Low Voltage Heating

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It is often practical to heat a propagation bench with electricity. The heating unit is easy to install and easy to control. And although electricity is expensive for ordinary heating purposes the cost is insignificant when you only want to heat a small part of your bench area and keep the rest of the house cool.

Ordinarily you would use lead covered heating cable. However, these cables are easily damaged, and when the insulation cracks they may be dangerous, because they carry 115 volts. Even the new plastic covered cables have this disadvantage.

Why not use low voltage heating as they do in England, Denmark and many other European countries? The principle is that the 115 volts from your power line are stepped down to about 30 volts. This voltage is not dangerous and the electricity does not leak out in the soil so you can use uninsulated iron fence wire as heating cables. The step down in voltage is done by a transformer which in this case is the only investment. The wire can be used for many purposes before it ends its days as heating cable. And because it is cheap you can leave it in the bench after use. You don't even need a thermostat because this kind of heating can be so designed that you leave the current on continuously and get the right amount of heat. However, for absolute control a thermostat may be advisable.

The Transformer

We have contacted the Allis-Chalmers Manufacturing Company, District Office, 472 South Salina Street, Syracuse 2, New York. They have suitable transformers for low voltage heating. Transformers may be obtained from many other manufacturers but here are the data Allis-Chalmers supplied us:

1-3 Kva. 60 cycles, single phase, 150^{o} rise, self-cooled, dry type, type HD transformer. High voltage 120 low voltage 30.	Net Price Ea. . .	$ 68.40
1-5 Kva. Ditto Item #1	Net Price Ea. . .	96.00
1-10 Kva. Ditto Item #1	Net Price Ea. . .	159.60

The weight and dimensions of these transformers are as follows:

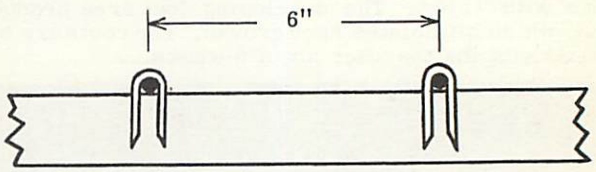
	Height	Length	Width	Weight
#1	15"	10"	10"	75#
#2	16"	12"	12"	100#
#3	25"	18"	13"	170#

Kva means almost the same (in this case) as the transformers output in watts. Number 1 gives maximum 3,000 watts, #2 gives 5,000 watts and #3 gives 10,000 watts as maximum.

The Cables

The heat you get (or the number of watts per square foot you supply) depends on the resistance of the wire.

The wires can be held in place by nailing to boards like this:

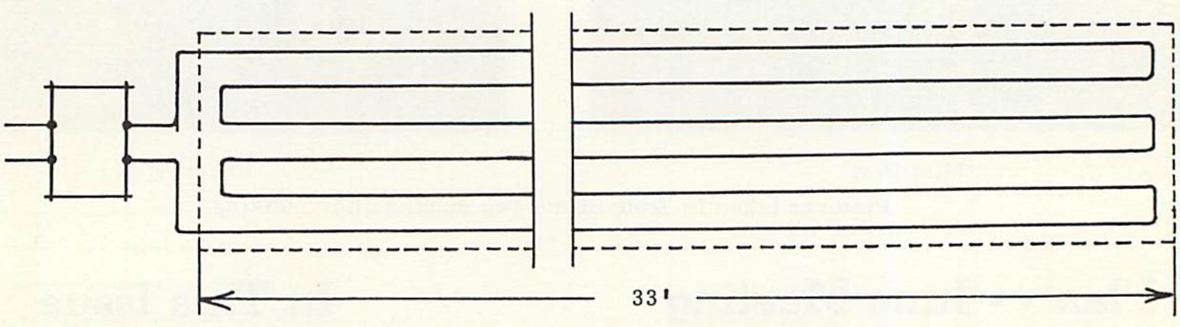


A short thick wire has little resistance and gives a lot of heat. A long thin wire has high resistance and gives little heat. If your wires are too short the transformer may be overloaded and burn out.

In order to avoid formulas I will describe the practical application of low voltage heating based on a Standard Unit which in the following examples is a 200 feet long galvanized iron wire, gauge #10 (B & S. diameter 2.588 mm or 101.9 mils. resistance 0.00579 ohms per foot). This unit will consume approximately 750 watt at 30 volts.

The wires are laid 6 inches apart in the soil in the

100 Square Feet Bench



This bench uses one standard unit. Transformer #1 will be sufficient.

same manner as ordinary heating cable. The applied wattage will then be about 7.5 watt per square foot.

The transformer should be close to the heated area. Cables carrying the current to the cables must be very heavy copper. This is especially important if many heating units are used. If the connecting cables are heated noticeably they restrict the flow of current and the heating cables cannot work at full capacity. The connections between the cables must be heavy duty and insure free flow of current. Contact resistance in the contact points will overheat these points and make the system ineffective.

