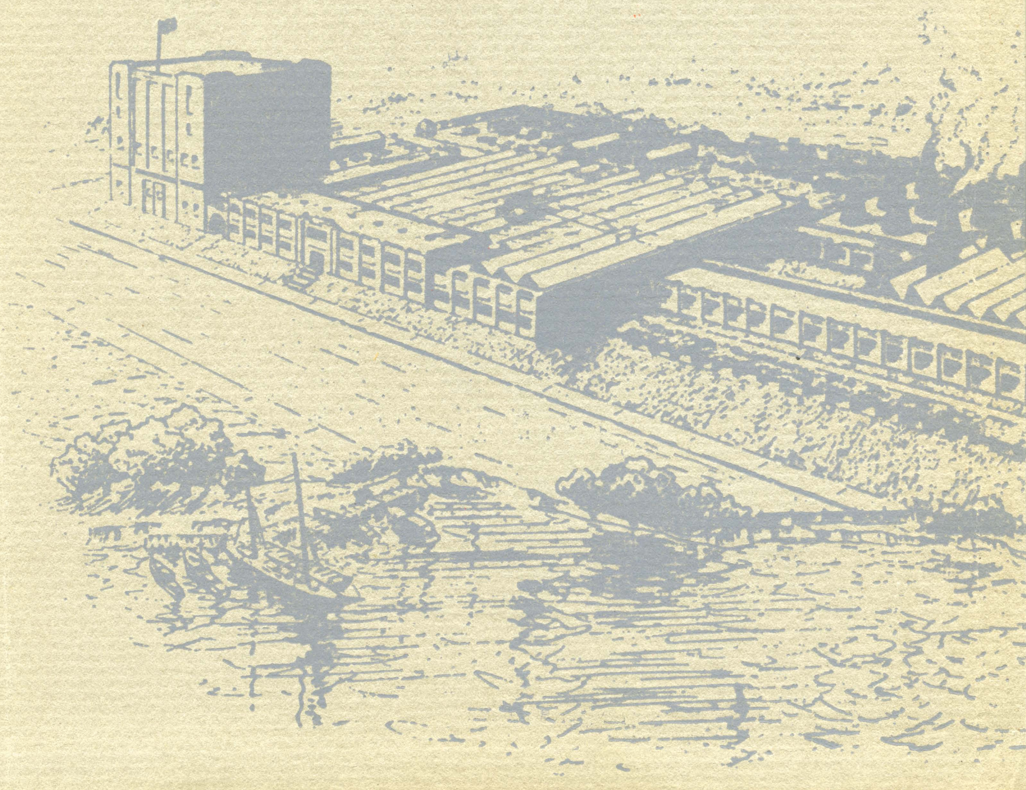
LOCKE

CATALOG 32

LOCKE INSULATOR CORPORATION

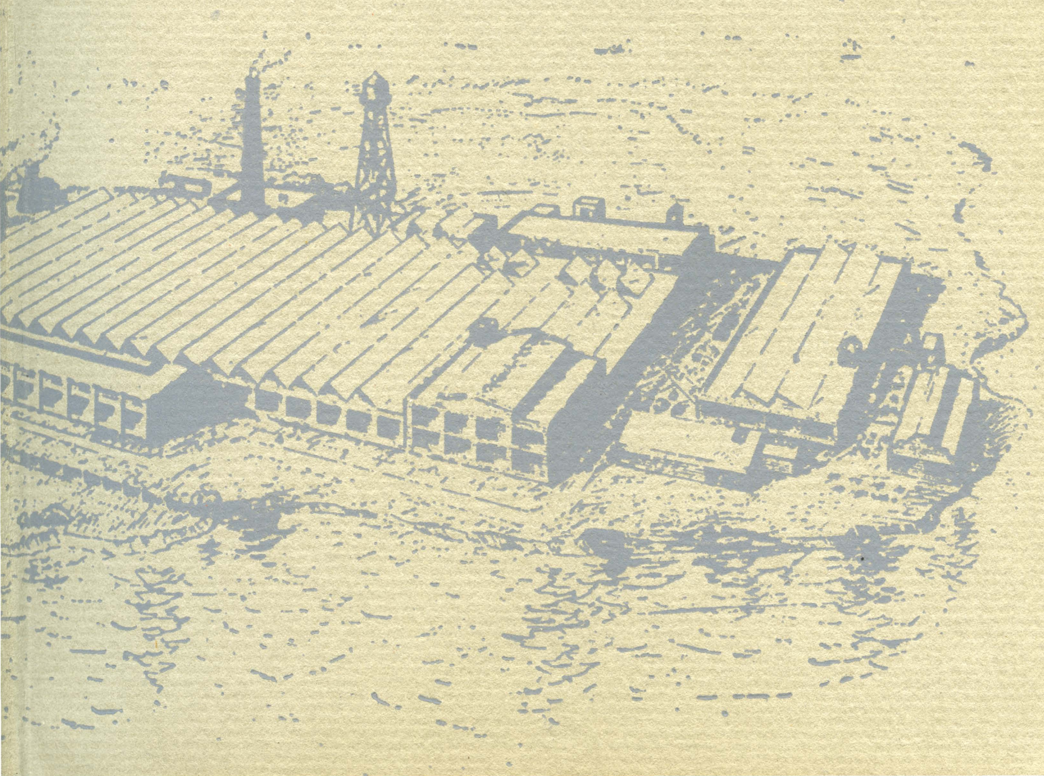
BALTIMORE, MD.

VICTOR, N. Y.



Property of

Geo. H. Manhart.



CATALOG NO. 32

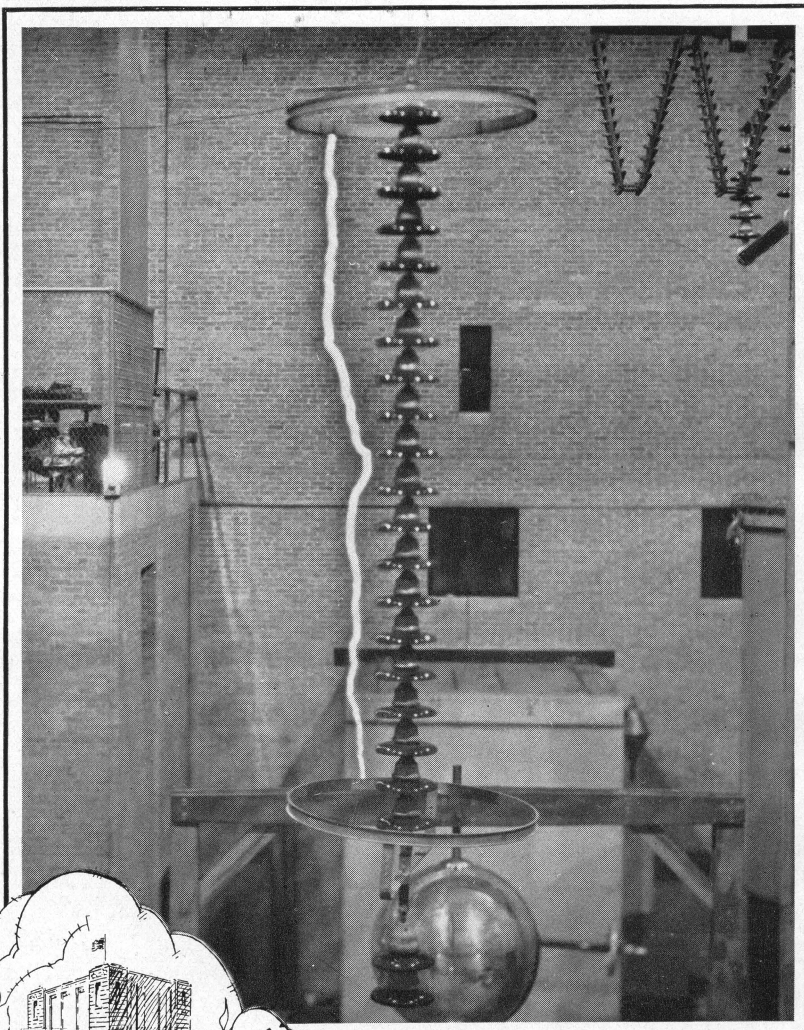
A HANDBOOK
OF RELIABLE INFORMATION FOR THOSE
INTERESTED IN MODERN METHODS
OF HIGH VOLTAGE TRANSMISSION

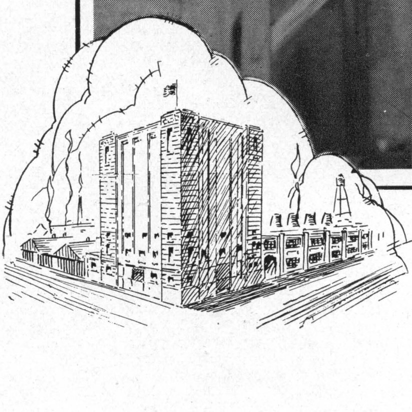
LOCKE INSULATOR CORPORATION
BALTIMORE, MARYLAND

FOREWORD

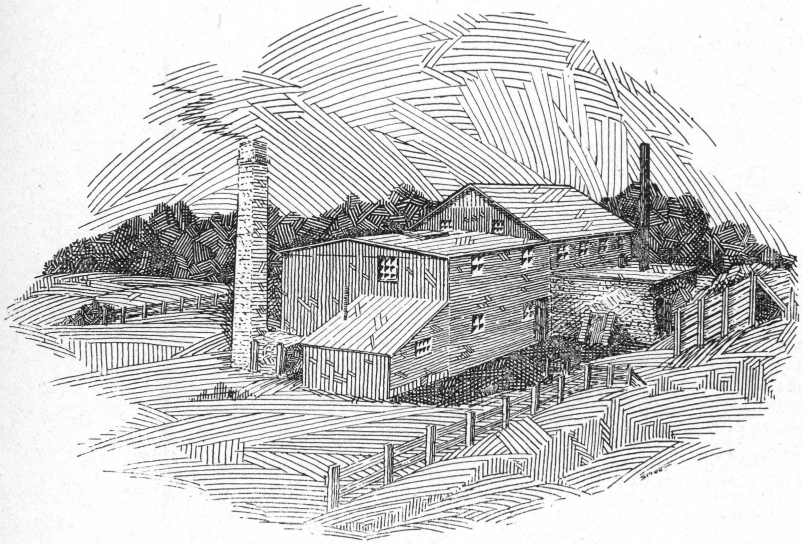
SINCE 1893, when Fred M. Locke produced the first wet-process porcelain insulator, no other material has been found to satisfactorily meet the demands of high voltage insulation.

The original work, started almost forty years ago, has been carried on by able hands. Today, Locke porcelain, thanks to constant research and development, is still the outstanding insulator medium.





A 3,000,000-VOLT LIGHTNING ARC-OVER IN THE LOCKE HIGH VOLTAGE LABORATORY



THE ORIGINAL LOCKE PLANT AT VICTOR, NEW YORK,
IN 1893. FROM A PHOTOGRAPH

Locke Methods and Processes

There is no secret in the manufacture of satisfactory insulators. The degree of this satisfaction is not dependent on mysterious processes but upon the selection and proportioning of ingredients as determined by scientific research, the employment of processes which both theory and practice have proved, and, most of all, exact factory control.

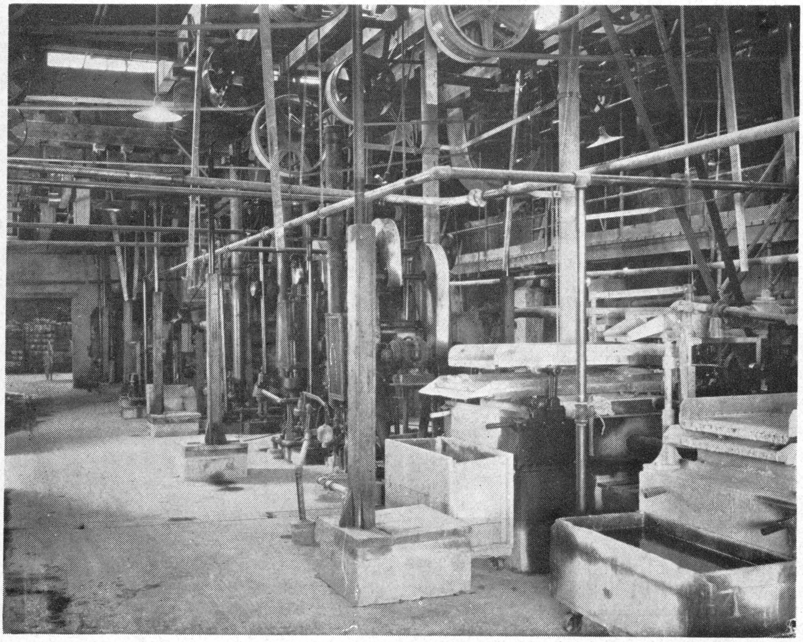
Every step in the manufacture of a porcelain insulator has some bearing upon the final product and, therefore, irregular treatment of the ware as it passes through the various phases of manufacture must be definitely deleted. If every single insulator is made in exactly the same way, the service in the field obtained from these units will be identical.

There are four types of material which enter into the making of high voltage porcelain, feldspar, flint, and two kinds of clays. The first step in plant control is to test the raw materials before they are released for production. The clays, which are largely imported from England, are tried out for plasticity and the manner in which they react with electrolytes. The feldspar is analyzed chemically and a physical screen test is made to be sure that the fineness of grain, which is very important, is maintained between definite limits. The flint, which is ground silicon dioxide, is tested in a similar manner and great care is exercised to insure there being no impurities which will cause a discoloration of the final product. After these materials have been found to be in accordance with purchase specifications they are released.

The problem is now to get the various ingredients mixed in the proper percentages. The ball clay, which, because of its very plastic characteristics, contains a great deal of lignite, is put through a separate process to remove the impurities. After this is done the clay is stored in a ball clay well. The less plastic China clay, washed and dried, is weighed out in the correct proportion and dumped into the ball mill for mixing. In weighing this clay, the scales are corrected for moisture content every day. To check the proper proportion of ball clay in the mix a small quantity of the dissolved material is weighed and from this weight and the known dry specific gravity the amount of liquid necessary to give a fixed quantity of the dry clay is calculated. The feldspar and flint contain no moisture so no correction has to be applied.

When the correct percentages of the four ingredients have been weighed out they are introduced into a large ball mill and thoroughly mixed together. This forms a liquid slip which weighs about 150 grams per 100 cc. This slip in turn is passed over a mesh lawn and an electromagnet and thence to a storage well where it is held for a short period. During this time its weight is carefully checked and a determination made of its viscosity. If the viscosity falls below the specified amount, the slip is chemically treated to correct this. Years of experience have shown that this chemical correction for viscosity is one of the most important factors leading to uniform clay. At the present time the Locke Corporation is the only manufacturer having this system perfected.

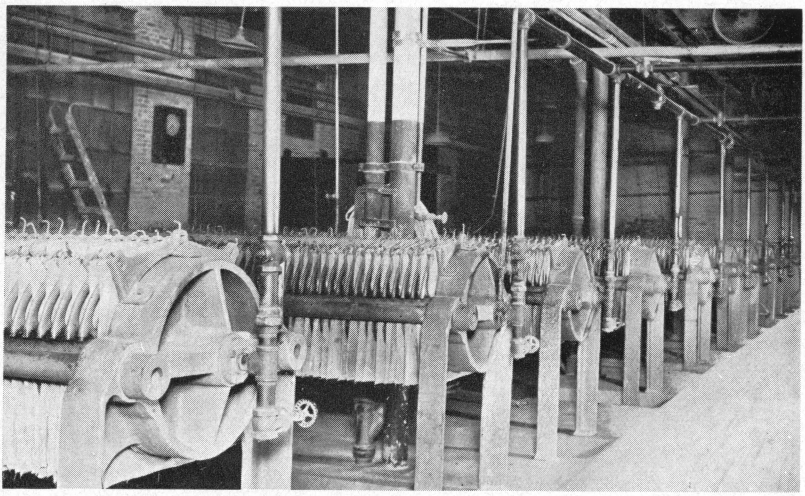
The next step is to pump the slip into the filter presses to remove some of the water, thus obtaining a plastic clay mass. If the viscosity and density have been properly corrected it will be quite easy to pump up the presses, leaving a fixed percentage of moisture in the



A SECTION OF THE SLIP HOUSE SHOWING THE LAWNS AND A FEW OF THE STORAGE TANKS

clay. The importance of the previous checks and corrections becomes obvious when it is realized that if this moisture content changes, the subsequent shrinkage of the insulators through the plant will vary considerably and cause a great deal of trouble due to drying cracks and general non-uniformity.

The clay is now removed from the filter presses and passed through the pug mills. A pug mill is nothing more than a large machine similar to an ordinary meat grinder. Several different types of pug mills are current, all of which have been given thorough trials in the Locke plants. The type at present in use has been found to be more effective than other types in eliminating laminations and occluded air pockets. After the clay has passed twice through the mill, sections are cut off large enough for the insulators into which it is to be formed. These pieces are called "balls" and they are taken to the plunging machine to be shaped into insulators. Before being placed in the plaster molds for forming in the machine, the clay balls are



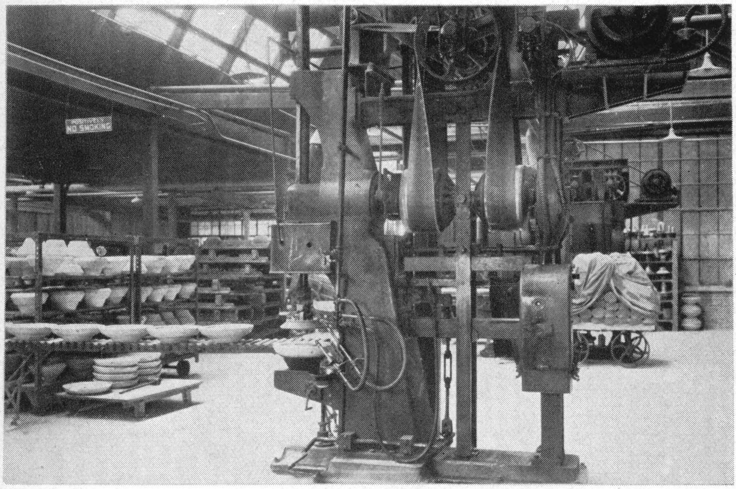
A BATTERY OF FILTER PRESSES

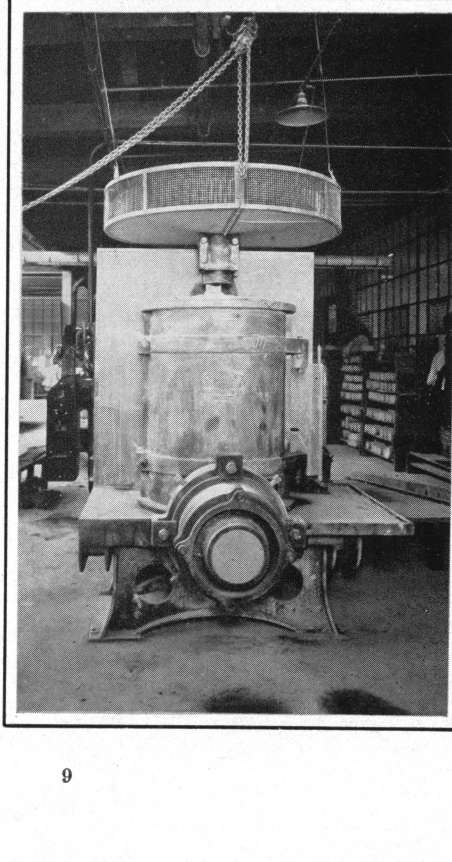
wedged, which is an operation done by hand. The wedging consists of patting the clay and bringing it into a shape which can be introduced into the mold without forming folds in its surface. This operation calls for a high degree of skill and is entrusted only to specially selected and trained men.

After the ball is dropped in the mold it is placed under the machine and a plunger comes down on the exposed clay surface, forming the insulator. After plunging, the ware in the molds goes through a mold release drier. This drier removes enough moisture to make it possible to empty the formed clay which by this time is stiff enough to hold its shape without support.

The next operation is "finishing," which consists in cutting off the sharp edges left by the plunging machine and removing the mold marks so that the finished product will be smooth.

An older method for forming the clay is known as jiggering, and is nothing more than shaping the insulator on an old fashioned potters' wheel, made modern by electric drive, instead of on the plunging machine. For certain pieces of limited production, this jiggering process is still in use. There is no difference in the final quality of the insulators as made by the two processes and it is purely a matter of economics as to which one is chosen.





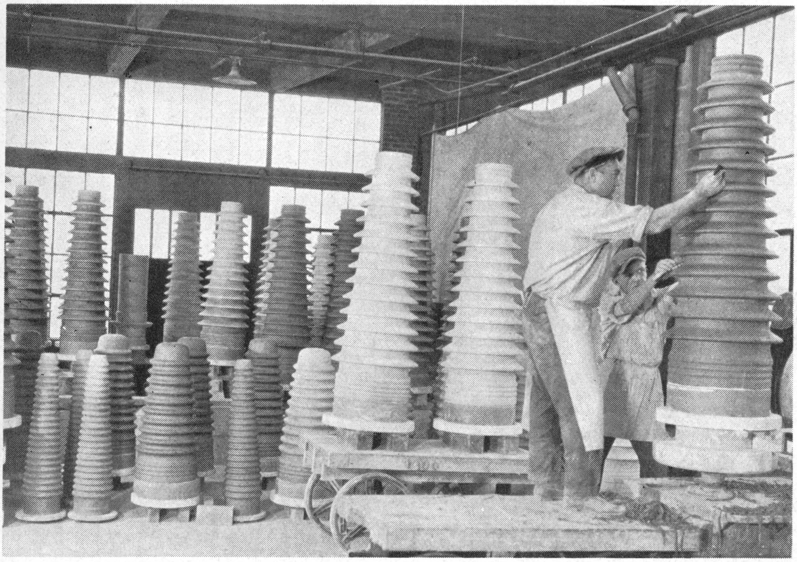
ABOVE: A MODERN CENTERING MACHINE

AT THE RIGHT: A SPECIAL PUG MILL. THE LARGEST OF ITS KIND EVER MADE.

A CORNER OF THE NEW CASTING DEPARTMENT. IN THE BACKGROUND THE CORE IS BEING DRAWN FROM AN OIL-FILLED BUSHING PORCELAIN

The casting method by which certain pieces are made is somewhat different. The clay body used for casting is made up in very much the same way as the plastic body which has been described, except for the fact that a fraction of one per cent of a special salt is added to the slip. This electrolyte or salt has the effect of making the clay sufficiently fluid that it may be poured, although the moisture content is only about four per cent greater than that of the plastic clay. To make a cast piece, therefore, requires only the pouring of a certain amount of casting slip into a plaster mold. The moisture of the slip is absorbed by the plaster, leaving a solid clay piece which is then taken through the rest of the plant routine in practically the same manner as the jiggered and plunged pieces.

This method is an exceedingly exact one and calls for the most precise control. Due to the fact that the various clays and feldspars are bound to differ slightly in chemical composition, special precautions are necessary to maintain exactly the same fluidity of slip. The tolerance here is practically zero. Not even the slightest deviation from the exact standards established can be safely made. Ex-



HAND FINISHING ONE OF THE LARGER CASTINGS

treme care is therefore necessary in the chemical control as well as the physical control of a casting slip.

When the pieces are emptied from the molds they still contain a certain amount of moisture and while in this so-called "leather hard" condition they are finished as has been described. From this point the ware enters the humidity driers, which removes the remaining moisture and brings the pieces into the "bone dry" state. A very rigid visual inspection is applied at this point and any ware showing the slightest sign of any imperfection is rejected.

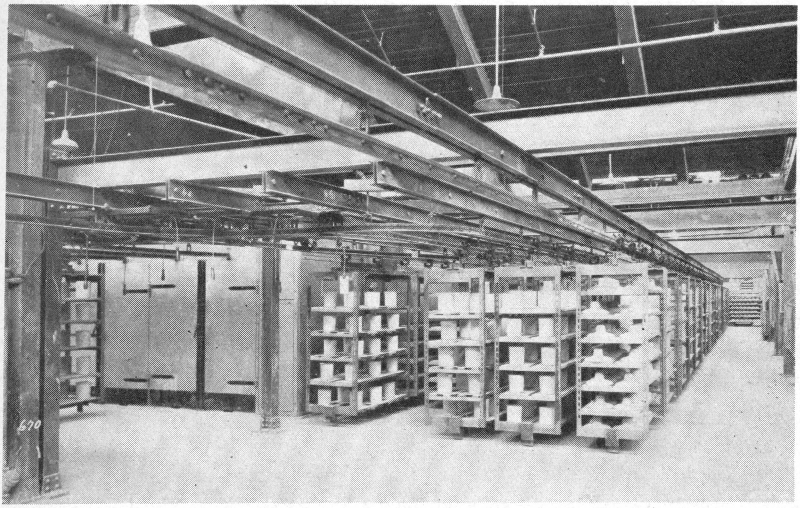
After inspection the next job is to apply the surface glaze to the clay. The glaze consists of a mixture of ingredients similar to those used in the body, with the addition of a coloring oxide which will cause it to melt in the kilns at a lower temperature than the porcelain and thus impart a smooth shiny dirt-resistant finish to the porcelain. A great deal of work has been done which goes to show that the strength of the finished product, because of its non-ductility, depends to a large extent upon the surface strength, which is nothing more than the glaze. The most rigid control, therefore, is exercised in this department and every care is taken to insure a proper fitting glaze regardless of its color. This is not a cut and try method but a strictly scientific determination.

At the same time that the pieces are glazed a roughened surface is applied at certain points which later on during assembly acts as a cement grip. This roughening is made up of small porcelain particles very much on the order of sand. A coating of glue and glaze is applied to the surface which is to be treated and the porcelain particles are held in place by the glue. During the firing the glue burns out and the glaze holds the particles rigidly to the fired porcelain.

Due to the fact that in the assembled insulator the mechanical stresses are applied to the porcelain through the cement grips, this surface is of the utmost importance. Sand particles vary considerably in size and regularity. Obviously, the wide variation which, in most insulators, exists in the size of the sand grains will introduce a decided variable into the performance of the insulator. By much experiment the Locke Insulator Corporation has determined the permissible tolerances in size which will allow the insulator to develop maximum strength and maximum uniformity. Following this the cement grip is reglazed over the sand. The reason for this is that the application of the sand to the porcelain forms angular depressions which under stress may develop into fissures. Since all electrical failures start as tiny mechanical cracks, the elimination of the possibility of such mechanical cracks is certainly desirable. By rounding the depressed angles, which is exactly what reglazing does, the likelihood of cracks forming is reduced to an absolute minimum, without in any way reducing the effectiveness of the necessary grip.

The next step is firing. Porcelain for high voltage work must be absolutely non-porous and free from firing strains which necessitates the utmost care in obtaining exactly the right temperature gradient during the firing cycle as well as a high degree of accuracy as regards the maximum temperature. To strike the mean between the low fired and probably porous piece and the over-fired and consequently exceedingly brittle piece is again a matter of exact control.

In order to arrive at the required uniformity during the firing cycle, three methods of temperature control are used. One of the most important of the three is the pyrometric cone. These cones are made up of standard porcelain bodies whose melting points vary about 30 degrees between the different numbers. For example, cone



WARE ON THE WAY TO AND FROM THE HUMIDITY DRYERS. ONE OF THESE DRYERS IS SHOWN AT THE LEFT

11 "down," or melted, represents a temperature about 30 degrees higher than cone 10 "down." It is evident that since the melting of a small piece of porcelain of this character takes time as well as temperature, these furnish some idea as to what is taking place in the actual porcelain under fire. Peep holes are provided so that visual inspection of the cones can be made at frequent intervals.

In addition to the use of quantities of pyrometric cones placed at all positions, optical pyrometers and thermocouples are made use of. In the tunnel kiln 20 different thermocouples are spaced along the kiln length. Some of these couples work on a recording pyrometer and others are of the indicating type.

Another factor that enters into the correct firing of porcelain is the composition of the flue gas. Frequent determinations are made at various parts of the kiln by means of an Orsat apparatus. The periodic kilns are used to fire the same type of ware and are controlled with equal care. The results obtained, as far as quality is concerned, are exactly the same as for the tunnel kiln. The periodic kilns are loaded, fired, cooled, and then drawn, the cycle taking just about one week. Since production demands are always varying, a certain number of periodics to absorb these variations enables better and more economic service to be rendered.

One other type of kiln is used in the firing of Locke Porcelain—the muffle kiln. This is used for large pieces or peculiar shapes which must be fired without saggers. The larger porcelain for both dry and oil-filled bushings are fired here.

From the kilns all insulators are taken to the Inspection Department where they are put through a very rigid inspection followed by a high-frequency electrical test. After this the pieces are given a 60-cycle test and are then ready for assembly. The high frequency will pick out cracks which are quite a distance from the center of the piece, while the 60-cycle test will eliminate certain other types of defect. The rejects on these tests are fortunately quite low—a tribute to the care exercised in all previous processes.

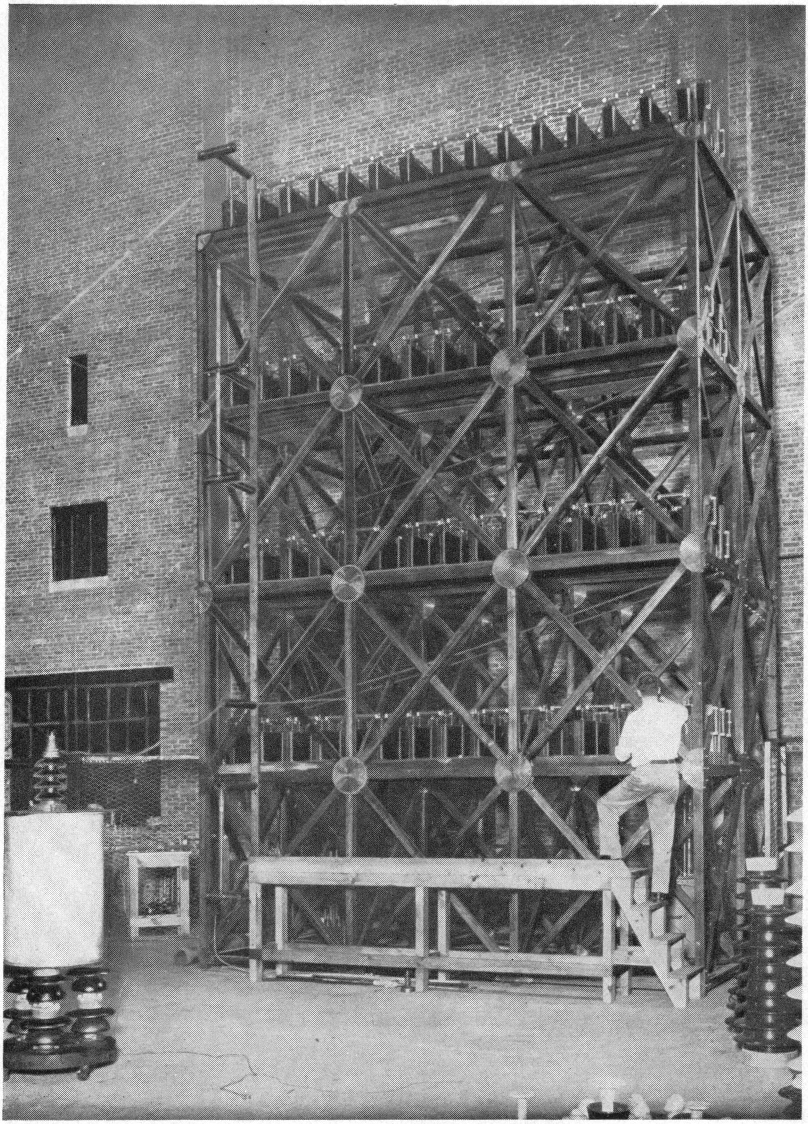
The multi-part insulators are now assembled, making use of the tested electrical pieces. The assembly consists of cementing porcelain parts together with neat Portland cement and cementing the proper hardware on to the porcelain assembly. A great deal of research work has been done on cement and it has been found after a period of five years that cement which is "sound" according to the Autoclave test will not expand over a period of time. Bituminous asphalt compounds and felt washers are provided to take care of expansion and shocks on the insulator pins. All metal parts which touch the cement are treated with a coating of asphalt dissolved in benzol which prevents the alkali in the cement reacting with the metal and causing loose assemblies.

While the cement is still soft the insulators are placed in steam closets where they are maintained at the desired temperature for a predetermined period. The heat of the steam insures a rapid and complete setting of the cement and further insures that all metal parts, and the cement, are thoroughly expanded during this operation. The metal parts, with their co-efficient of expansion greater than that of porcelain, cannot subsequently damage the porcelain by expansion and the consequent exertion of tension. In addition to this the excess moisture provides ample water for the complete hydration of the cement. This patented Locke Steaming Process has probably done more than any other detail in insulator assembly to prevent possible damage to the insulator by expansion of parts.

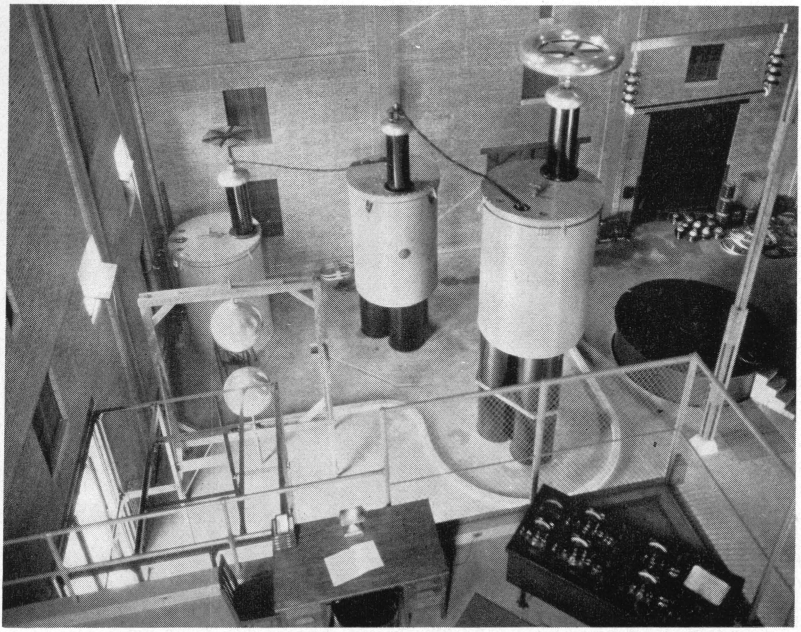
SUSPENSION INSULATORS ON THE REGULAR ROUTINE HIGH FREQUENCY TEST

The final process consists of cleaning off the excess cement from the porcelain parts and waterproofing the joints with a suitable compound. This waterproofing definitely stops any tendency the cement might have to change volumetrically with humidity. Also, particularly on suspension insulators, the application of the waterproofing compound to the cement in the pinhole has a decided dampening effect on corona formation and consequently decreases the possibility of radio interference.

All pedestal type and suspension type insulators are next given a mechanical test according to their ratings. After this all insulators are given the regular A.I.E.E. electrical test, 60-cycle for all assembled insulators other than suspension insulators and 60-cycle and high frequency test for the latter. The insulators are then stamped and turned over to the Packing Department where they are packed in specially designed crates. The crates used are the outcome of much study and experiment, both on our part and on the part of the transportation companies. While somewhat more expensive than the usual run of packing, this additional expense is offset by the exceedingly low losses sustained in transportation and the ease with which they can be handled in the field.



CLOSE-UP OF THE 3,000,000-VOLT SURGE GENERATOR

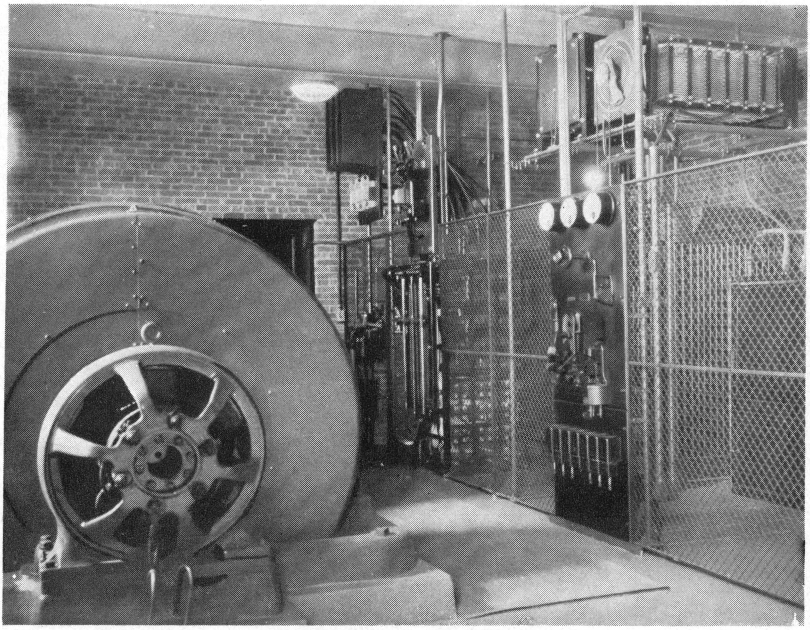


GENERAL VIEW OF 60- CYCLE TRANSFORMERS, CONTROL TABLE, AND PUNCTURE TANK

LOCKE RESEARCH LABORATORIES

The Locke Research Laboratories are dedicated to the advancement of the art and science of transmission. Equipment is available for every kind of research either electrical, mechanical, thermal, or ceramic. The high-voltage section is the only laboratory of its kind in the country operated under controlled humidity as specified by the A.I.E.E., as standard test conditions for electrical tests of insulators.

The equipment comprises, among other things, a 1050-kv-a. motor-generator set supplying power to the 1,050,000-volt 60-cycle transformers. The remote control table for the operation of the circuit breakers and field control for this machine and the transformers is on the roof of the motor-generator enclosure. Three 350-kv-a. transformers connected in cascade produce the high 60-cycle voltage. When desired, the transformers can be connected to give a three-phase star voltage of 605,000. Sprays are arranged to simulate rain, with a precipitation of 0.2 inch of water per minute

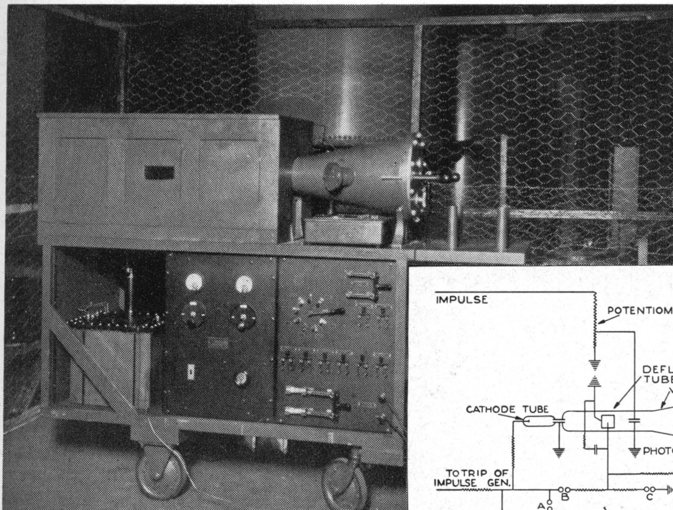


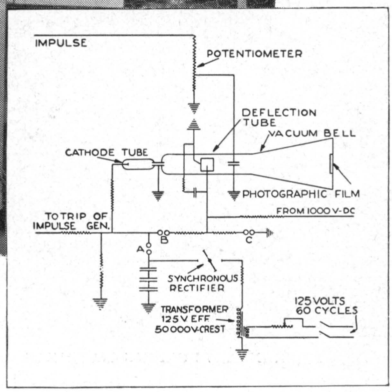
THE 1050-KV-A. MOTOR-GENERATOR SET

in a direction of 45 deg. to the perpendicular. The water used has been previously treated to assure a specific resistance of 6000 to 8000 ohms per inch cube as specified by the A.I.E.E. for wet tests on high-voltage insulators.

This laboratory is equipped with a cylindrical tank 12 by 12 feet holding approximately 10,000 gallons of transil oil in which the largest bushings may be flashed over without danger of side flashing through the oil to the metal. For fire protection a pump is installed which in an emergency can immediately transfer the oil from the laboratory to a buried tank outside the building.

The surge generator with a capacity of 3,000,000 volts is an arrangement by which a number of condensers may be charged in parallel and discharged in series. One hundred and twenty 0.25-mf. 25-kv. oil-filled condensers are charged through high resistance by means of a transformer and rectifying Kenotrons, the voltage being adjusted by an induction regulator in the primary of the transformer. To trip the apparatus, thereby producing the lightning



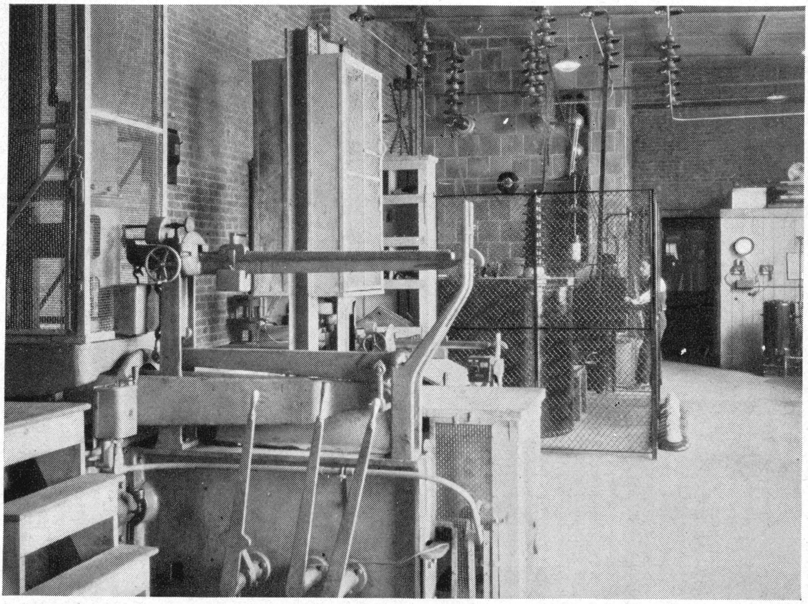


ABOVE: THE CATHODE RAY OSCILLOGRAPH

RIGHT: WIRING DIAGRAM

impulse, a three-electrode sphere gap is provided which is stable under ordinary conditions. When the potential of the center ball is changed this gap becomes unbalanced and breaks down doubling the voltage over the next gap which in turn flashes over, and so on down the line until the whole capacitance thus connected in series by means of the arcing paths, discharges to ground through a resistance. The drop over the latter resistor determines the desired voltage wave.

A cathode ray oscillograph is also part of the equipment. When it is desired to photograph the surge a circuit is used which starts a sequence of events leading up to the discharge of the lightning generator and culminating in the photograph. Three condensers in series are brought up to a negative potential through a synchronous rectifier to a point at which gap A breaks down, and this breakdown starts the sequence. A surge is sent out to the trip gap of the impulse generator and a voltage is impressed upon the cathode of the oscillograph starting the cathode beam in the evacuated tube. It will be noticed that one side of the deflection tube through which the



MECHANICAL PULLING MACHINES, ELECTRIC REFRIGERATOR, AND 250-KV. TRANSFORMER FOR PUNCTURE TESTS

beam passes is connected to a 1000-volt d-c. source which serves to deflect the cathode beam and to hold it to one side of the photographic film. When gap A breaks down gaps B and C also break down progressively and current flows to ground through the resistors connecting these gaps. A portion of the voltage drop thus produced serves to neutralize the 1000-volt d-c. on the deflection tube and the released cathode beam starts a sweep across the film just as a portion of the voltage from the main lightning generator, which has discharged in the meantime, is impressed upon the plates of the condenser shown within the tube. The deflection of the beam due to the latter voltage is in a direction at right angles to the sweep and thus a photograph with rectilinear coördinates showing the magnitude and character of the lightning wave is produced. The instrument may be adjusted by changing the resistance and other constants of the circuits.

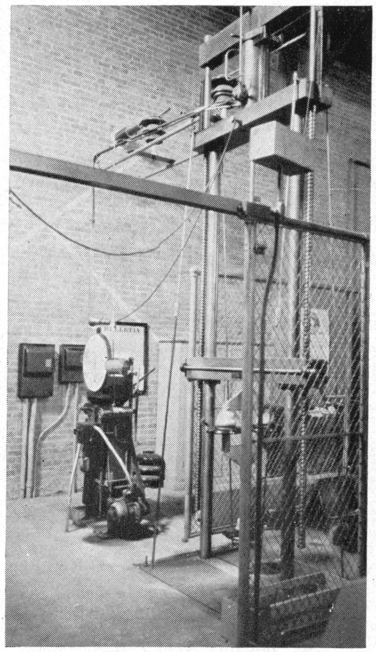
Another section of the Locke Research Laboratories is chiefly confined to apparatus for mechanical and thermal tests. There are three mechanical pulling machines with capacities of 30,000 to

80,000 lb., including an Amsler pulling apparatus hydraulically actuated using oil as the liquid medium. The advantages of the hydraulic pull as compared to the mechanical are flexibility of load application, accuracy, and clearance around the specimens under test. A drum is provided which rotates in proportion to the movement of the cross head and a pencil is attached to a mechanism which displaces it in a direction parallel to the axis of the drum as the load builds up, and this way a stress strain diagram may be obtained whenever it is desired.

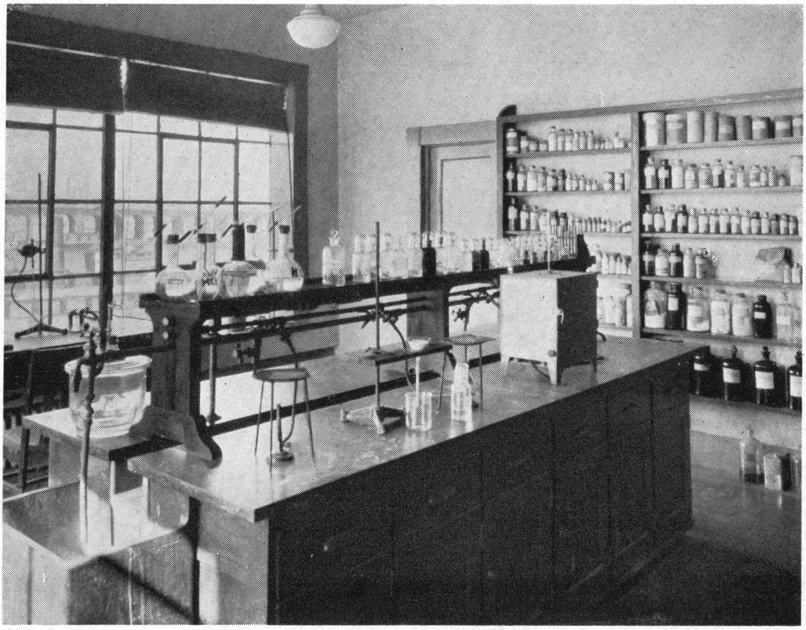
Here also is located an electric refrigerator capable of producing sub-zero temperatures. Water tanks which may be filled with boiling and ice water serve to put a routine number of porcelain insulators through hot and cold shocks. An ingenious device allows the insulators to be placed under mechanical loads simultaneously with the thermal shocks. In this section there is also a 250-kv. transformer and motor-generator set to furnish power and of course, the necessary switches and rheostats for control purposes. This transformer is used for routine puncture tests and miscellaneous work which does not require the large set.

The Locke Ceramic Laboratory in addition to carrying on much original research also conducts many of the routine tests which are essential to the exact factory control exercised in the Locke plants. All raw materials are tested here, many of them such as the clays, feldspar, and flint, before unloading. Cement, oil, asphalt, and various other products must also pass the receiving tests in this laboratory.

As the materials pass through the various stages in the plant samples are taken at specified intervals and examined to determine



THE AMSLER HYDRAULIC PULLING MACHINE



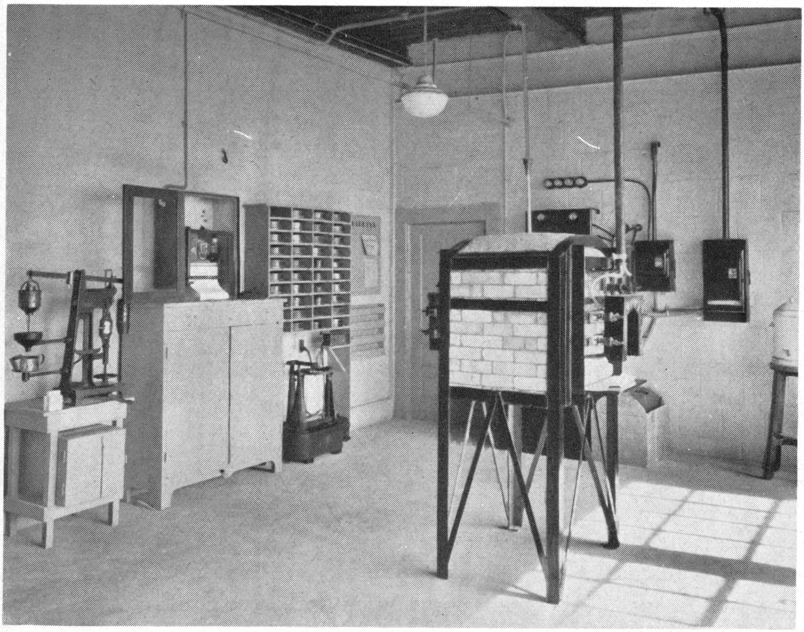
CHEMICAL SECTION OF THE CERAMIC LABORATORY

their uniformity from hour to hour and day to day. These checks include viscosity and density determinations of the slip and glazes and moisture determinations on the pugged clay as it comes from the mills.

In addition to this, various records kept by the plant foreman are turned over to the Ceramic Laboratory each day for analysis. By studying this data it is possible to maintain a condition of uniformity all through the plant thus insuring uniformity of the final product.

The research work comprehends the development and trial of new bodies, glazes, and processes, as well as a study of the physical and chemical qualities of many raw materials from various sources.

The Ceramic Laboratory contains complete chemical equipment necessary for every type of quantitative and qualitative analysis. This section is separated from the rest of the laboratory to prevent errors which might arise due to dust and foreign material necessarily released into the atmosphere by certain other tests and experiments. Certain special equipment for obtaining exceedingly



ONE OF THE ELECTRIC FURNACES IN THE CERAMIC LABORATORY CAPABLE OF REACHING A TEMPERATURE OF 2500 DEG. F. WITHIN FOUR HOURS

high temperatures is provided for the analysis of silicates. One of the several electric furnaces in use in this laboratory is capable of reaching a temperature of 2500 deg. F. within four hours and can be brought up along any desired temperature curve. Recording pyrometers are used which will plot the temperature maintained in six different parts of the kiln. This apparatus is used to determine the vitrification range of actual porcelain.

The laboratory is also equipped to make all types of fineness tests as well as strength tests on cement and allied materials. In another section is a balance room which also houses the equipment for microscopic studies on materials and on slides cut from porcelain bodies.

These laboratories—the high voltage, chemical and ceramic—constitute a unit capable of undertaking any and every research in the field of insulation for high voltage transmission. Their past contributions to this science are evidence of progress yet to be expected.

General Information

SINCE the introduction of wet process porcelain insulators, no other material has been found which will satisfactorily meet the demands of high voltage transmission.

Locke porcelain is strong, rugged, non-porous, and does not deteriorate.

MATERIALS

The flints, spars, and clays used in the fabrication of Locke Porcelain are those which test and experience have shown to be the best suited for the purpose. New sources all over the world are constantly being investigated.

DESIGN

Since Fred M. Locke designed and made the first wet process porcelain insulator design development has been constant and continuous. Almost forty years of research and close contact with operating conditions have determined Locke designs.

MANUFACTURE

Paralleling the ceramic and design development has come the evolution of processes and machinery. There is no process today in use that has not been tried in the Locke plants and either adopted or rejected according to its merits. Manufacturing control is exceedingly rigid and permits no variation.

GLAZING

Locke porcelain is absolutely non-porous even under tremendous pressure. The purpose of the glaze is to impart a smooth surface to which dirt will not adhere. Practically any desired color can be given to a porcelain insulator glaze. Glaze also, through recent patented processes, has materially aided not only in raising the average mechanical strengths of cemented insulators but also in increasing uniformity.

Electrical and Mechanical Values

The values given for Locke insulators are determined by the methods and under the conditions established by the specifications of the American Institute of Electrical Engineers (see page 287).

Leakage Distance

Where shown in this catalog leakage distance is the shortest distance between terminals measured over the surfaces of the insulator.

Tests

All insulators are tested as specified in the Insulator Test Specifications adopted as standard by the American Institute of Electrical Engineers (see page 287). In addition, routine tests have been developed and adopted which further assure the quality of every insulator shipped.

Weights

The weights given in this catalog may vary approximately 5 per cent, depending on the uncontrollable variation in the weight of packing material.

Dimensions

All dimensions given in this catalog are in inches (one inch equals 25.4 millimeters).

Packing

The various methods of packing used for the different types of Locke insulators and hardware have been decided by long experience with transportation. Packing used today represents the safest method yet evolved. Cases of breakage in shipment are very rare.

Patents

The articles shown herein are covered by United States Letters Patents or Patents Pending.

Locke Suspension Insulators

Suspension insulators are used to support the conductors at the higher voltages and to anchor them throughout the entire operating range.

The pin type insulator reaches its absolute economic limit at the 66-kv. range and even there it is frequently advisable, for safety or because of the possibility of future growth, to use the suspension type insulators.

Locke suspension insulators have shown a perfect record over such a long period that it is impossible to discover any evidence of deterioration of the porcelain. Exhaustive tests complementing this field experience are rapidly dispelling the ideas of limited life which previously obtained. And, with the constantly improving manufacturing methods and more exact factory control, it is not too much to suppose that insulators of the future, properly protected against lightning and destructive power arcs, will last indefinitely.

Locke suspension insulators are the outcome of almost forty years of constant experiment and research. Design and methods of assembly have been evolved along definite, proved lines, checked and rechecked at every step. Greater reliability and increased safety have automatically followed such improvements with the result that from being the weak link in the chain the insulators have developed into one of the strongest and most reliable.

Locke suspension type insulators are made in either the clevis type or ball and socket type. The choice between these types is largely a matter of individual preference. The clevis type connection furnishes a positive interlock preferred by many. External connections are simple and frequently require fewer adaptor fittings. The clevis type is especially desirable in such services as railroad trolley work where the insulator must be used in various different positions, each with its own particular problem.

The socket type insulator as designed and manufactured by the Locke Insulator Corporation is equally suitable for all services. By special attention to cotter key design and details of the socket, it has been made impossible to accidentally disconnect the insulator units.

The sockets are designed to fully develop the strength of the insulator. The size of standard parts make this type of insulator inadvisable where strength ratings in excess of 25,000 lb. are desired.

Locke suspension insulators are made in several well established designs.

A medium strength insulator made in the socket type with $4\frac{3}{4}$- and $5\frac{3}{4}$-inch spacing and in the clevis type with $5\frac{3}{4}$-inch spacing. Other spacings between these limits can readily be furnished.

Standard strength insulators are furnished either with the clevis or socket connection and have the recommended $5\frac{3}{4}$-inch spacing. In the socket type standard strength insulators can also be furnished with the $5\frac{1}{8}$-inch or $5\frac{3}{8}$-inch spacing. The standard strength insulators are satisfactory for most requirements.

Locke high strength insulators can be furnished in either clevis or socket type connections. Special clevis connections can be furnished where special attachments are required. These insulators are regularly made in the $5\frac{3}{4}$-inch spacing and are chiefly used at anchor points.

The extra high strength insulators which are of large diameter and slightly longer spacing are also furnished with the clevis connection. In making these extra high strength insulators the Locke Company has found no indication of having reached a limit in such designs.

Locke high strength and extra high strength insulators, differing only slightly from those now made, have been performing heavy service for more than fifteen years with extremely satisfactory results.

Insulator Spacing

The maximum arc-over values for both normal frequencies and lightning are obtained by the use of Locke standard $5\frac{3}{4}$-inch spacing. The tendency for the normal frequency power arc to cascade at this spacing is not noticeably greater under normal conditions than with the closer spaced insulators. Shielding is necessary to prevent cascading of the lightning arc regardless of spacing. Where tower clearances are sufficient, the Locke standard spacing gives the greatest protection against flashover for a given number of insulators.

Where tower clearances are limited and maximum leakage distance is desired, the use of the close connected insulators may be recommended. This condition generally does not exist except on transmission lines already erected and in use. In building new lines, it is generally possible and practical, and certainly desirable, to provide the necessary clearances for the longer spaced insulators.

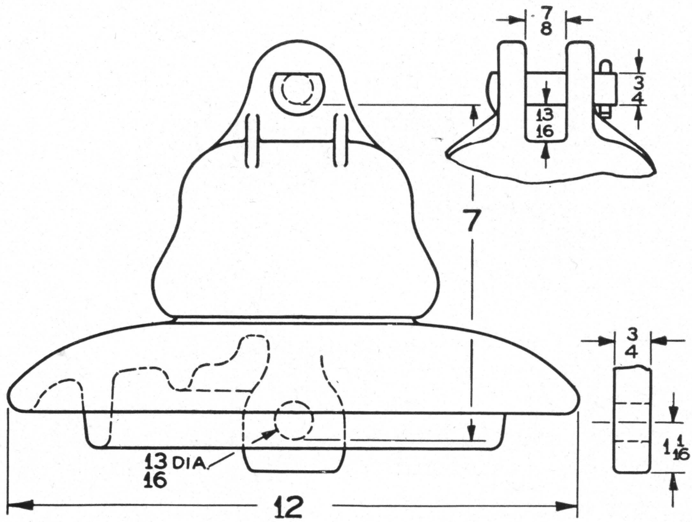
All metal parts except the bronze spring cotter are smoothly and thoroughly galvanized in the Locke Galvanizing Departments. These departments are essentially modern in every particular. They are furnished with the latest types of equipment and produce a grade of galvanizing which is considerably superior to the average commercial galvanizing.

The cement used in the assembly of Locke Suspension Insulators is constantly checked and tested. To assure uniformity it is mixed only in small batches. In this way the physical condition of the cement is held constant always.

After assembly the insulator is placed in steam closets assuring not only complete hydration of the cement during setting but also that the metal parts and the cement are thoroughly expanded during setting. The metal parts with their coefficient of expansion greater than that of the porcelain cannot subsequently damage the porcelain by expansion and the consequent exertion of tension.

The arc-over values given are measured in accordance with the A.I.E.E. Standards and the electrical characteristics of all Locke Suspension Type Insulators are given on pages 40, 41 and 53.

These insulators are regularly furnished glazed standard brown color. This glaze is the outcome of a great deal of original research and perfectly fits the porcelain. Variations in color can be made to suit special applications.



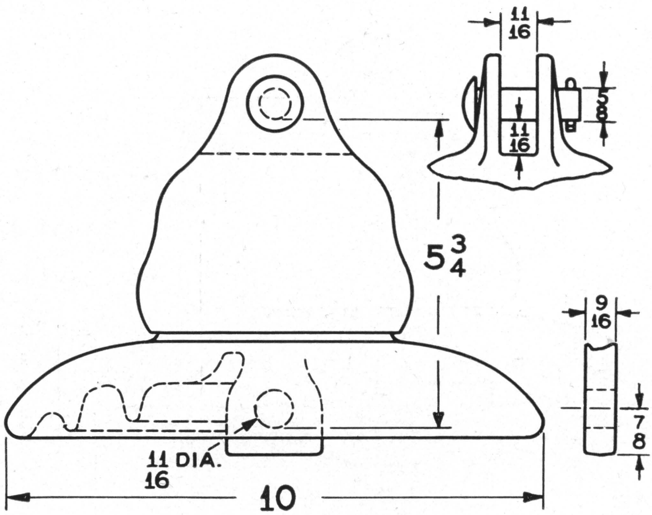
Insulator No. 15000

This extra high strength insulator has been performing perfectly for many years at important points on transmission lines and railroad electrifications.

Mechanical and electrical strength	35,000 lb.
Dry arc-over voltage	95,000
Wet arc-over voltage	55,000
Net weight each	22½ lb.
Packed weight each	27 lb.
Standard package	Crate of 6

Code Word . . . WIAUB

Full electrical characteristics of Insulator No. 15000 are given on page 41.



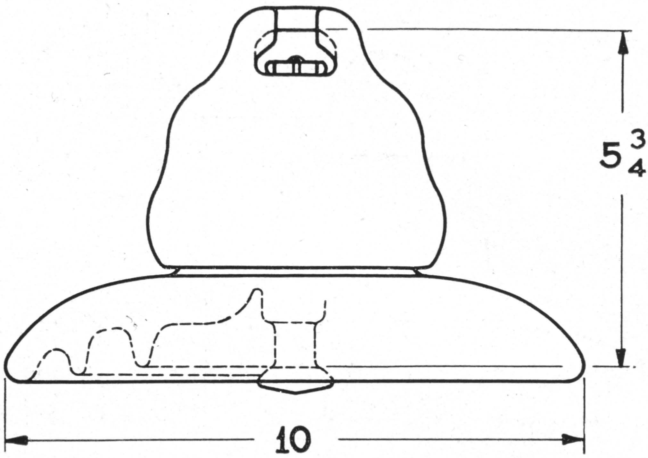
INSULATOR No. 7500

Locke No. 7500 Insulator is the clevis type counterpart of Insulator No. 18424. More of these insulators are in service than any other high strength insulator.

Mechanical and electrical strength	25,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	15 lb.
Packed weight each	18 lb.
Standard package	Crate of 6

CODE WORD . . . EBALD

Full electrical characteristics of Insulator No. 7500 are given on page 40.



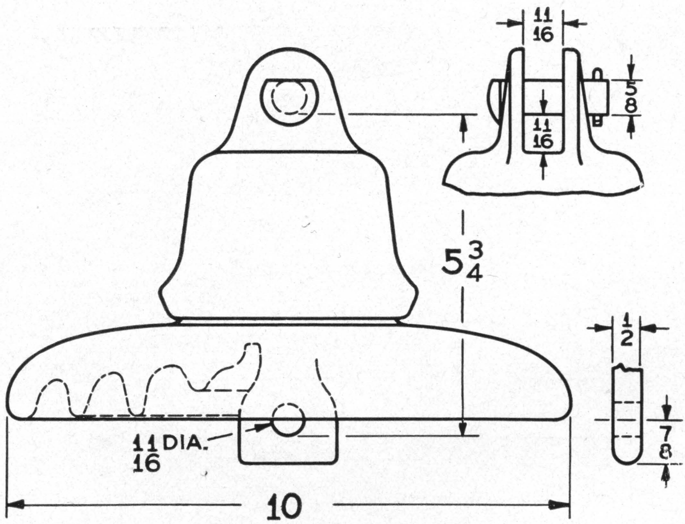
INSULATOR NO. 18424

Many years of service at critical points and under severe conditions have established an enviable reputation for this high strength insulator.

Mechanical and electrical strength	25,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	14¾ lb.
Packed weight each	17¾ lb.
Standard package	Crate of 6

CODE WORD . . . . WIAVE

Full electrical characteristics of Insulator No. 18424 are given on page 40.



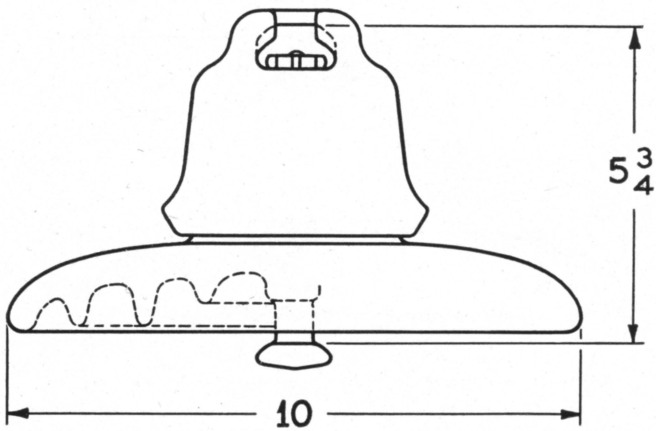
INSULATOR NO. 5800

Except that it has clevis instead of socket type hardware this insulator is the same as Locke No. 18400. Millions of these are in satisfactory service.

Mechanical and electrical strength	18,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	12 lb.
Packed weight each	15 lb.
Standard package	Crate of 6

CODE WORD . . . KEGUX

Full electrical characteristics of Insulator No. 5800 are given on page 40.



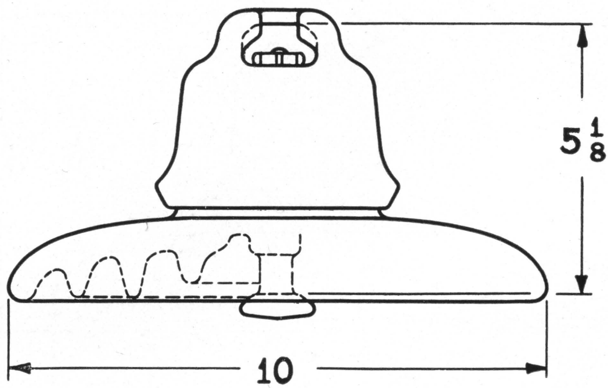
Insulator No. 18400

This is the standard Locke Suspension Type Insulator. Its splendid performance under all conditions has made it standard on many outstanding transmission lines.

Mechanical and electrical strength	18,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	11½ lb.
Packed weight each	14½ lb.
Standard package	Crate of 6

Code Word . . . WIAXK

Full electrical characteristics of Insulator No. 18400 are given on page 40.



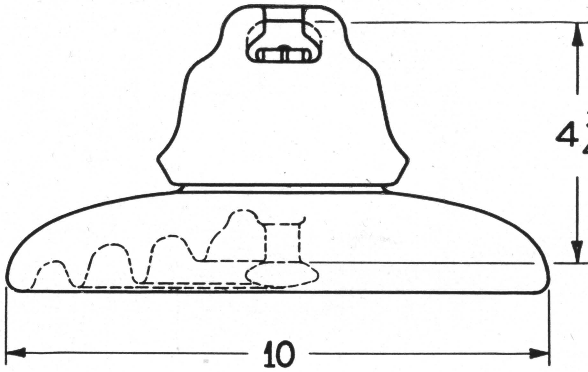
INSULATOR NO. 18401

Where tower clearances are limited or where excessive dirt makes maximum leakage distance for a given string length advisable, this insulator has been extensively used.

Mechanical and electrical strength	18,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	11½ lb.
Packed weight each	14½ lb.
Standard package	Crate of 6

CODE WORD . . . WIAYN

Full electrical characteristics of Insulator No. 18401 are given on page 40.



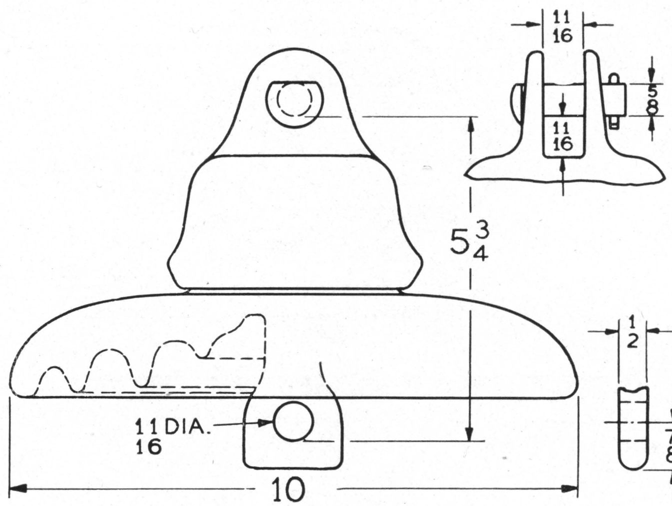
INSULATOR NO. 18034

For medium duty Locke No. 18034 has been eminently satisfactory. It is also made with standard 5¾-inch spacing under number 18045.

Mechanical and electrical strength	14,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	10½ lb.
Packed weight each	13 lb.
Standard package	Crate of 6

INSULATOR NO.	SPACING	CODE WORD
18034	4¾ inches	WIAWH
18045	5¾ inches	EPNPA

Full electrical characteristics of these insulators are given on pages 40 and 41.



