GMW

USER'S MANUAL

MODEL: 3470

45MM ELECTROMAGNET

Date Sold: _______________

Serial number: ___________

This manual is for the model 3470 electromagnet with serial numbers 206 and above.
For the model 3470 electromagnet with serial numbers 196 to 205 see manual M3470d
For the model 3470 electromagnet with serial numbers 195 and below see manual M3470c

File No: M3470h.407 Revision Date: July, 2009

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Email: sales@gmw.com Web site: http://www.gmw.com

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Drawing 18900391 Shipping Crate Assembly

Section 1
SPECIFICATIONS
Table 1. Model 3470 Specifications

Pole Diameter:	45mm (1.75 inch)
Pole Gap:	0 - 75mm (0 to 3 inch)
Standard Pole Face:	40mm (1.57 inch) cylindrical end. 20mm (0.79 inch) tapered end.
Coils (series connection)	
coil resistance (20°C)	7.3 Ohm
max resistance (hot)*	8.8 Ohm
max power (air)	3.5A/31V (0.11kW)
max power (water)	5A/44V (0.22kW)
Self Inductance	
Water Cooling (18°C)	1 liters/m (0.26 US gpm) 0.3 bar (5 psid)
Overtemperature Interlock	Elmwood 3450G thermostat part number 3450G 611-1 L50C 89/16 mounted on each coil and wired in series. Contact rating 120Vac,0.5A. Closed below 50°C.
Dimensions	Drawing 11801470 377mm W x 233mm D x 217mm H 14.8 inch W x 9.2 inch D x 8.6 inch H
Weight	27 kg (60 lb)

***CAUTION - The value of maximum coil resistance given should not be exceeded. At this resistance the coils are at maximum safe temperature for continuous operation.**

Section 1
SPECIFICATIONS
Table 2. Model 3470 Electrical and Water Connections

DC Current (refer to Drawing 11801470)

Right hand coil terminal 2	Positive
Left hand coil terminal 1	Negative

Ground

An M4 screw (Item 20 on drawing 11801470) is provided on the magnet yoke to enable the magnet to be grounded according to local safety regulations. It is normally appropriate to connect the magnet frame to the power supply ground.

Interlocks (refer to Drawing 11801470).

The temperature interlock wiring connections are made directly onto the temperature thermostats (Item 11 on drawing 11801470).

Water (refer to Drawing 11801470).

Outlet	¼ inch OD Tube
Inlet	¼ inch OD Tube

CAUTION - Ensure that the high current connections are tight. Loose connections may lead to oxidation and overheating. The field stability may be degraded and the current terminations damaged.

Section 2

WARNINGS

REFER TO WARNINGS BELOW BEFORE OPERATING ELECTROMAGNET

1 Personnel Safety

In operation the magnet fringing field is in excess of 0.5mT (5G). This can cause malfunctioning of heart pacemakers and other medical implants. We recommend that the fringing field should be mapped and warning signs be placed outside the 0.5mT (5G) contour. Entry to this region should be restricted to qualified personnel.

2 Clamp Bolts

Before operation **always ensure that both** clamp bolts (item 6 on drawing 11801470) are firmly tightened. Ensure that the poles are arranged so that that pole gap is approximately centered between the coils.

3 Ferromagnetic Objects

During operation the magnet exerts strong magnetic attraction towards ferromagnetic objects in the near vicinity of its pole gap or coils. Loose objects can be accelerated to sufficient velocity to cause severe personnel injury or damage to the coils or precision pole faces if struck. Keep ferromagnetic tools clear!

4 Arcing

This magnet stores considerable energy in its field during operation. Do not disconnect any current lead while under load or the magnetic field energy will be discharged across the interruption causing hazardous arcing.

5 Coil Hot Resistance

Do not exceed the maximum coil hot resistance given in the specifications or coil overheating and possible damage may occur.

6 Interlocks

These should ***always*** be connected if the magnet is operated unattended, to avoid the possibility of coil overheating caused by excessive power dissipation or inadequate cooling.

7 Watches, Credit Cards, and Magnetic Disks

Do not move magnetically sensitive items into the close vicinity of the magnet. Even some anti-magnetic watches can be damaged when placed in close proximity to the pole gaps during operation. Credit cards, and magnetic disks are affected by magnetic fields as low as 0.5mT (5G). Depending on the previous operating field and the pole gap, the remanent field in the gap can be in excess of 50G (5mT) with the magnet power supply off or disconnected.

Section 3

INSTALLATION

Caution: This is a heavy system. All movement, lifting and installation of the 3470 Electromagnet must be under the supervision of an experienced person to prevent the possibility of serious injury or damage to the Electromagnet and associated equipment.

Unpacking Instructions and Damage Inspection

To unpack the electromagnet please use the following procedure (Refer to Drawing 18800450).

1. First remove all of the "Posidrive Screws" located at the lower edge of all the side panels of the "Crate Top Cover".

2. Gently rock the "Crate Top Cover" to work it loose from the shipping crate base.

3. Grip the side panels of the Crate Top Cover. Lift "Crate Top Cover" high enough to clear top of electromagnet, move cover to a clear area.

4. Inspect the magnet to ensure that no damage has occurred to the magnet in shipment. If damage is evident report the damage in detail to the shipper for claim and simultaneously notify GMW in case assessment of the damage must be made. If no damage is found proceed with magnet unpacking and installation.

5. Remove the M8 Hex Head Coach Bolts that secure the magnet to the shipping crate base.

6. The magnet is now prepared for final installation. Follow the appropriate procedure for direct or base mounting listed below.

Direct Mounting

1. Move magnet to final location and bolt magnet down through the four mounting holes provided in the magnet angle bracket (refer drawing 11801470)

Pole Selection and Installation (Refer to drawing 11801470).

Using the field uniformity and induction curves determine the most desirable pole; cylindrical or tapered. In general:

If a uniform field is required use a cylindrical pole end.
If a high field is required use a tapered pole end.

Pole removal (refer to drawing 11801470).

1. Turn off the power supply.
2. Loosen the two pole clamping bolts (item 6 on drawing 11801470).
3. Slide the pole out of the magnet yoke.

Section 3

INSTALLATION

Pole fitting (refer to drawing 11801470).

1. Ensure the poles and pole sleeves are clean and free from debris.
2. Reverse the pole removal sequence above.

Electrical Circuit

Never connect or remove cables from the magnet with the power supply connected. The stored energy in the magnet can cause arcing resulting in severe injury to personnel or equipment damage.

The magnet has two coils which are connected in series. (Refer to drawing 11801470). The power supply cables should be connected directly to the dc current terminals marked + and -. Recommended current cable for the 3470 is stranded copper of 1.5 mm² cross section (16 AWG).

Because the magnet stores a significant amount of energy in its magnetic field, special care should be taken to insure that the current terminations are secure and cannot work loose in operation. Local heating at the terminations can cause rapid oxidation leading to a high contact resistance and high power dissipation at the terminals. If left unattended this can cause enough local heating to damage the terminals and the coils.

The 3470 Interlocks

The Model 3470 has two thermostats, Elmwood 3450G Part Number 3450G611-1 L50C 89/16. They are located on the outer coil cooling plate and wired in series. The thermostats are normally closed, opening when the coil cooling plate temperature exceeds 50°C +/3°C.

Cooling

The Model 3470 can be operated to an average coil temperature of 70°C. Assuming an ambient laboratory temperature of 20°C and a temperature coefficient of resistivity for copper of 0.0039/°C, the hot resistance of the coil should not exceed 20% more than the ambient temperature "cold" resistance. The coil thermostat will open when either coil cooling plate temperature exceeds approximately 50°C . Clean, cool (16°C - 20°C) water at 1 *l*/min at 0.3 bar (5 psid) should be used to cool the 3470 magnet.

The cooling copper tubes are electrically isolated from the coils to avoid electrochemical corrosion. A 50 micron filter should be placed before the input to the magnet to trap particulates and avoid unreliable operation of the water flow switch interlock if fitted.

For continuous operation of the magnet it may be appropriate to use a recirculating chiller to reduce water and drainage costs. The chiller capacity will depend on whether cooling is required for the magnet alone or magnet and power supply. For the Model 3470 Electromagnet alone a suitable chiller is the Bay Voltex model: RRS-090.

Cooling - continued

For recirculating cooling systems use distilled or deionized water with a biocide to prevent bacterial growth and corrosion. Do not use corrosion inhibitors in high quality electrical systems since the water conductivity is increased which can result in increased leakage currents and electrochemical corrosion.

At currents of approximately 3.50A and below the Model 3470 can be operated safely without water cooling. However the coil temperature will vary with the power dissipation. This results in dimensional changes of the magnet yoke and air cooling is not suitable when high field stability is required.

Freon, oil, ethylene glycol or other cooling mediums can be used. The flow required will be approximately inversely proportional to their specific heats. An experimental determination of the flow and pressure required will be necessary.

Avoid cooling the magnet below the dew point of the ambient air. Condensation may cause electrical shorts and corrosion.

During operation the resistance can be checked using a voltmeter across each coil. The voltage will rise to a constant value once thermal equilibrium has been reached. If it is desired to save water, the flow can be reduced until the hot resistance is approached. NOTE: This adjustment must be made slowly enough to allow for the thermal inertia of the coils.

Section 4

OPERATION

General

The magnet operates as a conventional electromagnet.

1. Adjust the poles to the desired gap with the poles approximately symmetrical about the center magnet line.

2. Adjust the cooling water flow to about 1 liters/min (0.26 USgpm) for the 3470. For operation at less than maximum power the water flow may be correspondingly reduced. Note that the inlet water temperature will determine the actual flow rate required. The above specified flow rates were determined with a water inlet temperature of approximately 18°C.

3. Turn on the power supply and increase the current until the desired field is reached.

Calibration

The induction curves may be used to estimate the field in the air gap to within four or five percent. More accurate field determination may be obtained by deriving experimentally a calibration curve for the particular pole and air gap combination being used. Magnetic hysteresis in the yoke and poles can cause an error of 30 to 70G (3 to 7mT) with an arbitrary application of such a calibration curve. This effect may be reduced to less than one percent by following a prescribed 'current setting schedule' designed to make the magnet 'forget' its prior magnetic history. The schedule should of course be used both in establishing the calibration curve and in its subsequent use. A possible schedule would be:

From zero current, increase to maximum current and reduce again to zero current. Increase again to maximum current and reduce to the current to give the desired field setting. Approaching the desired field from a higher setting will typically produce better field uniformity. This is because the field changes at the pole edges will normally lag the field change at the center thereby helping to compensate the radial decrease in field.

Greater precision in setting up the calibration curve will be achieved with the use of a digital teslameter and by making a numerical table. This table used with an interpolation routine will eliminate the error associated with reading a graph.

In any event, three points need to be remembered:

1. A calibration curve or table is only as good as the precision employed in generating it.

2. The field is defined only at the point it is measured. It will generally be different at a different point in the air gap. For example, the induction curves refer to the field on the pole axis and at the center of the air gap (median plane).

Section 4

OPERATION

Calibration - continued

3. The field is most directly a function of the current in the magnet coils. Voltage across the coils is not a good measure of field since the electrical resistance of the coils depends on the temperature (about 0.4% per degree Celsius).

Field Control Operation

The necessity to use calibration curves can be avoided by using a field controller to sense the magnetic field and provide a corresponding power supply control signal through the power supply programming inputs. Contact GMW for suitable instrumentation.

Section 5

MAINTENANCE

Periodically check that the poles are clean, properly lubricated and free of grit and dirt, which may cause binding. Be very careful not to damage the relatively soft pole surface since this may degrade the magnetic field uniformity in the gap.

Note that the surface treatments used provide good corrosion protection but in order to maintain the inherent mechanical precision of the magnet, heavy build-up of plating materials is deliberately avoided. As a result, high humidity or otherwise seriously corrosive atmospheres can cause corrosion. Periodically apply an appropriate corrosion protection, particularly when the magnet is stored for an extended period.

Check the cooling water circuit to ensure the water is clean and free of debris and bacterial growth. Ensure the in-line water filter (if fitted) is clean.

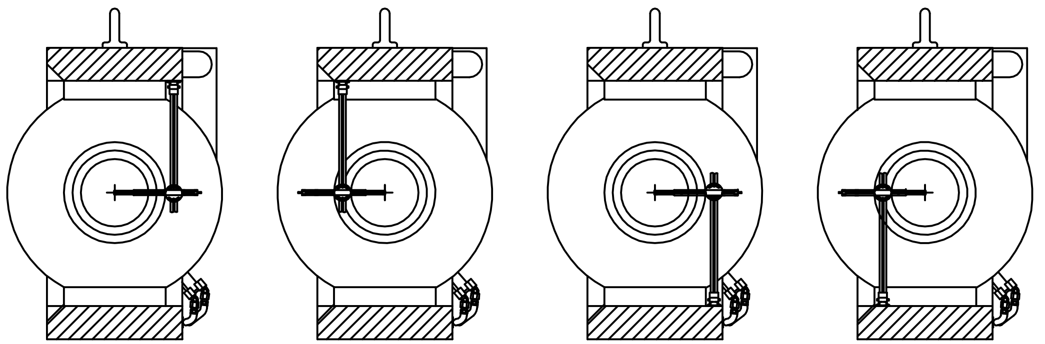
Section 6

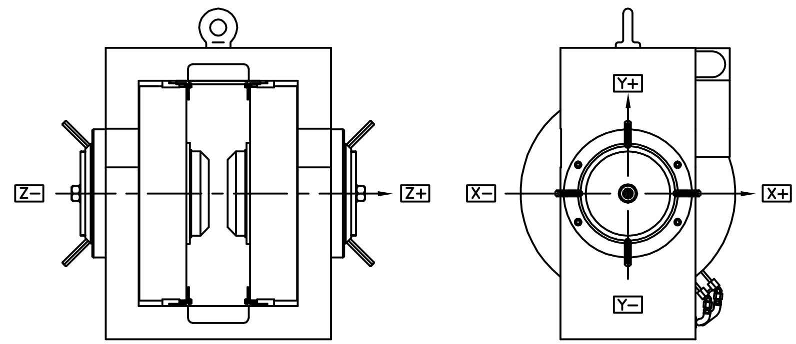
STANDARD OPTIONS

PROPRIETARY
THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION PROPRIETARY TO GMW INC. IT MUST NOT BE REPRODUCED OR DISCLOSED TO OTHERS OR USED IN ANY OTHER WAY, IN WHOLE OR IN PART EXCEPT AS AUTHORIZED IN WRITING BY GMW INC.

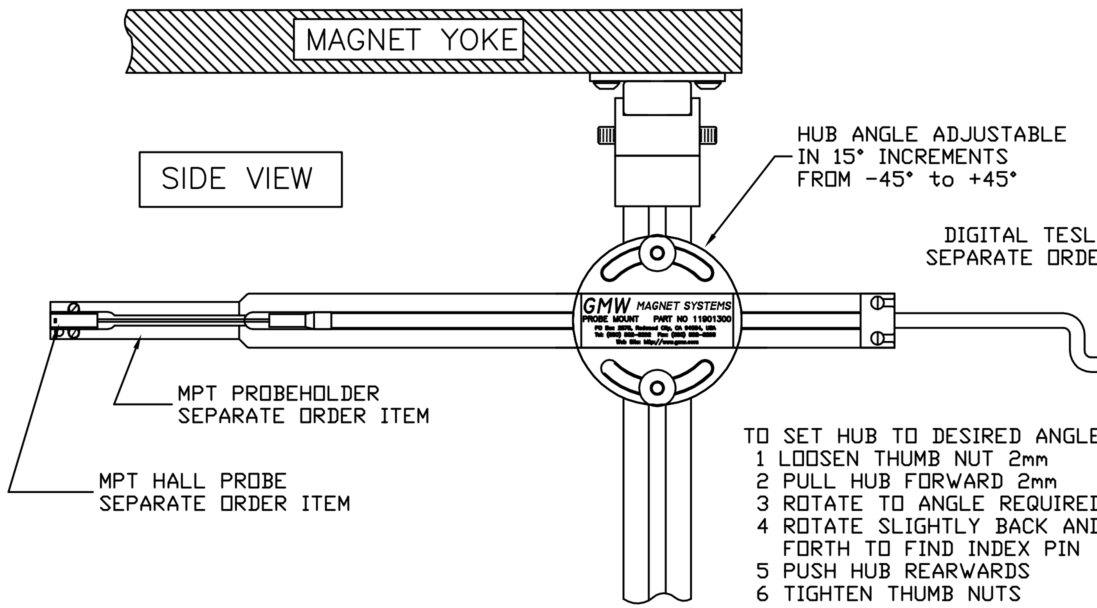
REVISIONS

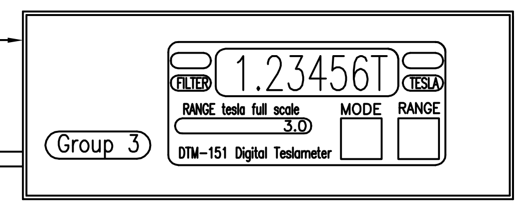
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		09/11/98	G.DOUGLAS





MAGNET MODEL	INSTALLATION POSITION	ASSEMBLY NUMBER	VERTICAL TRAVEL "Y"	HORIZONTAL TRAVEL "Z"
3474	REAR	11901251	280mm	200mm
3474	FRONT	11901252	280mm	100mm
3473	REAR	11901261	180mm	150mm
3473	FRONT	11901262	180mm	40mm
3472	REAR	11901271	130mm	100mm
3472	FRONT	11901272	130mm	30mm
5403	BOTH	11901280	130mm	100mm
3470	BOTH	11901290	130mm	100mm





TO SET HUB TO DESIRED ANGLE
1 LOOSEN THUMB NUT 2mm
2 PULL HUB FORWARD 2mm
3 ROTATE TO ANGLE REQUIRED
4 ROTATE SLIGHTLY BACK AND FORTH TO FIND INDEX PIN
5 PUSH HUB REARWARDS
6 TIGHTEN THUMB NUTS

NOTE: ABOVE PROBE MOUNT SHOWN INSTALLED ON MODEL: 3474 ELECTROMAGNET.
OTHER CONFIGURATIONS AND MOUNTINGS ARE AVAILABLE. CONSULT TABLE FOR GMW ELECTROMAGNETS.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN G.DOUGLAS — DATE 09/11/98
CHECK — DATE
ENGINEERING — DATE
NEXT ASSY — SYSTEM
SOFTWARE AUTOCAD 13

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

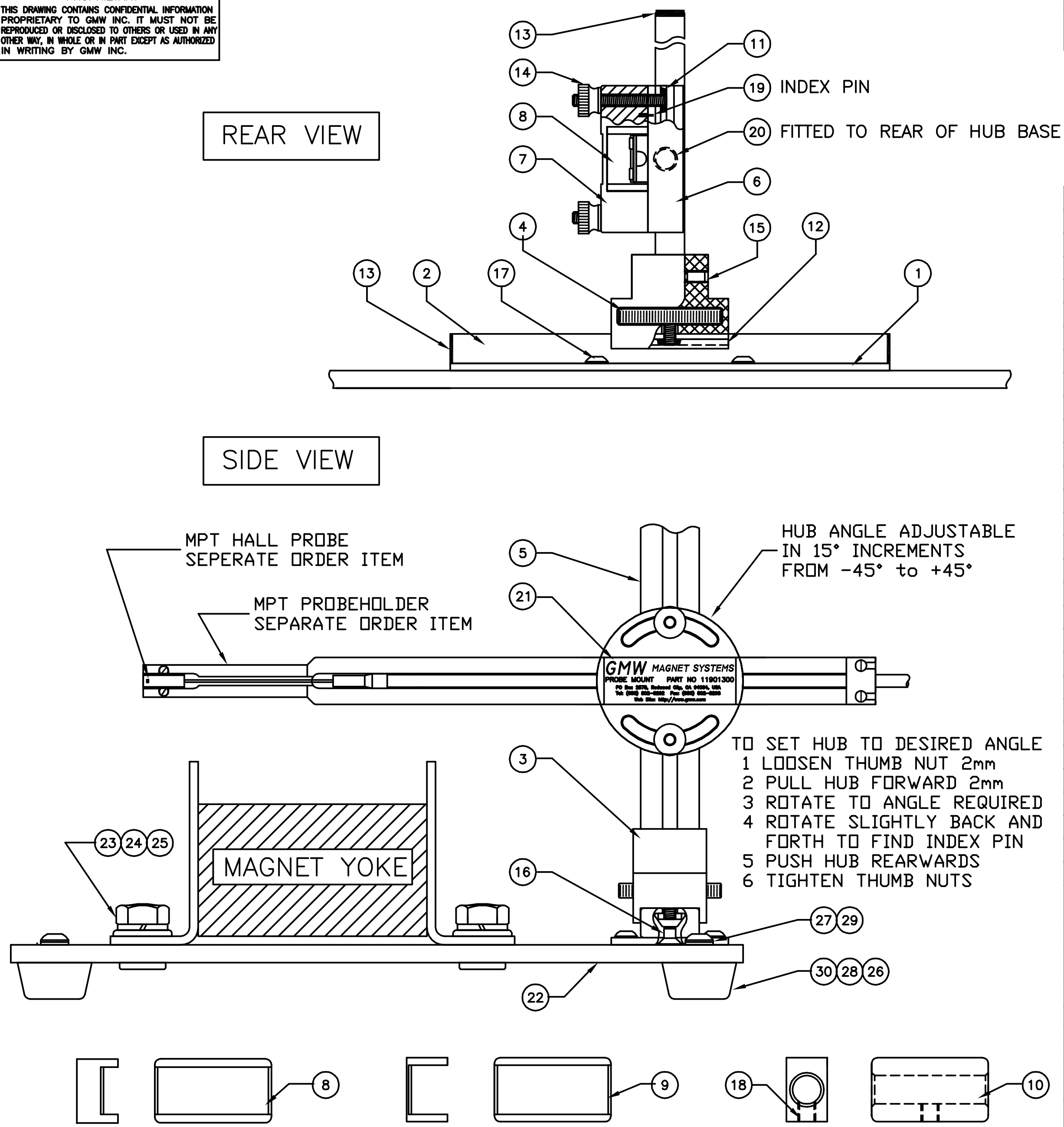
LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
PROBE MOUNT GENERAL ASSEMBLY

