

# TECHNICAL NEWS

from

 THE OKONITE COMPANY

Engineering Information for the Professional Engineer

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## INSULATION MAXIMUM VOLTAGE STRESS

Another term used to classify the dielectric strength of an insulating material is the maximum electrical stress in volts required to puncture a sample of known thickness. This stress in cable insulation can be viewed as electrical pressure, or voltage, to which a unit thickness of insulation is subjected.

Average values of dielectric strength are relatively similar when testing slabs of rectangular material since the distance between electrodes is an average fixed value. Therefore, the average stress in volts/mil is determined by dividing the voltage across the insulation by the insulation thickness in mils. Testing dielectric strength on round wire is another matter however. The stress is not uniform throughout the insulation wall, and the stress at any point in the insulation wall can be calculated by:

$$S = \frac{V}{2303r \log(D/d)}$$

Where:

$S$  = stress in volts/mil at a point in the insulation  $r$  mils from the cylindrical axis.

$V$  = voltage across the insulation in volts,

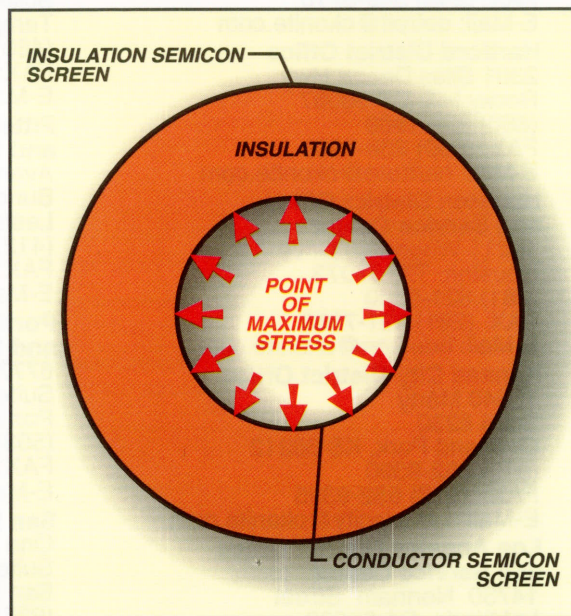
$D$  = outside diameter of the insulation in mils,

$d$  = outside diameter over the conductor semicon screen.

According to this formula the maximum stress occurs at the conductor surface ( $r = d/2$ ); therefore, the above formula becomes:

$$S_{\max} = \frac{0.868V}{d \log(D/d)}$$

It should be recognized that the actual stress at any point will vary through the insulation wall. The stress on the insulation near the conductor will be greater than the average stress, while that on the outside will be less. Since the voltage stress is the highest at the surface interface between the conductor screen and the insulation, sharp edges, points and small radii bumps, i.e. protrusions and indents must be avoided on this conducting surface as these will produce high-stress points. Therefore, smoothness of this interface is critical.



Based on the above max stress formula the following chart was developed to show the max stress for various system voltages, for the minimum conductor size with 133% insulation thickness level as specified by AEIC. It should be noted that within each voltage group as the conductor size gets larger the max stress would become smaller.

Rated Voltage Phase to Phase kV	Minimum Conductor Size AWG/kcmil	133% Insulation Thickness (mils)	Max. Stress (volts/mil)
5	#8	115	39.22
8	#6	140	51.56
15	#2	220	62.40
25	#1	320	78.27
35	#1/0	420	88.97
46	#4/0	580	84.59
69	500	650	100.82

E. J. Bartolucci  
Senior Staff Electrical Engineer

# Contacting Okonite

Operating within a structure of four regional offices, twenty-three district offices, and seven service centers, Okonite serves principal marketing areas in the United States. Export sales and service, the responsibility of Okonite's International Sales Division is headquartered in Ramsey, New Jersey. Additional information can be obtained by contacting the Okonite office nearest you or visiting our website at [www.okonite.com](http://www.okonite.com). Within our site the "Ask the Experts" feature has become a valuable tool for resolving cable selection and installation issues.

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Paterson, New Jersey  
Richmond, Kentucky  
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## OKONITE DISTRICT SALES OFFICES

### Atlanta District Office

645 Molly Lane  
Suite 120  
Woodstock, GA 30189  
(770) 928-9778  
FAX: (770) 928-0913  
E-Mail: [atlanta@okonite.com](mailto:atlanta@okonite.com)

### Birmingham District Office and Service Center

608 North 37th Street  
Birmingham, AL 35222  
(205) 592-8968  
FAX: (205) 592 2268  
E-Mail: [birmingham@okonite.com](mailto:birmingham@okonite.com)

### Boston District Office

169 South River Road  
Bedford, NH 03110  
(603) 625-1900  
(781) 749-3374  
FAX: (603) 624-2252  
E-Mail: [boston@okonite.com](mailto:boston@okonite.com)

### Charlotte District Office

11111 Carmel Commons Blvd.  
Suite 140  
Charlotte, NC 28226  
(704) 542-1572  
FAX: (704) 541-6183  
E-Mail: [charlotte@okonite.com](mailto:charlotte@okonite.com)

