INSTRUCTION MANUAL
FOR

MODEL 4501*
4" FIXED GAP ELECTROMAGNET

CUSTOMER: _____

CUSTOMER ORDER NO: 46700-21962/

ALPHA SALES ORDER NO: 060-4180

ALPHA SCIENTIFIC, INC.
460 Roland Way
Oakland, California 94621
Phone: (415) 635-2700

a subsidiary of systron-donner corporation

*Old Model 7500

INDEX

I. INTRODUCTION

The Alpha Model 4501 is a 4" diameter pole electromagnet. The air gap width without pole caps is 3.89 inches. Any desired configuration pole caps are available (See Section IX, ACCESSORIES).

This electromagnet is designed to be used with the Alpha Model 3000 Power Supply (with optional Model 3001 regulator), for experiments such as NMR, EPR and Magnetic Susceptibility measurements, and Hall Effect, Magneto-Optical, Biological studies, etc.

This manual is prepared to acquaint the user with proper installation, operation, maintenance techniques, and to list factory services and available accessories.

II. GENERAL DESCRIPTION

a. The Model 4501 is intended for use in the laboratory or classroom as a general purpose electromagnet. The magnet, which is rigidly mounted on 45° legs, may be installed on a turntable (Model 4521) for 360° rotation about its vertical axis. When mounted on a turntable, a vernier dial allows rotation to be set within 0.1°. In addition, either magnet or turntable may be installed on a rolling base (Model 4522).

b. Performance ratings with various pole cap configurations are given on "Magnetization Curves" (Section VI), which show field as a function of air gap and energizing current.

c. Construction Features

1. Mechanical - Extreme care has been exercised in the design of this magnet to provide optimum performance. The magnet consists of an "H" type yoke with separate pole bodies and optionally available with water cooled or air cooled coils. The yoke and pole bodies are fabricated from high quality, low carbon steel. The pole caps are made from a highly pure magnetic iron and have been machined and ground to provide maximum field homogeneity. Each pole cap is hard chrome plated to resist wear and corrosion. Using a NMR detector,

the pole caps are shimmed for the most uniform field centered on the pole axis. Axial holes are provided through the pole cores.

2. Electrical - The coils are wound with strip aluminum conductor insulated with mylar and epoxy resin. In the water cooled model, the water cooled heat sink is mounted flat against coil windings for good heat transfer. They are isolated electrically from the windings. The four cooling coils are connected in parallel between common manifolds. The manifolds are terminated with 3/8" female pipe threads.

III. INSTALLATION

a. If visible signs of damage to crate or to magnet are noticed, call a representative of the transportation company before proceeding further. The magnet must be lifted off the packing skid. Use the lifting eyebolt provided.

b. The overall dimensions of the Model 4501 are shown in the 4" Magnet Brochure provided. The weight of the magnet is approximately 230 pounds. When the magnet is purchased as a system consisting of both magnet and power supply, two 15' D.C. power supply cables will be provided. When the magnet is purchased alone, D.C. cables are not provided.

