Catalog 76

OHIO BRASS PRODUCTS
FOR
ELECTRIC TRANSIT SYSTEMS

All specifications in this catalog
are subject to change without notice.

THE OHIO BRASS COMPANY
MANSFIELD, OHIO, U.S.A. 44902

INTRODUCTION

This catalog of Ohio Brass products for electric transit systems is a complete revision and condensation of O-B's Transit Catalog No. 25. During the years since publication of the previous catalog, the sweeping changes which have occurred in the electric transit field have obsoleted large portions of O-B's original comprehensive offering of specialized equipment for trolley coaches and light rail vehicles.

Engineering and production divisions at Ohio Brass, however, have retained in the new catalog those products which are needed to maintain, repair, rebuild or expand existing systems. In many instances, options formerly offered are replaced by a product with universal application.

The catalog section describing Special Work Assemblies has been discontinued since detailed information on overhead design is no longer considered pertinent to transit customers. Special Work Assemblies are, however, still being supplied by Ohio Brass on negotiated orders.

Rail bonds as a product line have been discontinued by Ohio Brass and all listings have been eliminated from this catalog.

The table of contents on the opposite page has been included to provide a general guide to the divisions of this catalog. The final pages in the catalog are devoted to a numerical index of all parts listed by catalog number, while the alphabetical index gives page numbers for individual parts according to the nomenclature by which they are known in the transit industry.

All orders should include both the catalog number and the descriptive name. O-B's price sheets list terms and conditions applicable to all orders.

The Ohio Brass Company
380 North Main Street
Mansfield, Ohio 44902

WARRANTY

The Ohio Brass Company warrants all products sold by it to be merchantable (as such term is defined in the Uniform Commercial Code) and to be free from defects in material and workmanship. Buyer must notify the Company promptly of any claim under this warranty. The Buyer's exclusive remedy for breach of this warranty shall be the repair or replacement, F.O.B. factory, at the Company's option, of any product defective under the warranty which is returned to the Company within one year from the date of shipment. NO OTHER WARRANTY, WHETHER EXPRESS OR ARISING BY OPERATION OF LAW, COURSE OF DEALING, USAGE OF TRADE OR OTHERWISE IMPLIED, SHALL EXIST IN CONNECTION WITH THE COMPANY'S PRODUCTS OR ANY SALE OR USE THEREOF. The Company shall in no event be liable for any loss of profits or any consequential or special damages incurred by Buyer. The Company's warranty shall run only to the first purchaser of a product from the Company, from the Company's distributor or from an original equipment manufacturer reselling the Company's product, and is non-assignable and non-transferable and shall be of no force and effect if asserted by any person other than such first purchaser.

TYPE AGC TANGENT SPAN HANGER
With Adjustable Clamp

Hanger Complete
19360

Renewable Dirigo
Insulating Unit
16835

Type AGC tangent hangers consist of a replaceable Dirigo insulator housed in a metal shell, forming an air gap so spaced that flashover will take place at a voltage considerably below the dielectric strength of the insulator and yet high enough to prevent flashover from surge voltages of a magnitude generally encountered in street railway service. This hanger has excellent leakage characteristics because of the dry spot secured by the long overlap of the hanger shell.

The Type AGC hanger attaches to the span wire by a clamp. It is an all-purpose hanger suitable for both span construction and as an insulator for pulloff wires which must be carried across trolley wires.

The renewable insulating unit used in this hanger is an improved type having high dielectric and mechanical strength. By the design and arrangement of the metal parts, as shown in the cross section view on page 4, the surface most vital to electrical properties of the insulator is now located at the top where it is well protected by the hanger shell. Severe damage to the dielectric at the lower end of the insulator could be experienced without affecting either mechanical or electrical strength.

The insulating unit is assembled in the hanger shell by a ⅝-inch bolt and shakeproof lockwasher. No auxiliary insulation is required between hangers.

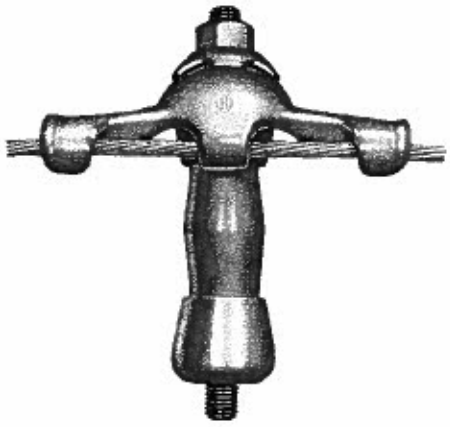
Vertical adjustment up to 14 degrees to compensate for span wire sag is obtained by movement of the clamp on the ⅝-inch top stud. This stud threads into both the hanger shell and the insulating unit, making a rigid assembly of these parts which can be rotated to obtain horizontal alignment of ear or clamp with trolley wire.

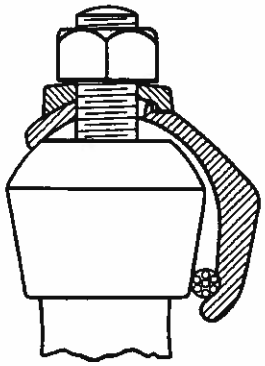
Clamp will take span wires from 3/16 to ½ inch. Length clamp castings: top, 4½ inches; bottom, 1¾ inches. Height bottom of insulator to center of span wire, 2½ inches.

Shell and clamp parts are malleable iron. Stud, hex nut and cup washer are of steel. All metal parts are hot-dip galvanized.

Catalog Number	Description	Net Weight Lbs. per 100
19360	Hanger Complete	300
16835	Dirigo Insulator Only	95
21550	Top Clamp Only	40

TYPE W TANGENT SPAN HANGER
With Adjustable Yoke





Illustrating How Yoke Clamps on Span Wire

The Type W tangent span hanger is equipped with a clamp-type yoke for span wire attachment. It is an all-purpose hanger suitable for both span construction and as an insulator for pulloffs which must be carried across trolley wires.

The yoke casting has a clamp in the center, which tightly clamps the span wire to the end casting of the wood insulating member when the nut on the top stud is tightened. The outrigger arms on the yoke also bear against the span wire forming a limited snubbing action. Yoke will clamp span wires from ¼ to ⅜ inch.

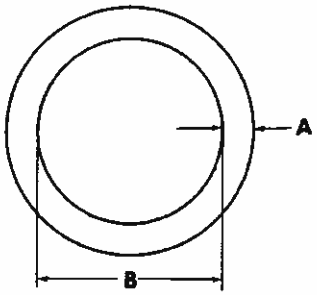
The span yoke is adjustable up to 14 degrees from the horizontal to compensate for span sag and to obtain vertical alignment of the insulating member. This member can be rotated for alignment of clamp with the trolley wire. After vertical and horizontal alignment are obtained, the hanger is locked in position by a ⅝-inch hex nut.

Hanger should be installed with the opening in the yoke arms facing traffic.

Diameter of wood, 1¼ inches; length of clear insulation, 2½ inches; height, bottom of insulating member to center of span wire, 4¼ inches; length of yoke casting, 6½ inches. The insulator end fittings and yoke are malleable iron. All metal parts are hot-dip galvanized. Routine mechanical test on insulator unit, 5000 pounds.

The wood insulating unit is painted gray for good appearance and maximum protection.

Catalog Number	Description	Net Weight Lbs. per 100
20847	Hanger Complete, ⅝-Inch Stud	290
21278	Insulating Unit Only, ⅝-Inch Stud	170
21549	Yoke Only	108



BULL RINGS

O-B bull rings are made of steel, hot-dip galvanized.

Ultimate strength: ⅝-inch stock, 18 000 pounds; ¾-inch stock, 25 000 pounds.

Catalog Number	A Dimension Inches	B Dimension Inches	Net Weight Lbs. per 100
18562	⅝	3	110
18567	¾	3	162

TYPE N-1 ROUND TOP HANGERS
750 Volts – Span Type

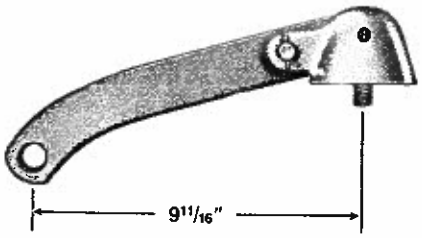
Insulation is completely enclosed and protected by the malleable iron shell. Outrigger arms are extra heavy for resistance to blows from wild trolley.

Forged stud is molded directly into insulation. A washer forms a broad bearing surface for boss of trolley ear and serves to reinforce the insulation.

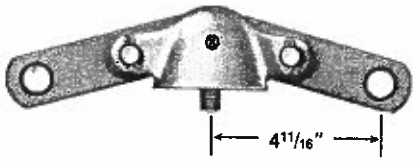
Stud, washer and shell are hot-dip galvanized. The shell is 3½ inches in diameter at lower edge.

Catalog Number	Description	Std. Pkg.	Net Wt. Lbs. per 100
3144	Type N-1 Hanger, with ⅝-Inch Stud	50	250

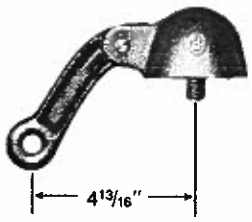
TYPE N SINGLE AND DOUBLE CURVE HANGERS
750 Volts



Type N-1 Single Curve



Type N-1 Double Curve



Type N-2 Single Curve

Type N-1 single and double curve hangers are so designed that it is not necessary to remove arms in order to install ears, facilitating construction work and ear replacement. Arms are of steel, and blows from dewired trolley poles will not break them.

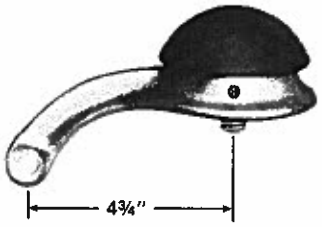
Type N-2 single curve hanger is equipped with a short malleable iron arm. It has some advantage in weight, but arm must be removed to install ear.

Hanger bodies are supplied with ⅝-inch plain stud.

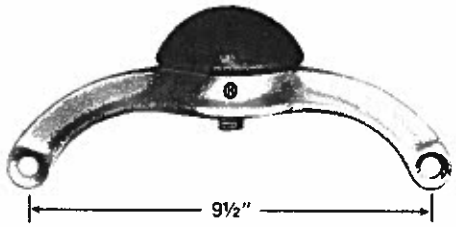
All metal parts are hot-dip galvanized.

Catalog Number	Description	Net Weight Lbs. per 100
11651	Type N-1 Double Curve Hanger	310
16221	Type N-1 Single Curve Hanger	300
11650	Type N-2 Single Curve Hanger	266
	Hanger Bodies Only, with Bolts and Cotters	
11652	Single Curve	170
11653	Double Curve	208
	Other Parts	
16220	Short Steel Arm Only, for Type N-1 Double Curve Hanger	65
16223	Long Steel Arm Only, for Type N-1 Single Curve Hanger	130
11654	Malleable Iron Arm Only, for Type N-2 Single Curve Hanger	65

TYPE G SINGLE AND DOUBLE CURVE HANGERS
750 Volts



Nos. 10437 and 10438
Single Curve



Nos. 10442 and 10443
Double Curve

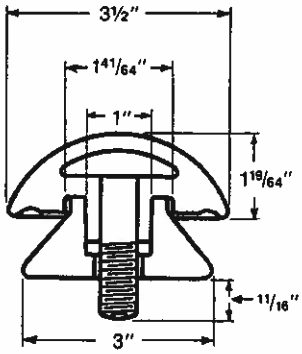
Holes for span wire are 9/16 inch in diameter. All metal parts are hot-dip galvanized.

Catalog Number	Description	Net Weight Lbs. per 100
10437	Type G Single Curve Hanger, ⅝-Inch Stud, Plain Cone	250
10438	Type G Single Curve Hanger, ⅝-Inch Stud, Lock Cone	250
10441	Casting Only, for Single Curve Hanger	138
10442	Type G Double Curve Hanger, ⅝-Inch Stud, Plain Cone	300
10443	Type G Double Curve Hanger, ⅝-Inch Stud, Lock Cone	300
10446	Casting Only, for Double Curve Hanger	200

TYPE G INSULATOR CAPS AND CONES
750 Volts

Cap

Cone



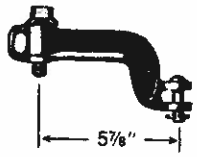
Made of O-B composition insulation and used interchangeably with Type G hangers and with all standard cap and cone hanger bodies of other makes.

Stud in cap is made of forged steel, hot-dip galvanized. The insulator cone is listed below both plain and recessed for use with steel lockwasher.

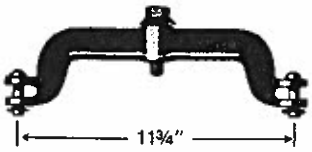
The lock cone prevents the cap from working loose in service when used with lockwasher. Lower face has a recess into which is molded a steel disc to provide bearing surface for a lockwasher.

Catalog Number	Description	Std. Pkg.	Net Wt. Lbs. per 100
5440	Insulator Cap, with ⅝-Inch Stud	50	75
5441	Insulator Cone, Plain, for ⅝-Inch Stud	50	26
5442	Insulator Cone, Lock, for ⅝-Inch Stud	50	38

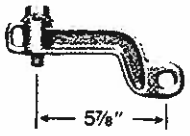
SINGLE AND DOUBLE CURVE PULLOVER YOKES
Type A – Without Insulators



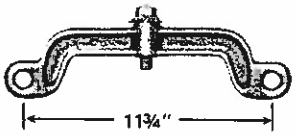
12788



12790



14072



14073

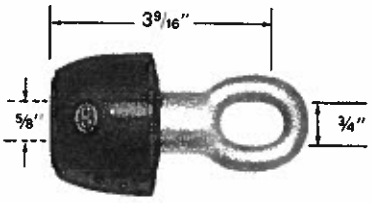
Type A-1 pullover yokes have clevis on each end. Opening in clevis is 9/16-inch, and will take any standard O-B Hi*Lite strain insulator. Furnished complete with clevis bolts and cotters.

Type A-2 pullover yokes have ¾-inch eye on each end instead of clevis and are intended for use with porcelain strain insulators, which are usually located far enough from the casting to avoid damage by wild trolley pole. This type is neater in appearance, is lighter in weight, and has fewer parts than the clevis type.

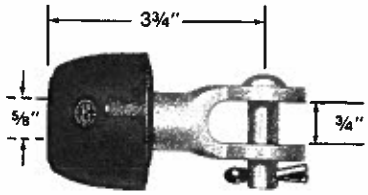
All parts are hot-dip galvanized.

Catalog Number	Description	Net Weight Lbs. per 100
	Type A-1 – With Clevis	
12788	Type A-1 Single Curve Yoke, ⅝ x 2¼-Inch Stud	202
12790	Type A-1 Double Curve Yoke, ⅝ x 2¼-Inch Stud	320
	Type A-2 – With Eye	
14072	Type A-2 Single Curve Yoke, ⅝ x 2¼-Inch Stud	155
14073	Type A-2 Double Curve Yoke, ⅝ x 2¼-Inch Stud	265

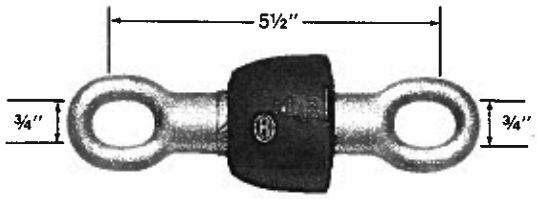
DIRIGO STRAIN INSULATORS – 750 Volts



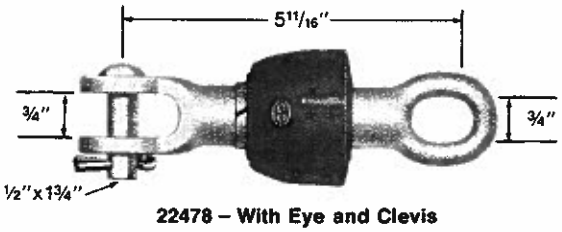
22479 – With ⅝-Inch Boss and Eye



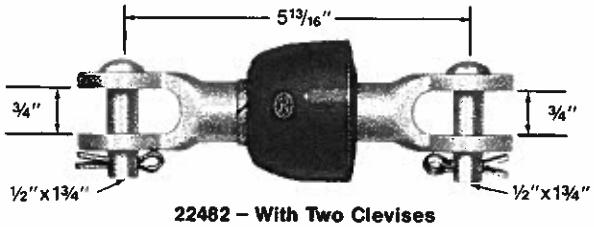
22481 – With ⅝-Inch Boss and Clevis



22480 – With Two Eyes



22478 – With Eye and Clevis



22482 – With Two Clevises

Use – For guy and span wire insulation, and may also be used for deadending.

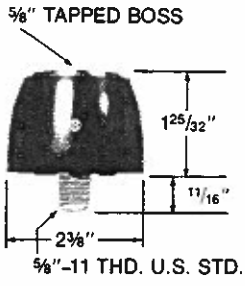
Design Features – A complete line of strain insulators utilizing the O-B Dirigo spool insulator No. 16835 which has been used in many exacting industrial, mining and transit applications. This spool offers mechanical and electrical values greatly in excess of insulators previously used for this service.

Mechanical and Electrical Values – All Dirigo spools are given an electrical test of 16 000 volts. Mechanically, the strain insulator assemblies are rated at a minimum breaking strength of 10 000 pounds. The spool has a cantilever rating of 3000 inch-pounds. The maximum operating temperature is 250-degrees Fahrenheit. All insulators are subjected to routine tests to assure uniform quality.

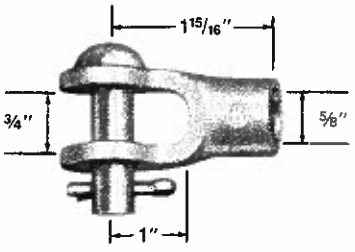
Material – The basic spool insulator has a fixed ⅝-inch stud on one end and a ⅝-inch tapped boss on the other end. Removable eyes, clevises, and studs are used in the assemblies and can be ordered separately, which simplifies the stocking problem (if insulators with various combinations of fittings are frequently required).

Dirigo Strain Insulators

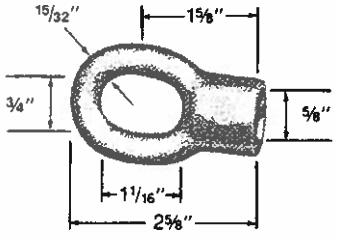
Catalog Number	Description	Net Weight Lbs. per 100
22478	Insulator with Eye and Clevis	186
22479	Insulator with ⅝-Inch Boss and Eye	126
22480	Insulator with Two Eyes	166
22481	Insulator with ⅝-Inch Boss and Clevis	146
22482	Insulator with Two Clevises	206



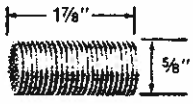
16835 – Dirigo Insulator



15573 – Clevis



15575 – Eye



22483 – Stud

Parts

Catalog Number	Description	Net Weight Lbs. per 100
15573	Clevis with Rivet and Cotter	50
15575	Eye	30
16835	Dirigo Insulator Only	95
22483	⅝ x 1⅝-Inch Stud	10

MARATHON TROLLEY EARS
For Wheel Operation on Round Trolley Wire

The sides of the improved Marathon ear are machine tapered at each end to provide for smooth transition of the collector from wire to ear. Because of flat side lip construction, an exclusive O-B development, a smoother underrun can be obtained as the lips are more easily peened around the wire. This feature also improves side clearance.

Full lip section is retained in the underrun for over 50 per cent of the ear length, amply protecting the wire and increasing the service life of the ear.

The ear is cast solid and the wire groove in the lips is accurately milled to size. The metal used is a high-grade bronze mixture. It is extremely tough, not brittle, and has exceptionally high strength and long life.

Size of boss, 5/8 inch. Boss is 1¼ inches in diameter. Height, top of trolley wire to top of boss, 17/32 inches.

Marathon Ears

Catalog Number	Description	Net Weight Lbs. per 100
	Length 9 Inches	
14728	Bronze, for 0 Round Wire	70
14729	Bronze, for 2/0 Round Wire	75
	Length 12 Inches	
14441	Bronze, for 2/0 Round Wire	94
	Length 15 Inches	
14444	Bronze, for 2/0 Round Wire	106
14445	Bronze, for 3/0 Round Wire	125
14446	Bronze, for 4/0 Round Wire	131

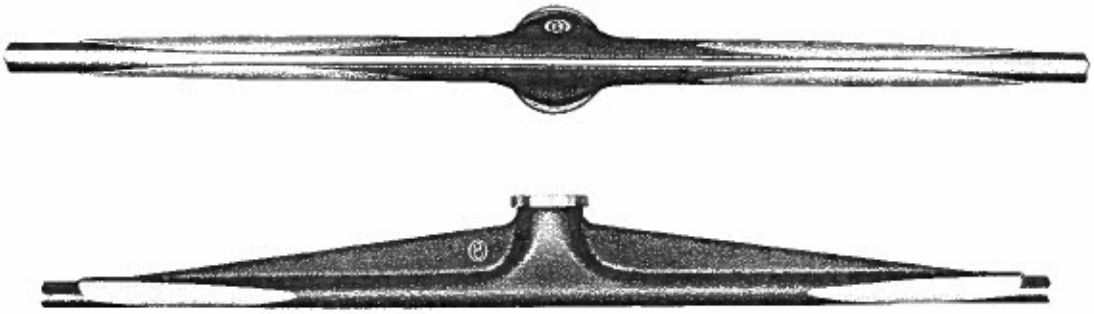
MARATHON FEEDER EARS

The improved Marathon feeder ears are identical with the improved Marathon ears except for the feeder lugs. No. 14739 has a projection on the web with a 13/32" diameter hole to which a terminal connector can be bolted. For ear replacement it is only necessary to remove the bolt and replace ear. This type ear provides an exceptionally good connection as it has a large contact surface. Marathon feeder ears are made in 15-inch length only.

Marathon Feeder Ears – Length 15 Inches

Catalog Number	Description	Net Weight Lbs. per 100
14739	Bronze, for 4/0 Round Wire	145

TYPE AS TROLLEY EARS
For Carbon Shoe Operation on Round Trolley Wire
Length – 15 Inches



Type AS ears are designed to provide the smoothest possible round wire suspension for carbon shoe operation. The low rate of wear which is characteristic of the carbon shoe collector permits comparatively thin lips with good side clearance. Lips are tapered on bottom and side for smooth and quiet transition for the shoe.

This length provides maximum protection to the trolley wire in straight-line operation. Size of boss, ⅝ inch. Made of bronze.

Catalog Number	Description	Net Weight Lbs. per 100
19448	Type AS Ears for 2/0 Round Wire	106
19449	Type AS Ears for 3/0 Round Wire	125
19450	Type AS Ears for 4/0 Round Wire	135

STRIPPING TOOL

Facilitates removal of ears from trolley wire. When pointed end is placed between wire and lips of ear, a few blows of a hammer will open lips sufficiently to strip ear from wire. Forged steel.

Catalog Number	Description	Net Weight Lbs. Each
8123	Stripping Tool	2.5

TYPE C TROLLEY WIRE SPLICERS
For Wheel and Carbon Shoe Operation

Narrow underrun provides unusual clearance for collector. Lips are tapered for smooth approach and leave. Metal is so distributed that splicer is not top-heavy.

Installation is easy. Wire enters in straight line, without forming. Holes permit visual inspection to determine if wire is properly seated against barrier at center of splicer.

Set-screws are set far enough apart to give plenty of wrench room. Size for 2/0 splicer, ⅜ x ⅞ inch; for 3/0 and 4/0 splicers, ⅜ x 1 inch. Can be used efficiently on either new or badly worn wire. Made of bronze. Length, 20 inches.

Catalog Number	Description	Net Weight Lbs. per 100
12473	For 0 and 2/0 Round and Grooved Wire	205
12474	For 3/0 Round and Grooved Wire	225
12475	For 4/0 Round and Grooved Wire	235

Can be supplied for combinations of round and grooved wire.

TYPE C SPLICING EARS
For Wheel and Carbon Shoe Operation

Similar to the splicer listed above except provided with a boss for attachment to a hanger. Made of bronze. Length, 21 inches; height over-all, 2 inches. Boss is ⅝ inch.

Catalog Number	Description	Net Weight Lbs. per 100
12478	For 0 and 2/0 Round and Grooved Wire	262
12480	For 3/0 Round and Grooved Wire	271
12482	For 4/0 Round and Grooved Wire	300

Can be supplied for combinations of round and grooved wire.

CLARK TROLLEY WIRE SPLICERS
For Wheel and Carbon Shoe Operation

A strong, substantial design for railway service. Lips close tightly around wire and give a smooth underrun.

Made of high-strength bronze. Distance between centers of wire openings at top, 5 inches. Length, 15 inches. Set-screws, ½ x 1¼ inches.

Catalog Number	Description	Net Weight Lbs. per 100
13200	For 0 and 2/0 Round and Grooved Wire	155
13201	For 3/0 Round and Grooved Wire	160
13202	For 4/0 Round and Grooved Wire	160

BULLDOG TROLLEY WIRE SPLICERS
For Wheel, Shoe or Pantograph Operation

This splicer is designed to attach to the top lobe of grooved wire so perfect clearance is given for the collector.

To install, the wires are inserted from each end and then the set-screws are tightened as noted below. The outer screws are added to dampen vibration. The downward pressure of the set-screws is largely relieved by the angle setting. This splicer can be depended upon to hold permanently up to the breaking strength of either copper or the higher-strength bronze wires.

Since the holding power of this splicer is dependent on rigidity of the lips which fit into the wire groove, a specially developed high-strength bronze alloy is used. This alloy also permits minimum weights which reduce hard spots.

Length of splicer, 10 inches. Holding set-screws, 7/16 x 3/4 inch. Dampener screw, 1/4 x 1/2 inch.

INSTALLATION NOTE: After seating on wire, tighten inner set-screw 1¼ turns and outer set-screw 1 turn. Small stainless steel dampener screw should be tightened just enough to seat wire firmly in wire groove.

Catalog Number	Description	Net Weight Lbs. per 100
16607	For 2/0 Grooved Wire	95
16608	For 3/0 Grooved Wire	98
16685	For 4/0 Grooved Wire	120
54944-3001	For Splicing 2/0 to 4/0 Grooved Wire	120

TYPE D TROLLEY WIRE SPLICERS
For Wheel and Carbon Shoe Operation

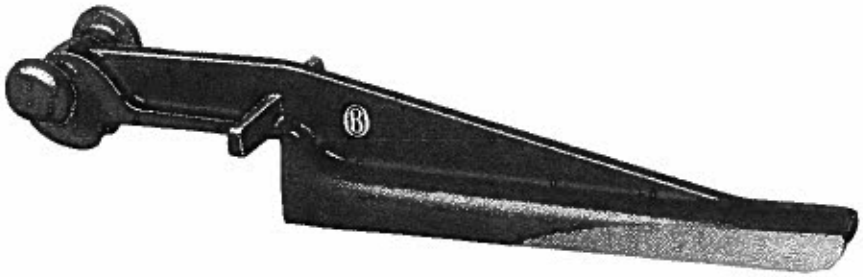
Combines great strength and long life with good clearance for collector. Lips are side tapered for smooth underrun. Has strength sufficient to break any copper, alloy or steel trolley wire with which it can be used.

The ends of the wires are bent back over the splicer on top and are always in sight for visual inspection from the ground.

Made of bronze. Distance between centers, wire openings at top of splicer, 2 inches. Length, 20 inches. Set-screws, ½ x 1 inch.

Catalog Number	Description	Net Weight Lbs. per 100
13178	For 0 and 2/0 Round and Grooved Wire	240
13179	For 3/0 Round and Grooved Wire	260
13180	For 4/0 Round and Grooved Wire	310

RENEWABLE BRONZE CAM TIPS
For Wheel Operation



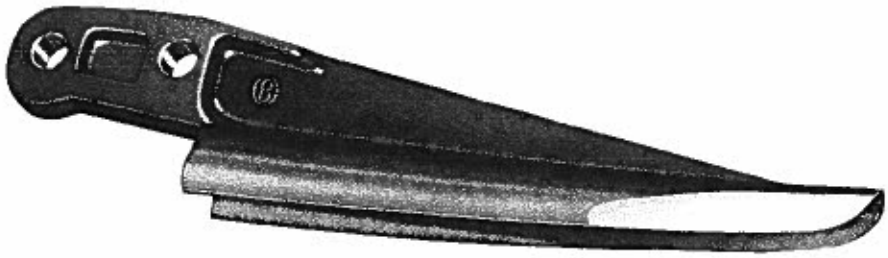
Lips are tapered at side and bottom to form a smooth, gradual approach and leave.

In installing, tips are placed upside down with ends pointing toward center of frog or other device. They are then forced over and down into position for peening lips around wire.

Tips in 2/0 and 3/0 size only are equipped with side lugs which are bent back to engage lugs on the leg or runner of the overhead device, locking the tip in position. Thus locked, there is less chance of wire fatigue. Length of lips, 6 inches.

Catalog Number	Description	Net Weight Lbs. per 100
16521	For 2/0 Round and Grooved Wire	75
16522	For 3/0 Round and Grooved Wire	75
12581	For 4/0 Round and Grooved Wire	70

TYPE SR RENEWABLE BRONZE TIPS
For Carbon Shoe Operation



Lips have a 3½-inch taper at side and bottom to provide an easy transition of the carbon shoe from wire to runner. Narrow cross section affords ample side clearance. Construction of lips makes smooth peening possible and easy.

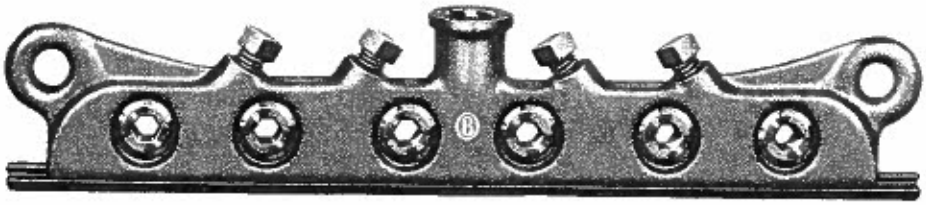
The Type SR tip is attached to the clevis end of runner by two $^{7}/_{16}$ x 1½-inch bolts. The tip is first installed in an upright position by the back bolt. It is then turned down over the wire, forcing the wire into the bottom of clevis groove on the familiar cam principle, after which the other bolt is inserted and the lips peened around the wire. In this rugged design all up and down movement of the tip is eliminated. Wire vibration is absorbed in the limited flexibility afforded by the tip body and is not concentrated at any one point.

Length of lips, 8 inches. Bolts for attachment are supplied with the overhead devices with which the Type SR tip is used.

Catalog Number	Description	Net Weight Lbs. per 100
20748	For 2/0 Round and Grooved Wire	130
20652	For 3/0 Round and Grooved Wire	125
20749	For 4/0 Round and Grooved Wire	120

TYPE T STRAIN CLAMPS
For Wheel, Shoe or Pantograph

Single



Double, with Boss

The Type T single strain clamp is used to anchor wire in one direction only. Double clamp is used to anchor wire in both directions.

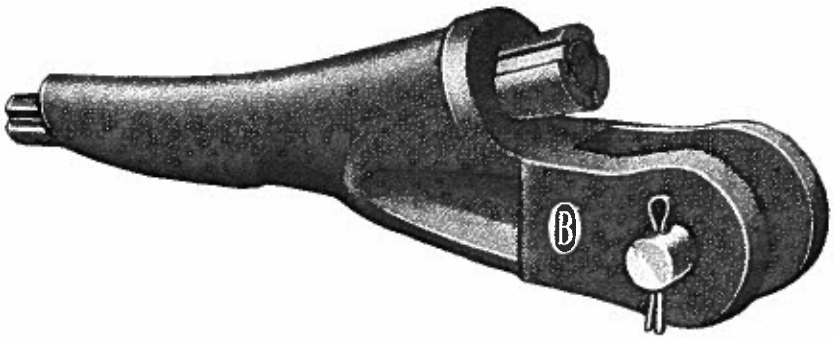
High-strength bronze jaws clamp on the upper lobe of grooved trolley wire with hollow bronze screws. The trolley wire is then anchored with 7/16 x 1¾-inch steel set-screws, which work on the same principle as a Bulldog splicer.

Length of wire groove: single clamp, 7¼ inches; double clamp with boss, 12 inches.

All clamps fit all grooved trolley wire.

Catalog Number	Description	Net Weight Lbs. per 100
16907	Type T Single Strain Clamp	140
17700	Type T Double Strain Clamp with ⅝-Inch Boss	275
19442	Wrench for Hollow-Head Screws	50

TROLLEY WIRE DEADEND CLAMPS



For deadending round or grooved contact wire. Made of bronze with stainless steel chuck for holding wire in place. Chuck is serrated on inside to give grip on wire and tapered on outside to fit into a tapered hole in body. Clevis fitted with ½-inch rivet, hot-dip galvanized, and cotter. Clevis opening, $^{13}/_{16}$ inch.

