

WAGNER INDUSTRIES, INC.

Roll To Roll Manufacturing Line
Model #: R2R-1

Manufactured for Purdue University

Manufactured by:
Wagner Industries, Inc.
51 Sparta Road
Stanhope, NJ 07874
(973) 347-0800
(973) 347-0885

Serial #: H3859

Ship Date: April 18, 2018

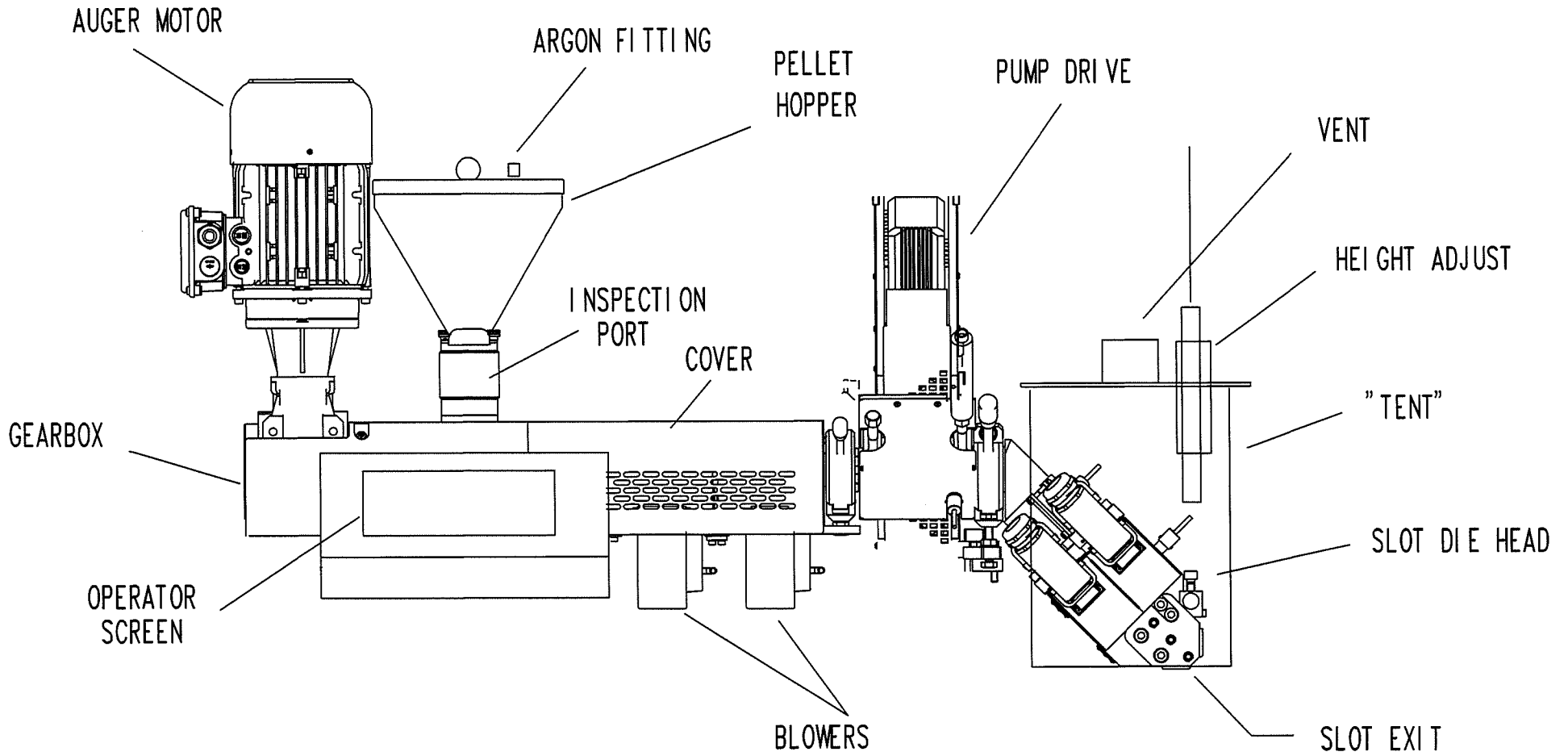
WAGNER MODEL R2R-1
S/N H3859
INDEX

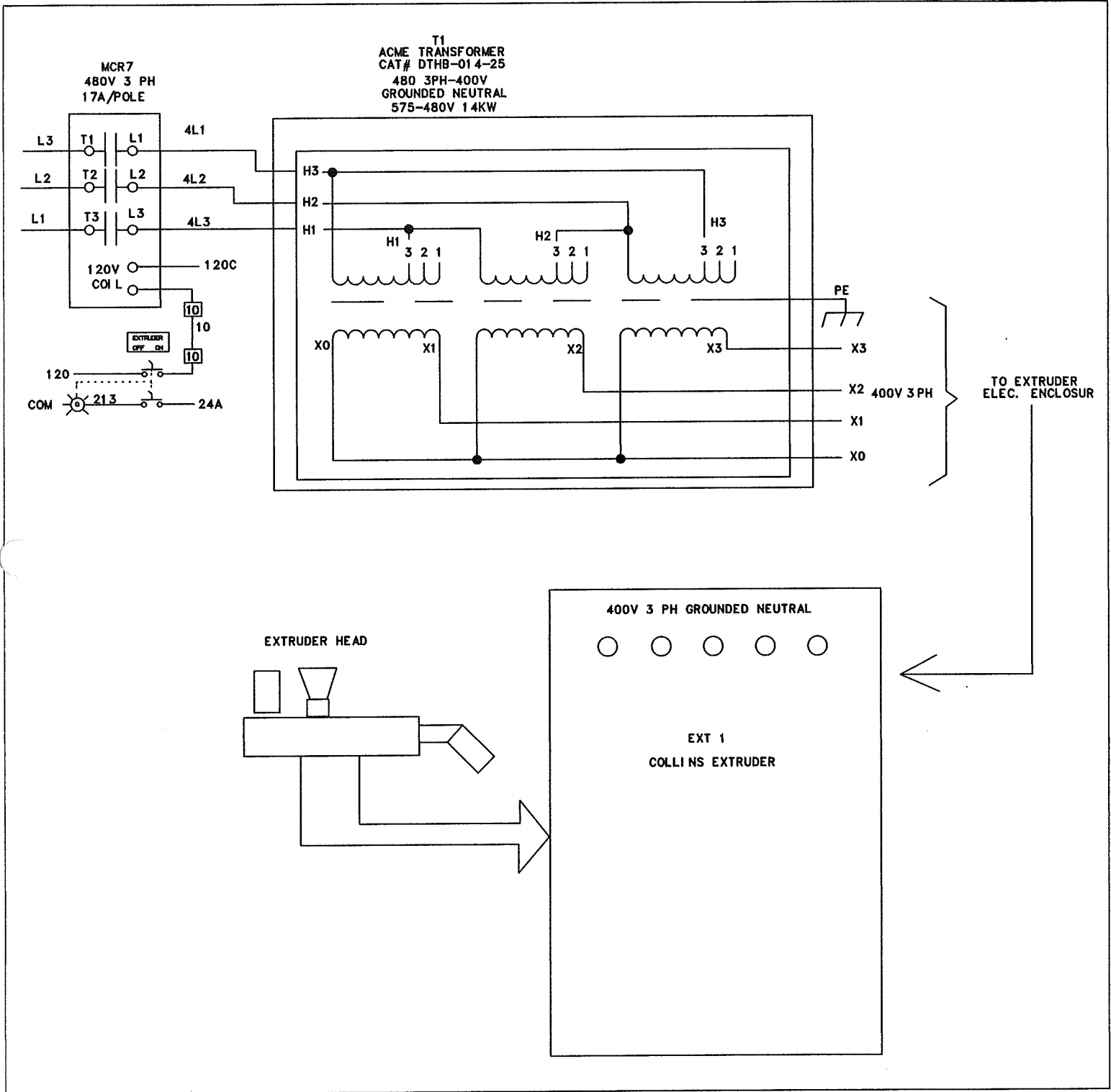
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SEC 5	E-SPIN CABINET
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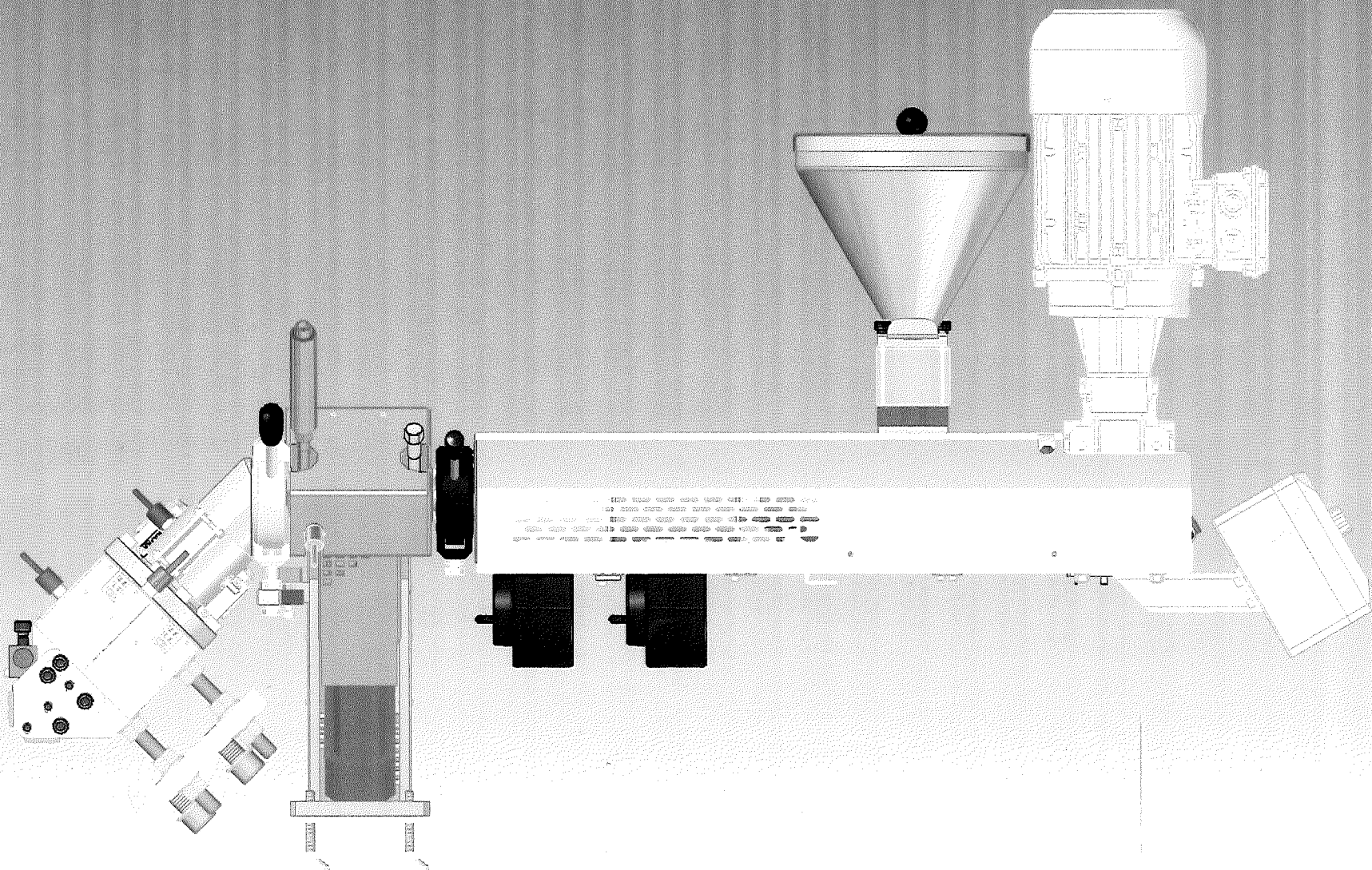
CH 6

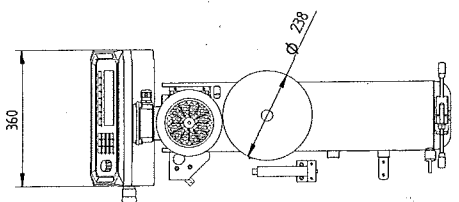
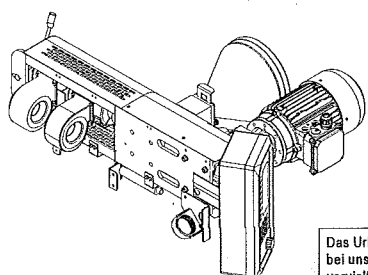
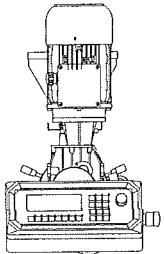
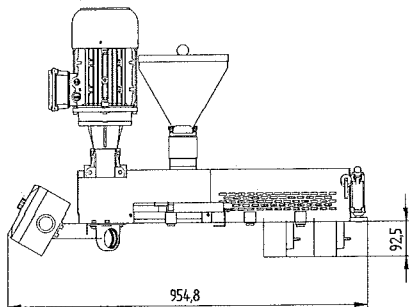
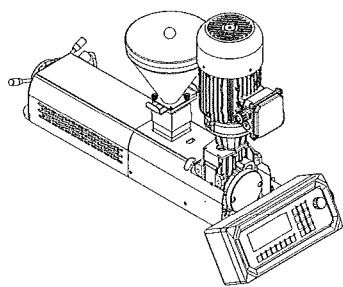
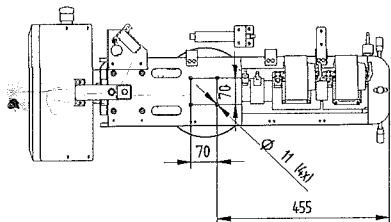
EXTRUDER

SEC 6A









Maßangaben in mm
dimensions in mm
dimensions en mm

Technische Änderungen vorbehalten
Technical changes reserved
Sous réserve de modifications techniques

Das Urheberrecht an dieser Zeichnung verbleibt bei uns; sie darf ohne unsere Genehmigung weder vervielfältigt noch Dritten zugänglich gemacht werden. Zuwiderhandlungen sind strafbar und verpflichten zu Schadenersatz. Alle sonstigen Rechte, insbesondere Patent- und Gebrauchsmusterrechte vorbehalten.

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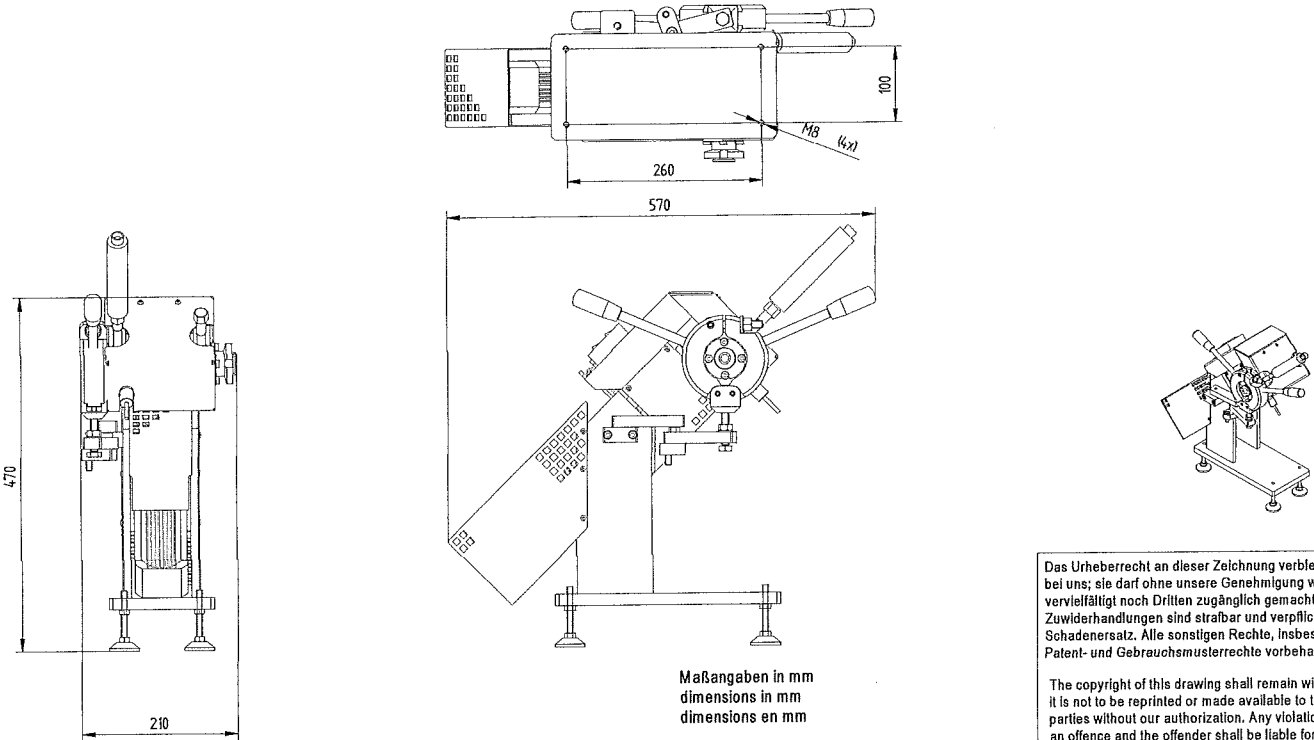
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	DIN EN ISO 13920 AE			(Werkstoff / material)		
				siehe Stückliste / refer to parts list		
H		Datum	Name	(Benennung / title)		
G		Bearb.	21.10.2014	TL Extruder 16 mm x 25 D, sonder / PUR		
F		Gepüfht				
E						
D						
C						
B						
A						
Zust.	Änderung / modification	Datum	Name (Urspr: --)	(Zeilchennummer / drawing number)	9110-16066-01	Blatt 1 / 1
				(Ers. 1: --)		(Ers. 2: --)



9110-16066-01

Blatt 1 / 1

A3



Maßangaben in mm
dimensions in mm
dimensions en mm

Technische Änderungen vorbehalten
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Sous réserve de modifications techniques

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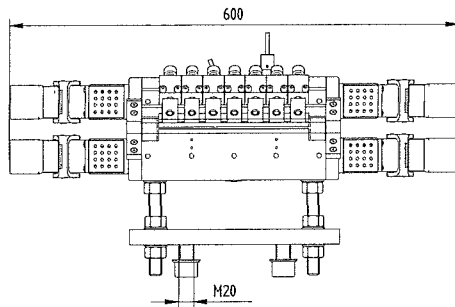
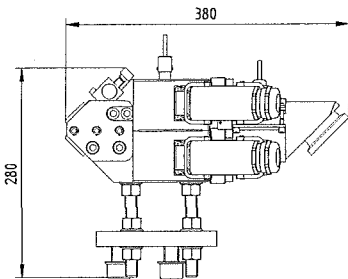
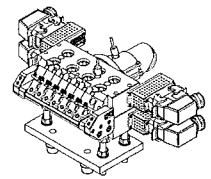
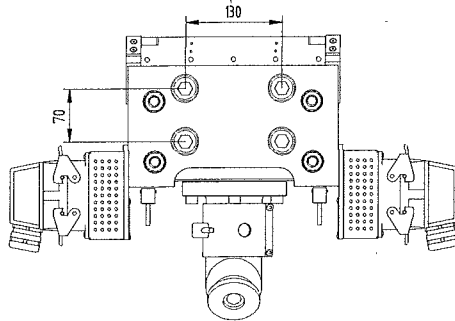
Dr. Collin GmbH, Ebersberg, Germany

(Zul.Äbw.)	DIN ISO 2768 mK DIN EN ISO 13920 AE	(Verwendungsbereich)	(Oberfläche)	Maßstab / scale 1:5 (Werkstoff / material) siehe Stückliste / refer to parts list (Benennung / title)	00052hp/igs/ndert/28.11.2013	
H	-	-	-	Schmelzepumpe 1,2 cm ³ /U / PURDW		
G	-	Bearb.	11.11.2016			frey
F	-	Geprüft				
E	-					
D	-					
C	-					
B	-					
A	-					
Zust.	Änderung / modification	Datum	Name	(Übers.)	(Erz.)	



(Zeichnungsnummer / drawing number) 3810-16066-01 Blatt 1 / 1

A3



Maßangaben in mm
dimensions in mm
dimensions en mm

Technische Änderungen vorbehalten
Technical changes reserved
Sous réserve de modifications techniques

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(ZulÄbw.)	DIN ISO 2768 mK	(Verwendungsbereich)	(Oberfläche)	Maßstab / scale 1:5	06052hp/gst/ndat 28.11.2013
	DIN EN ISO 13920 AE			(Werkstoff / material)	
				siehe Stückliste / refer to parts list	
H	-	Datum	Name	(Benennung / title)	
G	-	Bearb. 10.10.2018	hfreystetter	Mono-BS-Düse 200mm	
F	-	Geprüft 11.10.2018	Kloning		
E	-	-	-		
D	-	-	-		
C	-	-	-		
B	-	-	-	(Zeichnungsnummer / drawing number)	
A	-	-	-	0250-16066-01	
Text Änderung / modification		Datum	Zeichner (Übrprf: --)	(Ers.Z: --)	(Ers.A: --)

Dr. Collin GmbH

Sportparkstraße 2
85560 Ebersberg (Germany)

Tel.: +49 (0)8092/2096-0



LAB & PILOT SOLUTIONS

Customer : Purdue University
 Commission : 16066 PURDWE
 Drawing Number : 9110-16066-01E
 Type : TL-Extruder 16mm x 25 D E 20 T-H

Plant :
Specifications :

CAE-VERSION: EPlan P8 2.6.3

Date
Checked

No. The Pages : 49



Proj..	FREINBERGER	chang.	08.02.2017
Date	01.09.2016	Proj..	TRAGER
		Purdue University	

Title

Function
Titel- / Deckblatt:

Page No.
1

Machine-No.
9110-16066-01E

Informations about modifications

Modifications	Page	Path	Device Tag	Date	Name

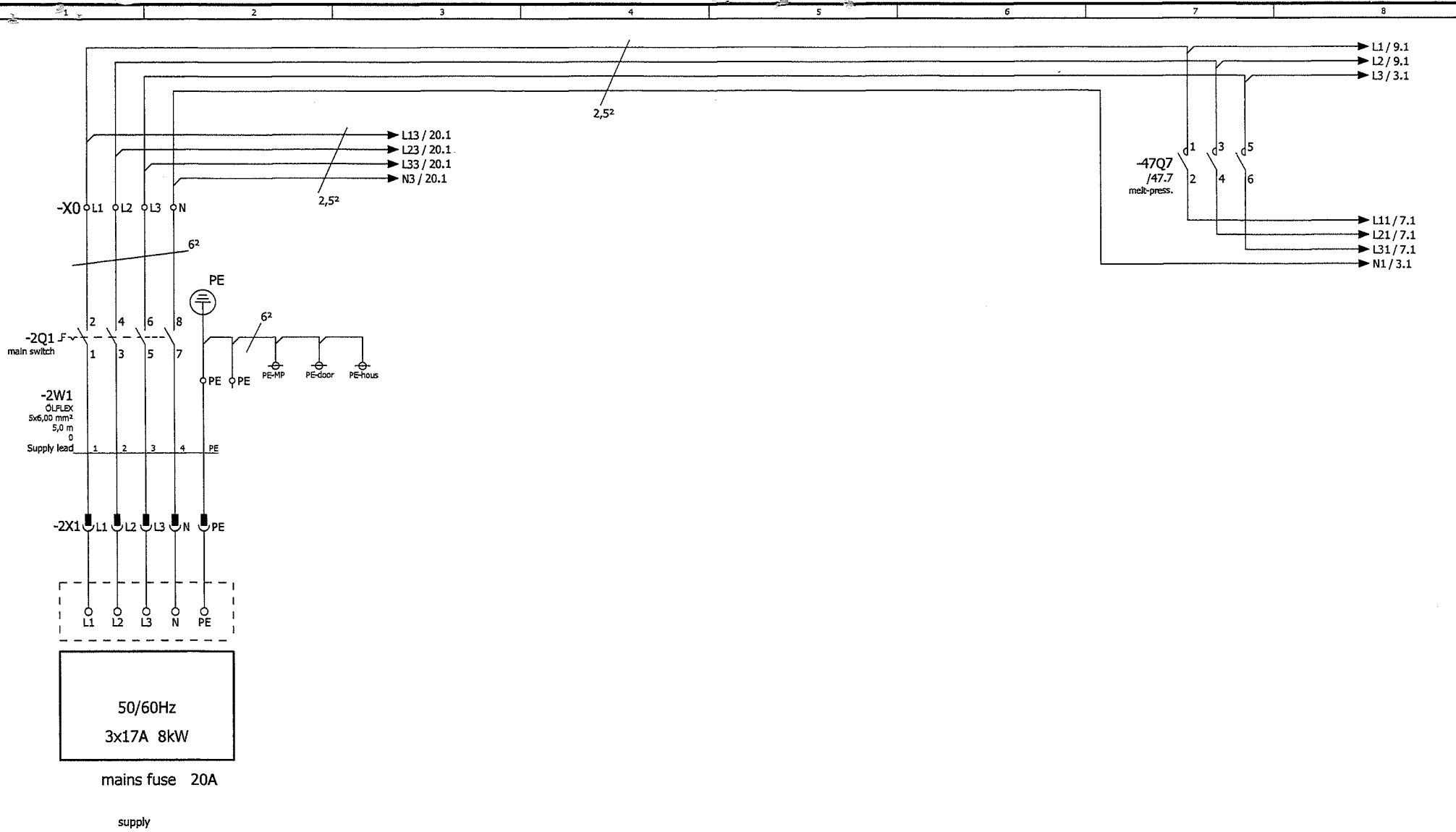


Proj..	FREINBERGER	chang.	08.02.2017
Date	01.09.2016	Proj..	TRAGER
		Purdue University	

Title

Function
Informations about modifications

Page No.	Machine-No.
1.1	9110-16066-01E



- For use on a solidly grounded wye source only
- overcurrent protection required in input line
- residual current protection only AC/DC sens. RCCBs Type "B" admissible

-2A1 [] -2A2 []



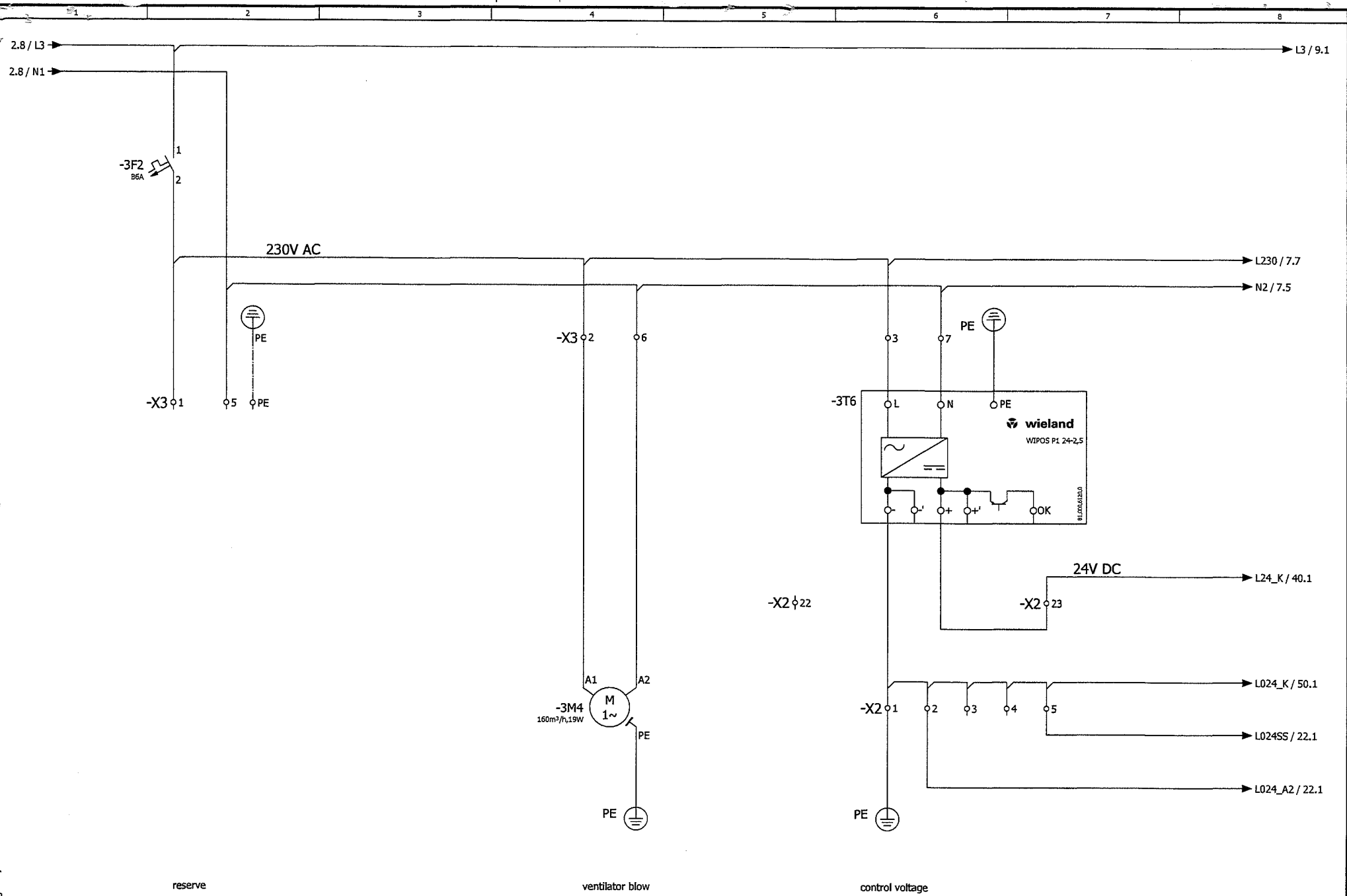
Proj..	FREINBERGER	chang.	08.02.2017
Date	01.09.2016	Proj..	TRAGER
		Purdue University	

Title

Function supply

Page No. 2

Machine-No. 9110-16066-01E



reserve

ventilator blow

control voltage



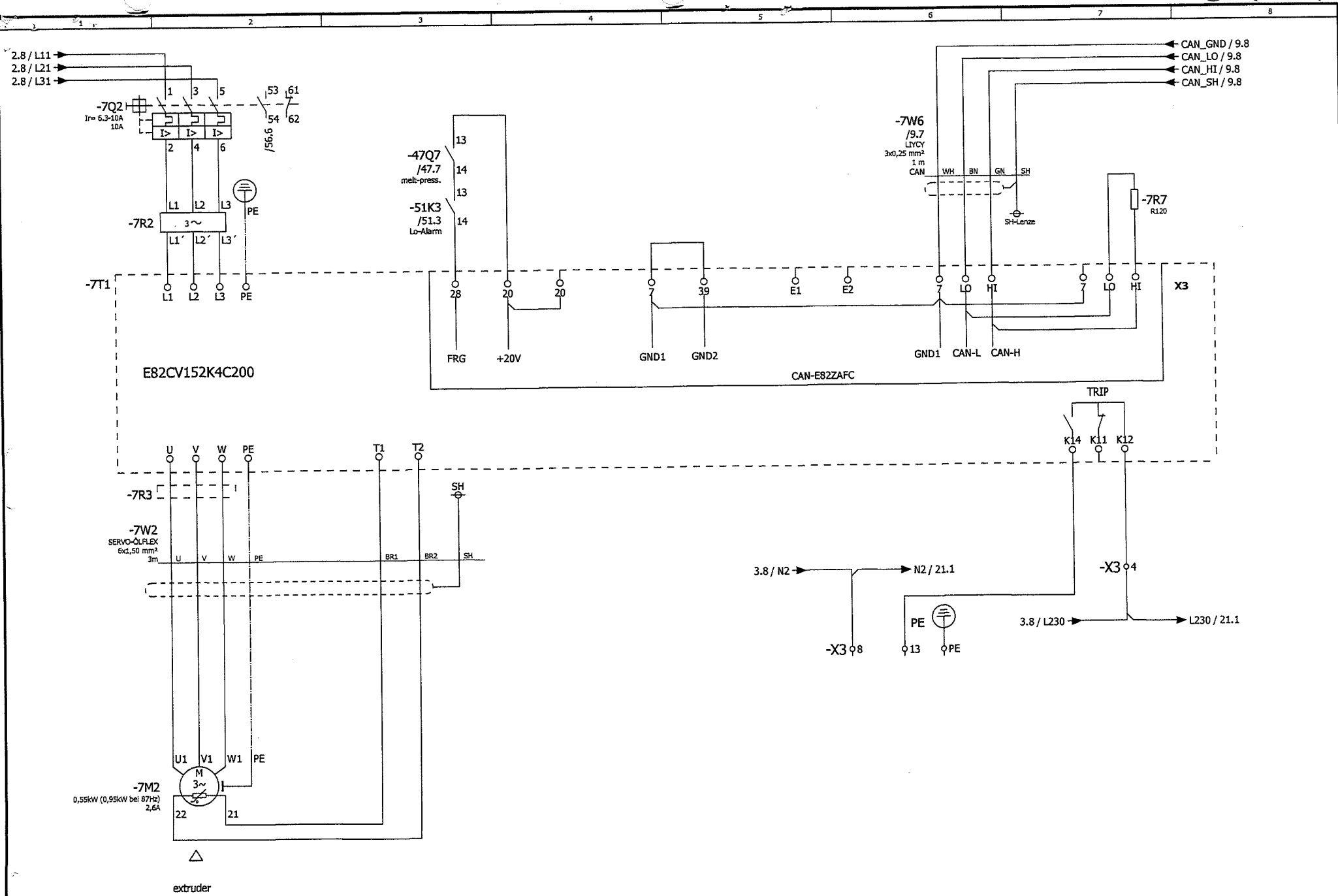
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			Purdue University

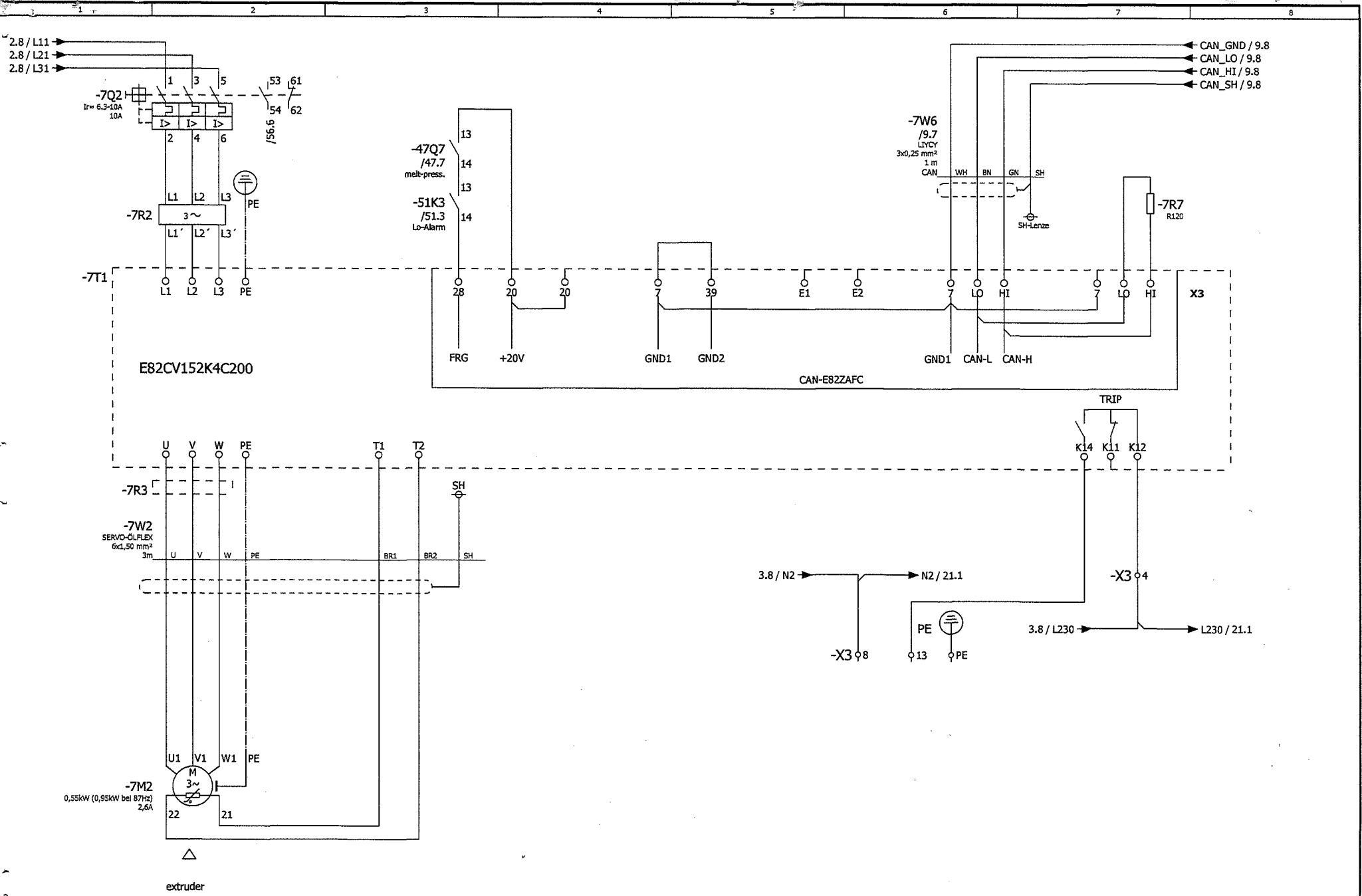
Title

Function
control voltage

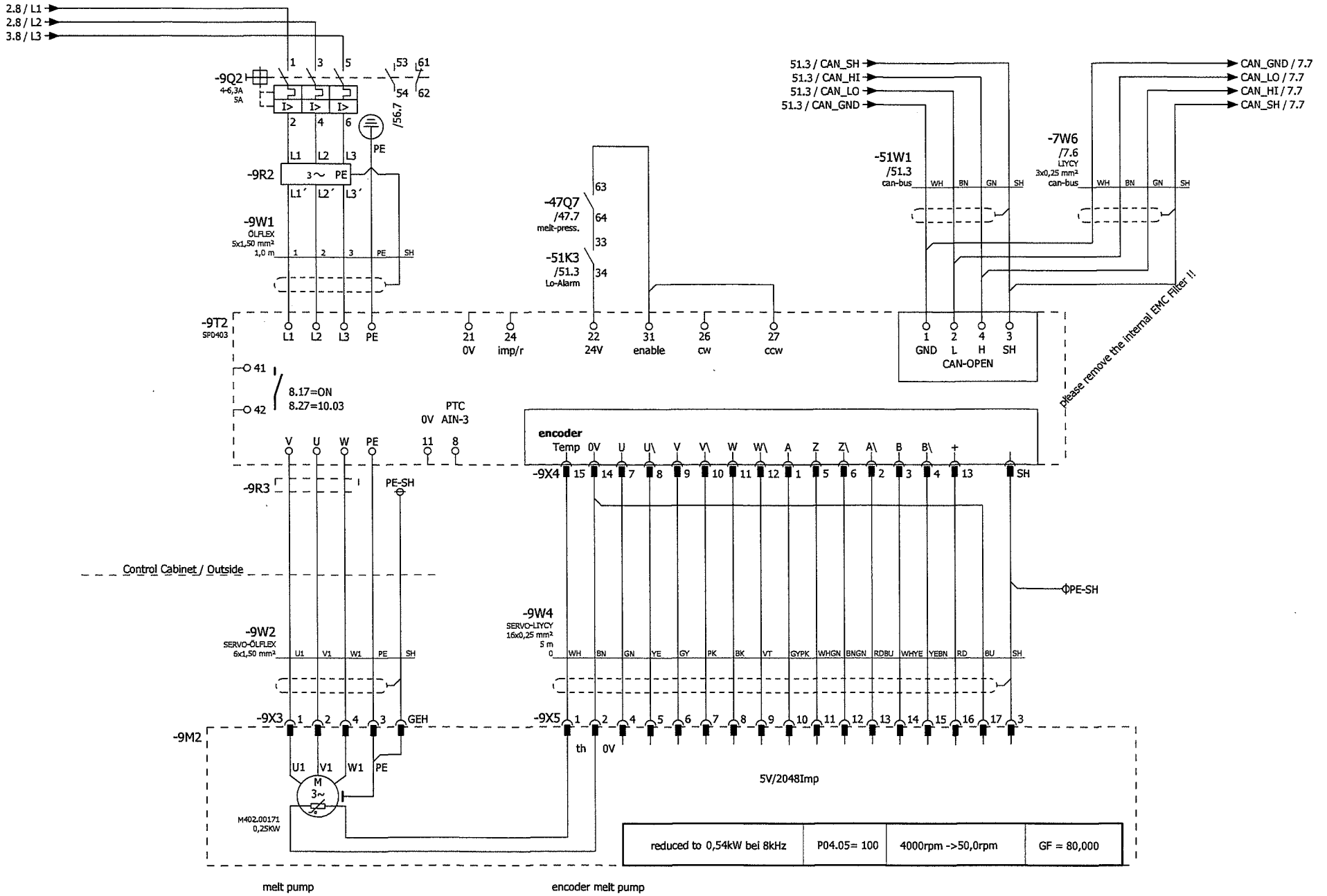
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Machine-No.
9110-16066-01E





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	Purdue University							



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	Purdue University							

2.3 / L13 →
 2.3 / L23 →
 2.3 / L33 →
 2.3 / N3 →

-47Q2
 /47.2
 load-heating

-20T6

-20W7
 /55.4
 LYCY
 2x0,25 mm²
 2,0 m

L12 / 22.1
 L22 / 22.1
 L32 / 22.1
 I+ / 55.7
 I- / 55.7
 I_SH / 55.7
 N_heat / 22.1

heating current



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Date	01.09.2016	Proj..	TRAGER
			Purdue University

Title

Function
 heating control

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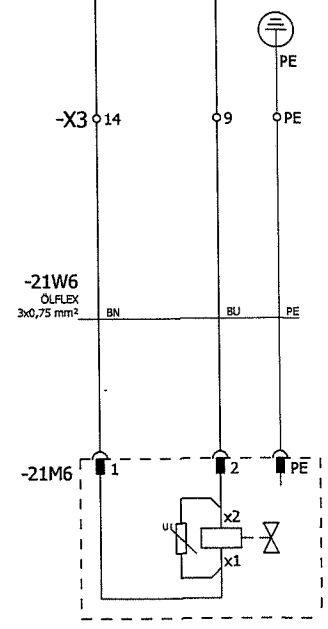
Machine-No.
 9110-16066-01E

7.7 / L230 →
7.6 / N2 →

L230 / 22.1
N2 / 22.1

53
-47Q2 /47.2
load-heating
54
11
-54K1 /54.1
cooling zone 1
14 12

-X3 φ25 φ26 φ27 φ28 φ29 φ30 φPE



-21W6
OLIFLEX
3x0,75 mm²
BN BU PE

-21M6 1 2 PE

take in
cooling Zone 1

reserve



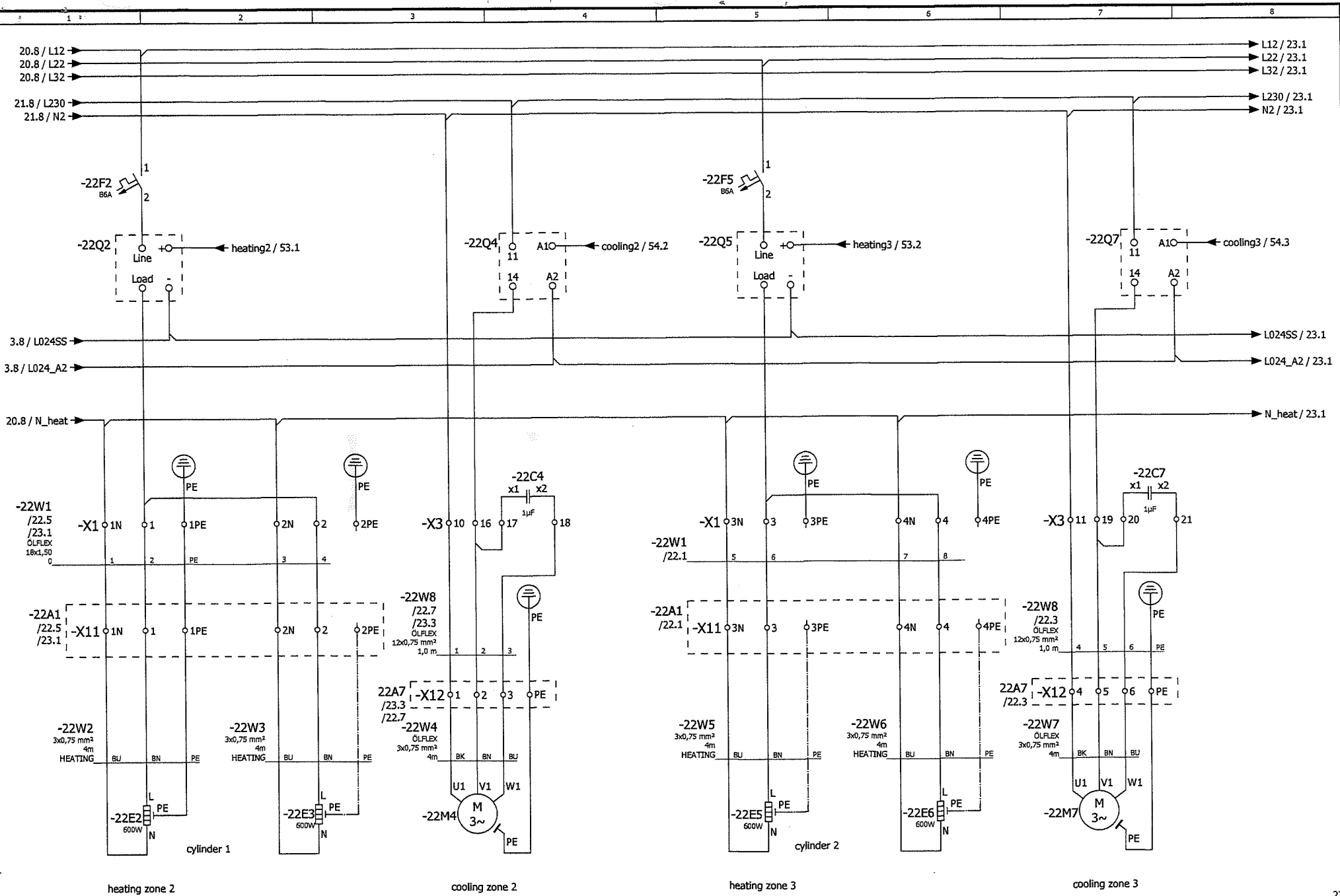
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Title

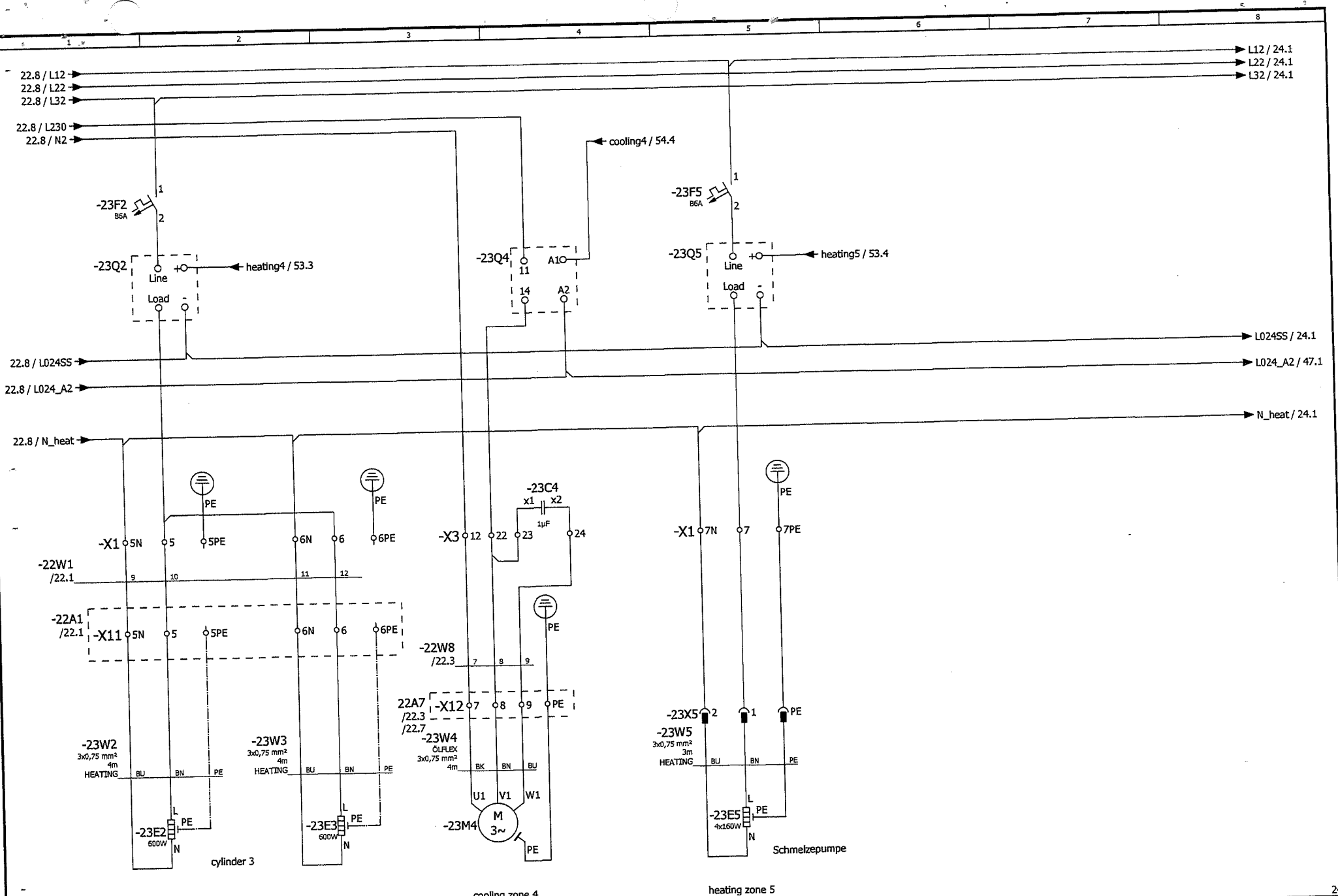
Function.
heating control

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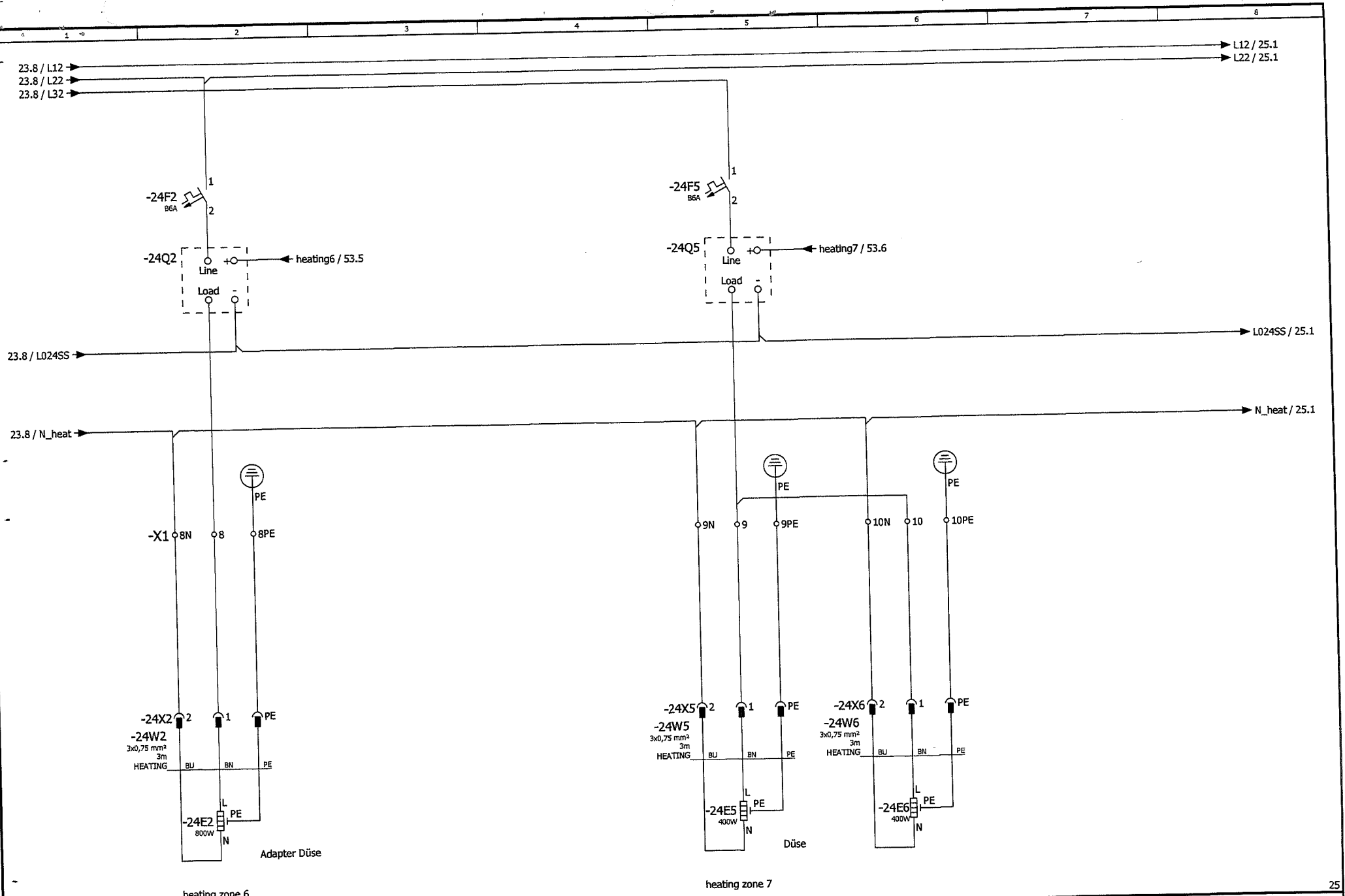
Machine-No.
9110-16066-01E



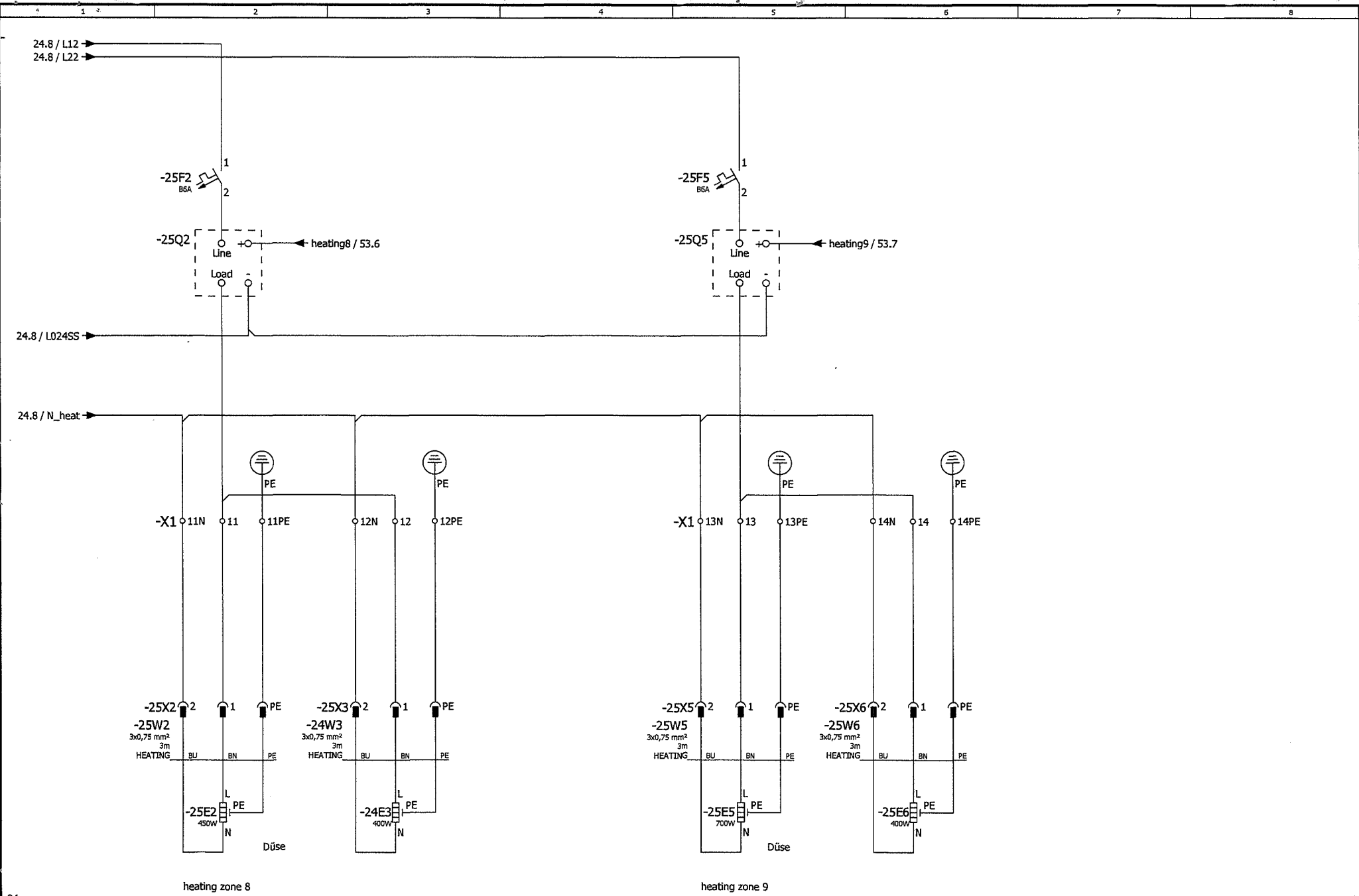
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		Purdue University					



 LAB & PILOT SOLUTIONS	Proj.. FREINBERGER Date 01.09.2016	chang. 08.02.2017 Proj.. TRAGER Purdue University	Title	Function heating control	Page No. 23	Machine-No. 9110-16066-01E
	22					
	24					



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		Purdue University				

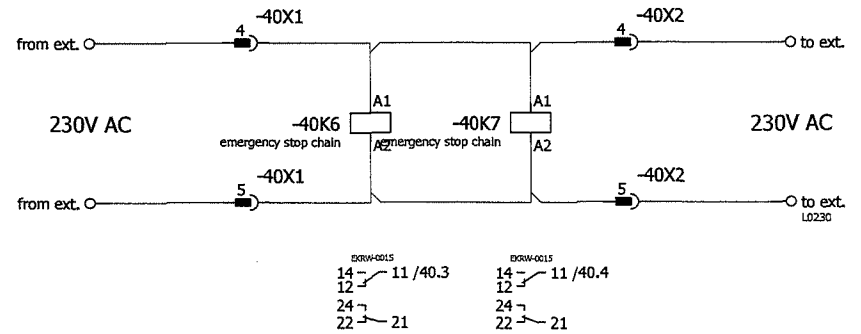
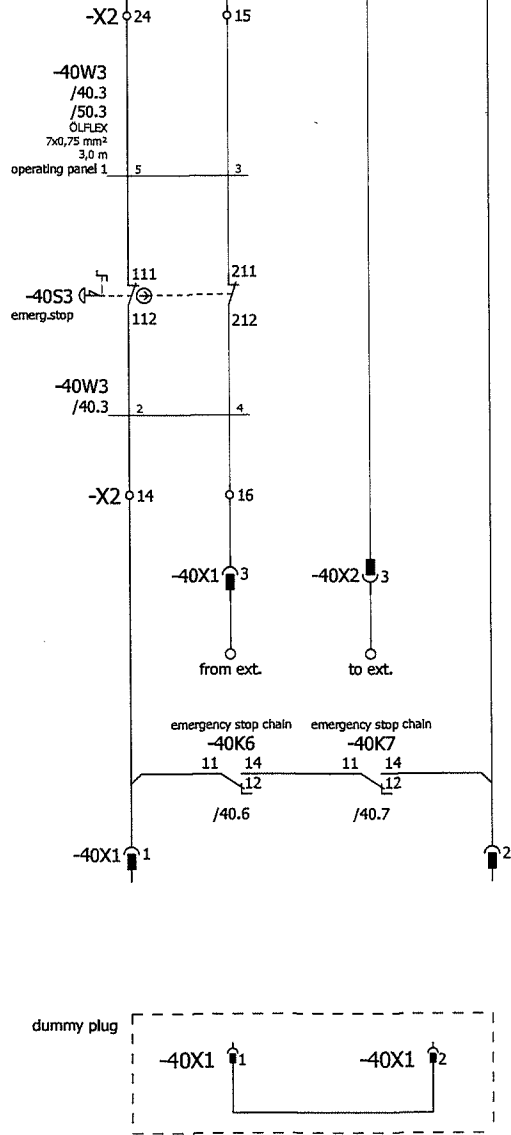


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	Purdue University										

3.8 / L24_K ->

L24_K / 50.1

em_off_OK / 47.1



emergency stop chain

40.8 / em_off_OK

em_off_OK / 56.1

-54K6
/54.6
load-heating

11
14 12

SYS_AI / 51.1

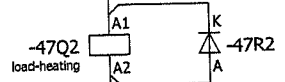
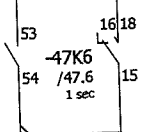
system fault/Hi-alarm

HI_AI_B4 / 51.1

pmax / 80.5

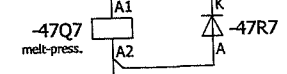
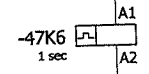
-47Q7
/47.7
melt-press.

-47K6
/47.6
1 sec

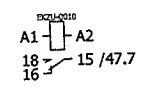


23.8 / L024_A2

L024_A2 / 51.1



- 1 ↔ 2 /20.2
 - 3 ↔ 4 /20.2
 - 5 ↔ 6 /20.2
 - 7 ↔ 8 /20.3
 - 53 ↔ 54 /21.6
 - 63 ↔ 64
 - 73 ↔ 74
 - 83 ↔ 84
- load-heating



1 sec

- 1 ↔ 2 /2.7
 - 3 ↔ 4 /2.7
 - 5 ↔ 6 /2.7
 - 13 ↔ 14 /7.3
 - 53 ↔ 54 /47.7
 - 63 ↔ 64 /9.4
 - 73 ↔ 74 /56.2
 - 83 ↔ 84
- melt-press.