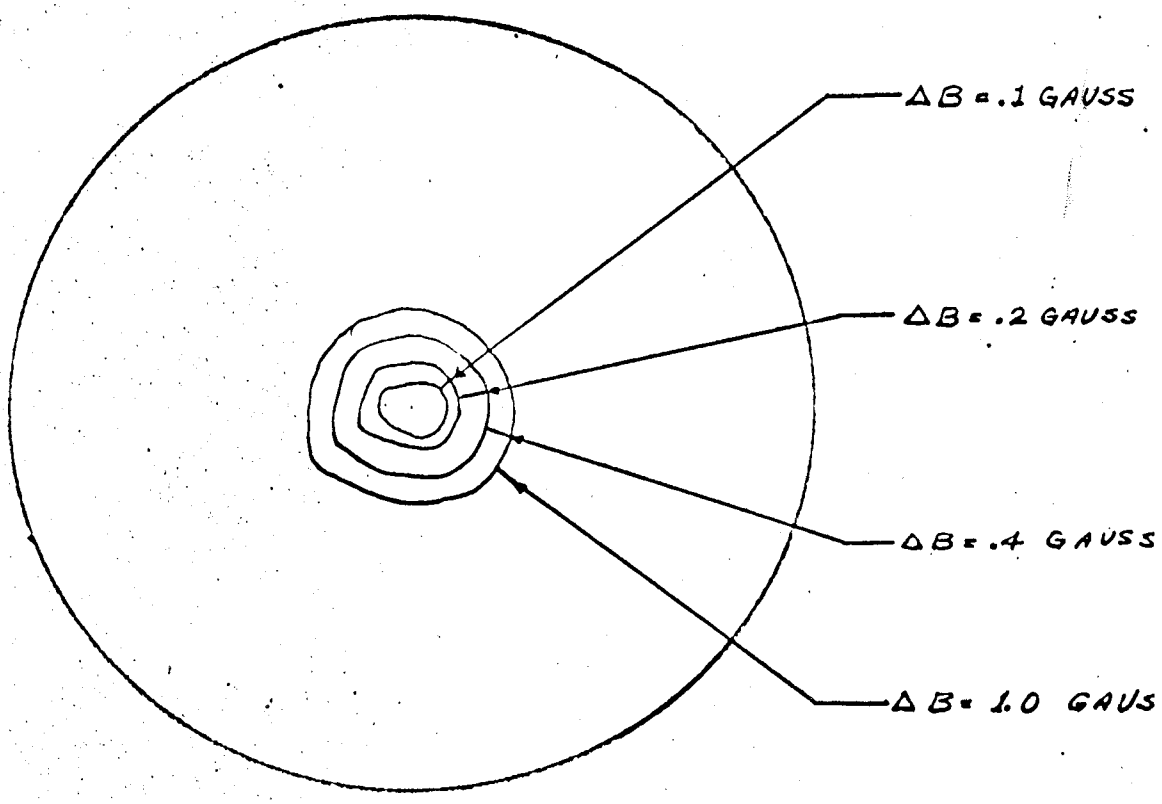
IV. OPERATION AND PRECAUTIONS

1. When energizing the magnet, apply full current and then reduce to the operating point as required.
2. To rotate the magnet about vertical axis, unlock the brake before turning the handle.
3. Make sure that the cooling water is turned on.
4. Be sure that there are no loose objects around the magnet while power is on.
5. The magnet cables and hoses should be tightened so that they can not be accidently broken or disconnected while power is on.
6. Care must be exercised not to damage power cables and interconnecting hoses when rotating the magnet about the vertical axis.

V. ELECTRICAL AND COOLING RATINGS

1. Rated Power = 1 Kilowatt.
2. Rated Voltage = 100 V.D.C. at 10 Amperes.
3. Cooling = 1 G.P.M. at 30 P.S.I.
4. Temperature Rise = 10°C average on water cooled models.
   40°C average on air cooled models (at 250 watt
5. Total Resistance at 20°C = 10 ohms. (Coils in series)

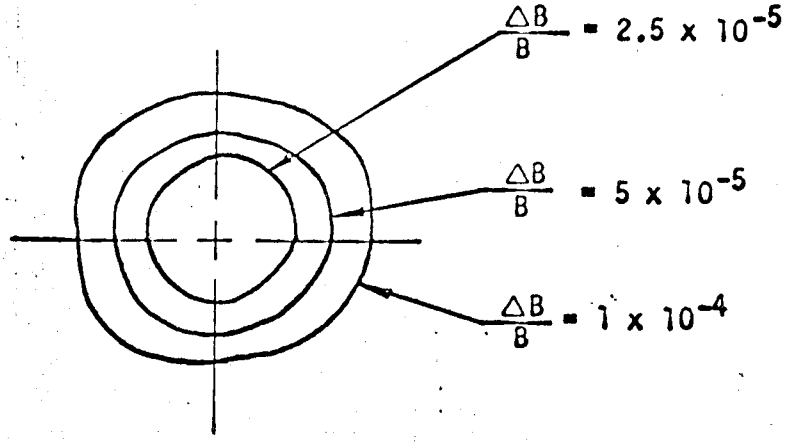
VI. MAGNETIZATION CURVES



HOMOGENEITY PLOT (4.0 K-G.)
4" CYLINDRICAL POLE CAPS ON
MODEL 4501 (WATER COOLED)
FULL SCALE
GAP = 1.50 INCHES

TYPICAL FIELD HOMOGENEITY PLOTS

MODEL 4501 (*)



B = 4000 Gauss at 1" air gap.