Catalog Number	Description	Net Weight Lbs. per 100
15961	For 3/0 Round Wire	115
15962	For 3/0 Grooved Wire	115
15963	For 4/0 Round Wire	115
15964	For 4/0 Grooved Wire	115

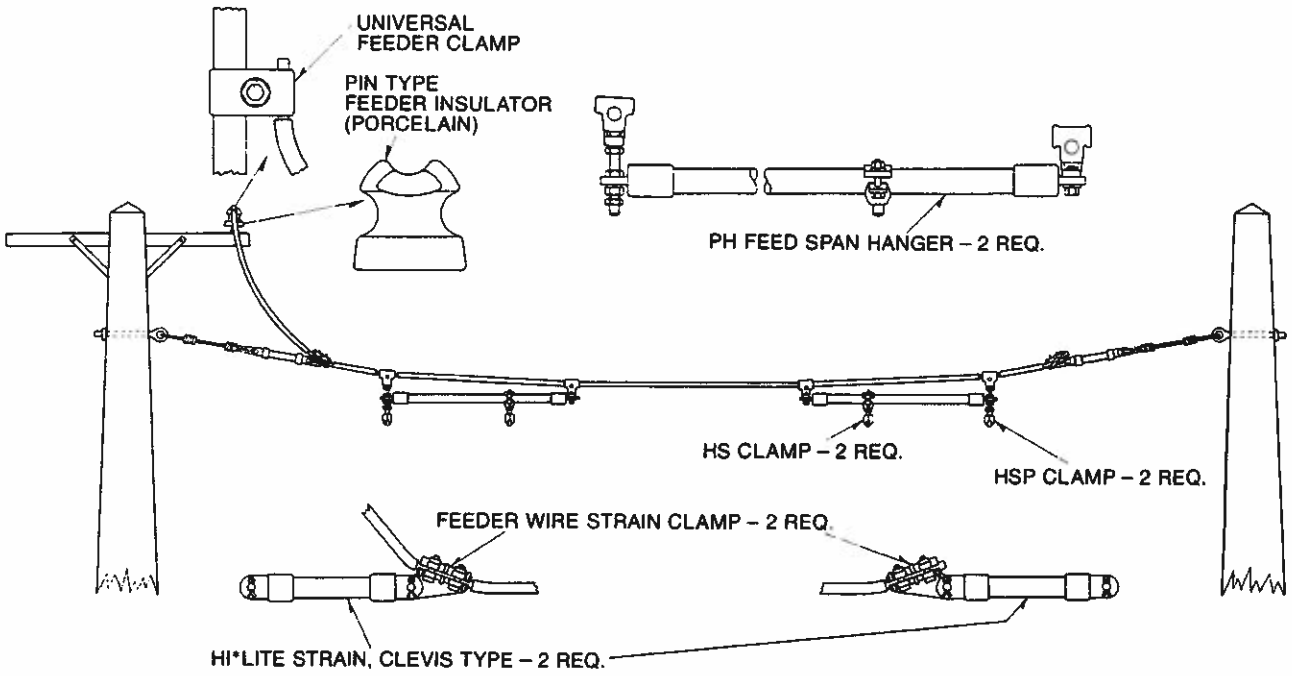
WEDGE GRIPS

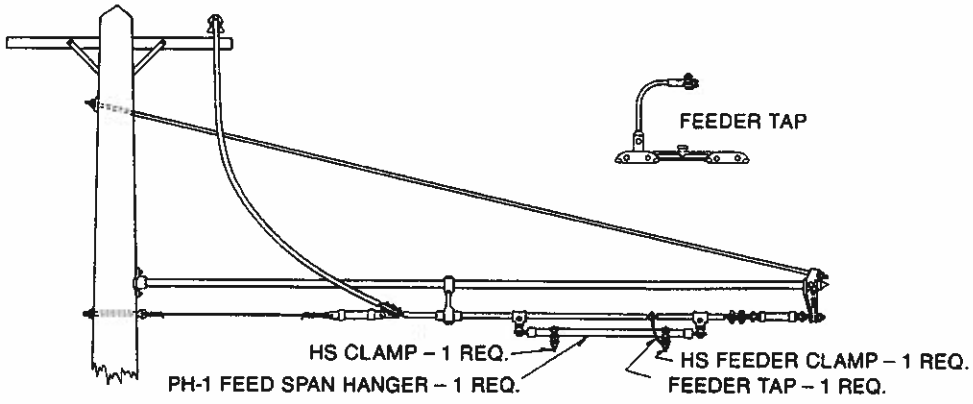
Wire is held firmly by two wedges, although it may be released by a few blows on outer end of wedges. Opening in clevis, $^{11}/_{16}$ inch. Diameter rivet, ⅝ inch. Will take 0 to 4/0 round or grooved wire or $^{5}/_{16}$- to ½-inch strand.

Catalog Number	Description	Net Weight Lbs. per 100
12634	Malleable Iron, Hot-Dip Galvanized	210

MATERIALS FOR FEEDER CONSTRUCTION

Feeder cables are heavy and bulky. Their installation is greatly improved and simplified by the many ingenious O-B fittings intended for this class of service. Both appearance and performance are enhanced by use of these specialized feeder materials.





INSULATED FEED-SPAN HANGERS

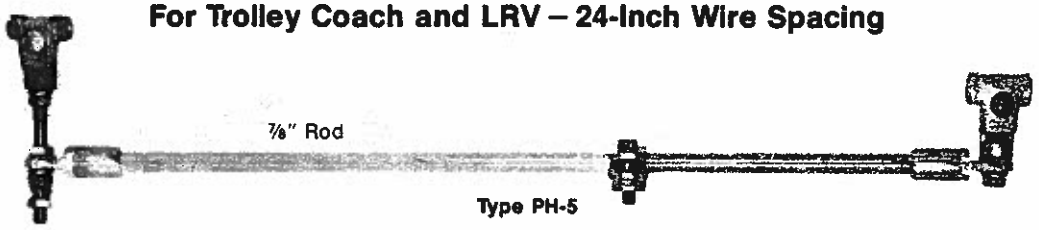
Low-cost installation, low maintenance and good appearance feature this type of hanger, which utilizes the feeder cable as the supporting span.

Electrical feeding of the group classified as Types PH-4 and PH-5 is accomplished by a bronze clamp attached to the bared feeder cable from which current flows to the trolley wire through a bronze stud and the Type HSP feeder clamp listed on page 15. The other cable clamp is malleable iron and fits over the cable insulation. Insulation between polarities consists of the cable insulation and approximately 10 inches of fiberglass. The negative clamp and stud assembly is adjustable to compensate for span sag and insure horizontal and vertical alignment of trolley wires.

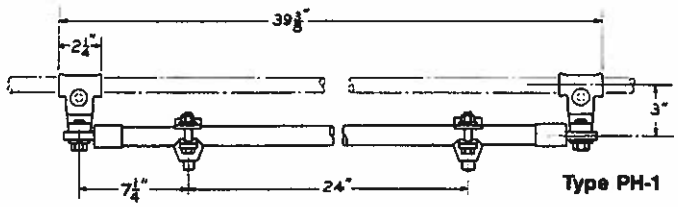
The Type PH-1 is used for suspending and insulating trolley wires from the feeder cable span of pole brackets, providing a uniform separation of trolley wires from end of bracket for both positive and negative feed points. Electrical feeding with this type hanger is through a feeder tap as shown on page 24 and the Type HS feeder clamp shown on page 15. Because the span is short, no adjustment for angularity is provided.

Type PH-7 is for the suspension of single trolley wires from negative feeder cable where LRV are operated between trolley coach lanes. It is designed to compensate for span sag. Supplementary insulation, such as the insulating unit No. 16835, is recommended for this hanger.

TYPE PH INSULATED FEED-SPAN HANGERS
For Trolley Coach and LRV – 24-Inch Wire Spacing



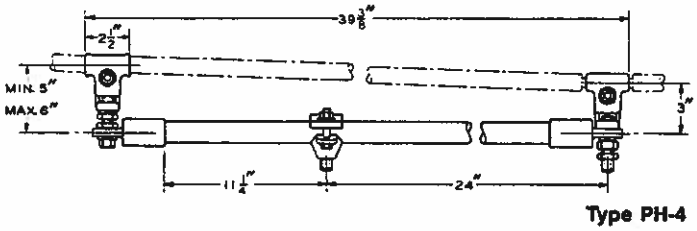
Type PH-5



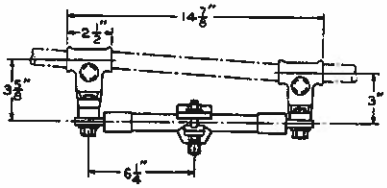
Type PH-1

Features common to all Type PH feed-span hangers are as follows:

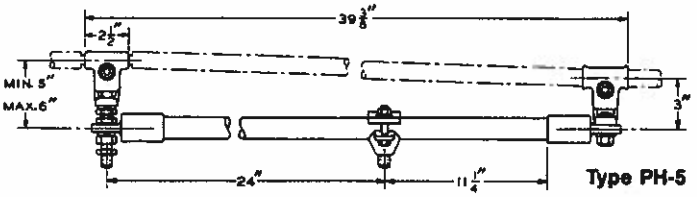
- Rigid assembly
- Hi*Lite insulator, ⅞-inch diameter, painted gray, tension tested to 7000 lb.
- Belled-end cable clamps
- Renewable parts
- Lock hanger studs



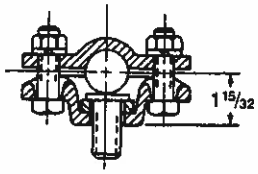
Type PH-4



Type PH-7



Type PH-5



Trolley Wire Support

Hanger dimensions are shown in the above line drawings. Clamps will accommodate 3/0 and 4/0 cable having diameter bare, minimum 0.470 and maximum 0.528. Insulated minimum 0.690, maximum 0.826. Can be supplied for other size cables on special order.

Hangers Complete

Catalog Number	Description	Net Weight Lbs. Each
54999-3001	Type PH-1, Non-Adjustable, Positive or Negative, for Trolley Coach	6.1
54937-3001	Type PH-4, Adjustable, Positive, for Trolley Coach	6.8
54936-3001	Type PH-5, Adjustable, Negative, for Trolley Coach	6.8
55011-3001	Type PH-7, Adjustable, for LRV	5.0

Parts

54980-6385	Hi*Lite Insulator Only for Types PH-1, PH-4 and PH-5 Hangers	2.9
54980-6125	Hi*Lite Insulator Only for Type PH-7 Hanger	1.7
19873	Cable Clamp Complete, M.I.Galv., for insulated Cable 0.690 to 0.826-In. O.D.	1.0
19914	Cable Clamp Complete, Bronze, for Bare Cable 0.470 to 0.528-In. O.D.	1.2
54962-3003	Trolley Wire Support Assembly	1.0
21418	Stud Assembly, Bronze – 3¼ Inches for Type PH-4	0.4
21417	Stud Assembly, Bronze – 6 3/16 Inches for Type PH-5	0.7

MATERIALS FOR FEEDER CONSTRUCTION

FLEXIBLE FEEDER TAP

A ready-made feeder tap consisting of a rubber insulated flexible cable which has a bronze clamp on one end for attachment to the feeder, and a copper terminal at the other end to engage the lug of a feeder ear. This terminal is provided with a bolt and lockwasher. Cable is cold pressed into the terminals, which insures good conductivity. The clamp will accommodate feeder ranging from 2/0 to 4/0 in size.

Advantages over the usual field make-up are a more uniform and reliable feed-in connection, better appearance, longer life, and a saving in installation time. The tap is for use only in conjunction with O-B feeder span construction illustrated on page 22, and Type PH feed span hanger listed on page 23. This tap, however, can be made to order in any length desired.

Length, from center of terminal bolt to center of feeder wire, 14 inches.

Tap is complete with terminal bolt, nut and lockwasher.

Catalog Number	Description	Net Weight Lbs. per 100
17708	3/0 Super-Flexible (App. 4200 Wires)	165

UNIVERSAL FEEDER CLAMPS
For Combinations from 2/0 to 1 000 000 Cmil

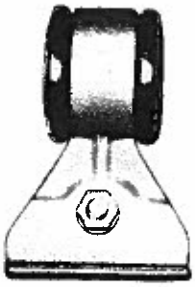
In this design, one pair of clamp castings serves as an efficient mechanical tap between all sizes of main-line and cross-span solid or stranded feeder within the range from 2/0 to 1 000 000 Cmil. For some of the combinations of small feeders, one casting must be turned end for end.

Careful consideration has been given to the current-carrying capacity of these clamps, not only in the bronze alloy selected but in the heavy sections and the provision of a ½ x 2½-inch steel bolt with lockwasher to insure a tight joint.

Clamping length, 1½ inches. See illustration on page 22 for application.

Catalog Number	Description	Net Weight Lbs. per 100
18547	Universal Feeder Clamp for all combinations from 2/0 to 1 000 000 Cmil	110

FEEDER-SPAN SUPPORTS



17706

17707

018112 DWG

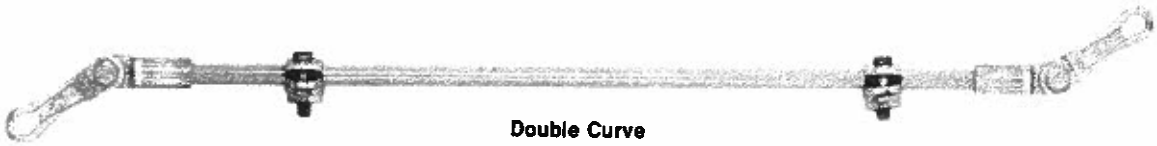
These supports were designed for the type of cross-span feeder construction employing parallel support and feeder spans. They also have been found useful for many special applications in supporting and insulating a lead cable from a parallel span wire.

Diameter of hole in spool is ⅞ inch. The clamp accommodates ¼-inch to ⅜-inch span wire. Support No. 17706 is generally used in cross-span feeder construction.

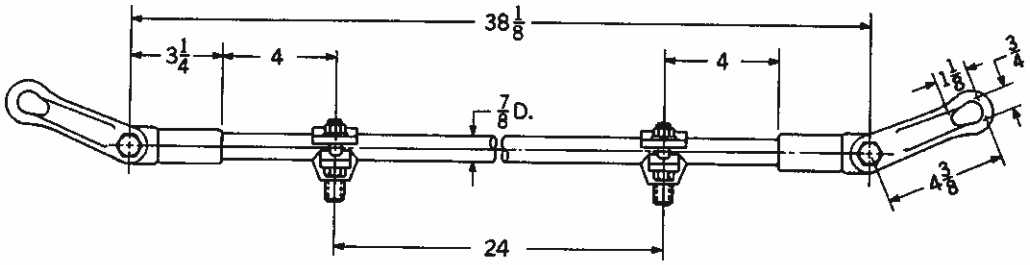
Castings are of malleable iron. All metal parts are hot-dip galvanized.

Catalog Number	Description	Net Weight Lbs. per 100
17706	Insulated Feeder Support, 3-inch Cable Separation, Complete	160
17707	Split Porcelain Spool Only (Two Halves)	35

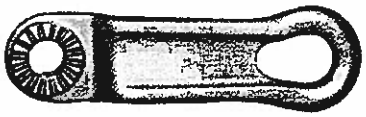
TYPE PH CURVE HANGER ASSEMBLIES WITH ADJUSTABLE ARMS
24-Inch Wire Spacing



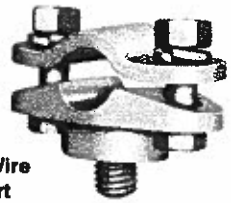
Double Curve



Hi*Lite Strain only



Adjustable Arm



Trolley Wire Support

The Type PH curve hanger assembly is equipped with separable, adjustable pulloff arms. The serrated eye to which this arm attaches is an integral part of the Hi*Lite strain end casting.

The trolley wire supports are made in two pieces so they may be removed and reused if the insulating member is broken. ⅝-inch hanger studs are centered under the insulating member and are provided with lockwashers so that a tight joint can be maintained between the ears and supports.

Single-curve hangers are identical to the double hangers except that one adjustable arm is omitted.

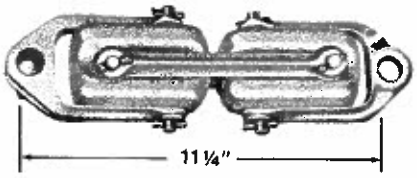
The Hi*Lite insulation between the positive and negative wires is 24 inches. Adjustable arm and end castings are malleable iron. All metal parts are hot-dip galvanized. Insulating members are painted gray for maximum weather protection.

The Hi*Lite strain insulator is tension proof tested to 7000 pounds.

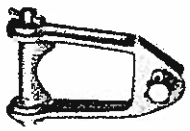
Hanger Assemblies Complete

Catalog Number	Description	Net Weight Lbs. per 100
54962-3001	Double Curve	600
54962-3002	Single Curve	543
	Parts	
54986-4001	Adjustable Arms Only	57
54980-6385	Hi*Lite Strain Insulator Only	300
54962-3003	Trolley Wire Support Assembly	100

TYPE JB PORCELAIN STRAIN INSULATOR ASSEMBLIES



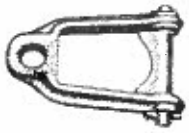
Insulator Assembly 15277



Clevis Fitting 15278

Design Features – Consists of two Type JB wet ware porcelain insulators (31504) interlocked with an intermediate fitting. Flexible bronze saddles are provided for use between bolts and insulators to increase the bearing area and distribute the strain evenly.

Material – Clevis with 13/16-inch opening; 5/8-inch steel rivet and eye fitting with 11/16-inch eye are made of malleable iron. All parts are hot-dip galvanized.



Eye Fitting 15279

Intermediate Fitting 15280

Catalog Number	Description	Net Weight Lbs. Each
15277	Insulator Assembly Complete	7.3
15278	Clevis Fitting Only	1.3
15279	Eye Fitting Only	1.0
15280	Intermediate Fitting Only ...	1.8

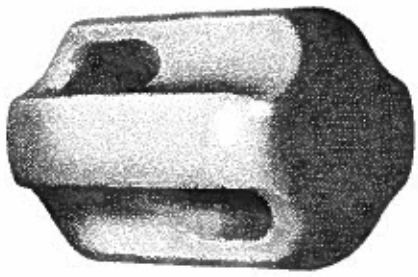
TYPE JB STRAIN INSULATORS

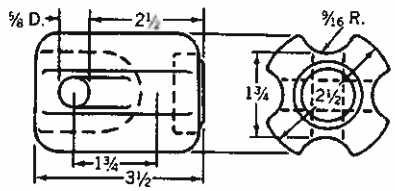
Type JB strain insulators are made of the highest grade wet ware porcelain. They are rugged and not susceptible to mechanical breakage. Holes are straight, making assembly easy even with stiff guy strand.

Mechanical strength ratings are values developed with hard drawn copper or mild steel cable.

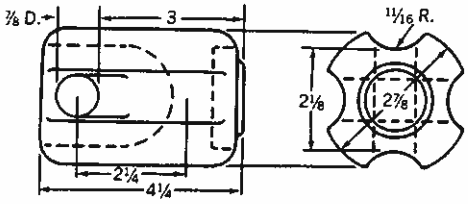
Type of strand and method of attachment will have a marked influence on the strength developed.

These insulators are intended primarily for guy or span wire insulation. They may also be used for low-voltage deadends.

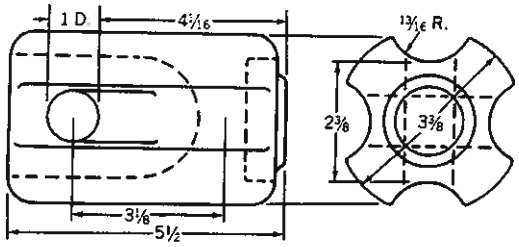




31502



31504



31506

Catalog Number	31502	31504	31506
Dry Flashover .....kilovolts	25	30	35
Wet Flashover .....kilovolts	14	16	18
Leakage Distance .....inches	1⅝	1⅞	2¼
Rated Ultimate Strength .....pounds	10,000	12,000	20,000
Packed Weight per 100 .....pounds	125	200	375
No. in Standard Package	50	50	25

LOW-VOLTAGE FEEDER DEADEND CLAMP AND FEEDER STRAIN CLAMP ASSEMBLIES

The feeder deadend clamp assembly is for use with low-voltage feeder cables, concentric or rope lay, of any size between 4/0 and 1 000 000 Cmil. Its compactness permits installation from pole, making the use of ladders or staging unnecessary. Design allows easy disassembly or assembly in the field. Made in two sizes, for 500 000 to 700 000 Cmil and 750 000 to 1 000 000 Cmil respectively.

Feeder cable may be cut off and deadended in the deadend clamp, or carried through for jumper connection to another feeder below or on either side, or above by using the strain clamp.

Clamp clevis of the deadend assembly is in line with center of cable. This permits a straight pull from feeder to pole or other structure and avoids any kinking or bending of cable under strain. An eye placed at outer end of the clamp provides for pulley block attachment to facilitate installation.

Slip strength values of both deadend and strain clamps are, in order of size, 4000, 7000 and 9000 pounds. Ultimate strength of insulation, either fiberglass or porcelain, exceeds 9000 pounds.

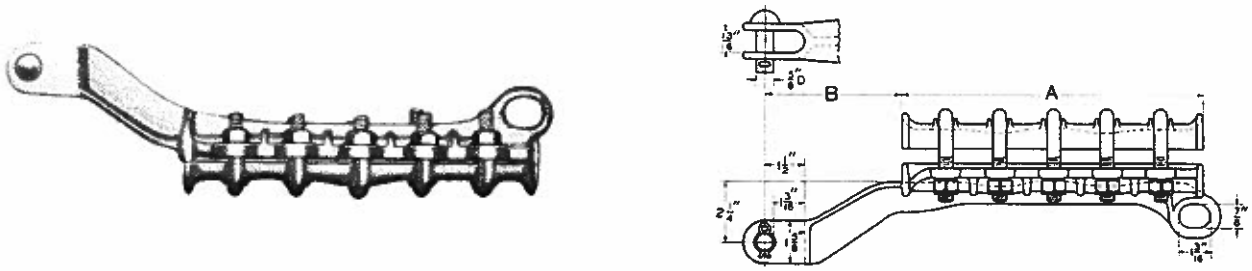
Insulation may be either porcelain or Hi*Lite. Hi*Lite insulation consists of a single fiberglass strain insulator, eye and clevis type, with five inches of clear insulation.

The porcelain insulator assembly consists of two interlocked wet ware porcelain strain insulators, and an eye fitting for attachment to clevis of clamp, an intermediate fitting between the insulators, and a clevis fitting for attachment to eyebolt in supporting structure. Flexible bronze saddles are furnished with each fitting for insertion between bolts and insulators, increasing the bearing area and distributing the strain evenly.

Clamp and fittings are of malleable iron, hot-dip galvanized.

The feeder strain clamp assembly differs from the deadend assembly only in having the clevis end of the clamp offset, permitting the feeder to be carried straight through so the clamp may be used in a strain or semi-tension position.

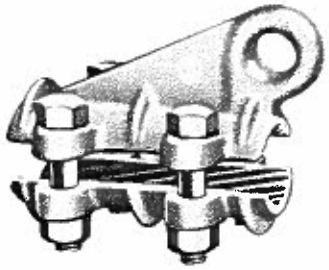
Deadend Clamp



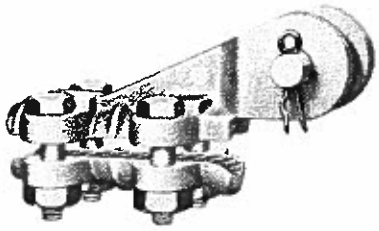
Strain Clamp

Catalog Number Deadend Clamp	Catalog Number Strain Clamp	Dimensions Inches A	B	C	Cable Size Cir. mils Minimum	Maximum	Cable Diameter Inches Minimum	Maximum	Number of U-Bolts	Net Weight Lbs. per 100
. . . . .	16164	7¾	5⅛	. . .	4/0	350 000	0.52	0.69	3	500
15275	15332	9¼	5⅛	5⅛	500 000	700 000	0.70	0.97	4	740
15276	15333	11¼	5⅛	5⅛	750 000	1 000 000	0.97	1.16	5	930

FEEDER WIRE STRAIN CLAMPS



Strain Clamp with Eye



Strain Clamp with Clevis

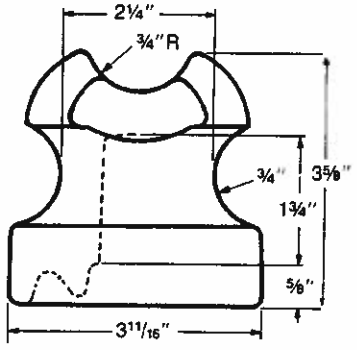
Each half has spiral grooves corresponding to the arrangement of the cable strands, giving great holding power.

Hole in eye, 11/16-inch diameter. Thickness of eye, 7/16-inch. Clevis opening, ¾-inch. Rivet, ½-inch x 1¾-inches. Length jaws, 3½ inches. Malleable iron. All parts are hot-dip galvanized.

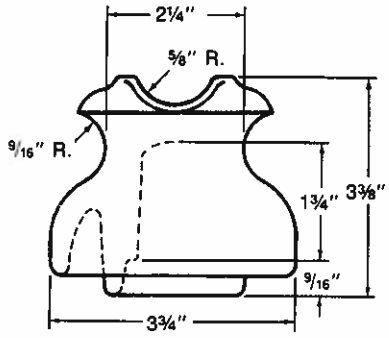
By the use of clamp No. 10571, it is possible to carry a cross-span feeder up to the main feeder, as shown in the illustration on page 22, eliminating one tap.

Catalog Number	Description	Net Weight Lbs. per 100
	Strain Clamp with Eye	
10571	For No. 1/0 Solid to 500 000 Cmil Bare Stranded Cable	165
10572	For 500 000 to 1 000 000 Cmil Bare Stranded Cable	260
20556	For 1 250 000 to 1 590 000 Cmil Bare Stranded Cable	430
	Strain Clamp with Clevis	
22798	For No. 1/0 Solid to 500 000 Cmil Bare Stranded Cable	200
22799	For 500 000 to 1 000 000 Cmil Bare Stranded Cable	285
22800	For 1 250 000 to 1 590 000 Cmil Bare Stranded Cable	450

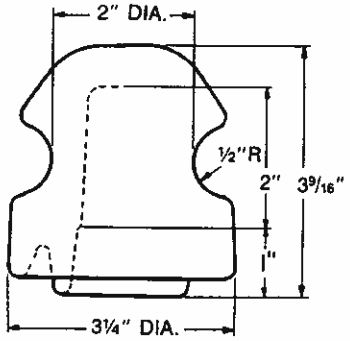
SMALL PINTYPE INSULATORS
7200-Volt Typical Application



9953



12847



29207

CHARACTERISTICS		Catalog Number 9953	12847	29207
Dry Flashover	kilovolts	50	50	35
Wet Flashover	kilovolts	25	25	20
Leakage Distance	inches	4	5	4
Dry Arcing Distance	inches	3¼	3⅜	2¼
Mechanical Strength, Approximate	pounds	3000	2500	3000
Diameter of Pin Hole, Porcelain Thread	inches	1	1	1
Minimum Length Pin	inches	4	4	4
Net Weight per 100	pounds	170	145	120
Packed Weight per 100	pounds	180	156	130
Number in Standard Package		50	50	50

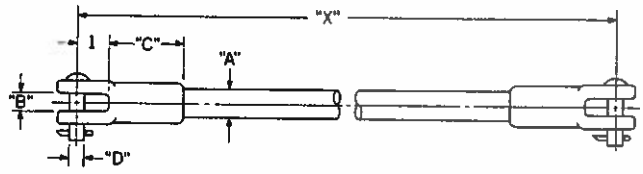
HI*LITE STRAIN INSULATORS

The Hi*Lite strain insulators are made with the same high-quality epoxy-fiberglass rod used in O-B's high-voltage line of insulators. The eye and clevis ends are of malleable iron. The tapped ends are of cold drawn steel. All end fittings are hot-dip galvanized. The end fittings are swaged to the ends of the fiberglass rod. After assembly, the exposed fiberglass rod is coated with gray alkyd paint for protection from weather.

Both 5/8-inch and 7/8-inch rod are used. The 7/8-inch is used in proximity to frogs and crossovers for greater impact resistance to flying trolley poles. Both sizes are proof-tested to 7000 pounds tension. Units can be furnished in virtually any length; however, the minimum recommended insulating length is 5 inches for 600-V to 750-V trolley systems.

To order, specify catalog number, length X in inches, and end fitting combination. The X lengths listed below are minimum, and longer lengths can be ordered.

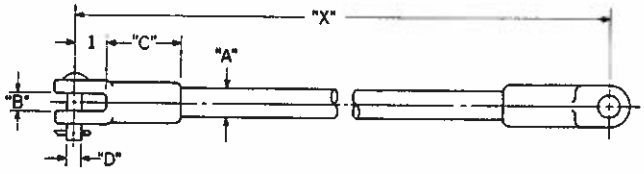
TWO CLEVISES IN SAME PLANE



Catalog Number	Dimensions in Inches X	A	B	C	D	Net Wt. Lbs. Per 100
53693-3001	26½	5/8	11/16	2⅝	¾	260
53693-3002	21¼	5/8	11/16	2⅝	¾	210
54960-6115	11.5	7/8	9/16	2¼	7/16*	261
54975-6120	12.0	7/8	13/16	2½	½	261
54985-6120	12.0	5/8	13/16	2½	½	198

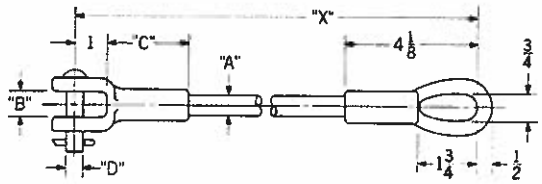
*Bolt, Nut and Lockwasher

TWO CLEVISES AT RIGHT ANGLES



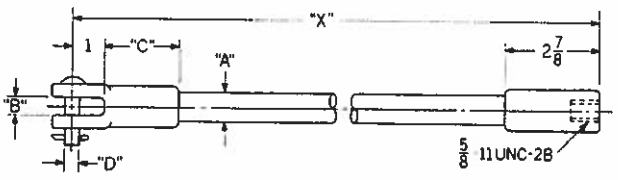
Catalog Number	Dimensions in Inches X	A	B	C	D	Net Wt. Lbs. Per 100
54995-6115	11.5	7/8	9/16	2¼	½	261
54984-6120	12.0	5/8	13/16	2½	½	198

CLEVIS AND EYE AT RIGHT ANGLES



Catalog Number	Dimensions in Inches X	A	B	C	D	Net Wt. Lbs. Per 100
54961-6128	12.8	5/8	13/16	2½	½	146

CLEVIS AND TAPPED END



Catalog Number	Dimensions in Inches X	A	B	C	D	Net Wt. Lbs. Per 100
54964-6111	11.1	7/8	9/16	2¼	½	208
54983-6118	11.8	5/8	13/16	2½	½	148

FLEXIBLE CURVE SEGMENTS

Curve segments simplify curve construction and improve overhead appearance by reducing the number of pulloffs required. Designs now available have increased their practical range of application to all curves including those of very long radius.

Flexibility

All O-B curve segments have a flexible end construction to enable the segment to conform to slight variations in angularity which may develop in construction or result from wire shifting. This feature has real value as it helps to maintain a smooth approach and avoid a sharp transition of the shoe collectors, as would be the case if absolute rigidity is maintained to the end of the segment. And change of direction would then come in the trolley wire where a sharp bend would occur. The necessity of end pulloffs for alignment is eliminated.

Renewability

All parts of O-B segments: strain plates, strain bars, runners, guards, Hi*Lite strains and tips are renewable. In the event of wear or damage on any part, it can be replaced without the necessity of renewing the assembly, a saving in time and cost.

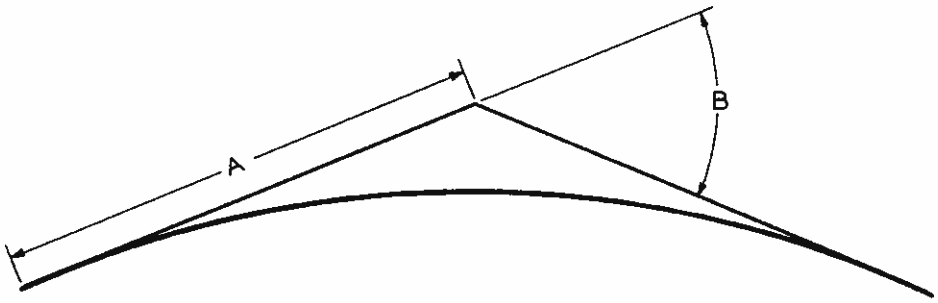
Application

The Type C-2 segment is generally favored within the angle range from 13 to 47 degrees. Its outstanding advantages are ease of installation and adjustability which enable two segments to cover the entire range of angularity from 13 to 47 degrees. The number of stock items is reduced and the range of application greatly increased.