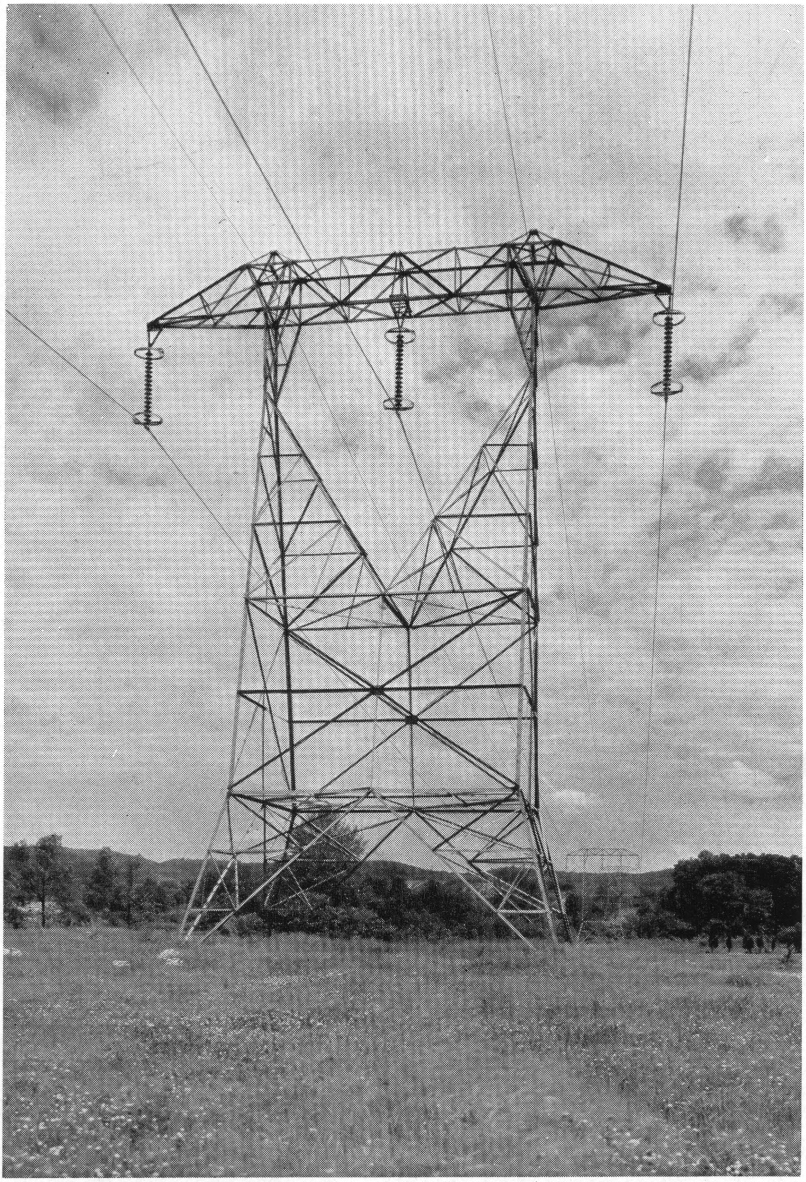
INSULATOR NO. 18046

This insulator is identical, except for hardware and spacing, to Locke No. 18034 and is eminently suited for medium duty service.

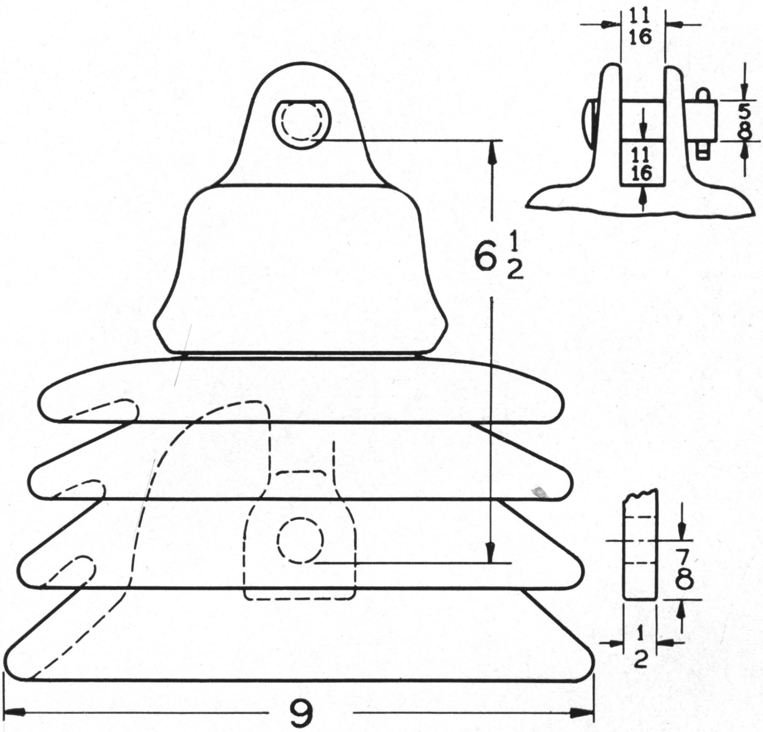
Mechanical and electrical strength	14,000 lb.
Dry arc-over voltage	75,000
Wet arc-over voltage	45,000
Net weight each	11½ lb.
Packed weight each	14½ lb.
Standard package	Crate of 6

CODE WORD . . . EPNUM

Full electrical characteristics of Insulator No. 18046 are given on page 41.



A TOWER ON THE ROSELAND-BUSHKILL 220-KV. LINE OF THE PUBLIC SERVICE ELECTRIC AND GAS COMPANY [NEW JERSEY]. LOCKE INSULATORS, GRADING SHIELDS AND HARDWARE ARE USED THROUGHOUT THIS LINE



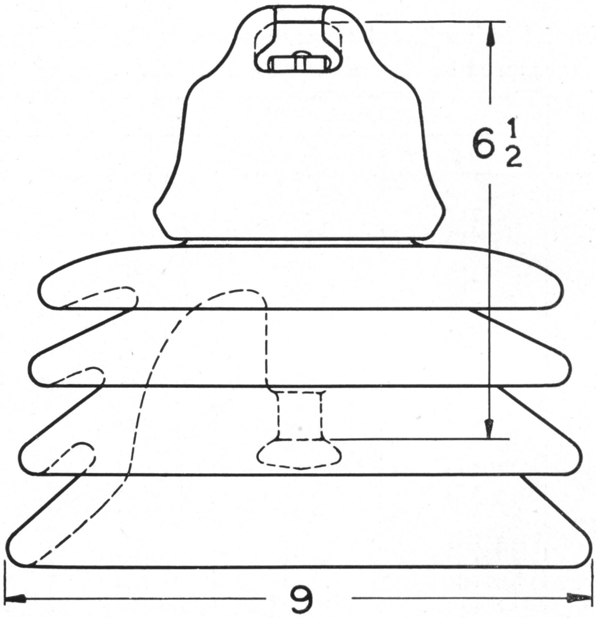
INSULATOR NO. 18026

This insulator is recommended for use where dirt or fog conditions are prevalent.

Mechanical and electrical strength	18,000 lb.
Dry arc-over voltage	100,000
Wet arc-over voltage	60,000
Net weight each	16¼ lb.
Packed weight each	20 lb.
Standard package	Crate of 6

CODE WORD . . . EPLOV

Full electrical characteristics of Insulator No. 18026 are given on page 41.



INSULATOR No. 18029

This insulator is recommended for use where dirt or fog conditions are prevalent.

Mechanical and electrical strength	18,000 lb.
Dry arc-over voltage	100,000
Wet arc-over voltage	60,000
Net weight each	15¾ lb.
Packed weight each	19½ lb.
Standard package	Crate of 6

CODE WORD . . . EPLUK

Full electrical characteristics of Insulator No. 18029 are given on page 41.

60-CYCLE ARC-OVER VALUES

In the following tabulations, average values in kilovolts are given as measured in accordance with A.I.E.E. Standards.

Number of Units	NUMBERS 18400 AND 5800		NUMBERS 18424 AND 7500	
	Dry	Wet	Dry	Wet
1	75	45	75	45
2	145	90	145	85
3	210	130	210	130
4	270	175	270	170
5	325	220	325	210
6	375	260	375	250
7	425	305	425	290
8	475	345	475	330
9	525	385	525	370
10	575	425	575	410
11	620	465	620	445
12	665	505	665	480
13	710	540	710	510
14	755	575	755	545
15	800	610	800	575
16	845	640	845	600
17	890	675	890	630
18	935	705	935	655
19	980	730	980	680
20	1025	755	1025	705

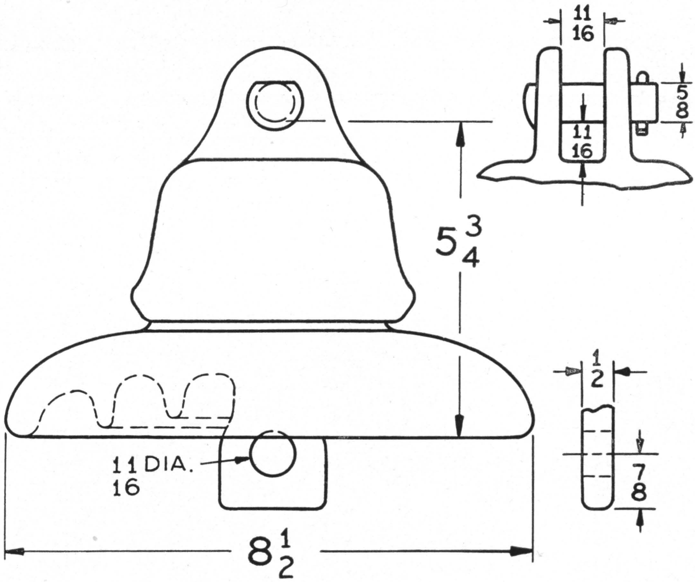
Number of Units	NUMBER 18401		NUMBER 18034	
	Dry	Wet	Dry	Wet
1	75	45	75	45
2	138	85	136	80
3	200	125	190	120
4	250	160	240	155
5	300	200	285	190
6	350	235	330	225
7	395	275	375	260
8	440	315	415	295
9	485	350	455	330
10	530	385	500	360
11	570	420	540	395
12	610	455	580	430
13	650	490	615	460
14	690	520	655	490
15	730	555	695	525
16	770	585	730	555
17	810	615	765	585
18	850	645	805	610
19	890	675	840	640
20	930	700	875	665

60-CYCLE ARC-OVER VALUES

In the following tabulations, average values in kilovolts are given as measured in accordance with A.I.E.E. Standards.

Number of Units	NUMBERS 18045 AND 18046	
	Dry	Wet
1	75	45
2	145	90
3	210	130
4	270	175
5	325	220
6	375	260
7	425	305
8	475	345
9	525	385
10	575	425
11	620	465
12	665	505
13	710	540
14	755	575
15	800	610
16	845	640
17	890	675
18	935	705
19	980	730
20	1025	755

Number of Units	NUMBER 15000		NUMBERS 18026-18029	
	Dry	Wet	Dry	Wet
1	95	55	100	60
2	175	105	160	115
3	250	150	225	165
4	315	200	285	215
5	380	245	350	270
6	440	290	410	325
7	500	335	470	375
8	560	380	530	420
9	615	425	590	465
10	670	465	650	510
11	725	505	710	560
12	780	545	770	605
13	835	580	835	650
14	890	615	900	700

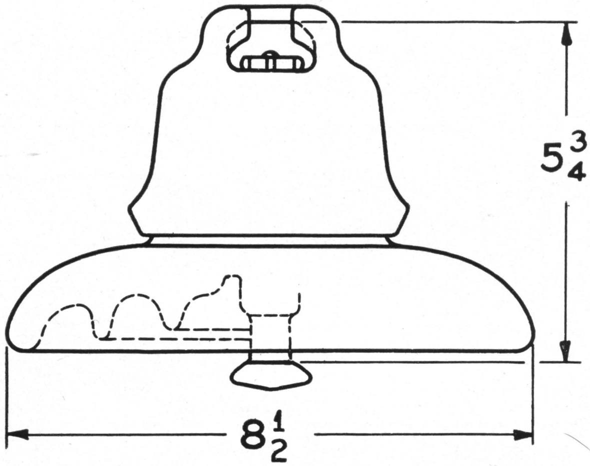


INSULATOR NO. 5885

This insulator has been extensively used on many important railroad electrifications.

Mechanical and electrical strength	15,000 lb.
Dry are-over voltage	65,000
Wet arc-over voltage	35,000
Net weight each	9 lb.
Packed weight each	11 lb.
Standard package	Crate of 6

CODE WORD . . . AWAJC

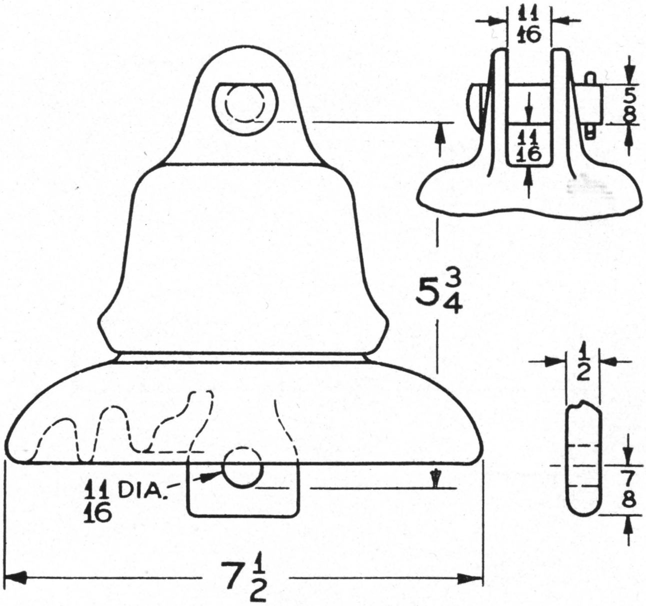


INSULATOR No. 18420

Insulator No. 18420 is the socket type counterpart of insulator No. 5885.

Mechanical and electrical strength	15,000 lb.
Dry arc-over voltage	65,000
Wet arc-over voltage	35,000
Net weight each	9 lb.
Packed weight each	11 lb.
Standard package	Crate of 6

CODE WORD . . . ERUVY

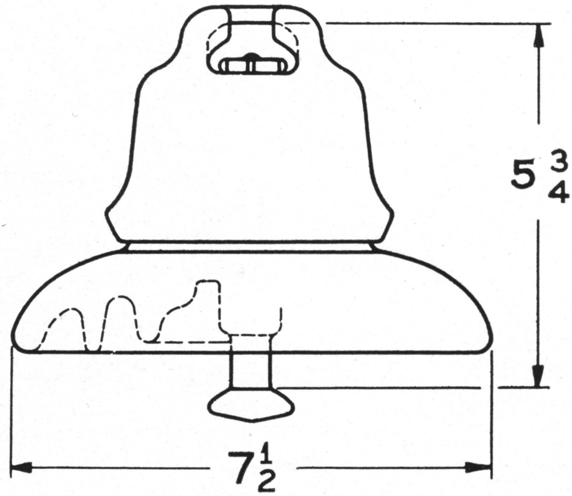


INSULATOR NO. 5875

Insulator No. 5875 is another suspension insulator which has been used on some of the major railroad electrifications.

Mechanical and electrical strength	15,000 lb.
Dry arc-over voltage	60,000
Wet arc-over voltage	35,000
Net weight each	8 lb.
Packed weight each	10½ lb.
Standard package	Crate of 12

CODE WORD . . . . . AVZUF

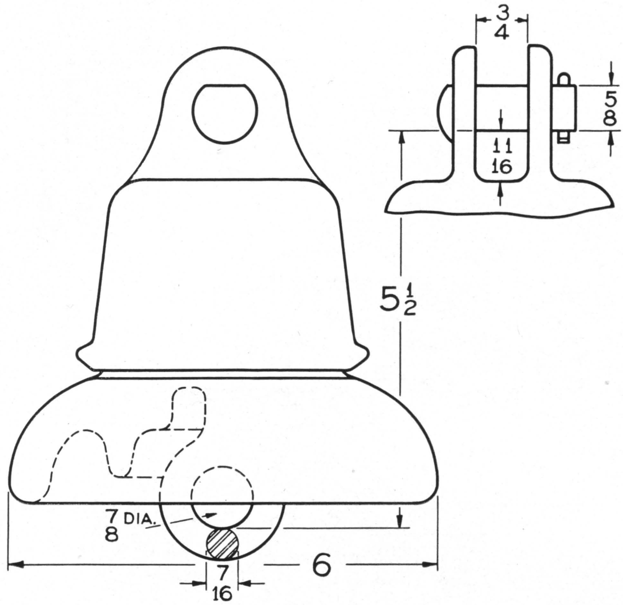


INSULATOR NO. 18422

This insulator differs from insulator No. 5875 only in the type of cap and bolt used.

Mechanical and electrical strength	15,000 lb.
Dry arc-over voltage	60,000
Wet arc-over voltage	35,000
Net weight each	8 lb.
Packed weight each	10½ lb.
Standard package	Crate of 12

CODE WORD . . . . . ERUXU

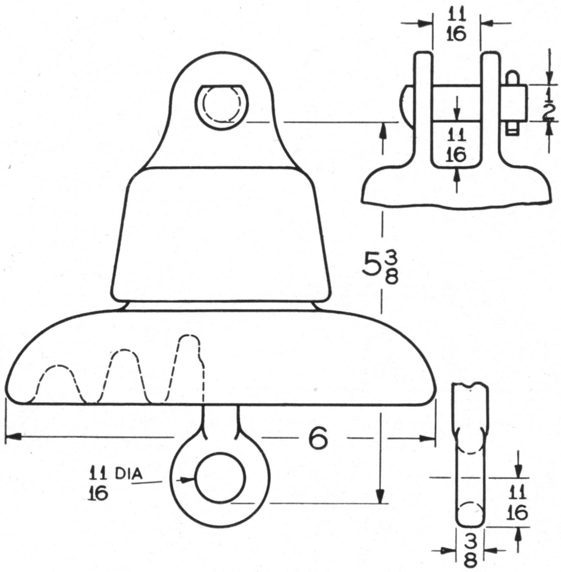


Insulator No. 18010

Locke Insulator No. 18010 was especially designed for dead ending heavy duty low voltage lines.

Mechanical and electrical strength	9,000 lb.
Dry arc-over voltage	50,000
Wet arc-over voltage	28,000
Net weight each	6½ lb.
Packed weight each	9 lb.
Standard package	Crate of 12

Code Word . . . . VOVUC

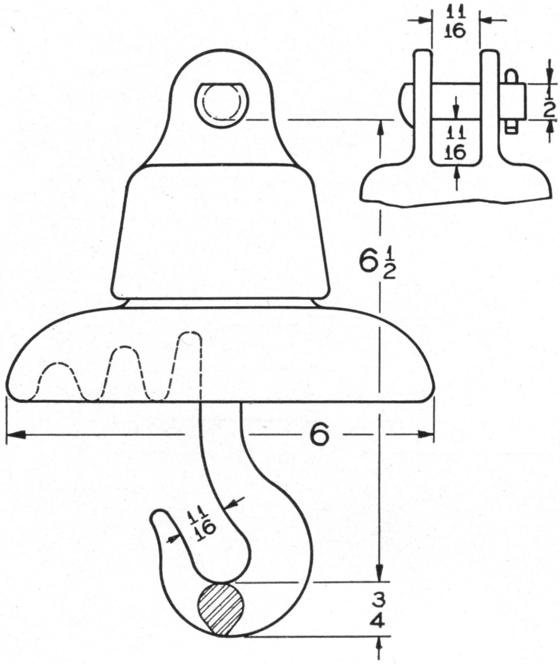


INSULATOR NO. 16583

This insulator has been widely adopted for dead ending rural and other light duty distribution lines.

Mechanical and electrical strength	5,000 lb.
Dry arc-over voltage	60,000
Wet arc-over voltage	33,000
Net weight each	$4\frac{1}{2}$ lb.
Packed weight each	$5\frac{1}{2}$ lb.
Standard package	Crate of 14

CODE WORD . . . . WIBKA

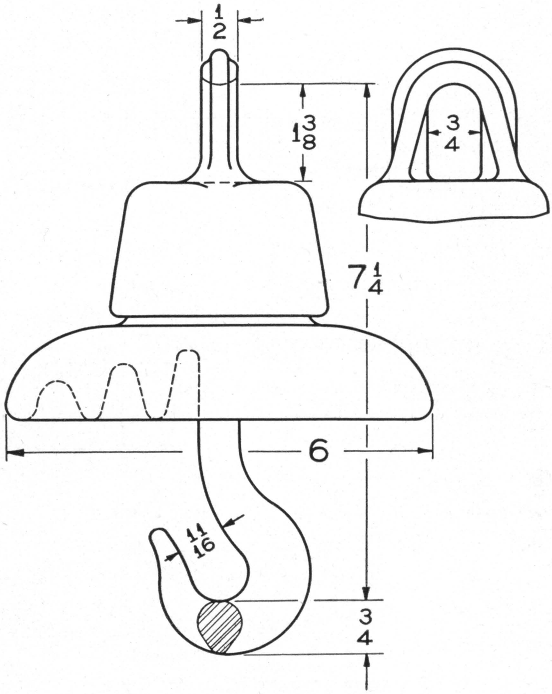


Insulator No. 16621

This insulator is identical with insulator No. 16583 except for the type of connection.

Mechanical and electrical strength	5,000 lb.
Dry arc-over voltage	60,000
Wet arc-over voltage	33,000
Net weight each	4½ lb.
Packed weight each	6½ lb.
Standard package	Crate of 10

Code Word . . . . WIBOM

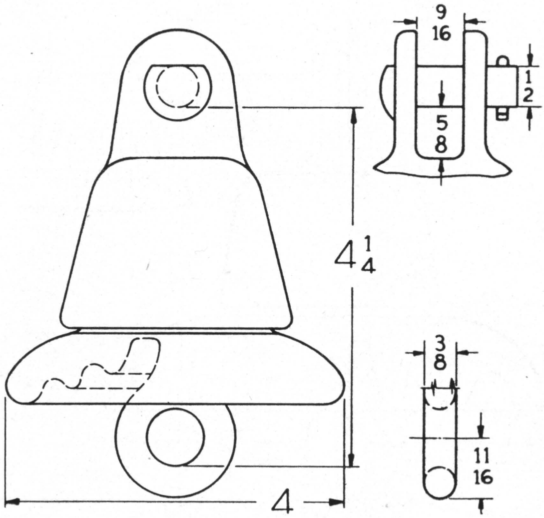


INSULATOR No. 16456

A hook and eye type insulator with the same porcelain as insulators Nos. 16583 and 16621.

Mechanical and electrical strength	5,000 lb.
Dry arc-over voltage	60,000
Wet arc-over voltage	33,000
Net weight each	4½ lb.
Packed weight each	6½ lb.
Standard package	Crate of 10

CODE WORD . . . . . WIBIU



INSULATOR NO. 3617

In addition to special applications this insulator has for years been used for dead-ending low voltage light duty lines.

Mechanical and electrical strength	2500 lb.
Dry arc-over voltage	40,000
Wet arc-over voltage	20,000
Net weight each	2 lb.
Packed weight each	$2\frac{1}{2}$ lb.
Standard package	Crate of 25

CODE WORD . . . . . WRAGY

Locke Hewlett Type Insulators

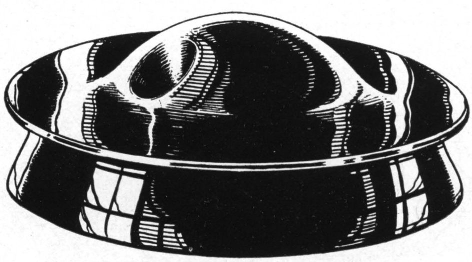
THERE has been a decided preference in the minds of many engineers for the Hewlett type of suspension insulator. This insulator has an enviable and justifiable reputation for dependability. While cement can no longer be regarded as a hazard, the freedom afforded the constituent parts in the Hewlett type of assembly is an advantage under certain conditions. Very thorough tests made on Locke Hewlett insulators which have been in constant service for over ten years show an entire absence of any deterioration.

STANDARD SERIES

The Locke Hewlett insulator, known as No. 7794, is applicable wherever a suspension insulator can be used.

Standard spacing is 5½ inches between centers of insulators giving ample room for manipulation of the hardware.

Numerous types of hardware have been developed and are on the market for use with the Hewlett discs, all of which have merit. The 4/0 A.W.G. copper link type as shown on the following pages is



standard. The lead lined link used with the protected link series may also be used with this standard series.

The couplings have been designed to develop the maximum strength of the copper link. End couplings are designed to protect the links from contact with the arc in the event of flashover.

Mechanical strength of the insulator with Locke standard hardware is 8,000 lb.

Protected Link Series

This series uses the same porcelain as the standard series. The links used in these insulators have a lead alloy cushion. The cushion being soft flows slightly, giving more surface contact with resultant higher strength. A flat surface between the copper link and lead liner prevents excessive flowing of the lead even at maximum loads.

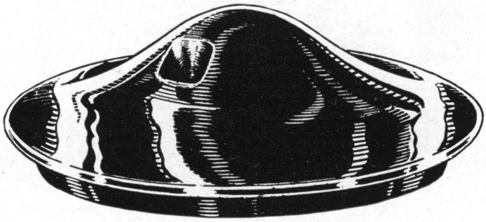
The couplings and end connectors are so constructed that in the event of arc-over the copper links are protected. Even under the severest cascade there is little if any danger of link breakage and consequent dropping of the line. Mechanical strength of this insulator with the special Locke hardware is 11,000 lb.

Various other combinations are possible with Hewlett insulators of the round-hole type. Either the solid copper link or the half-round copper link with lead lining may be used with or without the link protecting coupling.

Strap Link Series

The Locke Hewlett insulator No. 9140 has several advantages not incorporated in the Hewlett insulator as originally designed.

The improvements depend almost entirely upon a new method of fabrication which enables the insulator to be made with rectangular holes. This construction permits the use of flat connecting links which give a larger bearing surface between links and porcelain and more uniform stress.



The fish-tail edge, or under-petticoat, in this insulator has been drawn inward to protect its outside surface from water dripping off the top surface of the unit. This long petticoat is, however, easily washed by driving rains.

This unit is very rugged and is not easily damaged by rough handling.

In assembling No. 9140 units in strings the spacing is $5\frac{3}{4}$ inches. Mechanical strength of the insulator complete with hardware is 10,000 lb.

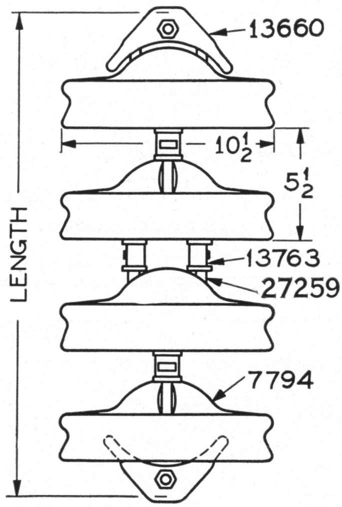
60-CYCLE ARC-OVER VALUES

In the following tabulations, average values in kilovolts are given as measured in accordance with A.I.E.E. Standards.

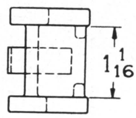
Number of Units	NUMBERS 9101 SERIES		NUMBERS 9601 SERIES	
	Dry	Wet	Dry	Wet
1	78	45	75	45
2	145	90	145	90
3	205	125	210	135
4	260	160	270	180
5	315	200	325	225
6	365	235	375	270
7	415	275	425	315
8	460	310	475	360
9	510	345	525	400
10	555	380	575	440
11	600	410	620	480
12	645	445	665	520
13	690	475	710	560
14	730	510	755	600
15	775	540	800	635

LOCKE HEWLETT TYPE

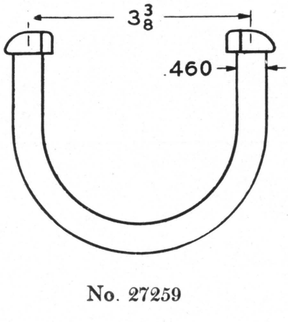
STANDARD SERIES



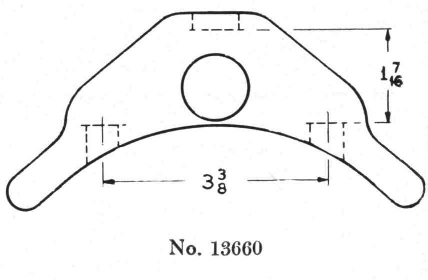
No. 9104



No. 13763



No. 27259



No. 13660

Locke Hewlett Type

Standard Series

Assembled Strings

Catalog No.	Code Word	Units	Length in Inches	LB. EACH	
				Net	Pkd.
9101	WRARD	1	7½	14¼	18¾
9102	WRASG	2	13	26⅝	33¾
9103	WRATJ	3	18½	39	50
9104	WRAUM	4	24	51⅜	66¼
9105	WRAVP	5	29½	63¾	81
9106	WRAWT	6	35	76⅛	96
9107	WRAYZ	7	40½	88½	110½
9108	WRAZC	8	46	100⅞	124½
9109	WREAJ	9	51½	113¼	145½
9110	WREBM	10	57	125⅝	160

Terminal fittings for these strings are shown on pages 64, 76, 77 and 84.
Electrical characteristics are given on page 53.

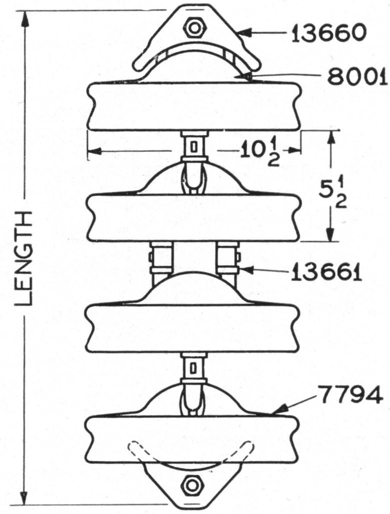
Interconnecting Hardware

Catalog No.	Code Word	Material	Mechanical Strength Lb.	LB. PER 100	
				Net	Pkd.
27259 Link	HOXOS	Copper	9,000	50	56¼
13763 Inter Coupling	WRELS	Bronze	10,000 per pr.	31¼	37½
13660 End Coupling	VOMEP	Forged Steel	12,000	185	200

All steel parts are supplied hot galvanized. Spring cotters are brass.
These insulators are regularly furnished glazed standard brown color.

Locke Hewlett Type

Protected Link Series



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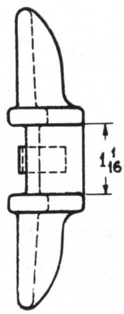

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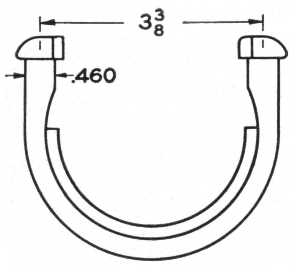

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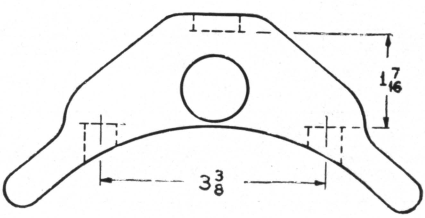


No. 13660

LOCKE HEWLETT TYPE

PROTECTED LINK SERIES

ASSEMBLED STRINGS

Catalog No.	Code Word	Units	Length in Inches	LB. EACH	
				Net	Pkd.
19101	VOGHT	1	7½	15	19½
19102	VOGMI	2	13	27¾	34¾
19103	VOGOP	3	18½	40½	51½
19104	VOGSY	4	24	53	67¾
19105	VOGUE	5	29½	65½	82¾
19106	VOGYR	6	35	78	98
19107	VOGZU	7	40½	90½	112½
19108	VOHAW	8	46	103	127½
19109	VOHCE	9	51½	117	149½
19110	VOHEP	10	57	130	165

Terminal fittings for these strings are shown on pages 64, 76, 77 and 84.
Electrical characteristics are the same as those of the 9101 series given on page 53.

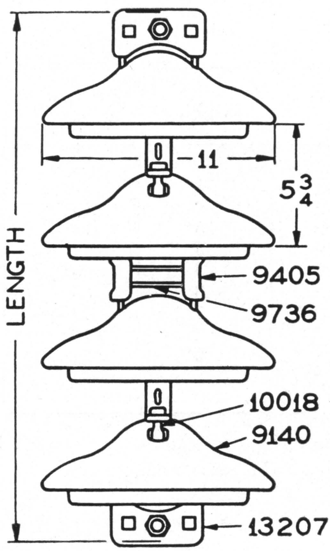
INTERCONNECTING HARDWARE

Catalog No.	Code Word	Material	Mechanical Strength, Lb.	LB. PER 100	
				Net	Pkg.
8001 Link	VOMAH	Copper	11,000	57	65
13661 Inter Coupling	VOMHZ	Bronze	12,000 per pr.	43	50
13660 End Coupling	VOMEP	Forged Steel	12,000	185	200

All steel parts are supplied hot galvanized. Spring cotters are brass.
These insulators are regularly furnished glazed standard brown color.

Locke Hewlett Type

Strap Link Series



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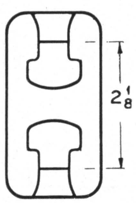

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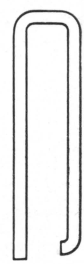

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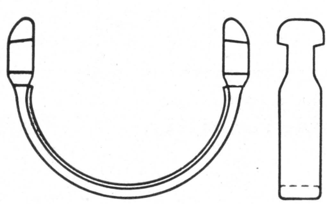

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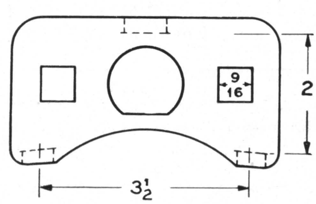


No. 13207

Locke Hewlett Type

Strap Link Series

Assembled Strings

Catalog No.	Code Word	Units	Length in Inches	LB. EACH Net	LB. EACH Pkd.
9601	VUCXI	1	8	13½	18
9602	VUCYR	2	13¾	25½	33
9603	VUCZO	3	19½	37½	49
9604	VUDAM	4	25¼	49½	66
9605	VUDEC	5	31	61½	79½
9606	VUDFI	6	36¾	73½	93¾
9607	VUDHO	7	42½	85½	108½
9608	VUDIS	8	48¼	97½	122½
9609	VUDKY	9	54	109½	144
9610	VUDME	10	59¾	121½	157½
9611	VUDOK	11	65½	133½	171¾
9612	VUDSU	12	71¼	145½	186
9613	VUDUA	13	77	157½	200¾
9614	VUDYT	14	82¾	169½	215½
9615	VUEBX	15	88½	181½	229½

Terminal fittings for these strings are shown on pages 76, 77 and 84.
Electrical characteristics are given on page 53.

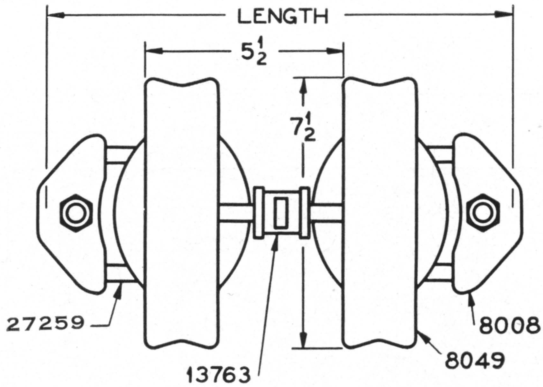
Interconnecting Hardware

Catalog No.	Code Word	Material	Mechanical Strength, Lb.	LB. PER 100 Net	LB. PER 100 Pkd.
9736 Spring Lock	VUJUG	Steel	......	9⅜	12½
10018 Connect'g Link	VUJYT	Forged Steel	12,000	43¾	50
13207 End Coupling	DOSAR	Forged Steel	12,000	175	200
9405 Coupling	VUKEY	Forged Steel	12,000 per pr.	50	56¼

All steel parts are supplied hot galvanized. Spring cotters are brass.
These insulators are regularly furnished glazed standard brown color.

Locke Hewlett Type

(7½-inch diameter)



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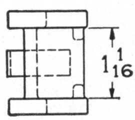

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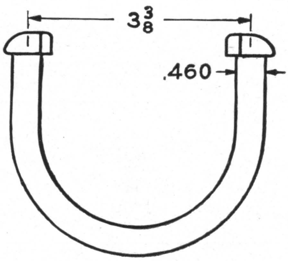

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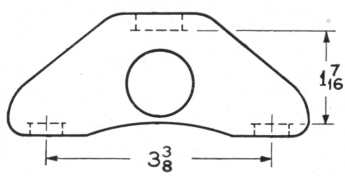


No. 8008

Locke Hewlett Type

(7½-inch diameter)

Insulator No. 8049

This small diameter Hewlett insulator can either be used singly by threading the cable through the hole serving it back upon itself or fitted with connecting hardware as shown.

Line voltage	7,500
Dry arc-over voltage	70,000
Wet arc-over voltage	50,000
Mechanical and electrical strength	7,000 lb.
Net weight each	6¼ lb.
Packed weight each	8½ lb.
Standard package	Crate of 18

Code Word . . . . VOLEL

Assembled in Strings

No. 8049 Hewlett insulator can be assembled in strings when line voltage or leakage conditions require two or more units in series.

Connectors, couplings, and links shown on page 56 can be used with No. 8049 porcelains as well as those shown on the opposite page and used in the assemblies listed below.

Assembly No.	Code Word	Unit	Arc-over Voltage Dry	Arc-over Voltage Wet	Length, Inches	Lb. Each Net	Lb. Each Pkd.
10431	VOFHS	1	70,000	50,000	7½	11	14¾
10432	VOFIP	2	120,000	100,000	13	19	25½
10433	VOFJY	3	180,000	150,000	18½	27	36

End couplings are forged steel, intermediate coupling bronze, links 4/0 copper. End couplings supplied hot-dip galvanized.

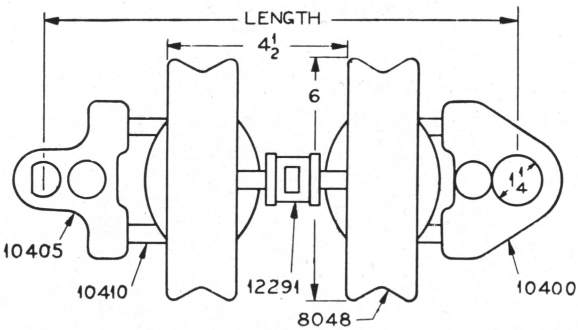
Terminal fittings for these strings are shown on pages 64, 76, 77 and 84.

Arc-over values are established with strings in horizontal strain position.

These insulators are regularly furnished glazed standard brown color.

Locke Hewlett Type

(6-inch diameter)



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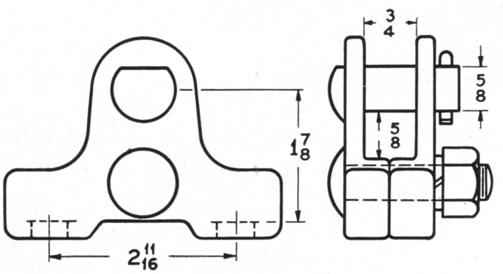

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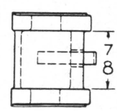

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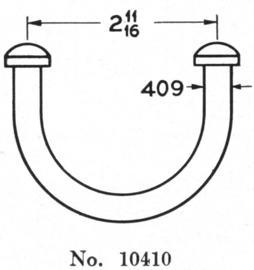

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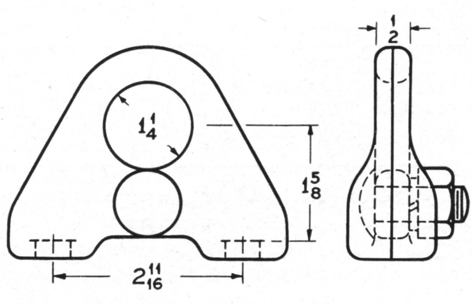


No. 10400

LOCKE HEWLETT TYPE
(6-inch diameter)

INSULATOR NO. 8048

This small diameter Hewlett insulator can either be used singly by threading the cable through the hole serving it back upon itself or fitted with connecting hardware as shown.

Line voltage	6,600
Dry arc-over voltage	60,000
Wet arc-over voltage	40,000
Mechanical and electrical strength	6,000 lb.
Net weight each	3¼ lb.
Packed weight each	4⅛ lb.
Standard package	Crate of 30

CODE WORD . . . . . VOLFS

NO. 8048 ASSEMBLED IN STRINGS

No. 8048 Hewlett insulator can be assembled in strings when line voltage or leakage conditions require two or more units in series.

End couplings illustrated can be used at either end of the string.

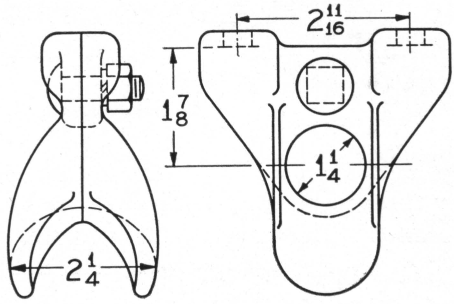
Catalog No.	Code Word	End Coupling	Units	ARC-OVER VOLTAGE		Length	LB. EACH	
				Dry	Wet		Net	Pkd.
10401–G1	VOFTA	Eye —Clevis	1	60,000	40,000	7¼	6¼	9
10401–G2	VOFYV	Eye —Eye	1	60,000	40,000	7¼	6¼	9
10401–G3	VOGAV	Clevis—Clevis	1	60,000	40,000	7¼	6¼	9
10402–G1	VOFUD	Eye —Clevis	2	100,000	80,000	11¾	10¾	14¾
10402–G2	VOGBA	Eye —Eye	2	100,000	80,000	11¾	10¾	14¾
10402–G3	VOGEX	Clevis—Clevis	2	100,000	80,000	11¾	10¾	14¾

End couplings are forged steel, intermediate couplings bronze, links 3/0 copper. End couplings supplied hot galvanized.

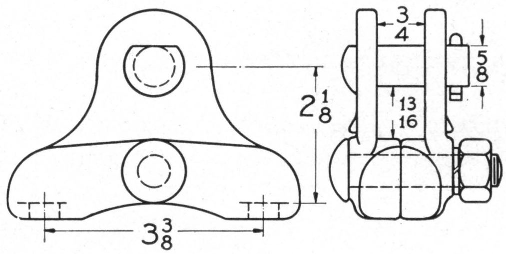
Fitting No. 27098, shown on page 64, may be used in place of the end fittings shown here.

Arc-over values are established with the strings in horizontal strain position.

These insulators are regularly furnished glazed standard brown color.



No. 27098
For 6-inch Hewlett Type Insulators



No. 8020
For 10½- and 7½-inch Hewlett Type
Insulators

Hewlett End Connectors

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
27098	HOLGH	Forged steel	6000	175
8020	BIHFU	Malleable Iron	10000	212

Suspension Insulator Attachments

FROM long experience in the requirements of transmission and distribution lines the Locke Insulator Corporation has developed a very complete line of suspension insulator attachments.

Many of these attachments have been in constant use practically since the inception of high voltage transmission. As the technique of construction has advanced, newer designs have been developed to meet the newer requirements.

On the following pages are listed attachments which it is believed will cover almost one hundred per cent of the demand for fittings and attachments; but where special cases make special fittings advisable, the Locke Insulator Corporation are ready and willing to furnish them.

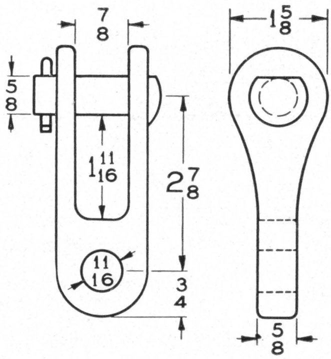
The ultimate strengths shown for these attachments are in all cases conservative. They are all manufactured under very exacting specifications and each piece must pass stringent acceptance tests.

All forged steel fittings are fabricated from a high grade copper-bearing steel especially selected for its corrosion-resisting qualities. Equally rigid specifications govern the malleable iron attachments and both these and the forged steel are heat treated to insure against brittleness after galvanizing.

The galvanizing is done in the Locke plants in what are probably the most up-to-date galvanizing departments in the country. No care is spared to assure the highest grade of finish and workmanship and no detail of design is too minor to be checked.

In making a selection from these attachments, the engineer is assuring himself not only a product which is suitable for the highest type of construction but also a product which by careful design will facilitate line erection.

Many other uses for these attachments, particularly the general utility clevises shown on Pages 66 to 70, will undoubtedly suggest themselves.



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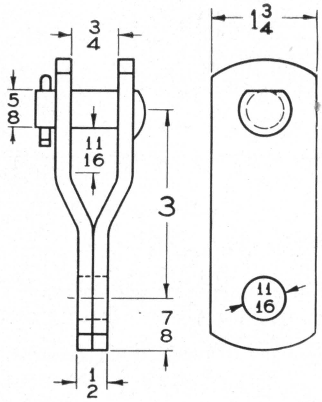

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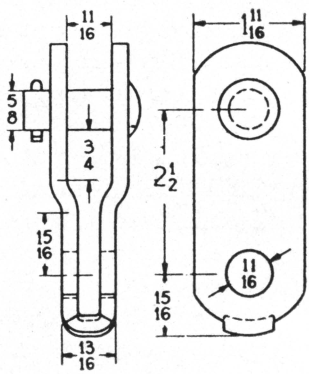
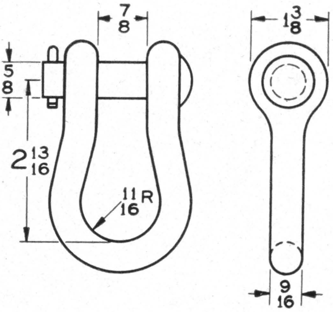


No. 43049

Clevises for Clevis Type Insulators

Catalog No.	Code Word	Material	Ultimate Strength	Pounds Per C Packed
9864	VEAOL	Steel	18,000	132
2263	SURJO	Malleable Iron	18,000	97
43049	MHEOK	Pressed Steel	18,000	113



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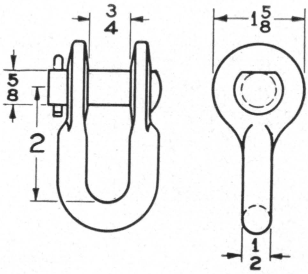

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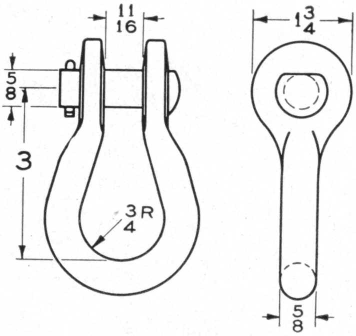

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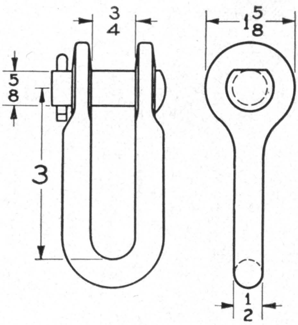
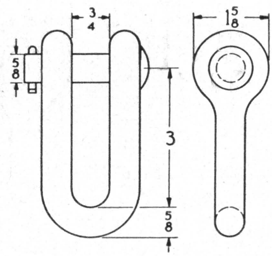


No. 3641

Clevises for Clevis Type Insulators

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
2937	UVATE	Forged Steel	20000	89
27105	VUFYO	Forged Steel	25000	111
3641	VUHIB	Forged Steel	20000	171
12196	REALT	Forged Steel	25000	126



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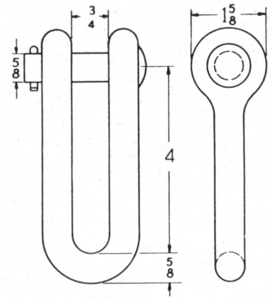

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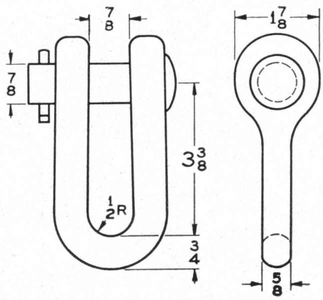

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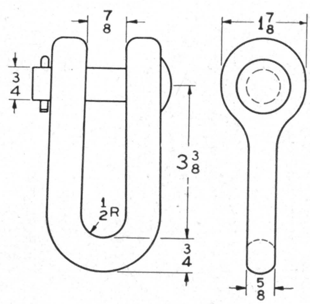
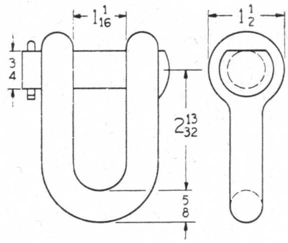


No. 27002

CLEVISES FOR CLEVIS TYPE INSULATORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
27264	HOYAB	Forged Steel	30000	125
27265	HOYBE	Forged Steel	30000	150
9996	VEAWH	Forged Steel	36000	227
27002	WIZYM	Forged Steel	36000	227



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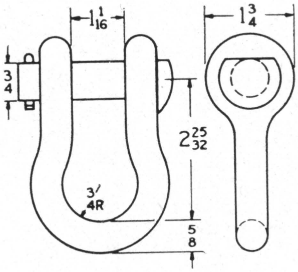

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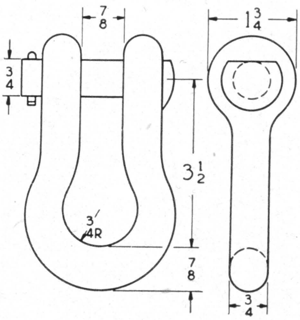

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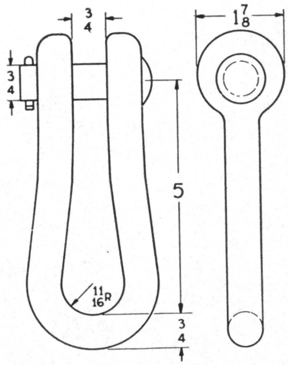
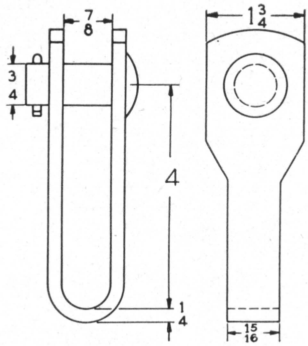


No. 27104

CLEVISES FOR CLEVIS TYPE INSULATORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
43018	MHADY	Forged Steel	40000	132
43023	MHAIN	Forged Steel	40000	169
43025	MHALX	Forged Steel	50000	202
27104	HOLPJ	Forged Steel	40000	250



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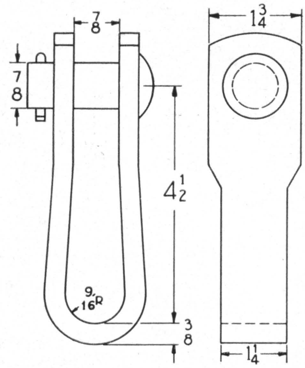

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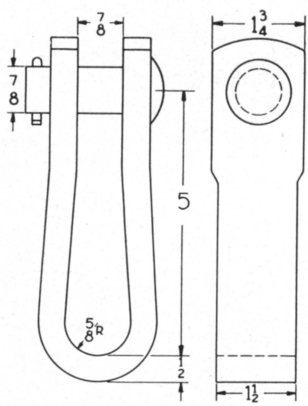
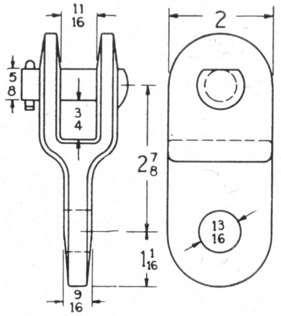


No. 27276

STRAP CLEVISES

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
27274	HOYOT	Steel	18,000	125
27275	HOYTF	Steel	30,000	225
27276	HOYUI	Steel	40,000	325



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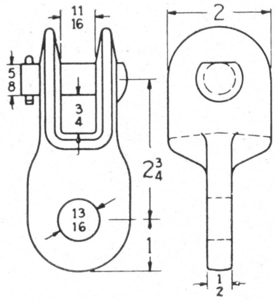

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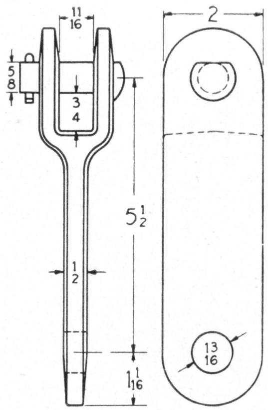
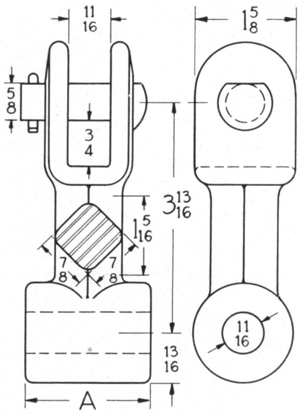


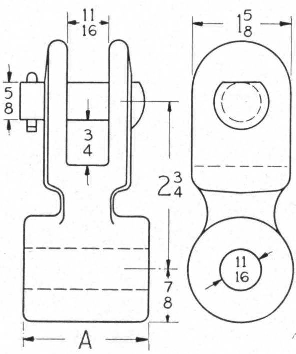
No. 43062

Clevis Connectors

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
43060	MHIEJ	Forged Steel	30000	144
43061	MHIHT	Forged Steel	30000	156
43062	MHIJZ	Forged Steel	30000	250



No. 43052

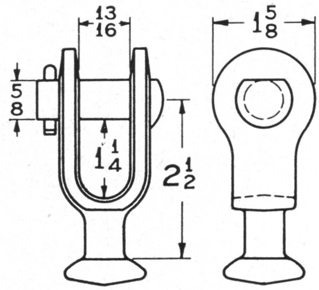


No. 43047

CLEVIS CONNECTORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
43047	MHEME	Forged Steel	35000	213
43052	MHEVD	Forged Steel	35000	210

NOTE:—"A" dimension on these connectors from ¾ of an inch up to $2\frac{1}{16}$ inches as specified. Weights given are for connectors with maximum "A" dimensions.



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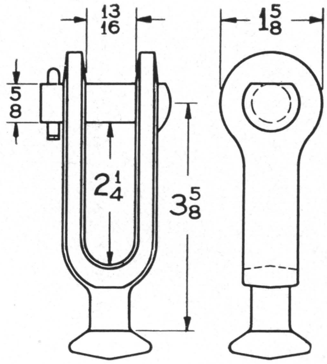

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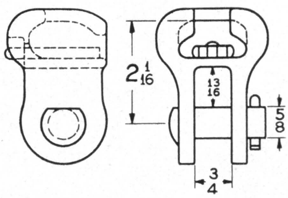

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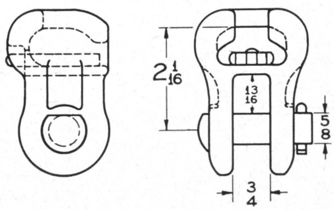
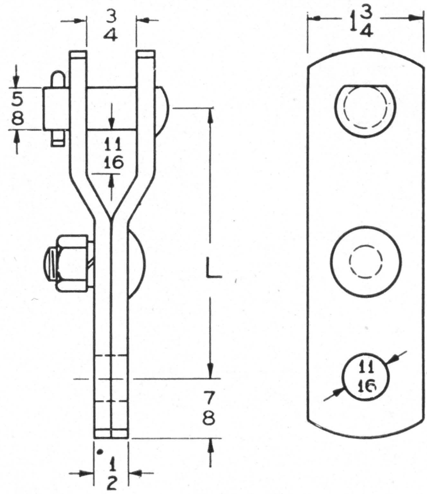


No. 27048

Clevises for Socket Type Insulators

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
8405	WRANU	Malleable Iron	18000	126
27048	VEATY	Malleable Iron	25000	166
8418	WRIPI	Forged Steel	25000	91
8421	VUGAW	Forged Steel	25000	100



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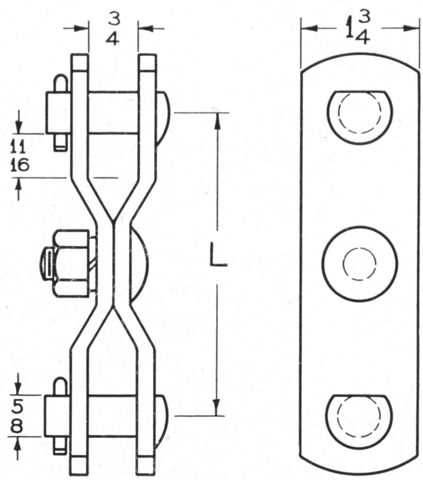
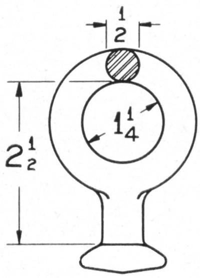


No. 27043

EXTENSION LINKS

Catalog No.	Code Word	Material	Ultimate Strength
27025	WOAAS	Steel	18,000
27043	WIZOK	Steel	18,000

Link No. 27025 can be furnished with any desired L dimension from 4 inches up.
Link No. 27043 can be furnished with any desired L dimension from 4½ inches up.



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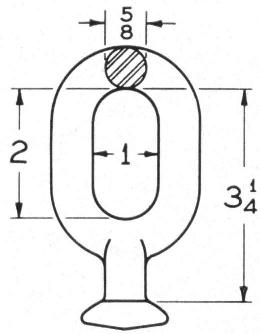

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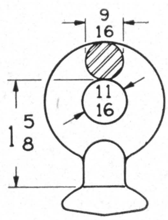

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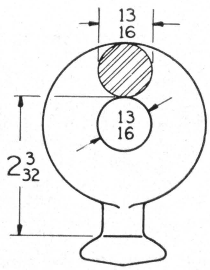

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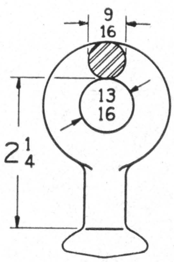
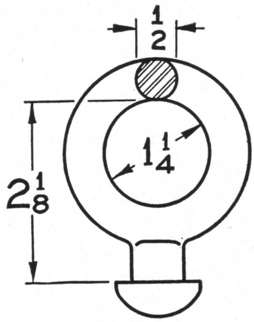


No. 43011

EYES FOR SOCKET TYPE INSULATORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
8406	WRAOX	Forged Steel	25000	51
13910	WIZSU	Forged Steel	25000	85
43010	MEZIG	Forged Steel	30000	44
43011	MEZOP	Forged Steel	30000	50
43013	MEZTO	Forged Steel	35000	100



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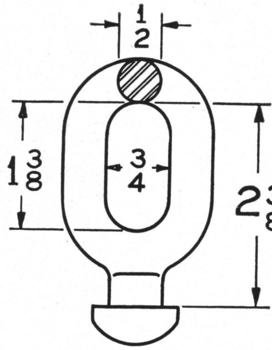

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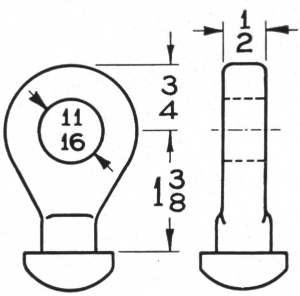
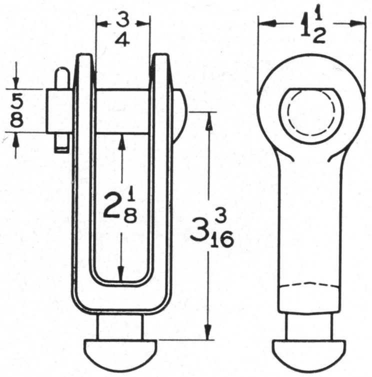


No. 8007

EYES FOR HEWLETT TYPE INSULATORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
8006	WREFZ	Forged Steel	18000	46
27047	VOMIC	Forged Steel	18000	46
8007	WREHF	Forged Steel	18000	36



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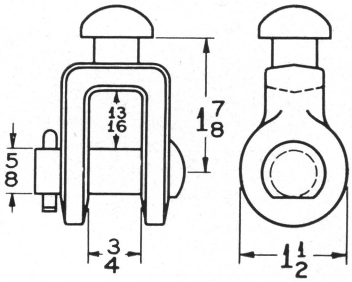

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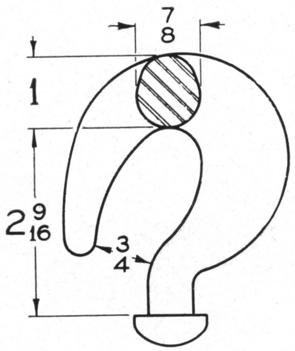
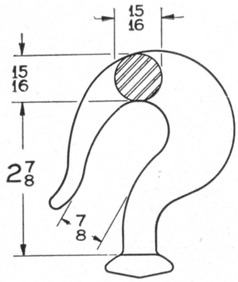


No. 8004

Hooks and Clevises for Hewlett Type Insulators

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
8018	VUKIZ	Forged Steel	18000	91
8028	WREMY	Forged Steel	18000	71
8004	WREEW	Forged Steel	18000	111



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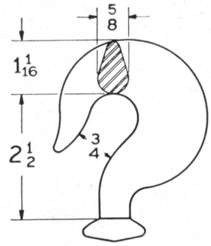

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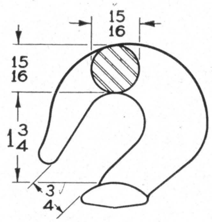

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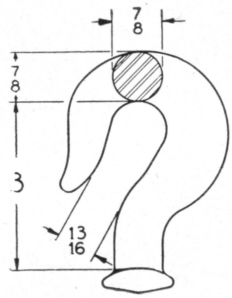
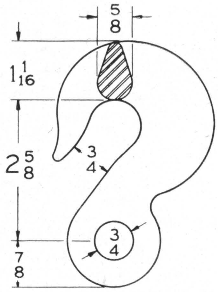


No. 43003

HOOKS FOR SOCKET TYPE INSULATORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
8440	VEAVE	Forged Steel	25,000	132
8404	WRALN	Forged Steel	18,000	105
13139	VOVNA	Forged Steel	18,000	111
43003	MEYXA	Forged Steel	27,000	125



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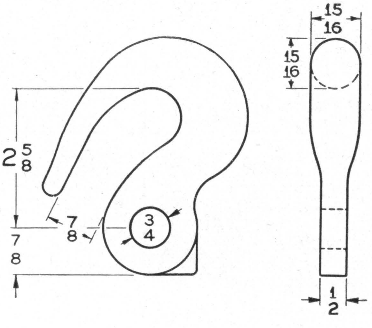

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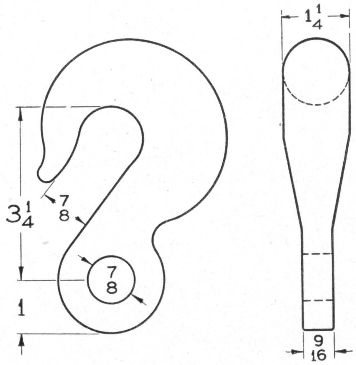
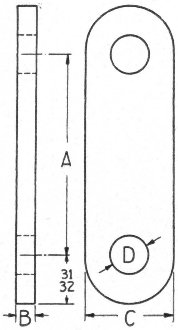


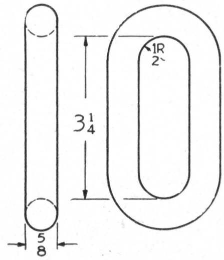
No. 27050

Hooks for Clevis Type Insulators

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
2569	VAECO	Forged Steel	15,000	100
9994	VEARS	Forged Steel	18,000	132
27050	HOHZH	Forged Steel	25,000	163



No. 43070



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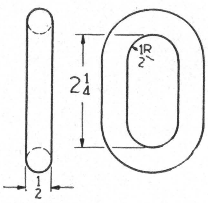

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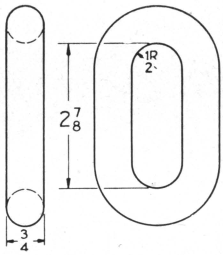
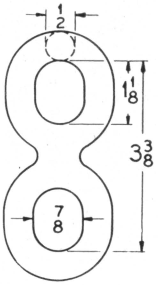


No. 9668

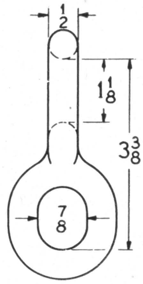
CONNECTING LINKS AND STRAPS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
43070	MHIVH	Forged Steel	......	..
43080	MHOIC	Forged Steel	30,000	44
43082	MHOKI	Forged Steel	40,000	88
9668	CAOLI	Forged Steel	50,000	130

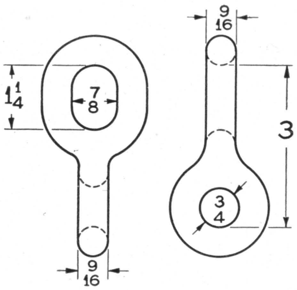
NOTE;—Strap No. 43070 can be furnished with "B" dimension 1/4 or 3/8 in. and with a "C" dimension range from 1 1/2 to 1 3/4 inch. The drilled holes are regularly 3/4 in. in diameter but can be drilled any size up to 1 inch. These straps can be furnished with "A" dimension any desired length. Strength and weight varies according to size of steel used.



No. 55789



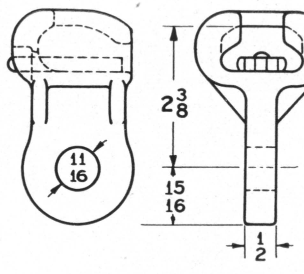
No. 55790



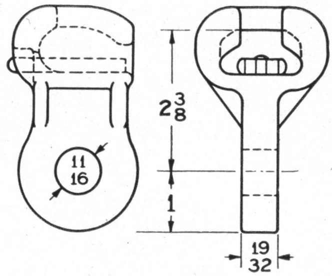
No. 3351

Double Eyes

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
55789	PRYBH	Forged Steel	20000	60
55790	PRYCK	Forged Steel	20000	60
3351	MADEN	Forged Steel	20000	81



No. 8407



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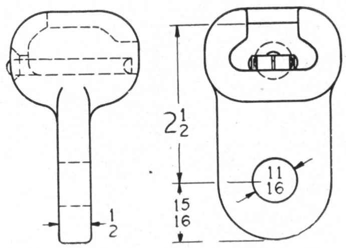
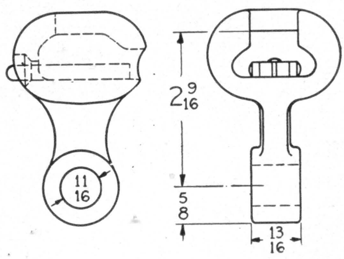


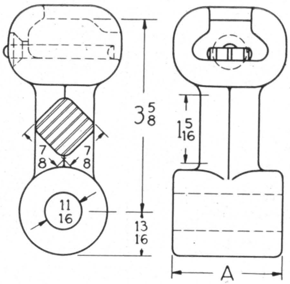
No. 43045



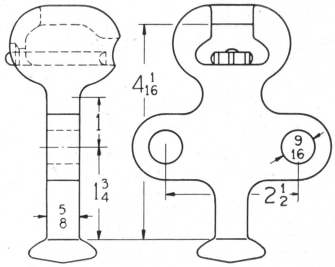
No. 43048

Connectors for Socket Type Insulators

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
8407	WRAPA	Malleable Iron	18000	112
27046	VEASV	Malleable Iron	25000	142
43045	MHEKV	Forged Steel	35000	125
43048	MHENH	Forged Steel	30000	88



No. 43051



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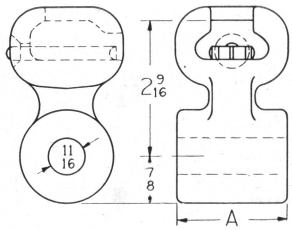
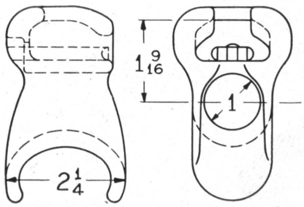


No. 43046

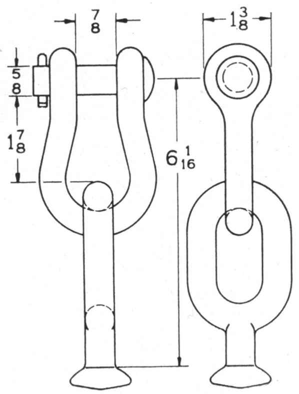


No. 27020

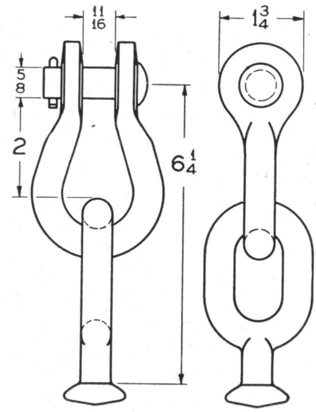
CONNECTORS FOR SOCKET TYPE INSULATORS

Catalog No.	Code Word	Material	Ultimate Strength	Pounds per C Packed
43046	MHELB	Forged Steel	35000	213
43050	MHEPN	Forged Steel	30000	175
43051	MHESU	Forged Steel	35000	210
27020	HOFYC	Malleable iron	14000	150

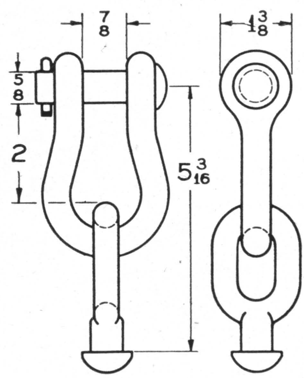
NOTE:—"A" dimensions on No. 43046 and No. 43051 from ¾ inch up to $2\frac{1}{16}$ inches maximum as specified. Weights given are for connectors with maximum "A" dimension.