MEASUREMENTS TAKEN ON MIDPLANE

MODEL NO. 4501 (WITH MDL 3002-1 P.S.) 4072

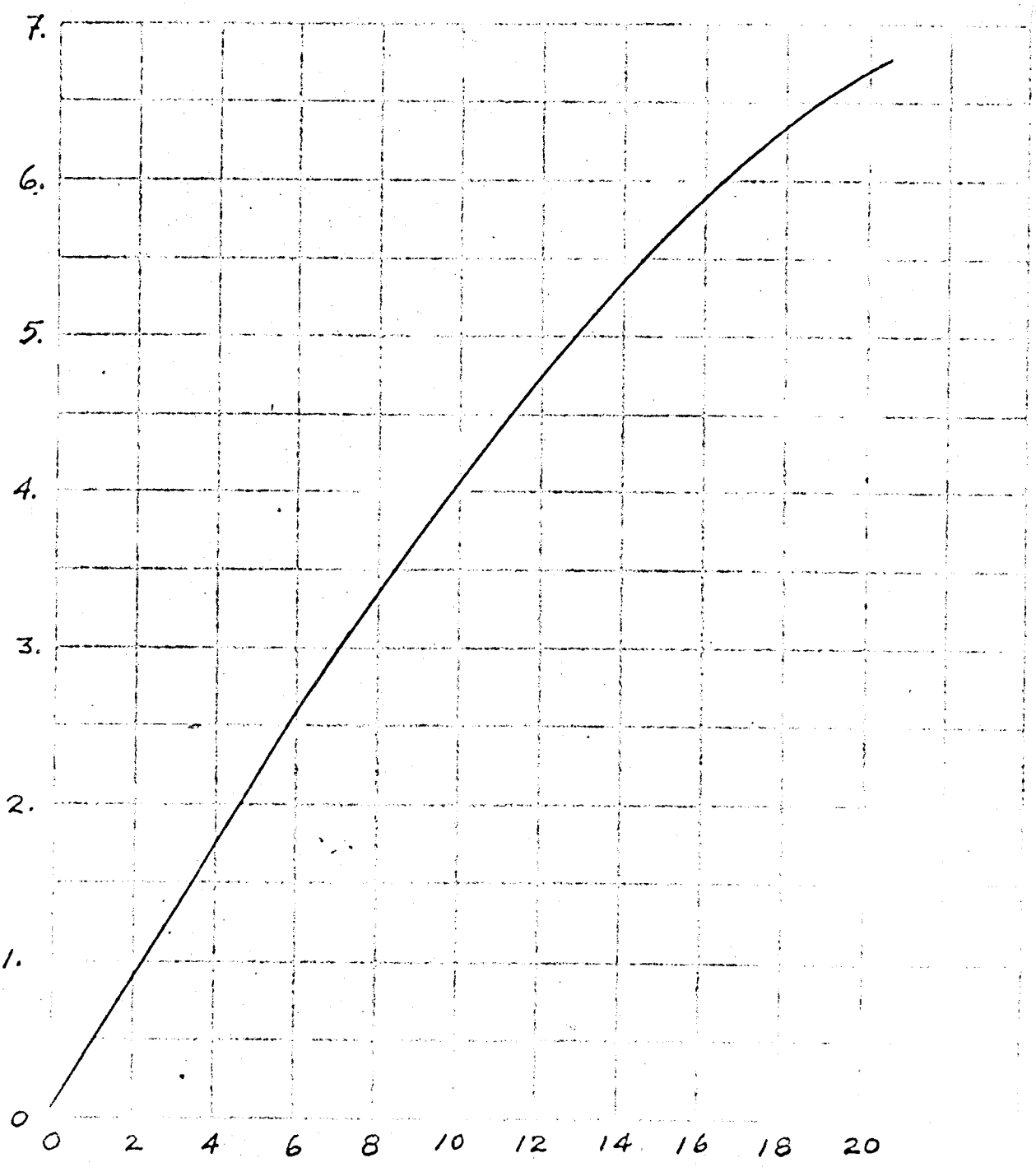
FIELD STRENGTH: 6.6 20 1 ½"

RATED POWER: 50 20 WITH CO
PARALL

POLE TIP STYLE: CYLINDRICAL

COOLING: WATER (1 G.P.M. @ 30 P.S.I.)

TEMPERATURE RISE: 10° C



MAGNETIZATION CURVE

MODEL NO. 450/1 (*) (WITH MDL 3000 P.S.)

