POWERCON CORPORATION

LEXCLAD INSULATION SYSTEMS

BROCHURE #PC-025

ELECTRONIC VERSION CREATED: 6/30/96

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Lexclad

INSULATION SYSTEMS

FOR INSULATING 5,000 TO 15,000 VOLT METAL ENCLOSED SWITCHGEAR BUSES

Extremely durable and dimensionally stable, Powercon Corporation's Lexclad Insulation Systems are constructed of a versatile new high temperature thermoplastic. These high performance insulation systems consists of a variety of molded boots, available in custom made and stock sizes, and extruded sleeves of various sizes, all for use in the insulation of copper or aluminum bus bars. Powercon's Lexclad Insulation Systems offer a unique combination of versatile performance and fabricating characteristics which other materials fail to match.

LEXAN(R) polycarbonate resin is the raw material used in the manufacturing of Lexclad Insulation Systems. This material was selected because of its excellent electrical properties and dimensional stability. LEXAN(R) resin performance characteristics surpass those of all other engineering quality thermoplastics.

LEXCLAD INSULATION SYSTEMS

In as much as Powercon has no control over the use to which others may put this material it does not guarantee the same results as those described herein will be obtained. Each user of the material should make his own tests to determine the material suitability for his own particular use. Statements concerning uses of materials described herein are not to be construed as suitable for these uses unless proper technology in the usage, application, and maintenance are strictly observed.

For further information please contact the Powercon Corporation.

LEXAN(R) SLEEVING FOR USE IN BUS INSULATION

Bus bar insulation extruded from Lexan resin in the form of tubing is a high temperature thermoplastic material having excellent dielectric and mechanical properties. As with all materials, effects of the environment in the application and cleaning should be considered.

Among other considerations to be given, is the effect of either cleaning materials or such items as taping joints and covering the tape with certain varnishes that spill onto the lexan.

Some materials such as methylene chloride, ethylene chloride and tetrachloroethane will dissolve lexan.

The use of these materials is generally not applied to lexan and basically when applied in very light applications will evaporate easily and have no basic effect on the lexan itself.

However, other materials such as acetone, ketones, esters, carbon tetrachloride and aromatic hydrocarbons will have a deleterious effect on Lexan(R) causing it to either crystallize or craze, with carbon tetrachloride being the most damaging compound.

If cleaning is required only the alaphatic carbons or alcohols should be used as they will have a minimal effect on the lexan. Grease may be washed off with material such as freon TF, isopropol alcohol, petroleum ether and V M & P naphtha. Ordinary soap and water is the best cleaner for Lexan(g.

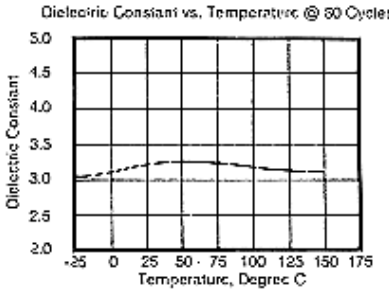
Care should be exercised in taping a joint which is to be coated with a varnish to make sure that the varnish does not get on the Lexan(P sleeving.

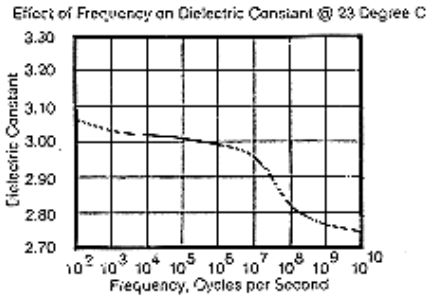
Should there be any questions please consult the Powercon Corporation

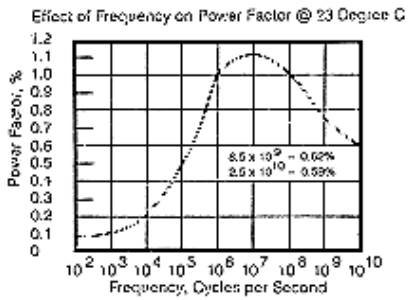
EXCELLENT ELECTRICAL PROPERTIES

Polycarbonate's good electrical properties, combined with excellent high temperature performance and dimensional stability, make Lexclad insulation a logical choice for electrical application.