SIZE A2 — DRAWING NO. 11901300 — REV A
SCALE 1:1 — WT kg — SHEET 1 OF 1



REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		09/16/98	G.DOUGLAS

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
30	4	REC-2197S	FOOT, RUBBER, RUSSELL-INDUSTRIES	
29	4	ISO 7380	SHCS M5 X 12 BUTTON HD S/S	
28	4	DIN 934	NUT, HEX M5 S/S	
27	4	DIN 433	WASHER, M5 X 1 FLAT S/S	
26	4	DIN 6797	WASHER, M5 INTERNAL LOCK S/S	
25	4	DIN 7890	WASHER, M10 SPRING S/S	
24	4	DIN 433	WASHER, M10 FLAT S/S	
23	4	DIN 934	NUT, M10 HEX S/S	
22	1	17903010	MAGNET MOUNTING PLATE	
21	1	10900320	LABEL, INDENTIFICATION	
20	1	SBMH8	BALL PLUNGER, M8 S/S VLIER	
19	2	VSM 12771B	DOWEL PIN M1 X 5 S/S [Index Pin]	
18	1	BN 1073	SET SCREW, M6 X 5 SLOTTED HD NYLON	
17	4	ISO 7380	SHCS M4 X 8 BUTTON HD S/S	
16	5	DIN 7991	SHCS, M4 X 6 FLAT HEAD S/S	
15	2	DIN 917	SHSS M4 X 8 CONE POINT S/S	
14	2	08M040070TN	THUMB NUT, NYLON	
13	3	18-830	ITEM PRODUCTS, END CAP, PLASTIC	
12	1	17902010	BASE STUD	
11	1	17902000	HUB STUD	
10	1	17901990	HUB INSERT [For Sentron Hall Probes]	
9	1	17901980	HUB INSERT [For Metrolab NMR probes]	
8	1	17901970	HUB INSERT [for Grp3 MPT Hall Probes]	
7	1	17901960	HUB COVER	
6	1	17901950	HUB BASE	
5	1	17901943	VERTICAL MOUNTING EXTRUSION [200mm long]	
4	1	17901930	BASE NUT	
3	1	17901920	BASE SUPPORT	
2	1	17902090	BASE MOUNTING EXTRUSION	
1	1	17902080	BASE MOUNTING PLATE	

PARTS LIST

DRAWN G.DOUGLAS	DATE 09/16/98
CHECK	DATE
ENGINEERING	DATE
NEXT ASSY	SYSTEM
SOFTWARE AUTOCAD 2000	

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
PROBE MOUNT
MODEL: 3470

SIZE	DRAWING NO.	REV
A2	11901290	A

SCALE 1:1 | WT kg | SHEET 1 OF 1

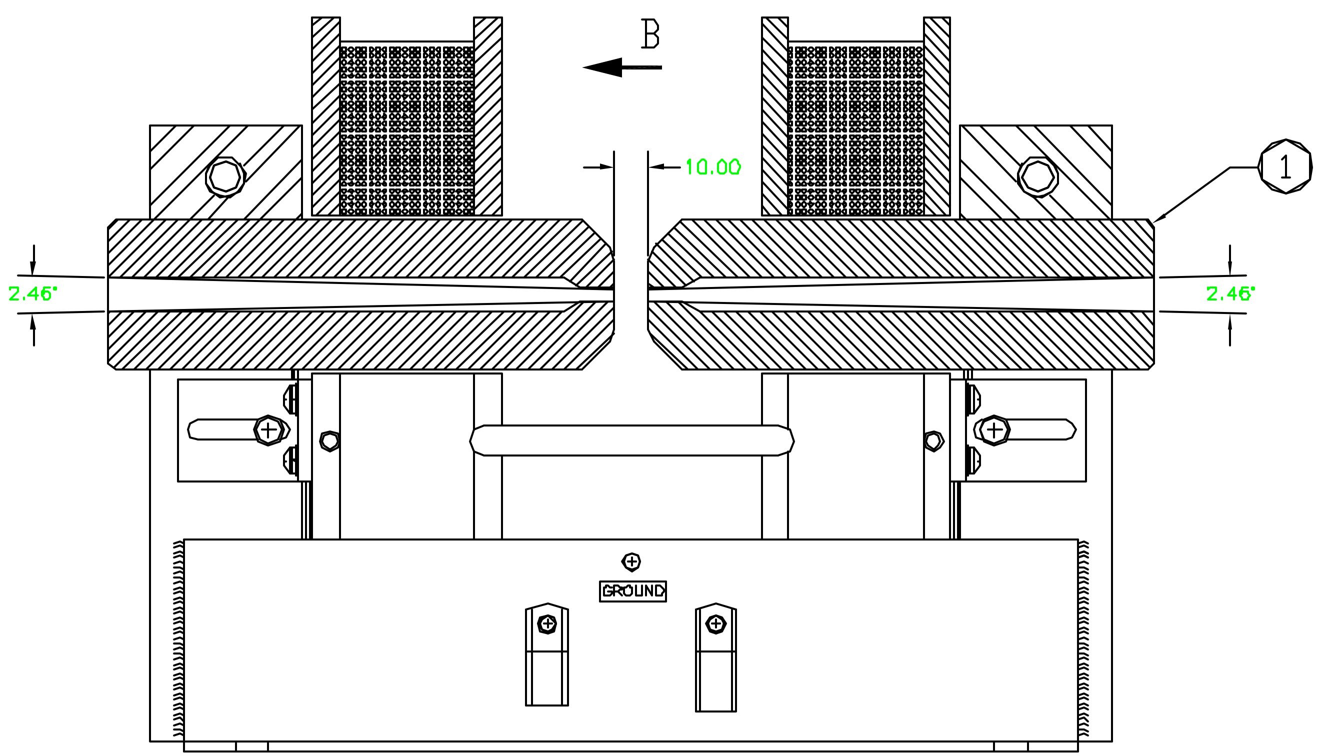
Section 7

CUSTOM OPTIONS

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		09/13/95	

LAB MAGNET
REAR VIEW



NOTE

1 POLE WITH 4mm HOLE AT FACE AND 10mm HOLE IN BACK
SEE DWG 17801501 FOR DETAILS

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN G.DOUGLAS	DATE 09/13/95	DO NOT SCALE FROM DRAWING	
CHECK	DATE	DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
ENGINEERING	DATE		
	3470		
NEXT ASSY	SYSTEM		

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63 ✓	1.6 ✓

THIRD ANGLE PROJECTION

SOFTWARE: AUTOCAD 12

GMW
P.O. Box 2578, Redwood City, CA 94064
Tel: (415)802-8292 Fax: (415)802-8298.

TITLE POLE GEOMETRY
US ARMY C7916

SIZE	DRAWING NO.	REV
A2	81190030	A

SCALE 1:1 | WT kg | SHEET 1 OF 1

GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 46

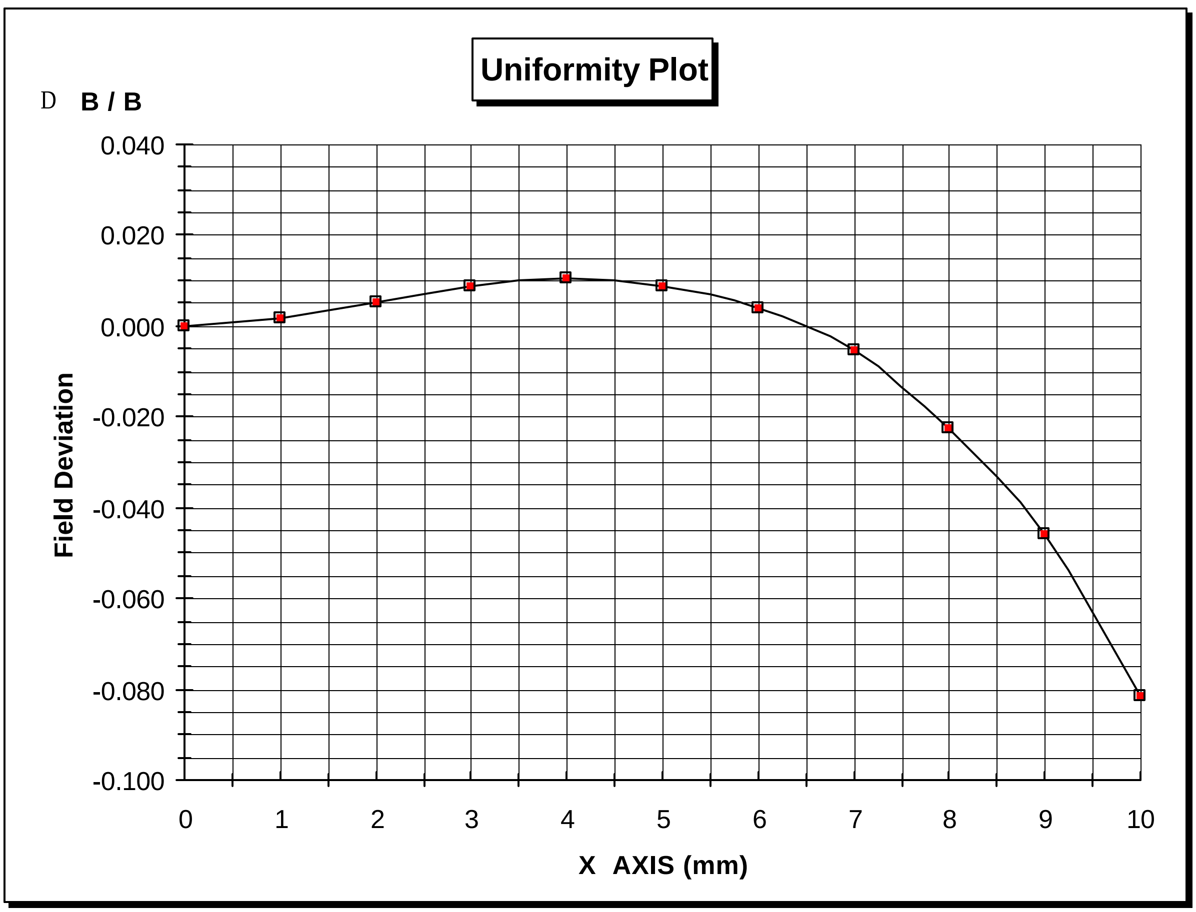
Magnet Current 3.5 Amps

Pole Face 20 mm
Pole Gap 10 mm
Hole Dia 4mm
US Army Redstone Arser

Engr Toomas Rett
Date 20 June, 1995

C7916

Plot Y = 0.0 mm, Z = 0.0 mm				
X - mm	Magnet Field Tesla	X + mm	Magnet Field Tesla	Magnet Field Average Tesla
0	0.78216	0	0.78214	0.78215
-1	0.78270	1	0.78396	0.78333
-2	0.78520	2	0.78714	0.78617
-3	0.78840	3	0.78972	0.78906
-4	0.79030	4	0.79010	0.79020
-5	0.79022	5	0.78776	0.78899
-6	0.78750	6	0.78324	0.78537
-7	0.78252	7	0.77334	0.77793
-8	0.77224	8	0.75658	0.76441
-9	0.75588	9	0.73654	0.74621
-10	0.73058	10	0.70608	0.71833
0	0.78214	0	0.78184	0.78199

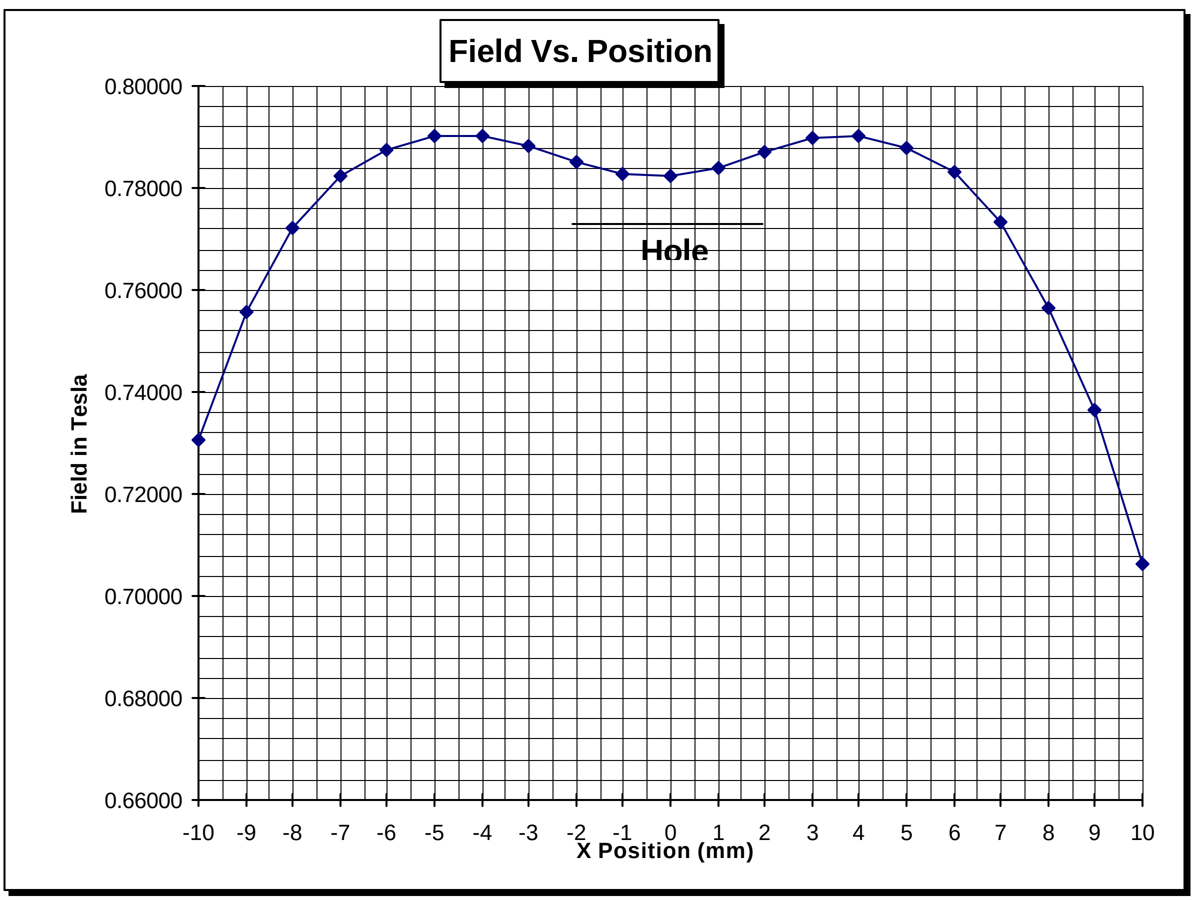


Doc no: SC7916U1.057

GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model	3470	Pole Face 20 mm	Engr Toomas Rett
Serial No	46	Pole Gap 10 mm	Date 20 June, 1995
		Hole Dia 4mm	
Magnet Curren 3.5 Amps		US Army Redstone Arser	C7916

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.78216	0	0.78214	0.78215
-1	0.78270	1	0.78396	0.78333
-2	0.78520	2	0.78714	0.78617
-3	0.78840	3	0.78972	0.78906
-4	0.79030	4	0.79010	0.79020
-5	0.79022	5	0.78776	0.78899
-6	0.78750	6	0.78324	0.78537
-7	0.78252	7	0.77334	0.77793
-8	0.77224	8	0.75658	0.76441
-9	0.75588	9	0.73654	0.74621
-10	0.73058	10	0.70608	0.71833
0	0.78214	0	0.78184	0.78199



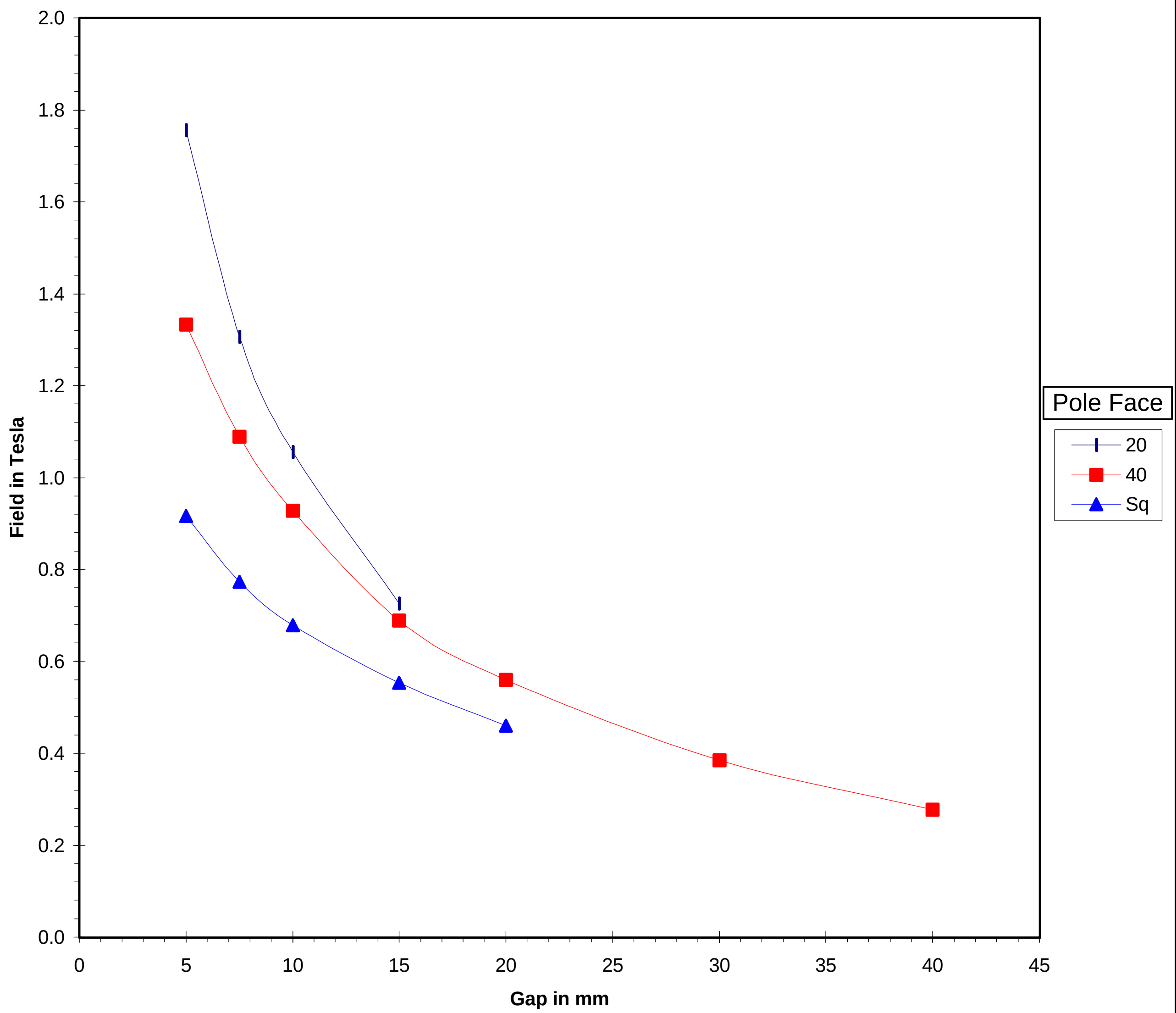
Doc no: SC7916U2.057

Section 8

EXCITATION CURVES

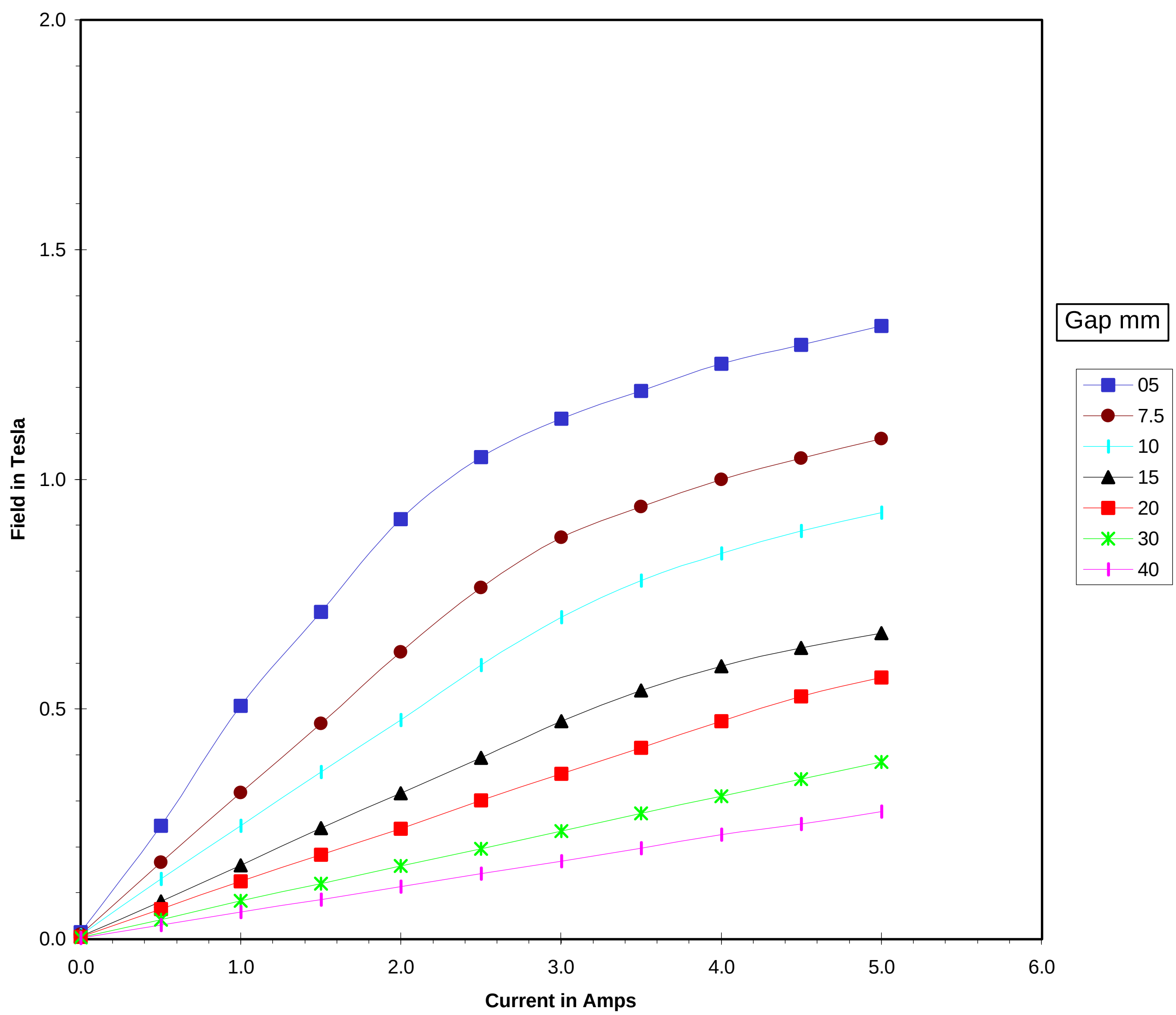
GMW Associates
Electromagnet Excitation Plot
Field Vs Gap

Contract No:		Page:	1 of 1	Date:	Sept 22, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:	Soren DCS 55-55	Set Current:	5.0 Amps
Serial No:	52	Serial No:	D1285	Target Field:	
Pole Face:	As per table below	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:	Coil position set to minimum gap		
Pole Gap:	As per table below				
Pole Spacers:	None				