ORDER NO. _____

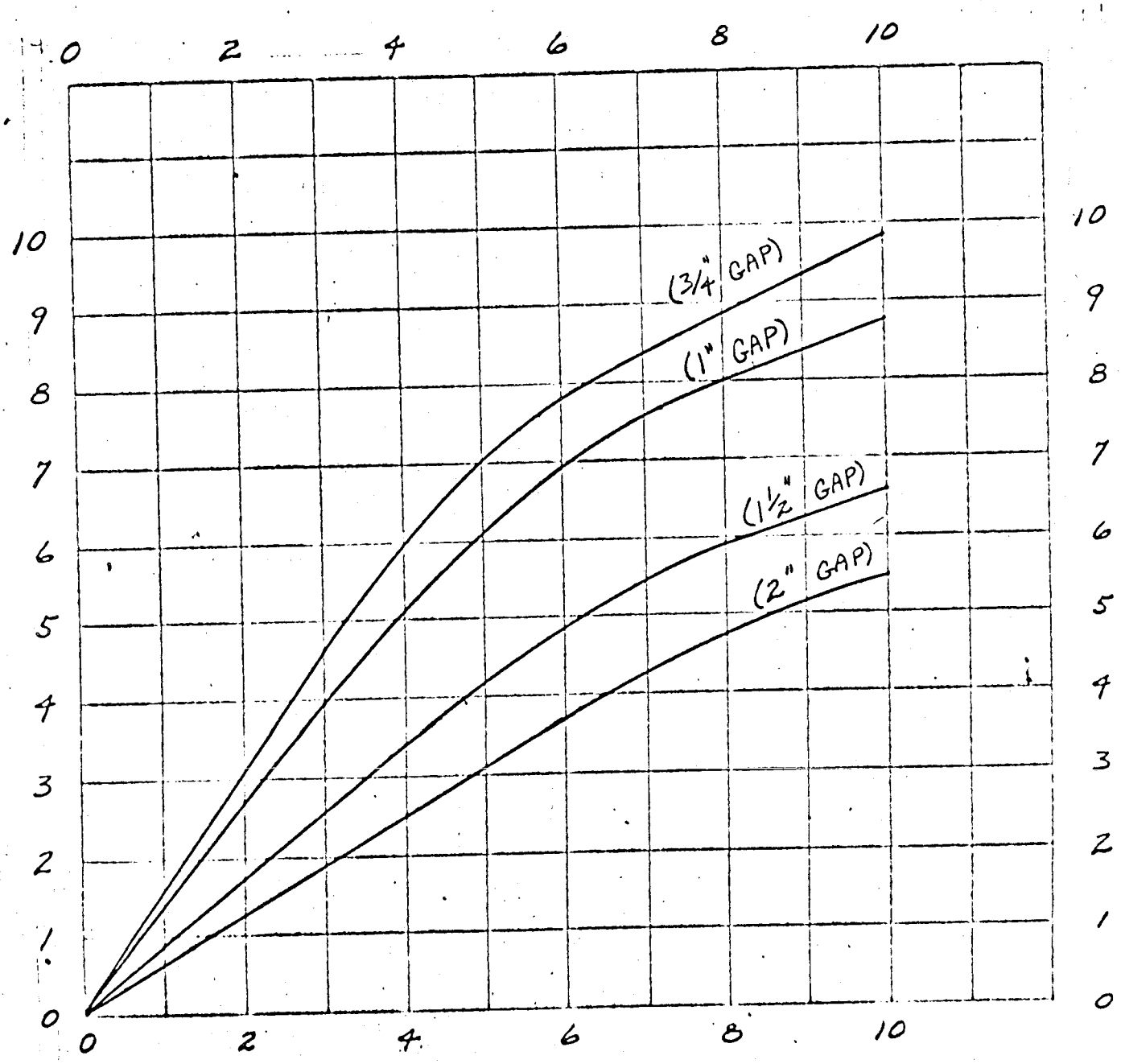
FIELD STRENGTH: _____ K-GAUSS @ _____ AMPS, WITH _____ GA

RATED POWER: _____ V. D. C. @ _____ AMPS.