Of the clamp segments Type DL and Type DR, those in the lower angle range up to and including 13 degrees have had the widest application. For the higher speeds which are usually obtained on long radius-low angle curves, the smooth underrun of the clamp-type segment is desirable. The long runner length per degree of curvature of these segments provides assurance of dependable operation.

Types C-2, DL and DR segments provide an ample factor of safety for the maximum speed at which coaches may operate within the limits set by the comfort and safety of passengers and city traffic regulations.

Tangent Dimensions



A = Tangent Dimension
B = Angle of Segment

Type of Segment	Tangent Dimensions Inches, in 5 Degree Intervals*							
	10	15	20	25	30	35	40	45
C-2	35.97	48.17	48.36	48.65	55.13	55.61	56.17	56.83
DR	54.15	54.33	54.54	54.88	55.26	55.74	56.29	56.96

	Tangent Dimensions Inches, in 2 Degree Intervals				
	2	4	6	8	10
DL	9.03	17.99	27.02	36.05	45.13

*For intermediate angles, proportional dimensions will be sufficiently accurate for practical application.

TYPICAL CURVE SEGMENT APPLICATIONS
For Trolley Coach

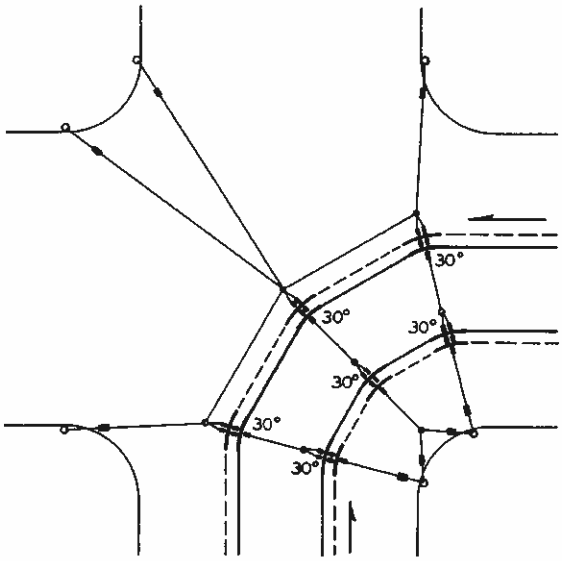


Figure 1

A simple two-way curve with six 30-degree units.

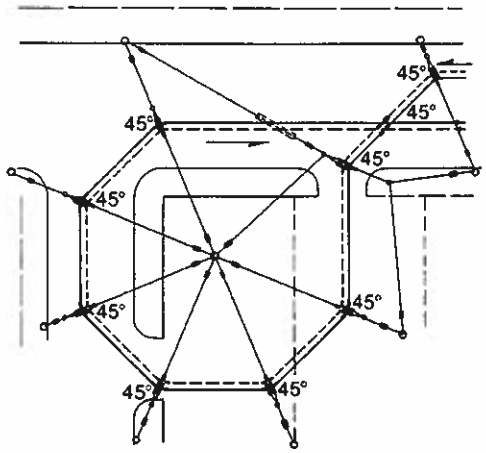


Figure 2

A closed loop made of eight 45-degree units.

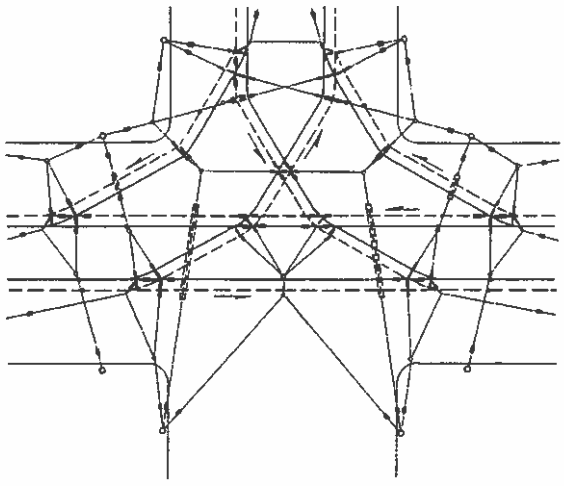


Figure 3

A typical intersection layout using 30-degree segments.

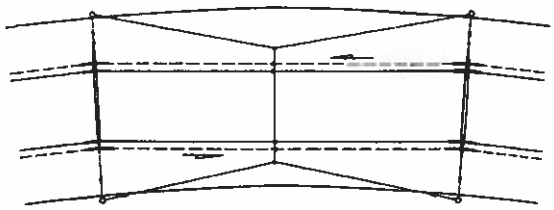
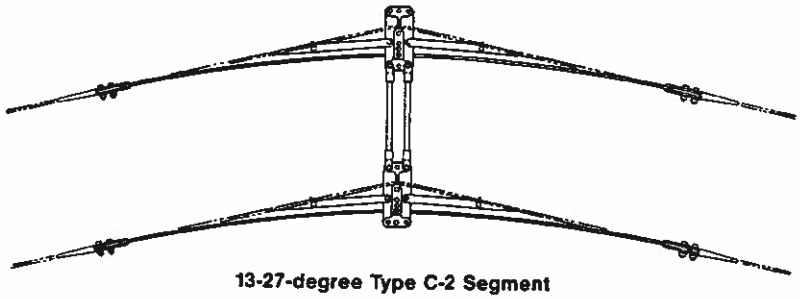


Figure 4

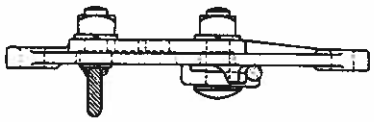
Low-angle curve segments. Complete data are not available as to the maximum distance apart curve segments can be placed on long-radius curves. Observation discloses, however, that longitudinal spans greater than 70 feet oscillate transversely to the extent that trolley wire fatigue may occur near, or at ends, of curve segment runners. Steady or dampener spans, as shown in the illustration above, are frequently inserted between curve segments to break up harmonic vibrations. These spans are not located centrally but are a few feet off center.

TYPE C-2 SEGMENTS

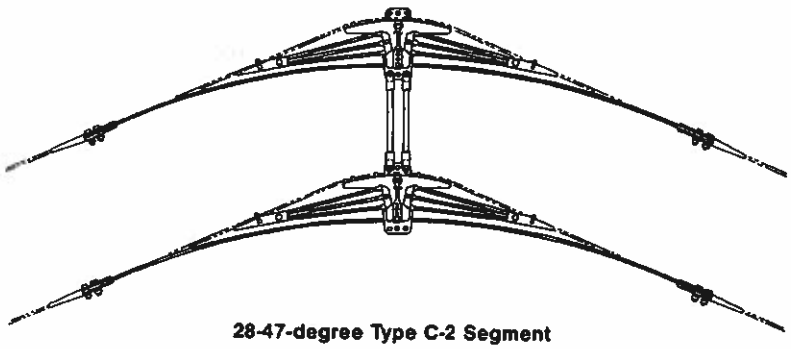
For Trolley Coach – 24-Inch Wire Spacing



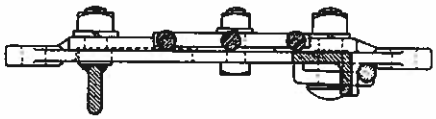
13-27-degree Type C-2 Segment



Cross Section at Plate of 13-27-degree Segment



28-47-degree Type C-2 Segment



Cross Section at Plate of 28-47-degree Segment

Type C-2 segments provide dependable operation at the comparatively high speeds necessary for revenue routes. In addition to this fundamental requirement, they are light in weight and easy to install.

The light weight of the Type C-2 segment is accomplished largely by carrying the trolley wire through without cutting, utilizing the wire as a strain member. This construction eliminates the heavy struts which are otherwise necessary and simplifies adjustment for alignment. Bronze approach tips of thin cross section are tapered to supply a smooth transition from wire to runner. The tip seats the wire firmly in the bottom of the clevis end by the familiar cam principle. It is first attached in an upright position at the inner bolt, then rotated downward over the wire and outer bolt installed. Lips are then peened around wire (Fig. 1).

Type C-2 segments are shipped in sections for ease in handling and installing. The assembly consisting of the strain plates and connecting Hi*Lite strain insulators (Fig. 5) is installed first. After the trolley wires are strung, tensioned and clamped to strain plates, the runners (Fig. 4) are bolted to the strain plates and attached to the wire. Anti-trapping guards (Fig. 6) are then attached. Any part of a Type C-2 segment may be renewed separately, reducing cost of maintenance.

Three sizes of the Type C-2 segment accommodate angles from 5 to 47 degrees. Adjustment is in 5-degree steps and intermediate angles are obtained by flexible end construction. Adjustment is obtained by attaching runners to holes in strain plates which are marked with the desired angle setting. This adjustable feature simplifies ordering and stocking and accommodates changes in angle which often become necessary during construction.

Type C-2 segments employ two Hi*Lite strain insulators between strain plates. Strain insulators for pulloff attachments to pole and between segments are not supplied as a part of curve segments. A double pulloff is recommended as providing a higher factor of safety.

Anchor adapters are used to anchor the trolley wire where it is necessary to attach a Type C-2 segment to a special work assembly. The adapter attaches to the clevis of the segment and is available with either a clevis end (Fig. 2) or a tongue end (Fig. 3).

Strain plates, clamps and anchor adapters are of malleable iron. Length wire seat of strain plate for 28- to 47-degree segment, 18 inches; 13- to 27-degree, 4½ inches; 5- to 12-degree, 4¼ inches. Diameter pulloff eyes, $^{21}/_{32}$ inch. Runners are of flat steel bar ⅜ x 1⅜ inches with rounded running surface. Clevis ends of runners are equipped with two $^{7}/_{16}$ x 1½-inch steel bolts for attachment of trolley wire tips. All ferrous parts are hot-dip galvanized.

Hi*Lite members are painted gray for good appearance and maximum protection.

TYPE C-2 SEGMENTS

Figure 1

Type SR tip, designed to carry trolley wire straight through.

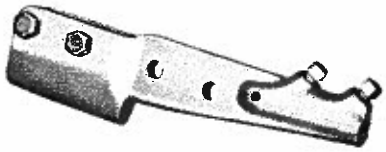


Figure 2

Clevis anchor adapter to join any tongue-end device.

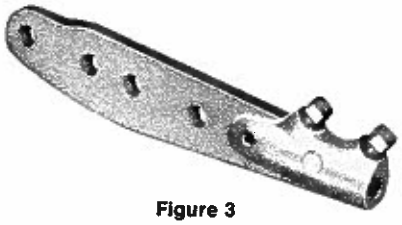


Figure 3

Tongue-end anchor adapter to join any clevis-end device.

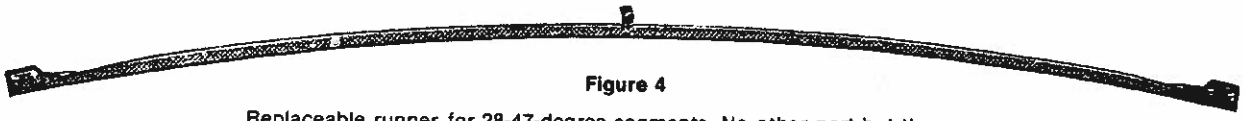


Figure 4

Replaceable runner for 28-47-degree segments. No other part but the runner need be changed in the event wear makes such replacement necessary.

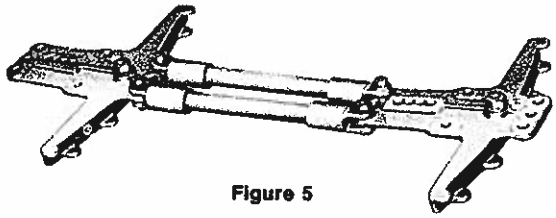


Figure 5

Plate assembly for 28-47-degree segment. This unit goes into the air first and becomes a permanent part of the overhead structure.

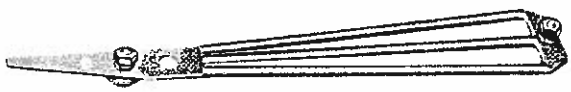


Figure 6

Anti-trapping guard. This guard is applicable to the 28-47-degree segment only.

Segments Complete

Catalog Number	Description	Degree Angle	Wire Size Round & Grooved	Runner Length* Feet	Net Wt. Each Lbs.
21370	Type C-2 Segment Complete with Tips	13-27	2/0	8	58
21372	Type C-2 Segment Complete with Tips	28-47	2/0	9	80
22079	Type C-2 Segment Complete with Tips	5-12	2/0	8	46
22301-3014	Type C-2 Segment Complete with Tips	5-12	4/0	8	46
22302-3005	Type C-2 Segment Complete with Tips	13-27	4/0	8	58
22303-3005	Type C-2 Segment Complete with Tips	28-47	4/0	9	80
	Runners Only, Complete With Clevis Bolts				
21375	Runner only without Tips (Fig. 4)	5-12	.....	8	15
21376	Runner only without Tips (Fig. 4)	13-27	.....	8	15
21377	Runner only without Tips (Fig. 4)	28-47	.....	9	17

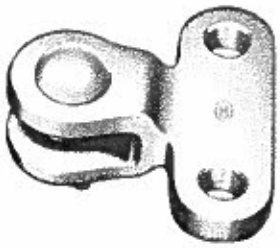
*Not including tips.

Other Parts

20290	Strain Plate (Fig. 5)	5-12	.....	7.0
20291	Strain Plate (Fig. 5)	13-27	.....	7.0
20293	Strain Plate (Fig. 5)	28-47	.....	9.0
20294	Guard, R.H. (Fig. 6)	13-27	.....	1.5
20295	Guard, L.H. (Fig. 6)	13-27	.....	1.5
20296	Guard, R.H. (Fig. 6)	28-47	.....	5.0
20297	Guard, L.H. (Fig. 6)	28-47	.....	5.0
20748	Type SR Tip, 2/0 Rd. & Grvd., 8-inch Lips (Fig. 1)			1.3
20749	Type SR Tip, 4/0 Rd. & Grvd., 8-inch Lips (Fig. 1)			1.3
54960-6160	Hi*Lite Strain Insulator (Fig. 5)	13-47	.....	2.8
54960-6175	Hi*Lite Strain Insulator (Fig. 5)	5-12	.....	2.5
	Adapters			
19434	Anchor Adapter with Tongue for 2/0 to 4/0 Rd. & Grvd. Wire (Fig. 2)			5.0
19435	Anchor Adapter with Clevis, Length of Underrun 3⅞ inch for 2/0 to 4/0 Rd. & Grvd. Wire (Fig. 3)			5.5

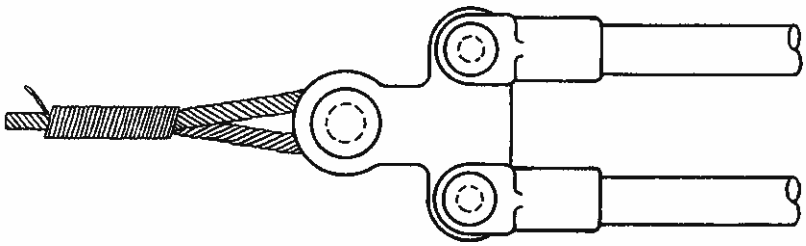
Type C-2 Segments are also available for 3/0 round or grooved wire

TYPE S INSULATOR YOKE



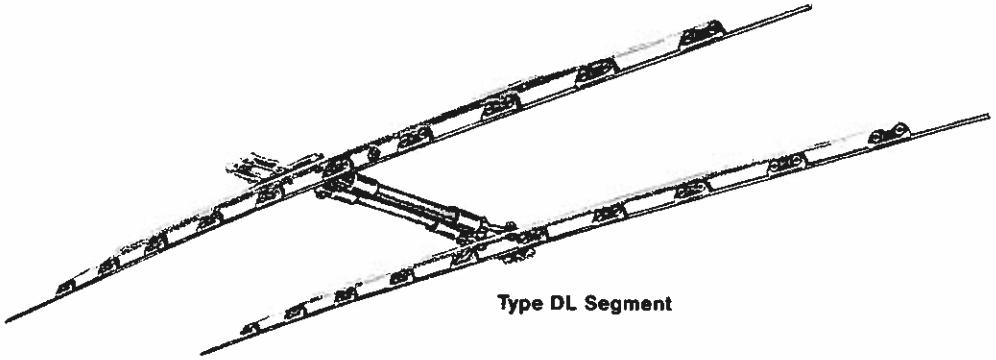
This yoke can be applied to advantage in installing all types of segments in span construction, attaching to the two outside pulloff Hi*Lite strains as shown in accompanying drawing. It serves to space these insulators apart, equalizing strain on each. Time required to install is reduced and appearance improved.

Diameter of pulloff eyes, 9/16 inch. Clevis opening, 13/16 inch. Spacing between centers of eyes, 2¾ inches. Casting is malleable iron. All parts are hot-dip galvanized.

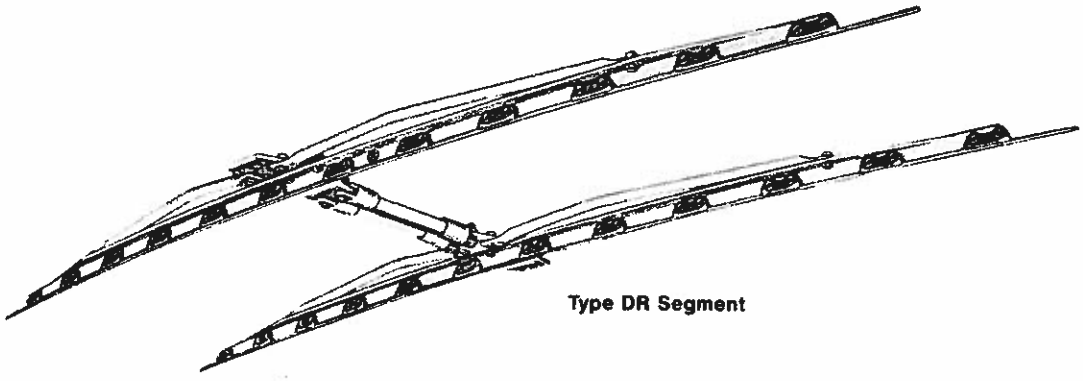


Catalog Number	Description	Net Weight Lbs. Each
21089	Type S Insulator Yoke Complete with 5/8 x 2-Inch Clevis Bolt and 3/16 x 1-Inch Cotter	1.5

CLAMP-TYPE CURVE SEGMENTS
For Trolley Coach
For Grooved Wire Only – 24-Inch Wire Spacing



Type DL Segment



Type DR Segment

O-B clamp-type curve segments attach to the upper lobe of grooved wire, leaving the lower lobe a free-running surface for the collector and providing a smooth, quiet underrun.

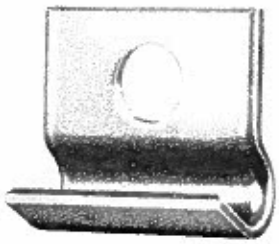
All parts of O-B clamp segments are separable and replaceable, a major convenience in installation, stocking and repairing. The runners have sufficient flexibility at the ends to compensate for small variations in angularities and to obtain alignment with trolley wires.

Strain insulators for pulloff attachment to pole or between segments are not supplied as a part of these segments. Double pulloff is recommended as providing a greater factor of safety.

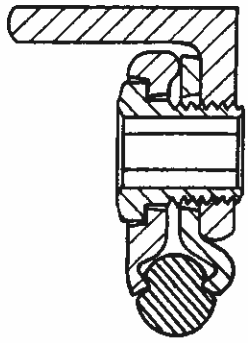
Wire slings, No. 20659, replace clamps during stringing and tensioning of the trolley wire. Their use facilitates wire installation. They are not a part of the segment and must be ordered separately.

All metal parts are hot-dip galvanized. Insulating members are painted gray for good appearance and maximum protection.

Listing of runners covers angle-iron units only. Clamps must be ordered separately.



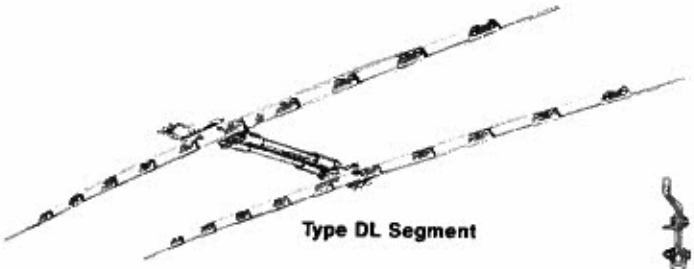
Wire Sling



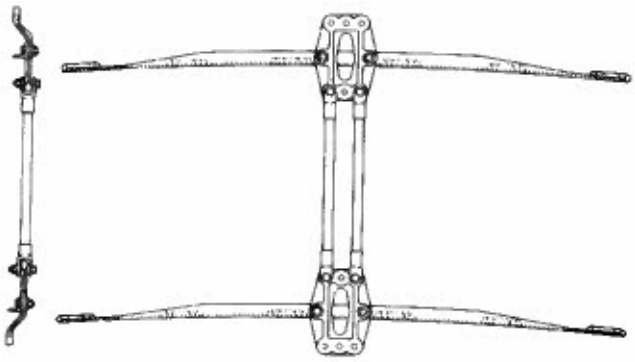
Cross Section View of Clamp

CLAMP-TYPE SEGMENTS
Type DL Segments – 2 Degrees to 10 Degrees

These segments have a length of nine inches per degree of curvature. They consist of formed lengths of steel angle iron to which are welded 5/8-inch studs for bolting to the strain plates; high-strength bronze clamps 3¾ inches long, which attach to the angle iron and to the trolley wire by means of two hexagonal-hole bronze hollow screws; malleable iron strain plates and two Hi*Lite strain spacers. Angle iron is 1¼ x 1¼ x 3/16-inch for two-degree angle only. For all other angles of these segments, 1¼ x 1½ x 3/16-inch angle iron is employed. Pulloff holes in strain plates are 9/16-inch in diameter.



Type DL Segment



Type DL Segment

TYPE DL SEGMENTS
For 2/0 and 3/0 Grooved Wire

Catalog Number		Runner Length Inches	Degree Angle	No. Clamps per Runner	Net Weight Lbs. Each	
Complete	Runner Only				Complete	Runner Only
20609	20600	18	2	3	20.0	2.2
20610	20601	27	3	4	22.0	2.8
20611	20602	36	4	5	25.0	4.0
20612	20603	45	5	6	28.0	5.0
20613	20604	54	6	6	30.4	6.2
20614	20605	63	7	7	33.6	7.4
20615	20606	72	8	8	36.4	8.4
20616	20607	81	9	9	39.6	9.6
20617	20608	90	10	10	42.8	10.8

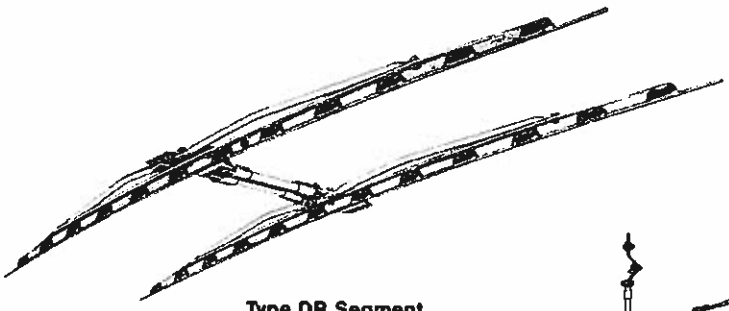
Parts for Type DL Segments

Catalog Number	Description	Net Weight Lbs. per 100
54960-6175	Hi*Lite Strain Spacer, Clevis Each End	287
19772	Strain Plate	360
19774	Clamp Assembly, Complete with Hollow Screws	40
19637	Hex-Hole Hollow Screw, Diameter 9/16-Inch, Bronze	3
19442	Hollow-Screw Wrench	12
	Wire Sling	
20659	Steel, for All Clamp-Type Segments	16

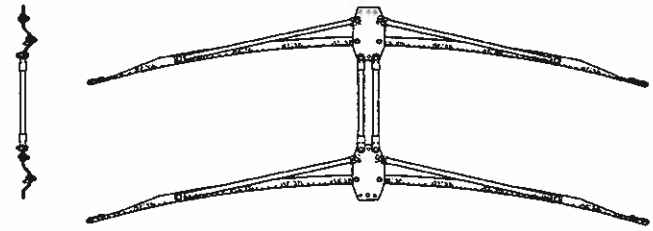
CLAMP-TYPE SEGMENTS
Type DR Segments – 11 Degrees to 47 Degrees

The Type DR segments employ 1¼ x 1½ x 3/16-inch angle iron runners and are otherwise similar to the Type DL segments except that strain plate is of steel and strain bars are used to provide the necessary rigidity under load. Pulloff holes in strain plate are 21/32-inch diameter.

All Type DR segments are nine feet long and employ 12 clamp assemblies on each runner.



Type DR Segment



Type DR Segment

Type DR Segments
For 2/0 and 3/0 Grooved Wire

Catalog Number		Degree	Net Weight Pounds Each	
Complete	Runner Only	Angle	Complete	Runner Only
20592	20584	11-13	73	13
20593	20585	14-17	73	13
20594	20586	18-22	73	13
20595	20587	23-27	73	13
20596	20588	28-32	73	13
20597	20589	33-37	73	13
20598	20590	38-42	73	13
20599	20591	43-47	73	13

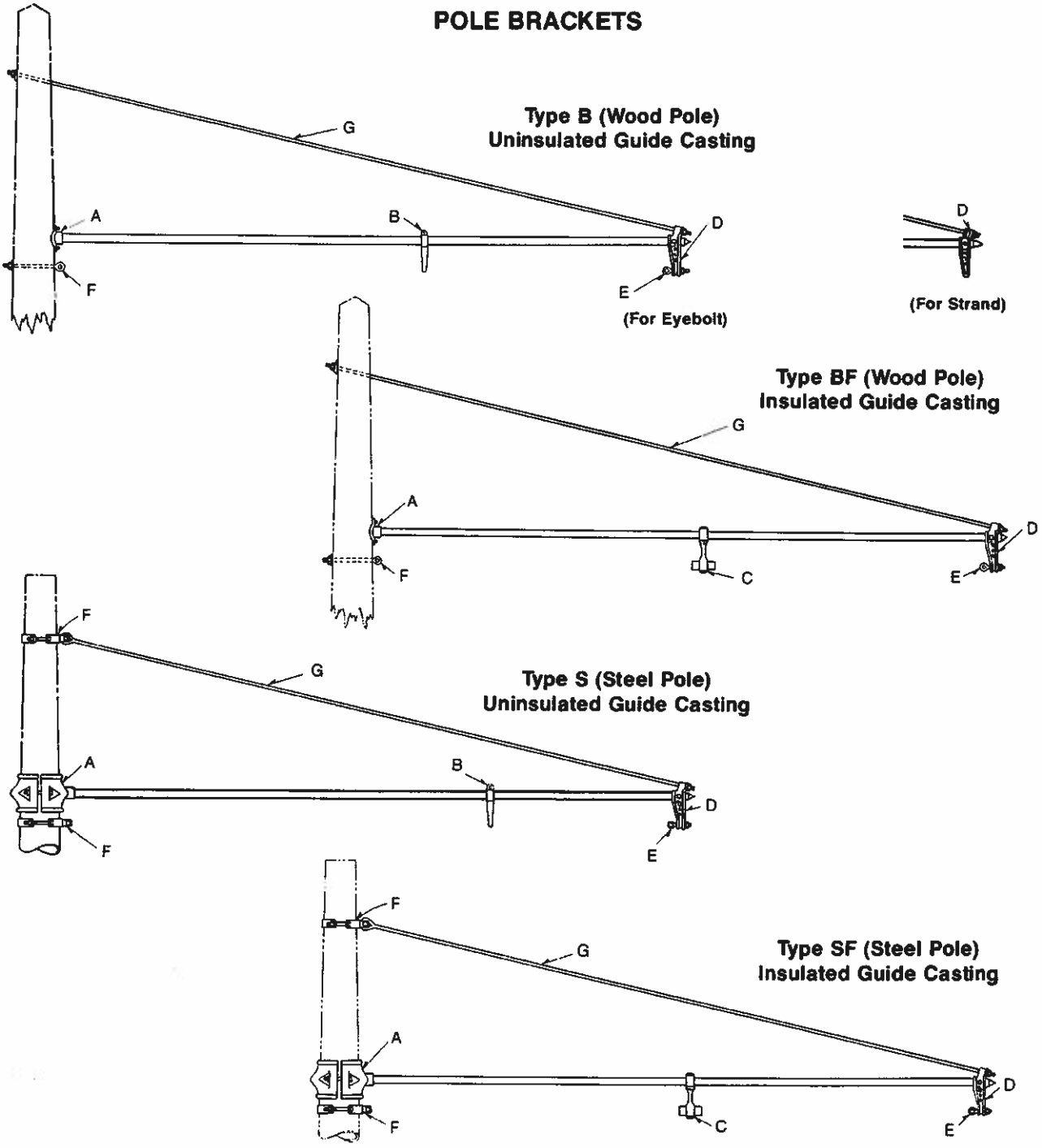
Parts for Type DR Segments

Catalog Number	Description	Net Weight Lbs. per 100
54960-6160	Hi*Lite Strain Spacer, Clevis Each End with 7/16 x 2-Inch Hex-Head Machine Bolt, Nut and Lockwasher	280
20582	Strain Plate	800
20583	Strain Bar Assembly, ¾-Inch Pipe	400
19774	Clamp Assembly, Complete with Hollow Screws	40
19637	Hex-Hole Hollow Screw, Diameter 9/16 Inch, Bronze	3
19442	Hollow-Screw Wrench	12

Wire Sling

20659	Steel, for All Clamp-Type Segments	16

POLE BRACKETS



Types B, BF, S and SF pole brackets, in lengths not to exceed 20 feet, are suitable for the following types of trolley coach or LRV construction:

1. All tangent.
2. All conventional curve.
3. All segment used where pole is outside of curve.
4. All segment of 12-degree angle and lower used where pole is inside of curve and where tension of trolley wire does not exceed 3000 pounds, i.e., maximum compression load does not exceed 1200 pounds. If bracket length exceeds 16 feet, safe loading is 50 pounds less for each foot of additional length.

POLE BRACKETS

Brackets employ 1½- or 2-inch steel pipe with 7/16- and ½-inch steel support rods. Each support rod is equipped with four nuts, one round washer and one beveled washer. The pole end of the rod has two inches of thread; the outer end, six inches. The pipe is held into a pole casting by the tension of the support rod and the lower support wire. Holes in the pole casting are for ½-inch lag screws, not supplied here. The lower support wire is recommended 5/16-inch regular grade steel strand. No wire or cable is supplied. Eyebolts are equipped with nuts and washers. All castings are malleable iron. All ferrous parts are hot-dip galvanized.

The Types B and S brackets use an uninsulated guide casting. Types BF and SF brackets are similar except that an insulated guide is supplied to carry the feeder cable to the feed-in point. The insulated guide uses a split porcelain spool with a ⅞-inch hole diameter. Center of pipe to center of spool: for 1½-inch pipe, 6⅜ inches; for 2-inch pipe, 7¼ inches.

To order, specify length of pipe arm. 2-inch pipe can be supplied in lengths from 10 feet to 16 feet in increments of one foot. 1½-inch pipe is normally supplied in 9- or 10-foot lengths.