GMW Associates
Electromagnet Excitation Plot
Field Vs Current

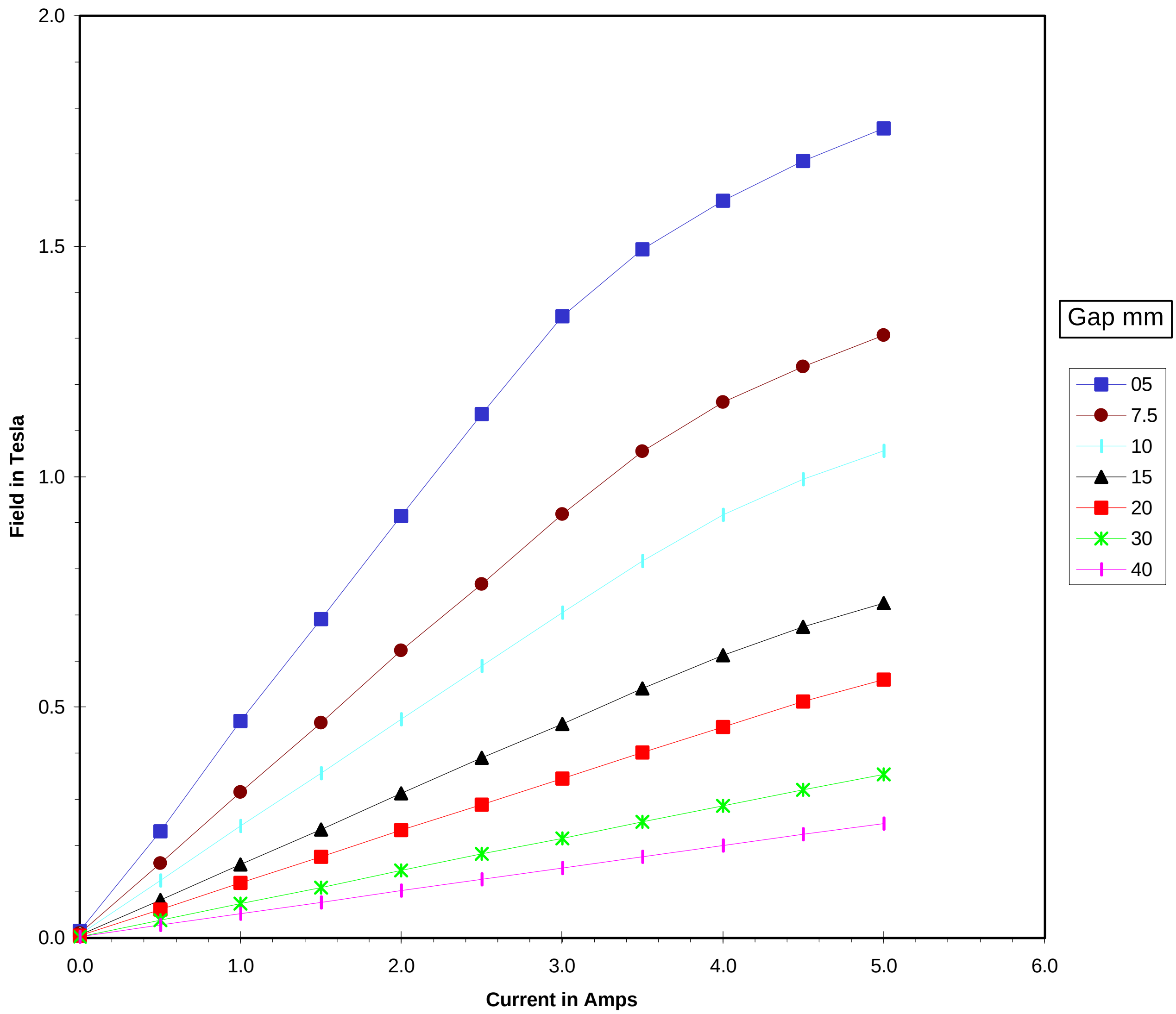
Contract No:		Page:	1 of 3	Date:	Sept 22, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:		Set Current:	
Serial No:	52	Serial No:		Target Field:	
Pole Face:	40	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:	Coil position set to minimum gap		
Pole Gap:	As per table below				
Pole Spacers:	None				



Filename: 3470 Ex 40-05-40.xls

GMW Associates
Electromagnet Excitation Plot
Field Vs Current

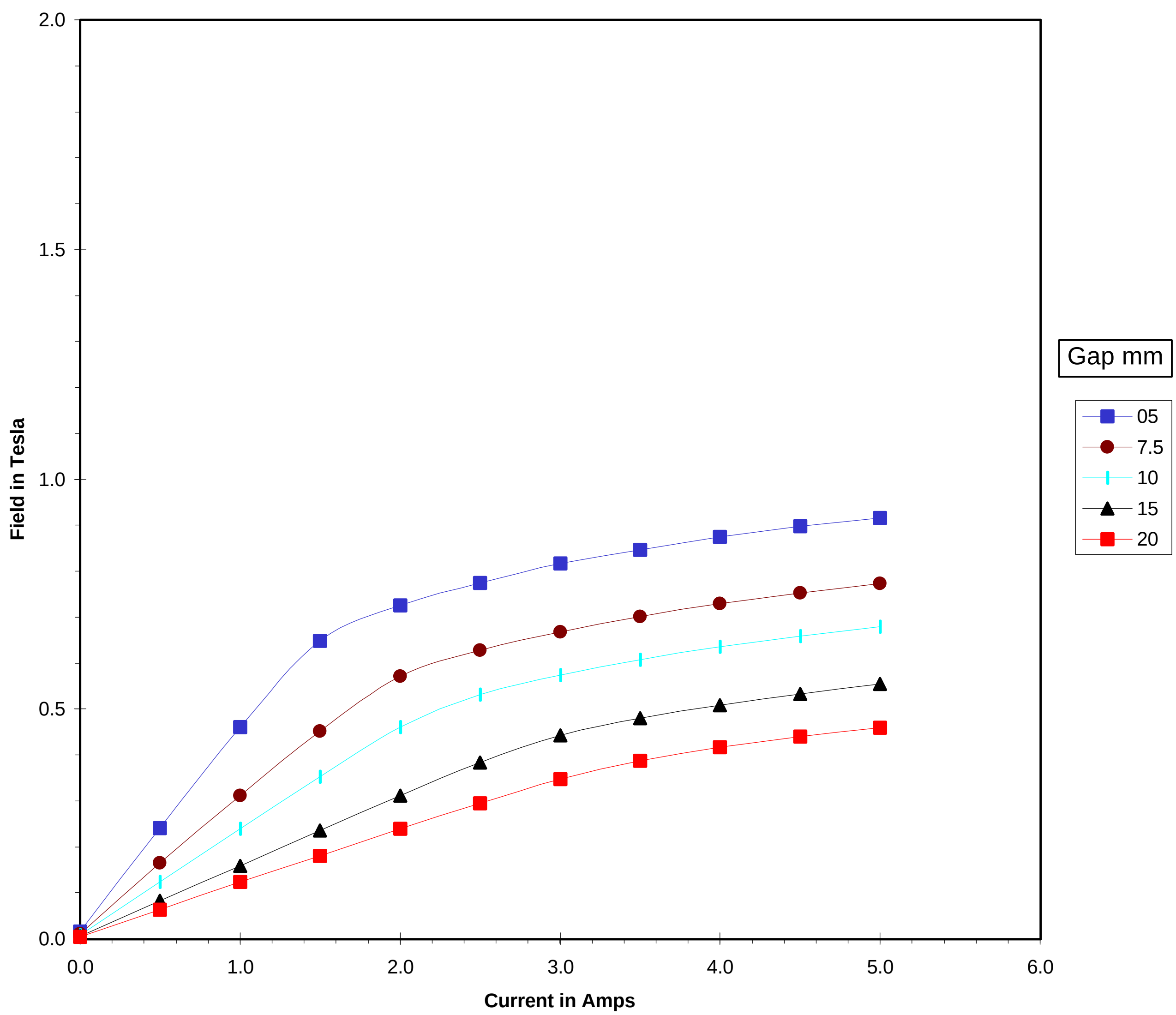
Contract No:		Page:	2 of 3	Date:	Sept 22, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:		Set Current:	
Serial No:	52	Serial No:		Target Field:	
Pole Face:	20	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:	Coil position set to minimum gap		
Pole Gap:	As per table below				
Pole Spacers:	None				



Filename: 3470 Ex 20-05-40.xls

GMW Associates
Electromagnet Excitation Plot
Field Vs Current

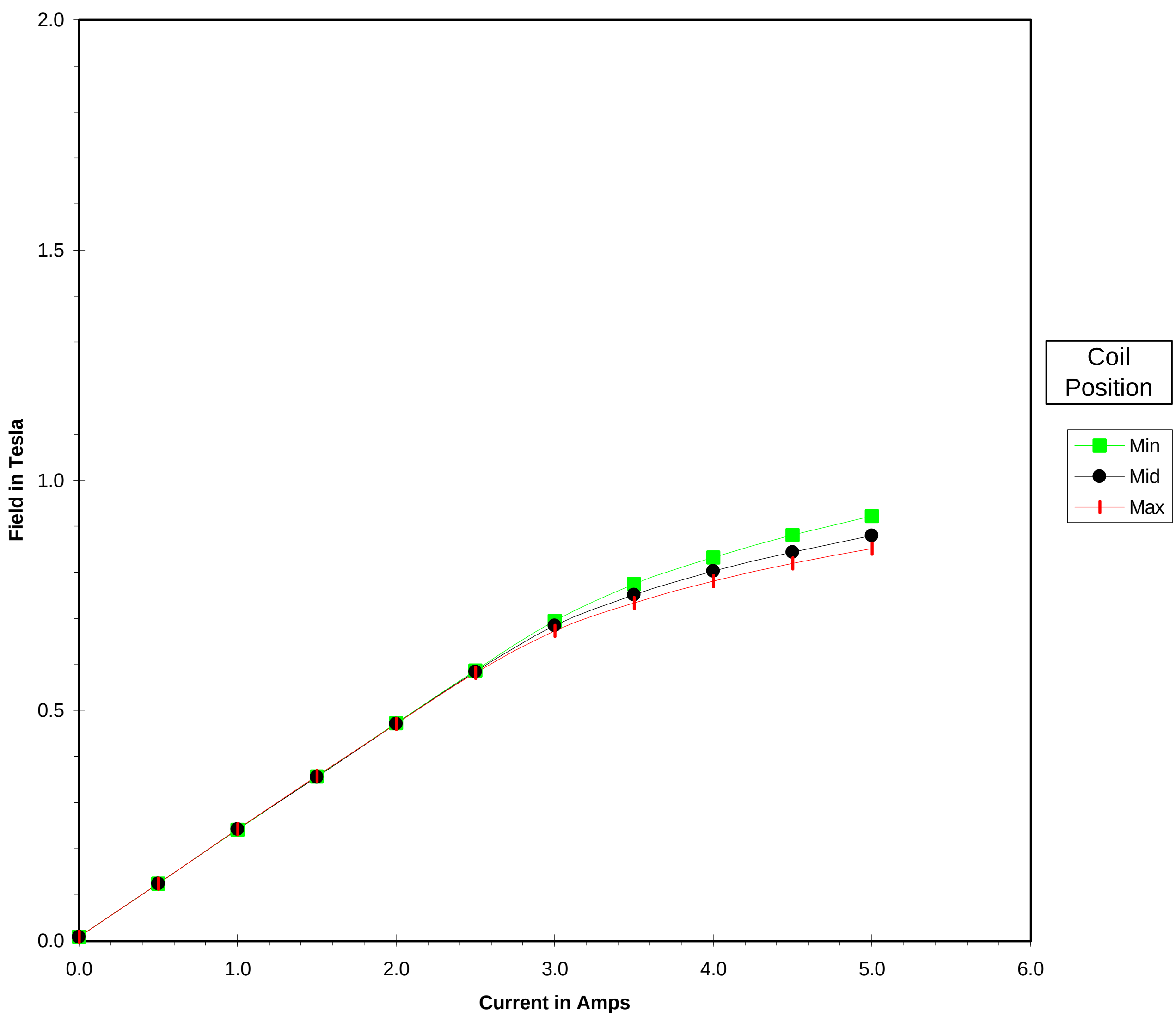
Contract No:		Page:	3 of 3	Date:	Sept 22, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:		Set Current:	
Serial No:	52	Serial No:		Target Field:	
Pole Face:	Square	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:	Coil position set to minimum gap		
Pole Gap:	As per table below				
Pole Spacers:	None				



Filename: 3470 Ex 45-05-40.xls

GMW Associates
Electromagnet Excitation Plot
Field Vs Current

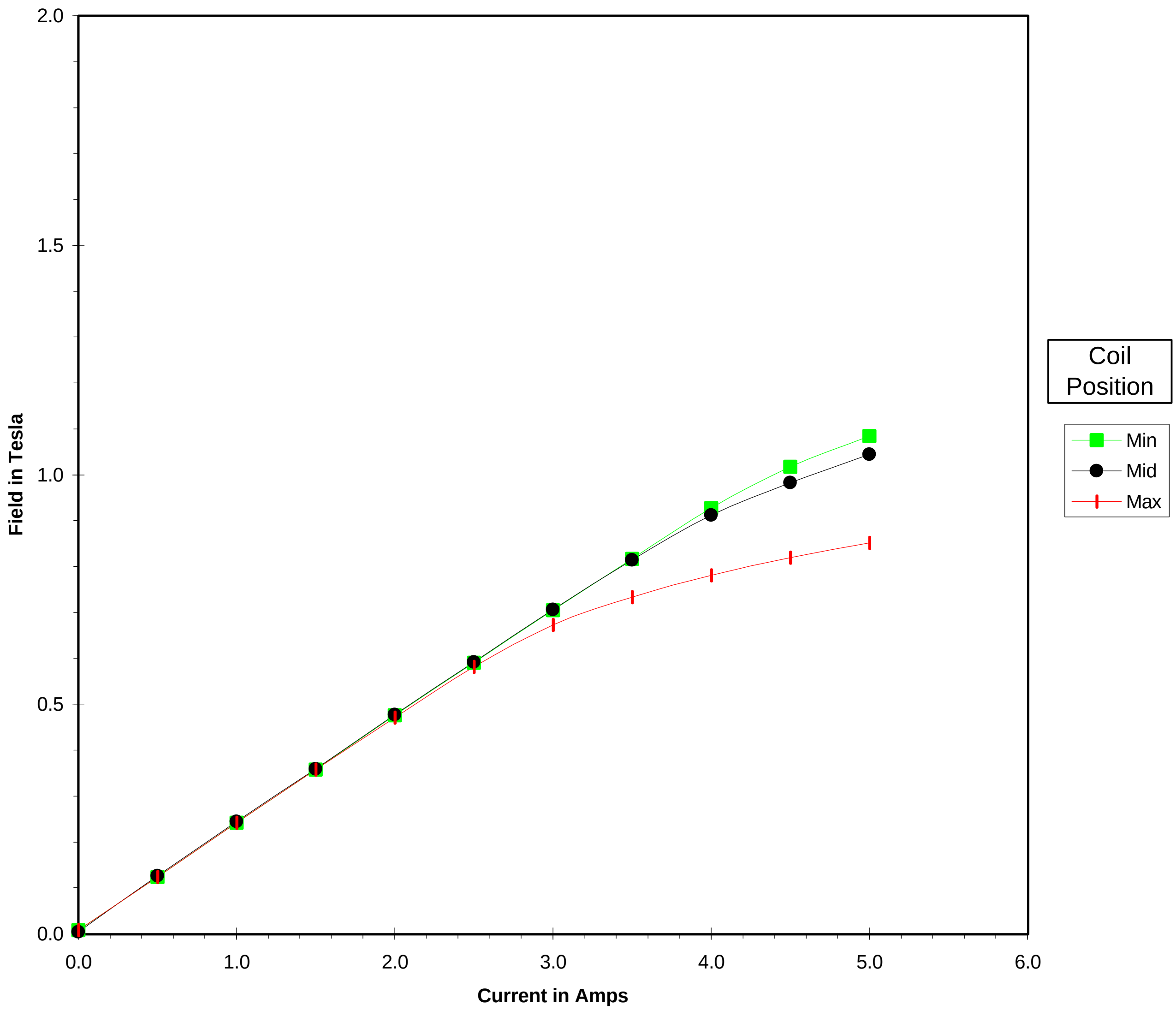
Contract No:				Date:	Oct 17, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:		Set Current:	
Serial No:	52	Serial No:		Target Field:	
Pole Face:	40	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:			
Pole Gap:	10mm				
Pole Spacers:	None				



Filename: 3470 Ex Coil Position 40-05-40.xls

GMW Associates
Electromagnet Excitation Plot
Field Vs Current

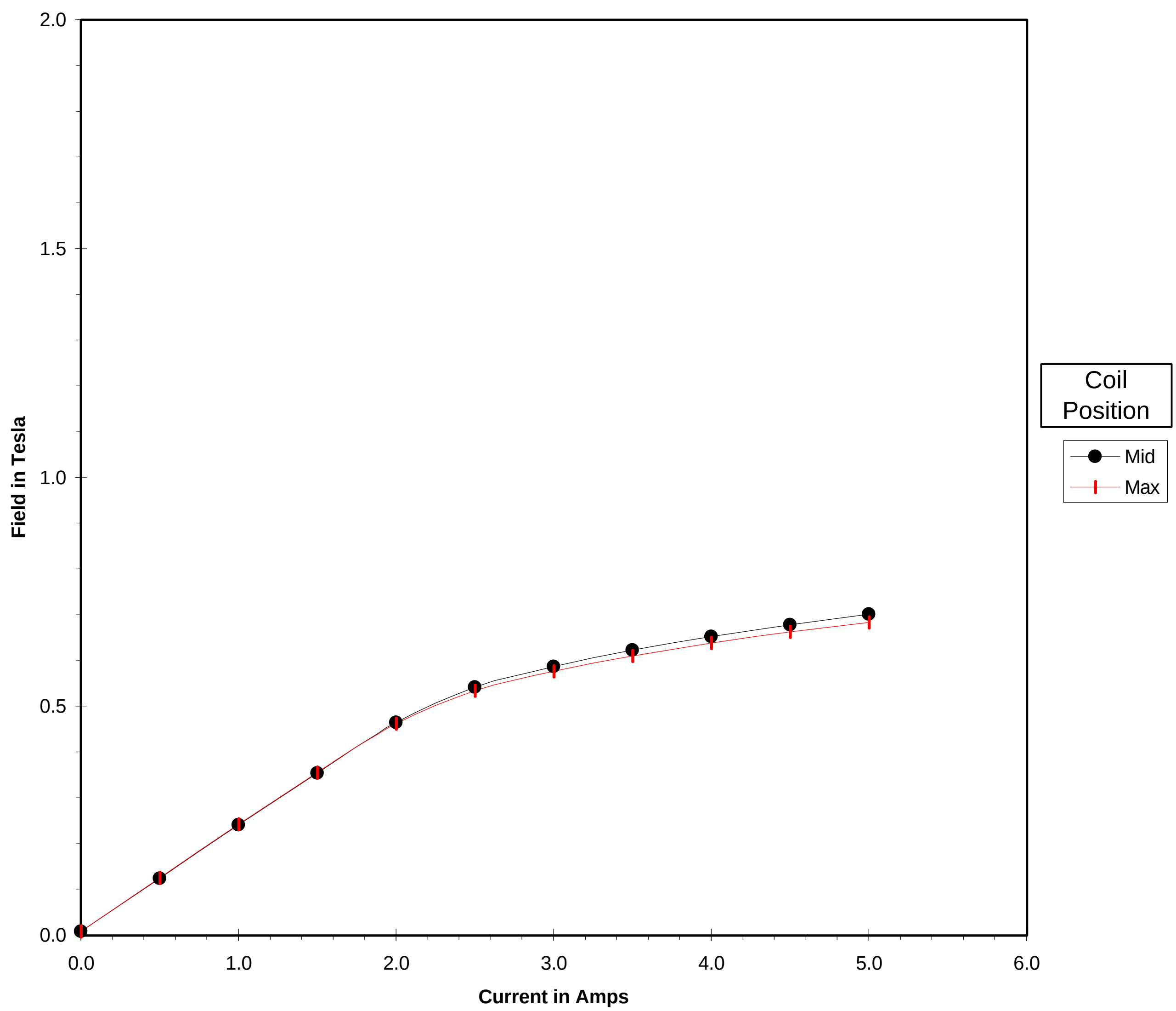
Contract No:		Page:	2 of 3	Date:	Oct 04, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:		Set Current:	
Serial No:	52	Serial No:		Target Field:	
Pole Face:	20	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:			
Pole Gap:	10mm				
Pole Spacers:	None				



Filename: 3470 Ex Coil Position 20-05-40.xls

GMW Associates
Electromagnet Excitation Plot
Field Vs Current

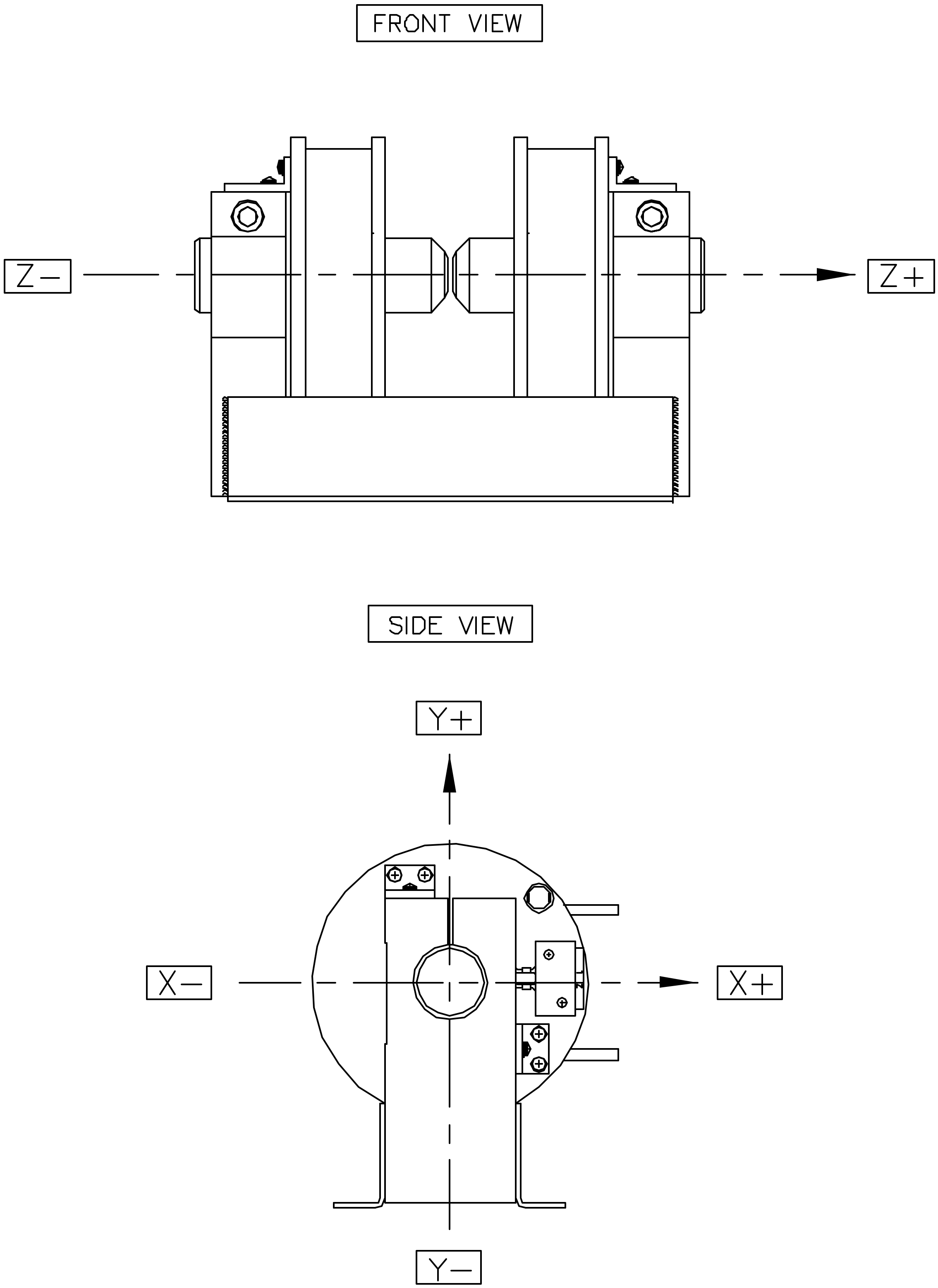
Contract No:		Page:	3 of 3	Date:	Oct 17, 95
Customer:				Engr:	G.Douglas
Model:	3470	Power Supply:		Set Current:	
Serial No:	52	Serial No:		Target Field:	
Pole Face:	45 Square	Position:	X=0, Y=0, Z=0		
Serial No:	None	Notes:			
Pole Gap:	10mm				
Pole Spacers:	None				