40

50



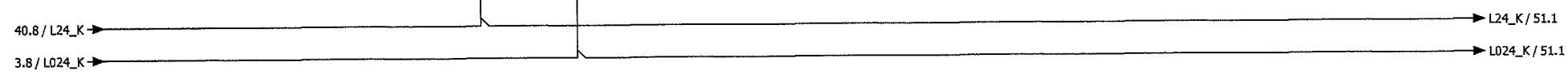
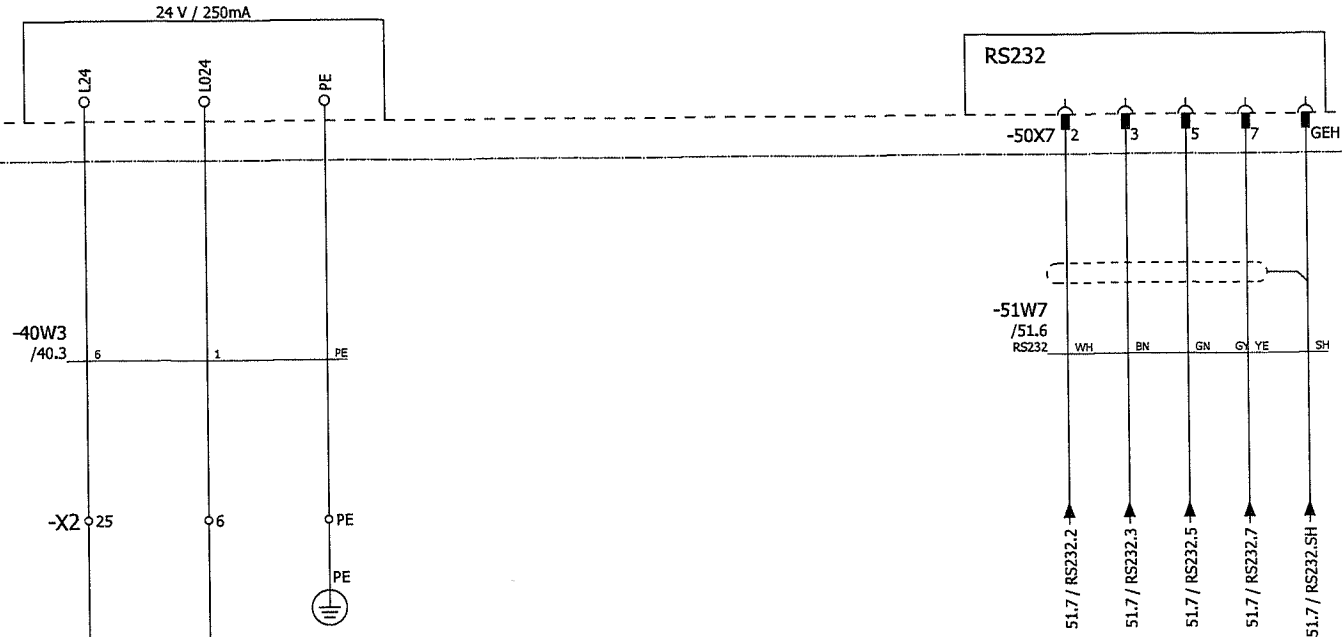
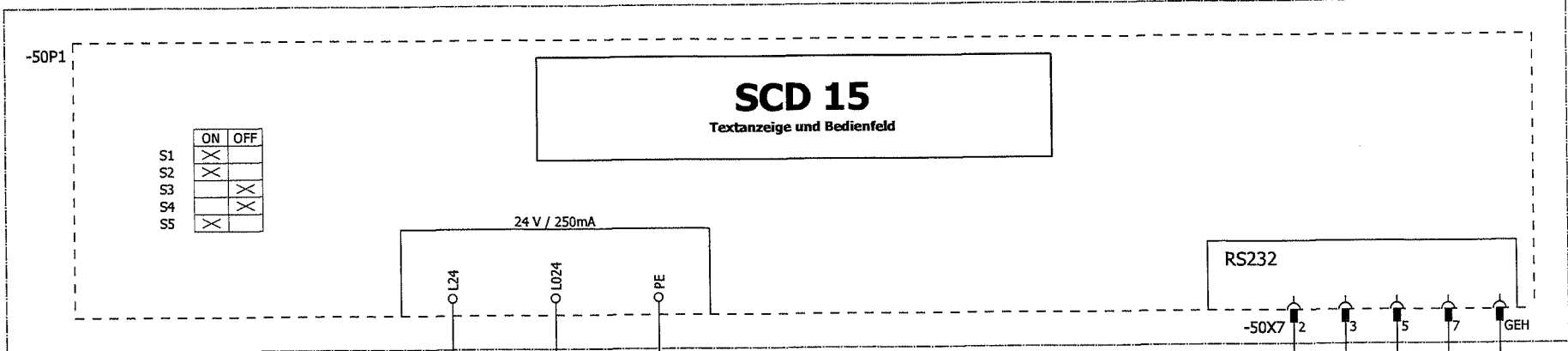
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Date	01.09.2016	Proj..	TRAGER
			Purdue University

Title

Function control

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Last change: 27.02.2014



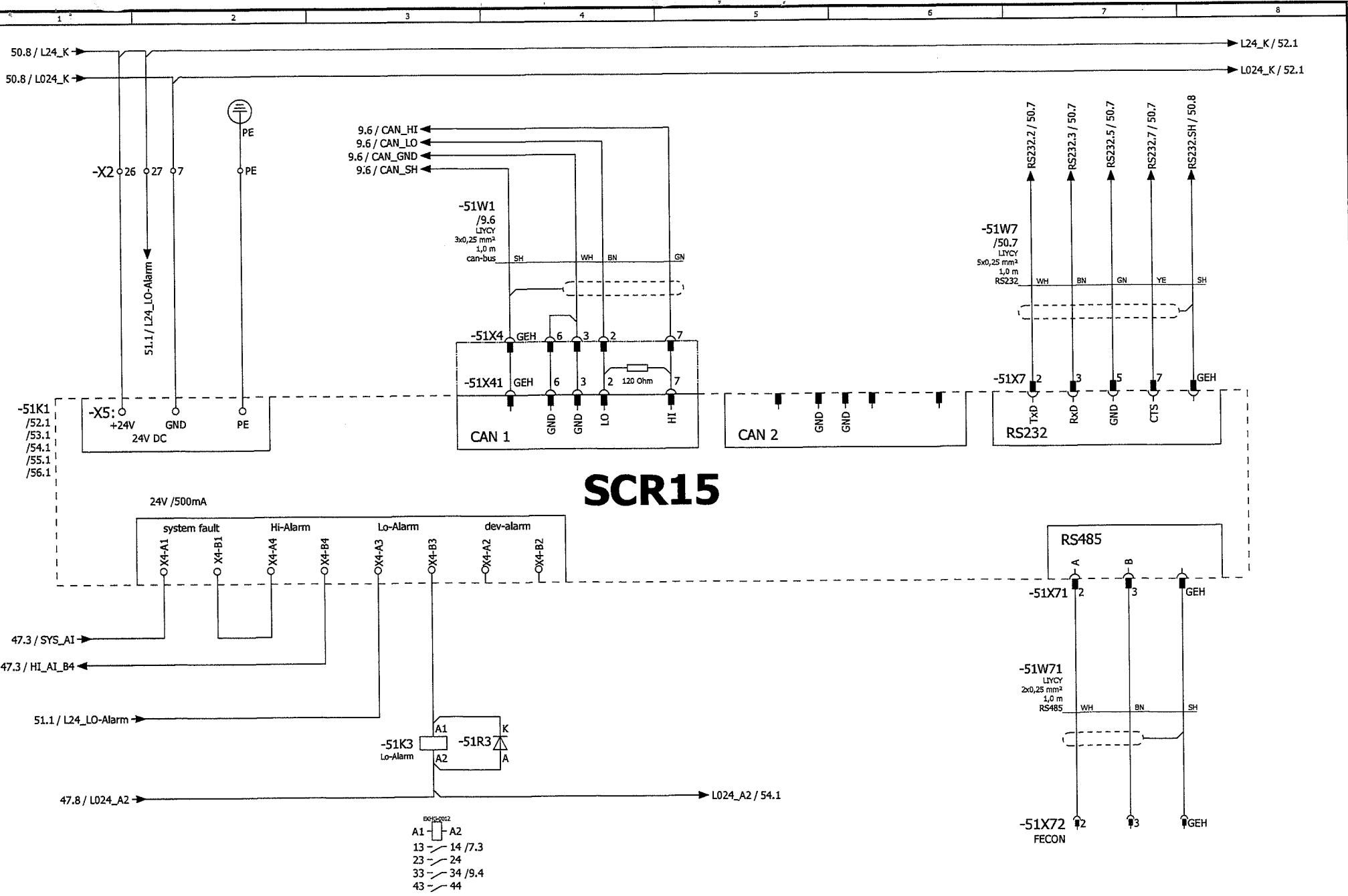
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Date	01.09.2016	Proj..	TRAGER
			Purdue University

Title

Function
SCD

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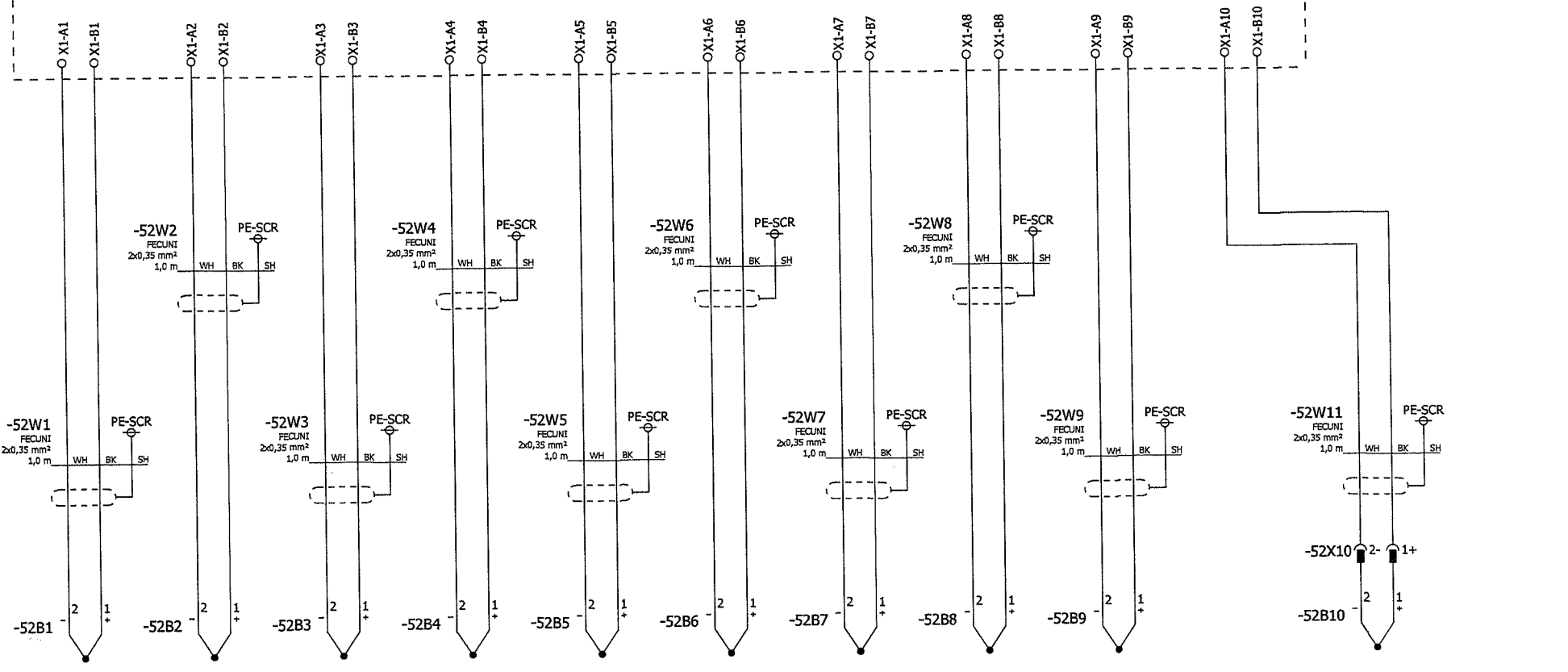
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51.8 / L24_K →
 51.8 / L024_K →

-X2 28 8

-51K1 / 51.1

Temperatur Messeingänge SCR 15



thermo zone 1 thermo zone 2 thermo zone 3 thermo zone 4 thermo zone 5 thermo zone 6 thermo zone 7 thermo zone 8 thermo zone 9 melt temperature

COLLIN <small>LAB & PILOT SOLUTIONS</small>	Proj.. FREINBERGER	chang. 08.02.2017	Title	Function temperature measurement	Page No.	Machine-No.
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52.8 / L024_K →

→ L024_K / 54.1

-51K1 / 51.1

Digitalausgänge 8 x 24V / 0,07A SCR 15

OX2-A1

22.2 / heating2

OX2-A2

22.5 / heating3

OX2-A3

23.2 / heating4

OX2-A4

23.5 / heating5

OX2-A5

24.2 / heating6

OX2-A6

24.5 / heating7

OX2-A7

25.2 / heating8

OX2-A8

25.5 / heating9

-X2 09

X2-A9 0



Proj..	FREINBERGER	chang.	08.02.2017
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			Purdue University

Title

Function
SCR15 digital outputs

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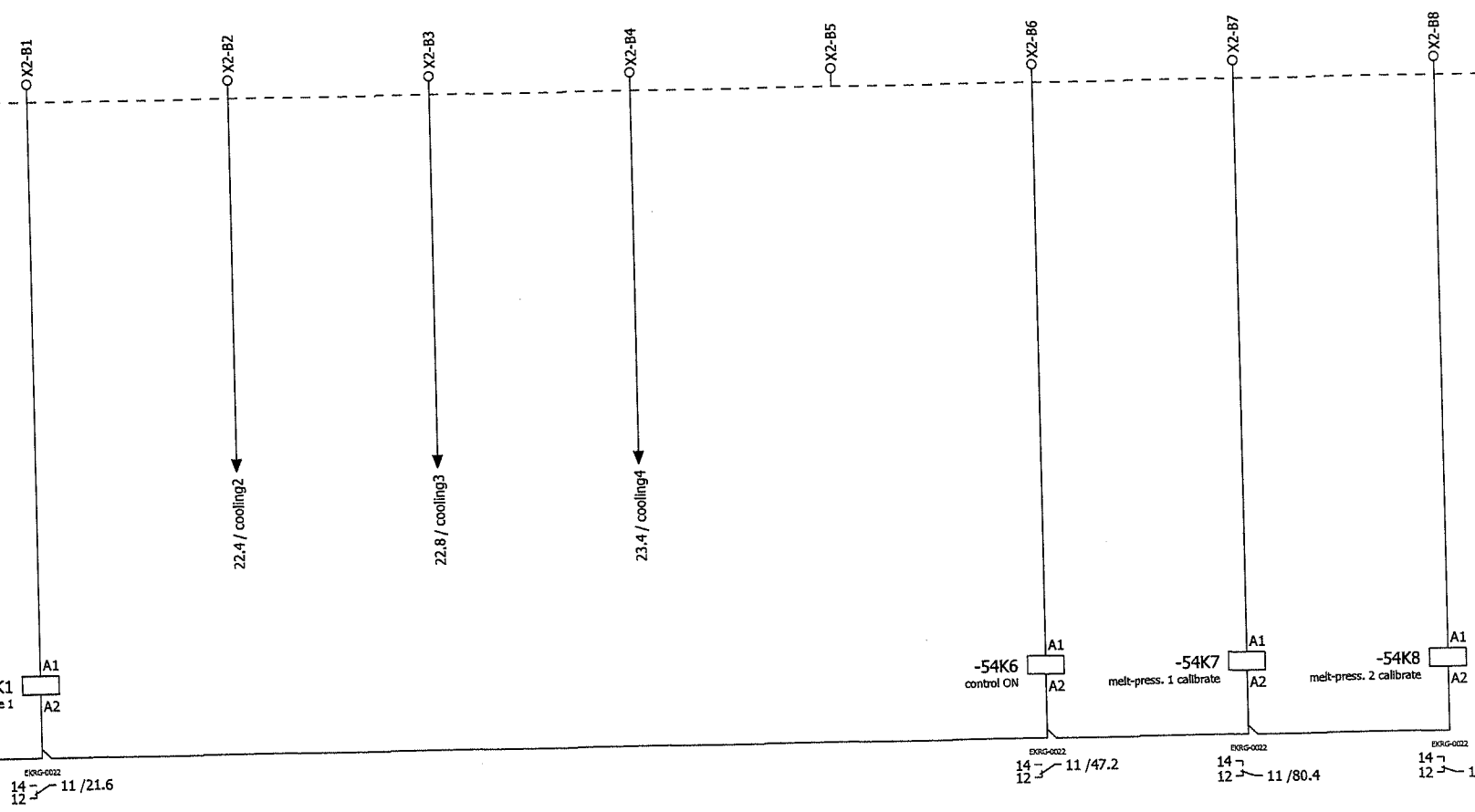
Machine-No.
9110-16066-01E

53.8 / L024_K

L024_K / 56.1

-51K1 / 51.1

Digitalausgänge 8 x 24V / 0,07A SCR 15



51.5 / L024_A2
EXIG-0022
14 11 / 21.6
12

EXIG-0022
14 11 / 47.2
12

EXIG-0022
14 11 / 80.4
12

EXIG-0022
14 11 / 80.7
12

cooling zone 1

cooling zone 2

cooling zone 3

cooling zone 4

malfunction

control ON

melt-press. 1 calibrate

melt-press. 2 calibrate

55



Proj..	FREINBERGER	chang.	08.02.2017
Date	01.09.2016	Proj..	TRAGER
			Purdue University

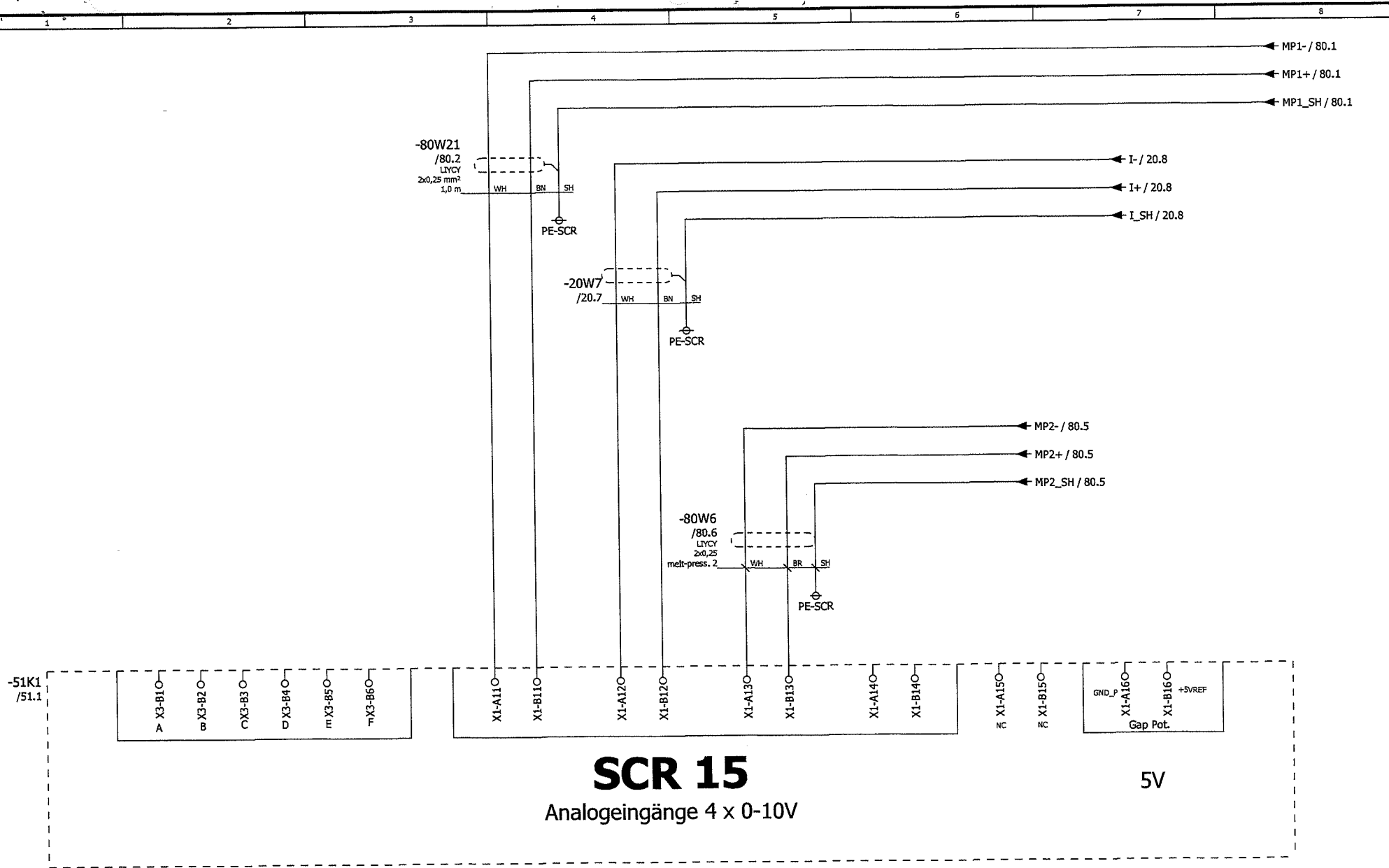
Title

Function
SCR15 digital outputs

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Last change: 27.02.2014

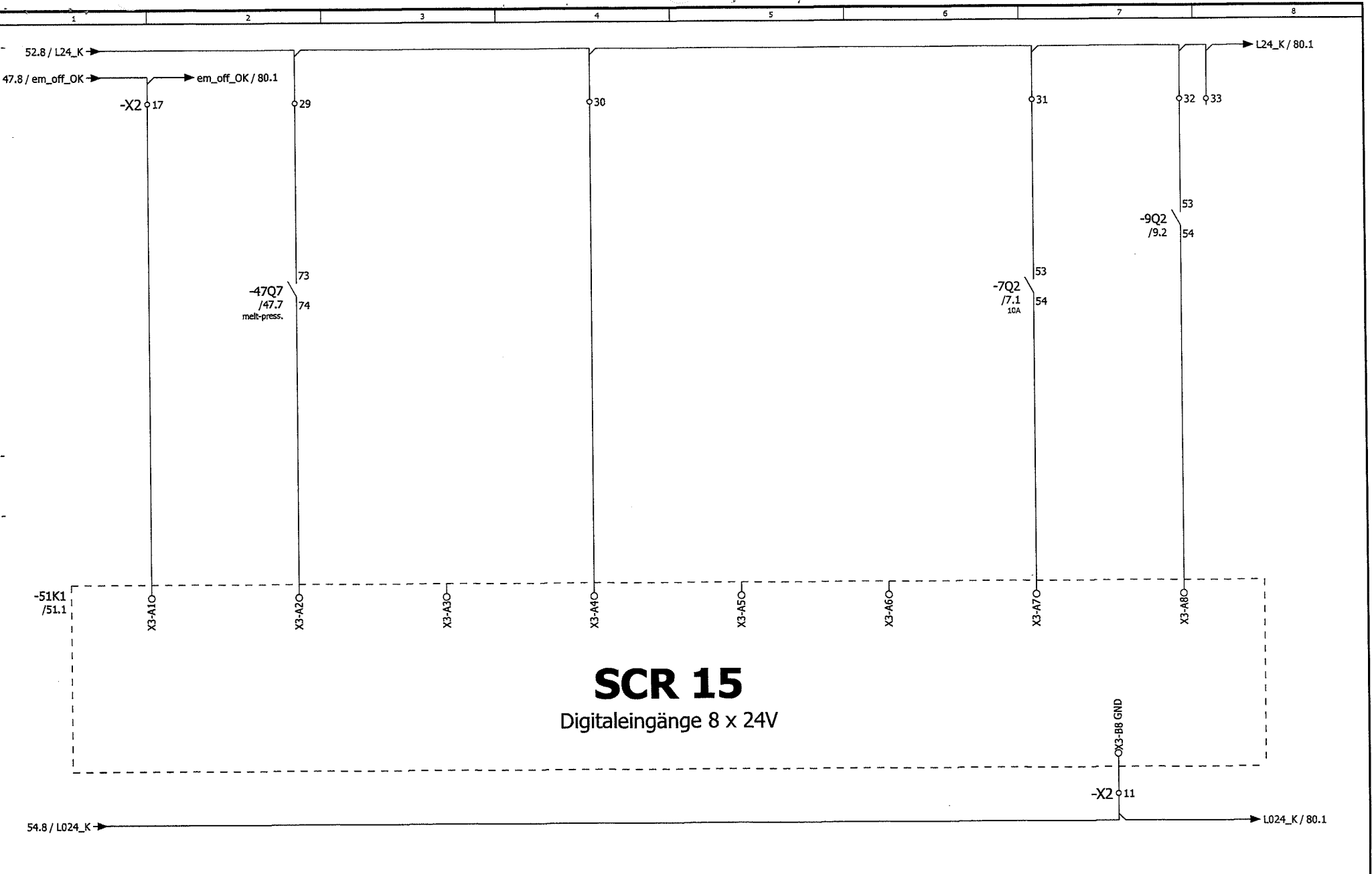


SCR 15

Analogeingänge 4 x 0-10V

melt-press. 1 heating current melt-press. 2

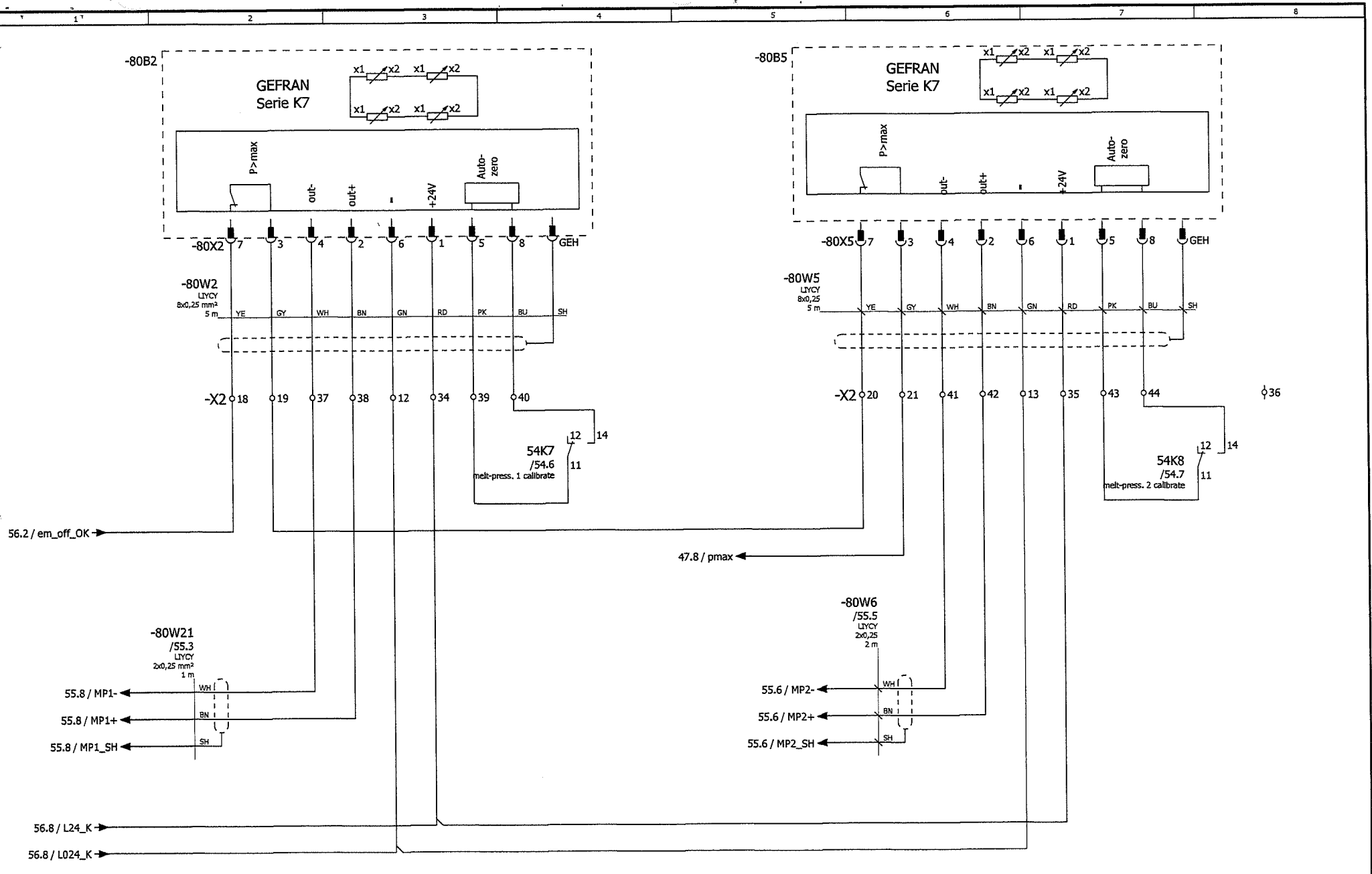
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	Date	01.09.2016	Proj..	TRAGER				
	Purdue University							



SCR 15

Digitaleingänge 8 x 24V

55	emerg.stop	melt-press. 1	level	release screw	release melt pump	80
		Proj.. FREINBERGER Date 01.09.2016	chang. 08.02.2017 Proj.. TRAGER Purdue University	Title	Function SCR 15 digital input	Page No. 56 Machine-No. 9110-16066-01E



56.2 / em_off_OK →

47.8 / pmax ←

55.8 / MP1- ←

55.8 / MP1+ ←

55.8 / MP1_SH ←

56.8 / L24_K →

56.8 / L024_K →

55.6 / MP2- ←

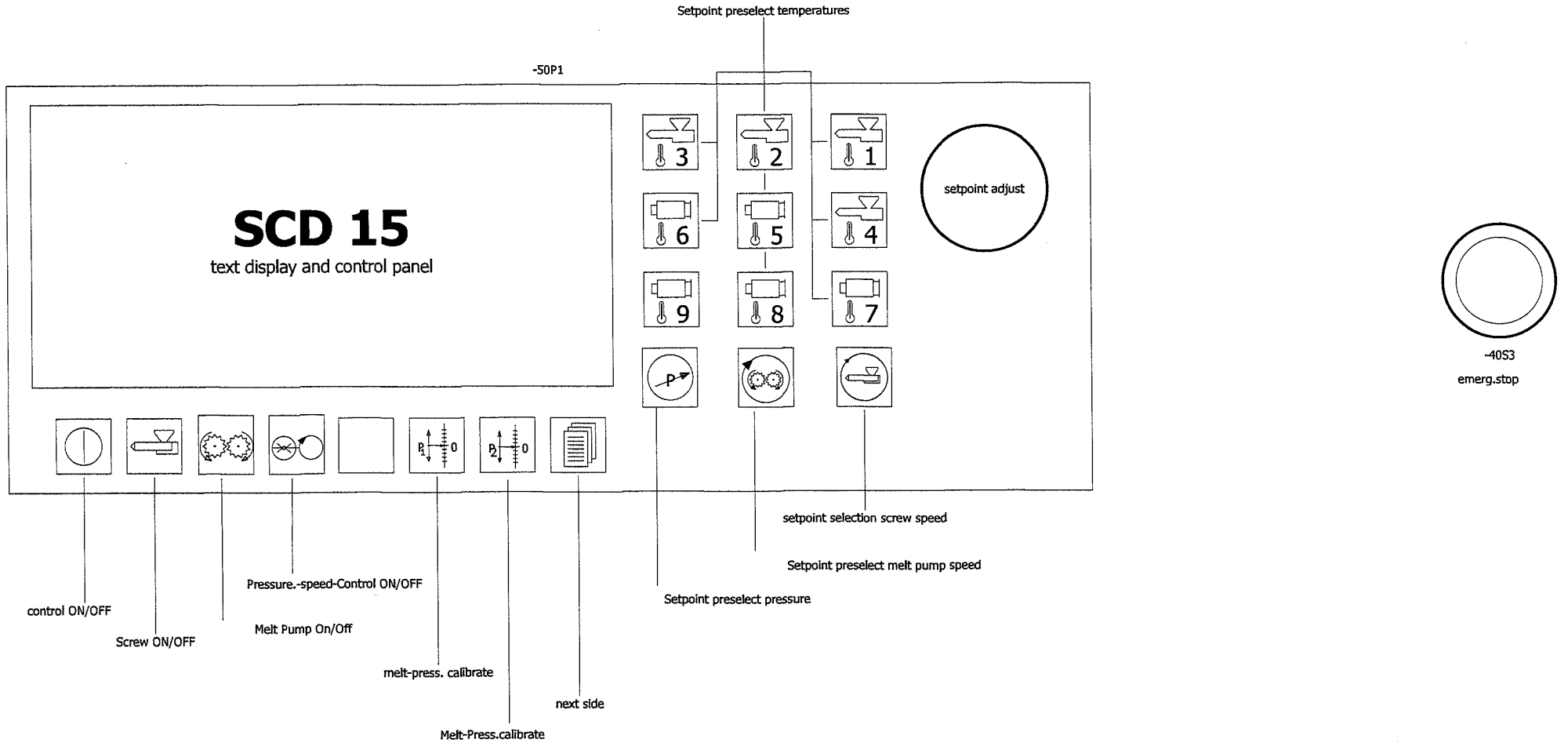
55.6 / MP2+ ←

55.6 / MP2_SH ←

melt-press. 1

melt-press. 2

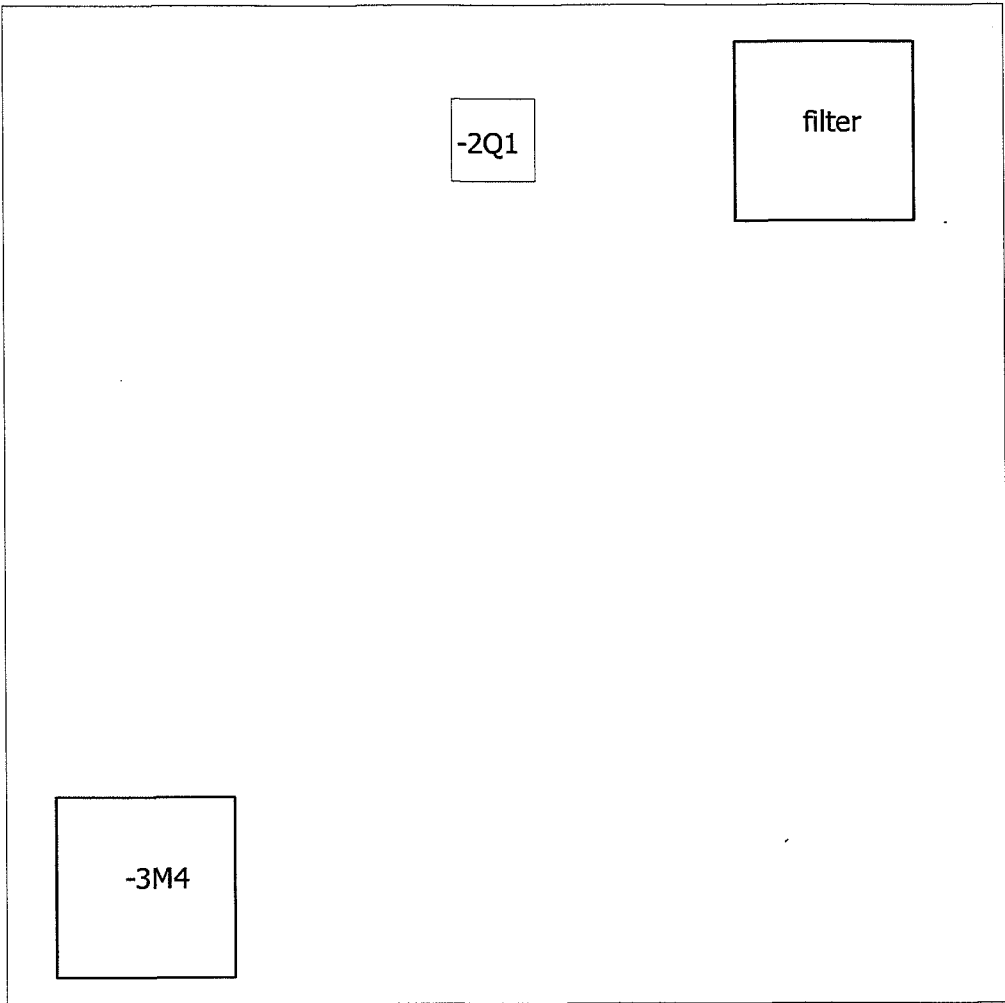
56	Proj.. FREINBERGER	chang. 08.02.2017	Title	Function Pressure Measuring	Page No. 80	Machine-No. 9110-16066-01E
	Date 01.09.2016	Proj.. TRAGER				
		Purdue University				



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Title	Function
	control panel

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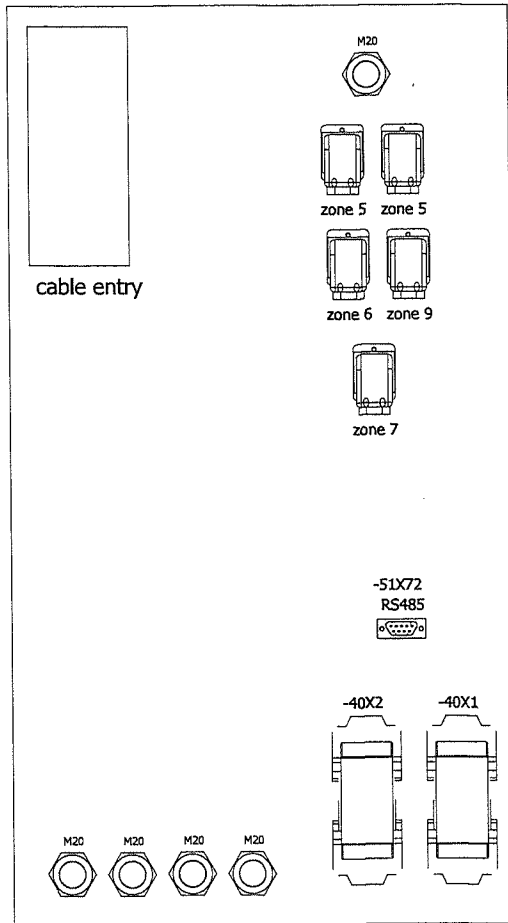
Proj..	FREINBERGER	chang.	08.02.2017
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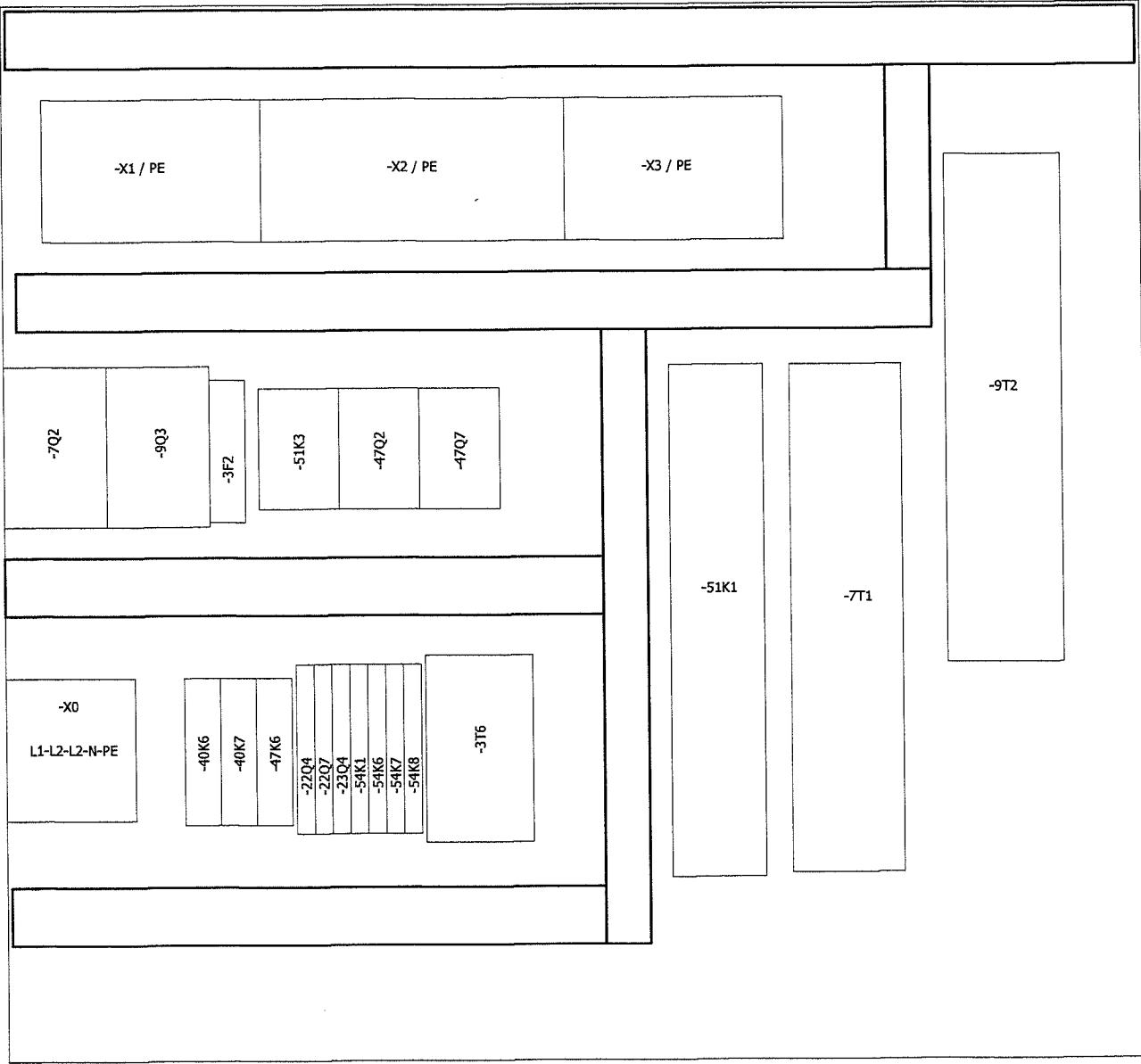
Function	Control Cabinet / door
----------	------------------------

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outside left



Proj..	FREINBERGER	chang.	08.02.2017	Title	Function control cabinet outside	Page No. 103	Machine-No. 9110-16066-01E
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		Purdue University					

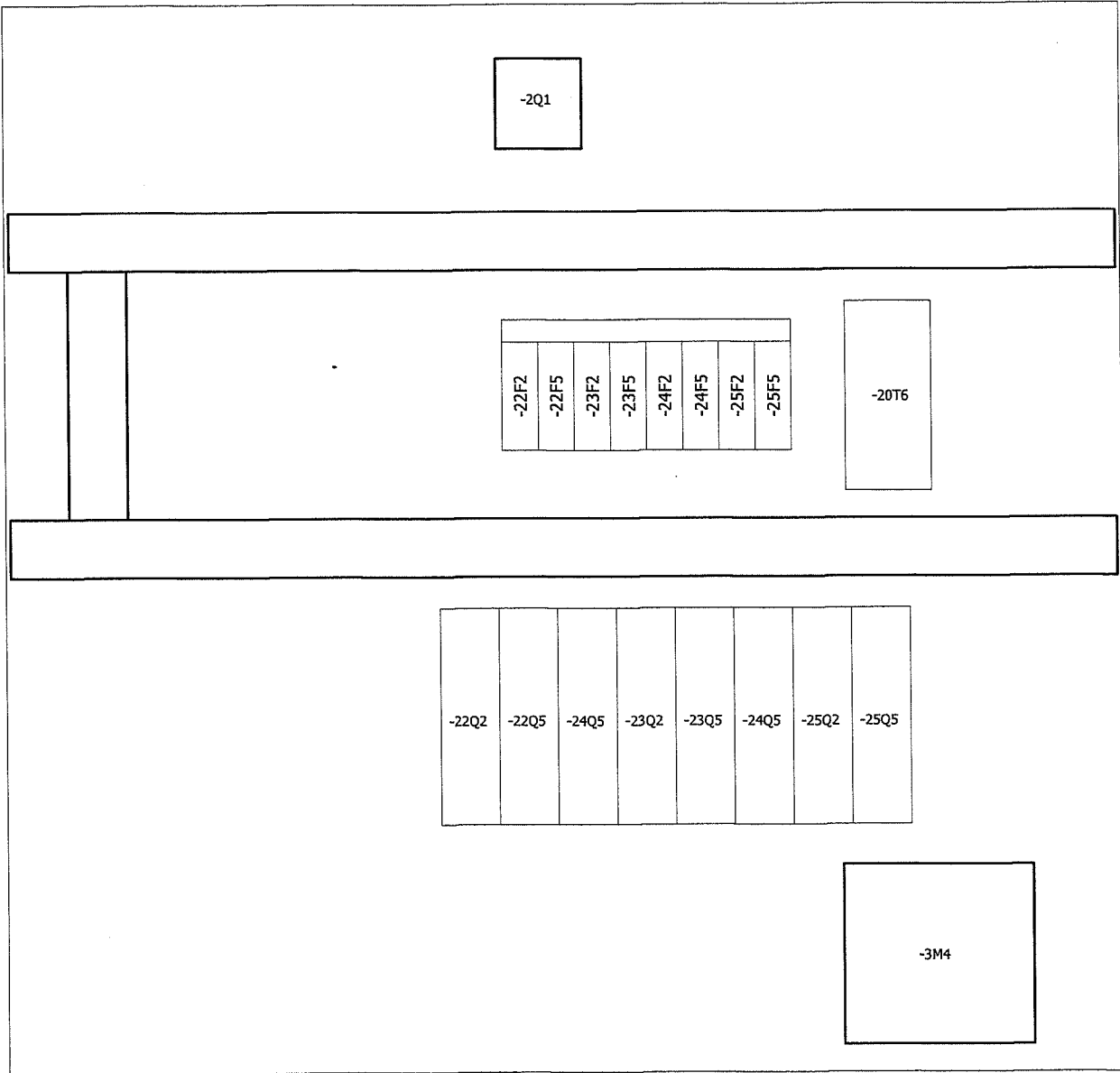


Proj..	FREINBERGER	chang.	08.02.2017
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Function	control cabinet/mounting plate
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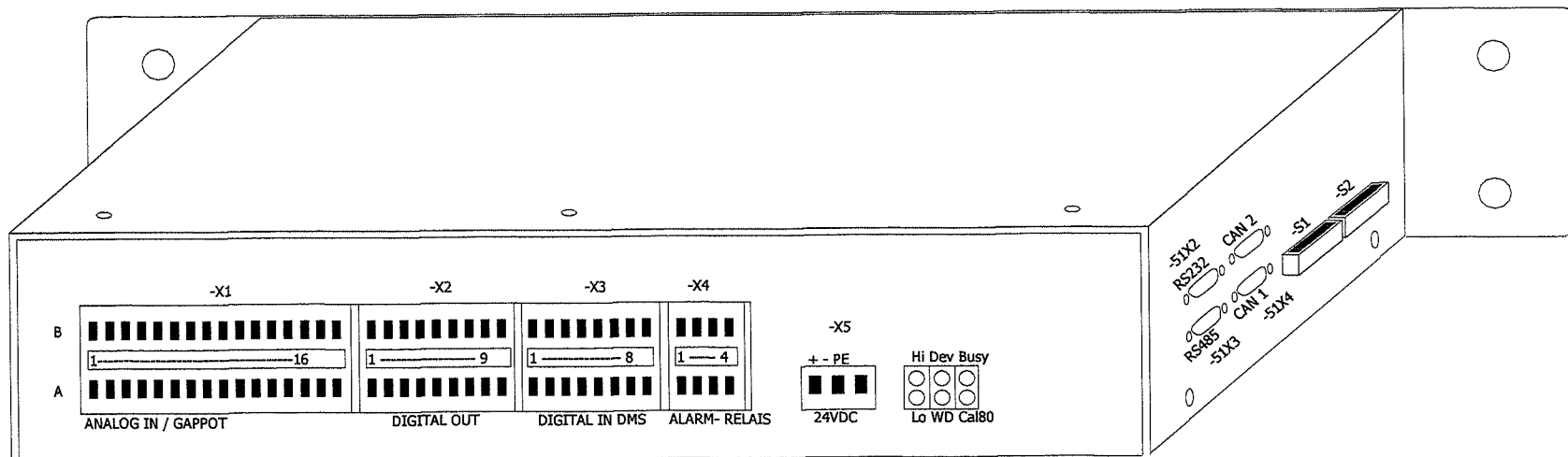
Proj..	FREINBERGER	chang.	08.02.2017
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Function	Control Cabinet Plate, Doorinstallation
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terminal arrangement SCR15



ON	OFF	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	S1.2
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.3
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.4
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.5
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.6
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.7
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1.8

ON	OFF	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2.1 = Address - LSB
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S2.2 = Address
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S2.3 = Address
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S2.4 = Address
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S2.5 = Address - MSB
<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2.6 = ON-19200 BAUD / OFF-9600 Baud
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S2.7
<input type="checkbox"/>	<input checked="" type="checkbox"/>	S2.8 = ON Terminalbetrieb / OFF Displaybetrieb

Adr.: 1

terminal diagram

C_P8_KLP_2.3_2

Cable name		Strip designation -22A7-X12							Cable name		
Cable type		Target designation	Connection	Terminal-No.	extern	Jumpers Internal	Jumpers extern	Target designation	Connection	Cable type	
										Page / Path	
-22M4	ÖLFLEX	-22M4	U1	1				-X3	10	ÖLFLEX	1 /22.3
-22M7	ÖLFLEX	-22M4	V1	2				-X3	16		2 /22.3
-23M4	ÖLFLEX	-22M4	W1	3				-X3	18		3 /22.3
		-22M7	U1	4				-X3	11		4 /22.7
		-22M7	V1	5				-X3	19		5 /22.7
		-22M7	W1	6				-X3	21		6 /22.7
		-23M4	U1	7				-X3	12		7 /23.3
		-23M4	V1	8				-X3	22		8 /23.3
		-23M4	W1	9				-X3	24		9 /23.4
		-22M4	PE	PE				-22A1	PE		10 /22.4
		-22M7	PE	PE				-22A1	PE		11 /22.7
		-23M4	PE	PE					PE		12 /23.4



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Function
terminal diagram:-22A7-X12

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terminal diagram

C_P8_KLP_2.3_2

Cable name		Strip designation -X0							Cable name		
Cable type		Target designation	Connection	Terminal-No.	Jumper extern	Jumpers Internal	Target designation	Connection	Cable type	Page / Path	
-2W1		-2Q1	2	L1			-47Q7	1			/2.1
							-47Q2	1			
		-2Q1	4	L2			-47Q7	3			/2.1
							-47Q2	3			
		-2Q1	6	L3			-47Q7	5			/2.1
							-47Q2	5			
		-2Q1	8	N			-X3	5			/2.2
							-47Q2	7			
	PE	-2X1	PE	PE			-PE				GNYE /2.2
				PE							GNYE /2.2



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Function	terminal diagram:-X0
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terminal diagram

Cable name		Strip designation -X1							Cable name	
Cable type		Target designation	Connection	Terminal-No.	Jumper extern	Jumpers Internal	Target designation	Connection	Cable type	
-22W1	ÖFLEX	2	-22A1-X11	1	1	•	-22Q2	Load		
		1	-22A1-X11	1N	1N	•	-47Q2	8		
		PE	-22A1-X11	1PE	1PE	•		PE		
		4	-22A1-X11	2	2	•				
		3	-22A1-X11	2N	2N	•				
					2PE	•		PE		
		6	-22A1-X11	3	3	•	-22Q5	Load		
		5	-22A1-X11	3N	3N	•				
					3PE	•		PE		
		8	-22A1-X11	4	4	•				
		7	-22A1-X11	4N	4N	•				
					4PE	•		PE		
		10	-22A1-X11	5	5	•	-23Q2	Load		
		9	-22A1-X11	5N	5N	•				
					5PE	•		PE		
		12	-22A1-X11	6	6	•				
		11	-22A1-X11	6N	6N	•				
					6PE	•		PE		
			-23X5	1	7	•	-23Q5	Load		
			-23X5	2	7N	•				
			-23X5	PE	7PE	•		PE		
			-24X2	1	8	•	-24Q2	Load		
			-24X2	2	8N	•				
			-24X2	PE	8PE	•		PE		
			-24X5	1	9	•	-24Q5	Load		
			-24X5	2	9N	•				
			-24X5	PE	9PE	•		PE		
			-24X6	1	10	•				
			-24X6	2	10N	•				
			-24X6	PE	10PE	•		PE		
			-25X2	1	11	•	-25Q2	Load		
			-25X2	2	11N	•				

terminal diagram

C_P8_KLP_2.3_2

Cable name		Strip designation -X1						Cable name	
Cable type		Target designation	Connection	Terminal-No.	Jumper extern	Jumpers Internal	Target designation	Connection	Cable type
		-25X2	PE	11PE				PE	
		-25X3	1	12					
		-25X3	2	12N					
		-25X3	PE	12PE				PE	
		-25X5	1	13			-25Q5	Load	
		-25X5	2	13N					
		-25X5	PE	13PE				PE	
		-25X6	1	14					
		-25X6	2	14N					
		-25X6	PE	14PE				PE	

Page / Path

/25.2
/25.3
/25.3
/25.3
/25.5
/25.5
/25.5
/25.6
/25.6
/25.6



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Function	terminal diagram:-X1
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terminal diagram

Cable name		Cable type		Strip designation		Cable name		Cable type		Page / Path
				Target designation	Terminal-No.	Jumpers	Target designation			
-80W3	ÖLFLEX	-PE	1	-3T6	-					/3.6
-80W2	LYCY		2	-22Q4	A2					/3.6
-80W5	LYCY		3							/3.6
			4							/3.6
			5	-22Q2	-					/3.7
			6	-50P1	L024					/50.3
			7				-51K1-X5			/51.2
			8							/52.7
			9				-51K1	X2-A9		/53.7
			10				-51K1	X2-B9		/54.7
			11				-51K1	X3-B8		/56.7
			12	-80B2-80X2	6					/80.3
			13	-80X5	6					/80.6
			14	-40S3	112		-40X1	1		/40.3
			15	-40S3	211		-40X2	3		/40.3
			16	-40S3	212		-40X1	3		/40.3
			17	-54K6	11		-51K1	X3-A1		/56.1
			18	-80B2-80X2	7					/80.2
			19	-80B2-80X2	3					/80.2
			20	-80X5	7					/80.5
			21	-80X5	3		-47Q7	53		/80.6
			22							/3.5
			23				-3T6	+		/3.7
			24	-40S3	111					/40.3
			25	-50P1	L24					/50.3
			26				-51K1-X5			/51.1
			27				-51K1	X4-A3		/51.1
			28							/52.7
			29				-47Q7	73		/56.2
			30				-51K1	X3-A4		/56.4
			31				-7Q2	53		/56.6
			32				-9Q2	53		/56.7

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terminal diagram

Cable name		Cable type		Strip designation -X2				Cable name		Cable type		Page / Path
-80W3	-80W5	-80W2	-80W6	-80W21	-80W6	Target designation	Connection	Terminal-No.	Jumper	Jumps	Target designation	Connection
QFLEX	LYCY	LYCY	LYCY	LYCY	LYCY				extern	Internal		
								33		•		
						-80B2-80X2	1	34		•		
						-80X5	1	35		•		
								36		•		
						-80B2-80X2	4	37		•	-51K1	X1-A11
						-80B2-80X2	2	38		•	-51K1	X1-B11
						-80B2-80X2	5	39		•	-54K7	11
						-80B2-80X2	8	40		•	-54K7	14
						-80X5	4	41		•	-51K1	X1-A13
						-80X5	2	42		•	-51K1	X1-B13
						-80X5	5	43		•	-54K8	11
						-80X5	8	44		•	-54K8	14
						-50P1	PE	PE		•		PE
						-51K1-X5		PE		•		PE



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Title	Function
	terminal diagram:-X2

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terminal diagram

C_P8_KLP_2.3_2

Cable name		Cable type		Strip designation		Cable name		Cable type		Page / Path	
-21W6		ÖLFLEX		-X3							
-22W8		ÖLFLEX		Target designation	Connection	Terminal-No.	Jumper	Jumpers	Target designation	Connection	
							extern	Internal			
				-3M4	A1	1		•	-3F2	2	/3.2
				-3T6	L	2		•			/3.4
				-47Q2	53	3		•			/3.6
						4		•	-7T1	K12	/7.7
						5		•	-X0	N	/3.2
				-3M4	A2	6		•			/3.4
						7		•	-3T6	N	/3.6
						8		•			/7.5
			BU	-21M6	2	9		•			/21.6
		1		-22A7-X12	1	10		•			/22.3
		4		-22A7-X12	4	11		•			/22.7
		7		-22A7-X12	7	12		•			/23.3
						13		•	-7T1	K14	/7.6
			BN	-21M6	1	14		•	-54K1	12	/21.6
		2		-22A7-X12	2	16		•	-22Q4	14	/22.3
						17		•	-22C4	x1	/22.3
		3		-22A7-X12	3	18		•	-22C4	x2	/22.4
		5		-22A7-X12	5	19		•	-22Q7	14	/22.7
						20		•	-22C7	x1	/22.7
		6		-22A7-X12	6	21		•	-22C7	x2	/22.7
		8		-22A7-X12	8	22		•	-23Q4	14	/23.3
						23		•	-23C4	x1	/23.4
		9		-22A7-X12	9	24		•	-23C4	x2	/23.4
						25		•			/21.1
						26		•			/21.1
						27		•			/21.1
						28		•			/21.2
						29		•			/21.2
						30		•			/21.2
						PE		•		PE	/3.2
						PE		•	-PE		/7.6
						PE		•			/21.2



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Function
terminal diagram:-X3

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cable overview

Cable designations	Description	Cable type	Cores	Ø in mm ²	Length in m	Remark
-2W1	CABLE CONTROL- 5x6qmm	ÖLFLEX	5	6,00	5,0 m	Supply lead
-7W2	CABLE SERVO 4x1,5+2x1qmm SHIELDED	SERVO-ÖLFLEX	6	1,50	3m	extruder
-7W6	CABLE DATA 3x0,25qmm	LIYCY	3	0,25	1 m	CAN
-9W1	CABLE CONTROL- 5x1,5qmm SHIELDED	ÖLFLEX	5	1,50	1,0 m	melt pump
-9W2	CABLE SERVO 4x1,5+2x1qmm SHIELDED	SERVO-ÖLFLEX	6	1,50	5 m	melt pump
-9W4	CONTROL CABLE F. INCREMENTAL ENCODER	SERVO-LIYCY	16	0,25	5 m	encoder melt pump
-20W7	CABLE DATA 2x0,25qmm	LIYCY	2	0,25	2,0 m	heating current
-21W6		ÖLFLEX	3	0,75		take in cooling Zone 1
-22W1	CABLE CONTROL- 18x1,5qmm	ÖLFLEX	18	1,50		heating zone 2
-22W2			3	0,75	4m	HEATING
-22W3			3	0,75	4m	HEATING
-22W4		ÖLFLEX	3	0,75	4m	cooling zone 2
-22W5			3	0,75	4m	HEATING
-22W6			3	0,75	4m	HEATING
-22W7		ÖLFLEX	3	0,75	4m	cooling zone 3
-22W8	CABLE CONTROL- 12x0,75qmm	ÖLFLEX	12	0,75	1,0 m	cooling zone 2
-23W2			3	0,75	4m	HEATING
-23W3			3	0,75	4m	HEATING
-23W4		ÖLFLEX	3	0,75	4m	cooling zone 4
-23W5			3	0,75	3m	HEATING
-24W2			3	0,75	3m	HEATING
-24W3			3	0,75	3m	HEATING
-24W5			3	0,75	3m	HEATING
-24W6			3	0,75	3m	HEATING
-25W2			3	0,75	3m	HEATING
-25W5			3	0,75	3m	HEATING
-25W6			3	0,75	3m	HEATING
-40W3	CABLE CONTROL- 7x0,75qmm	ÖLFLEX	7	0,75	3,0 m	operating panel 1
-51W1	CABLE DATA 3x0,25qmm	LIYCY	3	0,25	1,0 m	can-bus
-51W7	CABLE DATA 5x0,25qmm	LIYCY	5	0,25	1,0 m	RS232
-51W71	CABLE DATA 2x0,25qmm	LIYCY	2	0,25	1,0 m	RS485
-52W1		FECUNI	2	0,35	1,0 m	thermo zone 1
-52W2		FECUNI	2	0,35	1,0 m	thermo zone 2
-52W3		FECUNI	2	0,35	1,0 m	thermo zone 3
-52W4		FECUNI	2	0,35	1,0 m	thermo zone 4

Parts list

C_P8_STL_2.3_2

Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-22A1-X11	14	EXK--0094	TERMINAL ZDKPE 2,5 3/2 TS35	ZDKPE 2.5-2/N/L/PE	1895700000	Weidmuller
-22A7-X12	9	EXK--0074	TERMINAL ZDUA 2,5 1/2 TS15	ZDUA 2,5-2	172092	Weidmuller
-22A7-X12	3	EXK--0075	TERMINAL ZPEA 2,5 PE 1/2 TS15	ZPEA 2,5/PE	172095	Weidmuller
-X0	4	EXK--0018	TERMINAL WDU 10	WDU 10	1020300000	WEI
-X0	1	EXK--0022	TERMINAL WPE 10 PROT. EARTH	WPE 10	1010300000	WEI
-X0	1	EXK--0073	TERMINAL ZPE 6 PE 1/3 TS35	ZPE 6-2/3AN	1771360000	WEI
-X1	14	EXK--0094	TERMINAL ZDKPE 2,5 3/2 TS35	ZDKPE 2.5-2/N/L/PE	1895700000	Weidmuller
-X2	22	EXK--0066	TERMINAL ZDK 2,5 3/2 TS35	ZDK 2.5	1674300000	WEI
-X2	2	EXK--0067	TERMINAL ZDK 2,5 PE 1/4 TS35	ZDK 2.5PE	1690000000	WEI
-X3	15	EXK--0066	TERMINAL ZDK 2,5 3/2 TS35	ZDK 2.5	1674300000	WEI
-X3	4	EXK--0067	TERMINAL ZDK 2,5 PE 1/4 TS35	ZDK 2.5PE	1690000000	WEI
-2A1	2	EJK--0011	CABLE CHANNEL 65x30mm	BA66002507030B	2176034	HAGEMEYER
-2A1	1	EJM--0001	UNION SKINTOP M12x1,5 BRASS	HSK-M-EMV	1.691.1200.50	SCHWEIGER
-2A1	1	EJM--0009	UNION NUT M12x1,5 BRASS	GM-MS	1.161.1200.50	SCHWEIGER
-2A1	14	EJM--0002	UNION SKINTOP M16x1,5 BRASS	HSK-M-EMV	1.691.1600.50	SCHWEIGER
-2A1	14	EJM--0010	UNION NUT M16x1,5 BRASS	GM-MS	1.161.1600.50	SCHWEIGER
-2A1	2	EJM--0003	UNION SKINTOP M20x1,5 BRASS	HSK-M-EMV	1.691.2000.50	SCHWEIGER
-2A1	2	EJM--0011	UNION NUT M20x1,5 BRASS	GM-MS	1.161.2000.50	SCHWEIGER

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Parts list

C_P8_STL_2.3_2

Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-2A1	2	EXK--0034	TERMINAL KLBÜ 4-13,5 SC SHIELD	KLBU 4-13,5 SC	1712311001	Weidmuller
-2A1	3	EXK--0035	TERMINAL KLBÜ 3-8 SC SHIELD	KLBU 3-8 SC	1692261001	Weidmuller
-2A1	1	EJGS-0075	CABINET WITH MOUNT. PLATE	AE1360.500	AE1360.500	RITTAL
-2A2	1	EJGT-0066	CABINET CONTROL PANEL	COMMANDER 1F	130805008	ROSE
-2A2	1	EJGT-0072	CABINET FRONT PLATE SCD 15	Z.Nr.:443.9.93.0039.3	90310063	MACH
-2Q1	1	EQH--0023	MAIN SWITCH 32A 4-POL	KG 32	KG32B T104/01 E	Kraus &
-2W1	5 5,0 m	EWS--0004	CABLE CONTROL- 5x6qmm	YSLY-JZ 5x6	10149	HELUKABEL
-2X1	1	EXG--0034	PLUG CEE-CONNECT. 5-POL..	3	015 020 69	MENNEKES
-3F2	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-3M4	1	EEK--0001	FAN FILTER FAN 119x119	PAPST TYP 4650 N	15.4650	SCHWEIGER
-3M4	2	EEK-Z0001	FAN OUTPUT FILTER 128x128	LG 10 128x128	13.1010	SCHWEIGER
-3M4	1	EEK-Z0003	FAN PROTECTIVE GRATING 127x127	LZ 30P	19.0030	SCHWEIGER
-3T6	1	EGS--0035	SUPPLY 85-264VAC//24VDC/2,5A	WIPOS P1 24-2,5	81.000.6120.0	WIELAND
-7Q2	1	EQM--0024	PROT. MOTOR SWITCH 6,3-10A	PKZM0-10	072739	MOE
-7Q2	1	EQM-Z0019	AUX CONTACT UNIT 1/1 FRONT MOUNT.	NHI-E-11-PKZ0	082882	MOE
-7R2	1	EZFD-0040	FILTER MAINS OPERATED MOUNTED	EPA NF-K-16-LL	55030306	EPA
-7R3	1	EZFF-0009	FERRIT RING	B64290-L48-X830	330602	DISTRELEC
-7T1	1	ENDD-0076	CONTROL FREQ.CONVERTER 3-PHAS.5,5A	E82CV152K4C200	13437134	LENZE



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C_P8_STL_2.3_2

Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-7T1	1	EN--Z0088	CONTROL FUNCTION MODULE	E82ZAFCC001	13189245	LENZE
-7T1	1	EN--Z0089	CONTROL OPERATING MODULE	E82ZBC	417192	LENZE
-7W2	3 3m	EWG--0025	CABLE SERVO 4x1,5+2x1qmm SHIELDED	TOPSERV 113 HK-S0-LI12Y	74506	HELUKABEL
-7W6	1 1 m	EWF--0001	CABLE DATA 3x0,25qmm	LIYCY 3x0,25	94 F 3232	BURKLIN
-9Q2	1	EQM--0023	PROT. MOTOR SWITCH 4-6,3A	PKZM 0-6,3	072738	Moeller
-9Q2	1	EQM-Z0019	AUX CONTACT UNIT 1/1 FRONT MOUNT.	NHI-E-11-PKZ0	082882	MOE
-9R2	1	EZFD-0038	FILTER MAINS OPERATED MOUNTED	EPA NF-K-7-LL	55030305	EPA
-9R3	1	EZFF-0009	FERRIT RING	B64290-L48-X830	330602	DISTRELEC
-9T2	1	ENDD-0101	CONTROL FREQ.CONVERTER 3-PHAS 2,1A	UNI SP 0403	16800002803100	CT
-9T2	1	EN--Z0114	CONTROL FELDBUS SM-CANopen	SM-CANopen	82000000012000	CT
-9T2	1	EN--Z0149	CONTROL OPERATING MODULE	KEYPAD SP0	82000000014500	CT
-9T2	1	EXI--0102	PLUG INTERCHANGE UNIT 15-POL. HD	UDBV4	9698-0296	CT
-9W1	1 1,0 m	EWG--0002	CABLE CONTROL- 5x1,5qmm SHIELDED	Y-CY-JZ	1007024	HAGEMEYER
-9W2	1 5 m	EWG--0021	CABLE SERVO 4x1,5+2x1qmm SHIELDED	S950-191353	S950-19353	SCHWEIGER
-9W4	1 5 m	EN--Z0041	CONTROL CABLE F. INCREMENTAL ENCODER	S950-19108	401.COS95019108	SCHWEIGER
-20T6	1	ETW--0009	CONVERTER CURRENT 1-TERM	AT087	AT087	FELLER
-20W7	2 2,0 m	EWF--0009	CABLE DATA 2x0,25qmm	LIYCY	94 F 3230	BURKLIN
-21M6	1	EZV--0005	SUPPRESSION VALVE R-C	LRC-V8-0857	700857	LUTZE

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Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-22F2	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-22F5	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-22Q2	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN
-22Q4	1	EVIG-0017	SOLID-STATE-RELAIS 2A/240VAC	38.91	38.91.7.024.8240	FINDER
-22Q5	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN
-22Q7	1	EVIG-0017	SOLID-STATE-RELAIS 2A/240VAC	38.91	38.91.7.024.8240	FINDER
-22W1	1	EWS--0009	CABLE CONTROL- 18x1,5qmm	YSLY-JZ 18X1.5 QMM	1119318	LAPP
-22W8	1 1,0 m	EWS--0018	CABLE CONTROL- 12x0,75qmm	Y-JZ 12x0,75 RG	10043	HELUKABEL
-23F2	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-23F5	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-23Q2	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN
-23Q4	1	EVIG-0017	SOLID-STATE-RELAIS 2A/240VAC	38.91	38.91.7.024.8240	FINDER
-23Q5	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN
-23X5	1	EXS--0001	PLUG PIN INSERT 3-POL.+PE	FW 700 203	2063066	HAGEMEYER
-23X5	1	EXS--0002	PLUG JACK INSERT 3-POL.+PE	FW 700 103	0920 003 2711	STECKER
-23X5	1	EXS--0003	PLUG CASE TOP MOUNT 3-/4-POL.	FW 704 303	2063069	HAGEMEYER
-23X5	1	EXS--0004	PLUG CASE BUSH 3-/4-POL.	FW 702 603	09200031640	SCHWEIGER
-24F2	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller



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Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-24F5	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-24Q2	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN
-24Q5	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN
-24X2	1	EXS--0001	PLUG PIN INSERT 3-POL.+PE	FW 700 203	2063066	HAGEMEYER
-24X2	1	EXS--0002	PLUG JACK INSERT 3-POL.+PE	FW 700 103	0920 003 2711	STECKER
-24X2	1	EXS--0003	PLUG CASE TOP MOUNT 3-/4-POL.	FW 704 303	2063069	HAGEMEYER
-24X2	1	EXS--0004	PLUG CASE BUSH 3-/4-POL.	FW 702 603	09200031640	SCHWEIGER
-24X5	1	EXS--0001	PLUG PIN INSERT 3-POL.+PE	FW 700 203	2063066	HAGEMEYER
-24X5	1	EXS--0002	PLUG JACK INSERT 3-POL.+PE	FW 700 103	0920 003 2711	STECKER
-24X5	1	EXS--0003	PLUG CASE TOP MOUNT 3-/4-POL.	FW 704 303	2063069	HAGEMEYER
-24X5	1	EXS--0004	PLUG CASE BUSH 3-/4-POL.	FW 702 603	09200031640	SCHWEIGER
-24X6	1	EXS--0001	PLUG PIN INSERT 3-POL.+PE	FW 700 203	2063066	HAGEMEYER
-24X6	1	EXS--0002	PLUG JACK INSERT 3-POL.+PE	FW 700 103	0920 003 2711	STECKER
-24X6	1	EXS--0003	PLUG CASE TOP MOUNT 3-/4-POL.	FW 704 303	2063069	HAGEMEYER
-24X6	1	EXS--0004	PLUG CASE BUSH 3-/4-POL.	FW 702 603	09200031640	SCHWEIGER
-25F2	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-25F5	1	EFA--0081	FUSE UNIT B6A	FAZ-B6/1	278529	Moeller
-25Q2	1	EVIG-0016	SOLID-STATE-RELAY 25A/480VAC	GS-25/480-0	F000715	GEFRAN

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Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-40K7	1	EKRW-0015	RELAY 2W 5A/250VAC	49.72	49.72.8.230.0060	FINDER
-40S3	1	EST--0084	SWITCH EMERGENCY-STOP	M22-PV	216876	MOE
-40S3	1	EST--0085	SWITCH HOLDER FOR 3 CONTACT UNITS	M22-A	216374	Moeller
-40S3	2	EST--0086	SWITCH CONTACT UNIT 0/1	M22-K01	216378	MOE
-40W3	3 3,0 m	EWS--0022	CABLE CONTROL- 7x0,75qmm	7X0,75qmm	10038	HELUKABEL
-40X1	1	EXS--0016	PLUG PIN INSERT 10-POL.	HAN 10B//FW 710 210	09330102601	STECKER
-40X1	1	EXS--0017	PLUG JACK INSERT 10-POL.	HAN 10B//FW 710 110	09330102701	SCHWEIGER
-40X1	1	EXS--0018	PLUG CASE MOUNTED 10-POL..	FW 714 110	2245605	HAGEMEYER
-40X1	1	EXS--0019	PLUG CASE BUSH 10-POL.	FW 712 010	80.19300101521	SCHWEIGER
-40X2	1	EXS--0016	PLUG PIN INSERT 10-POL.	HAN 10B//FW 710 210	09330102601	STECKER
-40X2	1	EXS--0018	PLUG CASE MOUNTED 10-POL..	FW 714 110	2245605	HAGEMEYER
-47K6	1	EKZU-0010	TIME RELAY 1W	80.21.0.240.000	80.21.0.240.0000	FINDER
-47Q2	1	EKLG-0037	POWER RELAY 4/0//0/0	3RT 1317-2BB40	20.3RT 1317-2BB40	SCHWEIGER
-47Q2	1	EKL-Z0016	AUX CONTACT UNIT 4/0 TOP MOUNT.	3RH 1911-2FA40	20.3RH 1911-2FA40	SCHWEIGER
-47Q7	1	EKLG-0035	POWER RELAY 3/0//1/0 4kW	3RT 1016-2BB41	20.3RT 1016-2BB41	SCHWEIGER
-47Q7	1	EKL-Z0016	AUX CONTACT UNIT 4/0 TOP MOUNT.	3RH 1911-2FA40	20.3RH 1911-2FA40	SCHWEIGER
-47R2	1	EZB--0020	SUPPRESSION DIODE	3RT 1916-1LM00	20.3RT 1916-1LM00	SCHWEIGER
-47R7	1	EZB--0020	SUPPRESSION DIODE	3RT 1916-1LM00	20.3RT 1916-1LM00	SCHWEIGER

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Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-50P1	1	ENM--0167	CONTROLLER MULTI DISPLAY SCD 15	SCD 15	SD114	FELLER
-50X7	1	EXI--0011	PLUG SUB-D PIN 9-POL.	C 209	1381338	Conrad
-50X7	1	EXI--0015	PLUG CASE SUB-D 9-POL.	HDP 20 AMP	55F5351	BURKLIN
-51K1	1	ENM--0166	CONTROLLER MULTI SCR 15	SCR 15	SD113	FELLER
-51K3	1	EKHG-0012	CONTACTOR RELAY 4/0	3RH 1140-2BB40	3RH 1140-2BB40	SCHWEIGER
-51R3	1	EZB--0020	SUPPRESSION DIODE	3RT 1916-1LM00	20.3RT 1916-1LM00	SCHWEIGER
-51W1	1 1,0 m	EWF--0001	CABLE DATA 3x0,25qmm	LYCY 3x0,25	94 F 3232	BURKLIN
-51W7	1 1,0 m	EWF--0005	CABLE DATA 5x0,25qmm	LYCY 5x0,25	20032	HELUKABEL
-51W71	1 1,0 m	EWF--0009	CABLE DATA 2x0,25qmm	LYCY	94 F 3230	BURKLIN
-51X4	1	EXI--0012	PLUG SUB-D JACK 9-POL.	B 209	52F1152	BURKLIN
-51X4	1	EXI--0015	PLUG CASE SUB-D 9-POL.	HDP 20 AMP	55F5351	BURKLIN
-51X7	1	EXI--0011	PLUG SUB-D PIN 9-POL.	C 209	1381338	Conrad
-51X7	1	EXI--0015	PLUG CASE SUB-D 9-POL.	HDP 20 AMP	55F5351	BURKLIN
-51X41	1	EXI--0113	PLUG SUB-D,9 POL,CAN-R=120 Ohm	SUB-D9-VERBINDER	1.04.0075.03000	IXXAT
-51X71	1	EXI--0011	PLUG SUB-D PIN 9-POL.	C 209	1381338	Conrad
-51X71	1	EXI--0015	PLUG CASE SUB-D 9-POL.	HDP 20 AMP	55F5351	BURKLIN
-51X72	1	EXI--0012	PLUG SUB-D JACK 9-POL.	B 209	52F1152	BURKLIN
-52W11	1 1,0 m	EWA--0001	CABLE COMPENSATING- 2x0,35qmm	FeCuNi (Typ J)	1604385	IHNE+TESCH

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Device Tag	Quantity (Stk/m) Length (m)	Part number	Designation	Type number	Order number	Supplier
-54K1	1	EKRG-0022	RELAIS 1W 6A/250VAC	38.61	38.61.7.024.0050	FINDER
-54K6	1	EKRG-0022	RELAIS 1W 6A/250VAC	38.61	38.61.7.024.0050	FINDER
-54K7	1	EKRG-0022	RELAIS 1W 6A/250VAC	38.61	38.61.7.024.0050	FINDER
-54K8	1	EKRG-0022	RELAIS 1W 6A/250VAC	38.61	38.61.7.024.0050	FINDER
-80W2	1 5 m	EWF--0047	CABLE DATA 8x0,25qmm 5m	09/130304/249 1.NACHTRAG	1171412	Lacon
-80W5	1 5 m	EWF--0047	CABLE DATA 8x0,25qmm 5m	09/130304/249 1.NACHTRAG	1171412	Lacon
-80W6	2 2 m	EWF--0009	CABLE DATA 2x0,25qmm	LIYCY	94 F 3230	BURKLIN
-80W21	1 1 m	EWF--0009	CABLE DATA 2x0,25qmm	LIYCY	94 F 3230	BURKLIN



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23	heating control
24	heating control
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56	SCR 15 digital input
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Dr. Collin GmbH | Sportparkstrasse 2 | D-85560 Ebersberg

Wagner Industries, Inc.
Mr. Wagner
51 Sparta Rd.

Stanhope, NJ 07874
USA

22.06.2016
WAGNST-AV-at
cc Repr.: Collin Inc.

TEACH-LINE® Extruder E 16 T

Offer No. 589-16_1

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Description

TEACH-LINE® Extruder E 16 T

2.0 TEACH-LINE® Laboratory Extruder Type E 16 T

The extruder is a compact table-top design consisting of

- a processing unit,
- a drive,
- mounted on the electric cabinet with controls.

