

Electromagnet System for Testing Magnetron Types 2J21 / 725

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Part 3 2J21 & 725 Magnetron Electromagnet



Initially Designed an Electromagnet to operate the 2J21

Later

include the 725A Magnetron



CONCLUSION:

Seems to work great based on estimated amp- turns and required amps for pole separation, checking magnetron pulsed current and voltage versus the 725 performance curves (ie ~5500 gauss ; 12KV at 12 AMPS) and the assumed 12KV at 10 AMPS for the 2J21; every thing seems to fit. I have been operating the electromagnet at about 2.65 AMPS.

This is my first time ever at constructing an electromagnet of this size and based it mainly on Reference 2 with modifications ;replace 2" round steel stock with a 2 3/4 inch form instead to allow for removable pole magnetron adapters. In operation the winding get very warm causing the coil resistance to increase; I decided to use a box fan cooling set up to minimize the operating voltage after warm up.

I am hoping to someday examine various coil forms to minimize the wire resistance and also examine various practical ways to help the thermal conductivity; to hopefully minimize the Joulean heat loss.

Estimate current required to get ~ 5500 gauss between 0.6 air gap

Poles for 725A magnetron (~0.6" gap)



coils 1656 turns each #18 magnet wire

$$\frac{(0.55 \text{ Tesla})(0.01524 \text{ meter})}{(0.83 \text{ correction factor})(1.26\text{E-}6)} = 8014 \text{ AMP TURNS}$$

$$\frac{8014 \text{ AMP TURNS}}{\sim 3300 \text{ turns}} = 2.43 \text{ AMPS}$$

From early calculations ; correction factor was estimated

Poles for 2J21 magnetron (~1.2" gap)



rail holder



I checked the references below for refreshing my memory about MMF from my college days;

Ref 1EM [Norberto raggio's ELECTROMAGNET DESIGN COOKBOOK;](#)

<http://www.reocities.com/CapeCanaveral/2404/electro.html> ;

<http://soar.wichita.edu/dspace/bitstream/10057/1517/1/07084.pdf>

Ref 2EM “How to Build a Magneto Magnetizer” by Dave Gingery .. www.lindsaybks.com

Ref 3EM <http://chestofbooks.com/TheElectromagnet>

Ref 4EM [Electro-magnets.pdf](#) “An introduction to Electromagnet Design” by M. Kihara (June, 2000)

Ref 5EM [Magnetic_Circuit_Design.pdf](#) Magnetic Circuit Design

Ref 6EM [Magnetic circuit - Wikipedia, the free encyclopedia.htm](#) Magnetic circuit

Ref 7EM [Section 4A.htm](#) Magnetic Circuit Design: definition of the load line. by Dr. Peter Campbell

Ref 8EM [Chapter 1 Magnetism -- Calculating the strength of a magnet.htm](#)

Ref 9EM [eet_ch4.pdf](#) **48550 Electrical Energy Technology Chapter 4. Magnetic Circuit Analysis**