Filename: 3470 Ex Coil Position 45-05-40.xls

Section 9

TEST DATA



MAGNETIC PLOTTING AXIS

80900050	A	SHEET 1 OF 1

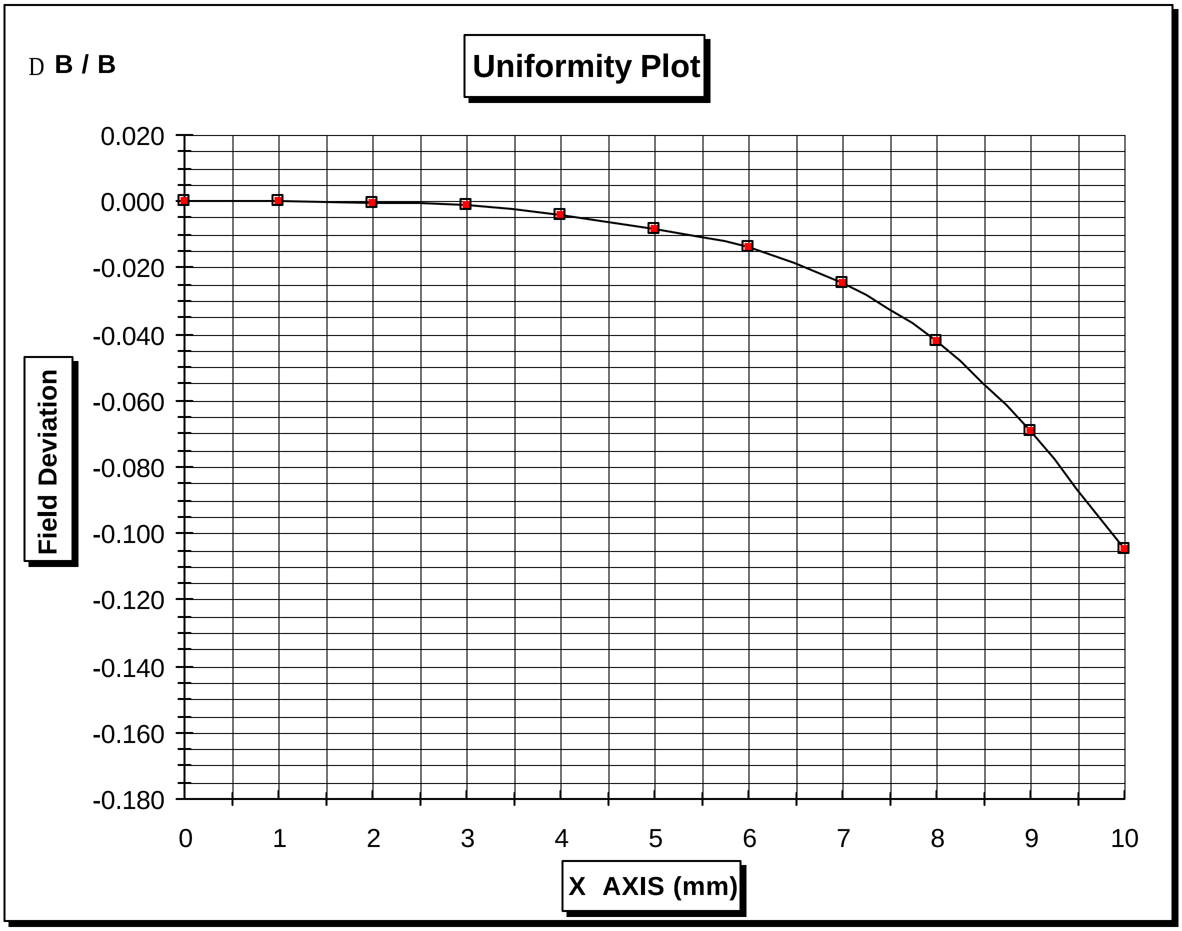
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 20 mm
Pole Gap 10 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	1.0120600	0	1.0119800	1.0120200
-1	1.0120200	1	1.0118600	1.0119400
-2	1.0115000	2	1.0110400	1.0112700
-3	1.0102600	3	1.0109820	1.0106210
-4	1.0087600	4	1.0073000	1.0080300
-5	1.0047000	5	1.0030600	1.0038800
-6	0.9992600	6	0.9965600	0.9979100
-7	0.9878800	7	0.9861200	0.9870000
-8	0.9701000	8	0.9692600	0.9696800
-9	0.9437000	9	0.9407800	0.9422400
-10	0.9081200	10	0.9034000	0.9057600
0	1.0119800	0	1.0120400	1.0120100



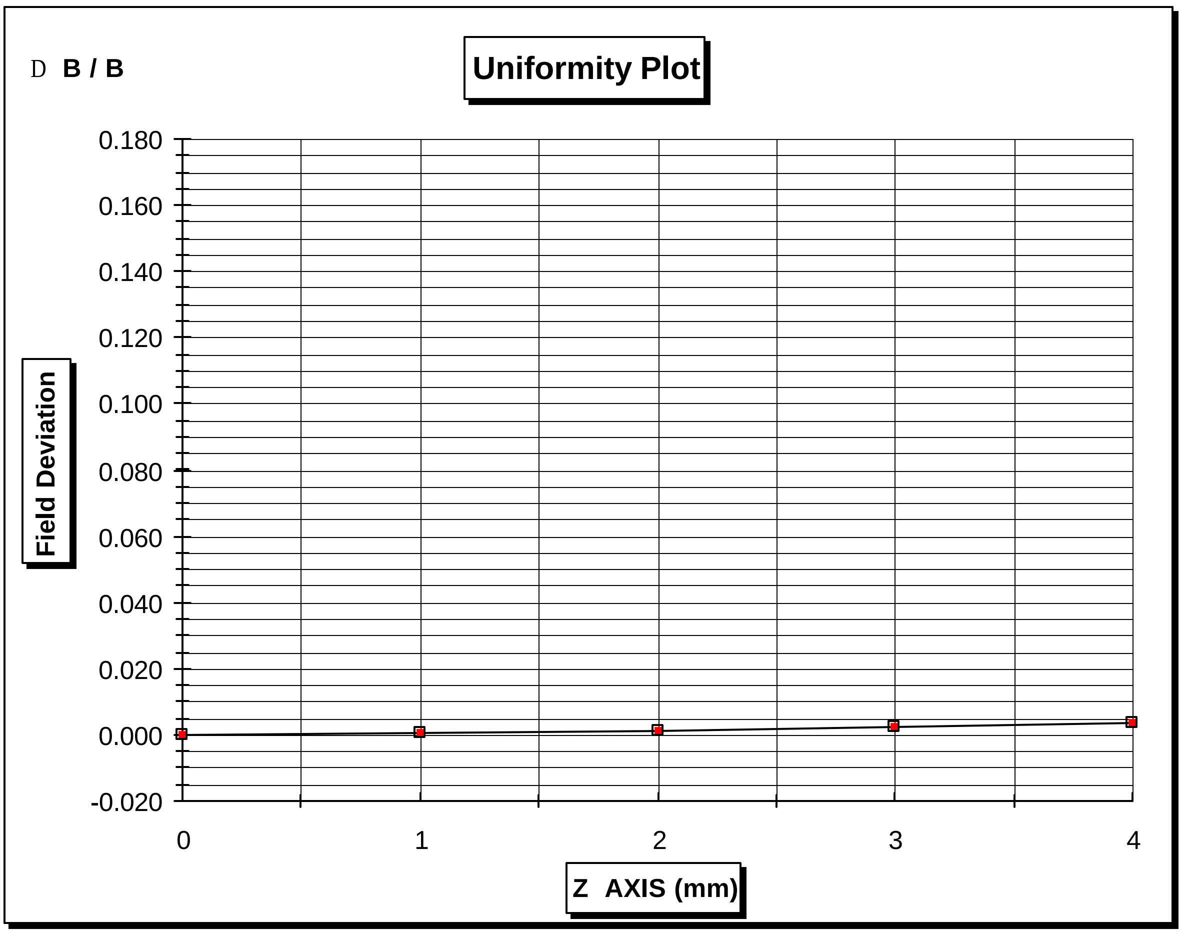
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 20 mm
Pole Gap 10 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, X = 0.0 mm				
Z -	Magnet Field	Z +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	1.012300	0	1.012280	1.012300
-1	1.012940	1	1.012400	1.012670
-2	1.014080	2	1.013160	1.013620
-3	1.015300	3	1.013860	1.014580
-4	1.016060	4	1.016060	1.016060
-5	0.000000	5	0.000000	0.000000
-6	0.000000	6	0.000000	0.000000
-7	0.000000	7	0.000000	0.000000
-8	0.000000	8	0.000000	0.000000
-9	0.000000	9	0.000000	0.000000
-10	0.000000	10	0.000000	0.000000
0	1.012300	0	1.012280	1.012290



Doc no: S3470U07.407

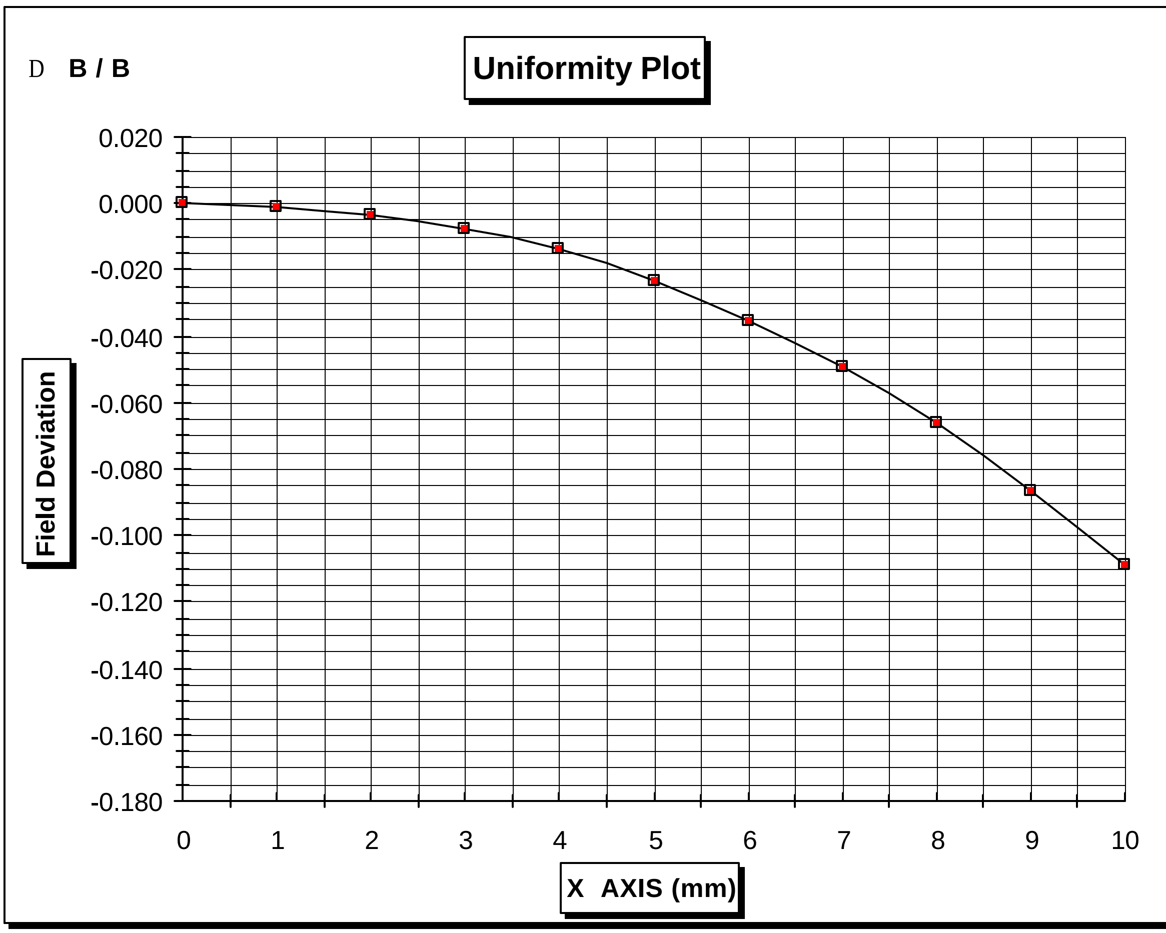
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 20 mm
Pole Gap 20 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.5493400	0	0.5493800	0.5493600
-1	0.5489200	1	0.5489200	0.5489200
-2	0.5474000	2	0.5475200	0.5474600
-3	0.5450400	3	0.5451600	0.5451000
-4	0.5418200	4	0.5420400	0.5419300
-5	0.5366000	5	0.5365000	0.5365500
-6	0.5299200	6	0.5297600	0.5298400
-7	0.5232600	7	0.5214800	0.5223700
-8	0.5129200	8	0.5133800	0.5131500
-9	0.5010600	9	0.5027600	0.5019100
-10	0.4887600	10	0.4899800	0.4893700
0	0.5493800	0	0.5493800	0.5493800



Doc no: S3470U03.407

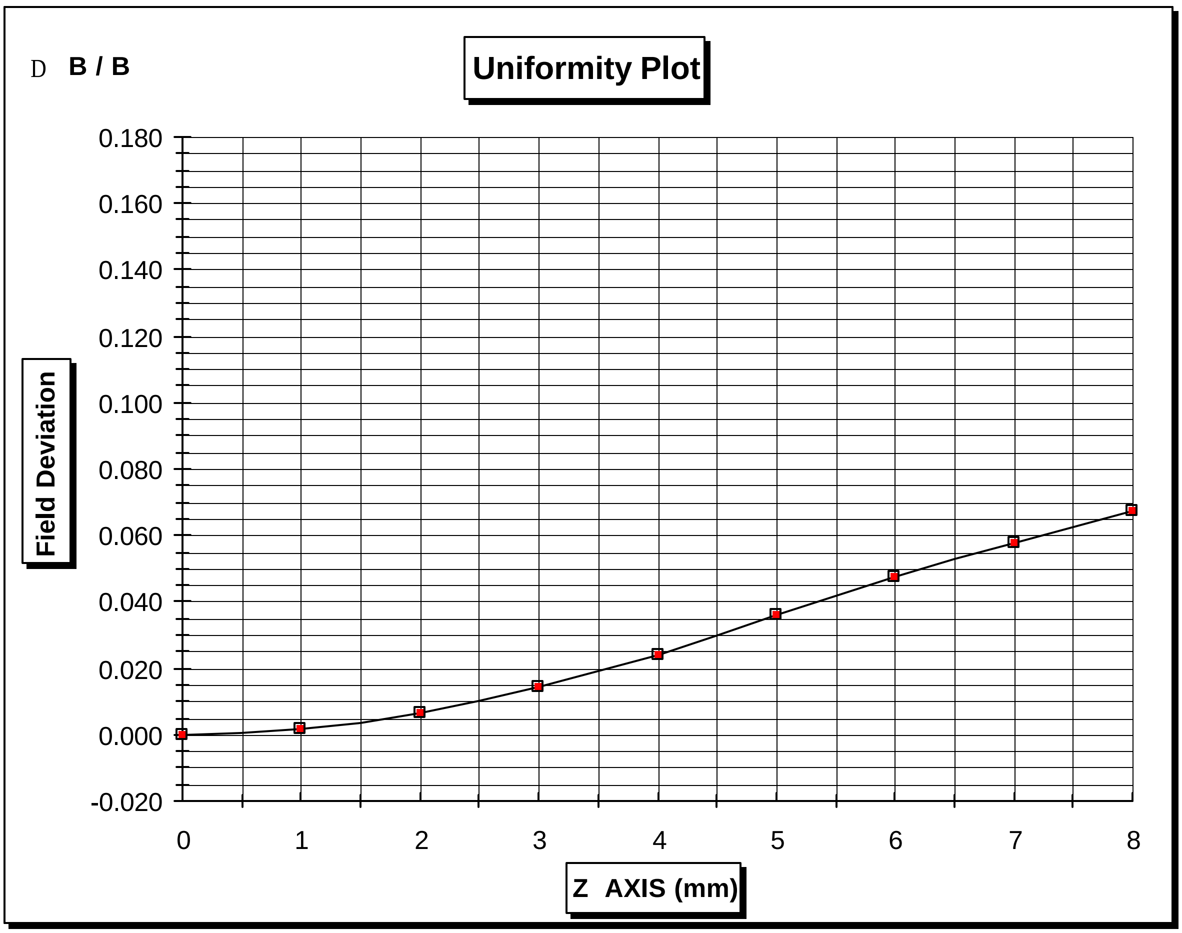
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 20 mm
Pole Gap 20 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Oct 4, 1995

Plot Y = 0.0 mm, X = 0.0 mm				
Z -	Magnet Field	Z +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.549660	0	0.549660	0.549660
-1	0.552300	1	0.548980	0.550640
-2	0.556380	2	0.550040	0.553210
-3	0.562000	3	0.552940	0.557470
-4	0.568460	4	0.557300	0.562880
-5	0.575520	5	0.563160	0.569340
-6	0.581520	6	0.569660	0.575590
-7	0.586900	7	0.576000	0.581450
-8	0.590820	8	0.582540	0.586680
-9	0.000000	9	0.000000	0.000000
-10	0.000000	10	0.000000	0.000000
0	0.549660	0	0.549660	0.549660



Doc no: S3470U05.407

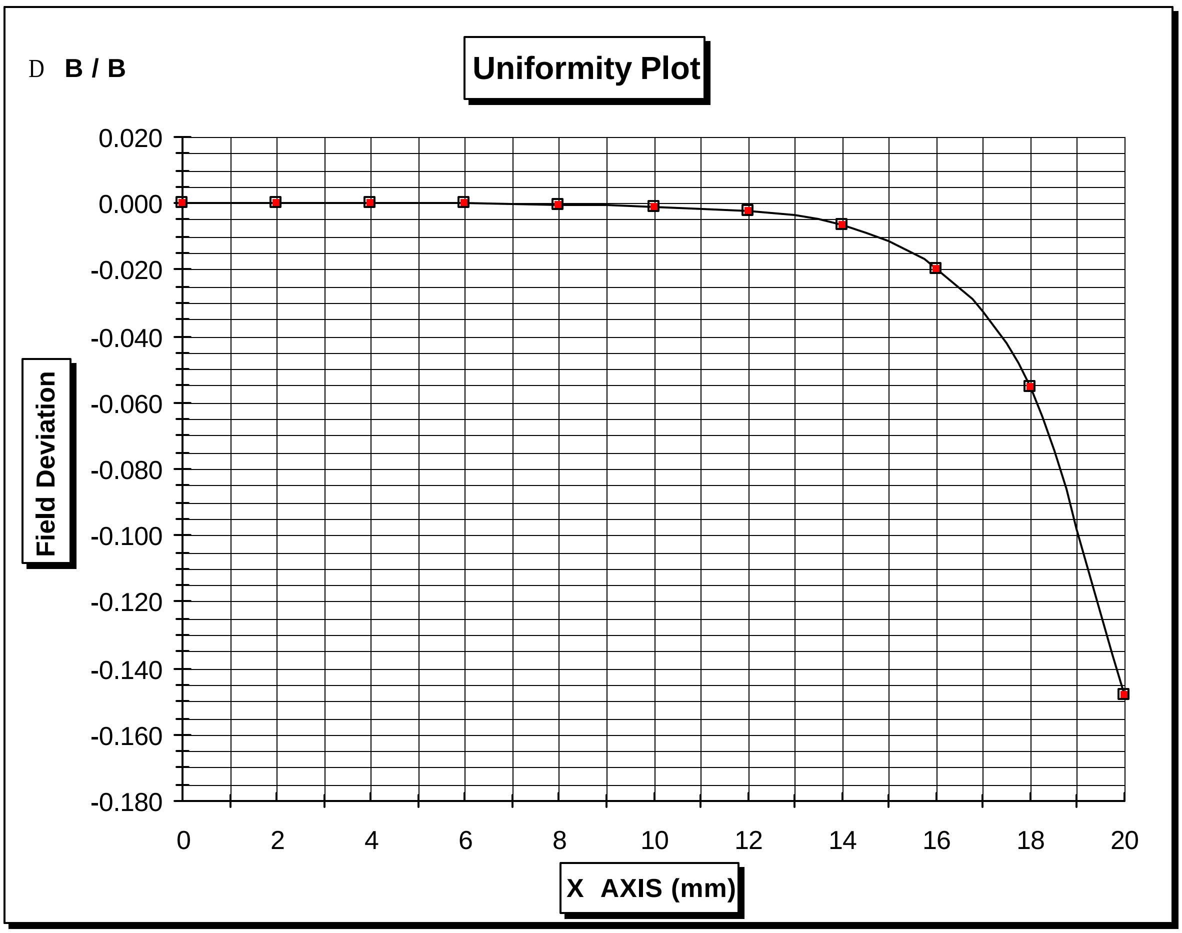
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 40 mm
Pole Gap 10 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.860880	0	0.860920	0.860900
-2	0.860920	2	0.860860	0.860890
-4	0.860920	4	0.860740	0.860830
-6	0.860900	6	0.860640	0.860770
-8	0.860800	8	0.860420	0.860610
-10	0.860400	10	0.859900	0.860150
-12	0.859540	12	0.858680	0.859110
-14	0.855520	14	0.854940	0.855230
-16	0.844000	16	0.844160	0.844080
-18	0.813680	18	0.812620	0.813150
-20	0.731560	20	0.734980	0.733270
0	0.860920	0	0.860880	0.860900



