and those as shown in Table J-3 for medium loading districts.

We do not provide any difference in the amount of sag between weather-proof and bare wire, and no consideration is given to the size or tensile strength, as it is our understanding that the sag tables are made up in such a way that the tensile strength of the wire was taken into consideration when they were prepared.

Curves Readily Calculated

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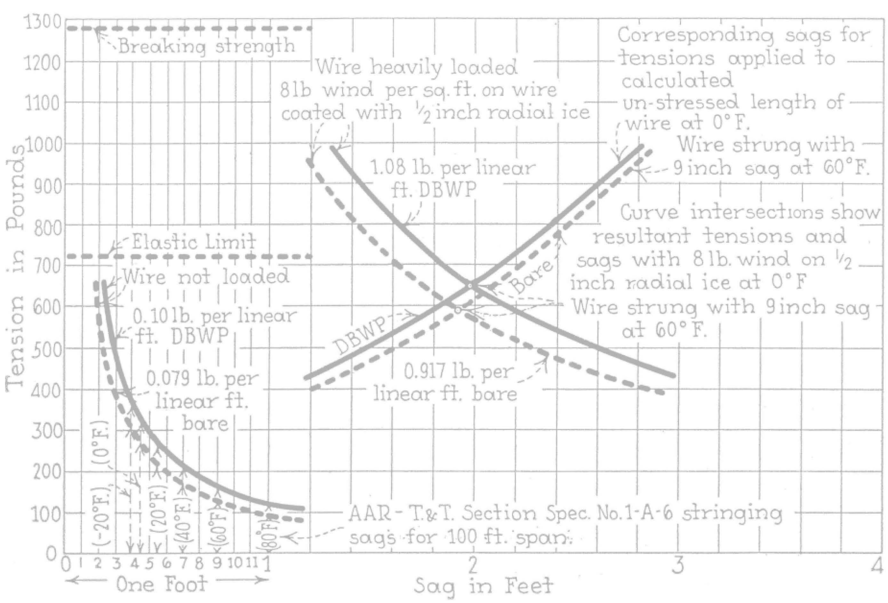
The recommended stringing sags of line wire for various spans at different temperatures, as given by A.A.R. Telegraph & Telephone Section Specification 1-A-6, are generally satisfactory for both bare and weather-proof wires. However, greater tensions will result in a weather-proof wire of a given size and material when strung at the same temperature and with the same sag on the same length span, than the tensions in a similar bare wire, due to the increased weight of the insulation, heavier ice load, assuming the same thickness of ice over the larger diameter, and greater wind pressures due to the greater exposed surface.

Besides having adequate electrical conductivity, the size of wire should be chosen so that it will be safe from breaking under the worst loading conditions expected. Calculations to determine what tension and sag will result from assumed loadings are readily accomplished with the aid of tables published by James S. Martin, based upon the catenary curve. However, for short spans the well-known parabolic formulas are sufficiently close. Whatever method of calculation is used, the following characteristics of the wire under consideration must be known: Outside diameter, weight per foot, breaking strength, elastic limit, modulus of elasticity, and temperature co-efficient of linear expansion.

The accompanying curves, for example, give the tensions and sags expected in No. 6 hard-drawn solid copper line wires, both bare and double-braid weather-proof, when strung at 60 deg. F. on a 100-ft. span with the A.A.R. recommended sag, and later subjected to a load of 8 lb. wind pressure per square foot on the wire when coated with ½ in. of radial ice at a temperature of 0 deg. F.



Curves showing initial tension at 60 deg. F. and the sags when subjected to ice loads

The curve for bare wire at the lower left, shows the initial tension at 60 deg. F. to be about 132 lb., corresponding to a sag of 9 in. The curve in the center of the drawing, sloping downward from left to right, shows the corresponding tensions for various sags when the wire is heavily loaded.

The curve sloping upward from left to right is calculated as follows: (1) Remove the 132-lb. initial tension and calculate the unstressed length of the wire at 60 deg. F., (2) reduce the temperature to 0 deg. F. and obtain the unstressed length at 0 deg. F., and (3) apply various tensions to the wire and calculate the corresponding sags. The point of intersection of the two curves in the center of the drawing thus indicates that, under the loading assumed, the sag will be about 1.93 ft. and the tension about 595 lb., which is well under the elastic limit and is considered safe.

The curves for the weather-proof wire were similarly drawn, assuming the same stringing temperature and sag. The curves for the weather-proof wire show greater tensions in all cases for the same sag due to the conditions outlined in the first paragraph above. The curve intersection shows that under heavy loading the sag will be about 1.99 ft. and the tension about 655 lb., being still under the elastic limit.

Had the weather-proof wire been assumed strung at the same initial tension as the bare wire, the sag at 60 deg. F. would have been about 11½ in. unloaded. At 0 deg. F. loaded, the intersection of the bare upward curve with the weather-proof downward curve gives a sag of about 2.04 ft. and a tension of 638 lb., which in this case is so near the value previously obtained that, in view of the fact that the breaking strength and other constants used in the calculations are average values, and that in practice the span length, temperature and stringing tensions are only approximated, it is quite satisfactory in this case to use the same stringing sags for both bare and weather-proof wires.

Back Locks on Approach Signals

"Do you require back locks on approach signals at mechanical interlockings? Would the type of signal or use of derails change your requirements regarding back locks?"

Required on Power Signals

W. N. Hartman
Assistant Signal Engineer, Chesapeake & Ohio, Richmond, Va.

Back locks, otherwise known as signal indication locks, are not required on mechanically-operated (wire pulled) approach signals at mechanical interlockings. This type of approach signal having proved unsatisfactory, however, has for many years been considered obsolete, and power-operated semaphores or light signals are now quite generally used for approach signals at mechanical interlockings.

When the approach signals are of the power-operated semaphore or light type, back locks are required regardless of the type of home interlocking signals employed and regardless of whether derails are used.