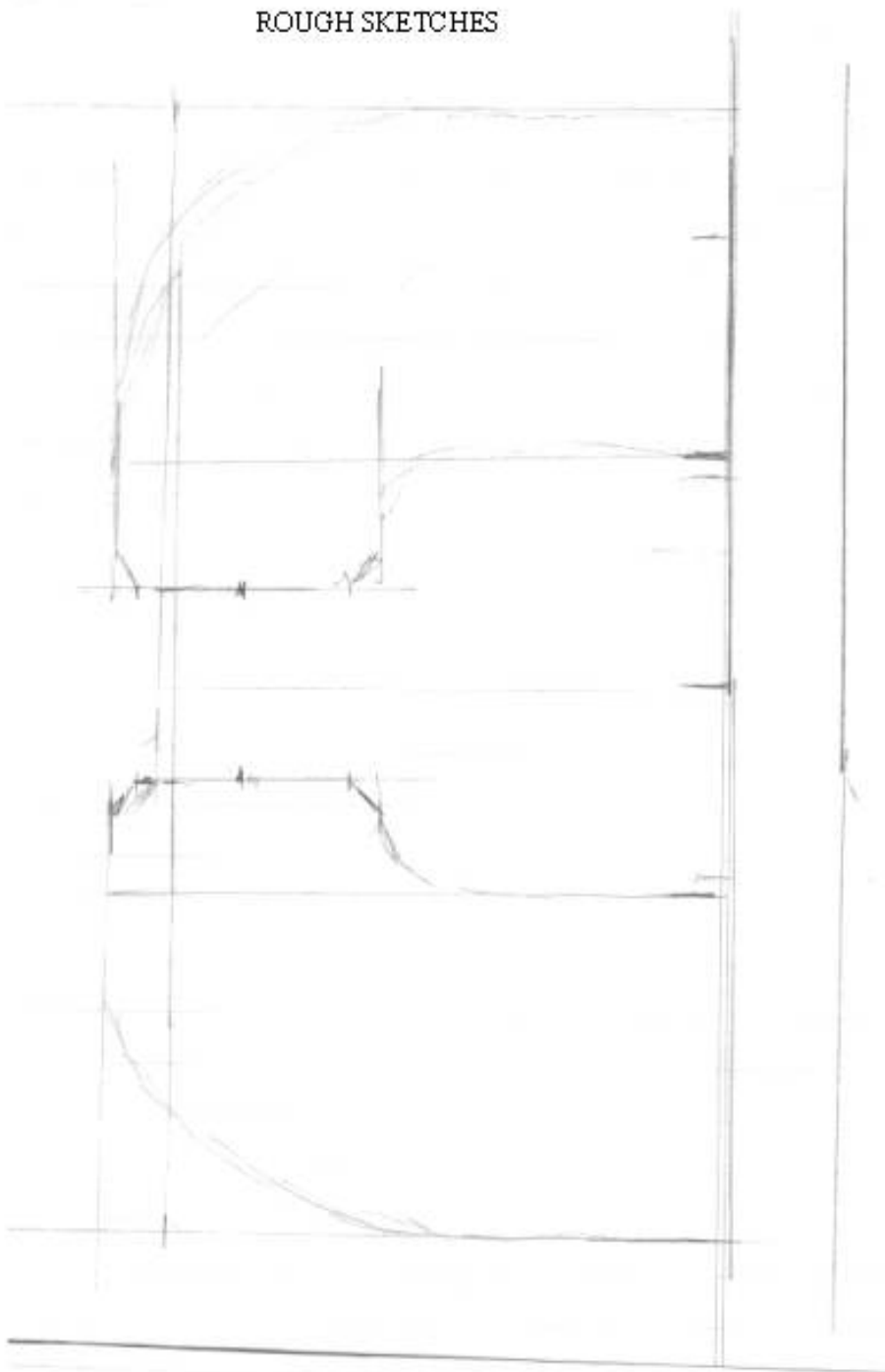
Ref 10EM [Magnetism quantities, units and relationships.htm](#)

Decided to build an electromagnet for the 2J21 and 725A magnetrons; got photos of the permanent magnets in order to get rough estimate of dimensions and physical outline; and adapt it to Ref 2