No. 27260



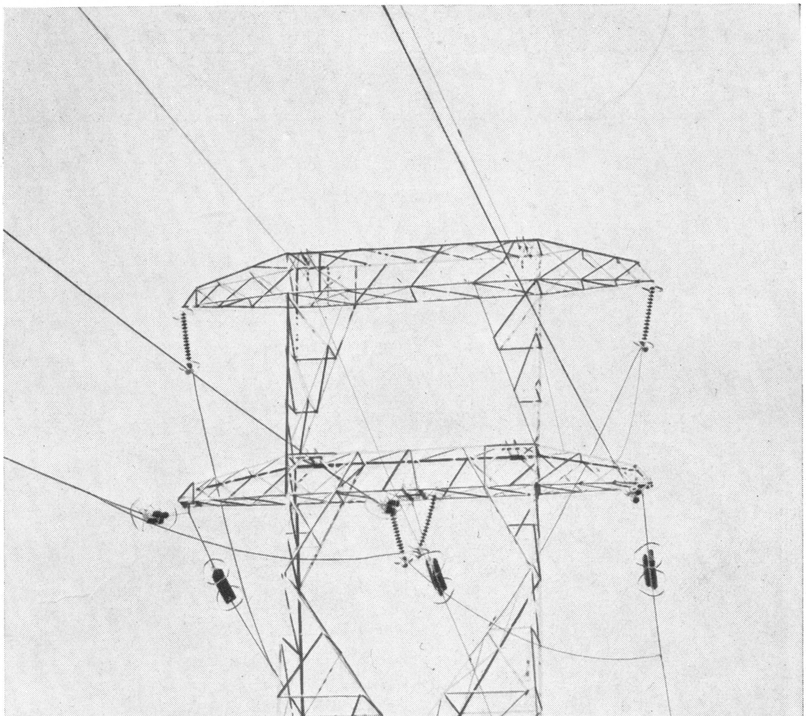
No. 13720



No. 8435

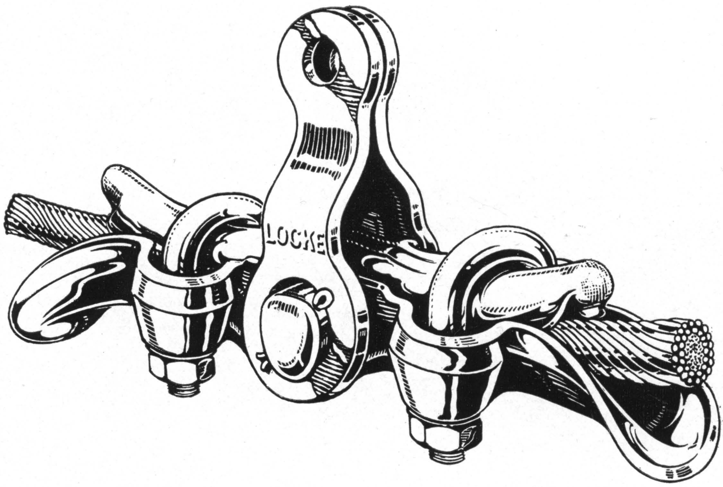
TOWER FITTINGS
FOR SOCKET AND HEWLETT TYPE INSULATORS

Catalog No.	Code Word	Material	Type Insulator	Ultimate Strength	Pounds per C Packed
27260	HOXRY	Forged Steel	Socket	20,000	196
13720	DUZTA	Forged Steel	Socket	25,000	211
8435	VUITC	Forged Steel	Hewlett	18,000	175



A TRANSPOSITION TOWER ON THE SIEGFRIED PHILADELPHIA LINE OF THE PENNSYLVANIA POWER AND LIGHT COMPANY

Locke Suspension Clamps



TRUNNION TYPE

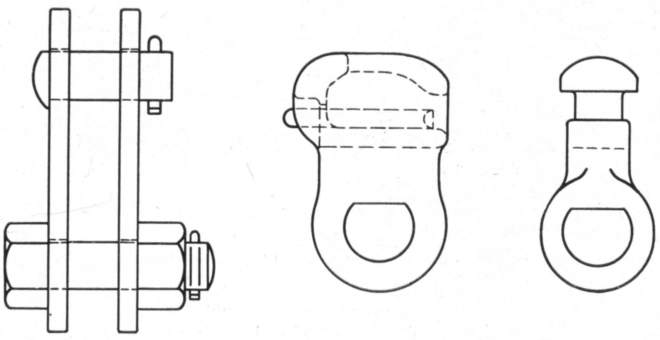
The Locke trunnion type clamps were designed to minimize conductor crystallization. This has been done by placing the point of support on the center line of the cable and pivoting the body at the approximate point of the center of gravity. This decreases the moment of inertia of the body and allows free oscillation of the body to follow the vertical vibrations of the conductor.

These clamps are made with a curved seat of long radius to fit the natural curve of the conductor. The keeper clamps the conductor only on this long radius so that there is no upward bend around the ends of the keeper even at the minimum take-off angle of 4°. The lips at the end of the body are designed to accommodate take-off angles from 7° to 45° without causing any sharp bend in the conductor.

The trunnion allows automatic alignment of the clamp with the conductor. This feature makes this clamp the only one suitable for use in semi-anchor positions.

All parts of these clamps are forged copper-bearing steel. Arcing horns of round rod welded to the keeper can be furnished. These rods are $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in. respectively, according to the size of the clamp. A 24-inch spread is standard for these horns but other spreads can be had if desired. See page 139.

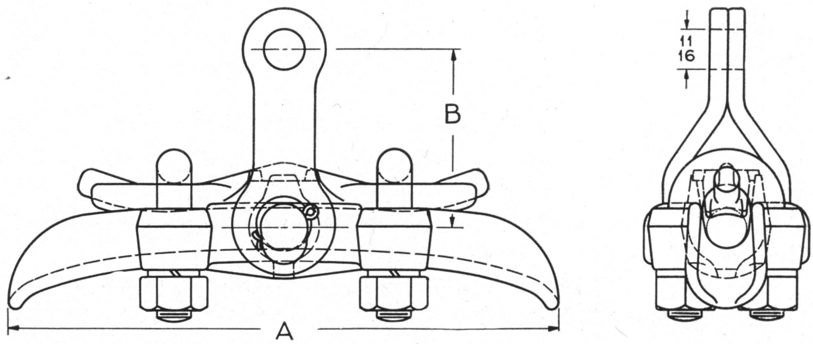
Trunnion clamps are regularly furnished with U bolts. Where only moderate holding power is desired J bolts can be supplied instead.



Clevis Socket Hewlett

Connectors Used With Locke Trunnion and Side Opening Clamps

Aluminum liners, accurately fitted to the clamp and keeper can be furnished where these clamps are for use with all-aluminum conductor or A.C.S.R. Socket, clevis or Hewlett attachments are furnished as required. It should be noted that where these clamps are for use with grading shields the attachment is usually part of the shield.



Locke Trunnion Type Clamps

Without Connectors

Plain Cable Seat

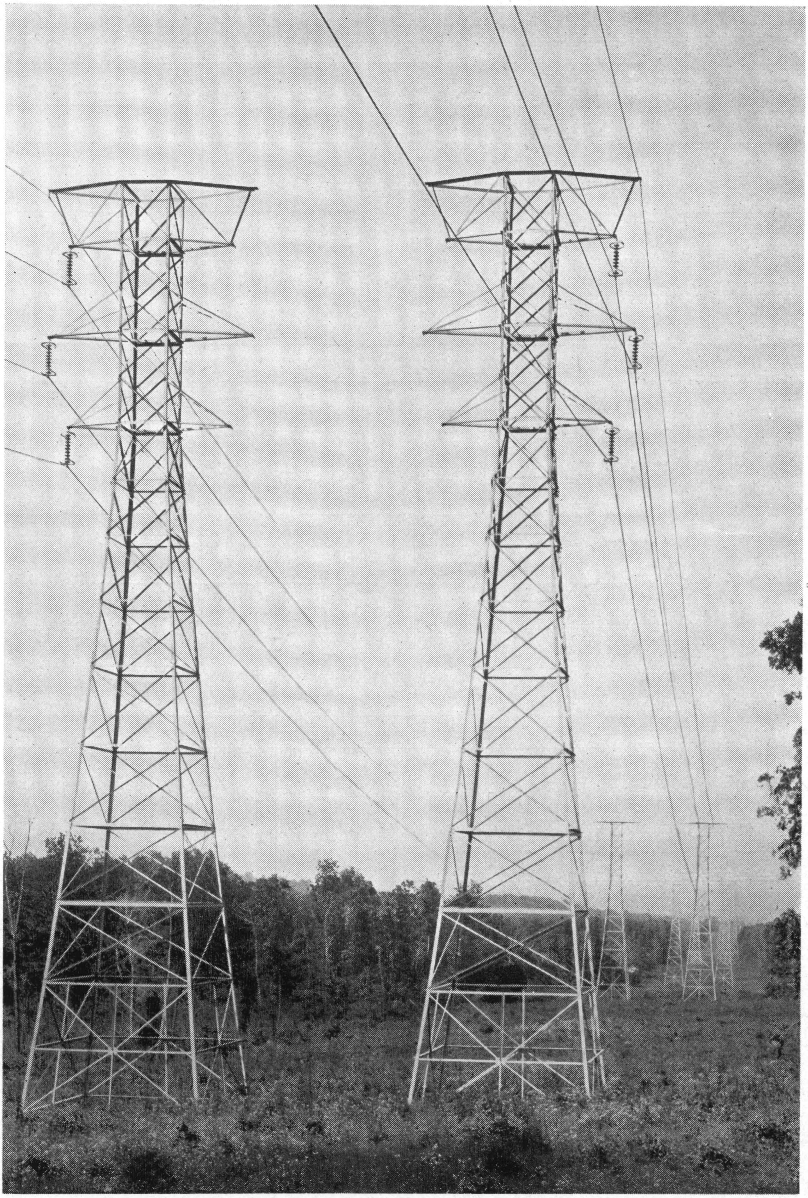
Catalog No.	Code Word	Dimensions in Inches		Minimum Cable Size	Groove Diameter	Lb. Each	
		A	B			Net	Pkd.
15075	BFAHF	9	$2\frac{15}{16}$	.25	.562	$4\frac{1}{4}$	$4\frac{3}{8}$
15076	BFAHG	10	$3\frac{3}{16}$	.437	.750	$5\frac{3}{4}$	$5\frac{7}{8}$
15077	BFAHH	11	$3\frac{7}{16}$	.687	1.000	7	$7\frac{1}{8}$
15078	BFAHI	12	$3\frac{7}{16}$	.937	1.25	9	$9\frac{1}{8}$
			With Aluminum Liners				
20150	CABFA	9	$2\frac{15}{16}$	.187	.500	$4\frac{1}{4}$	$4\frac{3}{8}$
20151	CABFB	10	$3\frac{3}{16}$	.375	.687	$5\frac{3}{4}$	$5\frac{7}{8}$
20152	CABFC	11	$3\frac{7}{16}$	.625	.937	7	$7\frac{1}{8}$
20153	CABFD	12	$3\frac{7}{16}$	.875	1.187	9	$9\frac{1}{8}$

Where clamps are furnished with connectors as listed on the following page, "B" dimension is measured from the center of the cable to the connecting point of the line insulator.

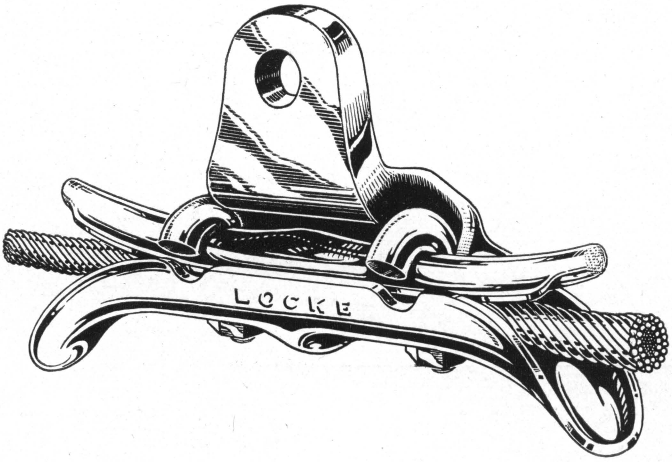
These clamps can be furnished with arcing horns as shown on page 139.

Locke Trunnion Type Clamps

Catalog No.	Code Word	Dimensions in In. A	Dimensions in In. B	Minimum Cable Size	Groove Diameter	Lb. Each Net	Lb. Each Pkd.
With Socket Type Connector							
Plain Cable Seat							
20102	NIMPT	9	5	.25	.562	5¾	6⅞
20108	NIMSZ	10	5¼	.437	.750	7¼	7⅜
20114	NIMUX	11	5½	.678	1.000	8½	8⅝
20120	NIMVZ	12	5½	.937	1.52	10½	10⅝
With Aluminum Liners							
20103	NIMXO	9	5	.187	.500	5¾	6⅞
20109	NIMYS	10	5¼	.375	.687	7¼	7⅜
20115	NINAC	11	5½	.625	.937	8½	8⅝
20121	NINCF	12	5½	.875	1.187	10½	10⅝
With Clevis Type Connector							
Plain Cable Seat							
20104	NIMAR	9	$5\frac{7}{16}$	.25	.562	5¾	6⅞
20110	NIMCE	10	$5\frac{11}{16}$	.437	.750	7¼	7⅜
20116	NIMDH	11	$5\frac{15}{16}$	.687	1.000	8½	8⅝
20122	NIMEP	12	$5\frac{15}{16}$	.937	1.25	10½	10⅝
With Aluminum Liners							
20105	NIMHU	9	$5\frac{7}{16}$	.187	.500	5¾	6⅞
20111	NIMIF	10	$5\frac{11}{16}$	.375	.687	7¼	7⅜
20117	NIMLA	11	$5\frac{15}{16}$	.625	.937	8½	8⅝
20123	NIMOK	12	$5\frac{15}{16}$	.875	1.187	10½	10⅝
With Hewlett Type Connector							
Plain Cable Seat							
20106	NINDI	9	4¾	.25	.562	5	5⅛
20112	NINEL	10	5	.437	.750	6½	6⅝
20118	NINFO	11	5¼	.687	1.000	7¾	7⅞
20124	NINGS	12	5¼	.937	1.25	9¾	9⅞
With Aluminum Liners							
20107	NINHY	9	4¾	.187	.500	5	5⅛
20113	NINIZ	10	5	.375	.687	6½	6⅝
20119	NINKE	11	5¼	.625	.937	7¾	7⅞
20125	NHYXE	12	5¼	.875	1.187	9¾	9⅞



LOCKE NO. 18400 INSULATORS AND LOCKE GRADING SHIELDS ON THE ROSELAND-WEST ORANGE 132-KV. LINE OF THE PUBLIC SERVICE ELECTRIC AND GAS COMPANY [NEW JERSEY]



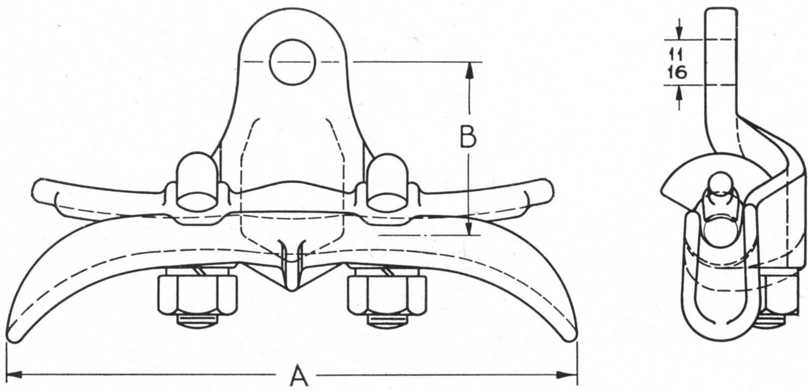
SIDE OPENING TYPE

The side opening feature, originated by the Locke Insulator Corporation has been of real benefit to transmission engineers and has met with considerable favor for hot line work.

These clamps are made with a curved seat of long radius to fit the natural curve of the conductor. The keeper clamps the conductor only on this long radius so that there is no upward bend around the ends of the keeper at the minimum take-off angle. The lips at the end of the body are designed to accommodate take-off angles from 7° to 45° without causing any sharp bend in the conductor.

The body of this clamp is malleable iron and the keeper is forged steel. Arcing horns of round rod welded to the keeper can be furnished. These rods are 3/8, 1/2, 5/8 and 3/4 in. in diameter respectively, according to the size of the clamp. A 24-inch spread is standard for these horns but other spreads can be made if desired.

Aluminum liners, accurately fitted to the clamp and keeper can be furnished where these clamps are for use with all aluminum conductor or A.C.S.R. Socket, clevis or Hewlett attachments are furnished as required. It should be noted that where these clamps are for use with grading shields the attachment is usually part of the shield.



Locke Side Opening Clamps

Without Connectors

Plain Cable Seat

Catalog No.	Code Word	Dimensions in Inches A	Dimensions in Inches B	Minimum Cable Size	Groove Diameter	Lb. Each Net	Lb. Each Pkd.
13916	BDJBG	9	2⅝	.25	.562	4	4⅛
13917	BDJBH	10	2½	.437	.750	5¾	5⅞
13918	BDJBI	11	2⅞	.687	1.000	8	8⅛
13919	BDJBJ	12	3⅛	.937	1.25	9½	9⅝
With Aluminum Liners							
20154	CABFE	9	2⅝	.187	.500	4	4⅛
20155	CABFF	10	2½	.375	.687	5¾	5⅞
20156	CABFG	11	2⅞	.625	.937	8	8⅛
20157	CABFH	12	3⅛	.875	1.187	9½	9⅝

Where clamps are furnished with connectors as listed on the following page, "B" dimension is measured from the center of the cable to the connecting point of the line insulator.

These clamps can be furnished with arcing horns as shown on page 139.

LOCKE SIDE OPENING CLAMPS

Catalog No.	Code Word	DIMENSIONS IN IN. A	DIMENSIONS IN IN. B	Minimum Cable Size	Groove Diameter	LB. EACH Net	LB. EACH Pkd.
WITH SOCKET TYPE CONNECTOR							
PLAIN CABLE SEAT							
20126	NASSU	9	$4\frac{11}{16}$	.25	.562	$5\frac{1}{2}$	$5\frac{5}{8}$
20132	NASUH	10	$4\frac{9}{16}$	.437	.750	$7\frac{1}{4}$	$7\frac{3}{8}$
20138	NASYM	11	$4\frac{15}{16}$	.687	1.000	$9\frac{1}{2}$	$9\frac{5}{8}$
20144	NASZT	12	$5\frac{3}{16}$	.937	1.25	11	$11\frac{1}{8}$
WITH ALUMINUM LINERS							
20127	NAZTE	9	$4\frac{11}{16}$	.187	.500	$5\frac{1}{2}$	$5\frac{5}{8}$
20133	NAZUL	10	$4\frac{9}{16}$	.375	.687	$7\frac{1}{4}$	$7\frac{3}{8}$
20139	NAZYU	11	$4\frac{15}{16}$	.625	.937	$9\frac{1}{2}$	$9\frac{5}{8}$
20145	NEAAN	12	$5\frac{3}{16}$	.875	1.187	11	$11\frac{1}{8}$
WITH CLEVIS TYPE CONNECTOR							
PLAIN CABLE SEAT							
20128	NIKOH	9	$5\frac{1}{8}$	.25	.562	$5\frac{1}{2}$	$5\frac{5}{8}$
20134	NIKRU	10	5	.437	.750	$7\frac{1}{4}$	$7\frac{3}{8}$
20140	NIKTA	11	$5\frac{3}{8}$	.687	1.000	$9\frac{1}{2}$	$9\frac{5}{8}$
20146	NIKUV	12	$5\frac{5}{8}$	.937	1.25	11	$11\frac{1}{8}$
WITH ALUMINUM LINERS							
20129	NILPS	9	$5\frac{1}{8}$	.187	.500	$5\frac{1}{2}$	$5\frac{5}{8}$
20135	NILSY	10	5	.375	.687	$7\frac{1}{4}$	$7\frac{3}{8}$
20141	NILUB	11	$5\frac{3}{8}$	.625	.937	$9\frac{1}{2}$	$9\frac{5}{8}$
20147	NILVH	12	$5\frac{5}{8}$	.875	1.187	11	$11\frac{1}{8}$
WITH HEWLETT TYPE CONNECTOR							
PLAIN CABLE SEAT							
20130	NEABR	9	$4\frac{1}{2}$	.25	.562	$4\frac{3}{4}$	$4\frac{7}{8}$
20136	NEACU	10	$4\frac{3}{8}$	.437	.750	$6\frac{1}{2}$	$6\frac{5}{8}$
20142	NEADX	11	$4\frac{3}{4}$	.687	1.000	$8\frac{3}{4}$	$8\frac{7}{8}$
20148	NEAFD	12	5	.937	1.25	$10\frac{1}{4}$	$10\frac{3}{8}$
WITH ALUMINUM LINERS							
20131	NEAHJ	9	$4\frac{1}{2}$	.187	.500	$4\frac{3}{4}$	$4\frac{7}{8}$
20137	NEAIM	10	$4\frac{3}{8}$	.375	.687	$6\frac{1}{2}$	$6\frac{5}{8}$
20143	NEAJP	11	$4\frac{3}{4}$	.625	.937	$8\frac{3}{4}$	$8\frac{7}{8}$
20149	NEAKT	12	5	.875	1.187	$10\frac{1}{4}$	$10\frac{3}{8}$

VIBRATION DAMPER TYPE

For use with the Aluminum Company of America's line of vibration damper rods as applied to A.C.S.R. the Locke Insulator Company has developed a line of clamps combining maximum efficiency with simplicity. These clamps are of the trunnion type and embody all the advantages previously described.

They are forged from copper-bearing steel, thoroughly and smoothly galvanized. The keeper clamps the conductor only on the long radius of the body so that there is no upward bend around the ends of the keeper at minimum take-off angles.

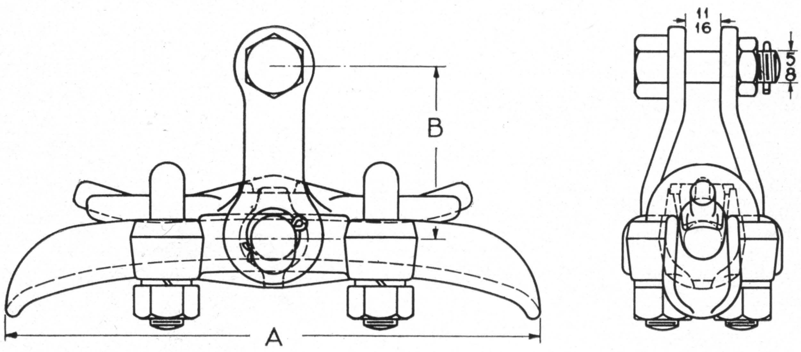
Being of trunnion type with the support on the center line of the conductor, they decrease the moment of inertia and allow the clamp to follow the vertical vibrations of the conductor as well as permitting automatic alignment of clamp with conductor.

The lips at the end of the body accommodate take-off angles from 3½ deg. to 45 deg. without a sharp bend in the conductor. This contrasts very favorably with the average clamp which will accommodate only angles from approximately 4 deg. to 14 deg. without such bending.

For use with vibration damper rods no aluminum liners are necessary.

Socket, clevis or Hewlett attachments are furnished as required. It should be noted that where these clamps are for use with grading shields the attachment is usually part of the shield.

Where desired these clamps can be supplied with arcing horns welded to the keeper.

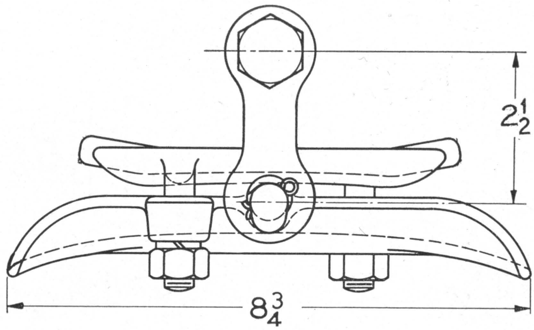


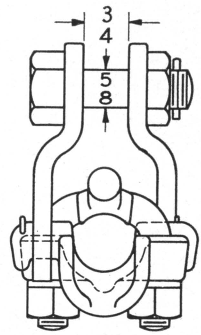
Locke Vibration Damper Clamps
Trunnion Type

Catalog No.	Code Word	Dimensions in Inches		Minimum Cable Size	Groove Dia.	Lb. Each	
		A	B			Net	Pkd.
20069	CAAGJ	9	$3\frac{3}{16}$	0.25	0.625	$5\frac{1}{4}$	$5\frac{3}{8}$
20078	CAAHI	10	$3\frac{1}{2}$	0.437	0.813	$6\frac{1}{4}$	$6\frac{3}{8}$
20077	CAAHH	11	$3\frac{9}{16}$	0.687	1.063	$7\frac{3}{4}$	$7\frac{7}{8}$
20035	CAADF	12	$3\frac{9}{16}$	0.937	1.313	$10\frac{3}{4}$	$10\frac{7}{8}$

These clamps are furnished with Connector No. 43060, shown on page 71, for use with clevis type insulators or with Connector No. 8007, shown on page 76, for use with Hewlett type insulators. For use with socket type insulators clamps 20069 and 20078 are furnished with Connector No. 8407, shown on page 82, Connector No. 27046, shown on page 82, being furnished with clamps 20077 and 20035.

These clamps can be furnished with arcing horns as shown on page 139.



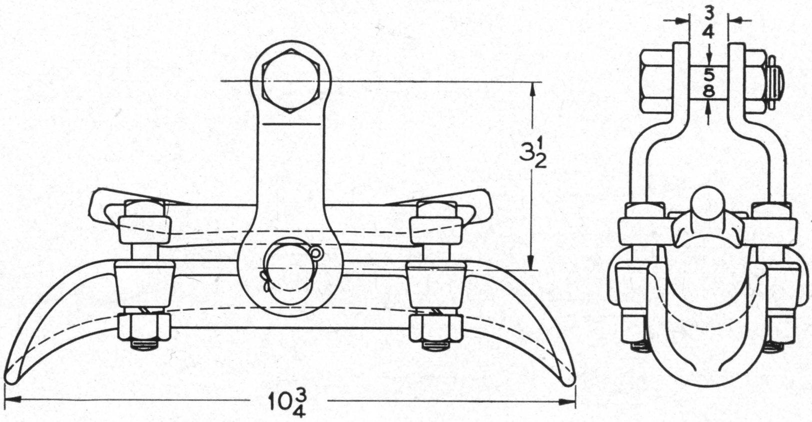


LOCKE VIBRATION DAMPER CLAMPS
TRUNNION TYPE

Catalog No.	Code Word	Minimum Cable Size	Groove Diameter	LB. EACH	
				Net	Pkd.
20062	CAAGC	0.775	1.062	$3\frac{3}{4}$	$3\frac{7}{8}$
20063	CAAGD	1.000	1.312	4	$4\frac{1}{8}$

These clamps are furnished with Connector No. 43060, shown on page 71, for use with clevis type insulators, with Connector No. 8407, shown on page 82, for use with socket type insulators or with Connector No. 8007, shown on page 76, for use with Hewlett type insulators.

These clamps can be furnished with arcing horns as shown on page 139.

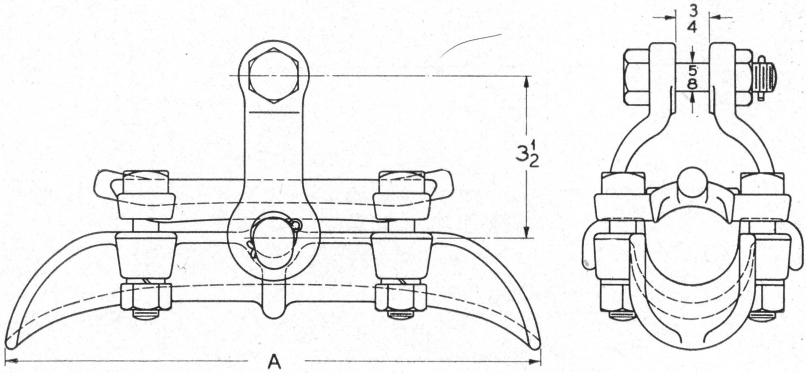


LOCKE VIBRATION DAMPER CLAMPS
TRUNNION TYPE

Catalog No.	Code Word	Minimum Cable Size	Groove Diameter	LB. EACH	
				Net	Pkd.
20064	CAAGE	1.250	1.500	8¼	8⅜
20065	CAAGF	1.490	1.781	9	9⅛

These clamps are furnished with Connector No. 43060, shown on page 71, for use with clevis type insulators, with Connector No. 8407, shown on page 82, for use with socket type insulators or with Connector No. 8007, shown on page 76, for use with Hewlett type insulators.

These clamps can be furnished with arcing horns as shown on page 139.

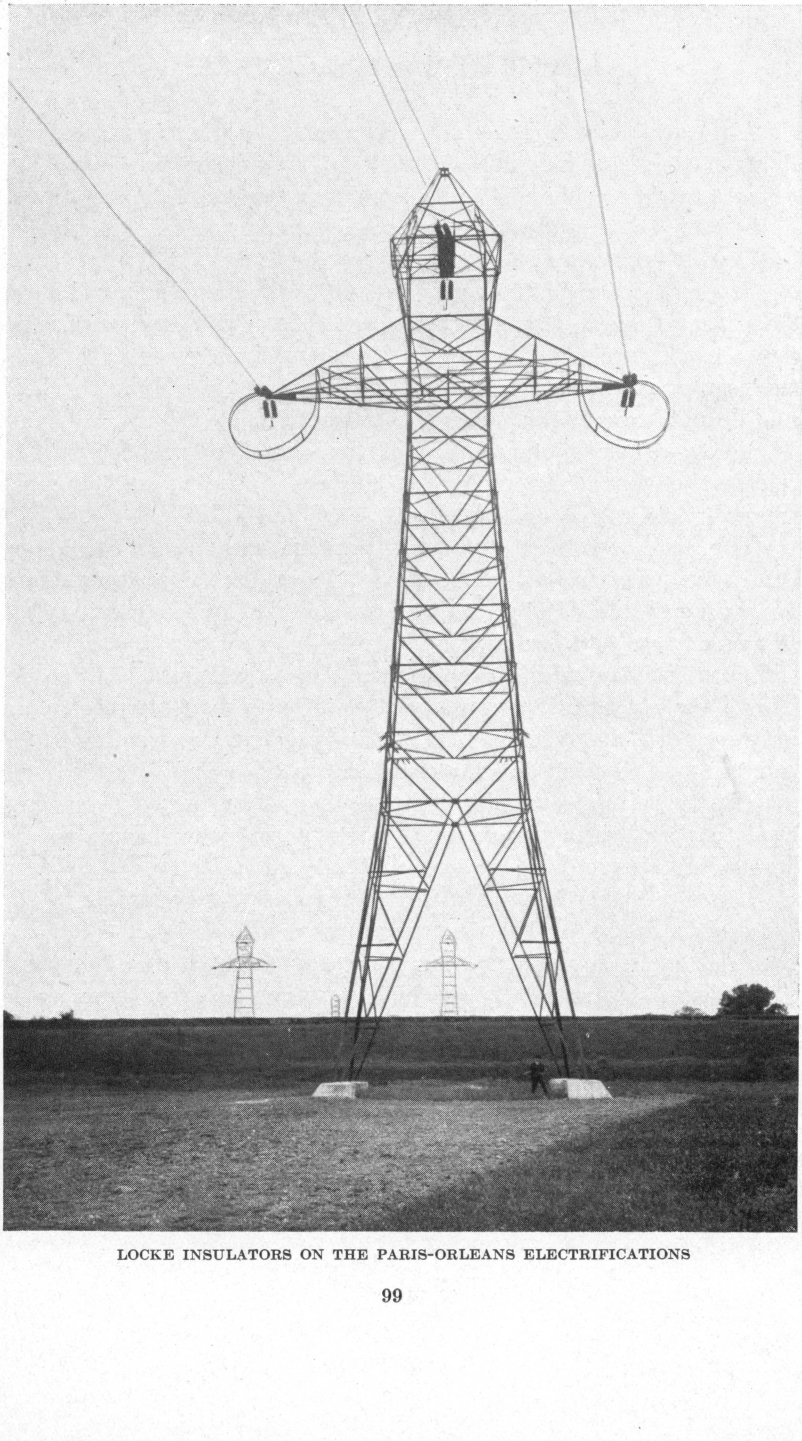


Locke Vibration Damper Clamps
Trunnion Type

Catalog No.	Code Word	Dimensions in Inches A	Minimum Cable Size	Groove Diameter	Lb. Each Net	Lb. Each Pkd.
20066	CAAGG	11½	1.670	2.000	11¼	11⅜
20067	CAAGH	12	1.920	2.250	12⅝	12¾

These clamps are furnished with Connector No. 43060, shown on page 71, for use with clevis type insulators, with Connector No. 27046, shown on page 82, for use with socket type insulators or with Connector No. 8007, shown on page 76, for use with Hewlett type insulators.

These clamps can be furnished with arcing horns as shown on page 139.



LOCKE INSULATORS ON THE PARIS-ORLEANS ELECTRIFICATIONS

LOCKE RELEASING CLAMPS

A releasing clamp frequently represents a real insurance against damage to structures in the event of conductor breakage, but unfortunately the majority of the clamps designed for this purpose have been so complicated and needed such precise installation that engineers have hesitated to adopt them.

These objections have been removed by Locke releasing clamps. They are simple in construction, positive in action, and require no delicate adjustments. Having no springs and no more parts than the regular suspension clamps they are easy to handle in the field and do not hamper the speed of construction.

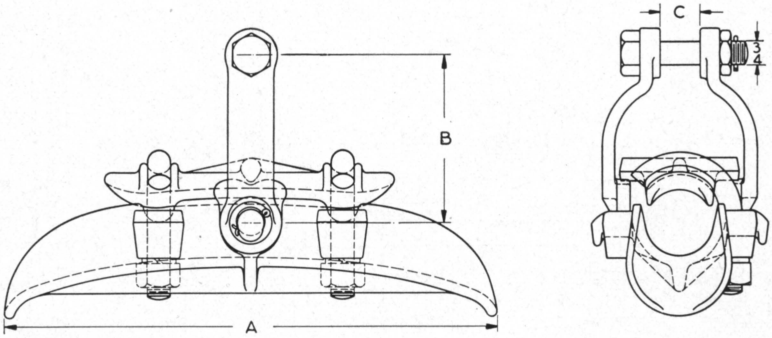
Locke releasing clamps are of the cam lift type designed to release the cable at an angle of 25 degrees plus of minus 5 degrees from vertical with a dead load of 1200 pounds.

The action of these clamps is positive and, under the above conditions, practically instantaneous. When the supporting straps are swung to one side by an unbalanced condition the cams on the straps engage lugs on either side of the keeper. This provides sufficient mechanical lift to spring the J bolts and release the cable. This lift is not sufficient to deform the J bolts with the result that on the return of the string to a vertical position the J bolts resume their normal position and the clamp again grips the cable.

The material from which these clamps are forged is a high-grade copper bearing steel and all parts except the bronze spring cotters are thoroughly and smoothly galvanized.

Locke releasing clamps have been made and furnished in the three sizes shown on the next page but can be furnished for any required cable. For information on clamps of this type the exact size of conductor must be specified, whether liners or armor rods are to be used, and either the approximate length of span or the vertical load.

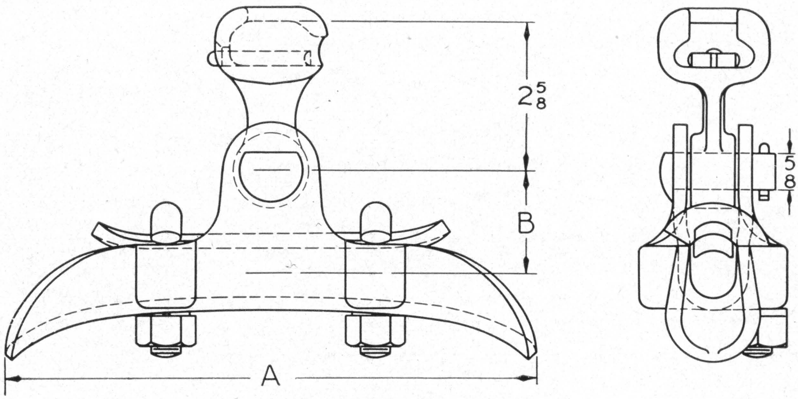
These clamps attach directly to Locke Grading Shields. Where no shields are used suitable connectors as listed on the next page can be furnished.



LOCKE RELEASING CLAMPS

Catalog No.	Code Word	DIMENSIONS			Groove Dia.	ACSR with Liners	ACSR Armor Rods	LB. EACH	
		A	B	C				Net	Pkd.
20100	EXUDE	13	4⅝	1	0.814	300,000 cm.	1/0	11¼	15
20101	EXUEG	16	4⅝	1¼	1.240	795,000 cm.	266,800 cm.	16	20
20044	EXOIN	16	5¼	1¼	2.250		795,000 cm. 874,500 cm. 900,000 cm.	20½	24

For attaching directly to socket type insulators use connector No. 43046 shown on page 83. For attaching directly to clevis type insulators use connector No. 43047 shown on page 72.

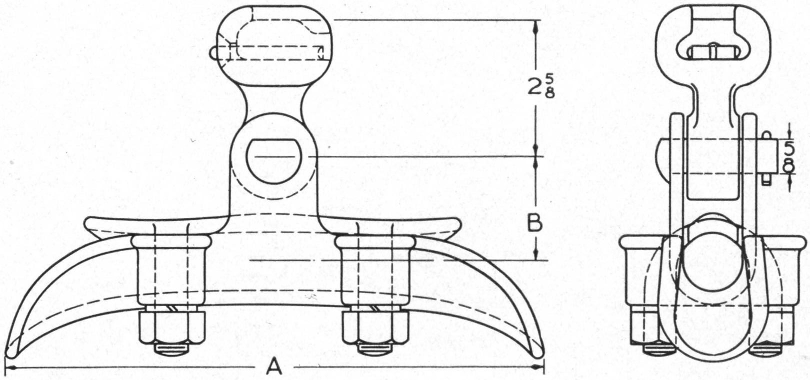


SUSPENSION CLAMPS

This pressed steel clamp has been especially designed for light duty service where an efficient inexpensive clamp is required.

Catalog No.	Code Word	DIMENSIONS IN INCHES		Minimum Cable Size	Groove Diameter	LB. EACH	
		A	B			Net	Pkd.
42201	LYXJE	7	$1\frac{9}{16}$	.162	.413	$2\frac{3}{4}$	$2\frac{7}{8}$
42202	LYXKH	9	$1\frac{3}{4}$	.413	.75	$4\frac{1}{2}$	$4\frac{3}{4}$
42203	LYXOU	10	$1\frac{15}{16}$	.75	1.06	$5\frac{3}{4}$	6

These clamps can be supplied with Clevis No. 43049 for use with clevis type insulators. Either clamp can be furnished with aluminum liners when specified.

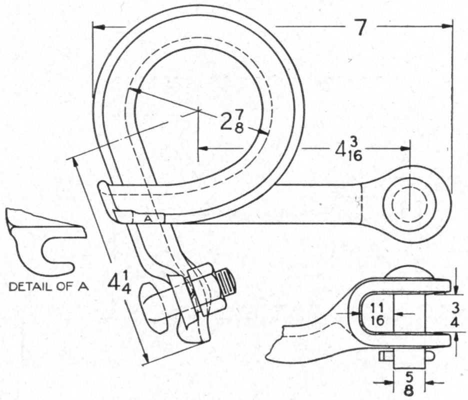


SUSPENSION CLAMPS

These forged steel clamps are made with the bolts an integral part of the keeper. This simplifies construction by reducing the number of loose parts to be handled in the field.

Catalog No.	Code Word	Dimensions in Inches		Minimum Cable Size	Groove Diameter	Lb. Each	
		A	B			Net	Pkd.
43203	MIEOG	10	$1\frac{15}{16}$	0.75	1.09	$6\frac{1}{4}$	$6\frac{1}{2}$
43204	MIEPJ	10	$2\frac{1}{8}$	1.09	1.44	$8\frac{1}{4}$	$8\frac{5}{8}$
43205	MIERM	12	$2\frac{1}{4}$	1.44	1.72	10	$10\frac{1}{2}$
43206	MIESP	12	$2\frac{7}{16}$	1.72	1.95	$10\frac{3}{4}$	$11\frac{3}{8}$
43207	MIEUW	12	$2\frac{9}{16}$	1.95	2.25	13	$13\frac{5}{8}$

These clamps can be supplied with Clevis No. 43047 for use with clevis type insulators. Either clamp can be furnished with aluminum liners when specified.



Strain Clamp No. 20087

Forged Steel

Clamp No. 20087 is a light, efficient, and economical dead end clamp for power lines, distribution circuits, substation buses, etc. This clamp is designed to take care of the entire range of conductors ordinarily used for this work.

The clamp may be used in either position to run the jumper above or below the cross-arm. It derives its holding power from the combined 270° of snubbing and the wedging action in the V-shaped groove.

The clamp is recommended for the following conductors:

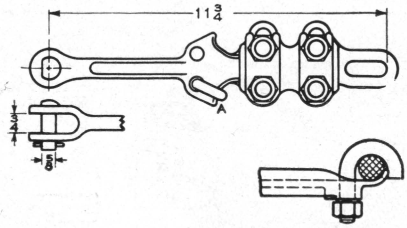
Copper:	
Bare, Solid	No. 6 to 2/0
Bare, Stranded	No. 7 to 4/0
T. B. W. P.	No. 9 to No. 1

For heavier T. B. W. P. insulation should be stripped and keeper clamped over bare conductor.

Aluminum:	
All Aluminum	No. 4 to 4/0
A.C.S.R. with flat armor wire	No. 4, 3 & 2

Net weight, each	2½ lb.
Packed weight, each	2⅝ lb.
Standard package	Bag 25

Code Word . . . . EXSZO



FOUR-BOLT TYPE STRAIN CLAMPS

This is a light duty clamp having a straight cableway that does not distort the conductor. The keeper, which is attached with machine bolts, distributes the pressure so that the conductor is not injured. Protecting sleeves are not necessary except in special cases.

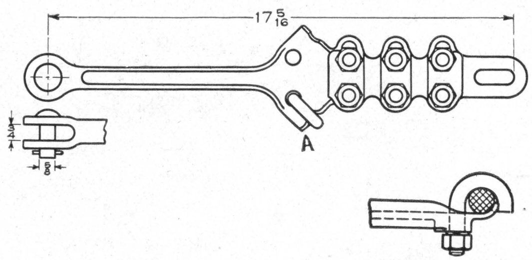
Slip strength with copper cable approximately 4,000 pounds.

For details of arcing horn attachment see page 145.

Connectors as listed are furnished with these clamps.

Catalog No.	Code Word	Connector No.	Insulator	Diameter Cable, Inches	LB. EACH Net	LB. EACH Pkd.
3304-G1	LYKON	None	Clevis Type	.188—.375	4	4⅛
3304-G2	VEAXK	8407	Socket Type	.188—.375	5¼	5⅜
3304-G3	VEAYN	8007	Hewlett Type	.188—.375	4¼	4⅜
3305-G1	LYNCE	None	Clevis Type	.375—.563	4¼	4⅜
3305-G2	VEBAH	8407	Socket Type	.375—.563	5½	5⅝
3305-G3	VEBBY	8007	Hewlett Type	.375—.563	4½	4⅝

Material: Clamp parts malleable iron, bolts steel.
All parts supplied hot galvanized except brass spring cotters.



SIX-BOLT TYPE STRAIN CLAMPS

These clamps have a long straight cableway, that does not distort the conductor. The keeper, which is attached with machine bolts, distributes the pressure so that the conductor is not injured. Protecting sleeves are not necessary except in special cases.

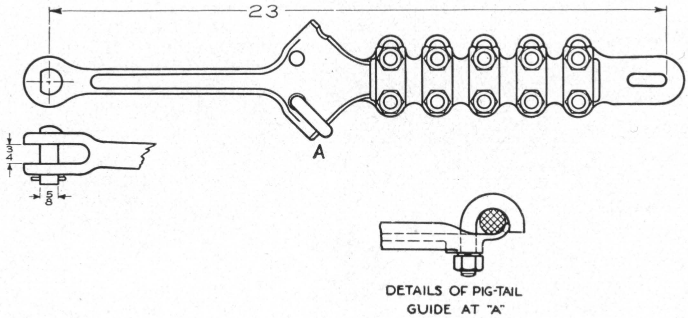
Slip strength with copper cable from 5,000 to 7,500 pounds depending on the diameter of cable.

For details of arcing horn attachments see page 145.

Connectors as listed are furnished with these clamps.

Catalog No.	Code Word	Connector No.	Insulator	Diameter Cable, Inches	LB. EACH	
					Net	Pkd.
3032–G1	USABA	None	Clevis Type	.250—.438	7	7⅛
3032–G2	VAYLB	8407	Socket Type	.250—.438	8	8⅛
3032–G3	VAYME	8007	Hewlett Type	.250—.438	7¼	7⅜
3033–G1	USBEG	None	Clevis Type	.438—.625	7	7⅛
3033–G2	VAYNE	8407	Socket Type	.438—.625	7¾	7⅞
3033–G3	VAYOK	8007	Hewlett Type	.438—.625	7½	7⅝
3034–G1	USINE	None	Clevis Type	.625—.750	7	7⅛
3034–G2	VAYSU	8407	Socket Type	.625—.750	8¼	8⅜
3034–G3	VAYUA	8007	Hewlett Type	.625—.750	7½	7⅝

Material: Main clamp parts forged steel, keepers malleable iron, bolts, nuts and lock washers, steel.
All parts supplied hot galvanized except brass spring cotters.



TEN-BOLT TYPE STRAIN CLAMPS

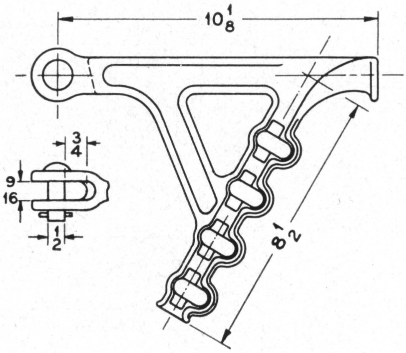
These heavy duty clamps have a long straight cableway, that does not distort the conductor. The keeper, which is attached with machine bolts, distributes the pressure so that the conductor is not injured. Protecting sleeves are not necessary except in special cases.

Slip strength with copper cable from 8,000 to 15,000 pounds depending on the diameter of cable. For details of arcing horn attachment see page 145.

Connectors as listed are furnished with these clamps.

Catalog No.	Code Word	Connector No.	Insulator	Diameter Cable, Inches	LB. EACH	
					Net	Pkd.
3109-G1	LUCMO	None	Clevis Type	.500— .625	11½	11⅝
3109-G2	VAYAH	8407	Socket Type	.500— .625	13	13⅛
3109-G3	VAYCZ	8007	Hewlett Type	.500— .625	12	12⅛
3110-G1	LUDDT	None	Clevis Type	.625— .750	12	12⅛
3110-G2	VAYEF	8407	Socket Type	.625— .750	13	13⅛
3110-G3	VAYFI	8007	Hewlett Type	.625— .750	12¾	12⅞
3111-G1	LUGRE	None	Clevis Type	.750—1.000	12	12⅛
3111-G2	VAYGL	8407	Socket Type	.750—1.000	13½	13⅜
3111-G3	VAYHO	8007	Hewlett Type	.750—1.000	12½	12⅝

Material: Malleable iron, steel bolts, nuts and lock washers.
All parts supplied hot galvanized except brass spring cotters.



STRAIN CLAMP NO. 10755

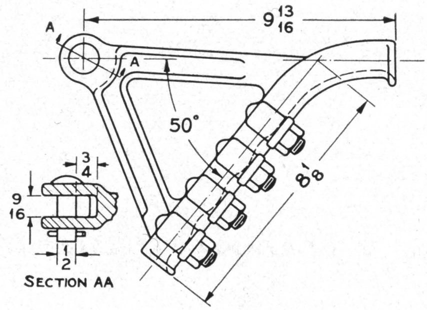
This clamp is designed for use with either clevis, socket or Hewlett type insulators by use of connectors listed below.

Arcing horns may be attached as shown on page 146.

Cable diameter	.187 in.—.500 in.
Net weight each	5 1/4 lb.
Packed weight each	5 3/8 lb.

CODE WORD . . . . WUIAY

Connector No. 9864 for Clevis Type Insulator—see page 66.
Connector No. 8407 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 11040

This clamp is designed for use with either clevis, socket or Hewlett type insulators by use of connectors listed below.

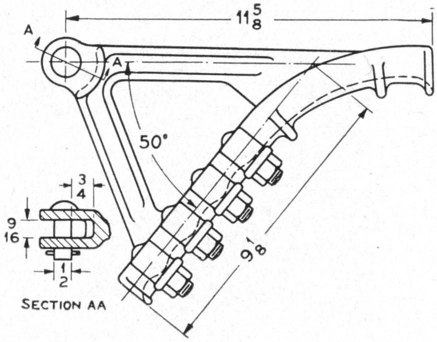
This clamp can be furnished with aluminum liners as Clamp No. 73613.

Arcing horns may be attached as shown on page 146.

Cable diameter	.312 in.—.687 in.
Cable diameter with liners	.212 in.—.587 in.
Net weight each	7½ lb.
Packed weight each	7⅝ lb.

CLAMP NO.	CODE WORD
11040	VUIOP
73613	VUIXO

Connector No. 9864 for Clevis Type Insulator—see page 66.
Connector No. 8407 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 11328

This clamp is designed for use with either clevis, socket or Hewlett type insulators by use of connectors listed below.

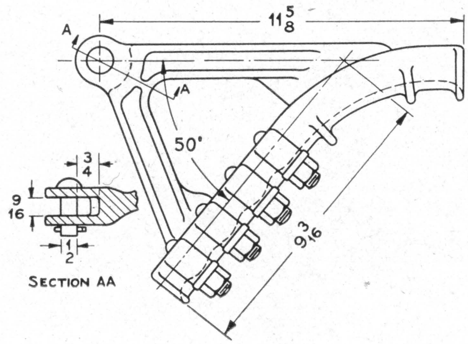
This clamp can be furnished with aluminum liners as Clamp No. 73618.

Arcing horns may be attached as shown on page 146.

Cable diameter	.375 in.—.750 in.
Cable diameter with liners	.275 in.—.650 in.
Net weight each	7½ lb.
Packed weight each	7⅝ lb.

CLAMP NO.	CODE WORD
11328	VUIJA
73618	VUJFL

Connector No. 9864 for Clevis Type Insulator—see page 66.
Connector No. 8407 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 12926

This clamp is designed for use with either clevis, socket or Hewlett type Insulators by use of connectors listed below.

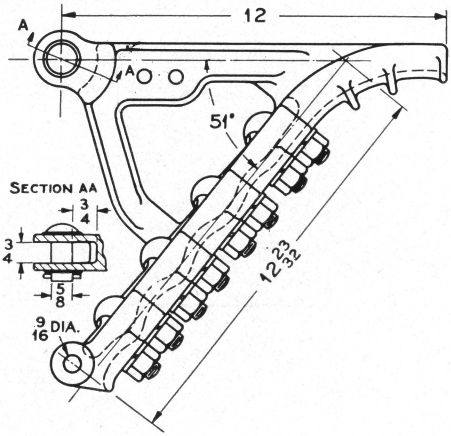
This clamp can be furnished with aluminum liners as Clamp No. 73623.

Arcing horns may be attached as shown on page 146.

Cable diameter	.625 in.—1.125 in.
Cable diameter with liners	.525 in.—1.025 in.
Net weight each	9 lb.
Packed weight each	9½ lb.

Clamp No.	Code Word
12926	VUILG
73623	VUJSA

Connector No. 9864 for Clevis Type Insulator—see page 66.
Connector No. 8407 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP No. 71095

This clamp is designed for use with high-strength conductor such as aluminum, steel-reinforced. It has a long smooth seat and a curve of large radius. With this clamp it is not necessary to separate the steel from the aluminum for separate gripping.

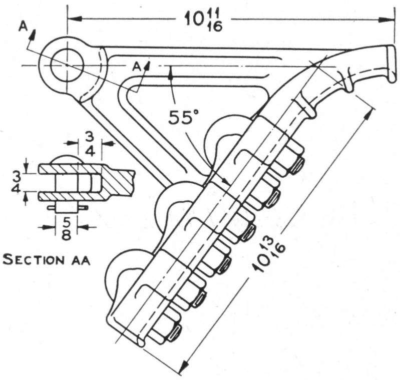
This clamp can be furnished with aluminum liners as Clamp No. 73510.

Arcing horns may be attached as shown on page 146.

Cable diameter	.310 in.—.600 in.
Cable diameter with liners	.210 in.—.500 in.
Net weight each	11¼ lb.
Packed weight each	12 lb.

Clamp No.	Code Word
71095	VUIEK
73510	VUBOS

Connector No. 9864 for Clevis Type Insulator—see page 66.
Connector No. 8407 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter. Clamps can be furnished in steel when special conditions make this necessary.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 11645

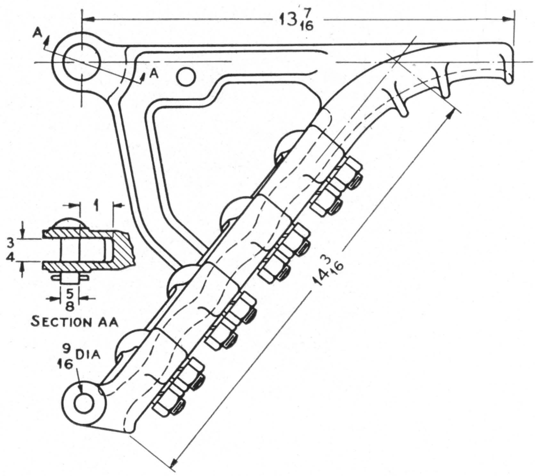
This clamp is designed for use with either clevis, socket or Hewlett type insulators by use of connectors listed below.

Arcing horns may be attached as shown on page 146.

Cable diameter	.437 in.—.625 in.
Net weight each	$11\frac{3}{4}$ lb.
Packed weight each	$12\frac{1}{4}$ lb.

CODE WORD . . . VUIHU

Connector No. 43060 for Clevis Type Insulator—see page 71.
Connector No. 27046 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Cast steel, bolts steel, brass spring cotter.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 72366

This clamp is designed for use with high-strength conductor such as aluminum, steel-reinforced. It has a long, smooth seat and a curve of large radius, so that the steel core will not cut into the outer strands of aluminum. With this clamp it is not necessary to separate the steel from the aluminum for separate gripping.

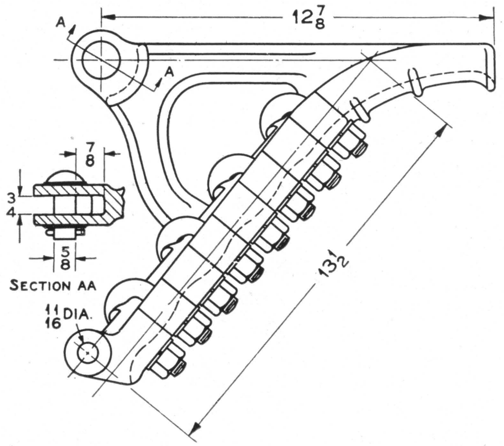
This clamp can be furnished with aluminum liners as Clamp No. 73512.

Arcing horns may be attached as shown on page 146.

Cable diameter	.500 in.—.660 in.
Cable diameter with liners	.400 in.—.560 in.
Net weight each	13½ lb.
Packed weight each	16 lb.

CLAMP NO.	CODE WORD
72366	WRAMT
73512	VUBUF

Connector No. 43060 for Clevis Type Insulator—see page 71.
Connector No. 27046 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter. Clamps can be furnished in steel when special conditions make this necessary.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 70231

This clamp is designed for use with high-strength conductor such as aluminum, steel-reinforced. It has a long smooth seat and a curve of large radius, so that the steel core will not cut into the outer strands of aluminum. With this clamp it is not necessary to separate the steel from the aluminum for separate gripping.

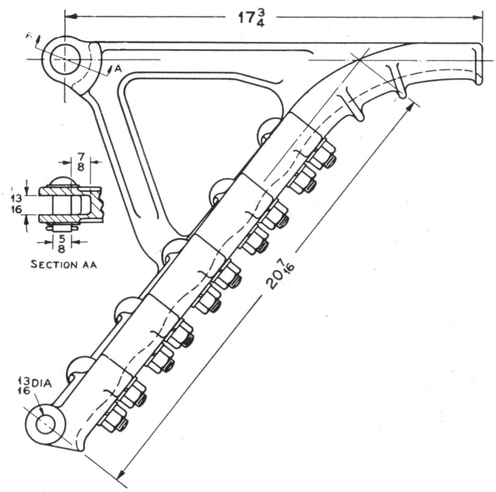
This clamp can be furnished with aluminum liners as Clamp No. 73514.

Arcing horns may be attached as shown on page 146.

Cable diameter	.625 in.—.825 in.
Cable diameter with liners	.525 in.—.725 in.
Net weight each	16¾ lb.
Packed weight each	16⅞ lb.

CLAMP NO.	CODE WORD
70231	VUIDH
73514	VUBYK

Connector No. 43060 for Clevis Type Insulator—see page 71.
Connector No. 27046 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotter. Clamps can be furnished in steel when special conditions make this necessary.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 71097

This clamp is designed for use with high strength conductor such as aluminum, steel-reinforced. It has a long smooth seat and a curve of large radius so that the steel core will not cut into the outer strands of aluminum. With this clamp it is not necessary to separate the steel from the aluminum for separate gripping.

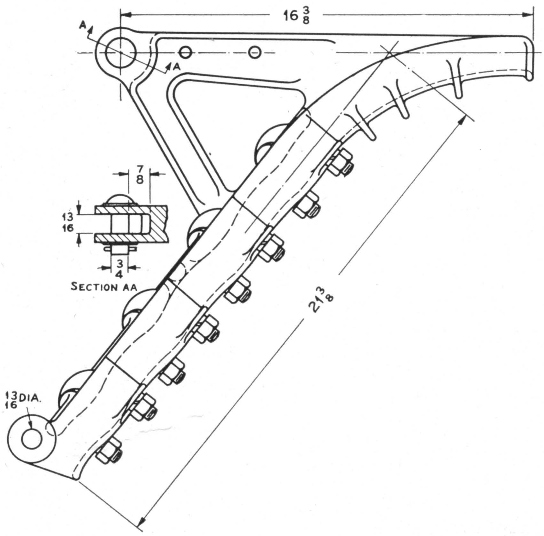
This clamp can be furnished with aluminum liners as Clamp No. 73516.

Arcing horns may be attached as shown on page 146.

Cable diameter	.750 in.—.980 in.
Cable diameter with liners	.650 in.—.880 in.
Net weight each	25 lb.
Packed weight each	29 lb.

CLAMP NO.	CODE WORD
71097	VUIFN
73516	VUCCY

Connector No. 43060 for Clevis Type Insulator—see page 71.
Connector No. 27046 for Socket Type Insulator—see page 82.
Connector No. 8007 for Hewlett Type Insulator—see page 76.
Material: Malleable iron, bolts steel, brass spring cotters. Clamps can be furnished in steel when special conditions make this necessary.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 73517

This clamp is designed for use with high strength conductor such as aluminum, steel-reinforced. It has a long smooth seat and a curve of large radius so that the steel core will not cut into the outer strands of aluminum. With this clamp it is not necessary to separate the steel from the aluminum for separate gripping.

This clamp can be furnished with aluminum liners as Clamp No. 73519.

Arcing horns may be attached as shown on page 146.

Cable diameter	.970 in.—1.200 in.
Cable diameter with liners	.870 in.—1.100 in.
Net weight each	27 lb.
Packed weight each	32 lb.

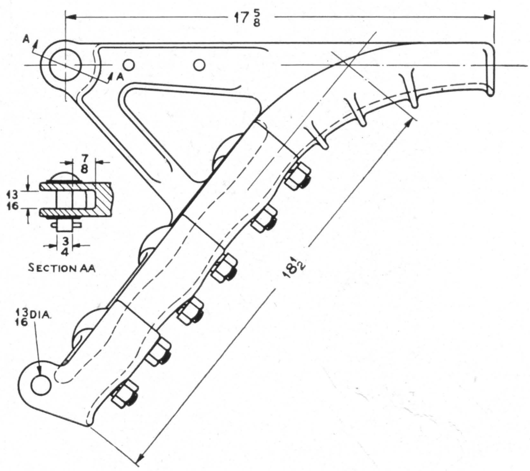
CLAMP NO.	CODE WORD
73517	WRARF
73519	VUCIL

These clamps are ordinarly used with yoke sets.

When required for direct attachment to suspension insulators suitable connectors will be supplied.

Material: Malleable iron, bolts steel, brass spring cotters. Clamps can be furnished in steel when special conditions make this necessary.

All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 72888

This clamp is designed for use with either clevis, socket or Hewlett type insulators by use of connectors listed below. This clamp can be furnished with aluminum liners as clamp No. 73626.

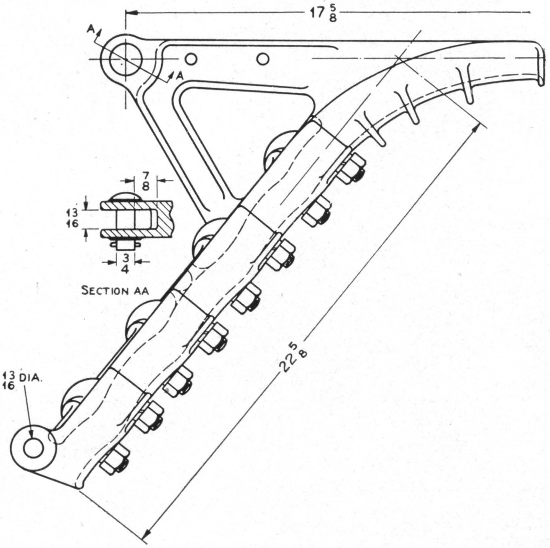
Where clamp is desired for steel-reinforced aluminum conductor, Clamp No. 73522 shown on page 119 is recommended.

Arcing horns may be attached as shown on page 146.

Cable diameter	1.0 in.—1.4 in.
Net weight each	27 lb.
Packed weight each	$32\frac{1}{2}$ lb.

CLAMP NO.	CODE WORD
72888	WRAOZ
73626	VUJRL

These clamps are ordinarily used with yoke sets.
When required for direct attachment to suspension insulators suitable connectors will be supplied.
Material: Malleable iron, bolts steel, brass spring cotter.
All parts supplied hot galvanized except spring cotter.



STRAIN CLAMP NO. 73520

This clamp is designed for use with high-strength conductor such as aluminum, steel-reinforced. It has a long smooth seat and a curve of large radius so that the steel core will not cut into the outer strands of aluminum. With this clamp it is not necessary to separate the steel from the aluminum for separate gripping.

This clamp can be furnished with aluminum liners as clamp No. 73522.

Arcing horns may be attached as shown on page 146.

Cable diameter	1.170 in.—1.380 in.
Cable diameter with liners	1.070 in.—1.280 in.
Net weight each	31 lb.
Packed weight each	36 lb.

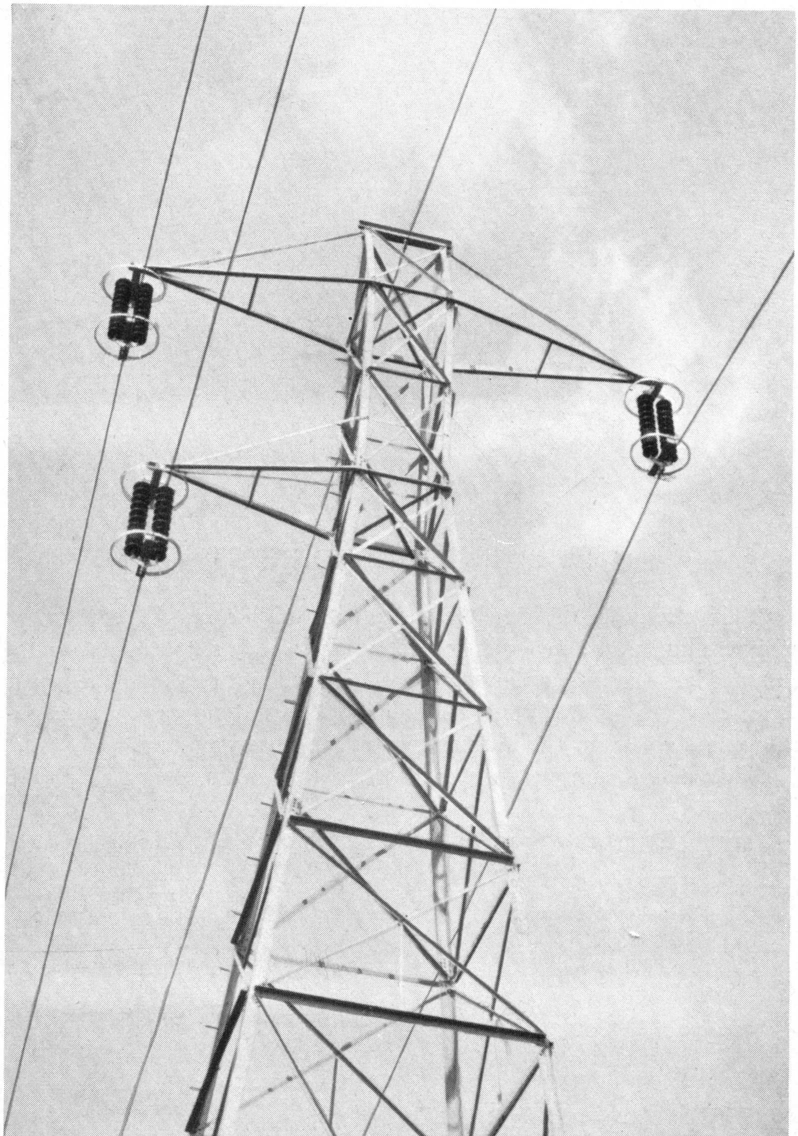
CLAMP NO.	CODE WORD
73520	VRASI
73522	VUCOJ

These clamps are ordinarily used with yoke sets.

When required for direct attachment to suspension insulators suitable connectors will be supplied.