The excellent electrical properties of Lexclad insulation are almost completely unaffected by exposure to humid environments. The high insulation resistance, the independence of dielectric constant to temperature, and low power factor suggest Lexclad insulation for use in highly critical electric systems. Its arc resistance with stainless steel electrodes is 10-11 seconds, with tungsten electrodes 120 seconds. The excellent Corona resistance of LEXAN(R) resin suggest use in high voltage applications. When tested by a method derived from the ASTM "Suggested Direct Electrode Test Method for Resistance to Corona Attack of Solid Insulating Material", a 0.004 inch thick LEXAN(R) film withstood a 9 KV stress for 15-1/2 hours before breakdown.







ELECTRICALS

Dielectric Strength	v/mil	400
Dielectric Constant		
60cps		3.17
10^4cps		2.98
Volume Resistivity	ohm-cm	$1.7x10^{17}$
Power Factor		
60 cps		0.0009
10^4cps		0.010
Arc Resistance	seconds	
Stainless Steel		10-11
Tungsten		120

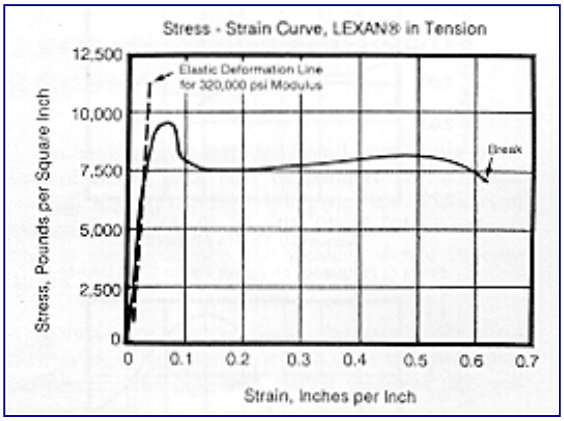
Other electrical data, including dielectric constant, dissipation factor, loss factor, and storage factor, as determined by ASTM D-150, include:

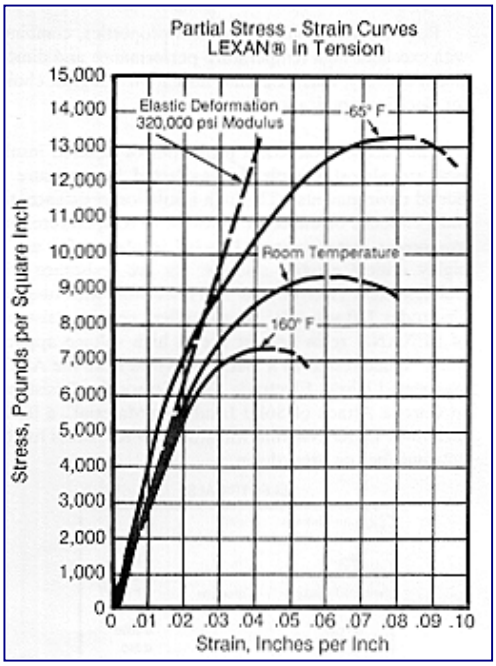
	Frequency (Cycles Per Second)								
	60	**10^3**	**10^4**	**10^5**	**10^6**	**10^7**	**10^8**	**10^9**	**10^{10}**
Dielectric Constant (K)	3.17	3.04	3.04	3.02	2.98	2.86	2.76	2.77	2.75
Dissipation Factor: (D) Tan δ	.0009	.0021	.0029	.0058	.0103	.0119	.0098	.0062	.0059
Loss Factor K.D.	0029	.0064	.0088	.0175	.0335	.0352	.0273	.0177	.0162
Storage Factors: 2=l/Tan δ	1111	476	345	173	97	84	102	162	169

Power Factor is essentially same as Dissipation Factor.
Dielectric Constant determined at 26°C and 40% relative humidity. Modified method used at higher frequencies.
When Tan δ is less than 0.1, the Power Factor is smaller by less than 0.5% of the value.

