal resistivities, heat transfer generally occurs resulting in acceptable cable temperatures, but at a critical value, heat can no longer be transferred, and the cable fails. In soils with high thermal resistivities the cable ampacity must be lowered to prevent a thermal runaway. Measuring the soil thermal resistivity quantifies the capacity of the soil to dissipate heat. This study performed thermal resistivity measurements in accordance with ASTM D5334. The measurements were performed at in-situ moisture contents and at dry as well as saturated conditions to develop the thermal dry out curve. This paper describes the principle of soil thermal resistivity measurements along with equipment used and test results for typical soils found in the area. The results are significant and provide insights to optimize heat transfer in buried electric cables.

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