

LAPP

STATION POST INSULATORS

CATALOG 10C



STATION POST INSULATORS

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The station post is an original Lapp design. It was introduced in 1931 to provide the electric power industry with switch and bus insulators having superior operating characteristics plus the strength and long life required for reliable substation operation. Today, after nearly sixty-five years of service on thousands of installations, Lapp station posts offer station design engineers maximum economy and trouble-free service in a wide variety of voltage and strength ratings.

All Lapp station post insulators meet ANSI leakage requirements. We also offer high leakage ("H") and extra-high leakage ("E") versions of these standard catalog items.

To meet actual requirements of intended service as closely as possible, Lapp has developed station post insulators in many strength classes. Included in these are standard, high strength, and extra-high strength station posts. Products are available in ratings from 95 kV BIL through 2050 kV BIL for operating voltages 7.5 kV thru 1100 kV.

Design Features

① Hardware

All Lapp station posts have externally attached caps and/or bases. A proven cementing system transfers the load uniformly from the hardware into the porcelain body.

② Porcelain Body

Each insulator body is made from the highest quality clay raw materials that have been processed to be fully vitrified porcelain. The body is glazed to add strength, improve surface appearance, and enhance ease of cleaning.

③ Uniform Leakage Path

Lapp's petticoat profile designs provide optimum leakage distance. Sheds are spaced to take advantage of the natural cleaning action of wind and rain and to avoid concentrated hot spots where local stress can cause flashover. This provides the optimum leakage surface.

④ Short, sturdy sheds

The porcelain sheds protect the body from impact or flashover. They will withstand severe mechanical attack. Even when broken, station post sheds break clean, usually leaving the body undamaged and the insulator still serviceable.

⑤ "Straight-line" flashover

Line terminals are separated by the full length of the insulator so that flashover goes outside the unit. Loss of one or more sheds does not significantly reduce flashover distance.

⑥ Standard bolt circles

Lapp station post caps and bases have bolt holes on standard bolt circles for interchangeability and ease of mounting. The minimum depth of all tapped holes on the end caps is equal to the diameter of the hole. Adapter plates and spacers for changing mounting hole diameters are available (see page 31).

Lapp station posts manufactured to IEC standards are available. See Catalog 11C.

①

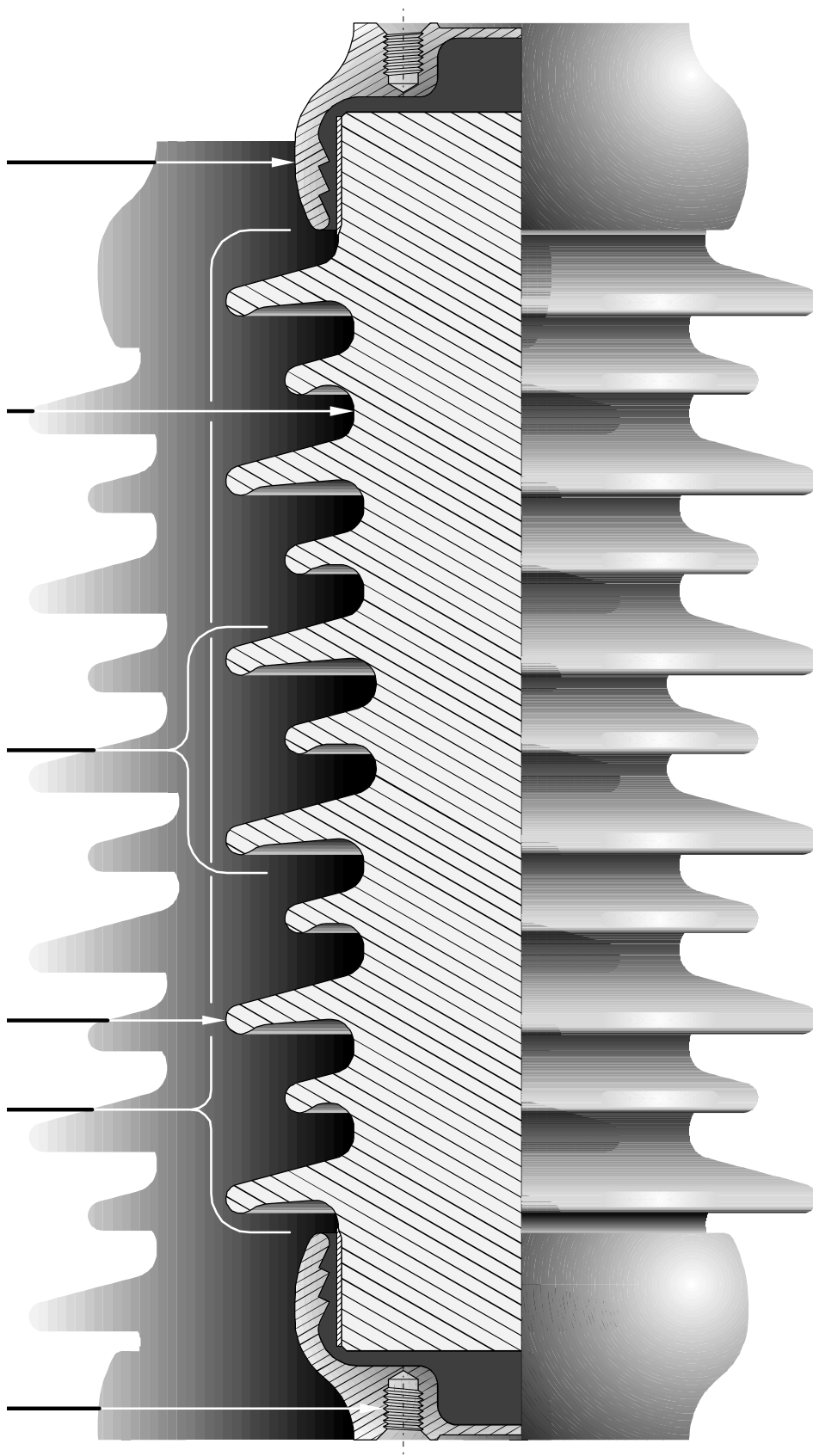
②

③

④

⑤

⑥



Minimum deflection

Lapp station posts provide maximum stiffness in a switch and bus insulator design, an important feature in taller stacks for higher voltages. Station post stacks for high voltage and EHV are made up of single-piece porcelain with externally attached hardware bolted together in a strong, rigid assembly.

Same strength inverted

Also available are Lapp station posts that have the same cantilever strength mounted upright or inverted. Whether they're mounted obliquely or horizontally, the station posts' superior electrical and mechanical characteristics provide a safe margin of operating security.

Economical EHV assemblies

Tapered station post stacks made up of mixed units of different diameters and strength ratings are lighter in weight than uniform-diameter assemblies and offer considerable economy. Electrical and cantilever characteristics are equivalent to uniform-diameter station posts.

Electrostatic rain deflector

The wet flashover characteristics of the taller station post stacks are improved by placing metal rain deflectors (U.S. Patent No. 2884479) between each of the sections. The deflectors use the electrostatic field surrounding the insulator to disperse falling rainwater and prevent flooding of the lower sections.

Total testing

Solid core station post insulators are given a routine mechanical proof test of either four-way cantilever (upright and inverted) or equal bending moment, depending on the voltage class. Cavity core station posts receive an electrical test in accordance with ANSI C29.9-1983 Section 7.4.1 before assembly of hardware. After assembly each cavity core unit is tested mechanically to 50% of rated tension strength.

Remarkable service record

Lapp station posts have compiled a remarkable service record since they were introduced nearly sixty-five years ago. Today, Lapp station posts are in service on all major systems in the United States, Canada and in many other countries around the world.

These years of operating experience, together with trim good looks, reliable low-maintenance operation, greater stiffness, and superior electrical and mechanical characteristics make Lapp station posts ideal insulators for modern switch and bus applications.

Station post reliability

When designers specify Lapp station post insulators, they do so with the confidence that they will receive products that are backed by a long history of low-maintenance service in a wide variety of demanding system applications.

Resistance to power arcover

The sturdy sheds on the porcelain column of the station post insulator keep power arcs away from the body and protect it from damage. If the arc is sufficiently severe to break away sheds, it is not unusual to find only the top or bottom shed damaged with the middle sheds left intact. Even in the improbable instance that all sheds are stripped off, the arcover distance of the insulator will not be decreased materially.

Freedom from radio-TV interference

Lapp station posts are low capacitance insulators by design. This characteristic enables Lapp station posts to meet the Radio Influence Voltage requirements established in ANSI C29.9.

Modern appearance

Utility companies have learned that attractive substations constitute an important part of good public relations. The use of Lapp station posts will enhance the appearance of substations at all voltage levels. Their trim, modern design harmonizes well with other apparatus and equipment in the area.

Mechanical damage

Just as the sheds protect the body of the insulator from the effects of power arcover, they also protect it against mechanical damage from stones and bullets. Generally, stones thrown at these insulators on structures of moderate height will do little or no damage. A bullet or stone striking a shed with sufficient energy will break the shed but leave the insulator body intact. Of course, any damaged insulator should be inspected to verify integrity of the insulator.

Mechanical loading

Lapp station posts are available in various ratings to allow switch designers to specify insulators to meet their particular loading requirements.

Lapp recognizes that switch insulator assemblies bear combined mechanical loads caused by the switching operations. These forces may include tension, torsion, compression, and cantilever loading. There may also be impact loads of significant magnitude.

Under impact loading the intensity of the load is the important characteristic. On Lapp station posts, the areas of load transfer to the porcelain are generous, so no high-intensity point loading occurs.

The inherent strength and rigidity of Lapp station posts are the result of careful design, the limited number of mechanical joints and their rugged, externally mounted hardware. The great strength and rigidity of Lapp station post insulators make them particularly well adapted for use on tall high voltage and EHV stacks where switch and bus alignment and operation are critical.

Lapp post designs have low natural frequency and high damping coefficient. These features are important considerations when seismic criteria are a part of the substation design parameters.

Petticoat Profiles

The cross-section shown in *Figure 1* is our conventional shed profile and will be supplied on most standard catalog items. The cross-section shown in *Figure 2*, our major/minor shed profile, will be supplied on some standard catalog items and is generally used on high leakage designs. The cross-section shown in *Figure 3*, our major/double minor shed profile, will be supplied on some standard catalog items and is generally used on extra-high leakage designs.

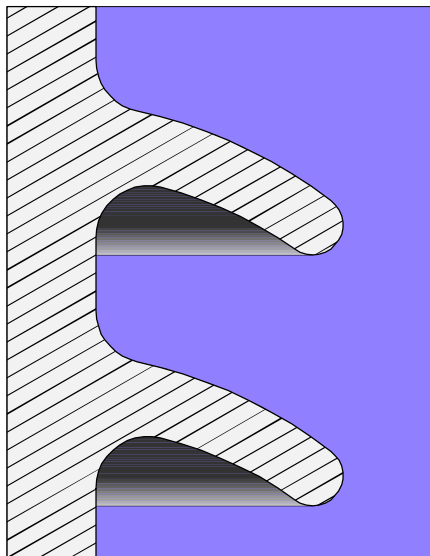


Figure 1

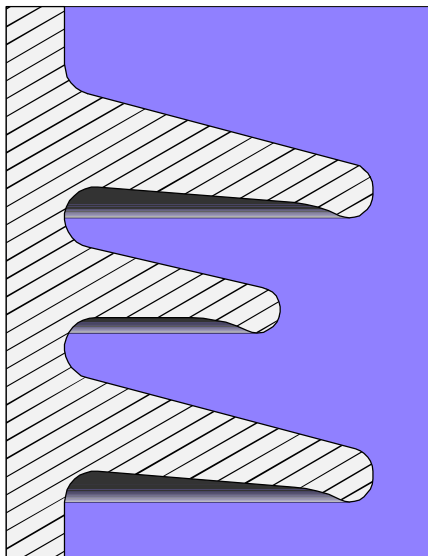


Figure 2

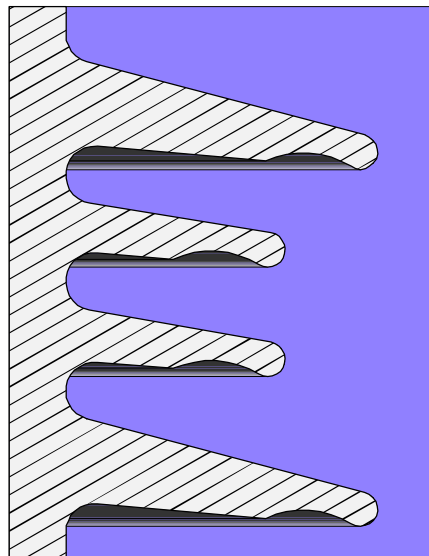


Figure 3

Design Applications

STANDARD STRENGTH UNITS

Standard strength station posts are recommended for all normal duty switch and bus applications. These units have the same cantilever strength rating mounted upright or underhung. They meet or exceed all ANSI Standards in electrical or mechanical characteristics for their class.

HIGH STRENGTH UNITS

High strength station post insulators provide an extra margin of mechanical strength for heavy-duty switch and bus applications. In addition, they match the standard strength station posts in all electrical characteristics. High strength station posts are usually required where mechanical loads from opening and closing switches are unusually heavy or where there is a threat of severe short circuit stresses on the insulator. Also these units permit longer, heavier bus runs with fewer insulators. A neater, more compact substation design while retaining the reliability and low-maintenance characteristics of all Lapp station posts insulators.

High strength station posts simplify economical upgrading of existing structures for heavier current loads.

EXTRA-HIGH STRENGTH UNITS

Extra-High strength station posts are available for switches subject to heavy mechanical loads. They're also useful for long or heavily loaded bus runs in substations where severe short circuit stresses could damage insulators with lower ratings.

Lapp extra-high strength station posts have all of the rugged good looks and electrical characteristics of the lower strength station posts insulators.

Specifications

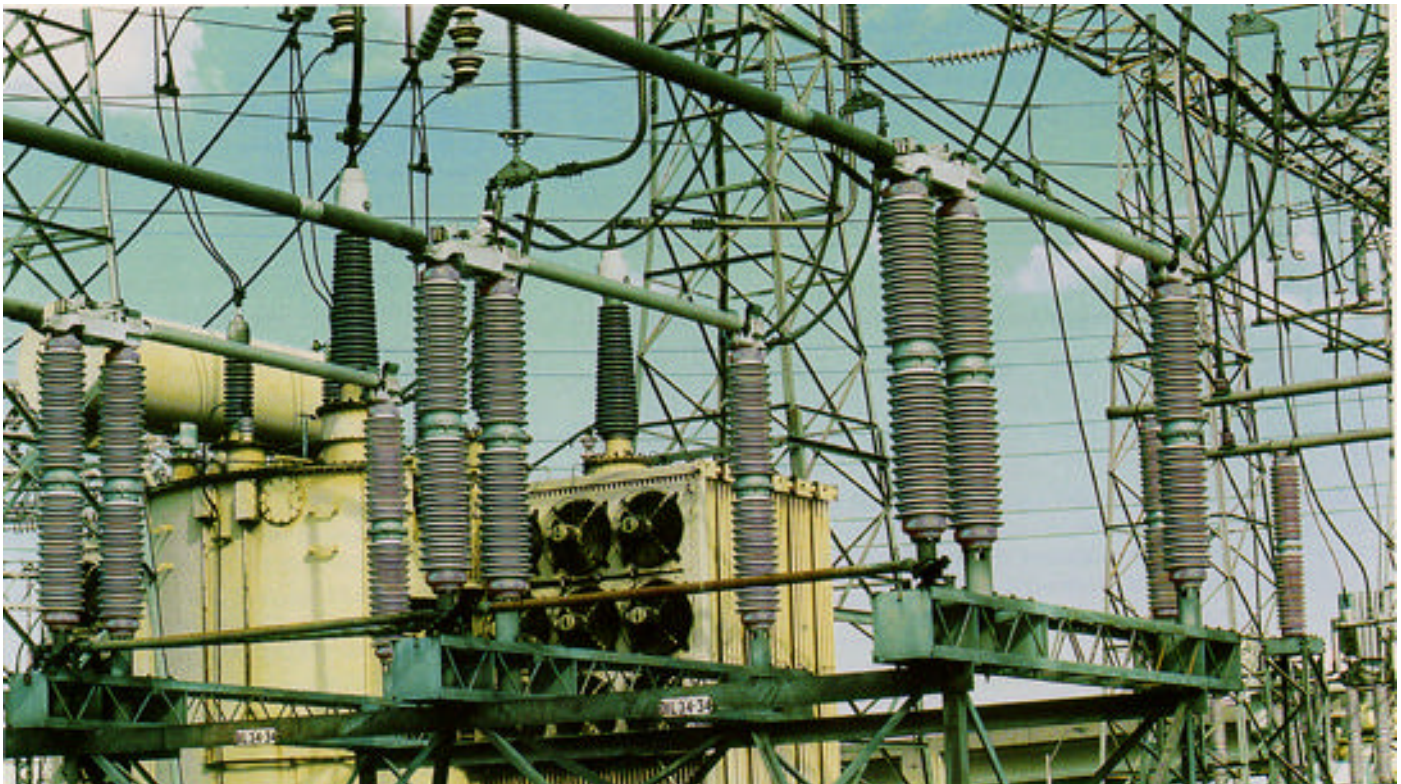
The IEEE standard for maximum recommended working load of Lapp station post insulators is 40% of published cantilever rating, 50% of published torsion rating, and 50% of published tension rating. For short circuit loads only, the maximum recommended working load is 100% of published ratings when using formulas from ANSI C37-1972.

Gray glaze is standard on all station post insulators. Chocolate glaze is available by deleting "-70" from the catalog number.

Caps and flanges are made of drop forged steel, malleable iron or ductile iron, and hot-dip galvanized. Tapped holes are Unified National Coarse Thread Series, 1/2-13, 5/8-11 and 3/4-10. Holes are tapped .015" oversize to allow for the use of galvanized cap screws.