IMPACT STRENGTH

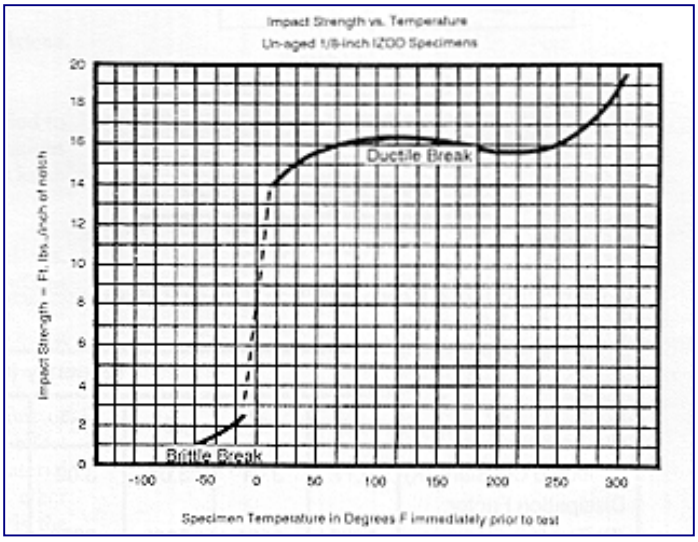
A spectacular advantage of LEXCLAD is its high impact resistance. Izod impact strength on 1/8 inch ASTM standard bars is 12-16 foot pounds per inch of notch. On 1/4 inch and 1/2 inch bars the value is between 2 and 3 foot-pounds per inch of notch. Unnotched bars show impact resistance greater than 60 foot-pounds per inch.





MECHANICALS

Impact Strength	14 ft-lbs/inch notch
Tensile Strength	8,500 psi
Elongation	75%
Flexural Strength	13,500 psi
Compression Strength	12.5psi x 10^3
Taber Abrasion (CS 17 Wheel, 1000g)	10mg/1000 cycles
Rockwell Hardness	M78
Deformation, Under Load: 122 F, 2000psi 158 F, 4000 psi	 0.2% 0.3%



LEXAN ® POLYCARBONATE

Density	0.043 lb/cu. in.
Modules of Elasticity	34 x 105 psi
Tensile Strength	8,500 psi
Ratio of Tensile Strength to Density	198,000
Strength/Weight Ratio	1

EXCELLENT DIMENSIONAL STABILITY

This important characteristic is reflected in the low moisture pickup of Lexclad insulation - a maximum of 0.35% in ten days. This feature, plus related ones of abrasion resistance, precision moldability, and corrosion resistance, contributes greatly to the widespread use of Lexclad insulation.

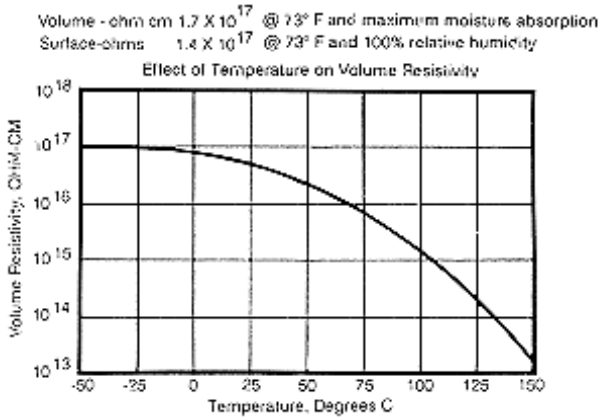
The low uniform shrinkage from mold dimensions allows design and production of precision parts at tolerances unmatched with other thermoplastic plastics. Many Lexclad parts have been molded with tolerances within plus or minus .002 inches per inch and some have been produced with tolerances within plus or minus .001 inches per inch

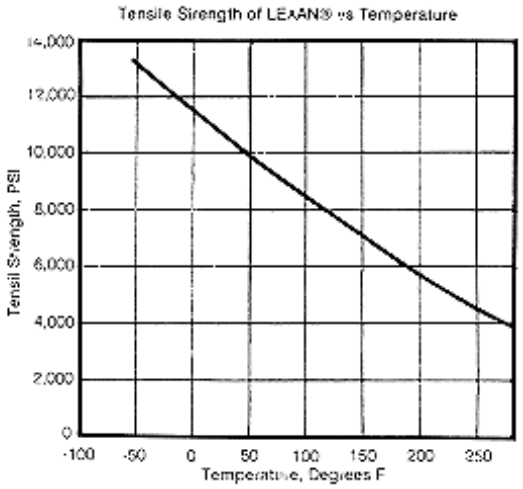
SELF-EXTINGUISHING.