Parts

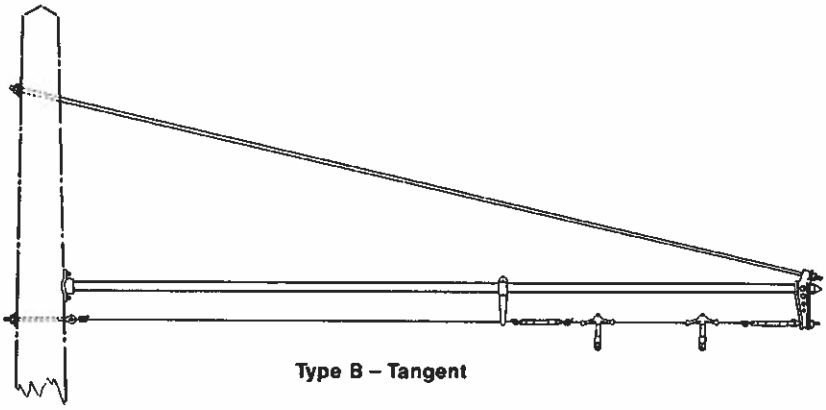
Catalog Number	Item*	Description	Net Weight Lbs. per 100
11810	A	Pole Casting for Wood Pole, 1½-Inch Arm	152
11811	A	Pole Casting for Wood Pole, 2-Inch Arm	230
20087-300X	A	Pole Clamp for Steel Pole (Size to be specified on order) 2-Inch Arm only	
20876-300X	A	Pole Clamp for Steel Pole (Size to be specified on order) 1½-Inch Arm only	
11816	B	Guide Casting Assembly, 1½-Inch Arm	160
11817	B	Guide Casting Assembly, 2-Inch Arm	180
12591	C	Insulated Guide Assembly, 1½-Inch Arm	198
12592	C	Insulated Guide Assembly, 2-Inch Arm	216
14244	D	Outer Span Holder for Eyebolt, 1½-Inch Arm	188
14245	D	Outer Span Holder for Eyebolt, 2-Inch Arm	240
11821	D	Outer Span Holder for Strand, 1½-Inch Arm	230
11822	D	Outer Span Holder for Strand, 2-Inch Arm	260
11933	E	Eyebolt Assembly, ½ x 6 Inches	50
21346	F	Eyebolt Assembly for Wood Pole, ½ x 16 Inches	120
24117-300X	F	Pole Clamp for Steel Pole (Size to be specified on order)	
11823	G	7/16-Inch Support Rod Assembly for Wood Pole, 10'6" for 9-Foot Arm	580
21042	G	½-Inch Support Rod Assembly for Steel Pole, 9'5" for 9-Foot Arm	550
11824	G	7/16-Inch Support Rod Assembly for Wood Pole, 11'6" for 10-Foot Arm	640
21043	G	½-Inch Support Rod Assembly for Steel Pole, 10'6" for 10-Foot Arm	600
21344	G	½-Inch Support Rod Assembly for Wood Pole, 13'8" for 12-Foot Arm	950
21044	G	½-Inch Support Rod Assembly for Steel Pole, 12'6" for 12-Foot Arm	700
21341	G	½-Inch Support Rod Assembly for Wood Pole, 14'8" for 13-Foot Arm	1030
21045	G	½-Inch Support Rod Assembly for Steel Pole, 13'7" for 13-Foot Arm	750
21343	G	½-Inch Support Rod Assembly for Wood Pole, 15'8" for 14-Foot Arm	1100
21046	G	½-Inch Support Rod Assembly for Steel Pole, 14'7" for 14-Foot Arm	800
21342	G	½-Inch Support Rod Assembly for Wood Pole, 16'9" for 15-Foot Arm	1160
21047	G	½-Inch Support Rod Assembly for Steel Pole, 15'8" for 15-Foot Arm	850
21345	G	½-Inch Support Rod Assembly for Wood Pole, 17'9" for 16-Foot Arm	1230
21048	G	½-Inch Support Rod Assembly for Steel Pole, 16'8" for 16-Foot Arm	900

*Refer to page 38.

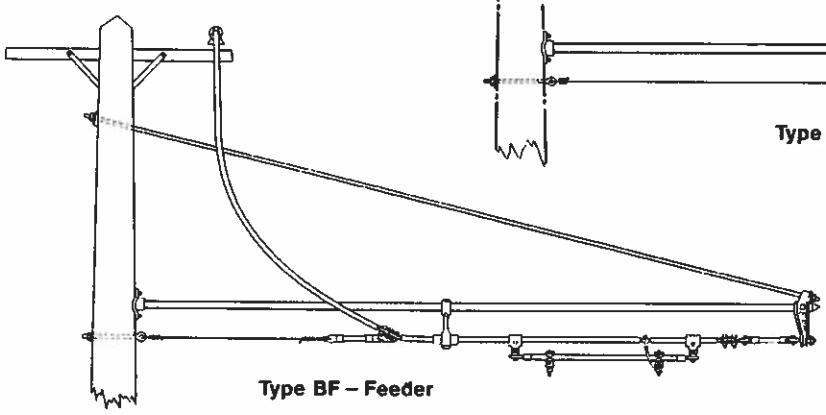
POLE BRACKETS

Pole brackets are used extensively in trolley coach overhead construction. Principal application is to one-way revenue loops and to exceptionally wide streets. The number of applications has increased with use and standard brackets are now available for tangent, feeder and both conventional and segment curve construction.

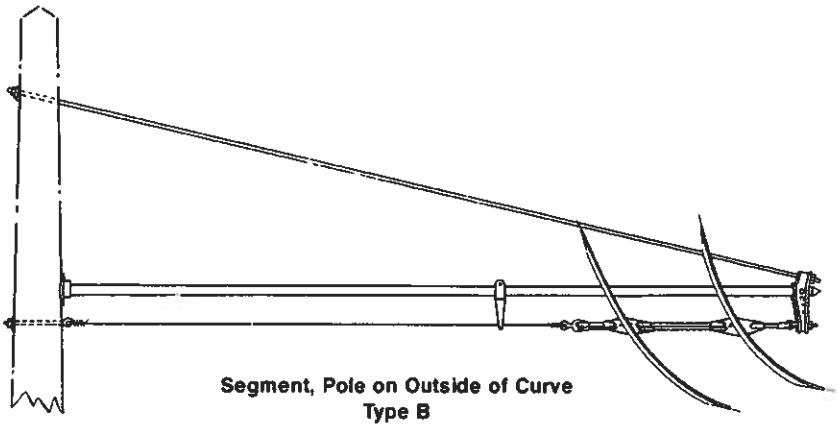
For appearance, and for reduction in weight and cost, the spacing of trolley wires from the curb in bracket construction is usually less than in span construction. The majority of installations employ 14-foot brackets which spaces the positive wire approximately 11 feet from the curb. In most cases, this spacing is feasible because brackets are generally used in districts away from traffic congestion.



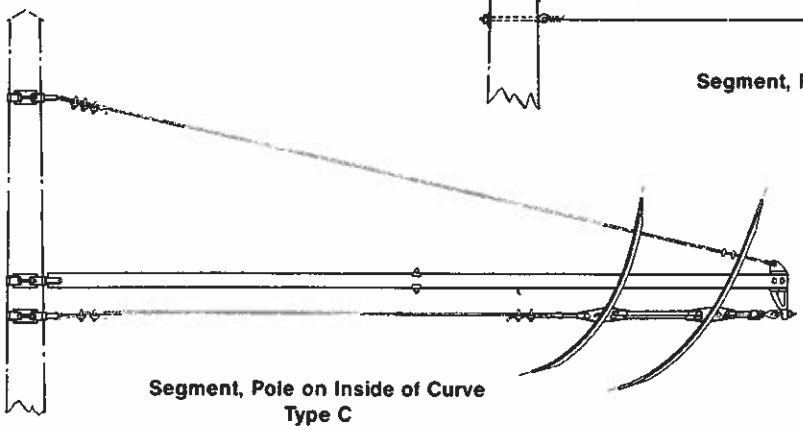
Type B – Tangent



Type BF – Feeder

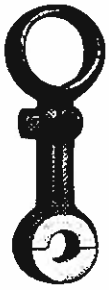


Segment, Pole on Outside of Curve
Type B



Segment, Pole on Inside of Curve
Type C

FEED-IN INSULATORS



For Pole Brackets – Long Spacing

For use on Type B pole bracket as insulated guide casting where feeder wire is carried through in place of ordinary strand.

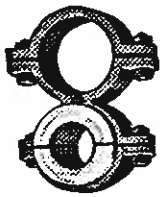
Malleable iron castings are same length as bracket castings so that tap is carried across in a straight horizontal line. Metal parts are hot-dip galvanized.

Only one bolt is used to hold the two castings together. Installed easily and quickly.

Insulation is split porcelain spool with hole ⅞-inch diameter.

Distance center pipe to center porcelain spool No. 12591, 6⅜ inches; No. 12592, 7¼ inches.

Catalog Number	Description	Net Weight Lbs. per 100
12591	For 1½-Inch Pipe	198
12592	For 2-Inch Pipe	216



For Pole Brackets – Short Spacing

Is shorter than the insulator listed above and carries feeder wire separately along pole bracket arm. Insulation is porcelain with an opening ⅞-inch in diameter. Metal parts are hot-dip galvanized.

Distance center pipe to center spool: No. 4462, 2¼ inches; No. 4463, 2½ inches.

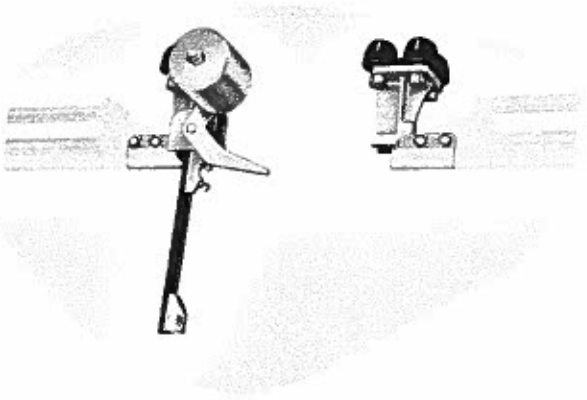
Catalog Number	Description	Net Weight Lbs. per 100
4462	For 1½-Inch Pipe	176
4463	For 2-Inch Pipe	185

FEED-IN HANGER

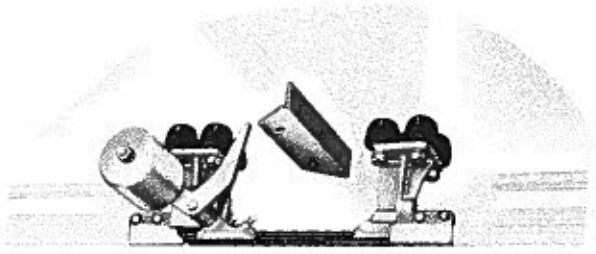
This hanger will take wire up to 9/16-inch diameter. Lower face is 1⅜-inch diameter providing good contact with ear. Galvanized machine bolt, ⅝ x 1¾ inches. A ⅝-inch lockwasher is provided.

Catalog Number	Description	Net Weight Lbs. per 100
3197	Syracuse Feed-In Hanger, Bronze	85

DOOR ENTRANCE TROLLEY BRIDGE



Bridge open



Bridge closed

This device bridges the gap in the trolley wire necessary for the opening and closing of rolling or sectional overhead doors. Applicable to all forms of electric transit operation employing overhead trolley wires.

Clevis ends are provided on support members for the attachment of No-Bo insulators Number 55025-3001 on page 44. Clevis end tips for anchoring the trolley wire to these insulators are listed on page 17. No-Bo insulators and anchor tips are not a part of this listing and must be ordered separately.

Inside the barn the movable runner, counter weight and trip lever are rigidly assembled to a shaft which rotates on needle bearings. Closing of door forces the runner into the open position. A trip plate, which fastens to the bottom of the door, trips lever as the door opens, returning runner to closed position. Underrun alignment is obtained by a wedge-shaped casting on the free end of the movable runner which centers in an opening in the outer support casting. Provision is made for oiling of bearings.

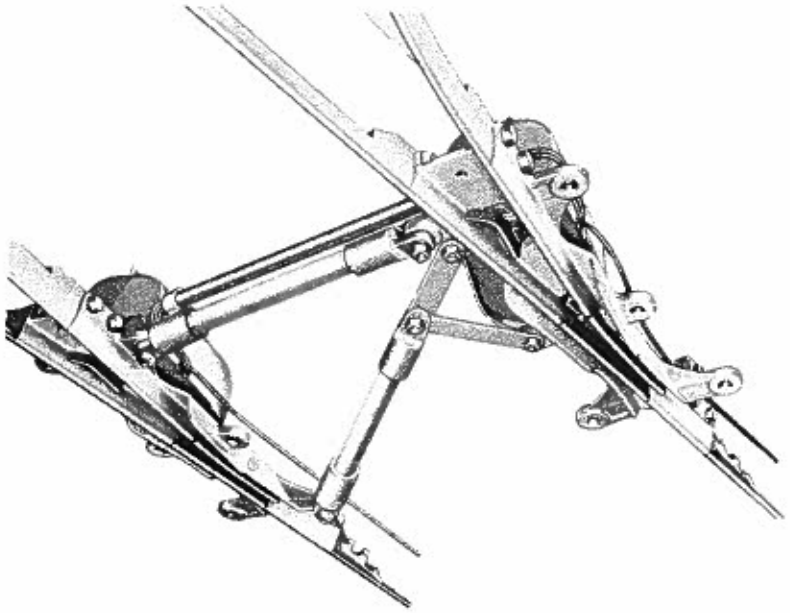
The movable runner is made from universal bar as listed on page 80. It is regularly supplied in 15⅞-inch length overall unless otherwise specified. Overall length of bridge complete is 25 inches. Height from bottom of underrun to top of insulating units is 8½ inches.

Four composition insulating units, ⅝-inch tap and stud, Number 20560, page 4, are employed for attaching each support member to the barn structure. Center spacing of these units is 2⅞ inches.

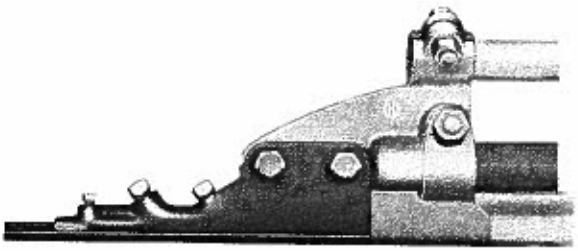
Support castings, runner end castings and trip lever are of malleable iron. Other metal parts are steel. Ferrous parts are hot-dip galvanized.

Catalog Number	Description	Net Weight Lbs. Each
→ **22460**	Door Entrance Trolley Bridge	58
24001-3002	Bearing End Assembly, without insulators or weight	23
24001-3003	Runner End Assembly, without insulators	6
24001-3004	Runner Assembly	2

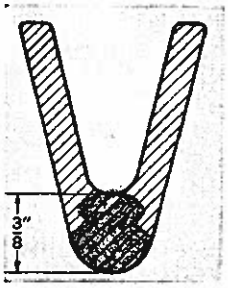
NARROW UNDERRUN SPECIAL WORK



Illustrating the smooth, level underrun of an O-B electric frog assembly. Note how the underrun forms a continuous level path for the trolley coach current collectors throughout the assembly. There are no high or uneven spots at points where trolley wires and spacers are joined to the frog pans.



Transition from wire to special work devices is accomplished by standard anchor tips. Note how the underrun of the No-Bo insulator conforms in size and shape to the trolley wire.



Cross-section of O-B special work runner superimposed on cross-section of grooved trolley wire. Note the ⅜-inch thickness of the wearing metal, and how it simulates trolley wire in size and contour.

O-B narrow underrun trolley coach overhead fittings have brought a high degree of operating efficiency to modern carbon shoe current collection. The underruns of all special work devices simulate closely the size, shape and smoothness of trolley wire. Ample side clearance is provided to fit the groove in carbon inserts.

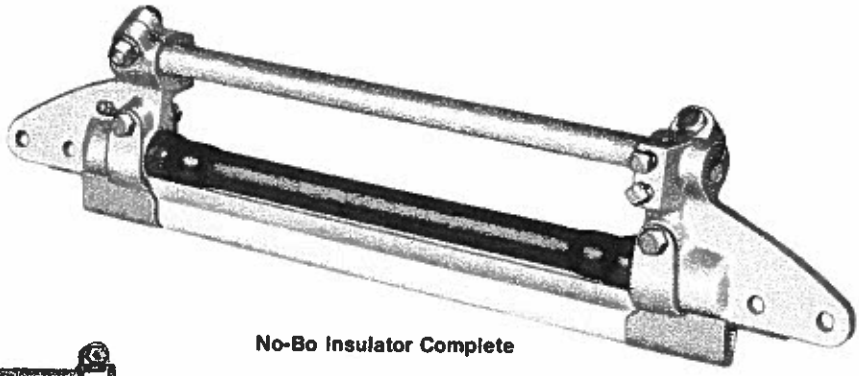
Underruns are designed to form a smooth path whenever they join in assembly. This is accomplished by two-bolt tongue and clevis connections. Anchor bolt holes are jig drilled and then checked with master gauges. And, to insure perfect alignment, each part is precision machined.

All parts necessary to make up special work assemblies are standardized so they are interchangeable with parts of other assemblies. Tongue ends are standard for all insulators and clevis ends for all frog and crossover pans.

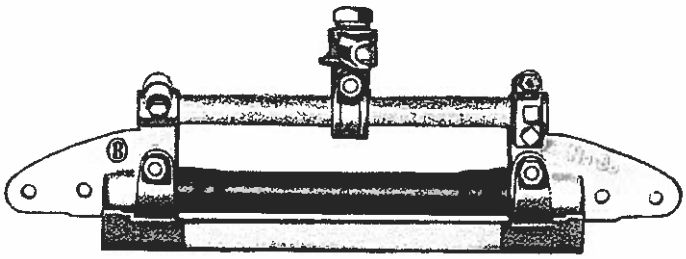
Standard tongue and clevis anchor tips butt the grooved wire flush to the underruns of all frog and crossover pans. These tips grip the wire by its upper lobe only, leaving the lower lobe free from any encircling devices. There are no high spots to encounter and a level, unbroken path for the current collector is a result.

Before shipment, the underrun of each trolley coach overhead fitting is smoothed by hand and then waxed. Moreover, all special work devices are assembled complete before partial disassembly for shipment. This is done to make sure all joining parts match perfectly and that underruns are in exact alignment.

NO-BO INSULATORS



No-Bo Insulator Complete



No-Bo Insulator with Suspension Yoke

Insulated Runner

End Clip

No-Bo insulators are ruggedly constructed and versatile in application. Under extreme tension they are strong enough to break the toughest trolley wire without affecting the insulating or mechanical qualities of the device.

The end castings develop a leverage under wire tension that puts the lower beam under tension and the upper beam under compression. Therefore, the complex opposing stresses that induce warpage in a single member are eliminated.

To insure adequate strength, both tension and compression members consist of a fiberglass rod. For arc protection, the tension beam is covered with a shrink-fit rubber tube.

The insulated runner is made of molded glass-melamine which has excellent wear and arc resistance.

Another important feature of the No-Bo is its universal application. One No-Bo is used as an insulated spacer, an insulated approach and, with the addition of a separable suspension, as a section insulator. This reduces stock requirements to a minimum.

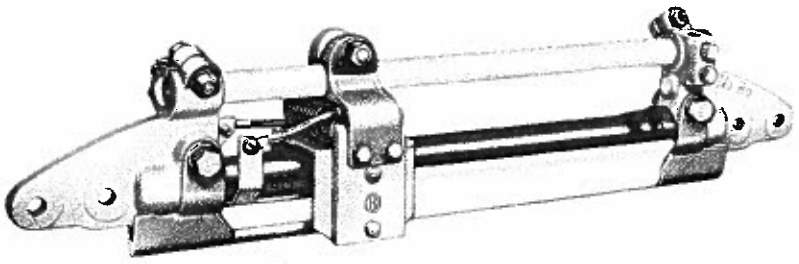
The long unit is standard for all turnout and crossover assemblies, except between adjustable crossovers above 57 degrees where restricted space requires the crossovers on page 69. The short unit can be used where reduced electrical clearances permit. A separable yoke and suspension assembly permits suspension of the No-Bo from span wires.

Contact wire is attached to the ends of the No-Bo by means of clevis tips, ordered separately from page 17. The No-Bo is also compatible with clevis ends of frogs, crossovers and live spacers.

Catalog Number	Description	Insulation Length, In.	Underrun Length, In.	Net Weight Lbs. Each
55025-3001	Long No-Bo Complete	14½	19¾	10.2
55025-3002	Long No-Bo with Suspension Yoke	14½	19¾	12.0
55025-3003	Short No-Bo Complete	10	15¼	9.6
55025-3004	Short No-Bo with Suspension Yoke	10	15¼	11.4
55025-3005	Yoke and Suspension Assembly Complete	...	...	1.8
22484	Long Insulated Runner	14½	...	1.0
17178	Short Insulated Runner	10	...	0.6
55024-4001	End Clip	...	...	0.6

TYPE B NO-BO INSULATOR
With Magnetic Arc Blowout

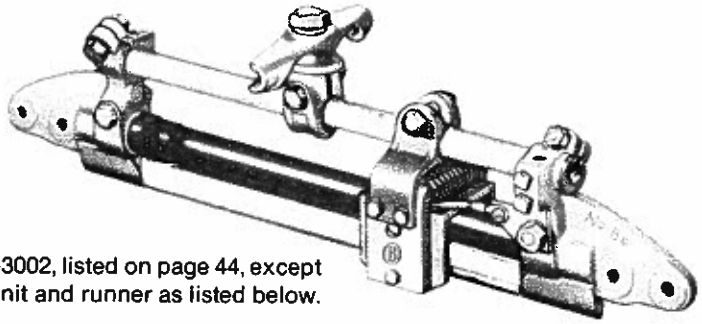
For use as Insulated Approach or Insulated Spacer



This insulator is the same as No. 55025-3001, listed on page 44, except equipped with magnetic blowout unit and runner as listed below.

Catalog Number	Description	Net Weight Lbs. Each
55030-3001	Type B No-Bo Insulator with Magnetic Arc Blowout	13.0

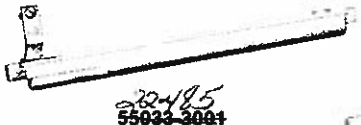
TYPE B NO-BO SECTION INSULATOR
With Magnetic Arc Blowout



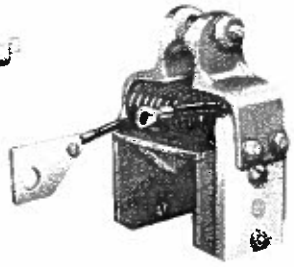
This insulator is the same as No. 55025-3002, listed on page 44, except it is equipped with magnetic blowout unit and runner as listed below.

Catalog Number	Description	Net Weight Lbs. Each
55030-3002	Type B No-Bo Section Insulator with Magnetic Arc Blowout	14.8

EQUIPPING OF INSULATORS NOW IN SERVICE



22485
~~55033-3001~~



55030-3003

Long No-Bo insulators Nos. 55025-3001 and 55025-3002 in service can be equipped with magnetic arc blowout by the addition of the blowout unit and insulated runner listed below.

Catalog Number	Description	Net Weight Lbs. Each
55030-3003	Type B Magnetic Arc Blowout Unit	3.8
~~55033-3001~~ 22485	Type B Insulated Runner, 14¼-Inch Underrun	0.72

FROGS AND CROSSOVERS

Design objectives of smooth underrun, simplicity of construction, a minimum of parts and ease of installation are successfully combined in these devices.

With the exception of the 8-degree trailing frog, the overall length of all frogs is the same regardless of type. This is an advantage in that all parts other than the frogs of special work assemblies of similar turnout angle and radius are identical, requiring a minimum of materials for maintenance.

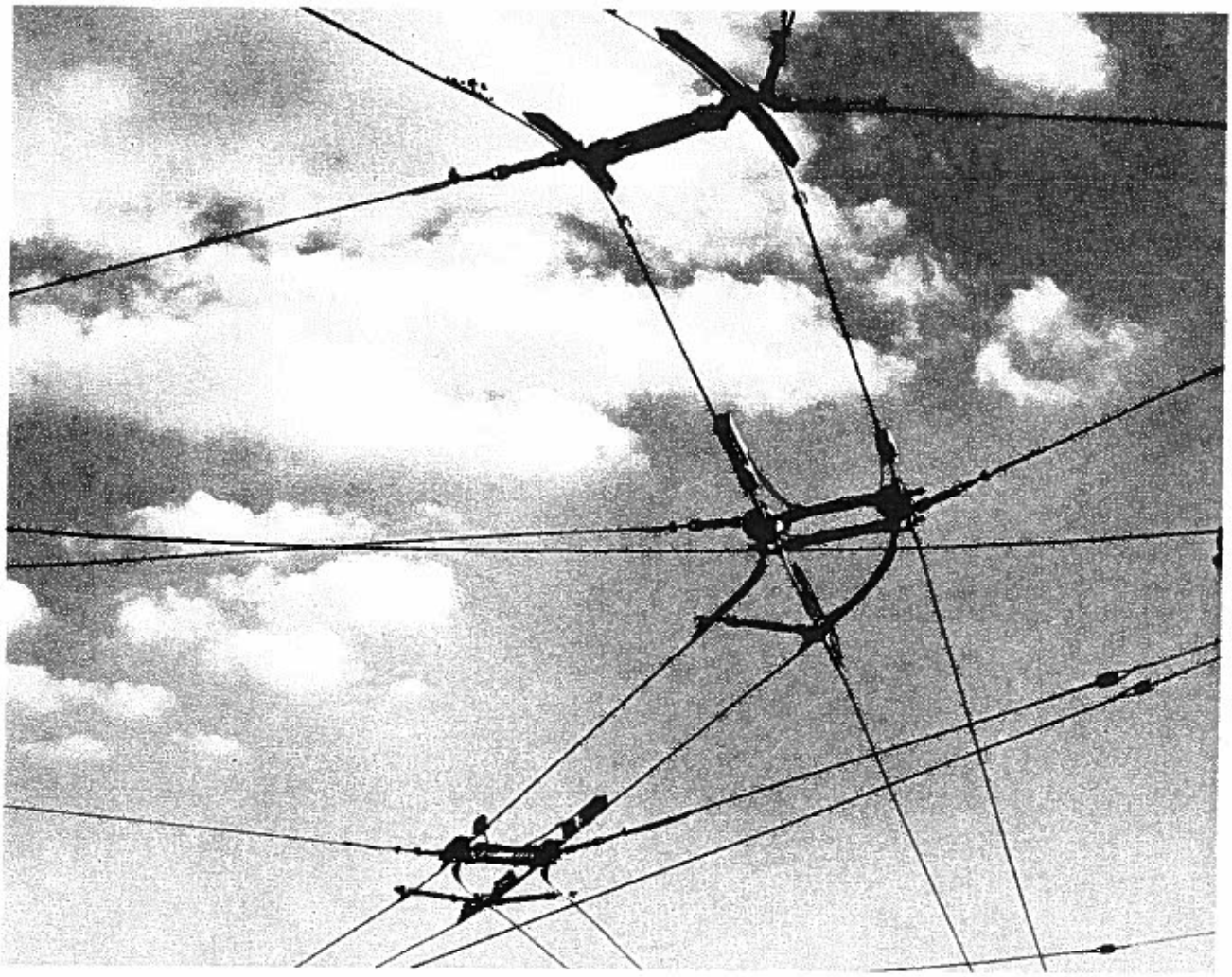
Another maintenance advantage of O-B frogs is that the same pan and runner castings serve to make up all movable runner frogs. Pan assemblies Nos. 19656 and 19657, used with mechanical reset frogs, have two oilless bushings. Assemblies Nos. 20343 and 20344, only one. All pans, however, are drilled for two bushings and are interchangeable by removing or adding a bushing.

For silent operation, movable runners of O-B frogs bear against rubber bumpers. On frog runners, a round bumper is cemented into a recess on each side of the free end.

All devices have exactly the same clevis end construction, including two bolts and lockwashers for rigid attachment to the tongues of tips, spacers or No-Bo insulators. Clevis end bolts are threaded to a depth of only ⅝ inch so the threaded portion will not bear against casting. As holes in castings are jig drilled, use of bolts with longer threading results in misalignment and an uneven underrun.

NOTE:

Where light rail vehicles (LRV) have been introduced to regular streetcar routes where frogs and crossovers are still needed, the pantograph or bow collectors will ride through some of the frogs or crossovers. Others will require special attention to assure a smooth underrun. Please advise us of any special applications so we can assure that the material we furnish you will be compatible with your current collectors.



SINGLE PAN ELECTRIC FROGS WITH MECHANICAL RESET
For LRV Trolley Coach Intersections

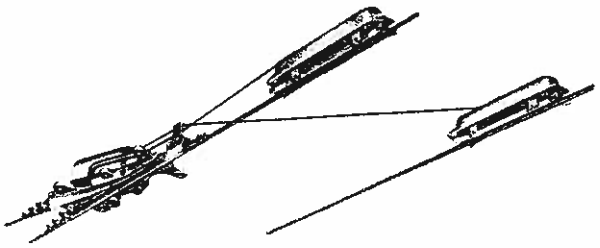
Electric frogs provide fast, smooth and positive operation with a minimum of wear on wire, collectors and fittings. They are recommended for all dual operation turnouts.

Each of the three types of frogs in the following listings is electrically operated in one direction only. Runners are reset to the other direction mechanically by a reset deflector in the same manner as described for double pan frogs Type TER-2 and Selectric-2.

For silent operation, movable runners are equipped with rubber bumpers.

TYPE VSE-2 SINGLE PAN ELECTRIC FROG
Without Anchor Tips

Operation is independent of power application. Electrical and mechanical operation, physical equipment, and arrangement of contactors are exactly the same as described for Selectric-2 frog, listed on page 52, except that the Type VSE-2 frog employs only one frog pan instead of two. Only complete frogs are listed below. See pages 53 and 54 for listing of parts.



Light rail vehicles can operate only in direction as mechanically reset.

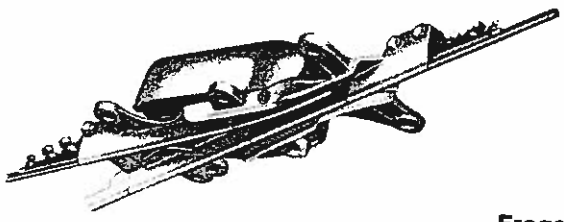
The Type VSE-2 frog is regularly supplied with two contactors in order to provide maximum protection from shock to linemen and from lightning damage to coil. On special order, it can also be supplied with only one contactor, placed in the negative wire, the other side of coil being grounded to pan. Parts are identical except for the omission of one lead wire and contactor and the addition of a ground connection.

TYPE VTER-2 SINGLE PAN ELECTRIC FROG
Without Anchor Tips

For power-on, power-off operation remote from intersection. Electrical and mechanical operation and physical equipment are exactly similar to the Type TER-2, listed on page 55, except that the Type VTER-2 frog employs only one contactor and one frog pan instead of two. Only complete frogs are listed below. See pages 56 and 57 for listing of parts.

Light rail vehicles can operate to both straight line and turnout.

TYPE VTEC-2 SINGLE PAN ELECTRIC FROG
Without Anchor Tips



For power-on, power-off operation from the contactor of an electric track switch.

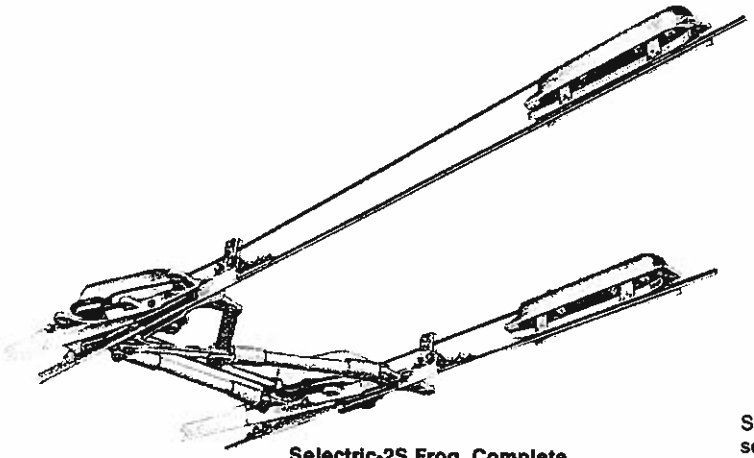
Employs same frog pans as are used in Selectric-2 frogs listed on page 52. Only complete frogs are listed below. See pages 53 and 54 for listing of parts.

Light rail vehicles can operate to both straight line and turnout.

Frogs Complete

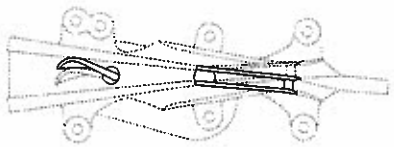
Catalog Number	Description	Net Weight Lbs. Each
19909	Type VSE-2S, R.H., reset to S.L.	41
19911	Type VSE-2S, L.H., reset to S.L.	41
19910	Type VSE-2C, R.H., reset to Curve	41
19912	Type VSE-2C, L.H., reset to Curve.	41
20270	Type VTER-2S, R.H., reset to S.L.	39
20271	Type VTER-2S, L.H., reset to S.L.	39
20272	Type VTER-2C, R.H., reset to Curve	39
20273	Type VTER-2C, L.H., reset to Curve	39
20266	Type VTEC-2S, R.H., reset to S.L.	29
20268	Type VTEC-2S, L.H., reset to S.L.	29
20267	Type VTEC-2C, R.H., reset to Curve	29
20269	Type VTEC-2C, L.H., reset to Curve	29

SELECTRIC-2 FROGS – 12 DEGREE
Electrically Operated
Without Anchor Tips – 24-Inch Wire Spacing



Selectric-2S Frog, Complete

Wire Support



Solid lines show position of runner and deflector as set electrically to straight line, and dotted lines as mechanically reset to turnout.

Although this type of frog is electrically operated, operation is independent of power application and is automatically controlled by the relative position of the collectors on the contact wires as determined by the position of the coach. It may be used only with crossovers of 23-degree, and higher, angles. Lower angle turnouts do not stagger collectors sufficiently to insure correct operation.