Material: Malleable iron, bolts steel, brass spring cotter. Clamps can be furnished in steel when special conditions make this necessary.

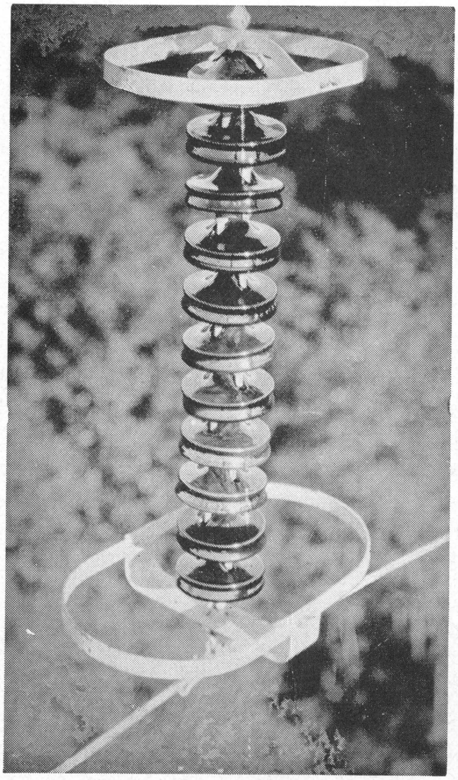
All parts supplied hot galvanized except spring cotter.



TYPICAL INSTALLATION OF LOCKE DOUBLE SUSPENSION GRADING SHIELDS

Locke Grading Shields

EARLY in the history of the use of suspension insulators it was recognized that the voltage across the insulator string was not divided uniformly among the units



A LOCKE GRADING SHIELD ASSEMBLY IN SERVICE. EVIDENCE OF FLASHOVER IS QUITE APPARENT BY THE BURNS ON THE RINGS. THE INSULATORS AND CONDUCTOR ARE UNTOUCHED

but that the line unit carried far more than its share. With the relatively low voltages and short insulator strings then in use this lack of uniformity in the voltage distribution was not of sufficient consequence to cause corrective steps to be taken.

With the advent of higher line voltages and longer insulator strings it was found that this condition was aggravated. A number of devices were tried to correct the difficulty but the only one which has been found successful from a practical standpoint is the Locke Grading Shield. The grading shield in its original form consisted merely of a ring, either circular or oval, placed at the live end of the string. This ring lowered the duty on the line units by:

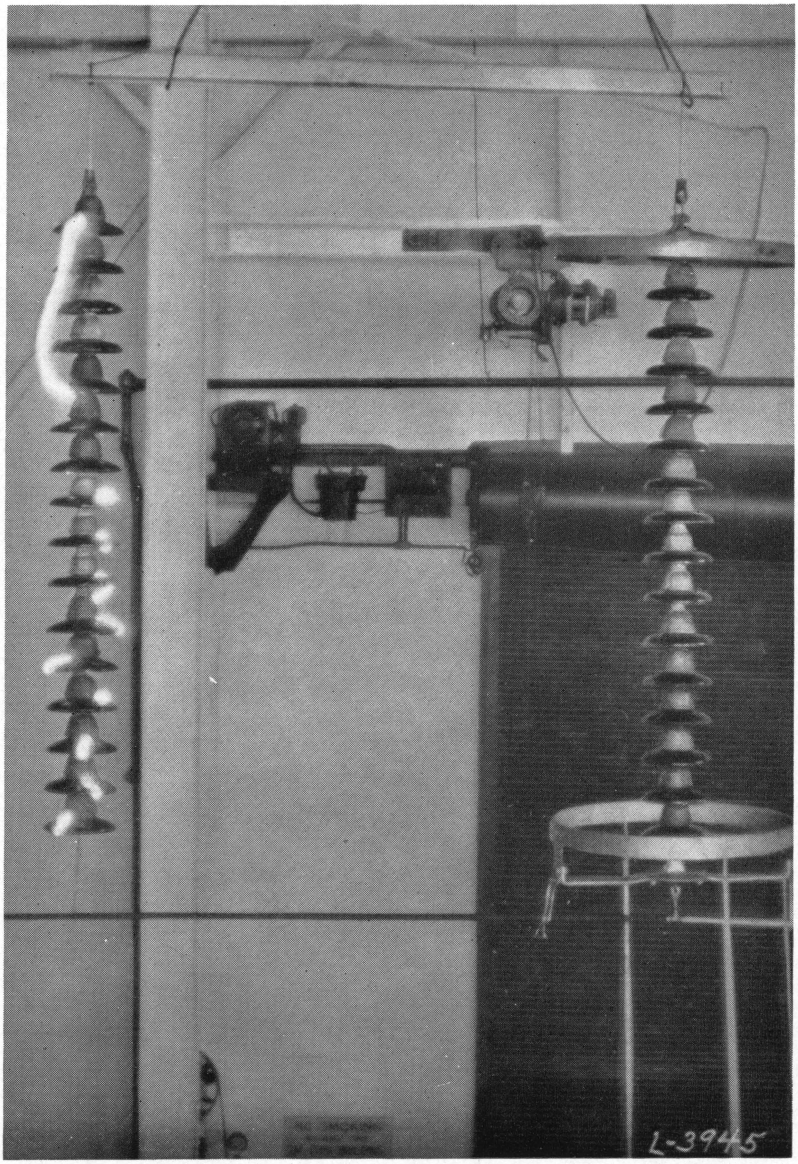
1. Balancing out the effect of the electrostatic capacity of insulator hardware to ground.
2. Spreading the electrostatic field at the bottom of the string and thus reducing the field concentration in the vicinity of the line units.

The ring at the bottom of the string also served as an arcing ring to prevent the arc from coming in contact with the porcelain when flashover occurred. Accordingly a top arcing horn was used in conjunction with the first grading shield installations. When these assemblies were properly adjusted the arc, either impulse or 60-cycle, would form between horn and ring without cascading the insulator string. This led to the adoption of the grading shield and horn assembly by a number of prominent transmission systems purely as a protective device.

Further experiments with impulse voltages showed that the use of a grading shield increased the impulse flashover voltage of an insulator string despite the fact that the arcing distance is shorter on a shielded string than on a non-shielded string of the same number of units. To understand the reason for this it is necessary to consider what takes place about an insulator string just prior to flashover.

When the 60-cycle voltage over an insulator string is raised, a conducting or semi-conducting cloud of corona forms about the line units. This corona cloud acts somewhat the same as a grading shield in improving the voltage distribution over the insulator string. Just prior to 60-cycle flashover it is probable that the voltage distribution over a non-shielded string is very nearly as good as that over a shielded string. Hence the grading shield gives no improvement in the 60-cycle flashover voltage.

On the other hand, under impulse the rate of voltage rise is so rapid that the protecting corona cloud does not have sufficient time



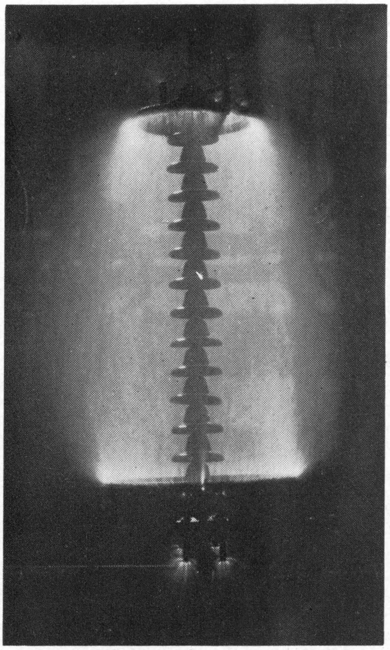
SHIELDED AND UNSHIELDED 16-UNIT STRINGS CONNECTED IN PARALLEL. UNDER LIGHTNING CONDITIONS THE UNSHIELDED STRING WILL ARC-OVER AT A LOWER VOLTAGE THAN THE SHIELDED STRING to form before flashover occurs. Hence, flashover takes place across the line-unit as soon as the voltage rises high enough to cause it to arc over. The second unit from the line then becomes in effect the line unit and it in turn arcs over. Thus a progressive cascade forms over the string. By applying a grading shield the duty on the line unit is reduced so that the total voltage must rise higher before flashover occurs. Now if the grading shield gap is reduced so that the flashover through air across the gap is slightly lower than that across the surface of the shielded insulators, the arc will always form across the grading shield gap, clear of the string, while the flashover voltage will still be higher than that of the non-shielded string. This increase in flashover will usually be of the order of 12 to 15 per cent on a modern shielded assembly, although it is subject to variation depending upon the wave form of the impulse.

The change from the original bottom ring and top horn assembly to the ring and ring assembly which is now the accepted standard was a logical progression indicated by both experience and experiment. When an impulse not quite high enough to cause flashover is applied to an insulator string equipped with bottom ring and top horns, an individual flashover of the top unit often takes place. Examination of the unshielded 60-cycle voltage distribution curves shows that this top unit usually carries a slightly higher duty than does the unit just below it. When impulse is applied to a string with top arcing horns the incipient arcs or ionized streamers which start from the horn tips are all of the same polarity and hence tend to repel each other. Some of these streamers are repelled toward the insulators and some away from the insulators. If the arc forms from one of these streamers which has started toward the insulators there is danger of it striking into the string. This led to the use of the top ring. With this installed the ionized streamers are repelled out radially away from the string so that there is no danger of the arc striking in. The repulsion of the incipient streamers under voltages not quite sufficient to cause complete breakdown is clearly shown in the photograph on page 125.

The top ring performs four functions:

1. It reduces the tendency to cascade since it eliminates the individual flashover of the top unit which may occasionally result in progressive cascade.

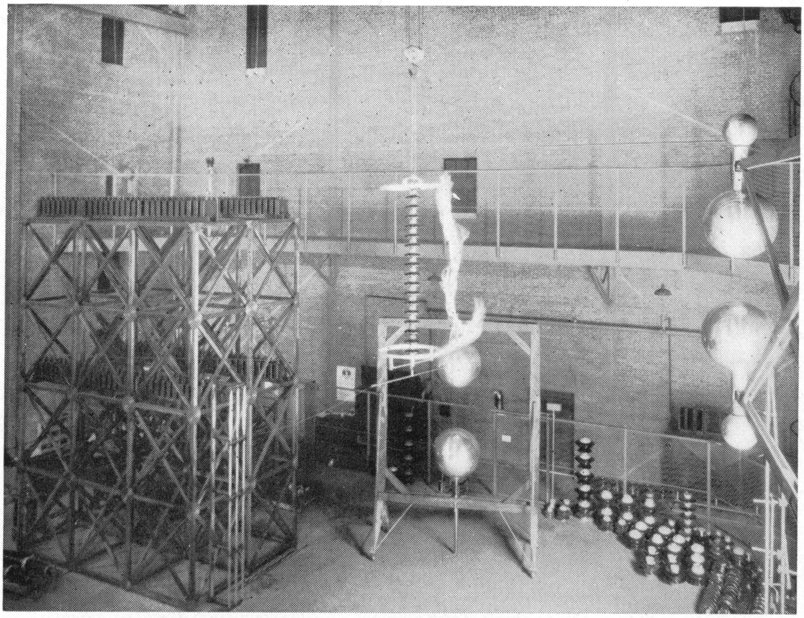
2. It virtually eliminates the possibility of arcs striking from the protective device into the string.
3. It gives a higher impulse flashover voltage since it reduces the high field concentration which would exist in the vicinity of the horn tips.
4. The combination of top and bottom shield forms a track around the insulator so that power arcs once established may



BARREL OF CORONA ABOUT SHIELDED INSULATOR STRING UNDER A LIGHTNING WAVE OF NOT QUITE SUFFICIENT MAGNITUDE TO CAUSE FLASHOVER. NOTE THAT THE STREAMERS EXTEND AWAY FROM THE STRING AS A RESULT OF THEIR MUTUAL REPULSION. THESE STREAMERS ARE INCIPIENT ARCS AND INDICATE THE PATH THAT AN ARC WILL FOLLOW

blow around the string without coming in contact with the porcelain.

Frequently in testing shielded insulators, increases in the apparent shielded impulse flashover voltage are obtained which are far too great to be accounted for by the improvements in the voltage gradient over the string. This additional increase is caused by the energy dissipation from the rings. When an impulse not quite high enough to cause flashover is applied the ionized streamers, which of course, represent a definite energy loss, are easily visible in a darkened room. The electrostatic capacity of the impulse generator is limited so that any energy loss prior to flashover results in a decrease in the actual applied voltage and hence in an apparent increase in the voltage necessary to cause flashover. Apparent in-



60-CYCLE FLASHOVER ON A SHIELDED STRING OF 18 STANDARD $5\frac{3}{4}$-IN. SPACED UNITS IN THE NEW LOCKE LABORATORY

creases in flashover as high as 35 per cent have been measured. The same action takes place on a transmission line. The capacity behind the induced lightning surge is also limited. Therefore, any energy dissipation from the shields will be advantageous on the line the same as in the laboratory. It is rather difficult to evaluate the amount of flashover voltage increase which could be expected on the line due to energy dissipation since this will depend upon the electrostatic capacity of the line.

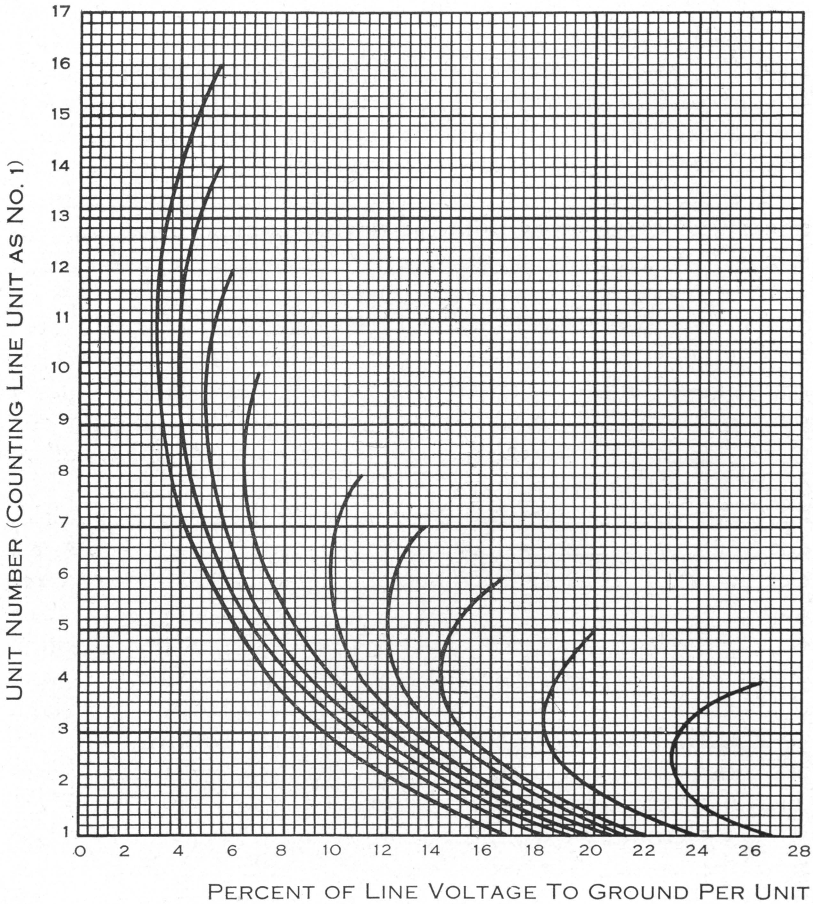
On the following pages are listed the standard Locke Grading Shields for every condition, voltage, and insulator. These grading shields are made of channel iron to insure maximum rigidity and resistance to distortion with minimum weight. The welded joints allow the use of a narrow support without any sacrifice of strength or stiffness. The connectors are integral with the single shields and are attached in the string in the same manner as the insulator. Double and triple shields are attached directly to the yokes.

It should be noted that the bottom tongues of the single suspension shields are designed to fit the clevis opening of Locke suspension and strain clamps. Special tongue thicknesses can be furnished to fit the clevis openings of other clamps.

The size of the shields given in the tabulations is the minimum having the desired electrical characteristics for a given string. Operating experience and laboratory tests have proved the recommended sizes to be satisfactory. It is apparent that the dimensions of the shields depend on the number of insulators used and therefore indirectly on the line voltage.

Either circular or oval shields can be used. The circular shield, due to its long transverse diameter frequently reduces the electrical clearances to the tower steel. The oval ring has as small a transverse diameter as possible without endangering successful operation. The ends of the bottom ring are bent slightly up so that the minimum distance is at the point farthest from the insulator string assuring the formation of the arc at a maximum distance from the porcelain.

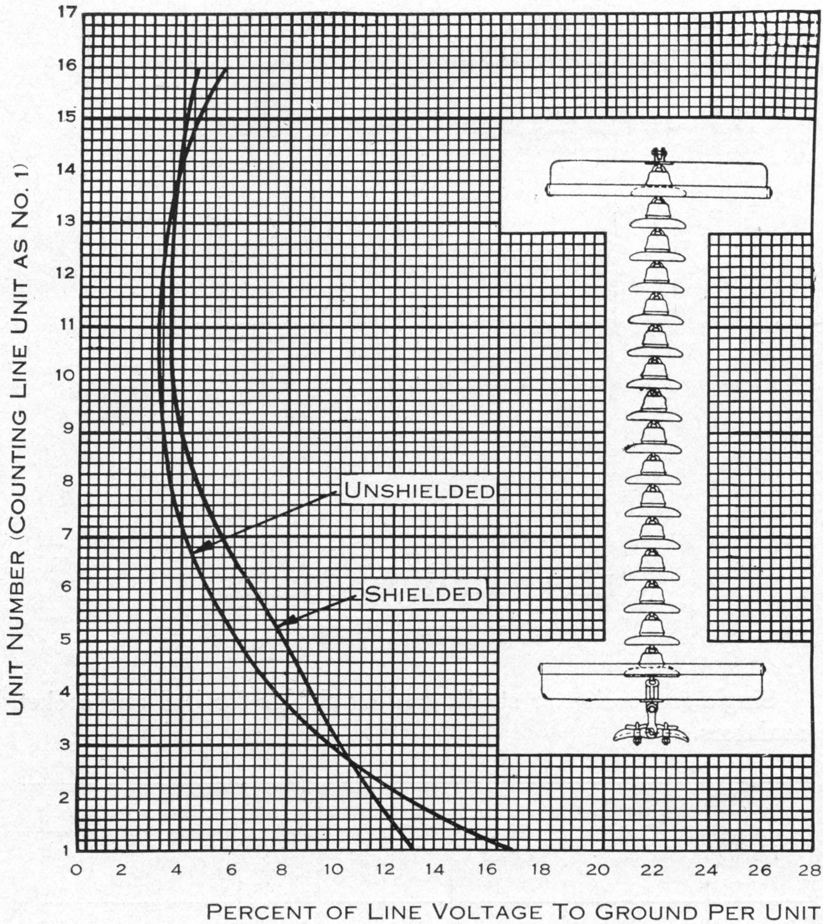
Electrical and mechanical clearances must be investigated to make sure that arcs will not form between the bottom ring or conductor and the tower steel or that the top shield support will not strike the arm above when the string swings to its maximum angle from the normal. The top clevis may be attached directly to a flexible tower hanger or, by means of a No. 12196 clevis, to a rigid tower fitting.



VOLTAGE DISTRIBUTION

LOCKE STANDARD CEMENTED TYPE SUSPENSION INSULATORS

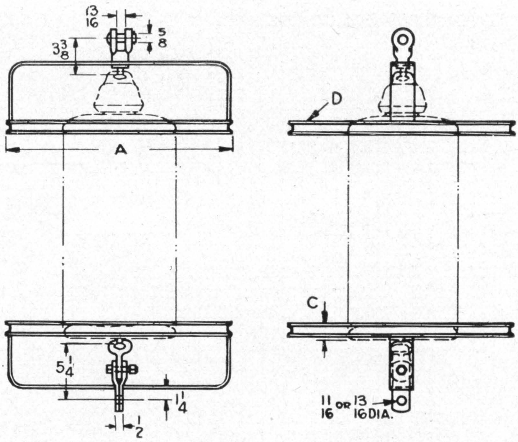
These curves are based on readings made with insulator strings having a standard suspension clamp attached holding one inch diameter conductor.



VOLTAGE DISTRIBUTION

LOCKE STANDARD CEMENTED TYPE SUSPENSION INSULATORS

These curves show the comparative voltage distribution over a string of sixteen standard (5¾″ spaced) suspension units shielded and unshielded.

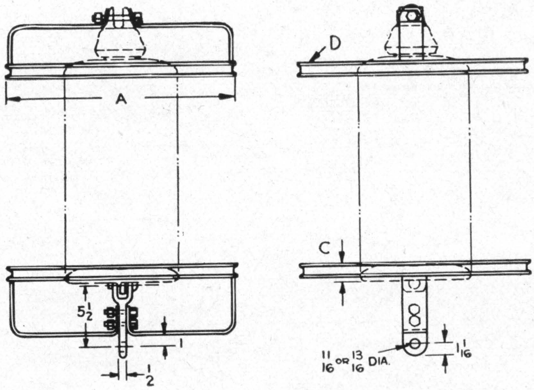


Locke Grading Shields
Circular Type

Single suspension or strain grading shields for ball and socket insulators.

Catalog No.	Code Word	No. Units*	Line Voltage	DIMENSIONS IN INCHES A	C	D
27107	HOLVB	5–6	66 Kv.	20	0	1/8 x 1/2 x 1
27108	HOLYI	7–9	110 Kv.	30	1	1/8 x 1/2 x 1
27109	HOMAX	9–10	132 Kv.	30	2	1/8 x 1/2 x 1
27110	HOMBT	10–12	154 Kv.	36	3	1/8 x 1/2 x 2
27111	HOMDZ	13–18	220 Kv.	40	3	1/8 x 1/2 x 2

* No. Units based on 5¾-in. spacing.

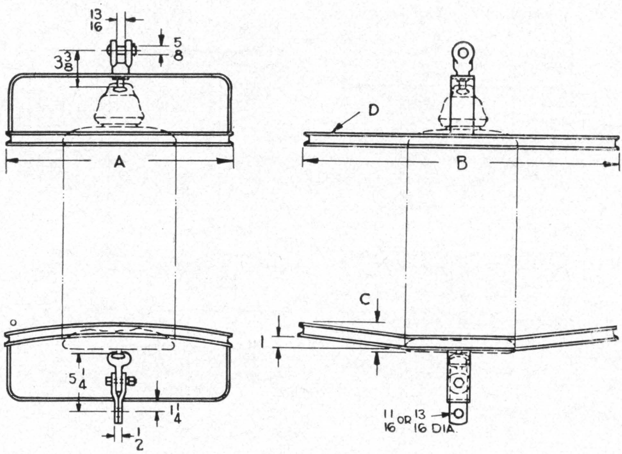


Locke Grading Shields
Circular Type

Single suspension or strain grading shields for clevis insulators.

Catalog No.	Code Word	No. Units*	Line Voltage	Dimensions in Inches		
				A	C	D
27112	HOMEC	5–6	66 Kv.	20	0	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27113	HOMGI	7–9	110 Kv.	30	1	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27114	HOMIM	9–10	132 Kv.	30	2	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27115	HOMLY	10–12	154 Kv.	36	3	$\frac{1}{8}$ x $\frac{1}{2}$ x 2
27116	HOMMB	13–18	220 Kv.	40	3	$\frac{1}{8}$ x $\frac{1}{2}$ x 2

* No. Units based on $5\frac{3}{4}$-in. spacing.

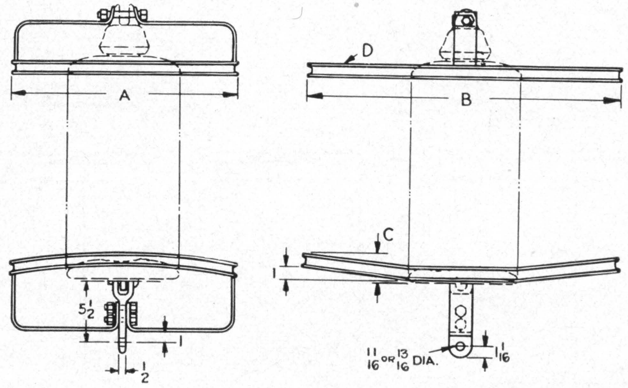


Locke Grading Shields
Oval Type

Single suspension or strain grading shields for ball and socket insulators.

Catalog No.	Code Word	No. Units*	Line Voltage	Dimensions in Inches			
				A	B	C	D
27117	HOMNE	7–9	110 Kv.	20	30	1	1/8 x 1/2 x 1
27118	HOMOD	9–10	132 Kv.	24	30	2	1/8 x 1/2 x 1
27119	HOMTU	10–12	154 Kv.	24	30	3	1/8 x 1/2 x 2
27120	HOMUP	13–18	220 Kv.	24	40	3	1/8 x 1/2 x 2

* No. Units based on 5¾-in. spacing.

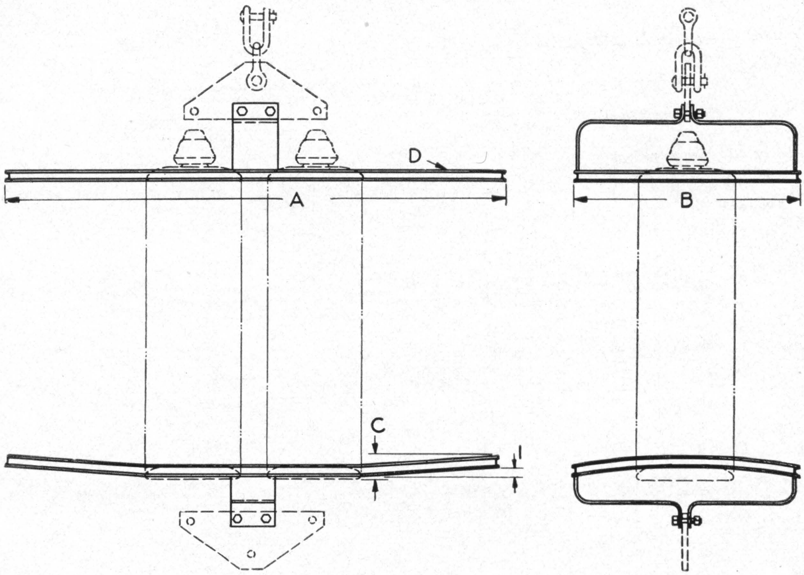


LOCKE GRADING SHIELDS
OVAL TYPE

Single suspension or strain grading shields for clevis insulators.

Catalog No.	Code Word	No. Units*	Line Voltage	DIMENSIONS IN INCHES			
				A	B	C	D
27121	HOMVA	7–9	110 Kv.	20	30	1	⅛ x ½ x 1
27122	HOMYJ	9–10	132 Kv.	24	30	2	⅛ x ½ x 1
27123	HONAM	10–12	154 Kv.	24	30	3	⅛ x ½ x 2
27124	HONBU	13–18	220 Kv.	24	40	3	⅛ x ½ x 2

* No. Units based on 5¾-in. spacing.

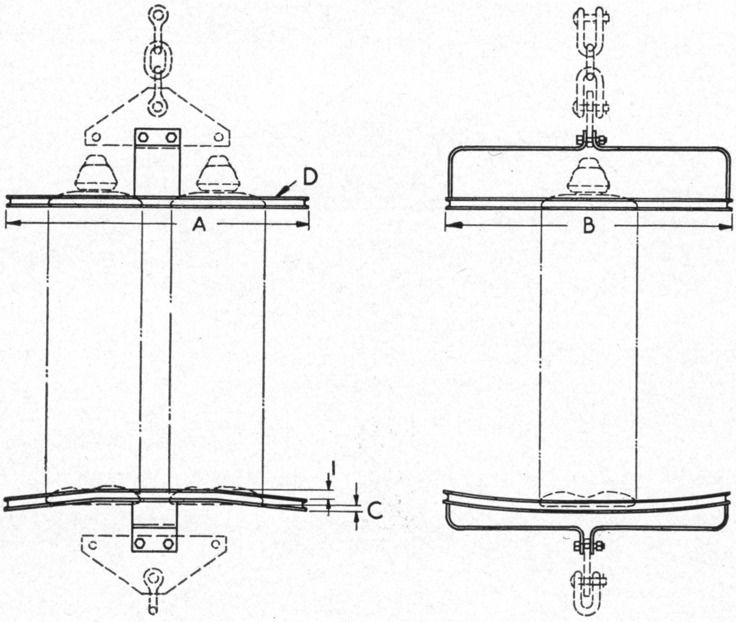


LOCKE GRADING SHIELDS
DOUBLE SUSPENSION

Catalog No.	Code Word	No. Units* per String	Line Voltage	DIMENSIONS IN INCHES			
				A	B	C	D
27125	HONCX	5–6	66 Kv.	33	20	0	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27126	HONDA	7–9	110 Kv.	43	20	1	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27127	HONED	9–10	132 Kv.	43	24	2	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27128	HONGJ	10–12	154 Kv.	43	24	3	$\frac{1}{8}$ x $\frac{1}{2}$ x 2
27129	HONIG	13–18	220 Kv.	53	24	3	$\frac{1}{8}$ x $\frac{1}{2}$ x 2

* No. Units based on $5\frac{3}{4}$-in. spacing.

NOTE.—Details of yoke set assemblies are shown on pages 149, 150 and 151.

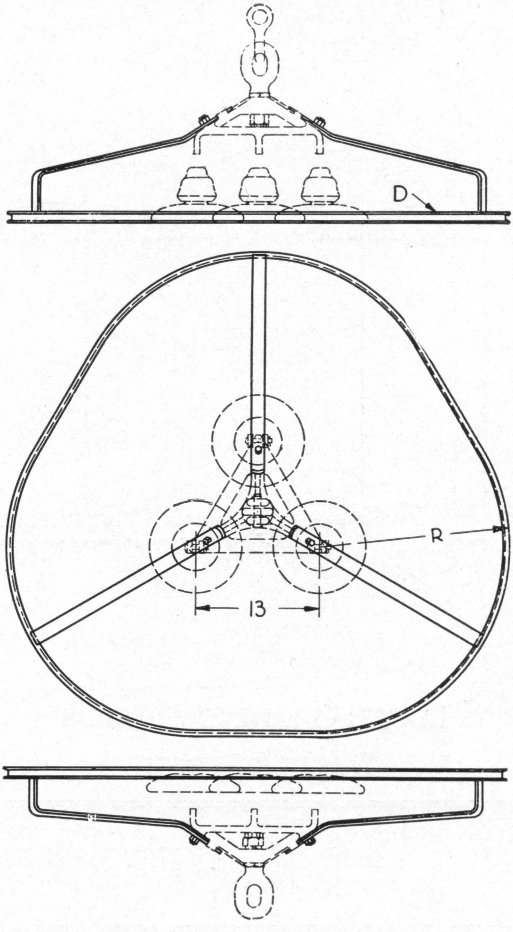


LOCKE GRADING SHIELDS
DOUBLE STRAIN

Catalog No.	Code Word	No. Units* per String	Line Voltage	DIMENSIONS IN INCHES A	B	C	D
27130	HONJT	5–6	66 Kv.	33	20	0	1/8 x 1/2 x 1
27131	HONNF	7–9	110 Kv.	33	30	1	1/8 x 1/2 x 1
27132	HONOI	9–10	132 Kv.	37	30	2	1/8 x 1/2 x 1
27133	HONPL	10–12	154 Kv.	37	30	3	1/8 x 1/2 x 2
27134	HONRO	13–18	220 Kv.	37	40	3	1/8 x 1/2 x 2

* No. Units based on 5¾-in. spacing.

NOTE.—Details of yoke set assemblies are shown on pages 149, 150 and 151.



LOCKE GRADING SHIELD
TRIPLE SUSPENSION OR STRAIN

Catalog No.	Code Word	No. Units* per String	Line Voltage	DIMENSIONS IN INCHES		
				R	C	D
27135	HONUY	5–6	66 Kv.	10	0	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27136	HONWE	7–9	110 Kv.	15	1	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27137	HONXH	9–10	132 Kv.	15	2	$\frac{1}{8}$ x $\frac{1}{2}$ x 1
27138	HONYK	10–12	154 Kv.	15	3	$\frac{1}{8}$ x $\frac{1}{2}$ x 2
27139	HOOAS	13–18	220 Kv.	20	3	$\frac{1}{8}$ x $\frac{1}{2}$ x 2

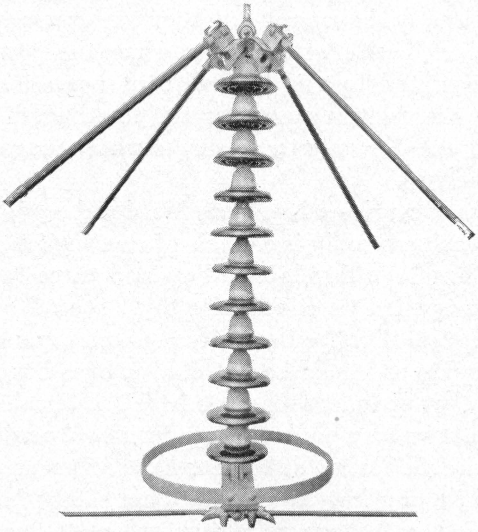
* No. Units based on $5\frac{3}{4}$-in. spacing.

NOTE.—Details of yoke set assemblies are shown on page 152.

Locke Fused Grading Shields

THE Locke Fused Grading Shield was originally designed for use on a transmission line where outages due to lightning were exceedingly costly due to the necessity for continuous power supply to an industrial plant. These earliest equipments practically eliminated outages.

While a condition of this kind is rare, Locke fused grading shields have since then been adopted by some of the largest operating companies in the country for protection of substations. With the modern tendency in transmission line design towards the over-insulation of



A TYPICAL LOCKE FUSED GRADING SHIELD ASSEMBLY

the line, it has been found that where the path of the storm is close to a line terminal this over-insulation has thrown the burden on the substation apparatus. It is relatively easy to add a few units to an insulator string and for the higher voltages at least, relatively inexpensive. On the other hand it is very difficult and expensive to attempt to raise the insulation of the substation apparatus to the level of the increased line insulation. It has therefore become customary to reduce the line insulation immediately adjacent to the terminal to a value which will balance with the equipment insulation.

Due to the rapidity with which lightning surges on transmission lines are attenuated most disturbances originating several miles out on the line will probably be reduced below dangerous proportions before they reach the reduced insulation. Nevertheless, there will naturally be an increased number of flashovers adjacent to the terminals resulting in a corresponding increase in number of line outages. The use of a standard grading shield on the shortened strings will prevent insulator damage but cannot prevent the line trip-out when flashover occurs.

If the fused grading shield is applied to the reduced insulation at the terminals and the gap between the fuse tip and shield adjusted to give the desired flashover voltage, then the excess voltage on the line will be relieved without an outage since the power current to ground is interrupted by the fuse without operation of the line relays. Unlike the lightning arrester the fused grading shield can be expected to care for only those surges whose magnitude is sufficient to arc the gap.

For this class of service a fused grading shield equipped with four fuses, so that each assembly is capable of clearing four arcs without fuse renewal, has been developed. Two and three fuse assemblies have also been applied to this service to fit special conditions and each type of installation has been attended with marked success.

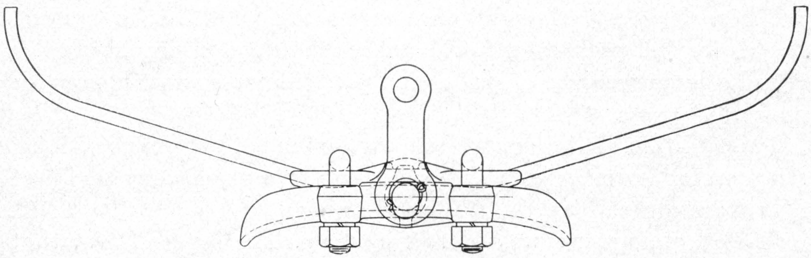
These reduced gaps should be installed on each line for a distance of approximately one-fourth mile out from the terminal. A number of installations have been made equipped with only a single assembly on each line wire. So far, no difficulties have arisen as a result of the use of this single gap but as an additional safety factor it is certainly advantageous to have more than one gap on each conductor.

It is important to remember that the last gap adjacent to the terminal should be placed as close as possible to the apparatus to be protected, otherwise it is quite possible that reflections will so build up within the substation as to result in breakdown or arc-over of the apparatus without affecting the fused grading shield.

The Locke Insulator Corporation will be pleased at any time to make specific recommendations for any application of this device.

Locke Arcing Horns

FLASHOVER data with horns will show that 60-cycle values are appreciably reduced by their use. There is not, however, an accompanying reduction in the lightning voltage necessary to cause arc-over as the fastest path is not between horns. A more detailed discussion of this is given in connection with the grading shields.



BOTTOM ARCING HORNS ARE FURNISHED WELDED TO THE CLAMP KEEPER

Arcing horns have proved very successful in many instances in keeping the arcs away from insulators and conductor, most particularly when these arcs arise from causes other than lightning. They cannot, however, be considered as a substitute for grading shields as they rarely prevent the lightning arcs from cascading over the insulator surface. They will frequently give protection by taking the power arc away from the insulator after it has been started by lightning. This effect is not always certain as it depends largely upon winds and magnetic effects of the arc itself. Arcing horns therefore are to be considered an inexpensive, but not always certain, protection to insulators and conductors.

A top arcing horn should always be used to prevent arc-overs from causing damage to the insulators. No device at the bottom of the string will keep the arcs away from the top where the tendency for the arc to hug the insulators is the greatest. The top horn should be of liberal spread and close to the top surface of the insulators to pick up the arc from whatever source it may arise.

Locke arcing horn combinations for suspension strings consist of a bottom horn projecting from the clamp keeper as shown on page 139 and a top horn attaching to the top unit of the string as shown on the following pages. The bottom horns are regularly furnished with a 24-inch spread. Other spreads can be made if desired.

Where special conditions require other than standard arcing horns, recommendations will be gladly given.

LOCKE SPHERICAL TIPPED ARCING HORNS

Where it is not thought economical to install Locke grading shields for full protection Locke spherical tipped arcing horns will afford a large measure of protection particularly against conductor burns.

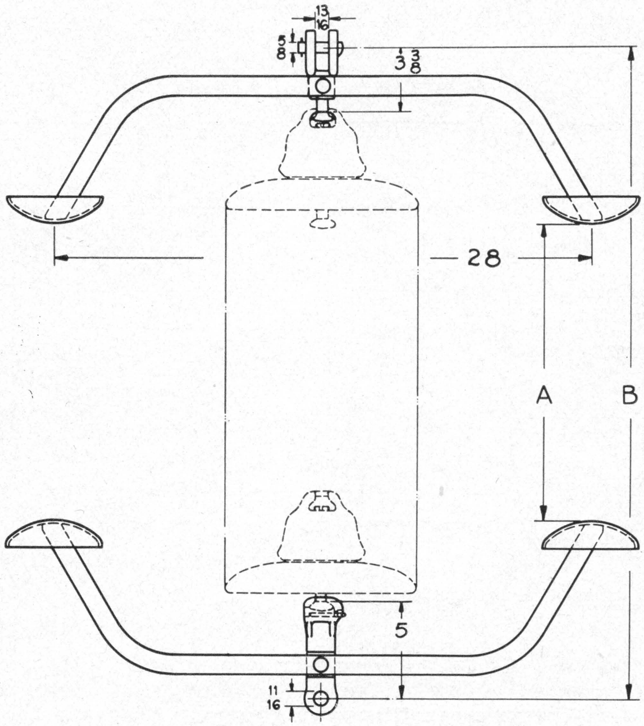
The addition of the semi-ellipsoid stampings to the conventional strap arcing horns gives a slight increase in 60-cycle dry and wet flashover values.

The stampings are welded to the strap. The severest test that can be made has shown that the stampings themselves can be practically consumed by a power arc without in any way damaging the weld or causing a loosening between parts.

While the fittings at the top and bottom of the string shown on the next page are standard, variations from these can easily be made to accommodate special requirements. The fittings shown have been devised to give the simplest form of mounting with the minimum increase in string length. As shown on the following pages these horns are fitted for socket-type insulators. Suitable attachments for either clevis or Hewlett-type insulators can always be furnished.

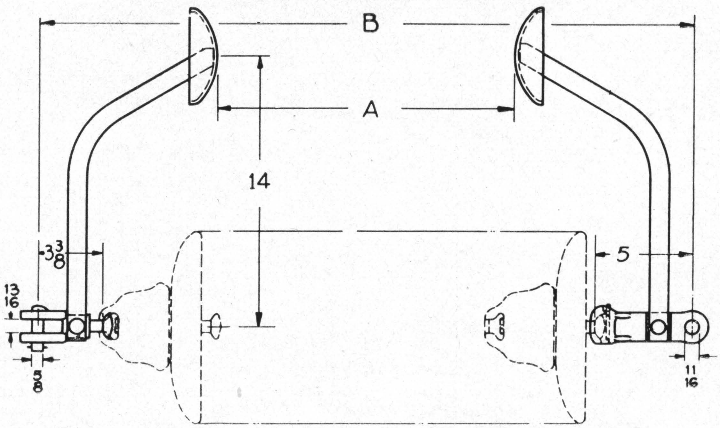
The spherical tips of these horns also eliminate the radio interference which arises with plain horns due to corona formation at the angular tip. Where lines running near habitations, particularly in regions remote from broadcasting stations, are to be equipped with horns, Locke Spherical Tipped Arcing Horns are strongly recommended.

All Locke Arcing Horns are thoroughly and smoothly hot galvanized.



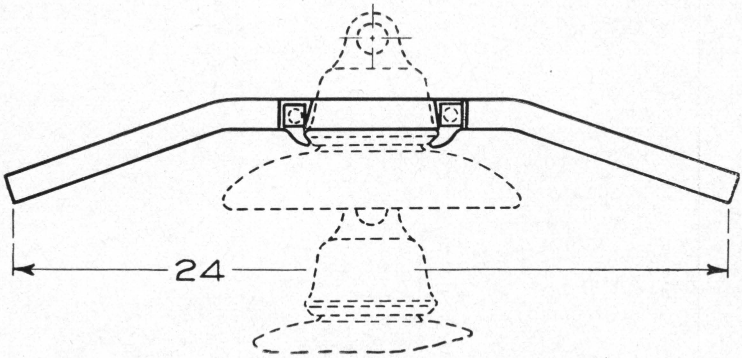
SPHERICAL TIPPED ARCING HORNS FOR SUSPENSION STRINGS

Catalog No.	Code Word	No. Standard Units (5¾″ spaced)	DIMENSIONS IN INCHES		LB. EACH	
			A	B	Net	Pkd.
27241	HOWED	4	15	31⅜	14½	14½
27242	HOWFO	5	20¾	37½	14½	14½
27243	HOWGS	6	25	42⅞	14⅝	14⅝
27244	HOWIL	7	29	48⅝	14¾	14¾
27245	HOWJB	8	34	54⅜	15	15
27246	HOWKE	9	39¾	60⅛	15	15
27247	HOWLH	10	45½	65⅞	15	15
27248	HOWMK	11	50	71⅝	15⅛	15⅛
27249	HOWOR	12	55	77⅜	15¼	15¼



Spherical Tipped Arcing Horns For Strain Strings

Catalog No.	Code Word	No. Standard Units (5¾″ spaced)	Dimensions in Inches		Lb. Each	
			A	B	Net	Pkd.
27250	HOWPU	4	15	31⅜	9	9
27251	HOWSA	5	20¾	37½	9	9
27252	HOWUP	6	25	42⅞	9⅛	9⅛
27253	HOWVJ	7	29	48⅝	9¼	9¼
27254	HOWYT	8	34	54⅜	9½	9½
27255	HOXEM	9	39¾	60⅛	9½	9½
27256	HOXIZ	10	45½	65⅞	9½	9½
27257	HOXLI	11	50	71⅝	9⅝	9⅝
27258	HOXNO	12	55	77⅜	9¾	9¾

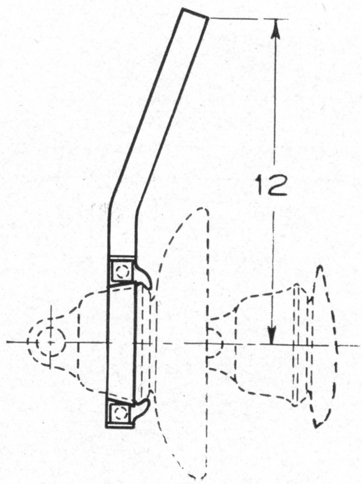


TOP ARCING HORNS FOR SUSPENSION STRINGS

The bottom, or clamp horns, are furnished as an integral part of the clamp keeper as shown on page 139.

Catalog No.	Code Word	Used with Clevis or Socket Type Insulators	LB. EACH	
			Net	Pkd.
5029–G4	KARIF	Standard Strength	$2\frac{1}{2}$	$2\frac{1}{2}$
7598–G4	WREPE	High Strength	$2\frac{3}{4}$	$2\frac{3}{4}$

Material: Steel, hot galvanized, 1-inch by $\frac{1}{4}$-inch stock.
Similar horns can be furnished for use with Hewlett Type Insulators.

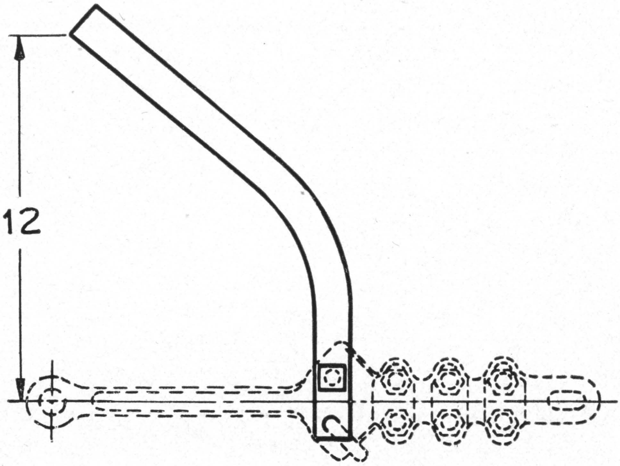


TOP ARCING HORNS FOR STRAIN STRINGS

The bottom or clamp horns for strain strings are shown on pages 145 and 146.

Catalog No.	Code Word	Used with Clevis or Socket Type Insulators	LB. EACH	
			Net	Pkd.
5030–G4	VUFER	Standard Strength	$1\frac{3}{4}$	$1\frac{3}{4}$
7597–G4	WREOB	High Strength	2	2

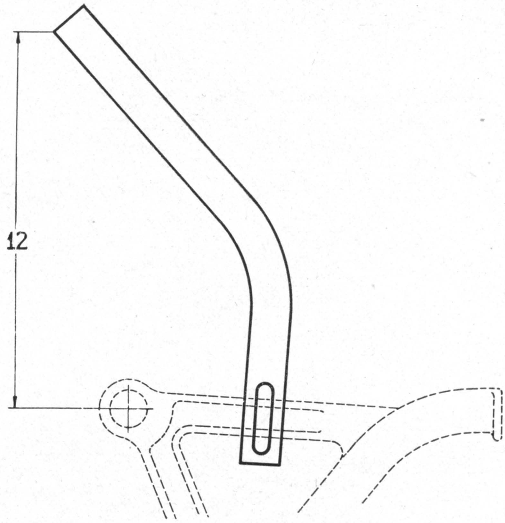
Material: Steel, hot galvanized, 1-inch by $\frac{1}{4}$-inch stock.
Similar horns can be furnished for use with Hewlett Type Insulators.



ARCING HORNS FOR STRAIN CLAMPS

Catalog No.	Code Word	Used with Insulator No.	Used with Clamp No.	LB. EACH Net	LB. EACH Pkd.
4694-G2	KANAZ	5800, 7500	3032G1, 3033G1, 3034G1	1¾	1¾
4694-G3	VLUFP	18400, 18401	3032G2, 3033G2, 3034G2	2	2
		All Hewletts	3032G3, 3033G3, 3034G3		
4696-G2	KANDY	5800, 7500	3109G1, 3110G1, 3111G1	2	2
4696-G3	VLUGT	18400, 18401	3109G2, 3110G2, 3111G2	2¼	2¼
		All Hewletts	3109G3, 3110G3, 3111G3		
4700-G2	KANIC	5800, 7500	3034G1, 3305G1	1⅝	1⅝
4700-G3	VLUIZ	18400, 18401	3304G2, 3305G2	1⅞	1⅞
		All Hewletts	3304G3, 3305G3		

Material: Steel, hot galvanized, 1-inch by ¼-inch stock except 4694-G2 and 4694-G3 which are 1¼-inch by ¼-inch.



ARCING HORNS FOR STRAIN CLAMPS

Catalog No.	Code Word	Used with Clamps		Lb. Each	
		No Connector	With Connector	Net	Pkd.
12409-G1	VLUOS		11040	$2\frac{1}{8}$	$2\frac{1}{8}$
12409-G2	VLURY		11328	$2\frac{1}{8}$	$2\frac{1}{8}$
12409-G3	VLUSB		71095	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G4	VLUTE	71095		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G5	VLUVK		12926	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G6	VLUWN	10755 11040 12926		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G7	VLUYU		11645	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G8	VLYAE	11645		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G9	VLYBH		70231	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G10	VLYCK	70231		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G11	VLYDN		71097	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G12	VLYER	71097		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G15	VOFLE		73517	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G16	VIMVO	73517		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G17	VOFOW		73520	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G18	VINAF	73520		$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G19	VOFRU		72888	$2\frac{1}{4}$	$2\frac{1}{4}$
12409-G20	VINBI	72888		$2\frac{1}{4}$	$2\frac{1}{4}$

Material: Steel, hot galvanized, $1\frac{1}{4}$-inch by $\frac{1}{4}$-inch stock.

Locke Yoke Sets

Locke double strain yokes are of two types; one for medium and the other for heavy loads. Attachments to the insulators and to the cross arms are made by suitable adapters. The top yoke is connected to the arm almost universally by a closed clevis, insuring adequate strength. The connection between the clevis and the yoke must have the flexibility of a universal joint to care for erection of the yokes and insulators and for the variation in angles of take-off in the arm. On the bottom or outer yoke the length of the adapter assures proper electrical clearance between the yoke and the insulator units.

The medium strength yokes are of malleable iron, attached directly to the cross arm through a forged steel clevis. The joint between yoke and clevis allows relative movement in any direction. Standard adapters connect it to the insulators, except with the clevis type where none is required at the upper yoke. Suitable clevises are available for attaching at the outer yoke all standard strain clamps and the Aluminum Company of America's standard compression type dead ends.

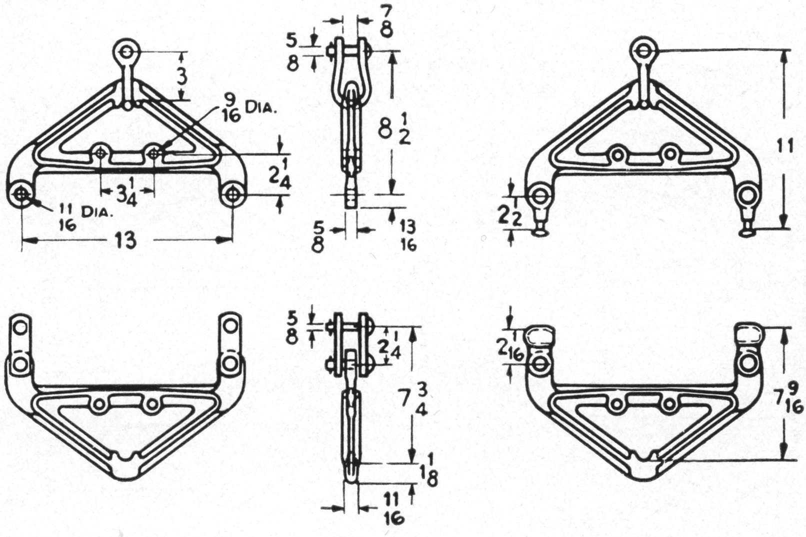
The high strength double suspension yoke consists of a flat steel plate. The clevis-link-clevis arrangement connects the top yoke plate to the cross arm with full flexibility and adequate clearance for any angle of take-off. Clevises for attaching to anchor clamps will be the same as with the malleable yokes. Special yoke arrangements to meet other external conditions can easily be made by use of standard shackles and links listed elsewhere in this catalog.

The triple yoke is designed for either strain or suspension position. The insulator strings are attached to the central members by adapters in the same manner as the double yokes. The tower connection is made by a clevis used in conjunction with an eyebolt passing through the central member. A similar eyebolt passes through the bottom yoke. A special clamp or some other special arrangement is usually used with the triple strings of insulators, and either fits the bottom eye directly or by means of a special adapter. This yoke has sufficient strength to be used with Locke high strength insulators. It is strong enough for almost all long span work.

Provision is made on all of the yokes so that grading shields or arcing horns may be attached. The grading shields shown on pages 130-136 have holes spaced the same as those in the high strength double strain yokes and the triple strain yokes.

RECOMMENDED CLEVISES TO ATTACH STRAIN CLAMPS TO DOUBLE YOKE SETS.

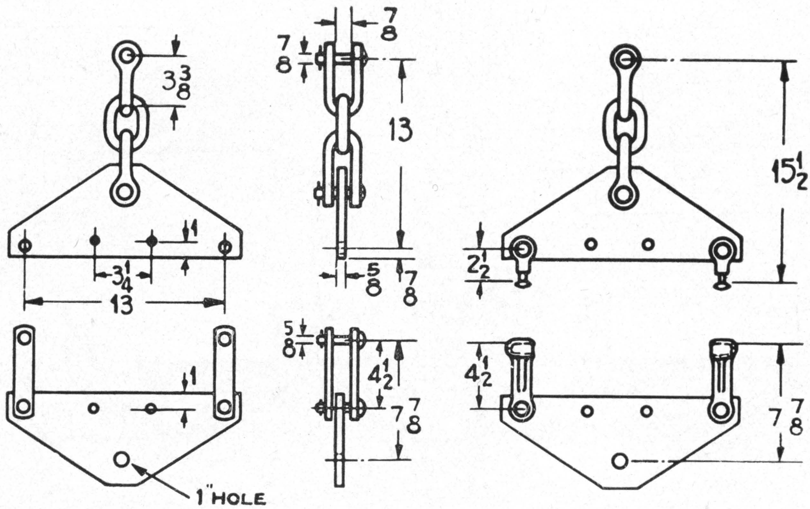
Clevis No.	Page	Clamps	Yokes
3641	67	3304, 3305, 10755, 11040, 11328, 12926	27277 27278, 27279, 27280, 27281
12196	67	3032, 3033, 3034, 3109, 3110, 3111, 11645, 71095, 70231, 71097, 72366	27277, 27278, 27279. 27280, 27281
9996	68	73517, 73520, 72888	All Double Yokes
9996	68	771 Series Alcoa Steel Clevis Ends	All Double Yokes
27274	70	772 Series Alcoa Steel Clevis Ends	All Double Yokes
27275	70	773 Series Alcoa Steel Clevis Ends	All Double Yokes
27276	70	774 Series Alcoa Steel Clevis Ends 775 Series Alcoa Steel Clevis Ends	All Double Yokes All Double Yokes



Double Yoke Sets

Catalog No.	Code Word	Type Insulator	Material	Mechanical Strength	Pounds Each Packed
27277	HOYVL	Clevis	MI and Steel	20,000	21
27278	HOYWC	Socket	MI and Steel	20,000	25
27279	HOYYV	Hewlett	MI and Steel	20,000	23

Attachments to connect yokes to standard strain clamps are listed on page 148. Yoke set No. 27279 is fitted with connectors No. 8028 shown on page 77.

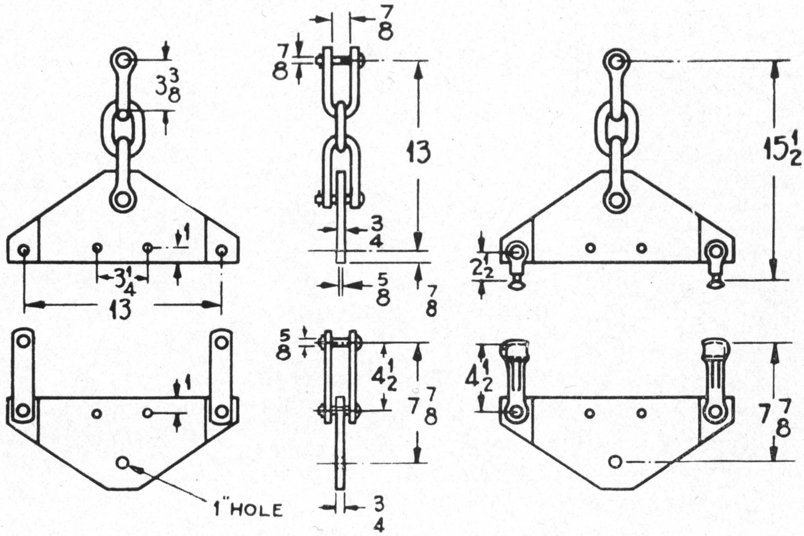


Double Yoke Sets

Catalog No.	Code Word	Type Insulator	Material	Mechanical Strength	Pounds Each Packed
27280	HOYZY	Clevis	Steel	36,000	32¾
27281	HOZAC	Socket	Steel	36,000	35½

When used as double suspension yoke the steel link between the upper clevises is omitted to bring the assembly into the proper plane.

Attachments to connect standard strain clamps are listed on page 148.

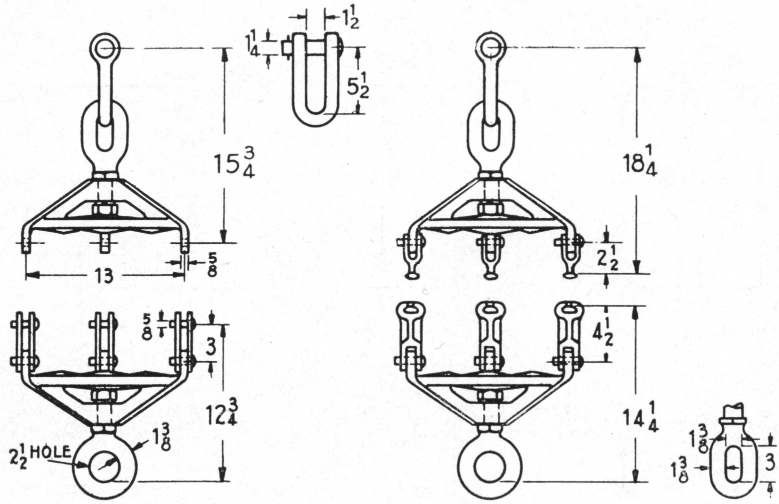


Double Yoke Sets

Catalog No.	Code Word	Type Insulator	Material	Mechanical Strength	Pounds Each Packed
27282	HOZCI	Clevis	Steel	50,000	37¼
27283	HOZDL	Socket	Steel	50,000	39¾

When used as double suspension yoke the steel link between the upper clevises is omitted to bring the assembly into the proper plane.

Attachments to connect standard strain clamps are listed on page 148.



TRIPLE YOKE SET SUSPENSION OR STRAIN

The triple yoke has a cast steel frame of novel triangular and star construction, giving the utmost strength for its weight. The eyes at the ends can be turned and positively locked as required. The shackle and eye combination gives the universal hinge at the cross arm, necessary for ease in erection.

The lugs for attaching to the insulators lie in parallel planes so that during erection undue bending strains upon insulator parts will not be encountered. Special bolt eye combinations can be furnished at the outer yoke to take any anchor clamp desired.

Catalog No.	Code Word	Type Insulator	Material	Mechanical Strength	Pounds Each Packed
27238	HOVYP	Clevis	Steel	75,000	76
27239	HOWAZ	Socket	Steel	75,000	85

Round eye is standard on bottom yokes but oval eye shown at right can be furnished.

Locke Pin Type Insulators

It is not generally recognized how many points must be taken into consideration in the design and manufacture of a standard pin type insulator. Nor has the emphasis frequently placed on non-essential factors been conducive to a more general appreciation of the essential features. Dependent, as the art originally was, on the old potters with their traditional air of mystery it was probably inevitable that the same atmosphere should pervade the manufacture of insulators. Today, however, the time is past for such meaningless gestures. The sole criterion of the worth of a product is results.

Pin type insulators can be made which will completely satisfy all test requirements and yet not give entirely satisfactory service in the field. Certain features of design which do not affect test results are equally essential for perfect performance. Some of these characteristics can be seen at a glance; some of them while equally important are not so obvious, and for that reason are frequently overlooked.

To engineers who are selecting insulators the following tabulation, giving the essential characteristics of satisfactory multipart pin type insulators, will serve as a guide.

A well designed pin type insulator must have the following characteristics:

1. The convex contour of the top conductor groove must present a distributed bearing surface to prevent a concentration of load upon any one point. Such concentration is liable to lead not only to insulator trouble but to breakage of the conductor.
2. The top wire groove must be sufficiently high above the surfaces of the top shell to give ample space for easy tying. In addition to this, such height is necessary to eliminate the danger of reducing the valuable insulating surface by contact between the top of the insulator and the conductor.
3. The side wire groove must be high to permit the holding of the conductor without sharp bends in either the tie wire

or the conductor. Such sharp bends may ultimately lead to conductor crystallization and line failure.

4. The side wire groove must be of large radius so that the conductor can be placed in this groove where desired for turning corners.
5. The shells must be so proportioned that there is equal voltage distribution between porcelain parts. This prevents cascading under lightning conditions and assures a puncture value considerably in excess of the flashover value.
   (It must be remembered that puncture tests under oil are no indication of the characteristics of the insulator in its normal element since the voltage distribution of the insulator is completely upset by immersion in oil.)
6. Equality of voltage distribution must also be maintained to assure high corona values and consequent freedom from radio interference.
7. The insulator must be designed to give maximum flashover value per pound of weight without sacrificing ruggedness or strength.
8. Insulators must be so designed that no hidden surfaces with the resultant accumulation of dirt are present. Ample leakage surfaces must be provided for all but very abnormal conditions and the insulator must be so designed that driving rains will clean every surface.
9. Clearance between all shells and particularly between the center shell and pin must be sufficient to prevent power leakage sparks from forming between them. Such leakage not only nullifies valuable insulating surfaces but causes "static" and even occasional flashovers.
10. The cementing of the shells must be scientifically performed to prevent damage to the porcelain. The joints must be reduced to a minimum width and the sanded surface coated with a resilient compound. The inside surface of the top shell where temperature changes occur more rapidly should be coated with a highly compressible material.
11. The cement used must be strictly uniform. Every batch must be analyzed and tested.
12. Cement mix must contain a low percentage of water to reduce shrinkage and expansion of cement to a minimum.

THE ORIGINAL LOCKE 60-KV. PIN TYPE INSULATOR STILL OPERATING SATISFACTORILY AFTER OVER A QUARTER OF A CENTURY OF SERVICE

13. All cement must be set in a hot saturated atmosphere. This assures thorough expansion during setting and complete hydration of all cement particles. Only by this method can future cement growth and consequent failure of the insulator be eliminated.
14. All exposed cement joints must be water-proofed to prevent the introduction of water into the cement pores which causes damage under freezing conditions.
15. The thread of the pin hole must be such that a perfect fit on the pin is obtained. Anything less than a perfect fit will not only materially reduce mechanical strength but where a porcelain thread is used will also induce corona within the pin hole. (This condition is entirely taken care of by the Locke metal threaded pin hole.)

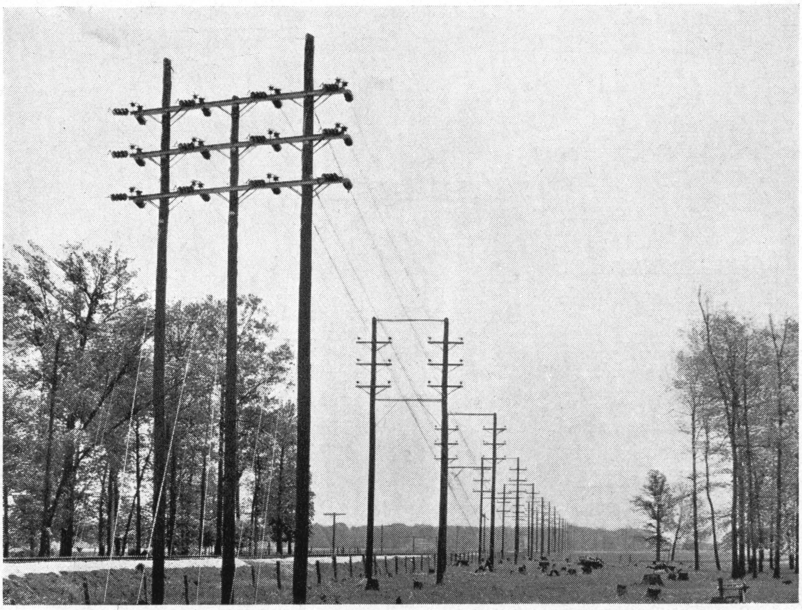
The design and construction of Locke multipart pin type insulators is a definite science. Long experience has dictated the characteristics necessary to perfect performance. Sustained experiment and constant research have furnished the technique by which it is possible to manufacture an insulator having all these requirements.

All insulator fabrication starts as a problem in ceramics. In this branch of the art progress has been constant until today Locke porcelain has reached a standard of quality undreamed of a few years ago. Chemical and physical analysis of all raw materials, scientific proportioning of ingredients, and exact factory control have played an exceptionally large part in the maintenance of the present high standards.

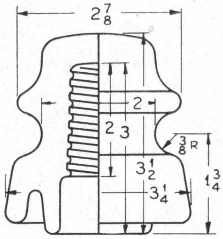
The metal threaded pin hole which is now standard on Locke multipart pin type insulators having a $1\frac{3}{8}$-inch pin hole represented a great advance. By removing the cause of corona in the pin hole it has gone far to eliminate complaints of radio interference. In addition, it has made possible the adoption of sturdier and less expensive pins and has simplified construction work.

Another feature of the design of Locke multipart pin type insulators is the wide space between shells and particularly between the lower skirt and the pin. The latter feature is of the utmost importance. Where the diameter of the lower shell is small and the diameter of the pin reasonably large, small leakage sparks will occur across the gap. In the event of wood pins this may lead to burned pins and cross arms. Where metal pins are used it means rapid deterioration of both pin and insulator, considerably lowered flashover value and very bad radio interference.

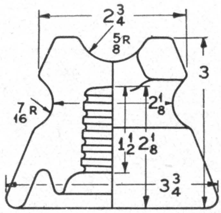
Locke pin-type insulators are regularly furnished with the standard brown glaze but other glazes can be furnished where desired. This will be found particularly convenient on the smaller one-piece insulators where some ready method of identifying the different circuits is wanted. White, green, slate or blue glazes are those most regularly used for this purpose.