The inherent self-extinguishing ability of Lexclad insulation is one of its outstanding characteristics. This important feature allows applications which must meet flammability requirements as well as in areas where its relative high heat stability is also required.

BROAD TEMPERATURE SERVICE RANGE

With heat deflection points up to 2800F, Lexclad insulation may be used in continuous service under certain operating conditions at temperatures as high as 2500F. Unlike many plastics, Lexclad insulation loses impact strength very slowly as temperatures drop. With a brittle point below -2100F, Lexclad insulation has more strength at sub-zero levels than many thermoplastics have at room temperatures. Oxidative stability on heating in air is good, and immersion in water and exposure to high humidity at temperatures up to 212OF have little effect on dimensions.





EFFECTS OF ENVIRONMENT

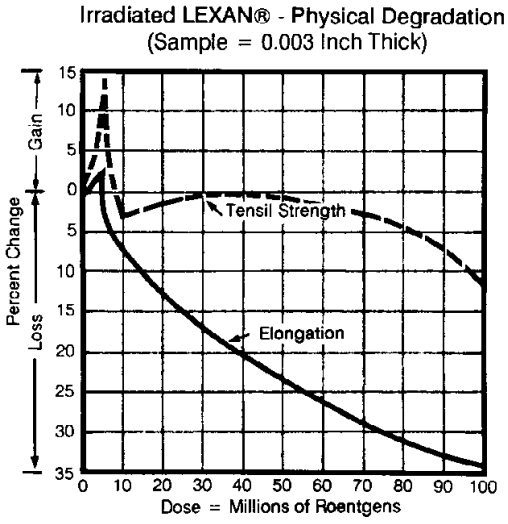
Water absorption of the polycarbonate used in Lexclad insulation systems is extremely low under all practical use conditions. This contributes to the dimensional stability of the plastic and to the almost complete independence of electrical properties from effects of humidity.

Exposed to 50% relative humidity at room temperature, Lexclad parts reach equilibrium at 0.15% water absorption, When immersed in water at room temperature, a maximum of 0.35% water is absorbed. Equilibrium is achieved in three to ten days, depending on the size of the part.

In boiling water, the maximum water absorption of 0.58% is attained in about 10 hours. Lexclad polycarbonate is dimensionally stable immersed in boiling water, water at room temperature. or exposed to 100% humidity,

Impact strength falls off gradually in the boiling water environment. It changes very little after 100 days at room temperature and 50% relative humidity, 85% relative humidity, or immersed in water.

Lexclad insulation has excellent resistance to rain erosion, attack by chemicals in the atmosphere, cyclic temperature variations, etc. The chief hazard in its out- door use is the ultraviolet portion of natural light from the sun. However, the effects of ultraviolet radiation do not affect its insulation characteristics.



After 12 months' outdoor exposure in Florida, there was no surface dulling of the stabilized product nor significant loss of Izod impact strength for samples wither unnotched or notched after exposure. After one year exposure in Pittsfield, Massachusetts, no surface dulling or roughness was shown.

Even at the temperatures of liquid nitrogen (77K or 1950C) and liquid helium (20'K or -260'C) Lexclad retains some ductility and flexibility- it is quite possible to consider Lexclad applications in these regions provided the impact requirements are not high. The tensile strength approximates 19,000 psi at liquid helium temperatures.