The drive unit consists of a frequency-modulated AC motor with direct coupled gear box mounted on the top of the electric cabinet.

The bearing housing contains the thrust bearing and holds the cylinder with water-cooled feeding zone, hopper, 3 heater bands, individually controlled, 2 of them with cooling fans, as well as a sheet cover to prevent accidental contact with the heater bands.

The cylinder is made of high-quality nitrided steel.

The electric cabinet is the base of the extruder. A front and rear door give easy access to the electric elements. The controls, i.e. 5 x temperature controls (3 x cylinder, 2 x adapter/die), adjustment of screw speed and optional indicator for melt pressure and emergency stop are integrated into the front door.

The cylinder head is provided with a quick-clamp designed as C-clamp (2 C-shaped semi-circular rings) for quick and easy coupling of dies to the front end. The sealing between cylinder and adapter is either made by a breaker plate or a distance ring. Both are included in the scope of supply; required screens are not included in the basic supply.

Technical data:

• Material cylinder	nitrided steel
• Screw Ø	16 mm
• Screw length	25 x D
• Installed capacity	0.96 kW
• Screw revolution	5 – 200 rpm
• Screw torque	42 Nm
• Max. throughput (LDPE)	2.5 kg/h
• Hopper volume	3.2 ltr
• Cylinder heating zones	3 x 800 W
• Cylinder cooling zones	2 x blower
• Heating zones for die/adapter max.	2 x 1000 W
• Connecting load extruder	5.7 kW
• Connecting load extruder and follow-up max.	6.2 kW

- Req. net-configuration 3 x 400 Volt, 50 Hz
L₁; L₂; L₃; N (loadable); PE, (TN-S-Net)
- Pre-fuse 3 x 16 A
- Cooling water in/out Fitting 8 mm Ø
- Water consumption approx. 3 ltr/min.
- Centreline height 355 mm
- Dimensions: LxDxH 780 x 585 x 610 mm
- Weight (net) 65 kg

The extruder is complete and ready to work and is delivered with a 5-wire cable (length: 5 m) and CEKON plug 16 A. The necessary special tools are included in the scope of supply.

- 2.1 **Screw 16 mm diam. x 25 D**
designed as a 3-section feedscrew with the following screw geometry:
- Length of feeding zone 8 x D
 - Length of compression zone 6 x D
 - Length of metering zone 11 x D
 - Compression 3.08 : 1

The screw is made of 1.8550 steel and nitrided.
The screw is complete with screw tip.
Other screw geometries available upon request.

- 2.1x **PA-Screw 16 mm diam. x 25 D**
designed as a 3-section feedscrew with the following screw geometry:
- Length of feeding zone 8 x D
 - Length of compression zone 6 x D
 - Length of metering zone 11 x D
 - Compression 3.08 : 1

The screw is made of 1.8550 steel and nitrided.
The screw is complete with screw tip.
Other screw geometries available upon request.

- 3.8_1x **Movable, height-adjustable support**
for melt pump of E 16 T
- 3.9x **Melt pump for TEACH-LINE® Extruder E 16 T**
with electrical control (only for extruder with extended cabinet control)
- 5.1 **Melt pressure measurement**
in front of the screw tip with sealing plug as well as amplifier in the control unit.
- 5.4.1x **Surcharge for preparation for Extrusion direction right to left**

- 6.7 **Melt temperature measurement with melt thermocouple (Fe-CuNi)**
- diaphragm design for incorporation in the barrel
 - amplifier
 - digital display in combination with ECS
 - standard material: 1.8550, nitrided steel

2. Die / Adapter

- 7.1.1.1 **"Flexible" melt pipes** with a defined length, 1 heating zone and thread on both sides for connection.
- 7.3.2.2 **Slot die**, width = 200 mm x 0.3 – 1.5 mm gap width; with flexible lip and 3 heating zones
Material of die 1.2311; surface getting in contact with the polymer: nitrided

Dr. Collin GmbH | Sportparkstrasse 2 | D-85560 Ebersberg

Wagner Industries, Inc.
Mr. Wagner

Stanhope, NJ 07874
USA

07.12.2016
WAGNST-AV-01
cc Repr.: AJH & Associates

Special adapter for angel 90°

Offer No. 1265-16

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Additional details and sales conditions

Unless otherwise expressly agreed in each individual case, this offer and the corresponding services to be delivered are subject to the General Sales Conditions (GSC) in the relevant current version attached to this offer. Terms and conditions of the CUSTOMER, which are different, contradictory or supplementary compared to these GSC are only integral part of the contract if DR. COLLIN has explicitly agreed with the validity of these terms and conditions. Silence, reference to such terms and conditions and/or acts of performance by DR. COLLIN is not considered as approval.

In reply to this offer, regardless of which kind and content, but especially by placing an order, the CUSTOMER declares that he has read and registered the GSC and in connection with this offer and the services of COLLIN, he also declares to be bound to the GSC.

Additional details:

By way of derogation from resp. as a supplement to the GSC, the offer is as follows:

Acceptance test conditions:

During this acceptance test, the complete mechanical and electrical performance required for an error-free and safe operation of the system is checked and determined by processing standard materials suggested by the seller. The acceptance test of the line is carried out free of charge in the seller's factory in the presence of 2 employees of the customer.

Boarding and travelling expenses of the buyer's acceptance personnel are borne by the buyer. The customer will be informed about the scheduled date 4 weeks prior to the acceptance test.

Assembly and start-up of the line and line components:

The assembly in the customer's factory is effected without the seller. Start-up/training in the customer's factory will be charged, plus travelling time (EUR 98.00/h) and travel expenses (at cost).
1,140.00/manday will be charged, plus travelling time (EUR 98.00/h) and travel expenses (at cost).

Our machines are designed to work with a supply net of 400 Volt, 50 Hz. TN-S net according to IEC 364-4-41 (L1, L2, L3, N, PE; N loadable, voltage fluctuation: max. $\pm 10\%$).

Documentation:

1x in German in DIN A4 format (assembly drawings are larger) and 1 electronic copy (CD).

Painting/Labeling:

Painting: in RAL 1007 and RAL 9002

to: Wagner Industries, Inc.
07.12.2016 WAGNST-AV-at
Offer No. 1265-16 – Special adapter for angel 90°

mutual agreement by the CUSTOMER and DR. COLLIN because of the lack of agreement according to this legal system. Place of arbitration is Zurich, Switzerland. Language of court is German.

Validity of the offer: 3 months
Country of Origin: Federal Republic of Germany

Delivery time:
Approx. 6 weeks after placing the order, clarification of all commercial and technical details including safety equipment requirements and receipt of down-payment.

Terms of payment:
100 % before shipment.

We hope our offer will find your approval and look forward to hearing from you again.
Please do not hesitate to contact us for further details.

Sincerely yours,

DR. COLLIN GmbH

Andreas Vogt
Head of Sales / Pilot Solutions

Subj: Re: Dr. Collin, GmbH. - Re: AW: Wagner Ind. / Purdue16066 PURDWE
 Date: 12/7/2016 5:57:34 P.M. Eastern Standard Time
 From: WIndust300@aol.com
 To: AJHINC@aol.com
 CC: mcakm1@gmail.com, windust300@aol.com

As Dr. Cakmak mentioned during your visit, the delay in finishing this machine was fully on the shoulders of Collins in not getting scaled drawings to Wagner for the frame design and construction. Now we are being offered a machine that you propose is too long to fit in our frame. We agreed to pay \$91K for the slot die extruder and waited for over 2 months for detailed drawings to fit it into the machine. Our agreement with Purdue University was to have this machine finished and delivered by years end. I was very upset that the corrective measure to fit your component in my machine was going to be my responsibility to cover all of your costs to the sum of over \$6K USD. I have no additional monies from the University as this is a fixed contract cost based on your original proposal. I certainly am not prepared to fund Collins for it's lack of timely drawings and offerings and will not pay to support Purdue either. At this time I am considering cancelling the project in it's entirety or finding another slot die supplier and delaying shipment. The have been too many changes since I started this project that will cause us to lose many thousands of dollars and as a result, will not agree to any additional monies being paid to Collins. The only alternative that I will offer will be to fund a small portion of the charges to the sum of \$2K USD. I will await your reply.

W. S. Wagner
 President
 Wagner Industries, Inc.

In a message dated 12/7/2016 2:33:44 P.M. Eastern Standard Time, AJHINC@aol.com writes:

Bill,
 Your reply communication with agreement to proceed with construction to the 90 degree elbow is urgent with the delivery timeline
 Please see the attached quotation and feel free to call me with any questions

Thank you,
 Andy Haesler
 AJH & Assoc., LLC
 917-744-8052

In a message dated 12/6/2016 1:55:12 P.M. Eastern Standard Time, AJHINC@aol.com writes:

Bill,
 with timeline and drawing attachments

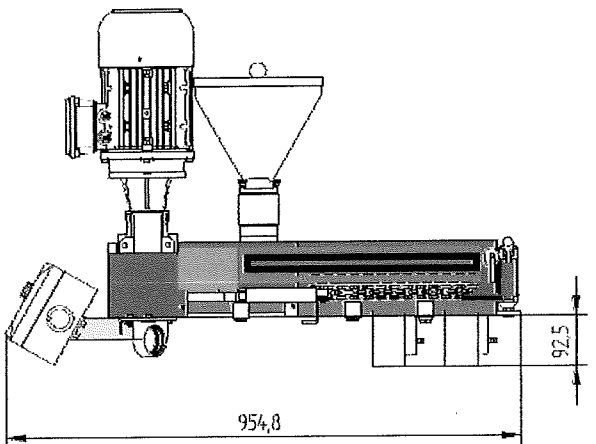
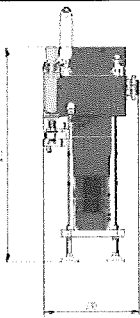
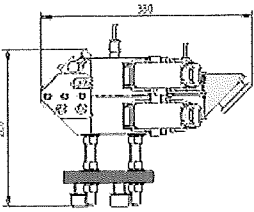
Andy Haesler
 AJH & Assoc., LLC
 Cell: 917-744-8052

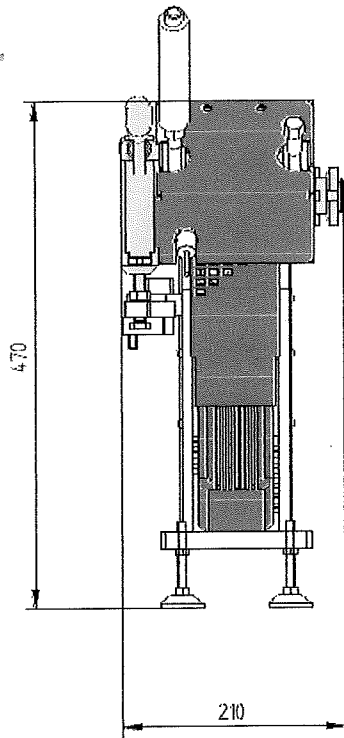
In a message dated 12/6/2016 1:49:29 P.M. Eastern Standard Time, AJHINC@aol.com writes:

Bill ,
 Please see below the tentative timeline

Thank you,
 Andy Haesler
 AJH & Assoc., LLC
 Cell: 917-744-8052

Part	Est. delivery in EBE	Important for assembling at Wagner
Extruder		1=high; 2=medium; 3=low
Bearing	27.12.16	3
Barrel	31.01.17	3
Screw	31.01.17	3
TL-Frame	16.12.16	1
Display	02.12.16	2

mounting bracket			
Covers	16.12.16	3	
Holder MDA	02.12.16	3	
Melt pump:			
Adapter C-Clamp	17.01.17	2	
Covers	04.01.17	3	
Servo Motor	04.01.17	3	
Die:			
Adapter 45°	10.01.17	1	
Heatingband f. Adapter	10.01.17	2	
Bracket for die	17.01.17	2	



Description

Special adapter for angle of 90°
7.1.14x Special adapter for angle of 90°

Investment

Special adapter for angle 90°

7.1.14x Special adapter for angle of 90°

4.540,00 USD

Net Value

6.540,00 USD

Summary:

Special adapter for angle 90°

6.540,00 USD

Net Value of the adapter

6.540,00 USD

Packaging

70,00 USD

Total Price of the adapter, EXW Ebersberg (Incoterms 2010), packed.

6.610,00 USD

CH 7

WAGNER MODEL R2R-1

S/N H3859

HV E-FIELD UNIT

SEC 7

THE E-FIELD UNIT IS A FULLY CONTAINED FOIL UNWIND FOR 6" (152MM) COPPER FILMS THAT ARE CHARGE UP TO 20KV. THE ENTIRE FRAME IS CONSTRUCTED OF G10 EPOXY/FIBERGLASS RIGID PLATES THAT HAVE SUFFICIENT ELECTRICAL INSULATING PROPERTIES TO WITHSTAND THE VOLTAGES PRESENT IN THIS SECTION. THE DESIGN OF THIS SYSTEM IS TO MATCH THE SPEED OF THE MAIN STAINLESS STEEL BELT AND ESTABLISH A STATIC ELECTRIC FIELD THAT "TRAVELS" AT THE SAME SPEEDS AS THE LINE. A VERTICAL GAP IS SET BY USING A DC GEAR-MOTOR AND BALLSCREW TO RAISE THE ENTIRE FRAME TO WHATEVER HEIGHT (GAP) IS DESIRED. THE GAP SETTING IS DISPLAYED ON A LED READOUT ON THE FRAME.

THE COPPER FILM IS UNWOUND WITH AN ADJUSTABLE TENSION AND OVER A TEFLON ROLLER. A COPPER RIDER WHEEL CONTACTS THE SURFACE OF THE FOIL. THE WHEEL IS CONNECTED TO THE HV AMPLIFIER WHICH GENERATES THE CHARGE. THE AMPLIFIER CAN BE CONTROLLED TO OUTPUT DC, SINE WAVE, SAWTOOTH, SQUAREWAVE AND PULSED WAVEFORMS. AN OSCILLOSCOPE DISPLAYS THE WAVEFORM AND RELATIVE OUTPUT LEVEL. THE FOIL MOVES DOWNWARD AND UNDER 3 HEATER PLATES THAT ARE INSULATED WITH RIGID CERAMIC PLATES. THESE PLATES CONDUCT HEAT VERY WELL WHILE PROVIDING ELECTRICAL INSULATION FROM THE GROUNDED HEATER PLATES. TEMPERATURES FOR THE 3 PLATES ARE CONTROLLED BY PID LOOP CONTROLLERS LOCATED ON THE MAIN OPERATOR PANEL. TEMPERATURES UP TO 400 TO 600 DEGREES ARE POSSIBLE. THE REWIND SECTION OF THE FOIL IS AN INSULATED TEE SLOT SHAFT COUPLING TO THE DC GEARMOTOR. A SILICON "O" RING BELT DRIVES A ROTARY ENCODER AS A FEEDBACK SIGNAL TO THE CONTREX M-TRIM SPEED CONTROLLER LOCATED IN THE MAIN OPERATOR PANEL. A DIGITAL DISPLAY INDICATES MM/MINUTE AND HAS A RANGE FROM 10 TO OVER 400 MM/MIN.

WAGNER MODEL R2R-1

S/N H3859

HV E-FIELD UNIT

SEC 7

NEVER ATTEMPT ADJUSTMENTS WITH HIGH VOLTAGE POWER SUPPLY TURNED ON! SEVERE SHOCK OR INJURY MAY RESULT!

THE HV FOIL CAN OPERATE IN ONE OF TWO MODES. THESE ARE FOLLOWER AND TENSION MODE. THE MODES ARE SET USING A TOGGLE SWITCH LOCATED NEXT TO THE CONTREX M-TRIM HV BELT SPEED CONTROLLER ON THE MAIN OPERATOR PANEL. IN THE FOLLOWER MODE, THE FOIL SPEED TRACKS THE MAIN BELT SPEED AT A RATIO OF 1:1. THIS IS THE NORMAL OPERATION OF THE MACHINE AS DESIGNED. IN THE TENSION MODE, THE FOIL IS MOVING (OR STATIONARY UNDER TENSION) AS SET BY A TORQUE VALUE SET USING THE TENSION SET POTENTIOMETER LOCATED NEAR THE FOIL TENSION TOGGLE SWITCH. WHEN IN THE TENSION MODE, THE OPERATOR SLOWLY ROTATES THE POTENTIOMETER UNTIL THE FOIL REWIND MOTOR STARTS TO PULL THE FOIL. AS THE FOIL "CINCHES UP" AGAINST THE CERAMIC PLATES, THE POT IS LEFT AT THAT SETTING FOR THE TEST PERIOD BEING RUN. THE HV SECTION USES A CLEAR POLYCARBONATE "WINDOW GUARD" THAT KEEPS THE USER FROM PLACING HANDS WITHIN THE FIELD ZONE. NEVER REMOVE THIS GUARD UNLESS DOING SETUP OR REPAIR WORK OR PERFORMING CLEANING OF THE UNIT. ALWAYS REPLACE THE WINDOW WHEN FINISHED WITH THE MAINTENANCE WORK.

THE UNIT CONSISTS OF A MATSUSADA HIGH VOLTAGE AMPLIFIER, A WAVETEK FUNCTION GENERATOR AND A TEKTRONICS OSCILLOSCOPE. THE THREE ITEMS ARE LOCATED ON THE SHELVES BEHIND AND TO THE RIGHT OF THE HV ASSEMBLY. CONNECTIONS FOR THE ITEMS ARE SHOWN ON THE ATTACHED WIRING DIAGRAM IN THIS SECTION OF THIS MANUAL. CHANGES TO THESE CONNECTIONS SHOULD NOT BE ATTEMPTED OR MADE SINCE DANGEROUS VOLTAGES COULD BE PRESENT.

VOLTAGE SETTINGS ARE MADE ON THE HV PANEL AT THE REAR OF THE MACHINE. THE HV ON RED PUSH BUTTON ALLOWS THE OUTPUT TO TURN ON AND THE VOLTAGE IS SET USING THE OUTPUT LEVEL POTENTIOMETER.

WAGNER MODEL R2R-1

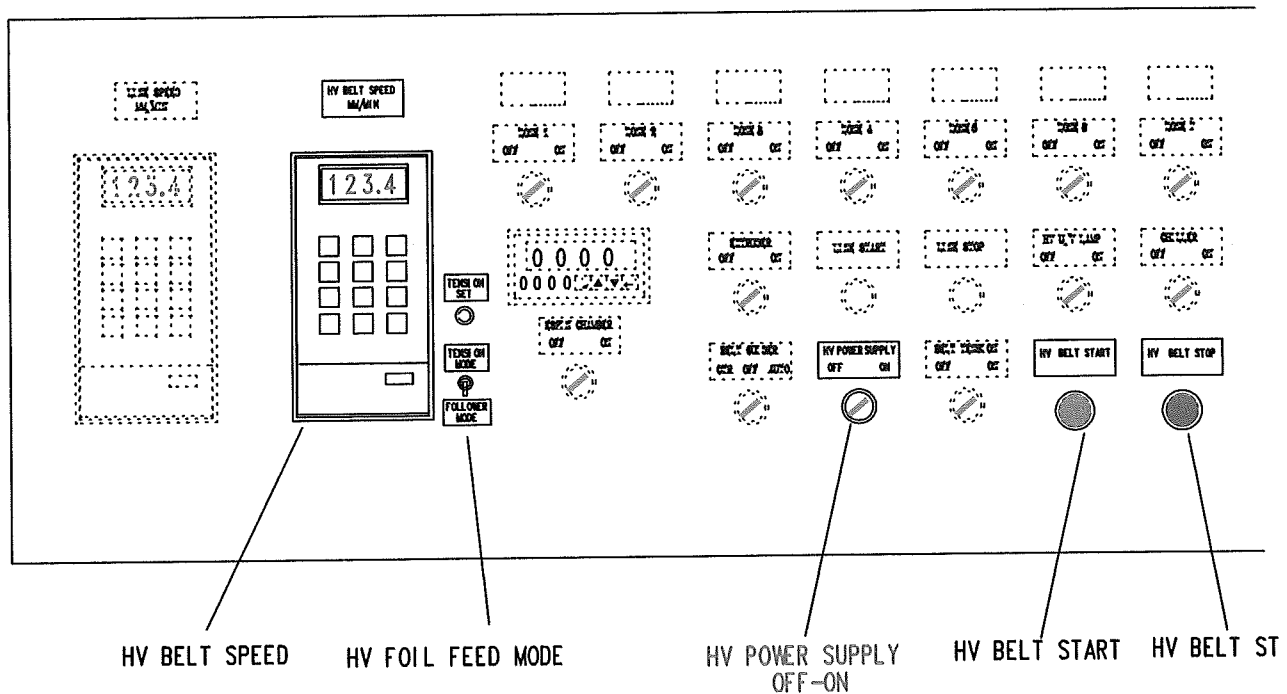
S/N H3859

HV E-FIELD UNIT

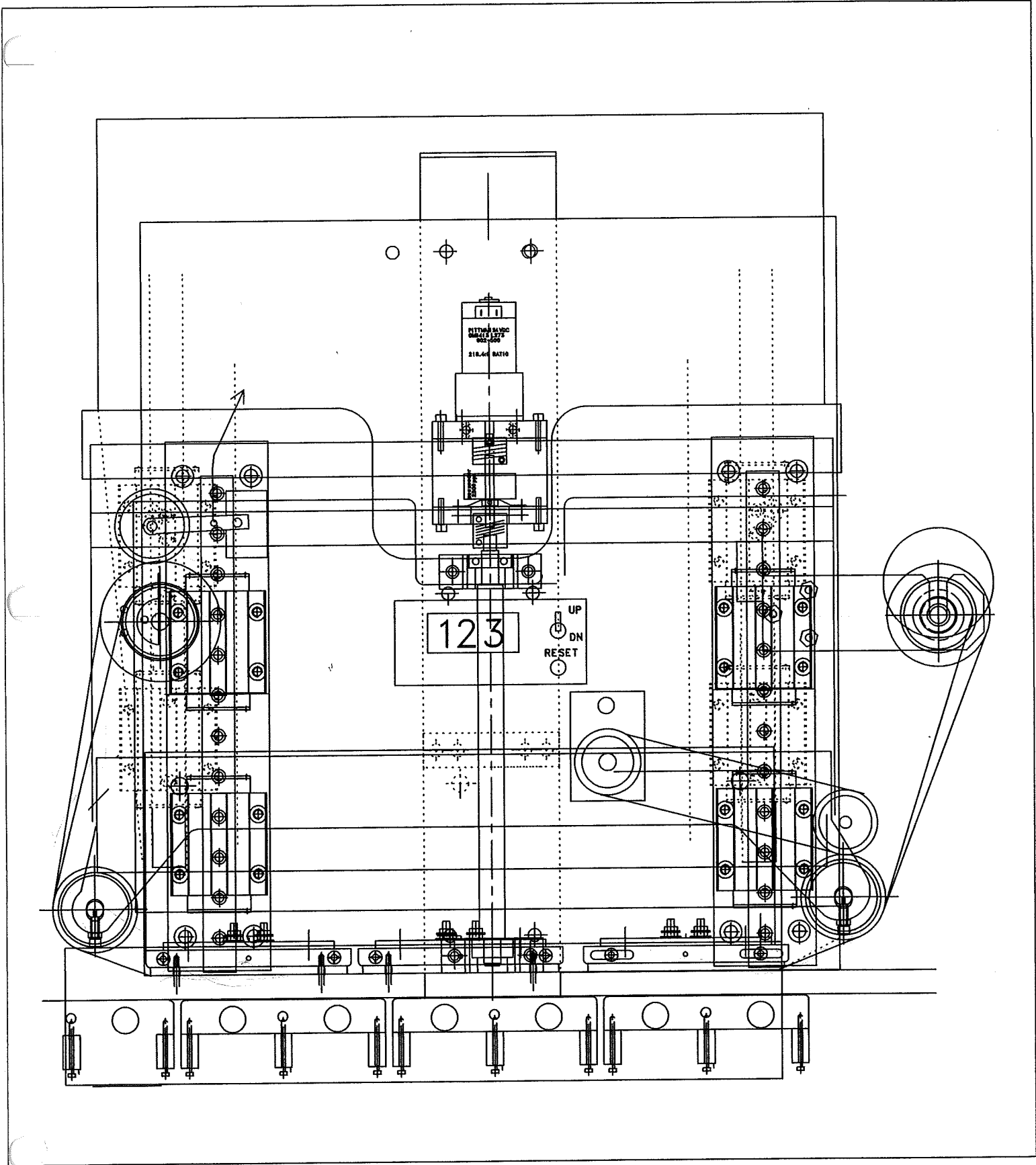
SEC 7

NEVER ATTEMPT ADJUSTMENTS WITH THE HIGH VOLTAGE POWER SUPPLY TURNED ON! SEVERE SHOCK OR INJURY MAY RESULT!

A YELLOW ROTATING BEACON INDICATES THAT THE HIGH VOLTAGE SECTION IS IN OPERATION. BE SURE OPERATOR WINDOW GUARDS ARE IN PLACE. THE E-FIELD SYSTEM IS TURNED ON AND OFF AT THE MAIN OPERATOR PANEL.



CAUTION! IF IN DOUBT ABOUT ANY CONDITION, SETTING OR SETUP MODES, ALWAYS ASK SOMEONE WITH THE TECHNICAL KNOWLEDGE ABOUT THIS MACHINE. NEVER ASSUME THE HIGH VOLTAGE IS OFF. ALWAYS CHECK THE FOIL SURFACE WITH A HIGH VOLTAGE PROBE DESIGNED TO HANDLE 30KV OR HIGHER. ALSO BE SURE FOIL IS DISCHARGED BEFORE TOUCHING. GROUND THE FOIL WITH A GROUNDED METAL SHORTING BAR OR PROBE BEFORE CONTINUING.



E-FIELD ASSY

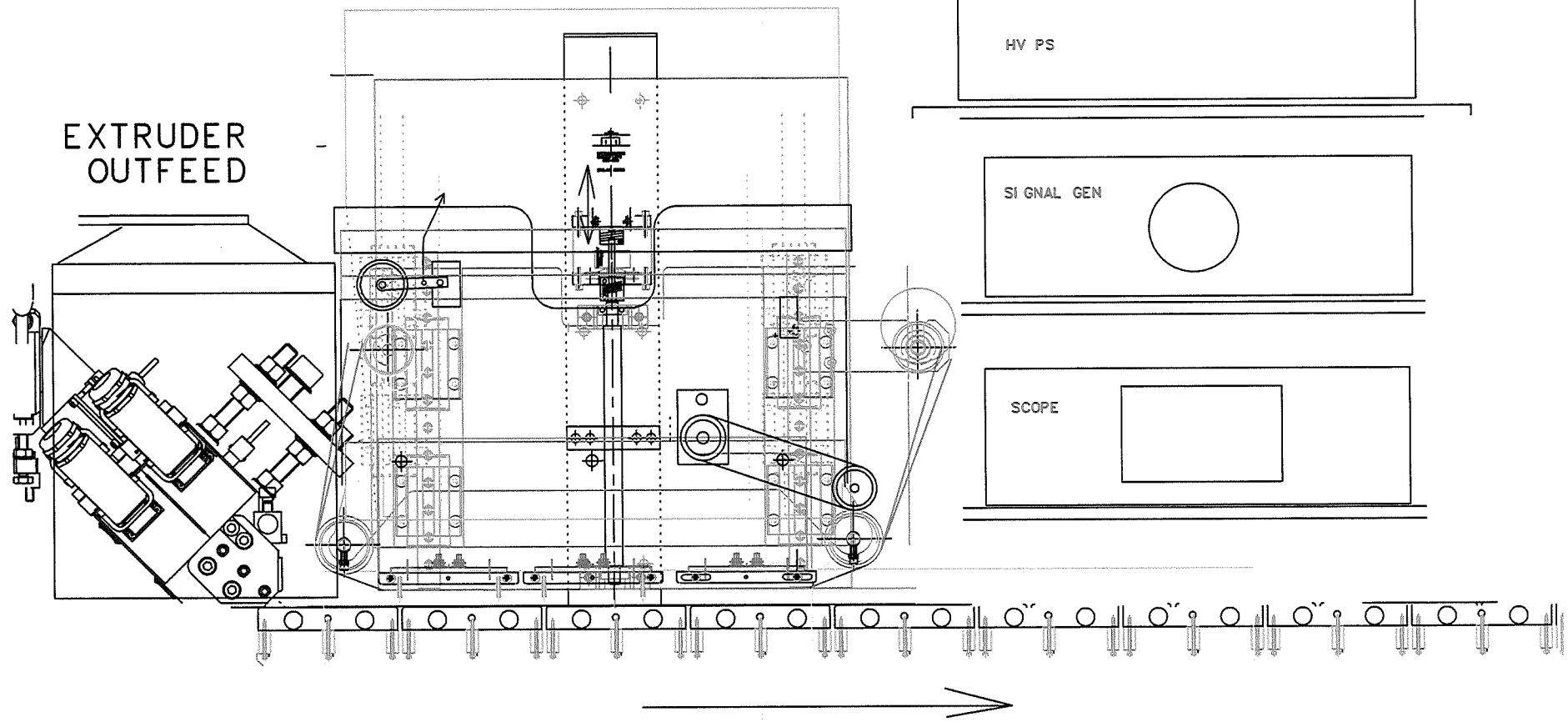
HV MODULES

EXTRUDER
OUTFEED

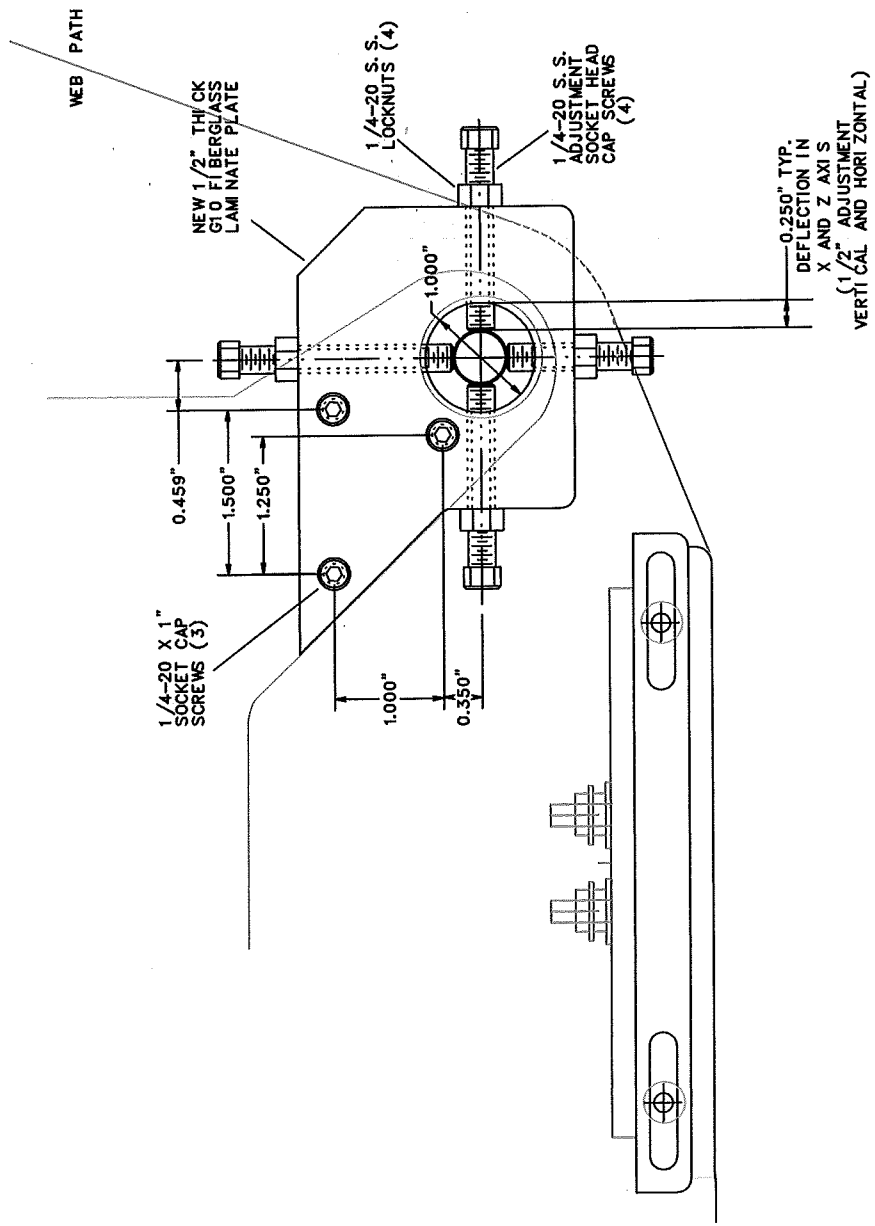
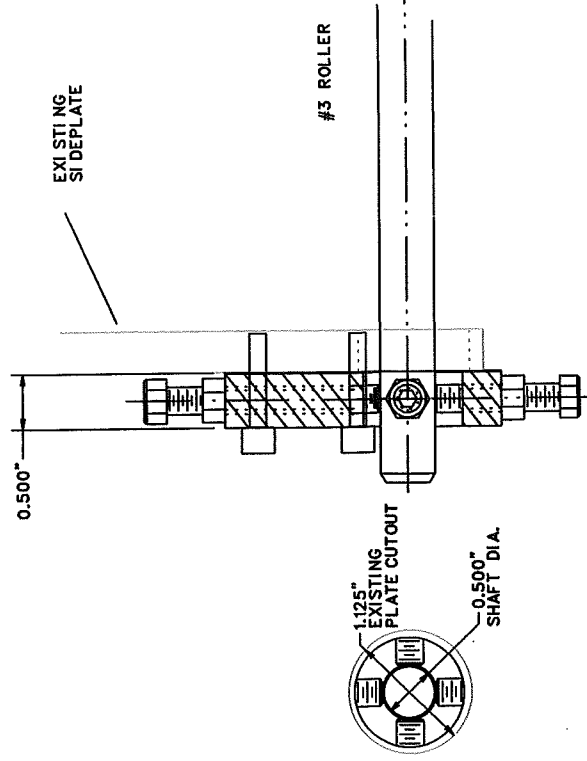
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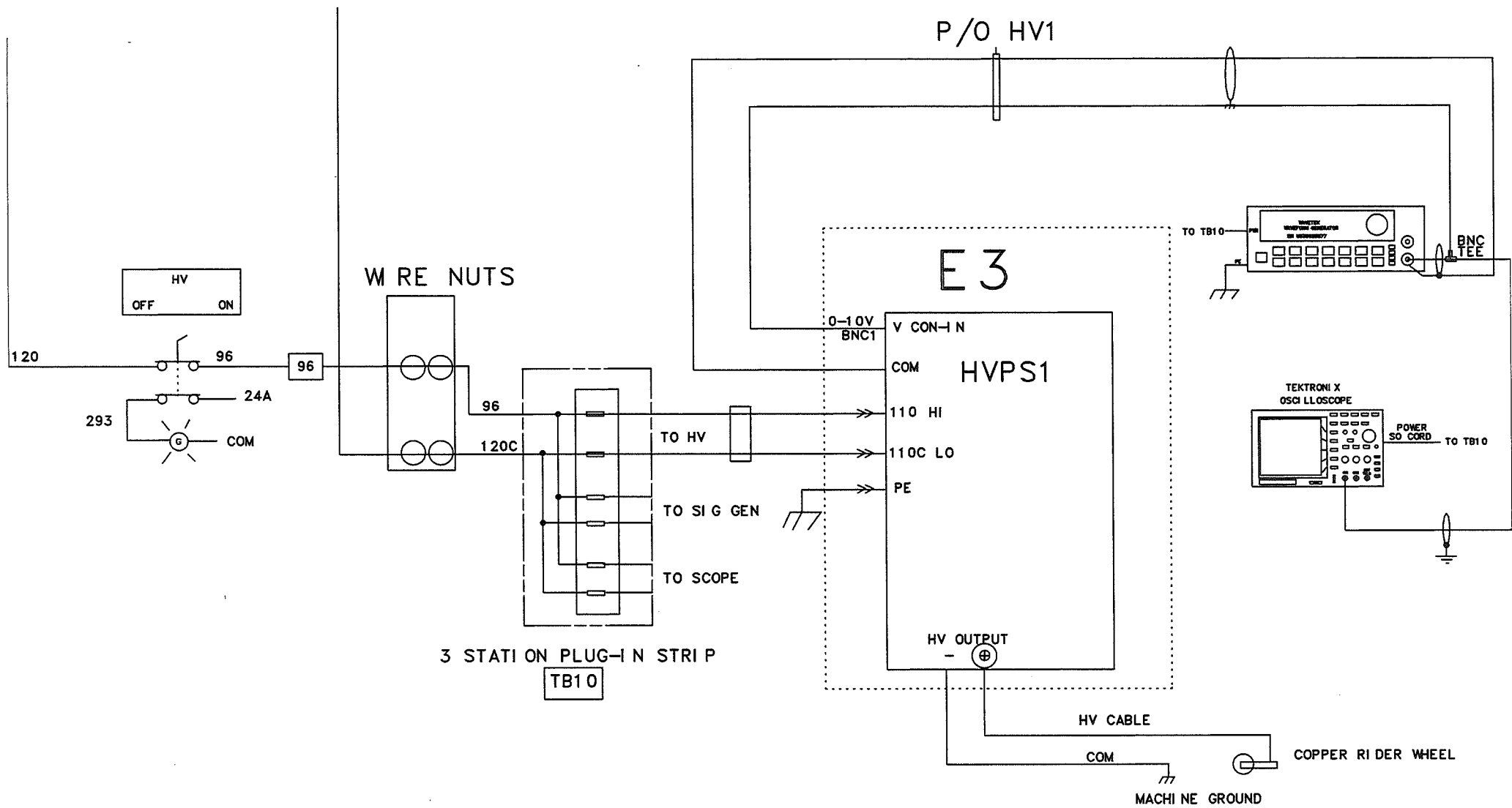
SI GNAL GEN

SCOPE

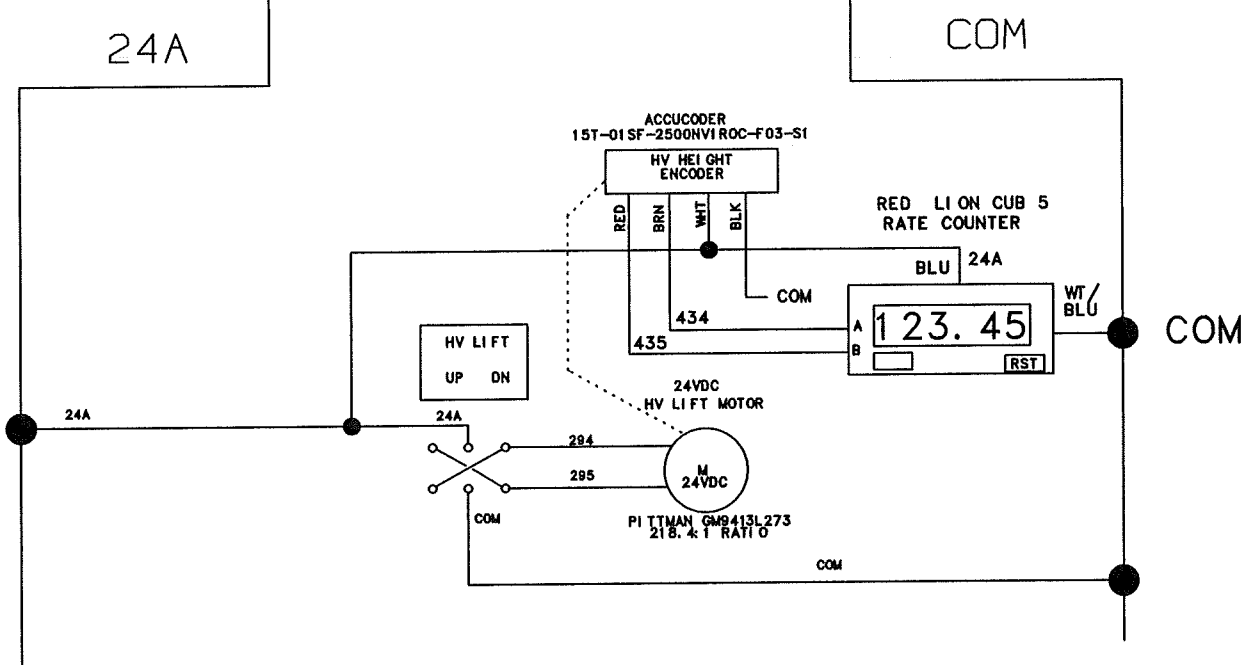


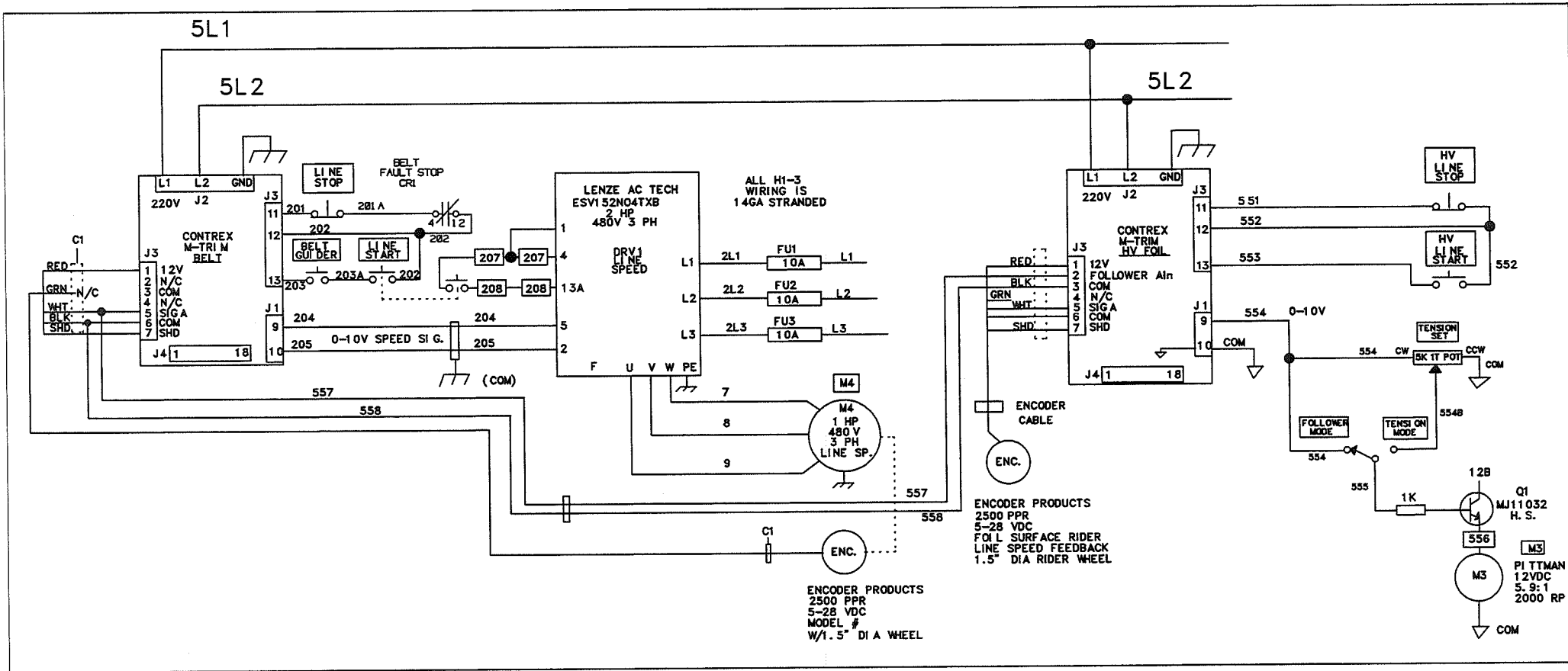
E-field Tension
Evening adapter
install 9/18 - 10/18

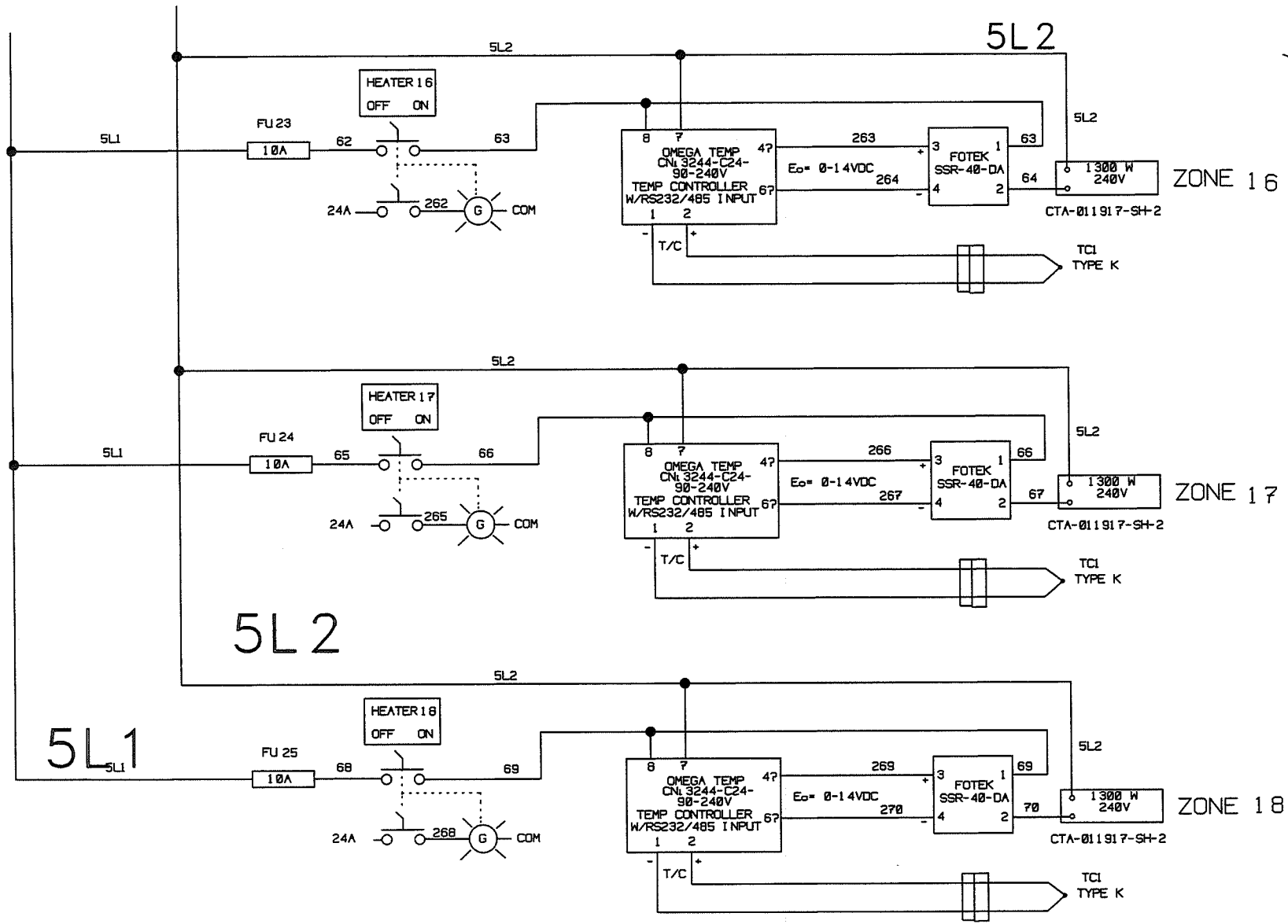




L1 PS1 L2
S-250-24
24V 10A







HIGH VOLTAGE
HEATER PLATES

CH 8

WAGNER MODEL R2R-1

S/N H3859

HEATER PLATE SECTION






SEC 8

IN ORDER TO KEEP POLYMER COATINGS IN A LIQUID STATE, A SERIES OF FIFTEEN ELECTRICALLY HEATED ALUMINUM PLATES ARE LOCATED UNDER THE FILM PASS LINE SO AS TO BE IN DIRECT CONTACT WITH THE SUBSTRATES. EACH PLATE CAN BE HEATED UP TO 600 C USING A LARGE SURFACE HEATED CONTACT PLATE MOUNTED BENEATH THE GOLD COLORED SECTIONS. A TYPE K THERMOCOUPLE IS EMBEDDED WITHIN EACH BLOCK FOR CONTROL FEEDBACK AND TEMPERATURE FEEDBACK. THE PID LOOP CONTROLS AND READOUTS ARE LOCATED ON THE MAIN OPERATORS PANEL. EACH SECTION CAN ALSO BE SWITCHED OFF IF NECESSARY. THERMAL TRANSFER THRU THE MACHINE STRUCTURE IS KEPT TO A MINIMUM BY THE USE OF CERAMIC STANDOFFS.

TESTS WITH FLIR CAMERAS HAVE SHOWN THAT TEMPERATURE DISTRIBUTION OVER THE PLATE SURFACES WERE EXCEPTIONALLY EVEN AND STABLE. TEMPERATURE CONTROL WAS WITHIN +/- 1-2 C AND WARM-UP FROM ROOM TEMP TO 500C WAS WITHIN 1-2 HOURS. HEATER WARMUP TIMES MUST BE KEPT TO A GRADUAL INCREASE AS STEPS OF 50 TO 100C AT A TIME SINCE HEATER ELEMENT BURNOUT DUE TO OVERHEATING CAN OCCUR. ALWAYS ALLOW AT LEAST 10 MINUTES SOAK TIME ONCE EACH TEMPERATURE STEP HAS BEEN REACHED. AT THAT TIME, THE NEXT UPPER TEMPERATURE VALUE CAN BE SET.

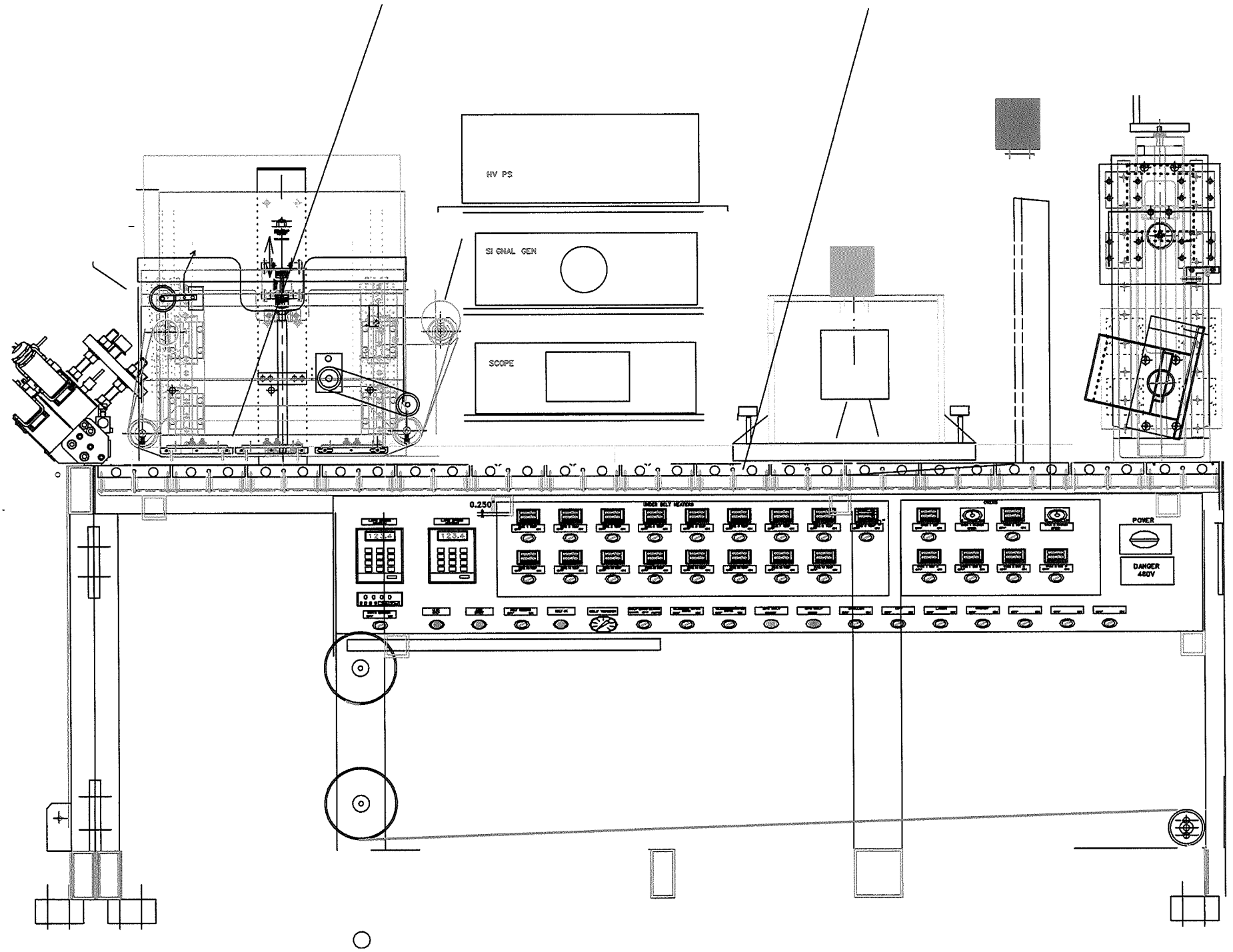
THE HEATERS ARE NUMBERED 1 THRU 15 ALONG THE BED WHILE HEATERS NUMBERED 16, 17 AND 18 ARE LOCATED WITHIN THE HV E-FIELD UPPER HEAD ASSEMBLY (SECTION 7). ALL PID TEMPERATURE CONTROLLERS HAVE RS232 CONNECTION CAPACITY FOR FUTURE CLOUD REMOTE SETTING CAPABILITY. FOR PROGRAMMING INFORMATION SEE THE DESCRIPTION IN THE OEM OMEGA TEMPERATURE CONTROLLER MANUAL IN THIS SECTION.

TO SET TEMPERATURES OF CHANNELS 1-18
HEATER PLATES
(OMEGA CNI 3244-C24)

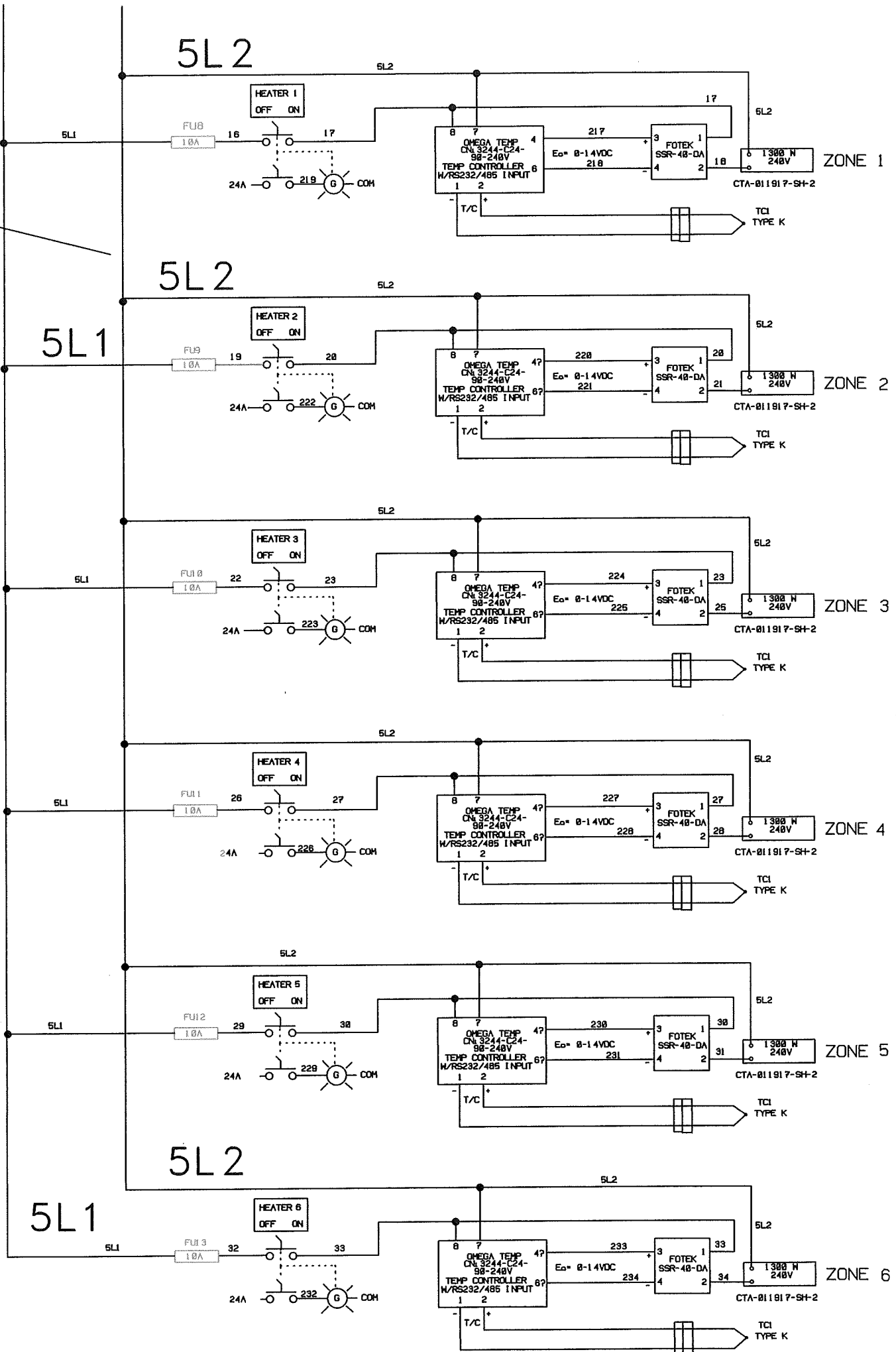
1. PRESS 
2. READ SP1
3. PRESS 
4. READ EXISTING SET TEMP
5. PRESS  OR  TO SET NEW DESIRED TEMP
6. PRESS  TO STORE
7. REPEAT STEP 6 UNTIL "RUN" IS DISPLAYED

HV
HEATERS 16-18

UNDERBED
HEATERS 1 THRU 15

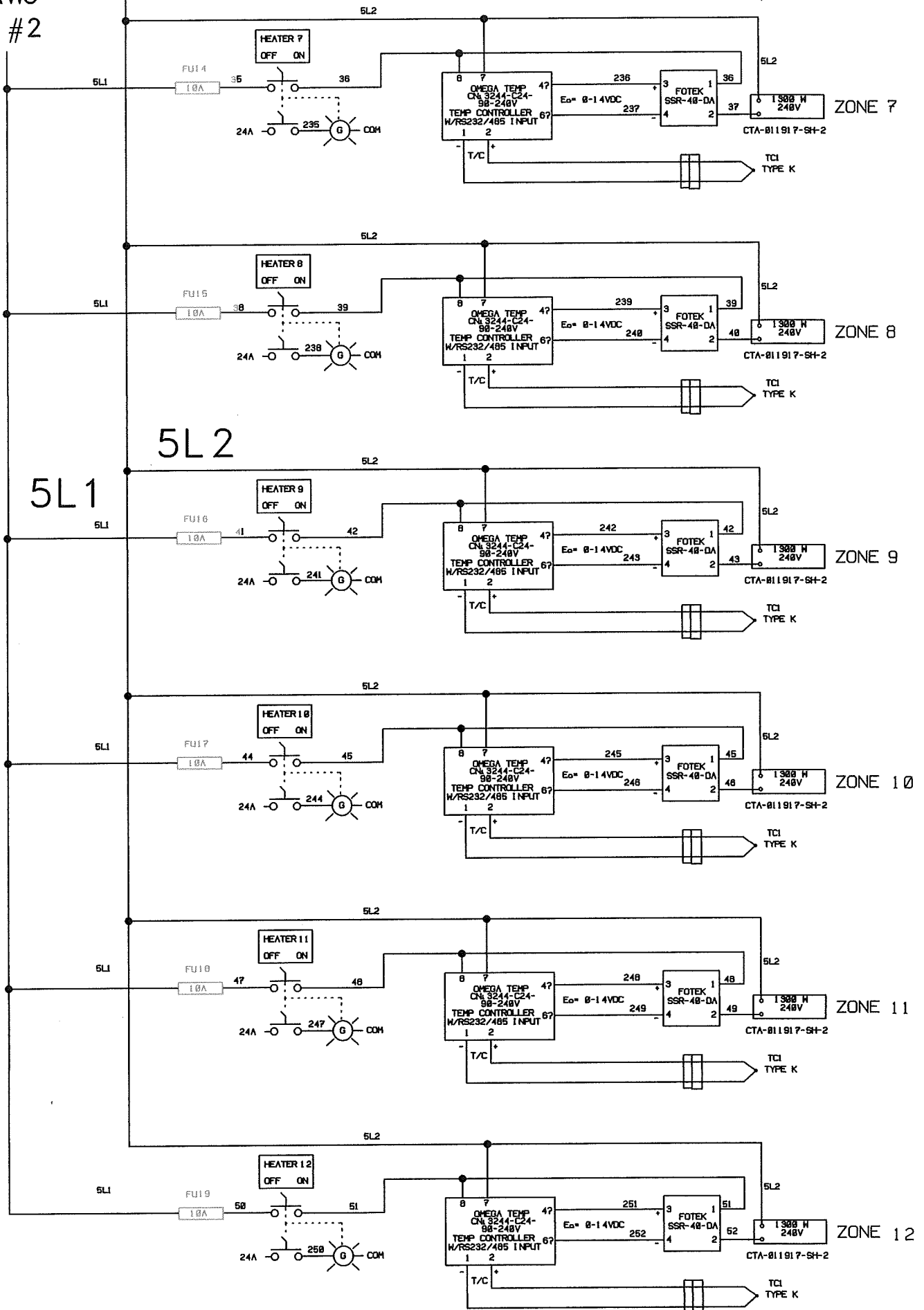


WHT
10AWG
5L2 #2



BLK
10AWG
5L1 #2

WHT
10AWG
5L2 #2



WHT
10AWG
5L2 #3

BLK
10AWG

5L1 #3

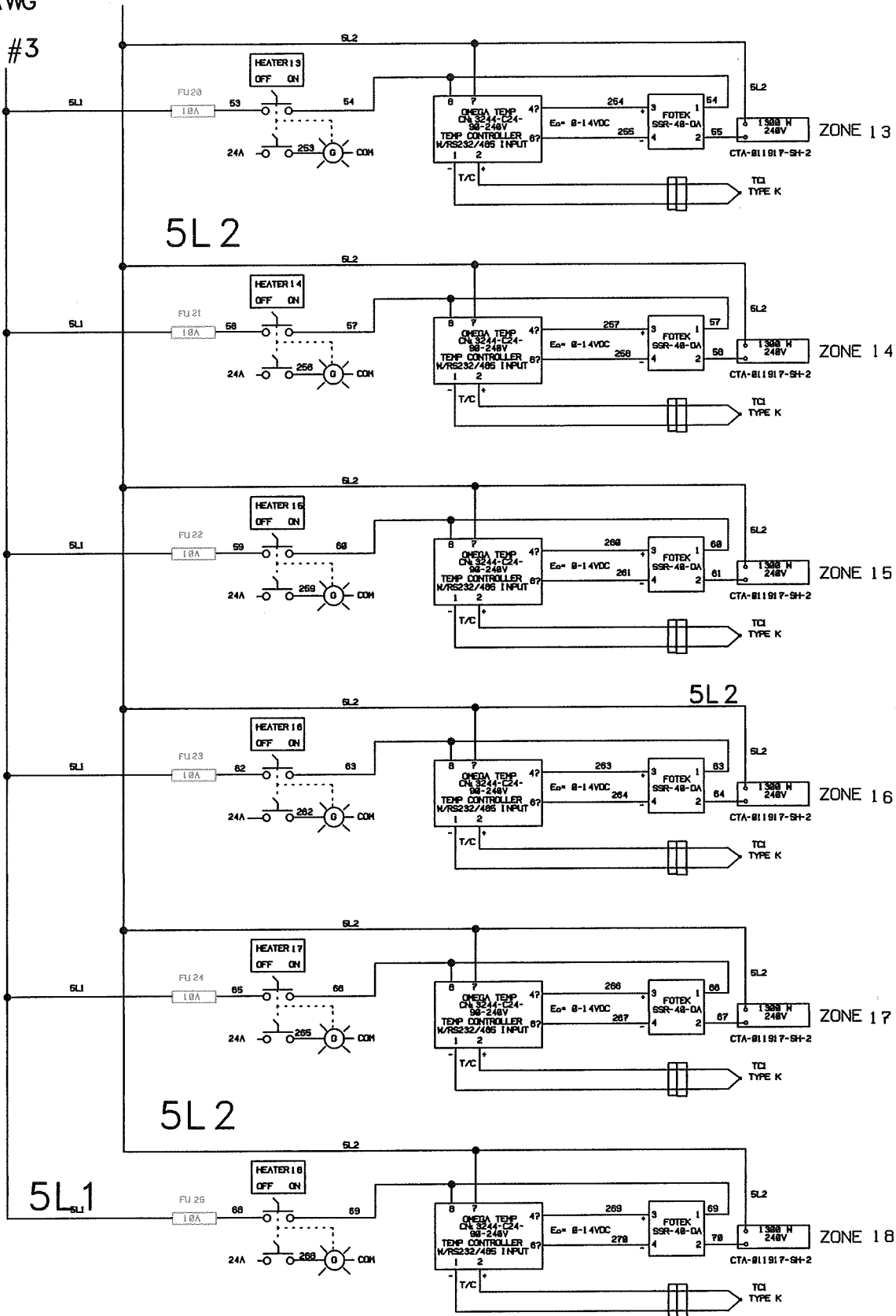
5L1

5L2

5L2

5L2

5L1

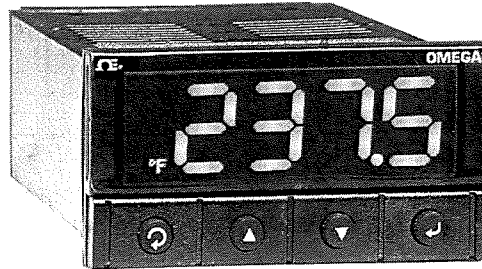


HI GH VOLTAGE
HEATER PLATES

CNi3244-C24

QUICK START 

CE



iSeries

CNi32 Temperature & Process Controller

omega.com[®]

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www.omega.com

Internet e-mail
info@omega.com

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ISO 9001 Certified

Omega Engineering, Inc.
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Laval (Quebec) H7L 5A1
TEL: (514) 856-6928
e-mail: info@omega.ca FAX: (514) 856-6886

For immediate technical or application assistance:

USA and Canada:

Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA[®]
Customer Service: 1-800-622-2378 / 1-800-622-BEST[®]
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN[®]

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En Español: (001) 203-359-7803
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Toll Free in Germany: 0800 639 7678
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Toll Free in England: 0800 488 488
e-mail: sales@omega.co.uk

START HERE

This Quick Start Reference provides information on setting up your instrument for basic operation. The latest complete Communication and Operation Manual as well as free Software and ActiveX Controls are available at www.omega.com/specs/series.

SAFETY CONSIDERATION



This device is marked with the international Caution symbol.

The instrument is a panel mount device protected in accordance with 2014/35/EU. Remember that the unit has no power-on switch. Building installation should include a switch or circuit-breaker that must be compliant to IEC 947-1 and 947-3.

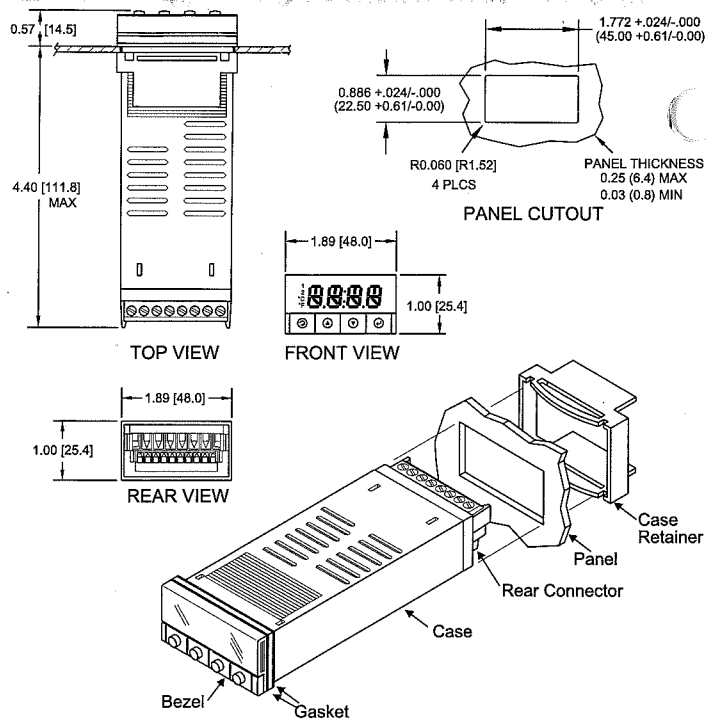
SAFETY:

- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reason.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.

EMC:

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wire close to the instrument if EMC problems persist.

MOUNTING



Panel Mounting Instruction:

1. Using the dimensions from the panel cutout diagram shown above, cut an opening in the panel.
2. Insert the unit into the opening from the front of the panel, so the gasket seals between the bezel and the front of the panel.
3. Slide the retainer over the rear of the case and tighten against the backside of the mounting panel.

Disassembly instruction:

If necessary, the unit may be removed from the panel and opened.



Warning: Disconnect all ac power from the unit before proceeding.

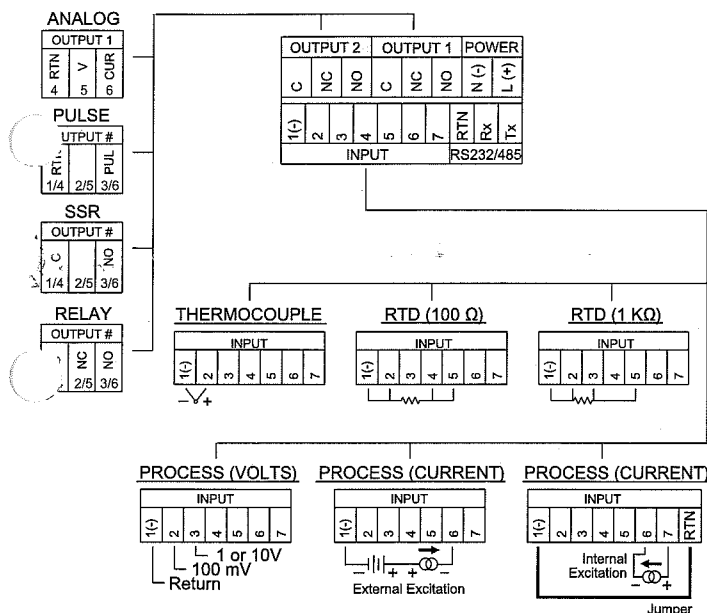
1. Make sure the AC power is disconnected.
2. Remove all wiring connections from the rear of the meter. To remove power and input connectors bend the side panel detents on the case outward to release the connectors, then pull connectors from the meter.
3. To remove meter from the case, squeeze left and right sides of the bezel to release, then pull from case.