Leakage distance shown in dimensional data conforms to ANSI minimum requirements. To designate increased leakage of up to 40% more than ANSI standards (High Leakage), an "H" suffix is added to the catalog number; example 315286H-70. To designate increased leakage greater than 40% more than ANSI standards (Extra-High Leakage), an "E" suffix is added to the catalog number, example 315286E-70.

Station posts manufactured to IEC standards are available. See Lapp Catalog 11C. For more information contact Lapp Insulator or your local Lapp representative.



STATION POST INSULATORS 900 kV BIL THRU 2050 kV BIL



Design Applications

STATION POST STACKS FOR HIGH VOLTAGE, EHV AND UHV

Lapp station post insulators are well-suited to high voltage and EHV switch and bus construction because of their strength, rigidity and adaptability to a wide range of stack heights and BIL ratings.

Match industry BIL ratings

Since industry practices vary widely in the choice of insulator levels in the design of EHV substations, Lapp station posts for the higher voltages are identified by Basic Impulse Insulation Level (BIL), rather than by voltage class.

The most popular BIL designations based on the kV crest value to withstand voltage of a 1.2 x 50 microsecond full wave impulse voltage are listed here. Lapp EHV station post insulators are available for all of these BIL ratings.

Industry Approved Basic Impulse Insulation Levels (BIL), kV

900	1300	1550	2050
1050	1470	1800	2300

Freedom from radio-TV interference

Lapp EHV station posts are low capacitance insulators and they are inherently free from radio and television interference. By design the hardware is separated by the full height of the porcelain, thus raising the voltage at which corona starts. Every Lapp station post meets Radio Influence Voltages established in ANSI C29.9. This is particularly important on tall stacking insulators for operation at EHV and UHV voltage levels.

Corona shields are available for EHV station posts where service conditions make extra shielding necessary.

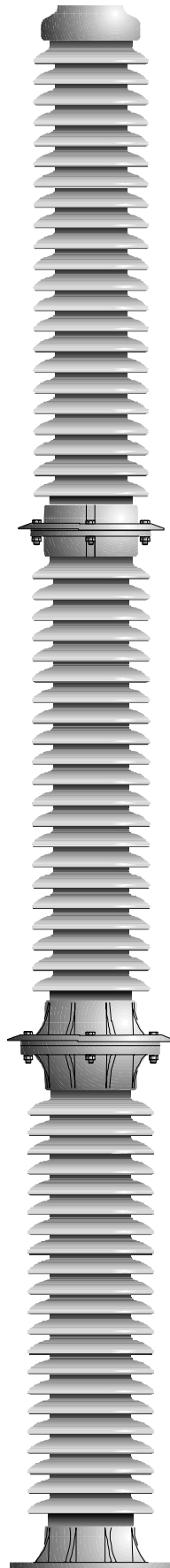
Electrostatic rain deflectors

Any type of tall insulator is susceptible to bridging as water flows down and accumulates on the lower sections. The Lapp Electrostatic Rain Deflector (Patent No. 2884479) uses the electrostatic field surrounding the insulator to disperse the falling water and eliminate bridging. In addition, these deflectors complement the Lapp leakage surface design of the insulator.

Electrostatic Rain Deflectors are supplied on all station posts rated 1300 kV BIL and above. They can be ordered for lower voltage units if desired (see page 31).

Minimum deflection under cantilever loading

Lapp station posts provide maximum stiffness, a feature of increasing importance as seismic criteria become a part of substation design.



Economy of tapered stacks

Although both uniform-diameter and tapered station posts are available for all EHV and UHV applications, it is usually more economical to use tapered stacks for BIL ratings above 1470 kV.

Tapered station post stacks are made up of mixed sections of different diameters and strength ratings. They are electrically equivalent to and provide the same bending strengths as uniform-diameter station posts but are lighter in weight and less expensive. Tension, torsion, and compression values are set by the smallest diameter section and will be less than the values of uniform-diameter stacks.

For example, a typical 3-unit, 1800 kV BIL tapered stack consists of one 10.62" diameter lower section, one 9.62" diameter center section and one 9.25" diameter top unit. This assembly is comparable in electrical characteristics to a uniform-diameter stack composed of three 10.62" sections. BIL rating and height are the same for both insulators, but the tapered station posts is lighter in weight. The result is lower insulator costs, plus savings in handling and erecting costs.

Specifications

The IEEE standard for maximum recommended working load for Lapp station post insulators is 40% of published cantilever rating, 50% of published torsion rating, and 50% of published tension rating. For short circuit loads only, the maximum recommended working load is 100% of published ratings when using formulas from ANSI C37-1972.

Gray glaze is standard on all station post insulators. Chocolate glaze is available by deleting "-70" from the catalog number.

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Leakage distance shown in dimensional data conforms to ANSI minimum requirements. To designate increased leakage of up to 40% more than ANSI standards (High Leakage), an "H" suffix is added to the catalog number; example 315308H-70. To designate increased leakage greater than 40% more than ANSI standards (Extra-High Leakage), an "E" suffix is added to the catalog number, example 315308E-70.

Station posts manufactured to IEC standards are available, see Lapp Catalog 11C. For more information contact Lapp Insulator or your local Lapp representative.

American National Standards no longer require testing for the following electrical values. This table is intended as a reference for those who wish to use its data.

BIL	AVERAGE FLASHOVER VALUES		WITHSTAND VALUES	
	Power Frequency Dry, kV	Power Frequency Wet, kV	Critical Impulse Negative, kV	Power Frequency Dry, kV
95	60	40	120	35
110	85	55	200	50
150	110	75	250	70
200	145	100	290	95
250	170	125	340	120
350	235	180	475	175
550	385	285	780	280
650	435	335	900	335
750	485	380	1020	385
900	575	475	1240	465
1050	660	570	1450	545
1300	745	660	1650	610
1470	830	740	1850	680
1550	865	780	1950	710
1800	990	900	2240	810
2050	1100	990	2600	940

Reference: ANSI C29.9 - 1983, Appendix B.



Summary of Switching Surge Withstands and Switching Surge Critical Flashovers of 900 kV BIL to 3300 kV BIL Lapp Station Post Insulators†

The flashover withstand values are the average of many tests on the same or an equivalent test specimen. Because they are averages of test values read directly from a test curve with none of the safety factors commonly associated with catalog values having been applied, they should not be considered as ratings.

BIL	Insulator Height inches	DRY				WET			
		Positive, kV		Negative, kV		Positive, kV		Negative, kV	
		WS	CFO	WS	CFO	WS	CFO	WS	CFO
900	80	745	825	985	1210	690	770	830	935
1050	92	855	955	1115	1380	805	900	945	1050
1300	106	980	1105	1260	1565	935	1045	1025	1180
1550	128	1145	1285	1445	1825	1105	1275	1210	1350
1800	152	1280	1460	1590	2050	1255	1450	1340	1460
2050	182	1410	1600	1720	2250	1390	1595	1435	1610
2425	210	1620	1845	1950	2460	1630	1770	1590	1800
2675	240	1750	2010	2120	2620	1790	1920	1710	1950
3050	270	1870	2140	*2280	*2760	1920	2060	1825	2100
3300	300	1950	2240	*2420	*2900	2000	2200	1930	2250

* Extrapolated values

† Tested with Base 24' above ground using 4" IPS Bus.

Wave shape: 200 x 4000 microseconds

RG Insulators Employ a Unique Semi-Conductive Glaze Which Inhibits Arcing and Flashover.

Since they were first installed in the 1970's, Lapp RG insulators have built an enviable operating record in contaminated areas where no standard insulator can perform. That's because RG insulators make use of a unique semi-conducting glaze which effectively inhibits arcing and flashover.

Whether the contamination problem is the result of coastal salt fog or mist, industrial pollution, agricultural dust or chemicals, the tens of thousands of RG insulators already in service have provided excellent performance for utilities around the world.

RG Insulators Can Significantly Reduce Construction and Operating Costs

They Reduce the Need to Over-Insulate

Over-insulation may reduce the number of flashovers in contaminated areas, but its effectiveness is never certain. In addition, larger insulators may require larger structures, which can lead to higher costs.

When you choose RG insulators, you don't need to over-insulate. In fact, RG insulators hold voltage in environments that caused flashover on regular insulators having two to three times the leakage distance.

That's what we call performance.

They Reduce the Need for Washing

Washing can cost utilities hundreds of thousands of dollars a year; a cost which RG insulators eliminate.

They Reduce EMI Problems Associated With Insulators

The outstanding performance of RG insulators reduces both radio noise and TV interference. In fact, at operating voltage, RIV on RG insulators remains at near zero under most conditions of surface contamination.

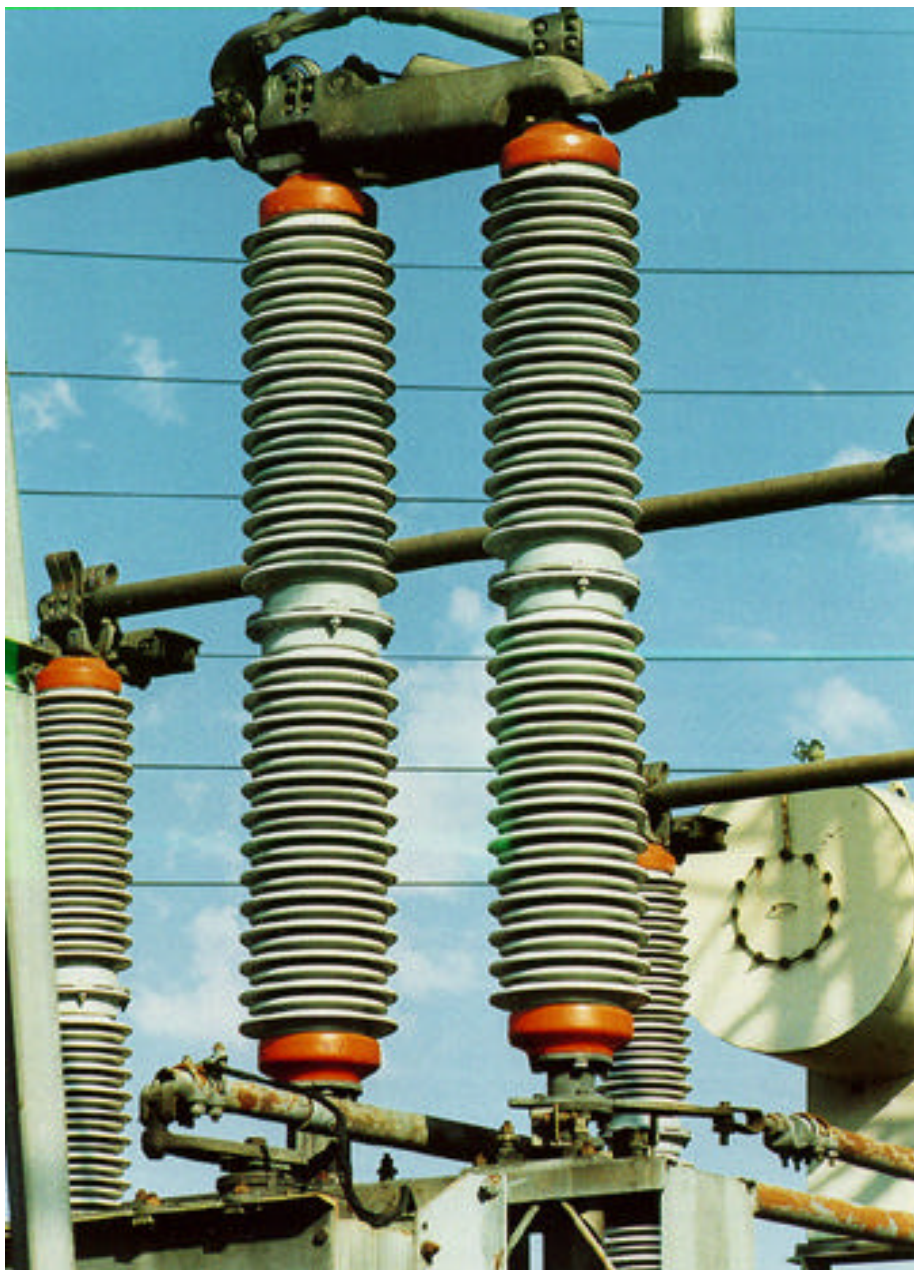
They Reduce the Need for Greasing or Coating

Periodically applying silicone grease or RTV coating to insulators in contaminated areas is another costly maintenance procedure which RG insulators eliminate.

The Glaze on RG Insulators is a Permanent, Integral Part of the Insulator

Unlike protective coatings which are applied *after* an insulator is glazed, the semi-conductive glaze on RG insulators is a permanent, integral part of the insulator.

Because the glaze is applied as part of the normal manufacturing process, RG insulators are less costly than insulators which are *first* glazed with a regular glaze and *then* covered with a hydrophobic coating.



900 kV BIL Resistance Graded Station Posts at Hamilton Beach T.S.



RG Insulators Gain Their Superior Performance From Three Factors:

1. Linear Voltage Distribution

Voltage drop across the entire length of the RG insulator surface is uniform so that all parts of the insulator are evenly stressed.

2. Heating Effect

The small current flow over the electrically equivalent resistor created on the surface of an RG insulator warms the surface to a few degrees above the ambient temperature. This discourages moisture accumulation, and moisture is usually necessary to make contaminants conductive.

3. Reduction of Dry Band Arcing

Dry bands form on RG insulators with uneven wetting and drying, just as they do on regular insulators. However, RG insulators provide a conductive shunt path across the dry bands, preventing any visible scintillations or arcing. The result? There are no local arcs that can grow into full length flashover.

They're Backed By Years of Field Experience

Commercially available since 1970, RG insulators have been used in a broad range of applications, from moderate to extremely severe contamination. This experience puts Lapp in a position which no other manufacturer can match when it comes to helping you meet the contamination demands of your application.

It has also shown us ways in which to improve our product designs. All Lapp's latest RG insulators demonstrate our commitment to providing the most comprehensive and up-to-date product designs available.

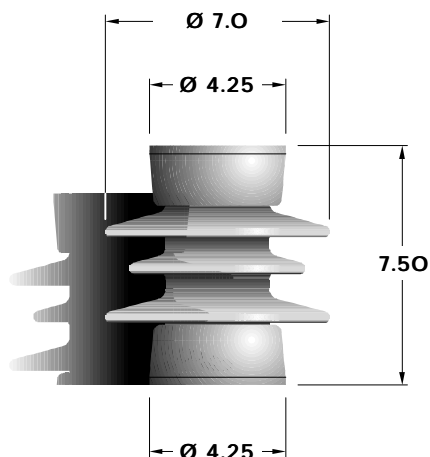
Want to Know More?

We recommend consulting Lapp directly when considering the installation of Resistance Graded Station Posts (RG®). For more details and technical assistance, write to Lapp or contact your Lapp representative.

RG® Resistance Graded Station Posts and Equivalent Regular Glaze Station Posts

BIL	Regular Glaze	RG Glaze Equivalent		BIL	Regular Glaze	RG Glaze Equivalent	
		Previous	Current			Previous	Current
95	315202-70	500001	535202	900	315126-70		535126
	315041-70		535041		317126-70	500176	537126
	315222-70	500011	535222		319126-70		539126
	318490-70	500021	535021		315175-70	500095	535175
110	315205-70	500002	535205		317175-70		537175
	317004-70		537004		319175-70		539175
	315044-70		535044		315304-70	500030	535304
	317044-70		537044		315304-70	500079	535304
	315225-70	500012	535225		315308-70	500031	535308
	318451-70	500022	500195		315308-70	500033	535308
	315007-70		535007		315308-70	500076	535308
	317007-70		537007		314925-70	500034	500194
150	317010-70		537010		314161-70	500032	500181
	315046-70		535046	1050	315128-70		535128
	317046-70		537046		317128-70		537128
	315208-70	500003	535208		319128-70		539128
	315227-70	500013	535227		315176-70		535176
	318453-70	500023	500196		317176-70		537176
	315010-70		535010		319176-70		539176
	315049-70		535049		315312-70	500040	535312
200	315210-70	500004	535210		315312-70	500080	535312
	315231-70	500014	535231		315316-70	500041	535316
	318455-70	500024	500197		315362-70	500042	535362
	319140-70		539140		315362-70	500045	535362
210	319139-70		539139	1300	315324-70	500051	535324
	315013-70		535013		315324-70	500086	535324
	317013-70		537013		315367-70	500054	535367
	315053-70		535053		315367-70	500088	535367
250	317053-70		537053		315368-70	500052	535368
	315214-70	500005	535214		315368-70	500087	535368
	315267-70	500015	535267		315369-70	500055	535369
	318459-70	500082	500198		315369-70	500089	535369
350	315016-70		535016	1470	315330-70	500061	535330
	317016-70		537016		315330-70	500063	535330
	315056-70		535056		315371-70	500091	535371
	317056-70		537056		315373-70	500065	535373
	319056-70		539056		315372-70	500062	535372
	314970-70		500199	1550	314732-70	500073	500203
	314982-70		500200		315379-70	500074	535379
	315216-70	500006	535216		318059-70	500092	500204
550	315278-70	500016	535278		315391-70	500083	535391
	318461-70	500081	500201	1800	315391-70	500118	535391
	315019-70		535019		314914-70	500084	500188
	317019-70		537019		314914-70	500119	500188
	319019-70		539019		314934-70	500085	500189
	315173-70		535173		314934-70	500120	500189
	317173-70		537173	2050	314867-70	500093	500205
	319173-70		539173		314867-70	500122	500205
650	315286-70	500007	535286		318032-70	500094	500206
	315287-70	500017	535287		318032-70	500123	500206
	318457-70	500027	500027				
	315288-70	500008	535288				
750	315289-70	500018	535289				
	314857-70	500028	500202				
	315025-70		535025				
	317025-70		537025				
	319025-70		539025				
	315174-70		535174				
	317174-70		537174				
	319174-70		539174				
	315291PA-70	500009	500009PA				
	315295PA-70	500019	500019PA				
	318441PA-70	500029	500029PA				