EFFECTS OF CHEMICALS

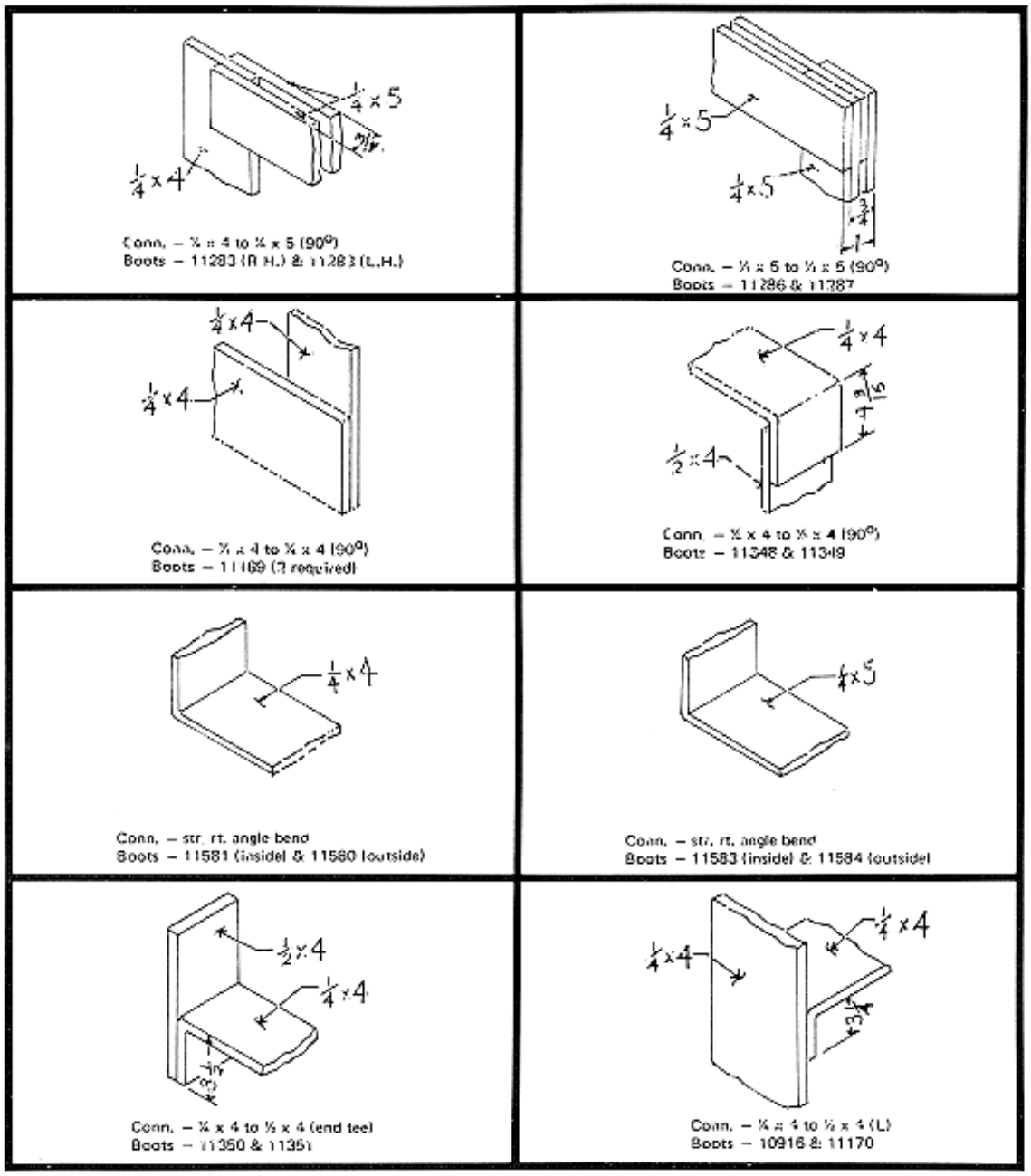
REAGENT	TEMPERATURE 73°F STRAIN LEVEL (%) 0	0.5	1.0	185°F 0	0.5	1.0	TEST LENGTH (DAYS)	WEIGHT CHANGE (%)	COMMENTS
ACIDS									
Acetic (100%)	A						1		Cracking, Distortion
Acetic (25%)	N						365	.58	Embrittles
Acetic (5%)	N						7	.56	
Acetic Anhydride	A						6		Crystallizing
Aqua Regia	N						30		Darkens, Embrittles
Citric (5%)	N						6	.56	
Formic	N	N					30	1.40	Cracking After 1 Month
Hydrochloric (1%)	N						7		
Hydrochloric (10%)	N						7	.59	
Hydrochloric (17%)	N						365		
Hydrochloric (25%)	C						365		
Hydrofluoric (6%)	N			N			3		