WIRING

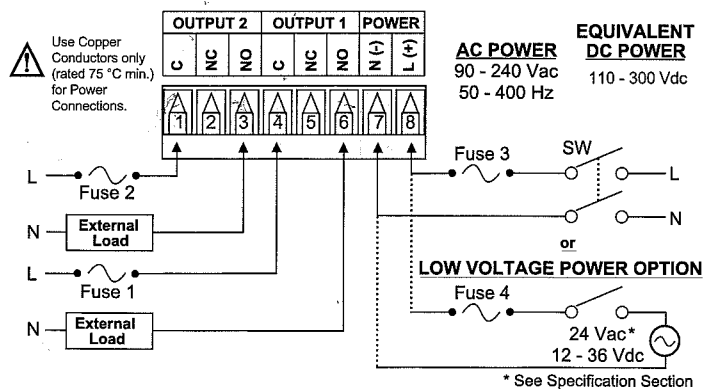
Wire the instrument according to the figure shown below.



Warning: Do not connect ac power to your device until you have completed all input and output connections. This device must only be installed by a specially trained electrician with corresponding qualifications. Failure to follow all instructions and warnings may result in injury!



Connect the main power connections as shown in the figure below.



FUSE	Connector	Output Type	For 115Vac	For 230Vac	DC
FUSE 1	Output 1	Relay	3 A(T)	3 A(T)	-
FUSE 2	Output 2	Relay	3 A(T)	3 A(T)	-
FUSE 3	Power	N/A	100 mA(T)	100 mA(T)	100 mA(T)
FUSE 4	Power	N/A	N/A	N/A	400 mA(T)

* See Specification Section

CONFIGURATION

MENU Mode:

Flashing display in MENU Mode means you can make your selection by pressing **▲** button. If the flashing display is not a four digit value, pressing **▼** button will always direct the instrument one step backward of the top menu item. The second push on the **▼** button will reset the instrument except after the setpoint and the alarms, that will go to the RUN Mode without resetting the instrument. The **▶** button will always sequence the instrument thru the menu items.

The **▶** button has two functions:

1. To save a selected flashing display
2. To direct the instrument to the next submenu level

RUN Mode:

- ▶ causes the display to flash the PEAK with the corresponding value. Press again to go back to RUN Mode.
- ▼ causes the display to flash VALLEY with the corresponding value. Press again to go back to RUN Mode.
- ▶ causes flashing PEAK or VALLEY to reset corresponding values. Pressing **▶** twice will cause the display to flash **STBY** and put the instrument into standby, which disables all outputs and alarms. Press **▶** one more time to go back to RUN Mode.

OPERATION - (For Thermocouple Input)

1. Apply Power to the Instrument

When your device is first powered up it will display the ambient temperature (assume 75°F).

Step 2. Enter Setpoint 1 Menu

Press **▶** one time from run mode to get to **SP1** Setpoint 1.

Step 3. Enter the Setpoint 1 Value Submenu

Press **▶**. Display shows the previous selection of Setpoint 1.

Step 4. Change the Setpoint 1 Value

Press **▲** or **▼** until desired value is displayed.

Step 5. Store the Setpoint 1 Value

Set the Setpoint 1 to 10 degree higher than Process value (SP1 = 85) and press **▶** to store, display flashes **STRD** message and advances to **SP2** Setpoint 2 Menu.

Step 6. Store the Setpoint 2 value

Repeat steps 3 and 4. Set the Setpoint 2 to 5 degree higher than Process value (SP2 = 80) and press **▶** to store, display flashes **STRD** message and advances to **CNFG** Configuration Menu.

Step 7. Enter the Input Type Menu

Press **▶** to enter **INPT** Input Type Menu.

Step 8. Enter to the submenu items of Input Menu

Press **▶** to display Input: Process, RTD or Thermocouple. If flashing **TC** is displayed press **▶** and proceed to step 11.

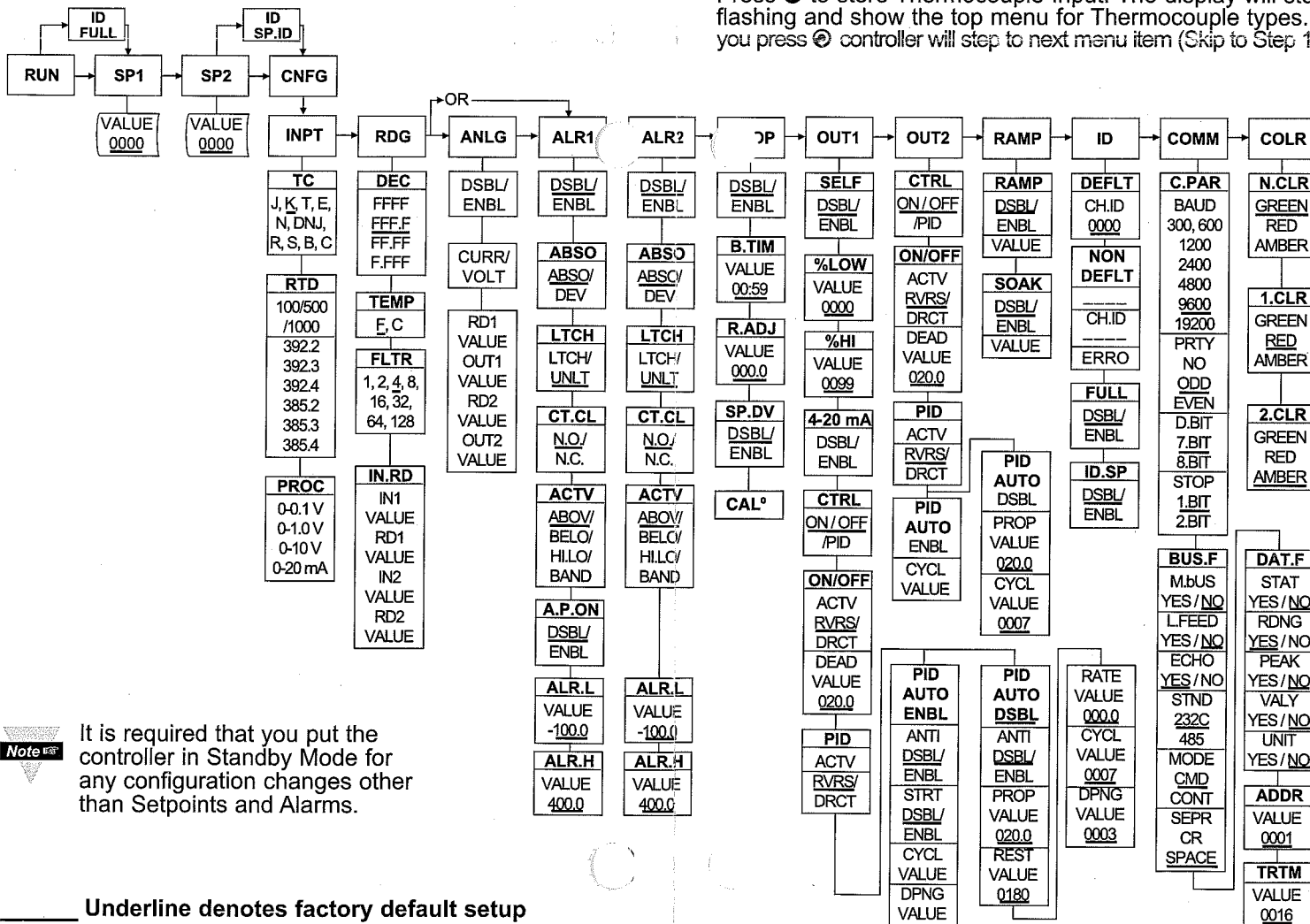
Step 9. Scroll through available selection of Input Menu

Press **▲** until a flashing **TC** for Thermocouple is displayed.

Step 10. Enter to the Thermocouple Input Submenu

Press **▶** to store Thermocouple Input. The display will stop flashing and show the top menu for Thermocouple types. If you press **▶** controller will step to next menu item (Skip to Step 14).

FLOW CHART



Note It is required that you put the controller in Standby Mode for any configuration changes other than Setpoints and Alarms.

Underline denotes factory default setup

Step 11. Enter to the Thermocouple Type Input Submenu
Press **⏏** to display flashing, previously selected Thermocouple type.

Step 12. Scroll through available selection of TC types
Press **⏏** to sequence thru flashing Thermocouple types, (select k -for type "K" CHROMEGA®/ALOMEGA®)
J K T E N DIN J R S B C - TC types
J k t E N d i n J R S b C - Display

Step 13. Store TC type
After you have selected the Thermocouple type press **⏏** to store your selection, the instrument automatically advances to the next menu item.

Step 14. Enter to Reading Configuration Menu
The display shows **RDC** Reading Configuration, which is the top menu for 4 submenus: Decimal Point, Degree Units, Filter Constant and Input/Reading Submenus.

Step 15. Enter to Decimal Point submenu
Press **⏏** to show **DEC** Decimal Point.

Step 16. Display the Decimal Point position
Press **⏏** again to display the flashing Decimal Point position.

Step 17. Select the Decimal Point position
Press **⏏** to select **FFF.F** Decimal Point position.

Step 18. Store selected Decimal Point position
By pressing **⏏** momentarily the Decimal Point position will be stored and the instrument will go to the next menu item.

Step 19. Enter to Temperature Unit Submenu
Display shows **TEMP** Temperature Unit.

Step 20. Display available Temperature Units
Press **⏏** to display the flashing Degree **F** or **C**.

Step 21. Scroll through Temperature Units selection
Press **⏏** to select **F** Degree.

Step 22. Store the Temperature Unit
Press **⏏** to display momentarily that the Degree Unit has been stored and the instrument will go automatically to the next menu item.

Step 23. Enter the Filter Constant Submenu
Display shows **FLTR** Filter Constant Submenu.

Step 24. Display the Filter Constant value Submenu
Press **⏏** to display the flashing, previously selected Filter Constant.

Step 25. Scroll through available Filter Constants
Press **⏏** to sequence thru Filter Constants **0001**, **0002**, **0004**, **0008**, **0016**, **0032**, **0064** and **0128**.

Step 26. Store the Filter Constant
Press **⏏** momentarily to store **0004** Filter Constant and the instrument will automatically go to the next menu item.

Step 27. Enter Alarm 1 Menu
The display will show **ALR1** the top menu for Alarm 1. In the following steps we are going to enable Alarm 1, Deviation, Unlatch, Normally Open, Active Above, Enable at power on and +2°F High Alarm i.e. Process Value > Setpoint 1 Value +2°F will activate Alarm 1.

Note If Analog Output Option is installed and enabled, the controller will skip Alarm 1 Menu item to Analog Output.

Step 28. Enter Alarm 1 Enable/Disable Submenu
Press **⏏** to display flashing **DSBL** / **ENBL**.

Step 29. Enable Alarm 1 Submenu
If flashing **ENBL** is displayed, press **⏏**, if **DSBL** is displayed, press **⏏** until **ENBL** is displayed, then press **⏏** to store and go to the next menu item.

Step 30. Select the Deviation Control Type Submenu
Press **⏏**. If flashing **DEV** Deviation is displayed press **⏏**, otherwise press **⏏** until flashing **DEV** is shown. Now press **⏏** to store and go to next menu item.

Step 31. Select the Latched Type Submenu
Press **⏏**. If flashing **UNLE** Unlatched is displayed press **⏏**, otherwise press **⏏** until **UNLE** is displayed. Press **⏏** to store and advance to next menu item.

Step 32. Select the Normally Open Type of Contact Closure Submenu
Press **⏏**. If flashing **N.O.** Normally Open is displayed, press **⏏**, otherwise press **⏏** until **N.O.** is displayed. Press **⏏** to store and advance to next menu item.

Step 33. Select the Above Type of Active Submenu
Press **⏏**. If flashing **ABO** Above is displayed, press **⏏**, otherwise press **⏏** until **ABO** is displayed. Press **⏏** to store and advance to next menu item.

Step 34. Enable Alarm 1 at Power On (A.P.O.N)
Press **⏏**. If flashing **ENBL** is displayed, press **⏏**, otherwise press **⏏** until **ENBL** is displayed. Press **⏏** to store and advance to next menu item.

Step 35. Enter Alarm 1 High Submenu
Press **⏏** twice to skip **ALR.L** Alarm 1 Low value. **ALR.L** is for below & **ALR.H** for above.

Step 36. Set the Alarm 1 High value (ALR.H)
Press **⏏**. Press **⏏** or **⏏** until value to set the display to **002.0**. Press **⏏** to save.

Step 37. Enter the Alarm 2 Menu
The display will show **ALR2** the top menu for Alarm 2. Repeat steps from 28 to 36 to set for Alarm 2 the same conditions as for Alarm 1.

Step 38. Skip the Loop Break Time Menu (LOOP)
Press **⏏** to go to the **OUT1** Output 1 Menu item.

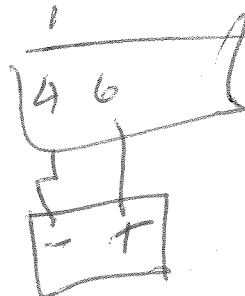
Step 39. Configuration the Output 1 Menu

Note Set Alarm 1 Disabled (Step 29) to be able to Enable Output 1.

Configure Out 1 as **CTRL / PID**, **ACTN / RURS**, **AUTO / DSBL**, **ANL / ENBL**, **PROP / 000.5**, **RESE / 0100**, **RATE / 010.0**, **CYCL / 0010** and **WANG / 0003**. Please refer to the operator's manual if needed. Press **⏏** to save and go to the next menu item.

Step 40. Configuration of Display Color Selection
Press **⏏** until the **COLOR** Display Color Selection Menu appears on the Display. Configure **COLOR** as **N.CLR / GRN** (green), **R.CLR / RED** (red), **A.CLR / AMBR** (amber). Please refer to the operator's manual if needed.

Step 41. Run a Test
Press **⏏** until reset the controller and return to **RUN** Mode to display **075.0** (Ambient Temperature). Now you are ready to observe temperature as it rises 10°F higher than displayed. Touch the tip of the Thermocouple to raise the temperature above the Alarm 2 High value **002.0**, and AL2 will turn on, and Display Color will change from Green to Amber. Continue touching the tip to raise the temperature above the Alarm 1 High value **007.0** and Display Color will change from Amber to Red. Annunciator "1" is turning on and off displaying output 1.



SPECIFICATION

Accuracy:

±0.5°C temp;
0.03% rdg. process typical

Resolution:

1°/0.1°; 10 µV process

Temperature Stability:

0.04°C/°C RTD;
0.05°C/°C TC @ 25°C (77°F);
50 ppm/°C process

Display:

4-digits, 9-segments LED,
10.2 mm (0.40") with red, green and
amber programmable colors

Input Types:

Thermocouple, RTD, Analog Voltage
and Current

TC: (ITS 90)

J, K, T, E, R, S, B, C, N, L

RTD: (ITS 68)

100/500/1000 ohm Pt sensor
2-, 3-, or 4-wire; 0.00385 or 0.00392
curve

Voltage:

0 to 100 mV, 0 to 1 V, 0 to 10 Vdc

Current:

0 to 20 mA (4 to 20 mA)

Output 1:

Relay 250 Vac @ 3 A Resistive Load
SSR, Pulse, Analog Voltage and Current

Output 2:

Relay 250 Vac @ 3 A Resistive Load,
SSR, Pulse

Options: Communication

RS-232 / RS-485 or

Excitation: 24 Vdc @ 25 mA

Exc. not available for Low Power Option

Line Voltage/Power:

90 - 240 Vac ±10%, 50 - 400 Hz*,
or 110 - 300 Vdc, 4 W

* No CE compliance above 60 Hz

Low Voltage Power Option:

12 - 36 Vdc, 3 W**

** Units can be powered safely with 24 Vac
but No Certification for CE/UL are claimed.

Dimensions:

25.4 H x 48 W x 126.3 D mm
(1.0 x 1.89 x 5")

Weight:

127 g (0.28 lb)

Approvals:

UL, UL-C, CE per 2014/35/EU

WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.



This device is marked with the international caution symbol. It is important to read the Setup Guide before installing or commissioning this device, as the guide contains important information relating to safety and EMC.

It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

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and are Trademark.

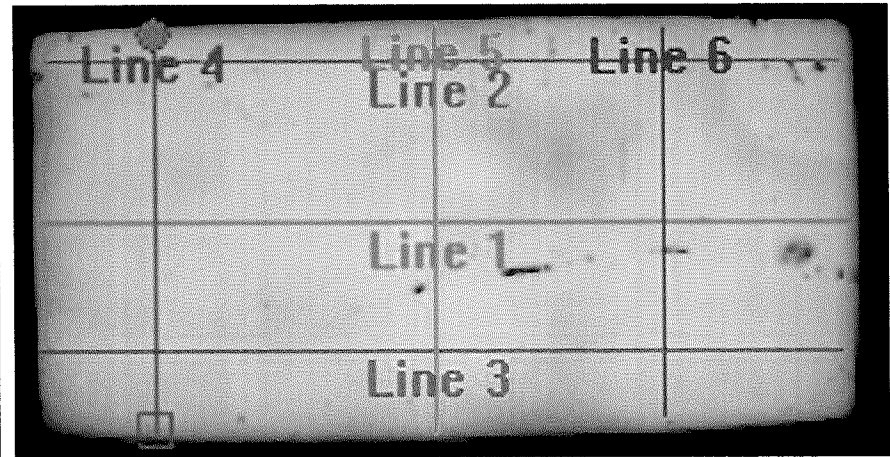
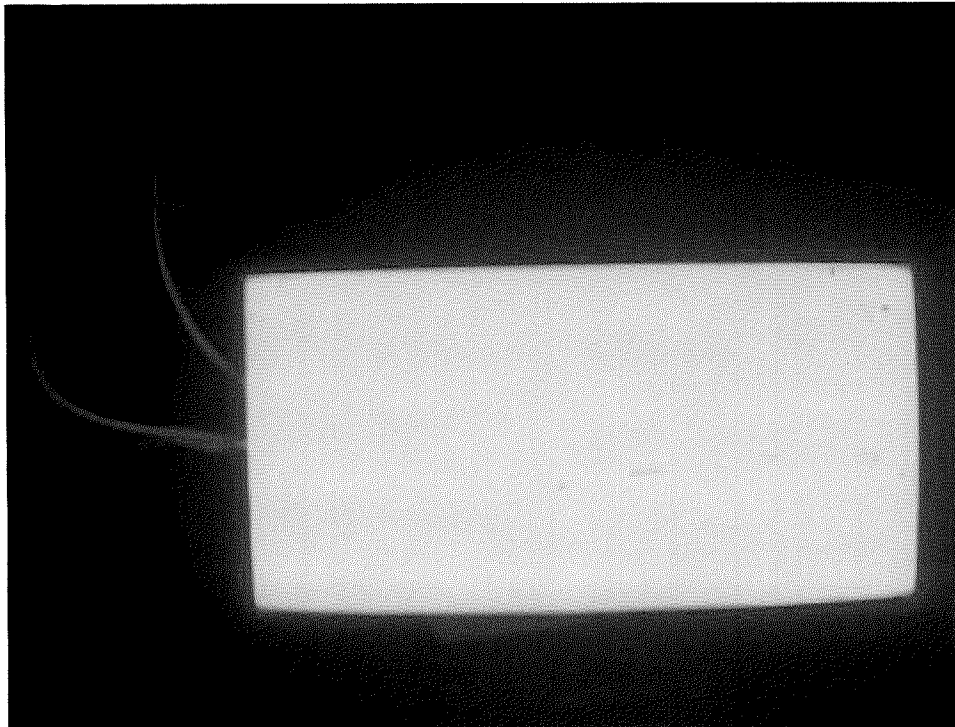
OMEGA ENGINEERING, INC.

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<p>OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. In addition to OMEGA's standard warranty period, OMEGA Engineering will extend the warranty period for four (4) additional years if the warranty card enclosed with each instrument is returned to OMEGA.</p>	
<p>If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY IS VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.</p>	
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<p>Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.</p>	
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<p>FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:</p> <ol style="list-style-type: none">1. Purchase Order number under which the product was PURCHASED,2. Model and serial number of the product under warranty, and3. Repair instructions and/or specific problems relative to the product.	<p>FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:</p> <ol style="list-style-type: none">1. Purchase Order number to cover the COST of the repair,2. Model and serial number of product, and3. Repair instructions and/or specific problems relative to the product.
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Heating Element #2 Evaluation

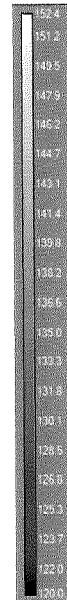
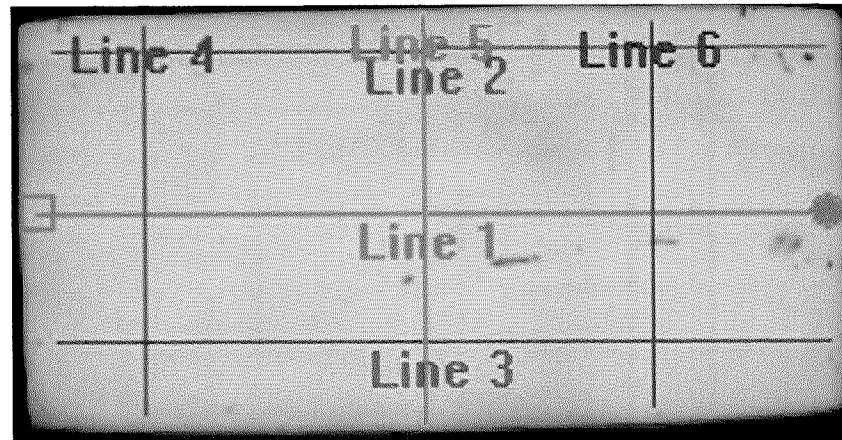
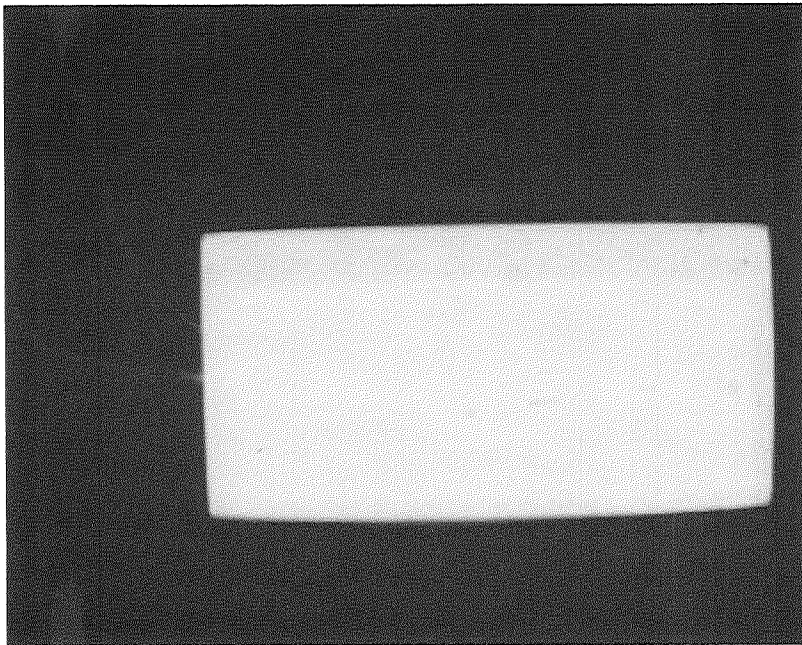
Gustavo Guzman, Siamak Shams, Armen Yildirim

~100C



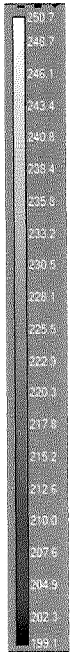
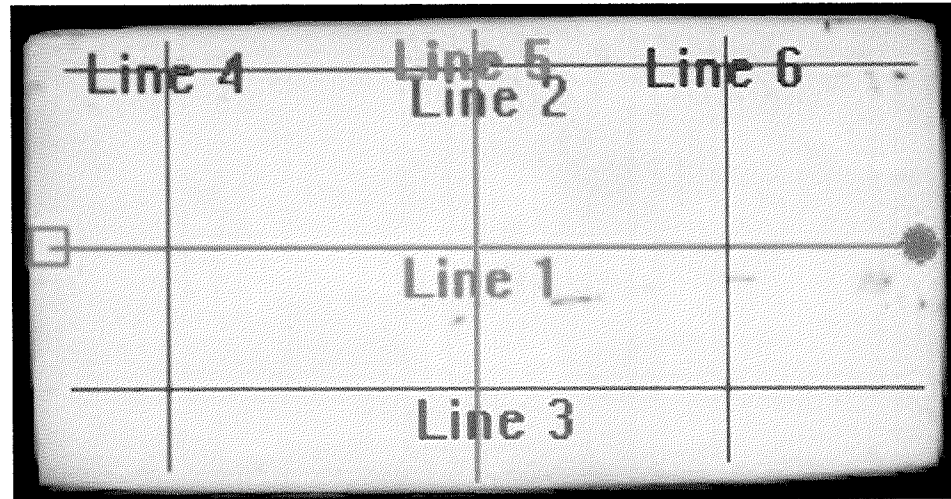
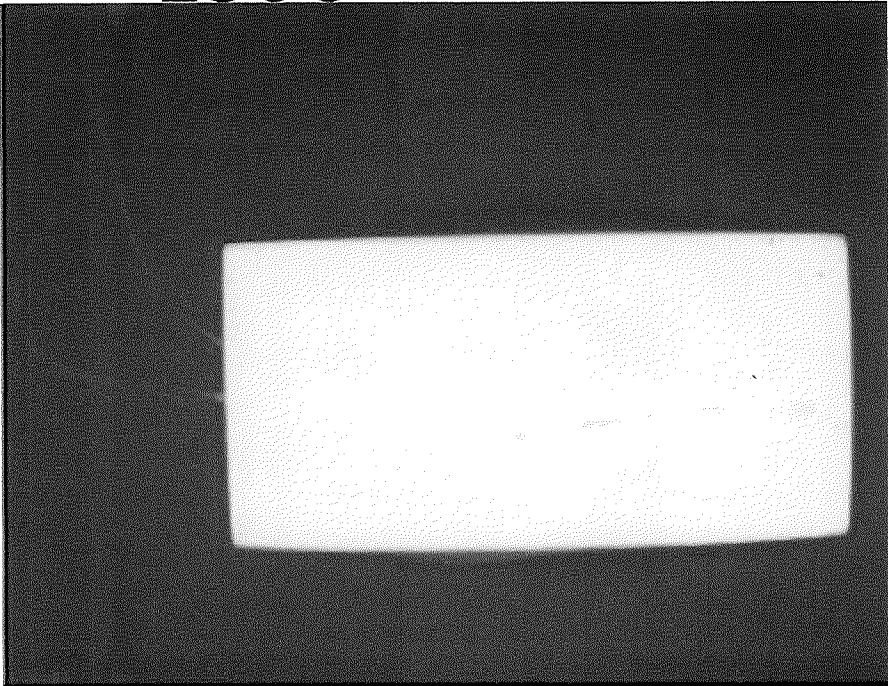
Statistic (units)	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6
Mean [C]	101.0	100.5	100.7	100.5	101.0	100.9
Std Dev [C]	0.4	0.4	0.4	0.4	0.6	0.5
Center [C]	(192.5, 145.0) 101.3	(194.0, 100.5) 100.9	(195.0, 180.0) 101.3	(114.0, 147.0) 100.7	(190.0, 147.0) 101.4	(252.0, 145.5) 101.2
Maximum [C]	(180, 145) 101.9	(219, 100) 101.4	(203, 180) 101.5	(114, 158) 101.0	(190, 168) 101.8	(252, 125) 101.5
Minimum [C]	(85, 145) 99.1	(299, 100) 98.9	(300, 180) 98.9	(114, 200) 98.7	(190, 203) 98.1	(252, 153) 97.0

~150C



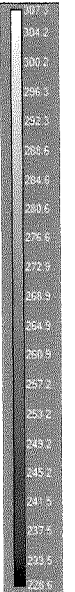
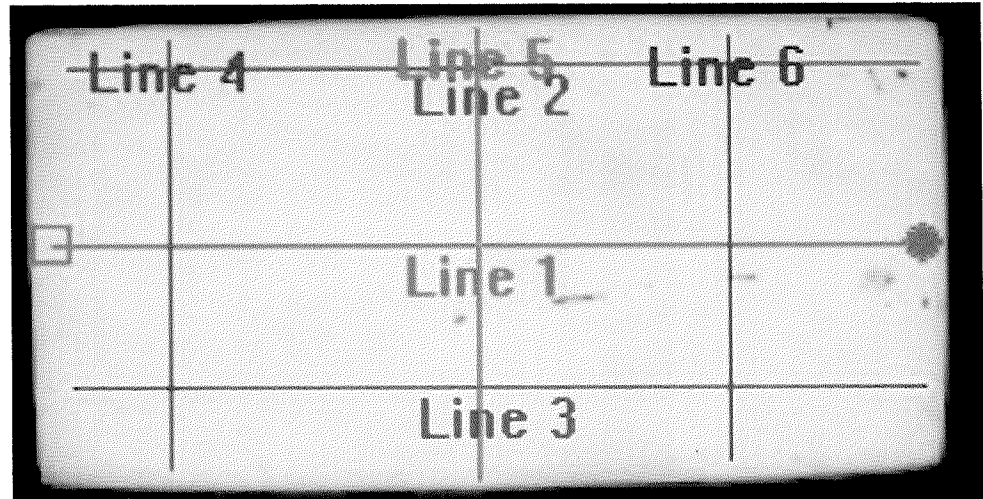
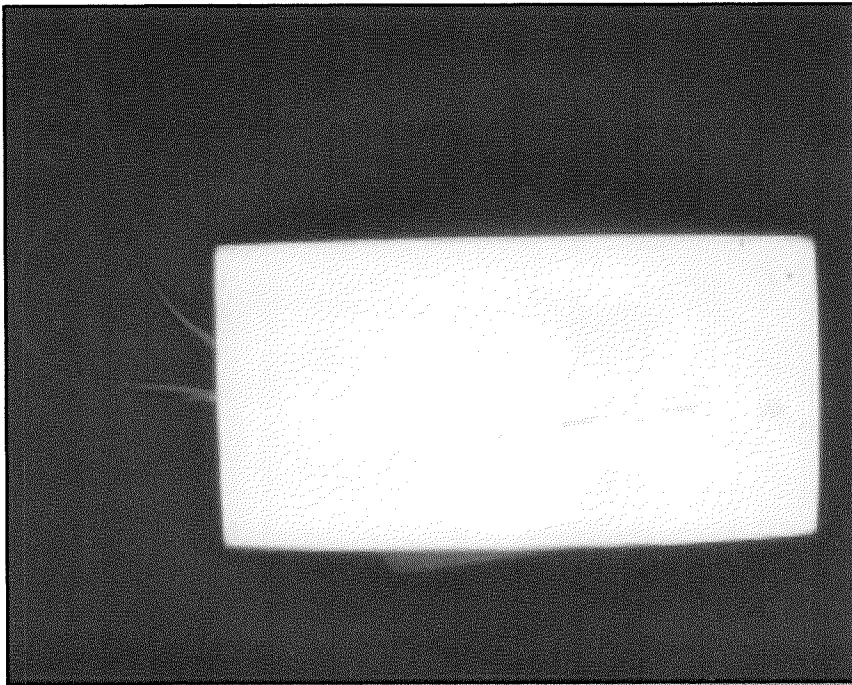
Statistic [units]	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6
Mean [°C]	144.9	144.0	144.3	144.2	144.7	144.7
Std. Dev. [°C]	0.7	0.7	0.6	0.7	0.9	0.8
Center [°C]	(192.5, 145.0) 145.3	(194.0, 100.5) 144.6	(195.0, 180.0) 145.1	(114.0, 147.0) 144.8	(190.0, 147.0) 145.4	(252.0, 145.5) 145.2
Maximum [°C]	(154, 145) 146.1	(219, 100) 145.3	(203, 180) 145.4	(114, 158) 145.0	(190, 168) 145.8	(252, 125) 145.7
Minimum [°C]	(300, 145) 142.1	(299, 100) 141.4	(300, 180) 141.5	(114, 200) 141.5	(190, 203) 140.5	(252, 153) 138.7

250C



Statistic [Units]	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6
Mean [°C]	246.5	245.1	245.0	244.9	246.2	246.0
Std. Dev [°C]	0.8	1.0	0.8	0.8	0.7	0.8
Center [°C]	(190.5, 145.0) 247.1	(187.0, 102.5) 246.6	(188.5, 181.0) 245.9	(114.0, 146.5) 245.8	(190.0, 147.5) 246.8	(251.0, 144.0) 246.3
Maximum [°C]	(154, 145) 248.5	(180, 102) 246.9	(202, 181) 246.7	(114, 139) 246.1	(190, 168) 247.6	(251, 156) 247.9
Minimum [°C]	(263, 145) 242.7	(263, 103) 242.4	(98, 181) 242.5	(114, 106) 242.0	(190, 195) 243.6	(251, 153) 242.2

~300C



Statistic [units]	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6
Mean [°C]	298.1	296.4	296.8	295.7	298.0	296.0
Std. Dev. [°C]	1.1	0.9	1.1	1.1	0.7	1.1
Center [°C]	(186.5, 145.0) 299.9	(182.5, 102.0) 297.6	(182.5, 181.5) 298.0	(114.0, 143.0) 297.0	(190.0, 142.5) 298.0	(266.0, 145.5) 296.6
Maximum [°C]	(154, 145) 300.7	(180, 102) 298.3	(180, 181) 299.1	(114, 158) 297.2	(190, 168) 300.0	(267, 164) 297.9
Minimum [°C]	(246, 145) 295.2	(245, 102) 294.2	(114, 181) 294.2	(114, 106) 290.8	(190, 101) 296.1	(265, 110) 292.6

CH 9

WAGNER MODEL R2R-1

S/N H3859

LASER

SEC 9

AS AN ADDED FEATURE TO THIS MACHINE, A SYNRAD 100 WATT IR LASER HAS BEEN INSTALLED WITH A MOUNT SYSTEM THAT ALLOWS FOR BOTH A VERTICAL AS WELL AS A PRE-ALIGNED BEAM PATH INTO THE MAGNET POLE PIECES.

THE BEAM SCANNER HEAD USES GALVO OPERATED MIRRORS TO CREATE A BEAM SWEEP THAT IS ADJUSTABLE ACROSS A PATH OF UP TO 6 INCHES OR WIDER WITH ADJUSTABLE SWEEP RATES AND POWER SETTINGS. BEAM GEOMETRY IS SET ON THE PC HMI SCREEN LOCATED AT THE LEFT (ENTRANCE) SIDE OF THE E-SPIN ENCLOSURE. TESTS HAVE SHOWN THAT AT POWER LEVELS OF 40-80 PERCENT OF FULL POWER (100 WATTS OUTPUT) ENOUGH HEAT IS GENERATED ON THE WEB SURFACE TO ACTUALLY CHAR THE COATINGS. THESE TESTS WERE DONE AT WEB SPEED SETTINGS OF 20MM/MIN WITH CONTINUOUS SWEEPS AT 3-5 SEC/SWEEP (EST.).

THE LASER USES A POWER SUPPLY LOCATED AT THE REAR OF THE MACHINE TO THE LEFT OF THE LASER MOUNTING POST. A SWITCH ON THE MAIN OPERATOR PANEL TURNS THE LASER SYSTEM ON ALONG WITH THE RED SAFETY BEACON. TYPICAL WIRING DIAGRAM IS SHOWN ON THE ATTACHED PAGE.

NOTE: ALWAYS USE THE METAL SHIELDS AROUND THE LASER AND MAGNET WHEN USING THIS SECTION OF THE MACHINE. NEVER OPERATE THIS EQUIPMENT WITHOUT PROPER EYE PROTECTION. NEVER LOOK DIRECTLY AT THE BEAM FROM DOWNSTREAM OF THE MAGNET AS THERE IS ALWAYS THE POSSIBILITY OF A REFLECTION OF THE BEAM OFF OF THE FILM SURFACE OR THE MAGNET POLE PIECES.

TWO CHILLER PLATES ARE LOCATED AT THE INFEED AND EXIT ENDS OF THE MAGNET. A CHILLER UNIT PROVIDES 50 DEGREE F COOLING. THE MAGNET ITSELF USES FACTORY COOLED WATER WHICH FLOWS THRU A SOLENOID VALVE AT THE REAR OF THE MACHINE FRAME.

RE: laser system info and questions

Nelson, Chris <chris.nelson@synrad.com>

Fri 9/14/2018 6:23 PM

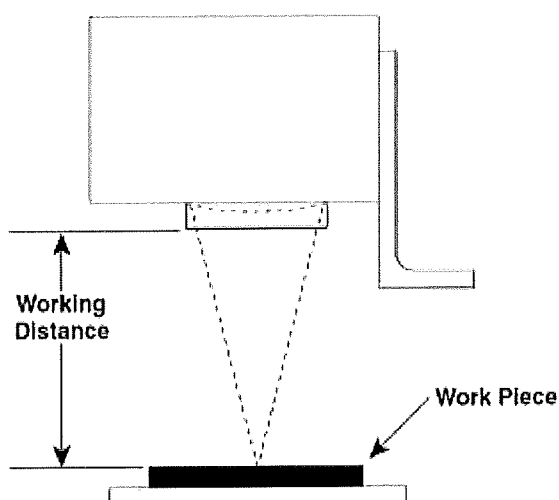
To: Glassmaker, Nicholas J <nlassma@purdue.edu>

Cc: Telesnicki, Guy J <gtelesni@purdue.edu>

Hi Nick,

Good questions all. The working distance of the FH Flyer scan head is dictated by the lens attached. You have the FLA-370, which provides a 540 μ m diameter beam at 350mm (13.78 inches) from the face of the lens mounting ring.

Just to be clear, you want to measure the WD as shown below:



Note that the beam at the lens surface is ~ 15 mm in diameter, coming to the focus point at the 13.78 WD, then expanding out at the same rate as it passes through the focal plane. Imagine the beam shape through space being like a very linear hourglass. The total DOF is ± 10 mm for this lens.

If your vendor found the ideal distance to be 22" from the laser an unfocused beam must have been desirable.

The amount of freedom you will have to go out of the focal plane and still get good results depends completely on the way your material interacts with the laser beam and the nature and quality of the processing you are after.

As to your questions:

1. The WD of the system is set by the lens being used. We have lenses with WD from 74 to 190mm and the 350 mm lens that you have. Note that all the FH Flyer lenses are F theta models and are designed to provide a consistent focused spot throughout the working area at the focal plane.
2. As you move away from the focal plane, the beam density drops exponentially with the increase in the beam diameter – Power (W) / Area of spot. How far out of the FL you can 'get good energy transfer' again depends on how the 10.6 μ m beam is absorbed by your material, and how much power density is required to get 'good' results.
3. I'm not sure how to answer this. The DOF is fixed to the focal plane, regardless of the angle of the substrate WRT the focal plane. As you tilt the substrate away from perpendicular to the hourglass axis,

you will end up with a smaller mark area on the substrate that is within the DOF.

4. Again, this all depends on how you define good. The bottom line here is that you will likely need to arrive at the desired working distance, incident angle and other system properties through trial and error.

I hope that helps! I would appreciate any feedback you might have. You can click on the 'How did I do?' icons below to provide feedback and help us to better serve our customers!

Chris Nelson
Technical Support Manager
Synrad

4600 Campus Place, Mukilteo, WA 98275, USA
T 1.425.609.5060
E chris.nelson@synrad.com W www.synrad.com

SYNRAD
A Novanta Company

How did I do?



[Click on a face to provide feedback on my performance!](#)

From: Glassmaker, Nicholas J [mailto:nklassma@purdue.edu]
Sent: Friday, September 14, 2018 1:48 PM
To: Nelson, Chris <chris.nelson@synrad.com>
Cc: Telesnicki, Guy J <gtelesni@purdue.edu>
Subject: laser system info and questions

Hello Chris,

There are two parts to the laser system that we have:

The larger box is model number FST1100SFB, serial number I100356160408, DOM Dec. 21, 2016.

The smaller connected box is labeled FH Flyer Marking Head; model number FHFLU-U, serial number FHFL0241780008; DOM Jan 24, 2017; the lens on the opposite side of the box says ser. number 834, FLA370, approx working dist. 350 +/- 5 mm.

We have this system mounted over a moving web and would like to use it to locally heat and melt polymer films. The vendor who assembled the system for us says that the ideal distance for laser processing is 22.332" from the laser.

When aimed directly down from a vertical mount toward the web, we can see a pattern burned onto our substrate when using high enough power. This seems to work at a range of different heights.

In most of our use cases, we actually would like to direct the laser at an acute angle at point that is roughly 30 inches away. (The system is mounted on an assembly that can raise and lower it and also change the angle relative to the substrate.) However, we have had trouble getting the burn test to work when we lower the angle and increase the distance.

Our questions are:

- 1) Can we change the focal length of the system by a setting, or is this fixed for the optical system that we have (described above)?
- 2) Is there a limit on the depth of field where we can get good energy transfer to our substrate?
- 3) Does the DOF change with angle?
- 4) Is our working distance of ~30 inches at an angle of <30 degrees to the substrate feasible for good energy transfer to the substrate?

I am available to discuss by phone on Monday if you'd rather not write out a response. My office number is 765-494-4312.

Thanks,

Nick Glassmaker

Nicholas Glassmaker
Research Scientist
Purdue University, Birck Nanotechnology Center
1205 West State Street
West Lafayette, IN 47907-2057
email: nklassma@purdue.edu
Phone: (765) 494-4312

From: Cakmak, Mukerrem
Sent: Friday, September 14, 2018 11:51 AM
To: Glassmaker, Nicholas J
Subject: Fwd: Laser program

Nick

Please see the contact of tech support manager. We may have to get another focusing lens. Please also ask him to see if there is any adjustable system that can be used for this purpose. Another one of bill wagner's mess to clean up.

Thanks

Miko

Begin forwarded message:

From: "Nelson, Chris" <chris.nelson@synrad.com>

RE: laser system info and questions

Nelson, Chris <chris.nelson@synrad.com>

Thu 10/10/2019 3:22 PM

To: Glassmaker, Nicholas J <nglassma@purdue.edu>

Cc: Telesnicki, Guy J <gtelesni@purdue.edu>

Hi Nick,

Sorry for the delay in getting back to you. Today has been non-stop meetings.

I've attached a guide to CO2 processing of plastics. Hopefully this we help get you pointed in the right direction.

*15 ips 50% power
good starting
cond.*

Regarding your other questions:

- Is the working distance +/- 5 mm? We think we are in this range for focus, but given the poor results so far, not 100% sure that we are in focus. This depends on the lens model you are using. Take a look at the lens mounting ring for a model number like 'FLA-' and a numerical value. Let me know what model you have and I'll give you the working distance and depth of focus (DOF).
- How do we trigger the laser? Can we have a timed sequence or photo detector and fiducial mark? You can trigger each mark manually through the WinMark software, or program the MKH file to use a basic automation setup to initiate the mark from a switch or a sensor. See the attached tutorial for setting up the basic automation. From the standpoint of the WinMark software and the marking head, it does not matter whether the input signal comes from a sensor, a switch or the output of a PLC.
- Related to the triggering, how do we set up a serial number in the software so that it counts up from 1? It looks like the barcode does this, but we couldn't figure out how to do just a numerical label. You can create a text object then use the Auto Text automation in WinMark to serialize from mark to mark. See the attached Auto Text tutorial.
- Is the base that the film rests on important? We have it resting on an aluminum plate. It should not be, as long as you are marking on the PET and not burning through it.

Chris Nelson

Technical Support Engineer

Synrad

4600 Campus Place, Mukilteo, WA 98275, USA

T 1.425.609.5060

E chris.nelson@synrad.com synradtechsupport@synrad.com W www.synrad.com

From: Glassmaker, Nicholas J <nglassma@purdue.edu>

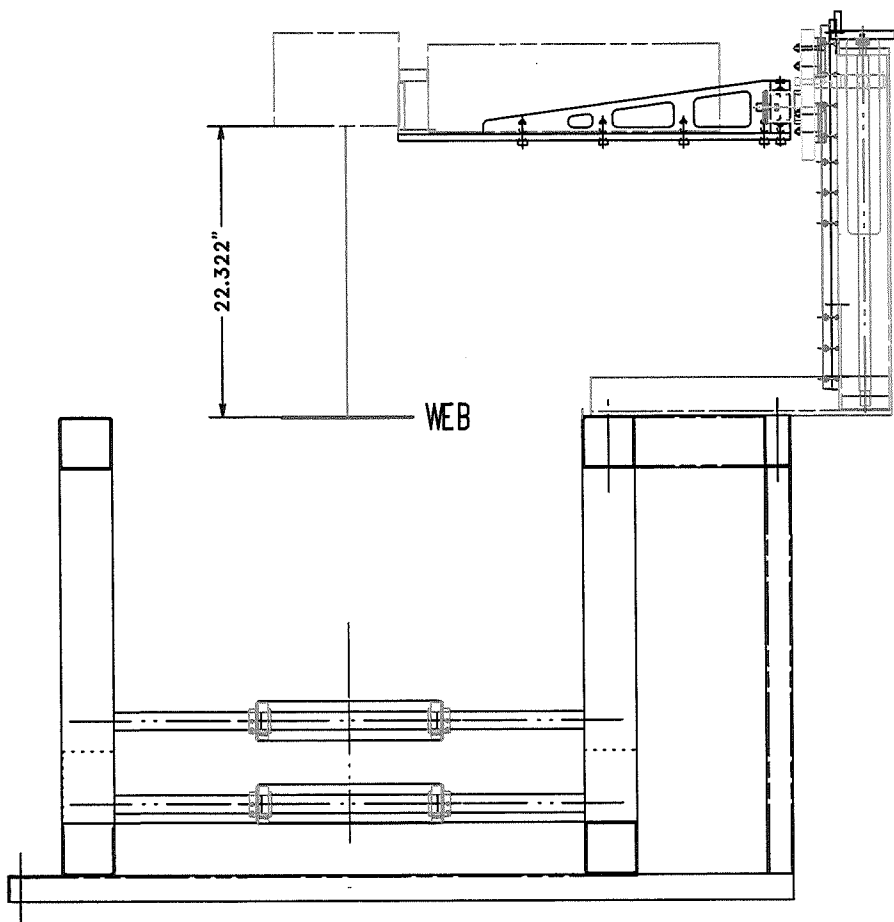
Sent: Thursday, October 10, 2019 11:28 AM

To: Nelson, Chris <chris.nelson@synrad.com>

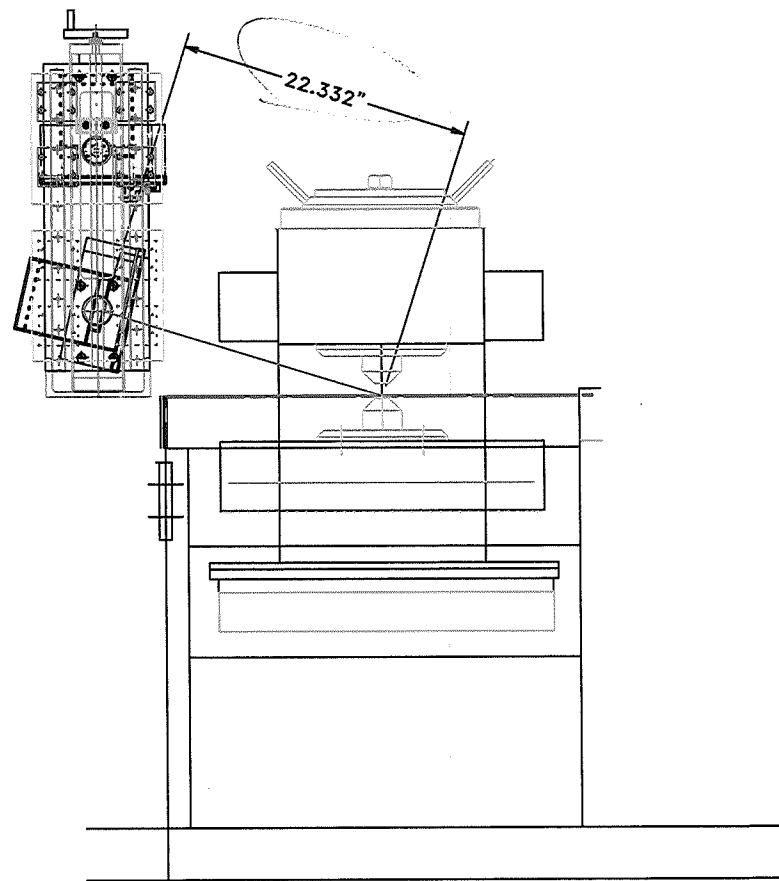
Cc: Telesnicki, Guy J <gtelesni@purdue.edu>

LASER BEAM PATHS AND LENGTHS

SEC 9



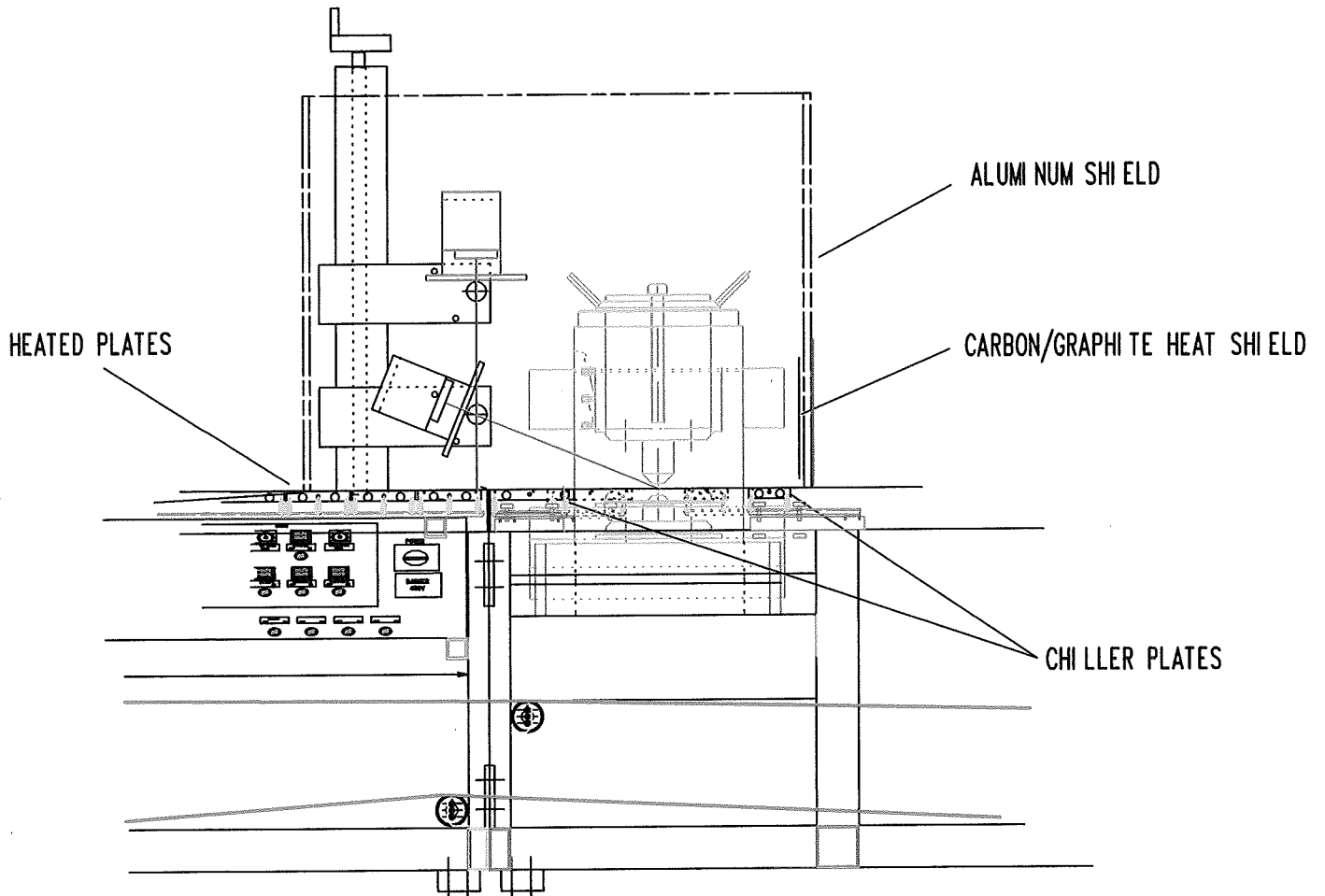
END (WEB PATH) VIEW
VERTICAL BEAM



OPERATOR SIDE VIEW
ANGLED BEAM

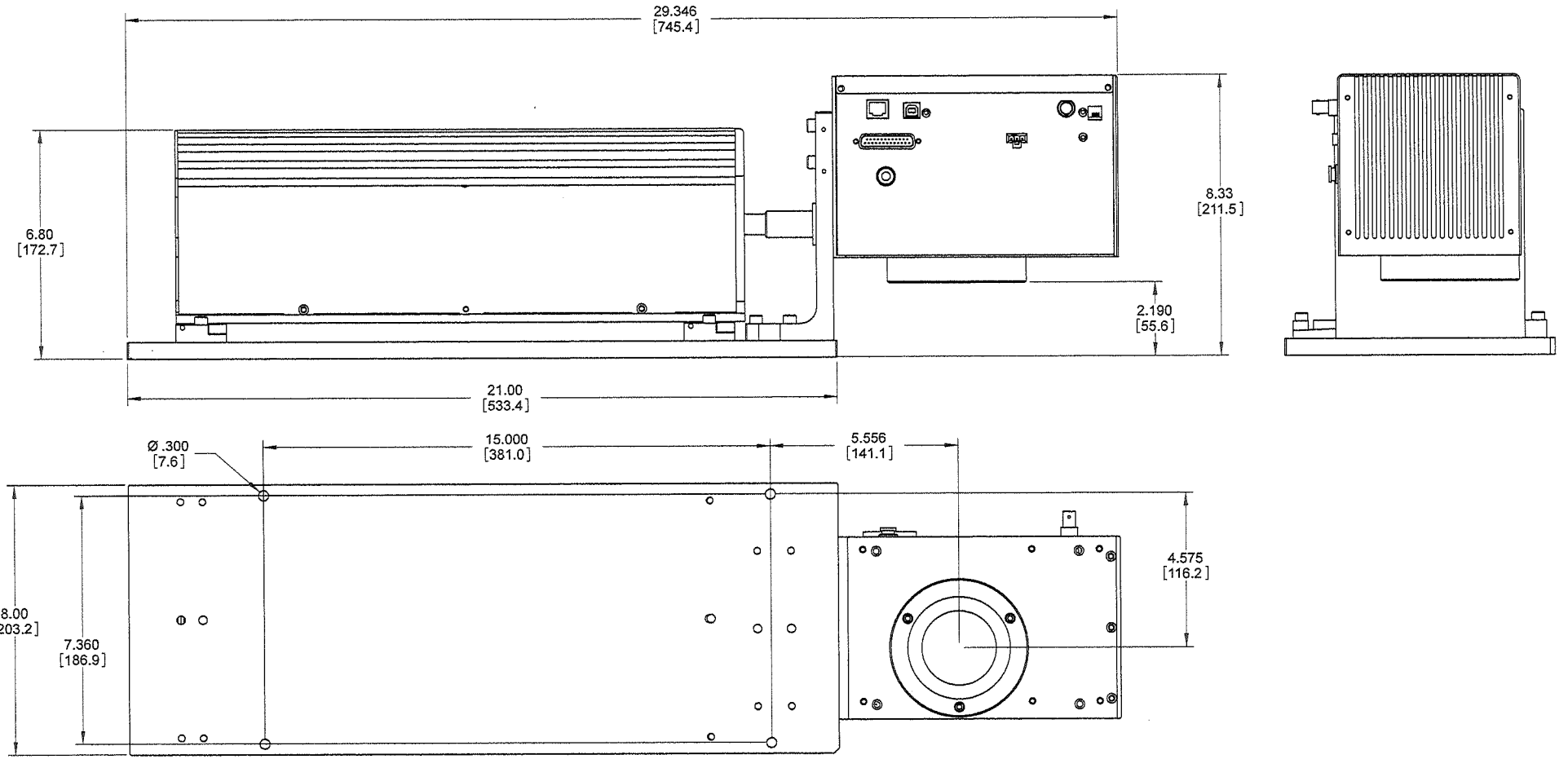
SEC 9A

LASER CHILLER PLATE LOCATIONS




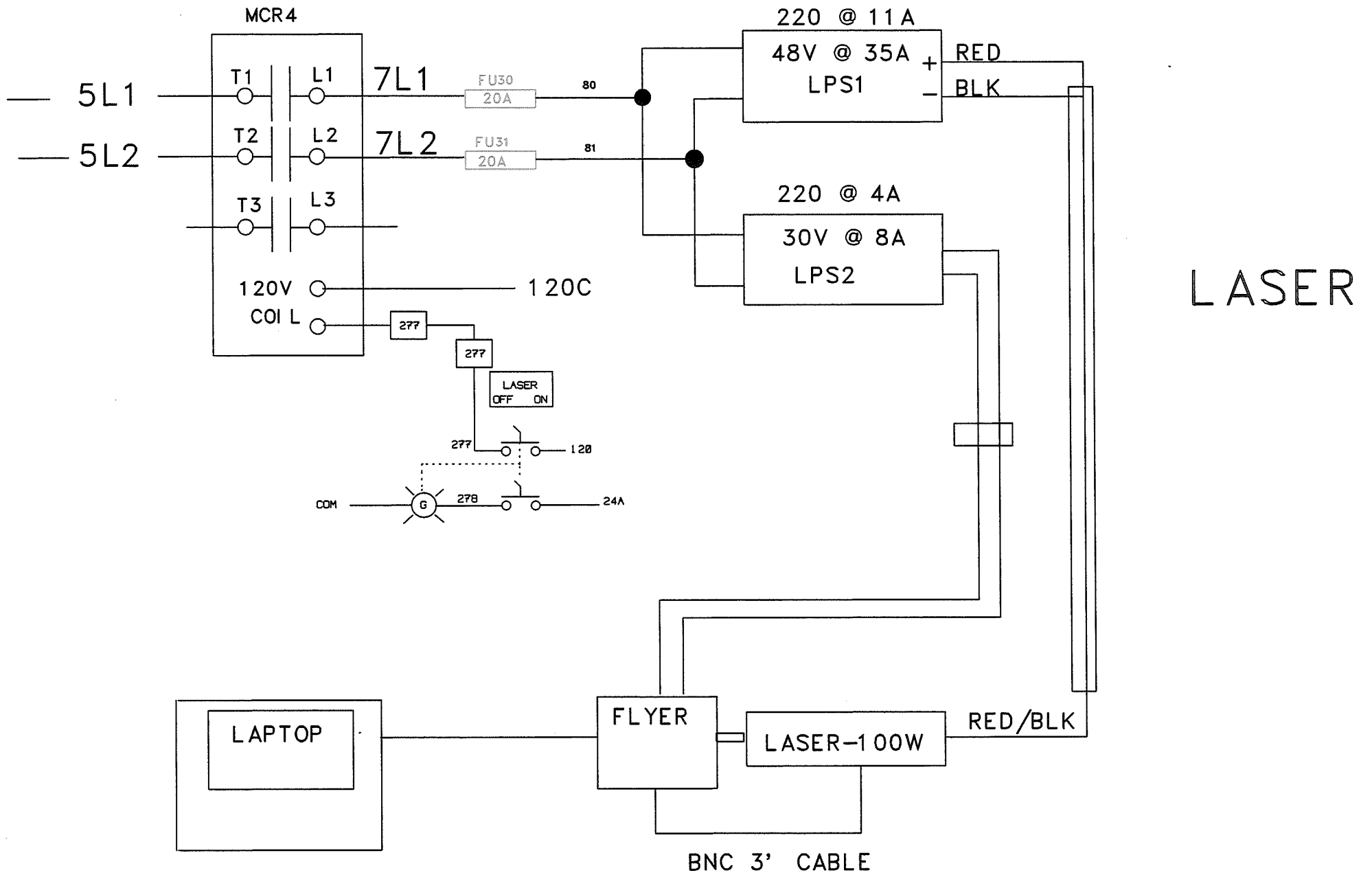
SEC 9B

REV	ECO	DATE	DESCRIPTION	DB
A	3575	13-Nov-07	RELEASE TO PRODUCTION	RLS

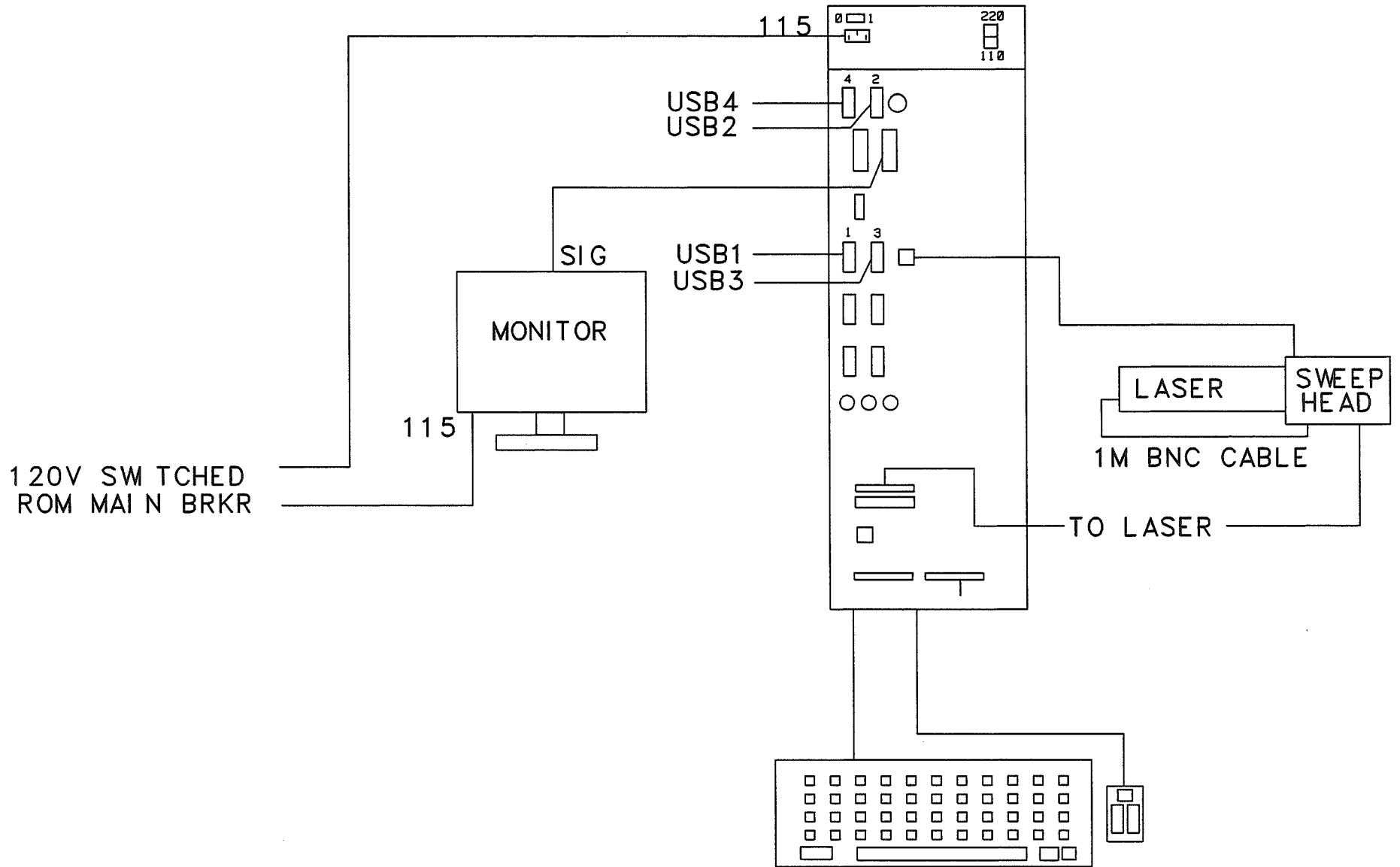


NOTE:
ALL DIMENSIONS ARE IN INCHES.
DIMENSIONS IN BRACKETS [] ARE MILLIMETERS.

TOLERANCES UNLESS NOTED: .x = ±0.1 ANGLE = ±0.5° .xx = ±0.01 .xxx = ±0.005		PROPRIETARY THIS DRAWING IS PROPRIETARY TO SYNRAD INC. AND SHALL NOT BE USED OR DISCLOSED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION OF SYNRAD INC.	 SYNRAD INC. 4600 Campus Place Mukilteo, WA 98275 Phone: (425)349-3500 Fax: (425)349-3667
MATERIAL: SEE BOM			
FINISH:		DESCRIPTION: OUTLINE & MOUNTING - FLYER, V30	
PART NUMBER: 300-19676-30		DWG/FILE NUMBER: 300-19676-30	
SHEET 1 of 1		ENG:	
UNITS: inches		CATEGORY:	
SIZE: B		FINISH CLASS:	
CHECKED BY:		DATE: 10-23-07	
APPROVED BY:		DATE:	



PC- WINDOWS 10



CH 10

WAGNER MODEL R2R-1
S/N H3859

MAGNET
SEC 10

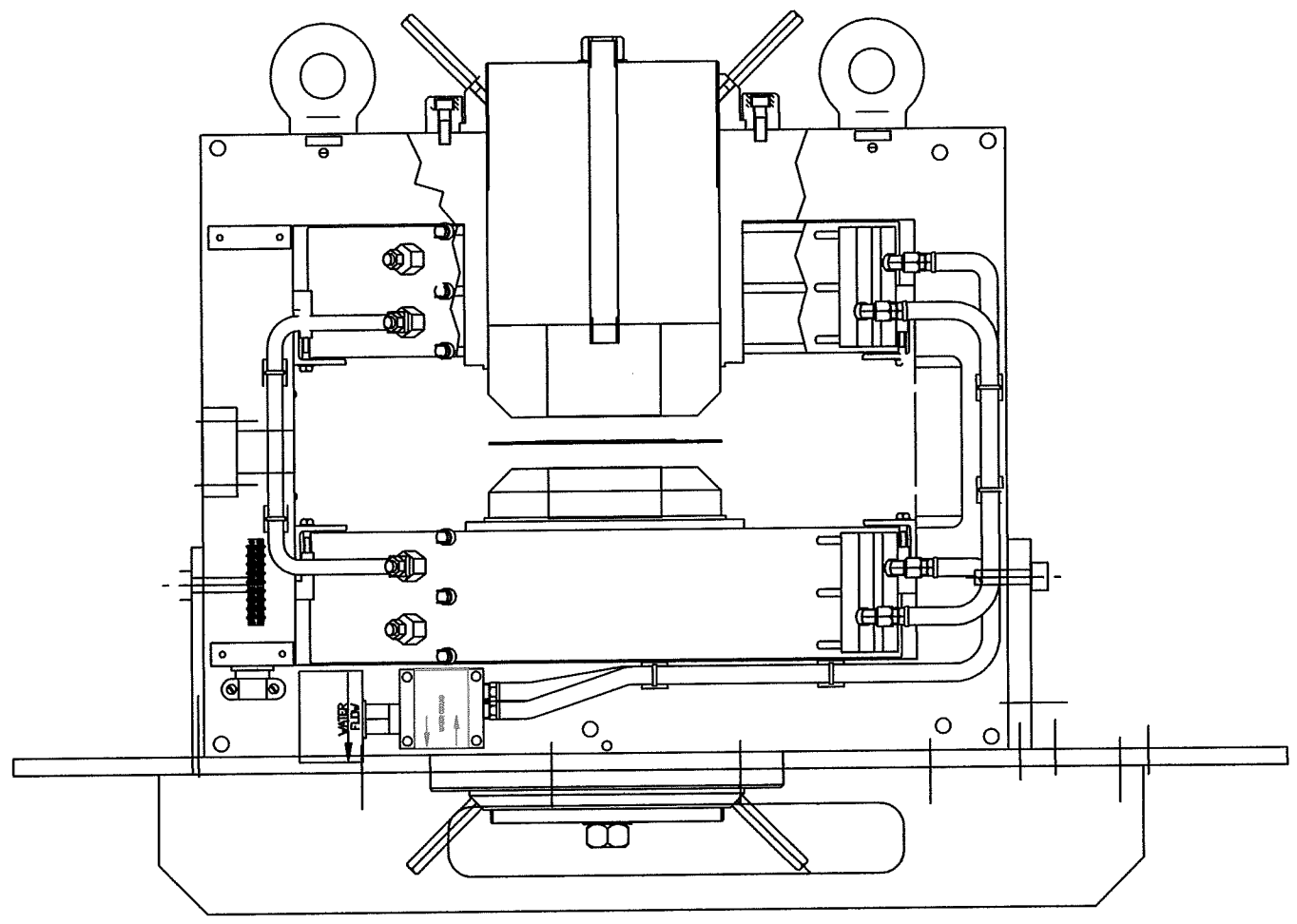
THE MAGNET IN THIS MACHINE IS RATED AT 2.7 TESLAS WITHIN THE 25MM GAP POLE PIECES. A SPECIALLY DESIGNED RECTANGULAR POLE FACE CONFIGURATION WAS MODIFIED TO CREATE A DISTORTED TOROIDAL FIELD THAT CREATES A FLATTENED FIELD STRENGTH ACROSS THE WEB. THIS REDUCES FIELD STRENGTH LOSS AT THE EDGES OF THE SAMPLES BEING INTRODUCED. THE MAGNET IS CONTROLLED BY A 140 AMP POWER SUPPLY LOCATED AT THE REAR OF THE MACHINE FRAME BEHIND THE MAGNET. TWO MANUAL SETTINGS CONTROL THE STRENGTH OF THE MAGNET BY VARYING THE VOLTAGE AND CURRENT INDIVIDUALLY. A HALL EFFECT PROBE WITHIN THE POLE FACE GAP SENSED THE FIELD STRENGTH AND IS DISPLAYED ON THE OPERATORS MAIN PANEL AS A DIGITAL READOUT CALIBRATED FROM 0 TO 3.0 TESLAS. WATER COOLING IS SUPPLIED THRU THE MAGNET COILS FROM AN OUTSIDE SOLENOID VALVE CONTROLLED COOLING TOWER SOURCES. THE MAGNETS FRAME IS MACHINED FROM ONE SOLID 3000 POUND BLOCK OF IRON. POLE GAP CAN BE SET BY USING THE TOP AND BOTTOM SCREW ADJUSTERS BUT IS NORMALLY SET AT 25MM GAPS. WHEN REQUIRED, THE LASER CAN BE USED TO FOCUS A SCANNER BEAM WITHIN THE POLE PIECES TO CAUSE THE COATINGS TO LIQUIFY DURING EXPOSURE TO THE MAGNETIC FIELDS. SHORTLY AFTER THIS STAGE, A CHILLER PLATE WILL "FREEZE" THE COATING THEREBY RETAINING THE ORIENTATION OF THE MAGNETIC POLES.

