A newly designed station wire, which supplants two previous designs, has advantages for both operating companies and telephone customers. It is smaller, less expensive, easier to install in ducts and conduits, and less obtrusive in exposed runs than predecessors.

Jacketed Station Wire

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STATION WIRE is the first link in the chain connecting a customer's telephone to the world-wide telephone network. Like other parts of the telephone system, station wire has undergone numerous design changes over the years, with the constant goal of providing a structure with desirable performance characteristics at the lowest possible cost. The latest design, known as D Station Wire, embodies a number of improvements over previous designs and is expected to fill the demand for a general-purpose station wire.

Station wire originally consisted of individually insulated copper conductors, twisted together to form a unit. The early types employed various combinations of rubber and textiles for electrical insulation and mechanical protection. Appearance was not considered important. In most residential installations, the wire simply was attached to walls and baseboards with tacks or nails. These exposed runs of twisted conductors were generally unsightly and were notable dust collectors. Many customers painted the wire to match its surroundings, but at best this made it only slightly less conspicuous.

A substantial rise in the demand for telephone service accompanied the post-war building boom. Conduit and duct systems for power and communications wiring were installed in the floors and walls of buildings, and in homes and offices the telephone wires were hidden in walls and partitions wherever possible. This trend imposed a new requirement on station wire; it had to be suitable for pulling through conduit, ducts and partitions. For exposed installations an improved appearance was important.

The first jacketed station wire (with an outer jacket binding the individually insulated conductors into a unit) evolved from development efforts begun in the late thirties. It was designated "Jacketed Inside Wire," and was produced in small quantities for field trials in 1940. The conductors were rubber insulated, and the jacket was neoprene.

Wartime restrictions on the use of synthetic

and natural rubber compounds prevented the manufacture of Jacketed Inside Wire for Bell System use. The search for substitute wire insulation materials between 1941 and 1945 led to tentative wire designs using thermoplastic compounds such as polyethylene and polyvinyl chloride (PVC).

In 1945, an unjacketed, plastic-insulated design called GS Station Wire was made standard for Bell System use. Consisting of copper conductors individually insulated with PVC and twisted together, the new wire was easier to keep clean and had improved electrical properties.

The concept of a jacketed, general-purpose wire had not been abandoned, however. There was a definite need for a wire suitable for either exposed runs or conduit, incorporating desirable electrical and mechanical characterisics and a good appearance. A new jacketed design, JK station wire, with jacket and insulation of PVC, was introduced in 1946. The design was a good one in many ways. There was a problem, however, in that the PVC of the conductors and the jacket tended to stick together. Also, the appearance was somewhat irregular. Further development was needed.

By 1952, the JK design had been modified several times before being stabilized as JKT Station Wire. The JKT design contained high-strength, 20-gauge copper-steel conductors. It was insulated with PVC and covered with an outer jacket of weather-resistant PVC so it could be used outdoors if necessary. A thin paper tape between the conductors and the jacket prevented them from sticking together.

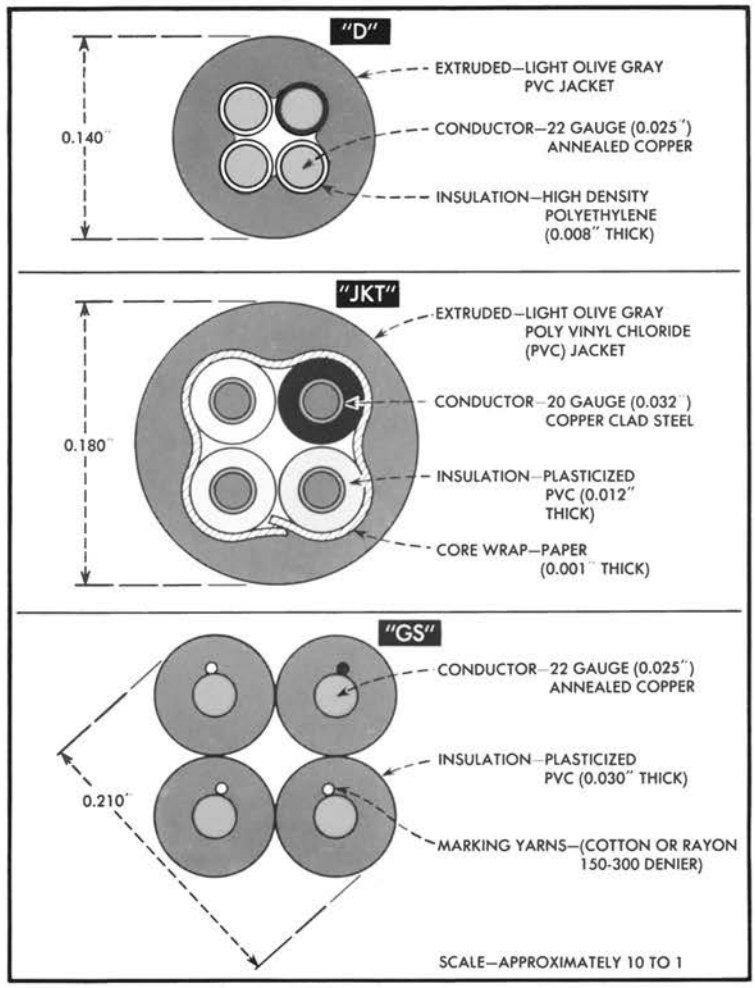
At about the same time JK wire and its successors were being introduced, staple guns were adopted for fastening the smaller, cylindrical structure wire to walls and baseboards.