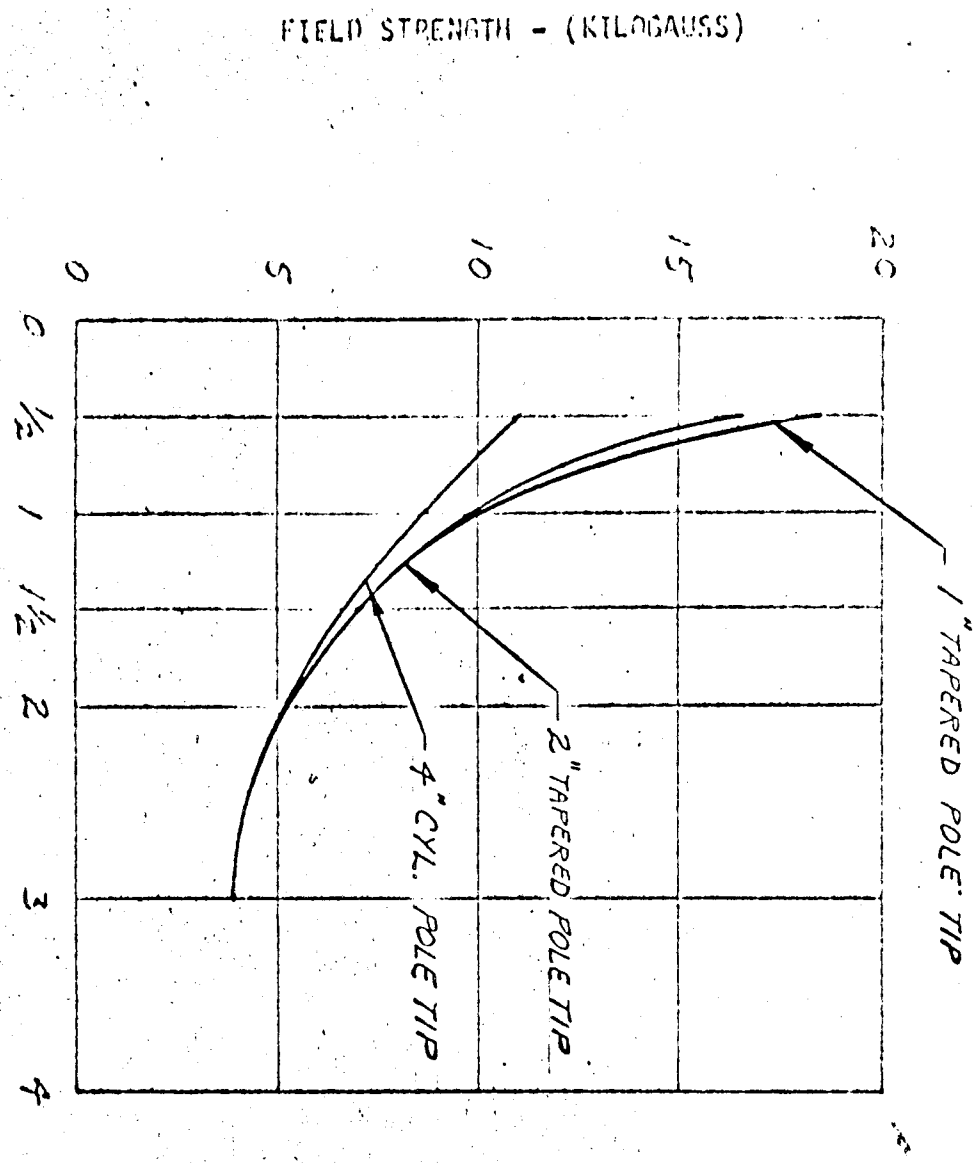
POLE TIP STYLE: 4" ø CYL.

COOLING: _____

TEMPERATURE RISE: _____



MODEL 450.1 (*) -


FIELD STRENGTH - (KILOGAUSS)
0
5
10
15
20
0
1/2
1
1 1/2
2
3
4
AIR GAP - (INCHES)
AT 10% ENERGIZING POWER
1" TAPERED POLE TIP
2" TAPERED POLE TIP
4" CYL. POLE TIP

VII. MAINTENANCE

a. Electrical - No special routine maintenance is required. If the coil insulation should be damaged, check with factory for information regarding repair.

b. Cooling System - When ordinary tap water is used for cooling, it is recommended that the cooling channels be flushed out periodically (at least annually) with a commerical flushing solution, as used in heat exchangers, to remove slag and deposits.

When the electromagnet is to be stored where freezing is a possibility, flush out the cooling water with compressed air and plug the fittings, or add anti-freeze.

c. Mechanical

1. To remove pole caps:
    a. Degauss the magnet so that the residual field in the magnet is less than 3 gauss.
    b. Brace the pole cap so that it will not fall when loosened.
    c. Unscrew hex head cap screw holding pole cap to pole.
    d. Carefully remove the pole cap. NOTE: The pole cap may adhere to the pole surface due to the fine surface finish on each part. In this case, it is necessary to slide the pole cap across the pole. The pole cap may be tapped with a soft nylon hammer.
2. To replace pole caps: Reverse above procedure.

VIII. FACTORY SERVICE

1. In all correspondence concerning this electromagnet, please note Model and Serial numbers which are stamped on the specification plate.
2. When requesting replacement parts or ordering accessories, please specify:
   a. Item or Drawing Numbers, if any.
   b. Description.
   c. Number required.
3. Factory service personnel can be contacted by telephone without obligation concerning maintenance or special problems. Maintenance can be performed in the field for a nominal charge. Contact Alpha Sales and Service Department for rates.

IX. ACCESSORIES

Contact the factory Sales Department or your local manufacturer's representative for current price and delivery of accessories.