CHILLER PLATES

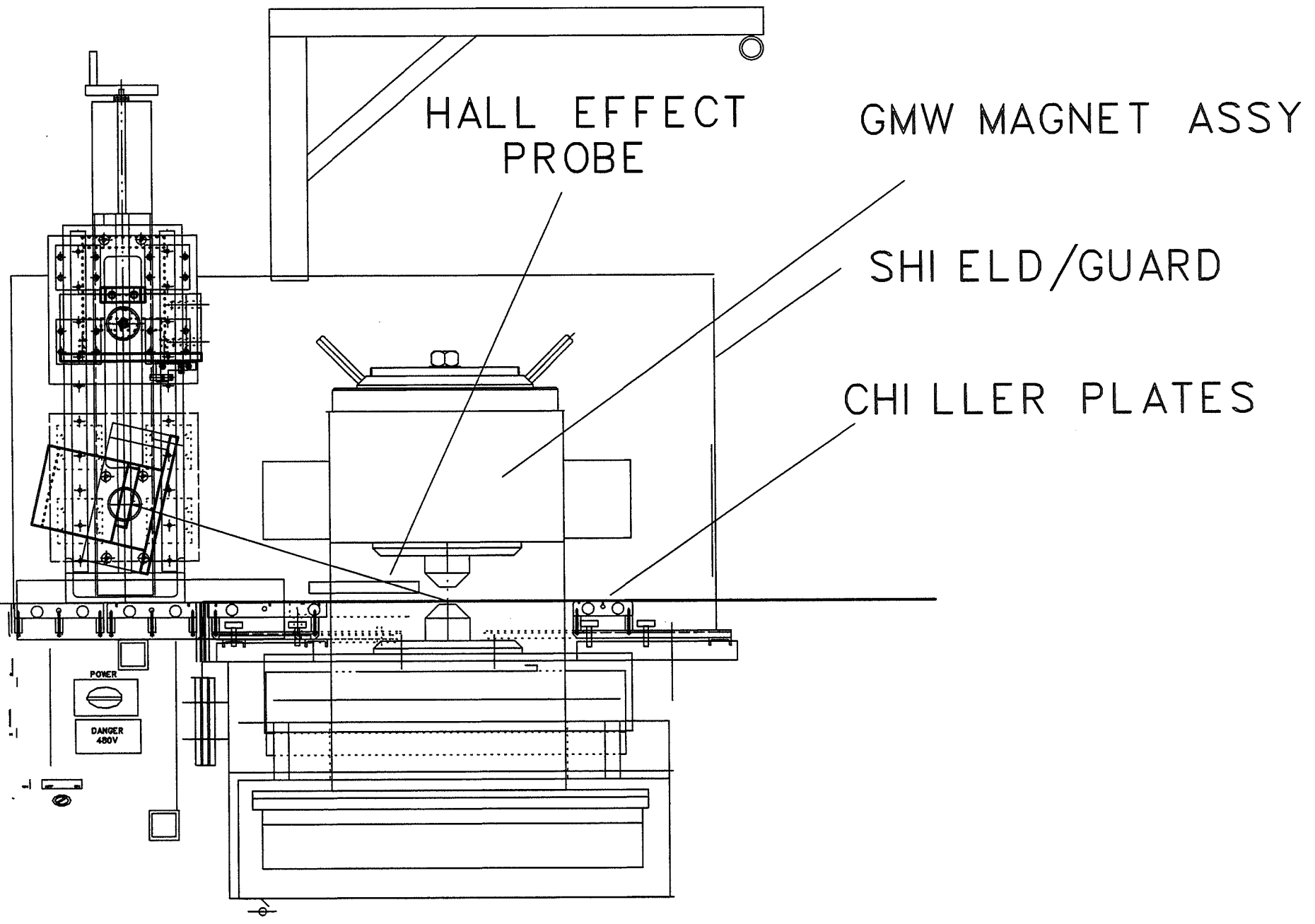
JUST PRIOR TO AND AFTER THE MAGNET THERE IS SEPARATE 6" X 12" WATER COOLED CHILLER PLATES THAT ARE CONTROLLED BY USE OF SHUTOFF VALVES LOCATED AT THE REAR OF THE MACHINE. GENERALLY, THE USER WILL ONLY USE ONE OR THE OTHER PLATE SO AS NOT TO PUT EXCESS STRAIN ON THE CHILLER UNIT AT THE REAR OF THE FRAME.

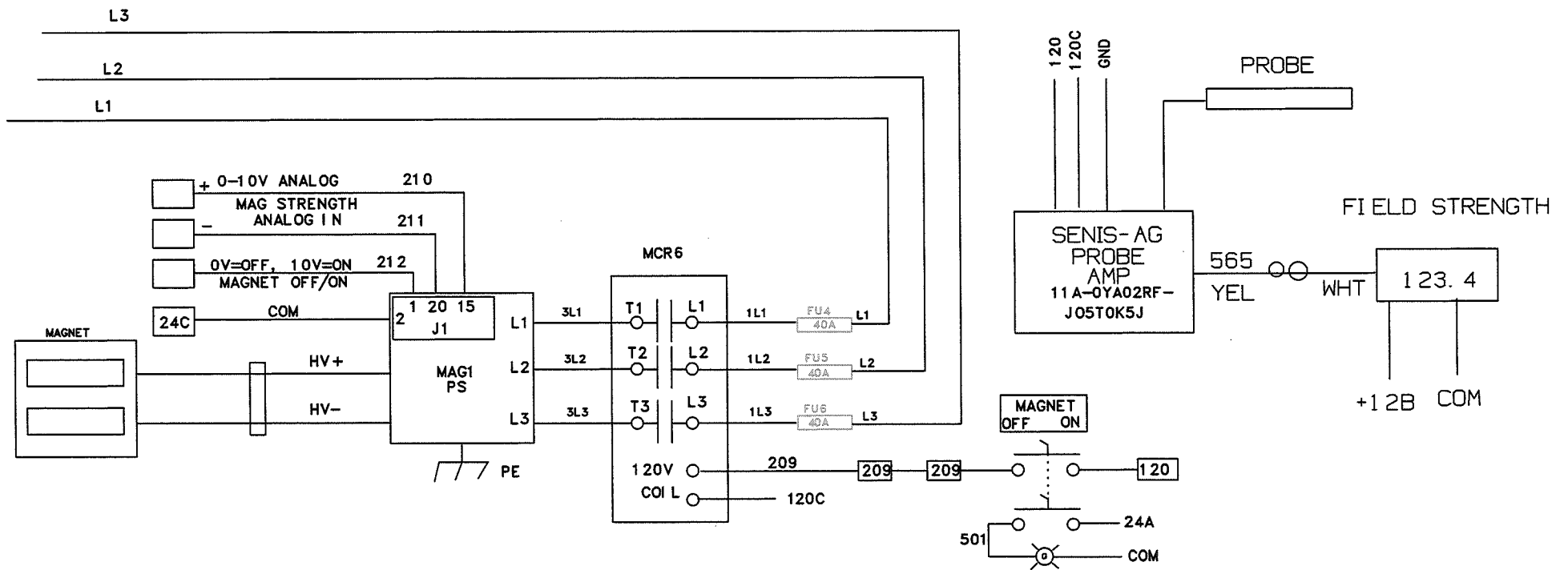
MAGNET END VIEW

SEC 1 0



SEC 1 0A





SENIS
magnetic & current measurement

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Switzerland
Tel: + 41 44 508 70 29
Fax: + 41 43 205 26 38
E-mail: transducers@senis.ch
Web: <http://www.senis.ch>

CERTIFICATE of CALIBRATION

Model: I1A-0YA02F-J05T0K5J
Serial Number: 175-16
Calibration Date: September 08th, 2016
Temperature: 25°C ± 2°C
Relative Humidity: 35% ± 3%

This notification serves to certify that the unit described above has been inspected and tested in accordance with specifications published by SENIS AG.

The accuracy and calibration of this instrument are traceable through equipment which is calibrated at planned intervals by comparison to certified standards maintained in the laboratories of SENIS AG.

The environment in which this instrument was calibrated is maintained within the operating specifications of the instruments and the standards.

Customer Use Only:

The recommended calibration interval is 12 months.

Tested by:

PREDRAG STEVANOVIC, *Dipl. Eng. El.*

P. Stevanovic

1-Axis Analog Magnetic Field Transducer_Calibration Document



Magnetic Field Reference: METROLAB PRECISION NMR TESLAMETER PT 2025

Digital Voltmeter: AGILENT 34401A, 6½ Digit Precision Multimeter

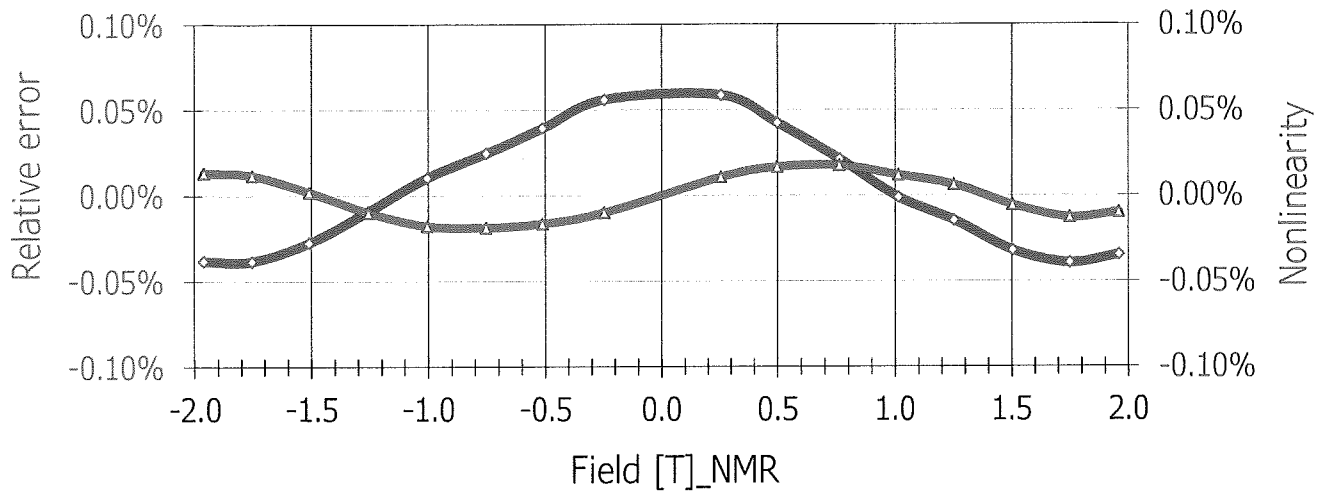
Type: I1A-0YA02F-J05T0K5J

SNR: 175-16

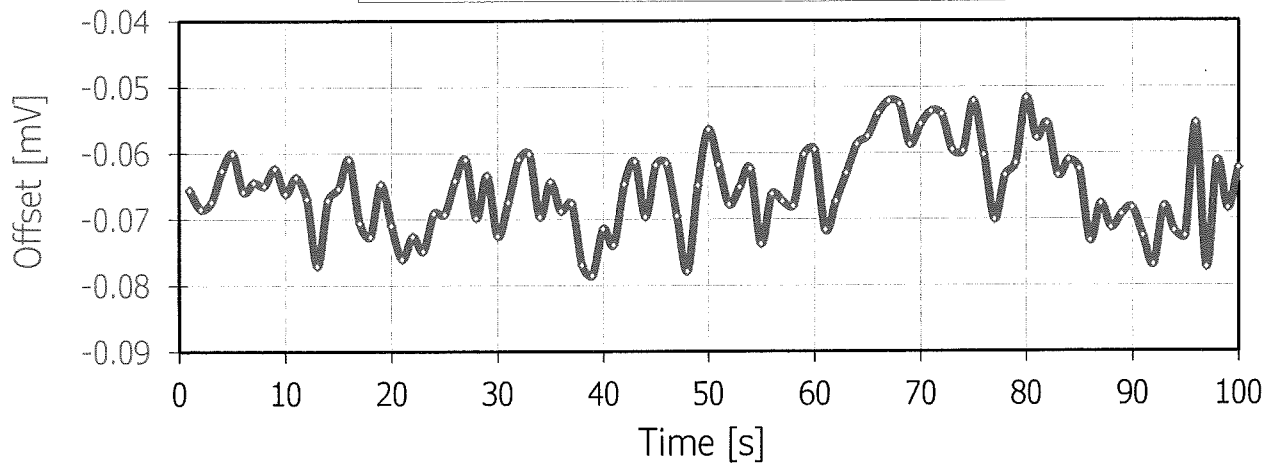
Date: September 8, 2016

Sensitivity: 2 V/T

Y-channel: DC Calibration



Y-channel: Offset fluctuation & drift



Tested by: P. Stevanovic

P. Stevanovic

DESCRIPTION:

The I1A-0YA02F-J05T0K5J is a SENIS analog magnetic flux density-to-voltage transducer with integrated single-axis Hall Probe. It measures magnetic fields perpendicular to the probe plane (By).

The Hall Probe contains a CMOS integrated circuit, which incorporates three groups of mutually orthogonal Hall elements and a temperature sensor. The integrated Hall elements occupy very small area (22µm x 22µm), which provides very high spatial resolution of the probe.

The Hall probe is connected with an electronic box (Module E in Fig. 1). The Module E provides biasing for the Hall probe and the application of the spinning-current technique, which cancels offset, low frequency noise and the planar Hall effect.

The additional conditioning of the Hall probe output signals in the electronic box includes Hall signal amplification, high linearization, compensation of the temperature variations, and limitation of the frequency bandwidth.

The outputs of the I1A magnetic field transducer are available at the connector CoS of the Module E:

- a high-level differential voltage proportional to the measured transverse (By) component of a magnetic flux density, and
- a ground-referred voltage proportional with the probe temperature.

KEY FEATURES:

- Integrated CMOS single-axis Hall probe that measures magnetic fields perpendicular to the probe plane (By)
- Very low noise and offset fluctuations
- Very high linearity
- Negligible inductive loops on the probe
- Integrated temperature sensor on the probe for temperature compensation

TYPICAL APPLICATIONS:

- Characterization and quality control of permanent magnets
- Development of magnet systems
- Mapping magnetic field
- Quality control and monitoring of magnet systems (generators, motors, etc.)
- Application in laboratories and in production lines, etc.

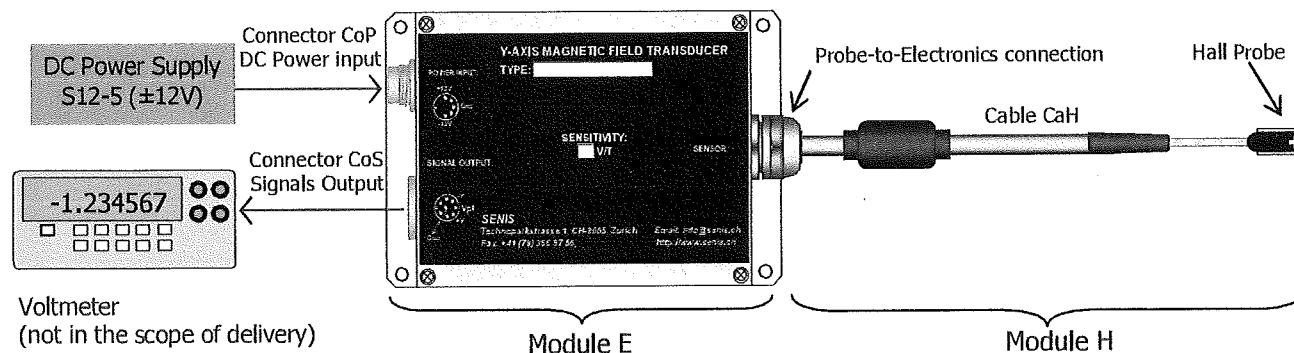


Figure 1. Typical measurement setup with a SENIS magnetic-field-to-voltage transducer with the integrated Hall Probe (Module H) and Electronic (Module E)

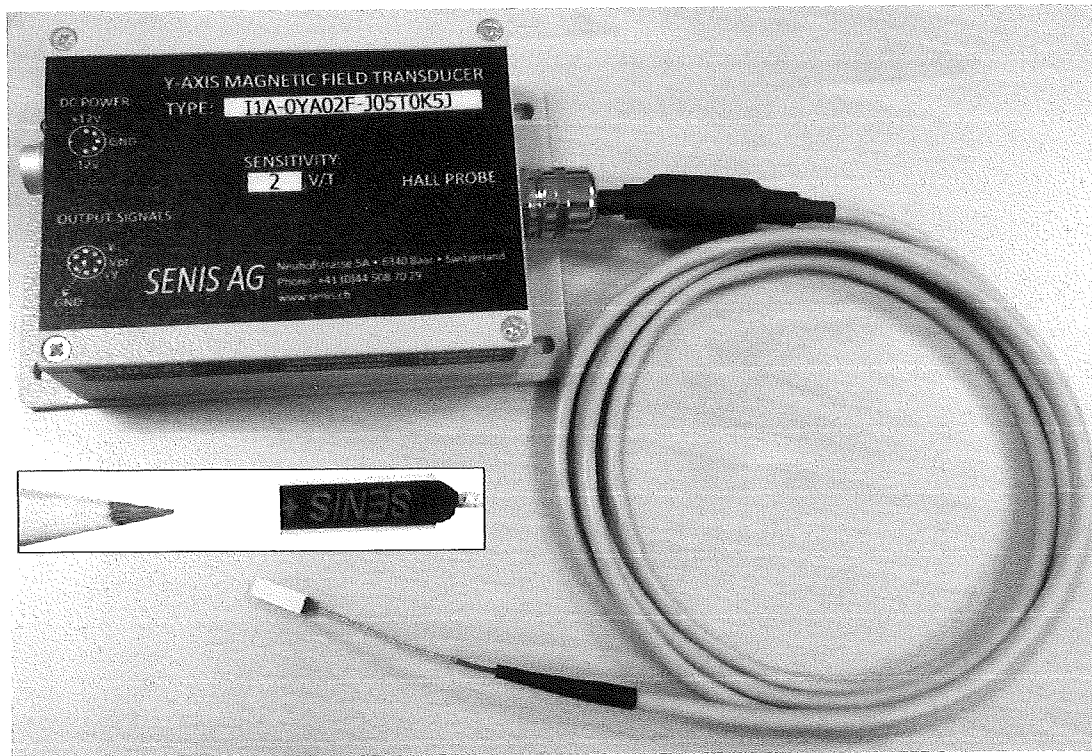


Figure 2. Single-axis analog magnetic field transducer type I1A-0YA02F-J05T0K5J

SPECIFICATIONS (Module H):

Hall Probe 0YA for SENIS I1A Magnetic Field Transducers is a very robust, single-chip integrated single-axis Hall-Probe. It measures magnetic fields perpendicular to the probe plane (By).

The Probe contains a CMOS integrated circuit, three groups of mutually orthogonal Hall elements and a temperature sensor. The integrated Hall elements occupy very small area ($22 \times 22 \mu\text{m}^2$), which provides very high spatial resolution of the probe.

The sensor chip is embedded in the probe package and connected to the CaH cable, which makes this probe both mechanically and electrically very robust. The silicon chip is glued onto a reference ceramic plate suitable for an appropriate fixing of the probe.

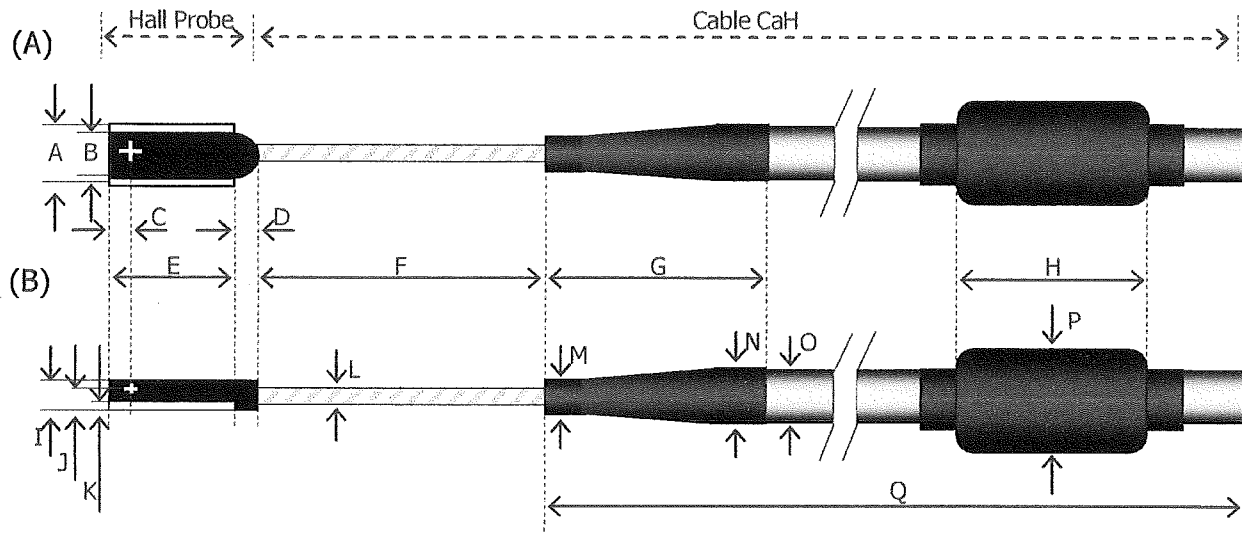
The outputs of the Hall Probe are high-level analog voltages proportional to the measured transverse (By) component of a magnetic flux density and a voltage proportional with the probe temperature.



KEY FEATURES OF THE I1A-0YA HALL PROBE SYSTEM

- Very robust Hall Probe. The chip is glued onto a reference ceramic plate suitable for an appropriate fixing of the probe
- Integrated CMOS 1-axis (By) Hall Probe
- Very low noise and offset fluctuations
- Very high spatial resolution ($22 \times 5 \times 22 \mu\text{m}^3$)
- Virtually no planar Hall effect
- Negligible inductive loops on the Probe
- Integrated temperature sensor on the probe for temperature compensation

PROBE AND CABLE DIMENSIONS AND CHARACTERISTICS



Probe and Cable dimensions and tolerances (mm):		
A = 5.00 ±0.05	G = 35 ±3	M = Ø 4.0 ±0.2
B = 4.0 ±0.1	H = 30 ±1	N = Ø 6.0 ±0.2
C = 1.0 ±0.1	I = 2.3 ±0.1	O = Ø 4.9 ±0.1
D = 2.0 ±0.1	J = 1.3 ±0.1	P = Ø 16 ±1
E = 14.50 ±0.05	K = 0.4	Q = 2'000 ±20
F = 50 ±1	L = 1.7 ±0.2	

Figure 3. Dimensions of the 0YA Hall probe and cable CaH (Module H): (A) Top view; (B) Right side view.

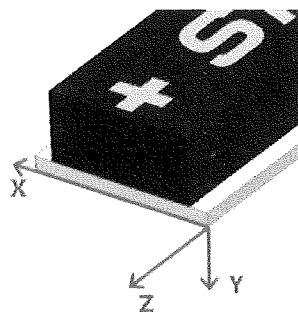


Figure 4. Isometric view with reference Cartesian coordinate system of the probe head. Magnetic field sensitive point (MFSP) is marked with the white cross

Dimension	X [mm]	Y [mm]	Z [mm]
Magnetic field sensitive volume (MFSV)	0.022	0.005	0.022
Position of the center of MFSV (see Fig.3)	2.5 ±0.1	-1.3 ±0.1	-1.0 ±0.1
Total external dimensions of the Probe	5.0 (ref. ceramics)	2.3 ±0.1	16.5 ±0.1
	4.0 ±0.1 (Probe head)		
Angular accuracy of the axes	± 0.5° with respect to the reference surface		
CaH Cable	Shielded, with a flexible thin part near the probe and ferrite sleeve on the thicker part (see Fig. 3)		
Total length of the CaH cable:	- Standard: 5 m (H-Module notation: I1A-0YA05F)		
	- Optional: X m (H-Module notation: I1A-0YA0xF)		
	NOTE: Various cable lengths are available upon request.		

INSTALLATION MANUAL FOR THE OYA HALL PROBE

Although the OYA probe is very robust with respect to its size, it should be handled with special care. Considering that we deal with a high-precision device of very small dimensions, following precautions should help to avoid damage of the probe during installation and handling, and ensure that the device's accurate calibration remains preserved.

The mounting of the probe should be carried out by application of very low pressure to its head and thin wires. If the probe head is clamped, the user needs to make sure that the environment surface in contact with the reference plane of the probe is flat and covers as much of the probe reference surface as possible (see Fig. 5). Do not apply more force than required to hold the probe in its mounting.

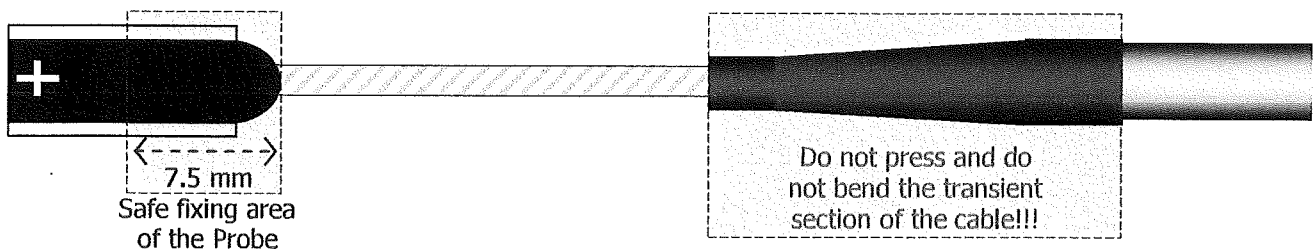


Figure 5. Safe fixing area of the OYA Probe head

In order to prevent rupture of the thin wires from the probe head, the user should fix and secure the probe cable in the proximity of the head. The thin wires of the flexible section of the probe need to be folded with care. Repeated strong bending of the thin cable must be avoided.

Also, avoid any high pressure and bending of the transient section between the thin and the thick cables.

MAGNETIC and ELECTRICAL SPECIFICATIONS:

NOTE: Unless otherwise noted, the given specifications apply for the transverse measurement channel (By) at room temperature (25°C) and after a device warm-up time of at least 15 minutes.

Parameter	Value	Remarks
Maximum magnetic flux density ($\pm B_{FS}$)	± 5 T (± 50 kG)	No saturation of the outputs
Linear range of magnetic flux density ($\pm B_{LR}$)	± 2 T (± 20 kG)	Fully calibrated measurement range
Total measurement accuracy	$< \pm 0.1\%$ @ $B \leq \pm 2$ T $< -1\%$ @ $B \leq \pm 3$ T $< -3\%$ @ $B \leq \pm 5$ T	See note 1
Output voltages (V_{out})	differential	See note 2
Sensitivity to DC magnetic field (S)	2 V/T (0.2 mV/G)	Differential output; See note 3
Tolerance of Sensitivity (S_{err}) @ $B \leq \pm B_{LR}$	$< 0.03\%$ of S	$100 \times S' - S / S$; notes 3 and 4
Nonlinearity (NL)	$< \pm 0.05\%$ @ $B \leq \pm 2$ T $< 1.0\%$ @ $B \leq \pm 3$ T $< 3.0\%$ @ $B \leq \pm 5$ T	See note 4
Planar Hall voltage (V_{planar}) @ $B \leq \pm B_{LR}$	$< 0.01\%$ of V_{normal}	See note 5
Temperature Coefficient of Sensitivity	$< \pm 100$ ppm/°C (± 0.01 %/°C)	@ Temperature range $25^\circ\text{C} \pm 10^\circ\text{C}$
Long-term instability of Sensitivity	$< 1\%$ over 10 years	
Offset (@ $B = 0$ T)	$< \pm 0.5$ mV (± 0.25 mT)	@ Temperature range $25^\circ\text{C} \pm 5^\circ\text{C}$
Temperature Coefficient of the Offset	$< \pm 0.05$ mV/°C (± 25 $\mu\text{T}/^\circ\text{C}$)	
Offset fluctuation & drift (0.01-10 Hz, i.e. $\Delta t = 0.05$ s, $t = 100$ s)	< 0.05 mV _{p-p} (25 μT_{p-p})	Standard Deviation RMS value is ≈ 8 μV_{RMS} (4 μT_{RMS}); See note 6
Output noise		
Noise Spectral Density @ $f > 10$ Hz (NSD _w)	≈ 0.6 $\mu\text{V}/\text{Hz}^{1/2}$ (0.3 $\mu\text{T}/\text{Hz}^{1/2}$)	Region of white noise
Broad-band Noise (10 Hz to f_T) V_{NRMS-B}	< 20 μV_{RMS} (10 μT_{RMS})	RMS noise; see note 7
Resolution		See notes 6 - 10
Typical frequency response		
0.1% error	< 20 Hz	Test signal: $B = 10\text{mT} \times \sin(2\pi ft)$ See page 7: AC Calibration-Frequency Response characterisation
1.0% error	< 70 Hz	
Frequency Bandwidth [f_T]	≈ 500 Hz	Sensitivity attenuation -3dB; Note 11
Output resistance	< 10 Ω , short circuit proof	
Temperature output		
Ground-referred voltage:	V_T [mV] = (T [°C] - 25°C \pm 1°C) x 50 [mV/°C]	
Magnetic Flux Density (B) units (T-tesla, G-gauss) conversion:		
1 T = 10 kG	1 mT = 10 G	1 μT = 10 mG

MECHANICAL and ELECTRONICS SPECIFICATIONS (Module E):

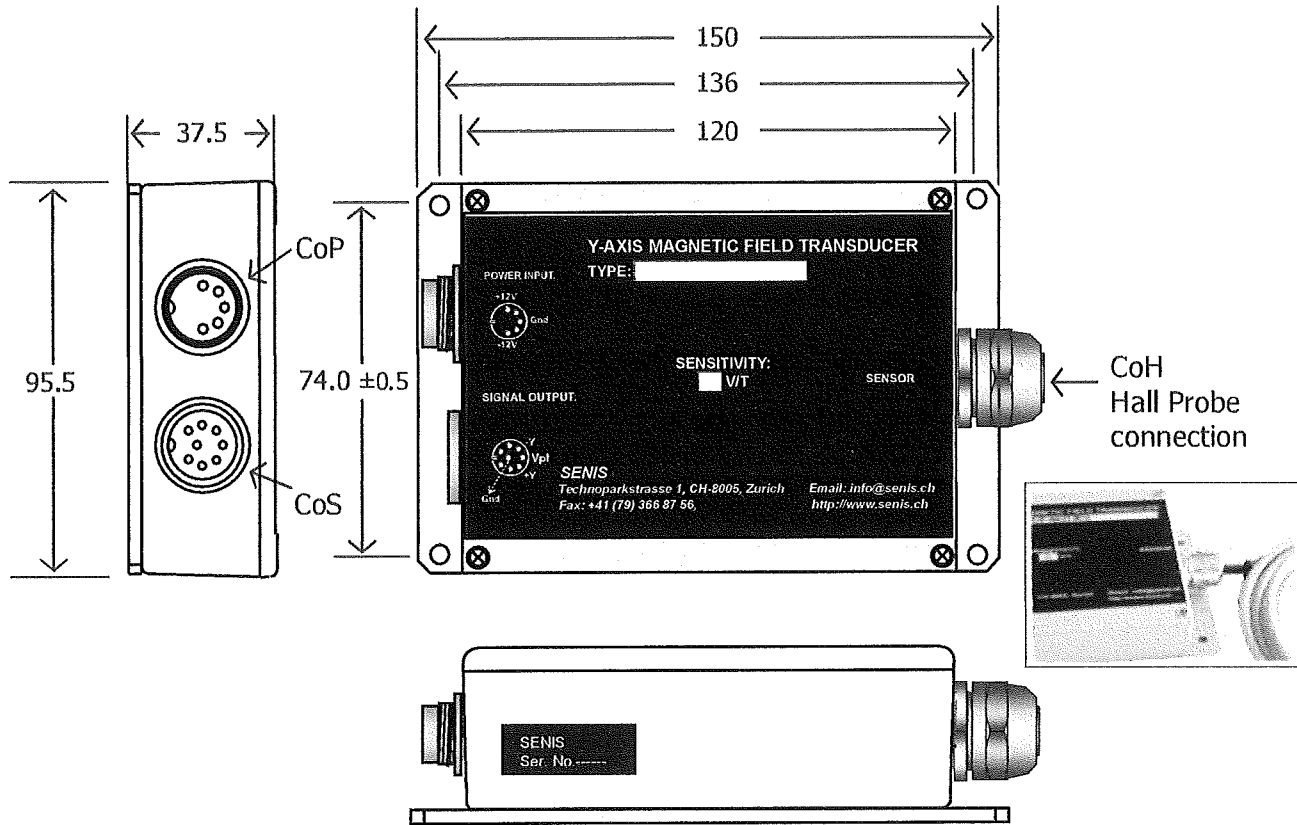


Figure 6. Structure and dimensions of the single-channel analog processing module type J05T0K5J

Module E	High mechanical strength, electrically shielded aluminum case [95 W x 120 L x 37 H mm] with mounting provision (see Fig. 6)	
Connector CoS DIN Kfv81, 8 poles (Mating plug SV81)	Field signal Y+, Y- Temperature signal Signal common (GND)	Pins 5 and 4, respectively Pin 2 Pin 8
Connector CoP DIN SFV50, 5 poles (Mating plug KV50)	Power, +12V Power, -12V Power common (GND)	Pin 3 Pin 1 Pin 2
Connector CoH	Fixed connection: Cable gland MS PG11	
DC Power	Voltage: Max. Ripple: Current:	± 12 V nominal, $\pm 2\%$ 100 mV _{pp} ca. ± 50 mA

Environmental Parameters:

Operating Temperature	+5°C to +45°C
Storage Temperature	-20°C to +85°C

OPTIONS:**DC Calibration Table (Vout vs. Bnmr)**

The DC Calibration Table of the transducer can be ordered as an option. The calibration table is an Excel-file, providing the actual values of the transducer output voltage for the test DC magnetic flux densities measured by a reference NMR Teslameter. The standard calibration table covers the linear range of magnetic flux density $\pm B_{LR}$ in the steps of $B_{LR}/10$. Different calibration tables are available upon request. By the utilisation of the calibration table, the accuracy of DC and low-frequency magnetic measurement can be increased up to the limit given by the resolution (see Notes 1 and 6 - 10).

AC Calibration - Frequency Response characterisation

Another option is the calibration table of the frequency response. This is an Excel file, providing the actual values of the transducer transfer function (complex sensitivity and Bode plots) for a reference AC magnetic flux density. The standard frequency response calibration table covers the transducer bandwidth, from DC to f_f , in the steps of $f_f/10$. Different calibration tables are also available upon request. Utilisation of the frequency calibration table allows an accuracy increase of the AC magnetic measurements almost up to the limit given by the resolution (see Notes 1 and 6 - 11).

The SENIS Single-axis Hall transducer I1A-0YA02F-J05T0K5J is applicable in the B-frequency range from DC to 500 Hz (-3dB point), where B being the density of the measured magnetic flux). In addition to the Hall voltage, at high B-frequencies also inductive signals are generated at the connection probe-thin cable. Moreover, the probe, the cable and the electronics in the E-module behave as a low-pass filter. As a result, the transducer has the "complex" sensitivity of the form:

$$S = S_H + jS_I$$

Here:

- S_H represents sensitivity for the output signal in phase with the magnetic flux density (that is the real part of the transfer function);
- S_I is the sensitivity with the 90° phase shift with respect to the magnetic flux density (i.e., the imaginary part of the transfer function).

Calibration data can be ordered for S_H and S_I for the transverse (Y) axis (as an option). This allows the customer to deduce accurate values of the measured magnetic flux density at even high frequencies by an appropriate mathematical treatment of the transducer output voltage V_{out} .

NOTES:

- 1) The accuracy of the transducer is defined as the maximum difference between the actual measured magnetic flux density and that given by the transducer. In other words, the term accuracy expresses the maximum measurement error. After zeroing the offset at the nominal temperature, the worst case relative measurement error of the transducer is given by the following expression:

$$\text{Max. Relative Error: M.R.E.} = S_{err} + NL + 100 \times Res / B_{LR} \quad [\text{unit: \% of } B_{LR}] \quad \text{Eq. [1]}$$

Here, S_{err} is the tolerance of the sensitivity (relative error in percents of S), NL is the maximal relative nonlinearity error (see note 4), Res is the absolute resolution (Notes 6-10) and B_{LR} is the linear range of magnetic flux density.

- 2) The output of the measurement channel has two terminals and the output signal is the (differential) voltage between these two terminals. However, each output terminal can be used also as a single-ended output relative to common signal. In this case the sensitivity is approx. 1/2 of that of the differential output (Note: The single-ended output is not calibrated).
- 3) The sensitivity is given as the nominal slope of an ideal linear function $V_{out} = f(B)$, i.e.

$$V_{out} = S \times B \quad \text{Eq. [2]}$$

Here V_{out} , S and B represent transducer output voltage, sensitivity and the measured magnetic flux density, respectively.

- 4) The nonlinearity is the deviation of the function $B_{measured} = f(B_{actual})$ from the best linear fit of this function. Usually, the maximum of this deviation is expressed in terms of percentage of the full-scale input. Accordingly, the nonlinearity error is calculated as follows:

$$NL = 100 \times \left[\frac{V_{out} - V_{off} - B}{S'} \right]_{\max} / B_{LR} \quad (\text{for } -B_{LR} < B < B_{LR}) \quad \text{Eq. [3]}$$

Notation:

B = Actual testing DC magnetic flux density given by a reference NMR Teslameter

$V_{out}(B) - V_{off}$ = Corresponding measured transducer output voltage after zeroing the offset

S' = Slope of the best linear fit of the function $f(B) = V_{out}(B) - V_{off}$ (i.e. the actual sensitivity)

B_{LR} = Linear range of magnetic flux density

Tolerance of sensitivity can be calculated as follows:

$$S_{err} = 100 \times |S' - S| / S \quad \text{Eq. [4]}$$

- 5) The planar Hall voltage is the voltage at the output of a Hall transducer produced by a magnetic flux density vector co-planar with the Hall plate. The planar Hall voltage is approximately proportional to the square of the measured magnetic flux density. Therefore, for example:

$$\left. \frac{V_{planar}}{V_{normal}} \right|_{@ B = B_0} = 4 \times \left. \frac{V_{planar}}{V_{normal}} \right|_{@ B = B_0/2} \quad \text{Eq. [5]}$$

Here, V_{normal} denotes the normal Hall voltage, i.e., the transducer output voltage when the magnetic field is perpendicular to the Hall plate.

- 6) This is the "6-sigma" peak-to-peak span of offset fluctuations with sampling time $\Delta t = 0.05s$ and total measurement time $t = 100s$. The measurement conditions correspond to the frequency bandwidth from

0.01Hz to 10Hz. The "6-sigma" means that in average 0.27% of the measurement time offset will exceed the given peak-to-peak span. The corresponding root mean square (RMS) noise equals 1/6 of "Offset fluctuation & drift".

- 7) Total output RMS noise voltage (of all frequencies) of the transducer. The corresponding peak-to-peak noise is about 6 times the RMS noise. See also Notes 8 and 9.
- 8) Maximum signal bandwidth of the transducer, determined by a built-in low-pass filter with a cut-off frequency f_T . In order to decrease noise or avoid aliasing, the frequency bandwidth may be limited by passing the transducer output signal through an external filter (see Notes 9 and 10).
- 9) Resolution of the transducer is the smallest detectable change of the magnetic flux density that can be revealed by the output signal. The resolution is limited by the noise of the transducer and depends on the frequency band of interest.

The DC resolution is given by the specification "Offset fluctuation & drift" (see also Note 6). The worst-case (AC resolution) is given by the specification "Broad-band noise" (see also Note 7). The resolution of a measurement can be increased by limiting the frequency bandwidth of the transducer. This can be done by passing the transducer output signal through a hardware filter or by averaging the measured values. (Caution: filtering produces a phase shift, and averaging a time delay!) The RMS noise voltage (i.e. resolution) of the transducer in a frequency band from f_L to f_H can be estimated as follows:

$$V_{nRMS-B} \approx \sqrt{NSD_{1f}^2 \times 1\text{Hz} \times \ln\left(\frac{f_H}{f_L}\right) + 1.57 \times NSD_W^2 \times f_H} \quad \text{Eq. [6]}$$

Notation:

- NSD_{1f} is the $1/f$ noise voltage spectral density (RMS) at $f=1$ Hz;
- NSD_w is the RMS white noise voltage spectral density;
- f_L is the low, and f_H is the high-frequency limit of the bandwidth of interest;
- the numerical factor 1.57 comes under the assumption of using a first-order low-pass filter.

For a DC measurement: $f_L=1/\text{measurement time}$. The high-frequency limit cannot be higher than the cut-off frequency of the built-in filter f_T : $f_H \leq f_T$. If the low-frequency limit f_L is higher than the corner frequency f_C then the first term in Eq. (6) can be neglected; otherwise: if the high-frequency limit f_H is lower than the corner frequency f_C then the second term in Eq. (6) can be neglected. The corresponding peak-to-peak noise voltage can be calculated according to the "6-sigma" rule, i. e., $V_{nP-P-B} \approx 6 \times V_{nRMS-B}$.

- 10) According to the sampling theorem, the sampling frequency must be at least two times higher than the highest frequency of the measured magnetic signal. Let us denote this signal sampling frequency by f_{samS} . However, in order to obtain the best signal-to-noise ratio, it is useful to allow for over-sampling (this way we avoid aliasing of high-frequency noise). Accordingly, for best resolution, the recommended physical sampling frequency of the transducer output voltage is $f_{samP} > 5 \times f_T$ (or $f_{samP} > 5 \times f_H$), if an additional low-pass filter is used (see Note 8). The number of samples can be reduced by averaging every N subsequent samples, $N \leq f_{samP} / f_{samS}$.
- 11) When measuring fast-changing magnetic fields, one should take into account the transport delay of the Hall signals, small inductive signals generated at the connections Hall probe-thin cable, and the filter effect of the electronics in the E-Module. Approximately, the transducer transfer function is similar to that of a first-order low-pass filter, with the frequency bandwidth from DC to f_T . The filter attenuation is -20 dB/dec (-6 dB/oct). The calibration table of the frequency response is available as an option.

GMW

USER'S MANUAL

MODEL: 3474-140
MODEL: 3474FG-140

250MM ELECTROMAGNET

Date Sold _____

Magnet SN _____

PROPRIETARY

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**Section 1
SPECIFICATIONS**

Table 1. Model 3474-140 General Specifications

Pole Diameter	250 mm (10 inch)
Pole Gap *	0 - 160 mm (0 to 6.3 inch)
Standard Pole Caps:	250 mm (10 inch) cylindrical 200 mm (8 inch) tapered 150 mm (6 inch) tapered 100 mm (4 inch) tapered 75 mm (3 inch) tapered 50 mm (2 inch) tapered 25 mm (1 inch) tapered
Coil Resistance (20° C)	series connection 0.44 ohm
Maximum Resistance (hot)**	0.54 ohm
Maximum Power [air]	40A/22V (0.88kW)
Maximum Power [water]	140A/76V (10.6kW)
Self Inductance	80mH (measured at 5Hz)
Water Cooling (18° C)	15 liters/m (4 US gpm) 2.0 bar (30 psid)
Overtemperature Interlock	Elmwood 3450G thermal sensor 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.
Water Flow Interlock	Johnson Controls flow switch part number F61KD mounted on outlet side of water circuit. Contact rating 120Vac/16A, 240Vac/8A non-inductive Set to open at a flow of less than 10 liter/min (2.7US gpm)
Dimensions	Drawing 11801602/11801603 920mm W x 636 mm D x 864 mm H (36.2 inch W x 25.0 Inch D x 34.0 inch H)
Weight	1800 kg (3970 lb)

* The 3474FG-140 is a fixed pole gap magnet. Pole gap can be fixed in the range of 5 to 160mm

****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 3474-140 Electrical and Water Connections

DC Current (Refer to Drawing 11801602/11801603)

Right hand terminal Negative
Left Hand terminal Positive

Ground

An M6 screw is provided alongside the dc current connections to enable the magnet frame 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 11801602/11801603)

1	Water flow	Normally open. Closed when flow
2	Water flow	over 10 l/min (2.7 USgpm)
3	Overtemperature	Normally closed. Open when coil
4	Overtemperature	temperature exceeds 50°C.
5	No connection	
6	No connection	
7	No connection	
8	Control ground	

Water (Refer to Drawing 11801602/11801603)

outlet 3/8 inch NPT
inlet 3/8 inch NPT
(mating couplings for 1/2 inch hose provided)

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 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!

3 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.

4 Coil Hot Resistance

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

5 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.

6 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 gap 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.

Model 3474 System Installation; Minimum Facility Requirements for Systems with Field Reversal, High Precision Systems and High Power Systems installed in North America

Floor Space:

Magnet Floor Area: 830 x 830mm (33 x 33")
 Floor Capacity: 1800kg (3,980lb)
 Power Supply & Rack Floor Area: 700 x 900mm (28 x 36")
 Floor Capacity: 100kg (220lb)

An area for access to the Magnet and Power Supply must be provided. The total area for the system and comfortable operation is about 3 x 3m (10 x 10ft). The area should be clean and free from obstructions.

Electrical Service:

	Systems with Field Reversal or High Precision Systems.	High Power System
MPS Power:		
Power Supply:	Power10 P83C-100150 Danfysik 853-160A/80V	Power10 P86C-100200
Voltage:	208Vac, Three Phase, 50 – 60Hz	208Vac, Three Phase, 50 – 60Hz
Current:	56 Amps per phase	74 Amps per phase
Circuit Breaker:	60 Amps minimum	80 Amps minimum
Power Cable:	4 Conductor, 4AWG Min.	4 Conductor, 3AWG Min.
Mains Outlet:	Nema 15-60R or equivalent	Hard-wired in to electrical panel
Mating Plug:	Nema 15-60P or equivalent	(no suitable plugs available)
Auxiliary Power for Rack:		
Voltage:	115Vac, Single Phase	
Current:	15A	

Note: Due to liability and insurance reasons, the mains power installation and connections must be completed by the facility electrician.

Water Cooling:

Water Temperature: 15°C to 20°C, non-condensing. Specifications given at 18°C
 Flow Rate: 15 liters / minute (4 US gpm)
 Pressure: 2 bar (30 PSID)
 Water Hose: 12.5mm I.D. (½"), rubber, 2 x 5m long minimum
 Plumbing Fittings: To connect 12.5mm hose to water source and drain. (It is recommended to have a 50 micron water filter to trap debris on the facility water source and shutoff valves on the water source and drain.)

System Computer (if required and not provided by GMW):

Processor: Intel Pentium III, 500MHz PC or better
 Memory: 128MB RAM
 Free Drive Space: 500MB
 Interface: IEEE-488 (GIPB), National Instruments GPIB-PCII/IIA, P/N: 777158-01
 Monitor Resolution: 1024 x 768 or better
 Operating System: Windows ME / 2000 / XP pro / NT4

Lifting Equipment for Installation:

Forktruck or other lifting device with minimum safe lifting capacity of 2000kg
 Nylon Slings with minimum safe lifting capacity of 2000kg

Continued...

General:

The Purchaser must provide all equipment and labor for delivering the equipment from the delivery dock to the installation site. You should have a User Manual for the Model 3474 250mm Electromagnet and for the magnet power supply. Please provide these to the person who will be responsible for the System installation. If you do not have the User Manual or need to discuss details of the installation please call GMW. If a GMW Engineer is to supervise the installation any delays caused by inadequate preparation may result in additional charges for Engineering Time.

Model 3474 System Installation; Check List

Site:

Floor space and work space cleared and ready for equipment installation.

Appropriate electrical services installed

Materials Required:

Power Plugs

Power Cable

Facility Electrician ready to make mains connections to power supply at the time of system install

Cooling water supply installed with shut-off valves

Materials Required:

12.5mm I.D. (1/2") water hose, 5m for source and 5m for drain

Water hose fittings appropriate for installed plumbing

Water hose clamps

Misc. Items (to be provided by facility):

Tools:

Power Drill with 5/16" socket (to open magnet crates)

24mm combination wrench (open and box end)

24 mm socket wrench (for attaching the angle brackets to the magnet)

3/4" socket wrench (for removal of magnet from shipping crate)

Nylon lifting slings, chains, cables and other rigging equipment suitable for lifting magnet.

Other Items:

4" x 4" x 3' wood blocks. (about 4 – 6 pieces)

3' x 3' 3/4" plywood

All required materials on this list are to be provided by the facility.

If you are providing your own equipment rack, it must be a minimum of 760mm (30") deep.

Note: The weight of an assembled 3474 magnet system is just over 4300 lbs. It is not possible to rig and move this magnet by hand, so use of proper lifting equipment is required (either an appropriately rated lift truck or a traveling crane). It is the responsibility of the facility to provide the means to move and lift the magnet for assembly on to its base and move it to its final installed position. If the means to do this is not available in-house, the customer may be required to hire an outside rigging company to lift and move the magnet. Scheduling of the riggers is the responsibility of the customer. Should the installation time be extended due to problems with the rigger scheduling, GMW reserves the right to bill for additional time beyond the original contracted amount.

Important: Due to liability and insurance reasons, the mains power installation and connections must be completed by the facility electrician. The GMW engineer will not complete the mains power connection. Please ensure that the facility electrician is available to do this work.

Section 3

INSTALLATION

Caution: This is a heavy system. The magnet mass is approximately 1800 kg (4000 lb) so lifting equipment of this capacity should be used to shift the magnet. Two lifting eyes threaded M33 are provided and they can be used in several holes. Be sure to ensure the eyes are screwed fully home before use. Flexible lifting slings of at least 4000kg (9,000 lb) lifting capacity are recommended to avoid damage to the magnet. All movement, lifting and installation of the 3474 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.

Mounting Position

The magnet can be operated in any position. 45 degree mounting angles are available to allow the field axis to be horizontal with the yoke inclined back at 45⁰ for access from the horizontal and vertical direction. Refer to drawing 11900930 for showing the 45⁰ mounting arrangement.

Alternatively, vertical mounting brackets can be used to position the field axis vertically. In each case the magnet should be oriented with the water lines below the electrical connections to reduce the chance of water leakage shorting electrical connections. Refer to drawing 11900490.

Unpacking Instructions and Damage Inspection

To unpack the electromagnet please use the following procedure (Refer to Drawing 18800191).

1. First remove all of the "Hex Head 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. Use one person on each side of the shipping crate grip the side panels of the Crate Top Cover. Lift "Crate Top Cover" high enough to clear top of electromagnet, walk cover sideways to clear area and place on floor.
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 M16 Hex Bolts that secure the magnet to the steel shipping angle brackets.
6. Remove the hex lag bolts that secure the steel "shipping angle brackets" to shipping crate base, and remove shipping angle brackets.
7. Install M16 lifting eye and washer to top of magnet yoke, screw down firmly.
8. The magnet is now prepared for final installation, follow the appropriate following procedure to install to 45°, vertical or direct mounting.

Direct Mounting

1. With suitable lifting equipment (e.g. 4000kg (9000 lb.) minimum safe lifting rating), lift magnet 50mm (2") clear of shipping crate base.
2. Slide shipping crate base clear.
3. Lower magnet to 50mm (2") above floor.
4. Move magnet to final location and secure using the steel shipping angle brackets. The brackets can be modified to suit installation space needs.

Section 3

INSTALLATION

45° Mounting (Refer to Drawing 11900480)

1. With suitable lifting equipment (e.g. 4000kg (9000 lb.) minimum safe lifting rating), lift magnet 50mm (2") clear of shipping crate base.
1. Slide shipping crate base clear.
2. Lower magnet to 50mm(2") above floor.
3. Move magnet to desired final location and place on 12mm (0.5") plywood sheet and wooden 100mm x 100mm (4" x 4") blocks (refer to figure 2).
4. Install 45° Mounting Brackets using M16 x 30 Hex bolts, flat and spring washers (refer to figure 2).
5. Lift magnet from top lifting eye about 50mm (2") remove 100mm x 100mm (4") wooden block located next to 45° mounting bracket (refer to figure 2).
6. Lower magnet so that it rests only on the front 100mm x 100mm (4") wooden block (refer to figure 3).
7. Install shackles and lifting sling to BOTH FRONT EYEBOLTS. Caution, keep hands and feet clear of magnet and 45° brackets during the following operation. Take weight of magnet and push the top front of the magnet rearward. The magnet weight should move over center. Lower magnet so that it rests on the 45° mounts (refer to figure 3 and 4).

Rolling or Rolling/Rotating Base Mounting (refer to Drawing 11900480)

Caution do not attempt to move magnet and rolling base or rolling/rotating base until the magnet has been firmly bolted down to the base (refer to figure 6).

1. To mount on rolling base or rolling/rotating base lift magnet from BOTH FRONT EYEBOLTS high enough to clear top of base (refer to figure 5).
2. Slide rolling base or rolling/rotating base underneath, lower magnet to 12mm (0.5") above base top surface (refer to figure 5).
3. Position rolling base or rolling/rotating base so the tapped holes in the base are aligned with the 45° mounting bracket hole (refer to figure 5).
4. Lower magnet onto rolling base or rolling/rotating base assembly (refer to figure 5).
5. Secure magnet and 45° mounting assembly to rolling base or rolling/rotating base with M16 x 25 long Hex Head Bolts (refer to figure 6).
6. Move magnet and rolling base or rolling/rotating base to desired location.
7. Screw down the four support legs located on each corner of the rolling or rolling/rotating base until the wheels clear the floor by 6mm (.25").
8. Secure the support legs with the locknut.
9. Secure rolling/rotating base to an adequate concrete floor to prevent movement and possible injury to personnel during an earthquake.

Section 3

INSTALLATION

Pole Cap Selection and Installation (Refer to Drawing 11801602/11801603)

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

If a uniform field is required use a cylindrical cap.

If a high field is required use a tapered cap.

The pole caps are machined from low carbon steel. This material is relatively soft and easily damaged. Since the pole caps are heavy and awkward to manipulate it is advisable to cover the pole faces to protect them from damage.

Pole cap removal using lifting eye bolt. (Refer to Drawing 11801602/11801603)

1. Turn off the power supply
2. Draw pole caps about 20mm into the pole sleeves, so the tapped M10 holes on the pole cap are still clear.
3. Fit the pole cap lifting eye bolt firmly into the top tapped hole (M10) of the pole cap to be removed.
4. Draw in the pole cap that is not to be removed until it is flush with the pole sleeve.
5. Tape cardboard or something similar to the face of the pole cap that is not to be removed to protect it from damage.
6. Support the pole weight, using a sling and overhead crane (approx. weight 38kg/84lbs).
7. Remove the axial retaining stud nut (item 33 on drawing 11801602/11801603).
8. Place the pole cap retaining stud wrench (item 2 on drawing 18900010) onto the end of the retaining stud (item 6 on drawing 11801602/11801603).
9. Remove retaining stud (item 6 on drawing 11801602/11801603) while supporting the pole cap.
10. **Carefully** rock the pole cap to break the adhesion to the pole and remove from the magnet

If lifting equipment is not available, the pole cap can be removed using the pole cap removal tool, using the following procedure.

Pole cap removal using pole cap removal tool. (Refer to Drawing 11801602/11801603)

1. Turn off the power supply
2. Draw pole caps about 20mm into the pole sleeves, so the tapped M10 holes on the pole cap are still clear.
3. Fit the pole cap removal tools (item 11 on drawing 18900010) firmly into two opposite tapped holes (M10) on the pole cap to be removed.
4. Tape cardboard or something similar to the face of the other pole cap to protect it from damage.
5. Loosen the axial retaining stud nut 1 turn, but do not remove. (item 33 on drawing 11801602/11801603).
6. Use two people to support the weight of the pole cap (approx. weight 38kg/84lbs).
7. Place the pole cap retaining stud wrench (item 2 on drawing 18900010) onto the end of the retaining stud (item 6 on drawing 11801602/11801603).
8. Remove retaining stud (item 6 on drawing 11801602/11801603) while supporting the pole cap.
9. **Carefully** rock the pole cap to break the adhesion to the pole and remove from the magnet

Section 3

INSTALLATION

Pole cap fitting.

1. Ensure the pole caps, pole cores, and pole sleeves are clean and free from debris.
2. Reverse the above pole cap removal sequence.

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 or equipment damage.

The magnet has two coils which may be connected in series (140A/76V) Model: 3474-140 or in series/parallel (280A/38V) Model: 3474-280 to match different power supplies. Refer to drawing 11801602/11801603. The power supply cables should be connected directly to the DC current terminals marked + and -. Recommended current cable is stranded copper of 120mm² cross section (250MCM) for the 280A/38V coil connections. For 140A/76V coil connections use 70mm² cross section (2/0 AWG) standard copper current cables. Refer to drawing 13900030 for details.

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.

Interlocks

Six thermal sensors Elmwood 3450G Part Number 3450G611-1 L50C 89/16 are wired in series and terminated in positions 3 and 4 on the Interlock Terminal block. They are normally closed, opening when the coil central cooling plate temperature exceeds 50°C +/3°C. The flow switch is connected to terminals 1 and 2. The contacts are normally open, closing when the water flow exceeds approx. 10 l/min.

Section 3

INSTALLATION

Cooling

The Model 3474 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 of 0.00393, the hot resistance of the coil should not exceed 20% more than the ambient temperature "cold" resistance.

The coil thermal sensor will open when the coil cooling plate temperature exceeds approximately 50°C. Clean, cool (12°C - 20°C) water at 15 l/min and 2.0 bar (30 psid) should be used to cool the magnet. The cooling tubes are not electrically connected to the coils so no electrochemical corrosion will occur. If the water supply contains particulates, a 50 micron filter should be placed before the input to the magnet to avoid unreliable operation of the flow switch.

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 3474 Electromagnet alone a suitable chiller is the Neslab HX-300 with PD-2 pump. 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 below 40A for coils that are series connected or 80A for series/parallel connected coils the Model 3474 can be operated safely without water cooling. However the coil temperature will vary with the power dissipation. This results in dimensional and permeability changes of the magnet yoke. 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. To reduce mechanical backlash when the magnetic field is applied, it is best to set the poles by increasing the gap.
2. Adjust the cooling water flow to about 15 liters/min (4 US gpm). For operation at less than maximum power the water flow may be correspondingly reduced.
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 gaussmeter 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).
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).

Section 4

OPERATION

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 pole adjustment mechanism is clean, properly lubricated and free of grit and dirt, which may cause binding of the mechanism. 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 is clean.

Section 6

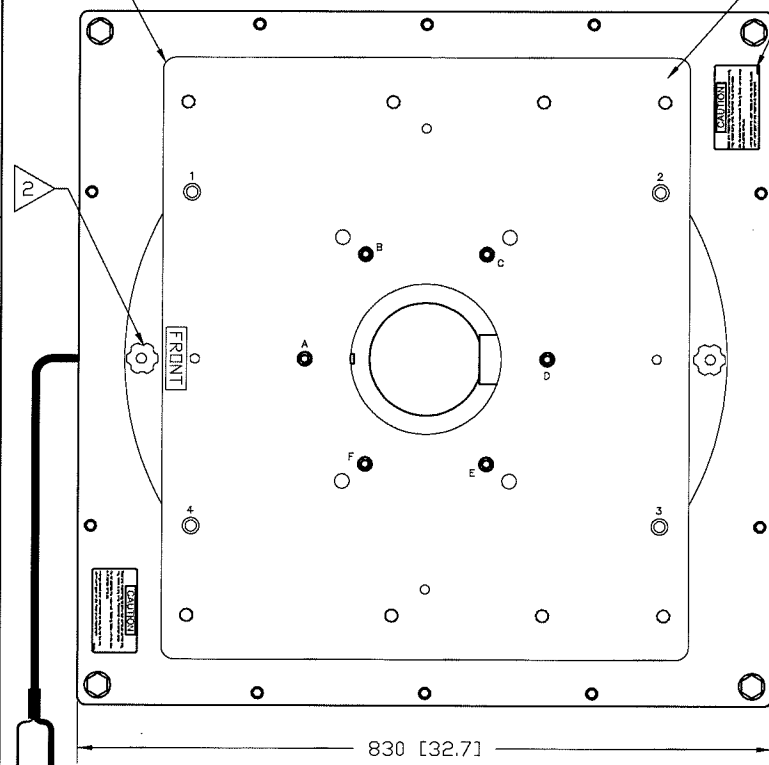
STANDARD OPTIONS

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.

TOP VIEW

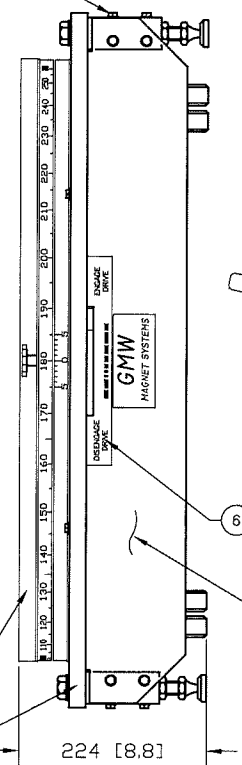
TRANSITION PLATE

NOTE: ROTATING BASE SHOWN AT THE 180 DEG POSITION

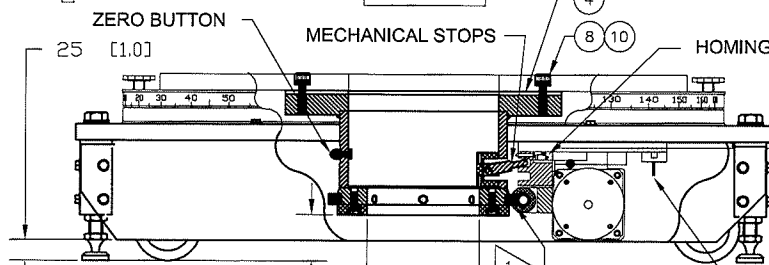


FRONT VIEW

SKIRT PANEL
SECURING SCREWS



SIDE VIEW

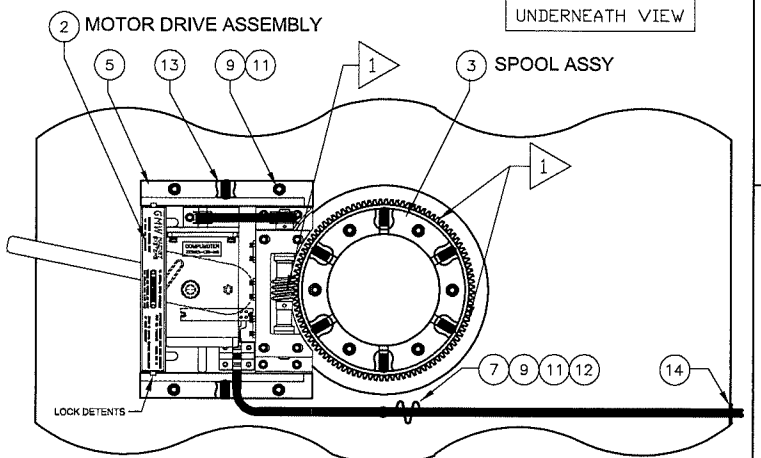


NOTE: ROTATING BASE SHOWN AT THE 180 DEG POSITION

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		11/30/97	G.DOUGLAS
B	CHG 45° MTG HOLES, ITEM 9 LENGTH TO 25MM		10/20/98	G.DOUGLAS
C	ADD ITEM 1 NOTES		04/10/08	G.DOUGLAS
D	ADD NOTE 2, ITEM 15		08/21/08	G.DOUGLAS

UNDERNEATH VIEW



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
15	2	10900180	CAUTION LABEL	
14	1		GROMMET 25MM OD X 20MM ID	
13	2	SBMH-10N	BALL PLUNGER, M6 S/S	
12	1	DIN 433	WASHER, FLAT M8 X 1.6 S/S	
11	5	BN 792	WASHER, M8 x 1.4 RIBBED SPRING/STEEL	
10	6	BN 792	WASHER, M10 x 1.6 RIBBED SPRING/STEEL	
9	5	DIN 912	SHCS, M8 X 25 S/S	
8	6	DIN 912	SHCS M10 X 35 S/S	
7	1	17901230	CABLE SUPPORT	
6	1	10900161	DISENGAGE/ENGAGE LABEL	
5	2	17901020	MOTOR DRIVE ASSEMBLY GUIDES	
4	1	17901210	SPOOL SPACER	
3	1	11900820	SPOOL ASSY	
2	1	11900811	MOTOR DRIVE ASSY	
1	1	11900980	ROLLING/ROTATING BASE ASSY	

PARTS LIST

DRAWN G.DOUGLAS	DATE 11/30/97	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																							
ENGINEERING	DATE	<table border="1"> <thead> <tr> <th>LINEAR</th> <th>INCHES</th> <th>mm</th> </tr> </thead> <tbody> <tr> <td>X.XXX</td> <td>±.009</td> <td>±0.03</td> </tr> <tr> <td>X.XX</td> <td>±.01</td> <td>±0.1</td> </tr> <tr> <td>X.X</td> <td>±.03</td> <td>±0.3</td> </tr> <tr> <td>X</td> <td>±.06</td> <td>±1</td> </tr> <tr> <td>DEG.</td> <td>±.5</td> <td>±0.5</td> </tr> <tr> <td>FINISH</td> <td>83</td> <td>1.6</td> </tr> </tbody> </table>	LINEAR	INCHES	mm	X.XXX	±.009	±0.03	X.XX	±.01	±0.1	X.X	±.03	±0.3	X	±.06	±1	DEG.	±.5	±0.5	FINISH	83	1.6	TITLE MOTORIZED ROTATING DRIVE MODEL: 3474
LINEAR	INCHES	mm																						
X.XXX	±.009	±0.03																						
X.XX	±.01	±0.1																						
X.X	±.03	±0.3																						
X	±.06	±1																						
DEG.	±.5	±0.5																						
FINISH	83	1.6																						
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	<table border="1"> <tr> <td>SIZE</td> <td>DRAWING NO.</td> <td>REV</td> </tr> <tr> <td>A2</td> <td>11900801</td> <td>D</td> </tr> </table>	SIZE	DRAWING NO.	REV	A2	11900801	D															
SIZE	DRAWING NO.	REV																						
A2	11900801	D																						
SOFTWARE AUTOCAD 2000			<table border="1"> <tr> <td>SCALE</td> <td>WT kg</td> <td>SHEET 1 OF 1</td> </tr> <tr> <td>1:4</td> <td></td> <td></td> </tr> </table>	SCALE	WT kg	SHEET 1 OF 1	1:4																	
SCALE	WT kg	SHEET 1 OF 1																						
1:4																								

- 1. APPLY GP or GRAPHITE GREASE TO WORM AND ALL THE TEETH ON THE WORM GEAR.
- 2. REMOVE ROTATION LOCKS [x2] FOR MOTORIZED OPERATION.