* The molded samples used in chemcial resistance testing are 2-1/2" x 1/2" x .140" impact bars, annealed for removal of molded-in strains. The indicated test strain leve s are induced by bending after the bars are placed in sta nless steel holding strips. The 0.5% level is utilized because molded-in stresses may reach or exceed this amount in actual parts. It is equivalent to a 1,700 psi tensile loading. The 1.0% strain is equivalent to an initial tensile load of 3,400 psi. NOTE: The suggested limit for continuous tensile loading of LEXAN® parts is 2,000 psi.

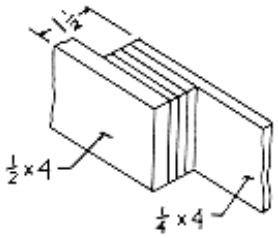
N = NO EFFECT C = CRAZING A = ATTACKED

BOOT FITTINGS

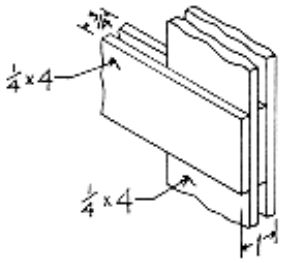
Besides our extruded bus bar sleeving, Powercon manufactures Lexclad translucent molded boots to meet a variety of joint configurations. At present Powercon has mold designs covering over 1200 configurations - bus tee connections, 90° end connections, in-line splice connections as well as special applications. The following detailed joint configurations are intended to illustrate the variety of design available and not to be construed as the limit of our product capabilities. Please consult factory on all boot inquiries.



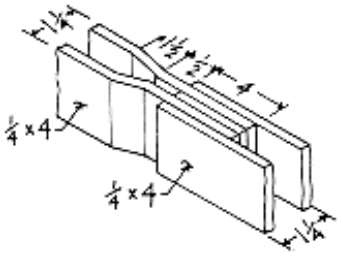
BOOT FITTINGS



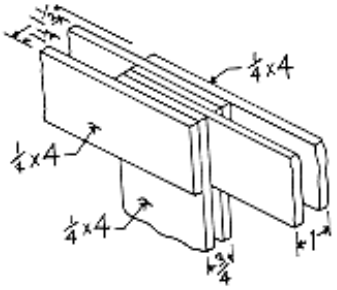
Conn. – ½ x 4 to ¼ x 4
Boots – 11285 (2 required)



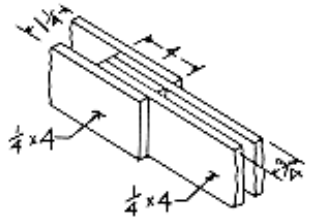
Conn. – ¼ x 4 to ¼ x 4 (tee)
Boots – 10915 & 10916



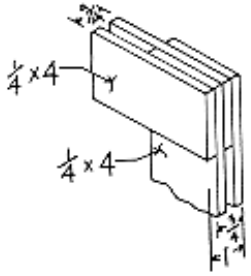
Conn. – ¼ x 4 to 4 (straight with offset)
Boots – 10913 (2 required)



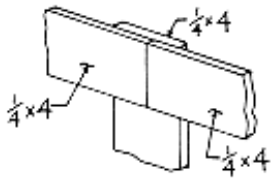
Conn. – ¼ x 4 to ¼ x 4 (tee)
Boots – 10916 x 10917



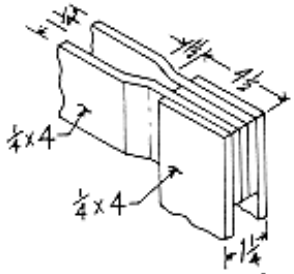
Conn. – ¼ x 4 to ¼ x 4 (straight)
Boots – 10920 (2 required)



Conn. – ¼ x 4 to ¼ x 4 (90°)
Boots – 10918 (2 required)

