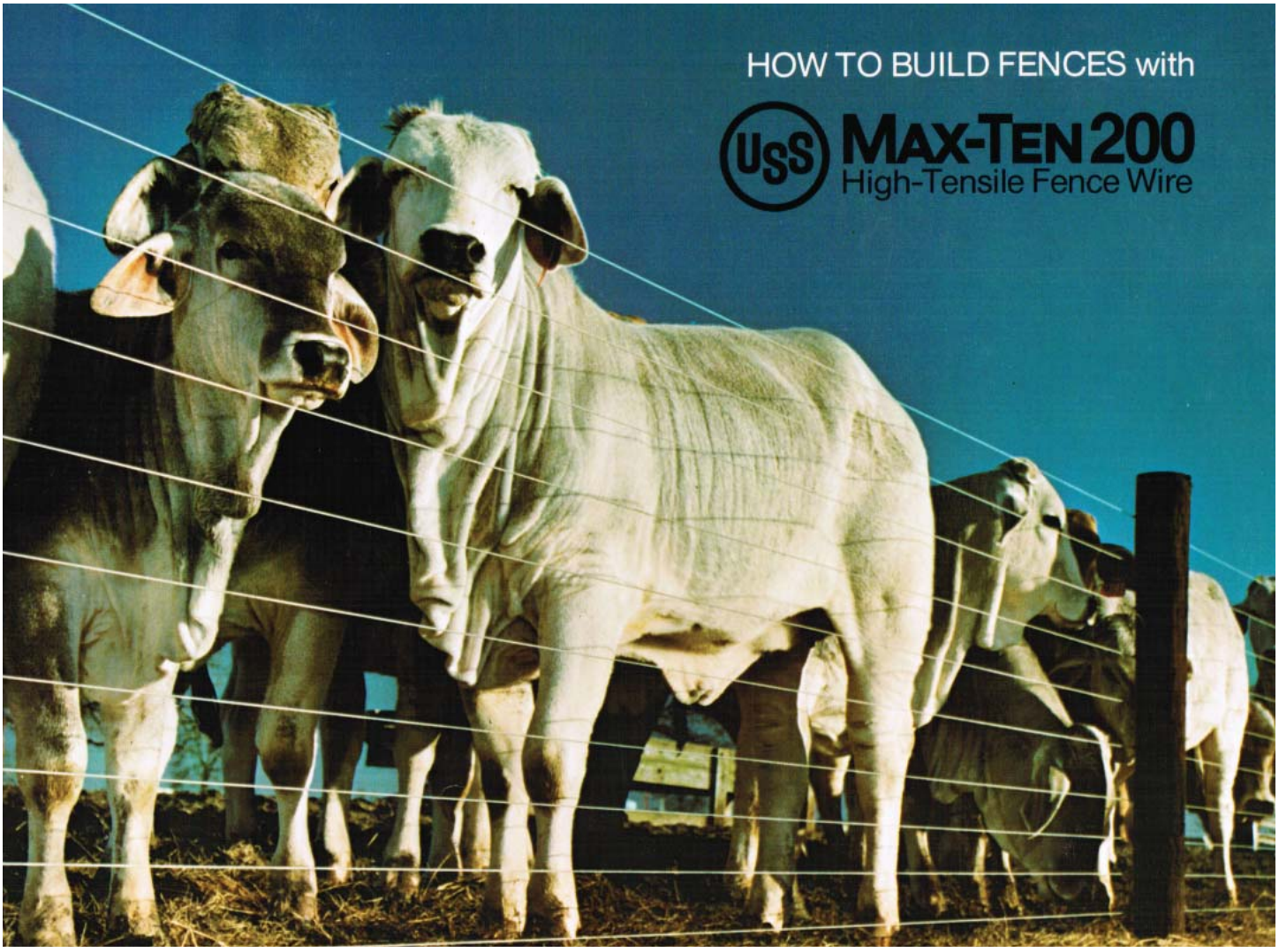
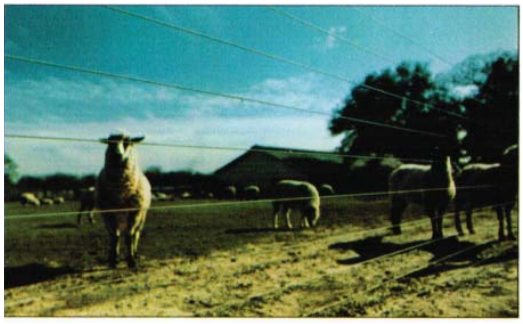
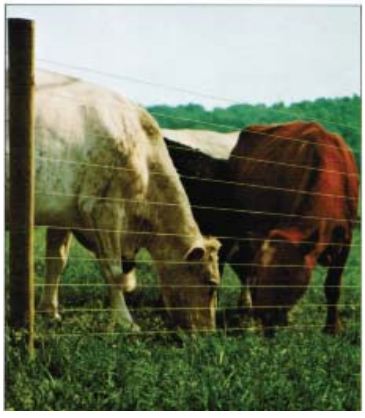
HOW TO BUILD FENCES with