At first the jacket was ivory or brown PVC, the goal being to make it more compatible with its surroundings. Beige was subsequently used instead of brown, and this was changed later to the light olive gray now standard for most Bell System station products.

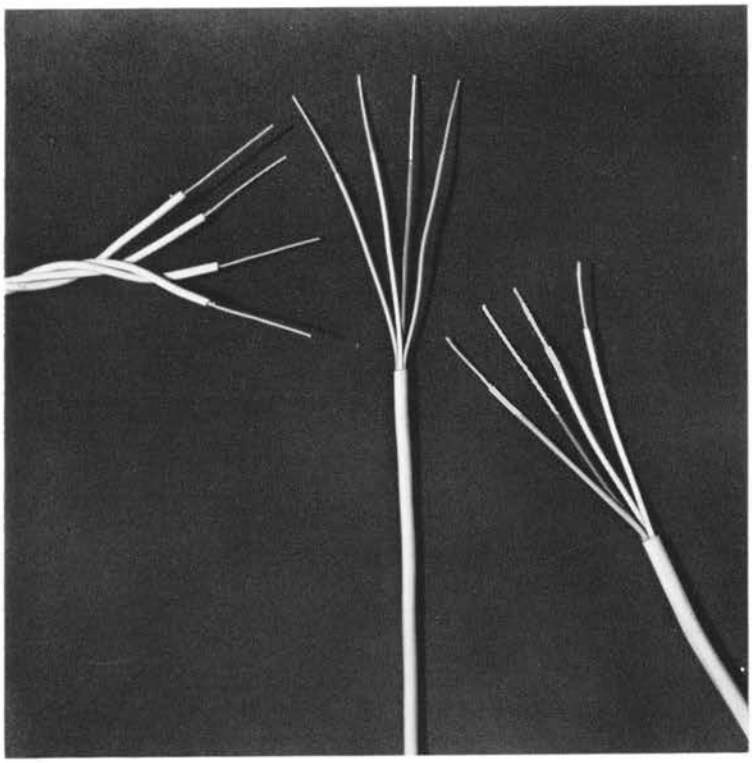
Most of the telephone companies soon made JKT wire standard for all their needs, but some continued to use GS wire in conduit and ducts. Lubricants were used, making JKT wire easier to pull into conduit, and in time the demand for GS wire declined.

The Western Electric Company, searching for ways to reduce the cost of JKT Station Wire, suggested design changes to utilize other materials that would be less expensive and would lend themselves to more advanced manufacturing techniques. Consequently, Bell Telephone Laboratories, with the cooperation of Western Electric Company engineers, began a thorough evaluation of station wire. First, a modified JKT wire with high-density polyethylene insulation on 21-gauge copper-steel conductors was tested. Other designs tried contained annealed copper, copper alloy, and copper-coated steel conductors in sizes from 21 to 26 gauge. Different formulations of PVC were tested with the various conductors, and surface friction characteristics of different kinds of jackets were explored.