### Chicago District Office and Service Center

1350 Shore Road  
Naperville, IL 60563  
(630) 961-3100  
FAX: (630) 961-3273  
E-Mail: [chicago@okonite.com](mailto:chicago@okonite.com)

### Cincinnati District Office

11260 Chester Road, Suite 240  
Cincinnati, OH 45246  
(513) 771-2122  
FAX: (513) 771-2126  
E-Mail: [cincinnati@okonite.com](mailto:cincinnati@okonite.com)

### Dallas District Office

2220 San Jacinto Blvd.  
Suite #300  
Denton, TX 76205  
(940) 383-1967  
FAX: (940) 383-8447  
E-Mail: [dallas@okonite.com](mailto:dallas@okonite.com)

### Denver District Office

10190 Bannock Street  
Suite #240  
Northglenn, CO 80260-6052  
(303) 255-5531  
FAX: (303) 255-3128  
E-Mail: [denver@okonite.com](mailto:denver@okonite.com)

### Detroit District Office

21800 Haggerty Road  
Suite No. 105  
Northville, MI 48167-9051  
(248) 349-0914  
FAX: (248) 349-3710  
E-Mail: [detroit@okonite.com](mailto:detroit@okonite.com)

### Hartford District Office

2301 Silas Deane Hwy.  
Rocky Hill, CT 06067  
(860) 258-1900  
FAX: (860) 258-1903  
E-Mail: [hartford@okonite.com](mailto:hartford@okonite.com)

### Houston District Office and Service Center

15211 Woodham Drive  
Houston, TX 77073  
(281) 821-5500  
FAX: (281) 821-7855  
E-Mail: [houston@okonite.com](mailto:houston@okonite.com)

### Kansas City District Office

10540 Marty  
Suite #230  
Overland Park, KS 66212  
(913) 652-9390  
FAX: (913) 652-9395  
E-Mail: [kansascity@okonite.com](mailto:kansascity@okonite.com)

### Los Angeles District Office and Service Center

14730 Northam Street  
LaMirada, CA 90638  
(714) 523-9390  
FAX: (714) 523-1783  
E-Mail: [losangeles@okonite.com](mailto:losangeles@okonite.com)

### Minneapolis District Office

Suite 200  
5100 Thimsen Avenue  
Minnetonka, MN 55345  
(612) 474-4617  
FAX: (612) 474-4735  
E-Mail: [minneapolis@okonite.com](mailto:minneapolis@okonite.com)

### New Orleans District Office and Service Center

101 Delta Drive, Suite J  
St. Rose, LA 70087  
(504) 467-1920  
FAX: (504) 467-1926  
E-Mail: [neworleans@okonite.com](mailto:neworleans@okonite.com)

### New York District Office

Three Garret Mountain Plaza  
West Paterson, NJ 07424  
NJ (973) 742-8040  
NY (212) 239-0660  
FAX: (973) 742-2156  
E-Mail: [newyork@okonite.com](mailto:newyork@okonite.com)

### Philadelphia District Office

Interstate Industrial Park  
KOR Center West Suite 205  
Benigno Boulevard  
P.O. Box 335  
Bellmawr, NJ 08099  
(856) 931-0595  
(215) 567-5739  
FAX: (856) 931-1193  
E-Mail: [philadelphia@okonite.com](mailto:philadelphia@okonite.com)

### Phoenix District Office

401 W. Baseline Road  
Suite #201  
Tempe, Arizona 85283  
(480) 838-8596  
FAX: (480) 897-8924  
E-Mail: [phoenix@okonite.com](mailto:phoenix@okonite.com)

### Pittsburgh District Office and Service Center

Avenue "B"  
Buncher Industrial Park  
Leetsdale, PA 15056  
(412) 734-2503  
FAX: (412) 741-4620  
E-Mail: [pittsburgh@okonite.com](mailto:pittsburgh@okonite.com)

### Portland District Office and Service Center

6777 S.W. Bonita Road  
Suite 150  
Portland, OR 97224  
(503) 598-0598  
FAX: (503) 620-7447  
E-Mail: [portland@okonite.com](mailto:portland@okonite.com)

### San Francisco District Office

One Annabel Lane  
Suite 212  
San Ramon, CA 94583  
(925) 830-0801  
FAX: (925) 830-0954  
E-Mail: [sanfrancisco@okonite.com](mailto:sanfrancisco@okonite.com)

### Tampa District Office

5415 Mariner Street  
Suite 107  
Tampa, FL 33609  
(813) 286-0581  
FAX: (813) 287-1546  
E-Mail: [tampa@okonite.com](mailto:tampa@okonite.com)

### Washington District Office

Interstate Industrial Park  
KOR Center West, Suite 205  
P.O. Box 335  
Bellmawr, NJ 08099  
(703) 904-9494  
FAX: (703) 904-1610  
E-Mail: [washington@okonite.com](mailto:washington@okonite.com)

### International Sales

Hilltop Road  
P.O. Box 340  
Ramsey, NJ 07446  
(201) 825-0300  
FAX: (201) 825-9026

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**THE OKONITE COMPANY**

Ramsey, New Jersey 07446

[www.okonite.com](http://www.okonite.com)