Tech Talk Ice Load

Ice is normally discussed in thickness. On a tower, a conductor or a rope, this would be the radial thickness, or “radial ice”, since it surrounds a circular or round object.

How to calculate ice weight distributed along a wire or rope span without using much math:
What does ice weigh per cubic foot and cubic inch?
57.5 pounds cu ft or 0.033 pounds cu in

What diameter is the object?

Look it up in wire or cable tables or measure it. Let’s use the examples of a #14 bare antenna conductor or ¼ inch guy strand.

We know the ¼ inch is ¼ inch, and a bare #14 AWG wire can be found here:
https://ihiconnectors.com/AWG%20wire%20sizes.htm

#14 solid no insulation is .064“ diameter

What are the square inches of ice on the wire? We use the radius since it is radial ice. Let’s say it is ¼ inch of radial ice. Calculator soup is one of my favorites. We use an annulus calculator like this, and remember radius is half of diameter:

https://www.calculatorsoup.com/calculators/geometry-plane/annulus.php

¼ inch guy line is .125 or 1/8th inch radius r1. With ¼ inch radial ice r1 we have:

outer radius r_1 = 0.375

inner radius r_2 = 0.125

Let pi π = 3.14159265359

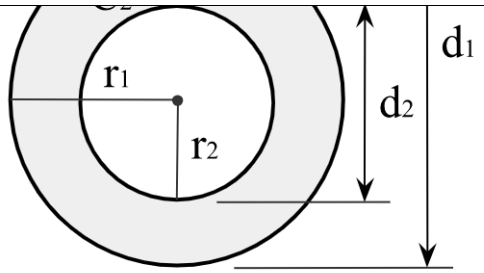
Units in

Significant Figures 4

Clear Calculate

Answer:

outer radius	r_1 = 0.375 in
inner radius	r_2 = 0.125 in
outer circumference	C_1 = 2.356 in
inner circumference	C_2 = 0.7854 in
outer circle area	A_1 = 0.4418 in^2
inner circle area	A_2 = 0.04909 in^2
annulus area	A_0 = 0.3927 in^2

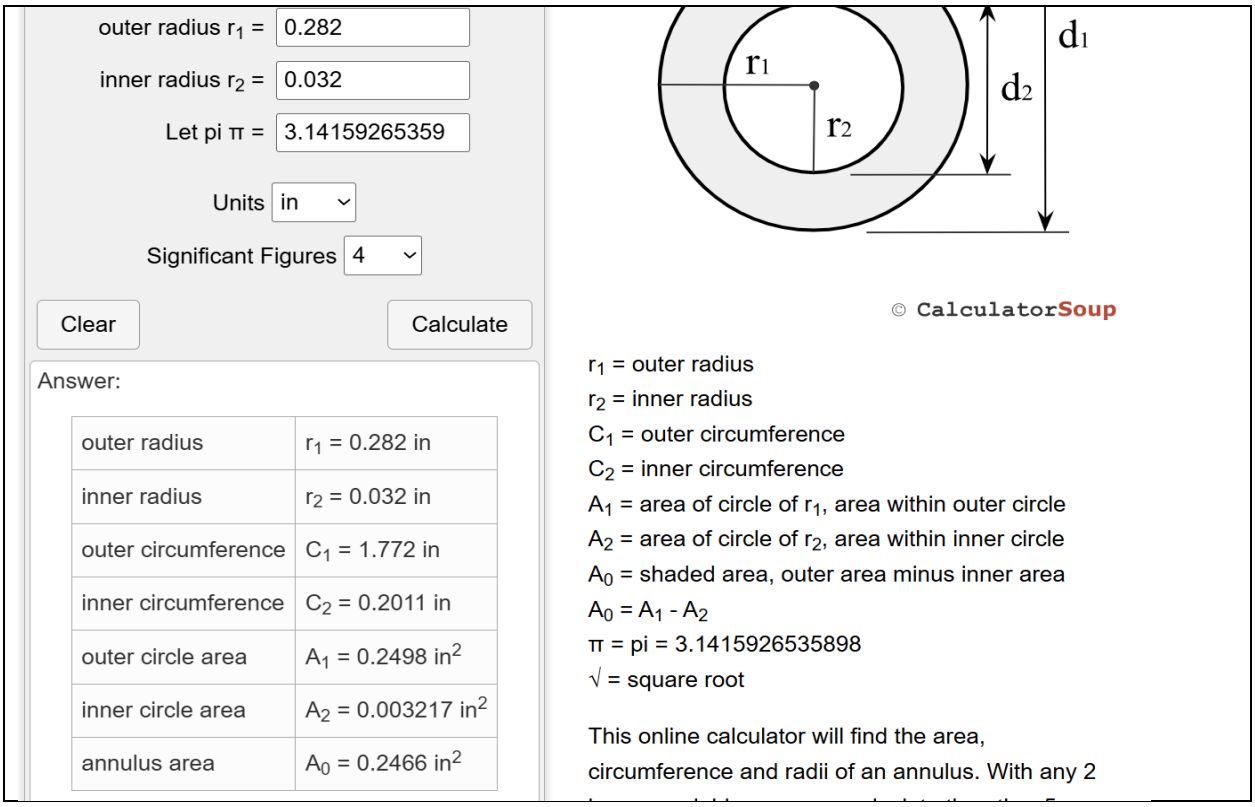


r_1 = outer radius
r_2 = inner radius
C_1 = outer circumference
C_2 = inner circumference
A_1 = area of circle of r_1, area within outer circle
A_2 = area of circle of r_2, area within inner circle
A_0 = shaded area, outer area minus inner area
$A_0 = A_1 - A_2$
π = pi = 3.1415926535898
√ = square root

This online calculator will find the area, circumference and radii of an annulus. With any 2

Why did I use .375? Because the 0.25 thick ice starts .125 out from the center! The annulus area of ice A0 is now: 0.3927 square inches

The 14-gauge 0.064-inch diameter wire has 0.032 radius. Ice area is found as:



outer radius r_1 = 0.282

inner radius r_2 = 0.032

Let pi π = 3.14159265359

Units in

Significant Figures 4

Clear Calculate

Answer:

outer radius	r_1 = 0.282 in
inner radius	r_2 = 0.032 in
outer circumference	C_1 = 1.772 in
inner circumference	C_2 = 0.2011 in
outer circle area	A_1 = 0.2498 in^2
inner circle area	A_2 = 0.003217 in^2
annulus area	A_0 = 0.2466 in^2

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r_1 = outer radius
r_2 = inner radius
C_1 = outer circumference
C_2 = inner circumference
A_1 = area of circle of r_1, area within outer circle
A_2 = area of circle of r_2, area within inner circle
A_0 = shaded area, outer area minus inner area
$A_0 = A_1 - A_2$
π = pi = 3.1415926535898
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The annulus area A0 of ¼ inch of radial ice is 0.2466 square inches!

We have two areas of ice, 0.3927 square inches for ¼ inch guy and 0.2466 square inches for a #14 bare wire.

We can either make the span in inches length and use ice weight in cubic inches, or convert area to feet and use 12*12 = 144 to convert square inches to square feet and use feet length to calculate cubic feet of ice weight. Let's do a 50-foot or 600-inch wire span.

Ice cu inch .033-pounds Ice cu ft 57.5 lbs.

	sq inches	Cu. inch area	Ice load	sq ft	Sq. ft area	Ice load
#14 wire	0.2466	*600=147.96	*.033=4.88 lb	.001713	*50=.0856	4.92 lbs
¼ inch	0.393	*600=235.8	*.033=7.78 lb	.00273	*50=.1365	7.85 lbs