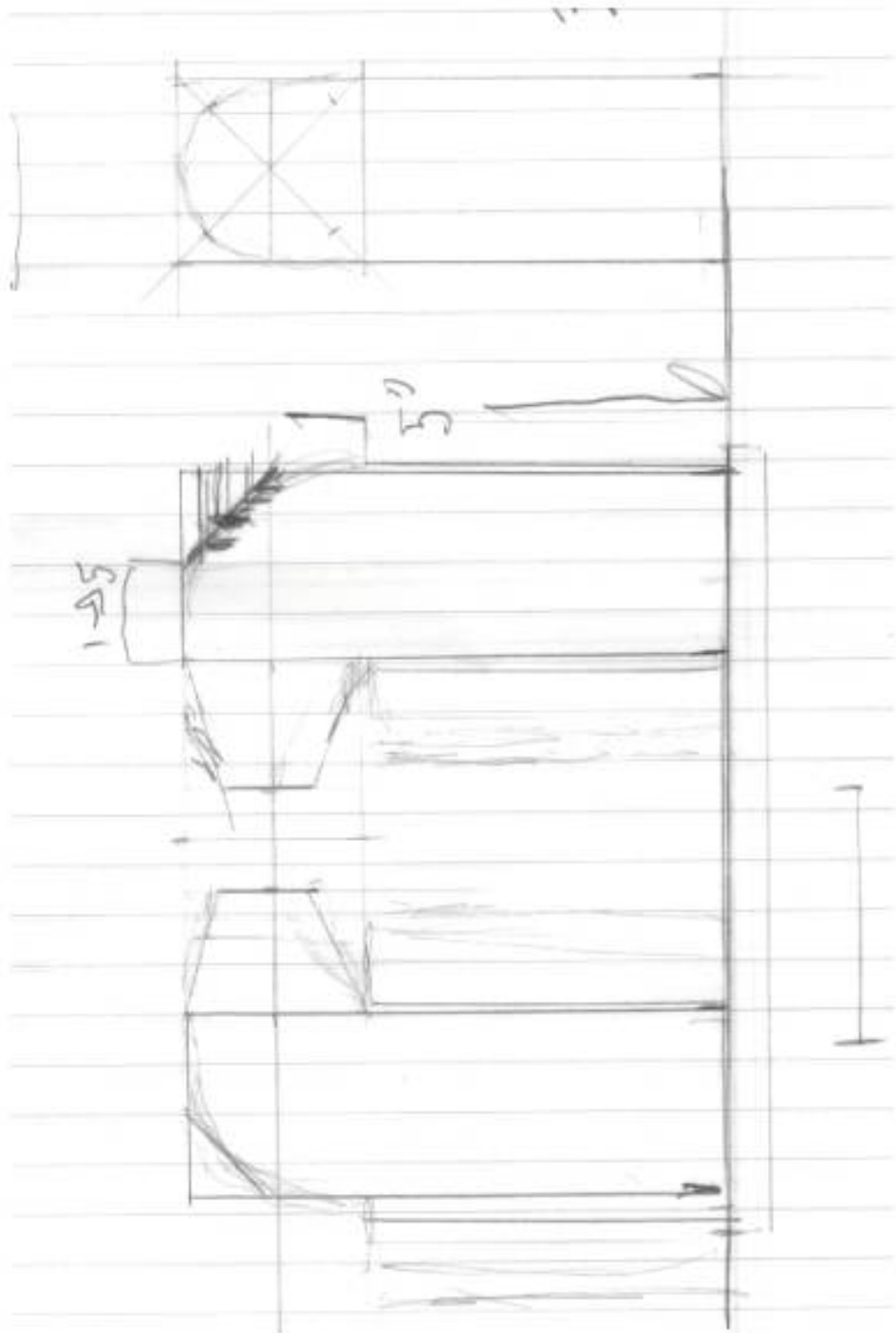
Decided to use 2” sheets stacked to get 2 X 2 sq inch core for the electromagnet winding; decided to use removable round stock magnetron pole pieces to the pole faces see [above](#)

Using picture from MIT series "Microwave Receivers" pg 336, used a reference point and drew 1st guess of the physical dimensions