NOTE: When ordering pole caps, always specify gap desired.

1.	Model 4510	4" Diameter Cylindrical Pole Caps
2.	Model 4511	4" Diameter Tapered Pole Caps (specify face di
3.	Model 4512	4" Diameter Cylindrical Axial Hole Pole Caps
4.	Model 4513	4" Diameter Tapered Axial Hole Pole Caps
5.	Model 4515	4" Diameter Constant Force H dh/dx Pole Caps
6.	Model 4516	4" Diameter Constant Gradient dh/dx Pole Caps
7.	Model 4520	Variable Height Base
8.	Model 4521	Rotating Base
9.	Model 4522	Rolling Base
10.	Model 1403	Equipment Mounting Table
11.	Model 4523	Mobile Cabinet
12.	Others Upon Request	

Scientific

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CORPORATION

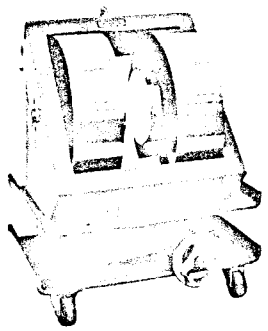
A NEW AND COMPLETE LINE OF 4" MAGNETS

PRECISION LABORATORY
ELECTROMAGNETS
FOR EVERY

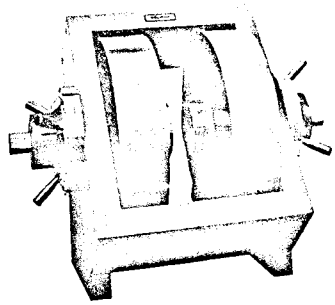
Alpha Scientific is now offering a complete line of laboratory electromagnets to meet a wide variety of applications in both industry and research.

A complete family of 4-inch Electromagnets are being offered which are ideally suited to applications such as Magnetic Susceptibility measurements, Electron Paramagnetic, and Nuclear Magnetic resonance demonstrations, and Hall effect studies.

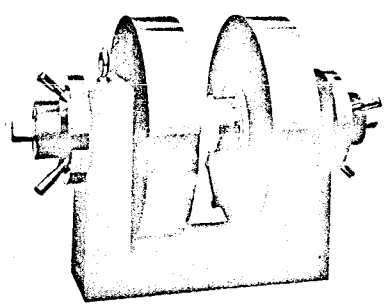
All of the 4-inch electromagnets are designed to be used with Alpha's complete line of Magnetic Susceptibility Systems. Matching Power Supplies and a wide variety of accessories can be purchased for each of these 4-inch electromagnets.