The Selectric-2 frog is simple in construction with attendant low cost of maintenance. Actuation is electrical in one direction only by means of one voltage coil on each frog pan wired to two contactors. As the collectors pass under the frogs in this direction, deflectors mechanically reset runners for operation in the other direction. Mechanical setting to straight line is usually preferred because of higher speeds; similar setting to curve being specified only when most coach movement is in that direction. Means are provided for holding runners in position as set electrically, or by mechanical reset. Mechanical reset position of runners cannot be changed by mechanical action of collectors.

Selectric-2 frogs with mechanical reset to straight line are designated in the following listing as Selectric-2S. Frogs with mechanical reset to curve are designated as Selectric-2C.

Selectric-2 frogs can be used in combined LRV and trolley coach operation, providing LRV operation is in mechanical reset direction only. Coaches and light rail vehicles may trail or back through this frog from either main line or curve. However, backing through from direction of electrical setting will change setting of runner to that direction.

Connector wires between pans are enclosed in a protective insulation conduit. Conduit is supported above pans by clamps attached to the end castings of the Hi*Lite strain spacer. Oilless bushings insure free movement of runners and deflectors.

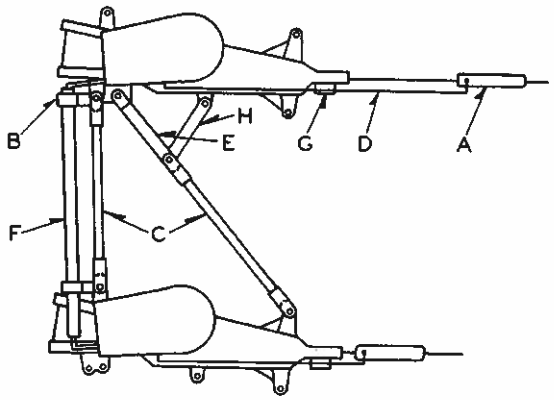
For silent operation, movable runners are equipped with rubber bumpers.

Overall length, not including contactors, 25 inches. Length from leaving end to intersection 17¾ inches. Overall length of contactors, 18 inches. All castings are malleable iron. Ferrous parts are hot-dip galvanized.

Frogs Complete

Catalog Number	Description	Net Weight Lbs. Each
19779	Selectric-2S Frog Assembly R.H., Reset to Straight Line, 2/0 to 4/0 Grooved	74
19780	Selectric-2S Frog Assembly L.H., Reset to Straight Line, 2/0 to 4/0 Grooved	74
19781	Selectric-2C Frog Assembly R.H., Reset to Curve, 2/0 to 4/0 Grooved	74
19782	Selectric-2C Frog Assembly L.H., Reset to Curve, 2/0 to 4/0 Grooved	74
20707	Selectric-2R Frog Assembly V, Reset to Right, 2/0 to 4/0 Grooved	74
20708	Selectric-2L Frog Assembly V, Reset to Left, 2/0 to 4/0 Grooved	74

SELECTRIC-2 FROGS – 12 DEGREE
Electrically Operated
Without Anchor Tips – 24-Inch Wire Spacing

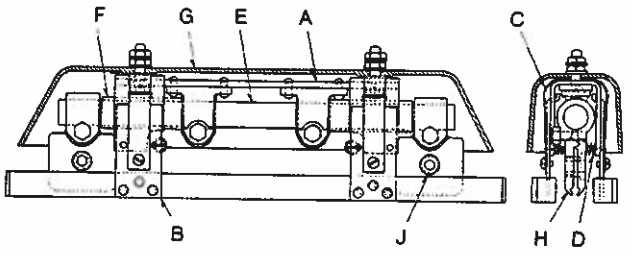


Parts

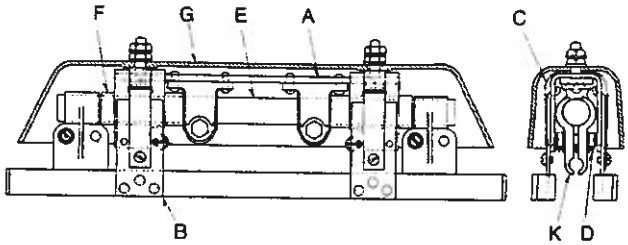
Catalog Number	Item	Description	Net Weight Lbs. Each
22549	A	Voltage Contactor, 2/0 to 4/0 Grooved	6.0
21473	B	Tube Support, Steel, with ¼ x ½-Inch Rd. Hd. Brass Mach. Screw	2.0
54960-6175	C	Hi*Lite Strain Spacers	3.0
21470	D	Set Insulated Lead Wires Complete	0.54
21028	E	Link, Steel, with 7/16 x 2-Inch Mach. Bolt, R.H. & L.H. Frogs only	1.4
21474	F	Insulator Tube for Lead Wires	0.3
18663	G	Insulated Lead Wire Support	0.3
21893	H	Guard	0.7

Note: The above listings include contactors for grooved wire only. If desired for use on universal bar, please specify on inquiry or order.

VOLTAGE CONTACTORS



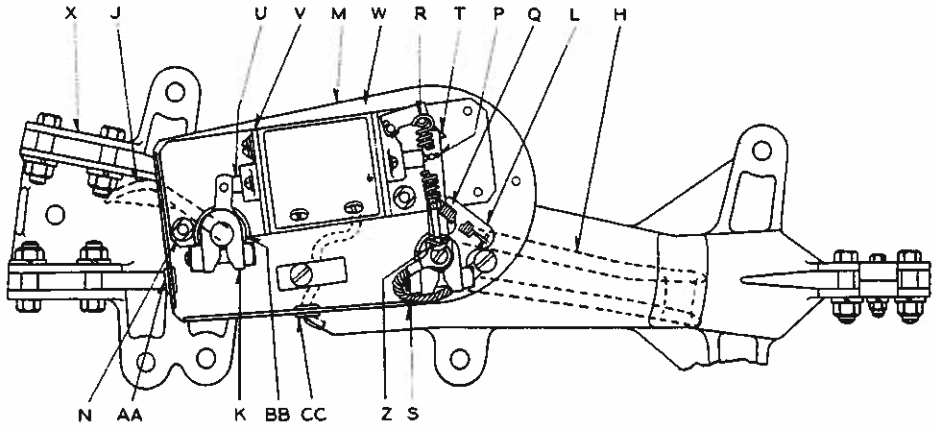
FOR GROOVED WIRE



FOR UNIVERSAL BAR

Catalog Number	Item	Description	Net Weight Lbs. Each
22549		Voltage Contactor Complete for 2/0, 3/0 and 4/0 Grooved Wire	6.5
22550		Voltage Contactor Complete for Universal Bar	6.3
		Parts	
22547	A	Bracket Complete with Terminal Screws, Steel	1.3
22398	B	Contact Bar Assembly, Steel	0.8
22400	C	Shunt, Bronze	0.04
22543	D	Coil Spring, Bronze	0.05
22548	E	Insulator Rod, ¾-Inch Dia., Phenol Canvas	0.27
21540	F	Insulator Sleeve, Fiber	0.02
22404	G	Cover, Fiberglass	1.13
22405	H	Clamp, Bronze, Complete with Screws, for Grooved Wire	0.65
19637	J	Hex-Hole Hollow Screw, 9/16-Inch Dia., Bronze	0.03
21558	K	Clamp, Bronze, Complete with Screws, for Universal Bar	0.3

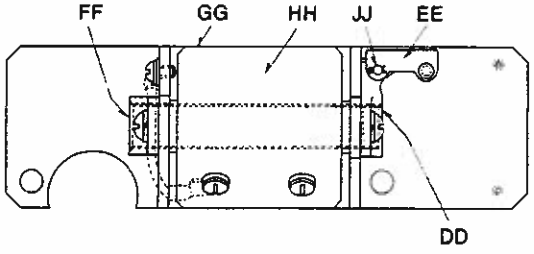
SELECTRIC-2 FROGS – 12 DEGREE
Electrically Operated
Without Anchor Tips – 24-Inch Wire Spacing



Parts

Catalog Number	Item	Description	Net Wt. Lbs. Each
19662	H	Movable Runner, Bronze, R.H. and V.	1.5
19663	H	Movable Runner, Bronze, L.H.	1.5
19664	J	Reset Deflector, Bronze, R.H. (for R.H. Frogs Reset to S.L.; L.H. Frogs, Reset to Curve; V Frogs, Reset to L.H.)	0.6
19665	J	Reset Deflector, Bronze, L.H. (for L.H. Frogs, Reset to S.L.; R.H. Frogs, Reset to Curve; V Frogs, Reset to R.H.)	0.6
21462	K	Reset Lever, Bronze, with ⅜ x 1½-Inch Mach. Bolt	0.34
21463	L	Lever Stop, Bronze, with ⅜ x 1½-Inch Mach. Bolt	0.33
22432	M	Cover Bottom, Steel	0.6
21465	N	Cover Support Stud, Steel, 9/16" Diam.	0.25
21466	P	Pin, Steel, 3/16-Inch Diam. with 1/16 x ½-Inch Cotter	0.01
16012	Q	Spring, Steel	0.02
20288	R	Spring, Bronze	0.03
21467	S	Shunt	0.07
21468	T	Lever, Bronze	0.16
19666	U	Plunger, Steel – Stainless Steel Links	0.65
19659	V	Coil Unit Complete with Coil	4.0
22430	W	Cover, Fiberglass	1.6
19656	X	Pan, R.H., M.I., with Oilless Bushings and Clevis End Bolts	15.5
19657	X	Pan, L.H., M.I., with Oilless Bushings and Clevis End Bolts	15.5
20657	X	Pan, V, M.I., with Oilless Bushings and Clevis End Bolts	15.5
21559	Z	Spring Bracket, Steel	0.03
21542	AA	Rubber Grommet	0.01
21501	BB	Oilless Bushing	0.45
21543	CC	Rubber Grommet	0.01

Coil Unit

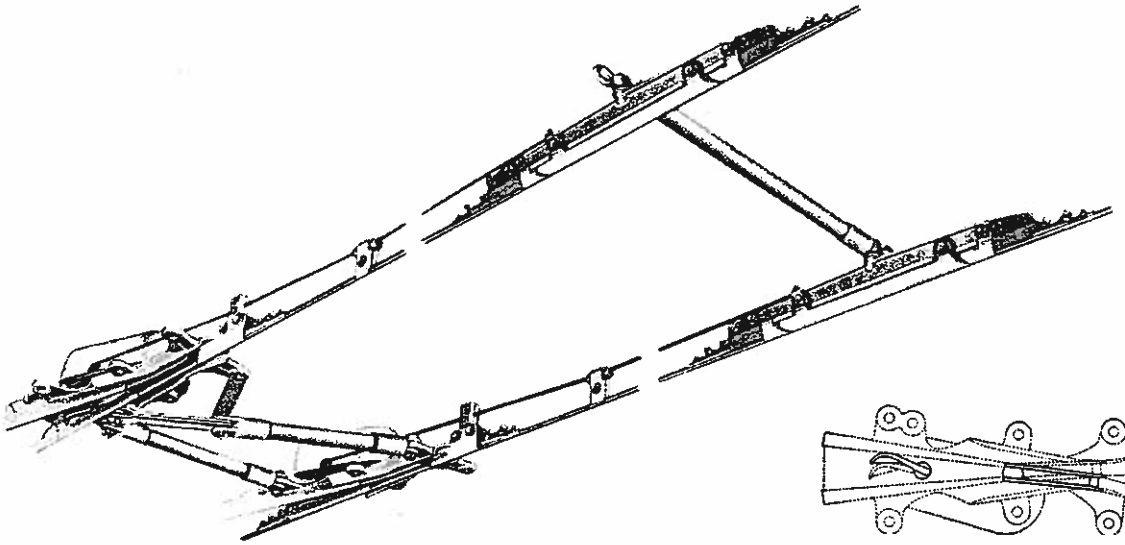


Coil Unit, No. 19659

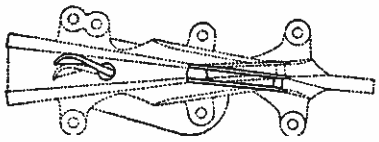
Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
21477	DD	Flange, Bronze	0.13
21475	EE	Rocker Assembly, Steel	0.05
21476	FF	Plunger Tube with Flange	0.17
21545	GG	Coil Stand Only without Coil, Steel	1.4
20359	HH	Voltage Coil	1.8
21483	JJ	Pin, 5/32-Inch Diam., Steel	0.01

TYPE TER-2 ELECTRIC FROGS – 12 DEGREE "Power-On" – "Power-Off" – Remote Control Without Anchor Tips – 24-Inch Wire Spacing



Type TER-2 Frog Installation



Solid lines show position of runner and deflector as set electrically to straight line, and dotted lines as mechanically reset to turnout.

The Type TER-2 frog is controlled by "power-on," "power-off" application and is adapted to locations where traffic conditions make it desirable to select direction of travel before reaching the intersection. Contactors may be inserted in the trolley wires as far ahead of the frogs as desired.

Runners are set by power application in one direction by one power coil and one power contactor for each polarity. As collectors pass under the frogs in this direction, deflectors mechanically reset runners for "power-off" operation in the other direction. Mechanical setting to straight line is usually preferred because of higher speeds, similar setting to curve being specified only when most coach movement is in that direction or to comply with local standards for power application.

There is no electrical connection between the frog pans of the Type TER-2 frog. Light rail vehicles operate either to straight line or curve, without disturbing setting for trolley coaches. Light rail vehicles or coaches may trail or back through from either direction.

Provision is made for holding frog runners in position as set, either electrically or by mechanical reset. Spring tension in the locking mechanism is adjusted at the factory to prevent operation by auxiliary currents up to 48 amperes. Tension may be increased to offset auxiliary currents up to 60 amperes. A separate spring holds the frog runner in mechanical reset positon. This setting cannot be changed by mechanical action of the collectors.

Oilless bushings insure free movement of runners and deflectors. Flexible copper shunts prevent arcing damage to bearing surfaces. For silent operation, movable runners are equipped with rubber bumpers.

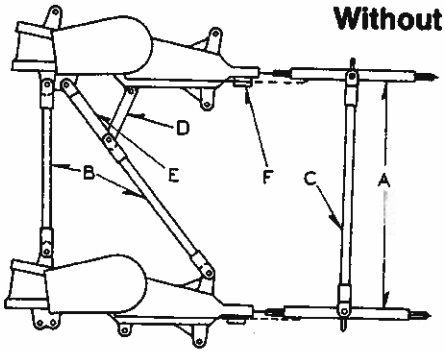
The power contactor has a tongue on each end for attachment of a clevis-end trolley wire anchor tip. The center runner is insulated from the body casting and is separated from the end clips by air gaps. Underrun length, 22 inches. A ⅝-inch boss is provided on the body casting for attachment of the insulated spacer.

Length overall of frog pans, 25 inches. Length from leaving end to intersection, 17¾ inches. All castings are malleable iron. Ferrous parts are hot-dip galvanized.

Frogs Complete

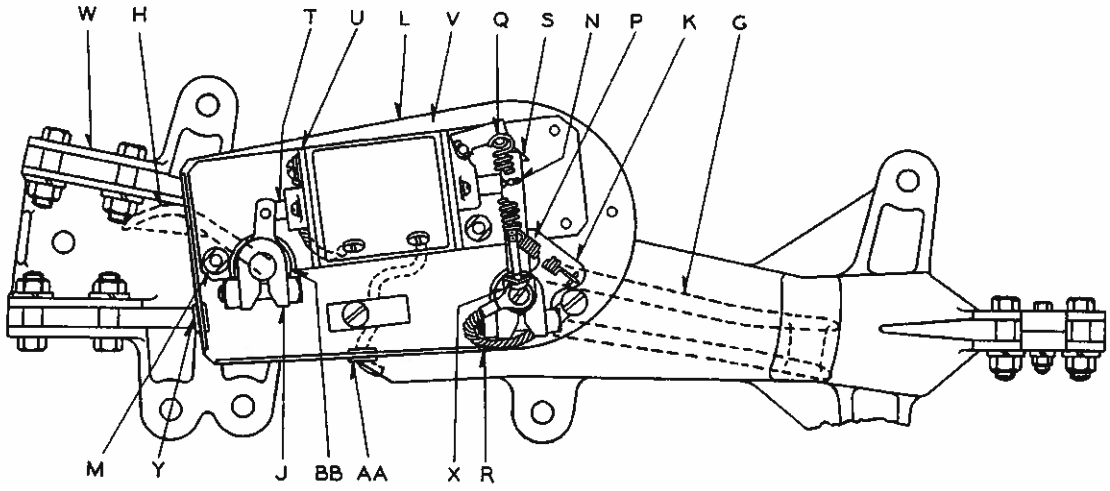
Catalog Number	Description	Net Weight Lbs. Each
19775	Type TER-2S Frog Assembly with Contactors, R.H. Power to Curve	82
19776	Type TER-2S Frog Assembly with Contactors, L.H. Power to Curve	82
19777	Type TER-2C Frog Assembly with Contactors, R.H. Power to Straight Line	82
19778	Type TER-2C Frog Assembly with Contactors, L.H. Power to Straight Line	82
20709	Type TER-2R Frog Assembly with Contactors, V Power to Right	82
20710	Type TER-2L Frog Assembly with Contactors, V Power to Left	82

TYPE TER-2 ELECTRIC FROGS – 12 DEGREE
"Power-On" – "Power-Off" – Remote Control
Without Anchor Tips – 24-Inch Wire Spacing



Parts

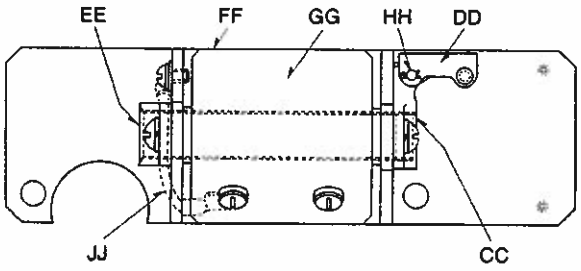
Catalog Number	Item	Description	Net Weight Lbs. Each
18481	A	Power Contactor	8.0
54960-6175	B	Hi*Lite Strain Spacer	3.0
54980-6240	C	Hi*Lite Strain Spacer	4.5
21028	E	Link, Steel, with 7/16 x 2-Inch Mach. Bolt for R.H. and L.H. Frogs Only	1.4
18663	F	Insulated Lead Wire Support	0.3
21893	D	Guard	0.7



Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
19662	G	Movable Runner, Bronze, R.H. and V	1.5
19663	G	Movable Runner, Bronze, L.H.	1.5
19664	H	Reset Deflector, Bronze, R.H. (for use on R.H. Frogs, Reset to S.L.; L.H. Frogs, Reset to Curve; V Frogs, Reset to L.H.)	0.6
19665	H	Reset Deflector, Bronze, L.H. (for use on L.H. Frogs, Reset to S.L.; R.H. Frogs, Reset to Curve; V Frogs, Reset to R.H.)	0.6
21462	J	Reset Lever, Bronze, with 3/8 x 1½-Inch Mach. Bolt	0.34
21463	K	Lever Stop, Bronze, with 3/8 x 1½-Inch Mach. Bolt	0.33
22432	L	Cover Bottom, Steel	0.6
21465	M	Cover Support Stud, 9/16-Inch Diam., Steel	0.25
21466	N	Pin, 3/16-Inch Diam., with 1/16 x ½-Inch Cotter, Steel	0.01
16012	P	Spring, Steel	0.02
20288	Q	Spring, Bronze	0.03
21467	R	Shunt	0.07
21468	S	Lever, Bronze	0.16
19666	T	Plunger, Steel, with Stainless Steel Links	0.65
19658	U	Coil Unit, Complete with Coil	4.0
22430	V	Cover, Fiberglass	1.9
19656	W	Pan, R.H., M.I., Complete with Oilless Bushings and Clevis End Bolts	15.5
19657	W	Pan, L.H., M.I., Complete with Oilless Bushings and Clevis End Bolts	15.5
20657	W	Pan, V, M.I., Complete with Oilless Bushings and Clevis End Bolts	15.5
21559	X	Spring Bracket, Steel	0.03
21542	Y	Rubber Grommet	0.01
21543	AA	Rubber Grommet	0.01
21501	BB	Oilless Bushing	0.45

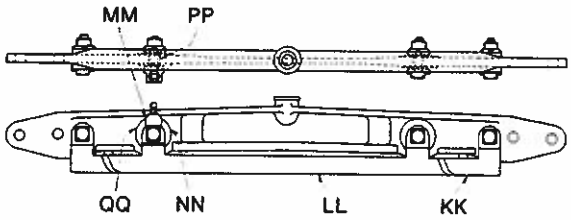
TYPE TER-2 ELECTRIC FROGS – 12 DEGREE
"Power-On" – "Power-Off" – Remote Control
Without Anchor Tips – 24-Inch Wire Spacing



Coil Unit, No. 19658

Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
21477	CC	Flange, Bronze	0.13
21475	DD	Rocker Assembly, Steel	0.05
21476	EE	Plunger Tube with Flange	0.17
21545	FF	Coil Stand Only without Coil, Steel	1.4
19660	GG	Power Coil	1.8
21483	HH	Pin, 5/32-Inch Diam., Steel	0.01
21585	JJ	Shunt	0.03

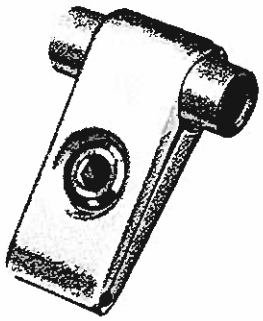


Contactor, No. 18481

Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
18482	KK	Arcing Clip, Bronze	0.4
18483	LL	Runner, M.I.	1.3
21532	MM	Terminal, Bronze, with Set-Screw	0.1
21535	NN	Insulator Washer, 19/16-Inch O.D., 1/32-Inch Thick	0.01
21534	PP	Insulator Bushing, 5/8-Inch O.D.	0.01
21533	QQ	Insulator Washer, 1 1/16-Inch O.D., 1/8-Inch Thick	0.01

INSULATED LEAD WIRE CLAMP
For Grooved Wire Only
For use with Type TER-2 Frogs



For use in carrying lead wires above trolley wires from frogs to contactors. Attaches to upper lobe of 2/0 to 4/0 grooved wire. Phenolic paper tube insulation, ½-inch inside diameter. Malleable iron jaw castings are held together by a bronze hollow screw with hex hole.

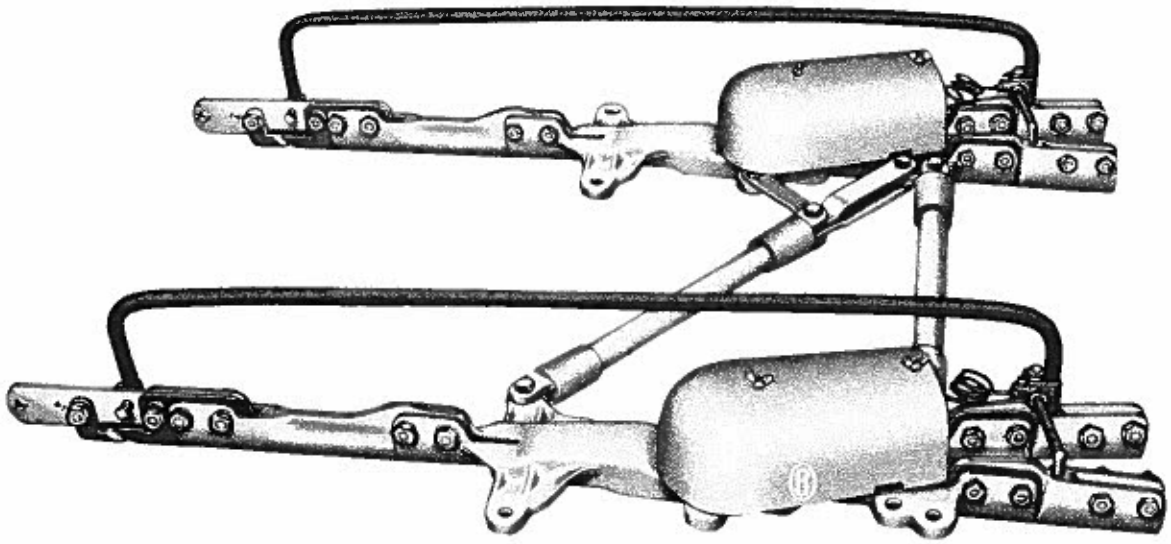
Length of trolley contact, 1¼ inches. Height, center of trolley to center of insulating tube, 2½ inches. Length of tube, 2¼ inches.

Clamps are usually spaced six feet apart.

Catalog Number	Description	Net Weight Lbs. per 100
19655	Insulated Lead Wire Clamp, 2/0 to 4/0 Grooved Wire	50

See listing of Type HSP clamps on page 15 for catalog reference on hollow screw wrench.

TYPE TE-2 ELECTRIC FROGS – 12 DEGREE
Without Anchor Tips – 24-Inch Wire Spacing



Type TE-2 electric frog provides for selective operation, either main line or turnout. No separate contactors are necessary as these are an integral part of the device. The frog pans are not connected electrically as each has its own series coil and operating mechanism. Each frog consists of two frog pans complete with mechanism, control insulators, Hi*Lite strain spacers, aluminum covers and jumpers.

The standard setting for operation of R.H. and L.H. frogs is "power-off" for straight line, "power-on" for turnout. If reverse setting is required, it should be specified on order. To reverse setting on the job, turn coil unit end for end and move position of spring stud to opposite boss, reversing direction of spring pull.

Movable runners are held in straight line "power-off" position by spring tension which is adjusted at the factory to prevent change to turnout position by auxiliary currents of 40 amperes or less. Spring tension can be increased in the field to offset auxiliary loads up to 50 amperes.

Two types of control insulators are used, one type for approach and one for leaving ends of frogs. The approach control insulator No. 18484 has a tongue on each end. The tongue of the insulated end attaches to clevis end of approach spacer. The outer tongue is for attachment to a Type TC or TCR clevis tip. As an arc is broken on this insulator, the metal clip on each side of the air gap is made renewable so that a smooth underrun can be maintained. All burning takes place on the metal clips and cannot damage the insulation. Spacers are interposed between control insulators and frogs at entering end to allow ample time for operation. As an arc is not broken at leaving ends of frog, the leaving control insulator No. 18520 does not require a renewable runner and is more simple in design. The insulated tongue end attaches to frog leg, and clevis at other end is for attachment of a Type T or TR tongue tip or of a live spacer with tongue end.

Trailing operation or backing through is possible from either main line or turnout.

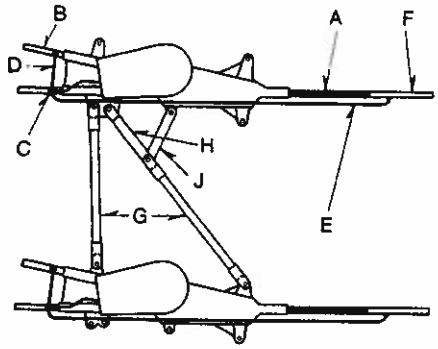
Flexible copper shunts between runner shafts and frog pans prevent arcing damage to bearing surfaces. For silent operation, movable runners are equipped with rubber bumpers.

Length overall underrun, 43 inches. Length from leaving end to intersection, 22¼ inches. All castings are malleable iron. All ferrous parts are hot-dip galvanized.

Frogs Complete

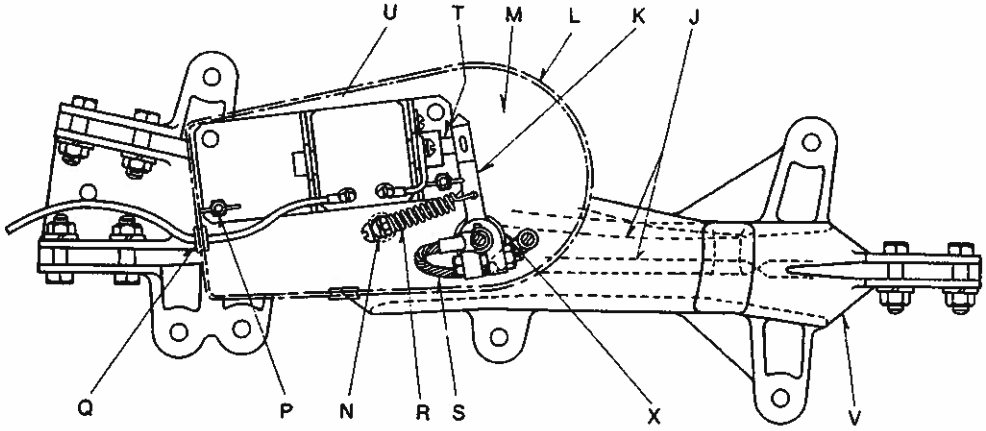
Catalog Number	Description	Net Weight Lbs. Each
20228	Right Hand, Power to Right	80
20229	Left Hand, Power to Left	80
21339	V, Power to Left	80
21340	V, Power to Right	80

TYPE TE-2 ELECTRIC FROGS – 12 DEGREE
Without Anchor Tips – 24-Inch Wire Spacing



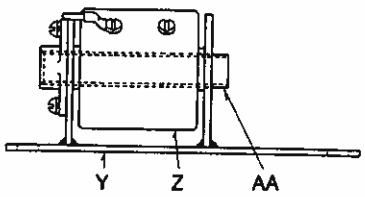
Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
17239	A	Type TC Live Spacer, M.I.	2.5
18520	B	Leaving Control Insulator, M.I.	2.0
21492	C	Jumper Terminal, Bronze, with Set-Screws	0.44
21493	D	End Jumper, Live, 3/0 Round	0.28
21494	E	Jumper, Insulated, 3/0 Round	2.25
18484	F	Approach Control Insulator, M.I.	3.0
54960-6175	G	Hi*Lite Strain Spacer	3.0
21028	H	Link, Steel, with 7/16 x 2-Inch Machine Bolt	1.4
21893	J	Guard	0.7



Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
19662	J	Movable Runner, Bronze, R.H. and V	1.5
19663	J	Movable Runner, Bronze, L.H.	1.5
21487	K	Lever, Bronze, with 3/8 x 1½-Inch Mach. Bolt	0.43
21489	L	Cover Bottom, Steel	0.57
21488	M	Cover, Aluminum	1.8
21490	N	Spring Support Stud, Steel, ½-Inch Diam.	0.11
21491	P	Cover Support Stud, Steel, ½-inch Diam.	0.24
21543	Q	Rubber Grommet	0.01
18264	R	Spring, Bronze	0.03
21467	S	Shunt	0.07
20040-3002	T	Plunger, Steel, with Stainless Steel Links	0.8
20003-3005	U	Coil Unit	2.2
20343	V	Pan, R.H., M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
20344	V	Pan, L.H., M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
20658	V	Pan, V, M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
21501	X	Oilless Bushing	0.45

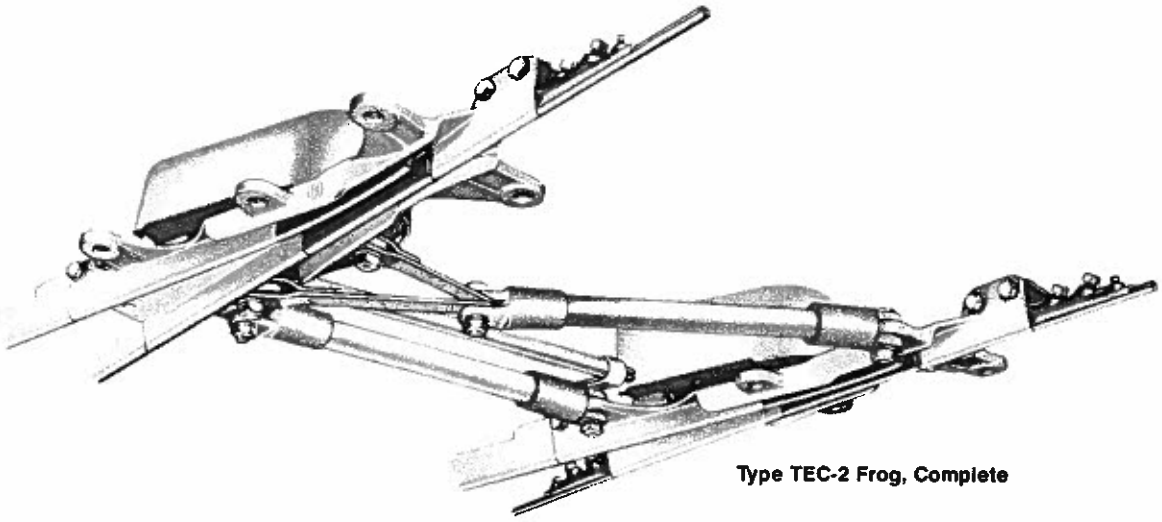


Coil Unit, No. 20003-3005

Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
20002-3002	Y	Coil Stand, Steel, without Coil	1.1
19660	Z	Coil	1.0
21476	AA	Plunger Tube with Flange, Bronze	0.18

TYPE TEC-2 ELECTRIC FROGS – 12 DEGREE
For use with Electric Track Switch Contactor
Without Anchor Tips – 24-Inch Wire Spacing



Type TEC-2 Frog, Complete

The Type TEC-2 electric frog is operated by "power-on" – "power-off" application in conjunction with an electric track switch. Each frog pan has two voltage coils, the two pans being electrically inter-connected and operated from the track switch circuit changer. Coaches or light rail vehicles may trail or back through this frog from either straight line or curve.