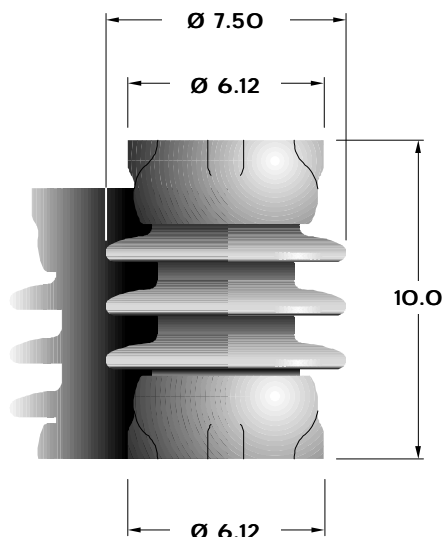
STANDARD STRENGTH UNIT



4 TAPPED HOLES
1/2-13 +.015 OVERSIZE
5/8" FULL THREAD
ON 3.0" BOLT CIRCLE

315202-70

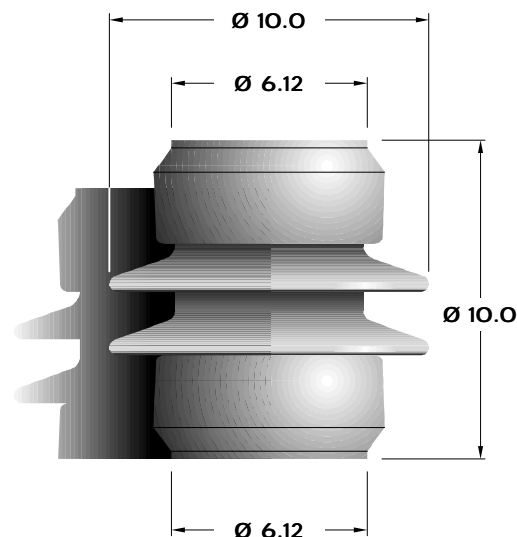
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315222-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
1 1/16" FULL THREAD
ON 5.0" BOLT CIRCLE

318490-70

CHARACTERISTICS

Lapp Catalog Number	315202-70	315222-70	318490-70
Ansi Technical Reference Number	T.R.202	T.R.222	
Dimensions			
Leakage Distance, Inches	10.5	10.5	10.5
Mechanical Values *			
Cantilever Strength, Upright, Pounds	2000	4000	8000
Cantilever Strength, Underhung, Pounds	2000	4000	8000
Tensile Strength, Pounds	7000	15000	28000
Torsion Strength, Inch-Pounds	6000	12000	40000
Compression Strength, Pounds	10000	20000	40000
Electrical Values			
Voltage Class, kV	7.5	7.5	7.5
Impulse Flashover, Positive, kV	105	105	105
Low Frequency Withstand, 10 Sec. Wet, kV	30	30	30
Impulse Withstand, kV	95	95	95
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	5	5	5
Maximum RIV, Microvolts at 1000 kHz	50	50	50
Weight			
Net Weight, Each, Pounds	14	32	46

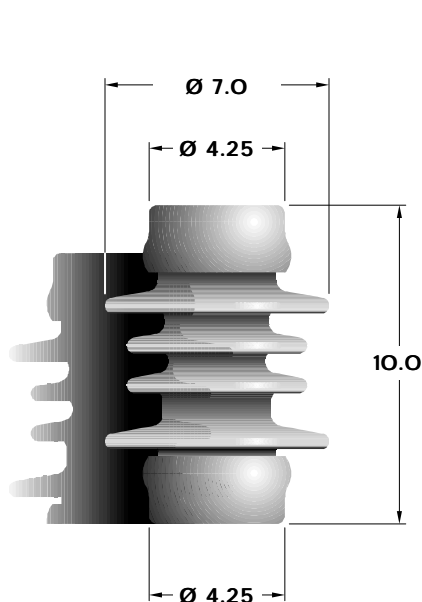
* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES

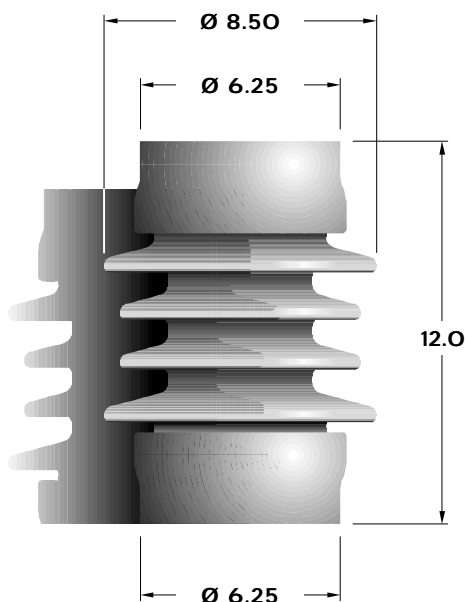
STANDARD STRENGTH UNIT



4 TAPPED HOLES
1/2-13 +.015 OVERSIZE
5/8" FULL THREAD
ON 3.0" BOLT CIRCLE

315205-70

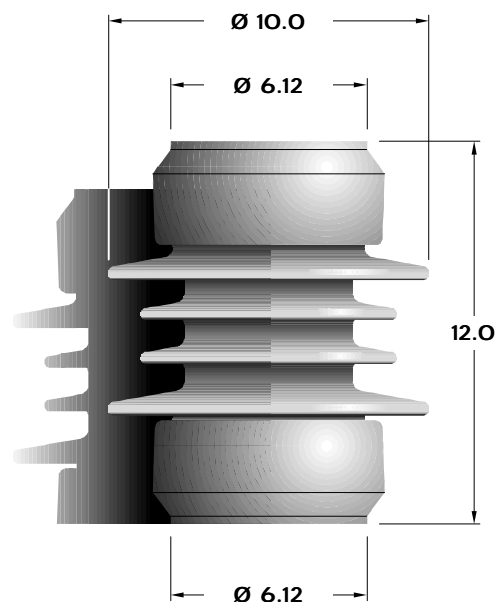
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315225-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
11/16" FULL THREAD
ON 5.0" BOLT CIRCLE

318451-70

CHARACTERISTICS

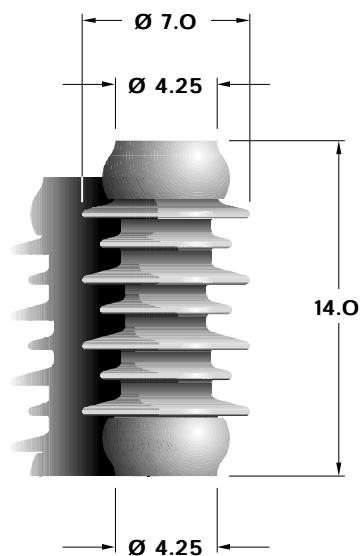
Lapp Catalog Number	315205-70	315225-70	318451-70
Ansi Technical Reference Number	T.R.205	T.R.225	
Dimensions			
Leakage Distance, Inches	15.5	15.5	17
Mechanical Values *			
Cantilever Strength, Upright, Pounds	2000	4000	8000
Cantilever Strength, Underhung, Pounds	2000	4000	8000
Tensile Strength, Pounds	8500	20000	28000
Torsion Strength, Inch-Pounds	7000	14000	40000
Compression Strength, Pounds	10000	20000	40000
Electrical Values			
Voltage Class, kV	15	15	15
Impulse Flashover, Positive, kV	125	125	125
Low Frequency Withstand, 10 Sec. Wet, kV	45	45	45
Impulse Withstand, kV	110	110	110
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	10	10	10
Maximum RIV, Microvolts at 1000 kHz	50	50	50
Weight			
Net Weight, Each, Pounds	18	44	52

* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time. **ALL DIMENSIONS ARE IN INCHES**

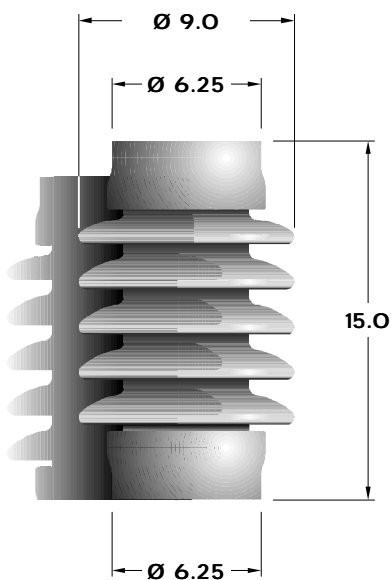
STANDARD STRENGTH UNIT



4 TAPPED HOLES
1/2-13 +.015 OVERSIZE
5/8" FULL THREAD
ON 3.0" BOLT CIRCLE

315208-70

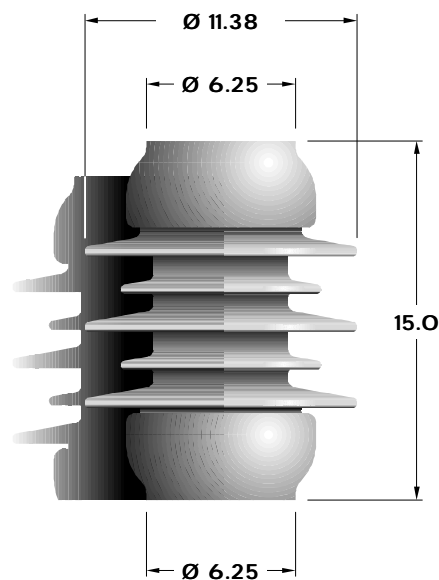
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315227-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

318453-70

CHARACTERISTICS

Lapp Catalog Number	315208-70	315227-70	318453-70
Ansi Technical Reference Number	T.R.208	T.R.227	
Dimensions			
Leakage Distance, Inches	24	24	24
Mechanical Values *			
Cantilever Strength, Upright, Pounds	2000	4000	8000
Cantilever Strength, Underhung, Pounds	2000	4000	8000
Tensile Strength, Pounds	10000	20000	28000
Torsion Strength, Inch-Pounds	8000	16000	40000
Compression Strength, Pounds	10000	20000	40000
Electrical Values			
Voltage Class, kV	23	23	23
Impulse Flashover, Positive, kV	170	170	170
Low Frequency Withstand, 10 Sec. Wet, kV	60	60	60
Impulse Withstand, kV	150	150	150
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	15	15	15
Maximum RIV, Microvolts at 1000 kHz	100	100	100
Weight			
Net Weight, Each, Pounds	30	58	75

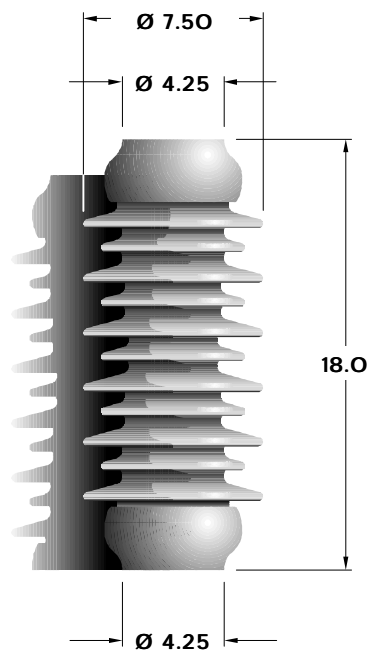
* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES

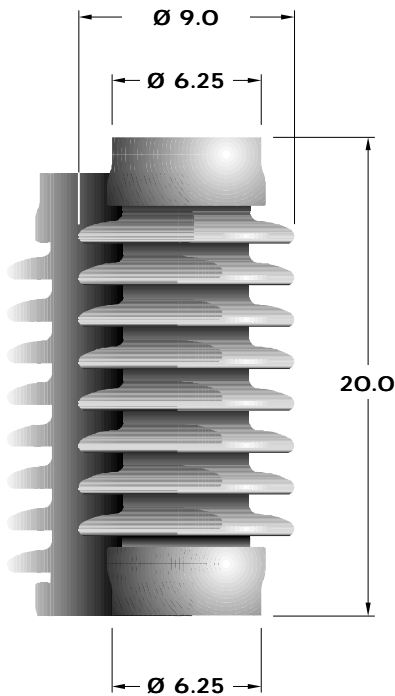
STANDARD STRENGTH UNIT



4 TAPPED HOLES
1/2-13 +.015 OVERSIZE
5/8" FULL THREAD
ON 3.0" BOLT CIRCLE

315210-70

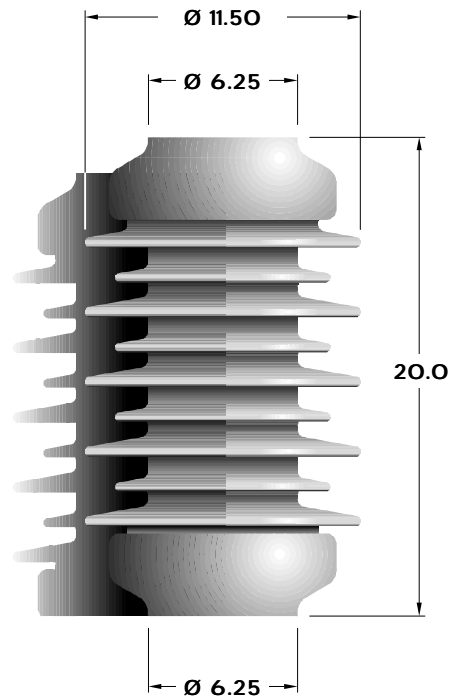
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315231-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

318455-70

CHARACTERISTICS

Lapp Catalog Number	315210-70	315231-70	318455-70
Ansi Technical Reference Number	T.R.210	T.R.231	
Dimensions			
Leakage Distance, Inches	37	37	37
Mechanical Values *			
Cantilever Strength, Upright, Pounds	2000	4000	8000
Cantilever Strength, Underhung, Pounds	2000	4000	8000
Tensile Strength, Pounds	12000	25000	28000
Torsion Strength, Inch-Pounds	10000	20000	40000
Compression Strength, Pounds	15000	30000	60000
Electrical Values			
Voltage Class, kV	34.5	34.5	34.5
Impulse Flashover, Positive, kV	225	225	225
Low Frequency Withstand, 10 Sec. Wet, kV	80	80	80
Impulse Withstand, kV	200	200	200
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	22	22	22
Maximum RIV, Microvolts at 1000 kHz	100	100	100
Weight			
Net Weight, Each, Pounds	41	74	117

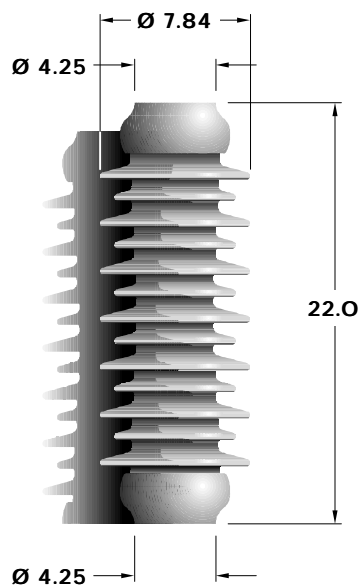
* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES 13

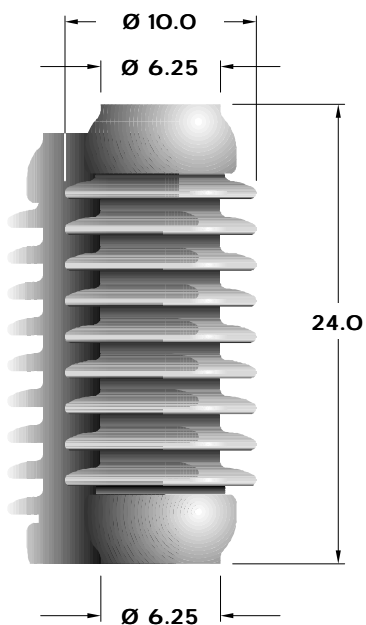
STANDARD STRENGTH UNIT



4 TAPPED HOLES
1/2-13 +.015 OVERSIZE
5/8" FULL THREAD
ON 3.0" BOLT CIRCLE

315214-70

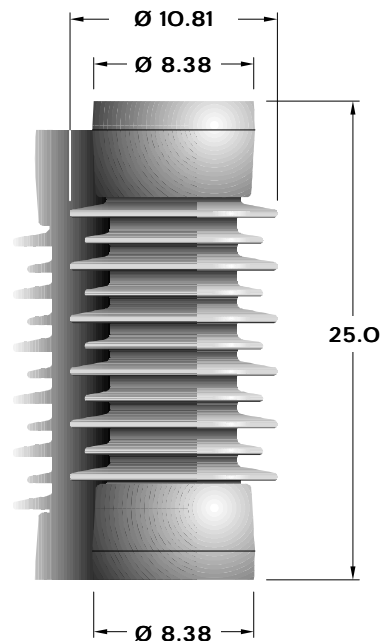
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315267-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

318459-70

CHARACTERISTICS

Lapp Catalog Number	315214-70	315267-70	318459-70
Ansi Technical Reference Number	T.R.214	T.R.267	
Dimensions			
Leakage Distance, Inches	43	43	43
Mechanical Values *			
Cantilever Strength, Upright, Pounds	2000	4000	8000
Cantilever Strength, Underhung, Pounds	2000	4000	8000
Tensile Strength, Pounds	14000	25000	40000
Torsion Strength, Inch-Pounds	12000	20000	90000
Compression Strength, Pounds	15000	60000	120000
Electrical Values			
Voltage Class, kV	46	46	46
Impulse Flashover, Positive, kV	280	280	280
Low Frequency Withstand, 10 Sec. Wet, kV	100	100	100
Impulse Withstand, kV	250	250	250
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	30	30	30
Maximum RIV, Microvolts at 1000 kHz	200	200	200
Weight			
Net Weight, Each, Pounds	50	111	159

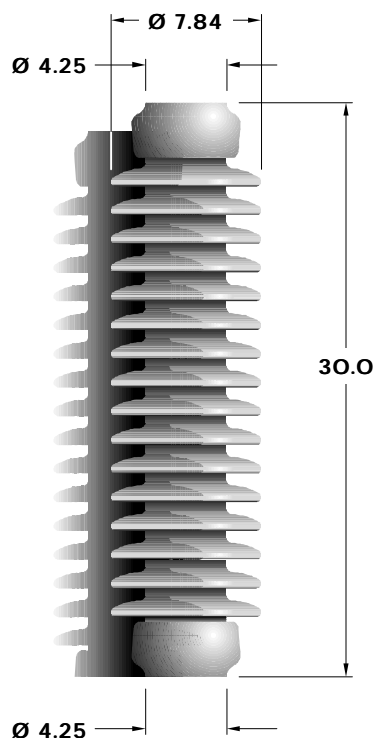
* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES