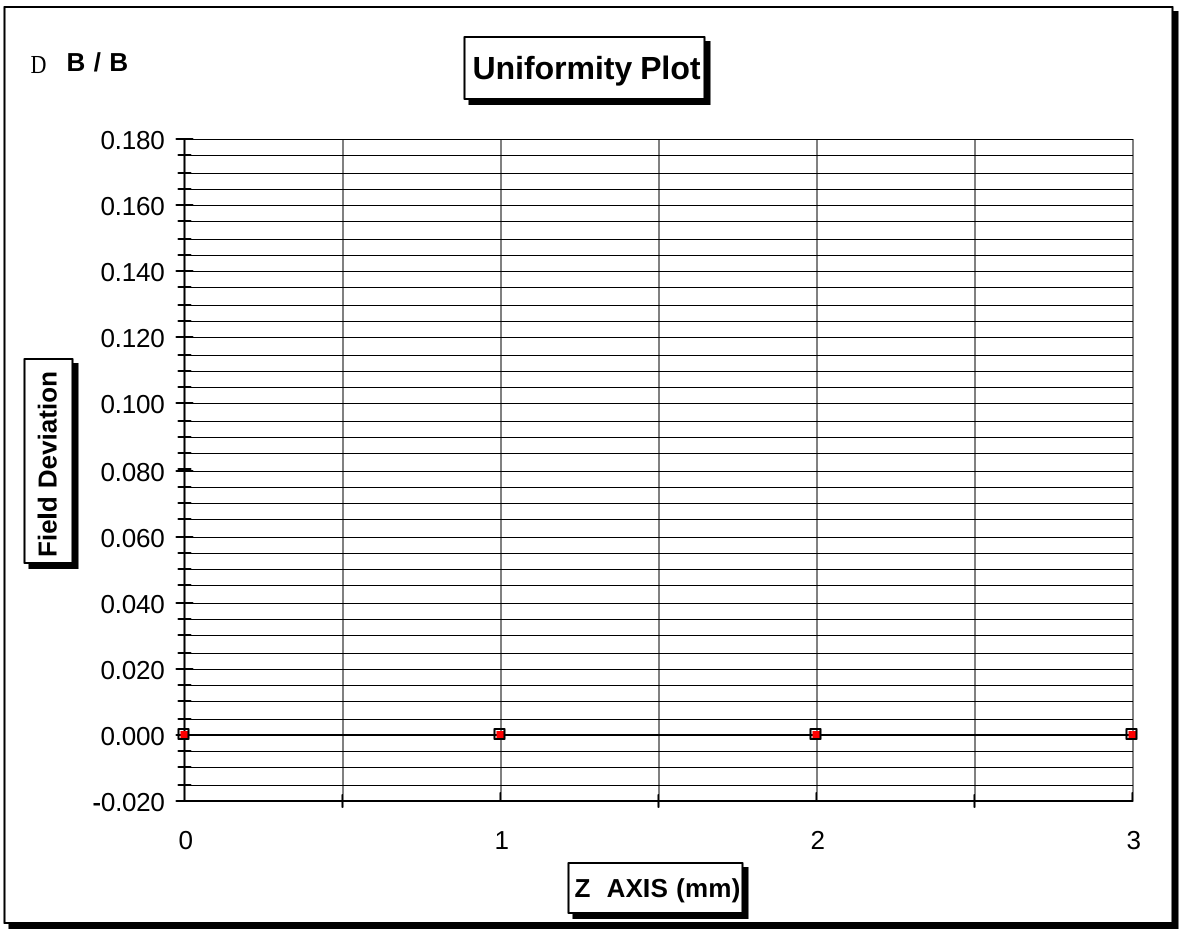
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 40 mm
Pole Gap 10 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, X = 0.0 mm				
Z -	Magnet Field	Z +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.859660	0	0.859720	0.859660
-1	0.859740	1	0.859720	0.859730
-2	0.859760	2	0.859740	0.859750
-3	0.859800	3	0.859720	0.859760
-4	0.000000	4	0.000000	0.000000
-5	0.000000	5	0.000000	0.000000
-6	0.000000	6	0.000000	0.000000
-7	0.000000	7	0.000000	0.000000
-8	0.000000	8	0.000000	0.000000
-9	0.000000	9	0.000000	0.000000
-10	0.000000	10	0.000000	0.000000
0	0.859660	0	0.859720	0.859690



Doc no: S3470U09.407

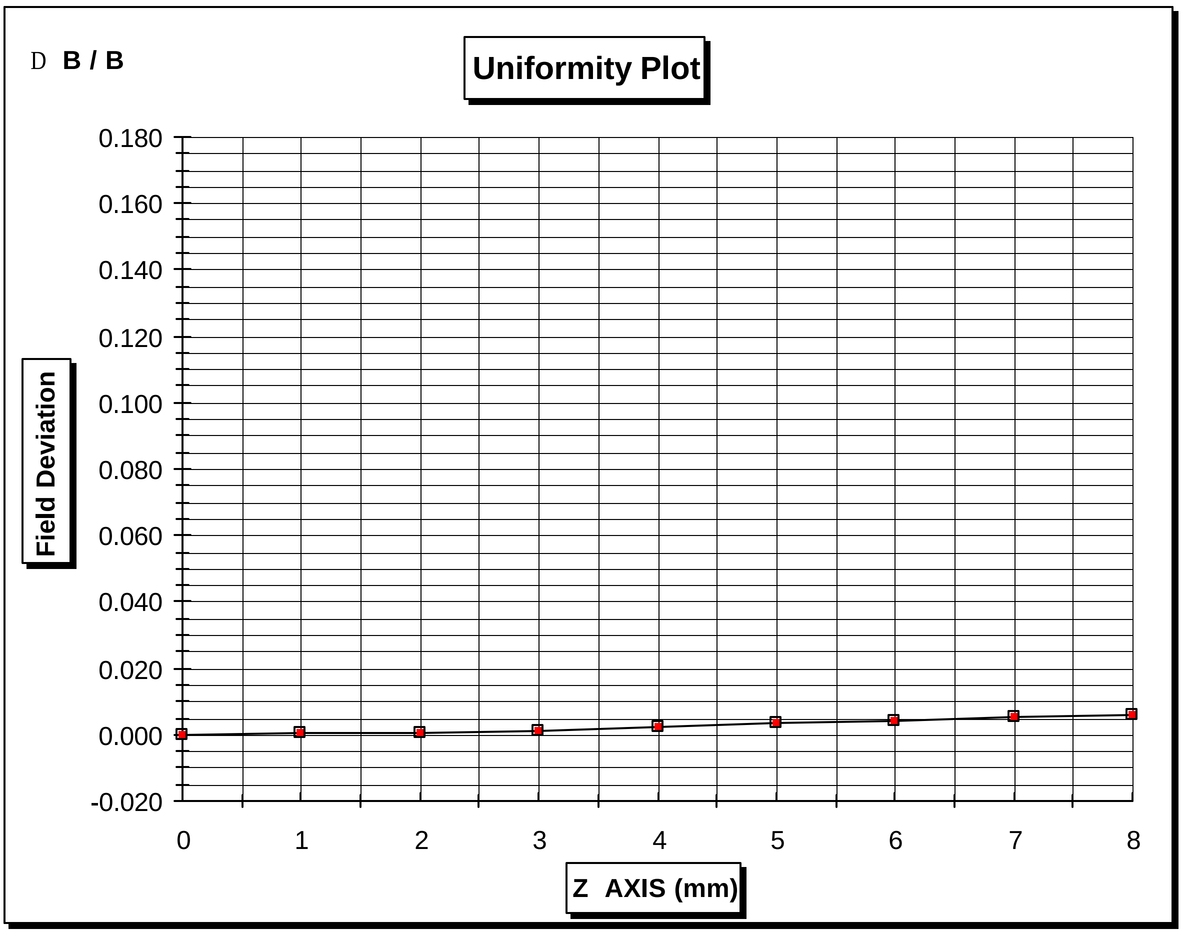
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 40 mm
Pole Gap 20 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, X = 0.0 mm				
Z -	Magnet Field	Z +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.530930	0	0.530980	0.530930
-1	0.531120	1	0.530950	0.531035
-2	0.531490	2	0.531060	0.531275
-3	0.531960	3	0.531340	0.531650
-4	0.532430	4	0.531730	0.532080
-5	0.533060	5	0.532310	0.532685
-6	0.533500	6	0.532810	0.533155
-7	0.533990	7	0.533290	0.533640
-8	0.534300	8	0.533660	0.533980
-9	0.000000	9	0.000000	0.000000
-10	0.000000	10	0.000000	0.000000
0	0.530930	0	0.530980	0.530955



Doc no: S3470U11.407

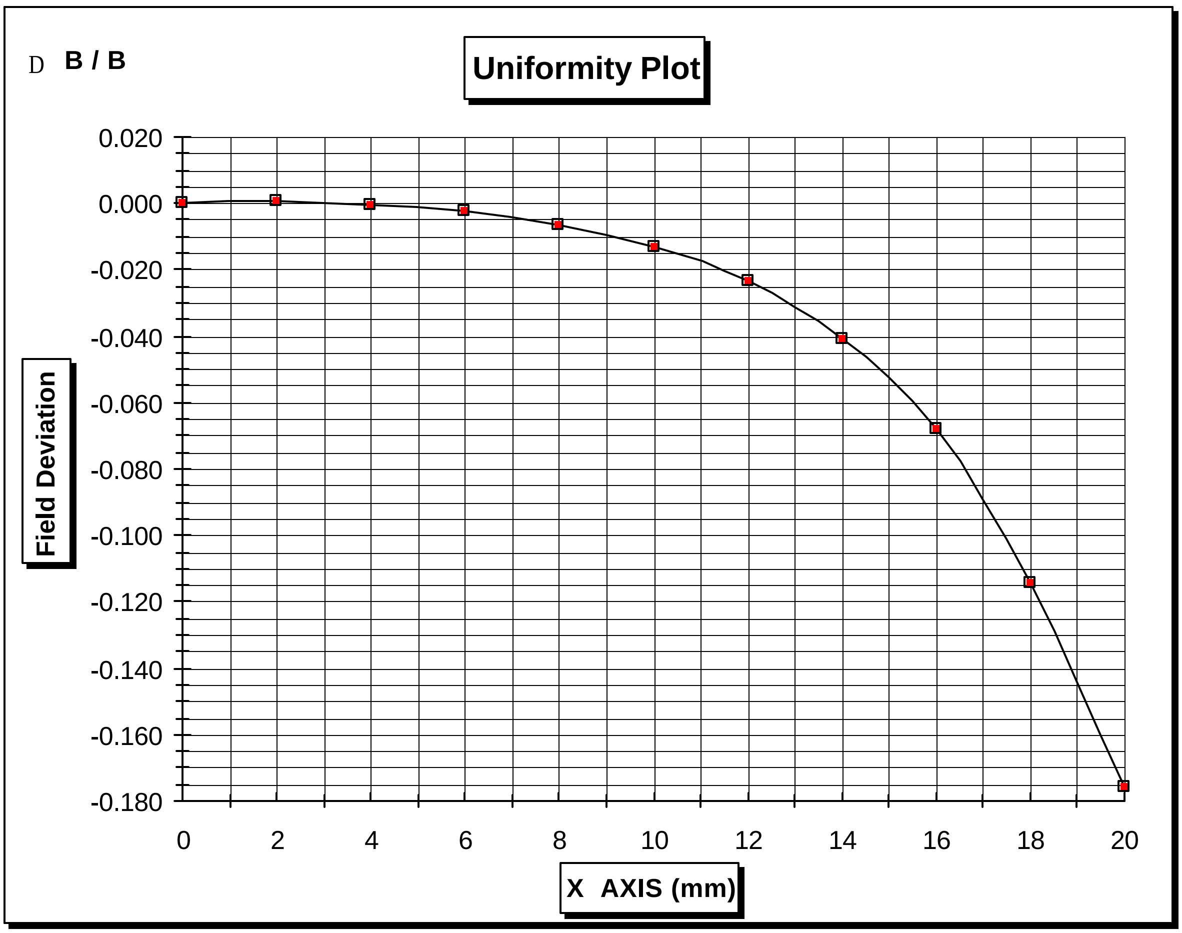
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face 40 mm
Pole Gap 20 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 25, 1995

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.531040	0	0.530103	0.530572
-2	0.530910	2	0.530880	0.530895
-4	0.530400	4	0.530300	0.530350
-6	0.529350	6	0.529180	0.529265
-8	0.527310	8	0.527230	0.527270
-10	0.524040	10	0.523480	0.523760
-12	0.518710	12	0.517320	0.518015
-14	0.509470	14	0.508250	0.508860
-16	0.494600	16	0.494310	0.494455
-18	0.470950	18	0.469040	0.469995
-20	0.438590	20	0.435750	0.437170
0	0.530103	0	0.531020	0.530562



Doc no: S3470U23.407

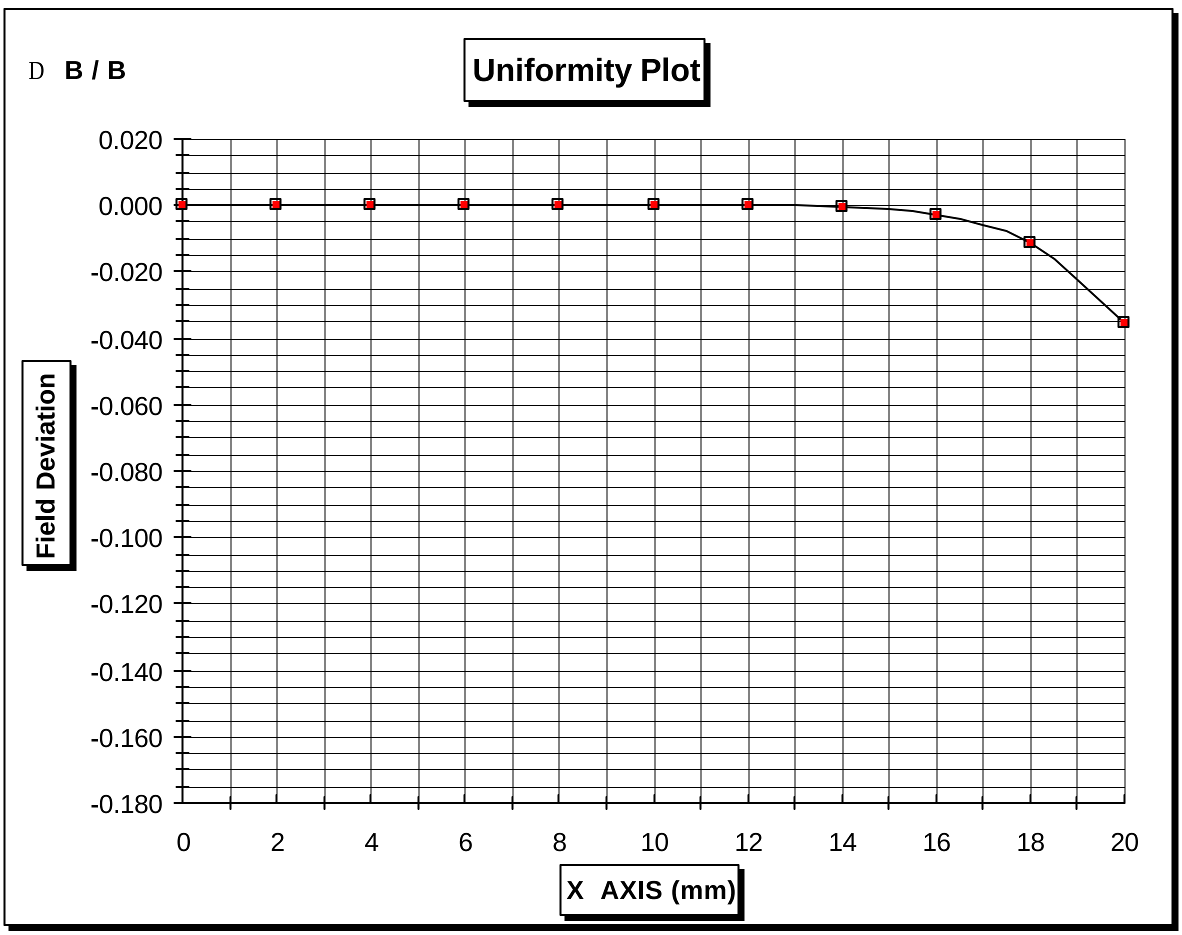
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face Square 45 mm
Pole Gap 10 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 22, 1995

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.678080	0	0.678080	0.678080
-2	0.678100	2	0.678180	0.678140
-4	0.678160	4	0.678140	0.678150
-6	0.678220	6	0.678120	0.678170
-8	0.678300	8	0.678100	0.678200
-10	0.678340	10	0.678060	0.678200
-12	0.678300	12	0.677900	0.678100
-14	0.677880	14	0.677340	0.677610
-16	0.676300	16	0.675700	0.676000
-18	0.671040	18	0.670160	0.670600
-20	0.655880	20	0.652620	0.654250
0	0.678080	0	0.678200	0.678140



Doc no: S3470U13.407

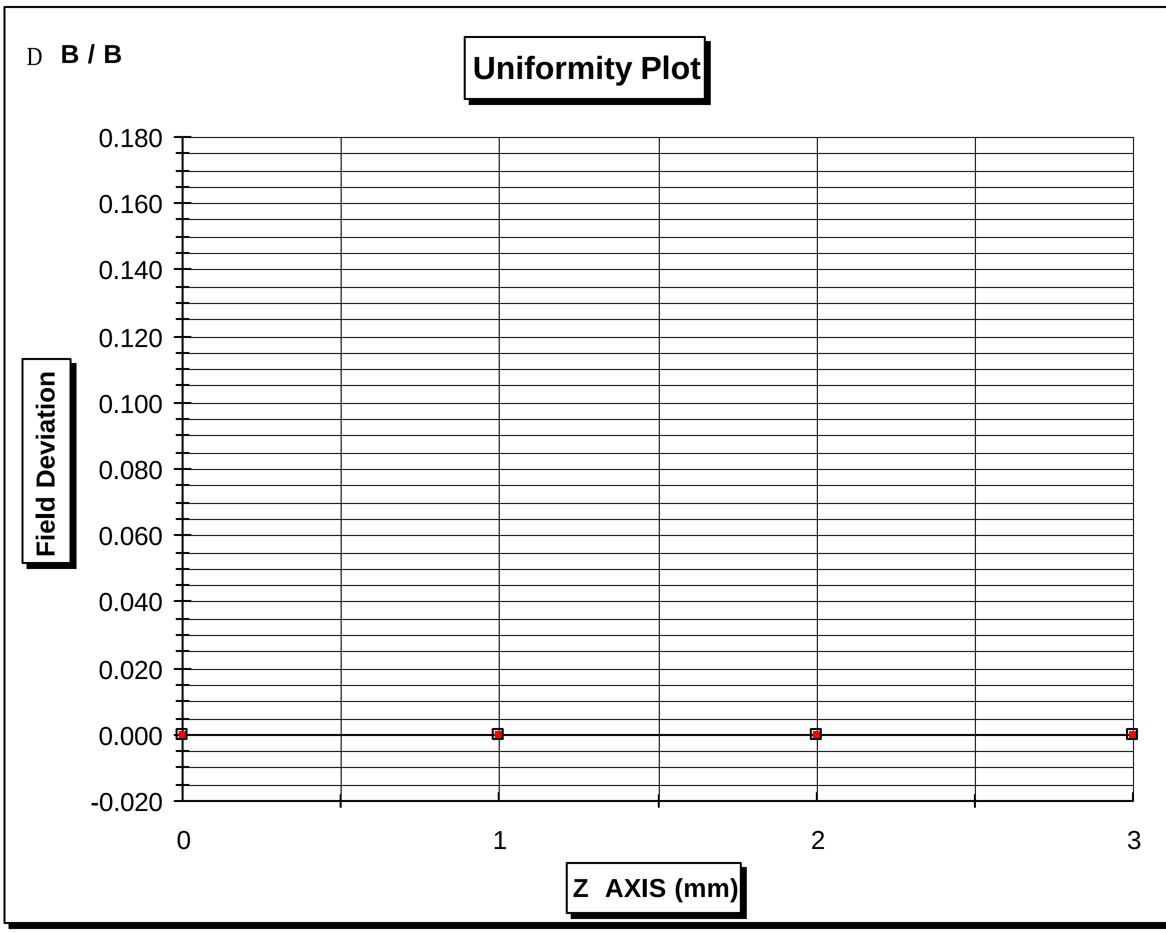
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face Square 45 mm
Pole Gap 10 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 22, 1995

Plot Y = 0.0 mm, X = 0.0 mm				
Z -	Magnet Field	Z +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.678180	0	0.678180	0.678180
-1	0.678180	1	0.678180	0.678180
-2	0.678160	2	0.678180	0.678170
-3	0.678140	3	0.678180	0.678160
-4	0.000000	4	0.000000	0.000000
-5	0.000000	5	0.000000	0.000000
-6	0.000000	6	0.000000	0.000000
-7	0.000000	7	0.000000	0.000000
-8	0.000000	8	0.000000	0.000000
-9	0.000000	9	0.000000	0.000000
-10	0.000000	10	0.000000	0.000000
0	0.678180	0	0.678180	0.678180