ROUGH SKETCHES



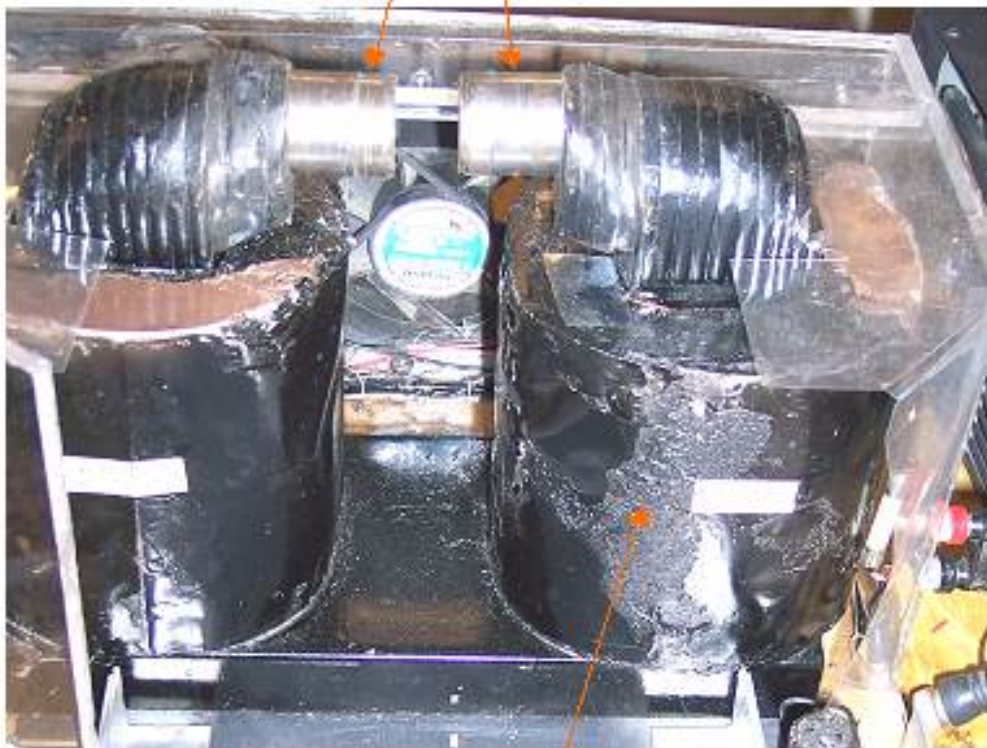
Sketch out magnetic core rough physical shape



Estimate current required to get ~ 5500 gauss between 0.6 air gap