RELEASE PINS
USED TO REMOVE MOTOR DRIVE ASSY
FROM ROLLING/ROTATING BASE ASSY

DISENGAGE LEVER
RELEASES MOTOR DRIVE

ROLLING/ROTATING BASE
[SEPARATE ORDER ITEM]

SKIRT PANEL

STEPPER MOTOR ELECTRICAL CONNECTIONS

ZERO BUTTON

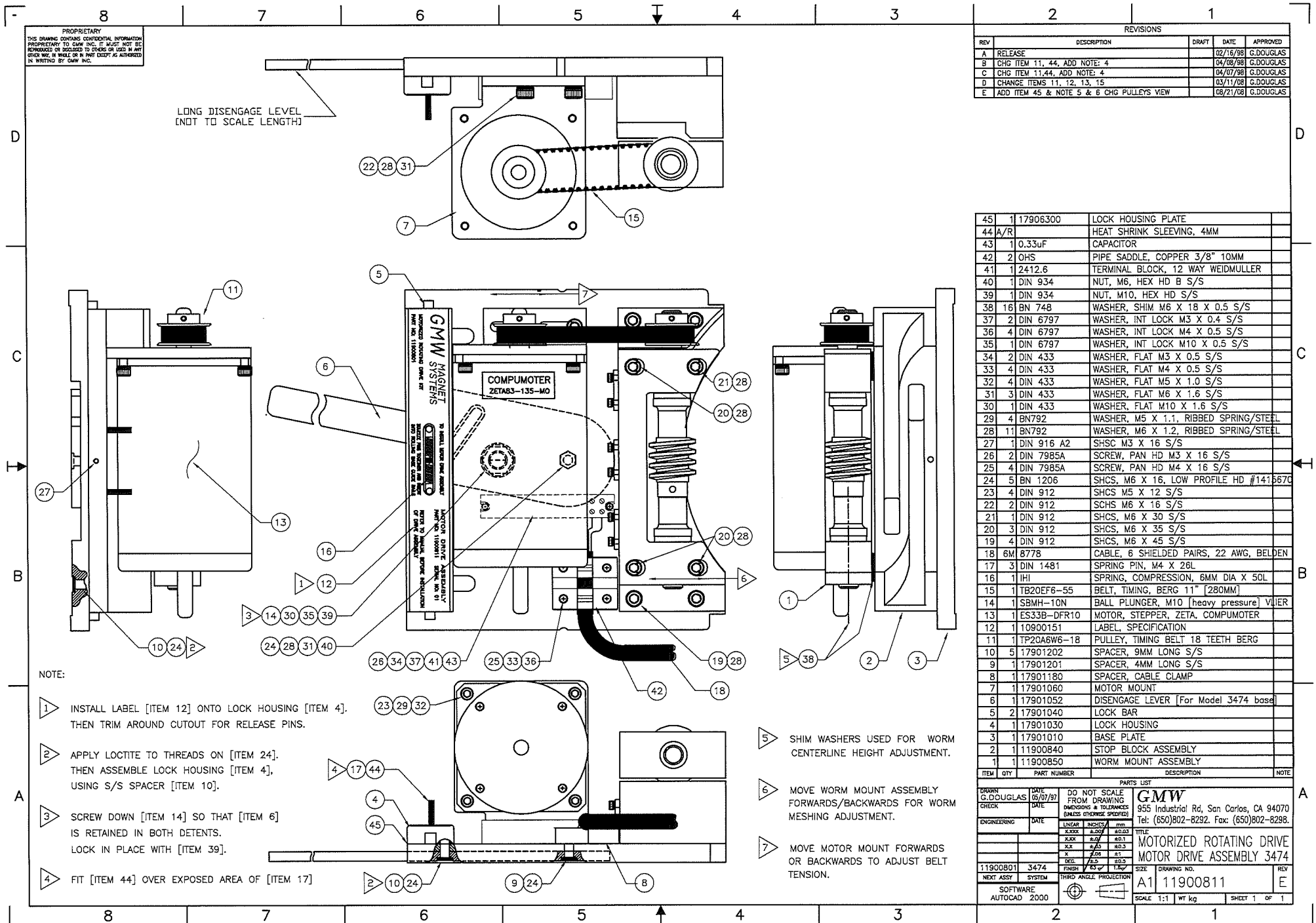
MECHANICAL STOPS

HOMING MICROSWITCH [0 DEG POSITION]

57 [2.2]
SPOOL CLEARANCE

134 [5.3]
SERVICE ACCESS

NOTE: ROTATING BASE SHOWN AT THE 180 DEG POSITION



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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/16/98	G.DOUGLAS
B	CHG ITEM 11, 44, ADD NOTE: 4		04/08/98	G.DOUGLAS
C	CHG ITEM 11,44, ADD NOTE: 4		04/07/98	G.DOUGLAS
D	CHANGE ITEMS 11, 12, 13, 15		03/11/98	G.DOUGLAS
E	ADD ITEM 45 & NOTE 5 & 6 CHG PULLEYS VIEW		08/21/98	G.DOUGLAS

QTY	PART NUMBER	DESCRIPTION	NOTE
45	1 17906300	LOCK HOUSING PLATE	
44	A/R	HEAT SHRINK SLEEVING, 4MM	
43	1 0.33uF	CAPACITOR	
42	2 OHS	PIPE SADDLE, COPPER 3/8" 10MM	
41	1 2412.6	TERMINAL BLOCK, 12 WAY WEIDMULLER	
40	1 DIN 934	NUT, M6, HEX HD B S/S	
39	1 DIN 934	NUT, M10, HEX HD S/S	
38	16 BN 748	WASHER, SHIM M6 X 18 X 0.5 S/S	
37	2 DIN 6797	WASHER, INT LOCK M3 X 0.4 S/S	
36	4 DIN 6797	WASHER, INT LOCK M4 X 0.5 S/S	
35	1 DIN 6797	WASHER, INT LOCK M10 X 0.5 S/S	
34	2 DIN 433	WASHER, FLAT M3 X 0.5 S/S	
33	4 DIN 433	WASHER, FLAT M4 X 0.5 S/S	
32	4 DIN 433	WASHER, FLAT M5 X 1.0 S/S	
31	3 DIN 433	WASHER, FLAT M6 X 1.6 S/S	
30	1 DIN 433	WASHER, FLAT M10 X 1.6 S/S	
29	4 BN792	WASHER, M5 X 1.1, RIBBED SPRING/STEEL	
28	11 BN792	WASHER, M6 X 1.2, RIBBED SPRING/STEEL	
27	1 DIN 916 A2	SHCS M3 X 16 S/S	
26	2 DIN 7985A	SCREW, PAN HD M3 X 16 S/S	
25	4 DIN 7985A	SCREW, PAN HD M4 X 16 S/S	
24	5 BN 1206	SHCS, M6 X 16, LOW PROFILE HD #1416670	
23	4 DIN 912	SHCS M5 X 12 S/S	
22	2 DIN 912	SCHS M6 X 16 S/S	
21	1 DIN 912	SHCS, M6 X 30 S/S	
20	3 DIN 912	SHCS, M6 X 35 S/S	
19	4 DIN 912	SHCS, M6 X 45 S/S	
18	6M 8778	CABLE, 6 SHIELDED PAIRS, 22 AWG, BELDEN	
17	3 DIN 1481	SPRING PIN, M4 X 26L	
16	1 IH1	SPRING, COMPRESSION, 6MM DIA X 50L	
15	1 TB20EF6-55	BELT, TIMING, BERG 11" [280MM]	
14	1 SBM1-10N	BALL PLUNGER, M10 [heavy pressure] VAIER	
13	1 ES33B-DFR10	MOTOR, STEPPER, ZETA, COMPUMOTER	
12	1 10900151	LABEL, SPECIFICATION	
11	1 TP20A6W6-18	PULLEY, TIMING BELT 18 TEETH BERG	
10	5 17901202	SPACER, 9MM LONG S/S	
9	1 17901201	SPACER, 4MM LONG S/S	
8	1 17901180	SPACER, CABLE CLAMP	
7	1 17901060	MOTOR MOUNT	
6	1 17901052	DISENGAGE LEVER [For Model 3474 base]	
5	2 17901040	LOCK BAR	
4	1 17901030	LOCK HOUSING	
3	1 17901010	BASE PLATE	
2	1 11900840	STOP BLOCK ASSEMBLY	
1	1 11900850	WORM MOUNT ASSEMBLY	

- NOTE:
- 1 INSTALL LABEL [ITEM 12] ONTO LOCK HOUSING [ITEM 4]. THEN TRIM AROUND CUTOUT FOR RELEASE PINS.
 - 2 APPLY LOCTITE TO THREADS ON [ITEM 24]. THEN ASSEMBLE LOCK HOUSING [ITEM 4], USING S/S SPACER [ITEM 10].
 - 3 SCREW DOWN [ITEM 14] SO THAT [ITEM 6] IS RETAINED IN BOTH DETENTS. LOCK IN PLACE WITH [ITEM 39].
 - 4 FIT [ITEM 44] OVER EXPOSED AREA OF [ITEM 17]

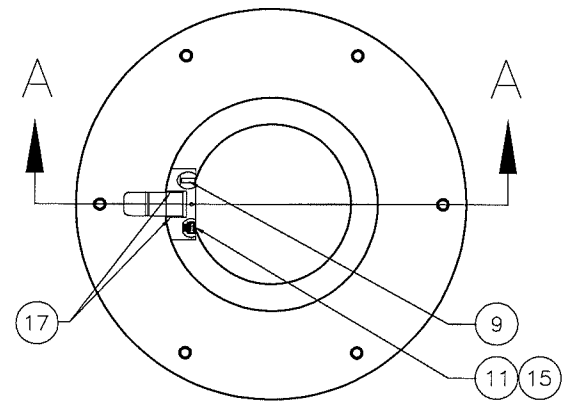
- 5 SHIM WASHERS USED FOR WORM CENTERLINE HEIGHT ADJUSTMENT.
- 6 MOVE WORM MOUNT ASSEMBLY FORWARDS/BACKWARDS FOR WORM MESHING ADJUSTMENT.
- 7 MOVE MOTOR MOUNT FORWARDS OR BACKWARDS TO ADJUST BELT TENSION.

DRAWN		DATE		DO NOT SCALE FROM DRAWING		GMW	
G.DOUGLAS	15/07/97	15/07/97	15/07/97	ENGINEERING & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	955 Industrial Rd, San Carlos, CA 94070		
CHECK		DATE			Tel: (650)802-8292. Fax: (650)802-8298.		
ENGINEERING		DATE			TITLE		
					MOTORIZED ROTATING DRIVE MOTOR DRIVE ASSEMBLY 3474		
					SIZE DRAWING NO. REV		
					A1 11900811 E		
					SCALE 1:1 WT kg SHEET 1 OF 1		

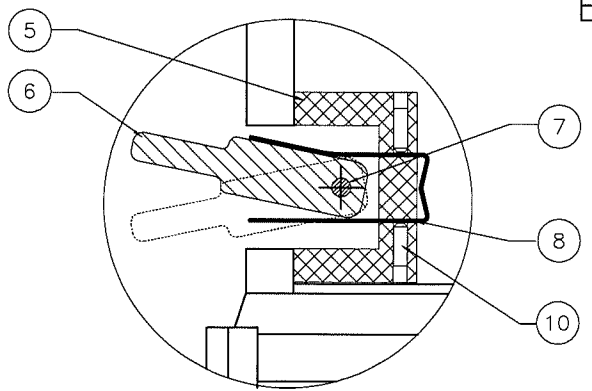
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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		07/07/97	G.DOUGLAS
B	ADD ITEM 17&18, MOD SPRING SHAPE		11/25/97	G.DOUGLAS
C	CHG ITEM 17, ADD ASSEMBLY NOTE		04/12/08	G.DOUGLAS

TOP VIEW

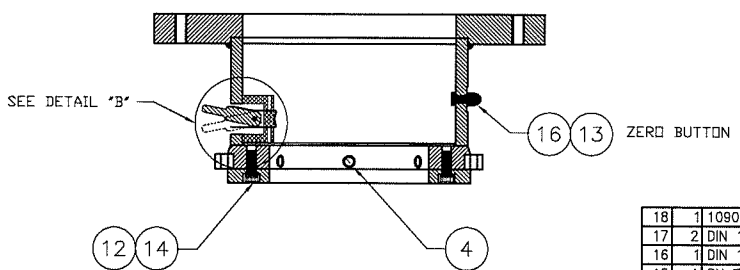
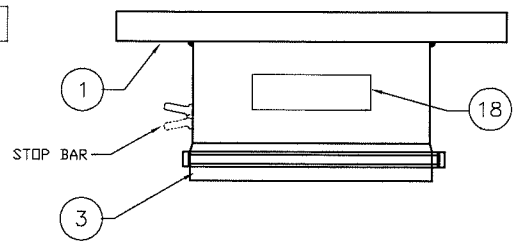


SCALE 4:1



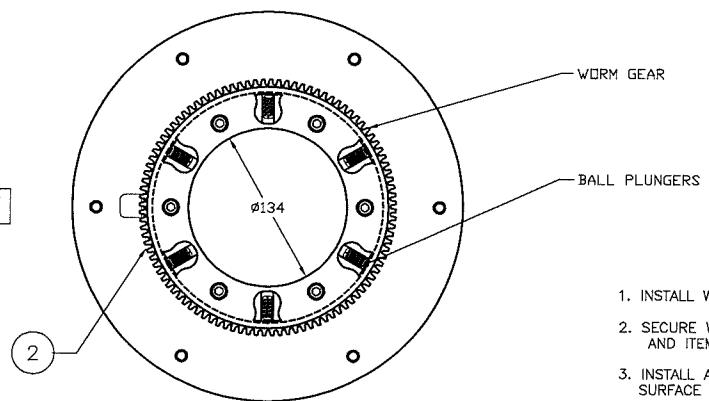
DETAIL "B"

SIDE VIEW



SECTION A-A

BOTTOM VIEW



ASSEMBLY NOTES

1. INSTALL WORM GEAR [ITEM 2] ONTO SPOOL [ITEM 1].
2. SECURE WORM GEAR IN PLACE WITH SPOOL CLAMP RING ITEM 3 AND ITEM 12 & 14.
3. INSTALL AND TIGHTEN BALL PLUNGERS ITEM 4 AGAINST REAR SURFACE OR WORM GEAR ITEM 2 TO PREVENT WORM GEAR ROTATING.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
18	1	10900170	LABEL, SPOOL IDENTIFICATION	
17	2	DIN 137	WASHER, CURVED 6 x 11x 0.5 S/S	
16	1	DIN 1587	NUT, HEX DOMED M6 X 12 S/S	
15	4	BN 792	WASHER, LOCK M6 X 1.2	
14	6	BN 792	WASHER, LOCK M8 X 1.4	
13	1	BN80	BOLT, M6 X 16 HEX NYLON	
12	6	DIN 912	SHCS M8 X 16 S/S	
11	4	DIN 912	SHCS M6 X 25 S/S	
10	2	DIN 913 A2	SHSS M3 X 10 S/S	
9	2	DIN 913 A2	SHSS M4 X 12 S/S	
8	A/R	1.0mm	PIANO WIRE S/S	
7	1	DIN 6325	DOWEL PIN, M6 X 60	
6	1	17901090	STOP BAR	
5	1	17901100	STOP BAR GUIDE	
4	6	SBMH-10N	BALL PLUNGER, VLIER S/S	
3	1	17901130	SPOOL CLAMP RING	
2	1	12900020	WORM GEAR, BRONZE	
1	1	11900830	SPOOL WELDED ASSY	

DRAWN		DATE		PARTS LIST	
G.DOUGLAS	04/27/97	DO NOT SCALE	FROM DRAWING	GMW	
CHECK		ENGINEERING & TECH SERVICES		955 Industrial Rd, San Carlos, CA 94070	
ENGINEERING	DATE	(UNLESS OTHERWISE SPECIFIED)		Tel: (650)802-8292, Fax: (650)802-8298.	
		LINEAR	INCHES	mm	TITLE
		XXX	1/16	2.54	MOTORIZED ROT DRIVE
		XX	1/32	1.27	SPOOL ASSEMBLY
		X	1/64	0.635	
		FINISH	RA	3.2	
11900800	3472/3/4				
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	SIZE	DRAWING NO.	REV
AUTOCAD 2000			A1	11900820	C
			SCALE	1:2	WT kg SHEET 1 OF 1

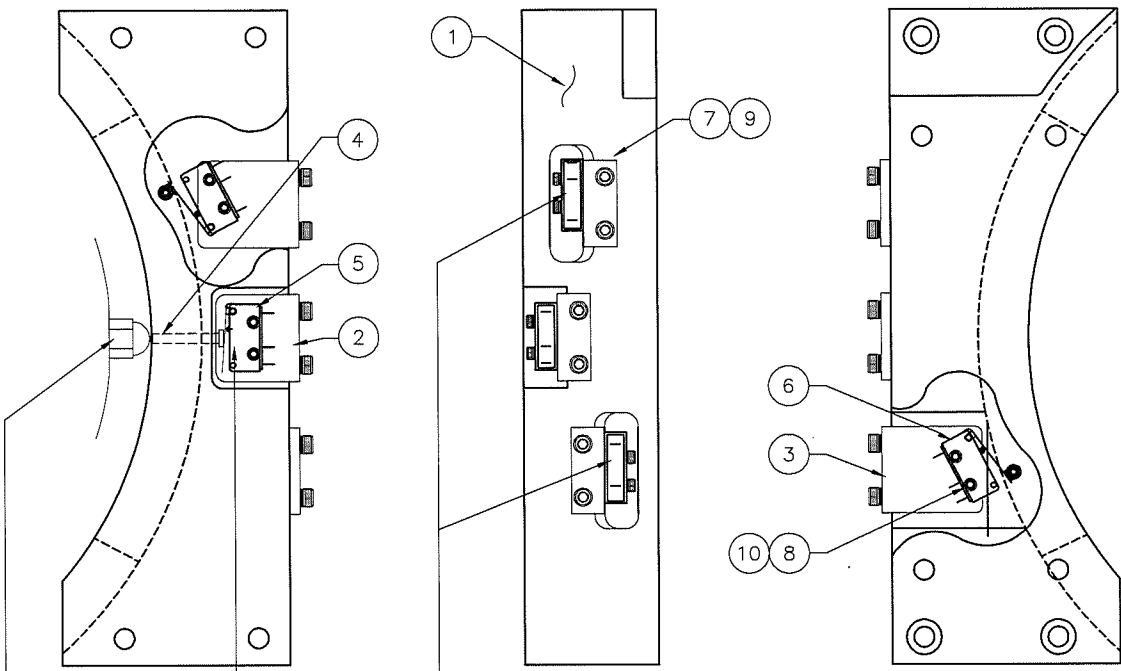
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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		07/07/97	G.DOUGLAS
B	UPDATE VIEW OF MICROSWITCH CUTOUTS		03/10/08	G.DOUGLAS

BOTTOM VIEW

REAR VIEW

TOP VIEW



MAXIMUM TRAVEL LIMIT MICROSWITCHES. NC CONTACT.
 MICROSWITCH OPENS WHEN MAX TRAVEL POSITION IS REACHED.

HOMING MICROSWITCH NO CONTACT. MICROSWITCH CLOSES
 CONTACT WHEN HOMING POSITION 0.0 DEG IS REACHED.

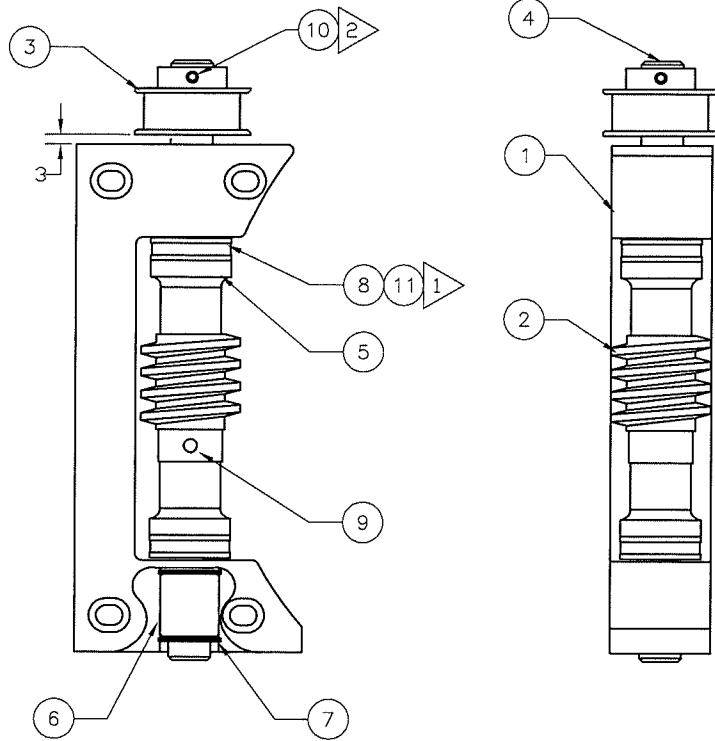
ZERO BUTTON (HOMING POSITION 0.0 DEG) MOUNTED ON SPOOL ASSEMBLY
 SEE DWG NO: 119000820 FOR MORE DETAILS.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
10	6	BN 752	WASHER, LOCK SP/S M2 X 0.5 SP/S	
9	6	BN 792	WASHER, LOCK SP/S M3 X 0.9 SP/S	
8	6	DIN 912	BOLT, SHCS M2 X 10 S/S	
7	6	DIN 912	BOLT, SHCS M3 X 10 S/S	
6	2	V4NT7	MICROSWITCH, BURGESS	
5	1	V4NT9	MICROSWITCH, BURGESS	
4	1	17901170	SHAFT, ZERO MICROSWITCH	
3	2	17901160	BRACKET, LIMIT MICROSWITCH	
2	1	17901150	BRACKET, ZERO MICROSWITCH	
1	1	17901070	STOP BLOCK	

PARTS LIST				
DRAWN G.DOUGLAS	DATE 05/02/97	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	±.001 / ±0.03	TITLE
		X.XX	±.01 / ±0.1	MOTORIZED.ROT.DRIVE
		X.X	±.03 / ±0.3	STOP BLOCK ASSY
		X	±.06 / ±1	
		DEG.	±.5 / ±0.5	
11900810		FINISH	63 / 1.6	SIZE
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		DRAWING NO.
SOFTWARE AUTOCAD 2000				A2 11900840
		SCALE 1:1	WT kg	SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		07/07/97	G.DOUGLAS
B	ADD ITEM 11 AND NOTE: 1, CHG ITEM 3		11/27/97	G.DOUGLAS
C	CHG ITEM 3		04/08/98	G.DOUGLAS
D	CHANGE ITEM 3,7,8		03/07/08	G.DOUGLAS
E	CHANGE ITEM 10 & PULLEY/BEARING VIEW, ADD NOTE 2		08/21/08	G.DOUGLAS



TOP VIEW

FRONT VIEW

NOTE:
 1 USE ITEM 11 TO PACK WORM DRIVE ASSEMBLY TO REDUCE
 SHAFT AXIAL MOVEMENT TO MINIMUM POSSIBLE. SHAFT MUST ROTATE FREELY.
 2 ENSURE SETSCREW FITS ONTO SHAFT FLAT SURFACE.

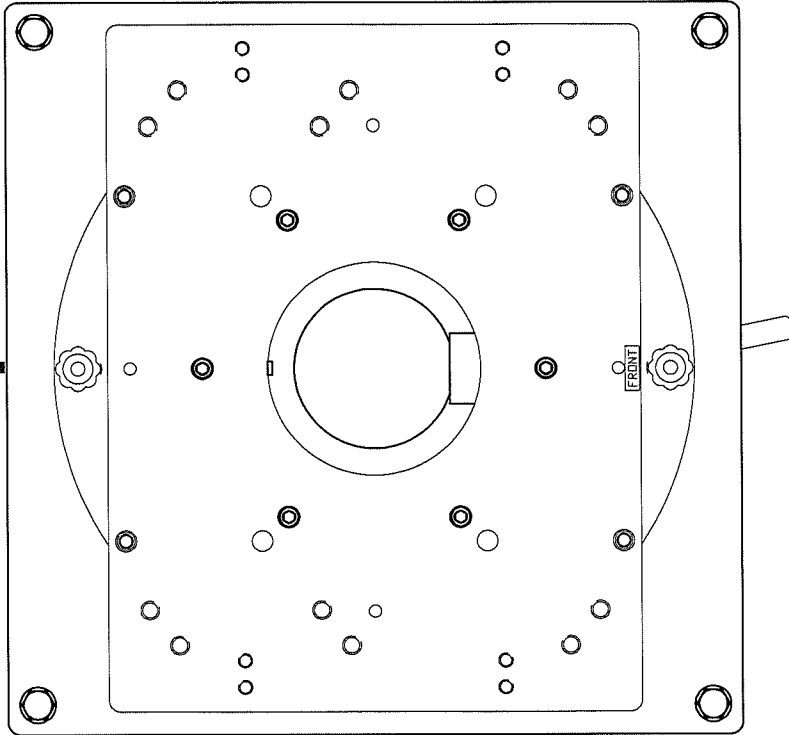
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
11	A/R	BN 748	SHIM WASHER, 14 X 26 X 0.1MM THICK	
10	1		SETSCREW 8-32 x 1/4" UNC	
9	1	DIN 1481	PIN, SPRING M4 X 18L, SP/S	
8	2	B5-6-SS	BEARING, THRUST 0.5" SHAFT, BERG	
7	4	Q9-71	BEARING RETAINING RING, BERG	
6	2	S99NH2-BN1624	BEARING, NEEDLE ROLLER, SDP	
5	2	17901190	SPACER, WORM	
4	1	12900060	WORM SHAFT	
3	1	TP20A8W6-18	PULLEY, 18 TEETH [for 0.5" shaft] BERG	
2	1	12900030	WORM	
1	1	17901080	WORM MOUNT	

PARTS LIST			
DRAWN G.DOUGLAS	DATE 05/03/97	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		
ENGINEERING	DATE	LINEAR INCHES/mm X.XXX ±.001/±0.03 X.XX ±.01/±0.1 X.X ±.03/±0.3 X ±.06/±1 DEG. ±.5/±0.5 FINISH 83/1.6	TITLE
11800810		THIRD ANGLE PROJECTION	MOTORIZED.ROT.DRIVE WORM MOUNT ASSY
NEXT ASSY	SYSTEM	SCALE 1:1	SIZE DRAWING NO. A2 11900850
SOFTWARE AUTOCAD 2000		WT kg	REV E
		SHEET 1 OF 1	

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TOP VIEW

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/17/98	G.DOUGLAS
B	INCR SIZE OF TRANSITION PLATE, ADD 5403EG MTG HOLES		07/02/03	G.DOUGLAS



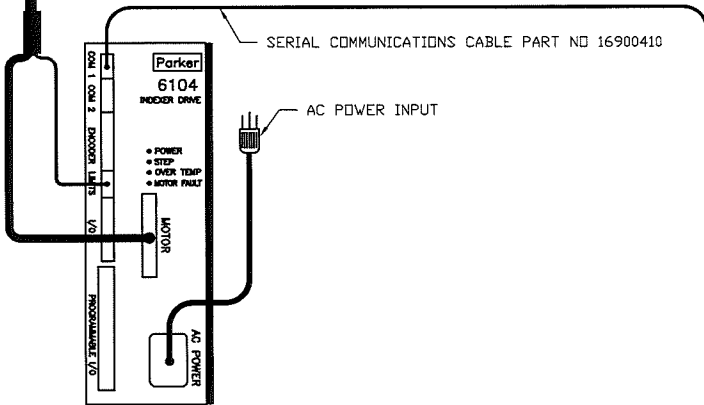
NOTE

1. THIS DRAWING SHOWS 3473/3472/5201 SYSTEM. WIRING IDENTICAL FOR 3474 SYSTEM.
2. SEE DRAWING NO: 13900350 FOR DETAILED ELECTRICAL WIRING.
3. MICROSWITCHES FUNCTIONS
 HOMING: ROTATES DRIVE TO 0.0 DEG POSITION
 LIMITS: STOPS ROTATION AT +/-200 DEG POSITION.
 MICROSWITCHES MOUNTED ON STOP BLOCK
 ASSEMBLY SEE DWG NO: 11900840 FOR DETAILS.

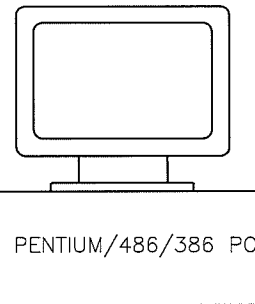
MOTOR AND LIMIT SWITCH CABLE PART NO 16900400

SERIAL COMMUNICATIONS CABLE PART NO 16900410

AC POWER INPUT



STEPPER MOTOR CONTROLLER



CONTROL COMPUTER

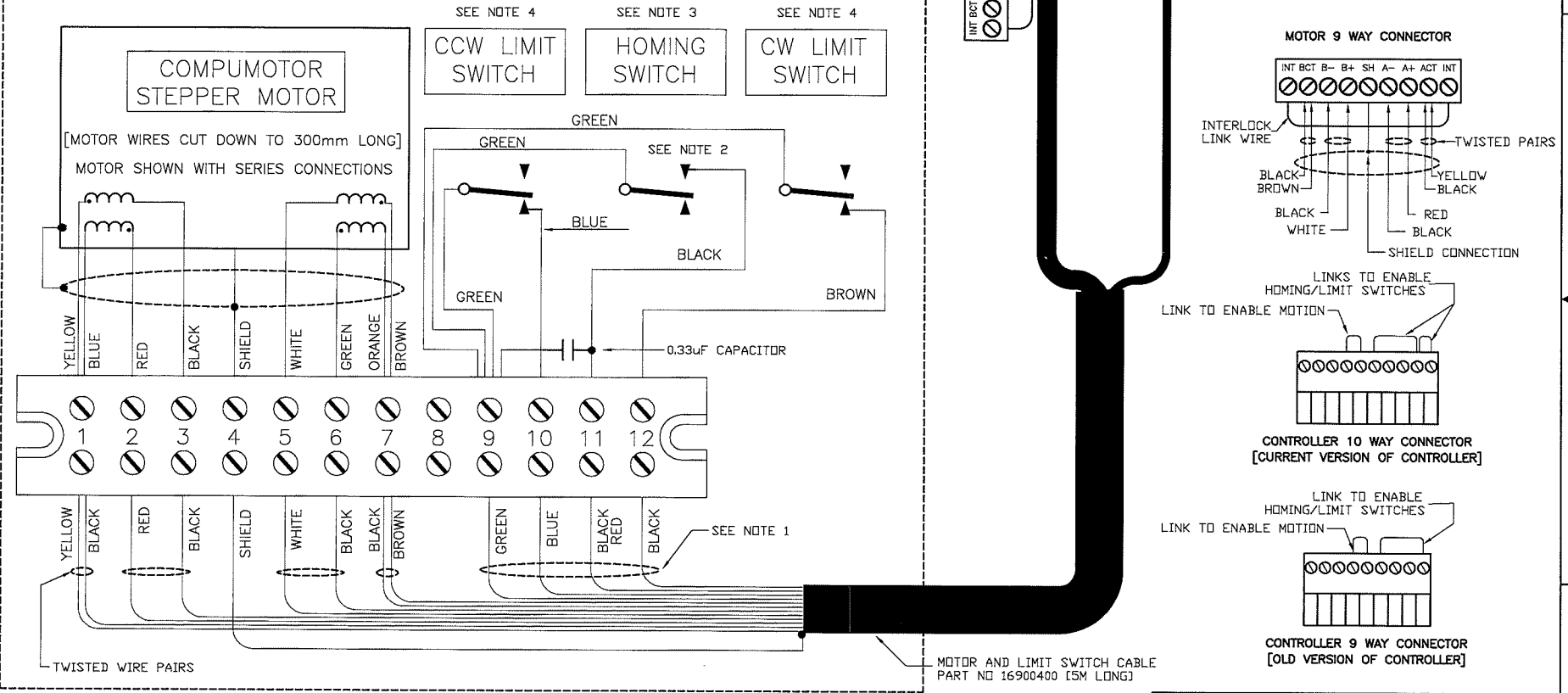
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN	G.DOUGLAS	DATE	02/17/98	DO NOT SCALE FROM DRAWING
CHECK		DATE		DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)
ENGINEERING		DATE		LINEAR DIMENSIONS mm
				XXX ±.001 ±0.03
				XX ±.001 ±0.1
				X ±.001 ±0.3
				Ø ±.001 ±1
				Ø ±.001 ±0.3
				FINISH 63 ±.001 ±0.3
NEXT ASSY		SYSTEM	THIRD ANGLE PROJECTION	SCALE 1:2 WT kg SHEET 1 OF 1
SOFTWARE		AUTOCAD 2000		
			GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298. MOTORIZED ROT. DRIVE ELECTRICAL ASSY	
			TITLE DRAWING NO. A1 11901020 REV B	

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/13/98	G.DOUGLAS
B	ADD CONTROLLER CONNECTOR LINKING		10/12/01	G.DOUGLAS
C	ADD MOTOR & LIMIT SWITCH CONNECTIONS		06/18/08	G.DOUGLAS

MOTOR DRIVE ASSEMBLY

MODEL 3474 MRD: SEE DWG NO: 11900811
MODEL 3473 MRD: SEE DWG NO: 11900810



- NOTE:
- 1 USE BLACK WIRES FROM GREEN AND WHITE PAIRS. DO NOT MIX WITH BLACK WIRES USED FOR STEPPER MOTOR.
 2. HOMING SWITCH USES NORMALLY OPEN CONTACT. CCW/CW LIMIT SWITCHES USE NORMALLY CLOSED CONTACTS.
 3. WHEN HOMING COMMAND IS GIVEN ROTATING BASE RETURNS TO ZERO DEG POSITION AND STOPS.
 4. ROTATION DIRECTIONS CCW AND CW REFERENCED TO ROTATING BASE VIEWED FROM TOP SURFACE LOOKING DOWNWARDS.

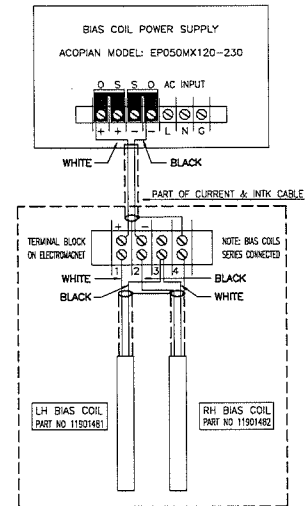
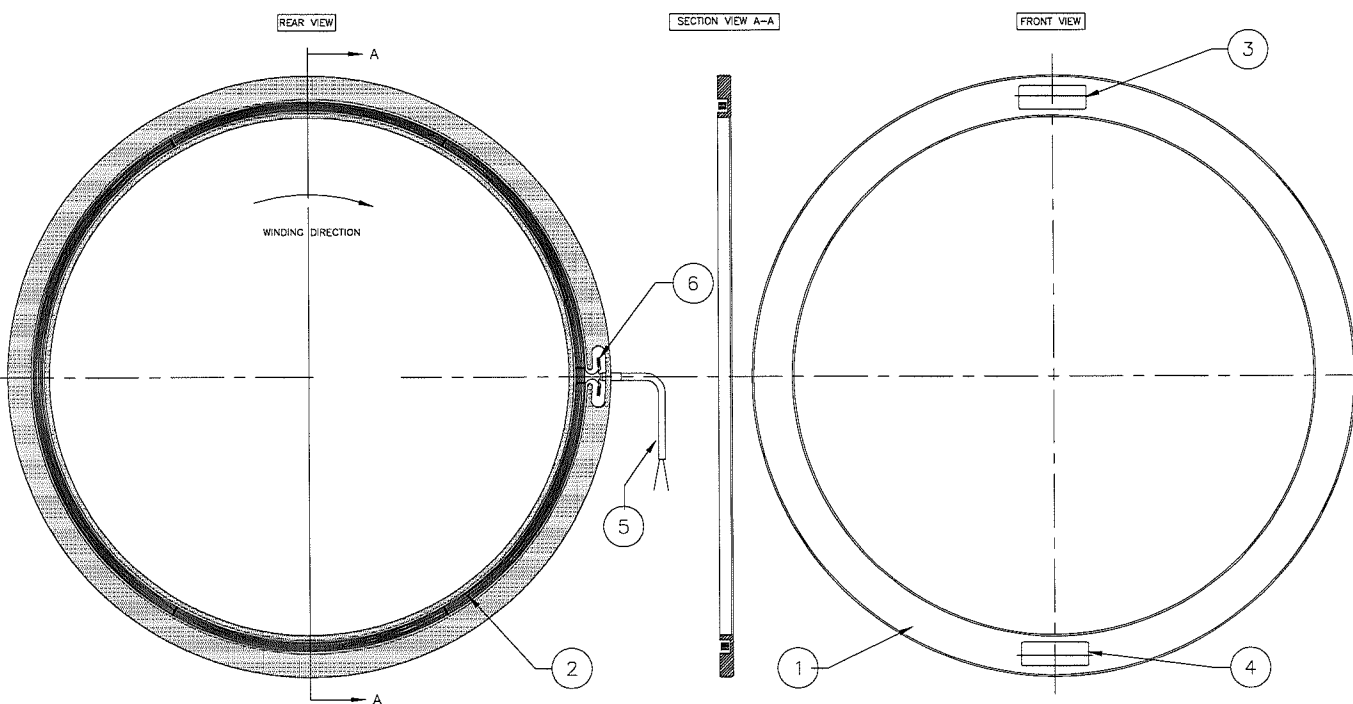
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
DRAWN G.DOUGLAS DATE 02/13/98 DO NOT SCALE FROM DRAWING (DIMENSIONS & TOLERANCES UNLESS OTHERWISE SPECIFIED) TITLE MOTORIZED.ROT.DRIVE ELECTRICAL WIRING				
ENGINEERING				
11900800	5201			
11900800	3473			
11900801	3474			
SOFTWARE AUTOCAD 2000				

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

SCALE 2:1 WT Kg SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		12/03/00	G.DOUGLAS



ASSEMBLY NOTES

1. ENSURE COIL WINDING IS FITTED TO SPOOL WITH WINDING DIRECTION AS SHOWN.
2. CONNECT START OF WINDING TO WHITE WIRE OF INPUT CABLE.
3. CONNECT FINISH OF WINDING TO BLACK WIRE OR INPUT CABLE.
4. HEATSHRINK INPUT CABLE & WINDING TERMINATIONS AS SHOWN.
5. TEST COMPLETED ASSEMBLY AT FULL POWER BEFORE POTTING.
6. POT COMPLETE ASSEMBLY AFTER PASSING FULL POWER TEST

SPECIFICATIONS

COIL RESISTANCE @ 20°C 30.0 OHMS
 [series connected]

SPOOL ID: 310mm [12.2"]

SPOOL OD: 360mm [14.2"]

SPOOL WIDTH: 6mm [0.24"]

FIELD @ MAX POWER: 150 GAUSS.

Installed on model: 3474 WITH 15mm GAP]

MAX CURRENT: 1.0 AMPS.

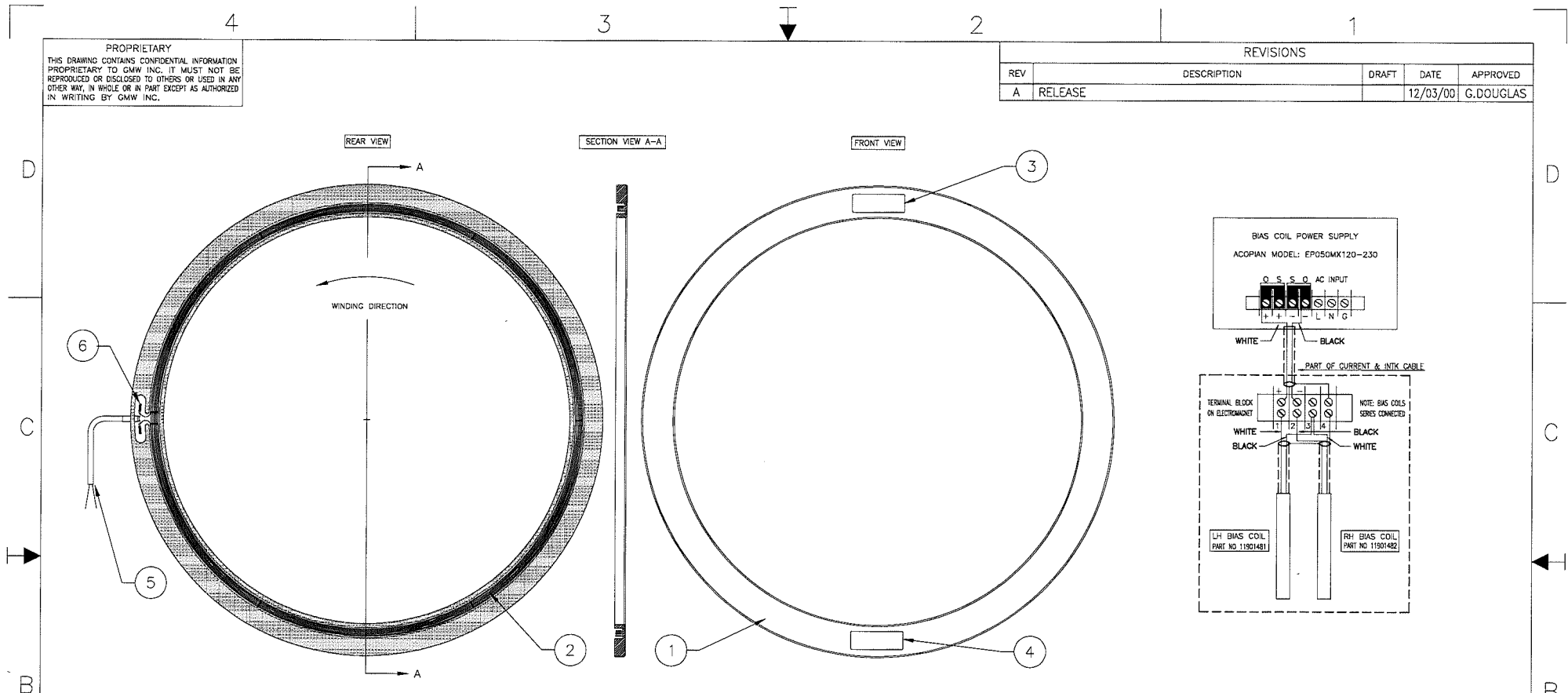
MAX VOLTS: 50 VOLTS

7	A/R	521	POTTING COMPOUND, EVERCOAT	
6	A/R		HEATSHRINK SLEEVING 5mm	
5	1m	5610B2401	CABLE, ALPHA 2 CORE, BLACK PVC	
4	1	10900420	LABEL, SPECIFICATIONS [LH SIDE]	
3	1	10900400	LABEL, MODEL & SERIAL NO.	
2	1	17904370	WINDING [100 turns 26AWG magnet wire]	
1	1	17904360	SPOOL	

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN G.DOUGLAS		DATE 12/03/00	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
CHECK		DATE	TITLE GMW P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8292. Fax: (650)802-8298.	
ENGINEERING		DATE	BIAS COIL ASSY [RH] MODEL: 3474	
NEXT ASSY		SYSTEM	SIZE	DRAWING NO.
3474			A2	11901482
SOFTWARE AUTOCAD 13		THIRD ANGLE PROJECTION		REV A
		SCALE 1:2		WT kg SHEET 1 OF 1

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IN WRITING BY GMW INC.

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		12/03/00	G.DOUGLAS



ASSEMBLY NOTES

1. ENSURE COIL WINDING IS FITTED TO SPOOL WITH WINDING DIRECTION AS SHOWN.
2. CONNECT START OF WINDING TO WHITE WIRE OF INPUT CABLE.
3. CONNECT FINISH OF WINDING TO BLACK WIRE OR INPUT CABLE.
4. HEATSHRINK INPUT CABLE & WINDING TERMINATIONS AS SHOWN.
5. TEST COMPLETED ASSEMBLY AT FULL POWER BEFORE POTTING.
6. POT COMPLETE ASSEMBLY AFTER PASSING FULL POWER TEST

SPECIFICATIONS

COIL RESISTANCE @ 20°C 30.0 OHMS
[series connected]

SPOOL ID: 310mm [12.2"]

SPOOL OD: 360mm [14.2"]

SPOOL WIDTH: 6mm [0.24"]

FIELD @ MAX POWER: 150 GAUSS.
Installed on model: 3474 WITH 15mm GAP]

MAX CURRENT: 1.0 AMPS.

MAX VOLTS: 50 VOLTS

7	A/R	521	POTTING COMPOUND, EVERCOAT	
6	A/R		HEATSHRINK SLEEVEING 5mm	
5	1m	5610B2401	CABLE, ALPHA 2 CORE, BLACK PVC	
4	1	10900410	LABEL, SPECIFICATIONS [LH SIDE]	
3	1	10900400	LABEL, MODEL & SERIAL NO.	
2	1	17904370	WINDING [100 turns 26AWG magnet wire]	
1	1	17904360	SPOOL	

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN G.DOUGLAS	DATE 12/03/00	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		
CHECK	DATE	TITLE		
ENGINEERING	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	±.5	±1.5
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		SIZE
		DRAWING NO.		REV
SOFTWARE AUTOCAD 13		A2 11901481		A
SCALE 1:2		WT kg	SHEET 1 OF 1	

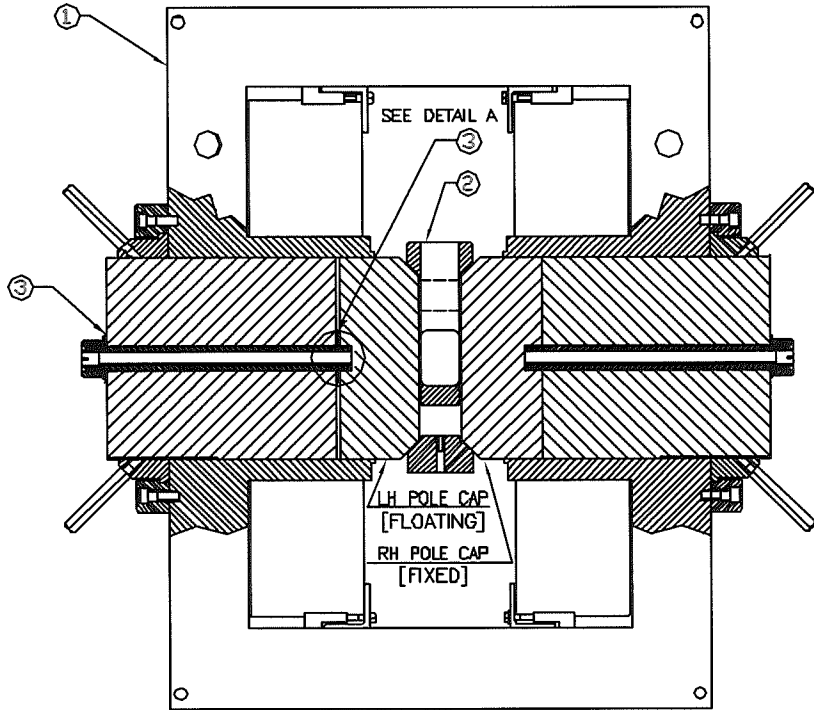
GMW
P.O Box 2578, Redwood City, CA 94064
Tel: (650)802-8292. Fax: (650)802-8298.

BIAS COIL ASSY [LH]
MODEL: 3474

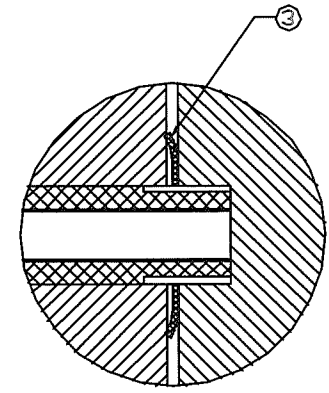
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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/28/97	G.DOUGLAS

MODEL: 3474 ELECTROMAGNET



FRONT VIEW



DETAIL A

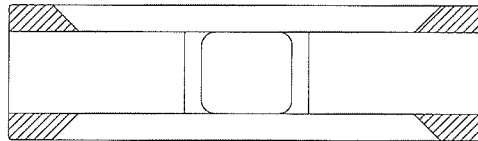
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
3	2	BN1375	SPRING, DISC, SPRING STEEL, BOSSARD	
2	1	11900460	POLE SPACER RING ASSEMBLY	
1	1	3474	ELECTROMAGNET, 250MM	

DRAWN G.DOUGLAS		DATE 02/28/97	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8282. Fax: (650)802-8298.	
CHECK		DATE			
ENGINEERING		DATE	LINEAR	TITLE	
			INCHES	POLE SPACER ASSEM MODEL: 3474	
			M.M.		
			X.XX		SIZE
			X.X		DRAWING NO.
			X.X		REV
			X		
			DEC.		
			FRESH		
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	SCALE	WT kg	
SOFTWARE AUTOCAD 13			1:4	SHEET 1 OF 1	

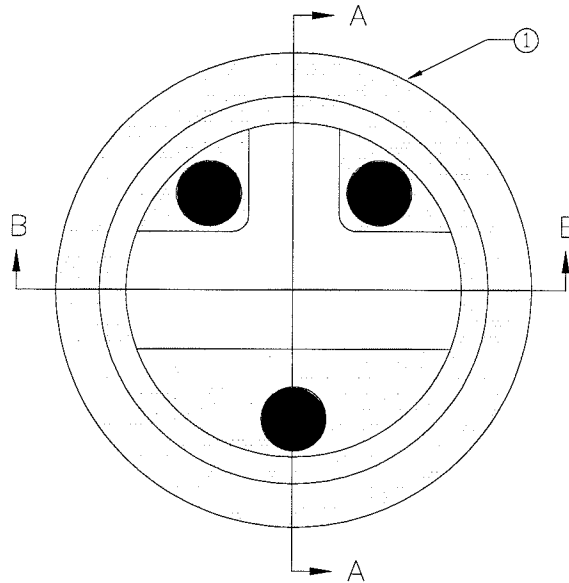
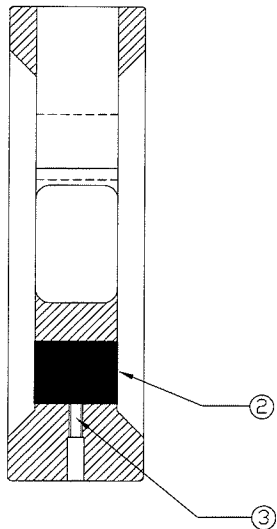
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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/25/97	G.DOUGLAS

SECTION B-B



SECTION A-A

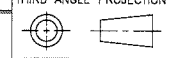


ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
3	3	BN1073	SET SCREW, SLOTTED HD, NYLON, BOSSARD	
2	3	17900690	POLE SPACERS, CERAMIC	
1	1	17900460	POLE SPACER RING, DELRIN	

DRAWN		DATE	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	TITLE
G.DOUGLAS	CHECK	02/25/97		
ENGINEERING		DATE		
			LINEAR	INCHES/ mm
			X.XXX	±.005/ ±0.03
			X.XX	±.01/ ±0.1
			X.X	±.03/ ±0.3
			X	±.06/ ±1
			DEC.	±.5/ ±0.5
			FINISH	83/ 1.6
NEXT ASSY	SYSTEM		THIRD ANGLE PROJECTION	SIZE
SOFTWARE	AUTOCAD 2000			DRAWING NO.
				A2 11900460
				SCALE 1:2
				WT kg
				SHEET 1 OF 1

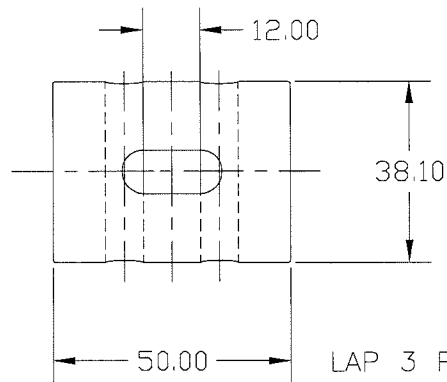
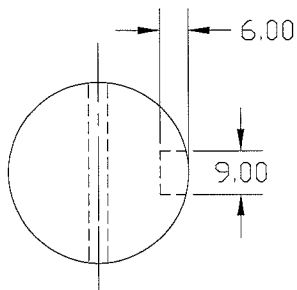
GMW
 P.O. Box 2578, Redwood City, CA 94064
 Tel: (650)802-8292. Fax: (650)802-8298.

POLE SPACER RING
MODEL: 3474

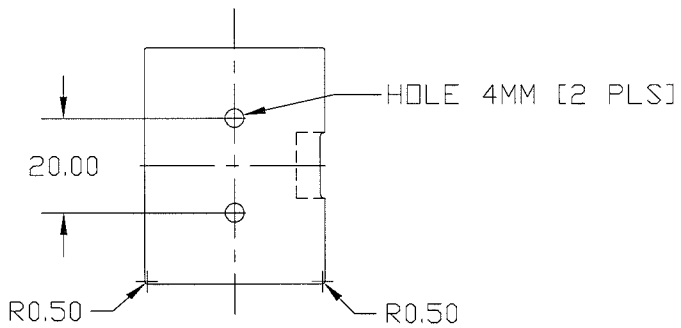


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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		10/07/96	G.DOUGLAS



LAP 3 POLE PIECES TO EQUAL LENGTH ± 0.001MM



MATERIAL: A1 ALUMINA ROD
 NO REQD: 3
 FINISH: NONE

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE																					
PARTS LIST																									
DRAWN G.DOUGLAS		DATE 10/07/96	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	 P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8292. Fax: (650)802-8298.																					
CHECK		DATE																							
ENGINEERING		DATE	<table border="1"> <thead> <tr> <th>LINEAR</th> <th>INCHES</th> <th>mm</th> </tr> </thead> <tbody> <tr> <td>X.XXX</td> <td>±.005</td> <td>±0.03</td> </tr> <tr> <td>X.XX</td> <td>±.01</td> <td>±0.1</td> </tr> <tr> <td>X.X</td> <td>±.03</td> <td>±0.3</td> </tr> <tr> <td>X</td> <td>±.06</td> <td>±1</td> </tr> <tr> <td>DEG.</td> <td>±.5</td> <td>±0.5</td> </tr> <tr> <td>FINISH</td> <td>63 ✓</td> <td>1.6 ✓</td> </tr> </tbody> </table>	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
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 ✓																							
11900460	3474			POLE SPACERS MODEL: 3474																					
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	<table border="1"> <tr> <td>SIZE</td> <td>DRAWING NO.</td> <td>REV</td> </tr> <tr> <td>A3</td> <td>17900690</td> <td>A</td> </tr> </table>	SIZE	DRAWING NO.	REV	A3	17900690	A																
SIZE	DRAWING NO.	REV																							
A3	17900690	A																							
SOFTWARE AUTOCAD 13			SCALE 1:1	WT kg																					
			SHEET 1	OF 1																					

4

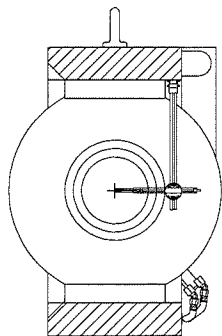
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2

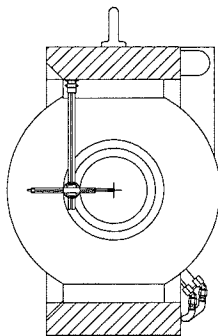
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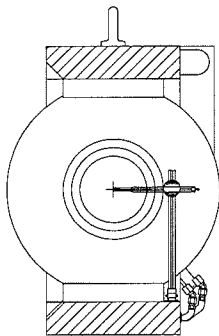
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		09/11/98	G.DOUGLAS
B	ADD 5451 TO SELECTION TABLE		10/07/03	G.DOUGLAS



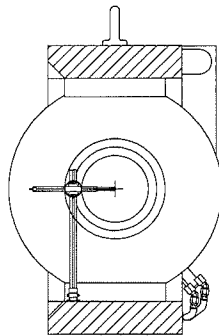
TOP/REAR INSTALLATION



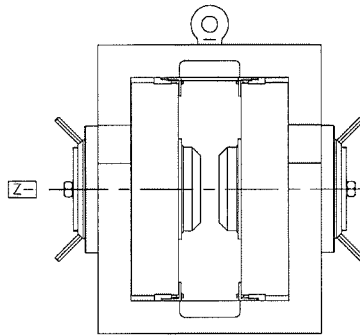
TOP/FRONT INSTALLATION



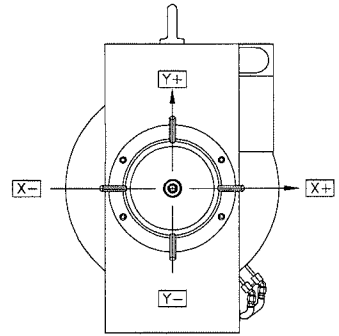
BOTTOM/REAR INSTALLATION



BOTTOM/FRONT INSTALLATION



MAGNET FRONT VIEW



MAGNET SIDE VIEW

MAGNET MODEL	INSTALLATION POSITION	ASSEMBLY NUMBER	VERTICAL TRAVEL "Y"	HORIZONTAL TRAVEL "Z"
3474/5451	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

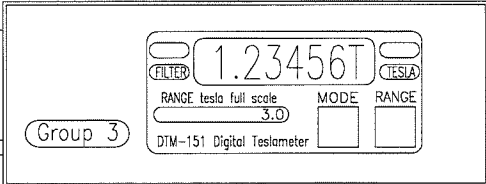


MAGNET YOKE

SIDE VIEW

HUB ANGLE ADJUSTABLE
 IN 15° INCREMENTS
 FROM -45° to +45°

DIGITAL TESLAMETER
 SEPARATE ORDER ITEM



MPT PROBEHOLDER
 SEPARATE ORDER ITEM

MPT HALL PROBE
 SEPARATE ORDER ITEM

- 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		
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		
NEXT ASSY		THIRD ANGLE PROJECTION		
SOFTWARE	AUTOCAD 2000			
TITLE		SIZE	DRAWING NO.	REV
PROBE MOUNT GENERAL ASSEMBLY		A2	11901300	B
SCALE 1:1		WT kg	SHEET 1 OF 1	

4

3

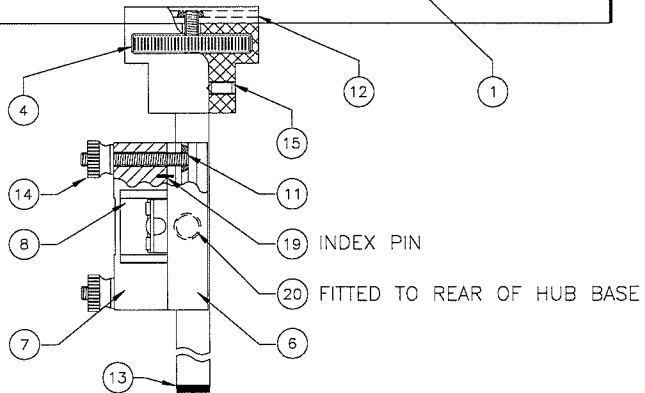
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1

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REAR VIEW

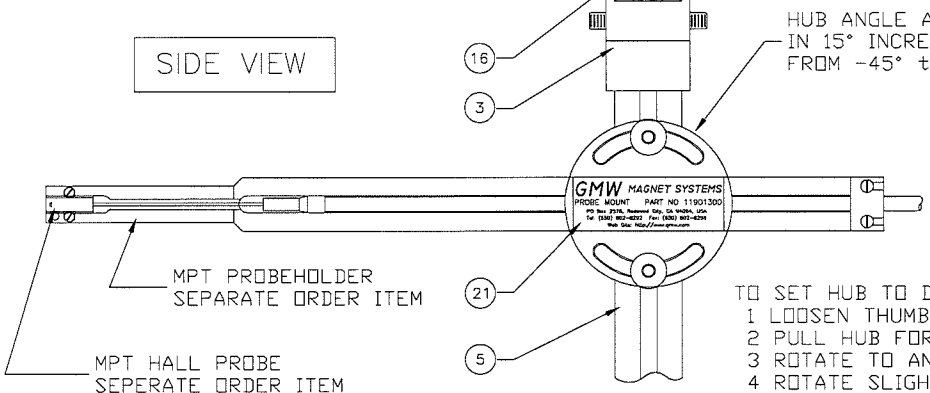


NOTE: THIS DRAWING SHOWS REAR INSTALLATION OF PROBE MOUNT
FOR FRONT INSTALLATION OF PROBE MOUNT SEE DRAWING NO 11901252



SIDE VIEW

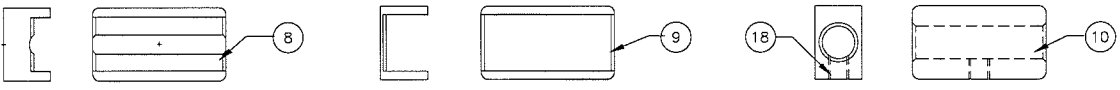
HUB ANGLE ADJUSTABLE
IN 15° INCREMENTS
FROM -45° to +45°



MPT PROBEHOLDER
SEPERATE ORDER ITEM

MPT HALL PROBE
SEPERATE ORDER ITEM

- 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



REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/28/98	G.DOUGLAS
B	UPDATE ITEM 8, P/N 17901970 TO REV. B		27 Jan, 09	M. Duffy

21	1	10900320	LABEL, IDENTIFICATION	
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	17901946	VERTICAL MOUNTING EXTRUSION [350mm long]	
4	1	17901930	BASE NUT	
3	1	17901920	BASE SUPPORT	
2	1	17901910	BASE MOUNTING EXTRUSION [250mm long]	
1	1	17901900	BASE MOUNTING PLATE [250mm long]	

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN G.DOUGLAS	DATE 08/17/98	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		
CHECK	DATE	GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.		
ENGINEERING	DATE	LINEAR	INCHES / mm	TITLE PROBE MOUNT MODEL: 3474
		X.XXX	±.009 / ±0.03	SIZE A2
		X.XX	±.01 / ±0.1	DRAWING NO. 11901251
		X.X	±.03 / ±0.3	REV B
		X	±.06 / ±1	SCALE 1:1 WT kg SHEET 1 OF 1
		DEG.	±.5 / ±0.5	
		FINISH	63 / 1.6	
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		
SOFTWARE AUTOCAD 2000				

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4 3 2 1

MAGNET YOKE

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/26/98	G.DOUGLAS

REAR VIEW

NOTE: THIS DRAWING SHOWS FRONT INSTALLATION OF PROBE MOUNT
FOR REAR INSTALLATION OF PROBE MOUNT SEE DRAWING NO 11901251

MAGNET YOKE

SIDE VIEW

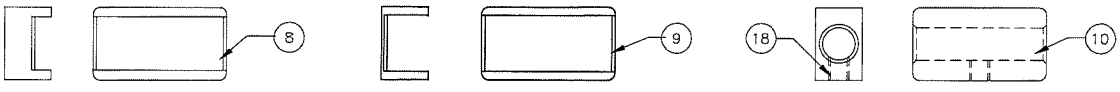
HUB ANGLE ADJUSTABLE
IN 15° INCREMENTS
FROM -45° to +45°

MPT PROBEHOLDER
SEPERATE ORDER ITEM

MPT HALL PROBE
SEPERATE ORDER ITEM

GMW MAGNET SYSTEMS
PROBE MOUNT PART NO 11901250
PO Box 3742, Hayward City, CA 94606-3742
Tel: (510) 882-8292 Fax: (510) 882-8298
Web Site: http://www.gmw.com

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



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
21	1	10900320	LABEL, IDENTIFICATION	
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	17901946	VERTICAL MOUNTING EXTRUSION [350mm long]	
4	1	17901930	BASE NUT	
3	1	17901920	BASE SUPPORT [150mm long]	
2	1	17901890	BASE MOUNTING EXTRUSION [150mm long]	
1	1	17901880	BASE MOUNTING PLATE	

DRAWN		DATE		DO NOT SCALE FROM DRAWING		PARTS LIST	
G.DOUGLAS	08/17/98	08/17/98		DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		GMW	
CHECK	DATE	LINEAR	INCHES	mm	955 Industrial Rd, San Carlos, CA 94070		
ENGINEERING	DATE	X.XXX	±.005	±0.03	Tel: (650)802-8292. Fax: (650)802-8298.		
		X.XX	±.01	±0.1	TITLE		
		X.X	±.03	±0.3	PROBE MOUNT		
		X	±.06	±1	MODEL: 3474/5451		
		DEC.	±.5	±0.5	SIZE	DRAWING NO.	REV
		FINISH	63	1.6	A2	11901252	A
NEXT ASSY		SYSTEM		THIRD ANGLE PROJECTION		SCALE	1:1 WT kg
SOFTWARE		AUTOCAD 2000		SHEET		1 OF 1	

4 3 2 1

Section 7

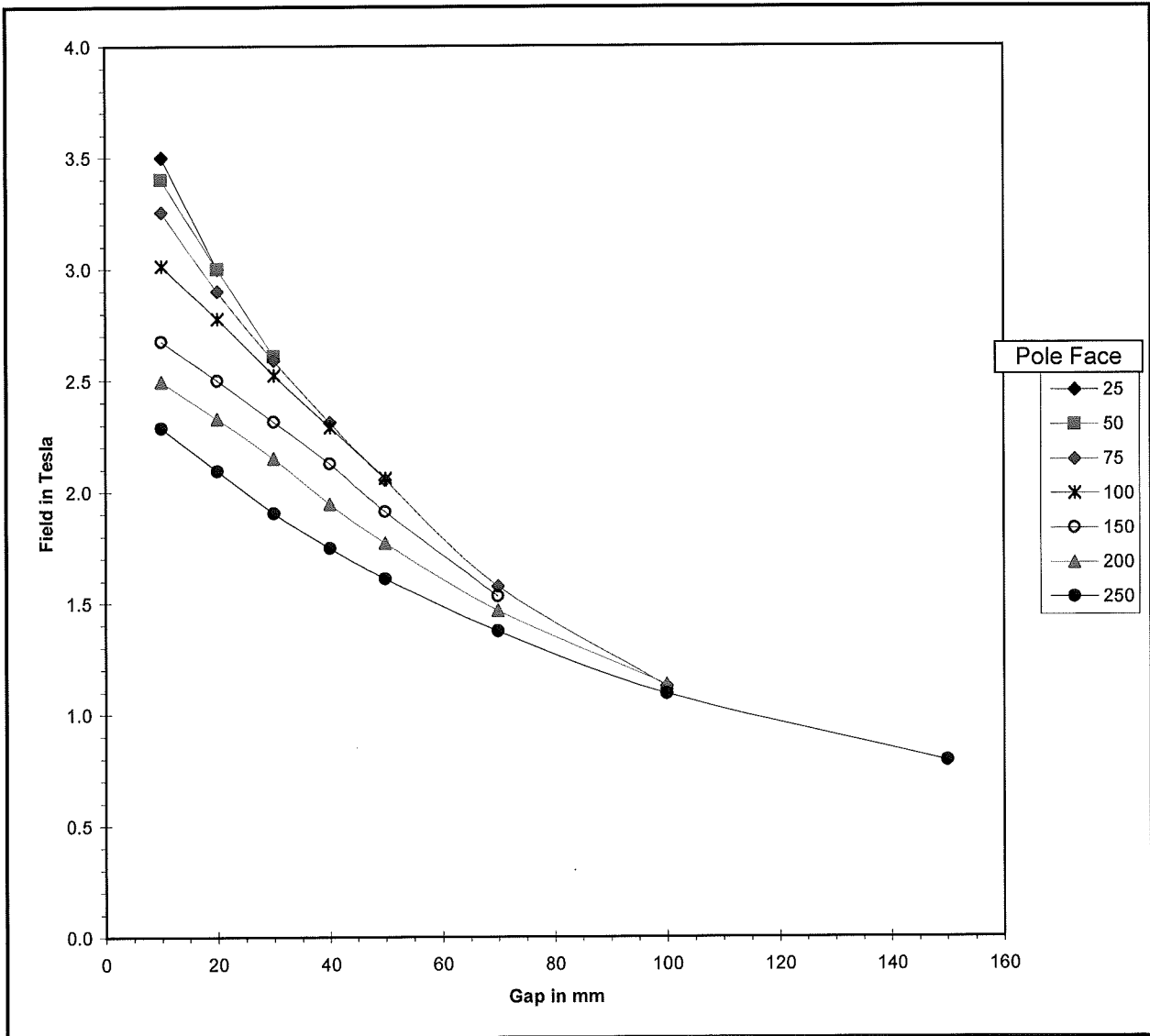
CUSTOM OPTIONS

Section 8

EXCITATION CURVES

GMW Associates
Electromagnet Excitation Plot
Field Vs Gap

Contract No:	Page: 1 of 1	Date: Feb 04, 2003
Customer:		Engr: Y. Qin
Model: 3474	Power Supply:	Set Current: 140 Amps
Serial No:	Serial No:	Target Field:
Pole Face: As per table below	Position: X=0, Y=0, Z=0	
Serial No: None	Notes:	
Pole Gap: As per table below		
Pole Spacers: None		

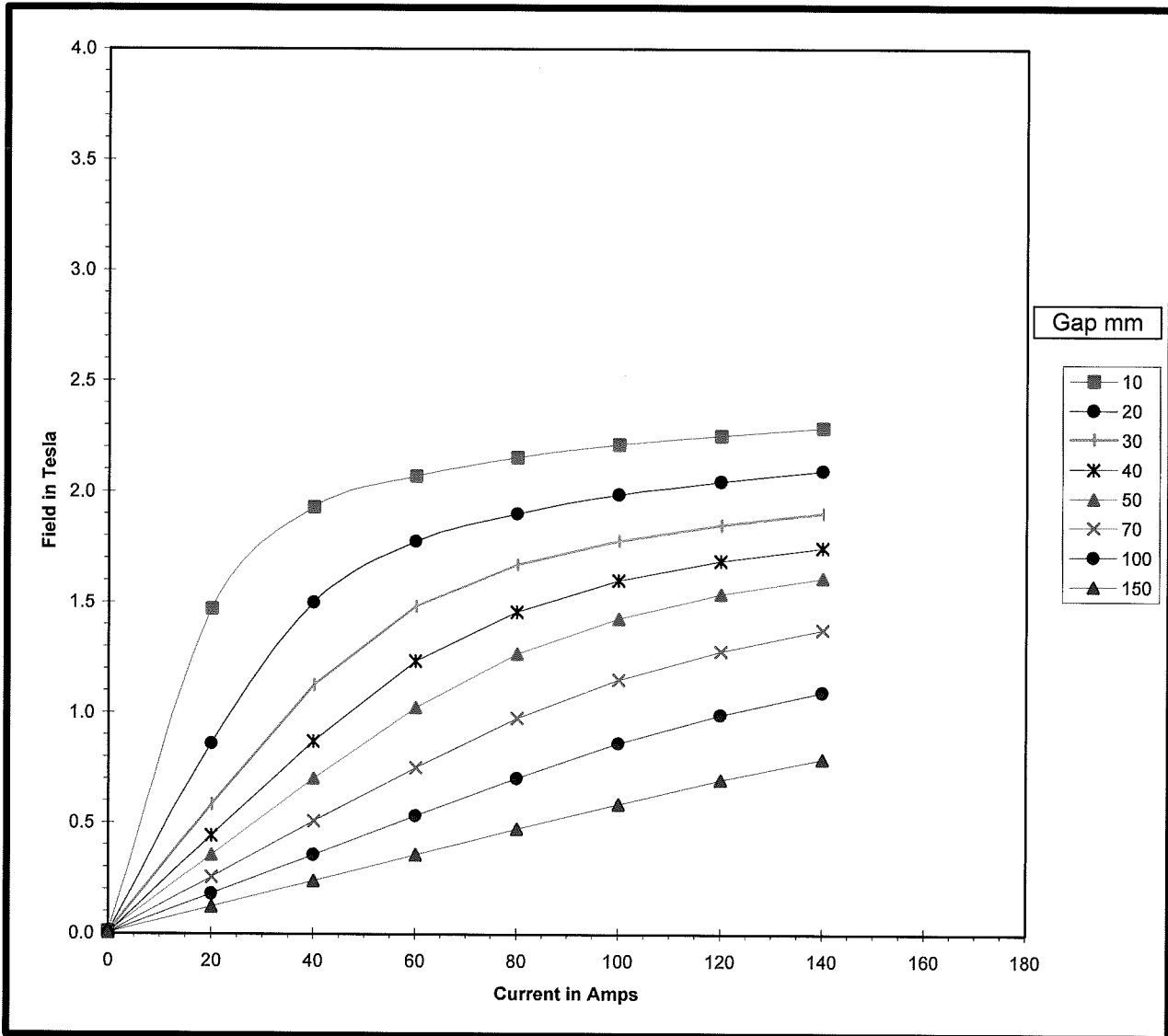


GMW Associates

Electromagnet Excitation Plot

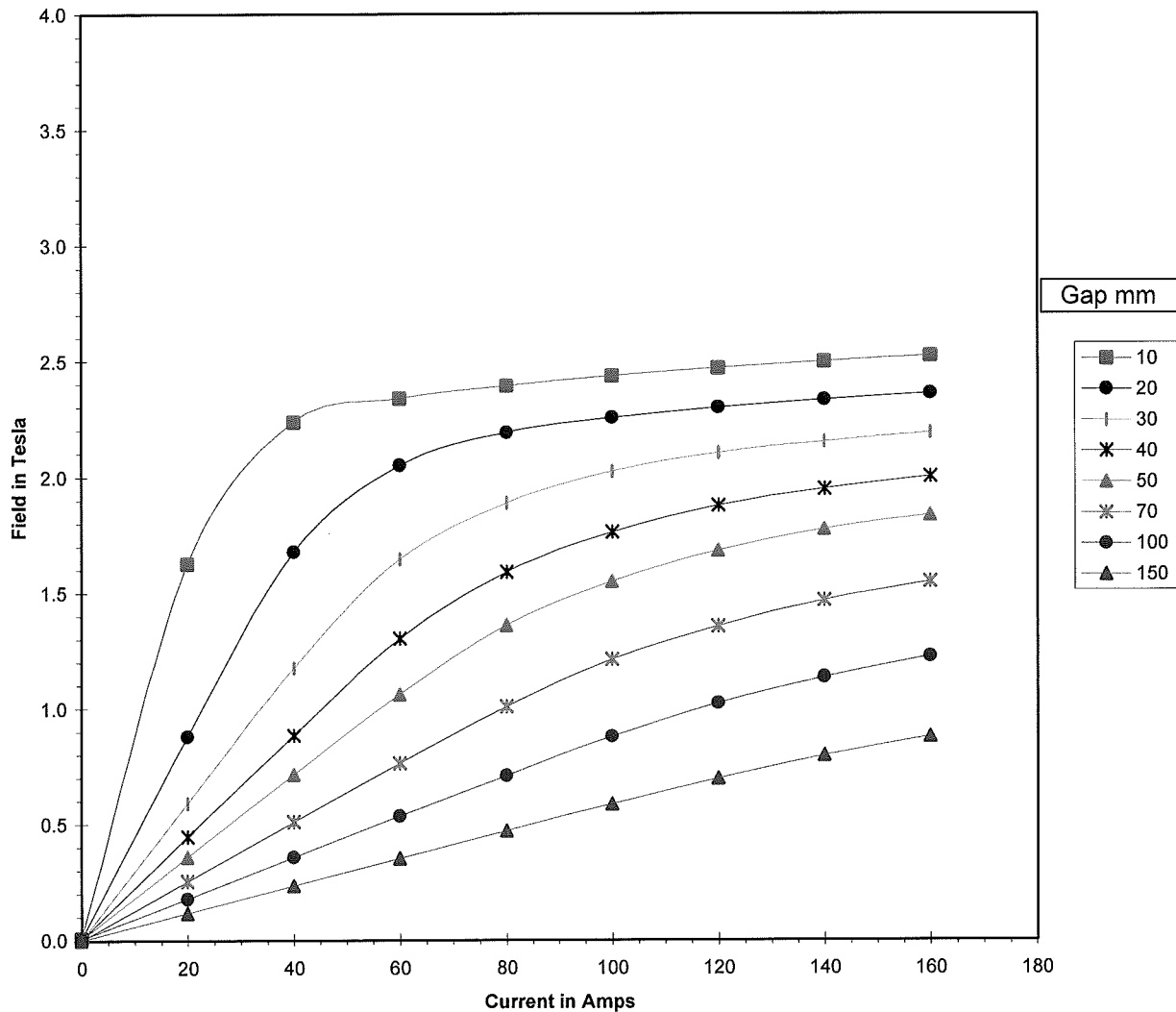
Field Vs Current

Contract No:	Page: 1 of 7	Date: April, 93
Customer:		Engr: G.Douglas
Model: 3474	Power Supply:	Set Current:
Serial No: 07	Serial No:	Target Field:
Pole Face: 250 mm	Position: X=0, Y=0, Z=0	
Serial No: None	Notes:	
Pole Gap: As per table below		
Pole Spacers: None		