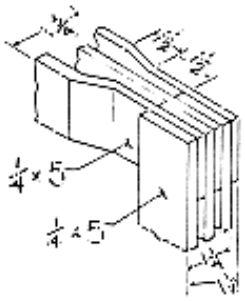


Conn. – ¼ x 4 to ¼ x 4 to ¼ x 4 (tee)
Boots – 11169 & 10916 (trim lgth of 10916 to 6¼)

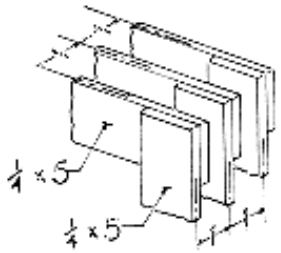


Conn. – ¼ x 4 to ¼ x 4 (90°)
Boots – 10914 (2 required)

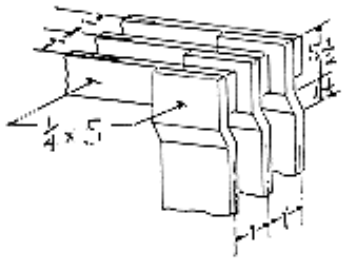
BOOT FITTINGS



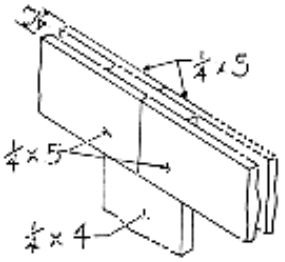
Conn. – ¼ x 5 to ¼ x 5 (90° with offset)
Boots – 11152 & 11153



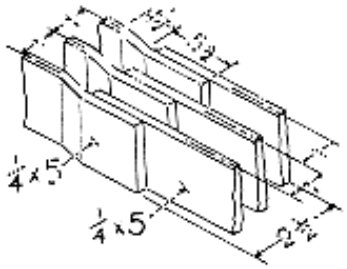
Conn. – ¼ x 5 to ¼ x 5 (90°)
Boots – 11151 (2)



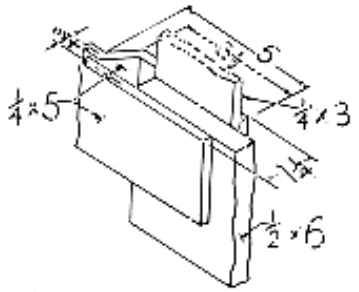
Conn – ¼ x 5 to ¼ x 5 (90° with offset)
Boots – 10910 & 11157



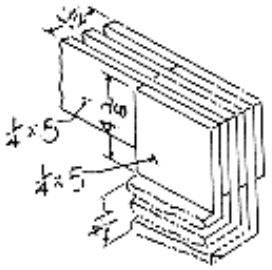
Conn – ¼ x 4 to ¼ x 5 (tee)
Boots – 11284 (2)



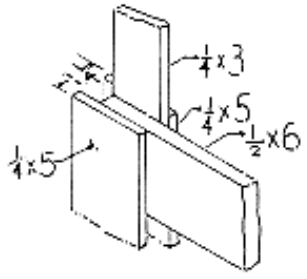
Conn – ¼ x 5 to ¼ x 5 (straight)
Boots – 11156 & 10911



Conn. – ¼ x 4 to ¼ x 5 to ½ x 6 (tee)
Boots – 11288 & 11289

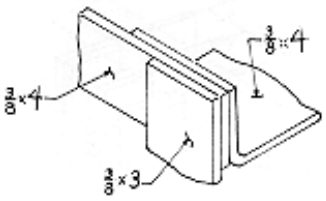


Conn – ¼ x 5 to ¼ x 5 (90° with angle)
Boots – 11154 & 11155

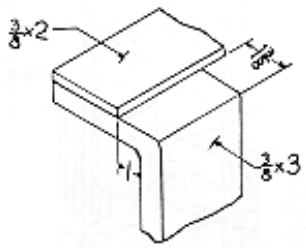


Conn. – ¼ x 3 to ¼ x 5 to ¼ x 6 (tee)
Boots – 11281 & 11282

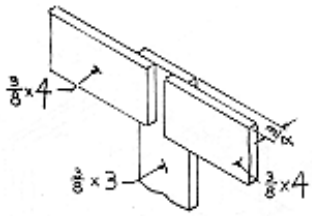
BOOT FITTINGS



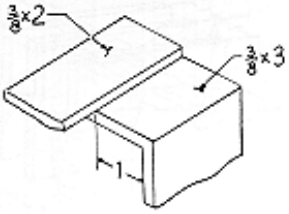
Conn. – 3/8 x 3 to 3/8 x 4 (90° tee)
Boots – 11162 & 11165 & rt. angle



