Rods

Quick Link: ***www.fair-rite.com/rod***

Pressed Fair-Rite rods are used extensively in high-energy storage designs. These rods can also be used for inductive components that require temperature stability or have to accommodate large dc bias requirements.

- The "A" dimension can be centerless ground to tighter tolerances.
- Figure 2 rods have a 0.6 mm (0.024") maximum chamfer on the end faces.
- For frequency tuned rod designs see section "Antenna/RFID Rods".
- For any rod requirement not listed here, feel free to contact our customer service group for availability and pricing.
- Explanation of Part Numbers: Digits 1&2 = product class, 3&4 = material grade.

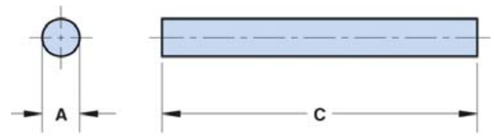


Figure 1

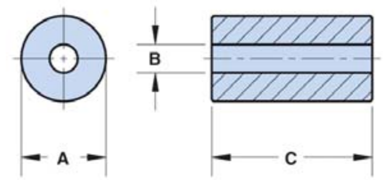


Figure 2

Legend

Dimensions (Top numbers are in millimeters, bottom numbers are in nominal inches.)

Low Permeability, 61(µi=125) material

Part Number	Fig.	A	C	Wt. (g)
4061272011	1	6.35 ±0.25 0.250	19.05 ±0.75 0.750	2.90
4061287011	1	6.35 ±0.25 0.250	22.10 ±0.70 0.870	3.40
4061276011	1	6.35 ±0.25 0.250	25.40 ±0.70 1.000	3.90
4061266011	1	6.35 ±0.25 0.250	38.10 ±0.75 1.500	5.80
4061378111	1	9.50 ±0.30 0.374	25.40 ±0.80 1.000	8.60
4061375411	1	9.50 ±0.30 0.374	41.30 ±0.80 1.626	14.00

Low Permeability, High Saturation 52 (µi=250) material

Part Number	Fig.	A	C	Wt. (g)
4052077111	1	2.00 ±0.13 0.079	15.00 ±0.45 0.591	0.23
4052098411	1	2.50 ±0.13 0.098	15.00 ±0.45 0.591	0.36
4052111011	1	3.00 ±0.13 0.118	20.00 ±0.60 0.787	0.69
4052155611	1	4.00 ±0.15 0.157	25.00 ±0.70 0.984	1.54
4052195211	1	5.00 ±0.20 0.197	25.00 ±0.70 0.984	2.40
4052235211	1	6.00 ±0.25 0.236	30.00 ±0.75 1.181	4.10
4052251111	1	6.50 ±0.25 0.256	30.00 ±0.75 1.181	4.80

Temperature Stable, 33 (µi=600) material

Part Number	Fig.	A	C	Wt. (g)
4033129021	1	3.25 -0.25 0.125	12.70 ±0.40 0.500	0.50
4033122011	1	3.25 -0.25 0.125	25.40 ±0.75 1.000	0.90
4033276011	1	6.35 ±0.25 0.250	25.40 ±0.75 1.000	3.90
4033266011	1	6.35 ±0.25 0.250	38.10 ±0.75 1.500	5.80