An insulated terminal block is provided on each pan for attachment of leads. Connecting wires between pans are colored for identification and are enclosed in a protective insulation conduit. Conduit is supported above pans by clamps attached at the ends of the Hi*Lite strain spacer.

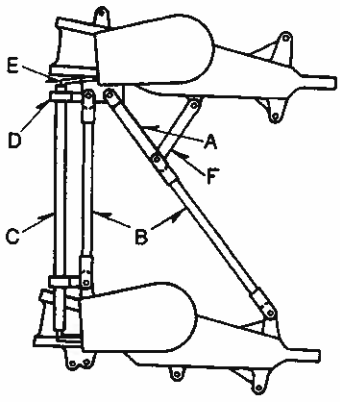
Oilless bushings insure free movement of runners. Flexible copper shunts between runner shafts and frog pans prevent arcing damage to bearing surfaces.

For silent operation, movable runners are equipped with rubber bumpers.

Length overall, 25 inches. Length from leaving end to intersection 17¾ inches. All castings are malleable iron. Ferrous parts are hot-dip galvanized.

Frogs Complete

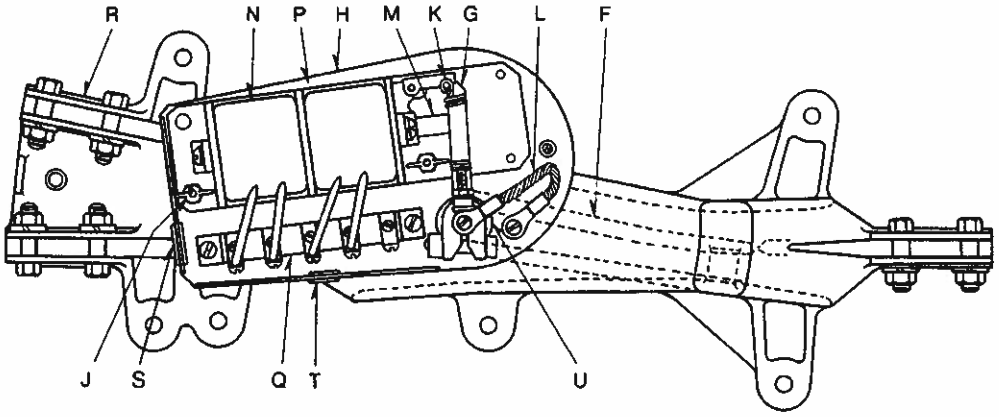
Catalog Number	Description	Net Weight Lbs. Each
19999	Frog Complete, Right Hand	58
20000	Frog Complete, Left Hand	58



Parts

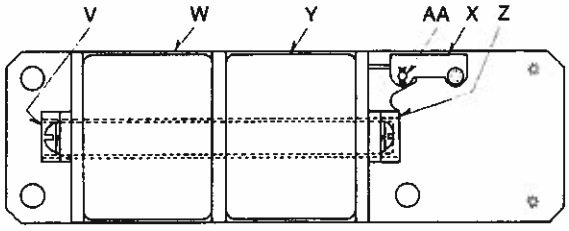
Catalog Number	Item	Description	Net Weight Lbs. Each
21028	A	Link, Steel, with 7/16 x 2-Inch Mach. Bolt	1.4
54960-6175	B	Hi*Lite Strain Spacer	3.0
21474	C	Insulator Tube for Lead Wires	0.3
21473	D	Tube Support, Steel, with ¼ x ½-Inch Mach. Screw	2.0
21484	E	Set Lead Wires, Complete	0.44
21893	F	Guard	0.7

TYPE TEC-2 ELECTRIC FROGS – 12 DEGREE
For use with Electric Track Switch Contactor
Without Anchor Tips – 24-Inch Wire Spacing



Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
19662	F	Movable Runner, Bronze, R.H.	1.5
19663	F	Movable Runner, Bronze, L.H.	1.5
21478	G	Lever, Bronze, with ⅜ x 1½-Inch Mach. Bolt	0.43
22431	H	Cover Bottom, Steel	0.54
21465	J	Cover Support Stud, 9/16-Inch Diam., Steel	0.25
18667	K	Coil Spring, Bronze	0.03
21467	L	Shunt	0.07
19016	M	Plunger, Steel, with Stainless Steel Links	0.4
20262	N	Coil Unit, Complete with Coils	5.5
22430	P	Cover, Fiberglass	2.0
22266	Q	Terminal Block Assembly	0.43
20343	R	Pan, R.H., M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
20344	R	Pan, L.H., M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
21542	S	Rubber Grommet	0.01
21543	T	Rubber Grommet	0.01
21501	U	Oilless Bushing	0.45



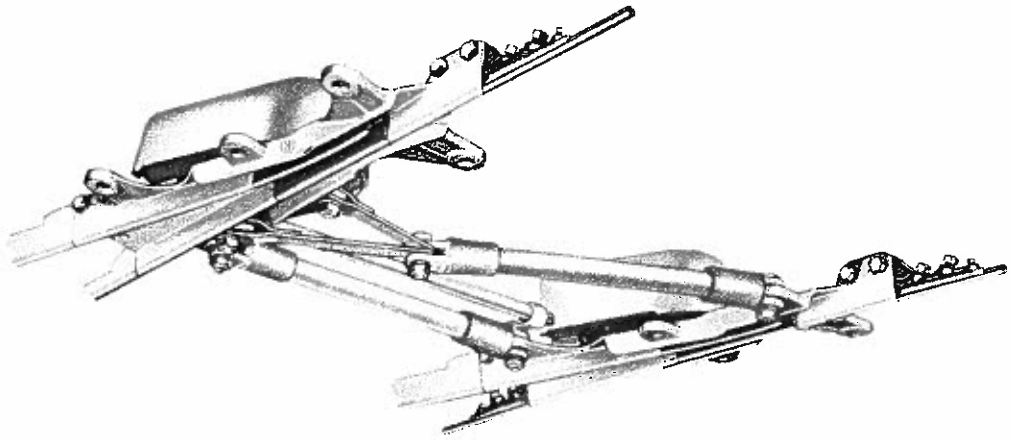
Coil Unit, No. 20262

Parts

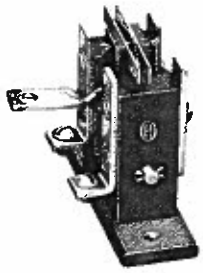
Catalog Number	Item	Description	Net Weight Lbs. Each
21486	V	Plunger Tube with Flange	0.18
21546	W	Coil Stand Only, without Coil, Steel	2.0
21475	X	Rocker Assembly, Steel	0.05
19365	Y	Coil	1.5
21482	Z	Flange, Bronze	0.2
21483	AA	Pin, 5/32-Inch Diam., Steel	0.01

Type TEC-2 frogs also available in V shape if desired.

TYPE TEP-2 ELECTRIC FROGS – 12 DEGREE
For Push-Button Control
Without Anchor Tips – 24-Inch Spacing



Type TEP-2 Frog, Complete



Type TEP-2 Light Switch

The Type TEP-2 frog is suitable for use in any push-button circuit. It is similar in all respects to the Type TEC-2 frog, listed on page 60, except that each pan is provided with a double-throw light switch, operated through mechanical connection to the runner and to the solenoid plunger.

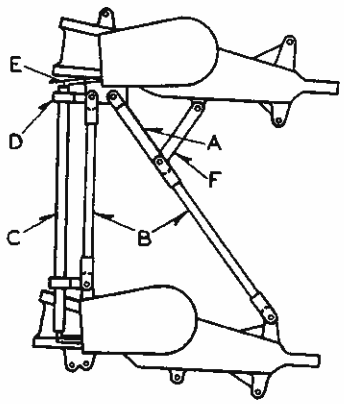
O-B supplies the frogs only for push-button operation. Control layout and panel are, however, readily available from manufacturers well equipped to provide this type of service and material.

For silent operation, movable runners are equipped with rubber bumpers.

Length overall, 25 inches. Length from leaving end to intersection, 17¾ inches. All castings are malleable iron. Ferrous parts are hot-dip galvanized.

Frogs Complete

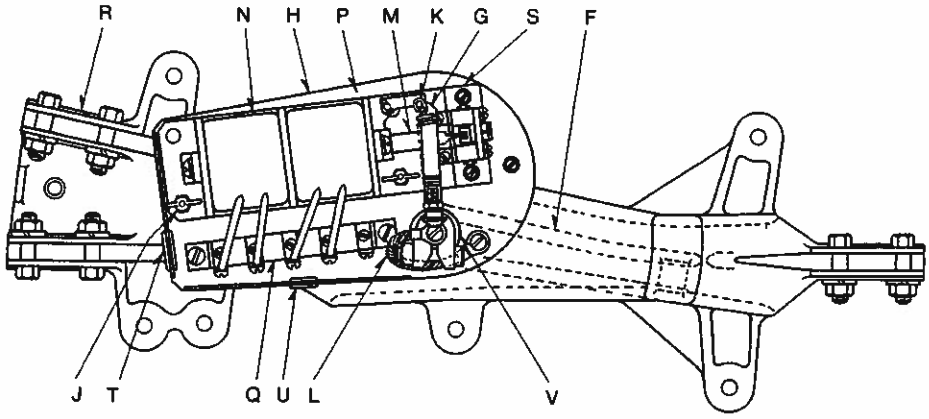
Catalog Number	Description	Net Weight Lbs. Each
20005	Frog Complete, Right Hand	60
20006	Frog Complete, Left Hand	60



Parts

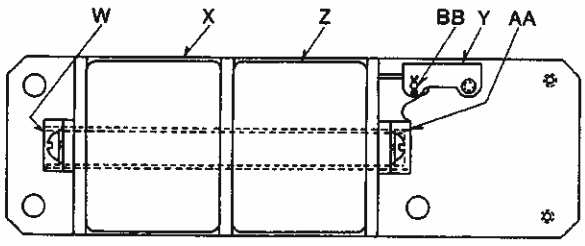
Catalog Number	Item	Description	Net Weight Lbs. Each
21028	A	Link, Steel, with 7/16 x 2-Inch Mach. Bolt	1.4
54960-6175	B	Hi*Lite Strain Spacer	3.0
21474	C	Insulator Tube for Lead Wires	0.3
21473	D	Tube Support, Steel, with ¼ x ½-Inch Mach. Screw	2.0
21484	E	Set Lead Wires, Complete	0.44
21893	F	Guard	0.7

TYPE TEP-2 ELECTRIC FROGS – 12 DEGREE
For Push-Button Control
Without Anchor Tips – 24-Inch Spacing



Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
19662	F	Movable Runner, Bronze, R.H.	1.5
19663	F	Movable Runner, Bronze, L.H.	1.5
21478	G	Lever, Bronze, with ⅜ x 1½-Inch Mach. Bolt	0.43
22431	H	Cover Bottom, Steel	0.54
21465	J	Cover Support Stud, 9/16-Inch Diam., Steel	0.25
18667	K	Coil Spring, Bronze	0.03
21467	L	Shunt	0.07
19016	M	Plunger, Steel, with Stainless Steel Links	0.4
20262	N	Coil Unit, Complete with Coils	5.5
22430	P	Cover, Fiberglass	2.0
22266	Q	Terminal Block Assembly	0.43
20343	R	Pan, R.H., M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
20344	R	Pan, L.H., M.I., Complete with Oilless Bushing and Clevis End Bolts	15.0
21894	S	Light Switch	1.0
21542	T	Rubber Grommet	0.01
21543	U	Rubber Grommet	0.01
21501	V	Oilless Bushing	0.45



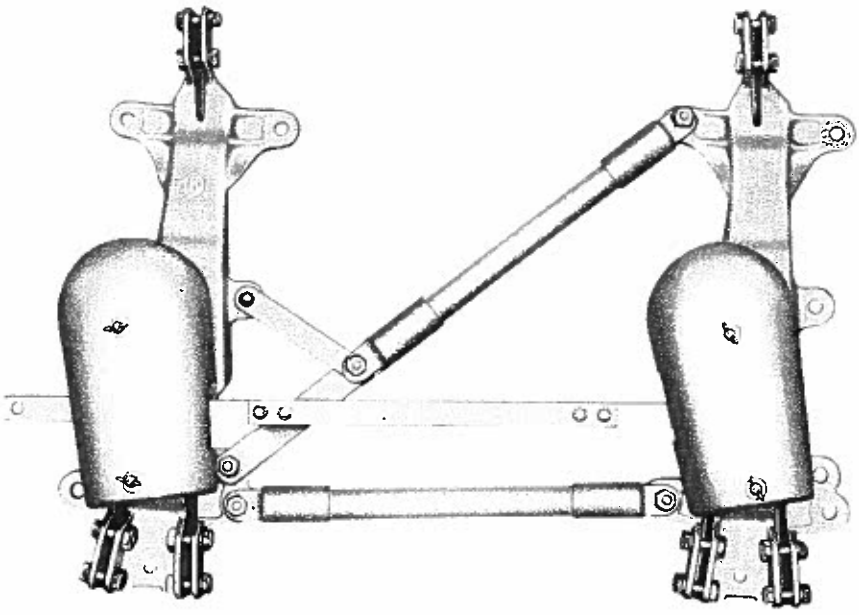
Coil Unit, No. 20262

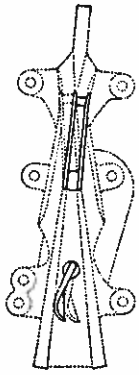
Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
21486	W	Plunger Tube with Flange	0.18
21546	X	Coil Stand Only, without Coil, Steel	2.0
21475	Y	Rocker Assembly, Steel	0.05
19365	Z	Coil	1.5
21482	AA	Flange, Bronze	0.2
21483	BB	Pin, 5/32-Inch Diam., Steel	0.01

Type TEP-2 frogs also available in V shape if desired.

TYPE TH-2 MECHANICAL RESET HAND-OPERATED FROGS
Rope Pull – 12 Degree
Without Anchor Tips – 24-Inch Wire Spacing





Solid lines show position of runner and deflector as set by rope pull to straight line, and dotted lines as mechanically reset to turnout.

For selective operation at points where direction alternates frequently between straight line and turnout, or where major coach movement is in one direction only.

Standard runner setting is for direction in which there will be the most operation. Rope pull sets runners in the other direction in which they are held by spring tension. Collectors contacting deflectors at leaving end of frog return the runners to reset positon. As no weights are necessary, rope can be hung so operator can reach it without leaving coach. Coaches may trail or back through these frogs without changing runner setting.

The frogs listed are for rope pulloff to the right. Can be supplied for rope pulloff to the left if specified on order, or direction of pull can be changed in the field by reversal of parts. For silent operation, movable runners are equipped with rubber bumpers.

Length overall, 25 inches. Length from leaving end to intersection, 17¾ inches. All ferrous parts are hot-dip galvanized.

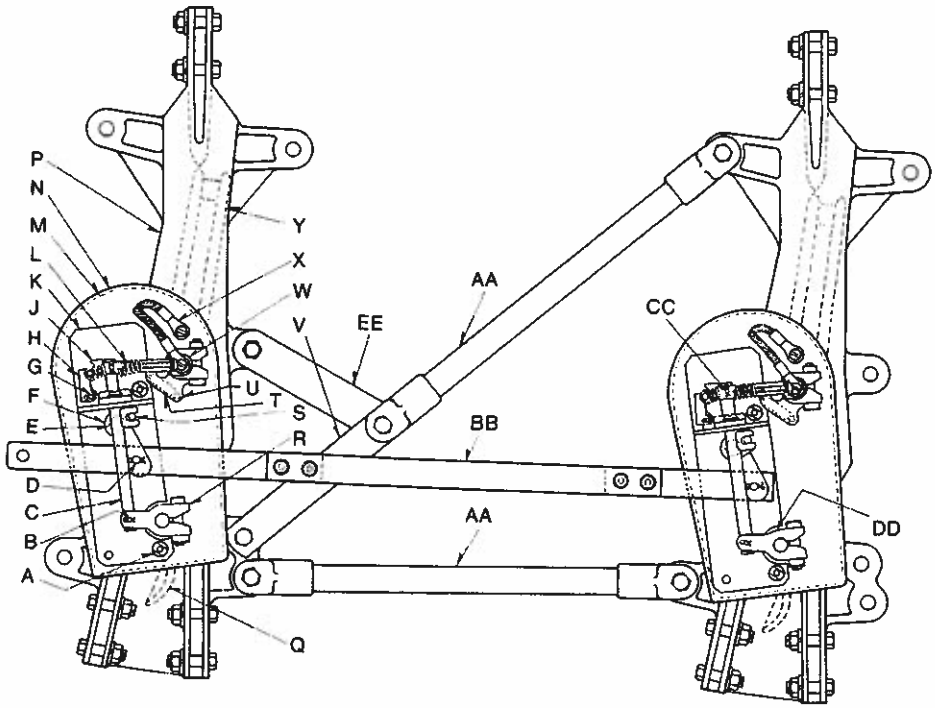
Frogs Complete

Catalog Number	Description	Net Weight Lbs. Each
21024	Type TH-2S, R.H., Rope Pull to Curve, Reset to S.L.	58
21025	Type TH-2C, R.H., Rope Pull to S.L., Reset to Curve	58
21026	Type TH-2S, L.H., Rope Pull to Curve, Reset to S.L.	58
21027	Type TH-2C, L.H., Rope Pull to S.L., Reset to Curve	58
21275	Type TH-2R, V, Rope Pull to Left, Reset to Right	58
21276	Type TH-2L, V, Rope Pull to Right, Reset to Left	58

Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
21491	A	Support, ½-Inch Diameter, Steel	0.24
21471	B	Pin, 3/16-Inch Diameter, with Cotters, Steel	0.01
21496	C	Link, Bronze	0.28
21503	D	Pin, ¼-Inch Diameter, with Cotters, Steel	0.02
21499	E	Stud, 9/16-Inch Diameter, Steel	0.11
21495	F	Lever, Bronze	0.37

TYPE TH-2 MECHANICAL RESET HAND-OPERATED FROGS
Rope Pull – 12 Degree
Without Anchor Tips – 24-Inch Wire Spacing

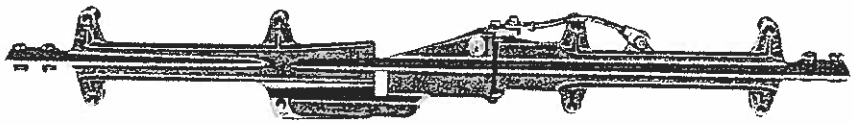


Parts (continued)

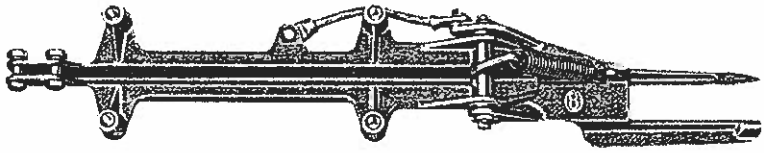
Catalog Number	Item	Description	Net Weight Lbs. Each
21483	G	Pin, 5/32-Inch Diameter, Steel	0.01
21475	H	Rocker Assembly, Steel	0.05
21468	J	Lever, Bronze	0.16
21547	K	Bracket Assembly, Steel	1.4
20288	L	Spring Assembly, Bronze	0.03
21500	M	Cover Bottom, Steel	0.46
21497	N	Cover, Fiberglass	1.75
19656	P	Pan, R.H., M.I., with Oilless Bushings and Clevis End Bolts	15.5
19657	P	Pan, L.H., M.I., with Oilless Bushings and Clevis End Bolts	15.5
20657	P	Pan, V, M.I., with Oilless Bushings and Clevis End Bolts	15.5
19664	Q	Reset Deflector, Bronze (for Use on R.H. Frogs, Reset to S.L.; L.H. Frogs, Reset to Curve; V, Reset to Left)	0.6
19665	Q	Reset Deflector, Bronze (for Use on L.H. Frogs, Reset to S.L.; R.H. Frogs, Reset to Curve; V, Reset to Right)	0.6
21462	R	Reset Lever, Bronze, with 3/8 x 1½-Inch Machine Bolt	0.34
21498	S	Pin, ¼-Inch Diameter, Steel	0.03
16012	T	Spring, Steel	0.02
21463	U	Lever Stop, Bronze, with 3/8 x 1½-Inch Machine Bolt	0.33
21028	V	Link, Steel, with 7/16 x 2-Inch Machine Bolt	1.4
21559	W	Spring Bracket, Steel	0.03
21467	X	Shunt	0.07
19662	Y	Movable Runner, Bronze, R.H. and V Reset to Right	1.5
19663	Y	Movable Runner, Bronze, L.H. and V Reset to Left	1.5
54960-6175	AA	Hi*Lite Strain Spacer	3.0
21094	BB	Connecting Rod Assembly, Hi*Lite Insulation (for R.H. Frogs, Reset to S.L. and Curve; and V Frogs, Reset to Left)	1.6
21190	BB	Connecting Rod Assembly, Hi*Lite Insulation (for L.H. Frogs, Reset to S.L. and Curve; and V Frogs, Reset to Right)	1.6
21466	CC	Pin 3/16-Inch Diameter, with Cotters, Steel	0.01
21501	DD	Oilless Bushing	0.45
21893	EE	Guard	0.7

TYPE L VERTICAL LIFT BRIDGE FROG
For Trolley Coach or LRV
Without Anchor Tips

Complete Frog Assembled in Operating Position

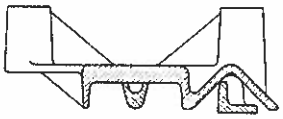


Bottom View Showing Underrun Alignment



Stationary and Intermediate Sections Only

Lift Section Only



Cross Section of Lift and Intermediate Sections in Engaged Position

Frog is made in three sections: lift, stationary and intermediate. As bridge descends, a V-shape groove of the lift section engages a guide of the intermediate section, centering the runner which is held in close contact by spring tension. Minimum overlap of runner is 1½ inches; maximum, 5½ inches. Provision has been made for slight lateral and vertical variations from center line.

Stationary and intermediate sections are assembled as a unit which must be mounted in the same plane as the lift section. Runners of both units must be in alignment with trolley wire.

Frog pans are usually mounted on wood planks, with barn hangers providing secondary insulation. The four mounting bosses on each pan are tapped ⅝ inch.

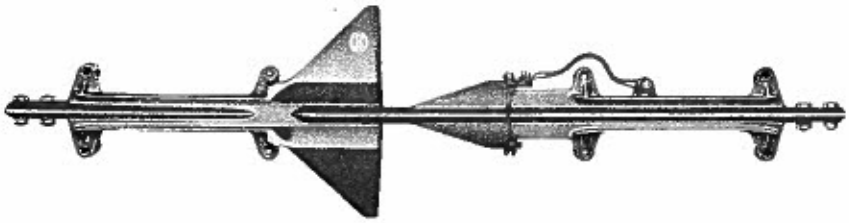
The stationary section No. 21426 includes clevis end bolts, shunt bolt, washers and adjustment screw which may be used to regulate height of intermediate section. Intermediate section No. 21428 includes shunt cap screw and washer. Lift section No. 21427 includes clevis end bolts and washers. A flexible copper shunt prevents arcing and pitting at hinged joint.

Length overall, minimum, 51¾ inches, maximum, 55¾ inches. Runner length, stationary section, 22 inches; intermediate section, 12¾ inches; lift section, 16¼ inches. Height, bottom of runner to top of boss, $2\frac{7}{16}$ inches. Castings, hinge pin and spring are of bronze. Bolts, cap-screw, washers and cotters are of steel, galvanized.

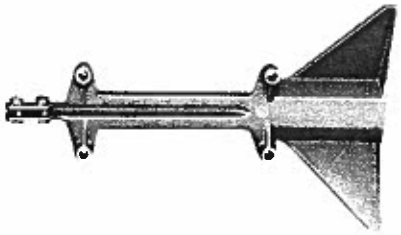
Catalog Number	Description	Net Weight Lbs. Each
21425	Type L Frog Complete	26.0
	Parts	
21426	Stationary Section Only	11.0
21427	Lift Section Only	10.0
21428	Intermediate Section Only	4.5
21429	Hinge Pin, ⅝ Inch With $\frac{3}{16}$ x 1-Inch Cotters	0.5
21430	Shunt	0.2
14708	Spring	0.3

TYPE SW SWING BRIDGE FROG
For Trolley Coach or LRV
Without Anchor Tips

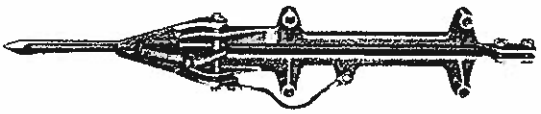
Complete Frog Assembled in Operating Position



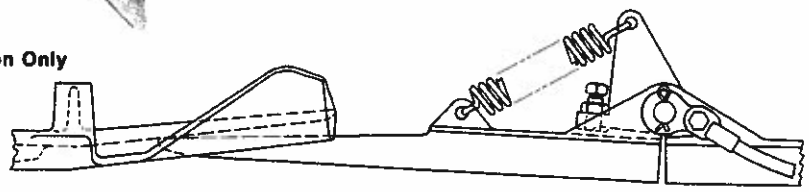
Bottom View Showing Underrun Alignment



Swing Section Only



Stationary and Intermediate Sections Only



Wing of Swing Section Deflects Intermediate Runner into Position

Frog is suitable for either swing or revolving bridge. Intermediate section is hinged with spring to stationary section. Wings on swing section deflect runner of intermediate section into place as the bridge swings into position from either side. Minimum overlap of runners is 1½ inches, maximum, 5½ inches. Provision has been made for slight lateral and vertical variations from center line.

Stationary and intermediate sections are assembled as a unit, which must be mounted in the same plane as the swing section. Runners of both units must be in alignment with trolley wire. Frog pans are usually mounted on wood planks, with barn hangers providing secondary insulation. The four mounting bosses on each pan are tapped ⅝ inch.

Length overall, minimum 53⅜ inches; maximum, 57⅜ inches. Length underrun, stationary section, 22 inches; swing, 24½ inches; intermediate, 14⅜ inches. Height from bottom of runner to top of boss, $2\frac{7}{16}$ inches. Wing spread, 14 inches.

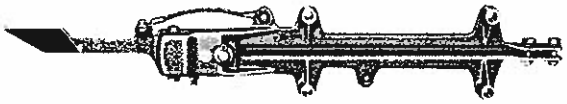
The stationary section No. 21426 includes clevis end bolts, shunt bolt and washer, and adjustment screw which can be used to regulate height of intermediate section. Swing section No. 21432 includes clevis end bolts and washers. Intermediate section No. 21433 includes shunt cap screw and washer. A flexible copper shunt prevents arcing damage to hinge pin. Castings, hinge pin and spring are of bronze. Bolts, screws, washers and cotters are of steel, galvanized.

Catalog Number	Description	Net Weight Lbs. Each
21431	Type SW Frog Complete	29.0
	Parts	
21426	Stationary Section Only	11.0
21432	Swing Section Only	12.5
21433	Intermediate Section Only	4.5
21429	Hinge Pin, ⅝ inch, with $\frac{3}{16}$ x 1-Inch Cotters	0.5
21430	Shunt Only	0.2
14708	Spring Only	0.3

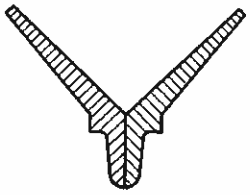
TYPE B BASCULE BRIDGE FROGS
For Trolley Coach or LRV
Without Anchor Tips

Two Units Assembled in Operating Position

Bottom View Showing Underrun Alignment



Single Unit Only No. 21434



Cross Section Showing Engagement of Movable Runners

Frog is suitable for either single or double leaf bascule bridges. Two of these frogs are required for the bridging of each trolley wire. Wing face on each movable runner guides half runner sections into engagement to form full runner section, as shown in cross-section line drawing. Compression springs hold sections in close contact.

Minimum overlap of runners is 1½ inches, maximum, 5½ inches. Maximum lateral variation from center line approximately one inch. Contour of runners permits a reasonable variation in vertical alignment.

Frogs must be mounted in same plane, usually on wood planks with barn hangers forming secondary insulation. The four mounting bosses are tapped ⅝ inch.

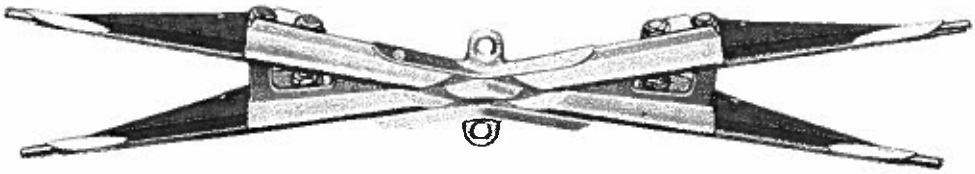
Height, bottom of runner to tops of bosses, 2 9/16 inches.

Pan section, No. 21435, includes clevis end bolts; a ⅜ x 3½-inch machine bolt with bushing and washers; compression spring; a 5/16 x 1-inch machine bolt and washer for shunt attachment; and a ⅜ x 1-inch set-screw with jam nut. Movable runner section, No. 21436, includes round washer and 3/16 x 1-inch cotter for attachment of stem to shaft of pan, and a 5/16 x ¾-inch cap-screw and washer for shunt attachment. The flexible shunt prevents arcing between castings.

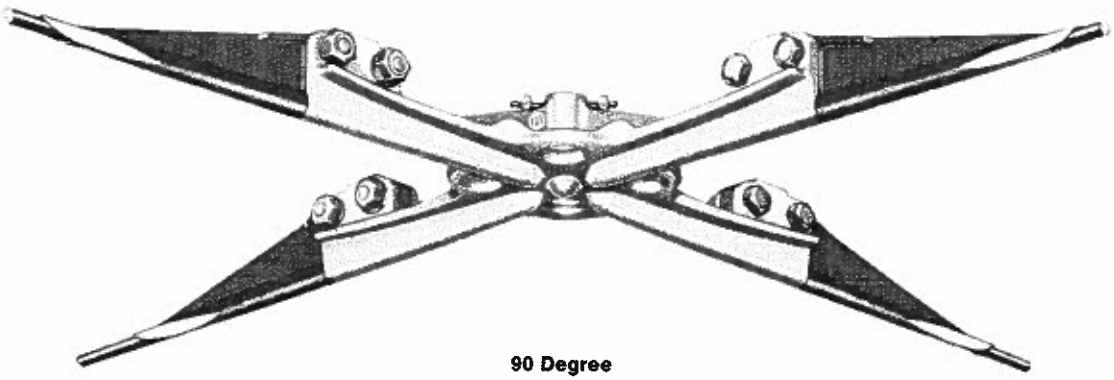
Underrun length: frog complete, 34⅝ inches; pan section, 22 inches; movable runner section, 12⅝ inches. Castings, bushings, round washers and spring are bronze. Shunt is copper. All other parts are steel, galvanized.

Catalog Number	Description	Net Weight Lbs. Each
21434	Type B Frog Complete (Single Unit Only)	15.0
	Parts	
21435	Pan Section Only	11.5
21436	Movable Runner Section Only	3.0
21437	Spring Only	0.1
21430	Shunt Only	0.2

TYPE SR LIVE RIGID CROSSOVERS
For Carbon Shoe Operation
Without Tips



23 Degree



90 Degree

The two most common crossing angles, 23 and 90 degrees, are provided for in this listing. Should rigid crossovers in other angles be required, the Type T trolley coach crossovers, as listed on page 70, may be specified.

The SR crossover can be installed at a trolley wire crossing after the wire is strung and may be replaced without disturbing the trolley wire.

Where light rail vehicles have been introduced to streetcar routes, the pantograph will ride through the 23-degree crossover. The 90-degree crossover can be used in this application only if there is sufficient bow in the pantograph to avoid snagging the crossing wire.

Castings are of malleable iron. All metal parts are hot-dip galvanized. See page 19 for listing of Type SR tips required for these crossovers.