Model 4501 with
Model 4521 Rotating Base
and Model 4522 Rolling Base

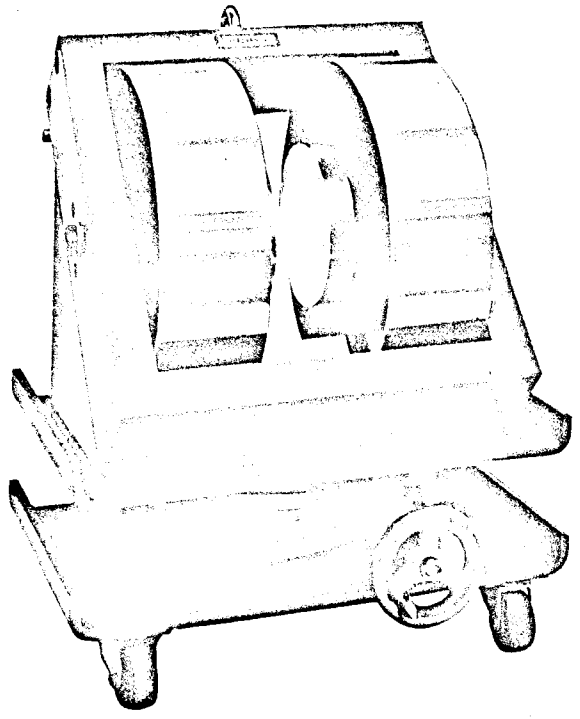


Model 4600



Model 4800

MODEL 4501



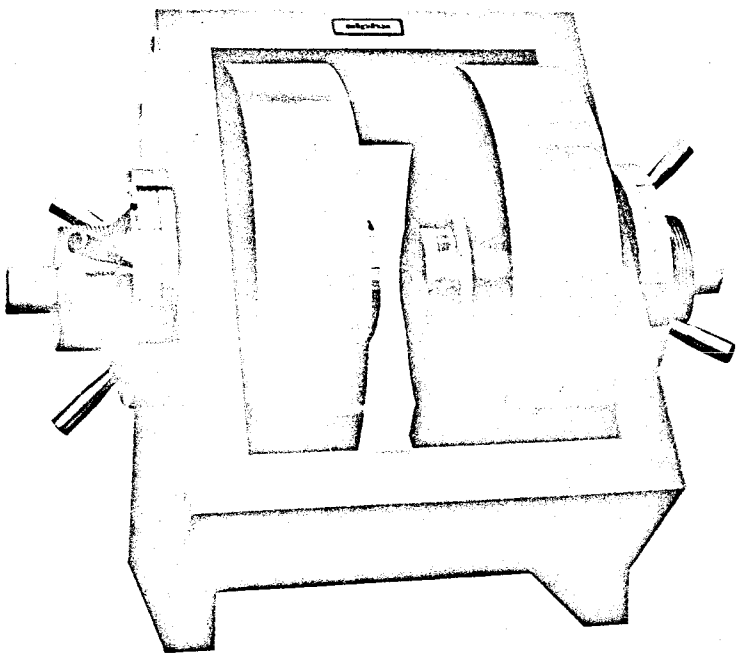
Features

* *Fixed Air Gap*
* *"H" Closed Yoke Design*
* *45° Mounting*
* *Water Cooled Coils*
* *Easily Removable Pole Caps*

Specifications

Power Requirements . . . . . 1 Kilowatt Maximum
Energizing Current . . . . . 10 Amperes
Cooling Required . . . . . 1.0 GPM at 30 psid
Temperature Rise . . . . . 10°C
Magnet Resistance . . 10.0 Ohms (coils in series)

MODEL 4600



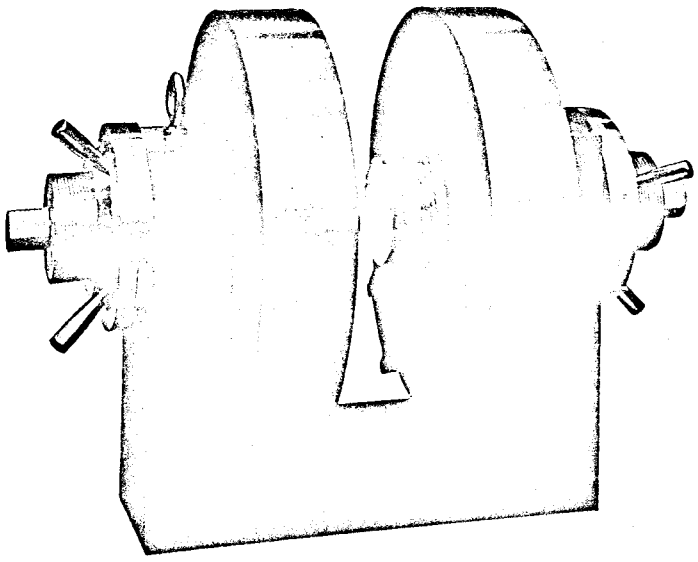
Features

* *Continuously Adjustable Air Gap*
* *"H" Closed Yoke Design*
* *45° Mounting*
* *Water Cooled Coils*
* *Easily Removable Pole Caps*
* *Pole Adjustment to Optimize Field Uniformity*

Specifications

Power Requirements . . . . 1.5 Kilowatts Maximum
Energizing Current . . . . . 30 Amperes
Cooling Required . . . . . 1.0 GPM at 30 psid
Temperature Rise . . . . . 15°C
Magnet Resistance . . . 1.5 Ohms (coils in series)

MODEL 4800



Features

* Continuously Adjustable Air Gap
* "C" or Open Yoke Design
* Vertical Mounting
* Water Cooled Coils
* [illegible]

Specifications

Power Requirements.....2 Kilowatts Maximum
Energizing Current.....50 Amperes
Cooling Required.....1.0 GPM at 30 psid
Temperature Rise.....20°C at Full Power
Magnet Resistance...0.8 Ohms (coils in series)

Physical Characteristics

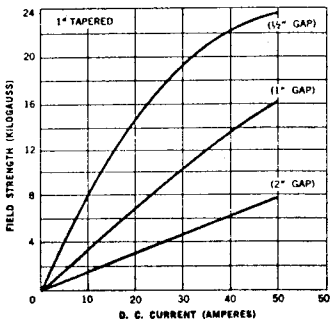
Air Gap.....0 to 4.25
Pole Diameter.....4.0" Nominal
Coil Spacing.....6 5/8"
Axial Hole.....25/32" Diameter (thru Pole Body)
Dimensions.....Height, 19 5/8"; Width, 28 3/16"; Depth, 16 7/8"