Doc no: S3470U17.407

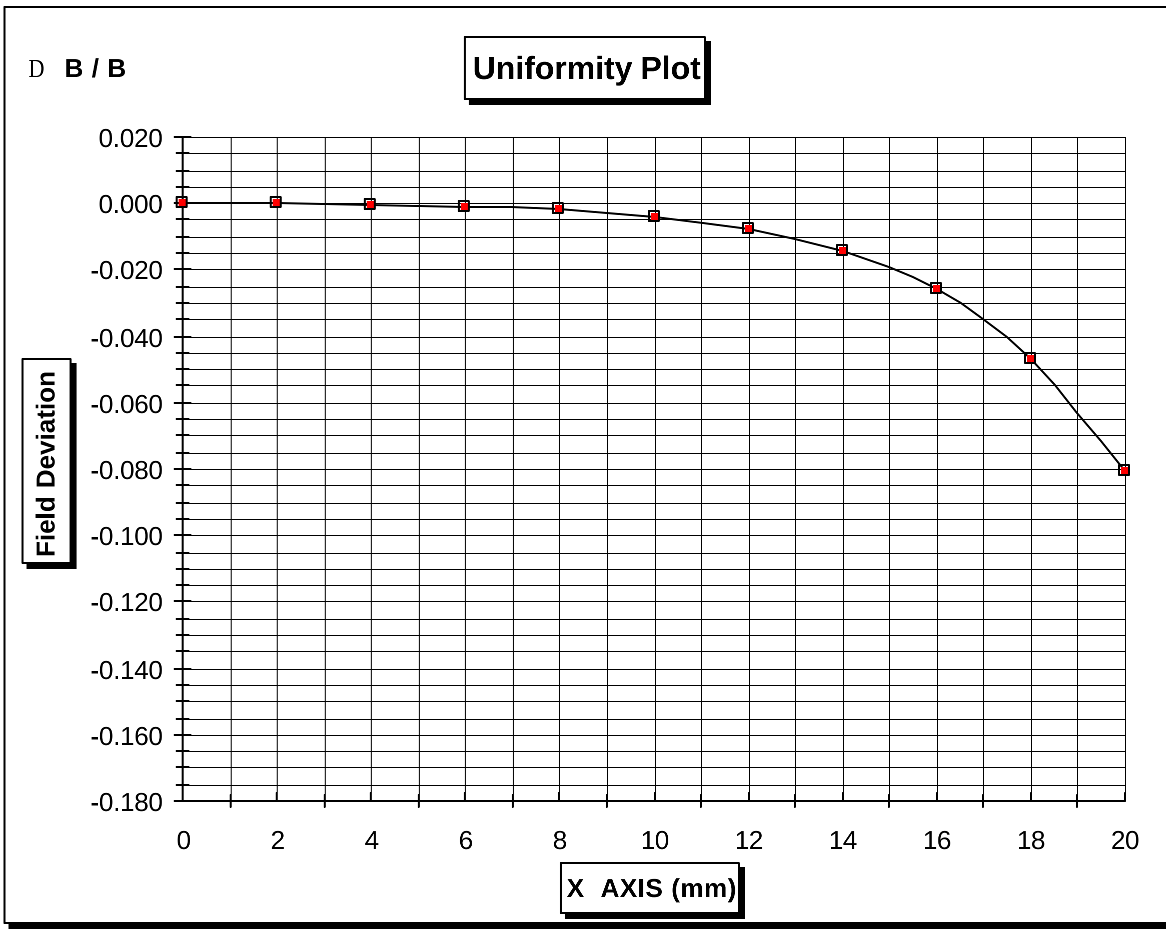
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face Square 45 mm
Pole Gap 20 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 22, 1995

Plot Y = 0.0 mm, Z = 0.0 mm				
X -	Magnet Field	X +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.458850	0	0.458840	0.458845
-2	0.458830	2	0.458790	0.458810
-4	0.458730	4	0.458660	0.458695
-6	0.458550	6	0.458370	0.458460
-8	0.458040	8	0.457920	0.457980
-10	0.457130	10	0.456930	0.457030
-12	0.455510	12	0.455050	0.455280
-14	0.452490	14	0.452130	0.452310
-16	0.447390	16	0.446840	0.447115
-18	0.437380	18	0.437120	0.437250
-20	0.422420	20	0.421550	0.421985
0	0.458840	0	0.458830	0.458835



Doc no: S3470U15.407

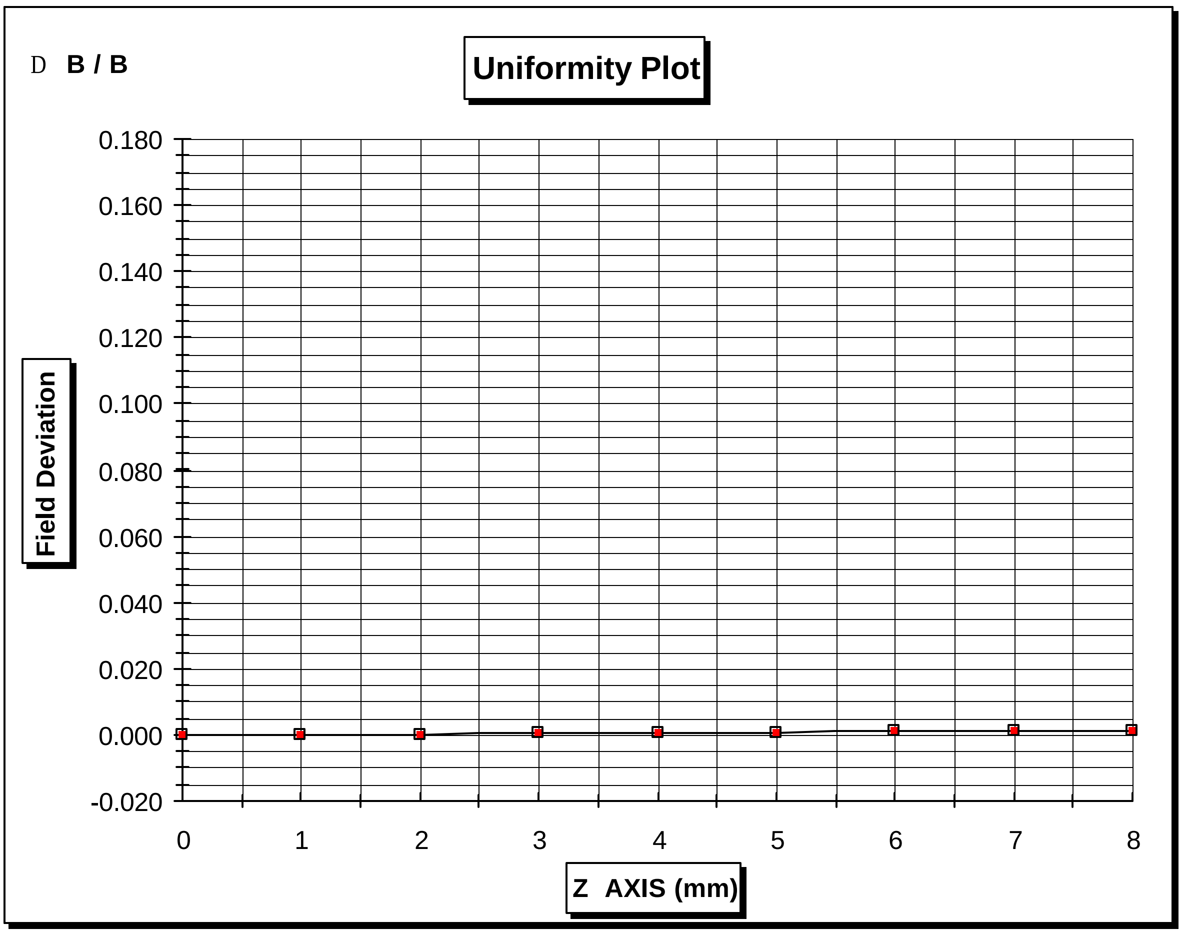
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT

Model 3470
Serial No 52

Pole Face Square 45 mm
Pole Gap 20 mm
Magnet Current 5.0 Amps

Engr Greg Douglas
Date Sept 22, 1995

Plot Y = 0.0 mm, X = 0.0 mm				
Z -	Magnet Field	Z +	Magnet Field	Magnet Field Average
mm	Tesla	mm	Tesla	Tesla
0	0.455440	0	0.455480	0.455460
-1	0.455460	1	0.455460	0.455460
-2	0.455540	2	0.455480	0.455510
-3	0.455620	3	0.455540	0.455580
-4	0.455720	4	0.455660	0.455690
-5	0.455820	5	0.455780	0.455800
-6	0.455880	6	0.455880	0.455880
-7	0.455980	7	0.456020	0.456000
-8	0.456020	8	0.456100	0.456060
-9	0.000000	9	0.000000	0.000000
-10	0.000000	10	0.000000	0.000000
0	0.455480	0	0.455460	0.455470



Doc no: S3470U19.407

Section 10

DRAWINGS

SERIES 3450/3450R/3455R/3455RBV 15 AMP THERMOSTATS

Typical Applications:

Power Supplies

Communication Equipment

Medical Equiopment

Computers (Where High AMP Loads are Present)

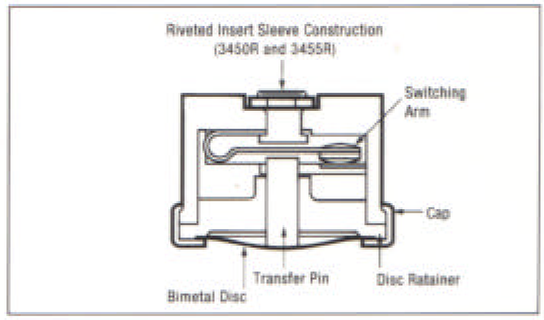
The Series 3450/3455R is a snap-acting, non-adjustable precision thermostat especially suited for industrial and electrical equipment.

The 3450 (.390" or 10mm overall) is ideal for applications that require precision control of high electric loads to 8 Amp resistive.

The 3450R and 3455R have a patented metal insert rivet construction.

The 3455R (.484" or 12.5mm) overall, has higher spacing as required by European approval agencies. Model 3455RBV is an epoxy overmold version of the 3455R, specifically designed for electrical insulation or protection in a high humidity environment. Consult factory for performance qualifications.

To insure that a safe combination of thermostat and application is achieved, the purchaser must determine product suitability for their individual requirements.



***Series 3450/3450R/3455R/3455RBV**

MODEL	ELECTRIC LIFE CYCLES	120 VAC	240 VAC	277VAC
3450	100,000	8.0A	-	-
3450R/	100,000	15A	8.3A	7.2A
3455R	100,000	4.4FLA 26.4LRA	2.2FLA 13.2LRA	-
	6,000	5.8FLA 34.8LRA	2.9FLA 17.4LRA	-
3455RBV	100,000	15A	8.3A	-
	6,000	5.8A 34.8LRA	2.9A 17.4LRA	-

A: Amps
FLA: Full Load Amps
LRA: Locked Rotor Amps
Contacts are available for millivolt and milliamp applications.
*Includes UL and CSA ratings.
Consult Elmwood Sensors for additional ratings.

Key Features:

- *Electric Rating to 15 Amp 120 VAC Resistive*
- *Environmental Exposure 0° to 350° F (–18° to 177° C)*
- *UL recognized and CSA certified and European Approved*
- *Single-Pole, Single-Throw (SPST)*
- *Pre-set and Tamperproof*
- *Variety of Mounting Brackets and Terminals Available*

Standard Temperature Characteristics

Operating Temperature Range The tightest specification determines the group	Tolerance Allowable° ± at mean temperature set points				Standard Mean Differential Nominal degrees between opening and closing points		Price Group*
	Open		Close				
	±°F	±°C	±°F	±°C	°F	°C	
32° to 79°F 0° to 25°C	5	2.8	8	4.4	30-50	16-28	I
	5	2.8	7	3.9	25-29	14-16	II
	5	2.8	6	3.3	20-24	11-13	III
	5	2.8	6	3.3	15-19	8-11	IV
80° to 200°F 25° to 95°C	5	2.8	8	4.4	30-50	16-28	I
	5	2.8	7	3.9	25-29	14-16	II
	5	2.8	6	3.3	20-24	11-14	III
	6	2.2	5	2.8	15-19	8-11	IV
201 to 250°F 96° to 120°C	6	4.4	8	4.4	30-50	16-28	I
	6	3.9	7	3.9	25-29	14-16	II
	6	3.3	6	3.3	20-24	11-14	III
	6	2.8	6	2.8	15-19	8-11	IV
251 to 302°F 121.7° to 148.9°C	7	3.9	8	4.4	30-50	16-28	I
	7	3.9	7	3.9	30-50	16-28	II
	7	3.9	7	3.9	20-29	11-16	III
	6	3.3	7	3.9	15-19	8-11	IV

*Grouped according to level of accuracy required. Group I with greatest latitude is less expensive than Group II, etc.
Please consult factory for temperature ranges, tolerances and differentials not noted. The operating temperature ranges include tolerances.
The ± tolerances shown have been established after careful review of many thermostat applications. Attempts should be made to establish the widest acceptable tolerance possible. For example, the chart may list a tolerance of ±5°F (±2.8°C); however, ±6°F (±3.3°C) may be acceptable for the application at reduced cost.
Note: Temperature checking methods may be slightly different, and allowance for a 1.8°F (1°C) variance should be considered.
See Section B of the Terminal and Bracket Guide for dimensional characteristics.

Operating Parameters

Dielectric Strength	Mil-STD-202 Method 301 -2000 VAC 60 Hz - Terminal to Case
Insulation Resistance	Mil-STD-202 Method 302 Cond. B - 500 Megohms - 500 Volts DC applied
Environmental Exposure	0° to 350°F (-18° to 177°C)
Operating Temp. Range	32° to 302°F (0° to 150°C)
Contact Resistance	Mil-STD-202, Method 307 - 50 Milohms
Marking	Mil-STD-1285
Weight	6 Grams (Brackets and wire leads not included)
Materials	Base: Phelonic
	Terminals: Plated Brass or Steel
	Closure: Aluminum, Stainless Steel, or Brass
	Brackets: Aluminum, Stainless Steel, or Brass
	Contacts: Silver

UL and CSA Listings

UL and CSA Listings are for use in equipment where the acceptability of the combination of the thermostat and equipment is determined by Underwriters' Laboratories, Inc. and/or the Canadian Standards Association.

UL File E36103, UL File SA4469 (3455RBV only), UL File MH8267 (3455R only), CSA File 21048.

PROPRIETARY
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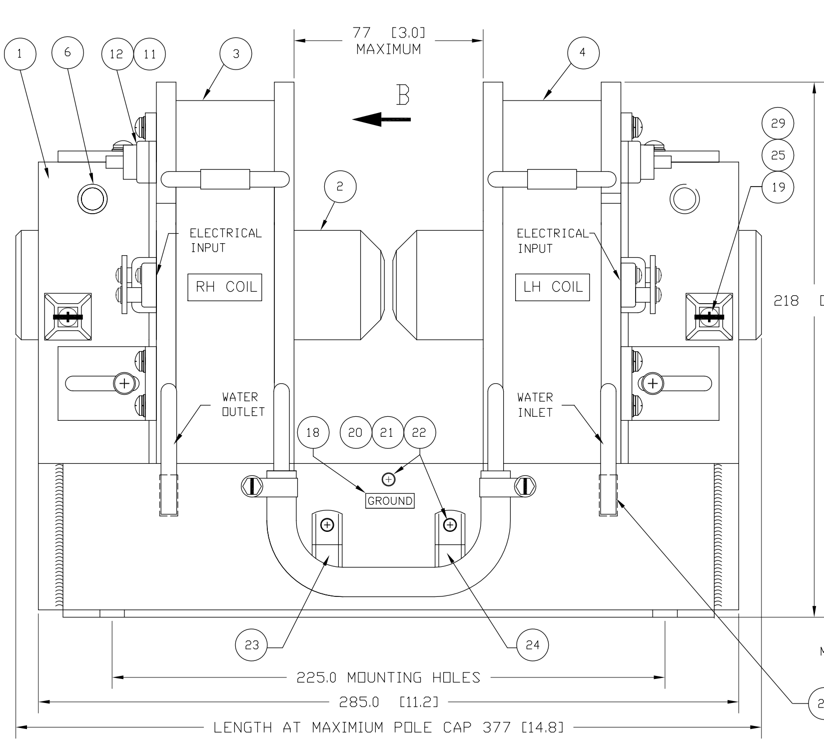
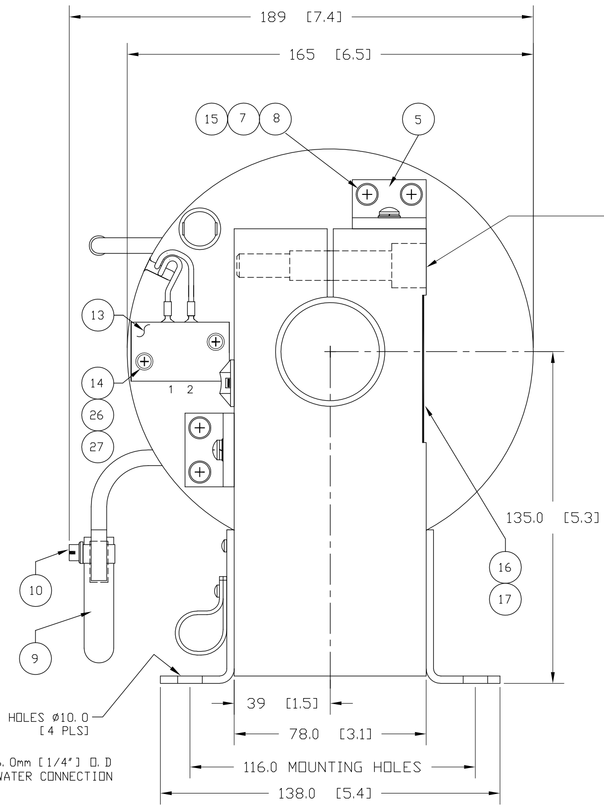
ELECTROMAGNET
REAR VIEW



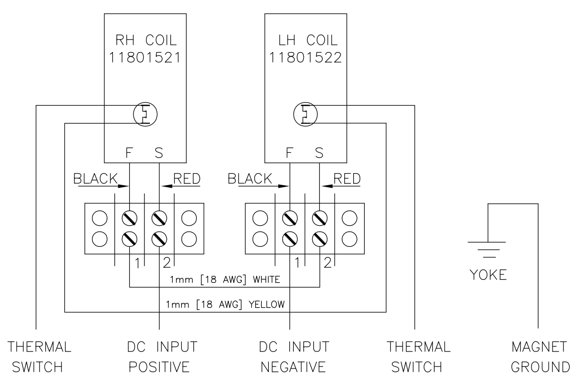


*** WARNING ***
DO NOT EXCITE ELECTROMAGNET UNTIL BOTH POLE SECURING SCREWS HAVE BEEN FULLY TIGHTENED

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/14/93	A.MARTIN
B	ADD ITEM 15 TO 23 DELETE COIL LINK WIRE		04/27/94	G.DOUGLAS
C	REMOVE NOTE 1, CHG PART NO'S ITEMS 19, 23–25		07/16/03	G.DOUGLAS
D	MAGNET TERMINAL BOX ADDED, REV NOT IMPLEMENTED			M.DUFFY
E	CHG WATER PIPE, T/B LAYOUT, IMPLEMENTED AFTER SN 195		03/29/05	G.DOUGLAS
F	CHG TEMP SW TO 50° C, IMPLEMENTED AFTER SN 205		04/21/06	G.DOUGLAS
G	ADD WIRE COLORS TO COIL CONNECTIONS + NOTE: 3		07/11/06	G.DOUGLAS
H	CHG ITEM 9 TO GATE PART NO, CHG ITEMS 29 TO M3		10/08/07	G.DOUGLAS
I	ADD NOTE @ D2, CHANGE ITEMS 23 & 24		02/07/08	G.DOUGLAS

ELECTROMAGNET SCHEMATIC
REAR VIEW



USER CONNECTIONS

ELECTROMAGNET SPECIFICATIONS

POLE DIAMETER, CYLINDRICAL END	40 mm [1.57"]
POLE DIAMETER, TAPERED END	20 mm [0.78"]
POLE GAP	0 TO 75 mm [3"]
COILS [series connected]	
MAX RESISTANCE	8.8 ohm
MAX POWER [air]	3.5A/31V
MAX POWER [water]	5A/44V
COOLING	1 liter/min [0.26 gpm] 0.3 bar [5 psid]
THERMAL INTERLOCK	
OPEN CIRCUIT	ABOVE 50° C [122° F]
RESISTIVE RATING	120VAC/0.17A
WEIGHT	27 kg [60 lbs]

NOTE: DO NOT EXCEED THE MAXIMUM SPECIFIED COIL RESISTANCE OR COIL OVERHEATING AND POSSIBLE DAMAGE MAY OCCUR.

NOTE

1. AFTER FINAL TEST PURGE WATER LINES AND FIT [ITEM 28] TO WATER INLET/OUTLET.
2. SUPPLY TWO HOSE CLAMPS [ITEM 10] PACKED IN PLASTIC BAG WITH EACH MAGNET.
3. FOR FINAL TEST CONNECT TEST CABLE DWG NO: 16900530 AS LABELED. ENSURE FIELD DIRECTION IS AS SHOWN ABOVE. NOTIFY QA DEPT IT FIELD DIRECTION IS INCORRECT.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
29	2	DIN 965A	SCREW, M3 x 6 FLAT HD PHILLIPS S/S	
28	2	SC0063	PLASTIC SEALING CAPS, 6.3 ID, KELVINDALE	
27	4	DIN 433	M3 WASHER, FLAT S/S	
26	4	DIN 7980	M3 WASHER, SPRING S/S	
25	2	268–513	CABLE TIE, 3.6mm WIDE NATURAL FARNELL	
24	1	PCBK–20	P–CLIP 20mm ID, BLACK NYLON CABAC	
23	1	PCBK–9	P–CLIP 10mm ID, BLACK NYLON CABAC	
22	3	DIN 7980	M4 WASHER, SPRING S/S	
21	3	DIN 433	M4 WASHER, FLAT S/S	
20	3	DIN 7985A	M4 x 10 PAN HD PHILLIPS SCREW S/S	
19	2	268–690	CABLE TIE PAD, COLOR NATURAL, FARNELL	
18	1	10900720	LABEL, GROUND	
17	1	10900710	LABEL CAUTION [RH SIDE]	
16	1	10900700	LABEL, MAGNET SPECIFICATION [LH SIDE]	
15	12	DIN 7980	M5 WASHER, SPRING S/S	
14	4	DIN 7985A	M3 x 20 PAN HD PHILLIPS SCREW S/S	
13	2	17801570	TERMINAL COVER	
12	2		WASHER, NEOPRENE 16x4x4mm	
11	2	3450 G8611–2	TEMPERATURE SENSOR 50°C ELMWOOD	
10	4	INDENT 72–173	HOSE CLAMP 8–12 S/S, NORMA	2
9	A/R	27043	HOSE 7/32" ID BLACK RUBBER, GATES	
8	12	DIN 433	M5 WASHER, FLAT S/S	
7	12	DIN 7985A	M5 x 12 PAN HD PHILLIPS SCREW S/S	
6	2	DIN 912	M12 x 60 SHCS S/S	
5	4	17801560	COIL MTG BRACKET	
4	1	11801522	COIL [LH]	
3	1	11801521	COIL [RH]	
2	2	17801500	POLE	
1	1	11801480	YOKE ASSEMBLY	

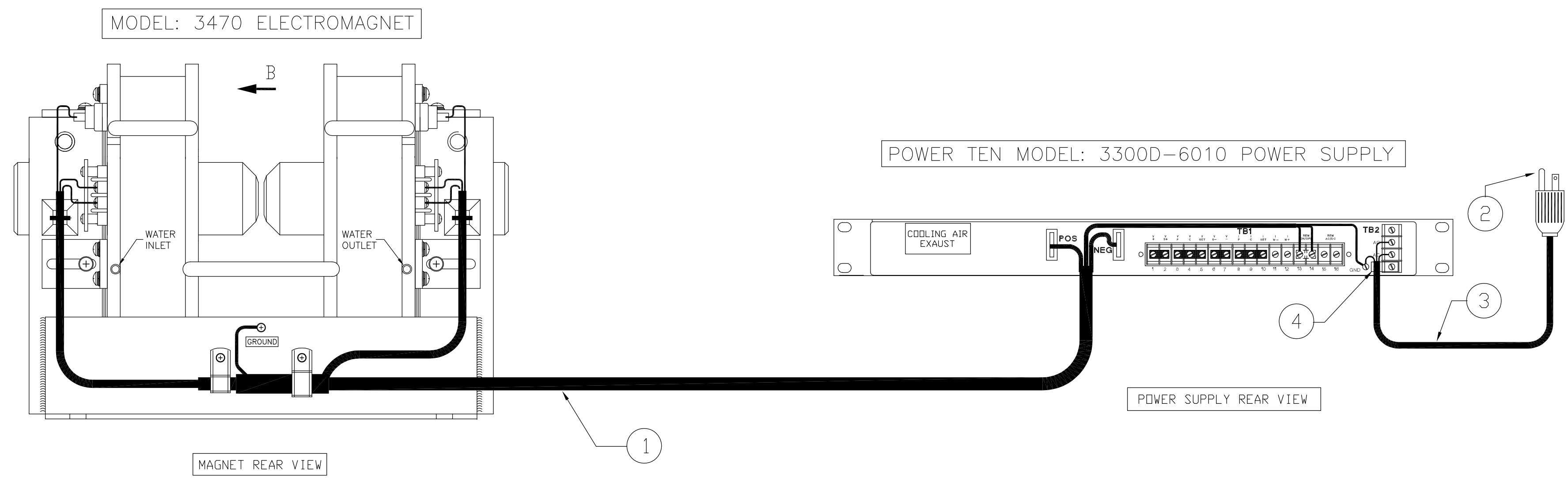
PARTS LIST

DRAWN A.MARTIN	DATE 08/14/93	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.
CHECK	DATE	LINEAR INCHES / mm: X.XXX ±.005 ±0.03; X.XX ±.01 ±0.1; X.X ±.03 ±0.3; X ±.06 ±1; DEG. ±.5 ±0.5; FINISH 63 1.6	TITLE MAGNET ASSEMBLY MODEL: 3470
ENGINEERING	DATE	THIRD ANGLE PROJECTION	SIZE A1 DRAWING NO. 11801470 REV I
NEXT ASSY	SYSTEM 3470		SCALE 1:1 WT kg SHEET 1 OF 1
SOFTWARE AUTOCAD 2000			

PROPRIETARY
THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION PROPRIETARY TO GMW INC. IT MUST NOT BE REPRODUCED OR DISCLOSED TO OTHERS OR USED IN ANY OTHER WAY, IN WHOLE OR IN PART EXCEPT AS AUTHORIZED IN WRITING BY GMW INC.