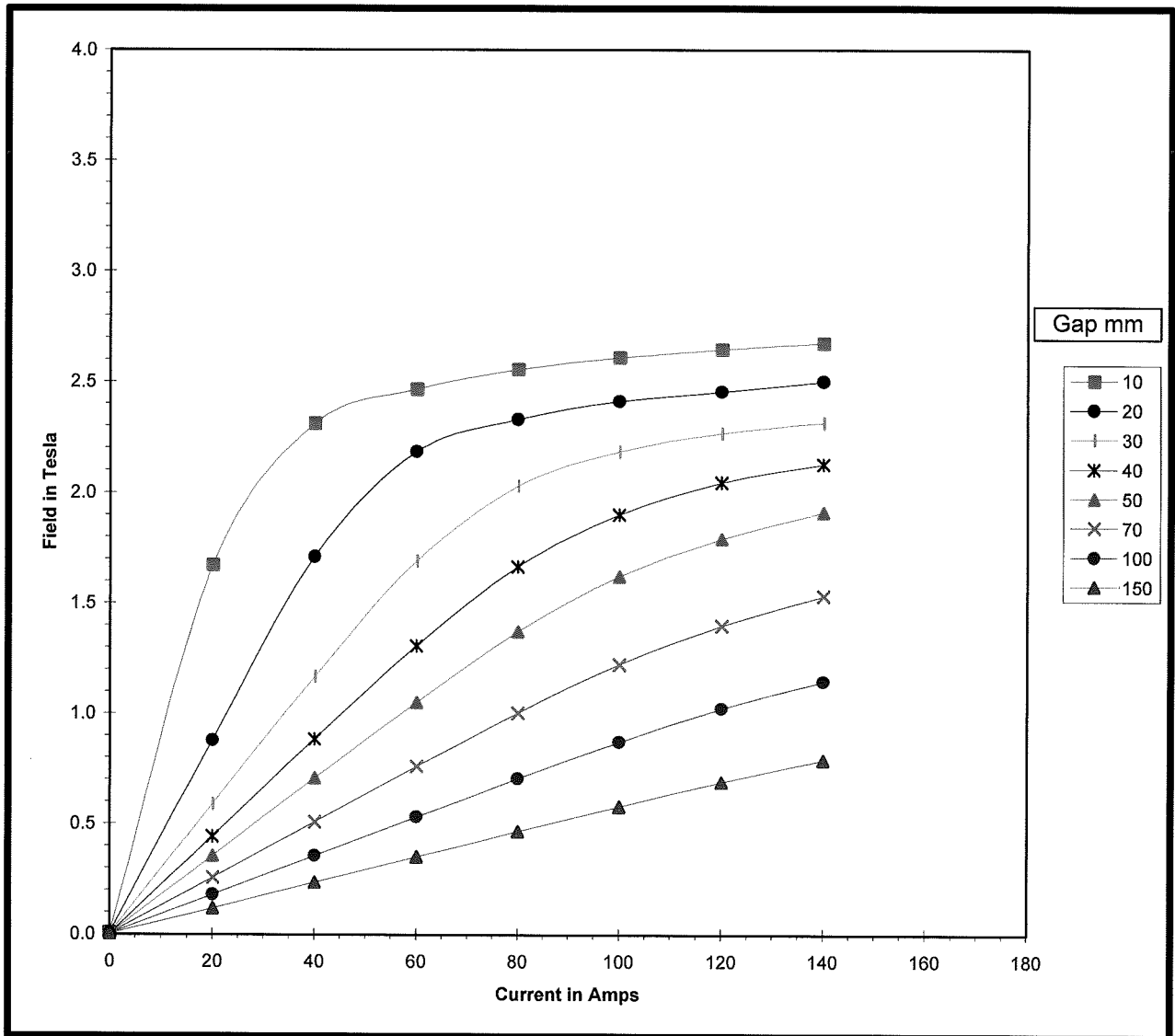
GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Contract No:		Page: 2 of 7	Date: Feb 12, 97
Customer:			Engr: E.Schulze
Model: 3474	Power Supply:	Set Current:	
Serial No: 09	Serial No:	Target Field:	
Pole Face: 200 mm	Position: X=0, Y=0, Z=0		
Serial No: None	Notes:		
Pole Gap: As per table below			
Pole Spacers: None			



GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Contract No:		Page: 3 of 7	Date: April, 93
Customer:			Engr: G.Douglas
Model: 3474		Power Supply:	Set Current:
Serial No: 07		Serial No:	Target Field:
Pole Face: 150 mm		Position: X=0, Y=0, Z=0	
Serial No: None		Notes:	
Pole Gap: As per table below			
Pole Spacers: None			



GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Contract No:
 Customer:

Page: 4 of 7

Date: March 03, 86
 Engr: R.Gummer

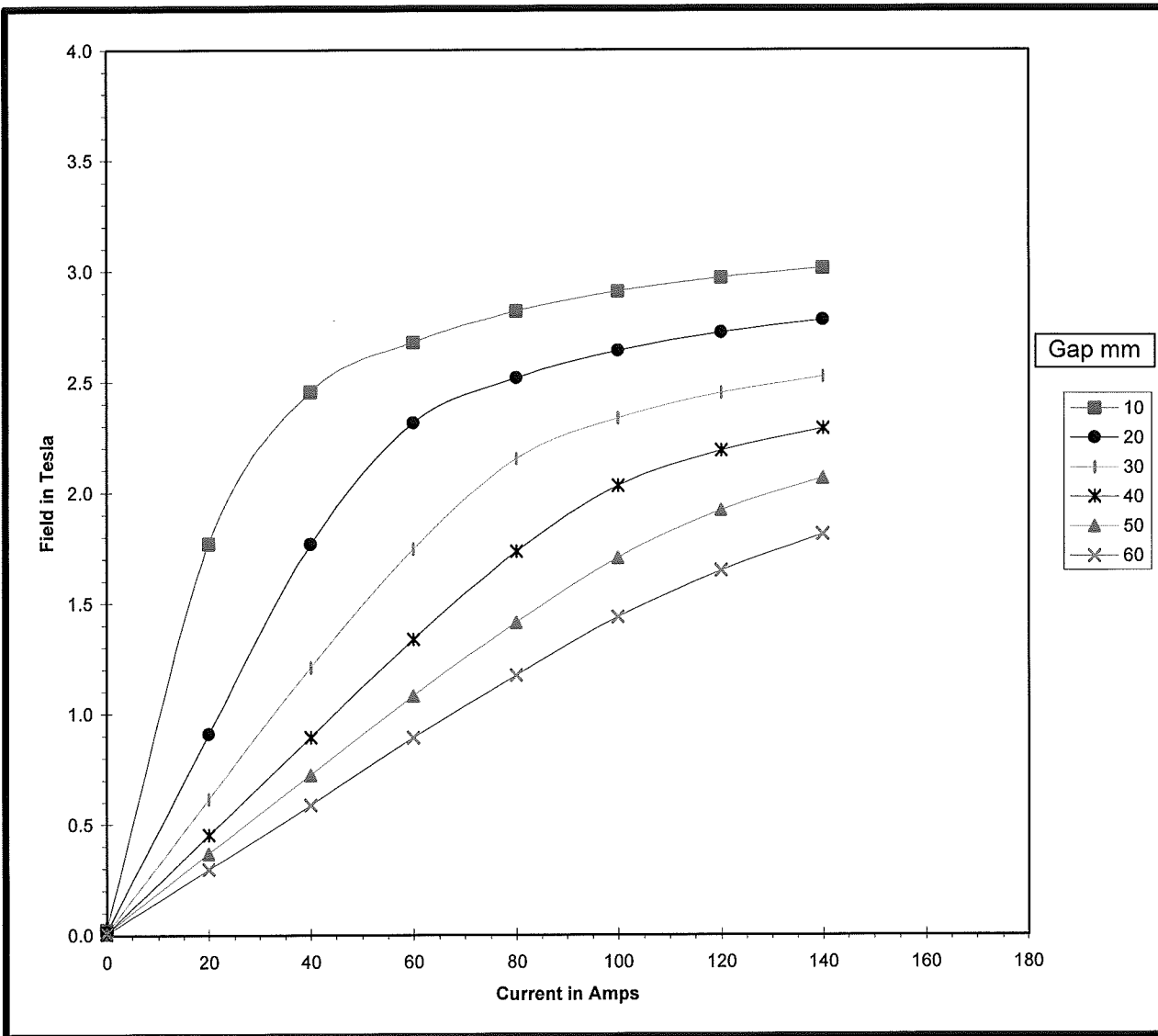
Model: 3474
 Serial No: 01

Power Supply:
 Serial No:

Set Current:
 Target Field:

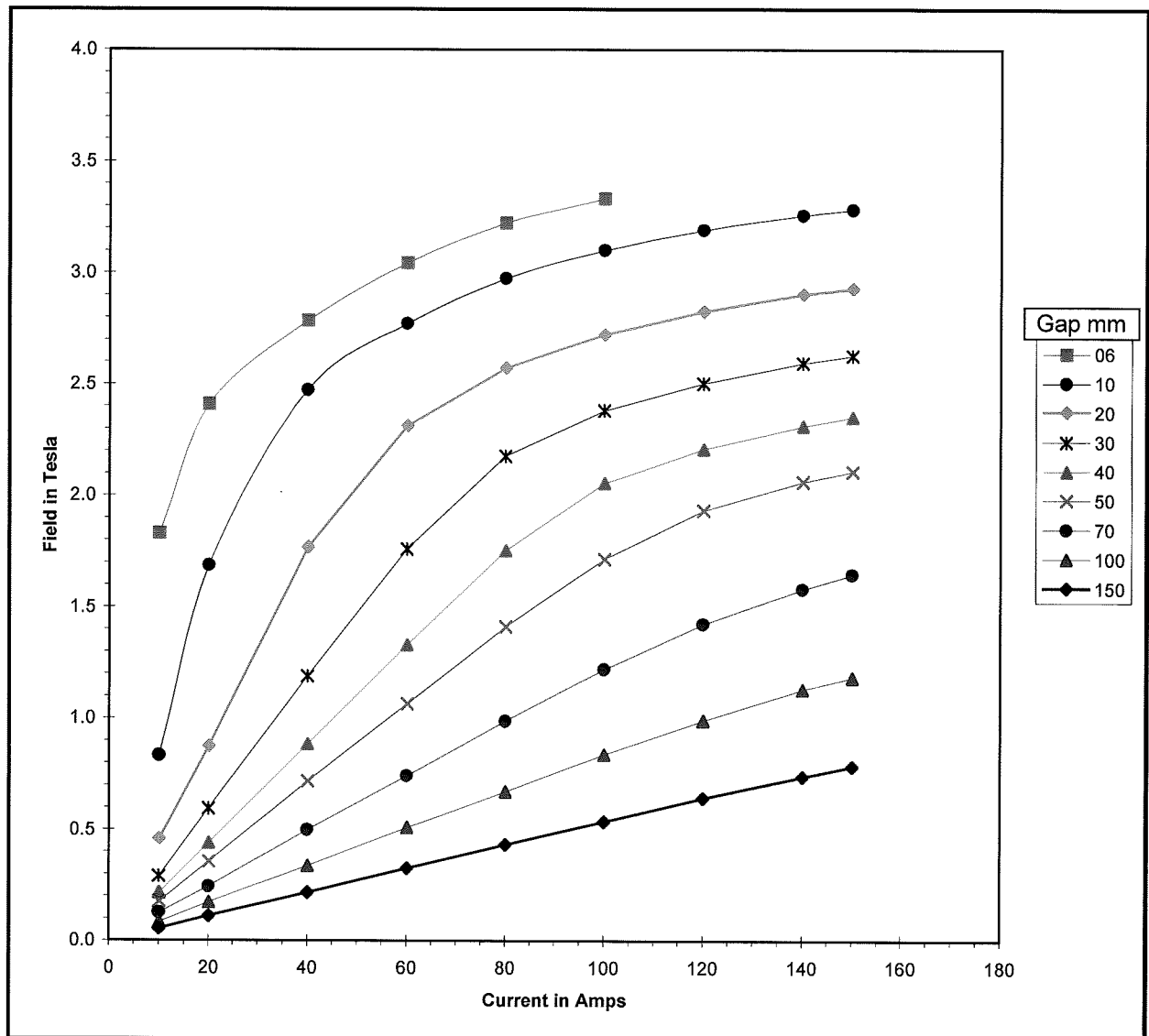
Pole Face: 100 mm
 Serial No: None
 Pole Gap: As per table below
 Pole Spacers: None

Position: X=0, Y=0, Z=0
 Notes:



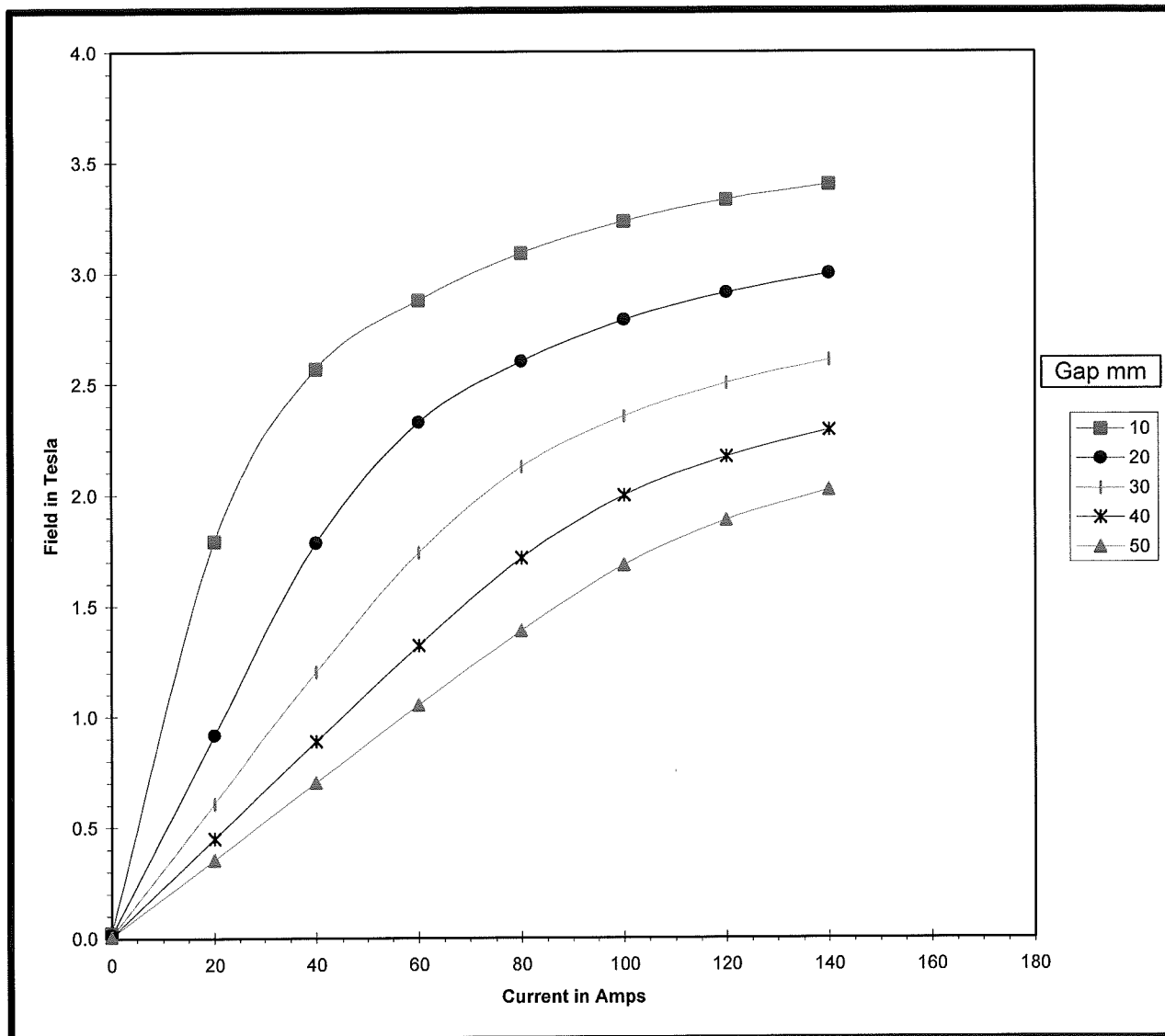
GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Contract No:	Page: 5 of 7	Date: Feb 4, 03
Customer:		Engr: Y.Qin
Model: 3474	Power Supply:	Set Current:
Serial No: 48	Serial No:	Target Field:
Pole Face: 75 mm	Position: X=0, Y=0, Z=0	
Serial No: None	Notes:	
Pole Gap: As per table below		
Pole Spacers: None		



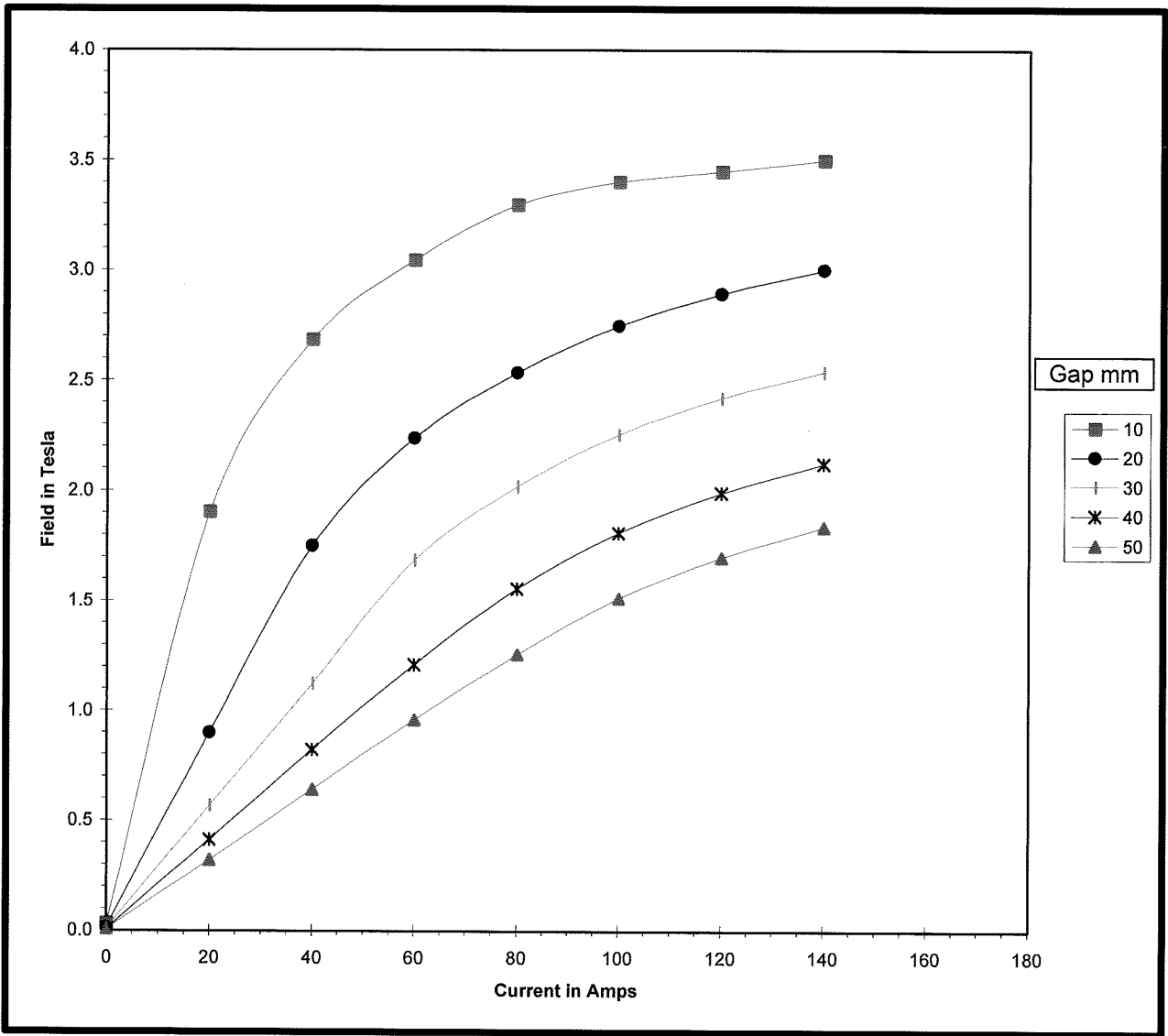
GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Contract No:	Page: 6 of 7	Date: March 03, 86
Customer:		Engr: R.Gummer
Model: 3474	Power Supply:	Set Current:
Serial No: 01	Serial No:	Target Field:
Pole Face: 50	Position: X=0, Y=0, Z=0	
Serial No: None	Notes:	
Pole Gap: As per table below		
Pole Spacers: None		



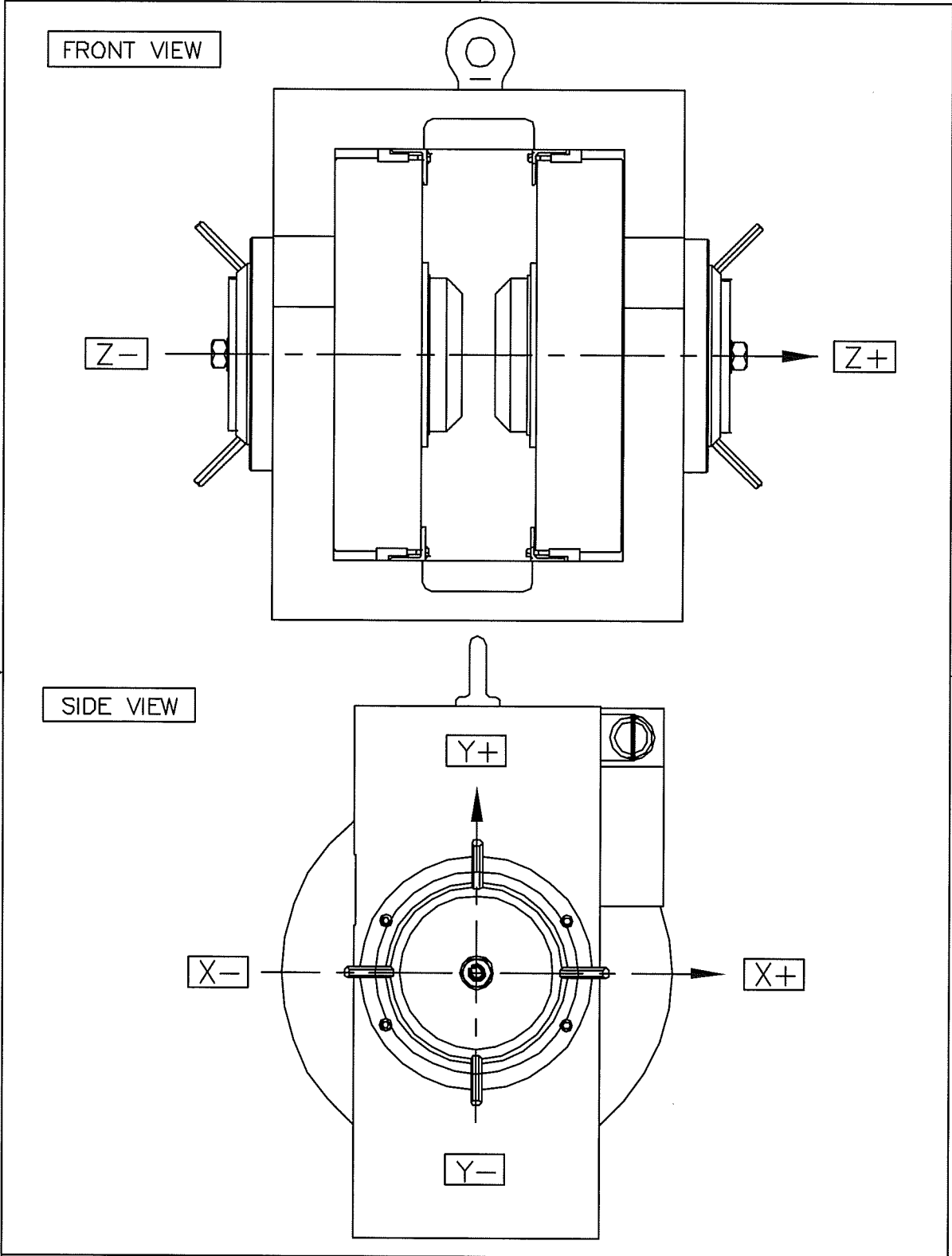
GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Contract No:		Page: 7 of 7	Date: March 03, 86
Customer:			Engr: R.Gummer
Model: 3474		Power Supply:	Set Current:
Serial No: 01		Serial No:	Target Field:
Pole Face: 25		Position: X=0, Y=0, Z=0	
Serial No: None		Notes:	
Pole Gap: As per table below			
Pole Spacers: None			



Section 9

TEST DATA



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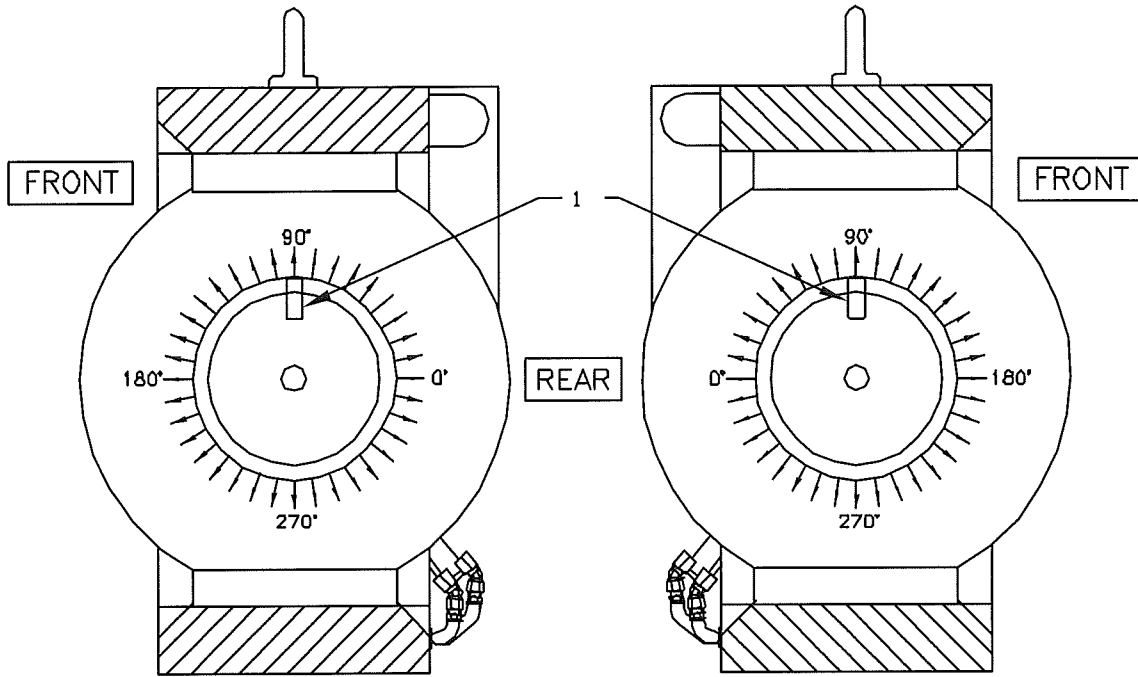
MAGNETIC PLOTTING AXIS

80900010

A

SHEET 1 OF 1

1 SHIM SHOWN FITTED TO POLE AT 90 DEG POSITION



LH POLE: CAP REMOVED

RH POLE: CAP REMOVED

LH POLE SHIM DETAILS		
NUMBER	THICKNESS	POSITION
1	_____mm	_____deg
2	_____mm	_____deg
3	_____mm	_____deg
4	_____mm	_____deg

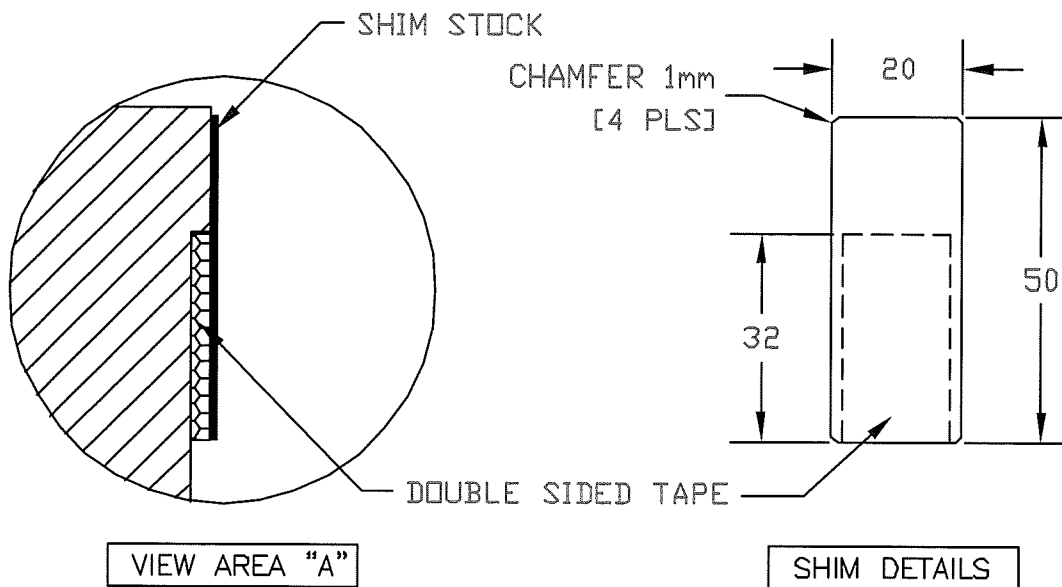
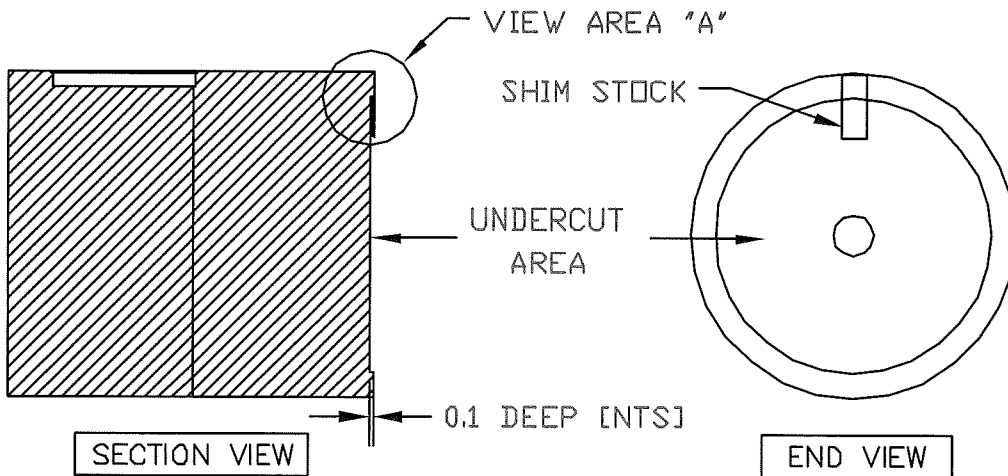
RH POLE SHIM DETAILS		
NUMBER	THICKNESS	POSITION
1	_____mm	_____deg
2	_____mm	_____deg
3	_____mm	_____deg
4	_____mm	_____deg

MAGNET MODEL: _____

DATA LOGGED BY: _____

MAGNET SERIAL NO: _____

DATA LOGGED DATE: _____



1. THOROUGHLY CLEAN AND DEGREASE AREA WHERE SHIM IS TO BE FITTED.
2. CUT SHIM STOCK TO DIMENSIONS SHOWN.
3. APPLY DOUBLE SIDED TAPE 0.1mm THICK TO AREA SHOWN.
4. FIT SHIM TO POLE FACE, ENSURE TAPE IS KEPT WITHIN UNDERCUT AREA.
5. REASSEMBLE POLE CAPS ONTO MAGNET.
6. REMAP MAGNET, IF RESULTS WITHIN SPECIFICATION THEN GO TO ITEM 7.
IF OUTSIDE SPECIFICATION ADJUST SHIMS, REMAP THEN GO TO ITEM 7.
7. FILL IN SHIMMING DETAILS ON SHEET NO 3474-0001.

PROPRIETARY

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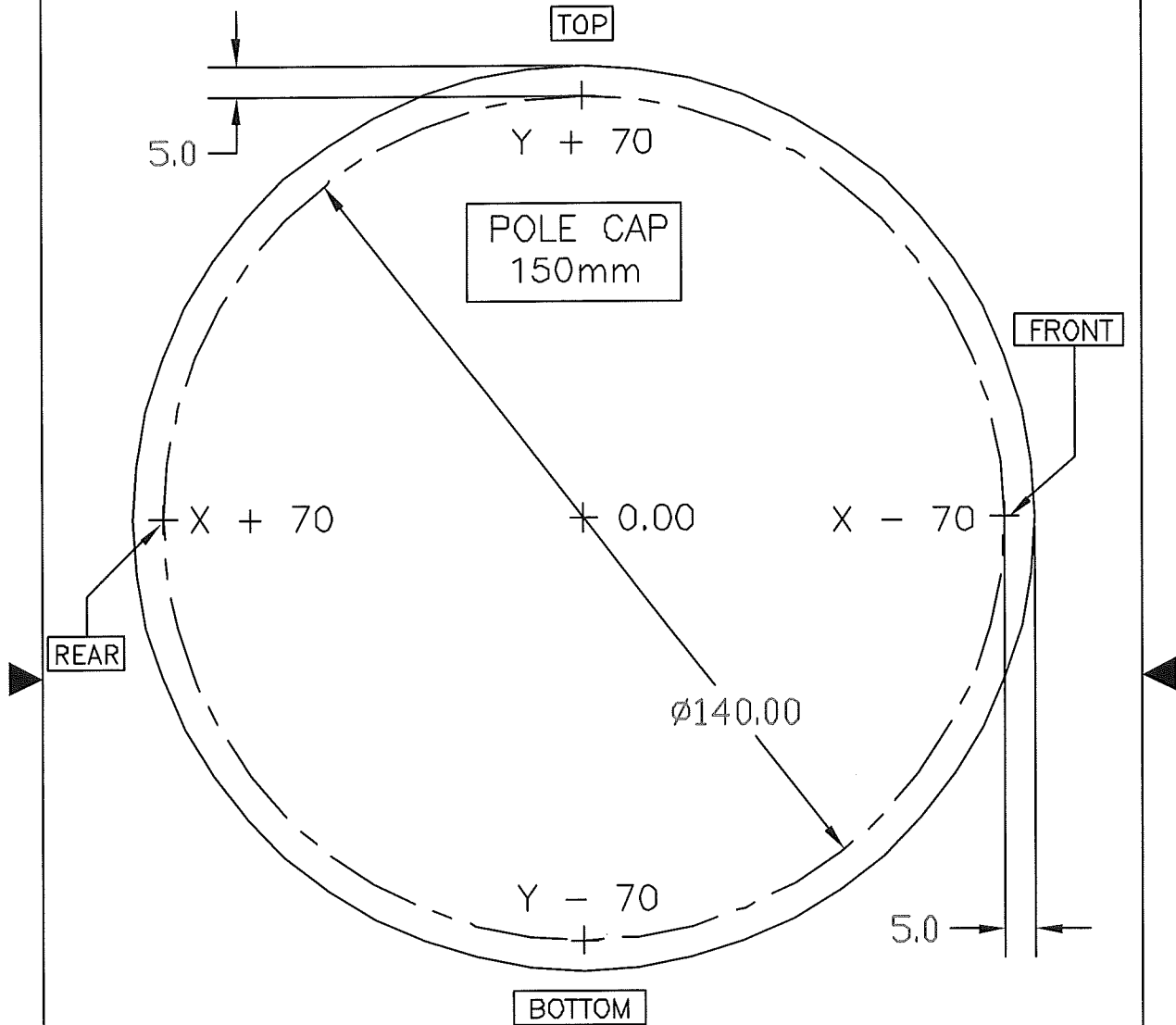
FINAL SHIMMING METHOD

80900110

A

SHEET 1 OF 1

TAKE MEASUREMENTS OF GAP TAPER AT POINTS MARKED WITH BORE GAUGE. RECORD RESULTS BELOW



MAGNET GAP TAPER LOG			
X + 70		Y + 70	
X - 70		Y - 70	
X DIFF		Y DIFF	

MAGNET MODEL: _____

DATA LOGGED BY: _____

MAGNET SERIAL NO: _____

DATA LOGGED DATE: _____

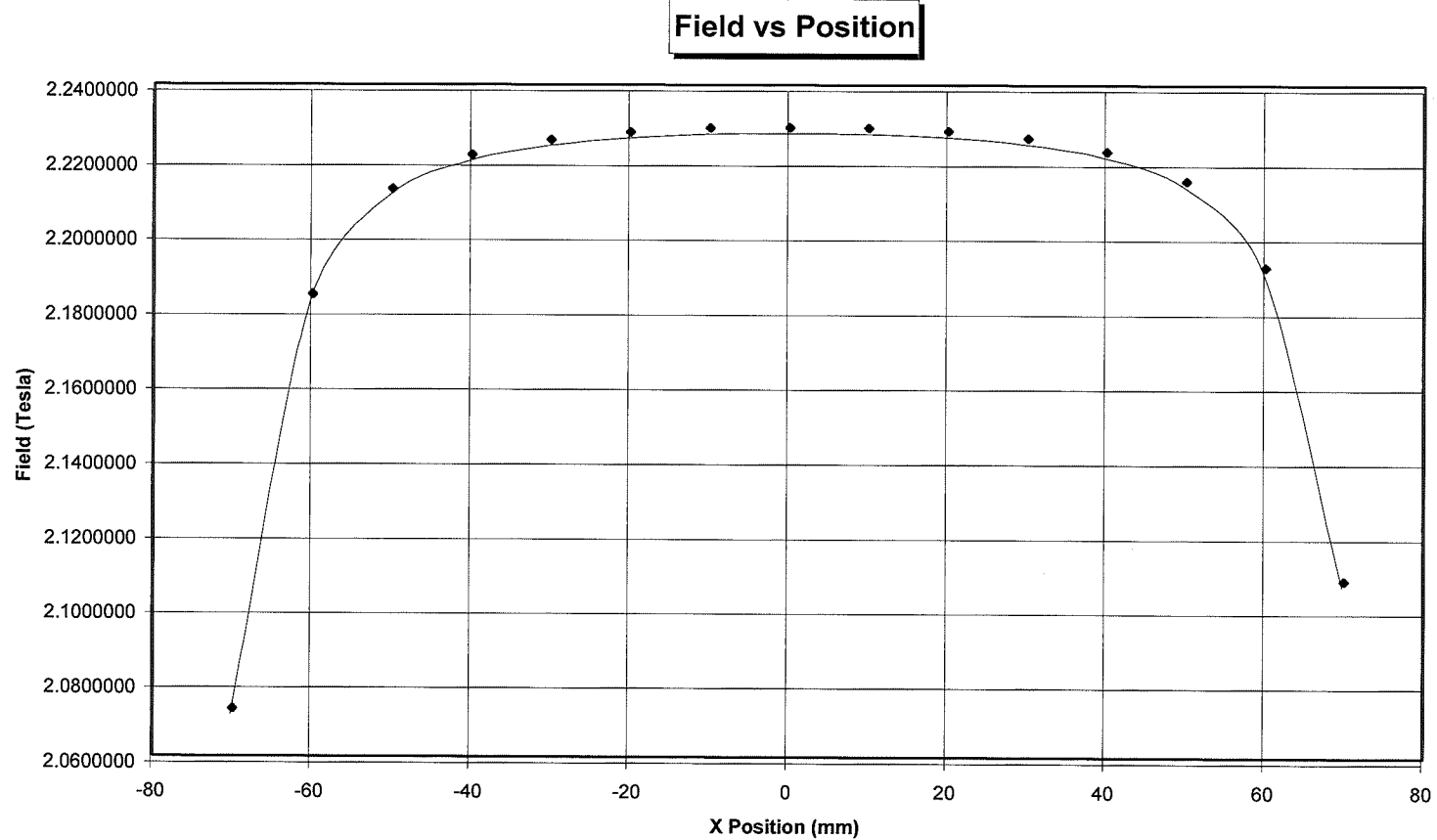
PROPRIETARY This document contains information proprietary to GMW Inc. It must not be reproduced or disclosed to others or used in any other way, in whole or part, except as authorized in writing by GMW Inc.	MAGNET GAP TAPER TEST		
	80900120	A	SHEET 1 OF 1

GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 150 mm Pole SN:
Pole Gap: 30 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 29 January, 1997



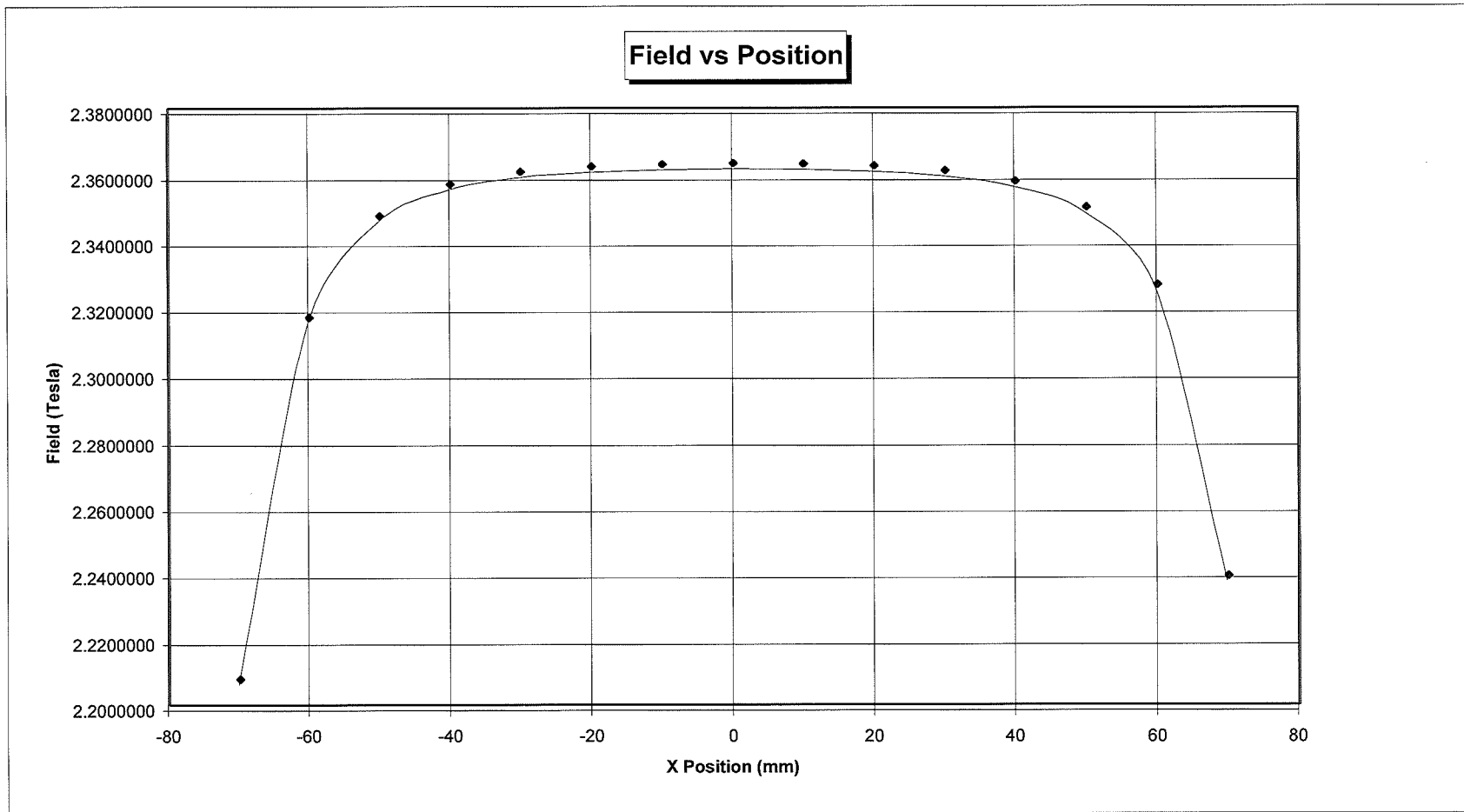
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 150 mm
Pole Gap: 30 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Pole SN:

Engr: E. Schulze
Date: 29 January, 1997

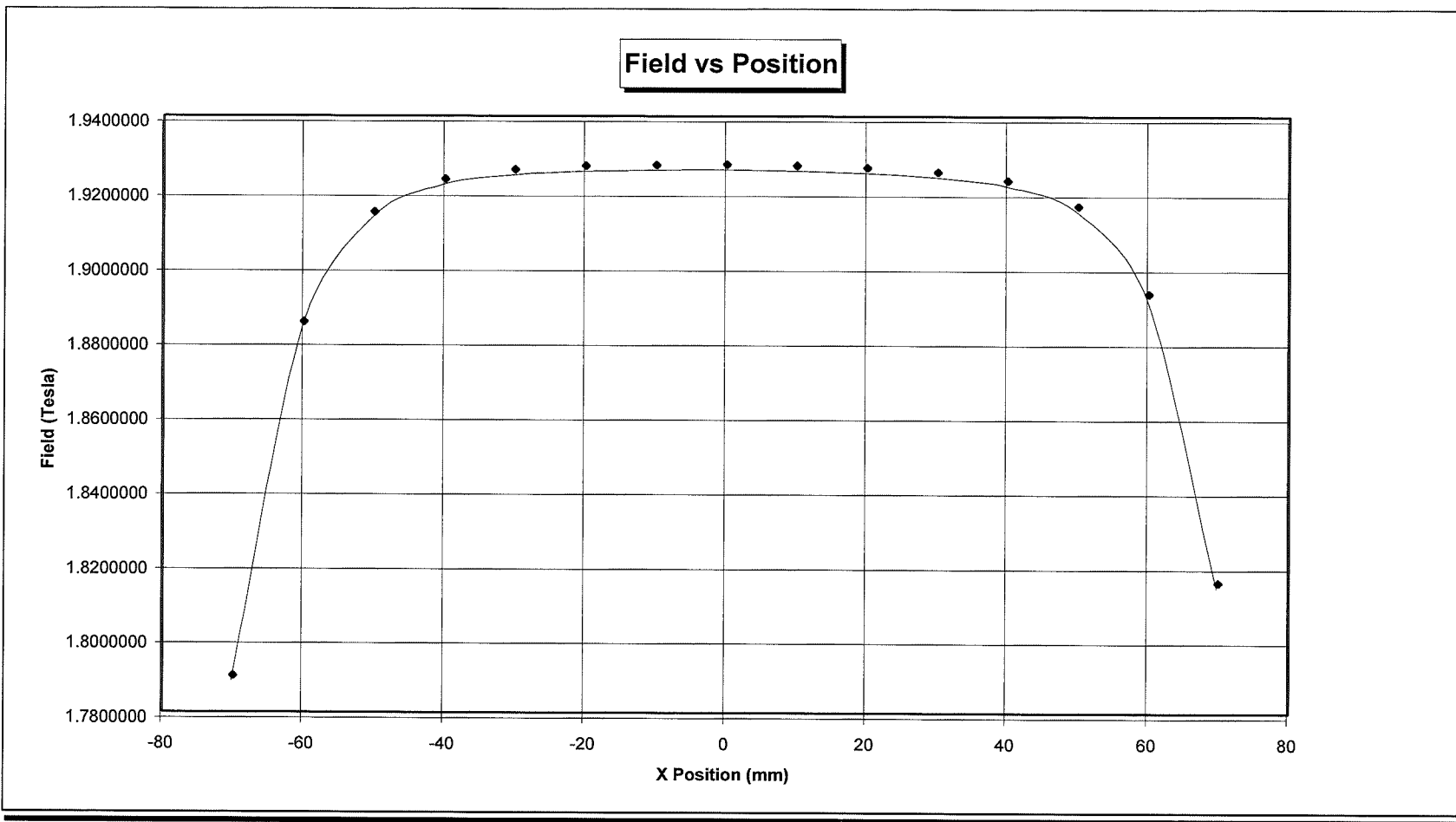


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 150 mm Pole SN:
Pole Gap: 40 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 29 January, 1997

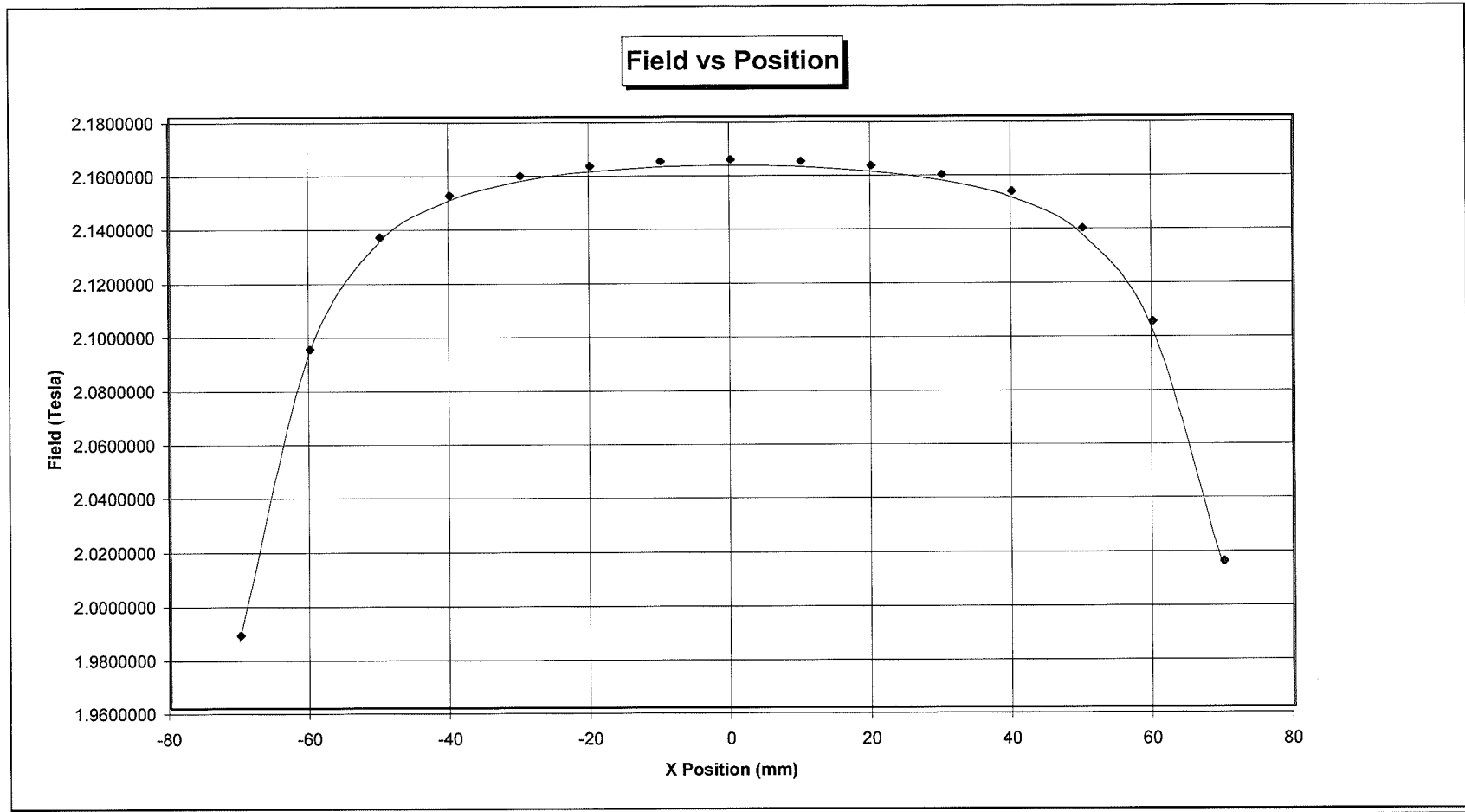


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 150 mm Pole SN:
Pole Gap: 40 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 29 January, 1997

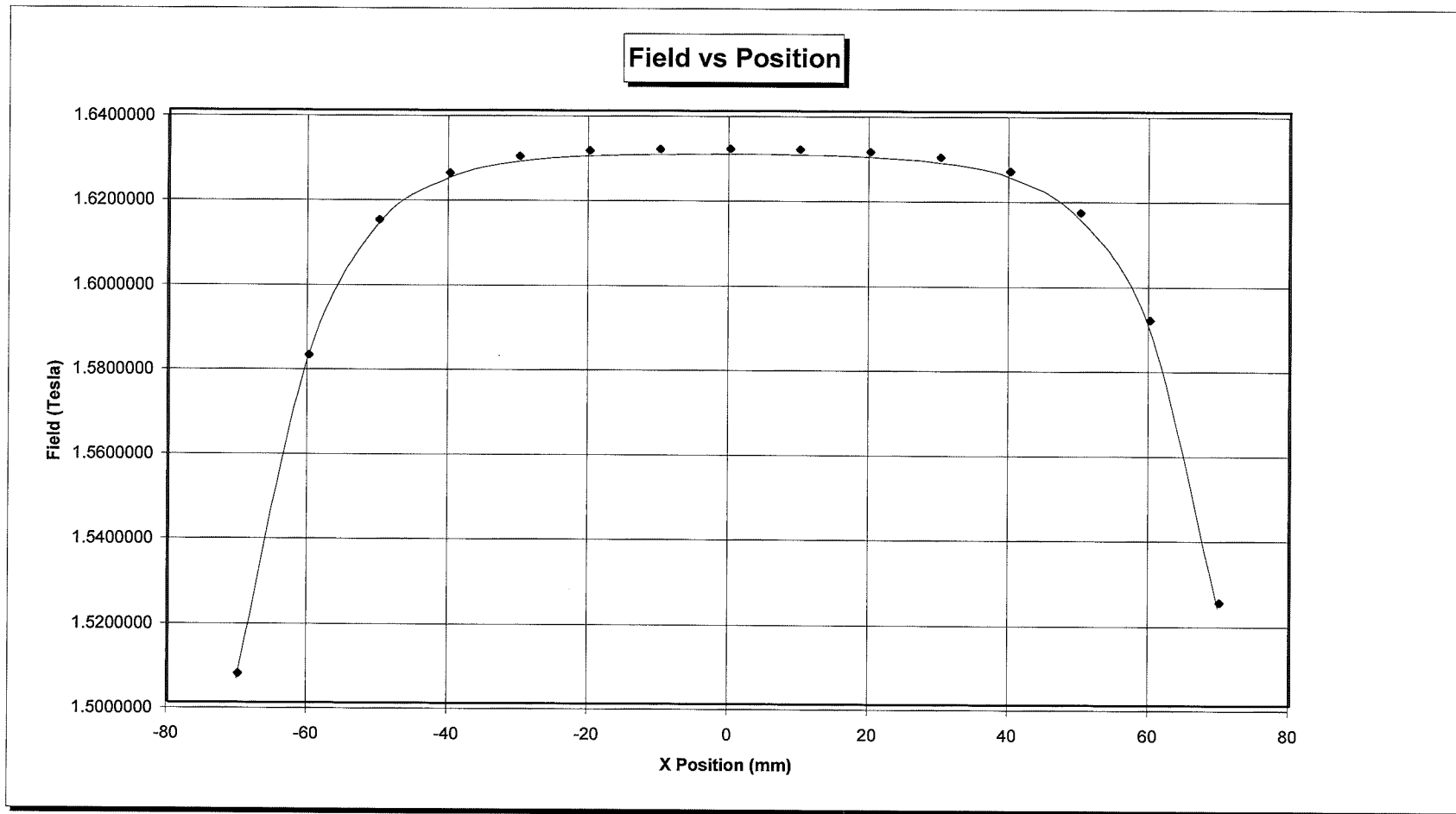


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 150 mm Pole SN:
Pole Gap: 50 mm
Pole Spacers: Not fitted
Fixed Axiz: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 29 January, 1997

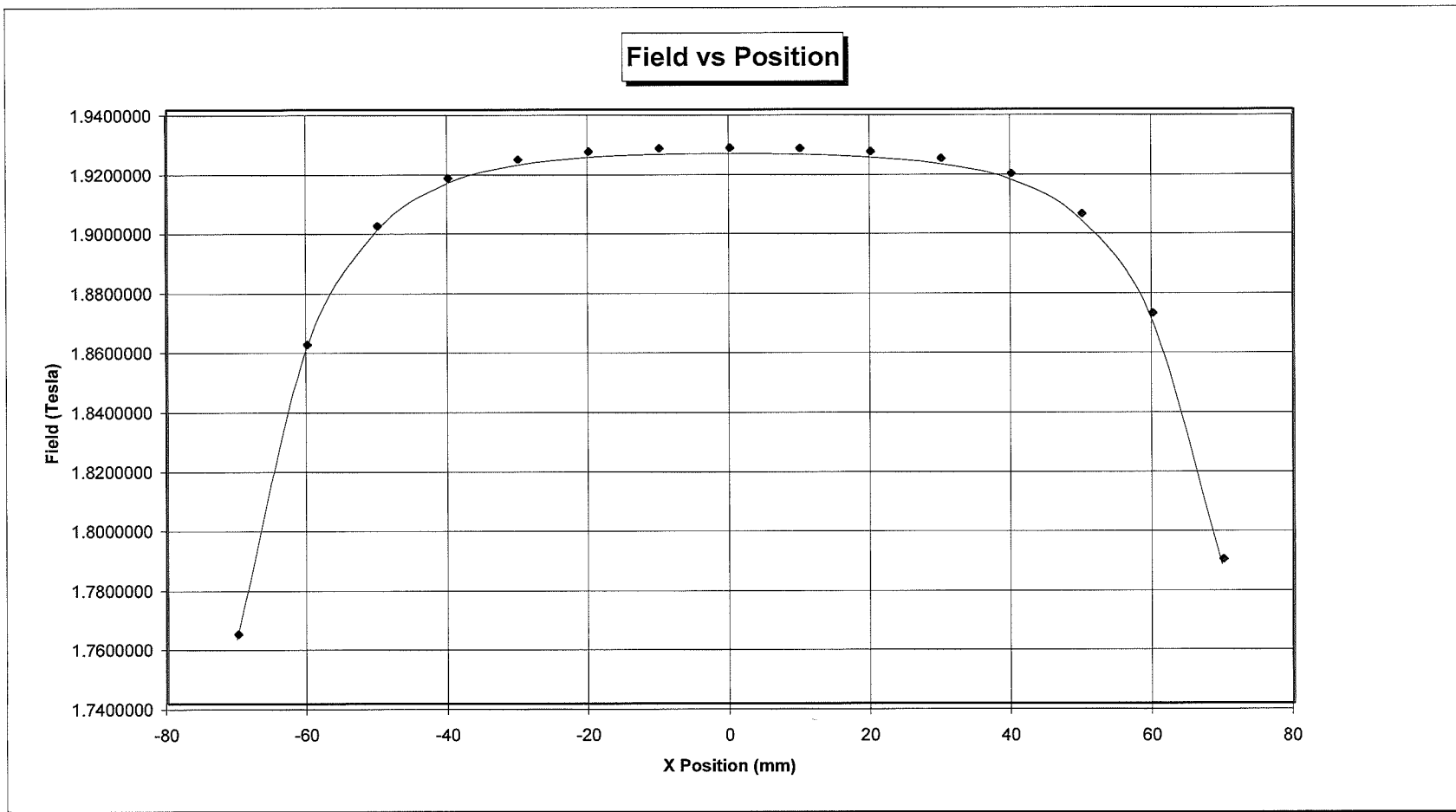


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 150 mm Pole SN:
Pole Gap: 50 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 29 January, 1997

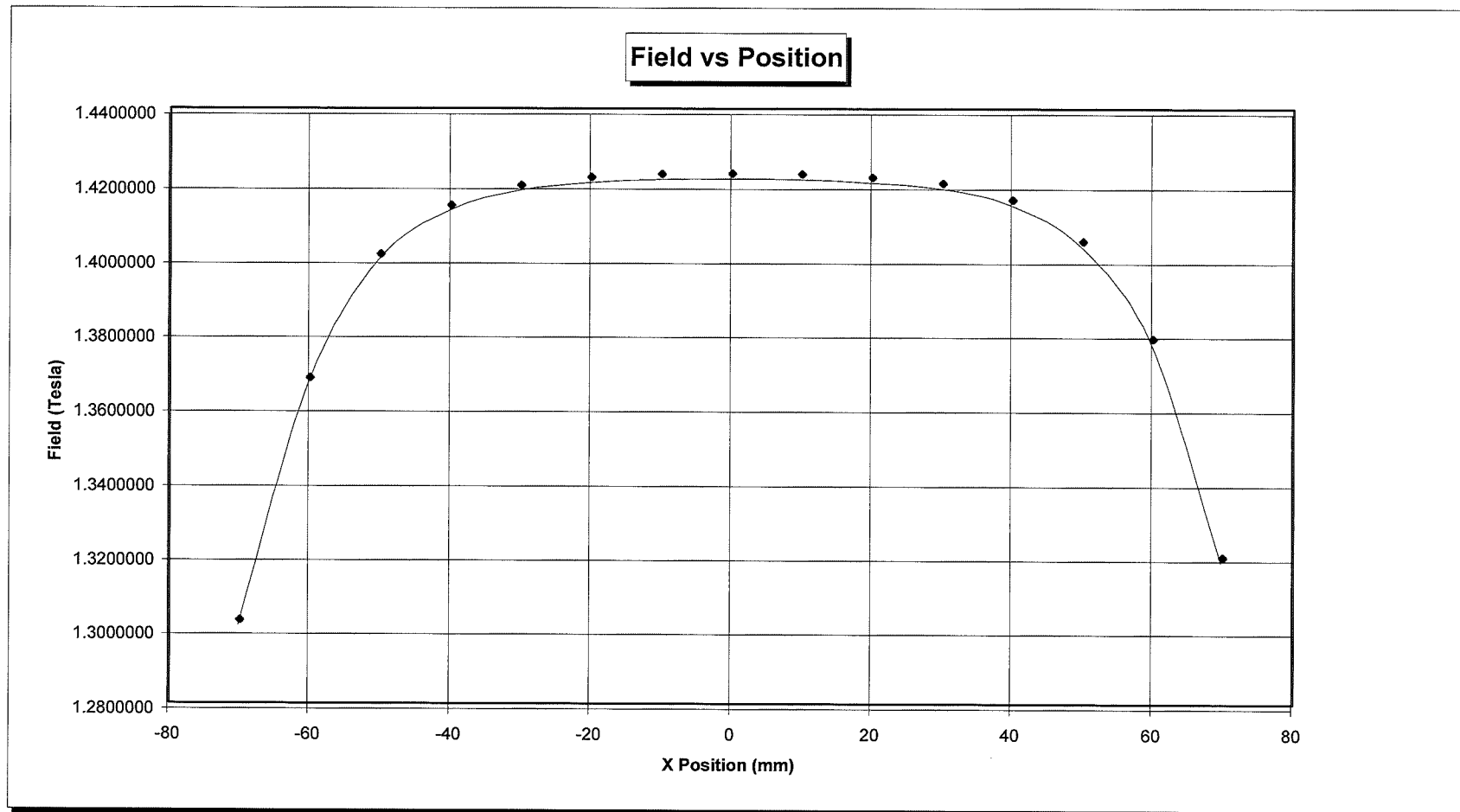


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 150 mm Pole SN:
Pole Gap: 60 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 29 January, 1997



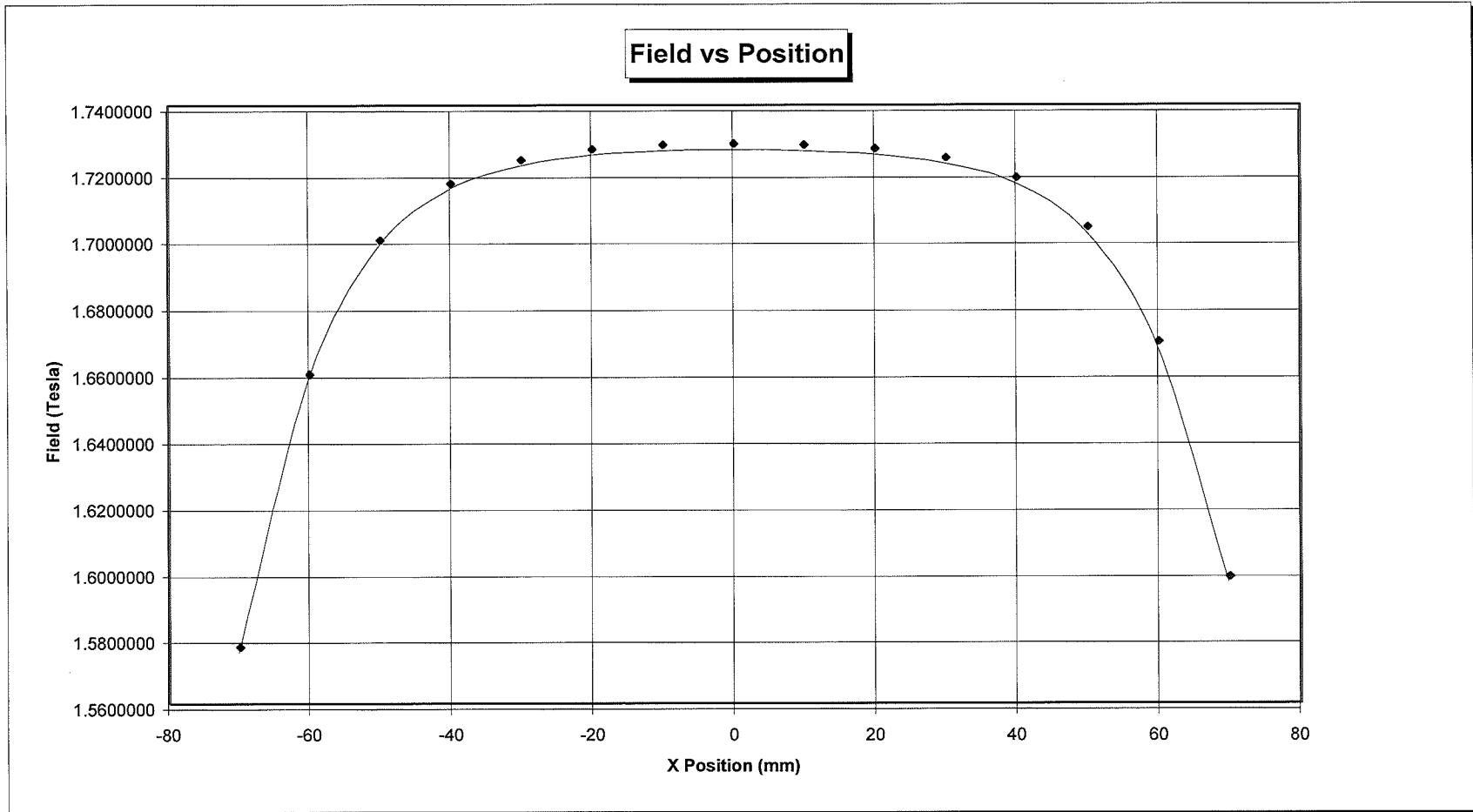
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 150 mm
Pole Gap: 60 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