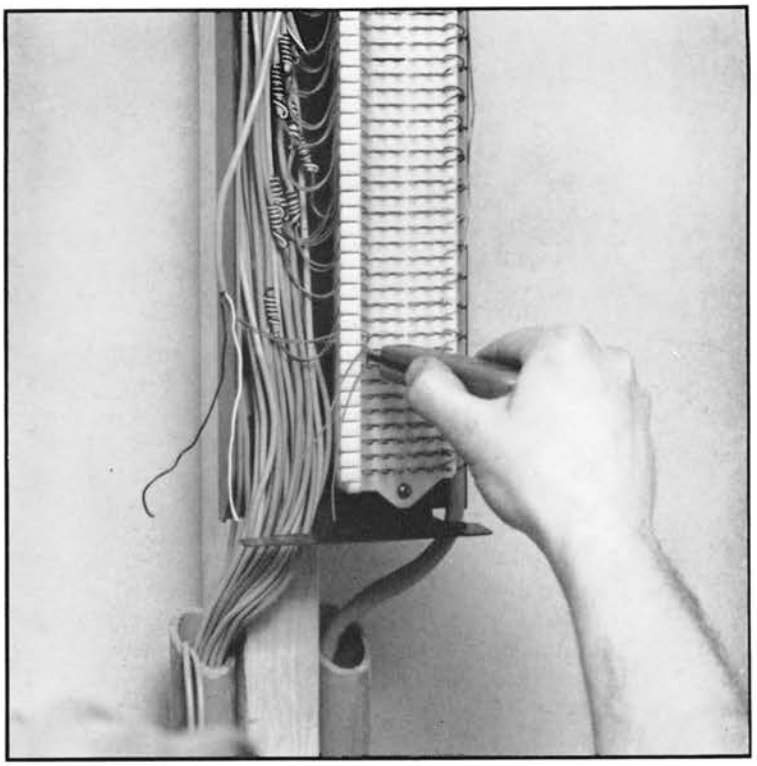
The wire that evolved from the laboratory tests, and from field trials in three telephone company areas, is new from conductors to jacket.



D Station Wire is all new from conductors to jacket. Even the polyvinyl chloride of the jacket itself is a new, low-friction type that is especially suitable for pulling into duct-work and conduit. The D Station Wire is cheaper to make, easier to use, and smaller than either of the earlier designs shown here.



These are, counterclockwise from the left, the GS, D and JKT station wire structures. The D Station Wire structure, made possible by modern advances in polymer chemistry, is smaller than the others and more satisfactory from several points of view.



A technician connects D Station Wire to "quick-connect" terminals with a hand tool. This tool presses the wire between the jaws of the terminal, where the insulation is crushed and contact is made. The tool also cuts off the excess end of wire.

This design, called D Station Wire, uses 22-gauge annealed copper conductors with high-density polyethylene insulation. Four conductors are twisted together into a spiral "quad" and covered with a jacket of a new PVC compound that has very low surface friction.

The new wire has a breaking strength about 60 per cent less than that of JKT wire. However, D wire's smaller diameter, greater flexibility, and better frictional properties make it easier to pull into conduits and ducts, so it does not need as high a breaking strength. This makes it possible to get more wires into a given conduit. One typical test was made with a one-inch diameter conduit 50 feet long with three 90-degree bends. Only four JKT or 10 GS wires could be pulled into it, while as many as 20 quads of D Station Wire could be pulled in easily.

This increase in conduit capacity was attained without lubricating the wires. Even when the wires are lubricated, the D wire still maintains an appreciable advantage. However, the elimination of the need for lubricants will be one of the significant improvements the new wire brings. Aside from the cost of the lubricant itself, additional time is required in using it. Lubricants are messy, and care must be taken to prevent soiling a customer's premises. Moreover, dried lubricant tends to obstruct a conduit.

D Station Wire is significantly easier to install. The thin polyethylene insulation and copper conductors make it possible to connect the wire to standard "quick-connect" terminals, using standard tools. With previous designs, the installer had to remove the jacket and strip the insulation from the conductors in order to connect wire to terminals. Also, the new wire is packaged in 500-foot coils instead of 300-foot ones, since its weight is considerably less and its size smaller than those of its predecessor. Because of the increased flexibility of the wire, the new package incorporates an anti-tangling device developed by packaging engineers of The Western Electric Company and BTL.

To permit longer installations in duct systems, a stringent capacitance unbalance requirement became necessary that was not specified for JKT Station Wire. The Western Electric Company resolved this by investigating the causes of unbalance and developing facilities to negate their effect.

The initial response from the telephone companies indicates that D Station Wire satisfies all their requirements for a general-purpose station wire. This includes new installations, additions to existing ones, and necessary replacements. Both the JKT and GS designs have been discontinued entirely—they are no longer needed.