For poles for 2J21 magnetron (~1.2" gap) estimate Gauss 2500

Poles for 725A magnetron (~0.6" gap)



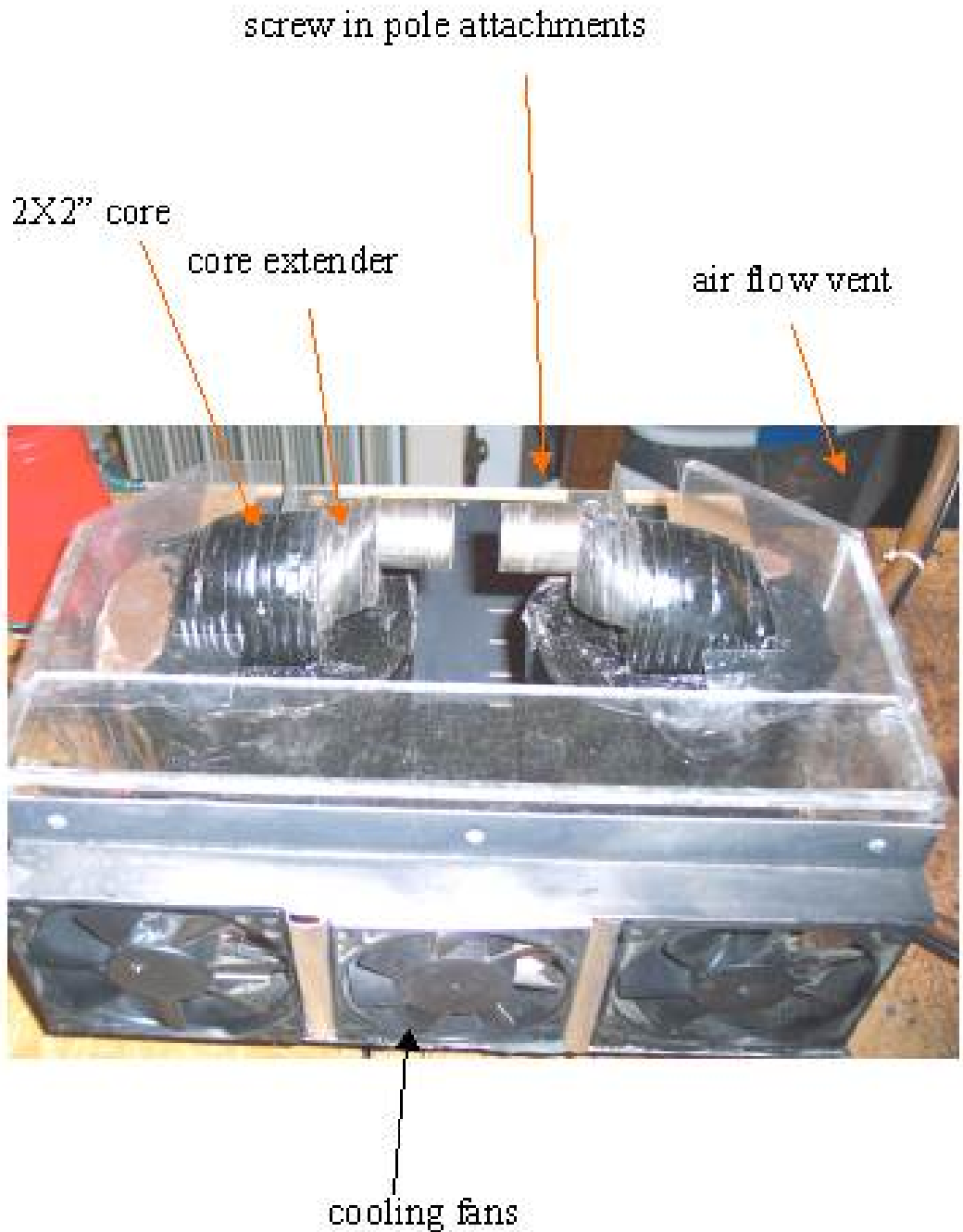
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electromagnet Rear View