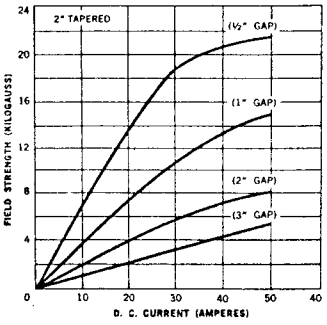
Centerline Height:

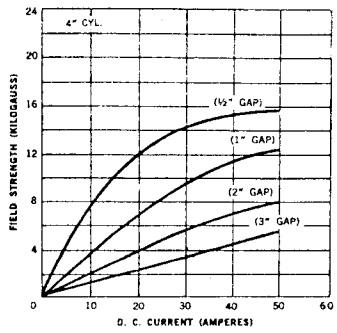
11 1/8" with Vertical Mounting
17 1/8" Mounted on Rotating Base
19 7/8" Mounted on Rotating and Rolling Base

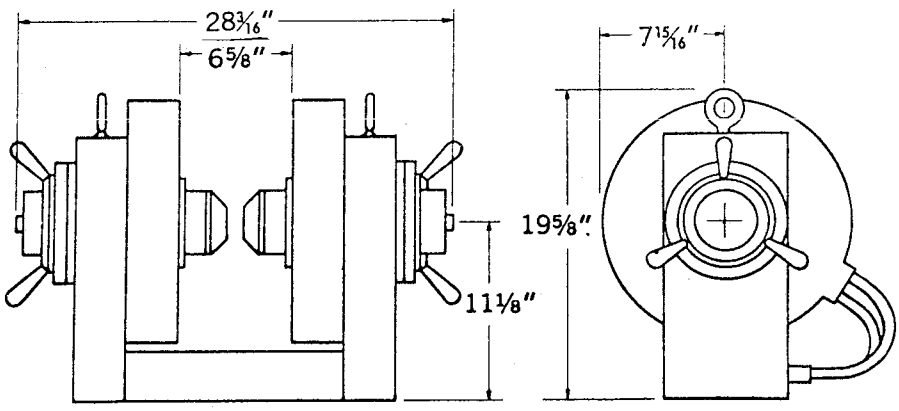
Shipping Weight:

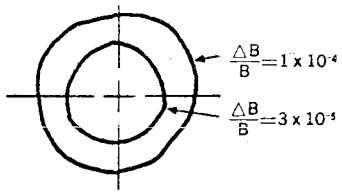
585 lbs. with Vertical Mounting
685 lbs. with Rotating Base
715 lbs. with Rotating and Rolling Base



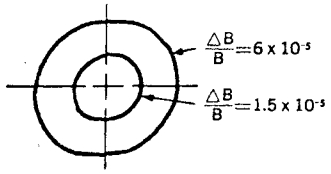








B=3500 Gauss at ¾" air gap.



B=6800 Gauss at ¾" air gap.

TYPICAL FIELD HOMOGENEITY PLOTS
TAKEN ON MIDPLANE
SCALE REDUCED TO ¼

Matching Power Supplies For [illegible] Laboratory Magnets

Magnet	Power Supply	
Model 4501	Model 3000, 100 volt, 10 Amp Filtered, Unregulated	Shipping Weight: 80 lbs.
	Model 3001, Regulator (5×10^{-4})	Shipping Weight: 30 lbs.
Model 4600	Model 3002-1, 50 volt, 30 Amp Regulated to $\pm 5 \times 10^{-5}$	Shipping Weight: 170 lbs.
Model 4800	Model 3003-1, 40 volt, 50 Amp Regulated to $\pm 1 \times 10^{-5}$	Shipping Weight: 250 lbs.

Accessories

Model 4510	Cylindrical Pole Caps
Model 4511	Tapered Pole Caps
Model 4512	Cylindrical Axial Hole Pole Caps
Model 4513	Tapered Axial Hole Pole Caps
Model 4514	Pole Shim Pairs
Model 4515	Constant H dH/dx Pole Caps
Model 4516	Constant dH/dx Pole Caps
Model 4520	Variable Height Base
Model 4521	Rotating Base
Model 4522	Rolling Base
Model 1403	Equipment Mounting Table
Model 4523	Mobile Cabinet

Ordering Information

Please Specify:
- Model Numbers of units desired
- Magnet Price includes one pair of cylindrical or tapered pole caps (specify)
- Pole Cap requirements (Face Dia. Gaps., etc.)
- Correct shipping address
- Method of shipment
- Special instruction if any

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