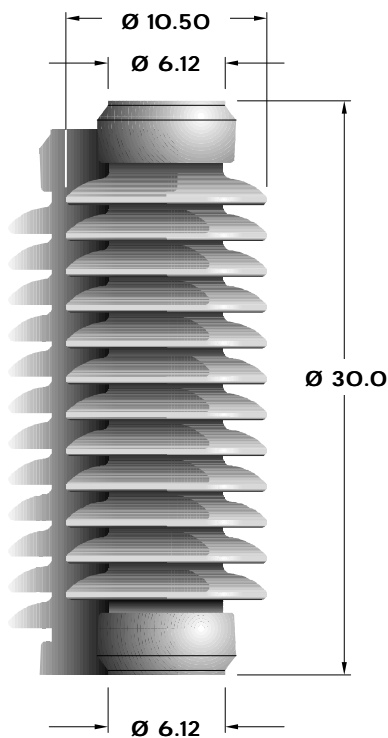
STANDARD STRENGTH UNIT



4 TAPPED HOLES
1/2-13 +.015 OVERSIZE
5/8" FULL THREAD
ON 3.0" BOLT CIRCLE

315216-70

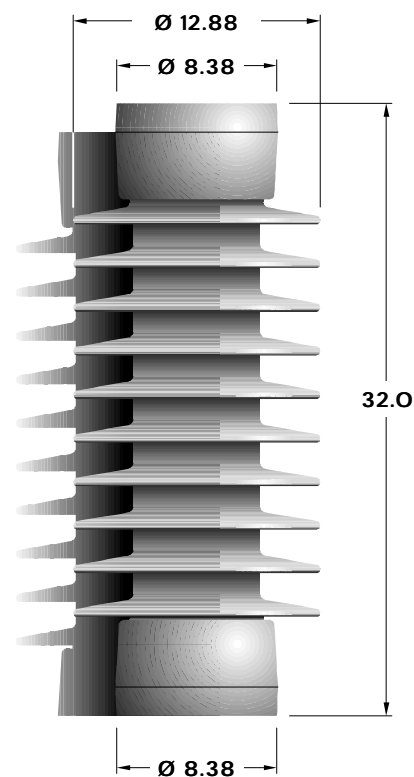
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
1 1/16" FULL THREAD
ON 5.0" BOLT CIRCLE

315278-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

318461-70

CHARACTERISTICS

Lapp Catalog Number	315216-70	315278-70	318461-70
Ansi Technical Reference Number	T.R.216	T.R.278	
Dimensions			
Leakage Distance, Inches	72	72	72
Mechanical Values *			
Cantilever Strength, Upright, Pounds	1500	3000	6000
Cantilever Strength, Underhung, Pounds	1500	3000	6000
Tensile Strength, Pounds	16000	25000	40000
Torsion Strength, Inch-Pounds	15000	40000	90000
Compression Strength, Pounds	25000	60000	120000
Electrical Values			
Voltage Class, kV	69	69	69
Impulse Flashover, Positive, kV	390	390	390
Low Frequency Withstand, 10 Sec. Wet, kV	145	145	145
Impulse Withstand, kV	350	350	350
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	44	44	44
Maximum RIV, Microvolts at 1000 kHz	200	200	200
Weight			
Net Weight, Each, Pounds	79	132	204

* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

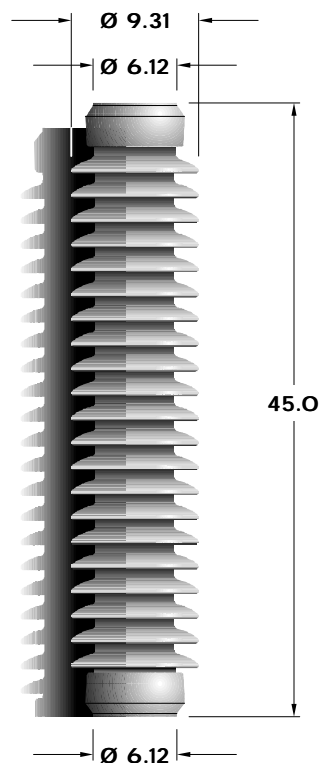
Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES 15

STANDARD STRENGTH UNIT

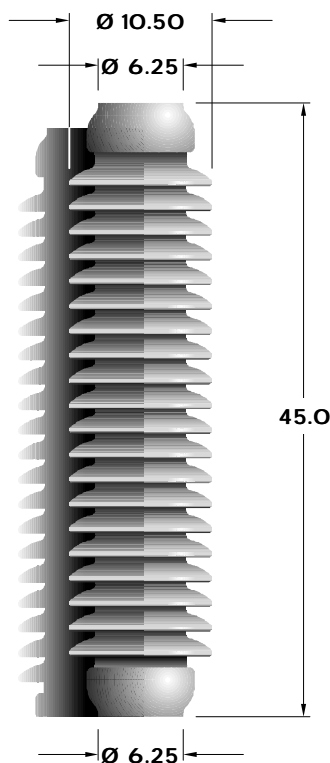
HIGH STRENGTH UNIT

EXTRA-HIGH STRENGTH UNIT



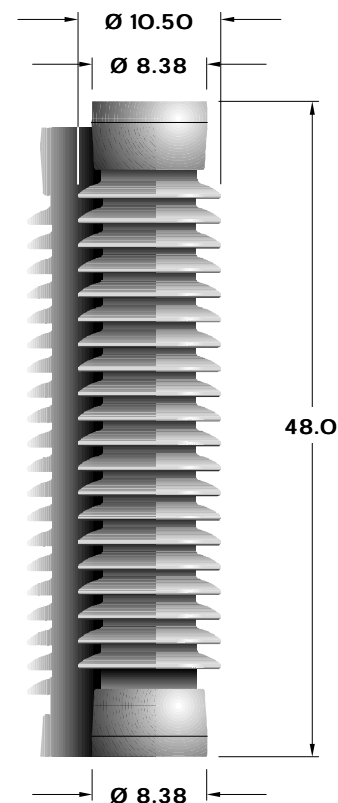
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
1 1/16" FULL THREAD
ON 5.0" BOLT CIRCLE

315286-70



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315287-70



4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

318457-70

CHARACTERISTICS

Lapp Catalog Number	315286-70	315287-70	318457-70
Ansi Technical Reference Number	T.R.286	T.R.287	
Dimensions			
Leakage Distance, Inches	99	99	99
Mechanical Values *			
Cantilever Strength, Upright, Pounds	1700	2600	4500
Cantilever Strength, Underhung, Pounds	1700	2600	4500
Tensile Strength, Pounds	20000	25000	40000
Torsion Strength, Inch-Pounds	40000	90000	120000
Compression Strength, Pounds	60000	75000	120000
Electrical Values			
Voltage Class, kV	115	115	115
Impulse Flashover, Positive, kV	610	610	610
Low Frequency Withstand, 10 Sec. Wet, kV	230	230	230
Impulse Withstand, kV	550	550	550
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	73	73	73
Maximum RIV, Microvolts at 1000 kHz	200	200	200
Weight			
Net Weight, Each, Pounds	161	213	272

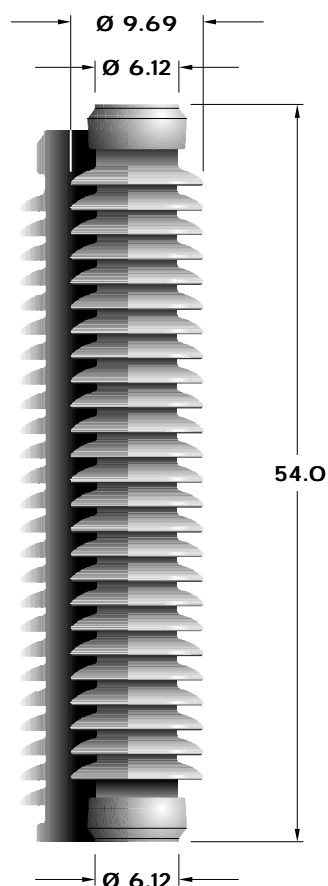
* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES

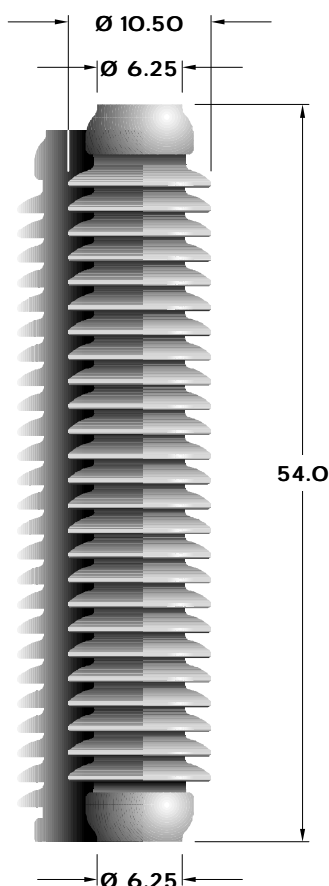
STANDARD STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
11/16" FULL THREAD
ON 5.0" BOLT CIRCLE

315288-70

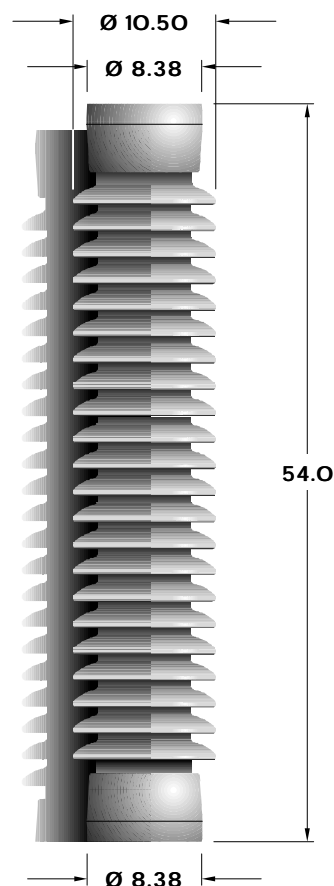
HIGH STRENGTH UNIT



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315289-70

EXTRA-HIGH STRENGTH UNIT



4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

314857-70

CHARACTERISTICS

Lapp Catalog Number	315288-70	315289-70	314857-70
Ansi Technical Reference Number	T.R.288	T.R.289	
Dimensions			
Leakage Distance, Inches	116	116	116
Mechanical Values *			
Cantilever Strength, Upright, Pounds	1450	2200	4100
Cantilever Strength, Underhung, Pounds	1450	2200	4100
Tensile Strength, Pounds	20000	25000	40000
Torsion Strength, Inch-Pounds	60000	90000	120000
Compression Strength, Pounds	60000	75000	120000
Electrical Values			
Voltage Class, kV	138	138	138
Impulse Flashover, Positive, kV	710	710	710
Low Frequency Withstand, 10 Sec. Wet, kV	275	275	275
Impulse Withstand, kV	650	650	650
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	88	88	88
Maximum RIV, Microvolts at 1000 kHz	200	200	200
Weight			
Net Weight, Each, Pounds	200	255	311

* For Maximum recommended working loads see "Specifications," page 5.

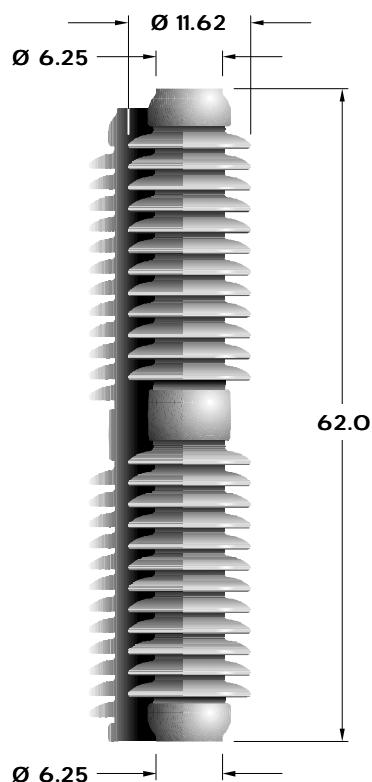
Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time. **ALL DIMENSIONS ARE IN INCHES**

STANDARD STRENGTH UNIT

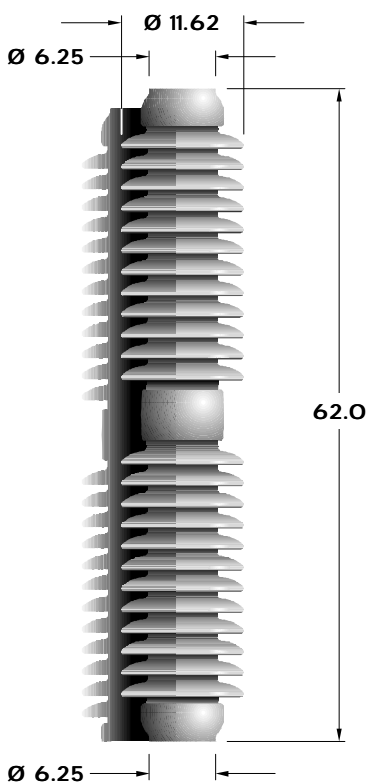
HIGH STRENGTH UNIT

EXTRA-HIGH STRENGTH UNIT



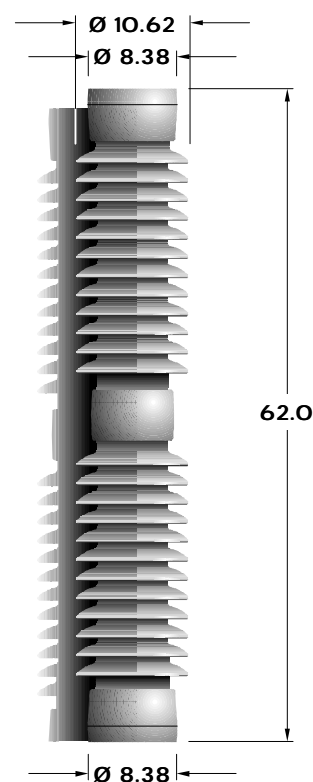
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315291-PA-70



4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE

315295-PA-70



4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

318441-PA-70

CHARACTERISTICS

Lapp Catalog Number	315291PA-70	315295PA-70	318441PA-70
Ansi Technical Reference Number	T.R.291	T.R.295	
Dimensions			
Leakage Distance, Inches	132	132	132
Mechanical Values *			
Cantilever Strength, Upright, Pounds	1200	1850	3500
Cantilever Strength, Underhung, Pounds	1200	1850	3500
Tensile Strength, Pounds	20000	25000	40000
Torsion Strength, Inch-Pounds	40000	90000	120000
Compression Strength, Pounds	60000	75000	120000
Electrical Values			
Voltage Class, kV	161	161	161
Impulse Flashover, Positive, kV	810	810	810
Low Frequency Withstand, 10 Sec. Wet, kV	315	315	315
Impulse Withstand, kV	750	750	750
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	103	103	103
Maximum RIV, Microvolts at 1000 kHz	200	200	200
Weight			
Net Weight, Each, Pounds	331	331	320

* For Maximum recommended working loads see "Specifications," page 5.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

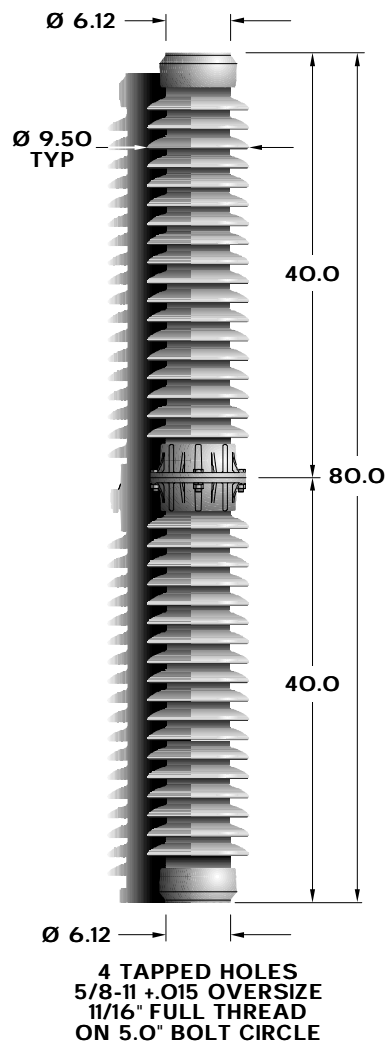
Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES

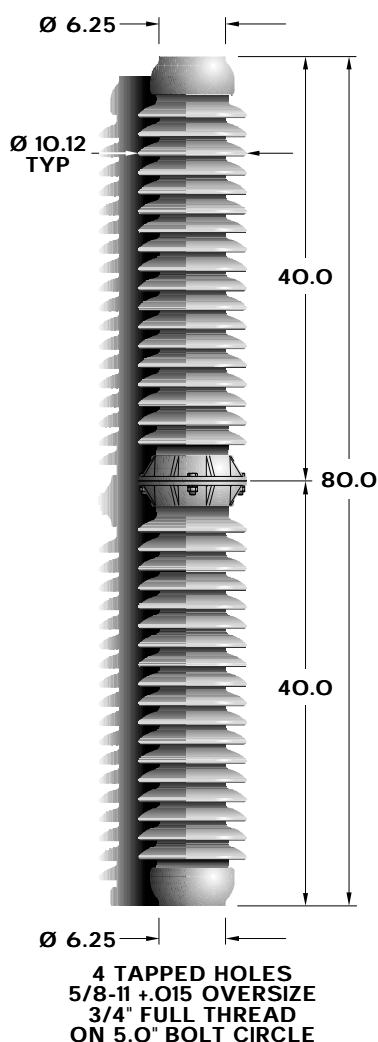
STANDARD STRENGTH UNIT

HIGH STRENGTH UNIT

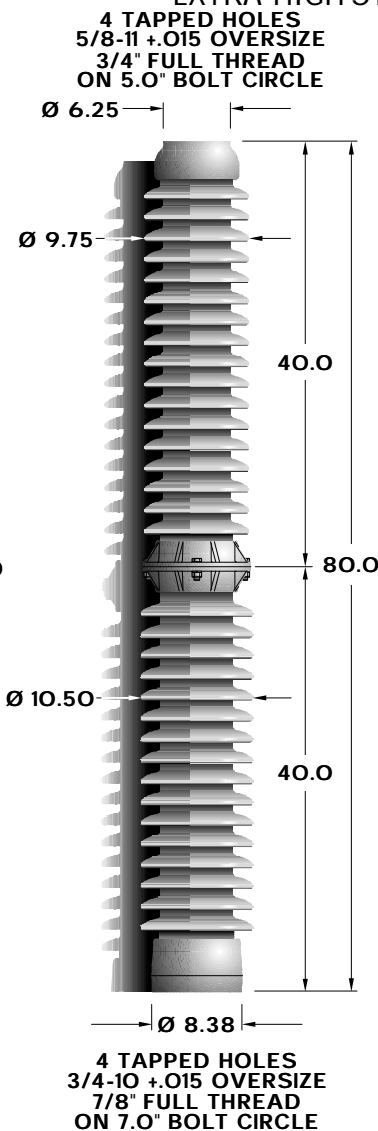
EXTRA-HIGH STRENGTH UNITS



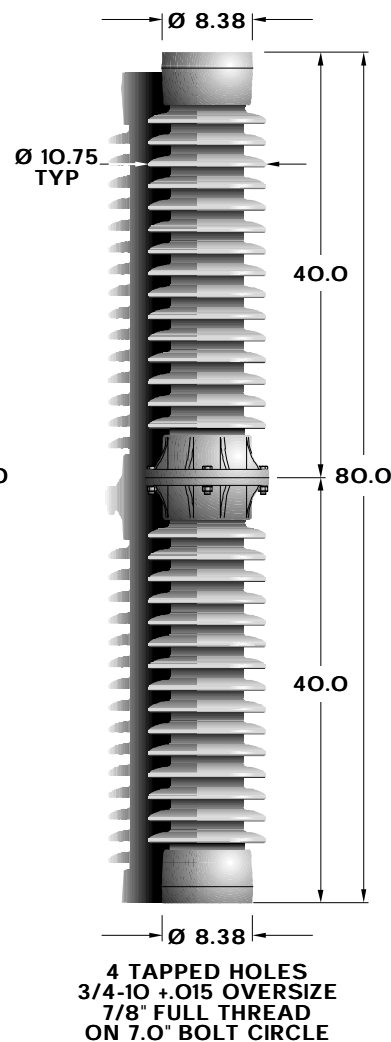
315304-70



315308-70



314925-70



314161-70

CHARACTERISTICS

Lapp Catalog Number	315304-70	315308-70	314925-70	314161-70
Ansi Technical Reference Number	T.R.304	T.R.308		
Dimensions				
Leakage Distance, Inches	165	165	165	164
Mechanical Values *				
Cantilever Strength, Pounds	950	1450	2450	2750
Tensile Strength, Pounds	20000	25000	20000	40000
Torsion Strength, Inch-Pounds	40000	90000	60000	120000
Compression Strength, Pounds	60000	75000	60000	100000
Electrical Values				
Impulse Flashover, Positive, kV	1010	1010	1010	1010
Low Frequency Withstand, 10 Sec. Wet, kV	385	385	385	385
Impulse Withstand, kV	900	900	900	900
Radio Influence Voltage Data				
Test Voltage, Rms to Ground, kV	146	146	146	146
Maximum RIV, Microvolts at 1000 kHz	500	500	500	500
Weight				
Net Weight, Each, Pounds	307	371	417	490

* For Maximum recommended working loads see "Specifications," page 6.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

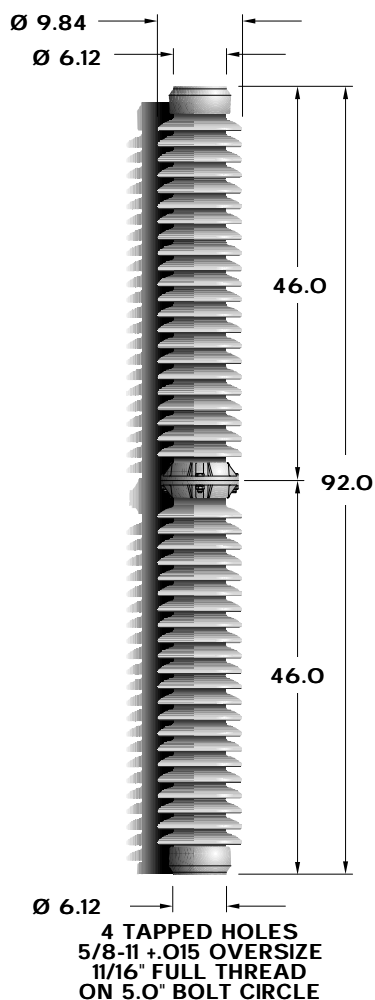
Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES 19

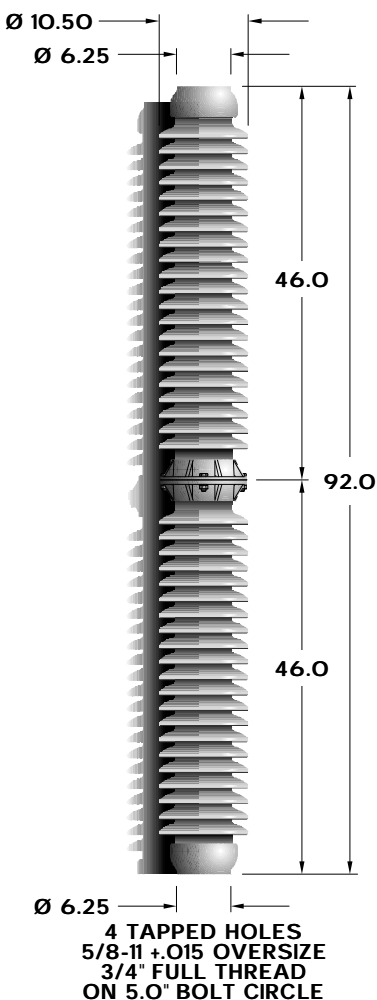
STANDARD STRENGTH UNIT

HIGH STRENGTH UNIT

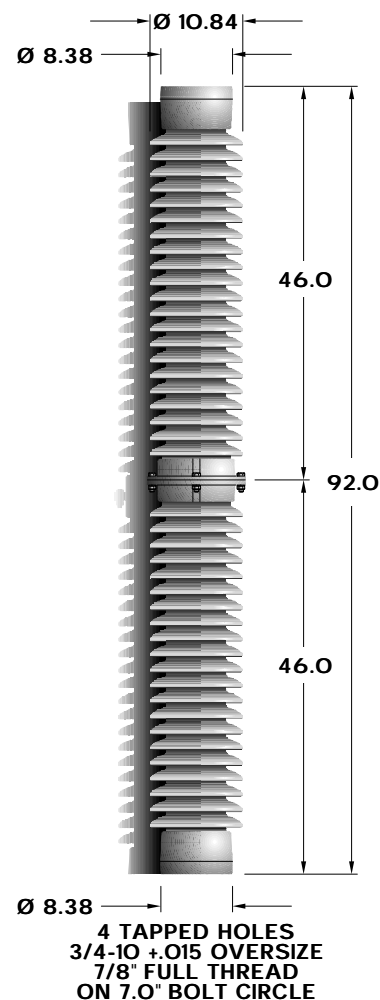
EXTRA-HIGH STRENGTH UNIT



315312-70



315316-70



315362-70

CHARACTERISTICS

Lapp Catalog Number	315312-70	315316-70	315362-70
Ansi Technical Reference Number	T.R.312	T.R.316	T.R.362
Dimensions			
Leakage Distance, Inches	198	198	198
Mechanical Values *			
Cantilever Strength, Pounds	800	1250	2300
Tensile Strength, Pounds	20000	25000	40000
Torsion Strength, Inch-Pounds	40000	90000	120000
Compression Strength, Pounds	60000	75000	100000
Electrical Values			
Impulse Flashover, Positive, kV	1210	1210	1210
Low Frequency Withstand, 10 Sec. Wet, kV	455	455	455
Impulse Withstand, kV	1050	1050	1050
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	146	146	146
Maximum RIV, Microvolts at 1000 kHz	500	500	500
Weight			
Net Weight, Each, Pounds	384	450	580

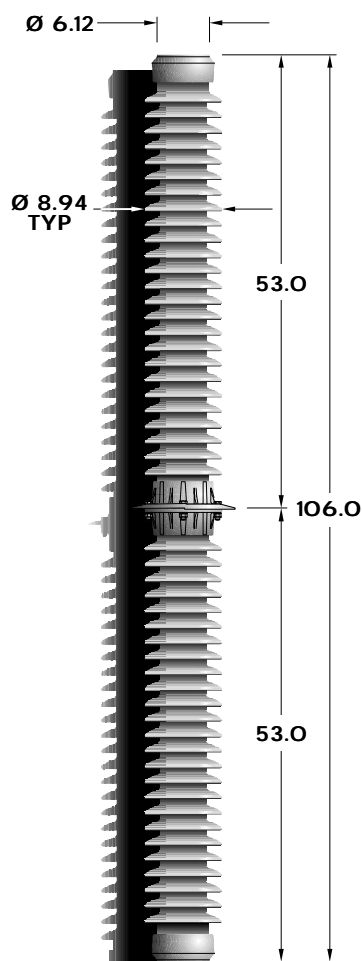
* For Maximum recommended working loads see "Specifications," page 6.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES

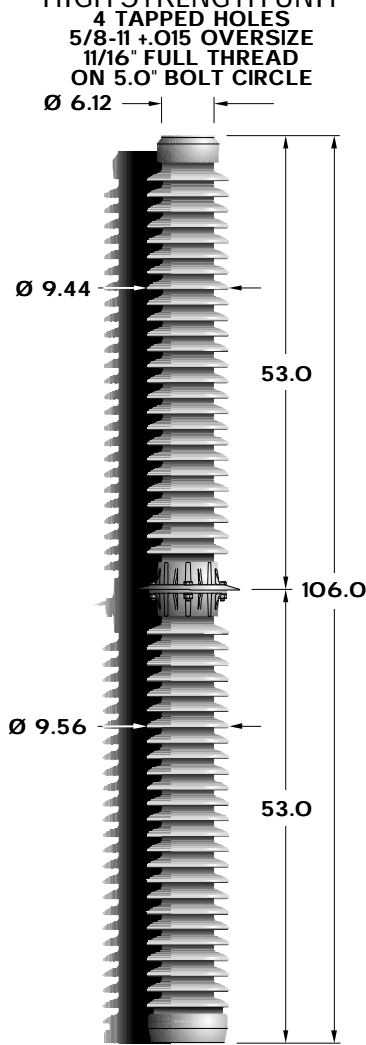
STANDARD STRENGTH UNIT



Ø 6.12
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
11/16" FULL THREAD
ON 5.0" BOLT CIRCLE

315324-70

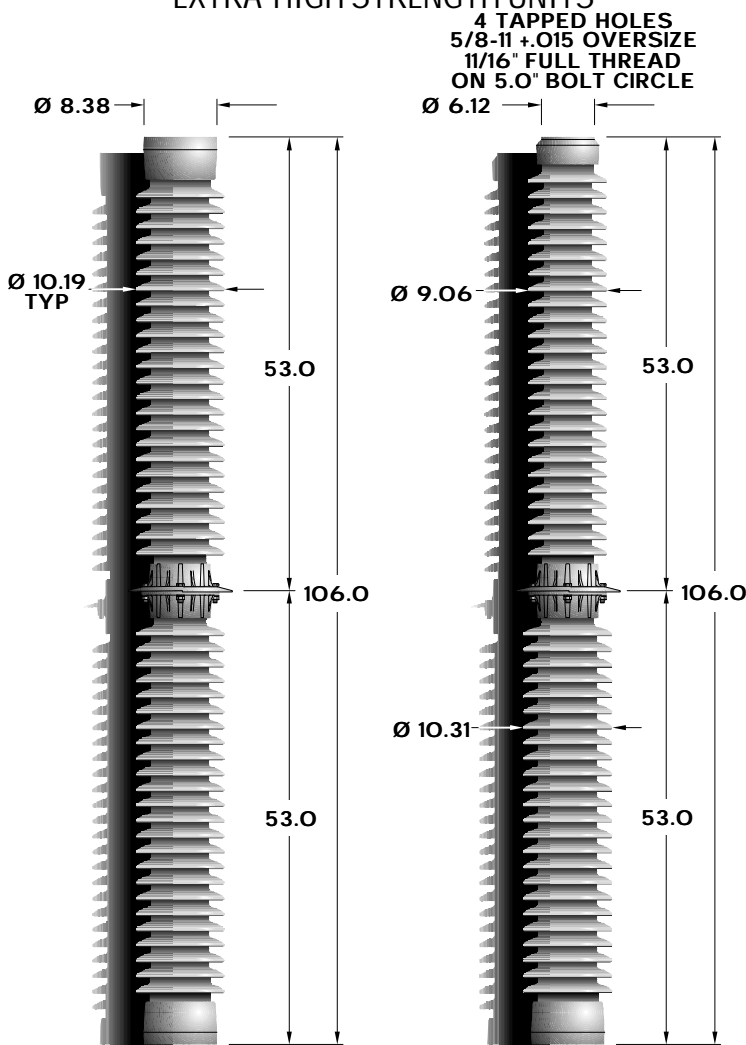
HIGH STRENGTH UNIT



Ø 8.50
4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

315367-70

EXTRA-HIGH STRENGTH UNITS



Ø 8.38
4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

315368-70

Ø 8.38
4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

315369-70

CHARACTERISTICS

Lapp Catalog Number	315324-70	315367-70	315368-70	315369-70
Ansi Technical Reference Number	T.R.324	T.R.367	T.R.368	T.R.369
Dimensions				
Leakage Distance, Inches	231	231	231	231
Mechanical Values *				
Cantilever Strength, Pounds	1000	1450	2000	2050
Tensile Strength, Pounds	25000	20000	40000	20000
Torsion Strength, Inch-Pounds	90000	40000	120000	40000
Compression Strength, Pounds	75000	60000	100000	60000
Electrical Values				
Impulse Flashover, Positive, kV	1410	1410	1410	1410
Low Frequency Withstand, 10 Sec. Wet, kV	525	525	525	525
Impulse Withstand, kV	1300	1300	1300	1300
Radio Influence Voltage Data				
Test Voltage, Rms to Ground, kV	220	220	220	220
Maximum RIV, Microvolts at 1000 kHz	1000	1000	1000	1000
Weight				
Net Weight, Each, Pounds	388	438	545	478

* For Maximum recommended working loads see "Specifications," page 6.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

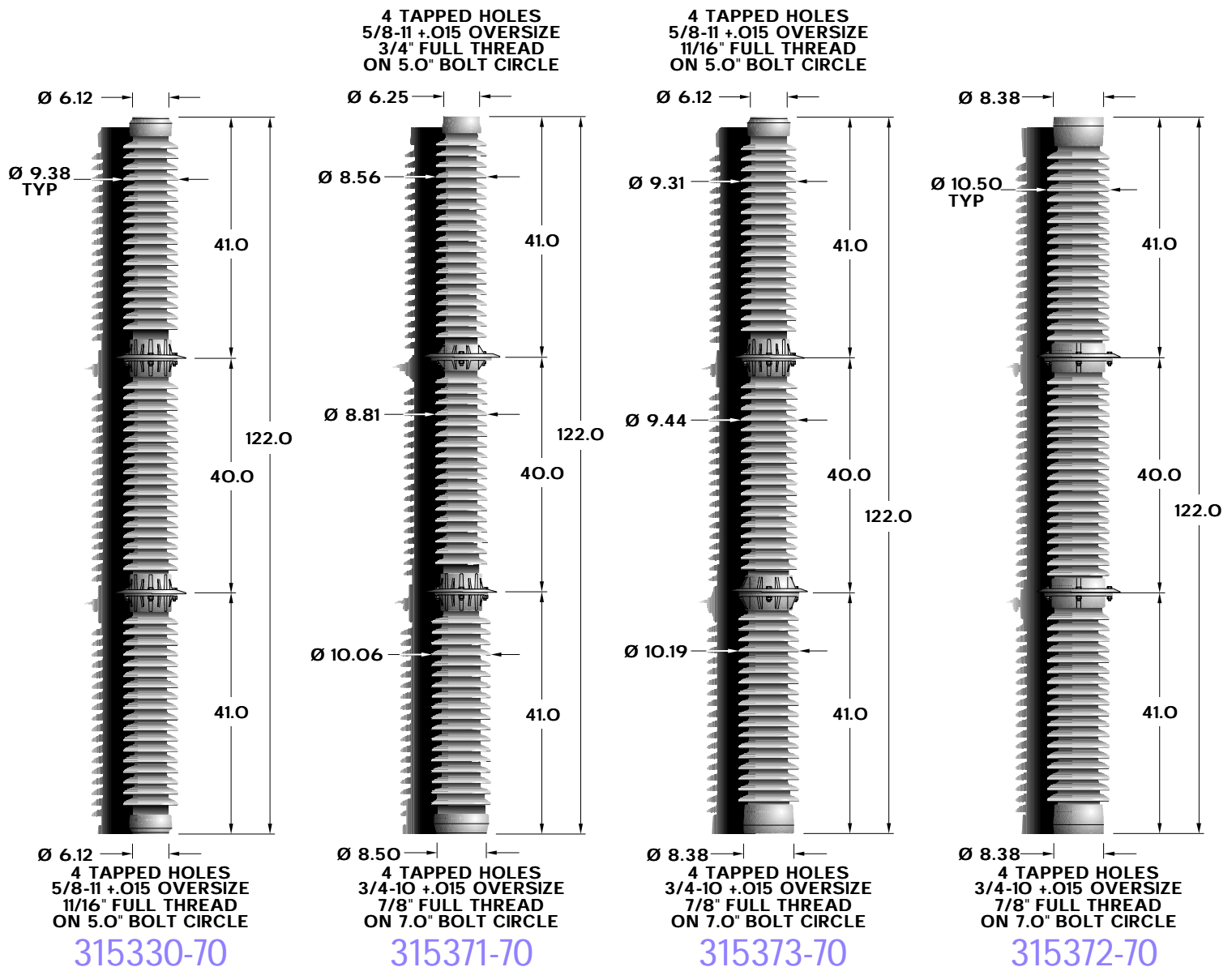
Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES 21

STANDARD STRENGTH UNIT

HIGH STRENGTH UNIT

EXTRA-HIGH STRENGTH UNITS



CHARACTERISTICS

Lapp Catalog Number	315330-70	315371-70	315373-70	315372-70
Ansi Technical Reference Number	T.R.330	T.R.371	T.R.373	T.R.372
Dimensions				
Leakage Distance, Inches	264	264	264	264
Mechanical Values *				
Cantilever Strength, Pounds	900	1170	1750	1750
Tensile Strength, Pounds	25000	20000	20000	40000
Torsion Strength, Inch-Pounds	90000	40000	40000	120000
Compression Strength, Pounds	75000	60000	60000	100000
Electrical Values				
Impulse Flashover, Positive, kV	1610	1610	1610	1610
Low Frequency Withstand, 10 Sec. Wet, kV	590	590	590	590
Impulse Withstand, kV	1470	1470	1470	1470
Radio Influence Voltage Data				
Test Voltage, Rms to Ground, kV	220	220	220	220
Maximum RIV, Microvolts at 1000 kHz	1000	1000	1000	1000
Weight				
Net Weight, Each, Pounds	500	485	559	673

* For Maximum recommended working loads see "Specifications," page 6.