USS MAX-TEN 200
High-Tensile Fence Wire







HOW TO BUILD FENCES WITH
MAX-TEN 200 HIGH-TENSILE FENCE WIRE

NOTICE

All technical data, design information and construction details contained in this publication are predicated solely on the use of 12½-gauge MAX-TEN 200 HIGH-TENSILE FENCE WIRE and should not be used for constructing fences with any other type of wire. The information contained in this publication is for general information only. It is not intended as a substitute for the competent professional assistance which obviously is a requisite to any specific application. While every effort has been made to ensure its accuracy, Kencove Farm Fence makes no express or implied warranty of any kind with respect to the information contained in this publication or the materials referred to therein. Anyone making use of the information herein does so at his own risk and assumes any and all liability resulting from such use.

CAUTION

It is recommended that proper grounding techniques for wire fences be followed during installation to provide maximum protection of humans and livestock from lightning or fallen overhead electrical wires. Such recommended practices are given in the National Fire Prevention Association (NFPA) Standard, Appendix E, in the National Electrical Safety (NES) Code, Section 9, or in the U.S. Department of Agriculture Farmers' Bulletin Number 2136.

ACKNOWLEDGEMENTS

Permission to reproduce various drawings, photographs, tables and other technical information contained herein, granted by TEXAS A&M UNIVERSITY, of College Station, Texas—and others too numerous to mention—is gratefully acknowledged.
Don Kendall
Kencove Farm Fence Blairsville, PA 15717

FOREWORD

The attractive fence shown on the cover of this booklet is constructed with six strands of coated, 12½-gauge MAX-TEN 200 HIGH-TENSILE FENCE WIRE, the most significant development in farm and range fencing since barbed wire was first introduced by a forerunner of Kencove in 1874.

Although relatively new in this country, high-tensile wire fences have been used to control sheep, cattle and horses on the vast ranches of Australia and New Zealand for nearly 30 years. While no more difficult to plan and erect than any other type of wire fencing, high-tensile wire fences are different and require special attention to designs as well as to methods and materials of construction- particularly to the selection of the posts and wire.

MAX-TEN 200 HIGH-TENSILE FENCE WIRE has nearly twice the breaking strength of two-ply barbed wire, but it is easier to handle and safer for livestock. With it, a six wire high-tensile fence costs less than a five-strand, two-ply barbed wire fence and 50% less than a woven wire fence of equal height; but a fence with MAX-TEN 200 HIGH-TENSILE FENCE WIRE lasts longer and looks neater with less maintenance than either of them.

Contained in this booklet is detailed information necessary to the selection of reliable materials for and step-by-step procedures for the proper erection of both non-electric and electrified high-tensile wire fences with MAX-TEN 200 HIGH TENSILE FENCE WIRE. Also included are safety precautions which must be exercised in erecting various types of fences utilizing such high-tensile steel wire.