Medium Permeability, 77 (µi=2000) & 78 (µi=2300) materials

Part Number	Fig.	A	B	C	Wt. (g)
4077122011	1	3.25 -0.25 0.125	_	25.40 ±0.75 1.000	1.00
4077172011	1	4.60 -0.30 0.175	_	22.20 ±0.75 0.875	1.70
4077272011	1	6.35 ±0.25 0.250	_	19.05 ±0.75 0.750	2.90
4077276011	1	6.35 ±0.25 0.250	_	25.40 ±0.75 1.000	3.80
4077292011	1	6.35 ±0.25 0.250	_	28.60 ±0.75 1.125	4.40
4077296011	1	6.35 ±0.25 0.250	_	31.75 ±0.75 1.250	4.80
4077266011	1	6.35 ±0.25 0.250	_	38.10 ±0.75 1.500	5.80
4077312911	1	8.00 ±0.35 0.315	_	38.10 ±0.75 1.500	9.20
4077374711	1	9.45 ±0.20 0.372	_	31.75 ±0.75 1.250	11.00
4078375111	1	9.45 ±0.20 0.372	_	38.10 ±0.75 1.500	13.00
4077375411	1	9.45 ±0.20 0.372	_	41.30 ±0.80 1.625	14.00
4077375211	1	9.45 ±0.20 0.372	_	50.80 ±1.00 2.000	17.00
4078377511	1	9.50 ±0.25 0.374	_	70.00 ±1.50 2.756	24.00
4077485111	1	12.30 ±0.40 0.485	_	31.75 ±0.75 1.250	18.00
4077484611	1	12.30 ±0.40 0.485	_	41.30 ±0.80 1.625	27.00
4277142009	2	9.00 ±0.30 0.354	3.20 ±0.10 0.126	13.50 ±0.30 0.532	3.60
4277242409	2	13.00 ±0.30 0.512	3.20 ±0.10 0.126	17.50 ±0.40 0.690	10.00
4278282509	2	17.00 ±0.40 0.670	4.20 ±0.15 0.165	18.95 ±0.45 0.746	19.40
4277352509	2	21.00 ±0.50 0.825	6.90 ±0.40 0.272	18.95 ±0.45 0.746	28.00
4277353509	2	21.00 ±0.50 0.825	6.90 ±0.40 0.272	29.00 ±0.60 1.140	43.00
4278453509	2	27.00 ±0.50 1.063	9.00 ±0.30 0.354	27.00 ±0.60 1.064	66.00

Rod Information

Figure 1 shows the rod permeability as a function of the length to diameter ratio for the six materials available in rods.

Figures 3, 4 and 5 illustrate typical temperature behavior of wound rods. Wound rods in 33 and 77 material yield the best temperature stable inductors, see Figure 4. Both show a typical inductance change of < 1% over the –40° to 120°C temperature range. The parts have a L/D ratio of 8.1. Lower ratios will change less. This is shown in detail in Figure 5 for the same 52 material but with the L/D ratio as the parameter. A lower ratio means a lower rod permeability but with improved temperature stability.

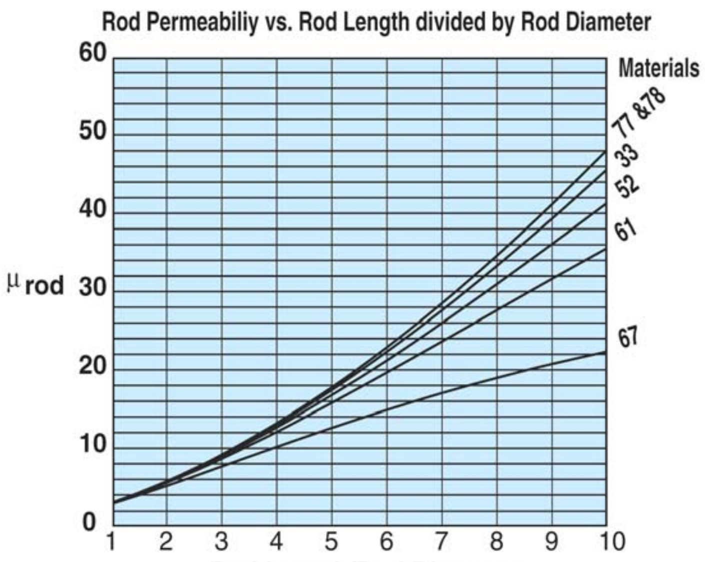


Figure 1

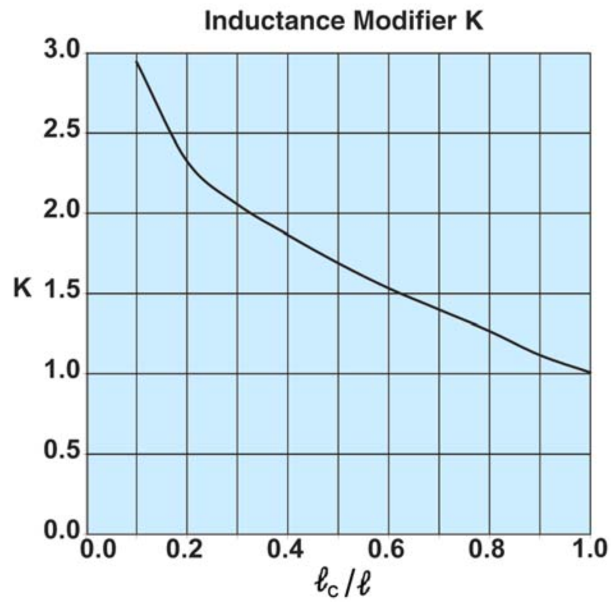


Figure 2

Wound Rod Inductance Calculations

To calcutate the inductance of a wound rod the following formula can be used,

$$L = K \mu_0 \mu_{rod} \frac{N^2 \, Ae}{\ell} 10^4 (\mu H)$$

Where: K = Inductance modifier

$\mu_o = 4\pi\, 10^{-7}$

μ_{rod} = rod permeability found in Figure 1.