Electromagnet Front View

Poles for 725A magnetron (~0.6" gap)

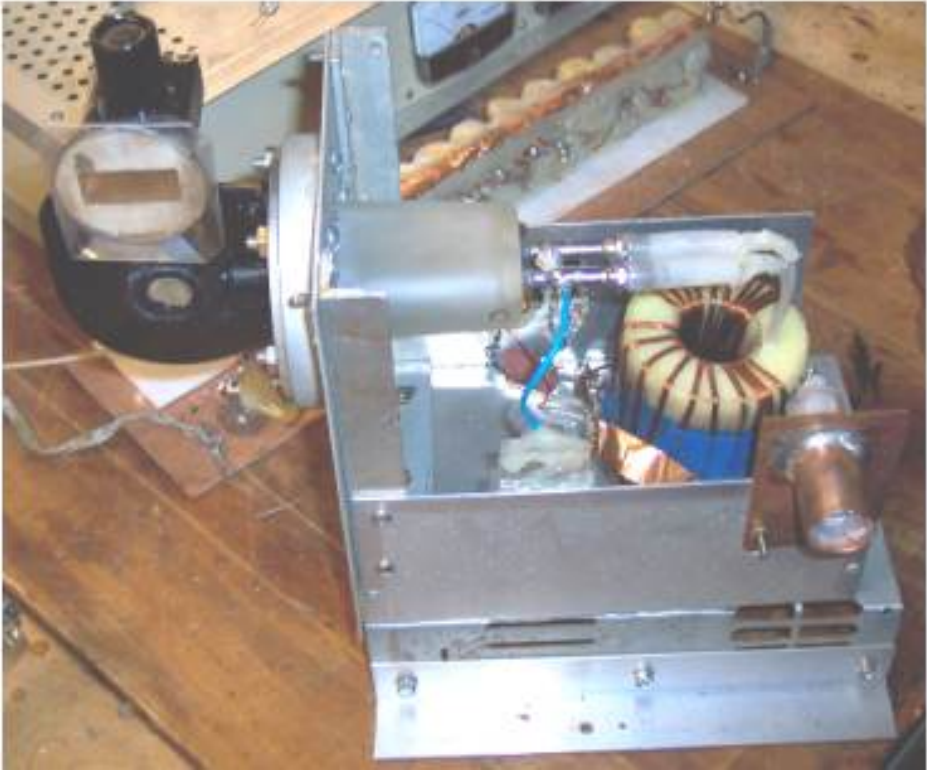


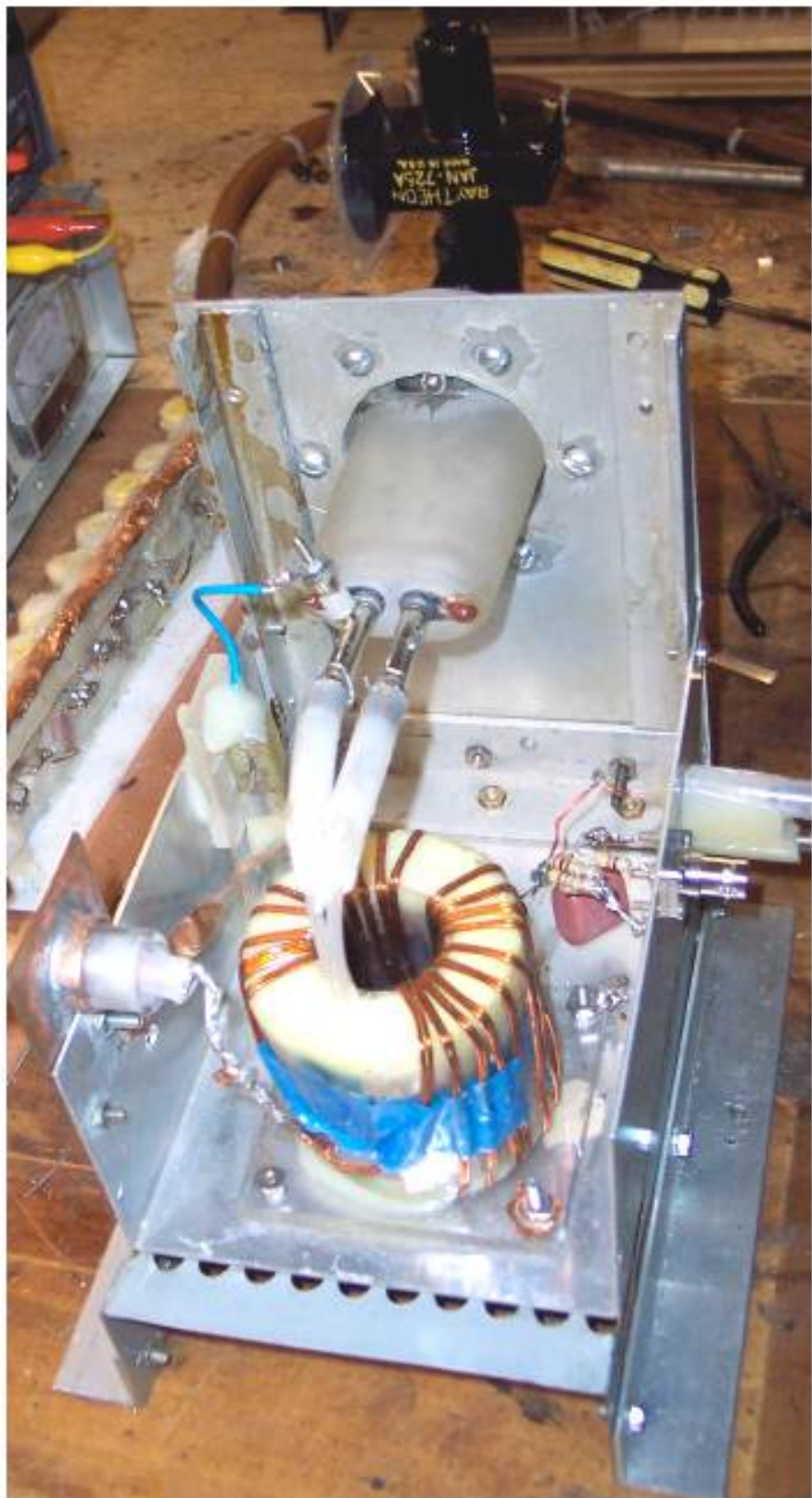
coils 1656 turns each #18 magnet wire