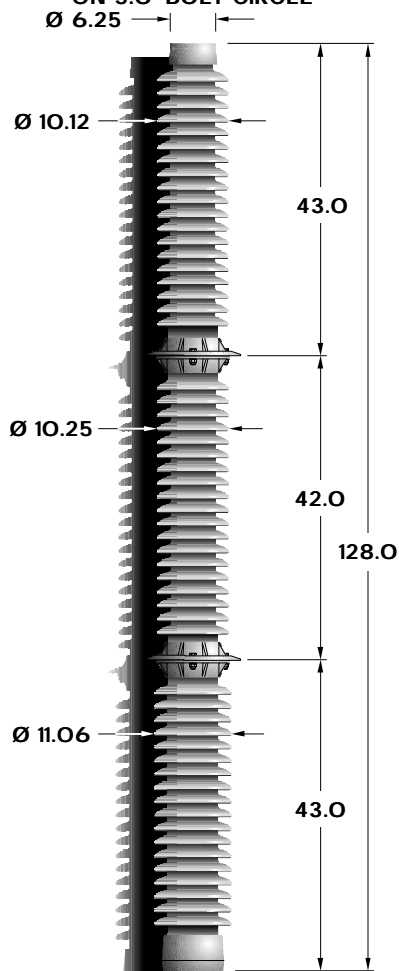
Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

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ALL DIMENSIONS ARE IN INCHES

STANDARD STRENGTH UNIT

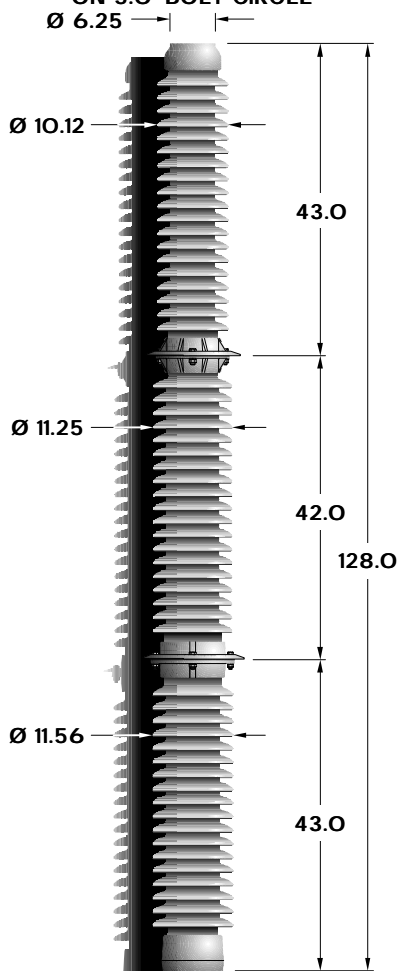
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
7/8" FULL THREAD
ON 5.0" BOLT CIRCLE



314732-70

HIGH STRENGTH UNIT

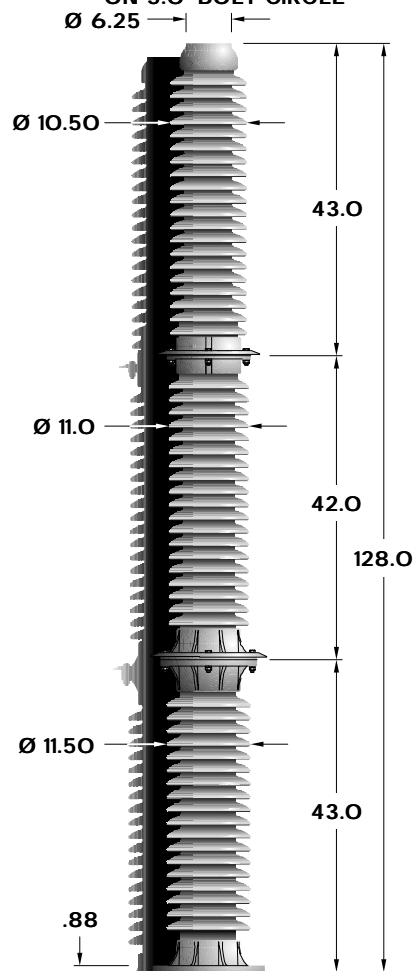
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
7/8" FULL THREAD
ON 5.0" BOLT CIRCLE



315379-70

EXTRA-HIGH STRENGTH UNIT

4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
7/8" FULL THREAD
ON 5.0" BOLT CIRCLE



318059-70

CHARACTERISTICS

Lapp Catalog Number	314732-70	315379-70	318059-70
Ansi Technical Reference Number		T.R.379	
Dimensions			
Leakage Distance, Inches	320	280	305
Mechanical Values *			
Cantilever Strength, Pounds	1000	1700	2500
Tensile Strength, Pounds	20000	20000	25000
Torsion Strength, Inch-Pounds	60000	40000	60000
Compression Strength, Pounds	60000	60000	60000
Electrical Values			
Impulse Flashover, Positive, kV	1710	1710	1710
Low Frequency Withstand, 10 Sec. Wet, kV	620	620	620
Impulse Withstand, kV	1550	1550	1550
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	318	318	318
Maximum RIV, Microvolts at 1000 kHz	2000	2000	2000
Weight			
Net Weight, Each, Pounds	630	733	863

* For Maximum recommended working loads see "Specifications," page 6.

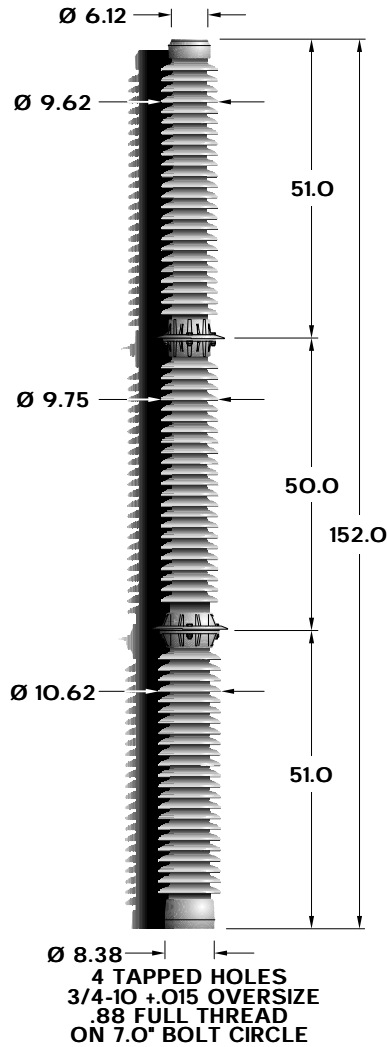
Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES 23

STANDARD STRENGTH UNIT

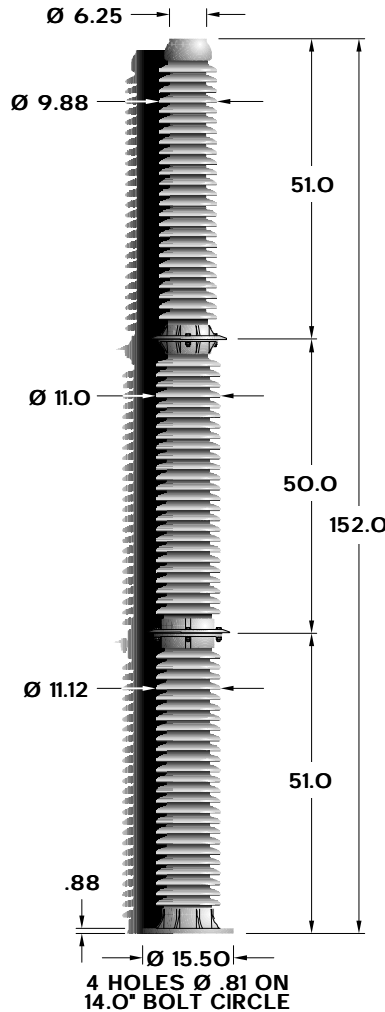
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
11/16" FULL THREAD
ON 5.0" BOLT CIRCLE



315391-70

HIGH STRENGTH UNIT

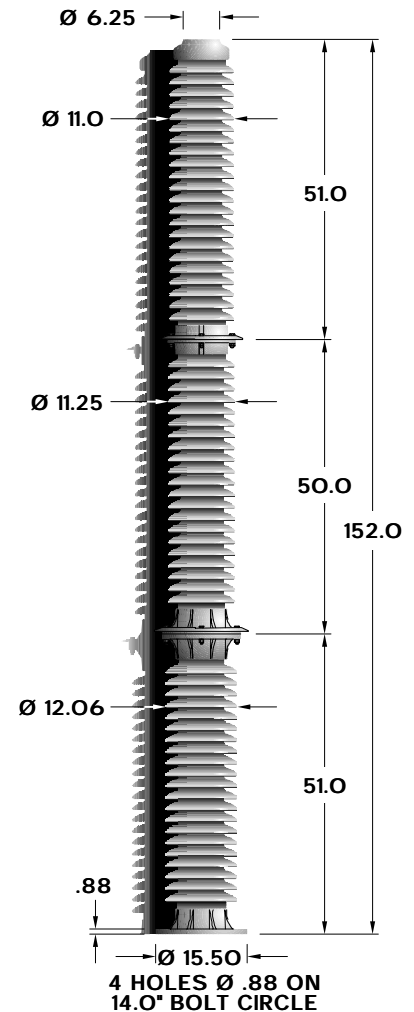
4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE



314914-70

EXTRA-HIGH STRENGTH UNIT

4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE



314934-70

CHARACTERISTICS

Lapp Catalog Number	315391-70	314914-70	314934-70
Ansi Technical Reference Number	T.R.391		
Dimensions			
Leakage Distance, Inches	330	360	360
Mechanical Values *			
Cantilever Strength, Pounds	1400	1750	2500
Tensile Strength, Pounds	20000	20000	25000
Torsion Strength, Inch-Pounds	40000	60000	90000
Compression Strength, Pounds	60000	60000	90000
Electrical Values			
Impulse Flashover, Positive, kV	2000	2000	2000
Low Frequency Withstand, 10 Sec. Wet, kV	710	710	710
Impulse Withstand, kV	1800	1800	1800
Radio Influence Voltage Data			
Test Voltage, Rms to Ground, kV	318	318	318
Maximum RIV, Microvolts at 1000 kHz	2000	2000	2000
Weight			
Net Weight, Each, Pounds	705	890	1031

* For Maximum recommended working loads see "Specifications," page 6.

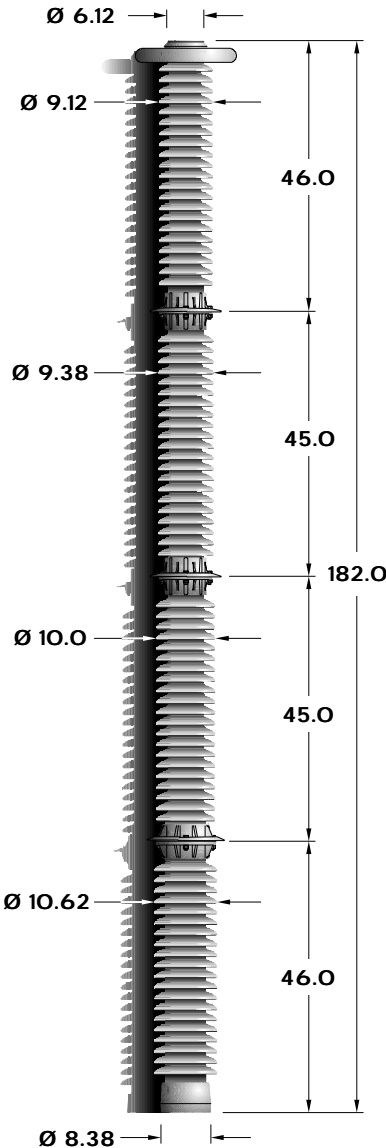
Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

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ALL DIMENSIONS ARE IN INCHES

STANDARD STRENGTH UNIT

4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
11/16" FULL THREAD
ON 5.0" BOLT CIRCLE

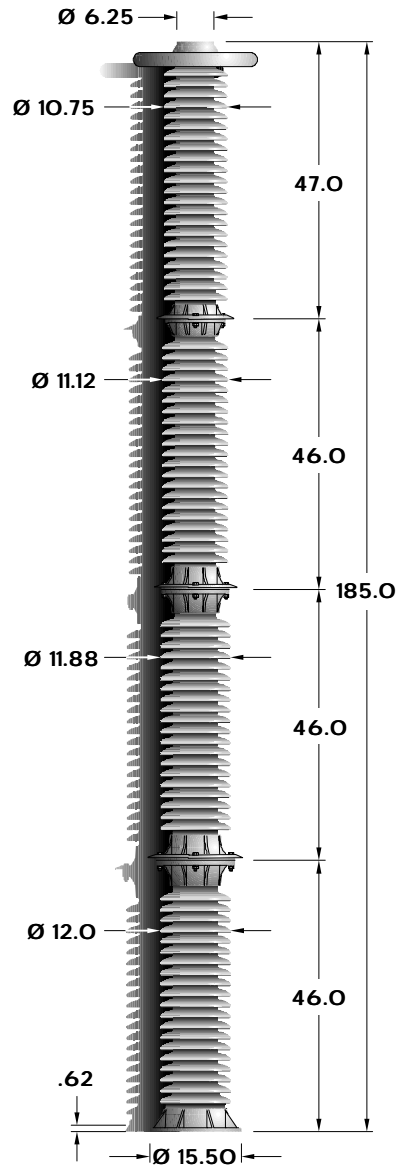


4 TAPPED HOLES
3/4-10 +.015 OVERSIZE
7/8" FULL THREAD
ON 7.0" BOLT CIRCLE

314867-70

HIGH STRENGTH UNIT

4 TAPPED HOLES
5/8-11 +.015 OVERSIZE
3/4" FULL THREAD
ON 5.0" BOLT CIRCLE



4 HOLES Ø .88 ON
14.0" BOLT CIRCLE

318032-70

CHARACTERISTICS

Lapp Catalog Number	314867-70	318032-70
Ansi Technical Reference Number		
Dimensions		
Leakage Distance, Inches	432	432
Mechanical Values *		
Cantilever Strength, Pounds	1200	2000
Tensile Strength, Pounds	20000	20000
Torsion Strength, Inch-Pounds	60000	60000
Compression Strength, Pounds	60000	60000
Electrical Values		
Impulse Flashover, Positive, kV	2370	2250
Low Frequency Withstand, 10 Sec. Wet, kV	830	830
Impulse Withstand, kV	2050	2050
Weight		
Net Weight, Each, Pounds	858	1223

* For Maximum recommended working loads see "Specifications," page 6.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.

Illustrations shown are true representations of Lapp products at the time of printing, but are subject to change at any time.

ALL DIMENSIONS ARE IN INCHES 25

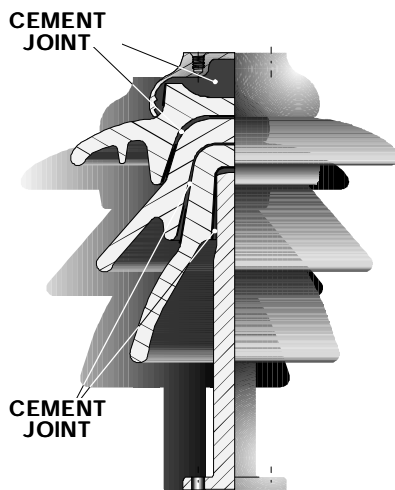
Lapp has been meeting the needs of electric utilities for over 80 years. The station post was a Lapp first, back in 1931. Today, Lapp continues to be at the forefront of insulator design with world class research facilities and engineering capabilities. The Lapp Cap and Pin Replacement Post offers electric utilities a direct replacement for cap and pin insulators, featuring all the characteristics required for reliable substation operation.

Design Advantages

Both cap and pin and station post insulators have been used for many years in substations. While the two products serve the same task, their designs are markedly different. Long term experience with both designs has shown that there are generic design deficiencies of the cap and pin that can almost certainly lead to insulator failure in service. Large numbers of cap and pin failures have lead several North American utilities to undertake replacement programs in which station posts are taking the place of cap and pin insulators. When comparing the two designs, the station post's advantages become evident and its viability as a replacement for the cap and pin becomes clear.