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		05/26/95	G.DOUGLAS



NOTE
1. POWER SUPPLY SHOWN WITH 115V 1 PHASE AC INPUT
2. REFER TO TABLE ON DWG 13900130 FOR AC INPUT RATINGS OTHER THAN 115V 1 PHASE AC INPUT

N/S=NOT SUPPLIED

*** WARNING ***
CHECK AC POWER VOLTAGE AND FREQUENCY MATCH POWER SUPPLY SPECIFIED REQUIREMENTS BEFORE APPLYING AC INPUT POWER

PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
4	1	PLC2S-S6-C	CABLE TIE SCREW DOWN MTG, PANDUIT	N/S
3	1	4A-1803	POWER CORD, TYPE SO 3 CORE 18AWG	N/S
2	1	5-15R	PLUG 1PHASE/15A,	N/S
1	1	16900090	CURRENT & INTERLOCK CABLE 10A	

DRAWN G.DOUGLAS DATE 05/26/95
CHECK DATE
ENGINEERING DATE
NEXT ASSY 3470 SYSTEM
SOFTWARE AUTOCAD 13

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

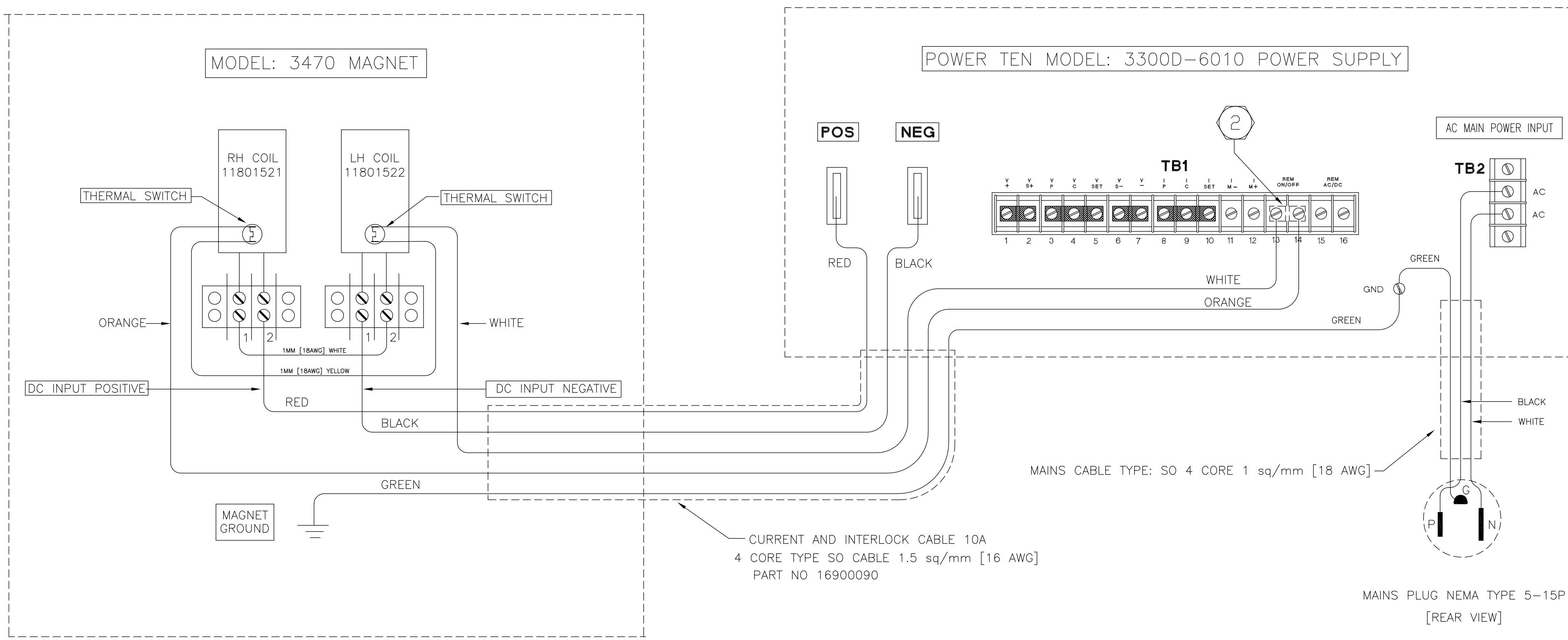
GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
ELECTRICAL ASSY
3470/PT6010

SIZE A1 DRAWING NO. 11900010 REV A
SCALE NTS WT kg SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/02/95	G.DOUGLAS



NOTE:
1. CONNECT MAGNET TEMPERATURE INTERLOCK WIRING DIRECTLY ONTO QC TABS ON TEMP THERMOSTATS
4. REMOVE LINK BETWEEN TERM 13 & TERM 14 ON POWER SUPPLY AT TB1, AND CONNECT INTERLOCK WIRES AS SHOWN

ELECTROMAGNET SYSTEM ELECTRICAL REQUIREMENTS			
AC INPUT POWER 1 PHASE, 47 to 63HZ	115V	–	
AC INPUT FULL LOAD CURRENT	9.3	–	
RECOMMENDED MAIN AC BREAKER	15	–	
RECOMMENDED AC POWER OUTLET	5–15R	–	
RECOMMENDED AC CABLE SIZE	1.0 SQ/MM	–	
NOTE: DRAWING SHOWS POWER SUPPLY SETUP FOR 1 PHASE 115V AC POWER			

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN G.DOUGLAS DATE 06/02/95
CHECK DATE
ENGINEERING DATE
3470
NEXT ASSY SYSTEM
SOFTWARE AUTOCAD 13

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

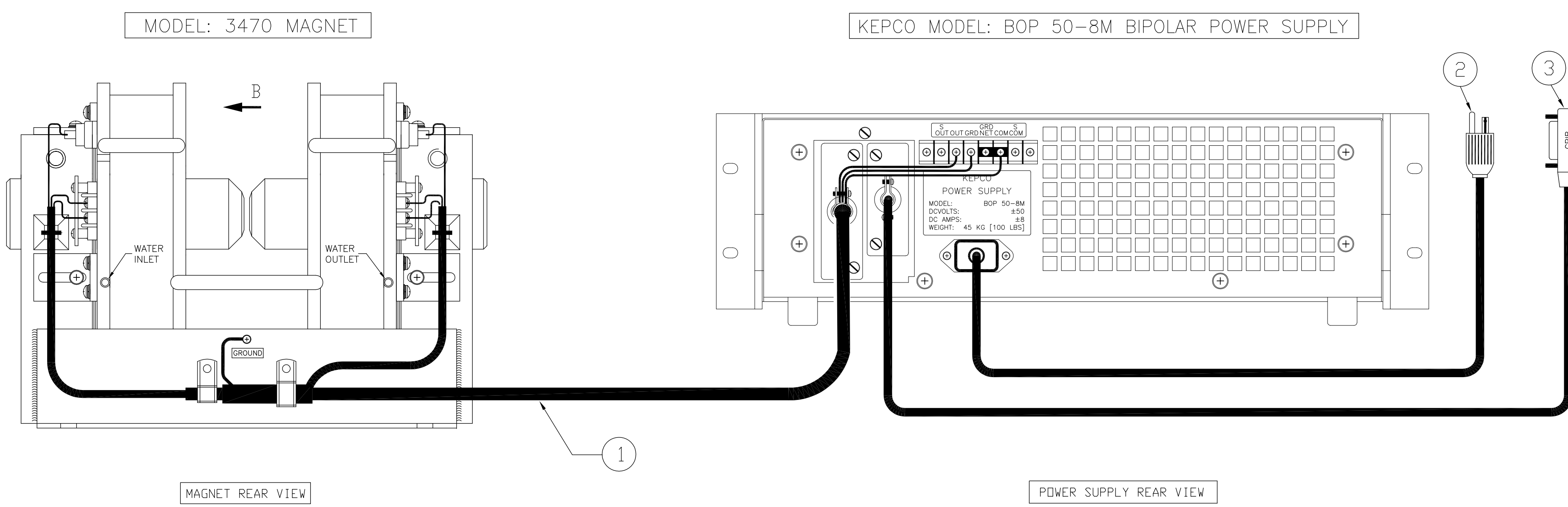
GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
ELECTRICAL WIRING 3470/PT6010

SIZE A1 DRAWING NO. 13900130 REV A
SCALE NTS WT kg SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/04/95	G.DOUGLAS



*** WARNING ***
CHECK AC POWER VOLTAGE AND FREQUENCY MATCH POWER SUPPLY SPECIFIED REQUIREMENTS BEFORE APPLYING AC INPUT POWER

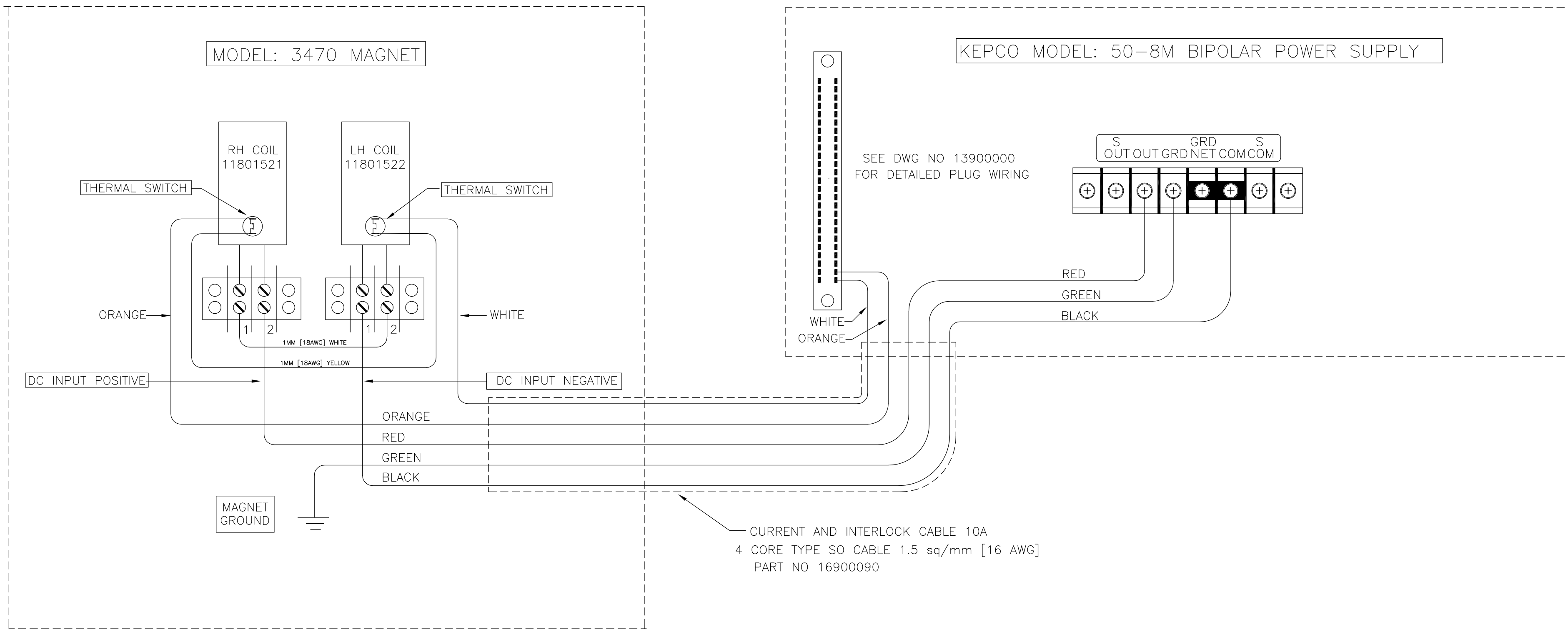
NOTE

1. POWER SUPPLY SHOWN WITH 115V AC INPUT
2. GPIB INTERFACE IS OPTIONAL EQUIPMENT
3. REFER TO TABLE ON DWG 13900140 FOR AC INPUT RATINGS OTHER THAN 115V AC INPUT

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
3	1	SNQ 488-2	GPIB CABLE [2M LONG]	2
2	1	KEPCO	AC POWER CORD [115V US TYPE]	
1	1	16900100	CURRENT & INTERLOCK CABLE 10A	

PARTS LIST

DRAWN G.DOUGLAS	DATE 06/04/95	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)			GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.
CHECK	DATE	LINEAR	INCHES	mm	
ENGINEERING	DATE	X.XXX	±.005	±0.03	TITLE ELECTRICAL ASSY 3470/BOP 50-8
		X.XX	±.01	±0.1	
		X.X	±.03	±0.3	
		X	±.06	±1	
		DEG.	±.5	±0.5	
	3470	FINISH	63	1.6	SIZE A1 DRAWING NO. 11900020 REV A
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION			SCALE NTS WT kg SHEET 1 OF 1
SOFTWARE AUTOCAD 2000					



NOTE:
(1) CONNECT MAGNET TEMPERATURE INTERLOCK WIRING DIRECTLY ONTO QC TABS ON TEMP THERMOSTATS

ELECTROMAGNET SYSTEM ELECTRICAL REQUIREMENTS			
AC INPUT POWER 1 PHASE, 50 to 65HZ	115V	208V	230V
AC INPUT FULL LOAD CURRENT	11.0	6.5	6.0
RECOMMENDED MAIN AC BREAKER	15	15	15
RECOMMENDED AC POWER OUTLET	5-15R	–	–
RECOMMENDED AC CABLE SIZE	1.5 SQ/MM	1.0 SQ/MM	1.0 SQ/MM
NOTE: DRAWING SHOWS POWER SUPPLY SETUP FOR 1 PHASE 115V AC POWER			

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/10/95	G.DOUGLAS

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN G.DOUGLAS DATE 06/10/95
CHECK DATE
ENGINEERING DATE
NEXT ASSY 3470 SYSTEM
SOFTWARE AUTOCAD 13

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

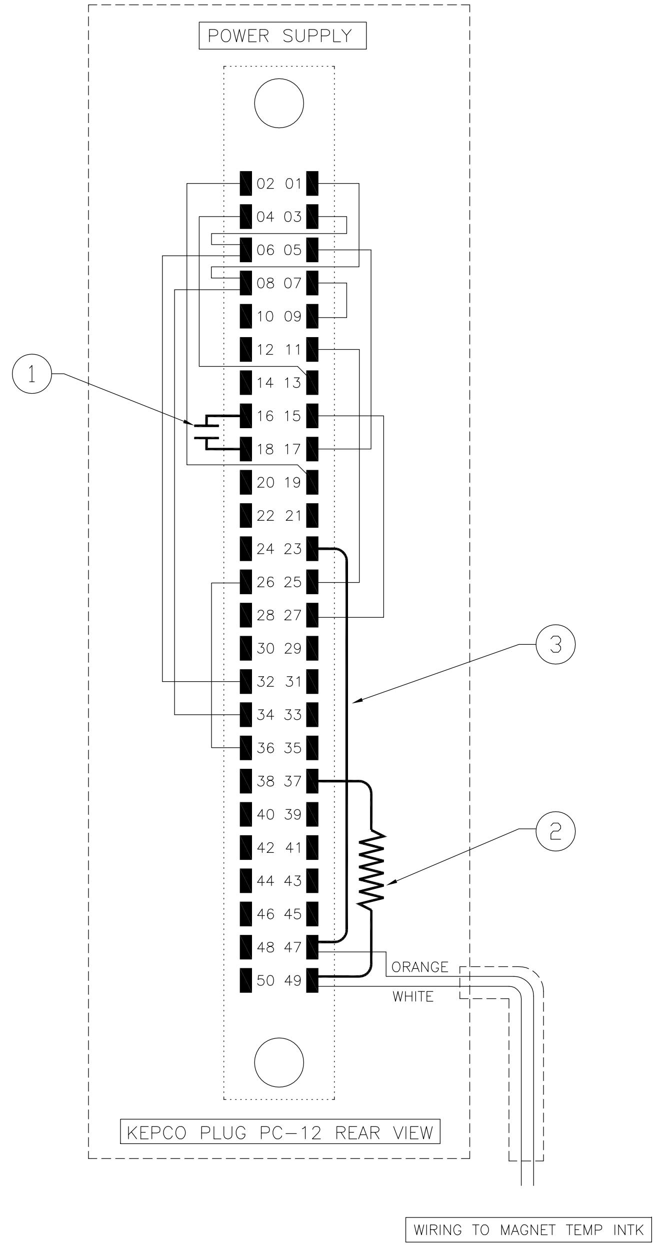
GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
ELECTRICAL WIRING 3470/BOP 50-8

SIZE A1 DRAWING NO. 13900140 REV A
SCALE NTS WT kg SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/10/95	G.DOUGLAS
B	CHANGE WIRE COLORS @ A5		03/21/00	G.DOUGLAS



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
3	1		WIRE LINK, HOOK UP WIRE 0.5 SQ/MM	
2	1		RESISTOR, 680 OHM/0.25 W	
1	1		CAPACITOR, MYLAR 0.33uF	

PARTS LIST

DRAWN G.DOUGLAS DATE 06/10/95
CHECK DATE
ENGINEERING DATE
NEXT ASSY 3470 SYSTEM
SOFTWARE AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63 ✓	1.6 ✓

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
ELECTRICAL WIRING BOP 50-8

SIZE A1 DRAWING NO. 13900000 REV B
SCALE NTS WT kg SHEET 1 OF 1

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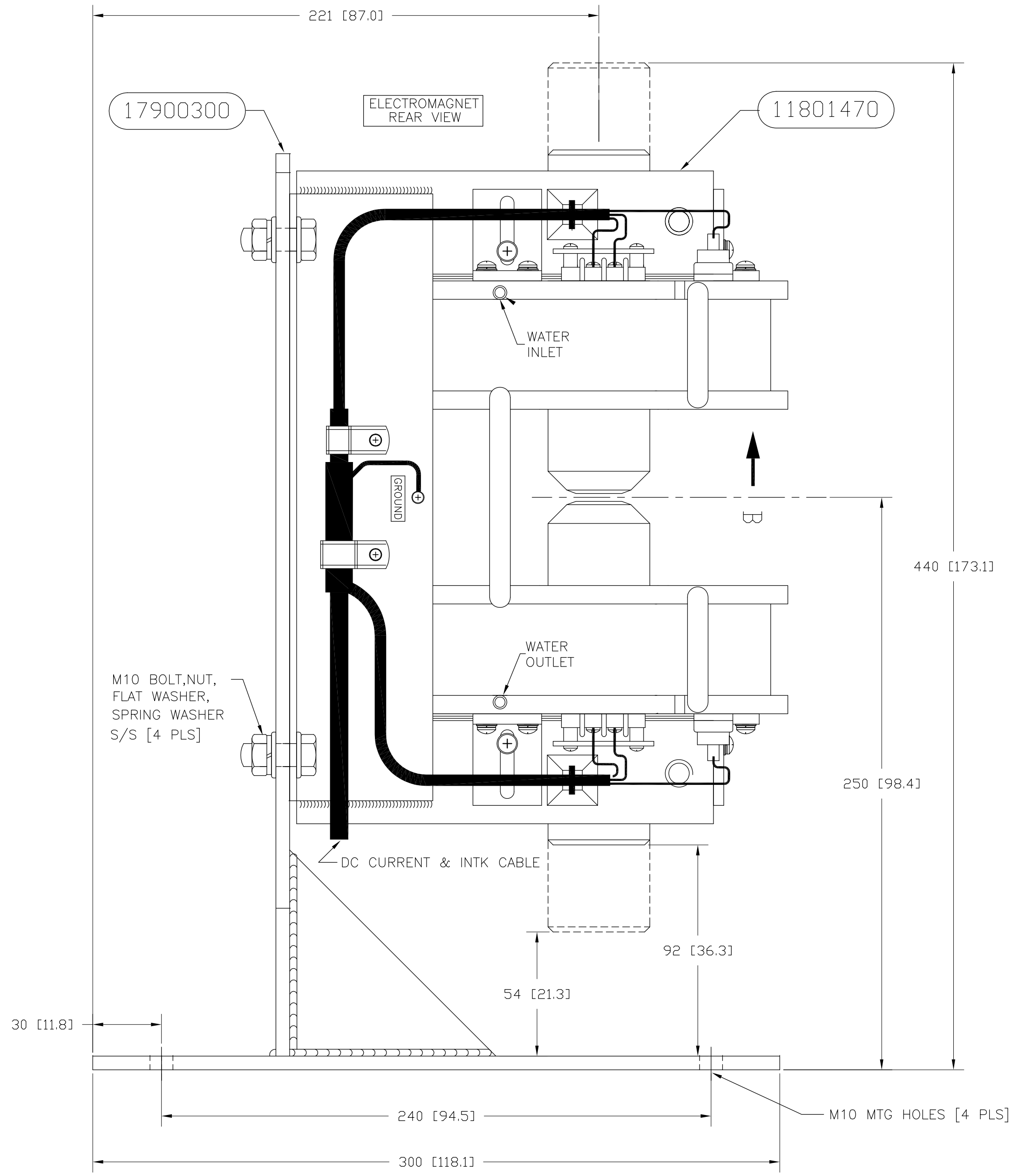
REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/23/95	G.DOUGLAS