To facilitate identification of the various components and tools used for erecting high-tensile wire fences, several trade names have been mentioned in this booklet. While such mention does not constitute endorsement of those particular items by Kencove, nor criticism of components and tools not mentioned, most of the items referred to have been tested by United States Steel's Research Laboratory or other responsible bodies—as well as in actual fence installations—and have been found satisfactory for the applications shown. It is important that anyone who wishes to build high-tensile wire fences becomes thoroughly familiar with the contents of this booklet before proceeding with construction.

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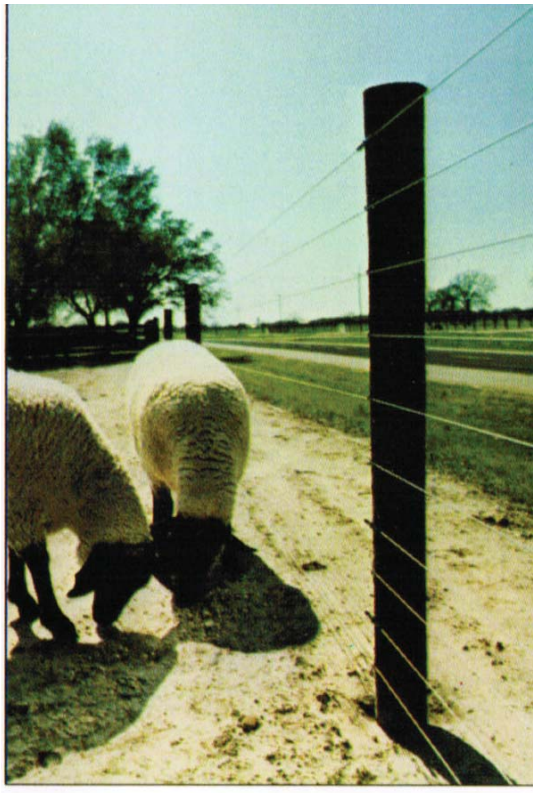


THE GROWING NEED FOR GOOD, LOW-COST FENCES

Every farmer and stockman knows the value of good fences. Without them, there would be no established land boundaries, no protection for crops, no control over the breeding and feeding or safety of livestock; and profitable farm management would be virtually impossible. In fact, the first step in establishing any successful agricultural enterprise is the erection of sturdy, reliable fences.

Once limited to placing stone walls or split logs around small, highly productive acreage, fencing has evolved through enclosing and subdividing larger tracts of land of lower productivity. This became practical before the turn of this century with the invention of low-cost barbed wire, and, a few years later, with the introduction of woven wire fencing.

While today's trend is toward fewer, but larger, highly mechanized farms and ranches—which has actually resulted in the removal of many miles of fence—much of the barbed wire and woven wire fencing erected following war-created steel shortages is now in need of replacement—at greatly increased costs. Higher land costs and higher costs for farm machinery, feedstuffs, fuel, fertilizers and other agricultural chemicals— as well as labor—have made the more efficient use of every available acre of land more vital than ever and have intensified the need for reliable, low-cost fences. In fact, it is widely accepted that the best fences are the lowest-cost fences that do the job, such as high-tensile wire fences constructed with 12 ½-gauge MAX-TEN 200 HIGH-TENSILE FENCE WIRE.

ADVANTAGES OF HIGH-TENSILE WIRE FENCES

No comparison need be drawn between the relative low cost, ease and speed of erection and longevity of wire fences and fences of other materials. These factors are well known. But high-tensile wire fences with MAX-TEN 200 HIGH-TENSILE FENCE WIRE provide many advantages over conventional barbed wire and woven wire fences, as well as fences of smooth, but low-tensile wire.

HIGH ELASTIC LIMIT, GREATER BREAKING STRENGTH

With adequate fence posts and brace assemblies, the principal cause of failure of any wire fence is exceeding the elastic limit of the wire. As its name implies, 12 ½-gauge MAX-TEN 200 HIGH-TENSILE FENCE WIRE has a minimum ultimate tensile

strength of 200,000 psi and nearly twice the breaking strength of two-ply barbed wire. It is capable of being pulled up tighter along an entire fence line, resulting in a stronger, straighter, more effective barrier with no loose or sagging wires to serve as starting points for stretching and breaking and ultimate penetration by livestock or predators.