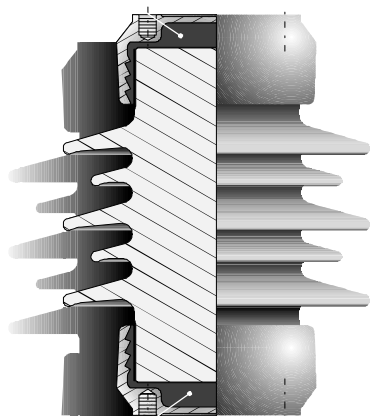
Porcelain has very high compressive strength (80,000 psi), sixteen times greater than its tensile strength (5,000 psi). Station Post insulators are designed to take advantage of this inherent quality by avoiding conditions which place porcelain in tension. Cap and pin insulators, on the other hand, can be subject to tensile forces generated between two or more porcelain shells from two possible sources: "growth" within the cement joint, and thermal expansion differences.

"Growth" within the cement joint can be a result of reactions between the cement and foreign chemical substances, such as industrial contaminants which may be in the service environment of the insulator. As these reactions proceed, the joint swells or "grows." In designs such as the cap and pin, which employ up to three separate internal joints, this swelling generates bursting (tensile) forces on the porcelain shells, ultimately leading to cracking. If the cement is of poor quality and contains excessive amounts of impurities such as free calcium oxide or magnesium oxide, reactions can occur within the cement itself which may lead to this type of mechanical failure. The station post design uses only external cement joints. Under conditions of "growth," external joints preclude the development of tensile stresses on the porcelain. Stresses are compressive in nature, and thus load the porcelain in its strongest state.



CAP AND PIN INSULATOR

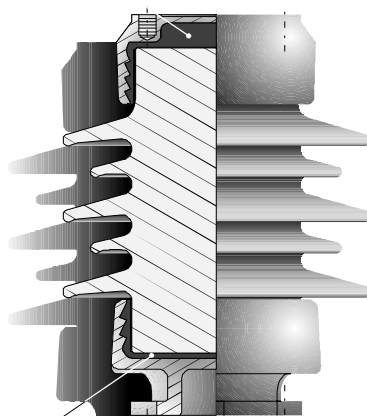
CEMENT
JOINT



CEMENT
JOINT

STATION POST

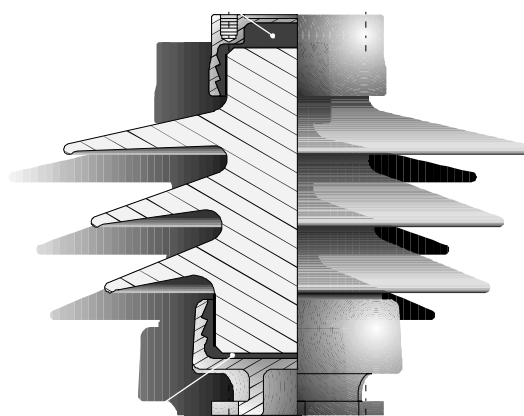
CEMENT
JOINT



CEMENT
JOINT

PEDESTAL POST

CEMENT
JOINT



CEMENT
JOINT

STACKING POST

The station post design, tested by more than 60 years of service, is much simpler than that of a corresponding cap and pin unit. Each station post section employs a large, single piece of porcelain in contrast to the cap and pin that is composed of one to three individual porcelain shells nested together and joined by cement. The simpler design and the use of fewer cemented joints means that station posts are more rigid and exhibit less deflection under load than do cap and pin insulators, an important feature in switch applications.

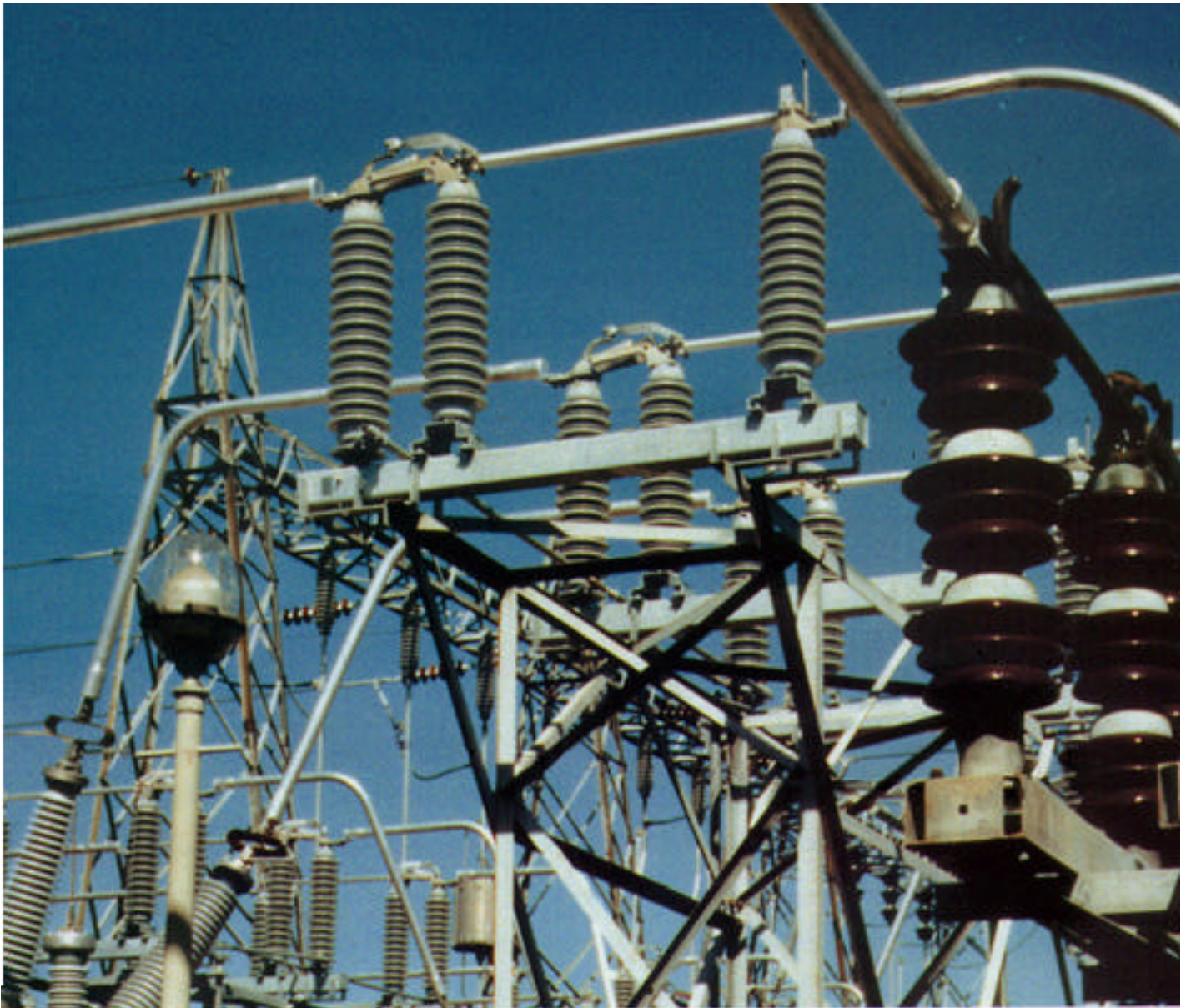
Specifications

The maximum working load for Lapp station post insulators is 40% of published cantilever rating, 50% of published torsion rating, and 50% of published tension rating. For short circuit loads only, the maximum recommended working load is 100% of published ratings when using formulas from ANSI C37-1972.

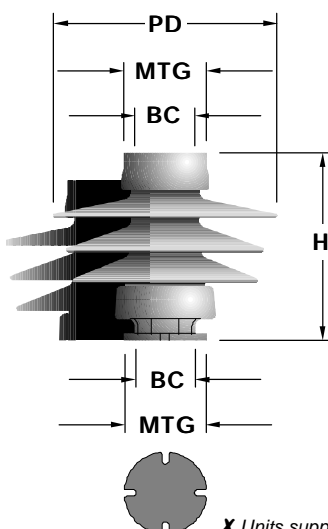
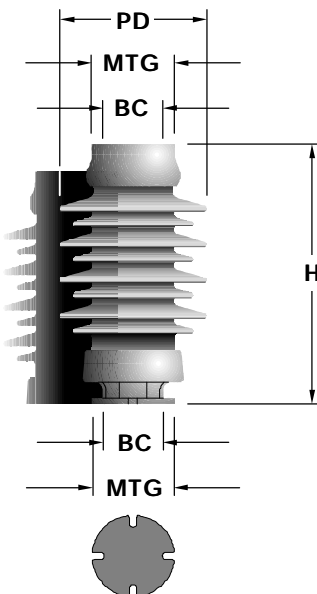
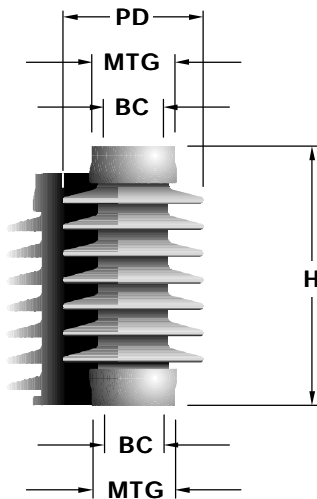
Light Gray glaze is standard on all insulators. Chocolate glaze is available by deleting "-70" from the catalog number.

Caps and flanges are made of drop forged steel, malleable iron or ductile iron, and hot dip galvanized. Tapped holes are Unified National Coarse Thread Series, 1/2"-13 and 5/8"-11. Holes are tapped .015" oversize to allow for the use of galvanized cap screws.

RG® Resistance Graded cap and pin replacement insulators, employing a unique semi-conductive glaze that effectively inhibits arcing and flashover, are also available. For more details and technical assistance, contact your local Lapp representative.



115 kV Cap and Pin Replacements photo courtesy of Bonneville Power Administration



STATION POST REPLACEMENTS

Technical Reference Number	H Height in.	Catalog Number	# of Sections	Cantilever Strength Upright lb.	Cantilever Strength Underhung lb.	Tension Strength lb.	Torsion Strength in.-lb.	Compression Strength lb.	Impulse Flashover Positive - kV
1	7.5	315202-70	1	2000	2000	7000	6000	10000	105
41	8.0	315041-70	1	4000	4000	10000	12000	20000	105
4	10.0	315205-70	1	2000	2000	8500	7000	10000	125
44	10.0	315044-70	1	4000	4000	15000	14000	20000	125
7	12.0	315007-70	1	2000	2000	5000	8000	10000	170
46	12.0	315046-70	1	4000	4000	20000	16000	20000	170
10	15.0	315010-70	1	2000	2000	7000	10000	15000	225
49	15.0	315049-70	1	4000	4000	20000	20000	30000	225
13	18.0	315013-70	1	2000	2000	8000	12000	15000	280
53	20.0	315053-70	1	4000	4000	15000	20000	30000	280
16	29.0	315016-70	1	1500	1500	12000	15000	25000	390
56	29.0	315056-70	1	3000	3000	25000	40000	60000	365
Special	29.0	314970-70	1	4500	4500	25000	90000	75000	390
19	43.5	315019-70	1	1700	1700	20000	60000	60000	580
173	43.5	315173-70	1	2900	2900	25000	90000	90000	610
25	58.0	315025-70	1	1200	1070	20000	40000	60000	810
174	58.0	315174-70	1	2000	1750	25000	90000	75000	810
126	72.5	315126-70	X 2	910	910	20000	40000	60000	1010
175	72.5	315175-70	X 2	1450	1450	25000	90000	75000	1010
128	87.0	315128-70	X 2	750	700	20000	40000	60000	1210
176	87.0	315176-70	X 2	1170	1100	25000	90000	75000	1210

PEDESTAL POST REPLACEMENTS

Technical Reference Number	H Height in.	Catalog Number	# of Sections	Cantilever Strength Upright lb.	Cantilever Strength Underhung lb.	Tension Strength lb.	Torsion Strength in.-lb.	Compression Strength lb.	Impulse Flashover Positive - kV
4	10.0	317004-70	1	2000	1000	5000	7000	10000	125
44	10.0	317044-70	1	4000	3000	10000	14000	20000	125
7	12.0	317007-70	1	2000	1000	5000	8000	10000	170
46	12.0	317046-70	1	4000	3000	10000	16000	20000	170
10	15.0	317010-70	1	2000	1000	7000	10000	15000	225
13	18.0	317013-70	1	2000	1000	8000	12000	15000	280
53	20.0	317053-70	1	4000	2500	20000	40000	60000	280
16	29.0	317016-70	1	1500	1000	12000	15000	25000	390
56	29.0	317056-70	1	3000	2350	20000	40000	60000	410
19	43.5	317019-70	1	1700	1470	20000	40000	60000	610
173	43.5	317173-70	1	2900	2350	20000	40000	60000	610
25	58.0	317025-70	1	1700	1470	20000	40000	60000	780
174	58.0	317174-70	1	2000	1750	25000	90000	75000	810
126	72.5	317126-70	X 2	910	840	20000	40000	60000	1010
175	72.5	317175-70	X 2	1450	1350	25000	90000	75000	1010
128	87.0	317128-70	X 2	750	700	20000	40000	60000	1210
176	87.0	317176-70	X 2	1170	1100	25000	90000	75000	1210

STACKING POST REPLACEMENTS

Technical Reference Number	H Height in.	Catalog Number	# of Sections	Cantilever Strength Upright lb.	Cantilever Strength Underhung lb.	Tension Strength lb.	Torsion Strength in.-lb.	Compression Strength lb.	Impulse Flashover Positive - kV
140	14.5	319140-70	X 1	7000	4000	20000	40000	60000	235
139	14.5	319139-70	X 1	10000	6000	25000	90000	75000	235
56	29.0	319056-70	X 2	3000	2350	20000	40000	60000	410
Special	29.0	314982-70	X 2	4500	3500	20000	40000	60000	410
19	43.5	319019-70	X 3	1700	1470	20000	40000	60000	610
173	43.5	319173-70	X 3	2900	2400	25000	90000	75000	610
25	58.0	319025-70	X 4	1200	1070	20000	40000	60000	810
174	58.0	319174-70	X 4	2000	1750	25000	90000	75000	810
126	72.5	319126-70	X 5	910	840	20000	40000	60000	1010
175	72.5	319175-70	X 5	1450	1350	25000	90000	75000	1010
128	87.0	319128-70	X 6	750	700	20000	40000	60000	1210
176	87.0	319176-70	X 6	1170	1100	25000	90000	75000	1210

X Units supplied with cap screw packages consisting of hex head cap screws, finished hex nuts and lock washers (galvanized steel) for section assembly.

Note: For RG glazed insulators equivalent to these standard insulators, see table on page 9.



CAP AND PIN REPLACEMENT INSULATORS

Low Frequency Withstand 10 Sec. Wet - kV	Impulse Withstand (BIL) - kV	Test Voltage Rms to Ground kV	Maximum RIV µm at 1000kHz	Leakage Distance in.	PD Porcelain Ø in.	MTG Mta.Surface Ø in.	BC Bolt Circle in.	TOP		BOTTOM		Technical Reference Number
								Tap +.015	Minumim Thread	Tap +.015	Minimum Thread	
30	95	5	50	10.5	7.0	4.25	3.0	1/2-13	0.62	1/2-13	0.62	1
30	95	5	50	10.0	9.50	6.12	5.0	5/8-11	0.69	5/8-11	0.69	41
45	110	10	50	15.5	7.0	4.25	3.0	1/2-13	0.62	1/2-13	0.62	4
45	110	10	50	14.5	8.75	6.12	5.0	5/8-11	0.69	5/8-11	0.69	44
60	150	15	100	20.0	8.0	4.25	3.0	1/2-13	0.62	1/2-13	0.62	7
60	150	15	100	24.0	10.50	6.25	5.0	5/8-11	0.75	5/8-11	0.75	46
80	200	22	100	38.0	10.62	4.25	3.0	1/2-13	0.62	1/2-13	0.62	10
80	200	22	100	35.0	10.75	6.25	5.0	5/8-11	0.75	5/8-11	0.75	49
100	250	30	200	50.0	11.0	4.25	3.0	1/2-13	0.62	1/2-13	0.62	13
100	250	30	200	40.0	10.62	6.25	5.0	5/8-11	0.75	5/8-11	0.75	53
145	350	44	200	52.0	7.84	4.25	3.0	1/2-13	0.62	1/2-13	0.62	16
145	350	44	200	70.0	10.50	6.12	5.0	5/8-11	0.69	5/8-11	0.69	56
145	350	44	200	72.0	12.0	6.25	5.0	5/8-11	0.75	5/8-11	0.75	Special
230	550	73	200	99.0	10.50	6.25	5.0	5/8-11	0.75	5/8-11	0.75	19
230	550	73	200	99.0	10.75	6.25	5.0	5/8-11	0.75	5/8-11	0.75	173
315	750	103	500	132.0	9.38	6.12	5.0	5/8-11	0.69	5/8-11	0.69	25
315	750	103	500	132.0	9.75	6.25	5.0	5/8-11	0.75	5/8-11	0.75	174
385	900	125	500	165.0	9.62	6.12	5.0	5/8-11	0.69	5/8-11	0.69	126
385	900	125	500	165.0	10.50	6.25	5.0	5/8-11	0.75	5/8-11	0.75	175
455	1050	146	500	198.0	9.50	6.12	5.0	5/8-11	0.69	5/8-11	0.69	128
455	1050	146	500	198.0	10.38	6.25	5.0	5/8-11	0.75	5/8-11	0.75	176