THE DELAWARE-MUNCIE LINE OF THE INDIANA GENERAL SERVICE COMPANY CONSTRUCTED ON LOCKE NO. 1044 INSULATORS WITH LOCKE REDHEAD PINS AND LOCKE NO. 18400 SUSPENSION INSULATORS



No. 44

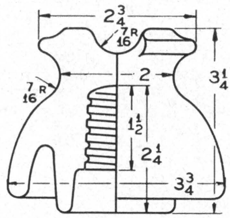


No. 2

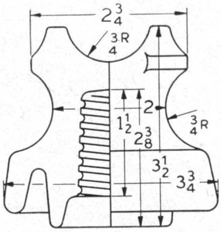
Pin Type Insulators

Insulator No.	44	2
	6,600 Volts	6,600 Volts
Dry arc-over voltage	35,000	50,000
Wet arc-over voltage	15,000	23,000
Leakage distance	4 inches	$4\frac{1}{4}$ inches
Mechanical strength	3,000 lb.	2,500 lb.
Minimum height pin	$4\frac{1}{2}$ inches	4 inches
Net weight each	$1\frac{1}{8}$ lb.	$1\frac{1}{4}$ lb.
Packed weight each	$1\frac{3}{8}$ lb.	$1\frac{1}{2}$ lb.
Standard package	Box of 50	Box of 50

Catalog No.	Code Word	Size Pin Hole
44	AAFXY	1 inch
2	AABIC	1 inch



No. 8881

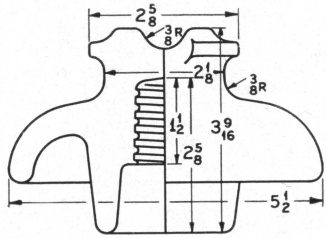


No. 3749

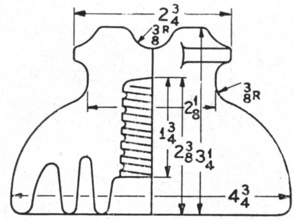
PIN TYPE INSULATORS

INSULATOR NO.	3749 7,500 VOLTS	8881 8,000 VOLTS
Dry arc-over voltage	50,000	50,000
Wet arc-over voltage	25,000	23,000
Leakage distance	4¼ inches	5¾ inches
Mechanical strength	3,000 lb.	2,500 lb.
Minimum height pin	4 inches	4 inches
Net weight each	1¼ lb.	1⅜ lb.
Packed weight each	1⅝ lb.	1½ lb.
Standard package	Box of 50	Box of 50

CATALOG NO.	CODE WORD	SIZE PIN HOLE
3749	ANVAM	1 inch
8881	BUGWO	1 inch



No. 298

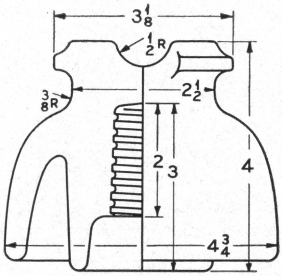


No. 4451

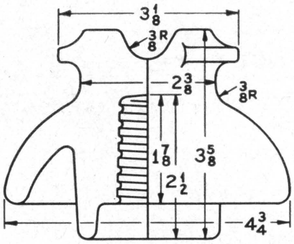
PIN TYPE INSULATORS

INSULATOR NO.	298 15,000 VOLTS	4451 13,000 VOLTS
Dry arc-over voltage . . .	65,000	60,000
Wet arc-over voltage . . .	35,000	30,000
Leakage distance	7 inches	8 inches
Mechanical strength . . .	2,500 lb.	2,500 lb.
Minimum height pin . . .	4½ inches	5 inches
Net weight each	1⅞ lb.	2⅛ lb.
Packed weight each	2⅝ lb.	2⅝ lb.
Standard package	Box of 36	Box of 32

CATALOG No.	CODE WORD	SIZE PIN HOLE
298	ABEWX	1 inch
4451	AREIY	1 inch



No. 6512

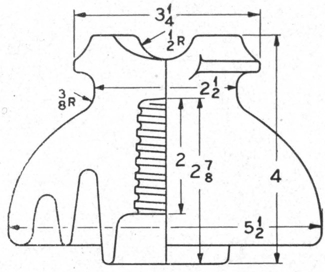


No. 9995

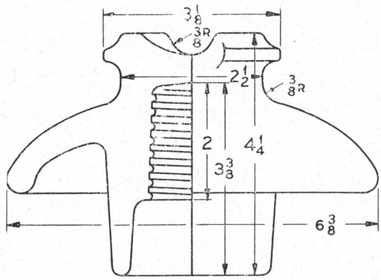
Pin Type Insulators

Insulator No.	9995	6512
	15,000 Volts	16,000 Volts
Dry arc-over voltage	65,000	65,000
Wet arc-over voltage	32,000	35,000
Leakage distance	6½ inches	8½ inches
Mechanical strength	2,500 lb.	2,500 lb.
Minimum height pin	4½ inches	5 inches
Net weight each	2¼ lb.	2⅜ lb.
Packed weight each	3⅛ lb.	4 lb.
Standard package	Box of 27	Box of 27

Catalog No.	Code Word	Size Pin Hole
6512	AYASD	1 inch
9995	CEOKU	1 inch



Nos. 6510 and 6511

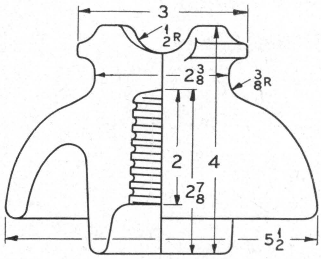


No. 303

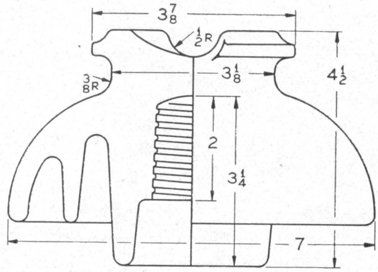
PIN TYPE INSULATORS

INSULATOR NO.	303	6510 and 6511
	20,000 VOLTS	20,000 VOLTS
Dry arc-over voltage	75,000	70,000
Wet arc-over voltage	40,000	40,000
Leakage distance	8¾ inches	9¼ inches
Mechanical strength	3,000 lb.	3,000 lb.
Minimum height pin	5 inches	5 inches
Net weight each	2¾ lb.	3 lb.
Packed weight each	4 lb.	4 lb.
Standard package	Box of 18	Box of 18

CATALOG No.	CODE WORD	SIZE PIN HOLE
303	ABFEX	1⅜ inches
6510	AYAPX	1 inch
6511	AYARO	1⅜ inches



Nos. 10270 and 23513

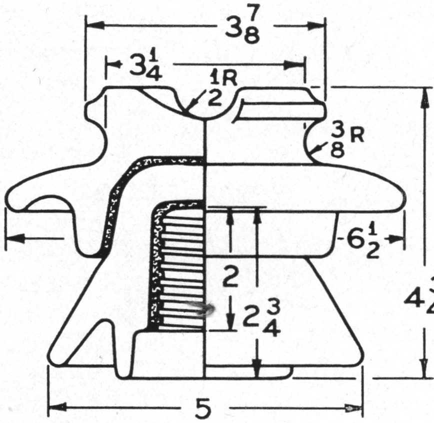


Nos. 1022 and 23514

PIN TYPE INSULATORS

INSULATOR NO.	10270 and 23513	1022 and 23514
	20,000 VOLTS	23,000 VOLTS
Dry arc-over voltage	70,000	85,000
Wet arc-over voltage	40,000	50,000
Leakage distance	8 inches	12½ inches
Mechanical strength	2,500 lb.	3,000 lb.
Minimum height pin	5 inches	5 inches
Net weight each	2¾ lb.	4½ lb.
Packed weight each	3½ lb.	6 lb.
Standard package	Box of 18	Box of 12

CATALOG No.	CODE WORD	SIZE PIN HOLE
10270	CIAGS	1 inch
23513	GAWHY	1⅜ inches
1022	AEBHF	1⅜ inches
23514	GAWIB	1 inch



INSULATOR NO. 1023

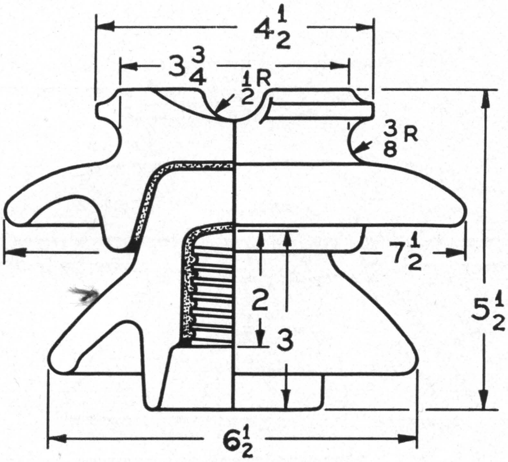
23,000 Volts

This insulator is regularly furnished with a $1\frac{3}{8}$-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	82,000
Wet arc-over voltage	60,000
Leakage distance	10 inches
Mechanical strength	2,500 lb.
Minimum height pin	5 inches
Net weight each	$4\frac{3}{4}$ lb.
Packed weight each	$7\frac{1}{4}$ lb.
Standard package	Crate of 15

CODE WORD

With threaded pin hole	AEBKO
With sanded pin hole	AEBKR



INSULATOR NO. 1027

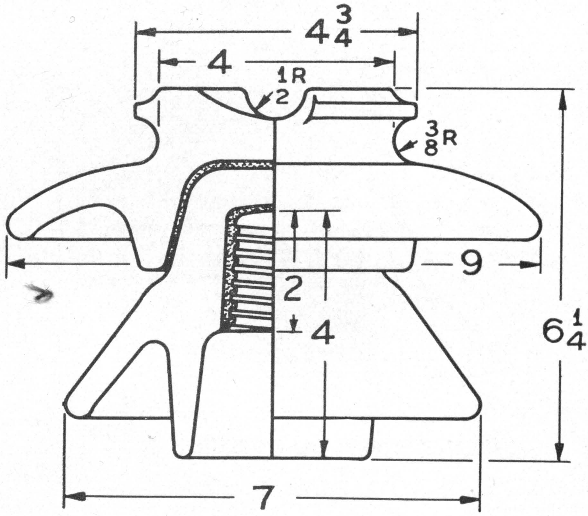
27,000 Volts

This insulator is regularly furnished with a 1⅜-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	95,000
Wet arc-over voltage	65,000
Leakage distance	12 inches
Mechanical strength	2,500 lb.
Minimum height pin	6 inches
Net weight each	6¼ lb.
Packed weight each	9¾ lb.
Standard package	Crate of 6

CODE WORD

With threaded pin hole	AEBSK
With sanded pin hole	AEBSN



INSULATOR NO. 1035

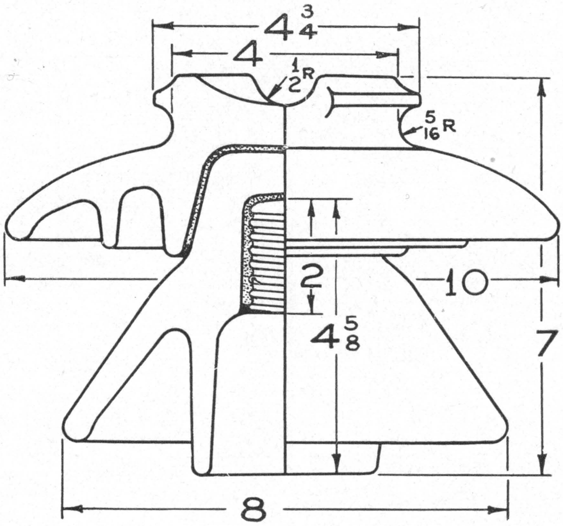
35,000 Volts

This insulator is regularly furnished with a 1⅜-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	110,000
Wet arc-over voltage	75,000
Leakage distance	16½ inches
Mechanical strength	3,000 lb.
Minimum height pin	7 inches
Net weight each	10 lb.
Packed weight each	13¼ lb.
Standard package	Crate of 6

CODE WORD

With threaded pin hole	AECEX
With sanded pin hole	AECEY



INSULATOR NO. 1044

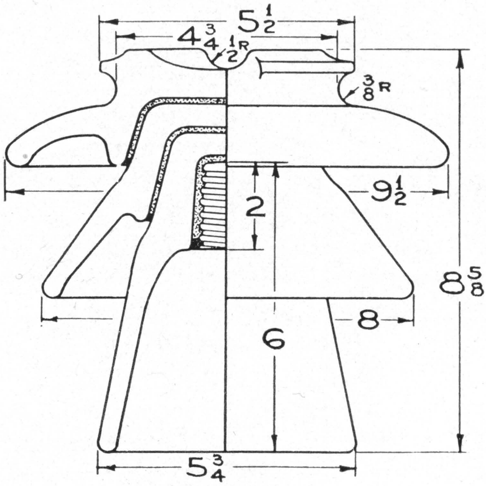
44,000 Volts

This insulator is regularly furnished with a 1 3/8-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with 1 9/16-inch sanded pin hole.

Dry arc-over voltage	125,000
Wet arc-over voltage	85,000
Leakage distance	20 inches
Mechanical strength	3,000 lb.
Minimum height pin	8 inches
Net weight each	15¼ lb.
Packed weight each	18¾ lb.
Standard package	Crate of 6

CODE WORD

With threaded pin hole	AECWY
With sanded pin hole	AECWZ



INSULATOR NO. 1045

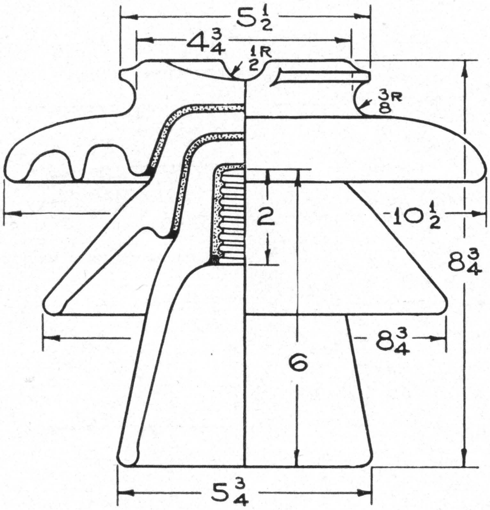
45,000 Volts

This insulator is regularly furnished with a $1\frac{3}{8}$-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	135,000
Wet arc-over voltage	95,000
Leakage distance	22 inches
Mechanical strength	3,000 lb.
Minimum height pin	10 inches
Net weight each	14 lb.
Packed weight each	18 lb.
Standard package	Crate of 3

CODE WORD

With threaded pin hole	AECYE
With sanded pin hole	AECYN



Insulator No. 1050

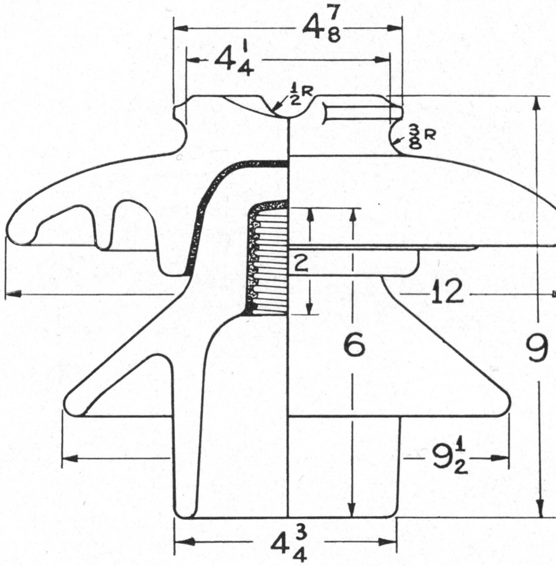
50,000 Volts

This insulator is regularly furnished with a 1⅜-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	140,000
Wet arc-over voltage	100,000
Leakage distance	25 inches
Mechanical strength	3,000 lb.
Minimum height pin	10 inches
Net weight each	19 lb.
Packed weight each	23¾ lb.
Standard package	Crate of 3

Code Word

With threaded pin hole	AEDIK
With sanded pin hole	AEDIN



INSULATOR NO. 1055

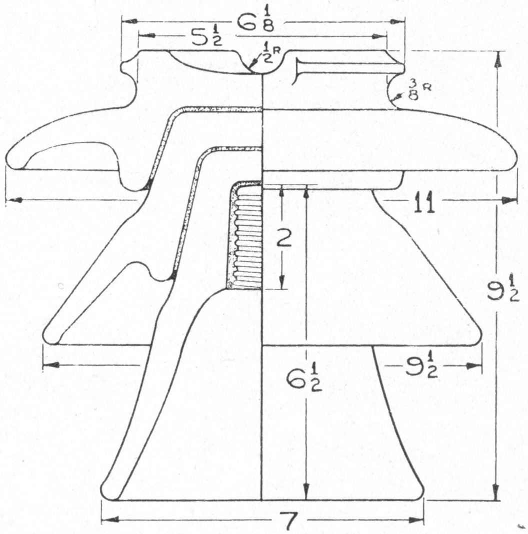
55,000 Volts

This insulator is regularly furnished with a 1⅜-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	140,000
Wet arc-over voltage	110,000
Leakage distance	26½ inches
Mechanical strength	3,000 lb.
Minimum height pin	10 inches
Net weight each	19½ lb.
Packed weight each	26¼ lb.
Standard package	Crate of 3

CODE WORD

With threaded pin hole	AEDUT
With sanded pin hole	AEDUX



INSULATOR NO. 1056

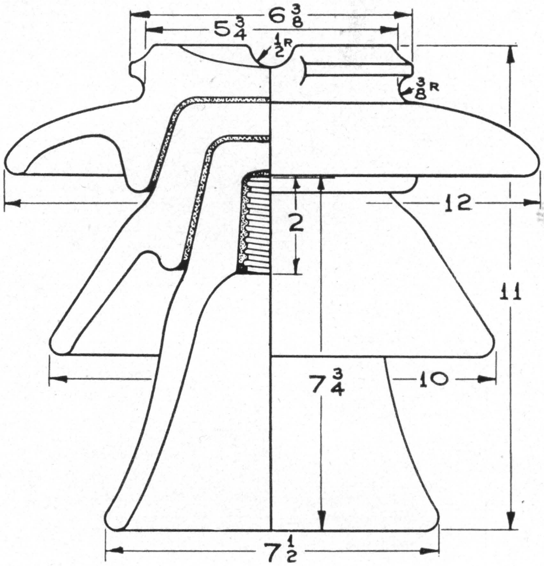
55,000 Volts

This insulator is regularly furnished with a 1⅜-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	150,000
Wet arc-over voltage	110,000
Leakage distance	26 inches
Mechanical strength	3,500 lb.
Minimum height pin	10 inches
Net weight each	20 lb.
Packed weight each	26 lb.
Standard package	Crate of 3

CODE WORD

With threaded pin hole	AEDYF
With sanded pin hole	AEDYN



INSULATOR NO. 1060

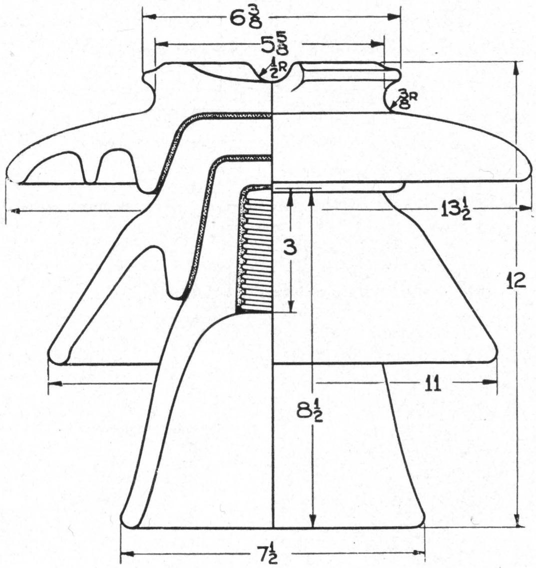
60,000 Volts

This insulator is regularly furnished with a $1\frac{3}{8}$-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	160,000
Wet arc-over voltage	120,000
Leakage distance	30 inches
Mechanical strength	3,500 lb.
Minimum height pin	12 inches
Net weight each	26 lb.
Packed weight each	$32\frac{3}{4}$ lb.
Standard package	Crate of 3

CODE WORD

With threaded pin hole	AEFFD
With sanded pin hole	AEFFN



Insulator No. 1066

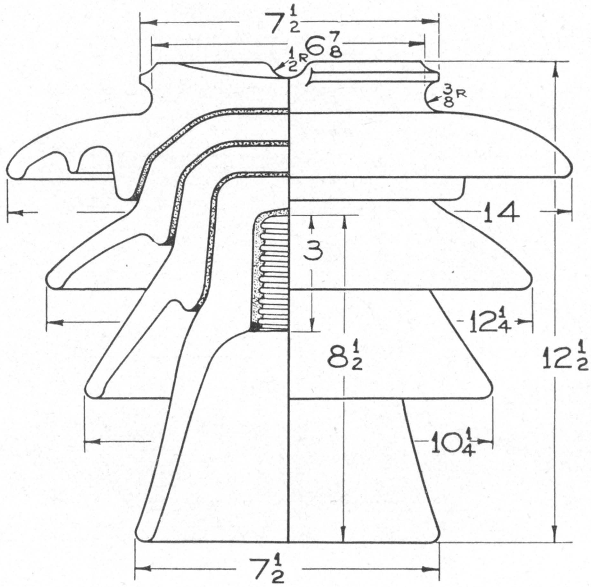
66,000 Volts

This insulator is regularly furnished with a $1\frac{3}{8}$-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

Dry arc-over voltage	170,000
Wet arc-over voltage	130,000
Leakage distance	33 inches
Mechanical strength	3,500 lb.
Minimum height pin	12 inches
Net weight each	$33\frac{1}{2}$ lb.
Packed weight each	$42\frac{1}{4}$ lb.
Standard package	Crate of 3

Code Word

With threaded pin hole	AEFTS
With sanded pin hole	AEFTY



INSULATOR No. 1070

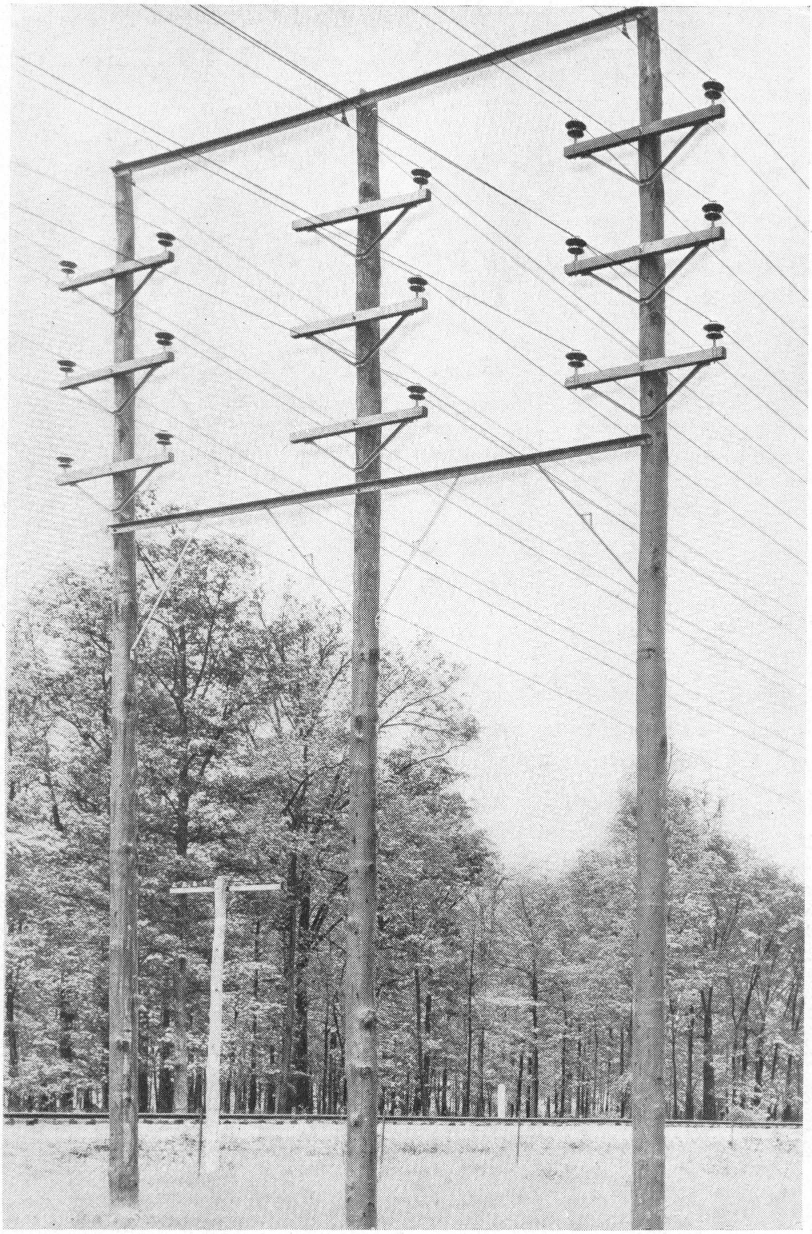
70,000 Volts

This insulator is regularly furnished with a $1\frac{3}{8}$-inch pin hole having the standard N. E. L. A. thread. When desired it can be furnished with $1\frac{9}{16}$-inch sanded pin hole.

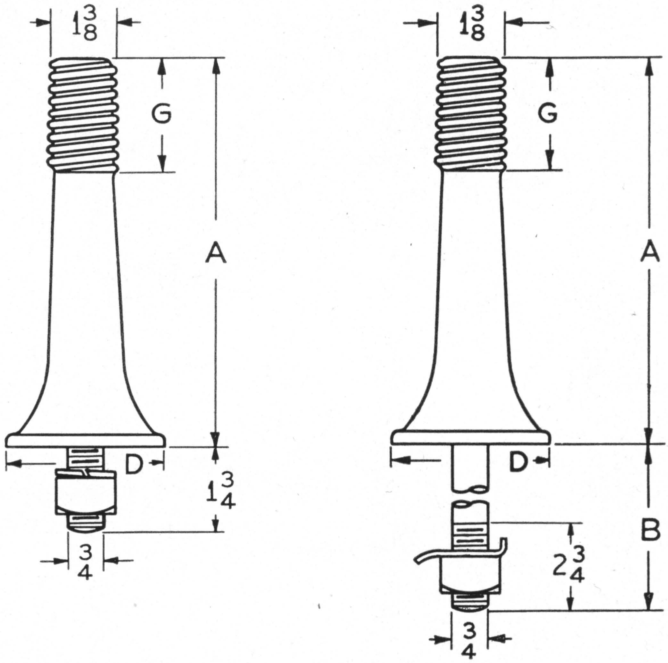
Dry arc-over voltage	180,000
Wet arc-over voltage	140,000
Leakage distance	39 inches
Mechanical strength	4,000 lb.
Minimum height pin	12 inches
Net weight each	45 lb.
Packed weight each	54 lb.
Standard package	Crate of 3

CODE WORD

With threaded pin hole	AEFYH
With sanded pin hole	AEFYN



THE MUNCIE FIVE CIRCUIT LINE OF THE INDIANA GENERAL SERVICE COMPANY. LOCKE INSULATORS AND LOCKE PINS



LOCKE REDHEAD AND LEADHEAD PINS

Locke Redhead and Leadhead pins have been designed to permit the insulators mounted on them to develop their full strength and maximum efficiency.

The Redhead pin is forged steel having the thread as an integral part of the pin. These pins are eminently satisfactory for use with any standard Locke multipart pin type insulator or any other insulator having a 1⅜-inch metal threaded pin hole with the standard N.E.L.A. thread. Being less expensive than the Leadhead pin they afford, in combination with Locke insulators, a worthwhile economy.

Locke Leadhead pins are identical in design with Locke Redhead pins except that the thread is lead. The lead is definitely bonded to the steel pin and threads are then turned on the cob making an exactly dimensioned head. While they may be used with insulators having a metal threaded pin hole they are designed primarily for mounting the older type insulators having the threads cut directly into the porcelain.

Either of these pins will develop greater mechanical strength than the cross arm on which they are mounted.

Locke Redhead Pins
Forged Steel

For Wood Cross Arms

Catalog No.	Code Word	Dimensions in Inches A	B	D	G	Lb. per 100 Packed
16006	VEWGI	6	6½	3	2¼	395
16008	VEWHL	8	7	3	2¼	470
16010	VEWIO	10	7	3½	2¼	576
16012	VEWLY	12	7	3¾	2¼	768
16014	VEXDA	14	7	3¾	2¼	938

For Metal Cross Arms

Catalog No.	Code Word	A	B	D	G	Lb. per 100 Packed
16106	VEUKT	6	1¾	3	2¼	331
16108	VEUMZ	8	1¾	3	2¼	400
16110	VEUNC	10	1¾	3½	2¼	508
16112	VEUOF	12	1¾	3¾	2¼	699
16114	VEWES	14	1¾	3¾	2¼	838

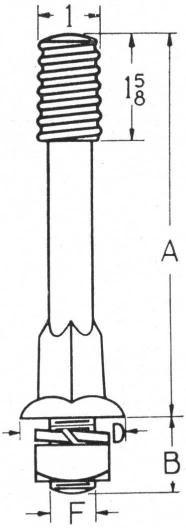
Locke Leadhead Pins
Forged Steel

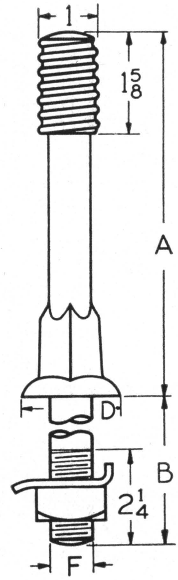
For Wood Cross Arms

Catalog No.	Code Word	Dimensions in Inches A	B	D	G	Lb. per 100 Packed
17006	VEXWE	6	6½	3	2⅛	486
17008	VHEDM	8	7	3	2⅛	572
17010	VHEEP	10	7	3½	2⅛	660
17012	VHEFT	12	7	3¾	2⅛	886
17014	VHEHZ	14	7	3¾	2⅛	1070

For Metal Cross Arms

Catalog No.	Code Word	A	B	D	G	Lb. per 100 Packed
17106	VEXED	6	1¾	3	2⅛	401
17108	VEXIP	8	1¾	3	2⅛	486
17110	VEXOI	10	1¾	3½	2⅛	635
17112	VEXRO	12	1¾	3¾	2⅛	793
17114	VEXUY	14	1¾	3¾	2⅛	977





Locke Leadhead Pins

1 Inch Thread

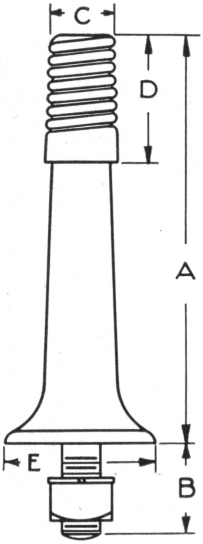
FORGED STEEL

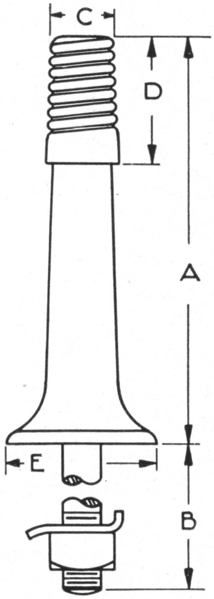
For Wood Cross Arms

Catalog No.	Code Word	Dimensions in Inches				Pounds per C Packed
		A	B	D	F	
27266	HOYCH	4¾	5½	1⅝	⅝	156
27267	HOYDK	6	5½	1⅝	⅝	166
27268	HOYEN	4¾	5¾	1¾	¾	205
27269	HOYGU	6	5¾	1¾	¾	220

For Metal Cross Arms

Catalog No.	Code Word	A	B	D	F	Pounds per C Packed
27270	HOYIA	4¾	1¼	1⅝	⅝	129
27271	HOYJD	6	1¼	1⅝	⅝	130
27272	HOYLJ	4¾	1½	1¾	¾	135
27273	HOYNP	6	1½	1¾	¾	157





FORGED STEEL PINS

Separable Thimble Type

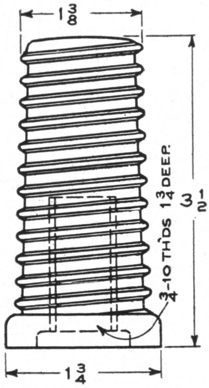
FOR WOOD CROSS ARMS

Catalog No.	Code Word	DIMENSIONS IN INCHES A	B	C	D	E	Pounds per C Packed
15624	VIYEC	6	6½	1 7/32	2½	3	384
15626	VIYHL	7	6½	1 7/32	2½	3	419
15628	VIYKV	8	7	1 7/32	2½	3	472
15630	VIYMB	9	7	1 7/32	2½	3½	564
15632	VIYOH	10	7	1 7/32	2½	3½	613
15634	VIYRN	11	7	1 7/32	2½	3¾	690
15636	VIYUX	12	7	1 7/32	2½	3¾	754

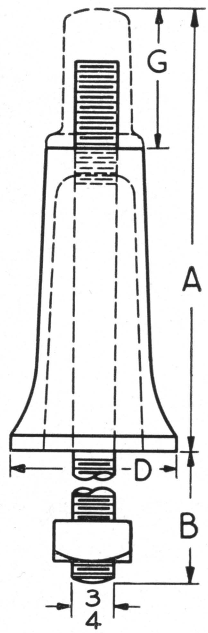
FOR METAL CROSS ARMS

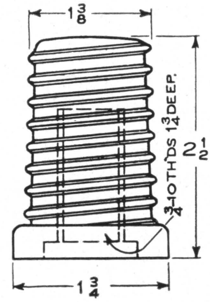
Catalog No.	Code Word	A	B	C	D	E	Pounds per C Packed
15623	VIYDZ	6	1¾	1 7/32	2½	3	310
15625	VIYGI	7	1¾	1 7/32	2½	3	347
15627	VIYIO	8	1¾	1 7/32	2½	3	392
15629	VIYLY	9	1¾	1 7/32	2½	3½	485
15631	VIYNE	10	1¾	1 7/32	2½	3½	533
15633	VIYPK	11	1¾	1 7/32	2½	3¾	608
15635	VIYTU	12	1¾	1 7/32	2½	3¾	668

This series of pins is furnished with ¾-inch bolts.

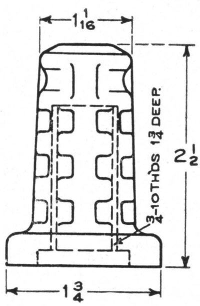


Lead threaded type
No. 9524

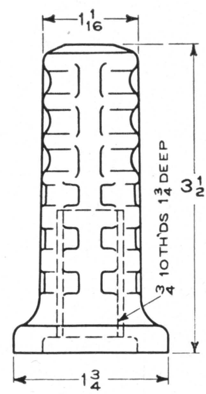




Lead threaded type
No. 9523



No. 9521



No. 9522

SEPARABLE THIMBLE LEE TYPE INSULATOR PINS

	Code Word
9521	VAZNI
9522	VAZOK
9523	VAZPO
9524	VAZTY

Thimbles and bases are cast iron, bolts are steel all hot galvanized. The illustration shows pin for flat top wood cross arm. For use with metal cross arm flat lock washer will be furnished. When intended for round top cross arm, saddles as shown on page 185 should be used.

Separable Thimble Lee Type Insulator Pins

For Wood Arms—Thimble Cemented in Insulator

Catalog No.	Code Word	Thimble No.	A	B	D	G	LB. EACH Net	LB. EACH Pkd.
9503-G1	VUKOH	9521	6	6¼	3	2½	2½	2⅝
9505-G1	VUKTE	9521	7	6¼	3	2½	3	3⅛
9507-G1	VEDYR	9521	8	6¼	3	2½	4½	4⅝
9509-G1	VEDZU	9521	10	6¼	3	2½	5	5¼
9511-G1	VEECE	9522	12	6¼	3¾	3½	6½	6¾
9513-G1	VEEDH	9522	14	6¼	3¾	3½	8	8¼

For Metal Arms—Thimble Cemented in Insulator

Catalog No.	Code Word	Thimble No.	A	B	D	G	LB. EACH Net	LB. EACH Pkd.
9502-G1	VUECA	9521	6	1¾	3	2½	2¼	2⅜
9504-G1	VUEEG	9521	7	1¾	3	2½	2¾	2⅞
9506-G1	VEEFN	9521	8	1¾	3	2½	4	4⅛
9508-G1	VEEHU	9521	10	1¾	3	2½	4½	4⅝
9510-G1	VEEIX	9522	12	1¾	3¾	3½	6	6¼
9512-G1	VEEJA	9522	14	1¾	3¾	3½	7½	7¾

For Wood Arm—Lead Thread

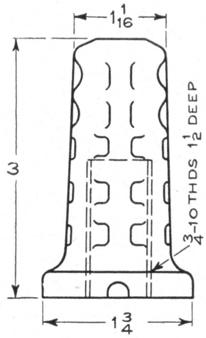
Catalog No.	Code Word	Thimble No.	A	B	D	G	LB. EACH Net	LB. EACH Pkd.
9503-G2	VUEFJ	9523	6	6¼	3	2½	3	3⅛
9505-G2	VUEGM	9523	7	6¼	3	2½	3½	3⅝
9507-G2	VEEKD	9523	8	6¼	3	2½	5	5¼
9509-G2	VEELG	9523	10	6¼	3	2½	5½	5¾
9511-G2	VAZAF	9524	12	6¼	3¾	3½	7	7¼
9513-G2	VAZCA	9523	14	6¼	3¾	3½	8½	8¾

For Metal Arm—Lead Thread

Catalog No.	Code Word	Thimble No.	A	B	D	G	LB. EACH Net	LB. EACH Pkd.
9502-G2	VUEHP	9523	6	1¾	3	2½	2¾	2⅞
9504-G2	VUEIT	9523	7	1¾	3	2½	3¼	3⅜
9506-G2	VAZES	9523	8	1¾	3	2½	4¾	4⅞
9508-G2	VAZGM	9523	10	1¾	3	2½	5¼	5½
9510-G2	VAZHP	9524	12	1¾	3¾	3½	6¾	7
9512-G2	VAZIV	9524	14	1¾	3¾	3½	8¼	8½

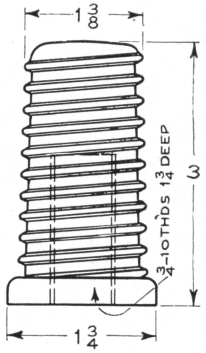
Pins can be furnished with any length bolt to fit any size cross arm.

THIMBLES FOR SEPARABLE THIMBLE LEE TYPE INSULATOR PINS



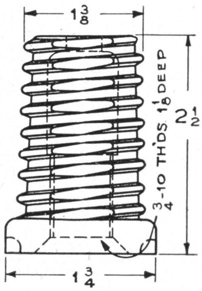
No. 9540

With Thimbles No. 9540 and No. 9546 the "A" dimension of the pins—as shown on page 180—may be varied to suit conditions.

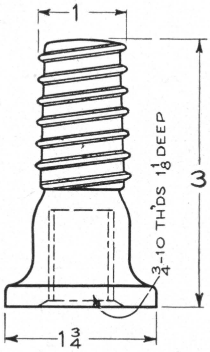


Lead threaded type

No. 9546



No. 27088

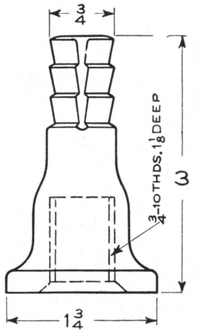


Lead threaded type

No. 13363

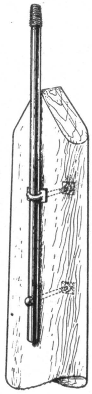
Adapter No. 27088 converts the Lee Type Pins into pins having the standard 1⅜-inch N. E. L. A. thread which will fit perfectly into the standard metal threaded pin-type insulators.

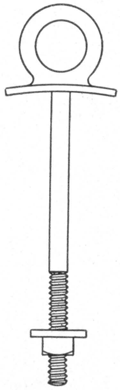
Thimbles No. 13363 and No. 9525 are used when pins are supplied for insulators having one-inch pinholes.



No. 9525

No. 52124





No. 52151

Solid Steel Pole Top Pin is made of a solid bar of a special alloy steel either 1 or 1⅛-inch in diameter and furnished with lead threads.

The number 52151 eyebolt is drop forged from open hearth steel and has a curved shoulder to fit the pole. A ⅝-inch machine bolt or lag screw is used to fasten the bottom of the pin to the pole.

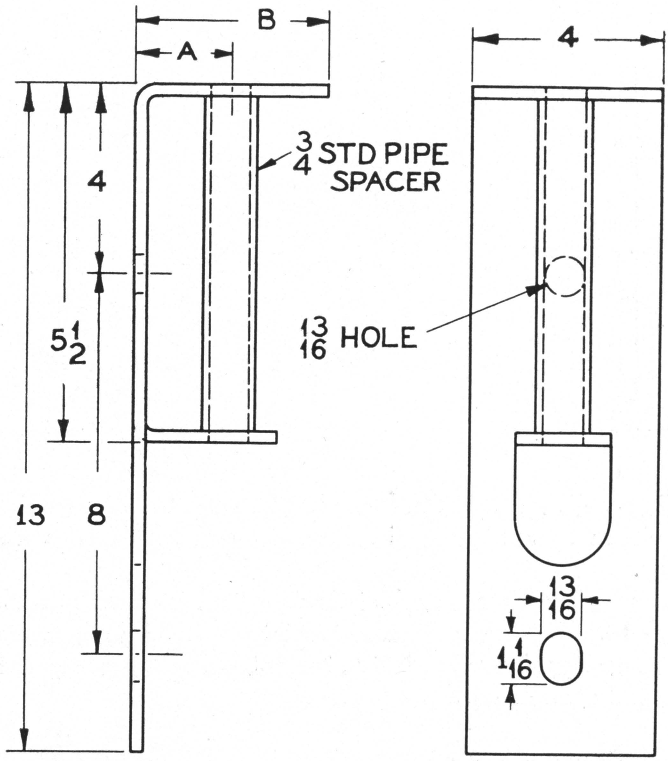
Pin and eyebolt both hot galvanized.

SOLID STEEL POLE TOP PINS WITH 1⅜-INCH LEAD THREAD

Catalog No.	Dimensions in Inches		Standard Package	Weight per 100
	Overall Length	Diameter of Pin		
52120	20	1	Bdle. 10	745
52124	24	1	Bdle. 10	833
52125	24	1⅛	Bdle. 10	979
52131	30	1⅛	Bdle. 10	1148
52137	36	1⅛	Bdle. 10	1317

EYEBOLTS

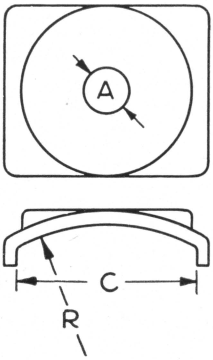
Catalog No.	Dimensions in Inches			Standard Package	Weight per 100
	Length to Center of Eye	Diameter of Bolt	Use with Pin Diameter		
52149	10	⅝	1	Bag 50	129
52151	12	⅝	1	Bag 50	145
52153	14	⅝	1	Bag 50	161
52150	10	⅝	1⅛	Bag 50	129
52152	12	⅝	1⅛	Bag 50	145
52154	14	⅝	1⅛	Bag 50	161



Pole Top Bracket No. 2700-2701

Made of ¼-inch steel plate. Spacers are made of wrought iron. All hot galvanized. Any of the standard pins shown on pages 177, 179 or 181 are suitable for use with these brackets.

Catalog No.	Code Word	Dimensions in Inches		Lb. per 100	
		A	B	Net	Pkd.
2700	VHAGS	2	4	475	481
2701	VIMUS	3	4¾	500	507

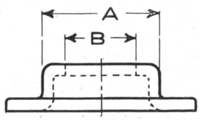


CROSS-ARM PIN SADDLES

For round top wood cross arms it is desirable to use a saddle under the pin base as shown.

These saddles are made of No. 7 gauge sheet steel, stamped into shape. All hot galvanized.

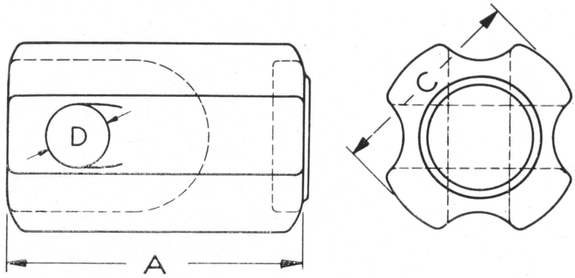
Catalog No.	Code Word	DIMENSIONS IN INCHES			LB. PER 100	
		A	C	R	Net	Pkd.
4645	RIBEM	$\frac{13}{16}$	$3\frac{1}{4}$	$4\frac{1}{2}$	$36\frac{1}{2}$	38
4646	RIBGI	$1\frac{1}{16}$	$3\frac{1}{4}$	$4\frac{1}{2}$	$36\frac{1}{2}$	38
4647	RAJUG	$\frac{13}{16}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$37\frac{1}{2}$	39
4648	RAJUV	$1\frac{1}{16}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$37\frac{1}{2}$	39
4649	RAJYH	$\frac{13}{16}$	$3\frac{3}{4}$	$4\frac{1}{2}$	61	64
4650	RAJYZ	$1\frac{1}{16}$	$3\frac{3}{4}$	$4\frac{1}{2}$	61	64
4651	RAKAC	$\frac{13}{16}$	4	$4\frac{1}{2}$	$62\frac{1}{2}$	66
4652	RAKBA	$1\frac{1}{16}$	4	$4\frac{1}{2}$	$62\frac{1}{2}$	66
4654	RIBIT	$\frac{13}{16}$	5	$4\frac{1}{2}$	$67\frac{1}{2}$	73
4655	RIBLY	$1\frac{1}{16}$	5	$4\frac{1}{2}$	$67\frac{1}{2}$	73



BOLT HOLE ADAPTERS

Frequently it is desired to install steel pins in cross arms already bored for wood pins. These adapters hold the bolt central in the holes. Made of pressed steel, hot galvanized.

Catalog No.	Code Word	DIMENSIONS IN INCHES		LB. PER 100	
		A	B	Net	Pkd.
9498	VUJFO	$1\frac{1}{4}$	$\frac{13}{16}$	$26\frac{1}{2}$	28
9498-1	VUJIY	$1\frac{1}{4}$	$1\frac{1}{16}$	$25\frac{1}{2}$	27
9498-2	VUJKE	$1\frac{1}{2}$	$\frac{13}{16}$	$28\frac{1}{2}$	31
9498-3	VUJOR	$1\frac{1}{2}$	$1\frac{1}{16}$	$27\frac{1}{2}$	29



GUY INSULATORS

INSULATOR NO.	502	504	506
Line voltage	2,200	4,400	6,600
Dry arc-over voltage	23,000	25,000	31,000
Wet arc-over voltage	12,000	14,000	17,000
Mechanical strength	7,500 lb.	12,000 lb.	20,000 lb
Use cable not over, diam., inch	3/8	1/2	5/8
Dimension A, inches	3 1/2	4 1/4	5 7/8
Dimension C, inches	2 1/2	2 7/8	3 3/8
Dimension D, inch	5/8	7/8	1
Net weight each	7/8 lb.	1 1/2 lb.	2 5/8 lb.
Packed weight each	1 1/8 lb.	1 3/4 lb.	3 1/8 lb.
Standard package	Box of 50	Box of 50	Box of 25

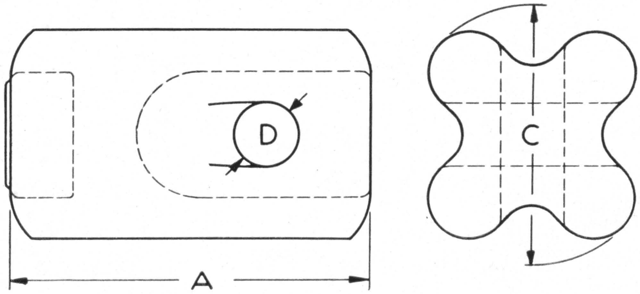
CODE WORD

502	VEZYM
504	VHAAZ
506	VHAEF

Mechanical strength is as measured when pulled with mild steel or hard copper cable. Extra high strength steel cable will not bear equally upon porcelain surfaces and will injure the insulator.

Arc-over voltages given were obtained under actual service conditions using full-sized cables.

These insulators are regularly furnished glazed standard chocolate color.



GUY INSULATORS

INSULATOR NO.	13371	13372	13373
Line voltage	2,200	4,400	6,600
Dry arc-over voltage	30,000	35,000	40,000
Wet arc-over voltage	10,000	12,000	16,000
Mechanical strength	7,500 lb.	12,000 lb.	16,000 lb.
Use cable not over, diam., inch	3/8	5/8	3/4
Dimension A, inches	3 1/2	4 1/4	6 3/4
Dimension C, inches	3 1/4	3 5/8	4 3/4
Dimension D, inch	5/8	7/8	1
Net weight each	1 1/8 lb.	2 3/8 lb.	4 1/2 lb.
Packed weight each	1 3/8 lb.	2 5/8 lb.	5 lb.
Standard package	Box of 50	Box of 32	Box of 16

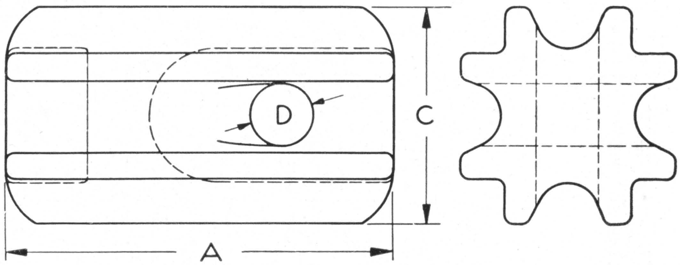
CODE WORD

13371 . . . . VRIHL
13372 . . . . VRIJS
13373 . . . . VRIKV

Mechanical strength is as measured when pulled with mild steel or hard copper cable. Extra high strength steel cable will not bear equally upon porcelain surfaces and will injure the insulators.

Arc-over voltages given were obtained under actual service conditions using full-sized cables.

These insulators are regularly furnished glazed standard chocolate color.



GUY INSULATORS

INSULATOR NO.	7664	7665	7666
Line voltage	2,200	4,400	6,600
Dry arc-over voltage	30,000	35,000	42,000
Wet arc-over voltage	15,000	18,000	22,000
Mechanical strength	7,500 lb.	12,000 lb.	20,000 lb.
Use cable not over, diam., inch	3/8	1/2	5/8
Dimension A, inches	3 1/2	5 3/8	6 3/4
Dimension C, inches	2 1/2	3	3 1/2
Dimension D, inch	5/8	7/8	1
Net weight each	1 lb.	2 1/4 lb.	3 5/8 lb.
Packed weight each	1 1/4 lb.	2 5/8 lb.	4 1/8 lb.
Standard package	Box of 50	Box of 25	Box of 25

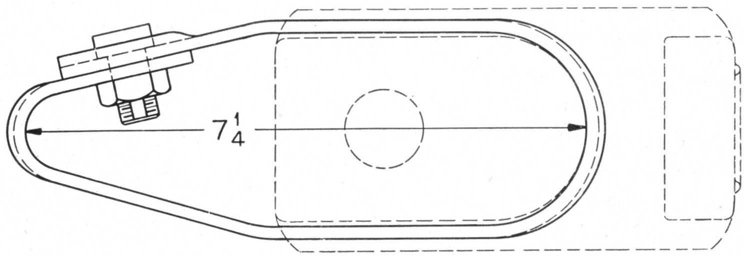
CODE WORD

7664	WOYTU
7665	WOYUX
7666	WOYVA

Mechanical strength is as measured when pulled with mild steel or hard copper cable. Extra high strength steel cable will not bear equally upon porcelain surfaces and will injure the insulators.

Arc-over voltages given were obtained under actual service conditions using full-sized cables.

These insulators are regularly furnished glazed standard chocolate color.



GUY INSULATOR CONNECTOR

This inexpensive connector is easy to apply and greatly simplifies construction of distribution or rural lines. It is made of steel and is designed to give greater strength than the strength of the cables with which it may be used.

This connector can be used with Locke guy insulators No. 504, 506, 7665, 7666, 13372, and 13373 or with any similar insulators having a hole 7/8-inch or over.

All parts hot galvanized.

Catalog No.	Code Word	Material	Pounds Per C Packed
27240	CHCEA	Steel	62 1/2

Locke Pedestal Insulators

Locke Pedestal Insulators are in such extensive use all over the world that a performance history is readily available. The designs have been proved correct, not only in the laboratory but in long years of service in the field. Today more than 50 per cent of all pedestal insulators in use in this country were designed and manufactured by the Locke Insulator Corporation.

Exacting standards are rigidly maintained. Precise factory control obtains from the moment of receipt of the raw material until the actual shipment of the insulator. Assembly is done by experienced workers, strictly supervised and safeguarded by every possible mechanical means. The cement used in assembly has been especially selected for this work and is constantly checked. The insulators are assembled in rigid jigs which assure accurate alignment. While the cement is still soft the insulators are placed in steaming closets where they are maintained at a specific temperature for a predetermined length of time. The heat of the steam insures a rapid and complete setting of the cement and further insures that all metal parts and the cement are thoroughly expanded while setting. The metal parts with their coefficient of expansion greater than that of the porcelain cannot subsequently damage the porcelain by expansion or contraction. The excess moisture provides ample water for the complete hydration of the cement.

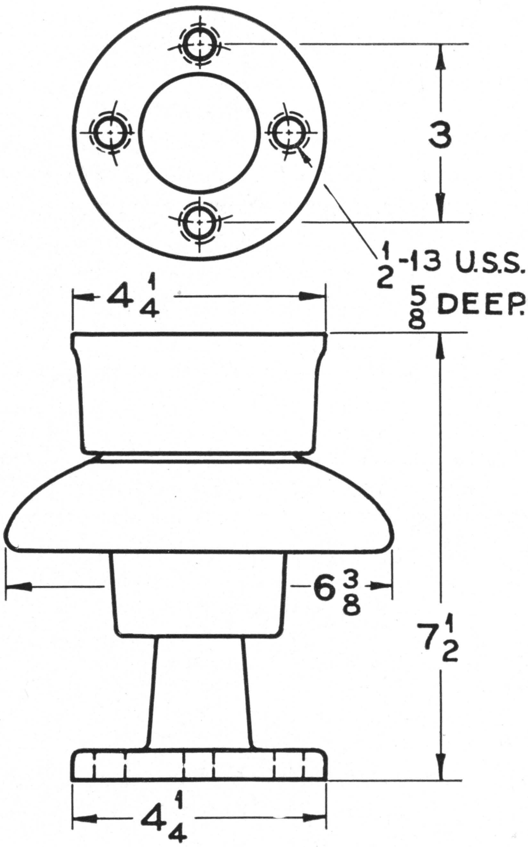
All cement joints are definitely waterproofed to prevent the introduction of water into the pores of the cement and the consequent possibility of damage under freezing conditions.

These insulators are regularly furnished with standard chocolate glaze.

The standard insulators shown on the following pages will take care of practically any service requirement. Where some peculiar condition seems to demand a variation from these standards, such variation can readily be taken care of.

The National Electric Manufacturers Association has published tentative flashover requirements for switch insulators recommended for use under the N.E.M.A.–N.E.L.A. line voltage ratings. These values are for the standard condition of 65 per cent relative humidity, temperature 25 deg. C., and a barometric pressure of 760 millimeters of mercury, the tests being made in accordance with the A.I.E.E. specifications for obtaining flashover values on insulators. In the following tabulation are given the N.E.L.A. line voltage classifications, the recommended N.E.M.A. dry flashover for switch insulators to be used under these ratings, and a table of Locke Insulators or combination of insulators, which will meet the N.E.M.A. requirements. It cannot be overemphasized that flashover tests, if not to be misleading, must be made in accordance with the latest A.I.E.E. specifications which take care of the large variations in flashover due to different humidities.

NEMA–NELA Line Voltage Rating	Recommended NEMA F.O.		Locke Pedestal Insulators that will meet the NEMA Recommendations
	Dry	Wet	
7500	55000	35000	10200
15000	75000	50000	29150
15000	75000	50000	23070
23000	95000	70000	29151
23000	95000	70000	23070
34500	125000	100000	10455
46000	155000	125000	9153
69000	220000	180000	2—23511
115000	340000	285000	3— 7785
138000	400000	350000	4—23042
138000	400000	350000	4— 7785
138000	400000	350000	4—13239
161000	455000	380000	4— 7785
161000	455000	380000	4—13239
230000	645000	560000	6— 7785
230000	645000	560000	6—13239



INSULATOR NO. 10200

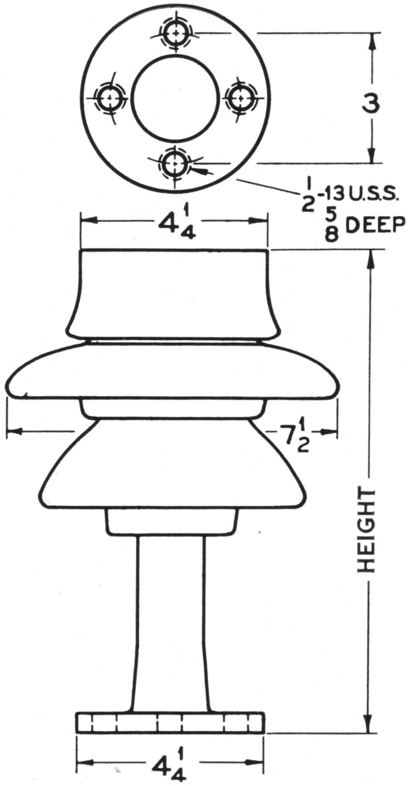
INSULATOR NO. 10200

This insulator is designed chiefly for medium duty service as a single unit. In special cases, where the mechanical load is very light, it may be used in stacks.

Caps are high grade gray iron castings. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	7,500
Dry arc-over voltage	65,000
Wet arc-over voltage	40,000
Leakage distance	8 inches
Bending strength	2,000 lb.
Tension strength	4,000 lb.
Torsion strength	6,000 in. lb.
Net weight each	10 lb.
Packed weight each	13 lb.
Standard package	Crate of 12

CODE WORD . . . WIONX



Insulator No. 29150 and 9150

Catalog No.	Height
29150	10 inches
9150	11 inches

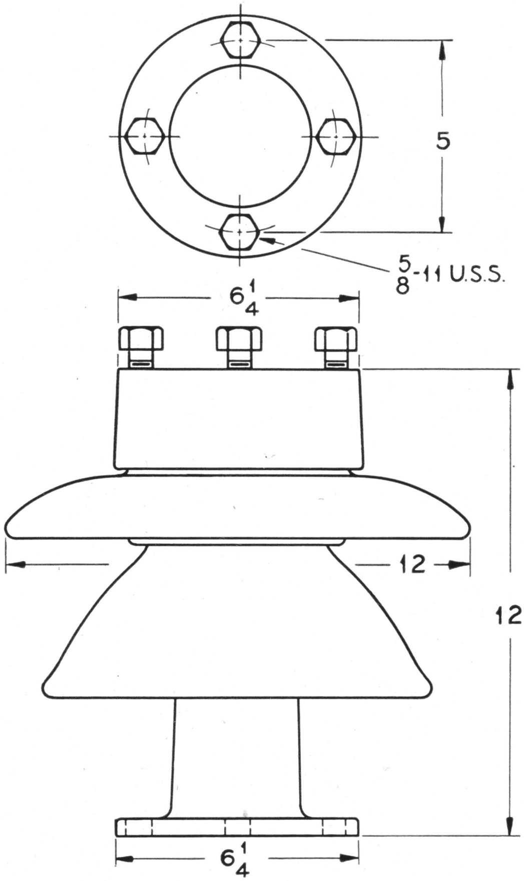
INSULATOR NO. 29150 AND 9150

This insulator is designed chiefly for medium duty service as a single unit. In special cases, where the mechanical load is very light, it may be used in stacks.

Caps are high grade gray iron castings. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	15,000
Dry arc-over voltage	85,000
Wet arc-over voltage	50,000
Leakage distance	11¾ inches
Bending strength	1,500 lb.
Tension strength	4,500 lb.
Torsion strength	6,000 in. lb.
Net weight each	15 lb.
Packed weight each	19½ lb.
Standard package	Crate of 12

CATALOG NO.	CODE WORD	HEIGHT
29150	IELIO	10 inches
9150	WIZEF	11 inches



INSULATOR NO. 23070

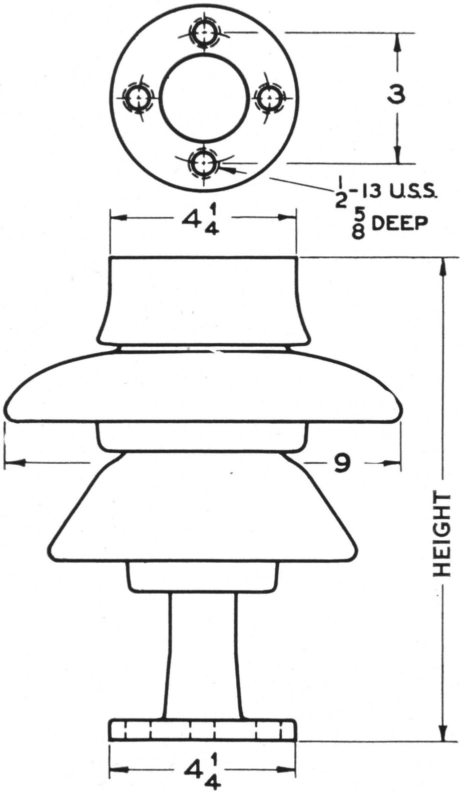
Insulator No. 23070

This insulator is designed for use where a sturdier insulator than the regular 15- to 23-kv. insulator is needed. In special cases it may be used in stacks. It is identical with Locke No. 8888 except in height of pin.

Caps and pins are of high grade malleable iron, machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	15,000–23,000
Dry arc-over voltage	120,000
Wet arc-over voltage	70,000
Leakage distance	18 inches
Bending strength	4,000 lb.
Tension strength	12,000 lb.
Torsion strength	15,000 in. lb.
Net weight each	38 lb.
Packed weight each	44 lb.
Standard package	3 per crate

Code Word . . . FYOCS



INSULATOR NO. 29151 AND 9151

CATALOG NO.	HEIGHT
29151	12 inches
9151	11 inches

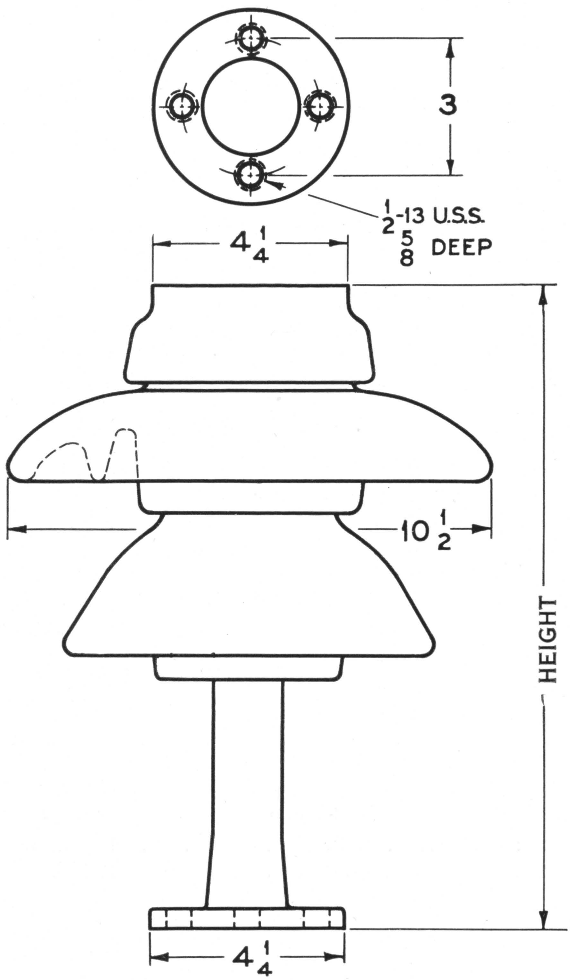
INSULATOR NO. 29151 AND 9151

This insulator is designed chiefly for medium duty service as a single unit. In special cases, where the mechanical load is very light, it may be used in stacks.

Caps are high grade gray iron castings. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage	23,000
Dry arc-over voltage	105,000
Wet arc-over voltage	70,000
Leakage distance	16 inches
Bending strength	2,000 lb.
Tension strength	5,000 lb.
Torsion strength	6,000 in. lb.
Net weight each	19 lb.
Packed weight each	22 lb.
Standard package	Crate of 6

CATALOG NO.	CODE WORD	HEIGHT
29151	IELLY	12 inches
9151	WIZFI	11 inches



Insulator No. 10100 and 23023

Catalog No.	Height
10100	14 inches
23023	13 inches

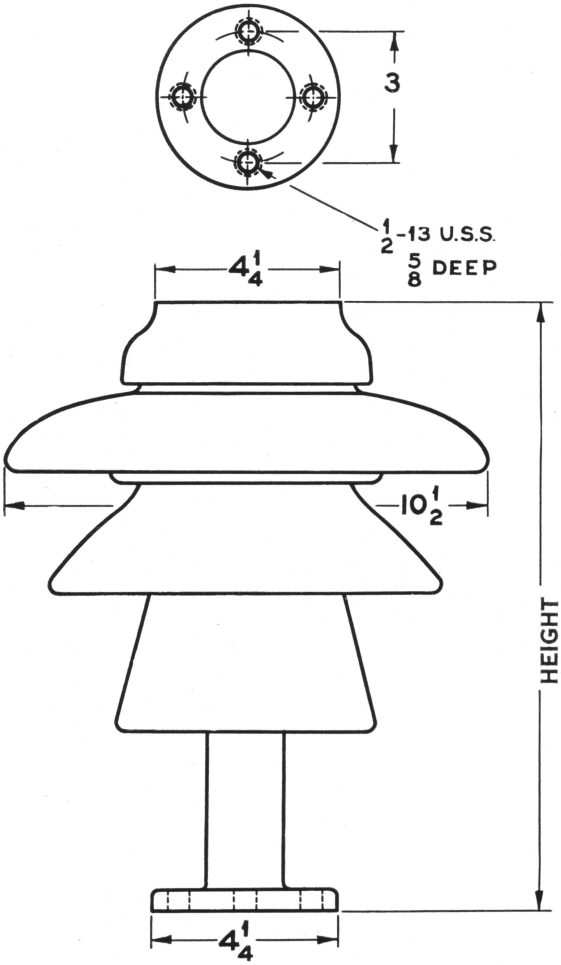
INSULATOR NO. 10100 AND 23023

These insulators are designed chiefly for medium duty service as units. In special cases, where the mechanical load is light, they may be used in stacks.

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	33,000
Dry arc-over voltage	130,000
Wet arc-over voltage	85,000
Leakage distance	21½ inches
Bending strength	2,000 lb.
Tension strength	5,000 lb.
Torsion strength	8,000 in. lb.
Net weight each	25¾ lb.
Packed weight each	37½ lb.
Standard package	Crate of 3

CATALOG NO.	CODE WORD	HEIGHT
10100	VERGD	14 inches
23023	VHADI	13 inches



Insulator No. 29152 and 10350

Catalog No.	Height
29152	15 inches
10350	14 inches

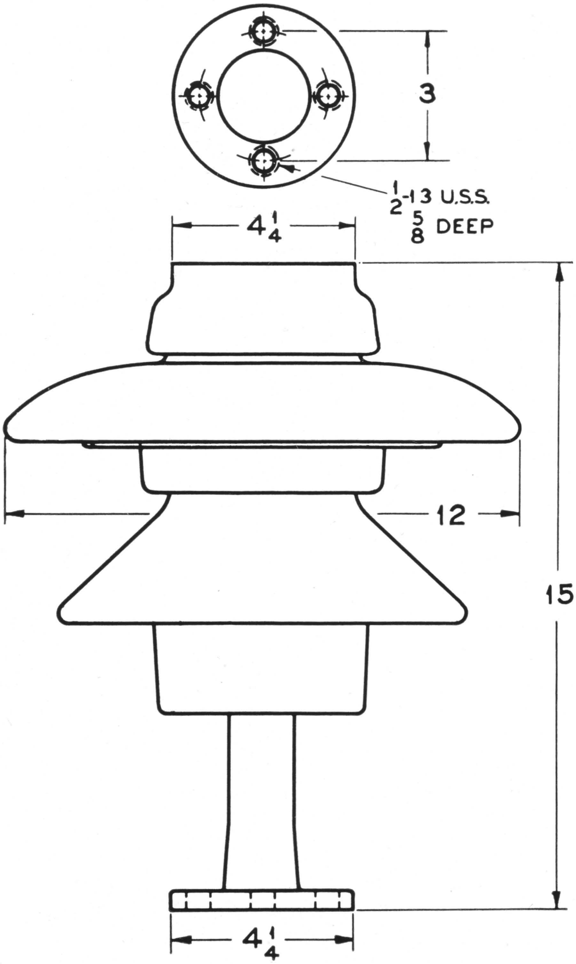
INSULATOR NO. 29152 AND 10350

This insulator is designed chiefly for medium duty service as a single unit. In special cases, where the mechanical load is very light, it may be used in stacks.