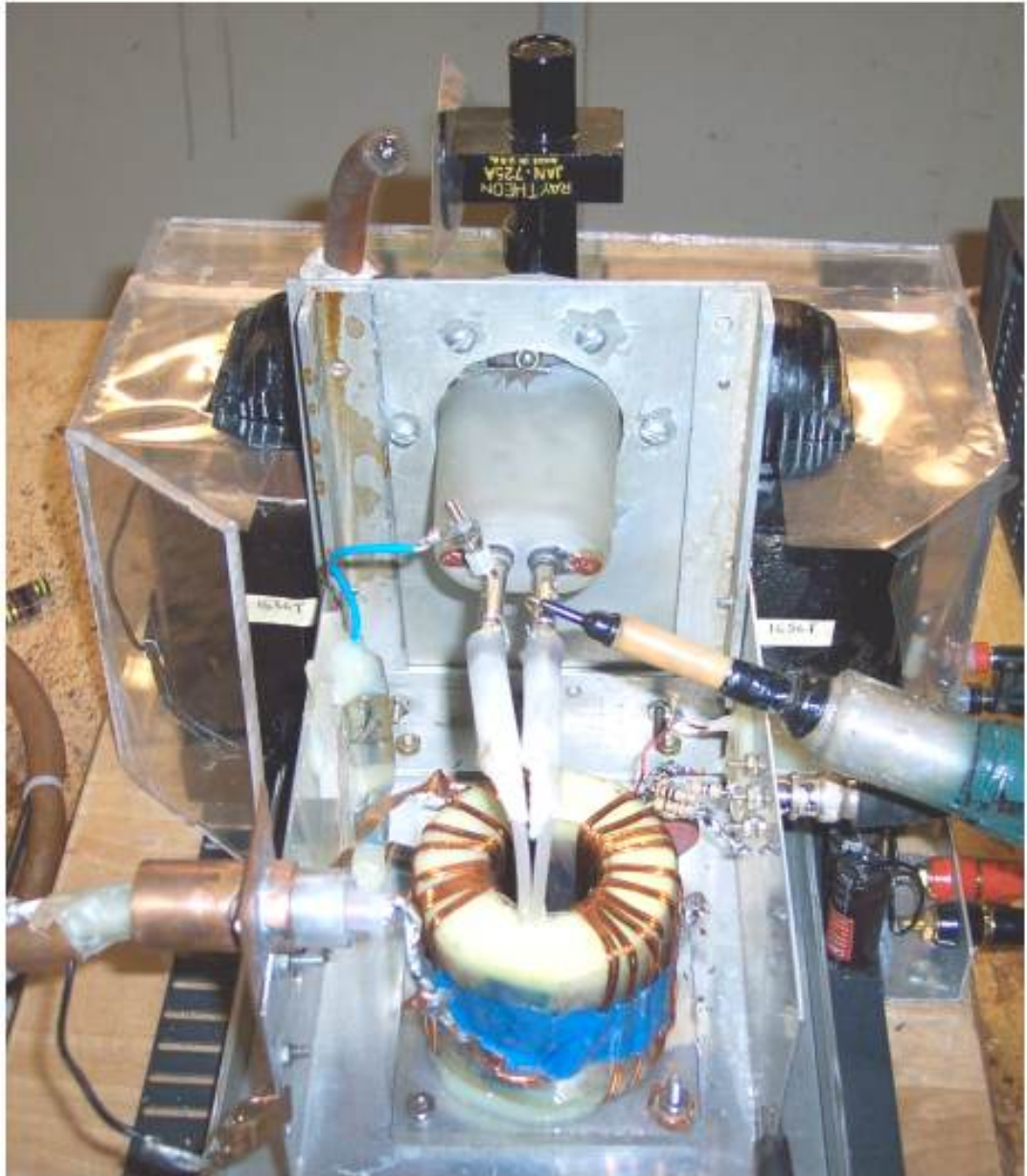
Magnetron Holder











Electromagnet Front View with rail plus magnetron holder

holder



holder mounts to rail

725A with pole pieces