Low Frequency Withstand 10 Sec. Wet - kV	Impulse Withstand (BIL) - kV	Test Voltage Rms to Ground kV	Maximum RIV µm at 1000kHz	Leakage Distance in.	PD Porcelain Ø in.	MTG Mta.Surface Ø in.	BC Bolt Circle in.	TOP		BOTTOM		Technical Reference Number
								Tap +.015	Minumim Thread	Slot Width	Flange Thick	
45	110	10	50	12.0	8.25	4.25	3.0	1/2-13	0.62	0.53	0.38	4
45	110	10	50	14.0	10.0	6.25	5.0	5/8-11	0.75	Ø .69	0.38	44
60	150	15	100	20.0	10.0	4.25	3.0	1/2-13	0.62	0.53	0.38	7
60	150	15	100	18.0	12.0	6.25	5.0	5/8-11	0.69	Ø .69	0.38	46
80	200	22	100	28.0	9.50	4.25	3.0	1/2-13	0.62	0.56	0.38	10
100	250	30	200	45.0	9.50	4.25	3.0	1/2-13	0.62	0.56	0.38	13
100	250	30	200	37.0	11.12	6.12	5.0	5/8-11	0.69	0.69	0.50	53
145	350	44	200	80.0	9.50	4.25	3.0	1/2-13	0.62	0.56	0.38	16
160	350	44	200	70.0	11.12	6.12	5.0	5/8-11	0.69	0.69	0.50	56
230	550	73	200	117.0	10.62	6.25	5.0	5/8-11	0.69	0.69	0.50	19
230	550	73	200	99.0	10.50	6.12	5.0	5/8-11	0.69	0.69	0.50	173
305	750	103	500	195.0	10.75	6.12	5.0	5/8-11	0.69	0.69	0.50	25
305	750	103	500	195.0	10.75	6.12	5.0	5/8-11	0.69	0.69	0.50	174
385	900	125	500	182.0	10.50	6.12	5.0	5/8-11	0.69	0.69	0.50	126
385	900	125	500	165.0	11.38	6.25	5.0	5/8-11	0.75	0.69	0.50	175
455	1050	146	500	198.0	10.25	6.12	5.0	5/8-11	0.69	0.69	0.50	128
455	1050	146	500	198.0	11.25	6.25	5.0	5/8-11	0.75	0.69	0.50	176

Low Frequency Withstand 10 Sec. Wet - kV	Impulse Withstand (BIL) - kV	Test Voltage Rms to Ground kV	Maximum RIV µm at 1000kHz	Leakage Distance in.	PD Porcelain Ø in.	MTG Mta.Surface Ø in.	BC Bolt Circle in.	TOP		BOTTOM		Technical Reference Number
								Tap +.015	Minumim Thread	Slot Width	Flange Thick	
75	210	22	100	33.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	140
75	210	22	100	33.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	139
160 ☼	350 ☼	44	200	66.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	56
160 ☼	350 ☼	44	200	66.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	Special
230 ☼	550 ☼	73	200	99.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	19
230 ☼	550 ☼	73	200	99.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	173
315 ☼	750 ☼	103	500	132.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	25
315 ☼	750 ☼	103	500	132.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	174
385 ☼	900 ☼	125	500	165.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	126
385 ☼	900 ☼	125	500	165.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	175
455 ☼	1050 ☼	146	500	198.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	128
455 ☼	1050 ☼	146	500	198.0	17.0	6.25	5.0	5/8-11	0.75	0.69	0.50	176

☼ Withstand ratings are predicated on the use of a subbase 3.50" high or its equivalent (see "Spacers" on page 31).
Note: The drawings shown are only illustrations and do not necessarily reflect the actual number of petticoats.

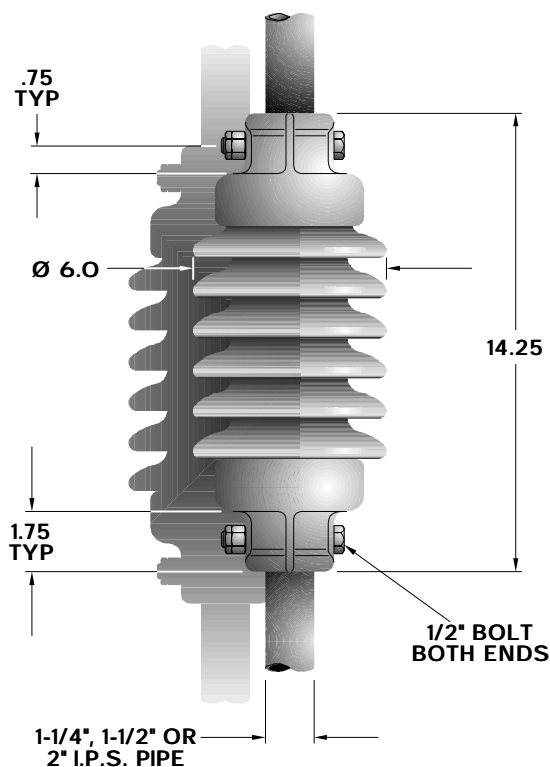
Switch operating rod insulators are essentially the same as station posts, consisting of a single porcelain unit with a special cap cemented on each end. Their small diameter, strength and reliability provide an ideal method of insulating switch operating rods to protect personnel and equipment.

Insulators are glazed light gray No. 70 as standard. Chocolate brown glaze is available on request. To specify chocolate glaze, remove "-70" from the catalog number. End hardware is ferrous, hot-dip galvanized.

CHARACTERISTICS OF SWITCH ROD INSULATORS

Dimensions	
Leakage Distance, Inches	19.0
Mechanical Values	
Ultimate Tensile Strength, Pounds	12000
Ultimate Torsion Strength, Inch-Pounds	25000
Electrical Values	
Low Frequency Dry Flashover, kV	90
Low Frequency Wet Flashover, kV	70

FOR BOLT ATTACHMENT TO PIPE



8138-70

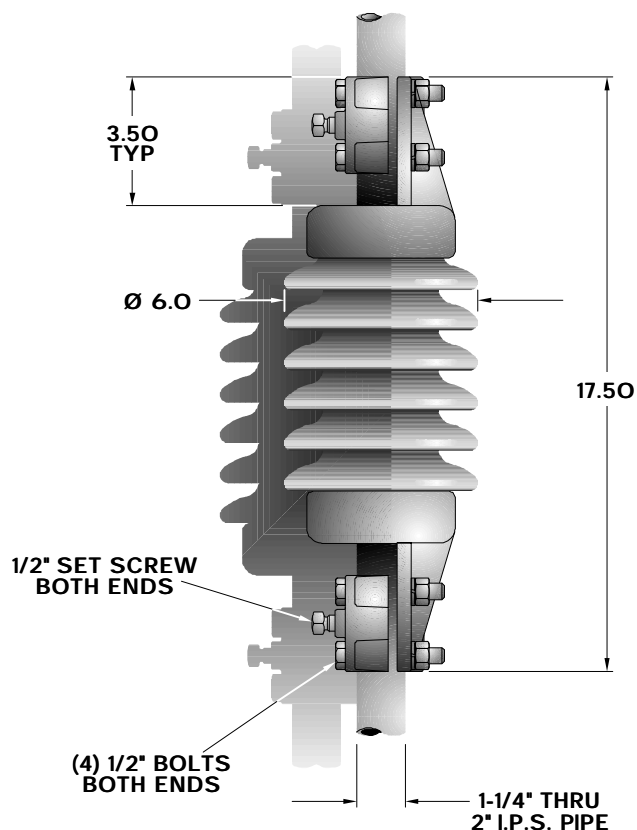
Catalog number 8138-70 has two removable collars that fit into sockets on the end caps. With collars, the insulator fits 1-1/4" I.P.S. pipe. Without the collars, 1-1/2" I.P.S. pipe can be used with the same insulator. This is a considerable convenience in stock keeping.

9/16" diameter through holes are required in each pipe for field installation of the insulator.

10891-70

Catalog number 10891-70 is similar to 8138-70 but has larger sockets on the end caps to accommodate 2" I.P.S. pipe.

FOR CLAMP ATTACHMENT TO PIPE



61400-70

Clamp attachments greatly simplify field installation of switch rod insulators since they keep the connection snug without drilling and bolting through the pipe. The clamp attachment provides a secure, rigid assembly that is equally good under tension, torsion or compression.

Catalog number 61400-70 will accommodate 1-1/4" or 1-1/2" I.P.S. pipe.

80523-70

Catalog number 80523-70 is similar to 61400-70 but has larger inside radii on the clamps to accommodate 2" I.P.S. pipe.

ELECTROSTATIC RAIN DEFLECTORS, TRANSITION PLATES, AND SPACERS

Rain Deflectors

Electrostatic Rain Deflectors, Lapp Patent No. 2884479, improve the wet flashover characteristics of the insulators by approximately 20% and are supplied on all station post stacks of 1300 kV BIL and above. Each shield consists of two half sections made from sheet aluminum.

Lapp Electrostatic Rain Deflectors are available for 8" through 18" bolt circles. Contact Lapp Insulator for more detailed information.

Figure 1 - Detail of a common rain deflector.

Figure 2 - Method of installing two-piece rain deflector under bolt head during assembly of station post stack. Do not install deflectors between insulator flanges.

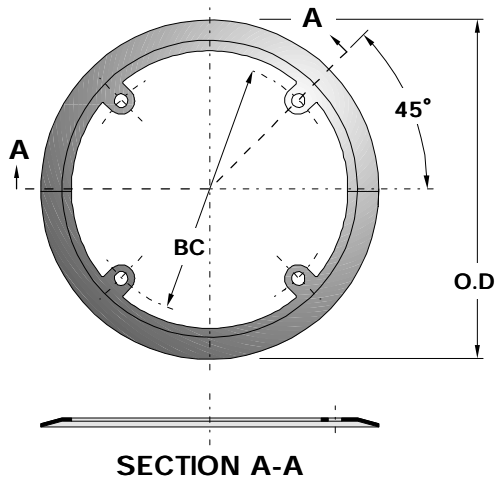
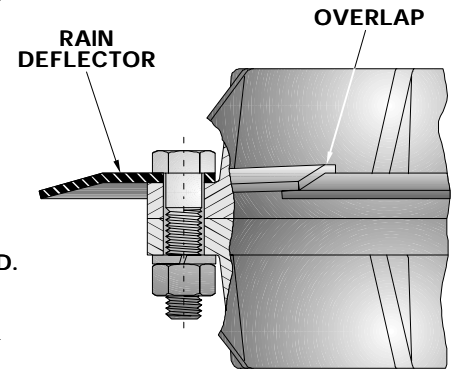


Figure 1



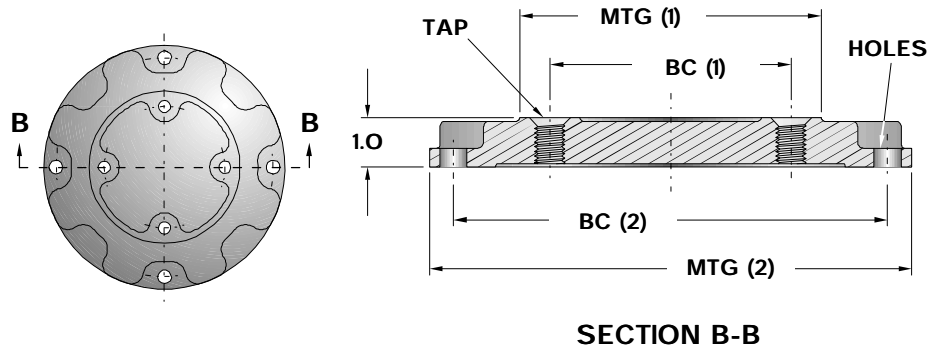
RAIN DEFLECTOR INSTALLATION

Figure 2

Transition Plates

These transition plates are designed for use with large diameter caps on station post stacks. Available in three sizes and strength ratings, these closely spaced units are for conversion of large bolt circle units to standard bolt circle mounting. The most common configurations are shown in the table to the right. Several others are also available, contact Lapp for more information.

The plates are ferrous, hot-dip galvanized. Tapped holes are .015" oversize to allow for the use of galvanized cap screws and still provide a good fit between the threads. Hex head capscrews, nuts and lock washers are furnished for large bolt circle mounting only.



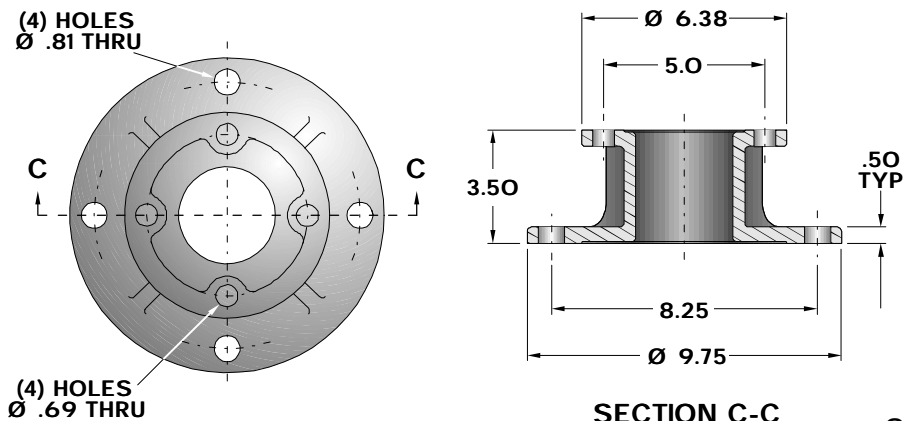
SECTION B-B

TRANSITION PLATE DIMENSIONS

Catalog No.	Strength Class	BC (1)	MTG (1)	TAP	BC (2)	MTG (2)	HOLES
70397	Standard	5	Ø 6.25	5/8-11	9	Ø 10	Ø .56
61845	High Strength	5	Ø 6.25	5/8-11	10.38	Ø 11.50	Ø .56
61844	Extra-High Strength	7	Ø 8.50	3/4-10	12	Ø 13.38	Ø .69

Spacers

Mounting base number 20161 is designed for use with 5" bolt circle insulators. The spacer is malleable iron, hot-dip galvanized. Four 5/8-11 X 1.25" long capscrews, and lock washers are supplied for attachment to the 5" bolt circle. Order others separately if required.



SECTION C-C

Cavity Core No.	Solid Core No.
10470-70	315202-70
11654-70	315046-70
24760-70	315286-70
25393-70	315041-70
25565-70	315208-70
25567-70	315214-70
27077-70	315205-70
34245-70	315222-70
34246-70	315225-70
34247-70	315227-70
34248-70	315231-70
34249-70	315267-70
34250-70	315278-70
34534-70	318490-70
34535-70	318451-70
34536-70	318453-70
34537-70	318455-70
50439-70	315316-70
50637-70	315312-70
50742-70	315304-70
50908-70	315288-70
51161-70	315291PA-70
51202-70	314161-70
51560-70	315330-70
51606-70	315324-70
51688-70	315308-70
51689-70	315362-70
52161-70	315295PA-70
52591-70	315289-70
53142-70	315368-70
53143-70	315372-70
53161-70	318441PA-70
54794-70	315287-70
55953-70	318457-70

Cavity Core No.	Solid Core No.
56241-70	314857-70
59668-70	314867-70
79297-70	315391-70
80044-70	314925-70
80104-70	315369-70
80110-70	315379-70
80621-70	315367-70
90603-70	315362-70
90742-70	315308-70
91507-70	315373-70
91987-70	315330-70
93350-70	314934-70
93447-70	315371-70
9521A-70	315216-70
97112-70	314914-70
97805-70	315016-70
9784-70	315007-70
9785-70	315210-70
98151-70	314732-70
98154-70	318032-70
300744-70	315391-70
303050-70	315308-70
305943-70	315013-70
308135-70	315010-70
309386-70	315304-70
309387-70	318059-70
309388-70	315312-70
309588-70	318461-70
309821-70	317019-70
311313-70	318459-70
311729-70	315019-70
311905-70	315324-70
311906-70	315368-70
311907-70	315367-70

Cavity Core No.	Solid Core No.
311908-70	315369-70
311998-70	314914-70
311999-70	314934-70
312554-70	314867-70
312555-70	318032-70
312793-70	315174-70
312794-70	315173-70
312799-70	315128-70
312800-70	315176-70
312801-70	315044-70
312802-70	315049-70
312803-70	315053-70
312812-70	315126-70
312813-70	315175-70
312997-70	319140-70
313473-70	319019-70
313475-70	319126-70
313993-70	319056-70
314199-70	319128-70
314201-70	317056-70
314228-70	317126-70
314504-70	317013-70
314505-70	317016-70
314564-70	317053-70
314591-70	319139-70
314615-70	317004-70
314777-70	317174-70
314828-70	317046-70
314965-70	315056-70
314970-70	314970-70
314982-70	314982-70
314994-70	319025-70



Catalog No.	Page	Catalog No.	Page	Catalog No.	Page
8138-70	30	315205-70	11,28	317016-70	28
10891-70	30	315208-70	12	317019-70	28
20161	31	315210-70	13	317025-70	28
61400-70	30	315214-70	14	317044-70	28
61844	31	315216-70	15	317046-70	28
61845	31	315222-70	10	317053-70	28
70397	31	315225-70	11	317056-70	28
80523-70	30	315227-70	12	317126-70	28
314161-70	19	315231-70	13	317128-70	28
314732-70	23	315267-70	14	317173-70	28
314857-70	17	315278-70	15	317174-70	28
314867-70	25	315286-70	16	317175-70	28
314914-70	24	315287-70	16	317176-70	28
314925-70	19	315288-70	17	318032-70	25
314934-70	24	315289-70	17	318059-70	23
314970-70	28	315291PA-70	18	318441PA-70	18
314982-70	28	315295PA-70	18	318451-70	11
315007-70	28	315304-70	19	318453-70	12
315010-70	28	315308-70	19	318455-70	13
315013-70	28	315312-70	20	318457-70	16
315016-70	28	315316-70	20	318459-70	14
315019-70	28	315324-70	21	318461-70	15
315025-70	28	315330-70	22	318490-70	10
315041-70	28	315362-70	20	319019-70	28
315044-70	28	315367-70	21	319025-70	28
315046-70	28	315368-70	21	319056-70	28
315049-70	28	315369-70	21	319126-70	28
315053-70	28	315371-70	22	319128-70	28
315056-70	28	315372-70	22	319139-70	28
315126-70	28	315373-70	22	319140-70	28
315128-70	28	315379-70	23	319173-70	28
315173-70	28	315391-70	24	319174-70	28
315174-70	28	317004-70	28	319175-70	28
315175-70	28	317007-70	28	319176-70	28
315176-70	28	317010-70	28		
315202-70	10,28	317013-70	28		