SECURITY WITH ECONOMY

It is well known that horses and cattle tend to weigh down and climb over wire fences, while sheep, calves and other small animals tend to spread the wires and climb through the fence. To thwart these tendencies, it is necessary to string several strands of barbed wire or—in the case of low-tensile woven wire—to add many closely spaced vertical wires to maintain horizontal wire spacing. It is also necessary to install one or more strands of barbed wire at the top of woven wire fences to prevent animals from weighing down and permanently distorting or breaking the wires. Although barbed wire is less expensive than woven wire, it is also less effective in containing sheep when they become heavily covered with wool, and it can cause depreciating damage to the hides of cattle and serious injury to horses.

Since it has no barbs, MAX-TEN 200 HIGH-TENSILE FENCE WIRE contains less than half as much steel as 12 ½ gauge, two-ply barbed wire, and it is safer for livestock. With it, a ten wire high-tensile fence costs about the same as a five-strand barbed wire fence and about 50 percent less than a woven wire fence of equal height and number of horizontal wires. Once up and stretched to the recommended 250 pounds minimum tension, each strand of 12 ½-gauge MAX-TEN 200 HIGH-TENSILE FENCE WIRE withstands at least 1,200 pounds of livestock pressure or cold weather contraction without losing its elasticity. Sheep do not like its spring-like stiffness and cannot spread the wires. Horses quickly realize they cannot weigh down the wires; and cattle that have charged high-tensile wire fences have bounced back with no damage to their hides, but no wish to try again. This superior resistance to damage by livestock and temperature changes practically eliminates high-tensile wire fence maintenance.

LONGER RESISTANCE TO CORROSION

The second most common cause of failure in fence wire is atmospheric corrosion. The American Society for Testing and Materials has studied how galvanizing delays the rusting of steel wire under a wide range of climatic conditions. Most kinds of barbed wire and woven wire have only a Type I zinc coating, but MAX-TEN 200 HIGH-TENSILE FENCE WIRE has Class 3 galvanizing, which means it has over 250 percent heavier coating of zinc than most brands of barbed wire and woven wire. This heavier coating can extend the life of MAX-TEN 200 HIGH-TENSILE FENCE WIRE up to 35 years in humid regions and to more than 50 years in relatively dry climates.

VERSATILITY

Experience shows that for enclosing livestock or excluding wild animals, more important than the overall height of the fence is the horizontal spacing of the individual wires. With high-tensile wire, it is possible to modify the spacing of the horizontal wires in a variety of ways to suit the particular fencing need. MAX-TEN 200 HIGH-TENSILE FENCE WIRE also lends itself beautifully to electric fences, and various designs have been erected and tested which contain cattle, sheep, goats, horses and hogs or turn away deer, dogs, coyotes and raccoons—even bears. Using high-tensile wire for electric fences permits the use of small fence posts and extending the spacing between conventional line posts to as much as 150 feet on level terrain, by installing pressure-treated hardwood battens or "droppers" between the posts. Also, individual wires can be selectively charged or grounded, depending upon the kinds of livestock to be contained or predators excluded. The design and construction of various kinds of electric fences with high-tensile wire are covered later in this booklet.

A BRIEF HISTORY

Although the concept of building farm and range fences with high-tensile wire is nearly thirty years old, it has only recently become of general interest in the United States. And, until MAX-TEN 200 HIGH-TENSILE FENCE WIRE was first introduced in the fall of 1978, a truly high-tensile wire (with 200.000 psi minimum tensile strength) for this purpose was not readily available. For these reasons, most domestic farmers and ranchers had never even seen—let alone built—a high-tensile wire fence, nor had a chance to observe its superior performance.

A New (Zealand) Idea - In the summer of 1973, John R. Wall, a native of New Zealand—and now President of KIWI FENCE SYSTEMS, INC., of Waynesburg, Pennsylvania—asked a Product Representative of United States Steel if it were possible for him to obtain some smooth. 12 ½-gauge high-tensile steel wire with Class 3 galvanizing to build some ten wire fencing to contain cattle and sheep. The USS Representative assured Mr. Wall that United States Steel manufactures such high-tensile wire and, although it had never been sold for fencing, he would provide a few thousand feet for this novel "experiment".