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN G.DOUGLAS DATE 06/23/95
CHECK DATE
ENGINEERING DATE
NEXT ASSY 3470 SYSTEM
SOFTWARE AUTOCAD 13

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63 ✓	1.6 ✓

THIRD ANGLE PROJECTION

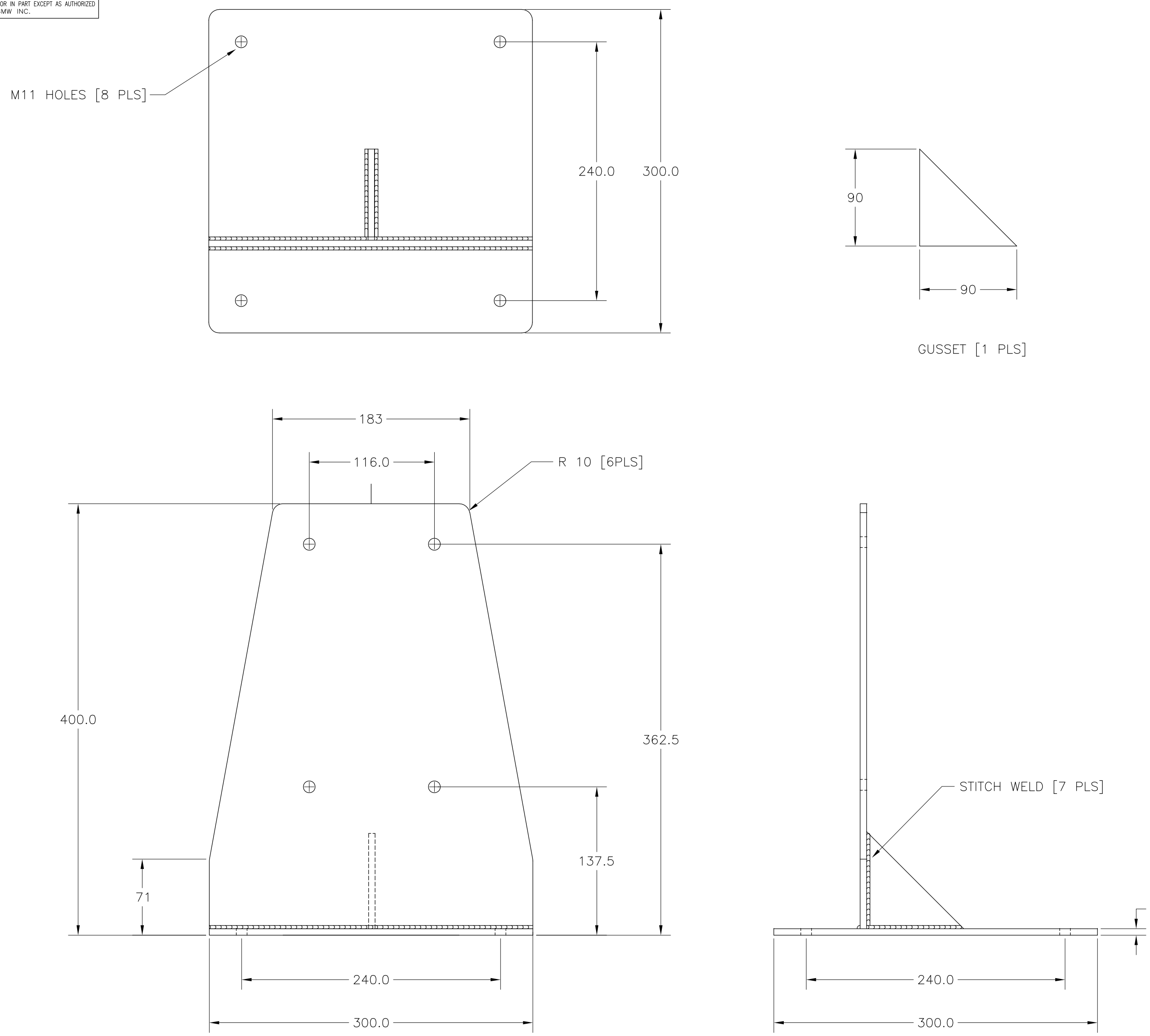
GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
VERT MOUNT ASSY
MODEL: 3470

SIZE A1 | DRAWING NO. 11900000 | REV A
SCALE 1:1 | WT kg | SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/19/95	G.DOUGLAS



NOTE

MATERIAL: MILD STEEL PLATE 6MM THICK

FINISH: PAINT INSTRUMENT TAN TO BSL TP8580010

NO REQ: 1

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN	G.DOUGLAS
DATE	06/19/95
CHECK	
ENGINEERING	
NEXT ASSY	3470
SYSTEM	
SOFTWARE	AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
VERT MOUNT BRK
MODEL: 3470

SIZE	DRAWING NO.	REV
A1	17900300	A

SCALE 1:2 | WT kg | SHEET 1 OF 1

PROPRIETARY

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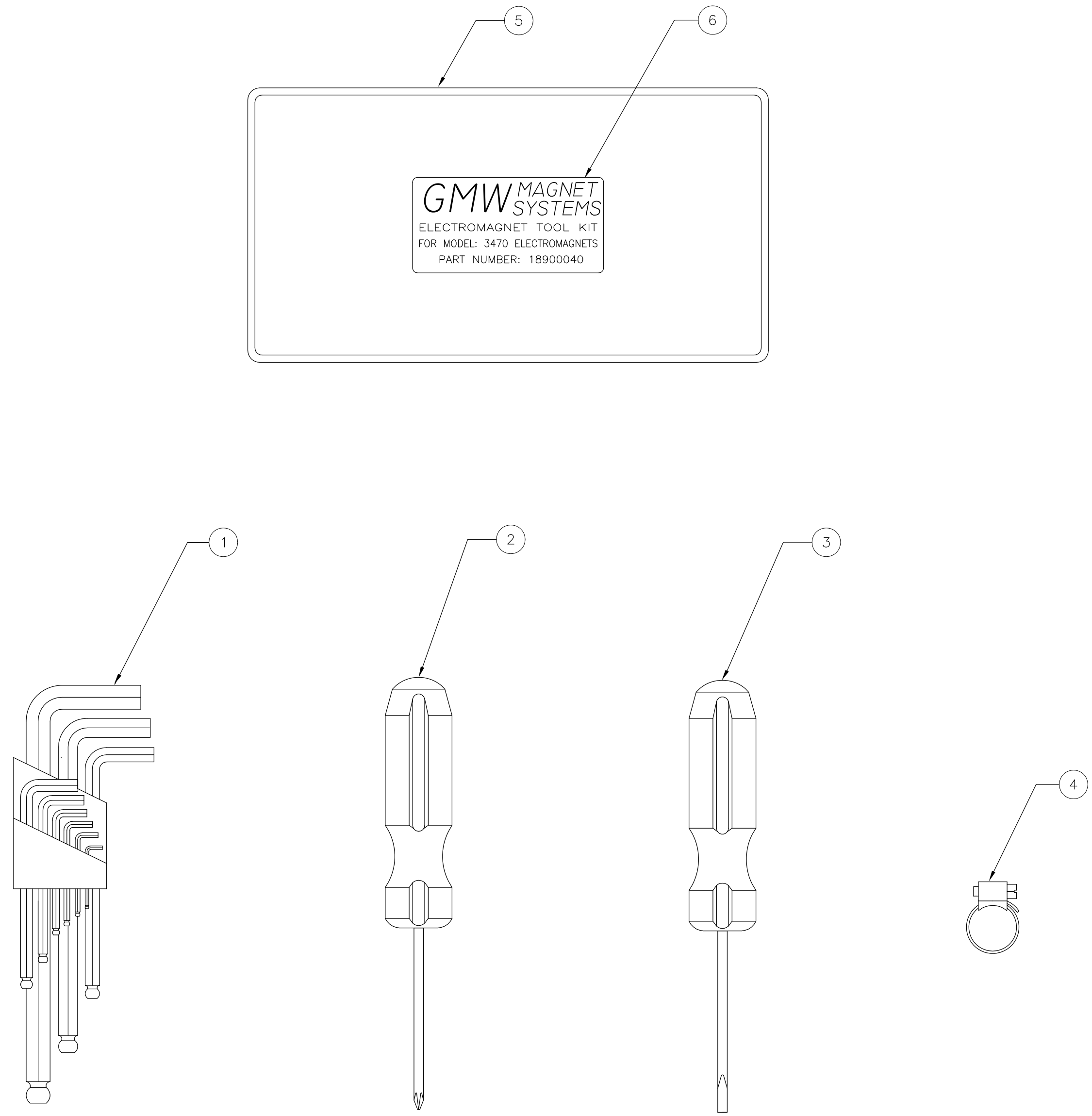
REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		06/02/95	G.DOUGLAS



PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
6	1		LABEL, TOOL KIT	
5	1	V401	STORAGE BOX, PLASTIC. FLAMBEAU	
4	2	350-006	HOSE CLIP, TRIDON	
3	1	62-133	SCREWDRIVER, SLOTTED. STANLEY	
2	1	62-021	SCREWDRIVER, PHILLIPS. STANLEY	
1	1	BLX 9mm	HEX KEY WRENCH SET, BONDHUS	

DRAWN G.DOUGLAS	DATE 06/02/95
CHECK	DATE
ENGINEERING	DATE
3470	
NEXT ASSY	SYSTEM
SOFTWARE AUTOCAD 2000	

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63 ✓	1.6 ✓

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

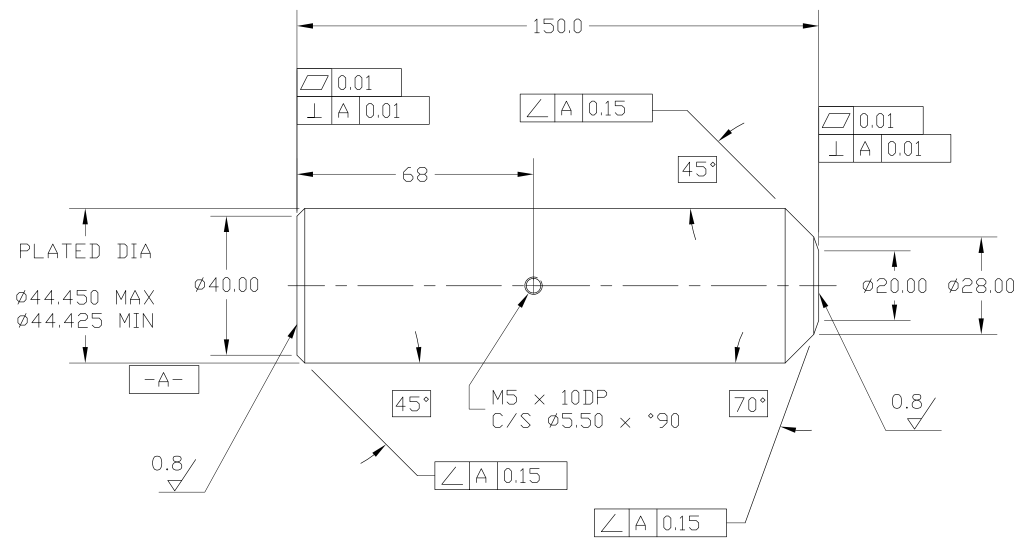
TITLE
MAGNET TOOL KIT
MODEL: 3470

SIZE	DRAWING NO.	REV
A1	18900040	A

SCALE 1:1 | WT kg | SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		04/08/93	A.MARTIN
B	ADD TOLERANCE TO POLE		04/25/94	G.DOUGLAS
C	CHG POLE DIAMETER, ADD FINISHED SIZE		10/23/98	G.DOUGLAS
D	ADD M5 HOLE @ D3, CHANGE NOTE 5 THRU NOTE 8		06/29/07	G.DOUGLAS



NOTE:

1. MATERIAL: 1006 LOW CARBON PLATE.
2. MATERIAL MUST BE CUT WITH THE AXIS OF THE PART RUNNING IN THE SAME DIRECTION AS THE RAW PLATE GRAIN.
3. POLE PIECES FOR EACH PRODUCTION RUN ARE TO BE CUT FROM THE SAME RAW PLATE, AND FROM THE SAME PROXIMITY.
4. ROUGH MACHINE RAW MATERIAL TO ø50, THEN FULLY ANNEAL TO BSL TP85800040
5. FINE MACHINE FINISH ON POLE FACES. AVOID NICKS AND SCRATCHES ON POLE FACES.
6. "ELECTROCLEAN ONLY AFTER GRINDING". DO NOT BEAD BLAST OR ORBITAL SAND SURFACES.
7. FINISH: EN PLATE .01 THICK TO BSL 85800120.

8 BREAK SHARP EDGES 0.10 MAX.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN A.MARTIN	DATE 04/08/93	
CHECK	DATE	
ENGINEERING	DATE	
11801470	3470	
NEXT ASSY	SYSTEM	
SOFTWARE AUTOCAD 2000		

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63✓	1.6✓

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

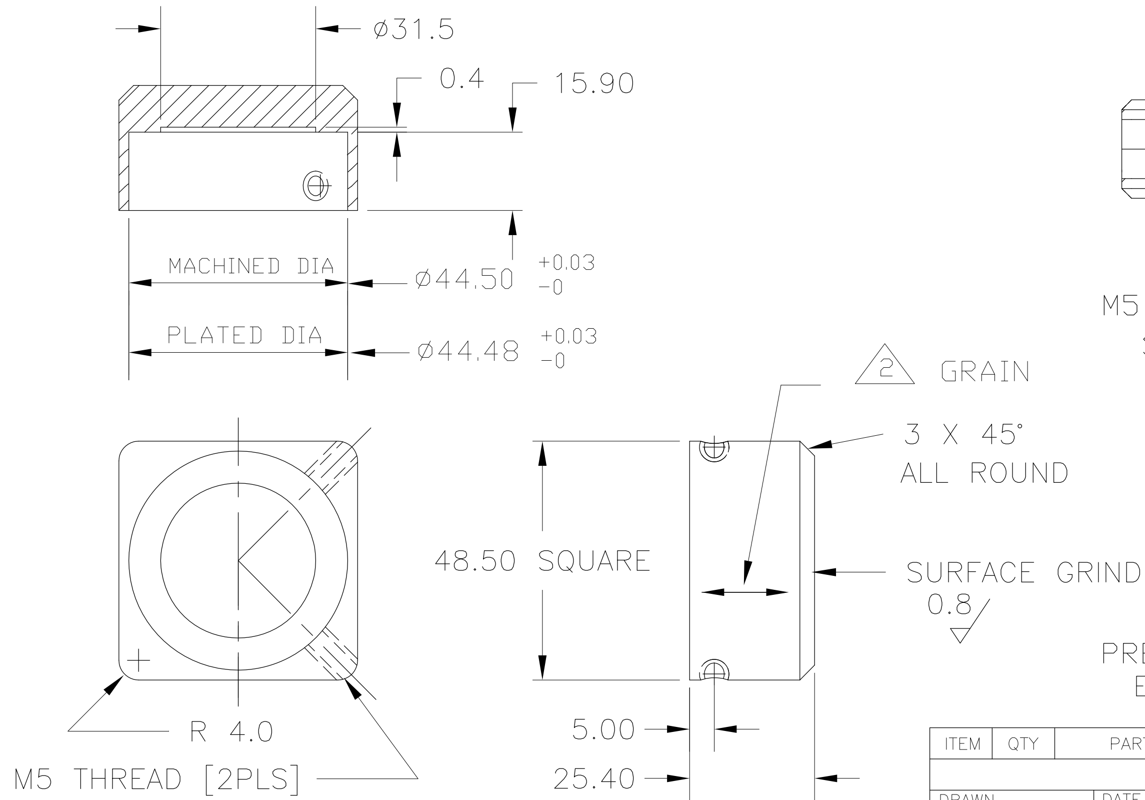
TITLE
POLE
MODEL: 3470

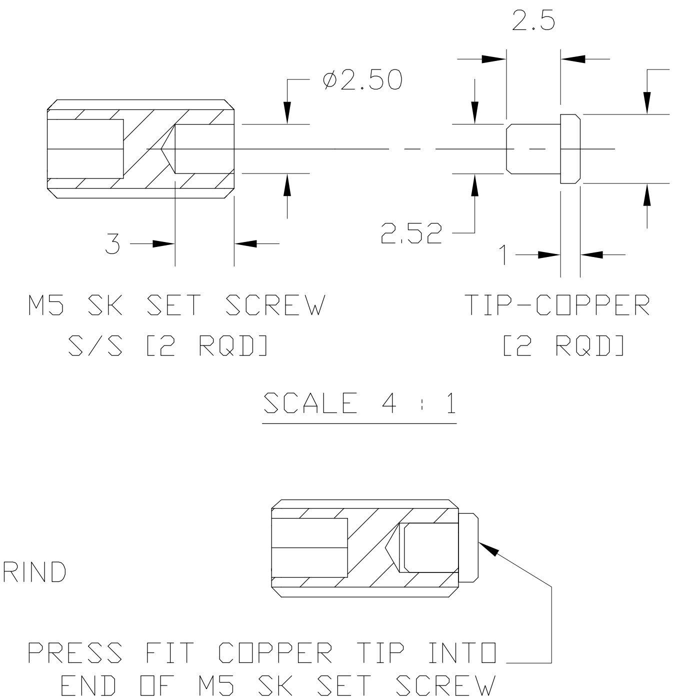
SIZE	DRAWING NO.	REV
A2	17801500	D

SCALE 1:1 | WT kg | SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/15/93	A.MARTIN
B	CHANGE SOCKET SET SCREW AND THREAD TO M5		04/27/94	G.DOUGLAS
C	ADD SET SCREW ASSEMBLY, SURF FINISH, NEW DIM 2.52		08/16/06	G.DOUGLAS





1. MATERIAL 1006 LOW CARBON PLATE
2. (△) CUT MATERIAL IN DIRECTION OF PLATE GRAIN AS INDICATED
3. REMOVE ALL SHARP EDGES 0.1 MAX.
4. EN PLATE 0.01 THICK TO BSL TP85800120

PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

DRAWN A.MARTIN	DATE 08/15/93
CHECK	DATE
ENGINEERING	DATE
11801470	3470
NEXT ASSY	SYSTEM

SOFTWARE
AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

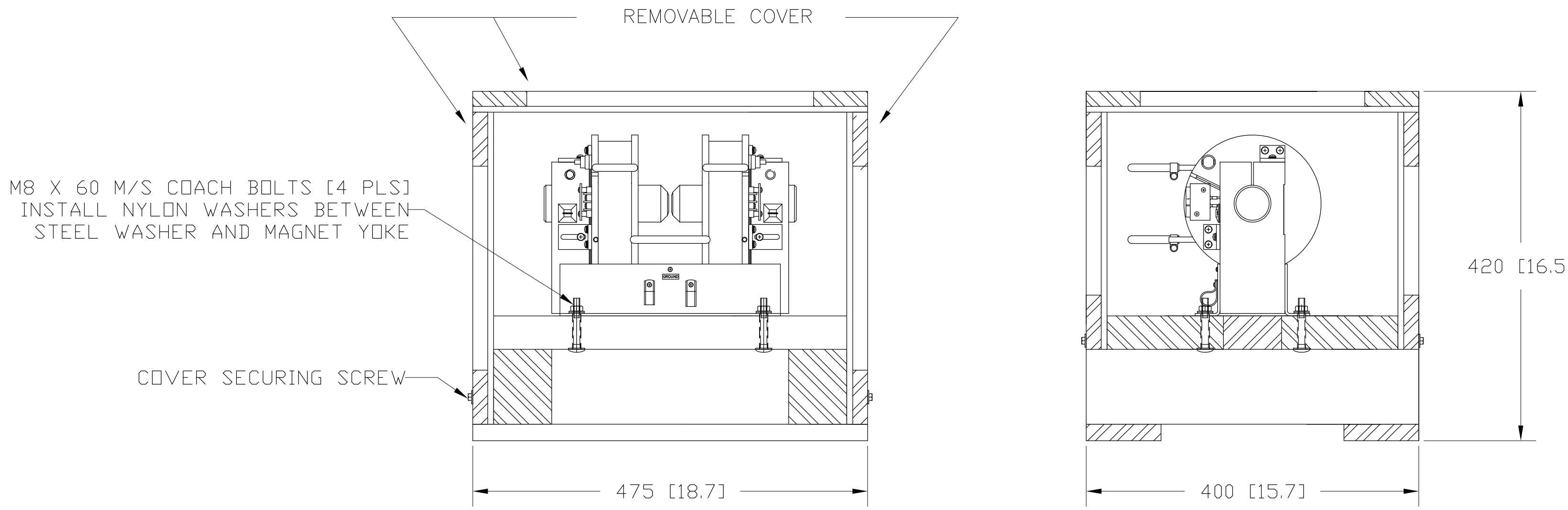
GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
SQUARE POLE CAP MODEL: 3470

SIZE	DRAWING NO.	REV
A3	17802760	C
SCALE 1:1	WT kg	SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		10/03/96	G.DOUGLAS
B	INCREASE SIZE OF PLANKING, CRATE, AND BOLT LENGTH		02/14/02	G.DOUGLAS



SHIPPING WEIGHT: 33 Kg [72 lbs]

NOTE:

1. THE 3470 SHIPPING CRATE HAS A ONE PIECE COVER

COVER REMOVAL:

1. REMOVE THE COVER SECURING SCREWS
2. GRIP THE COVER AT THE TOP LH AND RH CORNERS
3. LIFT THE COVER VERTICALLY HIGH ENOUGH TO CLEAR THE MAGNET
4. MOVE THE COVER SIDEWAYS AND PLACE ON FLOOR OR BENCH

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN	DATE
G.DOUGLAS	10/03/96
CHECK	DATE
ENGINEERING	DATE
3470	
NEXT ASSY	SYSTEM
SOFTWARE AUTOCAD 13	

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
SHIP CRATE ASSY
MODEL: 3470

SIZE	DRAWING NO.	REV
A2	18900391	B

SCALE 1:4 | WT kg | SHEET 1 OF 1