Catalog Number	Description	Net Weight Lbs. Each
	23 Degree – Length Overall, 18 Inches	
20764	For 2/0 to 4/0 Round and Grooved Wire	9.8
	90 Degree – Length Overall, 18 Inches	
20750	For 2/0 to 4/0 Round and Grooved Wire	12.0

TYPE TA AND TYPE TAS TITE-LOCK ADJUSTABLE CROSSOVERS
Without Anchor Tips

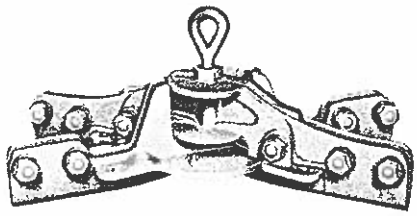
Similar in general design. Both adjustable from 40 to 90 degrees. Only essential difference is that one leg of TAS is short to provide more space for full-length No-Bo insulation between crossover pans. Pan assemblies and arcing tips which support them are renewable.

Angularity may be adjusted, and then all moving parts locked by means of a ½ x 5¼-inch eyebolt and lock nut. The eyebolt threads into a boss on the pan casting.

Collectors travel through the centers of these pans on their flanges, assuring smooth, positive operation.

All runners are 15-inches long overall, except one runner of Type TAS which is 12½-inches long. This short runner measures 7½ inches from center to one end and 5 inches to the other end, the latter being shorter to accommodate long insulation between wires. All castings are malleable iron, hot-dip galvanized.

Type TA

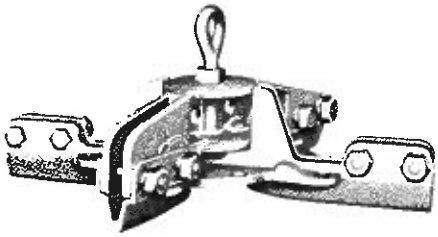


Type TA

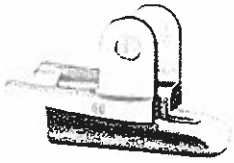
Arcing Tip

Catalog Number	Description	Net Weight Lbs. Each
16905	Type TA Live Adjustable Crossover, Complete	12.0
	Renewable Parts	
18797	Pan Assembly Complete with Bolts, Nuts and Lockwashers	5.0
18794	Arcing Tips	0.75

Type TAS



Type TAS



Arcing Tip for Long Leg

Arcing Tip for Short Leg

Catalog Number	Description	Net Weight Lbs. Each
18169	Type TAS Live Adjustable Crossover, Complete	13.25
	Renewable Parts	
18797	Pan Assembly Complete with Bolts, Nuts and Lockwashers	5.0
18794	Arcing Tip for Long Leg	0.75
18795	Arcing Tip for Short Leg	0.90

TYPE E LIVE ADJUSTABLE CROSSOVERS
For Wheel Operation
Without Tips

Pan and cross runner castings interlock and are held together without the use of screws or bolts. Deflector bars, to prevent trapping of dewired trolley, are used only for angles from 30 to 60 degrees.

It is not necessary to cut wires to install; simply lay wires in place, insert compression ring at center and attach renewable tips.

All castings are of malleable iron, hot-dip galvanized. Height overall, 3⅛ inches. Length overall, 18½ inches.

For 2/0 to 4/0 round and grooved wire. See page 19 for listing of cam tips required for these crossovers.

Catalog Number	Description	Net Weight Lbs. Each
21662	Type E Live Adjustable Crossover with Deflector Bars	11.0
21664	Type E Live Adjustable Crossover without Deflector Bars	10.0

TYPE SR LIVE ADJUSTABLE CROSSOVERS
For Carbon Shoe Operation
Without Tips

With Deflector Bars

Without Deflector Bars

Crossovers are adjustable from 30 to 90 degrees. Deflector bars provide protection against trapping of dewired trolley on crossing angles between 30 and 60 degrees. For crossing angles above 60 degrees, the deflector bars are omitted.

All castings are of malleable iron. All metal parts are hot-dip galvanized. Overall length, 18¾ inches.

For 2/0 to 4/0 round and grooved wire.

See page 19 for listing of Type SR tips required for these devices.

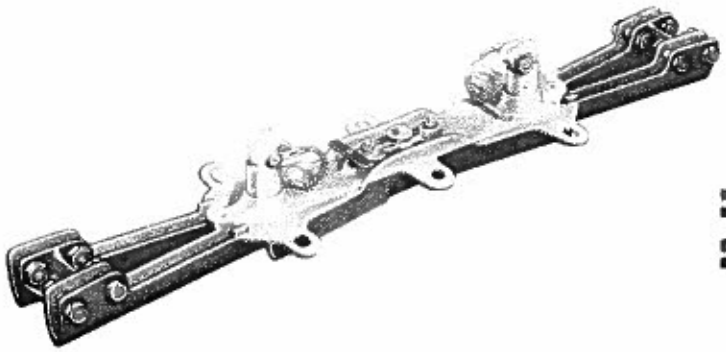
Catalog Number	Description	Net Weight Lbs. Each
20753	Type SR Live Adjustable Crossover with Deflector Bars	13.8
20754	Type SR Live Adjustable Crossover without Deflector Bars	12.9
	Parts	
20807	Pan Only, with Clevis Bolts	6.5
20358	Deflector Sets (Two Castings and One Bolt)	0.45

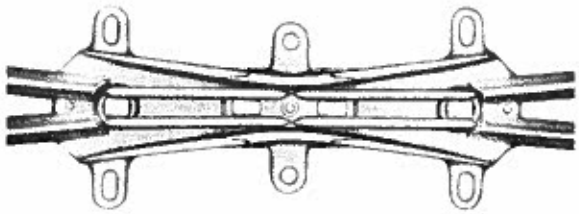
TYPE SM MECHANICAL CROSSOVERS
For Carbon Shoe, Wheel, LRV Pantograph
Without Anchor Tips

Type SM crossovers provide a separate underrun for each direction of operation so that heavier travel in one direction will not impair the smoothness of operation in the other direction. A continuous underrun assures positive guidance on the groove of the collector in each direction of travel. The crossovers are suitable for operation by either shoe or wheel collectors of standard width.

Double tongue runners are pivotally mounted at each end of crossover and linked together at their inner ends. They are normally held in neutral position by spring tension to reduce the amount of movement. Runner tongues are aligned for the direction of travel desired by collector pressure against the flange of the crossover.

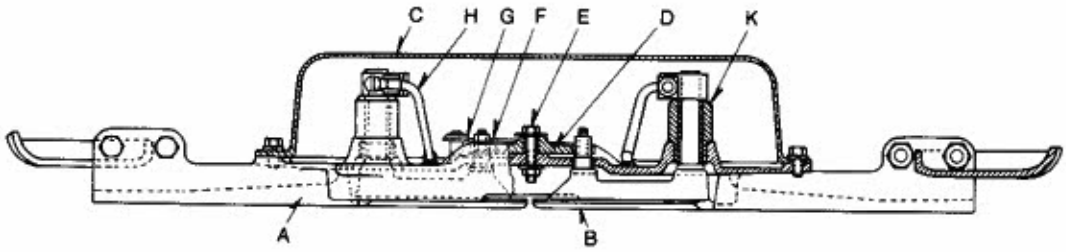
Pan castings are malleable iron, hot dip galvanized. Movable runners are bronze castings. Length overall of pans: 10 degree, 33 inches; 15 degree, 28 inches.





Crossovers Complete

Catalog Number	Description	Net Weight Lbs. Each
22441	Type SM Crossover, 10 degree	23.0
22442	Type SM Crossover, 15 degree	22.5



Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
22443	A	Pan, M.I., 10 degree, Complete with Oilless Bushings and Clevis End Bolts	18.5
22444	A	Pan, M.I., 15 degree, Complete with Oilless Bushings and Clevis End Bolts	18.0
22445	B	Runner, Bronze, 10 degree, Complete with Roller and Cotter	1.1
22446	B	Runner, Bronze, 15 degree, Complete with Roller and Cotter	1.0
22447	C	Cover, Fiberglass	2.2
22448	D	Link, Bronze	0.18
22449	E	Pivot Bolt, with Bushing, Nut and Washers, Steel	0.1
22450	F	Spring, Stainless Steel	0.02
22451	G	Spring Guard, Steel	0.03
21467	H	Shunt, Copper	0.07
21501	K	Oilless Bushing	0.45

TYPE CH INSULATED ADJUSTABLE SPACERS
For Use Between Rigid Crossovers
24-Inch Wire Spacing

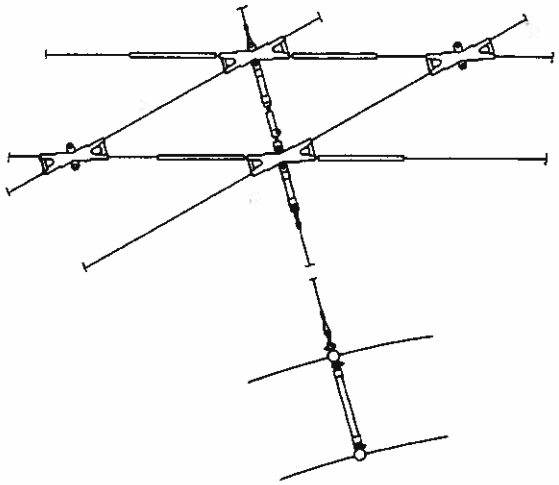
Useful as a rigid connection between crossovers in order to preserve the desired spacing between crossover pans when it is found necessary to pull the assembly into alignment or to carry curve pulloff through the crossover assembly to the pole. Cannot be used between pan castings of adjustable crossover.

Only two lengths are necessary, one for 70- to 90-degree crossovers and one for crossovers from 10 to 65 degrees. Each spacer has four-inch adjustment.

The Type CH spacer consists of a Hi*Lite strain insulator with clevis and threaded boss; a threaded stud pinned to boss with a cotter to prevent loosening in service; a turnbuckle casting with split end and bolt provision for tightening after adjustment; and a clevis stud, threaded full length.

Spacing of crossovers may be adjusted without disturbing clevis attachment.

Hi*Lite insulation is painted gray. Length of clear insulation: No. 54964-6111, 5 inches; No. 54964-6195, 13⅜ inches. Clevis of Hi*Lite strain has 9/16-inch opening and is equipped with a ½-inch round-head rivet and cotter. Clevis of stud has ¾-inch opening and is supplied with a 7/16 x 2-inch round-head rivet and cotter.

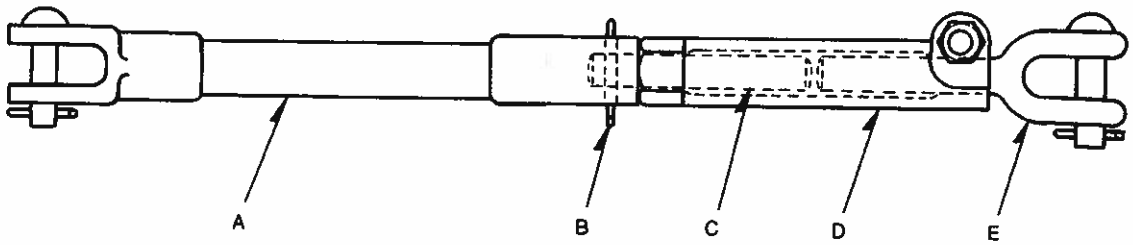


Length clevis pin centers No. 54982-3001, closed, 19⅛ inches; open, 23⅛ inches. Length clevis pin centers No. 54982-3002, closed, 27⅝ inches; open, 31⅝ inches.

All castings are malleable iron. Ferrous parts are hot-dip galvanized.

Spacers Complete

Catalog Number	Description	Net Weight Lbs. Each
54982-3001	For 10- to 65-Degree Crossovers	4.5
54982-3002	For 70- to 90-Degree Crossovers	5.0



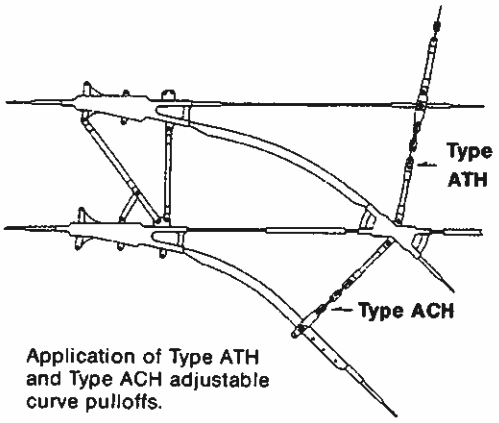
Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
54964-6111	A	Hi*Lite Strain Unit Only for 10 to 65 Degrees	2.25
54964-6166	A	Hi*Lite Strain Unit Only for 70 to 90 Degrees	2.45
	B	Cotter, Steel, ⅛ x 1½ Inches	0.01
21602	C	Stud, Steel, ⅝ x 3¾ Inches, for 10 to 65 Degrees	0.32
21603	C	Stud, Steel, ⅝ x 5½ Inches, for 70 to 90 Degrees	0.5
21601	D	Turnbuckle, M.I., with 7/16 x 1½ Inch Mach. Bolt, Threaded ⅝ Inch	1.1
21600	E	Clevis Stud, Steel Forging, ⅝ x 4⅝ Inch, Threaded 2 15/16 Inches	0.8

ADJUSTABLE CURVE PULLOFFS
24-Inch Wire Spacing

Type ATH Trolley Wire Pulloff

Type ACH Angle Iron Pulloff



Application of Type ATH and Type ACH adjustable curve pulloffs.

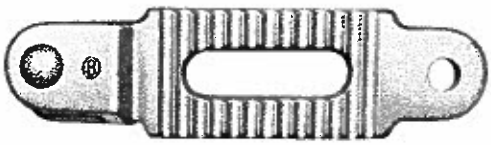
One or both types of pulloff are employed in the installation of all frog and crossover assemblies, but are standard equipment only on assemblies of angles from 23 to 45 degrees which use angle iron units. For other turnout assemblies, the Type ATH pulloff only is required and must be ordered separately.

Adjustment for length of pulloffs is obtained by varying chain length and by means of a bolt slot in the pulloff casting. (This slot permits adjustment equivalent to one chain link in steps of ⅛ inch.) Pulloff and clamp castings are serrated to prevent slippage under impact. Pulloff casting has $^{9}/_{16}$-inch clevis opening, $^{15}/_{32}$-inch eye.

Type ATH pulloffs are equipped with a ⅝-inch machine bolt and lockwasher for attachment to ear or clamp. The Type ACH pulloff has a ½-inch carriage bolt and lockwasher for attaching to angle iron unit.

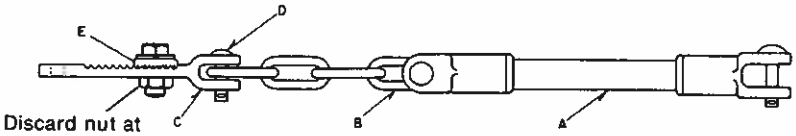
Pulloffs Complete

Catalog Number	Description	Net Weight Lbs. Each
55016-3001	Type ACH, 19½ to 28½-Inch Adjustment Between Wire Centers, ½-Inch Bolt	5
55016-3002	Type ATH, 19½ to 28½-Inch Adjustment Between Wire Centers, ⅝-Inch Bolt	5



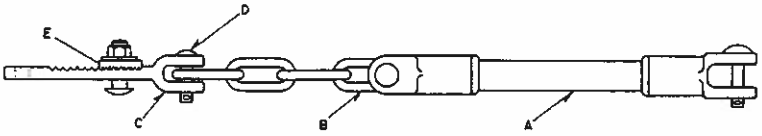
Number 22263

Number 22267



Discard nut at installation of trolley clamp.

Type ATH



Type ACH

Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
54995-6115	A	Hi*Lite Strain Insulator, 1¼ x 5-Inch Insulation, Clevis Each End	2.65
22264	B	Steel Chain, 6 Link	0.6
22263	C	Pulloff Casting, M.I., with Clevis Bolt and Cotter	1.3
13688	D	Clevis Bolt, $^{7}/_{16}$ x 1⅝-Inch, Without Cotter, Steel	0.14
22267	E	Clamp Casting, Bronze	0.2

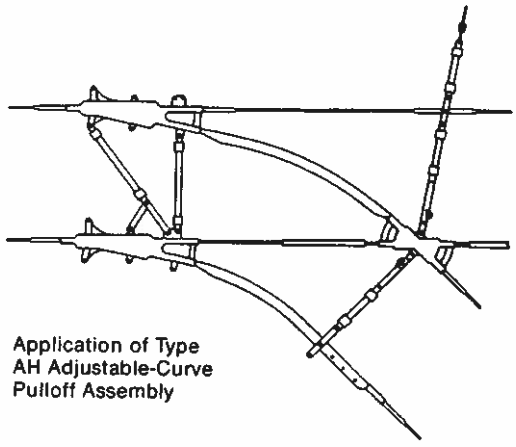
TYPE AH ADJUSTABLE-CURVE PULLOFF ASSEMBLIES
24-Inch Wire Spacing

Employed in the installation of all double frog and crossover assemblies, but standard equipment only on assemblies of angle from 23- to 45-degree which employ angle iron runners. For these assemblies, as illustrated in drawing, the Type AH pulloff serves only for pulloff across tangent wire. Pulloff to angle iron runner employs a Type CH spacer 54982-3001 attaching to a separable strap which is a part of the runner. For turnout assemblies less than 23-degree angle, two Type AH pulloffs are required and must be ordered separately.

Pulloff assembly 54982-3003 only is used as standard equipment in turnout assemblies. Other adjustment ranges are necessary occasionally, depending upon pole locations.

Pulloff assembly 54982-3003 is made up of strain strap assembly 21199 and Type CH spacer assembly 54982-3001, listed on page 75. Assemblies for other adjustment ranges are exactly the same except for length of stud attaching to Hi*Lite strain. Turnbuckle permits adjustment without disturbing end attachments.

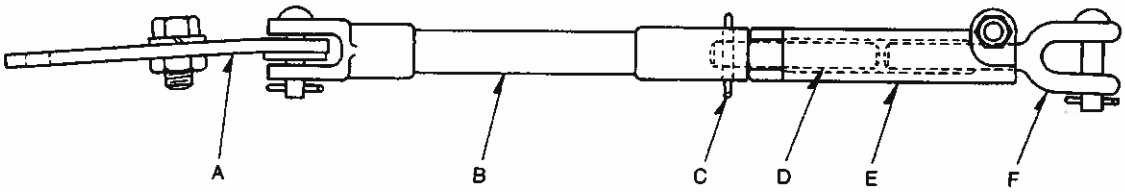
Strap 21199 is 1½ inches wide. Pulloff eyes are 9/16-inch diameter. All castings are of malleable iron. Ferrous parts are hot-dip galvanized.



Application of Type AH Adjustable-Curve Pulloff Assembly

Pulloff Assemblies Complete

Catalog Number	Description	Net Weight Lbs. Each
54982-3003	21⅝ to 25⅝-Inch Adjustment	5.5
54982-3004	23¼ to 27¼-Inch Adjustment	5.7



Parts

Catalog Number	Item	Description	Net Weight Lbs. Each
21199	A	Strap, Steel, with ⅝-Inch Stud and Lockwasher	1.0
54964-6111	B	Hi*Lite Strain Unit Only	2.25
	C	Cotter, Steel, ⅛ x 1½ Inch	0.01
21602	D	Stud, Steel, ⅝ x 3¾ Inch, for 21⅝ to 25⅝-Inch Adjustment	0.32
21603	D	Stud, Steel, ⅝ x 5½ Inch, for 23¼ to 27¼-Inch Adjustment	0.5
21601	E	Turnbuckle, M.I., with 7/16 x 1½-Inch Mach. Bolt	1.1
21600	F	Clevis Stud, Steel Forging, ⅝ Inch, L.H. Thread	0.8

TYPE T LIVE SPACERS
Tongue and Tongue

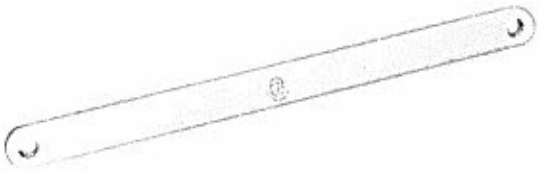
These spacers are used in place of short lengths of trolley wire in forming special work assemblies. They are made of ⅜ x 1-inch round edge flat steel bar to which steel tongues are welded. All spacers are hot-dip galvanized.

Minimum underrun length to which these spacers can be made is 5 inches. However, special Type T Spacers can be supplied in shorter lengths, if desired.

The following listing is for the purpose of showing the lengths and weights of spacers employed in standard special work assemblies.

Catalog Number	Length Underrun Inches	Net Wt. Lbs. Each
21204	7½	2.0
16795	8⅞	2.2
18256	10⅛	2.5
16794	11	2.6
18257	12¼	2.75
18258	14½	3.0
16792	15¼	3.12
18259	17⅛	3.25
21205	18⅞	3.6
16868	19¾	3.75
16790	20⅞	3.8
16789	23¾	4.0
19125	24⅛	4.1
19126	26¾	4.4
16788	28	4.5
19127	30	4.6
16787	32	4.75
19128	34	5.0
18144	36	5.4
19129	39⅞	5.8
18145	40½	6.0
19130	41¼	6.1
19131	42½	6.3
16786	45¼	6.4
19132	45¾	6.43
19133	47½	6.48
18146	48	6.5
21086	48⅞	6.6
19134	50¾	6.6
21213	51 13/16	6.7
16950	52¼	6.75
19135	53¼	7.0
21087	55⅜	7.2
19257	58½	7.5
18152	62½	8.0
17705	66¼	8.5
21023	66¾	8.6
21113	68¼	8.8
18151	70½	9.0
21085	74¾	9.2
18150	75	9.25
18149	78½	9.5
21207	92	11.2
18147	105	12.25
21206	106¼	12.6

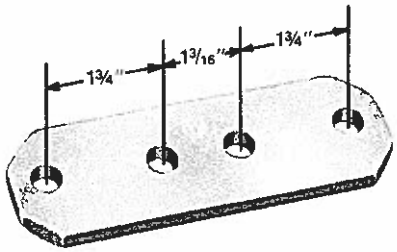
PAN CONNECTOR



Employed only in frog and crossover assemblies having insulation in curve. Made of steel ⅜-inch thick, 1⅜-inch wide, hot-dip galvanized. Holes are 9/16-inch diameter.

Catalog Number	Description	Net Weight Lbs. Each
21109	Length Between Hole Centers, 16 1/16 Inches	2.3
21110	Length Between Hole Centers, 15 1/16 Inches	2.0

BRACE



Used to join one frog or crossover pan flush to another. 15/32-inch holes.

Catalog Number	Description	Net Weight Lbs. Each
18232	Pan Connector, Steel, Galvanized	1.0

TYPE TC LIVE SPACERS
Tongue and Clevis

Steel

Malleable Iron

These spacers are used in place of short lengths of trolley wire in forming special work assemblies. Steel spacers are ⅜ x 1-inch round edge flat bar, to which tongue and clevis are welded. All spacers are hot-dip galvanized. Minimum underrun length is 6½ inches.

The following listings are for the purpose of showing the lengths and weights of spacers employed in standard special work assemblies.

Steel

Catalog Number	Length Underrun Inches	Net Weight Lbs. Ea.
19110	8¼	2.3
19111	10¼	2.7
21232	10 7/16	2.8
21215	11 15/16	3.0
17703	12⅛	3.3
21216	13 5/16	3.2
19114	14¼	3.4
21227	15	3.4
19124	15½	3.45
18143	16⅝	3.5
21226	17 7/16	3.6
18624	21	3.8
*19255	21	3.8
†19256	21	3.8
21217	21½	3.9

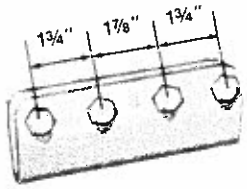
*Right hand curved.
†Left hand curved.

Catalog Number	Length Underrun Inches	Net Weight Lbs. Ea.
19115	22	4.0
19116	22¾	4.1
19117	24	4.2
21218	24 9/16	4.3
18617	25½	4.3
19118	26½	4.4
19119	27½	4.45
18625	28½	4.5
21219	29⅛	4.6
21225	31	4.8
19120	31½	4.7
21251	31⅞	5.0
17704	32 7/16	4.8
21220	33	5.2
19121	33⅞	4.9

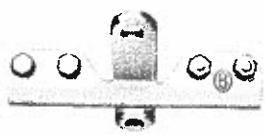
Catalog Number	Length Underrun Inches	Net Weight Lbs. Ea.
21252	34⅝	5.4
19122	35	5.1
18619	36 3/16	5.3
21361	36½	5.6
19123	37	5.5
18626	40 7/16	5.8
21880	43	5.9
21231	44 7/16	6.2
18620	44 13/16	6.0
21224	45 9/16	6.3
21250	48¾	6.7
18628	53	7.0
18627	57	7.25
21222	72⅛	9.0
18630	85¼	10.0
21221	86 7/16	10.5

Malleable Iron

Catalog Number	Length Underrun Inches	Turnout	Degree Angle	Net Weight Lbs. Ea.
17702	4⅜	.....	.....	1.8
18939	5¾	.....	.....	2.0
18618	7	.....	.....	2.2
17239	9¼	.....	.....	2.5
20985	7	R.H.	3	2.2
20986	7	L.H.	3	2.2
21111	7	R.H.	5	2.2
21112	7	L.H.	5	2.2



No. 21584



No. 21461

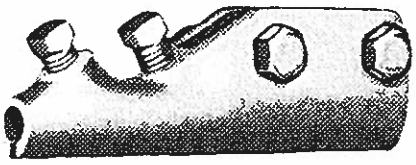
TYPE CC LIVE SPACERS
Clevis and Clevis

Spacer 21584 is of malleable iron and is employed to join two No-Bo insulators in series. Spacer 21461 is formed of steel and serves as part of long-radius frog and crossover assemblies for 30-degree turnouts. All Type CC spacers are supplied complete with clevis end bolts. All parts are hot-dip galvanized.

Catalog Number	Length Underrun Inches	Net Weight Lbs. Each
21584	6½	2.2
21461	9½	3.0

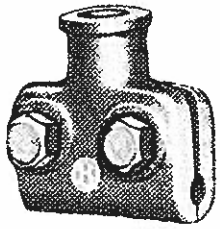
UNIVERSAL SPACER BARS AND FITTINGS

Reversible Bar, No. 18718

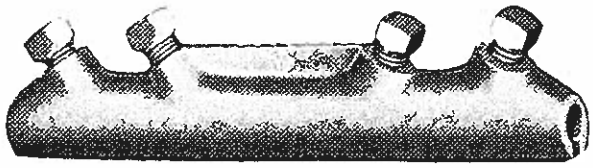


Clevis Tip, No. 18430

Tongue Tip, No. 18431



Support Clamp No. 18554



Splicer, No. 18553

Yoke, No. 19113

The universal spacer serves the same purpose as the live spacers listed on pages 78 and 79 and provides the same collector clearance. It fills the need for a rigid spacer which can be made up quickly on the ground for emergency requirements, such as repairing a damaged intersection assembly and last minute changes in angles of crossing. It is often substituted for short lengths of trolley wire between intersection assemblies and is extensively used as the trolley for barn and subway overhead.

Stock problems are simplified by the use of the universal spacer. Instead of carrying a stock of each of the numerous lengths of Types T and TC spacers, supplied as a part of the original intersection assemblies, the occasional replacements necessary can be made by carrying a few universal spacer bars and tips.

Universal spacer bar is copper, 1-inch high with 3/8-inch diameter lobes. As the lobe dimensions are identical, when one side becomes worn the bar may be reversed, forming a new full-size underrun. Universal bar is supplied in 18-foot lengths. It is light in weight and can be formed readily to any curvature desired.

Tips for joining bar to ends of special work are of two types: one with tongue, to fit clevis ends of all live pans; the other with clevis, to fit tongue ends of insulated spacers. The complete spacer may be made up with tongue on each end or with tongue and clevis, depending upon application. The bar is inserted in the tip from the end and is anchored by means of set-screws which are set at an angle in order to provide maximum holding power. These set-screws should be tightened 1¼ turns after seating against the bar.

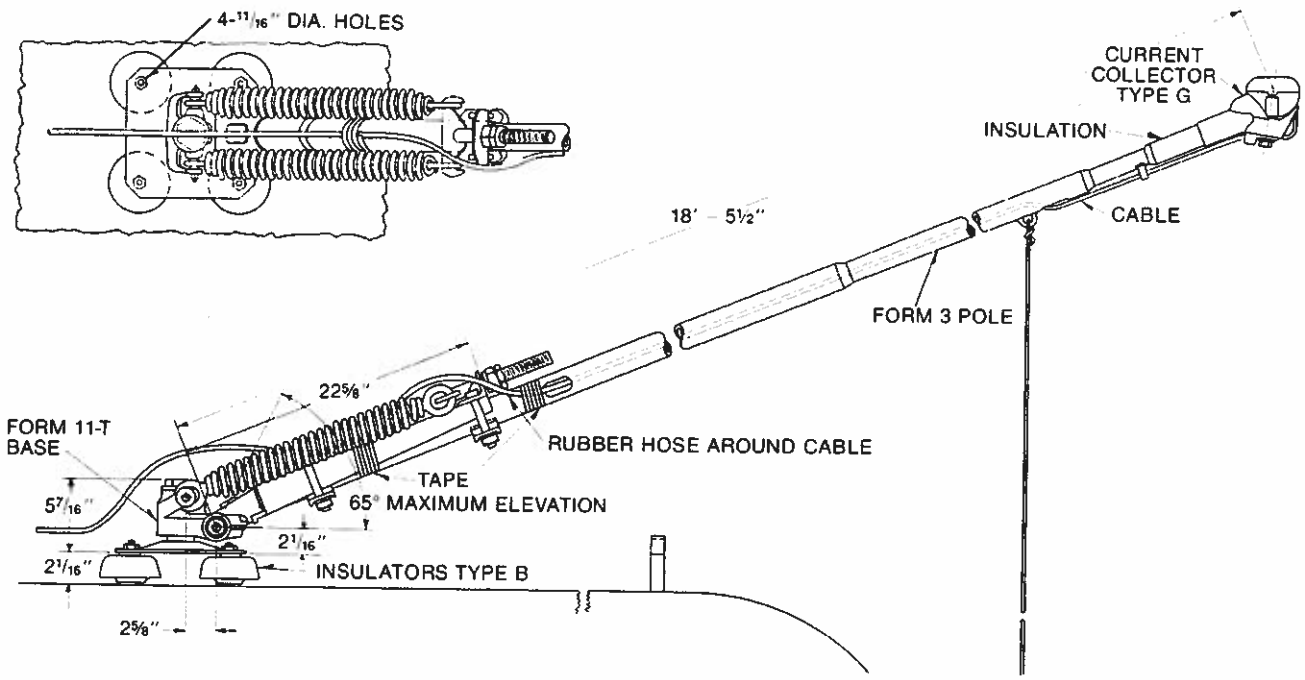
Splicers and intermediate supports are available for extra-long spacers. The bars are inserted in the splicer from each end and butted together in the center, after which the set-screws are tightened in the usual manner. The support is a clamp which grips the upper lobe of spacer bar. It has a 5/8-inch boss and is 2 3/16-inches high from center of bar groove to top of boss. The yoke attaches to support where it is necessary to pull off across spacer bar.

All fittings are of malleable iron except yoke which is steel, and tongue tip which is high-strength bronze. All ferrous parts are hot-dip galvanized. Set-screws in tips and splicers are 7/16 x 1 inch. Length of bar groove: tongue tip, 3⅞ inches; clevis tip, 6 inches; splicer, 7½ inches. Yoke measures 7½ inches between centers of pulloff eyes which are 9/16 inch in diameter; height, 1 7/32 inches.

Unless exact use can be determined before ordering, it is suggested that the first order for this material call for twice as many tips with tongue end as with clevis end, as there are usually more applications employing the tongue end tips.

Catalog Number	Description	Net Weight Lbs. per 100
→ 18718	Universal Spacer Bar Only (Supplied in 18-Foot Lengths)	1650
→ 18431	Universal Spacer Tip with Tongue	100
→ 18430	Universal Spacer Tip with Clevis	120
→ 18553	Universal Spacer Splicer	115
→ 18554	Universal Spacer Support Clamp	100
19113	Universal Spacer Yoke with 5/8-Inch Stud	113

ARRANGEMENT OF CURRENT COLLECTION EQUIPMENT
For Trolley Coaches



Above is a typical arrangement of O-B current collection equipment assembled on the roof of a trolley coach. Included in this assembly are the following devices:

Type G Swivel Current Collector
Form 3 Light-Weight Pole
Form 11-T Light-Weight Trolley Base
Type B Insulator for Trolley Base

Locating the trolley shoes directly back of rear bumper and with rope connected to eye on trolley pole is in accordance with recommended U.S.A. standards. This arrangement effectively eliminates the possibility of dirt falling on rear of coach and facilitates operation of overhead switches.

Cable is carried from the harp through inside of trolley pole and over top of the trolley base as illustrated. The cable at lower end can be attached to a cleat and then connected to the choke coil or lightning arrester on the roof ahead of the base.

The rubber insulation on the harp acts both as an insulator and a silencer. The insulators, upon which the bases are mounted, effectively eliminate current leakage from the base to the roof of the coach.