Having obtained the wire, John Wall replaced several hundred rods of deteriorated barbed wire boundary and subdivision fences on his farm, employing the same techniques he had practiced for more than 15 years building fences in New Zealand. At first, neighboring farmers and passers-by scoffed at John Wall's smooth-wire fences, but grudgingly admitted that they were indeed straight, secure and amazingly strong. Soon, Mr. Wall was building similar fences for his neighbors; and before long, he organized KIWI FENCE SYSTEMS, INC.

John R. Wall, a native of New Zealand, came to America with over 15 years of experience in designing and building high-tensile wire fences. His expertise has been further broadened by his working with various American agricultural colleges and universities in developing new and improved methods of controlling livestock and predators with non-electric and electrified high-tensile wire fencing. At this writing, Mr. Wall is available, on a fee basis, to conduct fencing seminars and field demonstrations anywhere in the United States. For more information, write: KIWI FENCE SYSTEMS, INC., R.D. 5, Box 122, Waynesburg, PA 15370, or telephone (412) 627-5640.

TOUGH, UNPLANNED TESTS

In the Spring of 1974, on a neighbor's farm, a severe thunderstorm uprooted a 14-inch diameter elm tree, the trunk of which fell across a ten wire high-tensile fence halfway between two posts, pulling the staples from the adjacent posts and weighing all ten wires down to the ground. John and his neighbor cut up the tree with a chain saw, and when they had lifted the logs off the fallen wires, all ten sprang back up to their original positions and had only to be re-stapled to the posts to repair the fence. Not a single wire was stretched or broken, and today—after six years— that same section of fence has not required one additional man-hour of maintenance.

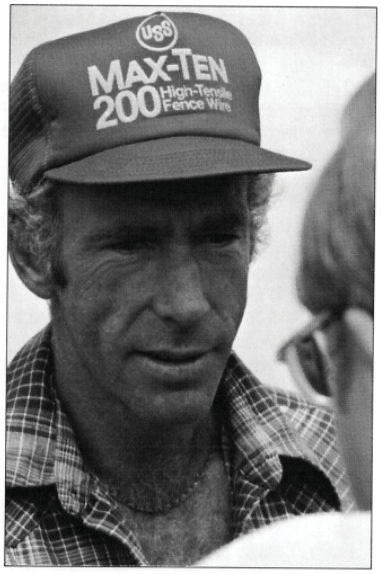
Some time later, Mr. Wall was cutting and baling hay near the crest of a steep hill. A 1200-lb. round bale of hay became loose, rolled several hundred feet down the hill and crashed dead-center into a 4-inch diameter wood line post in a five-year-old, ten wire high-tensile fence. It sheared off the post at ground level, rolled over the wires and on down the hill. The post and all ten wires immediately returned upright and remained an effective barrier until repairs could be made. Total repair consisted only of replacing the broken post and restapling the undamaged wires.

During the following three winters, accumulated snowfalls in Western Pennsylvania were among the highest ever recorded; and several times, John Wall's fences along his roadway were completely buried under plowed snow. He has never had to repair or replace a stretched or broken wire.

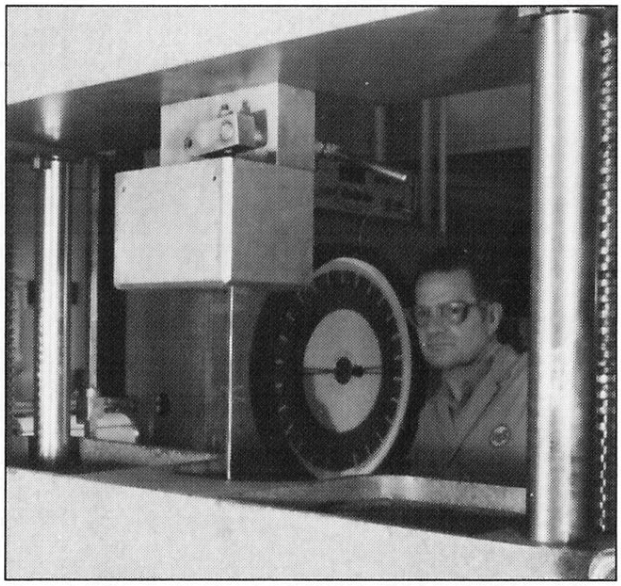
However unplanned and unscientific, such tests convinced John Wall and United States Steel that they had discovered a type of wire that was stronger than any other wire they had ever seen used for fencing.