Not a word is mentioned about temperature. This is because the conditions may vary considerably from place to place.

The amount of electricity required in each case depends on the temperature difference between the house and the bench. It also depends on the humidity and type of soil and how the bench is insulated. No specific figures can therefore be given.

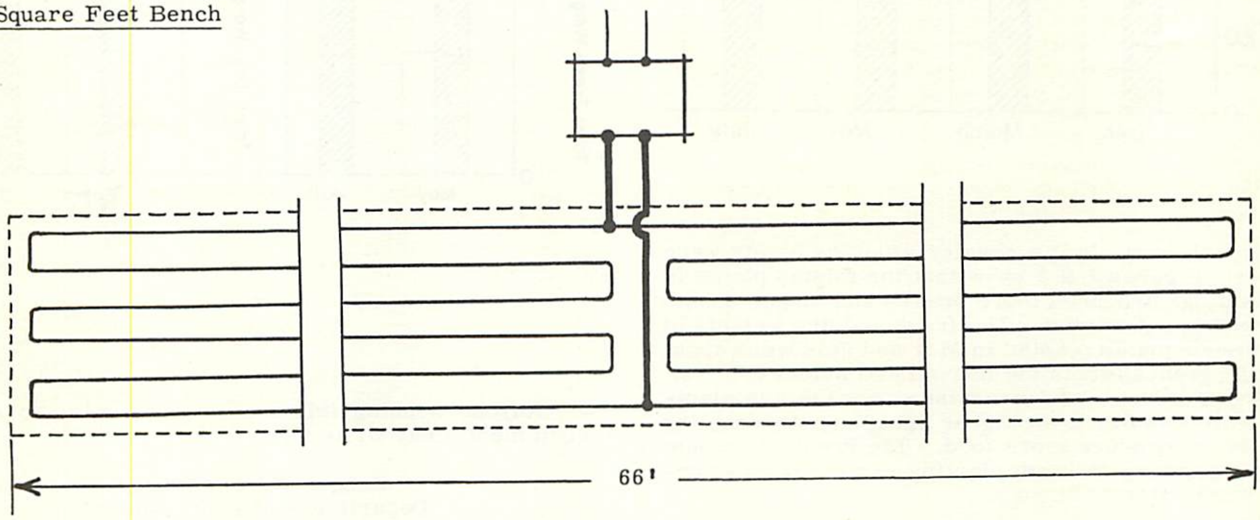
Heating of one cubic foot of soil requires between 0.006 and 0.24 kilowatt hours of electricity. This is net input and does not take care of losses. The examples shown here will meet the average requirements for a propagating bench in a 50°F house, but must of course, not be taken for more than they are. You may have to do a little experimenting yourself.

If the wires are shortened, you get more heat--if you use longer wires, you get less because you thereby change both the resistance of the wire and the area heated.

The temperature in the bench rises slowly when the current is applied, and goes slowly down due to the mass of the soil. This kind of heating is therefore well suited for manual temperature control. If you use a thermostat remember to place the switch on the 110 volt side of the transformer. Any ordinary switch will burn out if placed on the low current side.

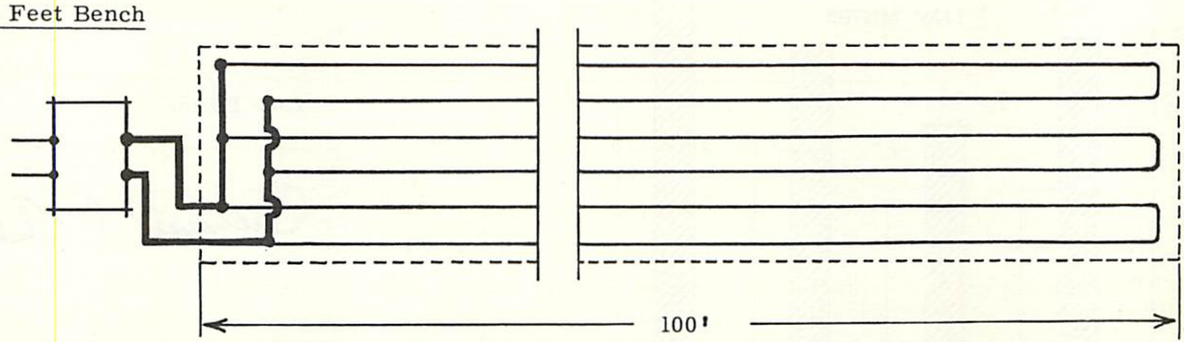
The conduction of heat from the wires depends on the humidity of the soil. If the set up is designed wrong and the wires become too hot, the soil around them will dry out and stop the conductance of heat.

200 Square Feet Bench



This bench uses 2 standard units of wire. Consumption approximately 1500 watt. Transformer # 1 is sufficient.

300 Square Feet Bench



Uses three 200 feet units of #10 wire. Consumption approximately 2250 watt. Transformer # 1

For larger areas transformer #2 or 3 must be used.

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