Trolley bases are spaced 24 inches, center to center, making the collector spacing the same as the standard spacing of the overhead wire.

TYPE G SWIVEL CURRENT COLLECTOR WITH RENEWABLE CARBON INSERT SHOE For Trolley Coaches

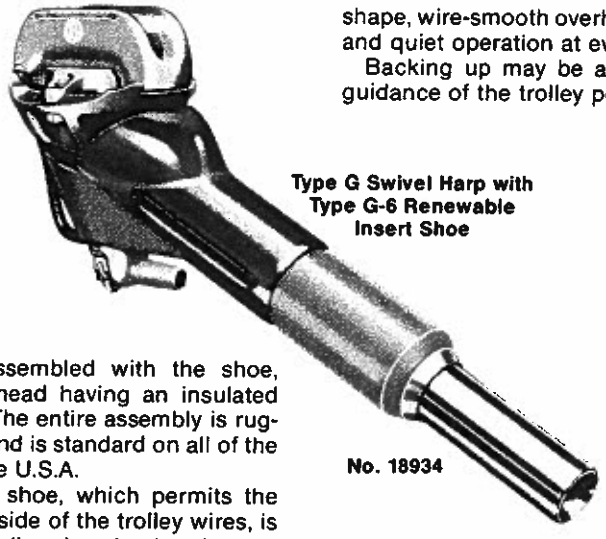
The Type G current collector with its simple swivel action gives to the trolley coach the flexibility of touring which has made it so important as a mass transportation vehicle. With the advent of the renewable carbon insert shoe and its smooth and easy operation on the overhead, this device provides a modern type of current collector for trolley coaches.

The complete device consists of the swivel saddle assembled with the shoe, mounted on the trolley pole head having an insulated shank for attachment to pole. The entire assembly is rugged in design, light in weight, and is standard on all of the trolley coach installations in the U.S.A.

The swiveling action of the shoe, which permits the coach to tour 12 feet on either side of the trolley wires, is secured through the use of a ball and socket bearing between the shoe and the harp. Utilization of the ball and socket principle makes the swivel action simple and efficient.

Because the vertical axis of the shoe is practically coincident with the longitudinal center of the line of contact between the wire and the shoe, the full contact surface of the shoe is constantly against the wire at all angles of the pole. In addition, the pivotal center of the shoe is located within the limits of wear of the shoe. This principle makes the shoe wear to a uniform depth and prevents the shoe from dewiring when the trolley coach is touring off center. The carbon shoe in conjunction with O-B wire-size, wire-shape, wire-smooth overhead produces amazingly smooth and quiet operation at every point in a system.

Backing up may be accomplished easily and without guidance of the trolley poles.



Type G Swivel Harp with Type G-6 Renewable Insert Shoe

No. 18934

The shoe holding the carbon insert is made of bronze, and hooks over the saddle top at one end and is fastened with a cap-screw at the other. The shoe itself may be removed from the saddle to install another shoe. No other parts of the device need be disturbed in making this change. The saddle is made of malleable iron, and is strong enough so there is no danger of its breaking or buckling. The saddle top, which includes the ball, is made of bronze bearing metal.

The design of the complete device has been streamlined so there are no projections to foul the overhead. The pole head is made of alloy steel stampings, heat-treated and welded to maintain the lightest possible weight with greatest strength. The shank of the pole head for attachment to the pole is mounted with resilient rubber to insulate the collector from the trolley pole. The rubber also serves to silence collector noises which might otherwise be transmitted to the roof of the coach. The cable connection is made to a copper terminal which is fastened to the end of the socket pin.

A copper shunt under spring pressure between the bronze ball and the socket joint provides a constant contact which carries the current through the assembly without arcing or pitting.

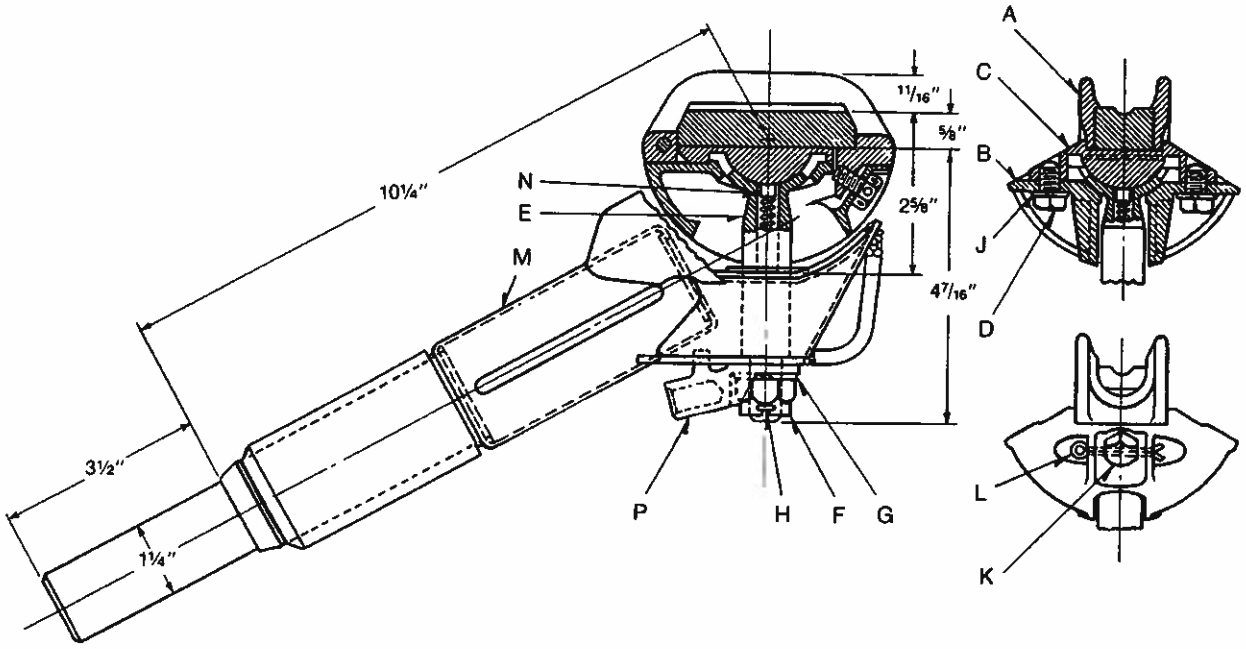
Regularly equipped with the Type G-6 renewable carbon insert shoe listed on page 84.

Metal shoes for combating ice and frost conditions listed on page 84.

Assembly of Type G Collector on End of Trolley Pole

Catalog Number	Description	Net Weight Lbs. Ea.
18934	Type G Swivel Current Collector Complete with Insulated Pole End and Type G-6 Shoe	6.0

PARTS LISTING FOR TYPE G CURRENT COLLECTOR
For Trolley Coaches



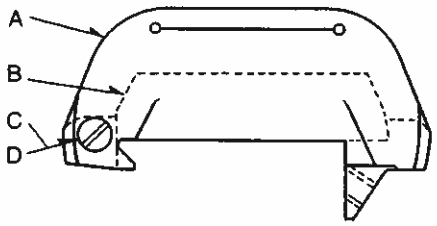
Catalog Number	Item	Description	Net Weight Lbs. Each
19349		Saddle Complete with Type G-6 Renewable Insert Shoe, Socket Pin, Shunt, etc. (Includes Numbers 18925, 16704, 18930, 16706, 16707, 16708, 16263 assembled).	3.25
18925	A	*Type G-6 Bronze Shoe with Renewable Carbon Insert	1.06
16704	B	Saddle Only	1.34
18930	C	Saddle Top for Number 18925	0.46
	D	5/16-Inch, 24 NF-2 x ½-Inch Long Hex. Hd. Cap-Screw	0.02
16706	E	Socket Pin	0.36
	F	Nut for Socket Pin (½-Inch 20 S.A.E. Castle Nut, Steel C.P.)	0.04
	G	½-Inch Lockwasher 1/16-Inch T. x 11/64-Inch W	0.01
	H	3/32 x ¾-Inch Cotter Pin	0.01
16707	J	5/16-Inch Lockwasher	0.01
16708	K	Mounting Screw for Shoe	0.02
	L	3/32 x 1¼-Inch Cotter Pin	0.01
16262	M	Body Complete with Pole End and Insulation	3.23
16263	N	Shunt	0.02
16264	P	Terminal	0.18

*For parts listing of Type G-6 shoe with renewable insert, see page 84.
Instruction and replacement parts booklet available on request.

TYPE G-6 RENEWABLE CARBON INSERT TROLLEY SHOE
For Trolley Coaches

No. 18925
Type G-6 Shoe Complete

Carbon Insert
No. 22570



With the perfection of the renewable carbon insert trolley shoe, a trolley coach overhead and collection system has been developed which conforms precisely to the theory of motor commutation. The carbon insert provides a material soft enough to prevent undue wear on the overhead, yet hard enough to give excellent mileage. By passage of the shoe over the wire, a high burnish is applied by the carbon insert which acts as a low-friction surface without the need for supplementary lubrication.

Since the cost of renewable inserts is less than maintenance and replacement costs of solid metallic shoes, and because no trolley wire lubrication is necessary, this shoe offers the user a material saving in current collection cost and at the same time materially increases the life of the overhead system.

The shoe consists of a carbon insert clamped into a bronze holder. This holder is drawn together at one end by a steel screw, binding the insert firmly into place. Thus gripped and supported, the insert will function properly even in the event of cracks which may normally develop in service.

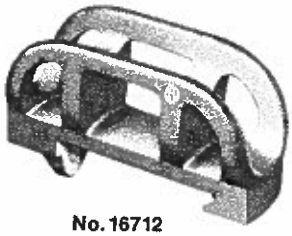
One bronze holder will last for repeated installations of new inserts. Inasmuch as the shoe travels through most overhead fittings on its flanges, eventual replacement of the holder will be necessary depending upon the amount of special work encountered. Metal in the holder is sufficiently soft so that major wear will fall on this inexpensive, easily replaced part rather than on overhead devices where replacement is much more of a factor.

Removal of worn inserts and installation of new ones is a quick, simple process. A screw on the side of the holder is loosened and a screwdriver inserted in the slot which divides one end. A slight twist of the screwdriver springs the holder apart which releases the grip on the insert. After a new insert has been slipped in, the screw is retightened and the device is ready for further service. A stock of shoes, ready for service, may be kept on hand.

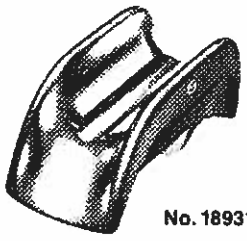
The Type G-6 renewable carbon insert trolley shoe is for use with the Type G current collector.

Catalog Number	Item	Description	Net Weight Lbs. per 100
18925	A	Type G-6 Shoe with Carbon Insert No. 22570, Complete	128
22570	B	Renewable Carbon Insert Only (50 per carton)	17
18929	C	No. 12-24 x 1¼-Inch Special High-Strength Machine Screw, Fillister Head	1.6
	D	No. 12 Lockwasher	0.1

SLEET SHOES FOR TYPE G CURRENT COLLECTOR



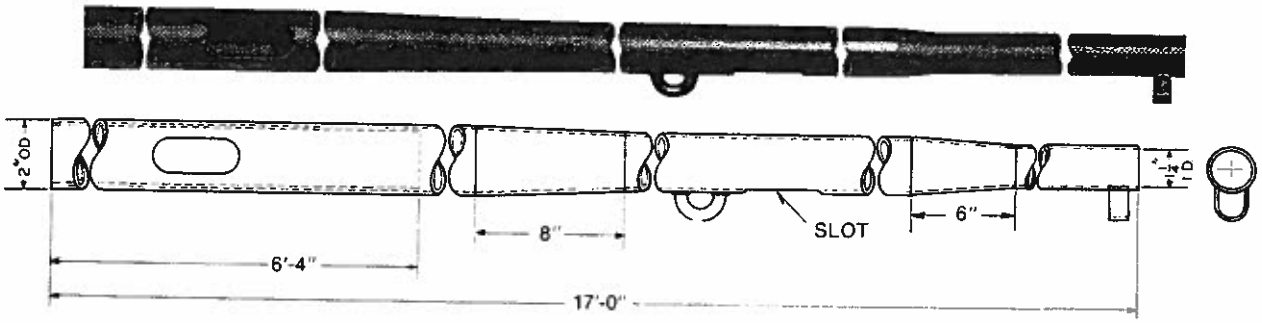
No. 16712



No. 18931

Catalog Number	Description	Net Weight Lbs. per 100
16712	Sleet Cutting Shoe, Malleable Iron	100
18931	Pregrooved Malleable Iron Shoe	160

FORM 3 LIGHTWEIGHT TROLLEY POLE
For Trolley Coaches



A high-carbon, heat-treated, seamless cold-drawn steel pole of extreme light weight, especially designed for trolley coach operation. The pole is 17 feet long, weighs only 29 pounds, yet has adequate strength to meet all conditions. Reinforcement is 6-feet 4-inches long at the butt end. It has a slot at the harp end, as indicated, for passing the cable from the harp to the inside of the pole. The second opening near the trolley base provides for leading the cable out to connect it with a terminal block on the roof of the trolley coach.

Lower eye on pole is for fastening trolley rope. The loop at the upper end acts to hold cable between harp and point of entry into the pole, eliminating necessity for holding cable to harp or pole with tape.

Outstanding in design are the uniform reductions in diameter, there being a taper 8-inches long at main reduction and a taper 6-inches long at harp end, thus eliminating abrupt changes in the structure of the tubing and providing maximum strength at these points.

The outside diameter of the pole at the butt end is two inches. The inside diameter at the harp end is made to fit over the shank of the Type G current collector. Shank of collector should be fastened to the pole with two ¼-inch button-head rivets. The cable is not furnished.

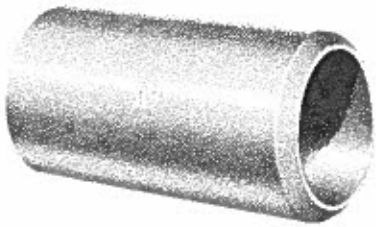
Catalog Number	Description	Net Weight Lbs. Each
16315	Form 3 Lightweight Trolley Pole	29

PROTECTIVE SLEEVE FOR TYPE G SWIVEL CURRENT COLLECTOR
For Trolley Coaches

This plastic sleeve protects the rubber insulation on the Type G current collector from damage during dewirements. If the sleeve becomes damaged, it can be replaced.

With the sleeve, the collector body lasts longer and maintenance costs drop in proportion. All new bodies come equipped with plastic sleeves. They also can be installed on harp bodies not now equipped with them.

The material used in the sleeve is a plastic especially selected for resistance to cutting and gouging.

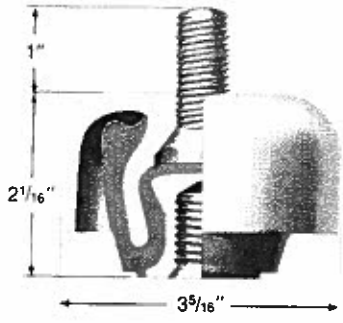


Catalog Number	Description	Net Weight Lbs. Each
22294	Protective Sleeve for Type G Swivel Current Collector	0.1

TROLLEY BASE INSULATOR
For Trolley Coaches

This insulator is used to prevent leakage of current from the trolley base to the roofs of trolley coaches and LRV. It consists of a metal shell with a molded insulator spool rigidly fastened together. The shell is a non-corrosive metal and forms a continuous air gap around the spool. Ruggedly designed, it is of sufficient strength to withstand the high stresses to which the insulator is subjected.

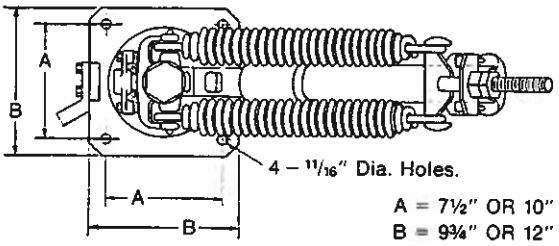
The diameter of the insulator is $3^{5}/_{16}$ inches and the depth is $2^{1}/_{16}$ inches. Furnished with ⅝-inch stud at top which is an integral part of the insulator and is anchored by being molded in the spool. The lower end is tapped for ⅝-inch stud.

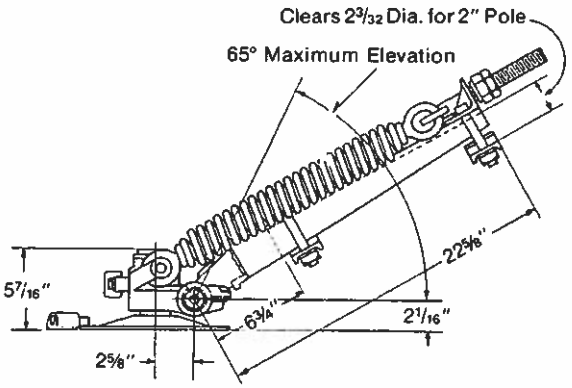


Catalog Number	Description	Net Weight Lbs. Each
20634	Type B Trolley Base Insulator	2.0

FORM 11-TA LIGHTWEIGHT TROLLEY BASES
For Trolley Coaches

Nos. 54622-3001
and 54622-3002
Catalog Number Does Not Include
Insulators Shown in Phantom





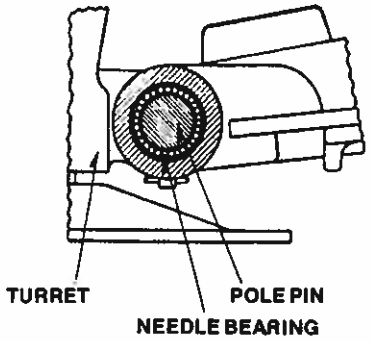


Figure 1

The O-B Form 11-TA trolley base is designed especially for trolley coach operation. The numerous advantages of this base from a weight, service and cost standpoint have caused it to be the outstanding selection of trolley coach operators.

Welded steel construction makes possible the combination of light weight with adequate strength and ruggedness. Needle bearings are used in the pole pin assembly, assuring smooth action and uniform tension on the trolley pole, as shown above in Figure 1.

The main turret bearing, composed of two adjustable Timken roller bearings, is fully enclosed and protected against dust and dirt with a screw cap at the top of the stem and a special grease-retaining washer in the bottom of the turret. See Figure 2 on next page.

FORM 11-TA1 LIGHTWEIGHT TROLLEY BASES
For Trolley Coaches

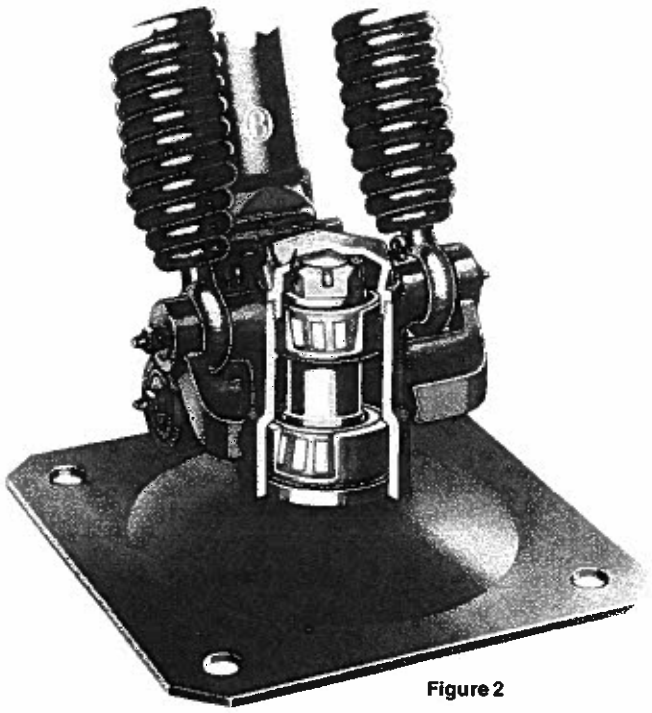


Figure 2

Owing to the use of alloy steel in the springs, only two tension springs are required to provide an adequate range of tension for the current collector.

The pole holder provides nearly two feet of reinforcement to the pole and is open underneath so that water can drain out at the bottom. The pole holder grips the pole with two pole clamps. The take-up bolt on the spring hook, which provides for varying spring tensions, is one inch in diameter. Due to the large diameter of this bolt, easy adjustment of tension is made possible.

The pole holder pin, also the pins and bushings holding tension springs at the turret are all provided with Alemite fittings, making lubrication simple and easy. Bushings or wearing pieces are provided at bottom hook of tension springs to prevent excessive wear on pins. A rubber block not only provides an ample cushion for a rebounding pole, but serves to dampen effectively this action.

Accessibility of moving parts provides for easy inspection and servicing (see Figure 3). A hold-down latch makes it possible to lock the pole in a horizontal position. This latch can be released only manually.

Standard No. 54622-3001, regularly supplied, has a base plate with mounting holes spaced 10 inches on centers. All holes are for ⅝-inch bolts. Height overall with pole horizontal is 5 7/16 inches. Pole holder is designed for a two-inch diameter pole at butt end.

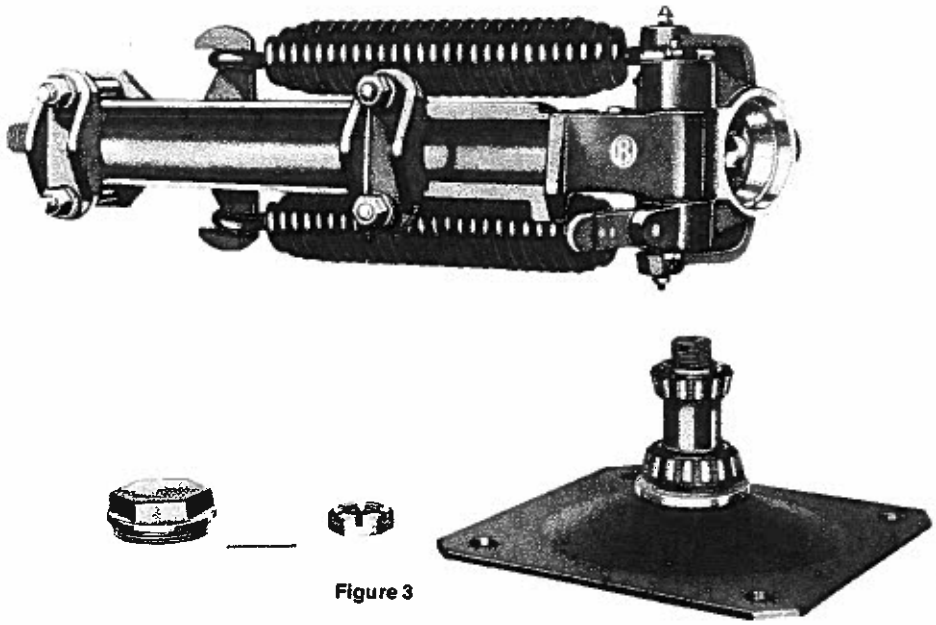
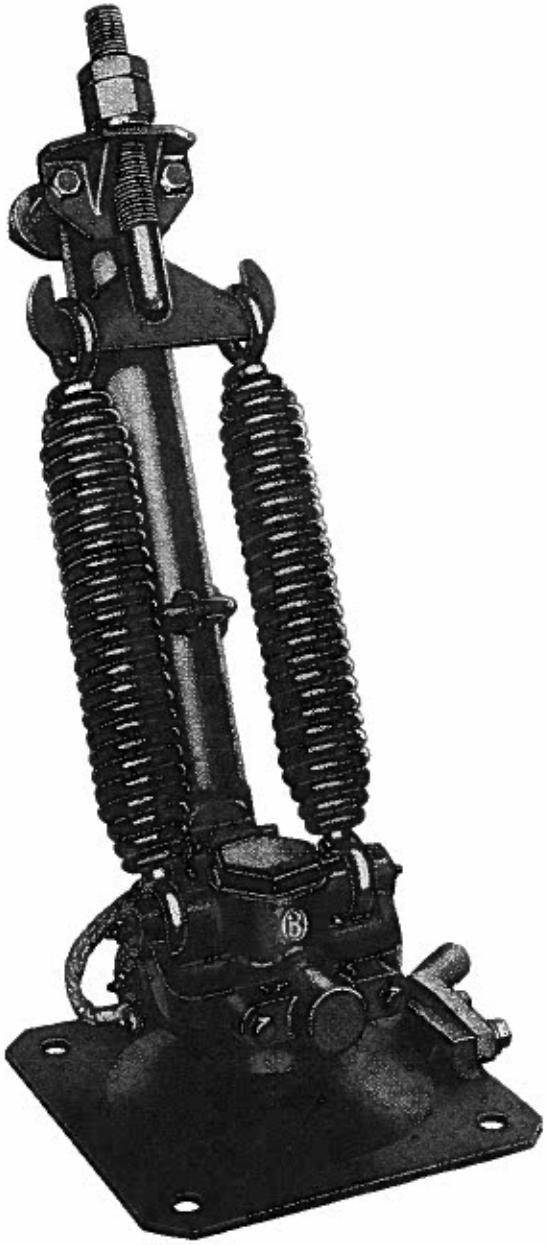


Figure 3

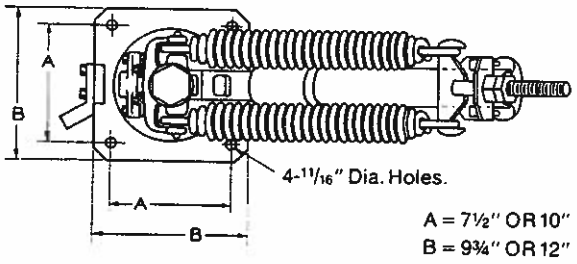
Catalog Number	Description	Net Weight Lbs. Each
54622-3001	Form 11-TA1 Lightweight Trolley Base with mounting holes on 10-inch centers	55
54622-3002	Form 11-TA1 Lightweight Trolley Base with mounting holes on 7½-inch centers	55

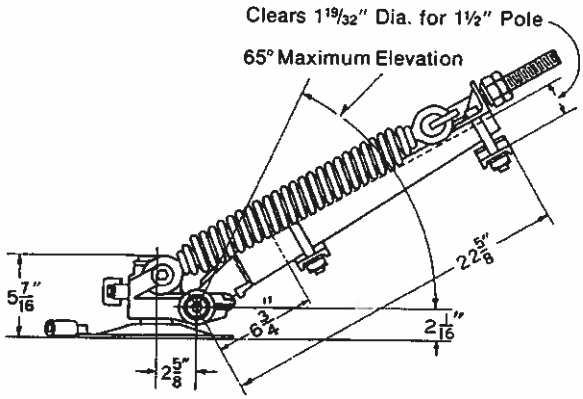
Instruction and replacement parts booklet available on request.

FORM 11-A1 LIGHTWEIGHT TROLLEY BASES
For Light Rail Vehicles



No. 54845-3001





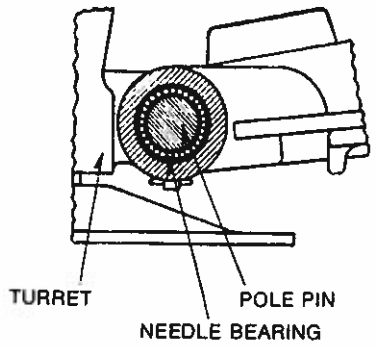
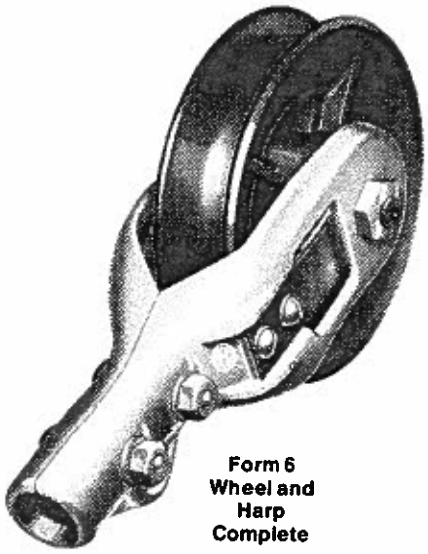


Figure 1

The O-B Form 11-A1 lightweight trolley base is designed specifically to meet the requirements of modern light rail vehicles from the standpoints of strength, appearance and weight. Light weight is secured by welded steel construction and without sacrificing strength or performance.

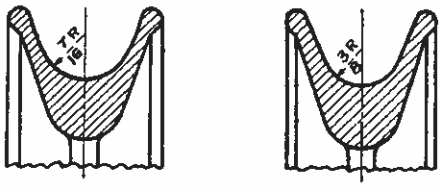
Equipped with highly sensitive needle bearings in the pole pin assembly, assuring smooth action and uniform tension on the trolley pole. See Figure 1 above.

FORM 6 TROLLEY WHEELS AND HARPS
For Light Rail Vehicles



Form 6 Wheel and Harp Complete

Figure 2



U Groove

A.T.A. Groove

Figure 3

Figure 1 Inside View of Harp Showing Side Contacts

While the Form 6 trolley wheel and harp is designed primarily for high-speed city service, it is being used successfully on all types of city cars. Basically this wheel differs from former O-B wheels only in the fact that the size of the axle has been reduced from 1⅝ to 1¼ inches.

This smaller axle makes possible increased mileage with much less wear on axle and bore of wheel. Due to the fact that there is a definite relationship between the diameter of the axle and the diameter of the wheel, which is particularly effective at high speeds, the wheel size for all types of service is limited to 5¾ inches.

The O-B wheel is capable of consistently delivering greater trouble-free mileage than ordinary devices. This increased mileage feature accounts for the fact that many large and small properties have adopted the O-B wheel and harp as standard. The fact that it is unnecessary to oil this wheel after it has once been installed accounts for much of its present popularity. As illustrated in Figure 2, the axle is constructed so that lubrication is accomplished by three force-feed graphite plugs. The axle is hardened and ground to insure minimum friction and long service life.

The construction and operating principle of the lubricating plugs are evident from the illustration. Dowel pin in one harp casting engages with off-center hole in the end of the axle, insuring assembly and replacement in correct position.

So this device will have ample current-carrying capacity, it is provided with two side current collecting contact washers which are held in constant contact with the hub of the wheel by phosphor bronze springs (see Figure 1). This provides a direct and excellent current path from wheel to harp. An improvement has also been made in the method of fastening the axle in the harp. The axle now has an integral stud at each end. These studs project through a hole in the harp castings and the entire assembly is securely fastened on the outside of the harp with a grip nut.

Substitution of the Form 6 harp and wheel for existing harps and wheels involves no change in standard railway practice.

The wheel itself can be furnished with U or A. T. A. standard groove, as illustrated in Figure 3. Trolley wheels are cast from high-grade bronze developed for this particular service and made only from new metal. The harp is composed of two malleable iron castings, hot-dip galvanized. Castings are bolted securely to the trolley pole with two through bolts. This method of clamping harp to pole insures good conductivity.

Two styles of sleet cutters are available and listed on page 92. A sleet wheel can also be furnished, as listed on page 94.

Catalog Number	Description	Net Wt. Lbs. Each
16928	Form 6 U-Groove Wheel and Harp Complete	7.0
16929	Form 6 A. T. A.-Groove Wheel and Harp Complete	7.0

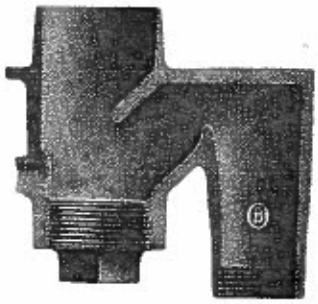
Instruction and replacement parts booklet available on request.

TROLLEY WIRE SLEET WHEEL
For Use with Form 6 Trolley Harps

Catalog Number	Description	Net Weight Lbs. Each
18636	Sleet Wheel for Form 6 Trolley Harp	3.5

AIR SAND TRAP

No. 13797



Internal Construction

Trap is very compact, thus economizing space where it is often needed. Can be placed in any convenient location where hose or pipe will reach the wheels. Cannot release sand except by an application of air. Has no moving parts to get out of order.

Consists of a one-piece casting fitted with a two-inch pipe plug, galvanized to prevent its rusting fast in trap.

By removing pipe plug, it is easy to remove caked or frozen sand.

The curved surfaces inside the trap offer a minimum resistance to flow of sand when under air pressure and facilitate cleaning.

Width of flanged top of trap, 4⅝ inches; length, 6⅝ inches. Height of trap overall from flanged top to end of hose connection is 4¾ inches. Hole for air-blast pipe is threaded for ¼-inch pipe.

Inside of spout threaded to take one-inch standard pipe.

Catalog Number	Description	Net Weight Lbs. Each
13797	Form 2 Air Sand Trap, Malleable Iron	6.0

CATALOG NUMBER INDEX

CATALOG NUMBER INDEX

CATALOG NUMBER INDEX

ALPHABETICAL INDEX

ALPHABETICAL INDEX