TOUGHER, PLANNED TESTS

Recognizing the outstanding physical characteristics of the wire, United States Steel immediately began investigating the possibilities of marketing it for fencing under the name MAX-TEN 200 HIGH-TENSILE FENCE WIRE. There were, however, many unanswered questions. Most of the technology and practical experience in fence construction with high-tensile wire had been developed in Australia and New Zealand and was not well known in this country. Also, many of the hardware and accessory items were manufactured abroad and had not been tested in use with 200,000 psi wire. Working closely with Mr. Wall, United States Steel's Research Laboratory initiated a comprehensive



John Wall, President of Kiwi Fence Systems, Inc.



research and development program to determine specifically which materials and techniques of construction would be most reliable for erecting fences with MAX-TEN 200 HIGH-TENSILE FENCE WIRE.

This continuing program has, to date, involved performing more than 90 physical tests to determine such properties as: (1) the minimum ultimate tensile strength, yield strength and breaking strength of MAX-TEN 200 HIGH-TENSILE FENCE WIRE, compared with other types of wire used for fencing; (2) the electrical resistance of different gauges of galvanized steel wire; (3) the comparative breaking strengths and the mechanics of failure of various knots and mechanical devices used in fastening and splicing MAX-TEN 200 HIGH-TENSILE FENCE WIRE; and (4) the tension loading to destruction of various hardware and accessory items that could be used for erecting fences

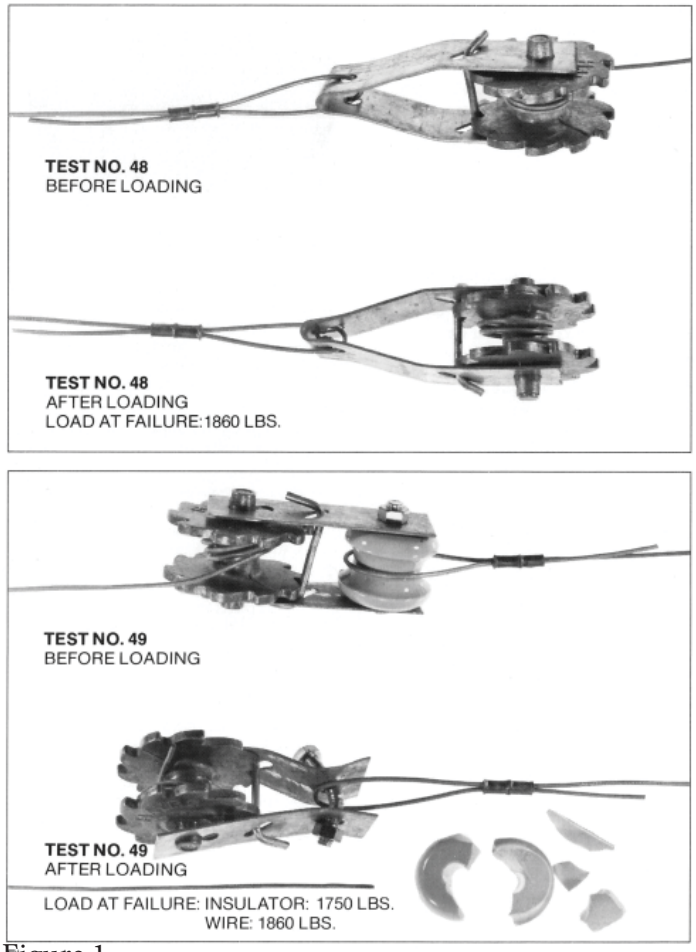


Figure 1

with MAX-TEN 200 HIGH-TENSILE FENCE WIRE. (Figure 1).