N = Number of turns

Ae = Cross sectional area of the rod (cm^2)

ℓ = Length of the rod (cm)

ℓ_c = Length of the winding (cm)

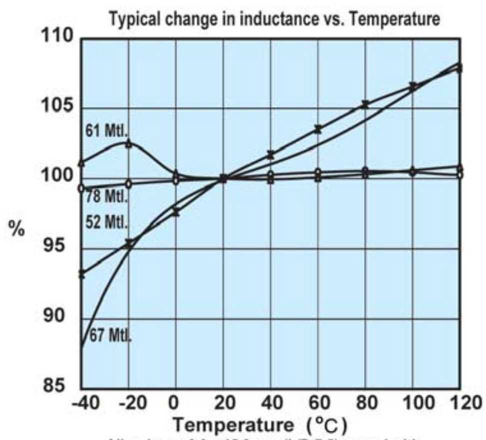
Rod Information

The inductance modifier is found in Figure 2. The ratio winding length divided by the rod length will give the inductance modifier. If the rod is totally wound the K = 1. Shorter but centered windings will yield higher K values.

Using the rod 3061990871 as an example.
For this rod the length over diameter ratio is 8.33 and for 61 material Figure 1 gives a μ_{rod} of 29. The rod has an $A_e = 0.0707\ cm^2$ and $\ell = 2.5$ cm.
A winding of 80 turns of 30 AWG wire will yield a fully wound rod, therefore K = 1.
Using the formula the calculated inductance is 65.96 μH.

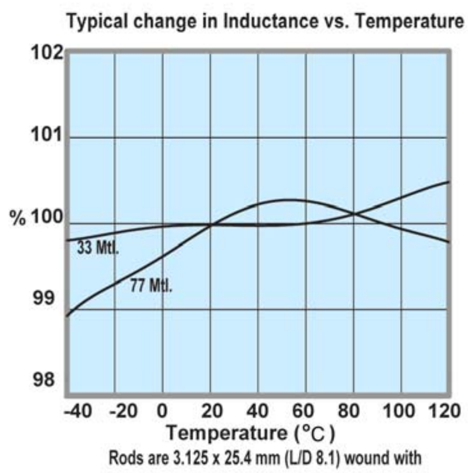
The same rod but wound with 50 turns of the 30 AWG wire has a winding length of 1.5 cm. The inductance modifier is 1.5/2.5 = 0.60, which results from Figure 2 in a K value of 1.51.
Again with the formula we calculated an inductance of 38.9 μH.

The measured values for both windings were 66.95 and 39.50 μH respectively.



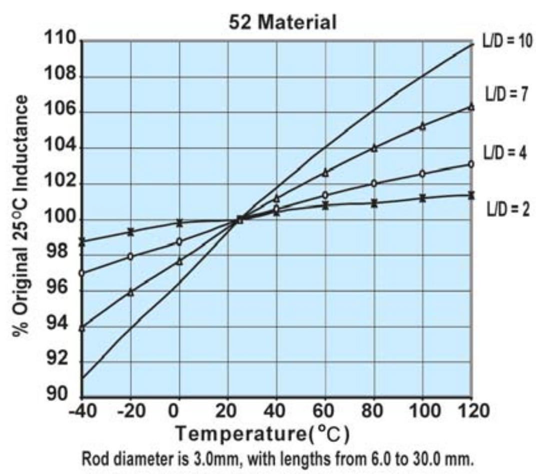
All rods are 2.0 x 15.0 mm (L/D 7.5) wound with 49T #30AWG in a single layer

Figure 3



Rods are 3.125 x 25.4 mm (L/D 8.1) wound with 67T #28AWG in a single layer.

Figure 4



Rod diameter is 3.0mm, with lengths from 6.0 to 30.0 mm. Rods are wound with a single layer.

Figure 5