Caps are high grade gray iron castings. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	34,500
Dry arc-over voltage	135,000
Wet arc-over voltage	100,000
Leakage distance	24 inches
Bending strength	2,000 lb.
Tension strength	5,000 lb.
Torsion strength	8,000 in. lb.
Net weight each	24½ lb.
Packed weight each	34½ lb.
Standard package	Crate of 3

CATALOG NO.	CODE WORD	HEIGHT
29152	IELNE	15 inches
10350	WIZKY	14 inches



INSULATOR NO. 10455

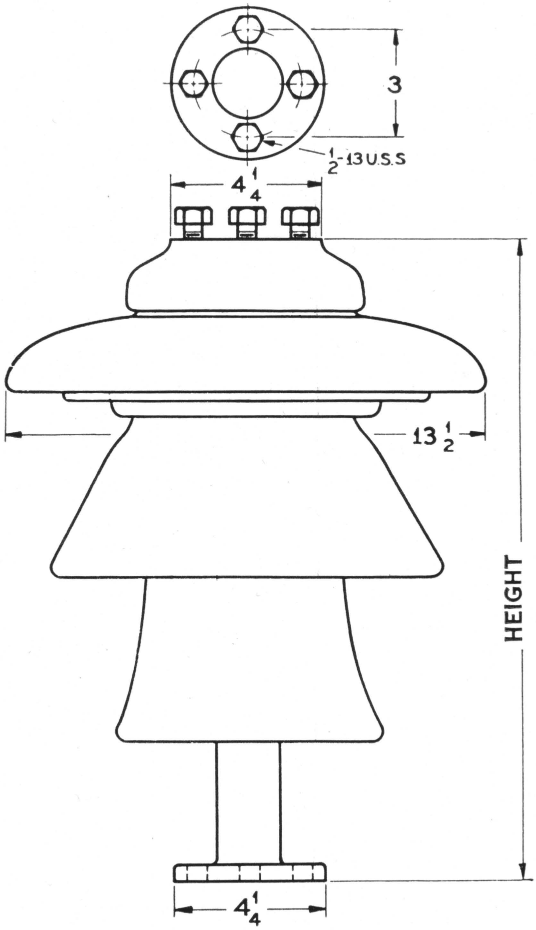
Insulator No. 10455

This insulator is designed chiefly for medium duty service as a single unit. In special cases, where the mechanical load is light, it may be used in stacks.

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	34,500
Dry arc-over voltage	145,000
Wet arc-over voltage	100,000
Leakage distance	25 inches
Bending strength	2,000 lb.
Tension strength	5000, lb.
Torsion strength	8,000 in. lb.
Net weight each	34 lb.
Packed weight each	43 lb.
Standard package	Crate of 3

Code Word . . . . WIZHO



INSULATOR NO. 9153 AND 23025

CATALOG NO.	HEIGHT
9153	18 inches
23025	15½ inches

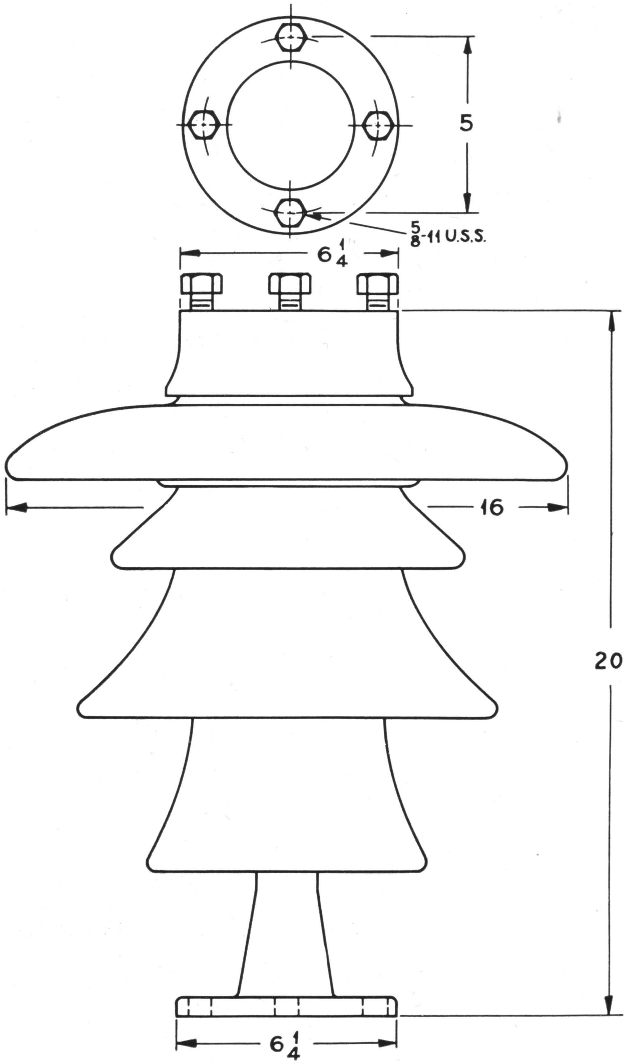
INSULATOR NO. 9153 AND 23025

These insulators are designed chiefly for medium duty service as single units. In special cases, where the mechanical load is light, they may be used in stacks.

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	46,000
Dry arc-over voltage	170,000
Wet arc-over voltage	130,000
Leakage distance	32 inches
Bending strength	2,000 lb.
Tension strength	6,000 lb.
Torsion strength	12,000 in. lb.
Net weight each, 9153	52 lb.
Net weight each, 23025	50 lb.
Packed weight each, 9153	71½ lb.
Packed weight each, 23025	69½ lb.
Standard package	Crate of 3

Catalog No.	Code Word	Height
9153	WIYZO	18 inches
23025	VHAFO	15½ inches



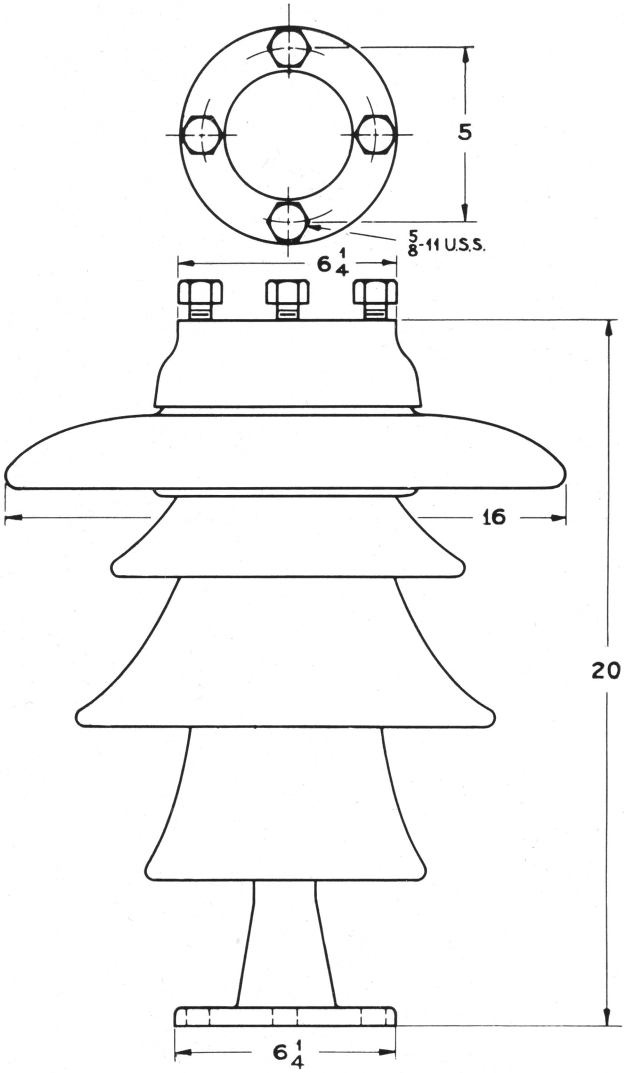
INSULATOR NO. 23067

INSULATOR NO. 23067

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	66,000
Dry arc-over voltage	200,000
Wet arc-over voltage	145,000
Leakage distance	47 inches
Bending strength	2,000 lb.
Tension strength	6,000 lb.
Torsion strength	12,000 in. lb.
Net weight each	74 lb.
Packed weight each	103 lb.
Standard package	Crate of 2

CODE WORD . . . . WIYST



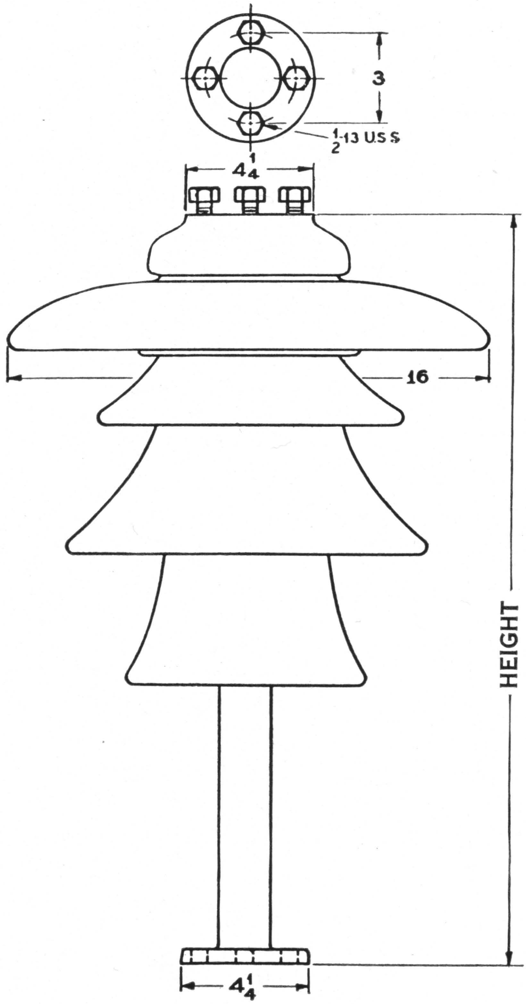
INSULATOR NO. 9944

INSULATOR NO. 9944

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	66,000
Dry arc-over voltage	200,000
Wet arc-over voltage	145,000
Leakage distance	47 inches
Bending strength	3,000 lb.
Tension strength	6,000 lb.
Torsion strength	12,000 in. lb.
Net weight each	74 lb.
Packed weight each	103 lb.
Standard package	Crate of 2

CODE WORD . . WIYUZ



INSULATOR NO. 9154 AND 23026

CATALOG NO.	HEIGHT
9154	25 inches
23026	20 inches

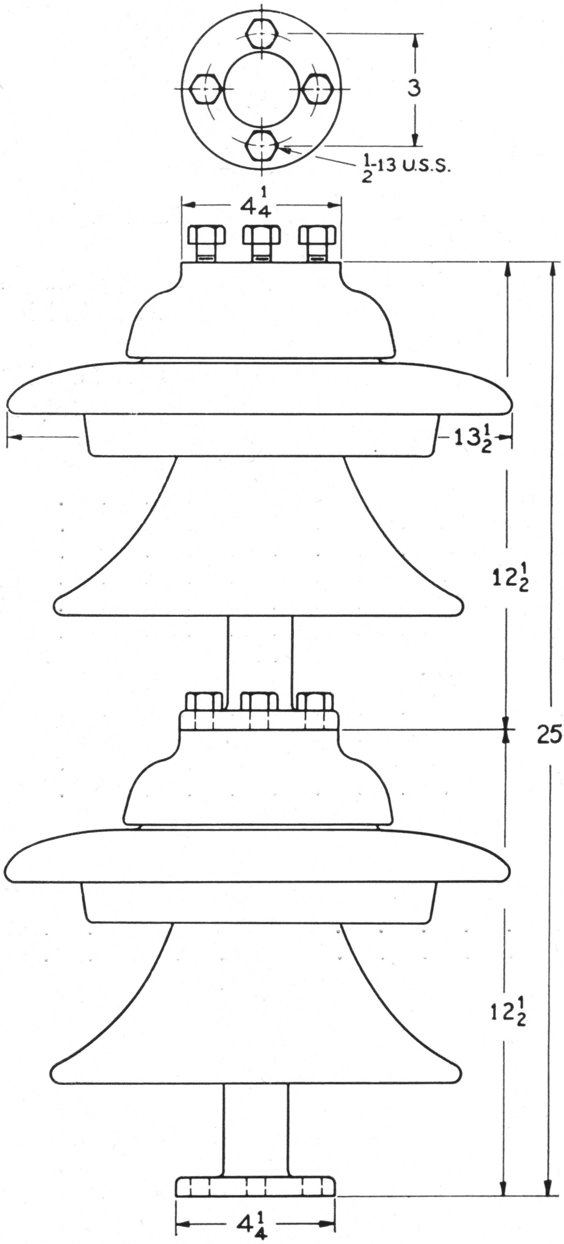
INSULATOR NO. 9154 AND 23026

These insulators are designed chiefly for light duty service as single units. In special cases, where the mechanical load is very light, they may be used in stacks.

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service	66,000
Dry arc-over voltage	200,000
Wet arc-over voltage	150,000
Leakage distance	47½ inches
Bending strength	2,000 lb.
Tension strength	6,000 lb.
Torsion strength	12,000 in. lb.
Net weight each, 9154	66 lb.
Net weight each, 23026	64 lb.
Packed weight each, 9154	96 lb.
Packed weight each, 23026	91 lb.
Standard package	Crate of 2

CATALOG NO.	CODE WORD	HEIGHT
9154	WIZAT	25 inches
23026	VHAHV	20 inches



INSULATOR NO. 23511

Two-Unit Stack

Insulator No. 23511

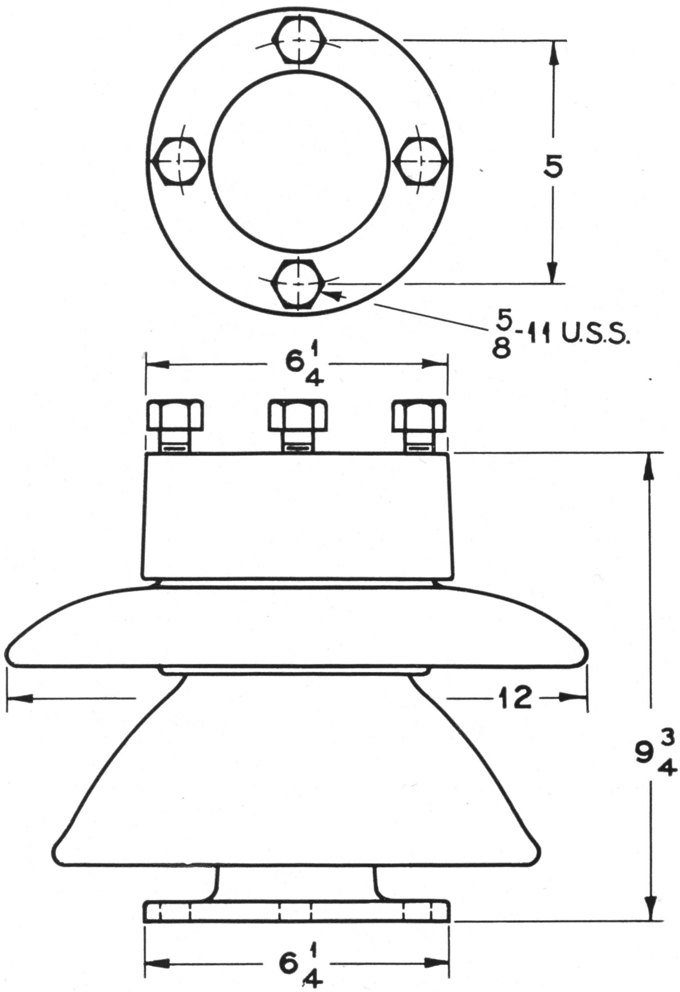
This insulator has been especially designed to meet the requirements of the new N. E. M. A. recommendations. It is intended for use two units high for 69-kv. service.

Caps are high grade malleable iron. Pins are forged steel. Caps and pins are machine faced, thoroughly and smoothly galvanized.

Line voltage, switch service, two units	69,000
Dry arc-over voltage, two units	225,000
Wet arc-over voltage, two units	180,000
Leakage distance, two units	48 inches
Bending strength, two units	1400 lb.
Tension strength	10,000 lb.
Torsion strength	12,000 in. lb.
Net weight, two units	90 lb.
Packed weight, two units	120 lb.
Standard package	Crate of 2

Code Word . . . CDFBB

A stack of two units of Insulator No. 23511 is known as 23510.



INSULATOR NO. 8888

INSULATOR NO. 8888

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized.

Four hex. head cap screws are furnished with each insulator.

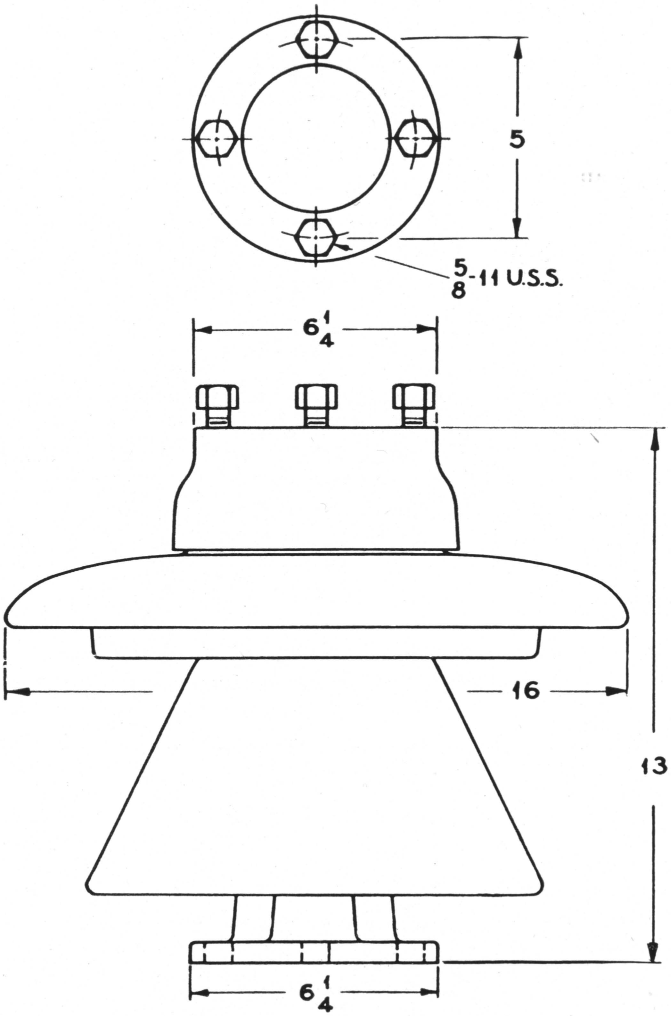
Various designs of mounting bases and clamps for different styles and sizes of conductor can be supplied. A few are shown on pages 228 to 234.

Units	Dry Arc-over Voltage	Wet Arc-over Voltage	BENDING STRENGTH, LB.	
			Upright	Underhung
1	120,000	65,000	4,000	2,500
2	205,000	125,000	1,750	1,300
3	280,000	180,000	975	800
4	350,000	235,000	675	600
5	415,000	290,000	520	475
6	480,000	340,000	420	400
7	545,000	395,000	350	330

Flashover values are obtained with the insulators mounted on a base such as No. 7791 and with bus in place.

Leakage distance	18 inches
Tension strength	12,000 lb.
Torsion strength	15,000 in. lb.
Net weight each	34 lb.
Packed weight each	$42\frac{1}{4}$ lb.
Standard package	Crate of 3

CODE WORD . . . . WRHAM



INSULATOR NO. 23042

INSULATOR NO. 23042

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized.

Four hex. head cap screws are furnished with each insulator.

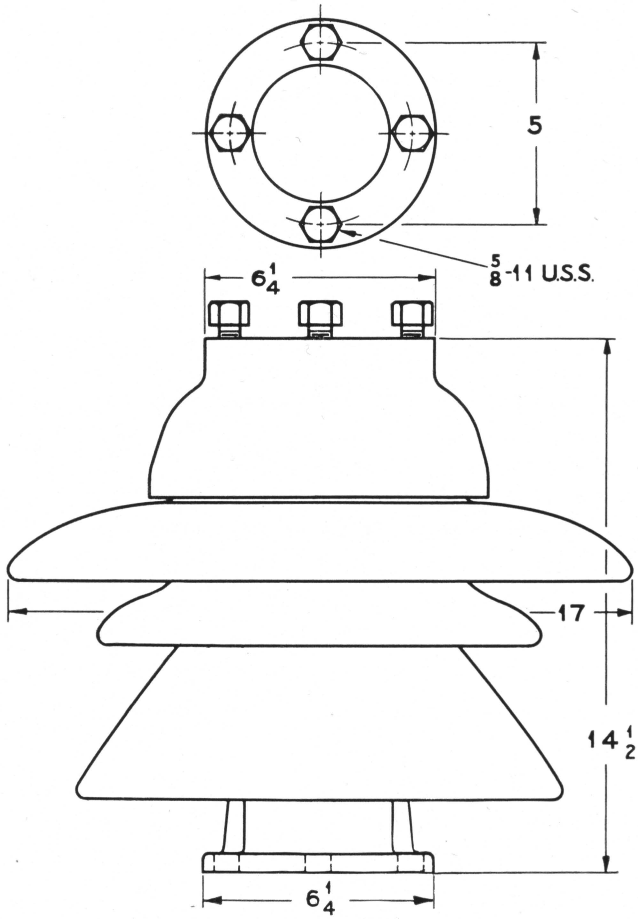
Various designs of mounting bases and clamps for different styles and sizes of conductor can be supplied. A few are shown on pages 228 to 234.

Units	Dry Arc-over Voltage	Wet Arc-over Voltage	BENDING STRENGTH, LB.	
			Upright	Underhung
1	155,000	95,000	6,000	3,000
2	260,000	190,000	2,000	1,500
3	360,000	285,000	1,200	1,000
4	460,000	380,000	800	700
5	560,000	475,000	600	550
6	660,000	570,000	440	400

Flashover values are obtained with the insulators mounted on a base such as No. 7791 and with bus in place.

Leakage distance	28 inches
Tension strength	15,000 lb.
Torsion strength	25,000 in. lb.
Net weight each	55 lb.
Packed weight each	79 lb
Standard package	Crate of 1

CODE WORD . . . . WOACY



INSULATOR NO. 7785

INSULATOR NO. 7785

This insulator is of very substantial construction and is for use where conditions require great mechanical strength.

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized. Four hex. head cap screws are furnished with each insulator.

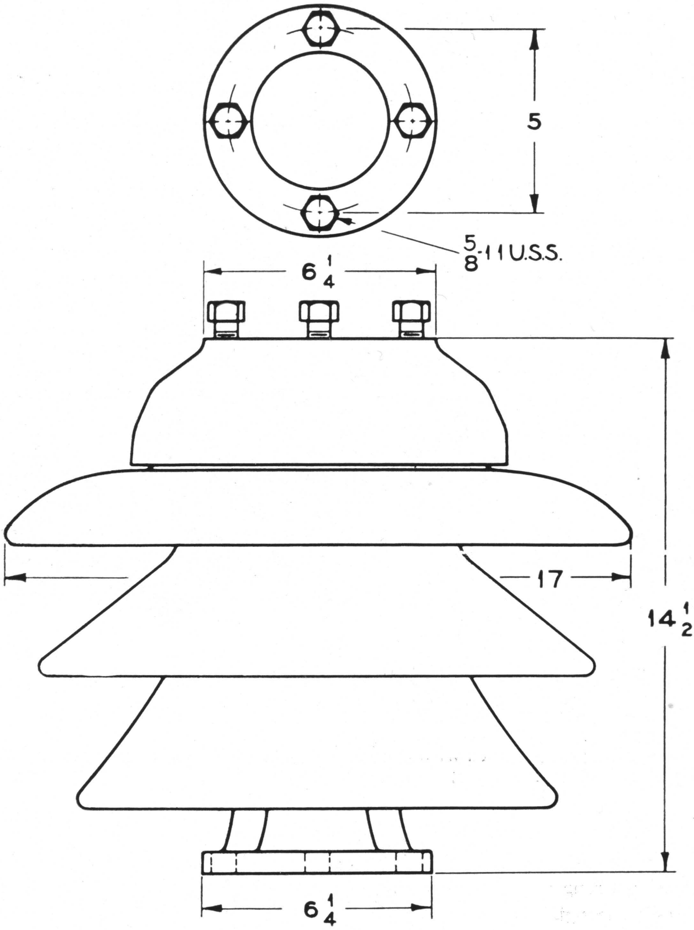
Various designs of mounting bases and clamps for different styles and sizes of conductor can be supplied. A few are shown on pages 228 to 234.

Units	Dry Arc-over Voltage	Wet Arc-over Voltage	BENDING STRENGTH, LB.	
			Upright	Underhung
1	165,000	95,000	7,000	3,400
2	275,000	190,000	3,000	2,350
3	380,000	285,000	1,700	1,470
4	480,000	380,000	1,150	1,040
5	575,000	470,000	910	840
6	660,000	560,000	750	700
7	740,000	630,000	600	560

Flashover values are obtained with the insulators mounted on a base such as No. 7791 and with bus in place.

Leakage distance	31 inches
Tension strength	18,000 lb.
Torsion strength	36,000 in. lb.
Net weight each	76 lb.
Packed weight each	99 lb.
Standard package	Crate of 1

CODE WORD . . . WOZED



INSULATOR NO. 13239

INSULATOR No. 13239

Insulator No. 13239 was designed to meet the demand for a heavy duty pin type pedestal insulator even stronger than Insulator No. 7785.

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized. Four hex. head cap screws are furnished with each insulator.

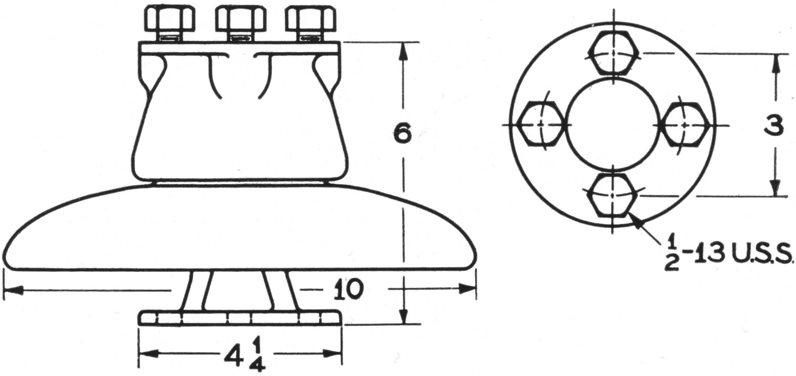
Various designs of mounting bases and clamps for different styles and sizes of conductor can be supplied. A few are shown on pages 228 to 234.

Units	Dry Arc-over Voltage	Wet Arc-over Voltage	BENDING STRENGTH, LB.	
			Upright	Underhung
1	165,000	110,000	10,000	6,500
2	275,000	205,000	4,250	2,875
3	380,000	300,000	2,325	1,825
4	480,000	395,000	1,600	1,350
5	575,000	480,000	1,225	1,075
6	660,000	565,000	980	875
7	740,000	640,000	825	750

Flashover values are obtained with the insulators mounted on a base such as No. 7791 and with bus in place.

Leakage distance	33 inches
Tension strength	18,000 lb.
Torsion strength	45,000 in. lb.
Net weight each	97 lb.
Packed weight each	128 lb.
Standard package	Crate of 1

CODE WORD . . . . WIZME



Insulator No. 8905

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized.

Four hex. head cap screws are furnished with each insulator.

Various designs of mounting bases and clamps for different styles and sizes of conductor can be supplied. A few are shown on pages 228 to 234.

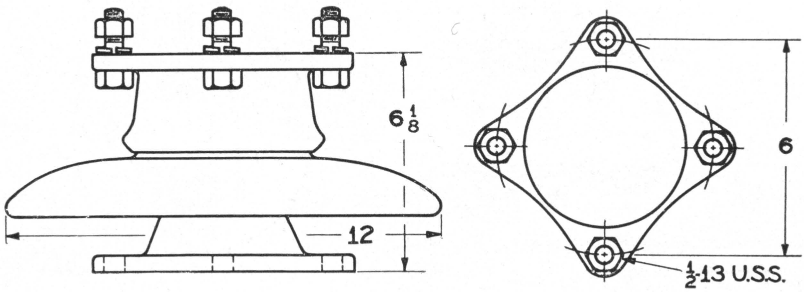
Units	Dry Arc-over Voltage	Wet Arc-over Voltage	Bending Strength, Lb.	
			Upright	Underhung
1	75,000	42,000	3,000	3,000
2	130,000	84,000	1,440	1,440
3	185,000	125,000	900	900
4	240,000	165,000	600	600
5	295,000	205,000	430	430
6	345,000	245,000	330	330

Flashover values are obtained with the insulators mounted on a base such as No. 9471 and with bus in place.

Strength in tension 9,000 lb. Strength in torsion 6,000 in. lb.

Leakage distance	10½ inches
Net weight each	13 lb.
Packed weight each	16 lb.
Standard package	Crate of 6

Code Word . . . . WUGYR



Insulator No. 12347

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized.

Four hex. head bolts, nuts and lock washers furnished with each insulator.

Various designs of mounting bases and clamps for different sizes and styles of conductor can be supplied. A few are shown on pages 228 to 234.

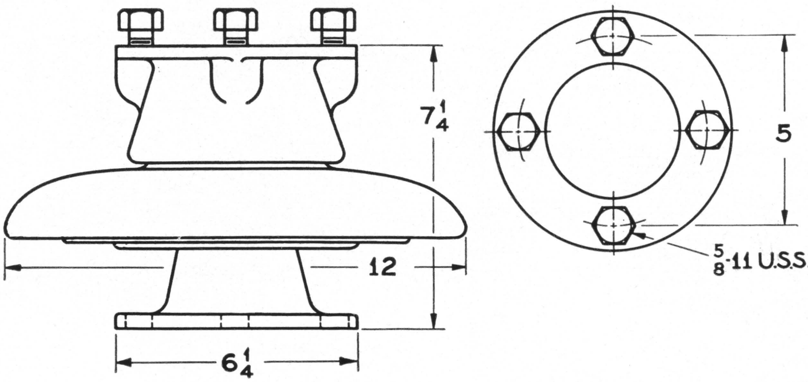
Units	Dry Arc-over Voltage	Wet Arc-over Voltage	Bending Strength, lb.	
			Upright	Underhung
1	75,000	35,000	5,000	4,075
2	130,000	70,000	1,920	1,790
3	185,000	105,000	1,200	1,150
4	240,000	140,000	840	815
5	300,000	175,000	680	660
6	355,000	210,000	600	590

Flashover values are obtained with the insulators mounted on a base similar to No. 7791 and with bus in place.

Strength in tension 11,000 lb. Strength in torsion 20,000 in. lb.

Leakage distance	10½ inches
Net weight each	24 lb.
Packed weight each	27 lb.
Standard package	Crate of 6

Code Word . . . . . VOHUD



Insulator No. 9473

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized.

Four hex. head cap screws are furnished with each insulator.

Various designs of mounting bases and clamps for different sizes and styles of conductor can be supplied. A few are shown on pages 228 to 234.

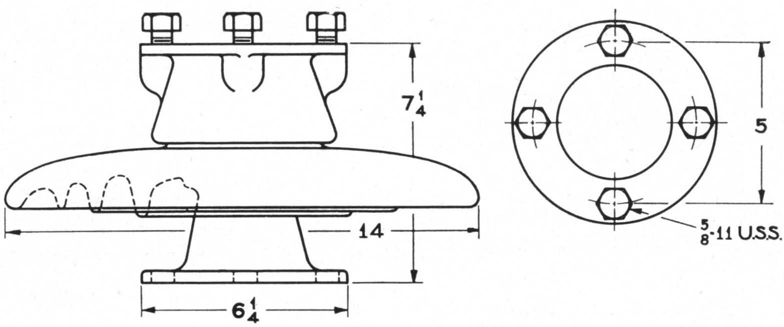
Units	Dry Arc-over Voltage	Wet Arc-over Voltage	Bending Strength, Lb.	
			Upright	Underhung
1	75,000	45,000	6,000	4,000
2	135,000	85,000	3,000	2,400
3	195,000	125,000	1,800	1,600
4	255,000	160,000	1,250	1,100
5	315,000	200,000	1,000	900
6	370,000	240,000	800	750
7	425,000	275,000	720	680
8	480,000	315,000	675	625

Flashover values are obtained with the insulators mounted on a base such as No. 7791 and with bus in place.

Strength in tension 12,000 lb. Strength in torsion 15,000 in. lb.

Leakage distance	11¼ inches
Net weight each	26 lb.
Packed weight each	32 lb.
Standard package	Crate of 4

Code Word . . . . WUGUE



INSULATOR NO. 13473

Caps and pins are malleable iron, machine faced, thoroughly and smoothly galvanized.

Four hex. head cap screws are furnished with each insulator.

Various designs of mounting bases and clamps for different sizes and styles of conductor can be supplied. A few are shown on pages 228 to 234.

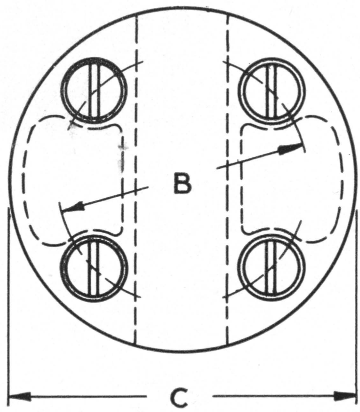
Unit	Dry Arc-over Voltage	Wet Arc-over Voltage	BENDING STRENGTH, LB.	
			Upright	Underhung
1	85,000	55,000	6,000	4,000
2	170,000	105,000	3,000	2,400
3	245,000	155,000	1,800	1,600
4	310,000	205,000	1,250	1,100
5	370,000	255,000	1,000	900
6	425,000	305,000	800	750
7	470,000	355,000	720	680
8	510,000	405,000	675	625

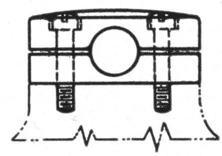
Flashover values are obtained with the insulators mounted on a base such as No. 7791 and with bus in place.

Strength in tension 12,000 lb. Strength in torsion 15,000 in. lb.

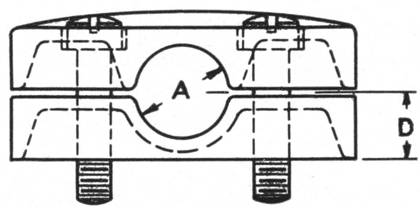
Leakage distance	14 inches
Net weight each	27 lb.
Packed weight each	34 3/4 lb.
Standard package	Crate of 4

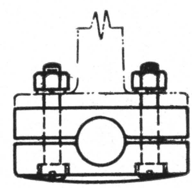
CODE WORD . . . . . WIZIS





CAP MOUNTED



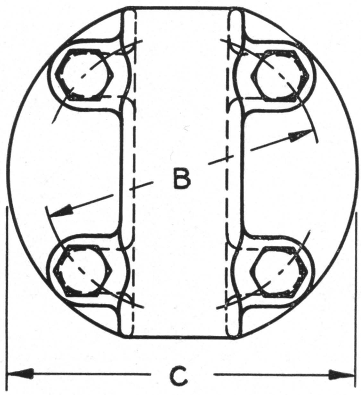


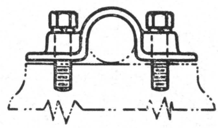
PIN MOUNTED

BUS CLAMPS

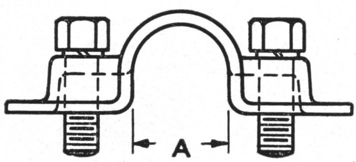
Catalog No.	Code Word	Dimensions in Inches							Lb. Each	
		Iron Pipe Size	External Dia.	A	B	C	D	Dia. Bolts	Net	Pkd.
27052	WESJO	1/2	.840	7/8	3	4 1/4	3/4	1/2	3	3 1/8
27053	WESKS	3/4	1.050	1 1/16	3	4 1/4	7/8	1/2	3	3 1/8
27054	WESMY	1	1.315	1 11/32	3	4 1/4	1	1/2	3	3 1/8
27055	WESOE	1/2	.840	7/8	5	6 1/4	3/4	5/8	4 1/2	4 5/8
27056	WESPH	3/4	1.050	1 1/16	5	6 1/4	7/8	5/8	4 1/2	4 5/8
27057	WESWA	1	1.315	1 11/32	5	6 1/4	1	5/8	4 1/2	4 5/8
27058	WESYG	1 1/4	1.660	1 11/16	5	6 1/4	1 3/16	5/8	5 1/2	5 1/2
27059	WETAN	1 1/2	1.900	1 15/16	5	6 1/4	1 5/16	5/8	5 1/2	5 1/2

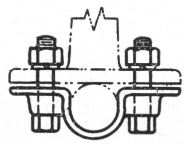
Clamps will be furnished for cap mounting unless otherwise specified.
Clamps are bronze. Bolts are hot galvanized steel.





CAP MOUNTED



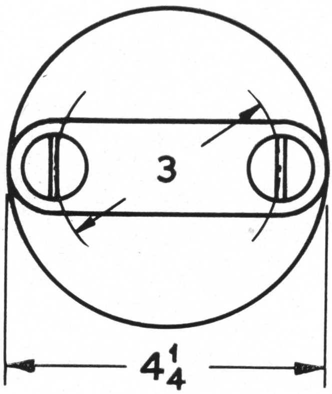


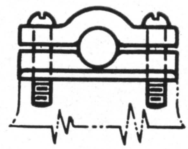
PIN MOUNTED

Bus Clamps

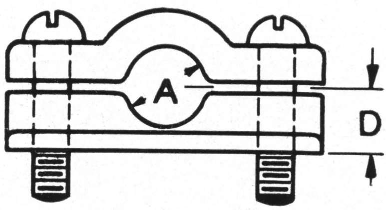
Catalog No.	Code Word	DIMENSIONS IN INCHES						LB. EACH	
		Iron Pipe Size	External Dia.	A	B	C	Dia. Bolts	Net	Pkd.
27060	WERNA	1/2	.840	7/8	3	4 1/4	1/2	3	3 1/8
27061	WEROD	3/4	1.050	1 1/8	3	4 1/4	1/2	3 1/8	3 1/4
27062	WERUT	1	1.315	1 3/8	3	4 1/4	1/2	3 1/4	3 3/8
27063	WERYF	3/4	1.050	1 1/8	5	6 1/4	5/8	4	4 1/8
27064	WERZI	1	1.315	1 3/8	5	6 1/4	5/8	4 1/4	4 3/8
27065	WESAM	1 1/4	1.660	1 3/4	5	6 1/4	5/8	4 1/2	4 5/8
27066	WESEZ	1 1/2	1.900	1 15/16	5	6 1/4	5/8	5	5 1/8
27067	WESHI	2	2.375	2 7/16	5	6 1/4	5/8	5 1/4	5 3/8
27068	WESIL	2 1/2	2.875	2 15/16	5	6 1/4	5/8	5 1/2	5 5/8

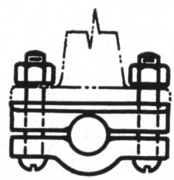
Clamps will be furnished for cap mounting unless otherwise specified.
Clamps are bronze. Bolts are hot galvanized steel.





CAP MOUNTED





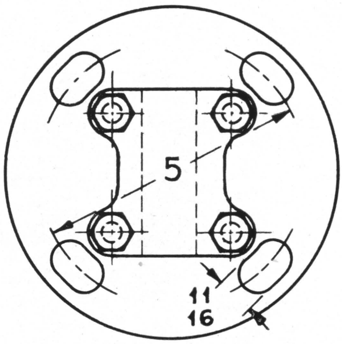
PIN MOUNTED

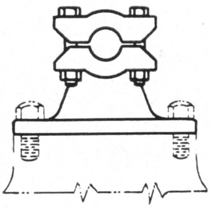
BUS CLAMPS

Catalog No.	Code Word	Sizes "A" Inches	DIM. IN INCHES Min.	Max.	D	LB. EACH Net	Pkd.
9853	VUKLI	1/8 to 5/8	.125	.625	11/16	2 3/8	2 1/2
9854	WADKE	5/8 to 1 1/8	.625	1.125	15/16	2 7/8	3
9855	WADOB	1 1/8 to 1 3/4	1.125	1.75	1 7/16	3 5/8	3 3/4
9856	WADPU	1 3/4 to 2 1/16	1.750	2.0625	1 7/16	3 1/2	3 5/8

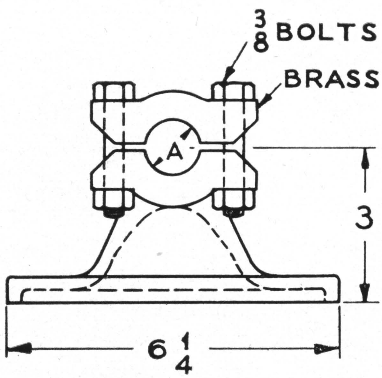
Clamps will be furnished with "A" diameter drilled as specified. Otherwise clamp with minimum diameter drilling will be furnished. Clamps will be furnished for cap mounting unless otherwise specified.

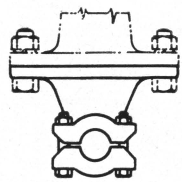
Clamps are bronze. Bolts are hot galvanized steel.





CAP MOUNTED



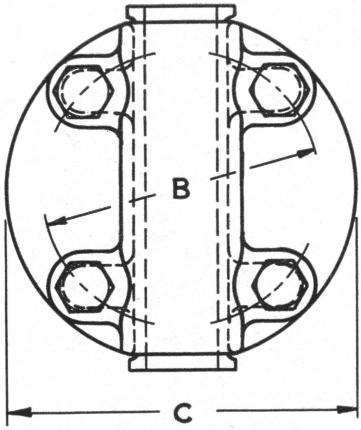


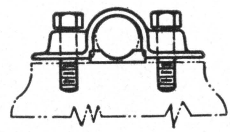
PIN MOUNTED

Bus Clamps

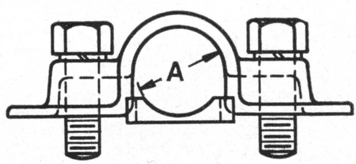
Catalog No.	Code Word	Sizes "A" Inches	LB. EACH	
			Net	Pkd.
8893	WUGHT	0—$\frac{7}{8}$	5	5$\frac{1}{8}$
8894	BUHRA	$\frac{7}{8}$—1$\frac{5}{16}$	5$\frac{1}{2}$	5$\frac{5}{8}$
8895	BUHSD	1$\frac{5}{16}$—1$\frac{3}{4}$	6	6$\frac{1}{8}$

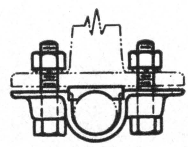
Clamps will be furnished with "A" diameter drilled as specified. Otherwise clamp with minimum diameter drilling will be furnished.
Clamp bases are malleable iron. Bolts are hot galvanized steel.





CAP MOUNTED



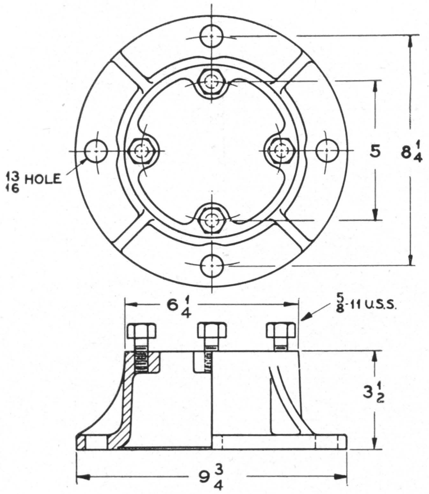


PIN MOUNTED

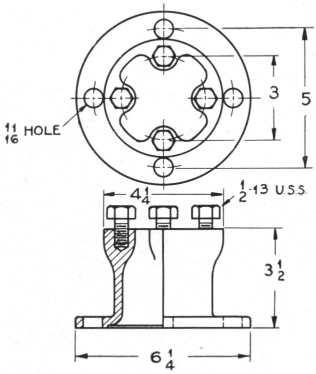
Bus Clamps

Cat. No.	Code Word	CABLE SIZE—"A" B.&S. GAUGE OR C.M. Min.	CABLE SIZE—"A" B.&S. GAUGE OR C.M. Max.	CABLE SIZE—"A" INCHES Min.	CABLE SIZE—"A" INCHES Max.	DIMENSIONS IN INCHES B	DIMENSIONS IN INCHES C	DIMENSIONS IN INCHES Dia. Bolts	LB. EACH Net	LB. EACH Pkd.
27069	VOYBS	3–0	4–0	.470	.528	3	4¼	½	3½	3⅝
27070	VOYDY	250,000	300,000	.574	.629	3	4¼	½	3½	3⅝
27071	VOYEB	350,000	400,000	.679	.726	3	4¼	½	3½	3⅝
27072	VOYFE	450,000	500,000	.772	.813	3	4¼	½	3⅝	3¾
27073	VOYGH	550,000	650,000	.851	.929	3	4¼	½	3⅝	3¾
27074	VOYHK	700,000	800,000	.964	1.031	3	4¼	½	3⅝	3¾
27075	VOYIN	850,000	950,000	1.062	1.123	3	4¼	½	3⅝	3¾
27076	VOYKU	4–0	250,000	.528	.574	5	6¼	⅝	4½	4⅝
27077	VOYLX	300,000	350,000	.629	.679	5	6¼	⅝	4½	4⅝
27078	VOYMA	400,000	450,000	.726	.772	5	6¼	⅝	4½	4⅝
27079	VOYND	500,000	600,000	.813	.893	5	6¼	⅝	4⅝	4¾
27080	VOYOG	650,000	750,000	.929	.998	5	6¼	⅝	4⅝	4¾
27081	VOYRM	800,000	900,000	1.031	1.094	5	6¼	⅝	4⅝	4¾
27082	VOYSP	950,000	1,000,000	1.123	1.152	5	6¼	⅝	4⅝	4¾

Clamps will be furnished for cap mounting unless otherwise specified.
Clamps are bronze. Bolts are hot galvanized steel.



No. 7791

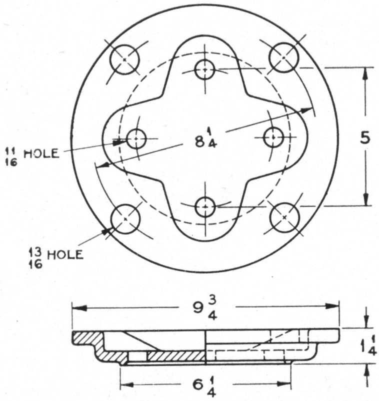


No. 9471

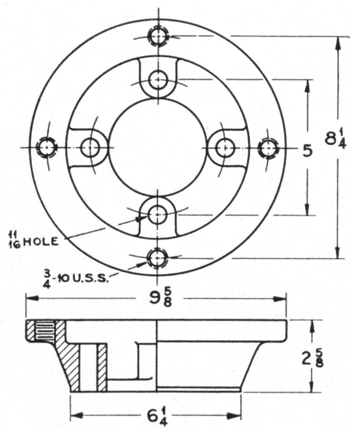
Bases for Pedestal Insulators

Malleable iron thoroughly and smoothly galvanized. Top and bottom surfaces are machined parallel.

Catalog No.	Code Word	LB. EACH Net	LB. EACH Pkd.
9471	WUGSY	12	14
7791	WUGBA	14	15¼



No. 9470



No. 9022

Top Plates for Pedestal Insulators

Malleable iron thoroughly and smoothly galvanized. Top and bottom surfaces are machined parallel.

These plates are used where it is necessary to attach the insulator to a flat ceiling or overhead steelwork.

Catalog No.	Code Word	LB. EACH	
		Net	Pkd.
9470	WUGMI	11	12
9022	VLYPZ	14½	16

Locke Oil-filled Bushings

The value of oil as an insulating medium is everywhere recognized. Its high insulating strength, reaching extremely high values under impulse voltages, its ability to circulate freely and thus serve as a heat dissipating medium and eliminate air pockets or voids in the insulation all combine to make insulating oil the best possible dielectric for high voltage bushings.

Locke oil-filled bushings are made for either transformer or oil-circuit breaker application in all voltages from 46,000 up.

They consist of heavily walled, petticoated porcelain shells and a cast metal sleeve, through which passes a metal rod or tube surrounded by concentrically spaced insulating barriers and filled with a high grade of insulating oil. The porcelain shells, one above and one below the metal sleeve, are each in one piece. Oil tightness is therefore assured as all joints are flange clamped and sealed with cork gaskets of ample size.

These bushings are free from corona on the insulating surfaces even up to voltage approaching flashover, thereby preventing the surface from heating. At voltages approaching flashover corona will form on the metal terminal parts at points not adjacent to the insulating surfaces. The presence of this corona represents a dissipation of energy and increases the time lag of the bushing. The voltage at which this corona will form is well above operating voltage assuring freedom from radio interference.

Corona within the tank is entirely suppressed by the use of the metal sleeve. The upper end is flanged forming a support upon and grounded to the tank cover and the lower end extends below the surface of the oil. Thus all of the exposed surface of the bushing within the tank is at ground potential.

The central conductors of the bushings are in most cases copper tubes, thus either a flexible cable or through rod connections may be used. The internal diameter of the tube limits the size of the flexible cable which can be used.

All Locke oil-filled bushings will carry their rated current without raising the temperature of any part to a point which will injure the insulation or exceed any established specifications.

Locke Equipment Bushings

LOCKE Equipment Bushings more than meet the exacting requirements for high voltage terminals suitable for electrical apparatus and are widely used as standard by some of the leading apparatus manufacturers in the country.

On pages 238 to 243 are listed a series of equipment bushings rated from 7.5 kv. to 69 kv. which offer not only excellent electrical and mechanical protection for carrying leads through oil filled apparatus but are sufficiently flexible that they can be readily used with nearly all kinds of equipment.

These types are admirably suited for either conservator or non-conservator type transformers. By slight modification, particularly the arrangement of the through conductor, they are equally suitable for oil circuit breakers. This latter use usually involves a solid rod conductor with suitable terminal fittings.

These bushings should only be used after the shank of the bushing is submerged in a good grade of dry transformer oil. (Locke roof and wall bushings, pages 245-8, and 251, should be used when both projections of the bushings beyond the mounting flange are exposed to atmospheric conditions.)

It is necessary in each case to have sufficient length of shank submerged in oil to prevent the lower end of the bushing from arcing under oil if flashover occurs on the exposed end. For the best performance the shank length below the flange should be about three times the maximum shank diameter. This approximation holds particularly true for bushings, types 15079 and 15548.

On all of these bushings the rain hoods are integral with the body of the porcelain and not glazed or slipped on, or made of separate shells cemented together. Such practices are considered obsolete for bushings of this type.

The assembly of the multipart bushings, Nos. 15079 and 15548, is of very great importance. The space between the shells is filled with a wood pitch compound of high quality specially developed for this particular kind of service. Absence of voids and entrapped air in these bushings makes them very satisfactory from an operating standpoint.

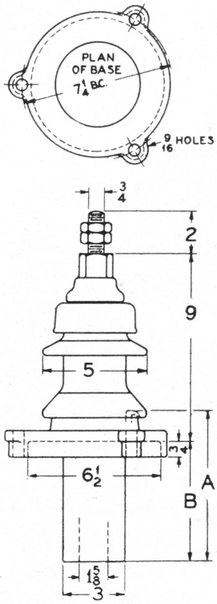
Flange and terminal fittings are assembled to these bushings in such a way that no open joints are exposed directly to the weather, hence it is impossible for moisture to penetrate through any part of the bushing and ultimately get into the insulating oil of the apparatus. Between each porcelain and hardware joint is a thick treated cork gasket assembled in such a manner that oil under pressures usually encountered in conservator transformer practice will not leak through the bushing.

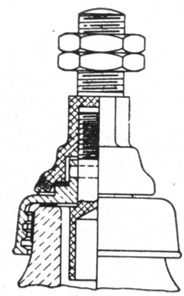
Flexible cable type terminals are considered as standard equipment on these bushings. All current carrying parts are built of high conductivity nonmagnetic materials. Integral with the cover terminal cap a threaded stud equipped with two hex contact nuts is provided. Smooth end terminal studs can be supplied upon request.

The current carrying capacity of these bushings is determined by the size of conductor that can be satisfactorily passed through the bushing. Locke standard flexible terminal lugs can be drilled to take a bare conductor having a maximum outside diameter of ¾ in.

These bushings are provided with grey cast iron mounting flanges, jig drilled. The flanges can be secured to the apparatus cover by using stud bolts or cap screws. Standard flanges are built with a smooth gasket seat which is shrouded on the outside in order to hold the gasket in place and protect it from weathering. Usually a thick cork gasket is placed between the bushing flange and the apparatus cover. Plain flanges can be supplied upon request.

For currents in excess of 600 amperes it is advisable to use nonmagnetic flanges in order to prevent undue heating. It is advisable wherever possible when using these bushings to completely fill the space between the conductor and the adjacent wall of the bushing with an insulating material. The thin air column between the conductor and the bushing will tend to be over-stressed electrically allowing a static discharge to take place. This has been considered a source of radio interference. By filling this space with a material having a greater permittivity than air and preferably close to that of porcelain, this discharge may be eliminated. It is a customary practice in the case of transformer bushings to wrap the flexible lead, which is pulled up through the bushing, with varnished cambric sufficient to completely fill the hole through the bushing.





LOCKE EQUIPMENT BUSHING NO. 16268

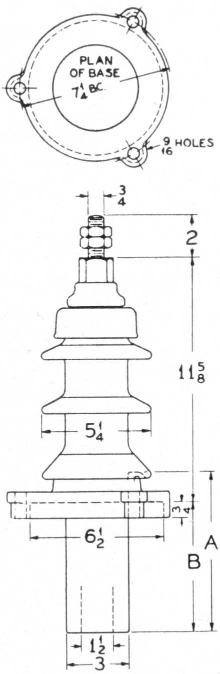
Maximum voltage	7,500
Maximum size copper cable	400,000 c.m.
Net weight	21 lb.
Packed weight	30 lb.
Standard package	Crate of 2

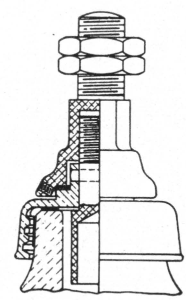
CODE WORD . . . RICDA

"B" dimension must be specified when ordering or "A" dimension when porcelain only is ordered.

Weights based on "B" being 12 inches.

These insulators are regularly furnished glazed chocolate color and can be equipped with any standard type of terminal.





LOCKE EQUIPMENT BUSHING NO. 15222

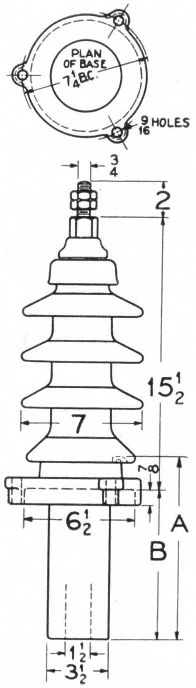
Maximum voltage	15,000
Maximum size copper cable	400,000 c.m.
Net weight	25 lb.
Packed weight	35 lb.
Standard package	Crate of 2

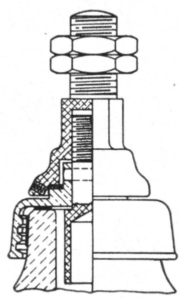
CODE WORD . . . RICBU

"B" dimension must be specified when ordering or "A" dimension when porcelain only is ordered.

Weights based on "B" being 16 inches.

These insulators are regularly furnished glazed chocolate color and can be equipped with any standard type of terminal.





Locke Equipment Bushing No. 16272

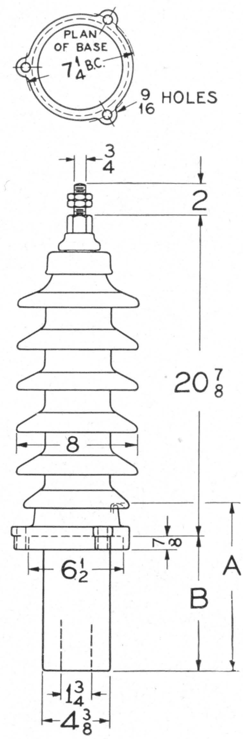
Maximum voltage	23,000
Maximum size copper cable	400,000 c.m.
Net weight	45 lb.
Packed weight	60 lb.
Standard package	Crate of 1

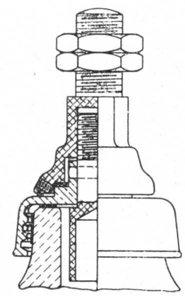
Code Word . . . RICAZ

"B" dimension must be specified when ordering or "A" dimension when porcelain only is ordered.

Weights based on "B" being 20 inches.

These insulators are regularly furnished glazed chocolate color and can be equipped with any standard type of terminal.



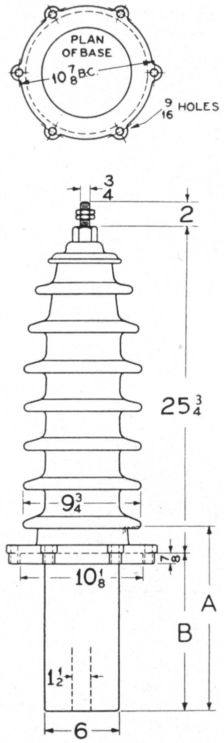


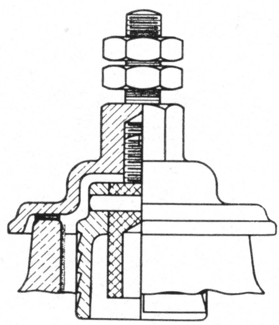
Locke Equipment Bushing No. 15780

Maximum voltage	34,500
Maximum size copper cable	400,000 c.m.
Net weight	61 lb.
Packed weight	80 lb.
Standard package	Crate of 2

Code Word . . . RIBYJ

"B" dimension must be specified when ordering or "A" dimension when porcelain only is ordered.
Weights based on "B" being 20 inches.
These insulators are regularly furnished glazed chocolate color and can be equipped with any standard type of terminal.





LOCKE EQUIPMENT BUSHING NO. 15548

Maximum voltage	46,000
Maximum size copper cable	400,000 c.m.
Net weight	124 lb.
Packed weight	165 lb.

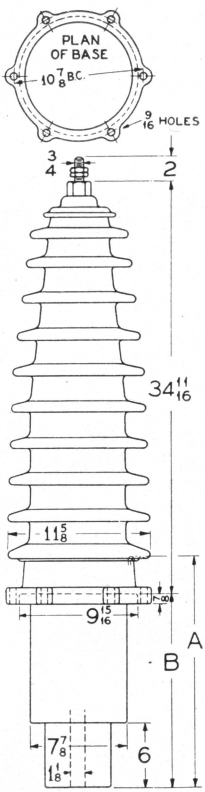
Quantities up to six shipped one per crate. Six or over shipped six per skid.

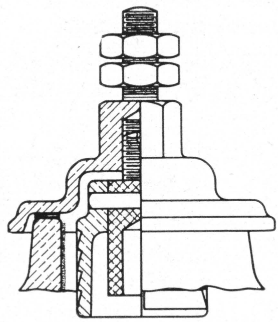
CODE WORD . . . RIBUS

"B" dimension must be specified when ordering or "A" dimension when porcelain only is ordered.

Weights based on "B" being 25 inches.

These insulators are regularly furnished glazed chocolate color and can be equipped with any standard type of terminal.





Locke Equipment Bushing No. 15079

Maximum voltage	69,000
Maximum size copper cable	400,000 c.m.
Net weight	235 lb.
Packed weight	300 lb.

Quantities up to six shipped one per crate. Six or over shipped six per skid.

Code Word . . . RIBTU

"B" dimension must be specified when ordering or "A" dimension when porcelain only is ordered.

Weights based on "B" being 27 inches.

These insulators are regularly furnished glazed chocolate color and can be equipped with any standard type of terminal.

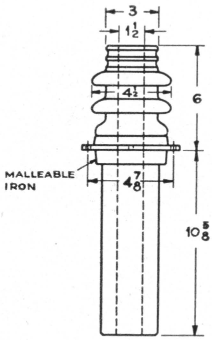
Locke Entrance Bushings

THE insulators shown on the following pages are very substantially constructed. They are built of concentric porcelain tubes held together with non-flowing insulating compound. This compound will not drip or leak under operating temperatures. Minimum cement joints are provided and are carefully waterproofed so as to prevent expansion troubles. Failure of insulators of this type are unknown. These insulators should not be confused with Locke Equipment Type Bushings in their application. The Equipment Type Bushings are designed so that maximum wet and dry flashover characteristics prevail on the outdoor end of the bushing.

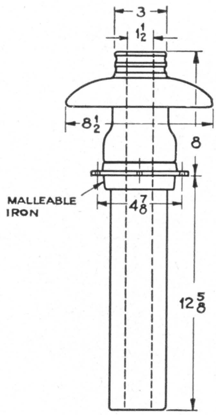
Locke Entrance Bushings are intended for carrying leads through roof and wall barriers hence the long corrugated porcelain shanks below the mounting ring. These insulators are intended to be mounted with the corrugated end on the inside of the building or housing protected from the weather and under relatively dry conditions. These bushings are so constructed that they are quiet in operation, free from corona and have high flashover values under both dry and wet conditions. Flashover values will be given on request.

These insulators are shown with a small mounting ring and without conductor rods. Sub-bases for roof mounting are shown on page 249. Bases are furnished with non-magnetic material when the conductor is to carry more than 500 amperes. Copper rod assemblies are intended to be used with these insulators. A complete line of rod assemblies may be found on pages 253 to 257. It will be found that these rod assemblies offer a very flexible means of carrying current through the bushing. Such assemblies are entirely mechanical requiring no cemented caps to the porcelain. The joint between cap and porcelain is water tight. When necessary conductors may be changed after bushings are installed without removing bushing from wall or roof mounting.

Recommended terminals for use with these rod assemblies are shown on pages 258 to 261.



No. 18501

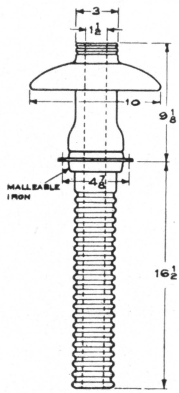


No. 18502

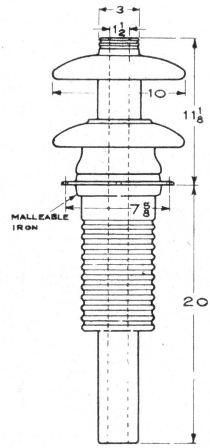
LOCKE ENTRANCE BUSHINGS

INSULATOR NO.	18501	18502
Line voltage	6,600	11,000
Net weight	12 lb.	15 lb.
Packed weight	20 lb.	26 lb.
Standard package	Box of 3	Box of 2
CODE WORD	VILKI	VILMO

Illustration shows insulator suitable for use as a Roof or Wall Entrance bushing, when assembled with appropriate fittings.
Bases for Roof or Wall mounting are shown on page 249.
Copper Rod conductors are shown on pages 255 and 257.
Terminals are shown on pages 258 to 261.
These insulators are regularly furnished glazed chocolate color.



No. 18503

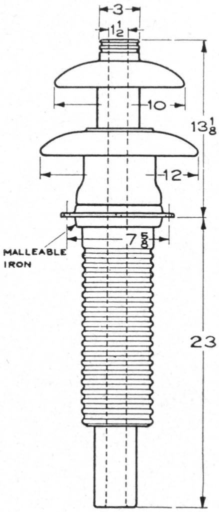


No. 18504

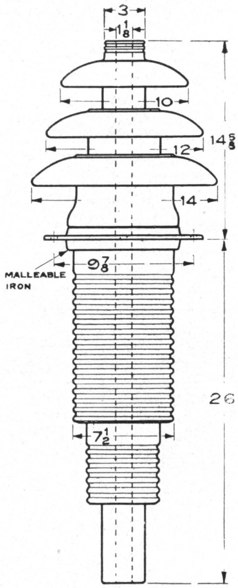
Locke Entrance Bushings

Insulator No.	18503	18504
Line voltage	22,000	33,000
Net weight	30 lb.	48 lb.
Packed weight	52 lb.	85 lb.
Standard package	Box of 2	Box of 1
Code Word	VILNS	VILOV

Illustration shows insulator suitable for use as a Roof or Wall Entrance bushing, when assembled with appropriate fittings.
Bases for Roof or Wall mounting are shown on page 249.
Copper Rod conductors are shown on pages 255 and 257.
Terminals are shown on pages 258 to 261.
These insulators are regularly furnished glazed chocolate color.



No. 18505

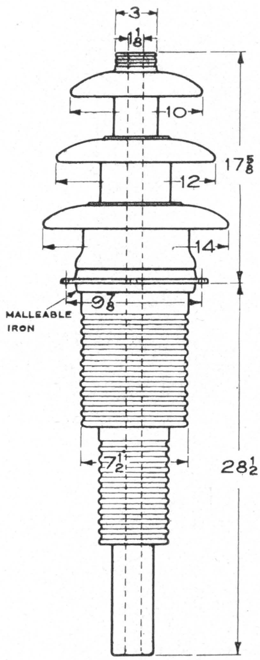


No. 18506

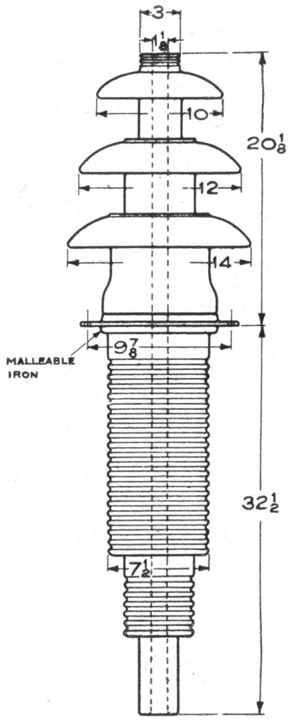
LOCKE ENTRANCE BUSHINGS

INSULATOR NO.	18505	18506
Line voltage	44,000	55,000
Net weight	95 lb.	110 lb.
Packed weight	140 lb.	170 lb.
Standard package	Box of 1	Box of 1
CODE WORD	VILPY	VILSE

Illustration shows insulator suitable for use as a Roof or Wall Entrance bushing, when assembled with appropriate fittings.
Bases for Roof or Wall mounting are shown on page 249.
Copper Rod conductors are shown on pages 255 and 257.
Terminals are shown on pages 258 to 261.
These insulators are regularly furnished glazed chocolate color.



No. 18507

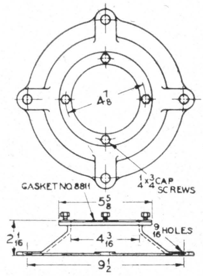


No. 18508

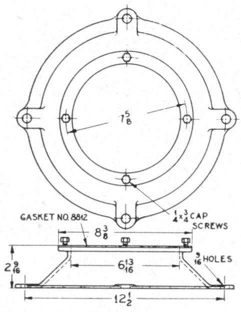
LOCKE ENTRANCE BUSHINGS

INSULATOR NO.	18507	18508
Line voltage	66,000	77,000
Net weight	155 lb.	190 lb.
Packed weight	275 lb.	400 lb.
Standard package	Box of 1	Box of 1
CODE WORD	VILUK	VILXU

Illustration shows insulator suitable for use as a Roof or Wall Entrance bushing, when assembled with appropriate fittings.
Bases for Roof or Wall mounting are shown on page 249.
Copper Rod conductors are shown on pages 255 and 257.
Terminals are shown on pages 258 to 261.
These insulators are regularly furnished glazed chocolate color.



No. 13328



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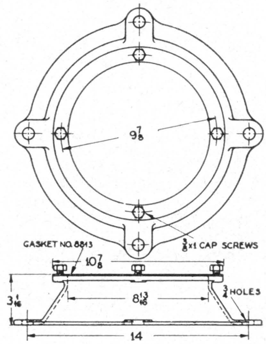


No. 13330

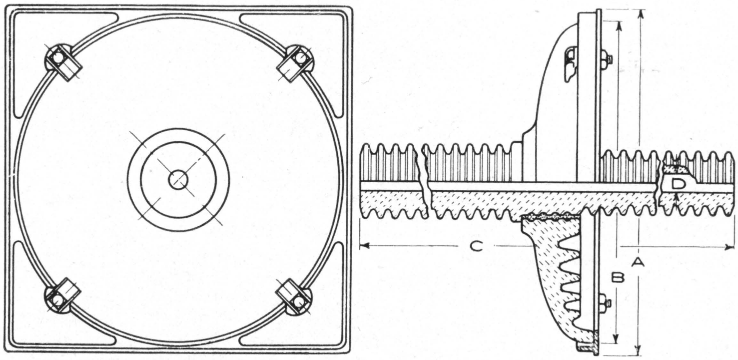
SUB-BASES FOR LOCKE ENTRANCE BUSHINGS

These bases are for mounting Wall or Roof Entrance Insulators shown on pages 245 to 248. They raise the exposed part of the insulator a reasonable distance above the roof to keep it free from snow and accumulated water.