The research study also included computer-programmed analyses of the behavior and structural integrity of various diameters and lengths of tapered round wood fence posts and brace assemblies, embedded to different depths in four different types of soil. A separate analysis was also made of the resistances to vertical uplift of wood fence posts driven to different soil depths in low-level terrain, with varying angles of wire inclination after tensioning.

While it is beyond the scope of this publication to include the complete results of this research, much of the data obtained has been relied upon in the preparation of this book. In some instances, these data have been used to substantiate recommended materials or erection techniques; in other instances, materials or construction methods on which tests or calculations indicated failure would occur before MAX-TEN 200 HIGH-TENSILE FENCE WIRE have been either modified or eliminated.

HIGH-TENSILE FENCE MATERIALS

As stated previously, erecting high-tensile fences is no more difficult than other types of wire fences, but high-tensile wire fences are different and require special attention to the materials of construction. Following are descriptions of the basic materials common to all types of high-tensile wire fencing; namely, the posts, the wire and the tools and hardware.

The Posts

Fence builders here and abroad have learned by experience that the most suitable material for fence posts in high-tensile wire fencing is wood—specifically, round, chemically pressure-treated softwood, such as Lodge Pole, Ponderosa, or Southern Pine. The principal reasons for this preference are that round, pressure-treated wood posts have a high-strength to relatively low-weight ratio, are economical in cost and provide long service life.

In typical ten wire, high-tensile wire fences, when all wires are pulled to the proper tension, the combined force acting on the end posts—even without livestock pressure—can exceed 2,000 pounds. And, a drop in temperature from 80° F to -20° F can exert an additional 800 pounds of tension in 500 feet of ten wire fence. For these reasons, the need for strong posts—particularly at end, corner and gate locations cannot be overemphasized. As shown in Figure 2 and in Table 1, wood posts are strong.

In addition to their strength, pressure-treated wood posts are relatively straight and have a natural taper which facilitates driving. The diameters of wood fence posts vary somewhat from post to post and from end to end. All diameters mentioned in the following pages are minimum and refer to the smaller ends of the posts. Round wood posts have no sharp edges to kink wires at corners or to injure livestock and they are available in a variety of lengths and diameters for every high-tensile wire fencing requirement. Pressure-treated wood posts are distributed by many reputable dealers throughout the United States who can offer posts with treatments to provide up to 40 years of resistance to damage by weather, termites or other wood-destroying insects, soil bacteria, decay fungi, soil or agricultural chemicals, and—in the case of pressure-creosoted posts— even fire.

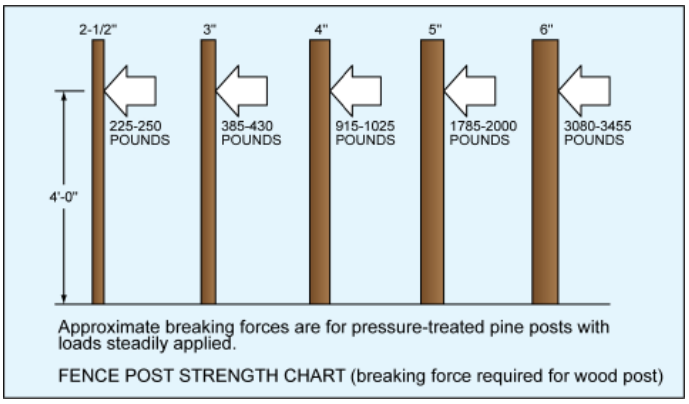


Figure 2

TYPES OF PRESSURE-TREATED WOOD POSTS

All wood posts for high-tensile wire fencing should be pressure-treated with wood preserving chemicals. While they cost slightly more than untreated wood posts, pressure-treated posts pay for themselves in greatly reduced fence maintenance and greatly extended fence life. Wood posts with brush-applied chemicals or posts which have been dipped for short periods in wood preservatives are not recommended for high-tensile wire fencing, and neither are posts with so-called hot-and-cold-bath or cold-soak treatments. Since it is impossible for a buyer of fence posts to determine the amount of chemical penetration in the wood, posts should be purchased only from a dealer who can certify the types of pressure-treated wood posts he offers.