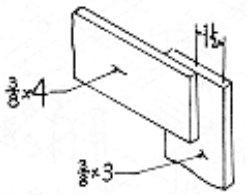
Conn. – 3/8 x 2 to 3/8 x 3 (90° L)
Boots – 11166 (L.H.) & 11167



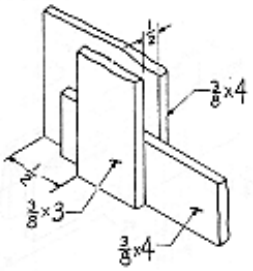
Conn – 3/8 x 3 to 3/8 x 4 (tee)
Boots – 11158 & 11159



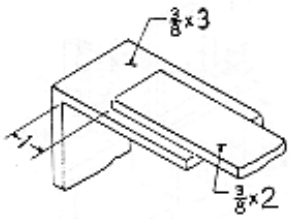
Conn. – 3/8 x 2 to 3/8 x 3 (90° L)
Boots – 11166 (R.H.) & 11167



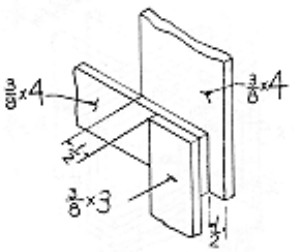
Conn – 3/8 x 3 to 3/8 x 4 (90°)
Boots – 11161 & 11162



Conn. – 3/8 x 3 to 3/8 x 4 (90°)
Boots – 11163 & 11164



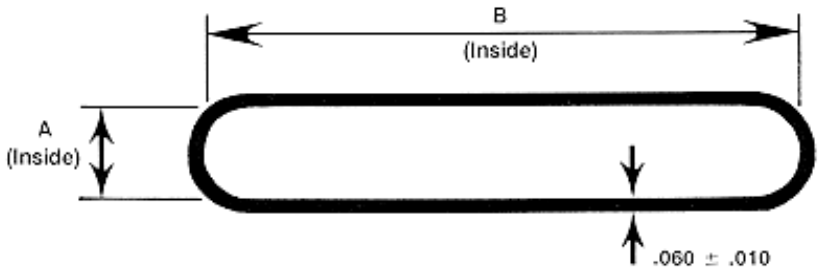
Conn. – 3/8 x 2 to 3/8 x 3 (straight with 90°)
Boots – 11167 & 11168



Conn. – 3/8 x 3 to 3/8 x 4 (tee)
Boots – 11163 & 11164

SLEEVES

Extruded sleeves are available in a variety of inside dimensions and lengths. The sleeve thickness is approximately 60 mils on all sides of the extrusion. Custom made sleeves are available upon consultation with the factory.



ITEM	PART NO.	BAR SIZE	DIMENSIONS (Tolerance +/-.015)	
			A	B
1	*Special	1/2 x 1-3/4	*	*
2	320	1/4 x 2	.282	2.032
3	*Special	3/8 x 2	*	*
4	*Special	1/2 x 2	*	*
5	322	1/4 x 3	.282	3.032
6	323	3/8 x 3	.407	3.032
7	324	1/2 x 3	.532	3.032
8	325	1/4 x 4	.282	4.032
9	326	3/8 x 4	.407	4.032
10	327	1/2 x 4	.532	4.032
11	328	1/4 x 5	.282	5.032
12	*Special	3/8 x 5	*	*
13	*Special	1/2 x 5	*	*
14	331	1/4 x 6	.282	6.032
15	332	3/8 x 6	.407	6.032
16	333	1/2 x 6	.532	6.032
17	*Special	5/8 x 6	*	*