The base should first be cemented into place and the joint made water tight. After the base is set, the insulator is mounted on the base and the ring, which is cemented to the insulator, is bolted to the base. A rubber gasket is supplied for insertion between the ring and base.

Catalog No.	Code Word	For Use on Insulator No.	LB. EACH	
			Net	Packed
13328	VINDO	18501; 18502; 18503	4½	5½
13329	VINEG	18504; 18505	8¼	9¼
13330	VINGY	18506; 18507; 18508	12¾	14¾

Material: Malleable iron, hot galvanized.



WALL OUTLET BUSHINGS

This type of wall insulator is an economical outlet bushing. It also lends itself very satisfactorily for indoor use, both as a floor and a wall bushing for higher voltages where it is desired to isolate different compartments and rooms.

All sizes are furnished complete with cast iron frames, galvanized. The frame protects the insulator against settling walls, and permits easy replacement in case of damage.

The porcelain parts are securely cemented together, making a substantial and water-proof construction.

The insulators may be fully exposed to the weather, but as a safeguard against falling ice and direct storm it is suggested that a simple roof be erected over them. Wherever possible installation should be made so that the exposed surface of the disc (corrugated side) will be washed by driving rains.

These insulators are regularly furnished glazed chocolate color.

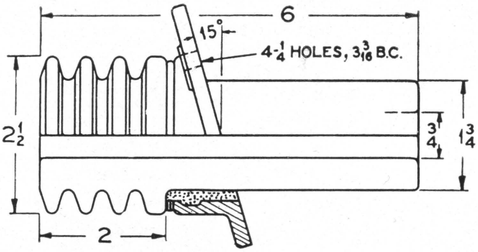
Wall Outlet Bushings

Insulator No.	**9619**	**9620**
Code Word	VECON	VECRU
Line voltage	23,000	35,000
Leakage distance	15¼ inches	20¾ inches
Dimension "A"	13⅜ inches	13⅜ inches
"B"	12 inches	12 inches
"C"	13 inches	21 inches
"D"	1 inch	1 inch
Net weight each	30 lb.	33 lb.
Packed weight each	55 lb.	70 lb.
Standard package	Box of 1	Box of 1

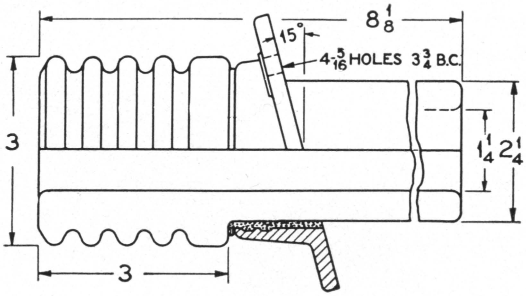
Insulator No.	**9621**	**9622**
Code Word	VECTA	VECUI
Line voltage	45,000	60,000
Leakage distance	26 inches	30½ inches
Dimension "A"	17⅜ inches	17⅜ inches
"B"	16 inches	16 inches
"C"	21 inches	21 inches
"D"	1 inch	1 inch
Net weight each	48 lb.	50 lb.
Packed weight each	110 lb.	112 lb.
Standard package	Box of 1	Box of 1

Insulator No.	**9623**	**9624**
Code Word	VECYP	VEDAX
Line voltage	70,000	80,000
Leakage distance	34 inches	44½ inches
Dimension "A"	17⅜ inches	19⅜ inches
"B"	16 inches	18 inches
"C"	27 inches	*50 inches
"D"	1 inch	1 inch
Net weight each	55 lb.	100 lb.
Packed weight each	115 lb.	190 lb.
Standard package	Box of 1	Box of 1

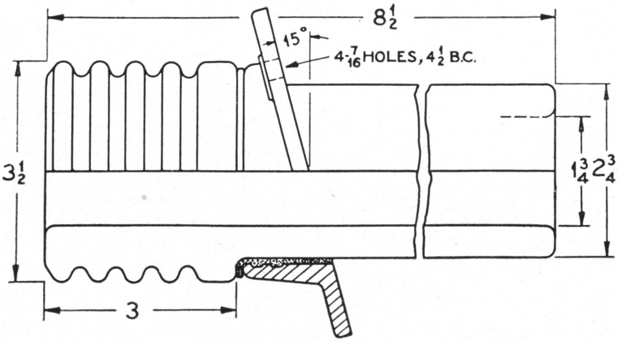
* The shank of Insulator No. 9624 consists of two concentric tubes the outer of which is corrugated. The inner tube is plain, 50-inch long, and projects 11½ inches at each end beyond the outer tube.



No. 8370



No. 24050



No. 24156

Outlet Bushings

These inexpensive bushings are in general use in meter house construction for insulating primary circuit outlets. Regularly furnished glazed chocolate color, complete with galvanized gray iron flanges. They can be supplied in any special length, either or both ends.

	Code Word
8370	VORZE
24050	VOSCO
24156	VOVYF

Copper Rod Assemblies

LOCKE Copper Rod Assemblies cover four convenient sizes of conductor. These are:

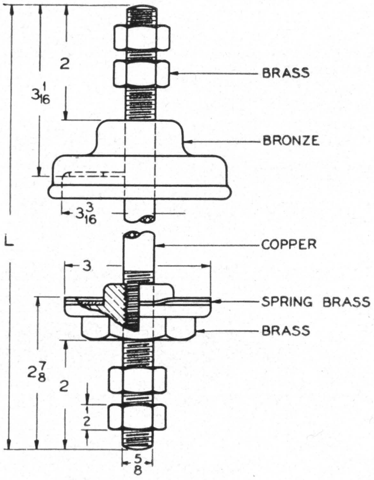
1. 5/8-inch diameter with a current capacity recommended to be 300 amperes.
2. 3/4-inch diameter with a current capacity recommended to be 400 amperes.
3. 1-inch diameter with a current capacity recommended to be 800 amperes.
4. 1 1/4-inch diameter with a current capacity recommended to be 1200 amperes.

Other rod sizes can be furnished upon request.

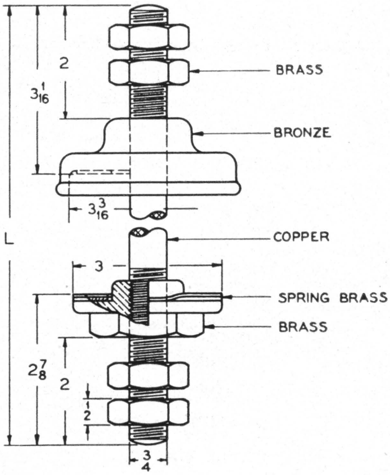
The plain end rod assemblies consist of a high conductivity rolled copper rod on the outside end of which is brazed a bronze cap sealed in such a way that no water can possibly penetrate into the bushing. Between the cap and the porcelain a resilient washer is provided. The lower end of the rod is fitted with a special thimble and jam nut which serves the purpose of centering the rod. The spring washer between the jam nut and the porcelain provides sufficient flexibility to take care of expansion and contraction under thermal changes.

The threaded end rod assemblies consist of a high conductivity rolled copper rod to which is attached at the upper end a bronze cap. This cap is threaded onto the rod and then tinned and sweated to form a water-tight joint. A resilient washer is provided under the cap for contact with the porcelain. The lower end of the rod assembly is provided with a special hex. centering nut backed up with a flexible spring washer which is placed in contact with the porcelain bushing. The combination of this contact nut and spring washer serves to centralize the conductor in the bushing and causes a spring tension which keeps the nut snug against the porcelain at all times. At each end of this rod assembly is provided two standard contact nuts suitable for clamping the conventional type terminals.

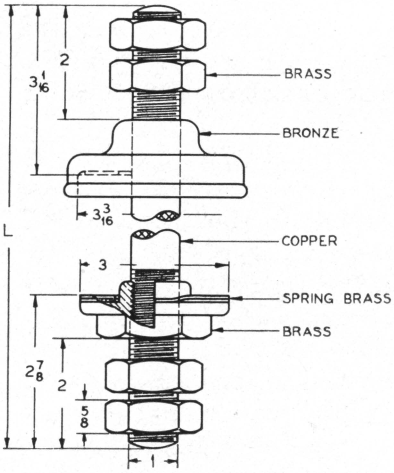
These rod assemblies are suitable for Locke standard equipment bushings and many special assemblies.



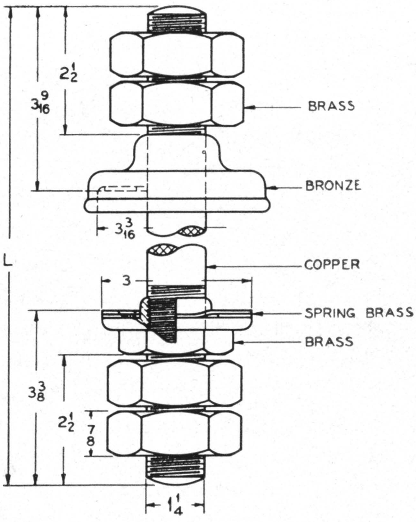
19600—19607



19608—19615



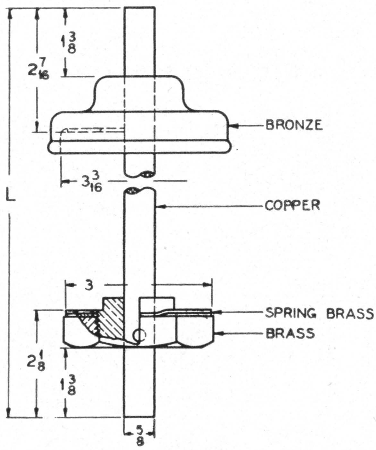
19616—19623



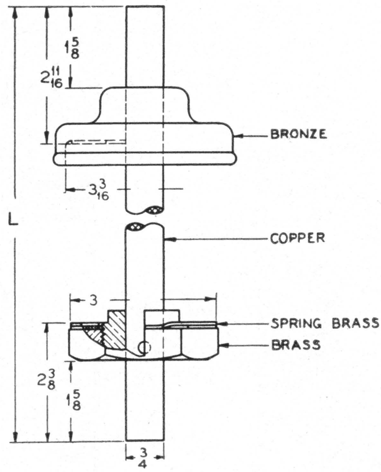
19624—19628

THREADED END ROD ASSEMBLIES

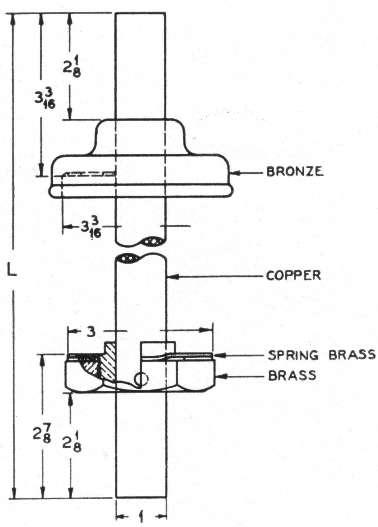
Catalog No.	Code Word	Rod Diameter in In.	Rod Length "L" in In.	Use with Insulator No.	Estimated Packed Wt. in Lb. Each
19600	BJGAA	5/8	23	18501	5 1/4
19608	BJGAI	3/4	23	18501	6 1/4
19616	BJGBG	1	23	18501	8 3/4
19624	BJGCE	1 1/4	24	18501	13 1/4
19601	BJGAB	5/8	27	18502	5 3/4
19609	BJGAJ	3/4	27	18502	6 3/4
19617	BJGBH	1	27	18502	9 3/4
19625	BJGCF	1 1/4	28	18502	15 1/4
19602	BJGAC	5/8	32	18503	6 1/4
19610	BJGBA	3/4	32	18503	7 1/4
19618	BJGBI	1	32	18503	11 1/2
19626	BJGCG	1 1/4	33	18503	17 1/4
19603	BJGAD	5/8	37 1/2	18504	6 3/4
19611	BJGBB	3/4	37 1/2	18504	8
19619	BJGBJ	1	37 1/2	18504	13
19627	BJGCH	1 1/4	38 1/2	18504	19 1/4
19604	BJGAE	5/8	42 1/2	18505	7 1/4
19612	BJGBC	3/4	42 1/2	18505	8 1/2
19620	BJGCA	1	42 1/2	18505	14
19628	BJGCI	1 1/4	43 1/2	18505	21 3/4
19605	BJGAF	5/8	47	18506	7 3/4
19613	BJGBD	3/4	47	18506	9 1/4
19621	BJGCB	1	47	18506	15 3/4
19606	BJGAG	5/8	52 1/2	18507	8 1/4
19614	BJGBE	3/4	52 1/2	18507	10
19622	BJGCC	1	52 1/2	18507	17 1/4
19607	BJGAH	5/8	59	18508	9
19615	BJGBF	3/4	59	18508	11 1/4
19623	BJGCD	1	59	18508	19 1/4



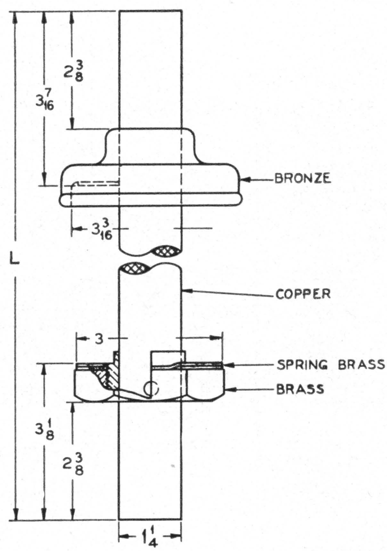
19642—19649



19650—19657



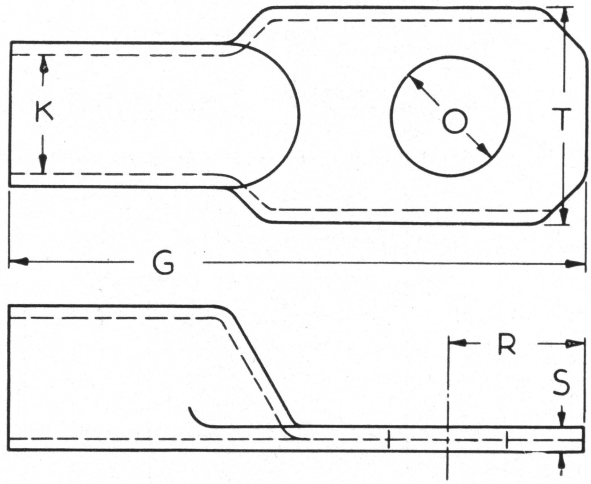
19658—19665



19666—19670

Plain End Rod Assemblies

Catalog No.	Code Word	Rod Diameter in In.	Rod Length "L" in In.	Use with Insulator No.	Estimated Packed Wt. in Lb. Each
19642	BJGEC	5/8	21½	18501	5
19650	BJGFA	3/4	22	18501	6
19658	BJGFI	1	23	18501	8¾
19666	BJGGG	1¼	23½	18501	13
19643	BJGED	5/8	25½	18502	5½
19651	BJGFB	3/4	26	18502	6½
19659	BJGFJ	1	27	18502	9¾
19667	BJGGH	1¼	27½	18502	15
19644	BJGEE	5/8	30½	18503	6
19652	BJGFC	3/4	31	18503	7
19660	BJGGA	1	32	18503	11½
19668	BJGGI	1¼	32½	18503	17
19645	BJGEF	5/8	36	18504	6½
19653	BJGFD	3/4	36½	18504	7¾
19661	BJGGB	1	37½	18504	13
19669	BJGGJ	1¼	38	18504	19
19646	BJGEG	5/8	41	18505	7
19654	BJGFE	3/4	41½	18505	8½
19662	BJGGC	1	42½	18505	14
19670	BJGHA	1¼	43	18505	21½
19647	BJGEH	5/8	45½	18506	7½
19655	BJGFF	3/4	46	18506	9
19663	BJGGD	1	47	18506	15¾
19648	BJGEI	5/8	51	18507	8
19656	BJGFG	3/4	51½	18507	10
19664	BJGGE	1	52½	18507	17¼
19649	BJGEJ	5/8	57½	18508	8¾
19657	BJGFH	3/4	58	18508	11
19665	BJGGF	1	59	18508	19

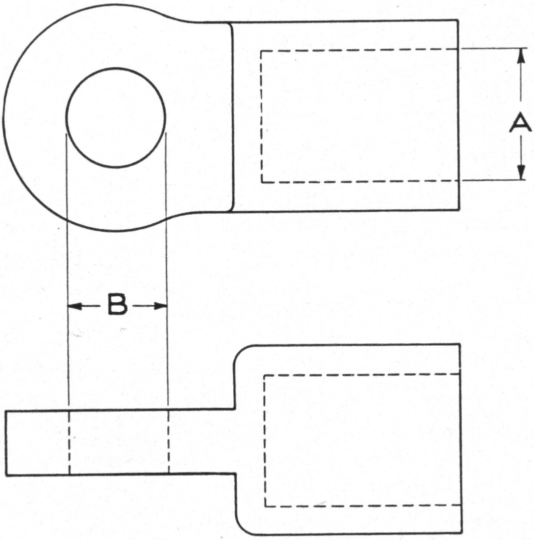


18306—18309

Punched Copper Terminals

Locke Punched Copper Tube Terminals are suitable for any standard rod assemblies. They are pressed from similar high conductivity copper tubing. Very high pressures are employed in the forming so that these terminals are absolutely waterproof. The corners of the tang are rounded in the trimming process and the barrel of the terminal is counterbored to facilitate entrance of the cable. All foreign matter and oxidation is removed in a final dipping process which leaves a surface to which solder will readily adhere.

Cat. No.	Code Word	Size of Cable	Dimensions in Inches						Packed Wt. Lb.
			O	K	G	R	S	T	
18306	BIDAG	300,000	$\frac{21}{32}$	.669	$3\frac{3}{16}$	$\frac{3}{4}$	.144	1.199	$\frac{1}{4}$
18307	BIDAH	500,000	$\frac{25}{32}$	.881	$4\frac{5}{32}$	$\frac{15}{16}$	.181	1.573	$\frac{1}{2}$
18308	BIDAI	1,000,000	$1\frac{1}{16}$	1.209	$5\frac{3}{8}$	$1\frac{1}{8}$	.229	2.19	$\frac{3}{4}$
18309	BIDAJ	1,500,000	$1\frac{5}{16}$	1.699	$7\frac{5}{8}$	$1\frac{9}{16}$	.364	3.03	$1\frac{1}{4}$

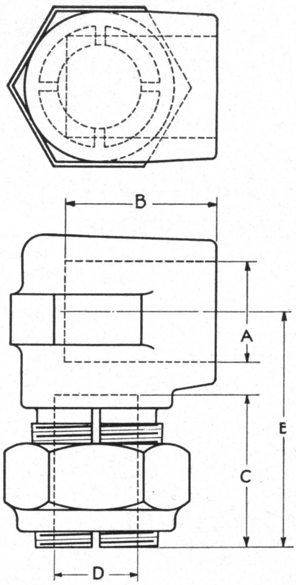


13563—13568

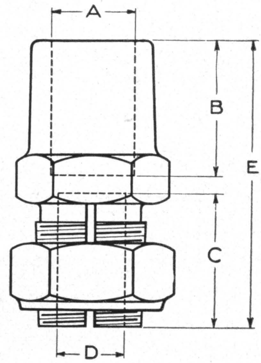
CAST COPPER TERMINALS

These high conductivity Cast Copper Lugs are machined smoothly on each side of the contact boss. The barrel of the lug is smooth bored leaving a surface to which solder will readily adhere. They can be soldered on the smooth end rod assembly to form an end connector or they can be clamped on the threaded end rod assembly by the use of jam nuts. These lugs can be furnished with a wide range of cable entrance holes and will take cable up to two million c.m. capacity.

Catalog No.	Code Word	Capacity in Cable Size	DIMEN. IN IN. A	DIMEN. IN IN. B	Packed Wt. Lb.
13563	BDFGD	300,000	$\frac{11}{16}$	$\frac{11}{16}$	$\frac{5}{8}$
13564	BDFGE	500,000	$\frac{7}{8}$	$\frac{13}{16}$	$\frac{7}{8}$
13566	BDFGG	1,000,000	$1\frac{1}{4}$	$1\frac{3}{16}$	$1\frac{3}{8}$
13568	BDFGI	1,800,000	$1\frac{11}{16}$	$1\frac{5}{16}$	$1\frac{3}{4}$



18310—18313



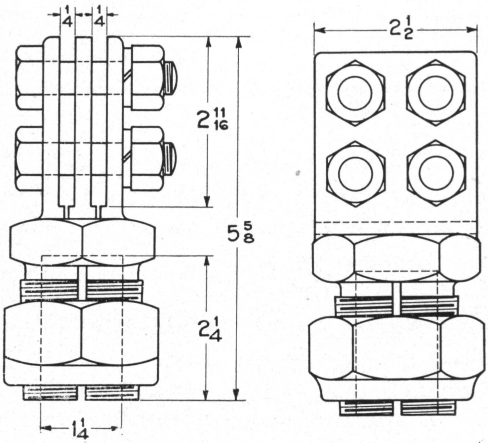
18314—18317

Right Angle and Straight Copper Terminals

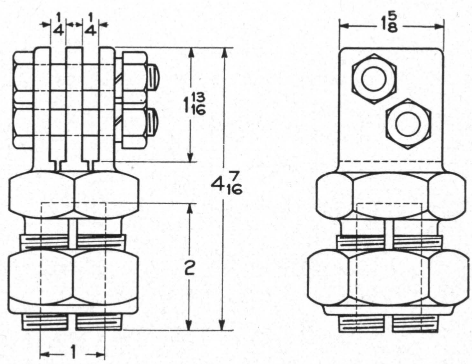
These clamp type terminals are built to carry high currents. Primarily intended for the smooth end rod assemblies they can be furnished with internal threading for use with the threaded end rod assemblies.

They are cast from a high grade silicon deoxidized copper, free from casting imperfections and carefully machined.

Catalog No.	Code Word	Dimensions in Inches					For Use With Rod Diameter	Packed Wt. Lb.
		A	B	C	D	E		
18310	BIDBA	¾	1¼	1¼	⅝	2⅛	⅝	1¾
18311	BIDBB	⅞	1½	1½	¾	2 5/16	¾	2½
18312	BIDBC	1¼	2	2	1	3	1	2¾
18313	BIDBD	1½	2¼	2¼	1¼	3½	1¼	5
Straight Terminals								
18314	BIDBE	¾	1¼	1¼	⅝	2¾	⅝	1
18315	BIDBF	⅞	1½	1½	¾	3¼	¾	1¾
18316	BIDBG	1¼	2	2	1	4¼	1	3¾
18317	BIDBH	1½	2¼	2¼	1¼	4¾	1¼	4¾



13271



13270

Bus Bar Terminals

These terminals are usually furnished made of high grade copper castings. For special designs high conductivity terminals manufactured by the cast brazing process may be furnished. Primarily intended for the smooth end rod assemblies they can be furnished with the threading for use with the threaded end rod assemblies.

Catalog No.	Code Word	For Use With Rod Diameter	Packed Wt. Lb.
13270	BDCHA	1	3¾
13271	BDCHB	1¼	5¾

Locke Radio Insulators

INSULATORS for radio broadcasting stations must be in many ways different from those used ordinarily in sub-stations. At commercial frequencies and with bulk power distribution, dielectric losses are almost negligible. At radio frequencies, where available power is small, these are of highest importance from both the standpoint of power loss and heating of the insulation.

All insulators are in reality condensers and therefore subject to the laws which govern condensers. The capacitance of a condenser is directly proportional to the area of the electrodes and inversely proportional to the distance between electrodes.

The capacitance of a condenser is also directly proportional to the dielectric constant of the insulating medium. Air has a dielectric constant of approximately one. Porcelain has a dielectric constant, of from 4.4 to 6.8, and glass from 5.5 to 10. While realizing that the frequency of the voltage has an effect on the dielectric constant these values indicate clearly the need of giving the shape, size and material of the dielectric considerable attention.

Realizing the charging current as well as being proportional to the capacitance is directly proportional to the frequency and voltage and that the heating effect varies as the square of the current it is obvious that charging currents at radio frequencies may, in addition to the resultant power loss, cause injuries to the insulating material which at normal frequencies would not occur.

Insulators for use at radio frequency therefore should embody the following points of design:

1. The metal parts should be small and as far apart as possible.
2. Air with its low dielectric constant rather than material of high dielectric constant, such as porcelain or glass, should be used as the principal insulation.

Since the pioneer days of radio broadcasting, Locke insulators for broadcasting stations have been widely used. For the interested engineer a variety of more or less standard types are available while the facilities of the Locke organization make the design and fabrication of special pieces a simple matter. Every assistance will be gladly given engineers interested in this subject.

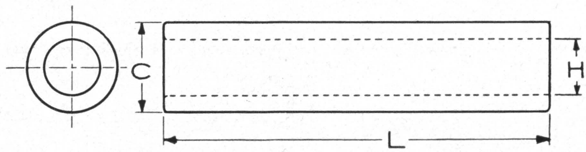
Locke Special Porcelains

THE facilities of the Locke Insulator Corporation are practically unequalled. The original plant was established at Victor, N. Y., in 1893 and since then has been constantly enlarged and improved. In 1922 it was found that despite the tremendous expansion this plant was no longer sufficient to keep up with the constantly growing demand for Locke Insulators. Accordingly an additional plant with a considerably greater output capacity than the original Victor Plant was erected at Baltimore, Maryland.

By 1929 the demand for special porcelains which did not fall into the regular production classes prompted the addition of a special porcelain department. This department—an entire plant in itself—is probably the most complete and certainly the most up-to-date in the country. In the few years it has been in operation it has produced some of the most intricate forms ever attempted in wet process porcelain. Special porcelains which only a few years ago would have been considered impossible of fabrication in wet-process porcelain are now regular production pieces, presenting no more difficulties in manufacture than the regular line insulators.

On some of the preceding pages certain of these porcelains such as the oil-filled and solid-type equipment bushings, and certain of the radio insulators, have been briefly described, but these by no means exhaust the possibilities of the special porcelain department. Specially selected and trained personnel provided with the latest and most approved equipment have worked with apparatus manufacturers and engineers to produce a variety of complicated porcelains, many of which must be seen to be appreciated. Special bushings, fuse cutout boxes, special potheads and pothead covers, have been developed and produced commercially, the facilities and foresight of this department and its engineering staff contributing decided economies.

The wide experience and unequalled facilities of this special porcelain department of the Locke Insulator Corporation are at the service of any engineer or manufacturer who has problems involving the design or manufacture of complex porcelain shapes.



STANDARD TUBES WITHOUT HEADS

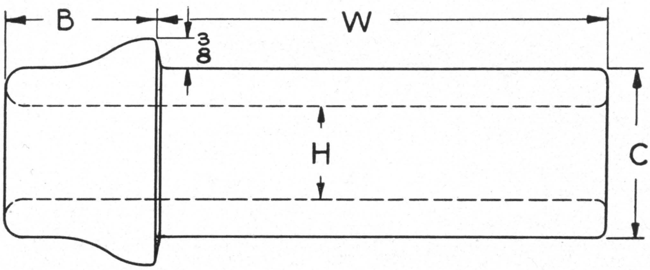
Special tubes can be supplied with inside diameter up to 7 inches, outside diameter up to 9 inches and lengths up to 72 inches.

Each tube is tested at 60-cycle flashover for 3 minutes before shipment.

Dimensions "L" must be specified on all inquiries and orders.

Catalog No.	Code Word	DIMENSIONS IN INCHES		Net Weight Lb. per Inch L.
		H	C	
9320	WUHEK	1	2	.23
9321	WUHHU	1¼	2¼	.27
9322	WUHIX	1½	2½	.31
9323	WUHJA	1¾	2¾	.35
9324	WUHLG	2	3	.39
9325	WUHOP	2	3½	.64
9326	WUHPT	2½	3½	.47
9327	WUHUF	2½	4	.76
9328	WUHVI	3	4	.55
9329	WUHXO	3	4½	.88
9330	WUHYS	3	5	1.25
9331	WUIAZ	3½	4½	.63
9332	WUIBC	3½	5	1.00
9333	WUICF	3½	5½	1.41
9334	WUIDI	4	5½	1.11
9335	WUIEL	4	6	1.57
9336	WUIFO	4	6½	2.06
9337	WUIGS	5	7	1.78

Shipping weight is approximately one-third greater than net weight.
These insulators are regularly furnished glazed chocolate color.



Standard Tubes with Heads

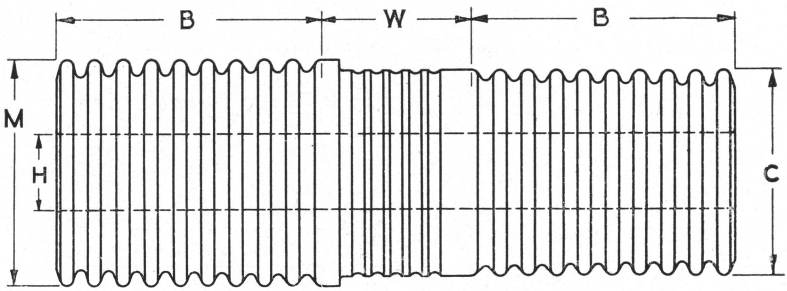
Standard sizes are furnished with dimension "W" 2 inches or in multiples thereof.

Each tube is tested at 60-cycle flashover, for 3 minutes before shipment.

Dimension "W" must be specified on all inquiries and orders.

Catalog No.	Code Word	Line Voltage	Dimensions in Inches			Lb. Each	
			B	H	C	Head	Per In. W.
7148	WROOL	2200	1	1	2	.28	.23
7149	WROPO	2200	1	1¼	2¼	.32	.27
7150	WRORS	2200	1	1½	2½	.37	.31
7151	WROSV	2200	1	1¾	2¾	.42	.35
7152	WROTY	2200	1	2	3	.46	.39
7153	WROUB	2200	1	2½	3½	.56	.47
7154	WROVE	2200	1	3	4	.65	.55
7155	WROWH	4400	2	1	2	.51	.23
7156	WROYN	4400	2	1¼	2¼	.59	.27
7157	WRUAZ	4400	2	1½	2½	.68	.31
7158	WRUBC	4400	2	1¾	2¾	.77	.35
7159	WRUCF	4400	2	2	3	.85	.39
7160	WRUDI	4400	2	2½	3½	1.03	.47
7161	WRUEL	4400	2	3	4	1.20	.55
7162	WRUFO	6600	3	1	2	.74	.23
7163	WRUGS	6600	3	1¼	2¼	.86	.27
7164	WRUHV	6600	3	1½	2½	.99	.31
7165	WRUIY	6600	3	1¾	2¾	1.12	.35
7166	WRUKE	6600	3	2	3	1.24	.39
7167	WRULH	6600	3	2½	3½	1.50	.47
7168	WRUMK	6600	3	3	4	1.75	.55

The above line voltage ratings are either for indoor or outdoor service under normal conditions.
Shipping weight is approximately one-third greater than net weight.
These insulators are regularly furnished glazed chocolate color.



STANDARD CORRUGATED BUSHINGS

Standard sizes are furnished with dimension "W" 2 inches or in multiples thereof.

Each bushing is tested at 60-cycle flashover for 3 minutes before shipment.

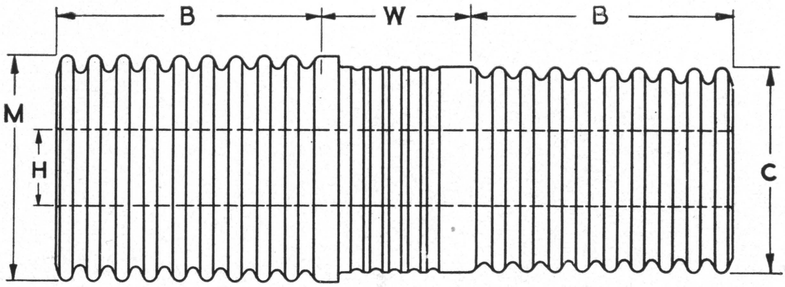
Dimension "W" must be specified on all inquiries and orders.

Catalog No.	Code Word	Line Voltage	DIMENSIONS IN INCHES				LB. EACH	
			B	H	C	M	Heads	Per In. W.
7100	WUBUZ	6,600	3	1	3	3½	2.49	.50
7101	WUBYL	11,000	4½	1	3	3½	3.53	.50
7102	WUBZO	15,000	6	1	3	3½	4.18	.50
7103	WUCAT	20,000	7½	1	3	3½	6.23	.50
7104	WUCEF	23,000	9	1	3¼	3¾	9.03	.56
7105	WUCFI	27,000	10½	1	3½	4	12.67	.70
7106	WUCHO	6,600	3	1½	3½	4	3.14	.62
7107	WUCIS	11,000	4½	1½	3½	4	4.72	.62
7108	WUCKY	15,000	6	1½	3½	4	6.29	.62
7109	WUCME	20,000	7½	1½	3½	4	7.87	.62
7110	WUCOK	23,000	9	1½	3¾	4¼	11.34	.74
7111	WUCSU	27,000	10½	1½	4	4½	15.67	.86
7112	WUCUA	6,600	3	2	4	4½	3.81	.75
7113	WUCYM	11,000	4½	2	4	4½	5.71	.75
7114	WUDAU	15,000	6	2	4	4½	7.62	.75
7115	WUDCA	20,000	7½	2	4	4½	9.52	.75
7116	WUDEG	23,000	9	2	4¼	4¾	13.63	.88
7117	WUDIT	27,000	10½	2	4½	5	18.71	1.02
7118	WUDNI	6,600	3	2½	4½	5	4.47	.88
7119	WUDOL	11,000	4½	2½	4½	5	6.71	.88
7120	WUDPO	15,000	6	2½	4½	5	8.95	.88
7121	WUDTY	20,000	7½	2½	4½	5	11.03	.88
7122	WUDUB	23,000	9	2½	4¾	5¼	15.91	1.02
7123	WUDVE	27,000	10½	2½	5	5½	21.57	1.17

The above line voltage ratings are either for indoor or outdoor service under normal conditions.

Shipping weight is approximately one-third greater than net weight.

These insulators are regularly furnished glazed chocolate color.



STANDARD CORRUGATED BUSHINGS

Standard sizes are furnished with dimension "W" 2 inches or in multiples thereof.

Each bushing is tested at 60-cycle flashover, for 3 minutes before shipment.

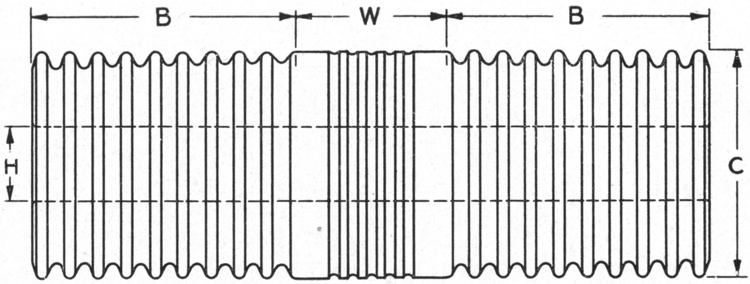
Dimension "W" must be specified on all inquiries and orders.

Catalog No.	Code Word	Line Voltage	DIMENSIONS IN INCHES				LB. EACH	
			B	H	C	M	Heads	Per In. W.
9250	WUDYN	6,600	3	3	5	5½	4.98	1.02
9251	WUEAV	11,000	4½	3	5	5½	7.47	1.02
9252	WUEBY	15,000	6	3	5	5½	9.96	1.02
9253	WUEDE	20,000	7½	3	5	5½	12.55	1.02
9254	WUEEH	23,000	9	3	5¼	5¾	18.45	1.18
9255	WUEFK	27,000	10½	3	5¼	5¾	21.52	1.18
9256	WUEHR	6,600	3	3½	5½	6	5.73	1.14
8914	WUFLE	11,000	4½	3½	5½	6	8.59	1.14
9257	WUEKA	15,000	6	3½	5½	6	11.46	1.14
9258	WUELD	20,000	7½	3½	5½	6	14.32	1.14
9259	WUEMG	23,000	9	3½	5¾	6¼	20.70	1.32
9260	WUENJ	27,000	10½	3½	5¾	6¼	24.10	1.32
9261	WUEOM	6,600	3	4	6¼	6¾	7.67	1.46
9262	WUERT	11,000	4½	4	6¼	6¾	11.50	1.46
9263	WUETZ	15,000	6	4	6¼	6¾	15.35	1.46
9264	WUEUC	20,000	7½	4	6¼	6¾	19.20	1.46
9265	WUEWI	23,000	9	4	6¼	6¾	23.00	1.46
9266	WUEYO	27,000	10½	4	6¼	6¾	27.90	1.46
9267	WUFAW	6,600	3	4½	6¾	7¼	8.45	1.61
9268	WUFEI	11,000	4½	4½	6¾	7¼	12.70	1.61
9269	WUFGO	15,000	6	4½	6¾	7¼	16.90	1.61
9270	WUFHS	20,000	7½	4½	6¾	7¼	21.70	1.61
9271	WUFIV	23,000	9	4½	6¾	7¼	25.30	1.61
9272	WUFJY	27,000	10½	4½	6¾	7¼	29.60	1.61

The above line voltage ratings are either for indoor or outdoor service under normal conditions.

Shipping weight is approximately one-third greater than net weight.

These insulators are regularly furnished glazed chocolate color.



STANDARD CORRUGATED BUSHINGS

Standard sizes are furnished with dimension "W" 2 inches or in multiples thereof.

Each bushing is tested at 60-cycle flashover for 3 minutes before shipment.

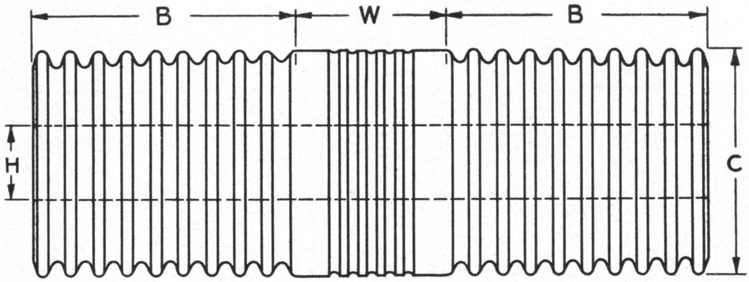
Dimension "W" must be specified on all inquiries and orders.

Catalog No.	Code Word	Line Voltage	DIMENSIONS IN INCHES			LB. EACH	
			B	H	C	Heads	Per In. W
7124	VELTJ	6,600	3	1	3	1.97	.50
7125	VELUV	11,000	4½	1	3	2.95	.50
7126	VELVP	15,000	6	1	3	3.94	.50
7127	VELYZ	20,000	7½	1	3	4.93	.50
7128	VEMEP	23,000	9	1	3¼	7.40	.60
7129	VEMIS	27,000	10½	1	3½	10.55	.72
7130	VEMJI	6,600	3	1½	3½	2.53	.62
7131	VEMLO	11,000	4½	1½	3½	3.80	.62
7132	VEMOM	15,000	6	1½	3½	5.07	.62
7133	VEMRE	20,000	7½	1½	3½	6.14	.62
7134	VEMUN	23,000	9	1½	3¾	9.38	.74
7135	VEMWU	27,000	10½	1½	4	13.18	.56
7136	VEMYA	6,600	3	2	4	3.10	.75
7137	VEMZD	11,000	4½	2	4	4.66	.75
7138	VENAG	15,000	6	2	4	6.22	.75
7139	VENEU	20,000	7½	2	4	7.77	.75
7140	VENHD	23,000	9	2	4¼	12.17	.88
7141	VENIH	27,000	10½	2	4½	15.82	1.02
7142	VENKM	6,600	3	2½	4½	3.67	.88
7143	VENOL	11,000	4½	2½	4½	5.51	.88
7144	VENSI	15,000	6	2½	4½	7.35	.88

The above line voltage ratings are either for indoor or outdoor service under normal conditions.

Shipping weight is approximately one-third greater than net weight.

These insulators are regularly furnished glazed chocolate color.



Standard Corrugated Bushings

Standard sizes are furnished with dimension "W" 2 inches or in multiples thereof.

Each bushing is tested at 60-cycle flashover for 3 minutes before shipment.

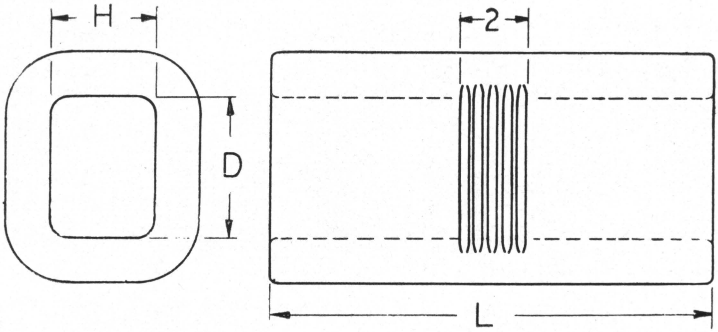
Dimension "W" must be specified on all inquiries and orders.

Catalog No.	Code Word	Line Voltage	Dimensions in Inches			Lb. Each	
			B	H	C	Heads	Per in. W.
7145	VENUO	20,000	7½	2½	4½	9.19	.88
7146	VENXY	23,000	9	2½	4¾	13.36	1.02
7147	VENYB	27,000	10½	2½	5	18.48	1.17
9280	VENZE	6,600	3	3	5	4.32	1.02
9281	VEOBL	11,000	4½	3	5	6.48	1.02
9282	VEOCO	15,000	6	3	5	8.64	1.02
9283	VEODS	20,000	7½	3	5	10.80	1.02
9284	VEOEV	23,000	9	3	5¼	15.66	1.18
9285	VEOFY	27,000	10½	3	5¼	18.27	1.18
9286	VEOGB	6,600	3	3½	5½	4.56	1.14
9287	VEOHE	11,000	4½	3½	5½	6.84	1.14
9288	VEOIH	15,000	6	3½	5½	9.12	1.14
9289	VEOJK	20,000	7½	3½	5½	11.40	1.14
9290	VEOKN	23,000	9	3½	5¾	17.64	1.32
9291	VEOMU	27,000	10½	3½	5¾	20.58	1.32
9292	VEONX	6,600	3	4	6¼	6.60	1.46
9293	VEOPD	11,000	4½	4	6¼	9.90	1.46
9294	VEORG	15,000	6	4	6¼	13.20	1.46
9295	VEOTM	20,000	7½	4	6¼	16.50	1.46
9296	VEOUP	23,000	9	4	6½	22.86	1.66
9297	VEOVT	27,000	10½	4	6½	26.67	1.66

The above line voltage ratings are either for indoor or outdoor service under normal conditions.

Shipping weight is approximately one-third greater than net weight.

These insulators are regularly furnished glazed chocolate color.



STANDARD RECTANGULAR BUSHINGS

Designed to accommodate rectangular bus bars or bus-bar stacks. When selecting the size, the holes should be at least ½ inch larger than the bus bar or stack to be accommodated.

Special pieces can be supplied to suit almost any requirement. Each bushing will be furnished with a 2-inch corrugated section around the center, to facilitate cementing into the floor or wall, unless otherwise specified. Wall thickness on all sizes is approximately 1¼ inches. Each bushing is tested before shipment for three minutes at 60-cycle flashover.

Dimension "L" must be specified on all inquiries and orders, also size conductor to be used.

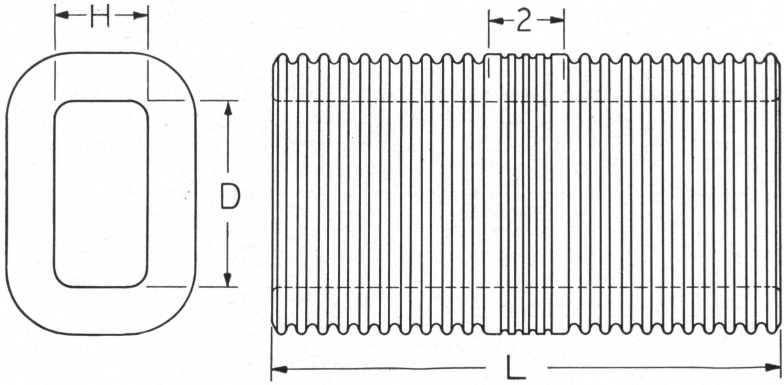
Shipping weight is approximately one-third greater than net weight.

Line voltage: Under normal conditions, bushings should extend from each side of floor or wall, 4 inches for 6600 volts; 5½ inches for 11,000 volts; 7½ inches for 15,000 volts; 9 inches for 20,000 volts; 10½ inches for 23,000 volts; 12½ inches for 27,000 volts.

These insulators are regularly furnished glazed chocolate color.

STANDARD RECTANGULAR BUSHINGS

Catalog No.	Code Word	Dimensions in Inches		Net Wt. Lb. per Inch L
		H	D	
9550	WRUOR	1½	3	1.75
9551	WRUPU	1½	3½	1.87
9552	WRURX	1½	4	2.00
9553	WRUSA	1½	4½	2.12
9554	WRUVJ	1½	5	2.25
9555	WRUWM	1½	5½	2.37
9556	WRUYT	1½	6	2.50
9557	WRYAD	2	3	1.87
9558	WRYDM	2	3½	2.00
9559	WRYEP	2	4	2.12
9560	WRYFT	2	4½	2 25
9561	WRYHZ	2	5	2.37
9562	WRYIC	2	5½	2.50
9563	WRYJF	2	6	2.62
9564	WRYKI	2½	3	2.00
9565	WRYMO	2½	3½	2.12
9566	WRYNS	2½	4	2.25
9567	WRYOV	2½	4½	2.37
9568	WRYPY	2½	5	2.50
9569	WRYSE	2½	5½	2.62
9570	WRYTH	2½	6	2.75
9571	WRYUK	3	3	2.12
9572	WRYXU	3	3½	2.25
9573	WRYYX	3	4	2.37
9574	WRYZA	3	4½	2.50
9575	WUAAR	3	5	2.62
9576	WUABU	3	5½	2.75
9577	WUADA	3	6	2.87
9578	WUAED	3½	3½	2.37
9579	WUAFG	3½	4	2.50
9580	WUAGJ	3½	4½	2.62
9581	WUAHM	3½	5	2.75
9582	WUAIP	3½	5½	2.87
9583	WUAJT	3½	6	3.00
9584	WUALZ	4	4	2.62
9585	WUAMC	4	4½	2.75
9586	WUANF	4	5	2.87
9587	WUARO	4	5½	3.00
9588	WUATV	4	6	3.12
9589	WUAVB	4½	4½	2.87
9590	WUAWE	4½	5	3.00
9591	WUAXH	4½	5½	3.12
9592	WUAYK	4½	6	3.25
9593	WUAZN	5	5	3.12
9594	WUBAS	5	5½	3.25
9595	WUBCY	5	6	3.37



Corrugated Rectangular Bushings

Designed to accommodate rectangular bus bars or bus-bar stacks. When selecting the size the hole should be at least ½-inch larger than the bus bar or stack to be accommodated. Special pieces can be supplied to suit almost any requirement.

These bushings have a decided advantage over the uncorrugated rectangular bushing in that it is possible to furnish a shorter bushing for a given rating than with the uncorrugated ones, the flashover value of a corrugated bushing being materially greater than that of a corresponding smooth bushing. Each bushing is tested before shipment for three minutes at 60-cycle flashover.

Wall thickness on all sizes is approximately 1¼ inches.

Dimension "L" must be specified on all inquiries and orders, also size conductor to be used.

Shipping weight is approximately one-third greater than net weight.

Line voltage: Under normal conditions, bushings should extend from each side of floor or wall, 3 inches for 6600 volts; 4½ inches for 11,000 volts; 6 inches for 15,000 volts; 7½ inches for 20,000 volts; 9 inches for 23,000 volts; 10½ inches for 27,000 volts.

These insulators are regularly furnished glazed chocolate color.

CORRUGATED RECTANGULAR BUSHINGS

Catalog No.	Code Word	DIMENSIONS IN INCHES H	D	Net Wt. Lb. per Inch L
24159	CEBFJ	1½	3	1.60
24160	CEBGA	1½	3½	1.70
24161	CEBGB	1½	4	1.80
24162	CEBGC	1½	4½	1.90
24163	CEBGD	1½	5	2.05
24164	CEBGE	1½	5½	2.15
24165	CEBGF	1½	6	2.25
24166	CEBGG	2	3	1.70
24167	CEBGH	2	3½	1.80
24168	CEBGI	2	4	1.90
24169	CEBGJ	2	4½	2.05
24170	CEBHA	2	5	2.15
24171	CEBHB	2	5½	2.25
24172	CEBHC	2	6	2.35
24173	CEBHD	2½	3	1.80
24174	CEBHE	2½	3½	1.90
24175	CEBHF	2½	4	2.05
24176	CEBHG	2½	4½	2.15
24177	CEBHH	2½	5	2.25
24178	CEBHI	2½	5½	2.35
24179	CEBHJ	2½	6	2.50
24180	CEBIA	3	3	1.90
24181	CEBIB	3	3½	2.05
24182	CEBIC	3	4	2.15
24183	CEBID	3	4½	2.25
24184	CEBIE	3	5	2.35
24185	CEBIF	3	5½	2.50
24186	CEBIG	3	6	2.60
24187	CEBIH	3½	3½	2.15
24188	CEBII	3½	4	2.25
24189	CEBIJ	3½	4½	2.35
24190	CEBJA	3½	5	2.50
24191	CEBJB	3½	5½	2.60
24192	CEBJC	3½	6	2.70
24193	CEBJD	4	4	2.35
24194	CEBJE	4	4½	2.50
24195	CEBJF	4	5	2.60
24196	CEBJG	4	5½	2.70
24197	CEBJH	4	6	2.80
24198	CEBJI	4½	4½	2.60
24199	CEBJJ	4½	5	2.70
24200	CECAA	4½	5½	2.80
24201	CECAB	4½	6	2.90
24202	CECAC	5	5	2.80
24203	CECAD	5	5½	2.90
24204	CECAE	5	6	3.05

Locke Miscellaneous Hardware

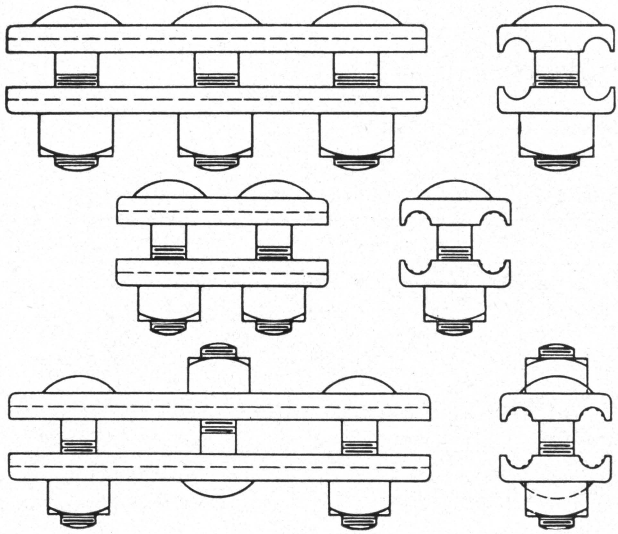
For the benefit of the construction man and designer, there are listed in the following pages various items of miscellaneous hardware in common use on distribution and transmission lines.

Practically every necessity in the way of miscellaneous hardware for ordinary construction is listed and many less usual items not listed can be furnished on request. This section does not include the more usual transmission line insulator attachments and tower fittings. These latter will be found listed in detail on pages 66 to 84 inclusive.

These miscellaneous items, while in many cases playing a relatively unimportant part in the operation of the line, are important in that they can seriously affect ease of installation and consequently speed of construction. For that reason not only have the designs been given especial consideration but particular attention has been paid to manufacture and finish. They are made and finished with the same exacting care which is characteristic of all Locke hardware. Each piece is fabricated from material best suited to its purpose, manufactured under the most rigid specifications, and carefully and thoroughly inspected. The hot dip galvanizing is applied by the most modern methods subject to constant check and control.

The designs are those which have been recognized as standard by some of the leading systems in the country. They are simple, efficient, easy to handle or stock, and strictly uniform.

Practically every item is constantly in stock and delivery can be made promptly. Related items such as pins, cross arm saddles, etc., will be found listed in other parts of this catalog.



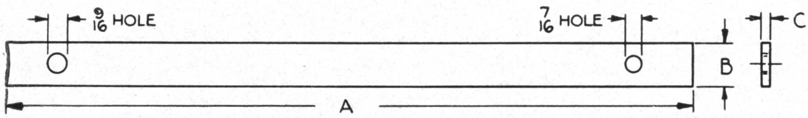
Guy Clamps

Guy Clamps Numbers 56448, 56449 and 56450 are made from open hearth steel $1\frac{9}{16}$ inches wide by $\frac{3}{8}$-inch thick and have diagonal ridges in the grooves which fit the lay of the strand. The bolts are $\frac{1}{2}$-inch with a square shoulder.

Numbers 56461 and 56462 are made from plates $1\frac{21}{32}$ inches wide and $\frac{3}{8}$ inch thick with a smooth groove and equipped with $\frac{5}{8}$-inch heat-treated steel bolts and have a square shoulder the same as lighter type. Number 56460 is drop forged and is 2 inches wide, $\frac{1}{2}$-inch thick equipped with $\frac{5}{8}$-inch bolts.

Catalog No.	Type	Length in Inches	Size Strand	Weight per 100	Standard Packing
56448	2 Bolt Light	3	$\frac{5}{16}$ to $\frac{7}{16}$	135	Box 175
56449	3 Bolt Light	4	$\frac{5}{16}$ to $\frac{7}{16}$	155	Box 125
56450	3 Bolt Light	6	$\frac{5}{16}$ to $\frac{7}{16}$	226	Box 100
56460	3 Bolt Heavy	6	$\frac{5}{16}$ to $\frac{5}{8}$	365	Box 75
* 56461	3 Bolt Heavy	6	$\frac{5}{16}$ to $\frac{5}{8}$	274	Box 75
56462	2 Bolt Heavy	4	$\frac{5}{16}$ to $\frac{5}{8}$	174	Box 100
56464	4 Bolt Heavy	8	$\frac{5}{16}$ to $\frac{5}{8}$	365	Box 50

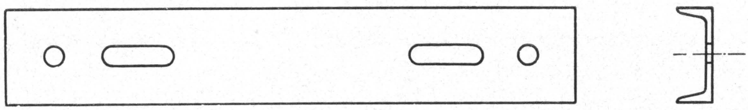
* Indicates N.E.L.A. Standard sizes.



FLAT CROSS ARM BRACES

Flat Cross Arm Braces are made from new open hearth steel and have a $\frac{9}{16}$-inch hole at one end with a $\frac{7}{16}$-inch hole at the other.

Catalog No.	DIMENSIONS IN INCHES			Weight per 100	Standard Packing
	Width of Steel	Thickness of Steel	Length of Brace		
57020	$1\frac{7}{32}$	$\frac{7}{32}$	20	142	Bdle. 20
57022	$1\frac{7}{32}$	$\frac{7}{32}$	22	156	Bdle. 20
57024	$1\frac{7}{32}$	$\frac{7}{32}$	24	170	Bdle. 20
57026	$1\frac{7}{32}$	$\frac{7}{32}$	26	184	Bdle. 20
57028	$1\frac{7}{32}$	$\frac{7}{32}$	28	198	Bdle. 20
57030	$1\frac{7}{32}$	$\frac{7}{32}$	30	212	Bdle. 20
57032	$1\frac{7}{32}$	$\frac{7}{32}$	32	226	Bdle. 20
57120	$1\frac{1}{4}$	$\frac{1}{4}$	20	167	Bdle. 20
57122	$1\frac{1}{4}$	$\frac{1}{4}$	22	183	Bdle. 20
57124	$1\frac{1}{4}$	$\frac{1}{4}$	24	200	Bdle. 20
57126	$1\frac{1}{4}$	$\frac{1}{4}$	26	216	Bdle. 20
57128	$1\frac{1}{4}$	$\frac{1}{4}$	28	233	Bdle. 20
57130	$1\frac{1}{4}$	$\frac{1}{4}$	30	250	Bdle. 20
57132	$1\frac{1}{4}$	$\frac{1}{4}$	32	266	Bdle. 20



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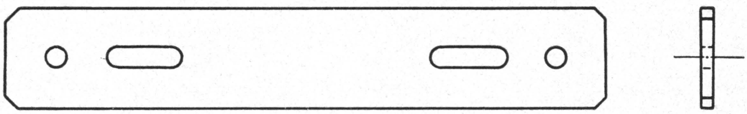


No. 55844

Double Arming Channels and Plates

The Double Arming Channels are made from open hearth channel steel 4 inches wide by 1½ inches deep. The Plates are made from open hearth flat steel 4 inches wide by ½ inch thick.

Both the plates and channels are adjustable for poles from 7 to 12 inches top diameter with gains ½ inch deep. The pin holes are $\frac{13}{16}$-inch diameter 2 inches from end. The slots are $\frac{13}{16}$ inch wide by 3 inches long.

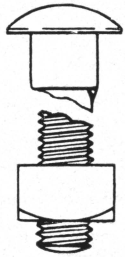
Catalog No.	Length in Inches	Weight per 100	Standard Packing
55824	24	1080	Bdle. 10
55830	30	1350	Bdle. 10
55844	24	1300	Bdle. 10
55850	30	1650	Bdle. 10

LAG SCREWS AND CARRIAGE BOLTS

Lag screws or heel bolts made in two types, the gimlet point and fetter drive. Carriage bolts have an extra long square section under the head and are made in accordance with N.E.L.A. specifications.

Gimlet Point

Fetter Drive



Carriage Bolt

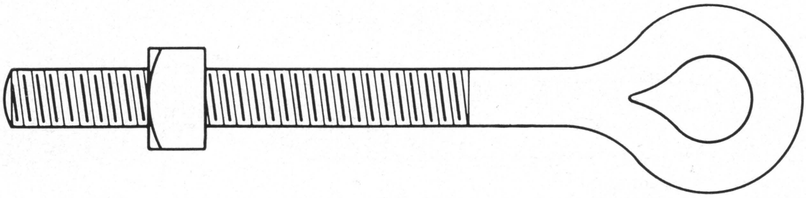
LAG SCREWS

Catalog No.	Diameter of Screw Inches	Length of Screw Inches	Type of Point	Weight Per 100	Standard Packing
58722	1/4	2	Gimlet Point	2.8	Box 6000
58722½	1/4	2½	Gimlet Point	3.3	Box 5000
58732	5/16	2	Gimlet Point	4.7	Box 4500
58732½	5/16	2½	Gimlet Point	5.6	Box 3000
58733	5/16	3	Gimlet Point	6.5	Box 2500
58733½	5/16	3½	Gimlet Point	7.4	Box 2000
58742¼	3/8	2¼	G. P. & F. D.	7.8	Box 3000
58742½	3/8	2½	G. P. & F. D.	8.3	Box 2500
58743	3/8	3	G. P. & F. D.	9.6	Box 2000
58743½	3/8	3½	G. P. & F. D.	10.9	Box 1500
58744	3/8	4	G. P. & F. D.	12.2	Box 1250
58744½	3/8	4½	G. P. & F. D.	13.5	Box 1000
58745	3/8	5	G. P. & F. D.	14.8	Box 1000
58746	3/8	6	G. P. & F. D.	17.4	Box 600
58752½	1/2	2½	G. P. & F. D.	16.7	Box 1200
58753	1/2	3	G. P. & F. D.	19.0	Box 1000
58753½	1/2	3½	G. P. & F. D.	21.3	Box 1000
* 58754	1/2	4	G. P. & F. D.	23.6	Box 800
58754½	1/2	4½	G. P. & F. D.	25.9	Box 700
58755	1/2	5	G. P. & F. D.	28.2	Box 600
58755½	1/2	5½	G. P. & F. D.	36.5	Box 550
58756	1/2	6	G. P. & F. D.	32.8	Box 500
58756½	1/2	6½	G. P. & F. D.	35.1	Box 500
58757	1/2	7	G. P. & F. D.	37.4	Box 500
58764	5/8	4	G. P. & F. D.	35.1	Box 550
58764½	5/8	4½	G. P. & F. D.	38.9	Box 500
* 58765	5/8	5	G. P. & F. D.	42.7	Box 450
58765½	5/8	5½	G. P. & F. D.	46.5	Box 400
58766	5/8	6	G. P. & F. D.	50.3	Box 350

CARRIAGE BOLTS

Catalog No.	Diameter of Bolt Inches	Length of Bolt Inches	Length of Thread Inches	Weight per 100	Standard Packing
58633	3/8	3	1¾	12.9	Box 1500
58633½	3/8	3½	1¾	14.3	Box 1250
* 58634	3/8	4	1¾	15.8	Box 1000
* 58634½	3/8	4½	1¾	17.2	Box 900
* 58635	3/8	5	1¾	18.7	Box 800
58635½	3/8	5½	1¾	20.1	Box 750
58636	3/8	6	1¾	21.6	Box 700
58643	1/2	3	2½	24.7	Box 800
58643½	1/2	3½	3	27.3	Box 700
58644	1/2	4	3	29.8	Box 600
58644½	1/2	4½	3	32.4	Box 500
58645	1/2	5	3	34.9	Box 450
58645½	1/2	5½	3	37.5	Box 400
58646	1/2	6	3	40.0	Box 350

* Indicates N.E.L.A. Standard sizes.

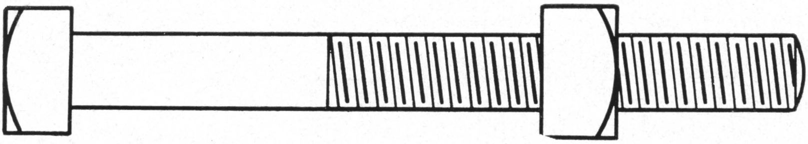


EYEBOLTS

These Eyebolts are drop forged from open hearth steel and have a large oval eye. 6-inch bolts are threaded 4 inches. All other sizes 6 inches.

Catalog No.	DIMENSIONS IN INCHES			Weight per 100	Standard Packing
	Diameter of Bolt	Length of Bolt to Center of Eye	Diameter of Eye		
58936	1/2	6	3/4x1	55	Box 100
58938	1/2	8	3/4x1	65	Box 100
58940	1/2	10	3/4x1	75	Box 100
58942	1/2	12	3/4x1	85	Box 100
58944	1/2	14	3/4x1	95	Box 100
58946	1/2	16	3/4x1	105	Box 100
58948	1/2	18	3/4x1	115	Box 100
58950	1/2	20	3/4x1	125	Box 100
58956	5/8	6	1 1/2x2	84	Box 100
58958	5/8	8	1 1/2x2	100	Box 100
58960	5/8	10	1 1/2x2	116	Box 100
58962	5/8	12	1 1/2x2	132	Box 100
58964	5/8	14	1 1/2x2	148	Box 100
58966	5/8	16	1 1/2x2	164	Box 50
58968	5/8	18	1 1/2x2	180	Box 50
58970	5/8	20	1 1/2x2	196	Box 50
58972	5/8	22	1 1/2x2	212	Box 50
58974	5/8	24	1 1/2x2	228	Box 50
58976	3/4	6	1 1/2x2	116	Box 50
58978	3/4	8	1 1/2x2	140	Box 50
58980	3/4	10	1 1/2x2	164	Box 50
58982	3/4	12	1 1/2x2	188	Box 50
58984	3/4	14	1 1/2x2	212	Box 50
58986	3/4	16	1 1/2x2	236	Box 50
58988	3/4	18	1 1/2x2	260	Box 25
58990	3/4	20	1 1/2x2	284	Box 25

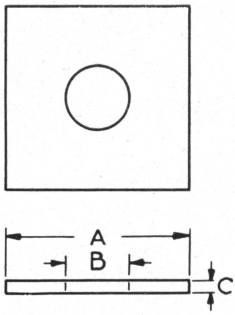
MACHINE BOLTS



Machine or Through Bolts are made from open hearth steel fifty-five to sixty-five thousand pounds tensile strength with rolled threads unless otherwise specified. The bolts are galvanized after the threads are formed and by our special process the threads are freed from excess spelter, thereby making nuts run full length of thread by hand.

Catalog No.	DIMENSIONS IN INCHES			Weight per 100	Standard Packing
	Diameter of Bolt	Length of Bolt	Length of Thread		
58603	3/8	3	3	13.1	Box 1500
58603½	3/8	3½	3	14.6	Box 1250
* 58604	3/8	4	3	16.0	Box 1000
* 58604½	3/8	4½	3	17.5	Box 900
* 58605	3/8	5	3	18.9	Box 800
58605½	3/8	5½	3	20.4	Box 750
58606	3/8	6	3	21.8	Box 650
58704½	½	4½	3	33.8	Box 550
58704¾	½	4¾	3	35.0	Box 500
* 58705	½	5	3	36.3	Box 500
* 58706	½	6	3	41.4	Box 400
* 58707	½	7	3	46.5	Box 400
58708	½	8	4	51.6	Box 350
58710	½	10	4	61.8	Box 150
58712	½	12	6	72.0	Box 150
58714	½	14	6	82.2	Box 150
58716	½	16	6	92.4	Box 150
58718	½	18	6	102.6	Box 100
58720	½	20	6	112.8	Box 100
* 58808	5/8	8	4	82.0	Box 100
* 58810	5/8	10	4	98.0	Box 100
* 58812	5/8	12	6	114	Box 100
* 58814	5/8	14	6	130	Box 100
58816	5/8	16	6	146	Box 100
* 58818	5/8	18	6	150	Box 100
* 58820	5/8	20	6	164	Box 100
* 58822	5/8	22	6	178	Box 100
* 58824	5/8	24	6	192	Box 100
58826	5/8	26	6	206	Box 100
58828	5/8	28	6	220	Box 50
58908	¾	8	4	112	Box 50
58910	¾	10	4	134	Box 50
58912	¾	12	6	156	Box 50
58914	¾	14	6	178	Box 50
58916	¾	16	6	200	Box 50
58918	¾	18	6	222	Box 50
58920	¾	20	6	244	Box 25
58922	¾	22	6	266	Box 25
58924	¾	24	6	288	Box 25
58926	¾	26	6	322	Box 25
58928	¾	28	6	344	Box 25

* Indicates N.E.L.A. Standard sizes.



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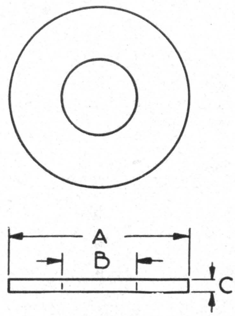


No. 56806

WASHERS

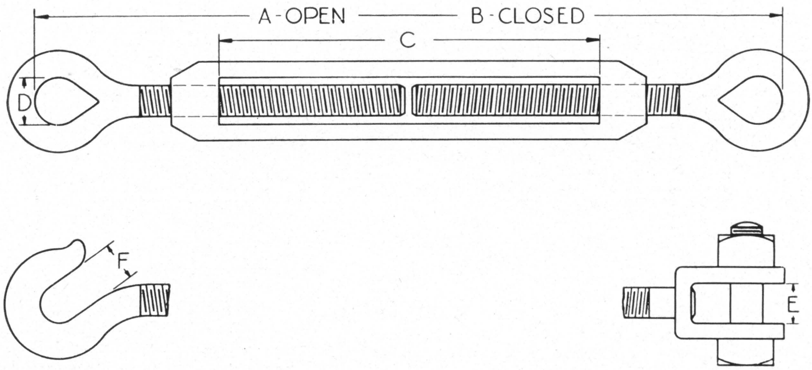
These Washers are made from new steel, uniform in size and evenly galvanized.