PRESSURE-CREOSOTED WOOD POSTS

Creosote is the oldest and most widely used wood preservative. In addition to providing excellent protection against insect damage and decay, pressure-creosoted posts have a low rate of water absorption and somewhat better resistance to grounding when used for electric fences. They have an average life expectancy of 35 to 40 years, and many are still standing after 75 years. An added advantage of pressure-creosoted wood posts is that they have superior resistance to grass fires, since they have a tendency to surface-char and self-extinguish. In buying pressure-creosoted posts, it is best to stipulate that they contain at least six pounds of creosote per cubic foot or meet the American Wood Preservers Association Standard C-5.

TABLE 1. Ultimate Lateral Load bearing Capacities of Driven Single Posts

Type of Post	Type of Soil*	Post Diameter (in.)	Depth of Embedment (in.)	Total Pull (lbs.)	Type of Failure
Line Post 6 -1/ 2 x 4 " dia.	I	4"	30"	100	Overturn**
	II	4"	30"	900	Overturn
	III	4"	30"	1400	Bending
	IV	4"	30"	1500	Bending
	Fixed	4"	30"	1968	Bending
Line Post 6' x 4" dia.	I	4"	42"	700	Overturn
	II	4"	42"	1300	Overturn
	III	4"	42"	1650	Bending
	IV	4"	42"	1700	Bending
	Fixed	4"	42"	1968	Bending
Rise or Dip Post 8 x 4 " dia.	I	4"	48"	230	Overturn
	II	4"	48"	1325	Overturn
	III	4"	48"	1700	Bending
	IV	4"	48"	1750	Bending
	Fixed	4"	48"	1968	Bending
Shallow or Medium Corner Post 8' x 5" dia.	I	5"	48"	300	Overturn
	II	5"	48"	2200	Overturn
	III	5"	48"	3250	Bending
	IV	5"	48"	3350	Bending
	Fixed	5"	48"	3800	Bending
Gate. End or Corner Post 8' x 6" dia.	I	5"	48"	410	Overturn
	II	5"	48"	3200	Overturn
	III	5"	48"	5400	Overturn
	IV	5"	48"	5600	Bending
	Fixed	5"	48"	6625	Bending

*

Type of Soil	Description	Identifying Characteristics
I	Soft Clay	Molded by light finger pressure
II	Medium Clay (saturated)	Molded by strong finger pressure
III	Stiff Clay, Medium Sand	Indented by thumb pressure
IV	Very Stiff Clay	Indented by thumbnail pressure
Fixed	Set in Concrete	—

** Overturn is defined as maximum displacement of 5 in at top of post

PENTA-TREATED WOOD POSTS

A wood preservative also used in pressure treating wood fence posts is penta-chlorophenol. In this process, the dry chemical is mixed with oil and the solution is impregnated deep within the wood in a pressure chamber. When the chamber is pumped out, the pentachlo-rophenol crystals remain in the cells of the wood. Although penta-in-oil pressure-treated posts may appear blotchy when first exposed to weather, this condition disappears with extended exposure. Penta-treated wood posts for high-tensile wire fences should meet the requirements of Section 1 of the AWPA Standard P-8.

CCA TREATED WOOD POSTS

Another excellent method of preserving wood fence posts is pressure treatment with CCA (chromated copper arsenate) salt dissolved in water. In this process, once the water is evaporated from the wood, the chemical remains in the cells as a dry salt which is toxic to insects and decay fungi. An advantage of fence posts treated in this manner is that they are dry and can be painted, if desired. CCA pressure-treated wood fence posts should meet the requirements of AWPA Standard P-5.

CAUTION

Wood-preserving chemicals can cause eye and skin irritations in persons handling pressure-treated wood fence posts. The use of protective clothing, rubber gloves and eye or face shields is necessary when handling, driving, drilling, nailing or stapling wood fence posts pressure-treated with such chemicals.