ROUND WASHERS

Catalog No.	Dimensions in Inches: Outside Diameter	Diameter of Hole	For Machine Bolt	For Carriage Bolt	Weight per 100	Standard Packing
56801	1	$\frac{7}{16}$	$\frac{3}{8}$	..	1.6	Box 15000
56802	$1\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	3.0	Box 7000
56803	$1\frac{3}{8}$	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{3}{8}$	4.2	Box 5000
56805	$1\frac{3}{4}$	$\frac{11}{16}$	$\frac{5}{8}$	$\frac{1}{2}$	7.5	Box 2500
56806	2	$\frac{13}{16}$	$\frac{3}{4}$	$\frac{5}{8}$	11.2	Box 2000

SQUARE WASHERS

Catalog No.	Dimensions in Inches: Size Washer	Diameter Hole	Size Bolt	Weight Per 100	Standard Packing
56812	$2\text{x}2\text{x}\frac{1}{8}$	$\frac{11}{16}$	$\frac{1}{2}$ or $\frac{5}{8}$	14.5	Box 1500
56814	$2\frac{1}{4}\text{x}2\frac{1}{4}\text{x}\frac{3}{16}$	$\frac{13}{16}$	$\frac{5}{8}$ or $\frac{3}{4}$	24.0	Box 1000
56816	$3\text{x}3\text{x}\frac{3}{16}$	$\frac{13}{16}$	$\frac{5}{8}$ or $\frac{3}{4}$	43.5	Box 500
56817	$3\text{x}3\text{x}\frac{1}{4}$	$\frac{13}{16}$	$\frac{5}{8}$ or $\frac{3}{4}$	58.5	Box 350
56818	$4\text{x}4\text{x}\frac{3}{16}$	$\frac{13}{16}$	$\frac{5}{8}$ or $\frac{3}{4}$	83.0	Box 250
56819	$4\text{x}4\text{x}\frac{1}{4}$	$\frac{13}{16}$	$\frac{5}{8}$ or $\frac{3}{4}$	117.0	Box 250
56820	$4\text{x}4\text{x}\frac{1}{2}$	$1\frac{1}{8}$	1	215.0	Box 100



DROP FORGED TURNBUCKLES

These Turnbuckles are drop forged except the clevis bolts, thereby insuring reliability and strength. The clevis bolts are made by forging the U-shaped clevis to the bolt in such a way as to develop the full strength of the bolt. 3/8-inch bolts are used in the 1/2-inch clevises; 1/2-inch bolt in the 5/8-inch, and 5/8-inch in the 3/4-inch clevises.

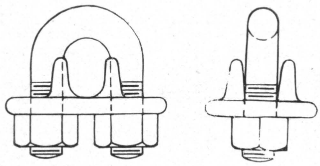
TABLE OF DIMENSIONS

Diameter of Bolt Inches	A Open Inches	B Closed Inches	C Length of Opening Inches	D Width of Eye Inches	E Opening of Clevis Inches	F Opening of Hook Inches
3/8	16 1/2	10 1/2	6	9/16	*	1/2
1/2	17 3/4	11 3/4	6	3/4	5/8	5/8
1/2	23 3/4	14 3/4	9	3/4	5/8	5/8
1/2	29 3/4	17 3/4	12	3/4	5/8	5/8
5/8	19 1/2	13 1/2	6	1 1/2	3/4	3/4
5/8	25 1/2	16 1/2	9	1 1/2	3/4	3/4
5/8	31 1/2	19 1/2	12	1 1/2	3/4	3/4
3/4	20	14	6	1 1/2	1	7/8
3/4	26	17	9	1 1/2	1	7/8
3/4	32	20	12	1 1/2	1	7/8

*3/8-inch Clevises not carried in stock.

DROP FORGED TURNBUCKLES

Catalog No.	Description	Weight per 100	Standard Packing
	EYE AND EYE		
57601	3/8 x 6	78	Bdle. 10
57602	1/2 x 6	136	Bdle. 10
57603	1/2 x 9	167	Bdle. 10
57604	1/2 x 12	199	Bdle. 10
57605	5/8 x 6	234	Bdle. 10
57606	5/8 x 9	284	Bdle. 10
57607	5/8 x 12	352	Bdle. 5
57608	3/4 x 6	349	Bdle. 5
57609	3/4 x 9	417	Bdle. 5
57610	3/4 x 12	507	Bdle. 5
	EYE AND HOOK		
57621	3/8 x 6	78	Bdle. 10
57622	1/2 x 6	136	Bdle. 10
57623	1/2 x 9	167	Bdle. 10
57624	1/2 x 12	199	Bdle. 10
57625	5/8 x 6	234	Bdle. 10
57626	5/8 x 9	284	Bdle. 10
57627	5/8 x 12	352	Bdle. 5
57628	3/4 x 6	349	Bdle. 5
57629	3/4 x 9	417	Bdle. 5
57630	3/4 x 12	507	Bdle. 5
	EYE AND CLEVIS		
57642	1/2 x 6	150	Bdle. 10
57643	1/2 x 9	181	Bdle. 10
57644	1/2 x 12	213	Bdle. 10
57645	5/8 x 6	244	Bdle. 10
57646	5/8 x 9	294	Bdle. 10
57647	5/8 x 12	362	Bdle. 5
57648	3/4 x 6	371	Bdle. 5
57649	3/4 x 9	439	Bdle. 5
57650	3/4 x 12	529	Bdle. 5
	CLEVIS AND CLEVIS		
57702	1/2 x 6	164	Bdle. 10
57703	1/2 x 9	195	Bdle. 10
57704	1/2 x 12	227	Bdle. 10
57705	5/8 x 6	254	Bdle. 10
57706	5/8 x 9	304	Bdle. 10
57707	5/8 x 12	372	Bdle. 5
57708	3/4 x 6	393	Bdle. 5
57709	3/4 x 9	461	Bdle. 5
57710	3/4 x 12	551	Bdle. 5
	HOOK AND CLEVIS		
57682	1/2 x 6	150	Bdle. 10
57683	1/2 x 9	181	Bdle. 10
57684	1/2 x 12	213	Bdle. 10
57685	5/8 x 6	244	Bdle. 10
57686	5/8 x 9	294	Bdle. 10
57687	5/8 x 12	362	Bdle. 5
57688	3/4 x 6	371	Bdle. 5
57689	3/4 x 9	439	Bdle. 5
57690	3/4 x 12	529	Bdle. 5
	HOOK AND HOOK		
57661	3/8 x 6	78	Bdle. 10
57662	1/2 x 6	136	Bdle. 10
57663	1/2 x 9	167	Bdle. 10
57664	1/2 x 12	199	Bdle. 10
57665	5/8 x 6	234	Bdle. 10
57666	5/8 x 9	284	Bdle. 10
57667	5/8 x 12	352	Bdle. 5
57668	3/4 x 6	349	Bdle. 5
57669	3/4 x 9	417	Bdle. 5
57670	3/4 x 12	507	Bdle. 5



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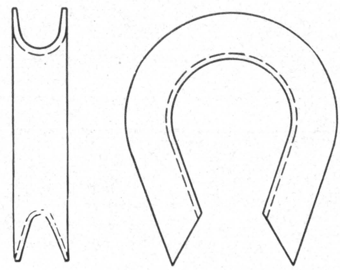


No. 56595

Guy Thimbles and Wire Rope Clips

Guy Thimbles are made of half oval steel, grooved to fit the size of strand and bent to a radius so the strand will not kink.

Wire Rope Clips are drop forged from open hearth steel and furnished with U-bolts and nuts.

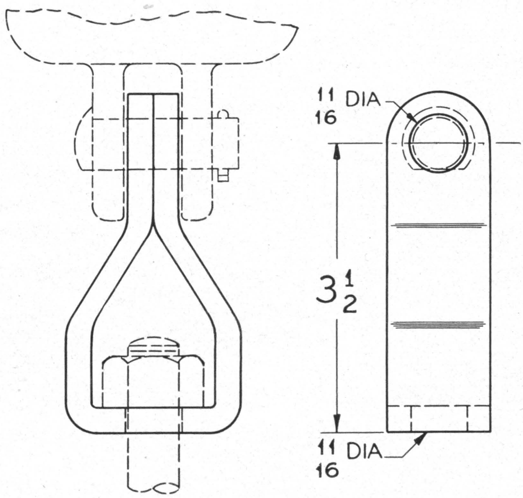
GUY THIMBLES

Catalog No.	Size of Strand Inches	Size of Guy Rod Inches	Weight Per 100	Standard Packing
* 56593	3/8	1/2 and 5/8	10	Box 1000
* 56594	1/2	5/8 and 3/4	22	Box 500
* 56595	5/8	1	45	Box 250

WIRE ROPE CLIPS

Catalog No.	Size of Strand Inches	Weight Per 100	Standard Packing
* 56482	3/8	37	Bag 50
* 56484	1/2	75	Bag 50
56485	5/8	87	Bag 50

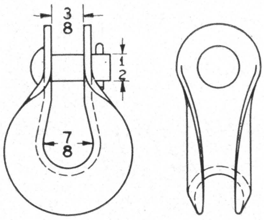
* Indicates N.E.L.A. Standard sizes.



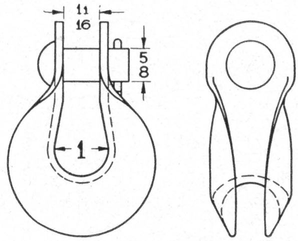
DEAD ENDING CLEVIS

This Dead Ending Clevis is forged from flat steel $\frac{5}{16}$ by $1\frac{1}{4}$ inch and fits both $\frac{1}{2}$-inch and $\frac{5}{8}$-inch bolts. It is also provided with a $\frac{5}{8}$ by $1\frac{9}{16}$-inch clevis bolt with a brass cotter pin.

Catalog No.	DIMENSIONS IN INCHES Length to Center of Bolt	Standard Packing	Weight per 100
50455	$3\frac{1}{2}$	Box 100	94



No. 50554



No. 50555

THIMBLE CLEVISES

The Thimble Clevises are pressed steel and have a well rounded surface that will not injure the insulation of the wires. The clevises are made in two sizes or strengths, 6000 and 8000 pounds respectively.

These clevises also allow for the replacement of a broken or defective insulator without disturbing the line by simply taking up the slack with a come-along; remove the cotter-bolt which passes through the eyebolt, insert a new insulator and replace the cotter-bolt.

Catalog No.	Size of Steel	Size of Cable Inches	Standard Packing	Weight per 100
50554	2 inch x 11 Gauge	7/8	Box 125	49
50555	2 5/8-inch x 9 Gauge	1	Box 100	67

Standards for Insulator Tests

Approved by Standards Committee A.I.E.E. on March 7, 1930
Approved by Standards Committee N.E.M.A. on June 27, 1930
Approved by American Standards Association on September 18, 1930

SCOPE AND PURPOSE

THESE standards are not to be interpreted as forming complete insulator specifications but rather as defining the methods of making the various tests described when they are required.

DEFINITIONS

41-1 Pin Insulator

A pin insulator is a complete insulator, consisting of one insulating member or an assembly of such members, without tie-wires, clamps, thimbles, or other accessories; the whole being of such construction that when mounted on an insulator pin, it will afford insulation and mechanical support to a conductor which has been properly attached with suitable accessories.

41-2 Shell

A shell is a single insulating member without cement or other connecting devices.

41-3 Suspension Insulator

A suspension insulator is a shell assembled with its necessary attaching members.

41-4 String

A string is two or more suspension insulators connected in series.

41-5 Dry Flashover Voltage

Dry flashover voltage is the voltage at which the air surrounding a clean dry insulator or shell completely breaks down between electrodes, the test being made as described under "Dry Flashover Test."

41-6 Wet Flashover Voltage

Wet flashover voltage is the voltage at which the air surrounding a clean wet insulator or shell completely breaks down between electrodes, the test being made as described under "Wet Flashover Test."

41-7 Puncture Voltage

Puncture voltage is the voltage at which an insulator or shell is electrically punctured when subjected to a gradually increasing voltage, the test being made as described under "Puncture Test."

41-8 Combined Mechanical and Electrical Strength

The combined mechanical and electrical strength of an insulator is the loading in pounds, at which the insulator fails to perform its function either electrically or mechanically, voltage and mechanical stress being applied simultaneously as described under "Combined Mechanical and Electrical Strength Test."

41-11 Leakage Distance

Leakage distance is the shortest distance between the live metallic and the grounded parts, measured along the surface of an insulator, when it is arranged for dry flashover test.

41-12 Striking Distance

Striking distance is the shortest distance between the live metallic and the grounded parts measured through the air and along the surface of the insulator when it is arranged for dry flashover test.

PAYMENT FOR MATERIAL TESTED

41-50

As far as practicable, tests to destruction shall be made upon insulators which have some defect and are not salable but are otherwise acceptable to the inspector for the test in question. In addition, purchaser shall be allowed to test commercial insulators to destruction up to ½ of 1 per cent of the total number ordered. These insulators shall be furnished by the manufacturer in addition to the number ordered and without charge. If further additional insulators are desired for such tests, they shall be paid for by the purchaser.

TESTING EQUIPMENT AND METHODS

41-60

The character of the testing equipment and the method of measuring voltage shall conform to the Standards of the A.I.E.E.

NOTE: When correction for air density is desired it shall be made in accordance with sections 4-74, 4-75, and 4-76 of these Standards. It is to be noted, however, that where a sphere gap is used to measure the flashover voltage of an insulator, the two are in parallel and subject to the same effects due to air density and consequently no correction needs to be made.

Except where high frequency is called for, the frequency of the test voltage shall be approximately 60 cycles.

NOTE: No great variation or error will be introduced by the use of 25 cycles, but 60 cycles has been specified for the purpose of setting a convenient standard.

In design tests, records shall be made of barometric pressure, air temperature, and humidity.

DESIGN TESTS, PIN INSULATORS

41-100 Dry Flashover Test

Dry flashover test shall be performed with the pin insulator mounted in a vertical position on a steel pin of circular section 1 in. (2.54 cm.) in diameter mounted on a cross arm, and of such length that the ratio of the shortest distance from the outer edge of the head around the insulator to the cross arm, to the shortest distance from the edge of the head around the insulator to the pin shall be 1.25. The cross arm shall be a grounded metallic tube not less than 3 in. (7.63 cm.) and not more than 5 in. (12.7 cm.) in outside diameter and shall extend at least 3 ft. (0.914 m.) on either side of the center line of the insulator pin. No other grounded structure shall be nearer than 3 ft. (0.914 m.) to any part of the insulator or conductor. The head of the insulator shall be fitted with a straight smooth metallic rod or tube not less than ½ in. (1.27 cm.) in outside diameter extending in a direction at right angles to the cross arm and at least 2 ft. (0.609 m.) in either direction from the center line of the insulator head. This rod shall be secured in the upper groove by means of at least one turn of wire not smaller than No. 8 A.W.G. placed in the side tie-wire groove, the ends being closely wrapped about the rod on each side of the insulator out to a point vertically above the edge of the largest petticoat.

The test shall be performed by applying voltage between the rod fastened to the head and the steel pin, and raising it at a rate of approximately 10,000 volts every 15 seconds to a value at which dry flashover occurs. The initial applied voltage may be raised quickly to approximately 80 per cent of dry flashover voltage.

Flashover voltages shall be determined at or corrected to a standard humidity corresponding to a vapor pressure of 0.6085 in. (15.45 mm.) of mercury. This is equivalent to a relative humidity of 65 per cent at 77 deg. F. (25 deg. C.) and barometric pressure of

30.0 in. (76.2 cm.) of mercury. Humidity shall be measured with wet and dry bulb thermometers, the air being circulated past the thermometers at a velocity of 3 meters (9.84 ft.) or more per second, or by the sling psychrometer. The measurements shall be reduced to vapor pressure with the assistance of the Smithsonian Meteorological Tables or by the following formula:

$$E = E' - 0.000367\ B\ (t - t')\ \left(1 + \frac{t' - 32}{1571}\right)$$

in which

E = Vapor pressure in inches
E' = Pressure of saturated aqueous vapor at temperature t'
t = Temperature of the air in Fahrenheit degrees
t' = Temperature of the wet-bulb thermometer in Fahrenheit degrees
B = Barometric pressure in inches

NOTE: It is expected that the data obtained from these tests will permit development of a practicable laboratory procedure for correcting flashover tests for humidity.

41-101 Wet Flashover Test

Except that no provision need be made for controlling the temperature and relative humidity of the air, the testing arrangement shall be the same as in the dry flashover test with the addition of equipment to provide a finely divided and reasonably uniform spray at an angle of 45 deg. from the vertical and at the rate of precipitation of 0.2 in. (5.07 mm.) per minute. The water shall have a resistance of from 6,000 to 8,000 ohms per inch cube (15,200 to 20,300 ohms per cm. cube) and shall be delivered to the spray nozzle at a pressure of not less than 35 and not more than 50 pounds per sq. in. (2.46 to 3.51 kg. per sq. cm.) measured at the nozzle. The vertical and horizontal dimensions of the vertical area sprayed shall be measured in a plane through the vertical axis of the insulator and shall be at least 1.75 times the corresponding overall projected dimensions of the insulator. The precipitation shall be determined by measurements taken, with the insulator removed, at the location of the top, center, and bottom of the vertical axis of the insulator when in its test position. The water shall be collected in a vessel having a top diameter of 6 in. Individual measurements shall show a variation of not more than 25 per cent from the mean of the three measurements.

This standard spray shall be applied to the insulator for one minute prior to the test and during the test. Before applying the standard spray, the insulator shall be given a thorough preliminary wetting either by immersion, by spraying in an inverted position, or by using a hose on the insulator in its test position.

The test shall be performed by applying voltage between the rod fastened to the head and the steel pin, and raising it at a rate of approximately 10,000 volts every 15 seconds to a value at which wet flashover occurs. The initial applied voltage may be raised quickly to approximately 80 per cent of the wet flashover voltage.

41-102 Corona Test

The testing arrangement shall be the same as for dry flashover test using a darkened room. A voltage well above the corona point shall be applied and slowly lowered until all visible brush discharges disappear from the insulator. The point of disappearance shall be the corona voltage. The observer shall have been in the dark for at least fifteen minutes.

41-103 Puncture Test

Puncture test shall be performed with the insulator inverted and so immersed in insulating oil that the oil will be at least 6 in. (15.24 cm.) deep over all parts of the insulator. The insulating oil shall be capable of withstanding 15 kilovolts between 1 in. (2.54 cm.) discs spaced 0.1 in. (0.254 cm.) apart. The head of the insulator shall be covered with a cap of conducting cement approximately 1 in. (2.54 cm.) thick and ¾ in. (1.90 cm.) larger in radius than the insulator head. The pinhole shall be provided with a cemented thimble in which shall be inserted a close fitting metal pin. Oil may be excluded from the space between the pin and the thimble by means of cement.

NOTE: Procedure for testing oil is completely described in A.S.T.M. Standard D-117-27.

The test shall be performed by applying voltage between the cement cap and the steel pin, and raising it at a rate of approximately 10,000 volts every 15 seconds to a value at which puncture occurs. The initial applied voltage may be raised quickly to the dry flashover voltage.

41-104 Flashover Tolerances for Pin Insulators

The flashover voltages of a pin-insulator design shall be considered as checked, if the average of the dry flashover voltage of three insulators shall be within 5 per cent and the average of the wet flashover voltages of three insulators shall be within 10 per cent of the corresponding assigned voltage.

NOTE: These flashover tolerances are made to provide for testing variables which are difficult to control.

DESIGN TEST, SUSPENSION INSULATORS

41-150 Dry Flashover Test

Dry flashover test shall be performed with the insulator or string suspended vertically by the maker's standard cross-arm suspension hardware carried at the end of a grounded wire or suitable conductor suspended so that the vertical distance from the uppermost point of the insulator hardware to the supporting structure shall not be less than 3 ft. (0.914 m.). No other grounded structure shall be nearer than 3 ft. or one and one-half times the string length to any part of the insulator or string. The insulator stud, or corresponding fitting, shall carry an inverted pipe tee made of smooth ¾-in. pipe standard iron pipe size, the head of the tee being not less than 6 ft. (1.828 m.) long, the stem of the tee being coupled at the middle point of the head and having such a length that the distance from the upper surface of the horizontal head of the tee to the lowest edge of the porcelain shall not exceed 0.7 of the diameter of the lowest insulator.

The test shall be performed by applying voltage between the stem of the pipe tee and the grounded suspension and raising it at the rate of approximately 10,000 volts every 15 seconds to a value at which dry flashover occurs. The initial applied voltage may be raised quickly to approximately 80 per cent of the dry flashover voltage.

Flashover voltages shall be determined at or corrected to a standard humidity corresponding to a vapor pressure of 0.6085 in. (15.45 mm.) of mercury. This is equivalent to a relative humidity of 65 per cent at 77 deg. F. (25 deg. C.) and barometric pressure of 30.0 in. (76.2 cm.) of mercury. Humidity shall be measured with wet and dry bulb thermometers, the air being circulated past the thermometers at a velocity of 3 meters (9.84 ft.) or more per second, or by the sling psychrometer. The measurements shall be reduced to vapor pressure with the assistance of the Smithsonian Meteorological Tables or by the following formula:

$$E = E' - 0.000367\ B\ (t - t')\ \left(1 + \frac{t' - 32}{1571}\right)$$

in which

E = Vapor pressure in inches

E' = Pressure of saturated aqueous vapor at temperature t'

t = Temperature of the air in Fahrenheit degrees

t' = Temperature of the wet-bulb thermometer in Fahrenheit degrees

B = Barometric pressure in inches

NOTE: It is expected that the data obtained from these tests will permit development of a practicable laboratory procedure for correcting flashover tests for humidity.

41-151 Wet Flashover Test

Except that no provision need be made for controlling the temperature and relative humidity of the air the testing arrangement shall be the same as in the dry flashover test with the addition of equipment to provide a finely divided and reasonably uniform spray at an angle of 45 deg. from the vertical and at a rate of 0.2 in. (5.07 mm.) per minute. The water shall have a resistance of from 6,000 to 8,000 ohms per inch cube (15,200 to 20,300 ohms per cm. cube) and shall be delivered to the spray nozzle at a pressure of not less than 35 and not more than 50 pounds per sq. in. (2.46 to 3.51 kg. per sq. cm.) measured at the nozzle. The vertical and horizontal dimensions of the vertical area sprayed shall be measured in a plane through the vertical axis of the insulator or string and shall be at least 1.75 times the corresponding overall projected dimensions of the insulator or string. The precipitation shall be determined by measurements taken, with the insulator string removed, at the location of the top, center and bottom of the vertical axis of the insulator or string when in its test position. The water shall be collected in a vessel having a top diameter of 6 in. Individual measurements shall show a variation of not more than 25 per cent from the mean of the three measurements.

This standard spray shall be applied to the insulator or string for one minute prior to the test and during the test. Before applying the standard spray, the insulator or string shall be given a thorough preliminary wetting either by immersion, by spraying in an inverted position or by using a hose on the insulator or string in its test position.

The test shall be performed by applying voltage between the stem of the pipe tee and the grounded suspension and raising it at the rate of approximately 10,000 volts every 15 seconds to a value at which wet flashover occurs. The initial applied voltage may be raised quickly to approximately 80 per cent of the wet flashover voltage.

41-152 Corona Test

The testing arrangement shall be the same as for the dry flashover test using a darkened room. A voltage well above the corona point shall be applied and slowly lowered until all visible brush discharges disappear from the insulator. The point of disappearance shall be the corona voltage. The observer shall have been in the dark for at least fifteen minutes.

44-153 Puncture Test

Puncture test shall be performed with the insulator inverted and so immersed in insulating oil that the oil will be at least 6 in. (15.24 cm.) deep over all parts of the insulator. The insulating oil shall be capable of withstanding 15 kilovolts between 1 in. (2.54 cm.) discs spaced 0.1 in. (0.254 cm.) apart.

In testing link-type insulators the holes may be filled with conducting material.

NOTE: Procedure for testing oil is completely described in A.S.T.M. Standard D-117-27.

The test shall be performed by applying voltage between the cap and stud or corresponding metal fittings and raising it at the rate of approximately 10,000 volts every 15 seconds to a value at which puncture occurs. The initial applied voltage may be raised quickly to approximately the dry flashover voltage.

41-154 Combined Mechanical and Electrical Strength Test

This test shall be performed with the insulator mounted so that tensile force can be gradually applied simultaneously with a potential approximately 75 per cent of the rated dry flashover voltage. Tensile force and potential shall be applied between the cap and stud or corresponding fittings of the insulator.

The tensile force may be brought up rapidly to a value approximately 75 per cent of the probable force at failure after which it shall be increased by increments not exceeding 1,000 lb. every 30 seconds until electrical or mechanical failure occurs.

In the case of cemented insulators the test shall be made not more than seven days after cementing.

NOTE: It is recognized that cemented insulators do not reach their full strength in seven days, but this time has been selected as a convenient standard that does not interfere too much with production.

41-155 Test Tolerances for Suspension Insulators

The flashover voltages of a suspension insulator design shall be considered as checked, if the average of the dry flashover voltage of three insulators shall be within 5 per cent and the average of the wet flashover voltage of three insulators shall be within 10 per cent of the corresponding assigned flashover voltage. The combined mechanical and electrical strength of a suspension insulator shall be considered as checked if the average of the combined mechanical and electrical strengths of three insulators shall not be less than the assigned combined mechanical and electrical strength.

NOTE: These tolerances are made to provide for testing variables which are difficult to control.

ROUTINE TESTS, PIN INSULATORS

41-200 Preliminary Test

Before assembly all shells shall be subjected to a vigorous dry flashover for three minutes. If more than 5 per cent fail, the lot may be retested. If on retest more than 3 per cent fail, the lot shall be rejected, and if not more than 3 per cent fail the lot shall be accepted. This is the only routine flashover test expected of one-piece pin insulators.

NOTE: Where the term lot is used, it should be defined as including only the number of shells on the testing pan at one time or the number of insulators agreed upon by manufacturer and purchaser.

41-201 Test after Assembly

After assembly the insulators shall be subjected to a vigorous dry flashover for three minutes. Insulators failing under this test shall be rejected.

41-202 Puncture Test

Puncture test shall be made on insulators which have passed the routine flashover tests. Rejection of insulators for puncture shall be based on the "Per Cent Average Variation" in puncture voltage determined as follows:

41-203 Determination of "Per Cent Average Variation" in Puncture Test

Purchaser will select from the insulators offered for final inspection not more than ½ of 1 per cent of the total quantity and not less than three insulators.

Let

$V_1\ V_2\ V_3 \ldots\ldots\ldots\ldots V_n$ = individual puncture value

V = average puncture voltage

$V = (V_1 + V_2 + V_3 \ldots\ldots\ldots\ldots + V_n)\ /n$

Let

$$a_1 = V - V_1 \qquad a_2 = V - V_2$$
$$a_3 = V - V_3 \qquad a_n = V - V_n$$

Consider all these values of a as positive, that is, neglect the signs.

Let

a = average variation

A = per cent average variation

Then

$a = (a_1 + a_2 + a_3 \ldots\ldots\ldots\ldots + a_n)\ /n$

$A = 100\ a/V$

Example:

Five insulators punctured at: 150, 135, 145, 138, 142 kv. respectively.

$$V = (150+135+145+138+142)\ /5 = 142$$
$$a = (8+7+3+4+0)\ /5 = 4.4$$
$$A = 100 \times 4.4/142 = 3.09 \text{ per cent.}$$

If "Per Cent Average Variation," A, exceeds 10 per cent, the entire quantity shall be rejected, or at the manufacturer's option and expense an additional 2 per cent or a minimum of 10 insulators may be tested. In this case the results of the second test alone shall be considered and if the "Per Cent Average Variation," A, exceeds 10 per cent, the entire quantity represented shall be rejected. Further, if the average puncture voltage V is less than 133/3 per cent of rated dry flashover voltage, the entire quantity represented shall be rejected.

41-250 Thermal Test, Preliminary

After the routine "Preliminary Test," a number of representative shells of each type used shall be subjected to a "Thermal Test." The number tested shall not exceed 1/10 of 1 per cent of the order and shall not be less than five shells. Each cycle shall consist of immersing the shell in a bath of water maintained at a temperature of approximately 205 deg. F. or 96 deg. C. and then in a bath of water maintained at a temperature of approximately 39 deg. F. or 4 deg. C. The length of each immersion shall be ten minutes, and the transfer periods between successive immersions and cycles shall not exceed five seconds. During the transfer the shell shall be tapped to detect cracks which may have occurred. After the fifth and tenth cycles and following the cold bath, the shell shall be flashed over momentarily.

If more than 20 per cent of the shells subjected to this test fail during the test including the application of voltage, the entire quantity represented shall be rejected.

41-251 Thermal Test, Final

After the "Test after Assembly" a number of representative assembled insulators shall be subjected to a "Thermal Test." Procedure for this test shall be the same as the procedure for the "Thermal Test" on pin insulator shells except that each insulator shall be mounted on a pin of the type to be used with it, that the temperature of the hot bath shall be approximately 150 deg. F., or 66 deg. C., and the word "insulator" shall be substituted for the word "shell."

This is the only thermal test expected of one-piece insulators.

41-252 Porosity Test

Fragments of the porcelain broken so that clean fresh surfaces are exposed, shall be immersed in a solution of fuchsine in alcohol or of eosin in water, and the pressure raised to approximately 4,000 lb. per sq. in. (421.9 kg. per sq. cm.) and held at this pressure for approximately fifteen hours, or at the manufacturer's option the pressure may be raised to 10,000 lb. per sq. in. (703.1 kg. per sq. cm.) and held for six hours. The porcelain samples shall be dried and broken as soon as possible after the release of the pressure. If there is any penetration of the dye into the porcelain, all insulators for which the fragments are representative shall be subject to rejection.

Routine Tests, Suspension Insulators

41-300 Preliminary Test

Before assembly, all shells shall be subjected to a vigorous dry flashover for not less than a total of five minutes.

If any shell fails during the fourth or fifth minute of the test, the test shall be continued until no shell fails during the last two minutes of test. The excess time is based on the testing of quantities up to 100 at one time. For quantities greater than 100, the excess time after the last failure may be less than two minutes by agreement between manufacturer and purchaser. If more than 5 per cent fails the lot may be retested. If on retesting, more than 3 per cent fails the lot may be rejected.

Note: Where the term lot is used, it should be defined as including only the number of shells on the testing pan at one time or the number of insulators agreed upon by manufacturer and purchaser.

41-301 Mechanical Test

All assembled insulators shall withstand for three seconds without sign of distress, a tensile force in line with the axis of the insulator, amounting to approximately 40 per cent of the assigned combined mechanical and electrical strength. This test shall be given before the final electrical test, and in the case of cemented insulators shall be made not more than seven days after cementing.

41-302 Test after Assembly

All assembled insulators shall either be subjected to the high frequency test (*a*) followed by the 60-cycle test (*b*) or shall be subjected to the overvoltage test (*c*).

(*a*) *High-frequency Test*

For this test the manufacturer at his option may be governed by either of the following specifications:

1. After assembly, each suspension insulator shall be subjected to a damped high frequency or impact test for from three to five seconds in which the insulator shall be tested at a voltage approximately 15 per cent above the 60-cycle dry flashover value. The frequency shall be of the order of 200,000 cycles per second in damped trains, the source of energy being a circuit having a frequency of 25 to 60 cycles. All insulators failing shall be rejected.

2. After assembly, each suspension insulator shall be subjected to a high-frequency discharge from a 60-cycle transformer adjusted for a no-load voltage of not less than 115 per cent of the 60-cycle dry flashover of the insulator, this test to be continued for a period of not less than three seconds. The high frequency super-imposed upon the 60-cycle voltage shall not be less than 100,000 cycles per second. All insulators failing shall be rejected.

(*b*) *60-cycle Test*

After assembly each suspension insulator shall be subjected to a vigorous dry flashover for five minutes. All insulators failing shall be rejected.

(*c*) *Overvoltage Test*

After assembly each suspension insulator shall be lowered in an upright position into a bath of insulating oil, slightly immersing the tips of the lowest parts and the rim to a depth sufficient to prevent flashover. Air shall cover the bottom of the insulator to conduct the charging current to the porcelain. 120 per cent of dry flashover voltage shall then be applied between the two terminals of the insulator for a total time of five minutes. All insulators failing shall be rejected.

41-303 Puncture Test

Puncture test shall be made on insulators which have passed the "Test after Assembly." Rejection of insulators for puncture shall be based on the "Per Cent Average Variation" in puncture voltage determined as follows:

41-304 Determination of "Per Cent Average Variation" in Puncture Test

The "Per Cent Average Variation in Puncture" and the average puncture to flashover ratio shall be the same as specified in (*41-203*).

41-305 Combined Mechanical and Electrical Strength Test

At least three insulators shall be selected for this test from each 1,000 ordered. If any fail at less than 85 per cent of the assigned combined mechanical and electrical strength, an additional 20 insulators shall be tested at the manufacturer's expense. If none fail below 85 per cent of the assigned value, the entire quantity represented shall be accepted and if any fail the entire quantity rejected.

41-350 Thermal Test

After the routine "Test after Assembly" a number of representative assembled insulators shall be subjected to a "Thermal Test." Procedure for this test shall be the same as the procedure for the "Thermal Test" on pin insulator shells except that the word "insulator" shall be substituted for the word "shell."

41-351 Porosity Test

Fragments of the porcelain, broken so that clean fresh surfaces are exposed, shall be immersed in a solution of fuchsine in alcohol or of eosin in water, and the pressure raised to approximately 4,000 lb. sq. in. (421.9 kg. per sq. cm.) and held at this pressure for approximately fifteen hours, or at the manufacturer's option the pressure may be raised to 10,000 lb. per sq. in. (703.1 kg. per sq. cm.) and held for six hours. The porcelain samples shall be dried and broken as soon as possible after the release of the pressure. If there is any penetration of the dye into the porcelain, all insulators for which the fragments are representative shall be subject to rejection.

Methods of measuring high voltages used in flashover and dielectric tests have been the source of much misunderstanding. In order to clarify the situation the following paragraphs from the Standards of the A.I.E.E. Measurement of Test Voltage in Dielectric Tests, May 1928, are reprinted.

VOLTAGE MEASUREMENT

4-50 Measurement of Voltage in Dielectric Tests

There are two methods of measuring the voltage in dielectric tests, namely:

1. The voltmeter method.
2. The spark gap method, using either the sphere spark gap or the needle spark gap.

4-51 Measurements with Voltmeter

In measuring the voltage with a voltmeter, the instrument should preferably derive its voltage directly from the high-voltage circuit, either by means of a voltmeter coil placed in the testing transformer, or through an auxiliary potential transformer. It is permissible to measure the voltage at other places such as the testing transformer primary, provided that corrections can be made for variations in ratio caused by the charging current of the apparatus under test, or that there is no material variation in the ratio. In any case where the capacitance of the apparatus to be tested is such as to cause wave distortion, the testing voltage must be checked by a spark gap as set forth in (*4-52*) to (*4-57*,) or by a crest-voltage voltmeter. If the crest-voltage meter is calibrated in crest volts, its readings must be reduced to the corresponding r.m.s. sinusoidal value by dividing by the $\sqrt{2}$.

4-52 Measurements with Spark Gaps

(a) *General:*

If proper precautions are taken, spark gaps may be used to advantage in checking transformer ratios and the calibration of voltmeters for dielectric tests of apparatus.

(b) *Range of Voltage:*

The sphere spark gap shall be used for voltages above 50 kv. and is preferable down to 10 kv. The needle spark gap may, however, be used for voltages of from 10 to 50 kv.

4-53 Use of Spark Gaps in Dielectric Tests

When using spark gaps to check the applied voltage in dielectric tests of electrical apparatus every precaution must be taken against the occurrence of over-voltage oscillations due to spark gap discharges in the circuit from which the apparatus is being tested. In order to accomplish this purpose and limit the resulting current at the time of breakdown, a non-inductive resistance of about one ohm per volt of test voltage shall be inserted in series with the sphere gap. If the test is made with one terminal grounded, the entire resistance shall be inserted in series with the non-grounded electrode; if neither terminal is grounded one-half of the resistance shall be inserted in series with each electrode. In either case this resistance shall be as near the spark gap as possible and not in series with the apparatus under test. A water tube is the most suitable form of resistor for this purpose. Carbon resistors of high specific resistance should not be used as their resistance may become very low at high voltages. The spheres should be kept clean, and care should be taken that they do not become heated appreciably due to successive discharges. Carbon rods of approximately ¾ in. diameter and approximately 8 in. long having a resistance of not more than 4,000 ohms per unit may be used.

4-54 Use of Voltmeter with Spark Gap Measurements

In measuring voltage with spark gap, a voltmeter, as specified (*4-51*), should always be used in connection with the spark gap. With the spark gap set for a given voltage, 50 per cent of the voltage may be applied as rapidly as desired but the last 50 per cent of the voltage should be raised to the required value in not less than 30 seconds, a reading of the voltmeter being taken simultaneously with the breakdown of the spark gap. With an interval of at least a minute between successive trials this should be repeated until at least three consistent consecutive voltmeter readings are obtained. The average voltmeter reading thus obtained shall be considered as the required value to give the high-tension voltage for which the spark gap was set.

4-55 Use of Spark Gaps with Apparatus of Low Capacitance

When the charging current of the apparatus under test is not sufficiently large to distort the high-voltage wave shape, or change the ratio of transformation, the spark gap should be set for the required test voltage with the apparatus to be tested disconnected. Simultaneous readings of voltmeter and spark gap breakdown should then be taken, as described in (*4-54*). With the spark gap setting increased about 20 per cent the apparatus under test should be connected in parallel with the spark gap and the voltage raised until the voltmeter reading previously determined is obtained. This voltage should be held for the required time interval.

4-56 Use of Spark Gaps with Apparatus of High Capacitance

When the charging current of the apparatus under test is such that it might appreciably distort the voltage wave or change the effective ratio of the testing transformer, the first readings of voltage should be taken with the spark gap set for the required test voltage and the apparatus under test connected in the circuit in parallel with the spark gap. Simultaneous readings of voltmeter and spark gap breakdown should then be taken, as described in (4-54). With the spark gap setting increased about 20 per cent, but still connected in parallel with the apparatus under test, the voltage should be raised until the voltmeter reading previously determined is obtained. This voltage should be held for the required time interval.

4-57 Use of Spark Gaps when Making Arc-over Tests

When making arc-over tests on large insulators, bushings, etc., partial arc-over of the apparatus under test may produce oscillations which will cause the measuring gap to discharge prematurely. The measured voltage would then appear too high. In such tests a calibration curve of the testing transformer should be taken with a spark gap and voltmeter. This curve should include at least four points with the apparatus under test in the circuit in parallel with the spark gap and two points with the apparatus disconnected. Calibration points with the apparatus in the circuit should not be taken for values of voltages which cause disturbances on the apparatus sufficient to cause erratic spark gap readings. In general the apparatus should not be connected for values within 20 per cent of its arc-over voltage. The values of voltmeter readings, thus obtained, should be plotted against the voltage for which the spark gap was set and the equivalent ratio of the testing transformer thus obtained. The spark gap should then be greatly lengthened or disconnected from the testing circuit and the voltage raised as described in (4-54), with the apparatus connected until the apparatus arcs over. The arc-over voltage may then be determined by multiplying the voltmeter reading by the equivalent ratio found above or directly from the calibration curve. *Direct measurement of the spark-over of one gap by another gap should always be avoided.*

NEEDLE SPARK GAP

4-60 Needle Gap

The needle spark gap shall be between new sewing needles, supported axially at the ends of linear conductors which are at least twice the length of the gap. There must be a clear space around the gap for a radius at least twice the gap length.

4-61 Needle Gap Sparking Distances

The sparking distances in air between No. 00, double long sewing needle points for various r.m.s. sinusoidal voltages shall be assumed to be as shown in Table I.

4-62

TABLE I
NEEDLE-GAP SPARK-OVER VOLTAGES
(At 25 deg. cent. and 760 mm. barometric pressure)

Sinusoidal R. M. S. kv.	Millimeters	Sinusoidal R. M. S. kv.	Millimeters
10	11.9	35	51
15	18.4	40	62
20	25.4	45	75
25	33	50	90
30	41		

The values in Table I refer to relative humidity of 80 per cent. Variations from the humidity may involve appreciable variations in sparking distance. There are other causes of variation and for this reason the needle gap is not generally recommended.

Diameters and Cross Sections
Solid Wire

Birmingham (B.W.G.) gauge is generally used for iron and steel.
Brown and Sharpe (B. & S.) gauge is standard for electrical wires except iron and steel.
Wires of diameters larger than No. 4/0 B. & S. are seldom made.
For conductors larger than 4/0 the wire is stranded into cables.

B. & S. Gauge	Diameter of Wire		Cross Section Area			Breaking Strength Lb.		Weight Lb. Per 1000 Feet
	Inches	Mm.	Cir. Mils	Sq. Inches	Sq. Mm.	Hard Drawn	Annealed	
0000	.4600	11.68	211,600	.1662	107.2	8143	5320	641
000	.4096	10.40	167,800	.1318	85.03	6721	4220	508
00	.3648	9.266	133,100	.1045	67.43	5517	3340	403
0	.3249	8.252	105,500	.08289	53.48	4517	2650	320
1	.2893	7.348	83,690	.06573	42.41	3687	2100	253
2	.2576	6.544	66,370	.05213	33.63	3003	1670	201
3	.2294	5.827	52,640	.04134	26.67	2439	1325	159
4	.2043	5.189	41,740	.03278	21.15	1970	1050	126
5	.1819	4.621	33,100	.02600	16.77	1591	880	100
6	.1620	4.115	26,250	.02062	13.30	1280	700	79
7	.1433	3.665	20,820	.01635	10.55	1030	550	63
8	.1285	3.264	16,510	.01297	8.366	826	440	50

DIAMETERS AND CROSS SECTIONS
BARE CABLES

B. & S. Gauge	Circular Mils	No. of Wires	DIAMETER OF CABLE		CROSS SECTION AREA		MINIMUM BREAKING STRENGTH LB.		Weight Lb. Per 1000 Feet
			Inches	Mm.	Sq. Inches	Sq. Mm.	Hard Drawn	Soft*	
	2,000,000	61	1.630	41.402	1.571	1013.609			6205
	1,750,000	61	1.526	38.760	1.374	886.505			5429
	1,500,000	61	1.411	35.839	1.178	760.046			4654
	1,250,000	61	1.289	32.741	.9817	633.393			3878
	1,000,000	61	1.152	29.261	.7854	506.740	45,030	22,000	3100
	950,000	61	1.123	28.254	.7461	481.384	42,780	21,000	2945
	900,000	61	1.094	27.788	.7069	456.092	40,520	19,900	2790
	850,000	61	1.062	26.975	.6676	430.736	38,270	18,800	2635
	800,000	61	1.031	26.187	.6283	395.379	36,020	17,700	2480
	750,000	61	.998	25.349	.5890	380.023	34,090	16,600	2325
	700,000	61	.964	24.486	.5498	354.731	31,820	15,400	2170
	650,000	61	.929	23.596	.5105	329.375	29,770	14,300	2015
	600,000	37	.893	22.682	.4712	304.018	27,020	13,400	1860
	550,000	37	.851	21.615	.4320	278.726	24,760	12,200	1703
	500,000	37	.813	20.650	.3927	253.370	22,510	11,100	1548
	450,000	37	.772	19.609	.3534	228.014	20,450	9,950	1393
	400,000	19	.726	18.440	.3142	202.722	17,560	7,860	1238
	350,000	19	.679	17.247	.2749	177.365	15,590	7,740	1083
	300,000	19	.629	15.977	.2356	152.009	13,510	6,620	926
	250,000	19	.574	14.580	.1963	126.653	11,260	5,530	772
0000	211,600	19	.528	13.411	.1662	107.232	9,617	4,680	653
000	167,772	7	.470	11.938	.1318	85.037	7,366	3,710	512
00	133,079	7	.414	10.516	.1045	67.423	5,926	2,940	407
0	105,625	7	.368	9.347	.08289	53.481	4,752	2,340	322
1	83,694	7	.328	8.331	.06573	42.409	3,804	1,850	255
2	66,358	7	.292	7.417	.05213	33.634	3,045	1,470	203

* Based on 31,000 lb. per square inch, Minimum Tensile Strength.

ALUMINUM CABLE, STEEL-REINFORCED BARE

A.C.S.R. Aluminum Area		Copper Equivalent	Stranding Number and Diam. of Strands (Inches)		Diameter Inches		Elastic Limit Lb.	Ultimate Str'th Lb.
Circular Mils	Square Inches	C. M. or No.	Alum.	Steel	Complete Cable	Steel Core		
1590000	1.249	1000000	54x.1716	19x.1030	1.545	.515	38100	55300
1510500	1.186	950000	54x.1673	19x.1004	1.506	.502	36200	52500
1431000	1.124	900000	54x.1628	19x.0977	1.465	.489	34200	49800
1351500	1.062	850000	54x.1582	19x.0949	1.424	.475	32300	47000
1272000	.9990	800000	54x.1535	19x.0921	1.382	.461	30400	44200
1192500	.9366	750000	54x.1486	19x.0892	1.338	.446	28500	41500
1113000	.8741	700000	54x.1436	19x.0862	1.293	.431	26600	38700
1033500	.8117	650000	54x.1384	7x.1384	1.246	.415	25000	36300
954000	.7493	600000	54x.1329	7x.1329	1.196	.399	23100	33500
900000	.7069	566000	54x.1291	7x.1291	1.162	.387	21800	31600
874500	.6868	550000	54x.1273	7x.1273	1.146	.382	21200	30700
795000	.6244	500000	54x.1214	7x.1214	1.093	.364	19250	27950
795000	.6244	500000	26x.1749	7x.1360	1.108	.408	21960	31250
795000	.6244	500000	30x.1628	19x.0977	1.140	.489	27250	37770
715500	.5620	450000	54x.1151	7x.1151	1.036	.345	17360	25200
715500	.5620	450000	26x.1659	7x.1290	1.051	.387	19760	28130
715500	.5620	450000	30x.1544	19x.0926	1.081	.463	24500	33970
666600	.5235	419000	54x.1111	7x.1111	1.000	.333	16180	23430
636000	.4995	400000	54x.1085	7x.1085	.977	.326	15400	22300
636000	.4995	400000	26x.1564	7x.1216	.990	.365	17560	25000
636000	.4995	400000	30x.1456	19x.0874	1.019	.437	21800	30230
605000	.4752	380500	54x.1059	7x.1059	.953	.318	14675	21270
556500	.4371	350000	26x.1463	7x.1138	.927	.341	15370	21875
556500	.4371	350000	30x.1362	7x.1362	.953	.409	19370	26800
500000	.3927	314500	30x.1291	7x.1291	.904	.3873	17400	24080
477000	.3746	300000	26x.1355	7x.1054	.858	.3162	13175	18750
477000	.3746	300000	30x.1261	7x.1261	.883	.3783	16600	23000
397500	.3122	250000	26x.1236	7x.0961	.783	.2883	10975	15620
397500	.3122	250000	30x.1151	7x.1151	.806	.3453	13800	19170
336400	.2642	4/0	26x.1138	7x.0885	.721	.2655	9295	13230
336400	.2642	4/0	30x.1059	7x.1059	.741	.3177	11715	16200
300000	.2356	188700	26x.1074	7x.0835	.680	.2505	8280	11780
300000	.2356	188700	30x.1000	7x.1000	.700	.3000	10450	14450
266800	.2095	3/0	6x.2109	7x.0703	.633	.2109	6470	9385
266800	.2095	3/0	26x.1013	7x.0788	.642	.2364	7365	10480
4/0	.1662	2/0	6x.1878	1x.1878	.563	.1878	5940	8435
3/0	.1318	1/0	6x.1672	1x.1672	.502	.1672	4690	6660
2/0	.1045	1	6x.1490	1x.1490	.447	.1490	3730	5300
1/0	.0829	2	6x.1327	1x.1327	.398	.1327	2960	4200
1	.0657	3	6x.1182	1x.1182	.355	.1182	2355	3340
2	.0521	4	6x.1052	1x.1052	.316	.1052	1860	2660
3	.0413	5	6x.0937	1x.0937	.281	.0937	1480	2100
4	.0328	6	6x.0834	1x.0834	.250	.0834	1170	1665
5	.0260	7	6x.0743	1x.0743	.223	.0743	930	1315
6	.0206	8	6x.0661	1x.0661	.198	.0661	735	1045
7	.0163	9	6x.0589	1x.0589	.177	.0589	575	820
8	.0130	10	6x.0525	1x.0525	.158	.0525	465	660

Aluminum Cable, Steel-Reinforced Bare

Ohms Per Mile (61% at 25°C.)	Weight—Pounds: Per 1000 Feet Total	Per 1000 Feet Alum.	Per 1000 Feet Steel	Per Mile Total	Per Mile Alum.	Per Mile Steel	Percent of Total Weight Alum.	Percent of Total Weight Steel	Standard Shipment: Length of Each Piece (Feet) Reels	Length of Each Piece (Feet) Coils	No. L'ths on Reel	Diameter over Armor Rods
.0587	2033	1491	542	10735	7872	2863	73.4	26.6	2055	......	1	
.0618	1932	1417	515	10202	7482	2720	73.4	26.6	2165	......	1	
.0652	1830	1342	488	9662	7086	2576	73.4	26.6	2285	......	1	
.0691	1728	1268	460	9125	6695	2430	73.4	26.6	2420	......	1	
.0734	1627	1193	434	8588	6299	2289	73.4	26.6	2570	......	1	
.0783	1526	1119	407	8055	5908	2147	73.4	26.6	2745	......	1	
.0839	1424	1044	380	7517	5512	2005	73.4	26.6	2940	......	1	
.0903	1330	969	361	7022	5118	1904	72.9	27.1	3170	......	1	2.322
.0979	1227	895	332	6481	4725	1756	72.9	27.1	3430	......	1	2.212
.104	1158	844	314	6114	4457	1657	72.9	27.1	3635	......	1	2.150
.107	1125	820	305	5942	4331	1611	72.9	27.1	3740	......	1	2.134
.117	1024	746	278	5402	3937	1465	72.9	27.1	4115	......	1	2.025
.117	1094	746	348	5776	3937	1839	68.2	31.8	3960	......	1	2.040
.117	1234	746	488	6513	3937	2576	60.5	39.5	4565	......	1	2.128
.131	920	671	249	4860	3543	1317	72.9	27.1	4575	......	1	1.918
.131	984	671	313	5197	3543	1654	68.2	31.8	4410	......	1	1.959
.131	1109	671	438	5857	3543	2314	60.5	39.5	5075	......	1	2.013
.140	857	625	232	4529	3302	1227	72.9	27.1	4910	......	1	1.856
.147	819	597	222	4321	3150	1171	72.9	27.1	5140	......	1	1.809
.147	875	597	278	4620	3150	1470	68.2	31.8	4950	......	1	1.846
.147	987	597	390	5211	3150	2061	60.5	39.5	5710	......	1	1.901
.154	779	568	211	4111	2996	1115	72.9	27.1	5400	......	1	1.763
.168	766	522	244	4044	2756	1288	68.2	31.8	5660	......	1	1.715
.168	871	522	349	4600	2756	1844	59.9	40.1	3260	......	1	1.763
.187	782.8	469.0	313.8	4133	2476	1657	59.9	40.1	3635	......	1	1.670
.196	656.6	447.4	209.2	3467	2362	1105	68.2	31.8	6600	......	1	1.602
.196	746.8	447.4	299.4	3943	2362	1581	59.9	40.1	3810	......	1	1.649
.235	546.8	372.9	173.9	2887	1969	918	68.2	31.8	3965	......	1	1.447
.235	622.4	372.9	249.5	3286	1969	1317	50.9	40.1	4575	......	1	1.490
.278	463.0	315.5	147.5	2445	1666	779	68.2	31.8	4685	......	1	1.349
.278	526.7	315.5	211.2	2781	1666	1115	59.9	40.1	5400	......	1	1.369
.311	412.7	281.4	131.3	2179	1486	693	68.2	31.8	5250	......	1	1.258
.311	469.7	281.4	188.3	2480	1486	994	59.9	40.1	6060	......	1	1.294
.350	343.3	250.3	93.0	1813	1322	491	72.9	27.1	2725	......	1	1.179
.350	367.2	250.3	116.9	1939	1322	617	68.2	31.8	5900	......	1	1.188
.441	293.4	198.5	94.9	1549	1048	501	67.6	32.4	3435	......	1	1.051
.556	232.4	157.4	75.0	1227	831	396	67.6	32.4	4330	......	1	.938
.702	184.5	124.8	59.7	974	659	315	67.6	32.4	5470	......	1	.835
.885	146.4	99.0	47.4	773	523	250	67.6	32.4	3445	1722	2	.744
1.12	116 1	78.5	37.6	614	415	199	67.6	32.4	4345	2172	2	.657
1.41	92.1	62.3	29.8	486	329	157	67.6	32.4	5475	2737	2	.586
1.77	73.0	49.4	23.6	386	261	125	67.6	32.4	3450	3450	4	.521
2.24	57.9	39.2	18.7	306	207	99	67.6	32.4	4350	4350	4	.548
2.82	45.8	31.0	14.8	242	164	78	67.6	32.4	5495	5495	4	.491
3.56	36.4	24.6	11.8	192	130	62	67.6	32.4	6930	6930	4	.434
4.48	28.8	19.5	9.3	152	103	49	67.6	32.4	8750	8750	4	.391
5.65	22.9	15.5	7.4	021	82	39	67.6	32.4	10690	10690	4	.348

Diameters—Triple Braid Weatherproof Wires and Cables

Size of Cable Circular Mils or B. & S. Gauge	Current Carrying Capacity (Underwriters') Amperes	Approx. Weight Pounds		Approx. Diameter Over Insulation (Minimum) Inches	Concentric Stranding		Reels	
		Per 1000 Ft.	Per Mile		No. of Wires	Diam. of Wires	Approx. Length Feet	Approx. Weight Pounds
1,000,000	1,000	3,675	19,400	1.402	61	.1280	1,000	3,675
900,000	900	3,330	17,600	1.312	61	.1215	1,000	3,330
800,000	825	2,990	15,800	1.271	48	.1291	1,000	3,000
700,000	750	2,650	14,000	1.181	37	.1375	1,000	2,650
600,000	675	2,235	11,800	1.110	37	.1273	1,000	2,235
500,000	600	1,895	10,000	1.001	37	.1162	1,500	2,850
450,000	550	1,725	9,100	.982	27	.1291	1,500	2,587
400,000	500	1,555	8,200	.936	27	.1217	1,500	2,325
350,000	450	1,345	7,100	.888	27	.1139	2,000	2,690
300,000	400	1,175	6,200	.836	27	.1054	2,000	1,763
250,000	350	985	5,200	.761	19	.1147	2,000	1,670
0000	320	800	4,220	.684	19	.1055	2,000	1,600
000	260	653	3,450	.647	12	.1182	2,640	1,725
00	220	522	2,760	.570	7	.1379	2,640	1,380
0	180	434	2,240	.525	7	.1228	2,640	1,120
1	150	328	1,730	.484	7	.1093	800	260
2	125	270	1,430	.417	7	.0974	1,000	270
3	100	206	1,090	.385	7	.0867	1,200	250
4	85	170	900	.357	7	.0772	1,500	255
5	75	140	740	.331	7	.0688	2,000	280
6	65	115	610	.309	7	.0612	2,500	285
8	45	78	410	.271	7	.0486	2,500	195

I-BEAM CORE HOLLOW COPPER CONDUCTORS FOR HIGH VOLTAGE TRANSMISSION LINES

Design No.	DIAMETER INCHES		Layers	WIRES		Conductance HD Copper Equiv.—CM	Minimum Breaking Strength Lb.	WEIGHT LB. PER 1000 FT.			Re-marks
	Cable	Core		No.	Diam.—Inches			Wires	Cores	Total	
404	1.254	1.012	1	28	.1214	486,700	20,200	1274	412	1686	
405	1.180	.936	1	26	.1221	447,500	18,760	1197	334	1531	
361	1.100	.556	2	16+20	.1284 .1435	700,000	30,600	2086	117	2204	220,000-volt class
360	1.100	.675	2	22+28	.1065	600,000	26,450	1751	176	1927	
402	1.106	.790	1	18	.1580	500,000	20,830	1388	283	1671	
403	1.100	.855	1	24	.1222	413,100	17,330	1107	306	1413	
4b	1.002	.612	2	22+28	.0970	500,000	22,150	1453	159	1612	
401	0.993	.596	1	12	.1985	500,000	20,680	1460	156	1616	
359	1.000	.760	1	22	.1200	350,000	15,150	978	235	1213	
378	.745	.319	2	12+18	.1064	350,000	15,650	1049	62	1111	154-kv. class
178	.769	.461	1	12	.1537	300,000	12,800	875	89	964	
37	.750	.513	1	16	.1184	250,000	10,600	692	135	827	
50	.670	.434	1	14	.1183	211,600	9,160	605	93	698	

NOTE.—The above are representative sample designs.

Areas and Circumferences of Circles

Diameter	Circumference	Area	Diameter	Circumference	Area	Diameter	Circumference	Area
1/64	.049087	.00019	1. 15/16	6.08684	2.9483	4. 15/16	15.5116	19.147
1/32	.098175	.00077	2.	6.28319	3.1416	5.	15.7080	19.635
3/64	.147262	.00173	1/16	6.47953	3.3410	1/16	15.9043	20.129
1/16	.196350	.00307	1/8	6.67588	3.5466	1/8	16.1007	20.629
3/32	.294524	.00690	3/16	6.87223	3.7583	3/16	16.2970	21.135
1/8	.392699	.01227	1/4	7.06858	3.9761	1/4	16.4934	21.648
5/32	.490874	.01917	5/16	7.26493	4.2000	5/16	16.6897	22.166
3/16	.589049	.02761	3/8	7.46128	4.4301	3/8	16.8861	22.691
7/32	.687223	.03758	7/16	7.65763	4.6664	7/16	17.0824	23.221
1/4	.785398	.04909	1/2	7.85398	4.9087	1/2	17.2788	23.758
9/32	.883573	06213	9/16	8.05033	5.1572	9/16	17.4751	24.301
5/16	.981748	.07670	5/8	8.24668	5.4119	5/8	17.6715	24.850
11/32	1.07992	.09281	11/16	8.44303	5.6727	11/16	17.8678	25.406
3/8	1.17810	.11405	3/4	8.63938	5.9396	3/4	18.0642	25.967
13/32	1.27627	.12962	13/16	8.83573	6.2126	13/16	18.2605	26.535
7/16	1.37445	.15033	7/8	9.03208	6.4918	7/8	18.4569	27.109
15/32	1.47262	.17257	15/16	9.22843	6.7771	15/16	18.6532	27.688
1/2	1.57080	.19635	3.	9.42478	7.0686	6.	18.8496	28.274
17/32	1.66897	.22166	1/16	9.62113	7.3662	1/8	19.2423	29.465
9/16	1.76715	.24850	1/8	9.81748	7.6699	1/4	19.6350	30.680
19/32	1.86532	.27688	3/16	10.0138	7.9798	3/8	20.0277	31.919
5/8	1.96350	.30680	1/4	10.2102	8.2958	1/2	20.4204	33.183
21/32	2.06167	.33824	5/16	10.4065	8.6179	5/8	20.8131	34.472
11/16	2.15984	.37122	3/8	10.6029	8.9462	3/4	21.2058	35.785
23/32	2.25802	.40574	7/16	10.7992	9.2806	7/8	21.5984	37.122
3/4	2.35619	.44179	1/2	10.9956	9.6211	7.	21.9911	38.485
25/32	2.45437	.47937	9/16	11.1919	9.9678	1/8	22.3838	39.871
13/16	2.55254	.51849	5/8	11.3883	10.321	1/4	22.7765	41.282
27/32	2.65072	.55914	11/16	11.5846	10.680	3/8	23.1692	42.718
7/8	2.74889	.60132	3/4	11.7810	11.045	1/2	23.5619	44.179
29/32	2.84707	.64504	13/16	11.9773	11.416	5/8	23.9546	45.664
15/16	2.94524	.69029	7/8	12.1737	11.793	3/4	24.3473	47.173
31/32	3.04342	.73708	15/16	12.3700	12.177	7/8	24.7400	48.707
1.	3.14159	.78540	4.	12.5664	12.566	8.	25.1327	50.265
1/16	3.33794	.88664	1/16	12.7627	12.962	1/8	25.5254	51.849
1/8	3.53429	.99402	1/8	12.9591	13.364	1/4	25.9181	53.456
3/16	3.73064	1.1075	3/16	13.1554	13.722	3/8	26.3108	55.088
1/4	3.92699	1.2272	1/4	13.3518	14.186	1/2	26.7035	56.745
5/16	4.12334	1.3530	5/16	13.5481	14.607	5/8	27.0962	58.426
3/8	4.31969	1.4849	3/8	13.7445	15.033	3/4	27.4889	60.132
7/16	4.51064	1.6230	7/16	13.9408	15.466	7/8	27.8816	61.862
1/2	4.71239	1.7671	1/2	14.1372	15.904	9.	28.2743	63.617
9/16	4.90874	1.9175	9/16	14.3335	16.349	1/8	28.6670	65.397
5/8	5.10509	2.0739	5/8	14.5299	16.800	1/4	29.0597	67.201
11/16	5.30144	2.2365	11/16	14.7262	17.257	3/8	29.4524	69.029
3/4	5.49779	2.4053	3/4	14.9226	17.721	1/2	29.8451	70.882
13/16	5.69414	2.5802	13/16	15.1189	18.190	5/8	30.2378	72.760
7/8	5.89049	2.7612	7/8	15.3153	18.665	3/4	30.6305	74.662

DECIMAL EQUIVALENTS

INCH AND MILLIMETERS

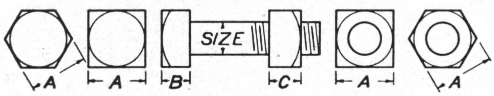
Inch Fraction		Inch Decimal	Milli- meters	Inch Fraction		Inch Decimal	Milli- meters
1/64	=	.015625	.397	33/64	=	.515625	13.10
1/32	=	.03125	.79	17/32	=	.53125	13.49
3/64	=	.046875	1.19	35/64	=	.546875	13.89
1/16	=	.0625	1.59	9/16	=	.5625	14.29
5/64	=	.078125	1.98	37/64	=	.578125	14.68
3/32	=	.09375	2.38	19/32	=	.59375	15.08
7/64	=	.109375	2.78	39/64	=	.609375	15.48
1/8	=	.125	3.17	5/8	=	.625	15.87
9/64	=	.140625	3.57	41/64	=	.640625	16.27
5/32	=	.15625	3.97	21/32	=	.65625	16.67
11/64	=	.171875	4.37	43/64	=	.671875	17.07
3/16	=	.1875	4.76	11/16	=	.6875	17.46
13/64	=	.203125	5.16	45/64	=	.703125	17.86
7/32	=	.21875	5.56	23/32	=	.71875	18.26
15/64	=	.234375	5.95	47/64	=	.734375	18.65
1/4	=	.25	6.35	3/4	=	.75	19.05
17/64	=	.265625	6.75	49/64	=	.765625	19.45
9/32	=	.28125	7.14	25/32	=	.78125	19.84
19/64	=	.296875	7.54	51/64	=	.796875	20.24
5/16	=	.3125	7.94	13/16	=	.8125	20.64
21/64	=	.328125	8.33	53/64	=	.828125	21.03
11/32	=	.34375	8.73	27/32	=	.84375	21.43
23/64	=	.359375	9.13	55/64	=	.859375	21.83
3/8	=	.375	9.52	7/8	=	.875	22.22
25/64	=	.390625	9.92	57/64	=	.890625	22.62
13/32	=	.40625	10.32	29/32	=	.90625	23.02
27/64	=	.421875	10.72	59/64	=	.921875	23.42
7/16	=	.4375	11.11	15/16	=	.9375	23.81
29/64	=	.453125	11.51	61/64	=	.953125	24.21
15/32	=	.46875	11.91	31/32	=	.96875	24.61
31/64	=	.484375	12.30	63/64	=	.984375	25.
1/2	=	.5	12.7	1	=		25.4

STEEL AND IRON PIPE SIZES

Sizes	STANDARD				
	DIAMETER, INCHES		Thickness Inches	Wt. Lb. Per Foot	Threads Per In.
	External	Internal			
1/2	.840	.622	.109	.850	14
3/4	1.050	.824	.113	1.130	14
1	1.315	1.049	.133	1.678	11 1/2
1 1/4	1.660	1.380	.140	2.272	11 1/2
1 1/2	1.900	1.610	.145	2.717	11 1/2
2	2.375	2.067	.154	3.652	11 1/2
2 1/2	2.875	2.469	.203	5.793	8
3	3.500	3.068	.216	7.575	8

Sizes	EXTRA STRONG				DOUBLE EXTRA STRONG			
	DIAMETER, INCHES		Thickness Inches	Wt. Lb. Per Foot	DIAMETER, INCHES		Thickness Inches	Wt. Lb. Per Foot
	Ext.	Int.			Ext.	Int.		
1/2	.840	.546	.147	1.087	.840	.252	.294	1.714
3/4	1.050	.742	.154	1.473	1.050	.434	.308	2.440
1	1.315	.957	.179	2.171	1.315	.599	.358	3.659
1 1/4	1.660	1.278	.191	2.996	1.660	.896	.382	5.214
1 1/2	1.900	1.500	.200	3.631	1.900	1.100	.400	6.408
2	2.375	1.939	.218	5.022	2.375	1.503	.436	9.029
2 1/2	2.875	2.323	.276	7.661	2.875	1.771	.552	13.695
3	3.500	2.900	.300	10.252	3.500	2.300	.600	18.583

U. S. STANDARD MACHINE BOLTS



DIMENSIONS

Size Inches	INCHES			Threads Per Inch
	A	B	C	
1/4	1/2	1/4	1/4	20
5/16	19/32	19/64	5/16	18
3/8	11/16	11/32	3/8	16
7/16	25/32	25/64	7/16	14
1/2	7/8	7/16	1/2	13
9/16	31/32	31/64	9/16	12
5/8	1 1/16	17/32	5/8	11
3/4	1 1/4	5/8	3/4	10
7/8	1 7/16	23/32	7/8	9
1	1 5/8	13/16	1	8

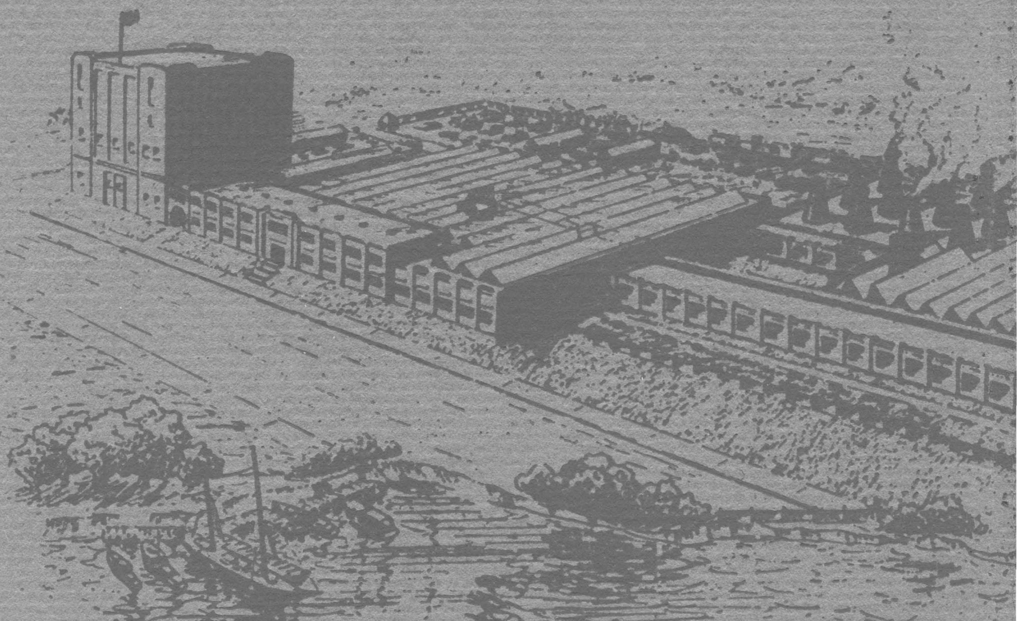
Index

Index of Catalog Numbers

Index of Code Words

LOCKE

R-00



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