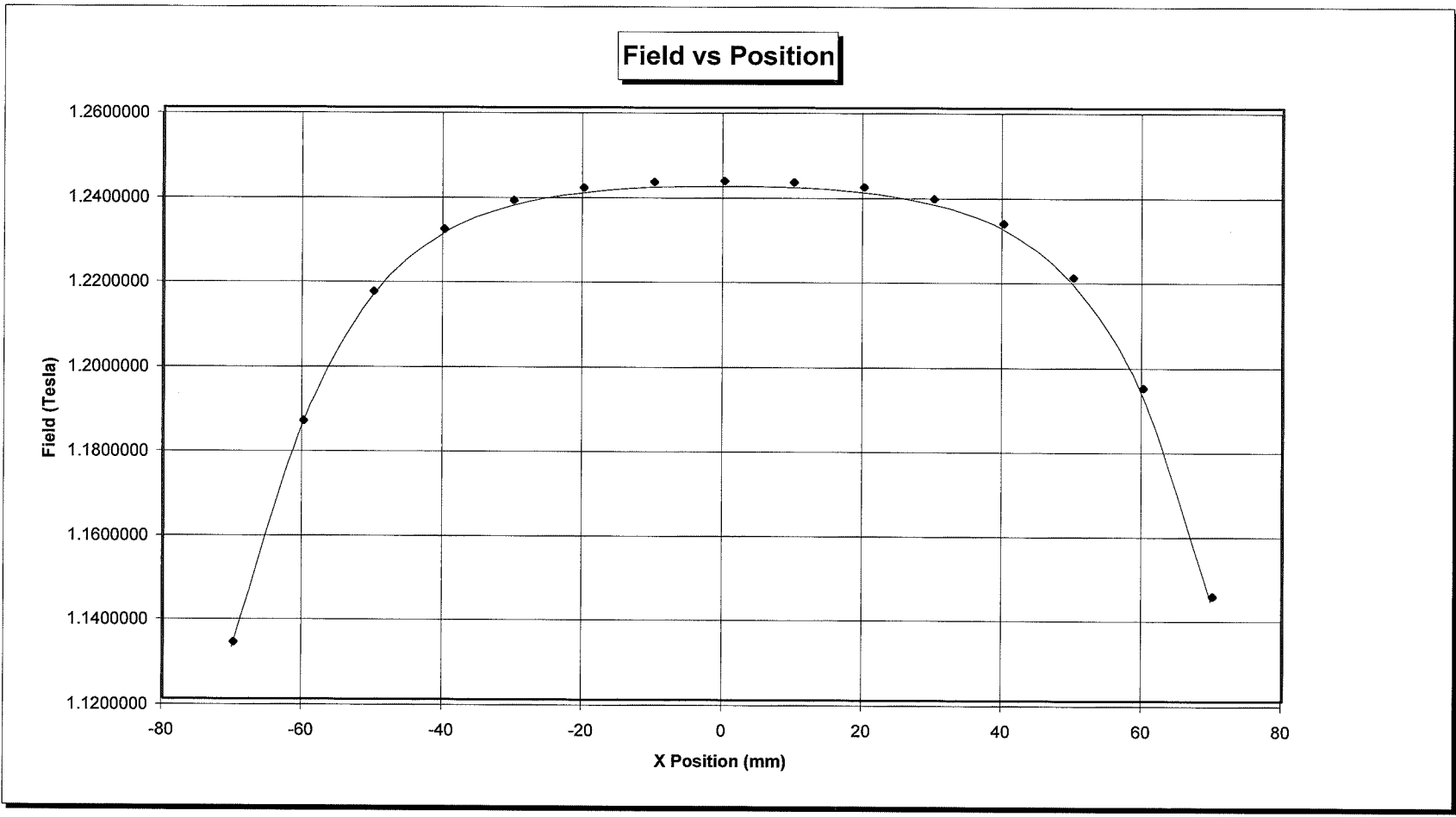
Pole SN:

Engr: E. Schulze
Date: 29 January, 1997



GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model	3474-140	Pole Face: 150 mm	Pole SN:	Engr: Mike Duffy
Serial No	09	Pole Gap: 70 mm		Date: 28 January, 1997
Contract No:	C7955	Pole Spacers: Not fitted		
Note:	100A	Fixed Axis: Y=0, Z=0		
		Variable Axis: X		



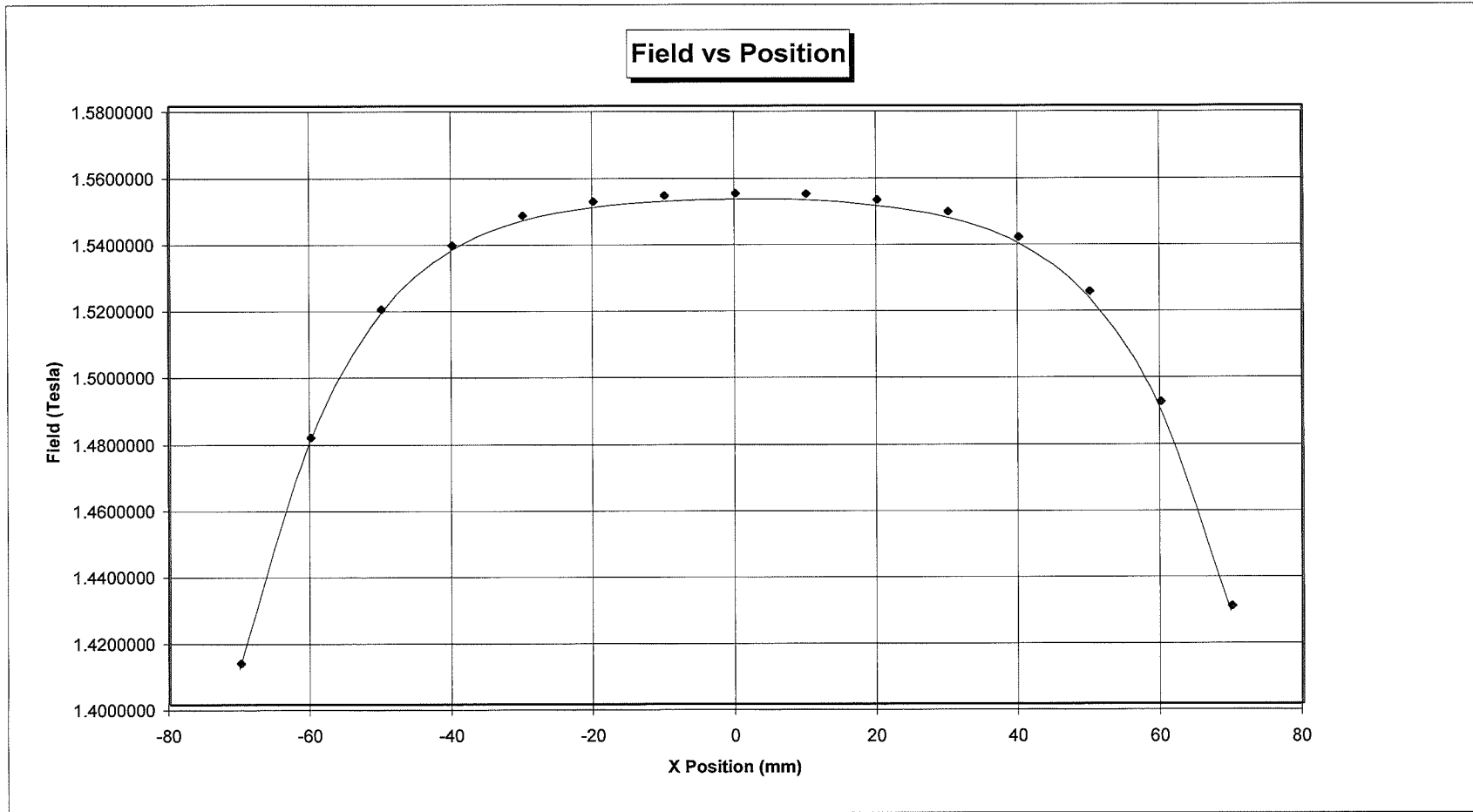
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140A

Pole Face: 150 mm
Pole Gap: 70 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Pole SN:

Engr: Mike Duffy
Date: 28 January, 1997

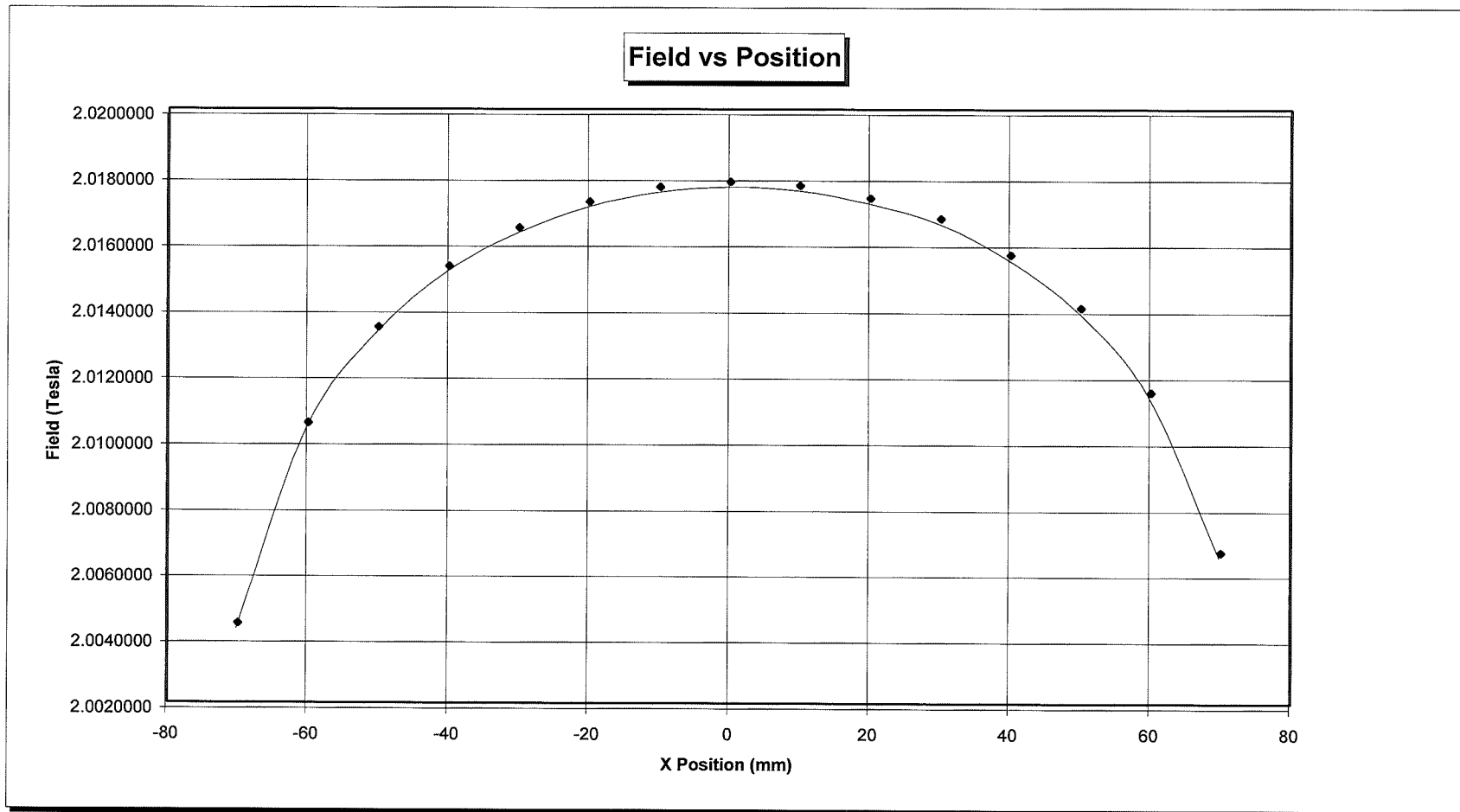


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 200 mm Pole SN:
Pole Gap: 30 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 12 February, 1997



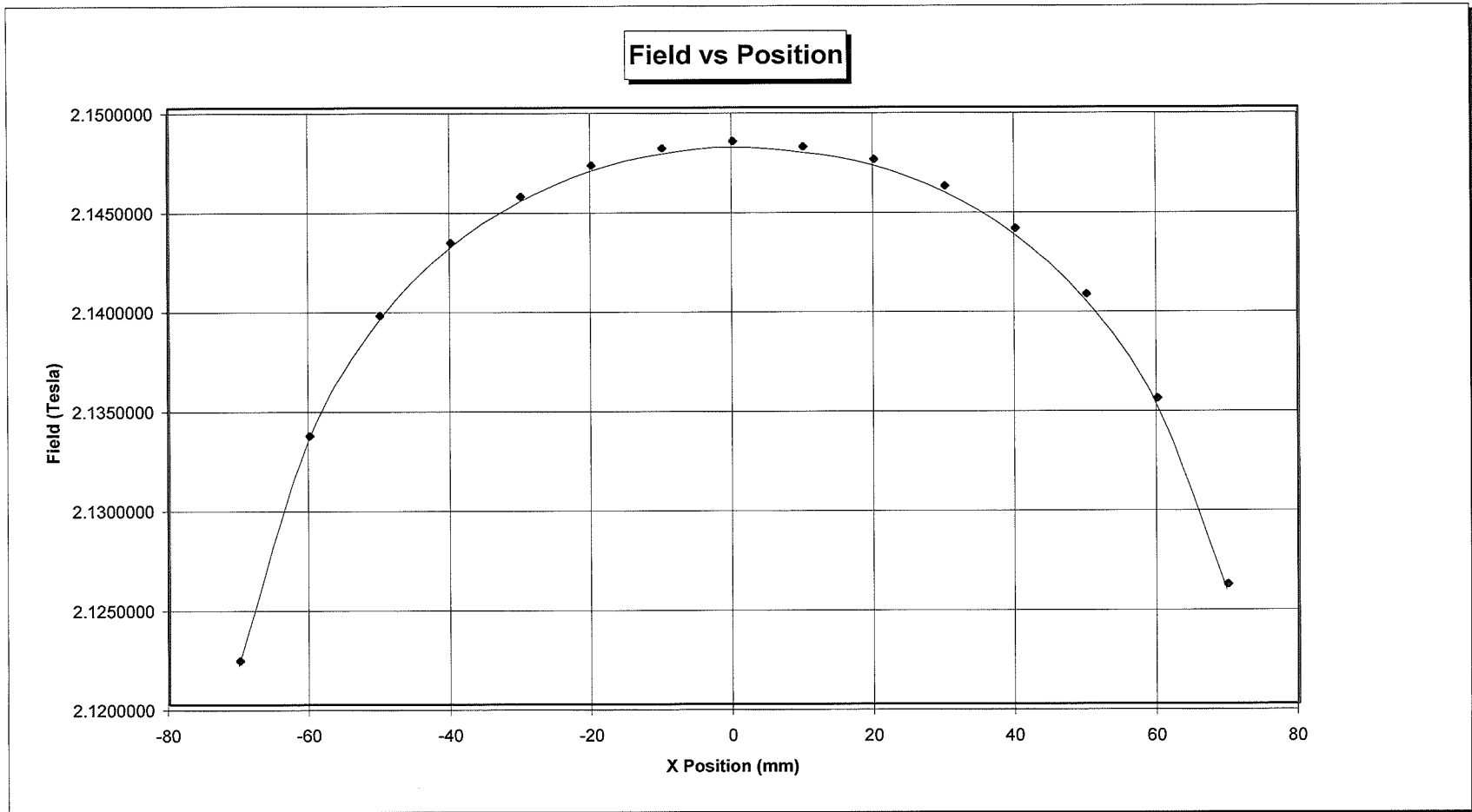
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 200 mm
Pole Gap: 30 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Pole SN:

Engr: E. Schulze
Date: 12 February, 1997

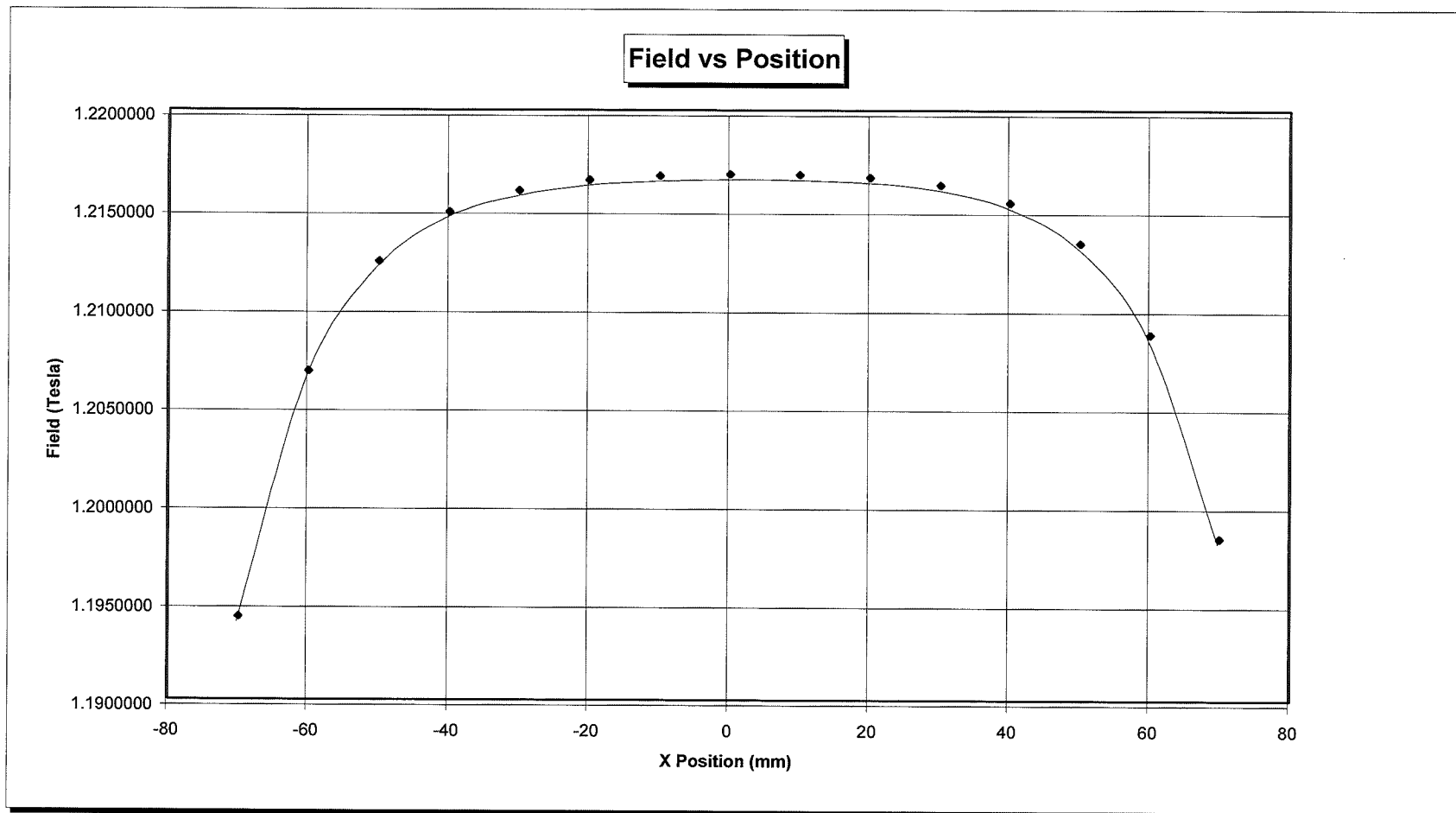


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 200 mm Pole SN:
Pole Gap: 70 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Engr: E. Schulze
Date: 12 February, 1997



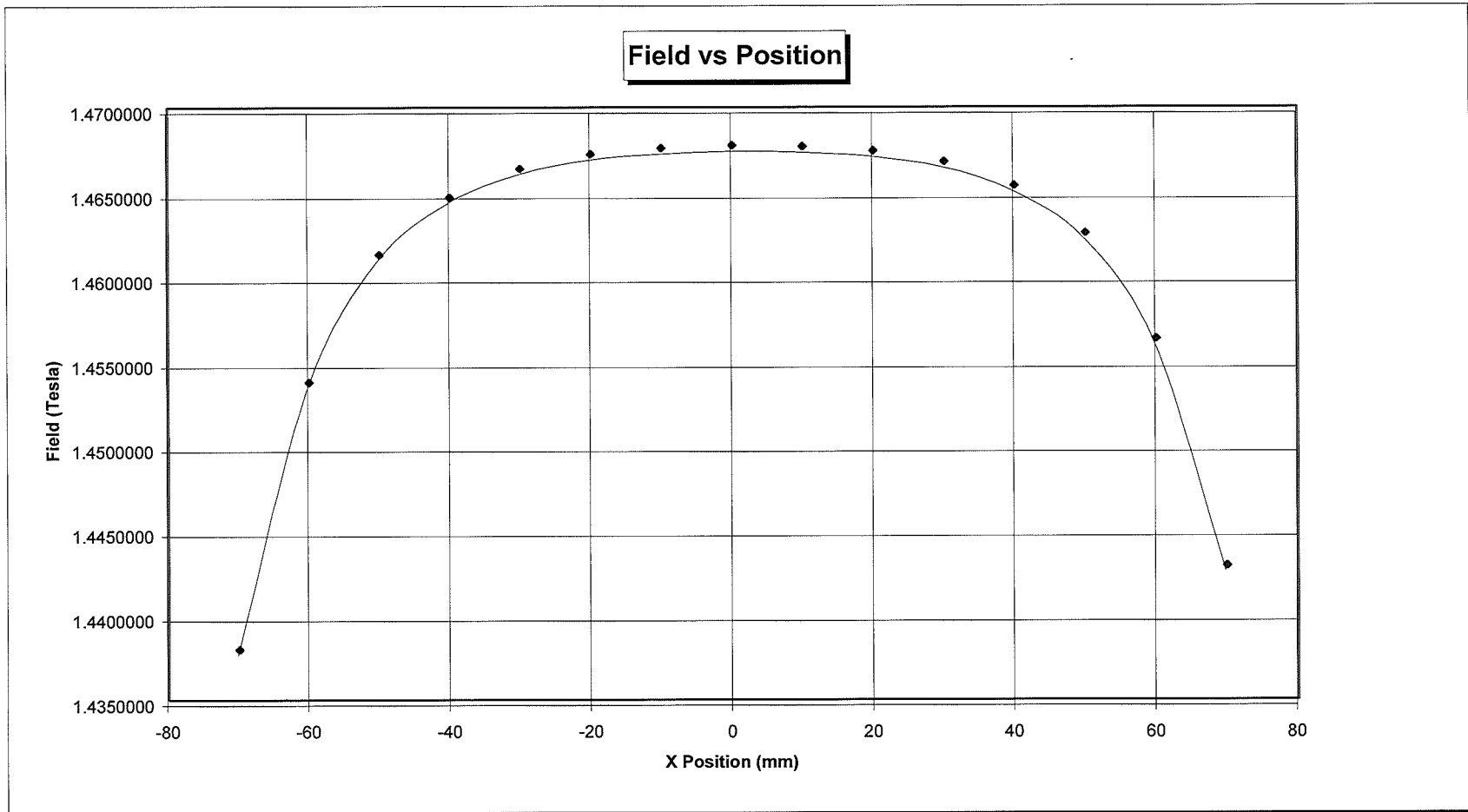
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 200 mm
Pole Gap: 70 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Pole SN:

Engr: E. Schulze
Date: 12 February, 1997



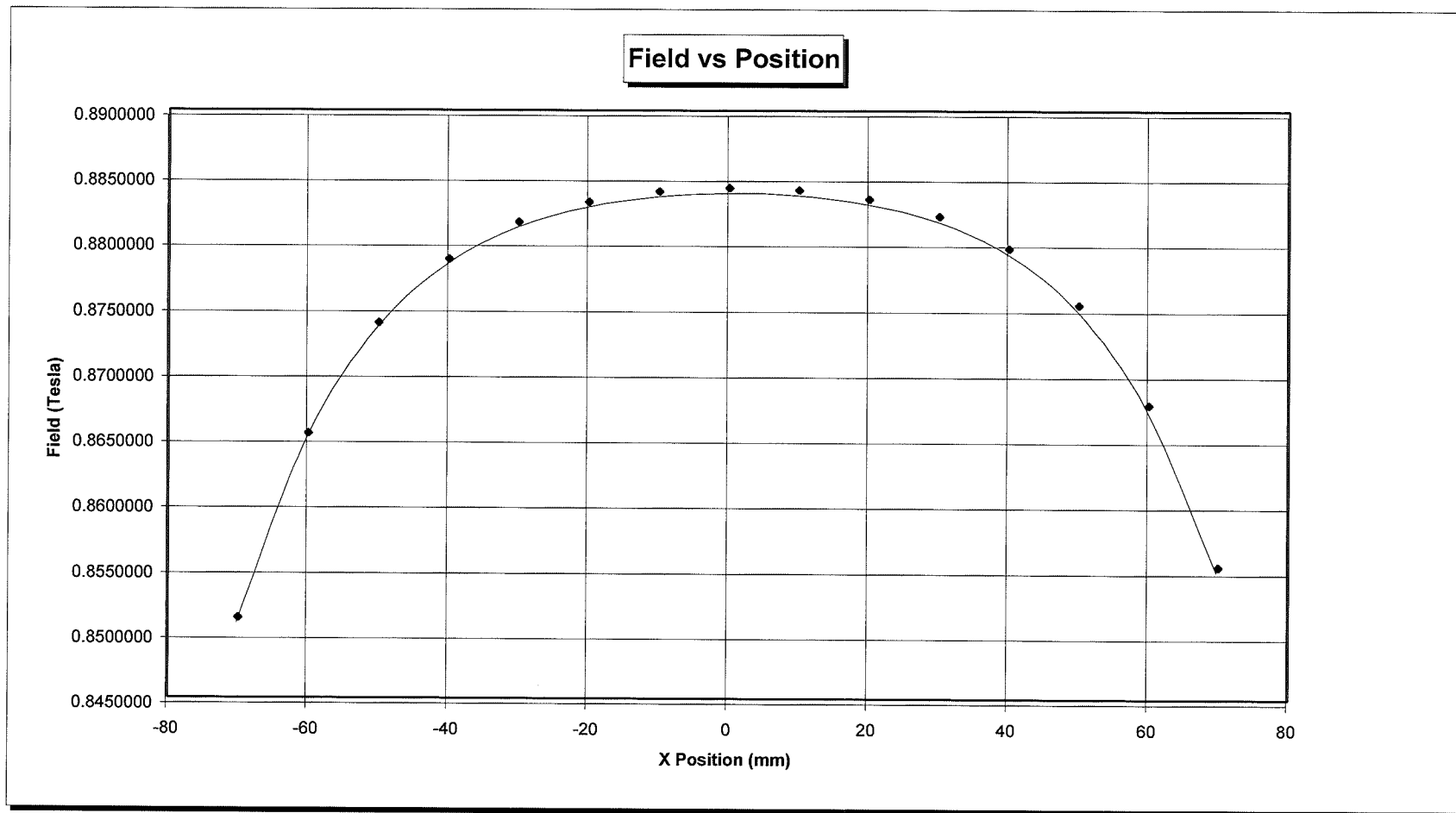
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 100 Amp.

Pole Face: 200 mm
Pole Gap: 100 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Pole SN:

Engr: E. Schulze
Date: 12 February, 1997



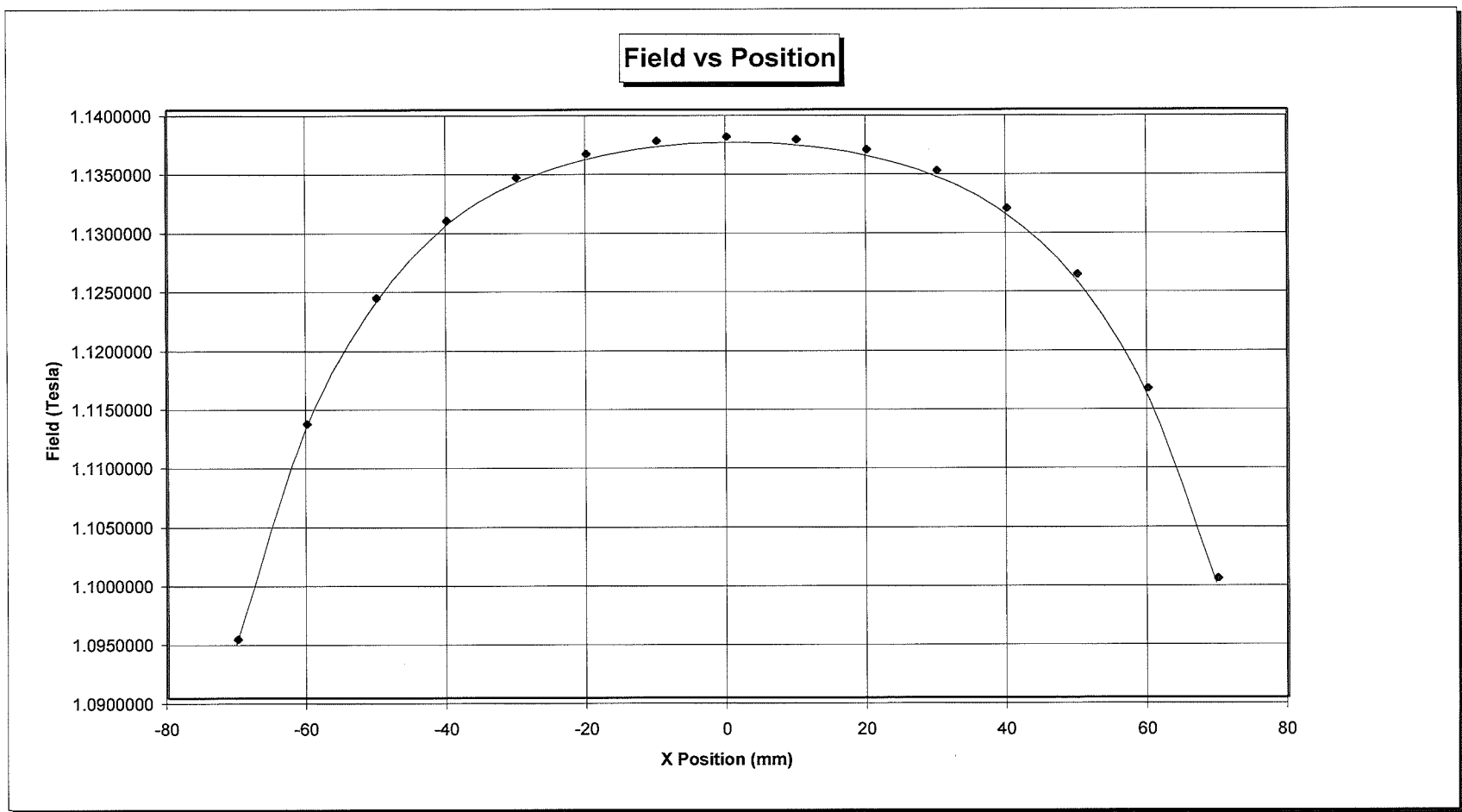
GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - Field Vs Position

Model 3474-140
Serial No 09
Contract No: C7955
Note: 140 Amp

Pole Face: 200 mm
Pole Gap: 100 mm
Pole Spacers: Not fitted
Fixed Axis: Y=0, Z=0
Variable Axis: X

Pole SN:

Engr: E. Schulze
Date: 12 February, 1997

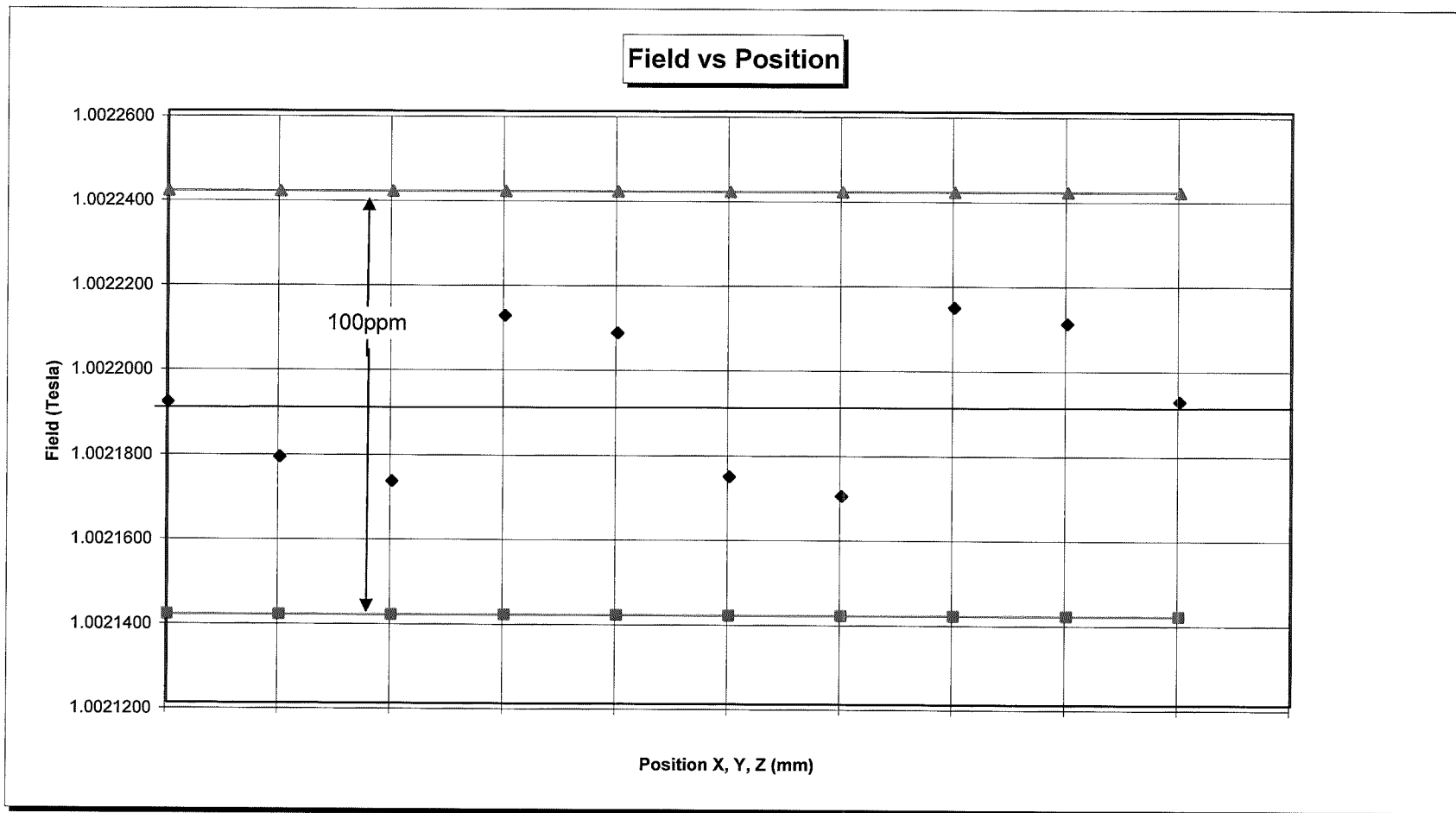


GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - 10mm Cube

Model 3474-140
 Serial No 09
 Contract No: C7955
 Note: 1.0T

Pole Face: 200 mm Pole SN:
 Pole Gap: 50 mm
 Pole Spacers: Fitted
 Fixed Axis:
 Variable Axis: X, Y, Z

Engr: E. Schulze
 Date: 14 February, 1997



GMW ASSOCIATES
LABORATORY ELECTROMAGNET UNIFORMITY PLOT - 10mm Cube

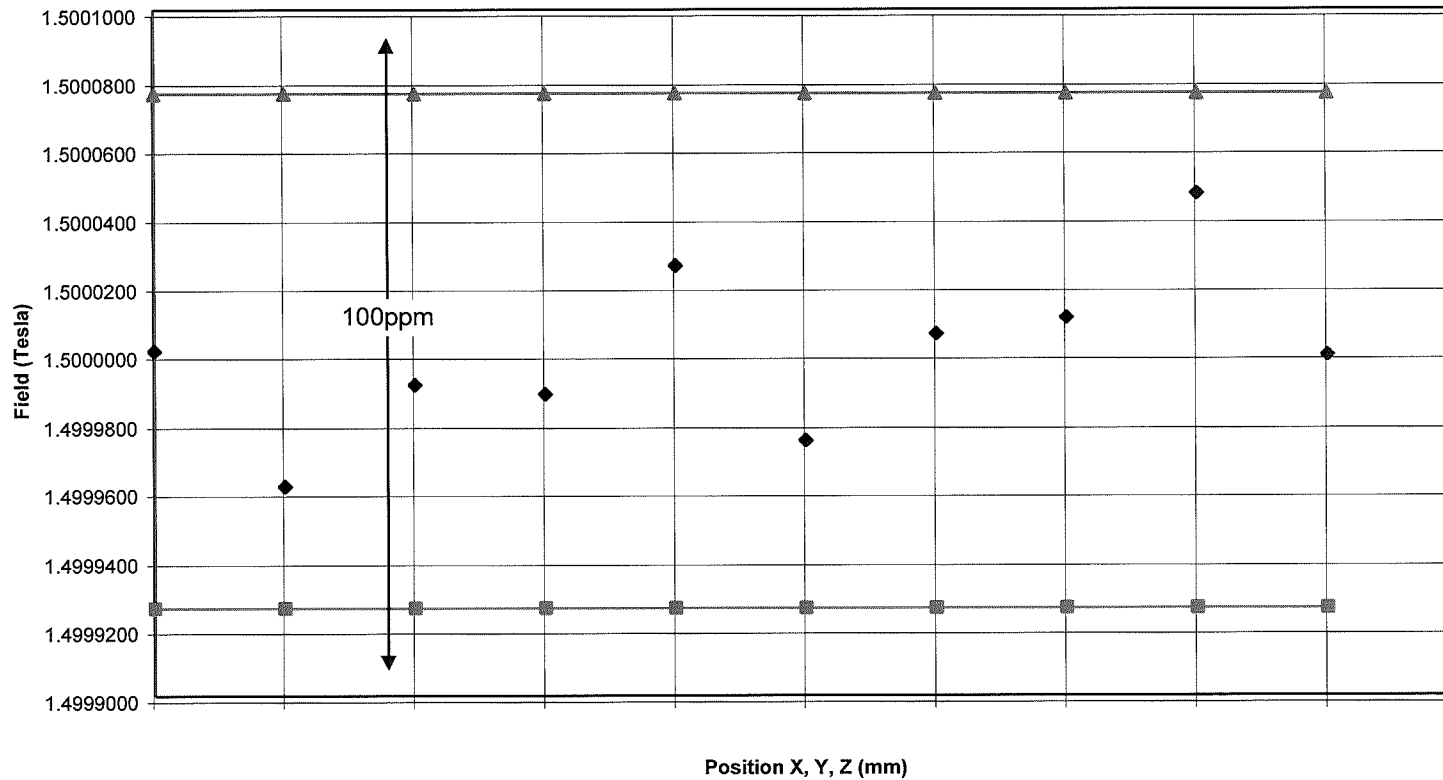
Model 3474-140
Serial No 09
Contract No: C7955
Note: 1.5T

Pole Face: 200 mm
Pole Gap: 50 mm
Pole Spacers: Fitted
Fixed Axis:
Variable Axis: X, Y, Z

Pole SN:

Engr: E. Schulze
Date: 14 February, 1997

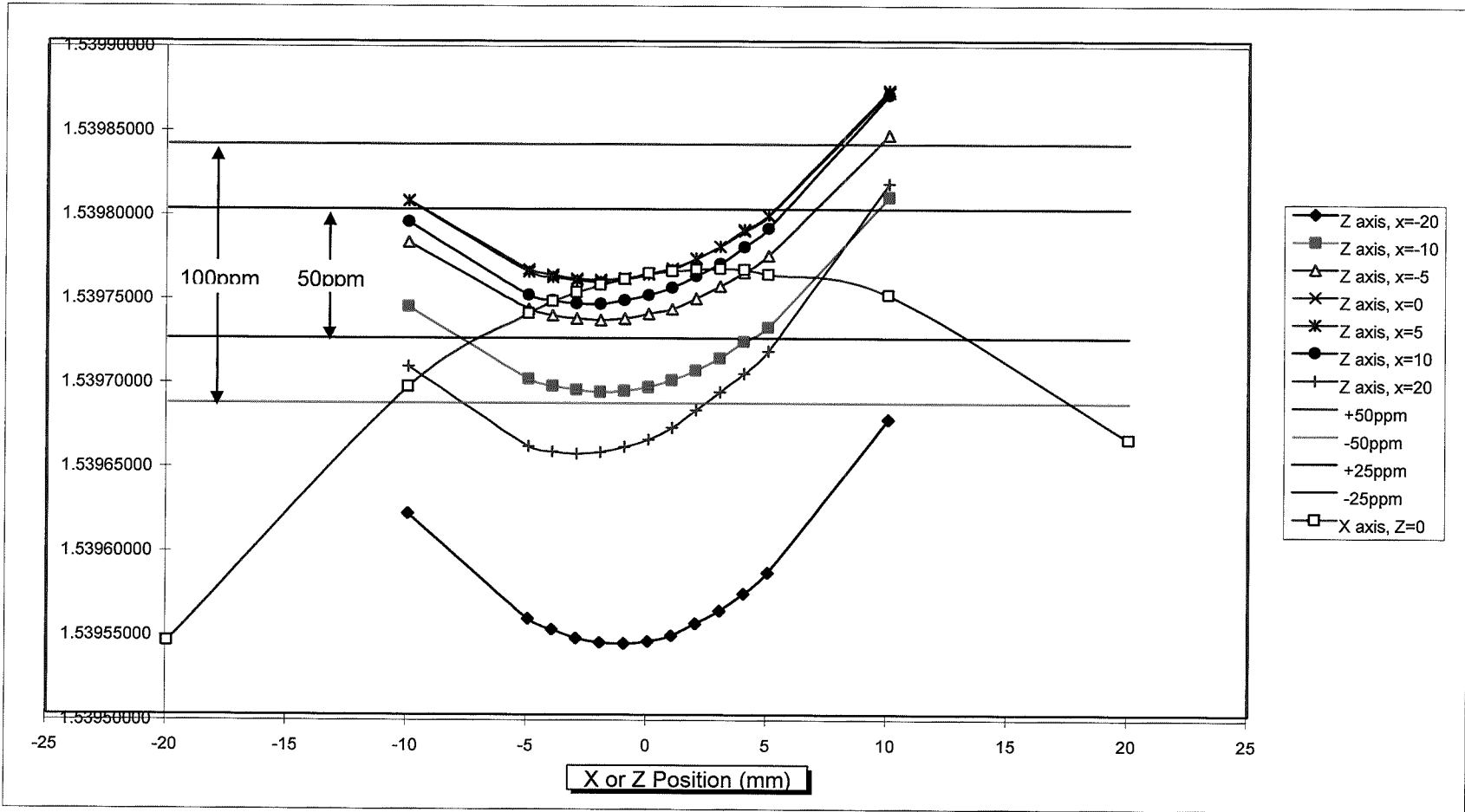
Field vs Position



GMW ASSOCIATES

LABORATORY ELECTROMAGNET UNIFORMITY Z-Axis as a function of X-Axis

Model:	3474-140	Pole Face: 200 mm	Pole SN:
Serial No:	09	Pole Gap: 50 mm	Engr: E. Schulze
Contract No:	C7955	Pole Spacers: Fitted	Date: 14 February, 1997
Note:	100A	Fixed Axis: Y=0	
		Variable Axis: X, Z	



GMW ASSOCIATES LABORATORY ELECTROMAGNET STABILITY PLOT

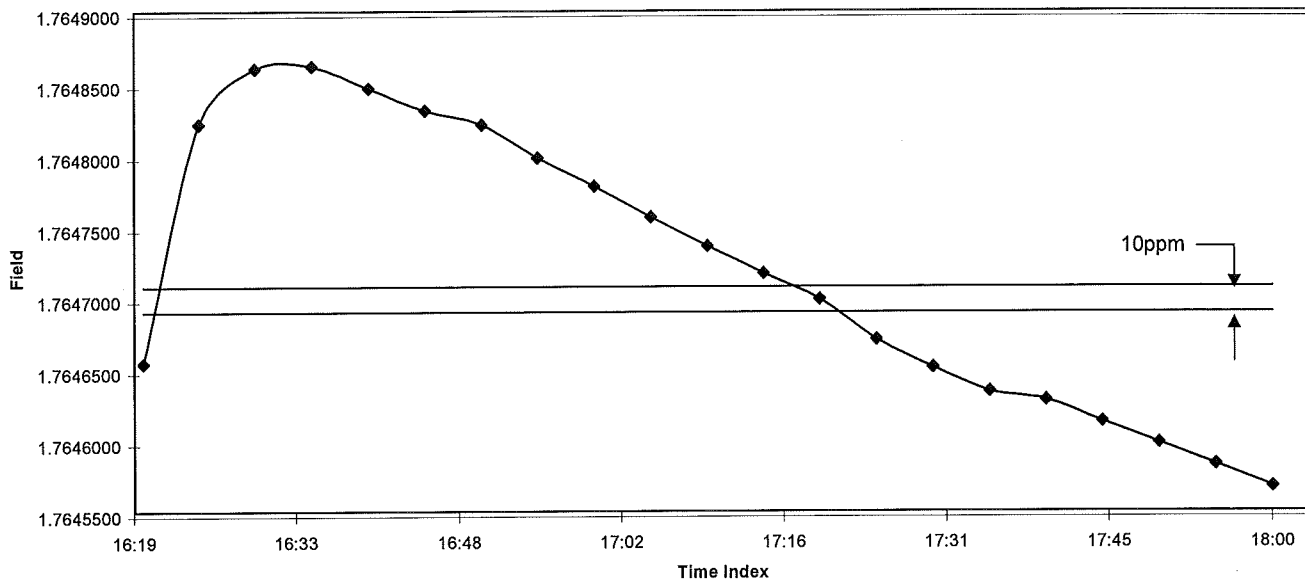
Model: 3474-140
 Serial No: 09
 Contract No: C7955
 Note: 140A
 Field measurement done with MetroLab 2025 & 1062-5 NMR system.

Pole Face: 200 mm
 Pole Gap: 50 mm
 Pole Spacers: Fitted
 Fixed Axis: X=0, Y=0, Z=0

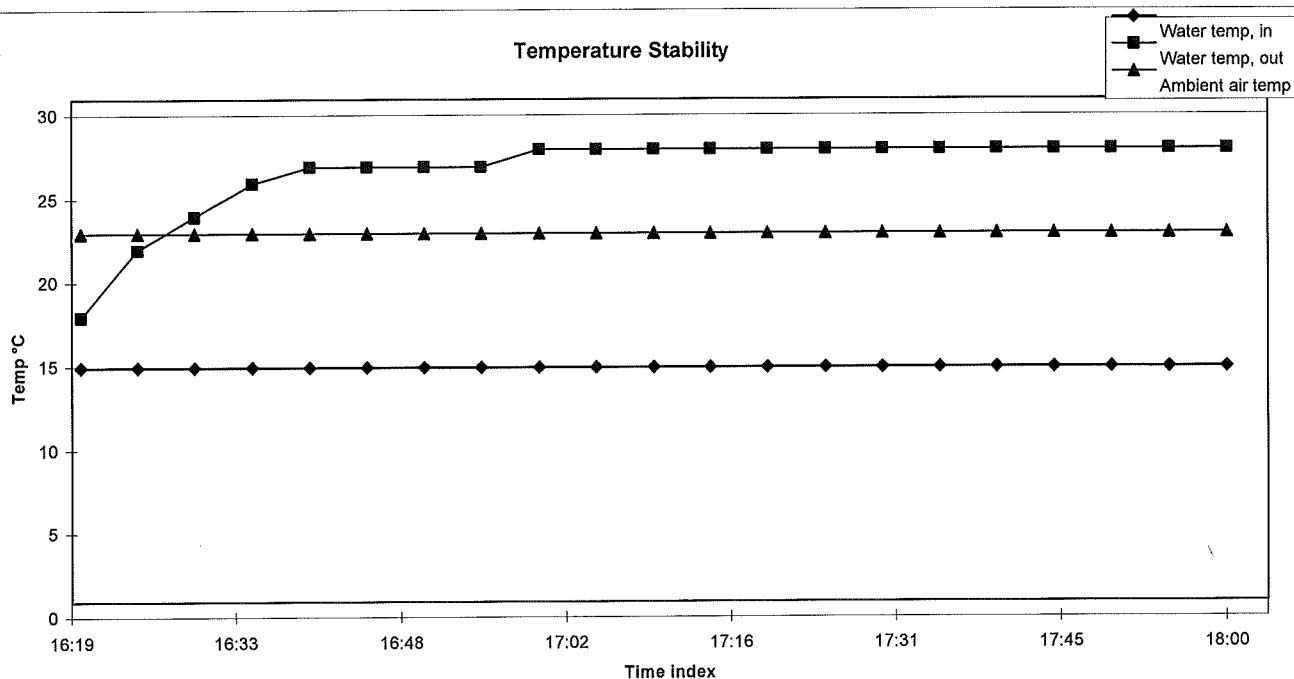
Pole SN:

Engr: E. Schulze
 Date: 14 February, 1997

Field Stability

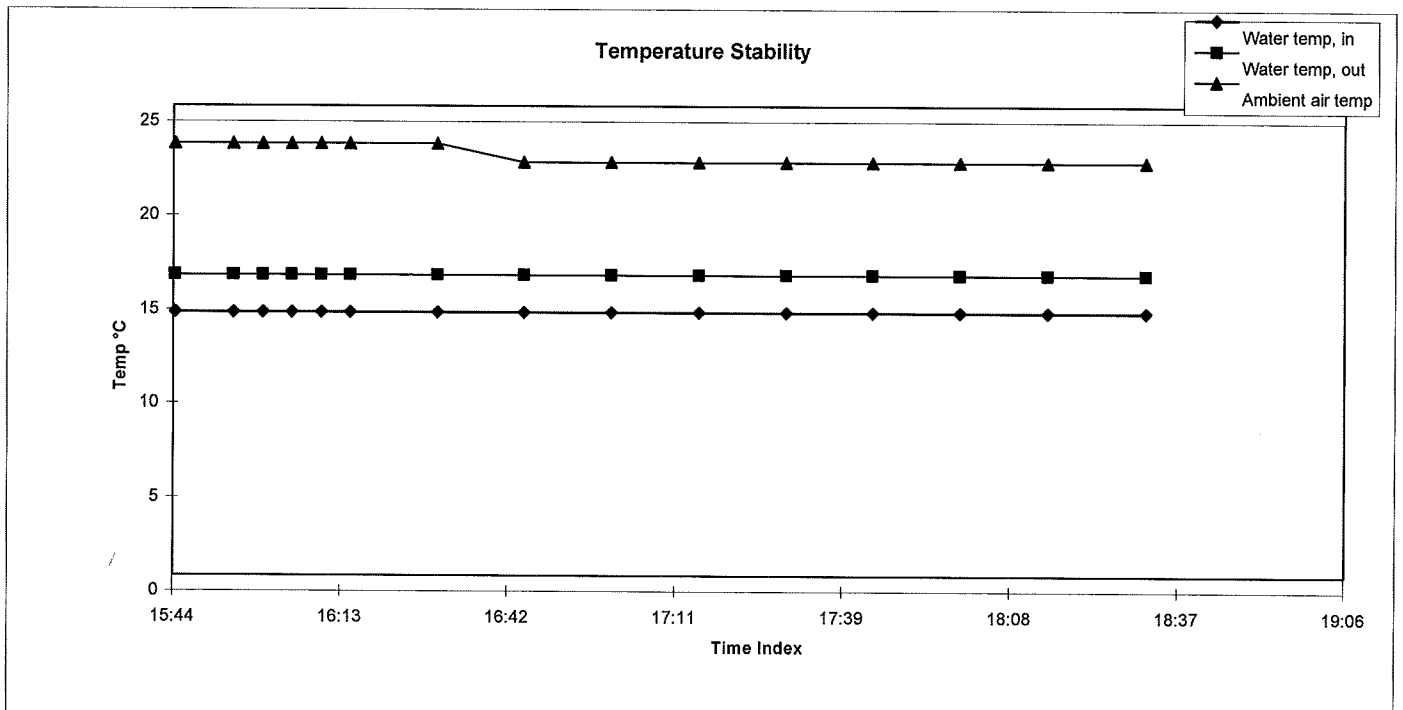
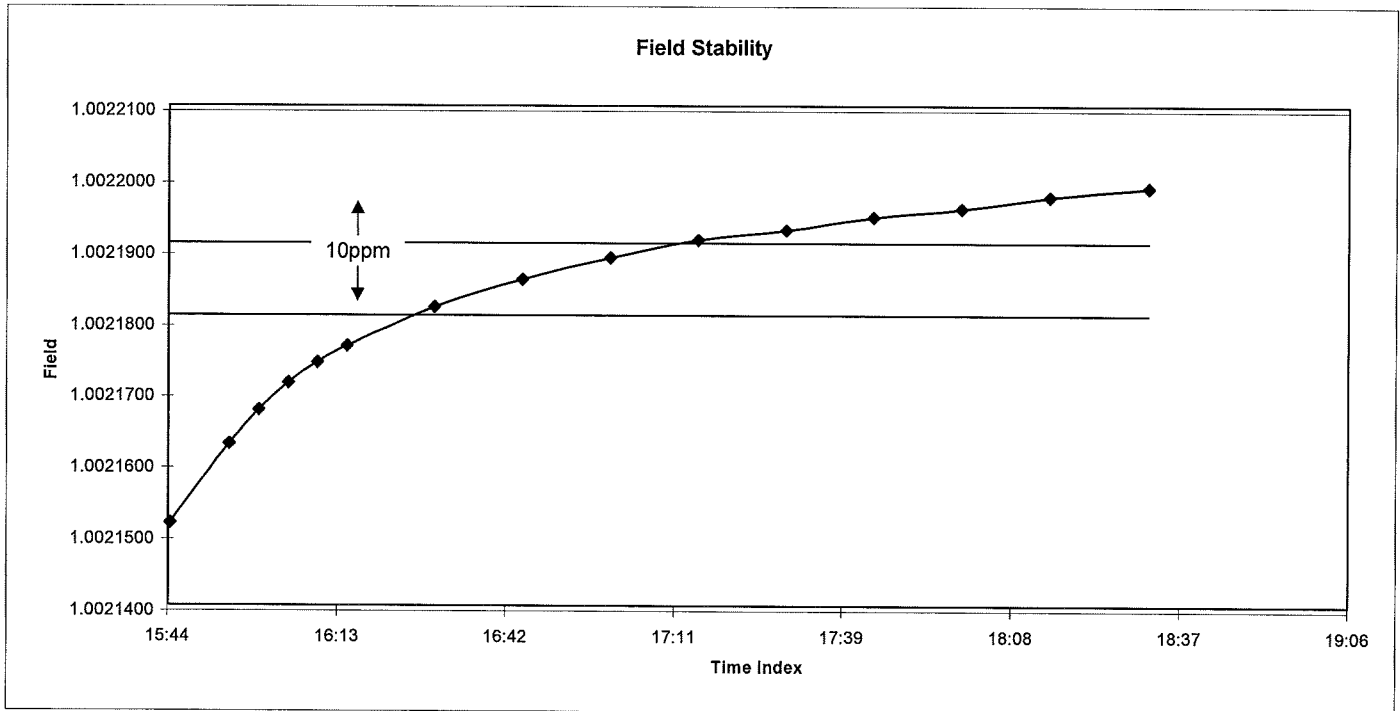


Temperature Stability



GMW ASSOCIATES LABORATORY ELECTROMAGNET STABILITY PLOT

Model: 3474-140	Pole Face: 200 mm	Pole SN:
Serial No: 09	Pole Gap: 50 mm	Engr: E. Schulze
Contract No: C7955	Pole Spacers: Fitted	Date: 25 February, 1997
Note: 56A	Fixed Axis: X=0, Y=0, Z=0	
Field measurement done with MetroLab 2025 & 1062-5 NMR system.		



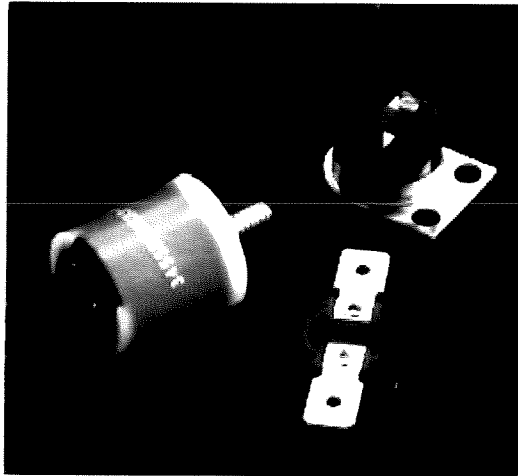
Section 10

DRAWINGS

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

Typical Applications:

- Power Supplies
- Communication Equipment
- Medical Equipment
- Computers (Where High AMP Loads are Present)



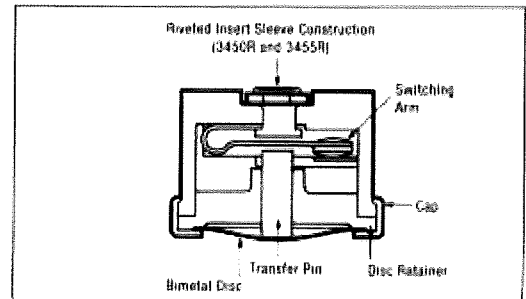
The Series 3450/3455R is a snap-acting, non-adjustable precision thermostat especially suited for industrial and electrical equipment.

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	8.5A	7.2A
3455R	100,000	4.4FLA/25.4LRA	2.2FLA/13.2LRA	-
	6,000	5.8FLA/34.8LRA	2.9FLA/17.4LRA	-
3455RBV	100,000	15A	8.5A	-
	6,000	5.8A/34.8LRA	2.9A/17.4LRA	-

A: Amps
 FLA: Full Load Amps
 LRA: Locked Rotor Amps
 Contacts are available for milliwatt and milliamper 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

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

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 +°F +°C		Close ±°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	MI STD-202 Method 301 - 2000 VAC 50 Hz - Terminal to Case
Insulation Resistance	MI STD-202 Method 302 Cond. B - 500 Megohms - 500 Vdc 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	MI STD-202, Method 307 - 50 Milliohms
Marking	MI STD-1285
Weight	6 Grams (Brackets and wire leads not included)
Materials	Base: Phenolic 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 E26103, UL File SA3169 (3455RBV only), UL File M68296 (3455R only), CSA File 21048.

F61 SERIES PENN FLOW SWITCHES

27
RA

F61 SERIES FLOW SWITCH

STANDARD FLOW RATE — SPDT

The F61 flow switch is designed for use on liquid lines using water, ethylene glycol solutions, or other liquids not injurious to the brass and phosphor bronze parts that come in contact with the liquid. The SPDT contacts make or break an electrical circuit when flow starts or stops.

F61KB-11: NEMA 1 type enclosure.

F61MB-1: This flow switch meets NEMA type 4 requirements and is UL listed as raintight. Use on indoor or outdoor applications in high humidity atmospheres, on liquid lines handling fluids below dewpoint or below 32°F (0°C).

Use on lines carrying well water, swimming pool water, sea water, brine or ethylene glycol. Not for use with hazardous fluids or in hazardous atmospheres.

The bronze paddle is of three segments for use in pipes from 1 in. to 3 in. diameter. Paddle segments may be removed or trimmed as needed. Catalog No. F61KB-11 and F61MB-1 include a 6 in. paddle for pipes 4 in. to 6 in.

Pipe Connection: 1 in. NPT.

Max Liquid Pressure: 150 PSIG (1034 kPa).

Max Liquid Temperature: 250°F (121°C).

Min Liquid Temperature, F61KB-11: 32°F (0°C).

F61MB-1: -20°F (-29°C).

Dimensions:

F61KB-11: 8¹¹/₁₆ in. H (3 in. paddle), 4 in. W, 2¹³/₁₆ in. D.

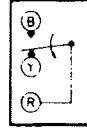
F61MB-1: 8¹¹/₁₆ in. H (3 in. paddle), 4⁹/₁₆ in. W, 2¹³/₁₆ in. D.

TO ORDER: Specify F61KB-11 for NEMA 1 enclosure, F61MB-1 for NEMA 4 enclosure.

ELECTRICAL RATINGS

Motor Ratings VAC	120	208	240	277
Horsepower	1	1	1	—
AC Full Load amp	16.0	8.8	8.0	—
AC Locked Rotor amp	96.0	52.8	48.0	—
Non-Inductive or Resistance Load amp	16	16	16	16
Pilot Duty — 125 VA, 24/277 VAC				

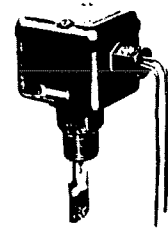
Series F61



ACTION ON INCREASE OF FLOW



F61KB-11
Replaces McDonnell & Miller FS4-3



F61MB-1
Replaces McDonnell & Miller FS8V-12

TYPICAL FLOW RATES — GPM (m³/hr) REQUIRED TO ACTUATE SWITCH

Line Pipe Size in.	1	1 ¹ / ₄	1 ¹ / ₂	2	2 ¹ / ₂	3	4*	5*	6*	8*	
Min Adj.	Flow Increase R to Y Closes	4.2 (1.0)	5.8 (1.3)	7.5 (1.7)	13.7 (3.1)	18.0 (4.1)	27.5 (6.2)	65.0 (14.8) 37.0† (8.4)	125.0 (28.4) 57.0† (12.9)	190.0 (43.1) 74.0† (16.8)	375.0 (85.2) 205.0† (46.6)
	Flow Decrease R to B Closes	2.5 (0.6)	3.7 (0.8)	5.0 (1.1)	9.5 (2.2)	12.5 (2.8)	19.0 (4.3)	50.0 (11.4) 27.0† (6.1)	101.0 (22.9) 41.0† (9.3)	158.0 (35.9) 54.0† (12.3)	320.0 (72.7) 170.0† (38.6)
Max Adj.	Flow Increase R to Y Closes	8.8 (2.0)	13.3 (3.0)	19.2 (4.4)	29.0 (6.6)	34.5 (7.8)	53.0 (12.0)	128.0 (29.1) 81.0† (13.4)	245.0 (55.6) 118.0† (26.8)	375.0 (85.2) 144.0† (32.7)	760.0 (172.6) 415.0† (94.2)
	Flow Decrease R to B Closes	8.5 (1.9)	12.5 (2.8)	18.0 (4.1)	27.0 (6.1)	32.0 (7.3)	50.0 (11.4)	122.0 (27.7) 76.0† (17.3)	235.0 (53.4) 111.0† (25.2)	360.0 (81.8) 135.0† (30.7)	730.0 (165.8) 400.0† (90.8)

* Flow rates for these sizes are calculated.

† These GPM figures are for switch with 6 in. paddle. For 4 in. and 5 in. line pipe the paddle is trimmed.

LOW FLOW RATE — SPDT

For use on liquid lines using water, ethylene glycol solutions, or other liquids not injurious to the brass and phosphor bronze parts. SPDT contact switch is activated by a low flow rate; however, it has a large flow capacity with minimum pressure drop. Typical applications include:

- Water purification and treatment systems.
- Booster pumps.
- Fast shut down on high input boilers to guard against circulation failure.
- Cooling systems for electronic tubes, bearings and compressors.

F61KD: NEMA 1 type enclosure.

F61MD: NEMA 4 (vaportight) enclosure.

Min Liquid Temperature, F61KD: 32°F (0°C).

F61MD: -20°F (-29°C).

Dimensions: 5¹/₂ in. H, 4 in. W, 2¹³/₁₆ in. D.

TO ORDER: Specify Catalog Number only.

ELECTRICAL RATINGS

Motor Ratings VAC	120	208	240	277
Horsepower	1	1	1	—
AC Full Load amp	16.0	8.8	8.0	—
AC Locked Rotor amp	96.0	52.8	48.0	—
Non-Inductive or Resistance Load amp	16	16	16	16
Pilot Duty — 125 VA, 24/277 VAC				



F61KD

Catalog Number	Inlet and Outlet Size Female NPT	Enclosure NEMA Type	Adjustment Range — GPM (m ³ /hr)		Maximum Liquid Temp °F (°C)	Maximum Liquid Pressure PSIG (kPa)	Ship wt lb
			R to Y Closes Flow Increase	R to Y Opens Flow Decrease			
F61KD-3	1/2 in. x 1/2 in.	1					
F61KD-4	3/4 in. x 3/4 in.	1	Minimum .6 (0.14) Maximum 1.1 (0.25)	Minimum .3 (0.07) Maximum 0.9 (0.2)	250 (121)	150 (1034)	2.2
F61MD-2	3/4 in. x 3/4 in.	4					

★ Non-Stock Item. Built to Order.

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REAR VIEW OF MAGNET SHOWN WITH
TERMINAL COVER ITEM 12 REMOVED.

- NOTES
1. USE GRAPHITE GREASE SPARINGLY ON CORE THREAD.
 2. INSTALL POLE BOLT [ITEM 6] FULLY INTO POLE CAP, BACK OFF ONE TURN, HOLD WITH WRENCH [ITEM 19] AND TIGHTEN NUT [ITEM 4].
 3. R.H. CABLE ENTRY SHOWN, L.H. CABLE ENTRY OPTIONAL.
 4. SEE ELECTRICAL ASSEMBLY DWG NO 11901380 FOR WIRING DETAILS.
 5. SEE I/O MANIFOLD ASSEMBLY DRAWING NO 11901360 FOR DETAILS.
 6. SEE FIXED GAP POLE ASSEMBLY DRAWING NO 11901430 FOR DETAILS.

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/28/00	G.DOUGLAS

MAGNET SPECIFICATIONS

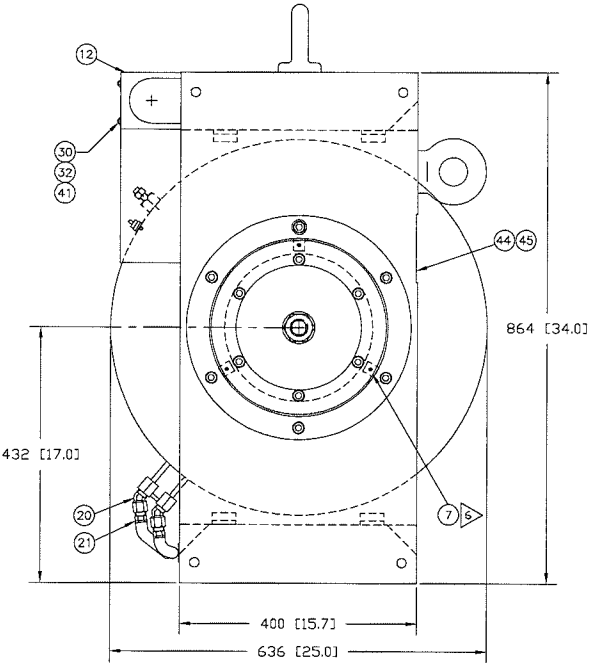
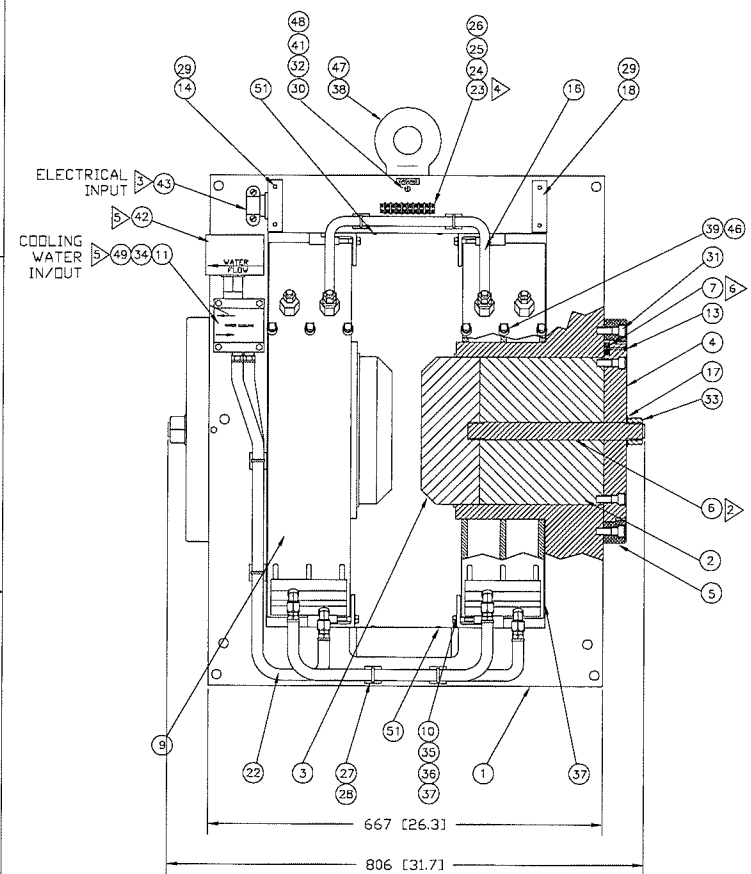
POLE DIAMETER: 250mm [10"]
 POLE GAP: FIXED 160mm max [0-6.3"]
 COIL GAP: 186mm min [7.3"]
 POLE CAPS: CYLINDRICAL 250mm [10"]
 TAPERED 200, 150, 100, 75, 50, 25mm
 [8"] [6"] [4"] [3"] [2"] [1"]

COILS [series connected]

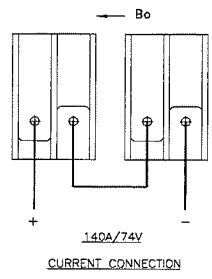
20°C RESISTANCE 0.44 ohm
 MAX RESISTANCE 0.54 ohm
 MAX POWER [air] 40A/22V
 MAX POWER [water] 140A/74V

COOLING: 15 liter/min [4 US gpm] 2.0 bar (30 psid)
 THERMAL INTERLOCK: OPEN CIRCUIT ABOVE 50° C
 FLOW INTERLOCK: OPEN CIRCUIT BELOW 10 liter/min
 MASS: 1800 kg [3970 lb]

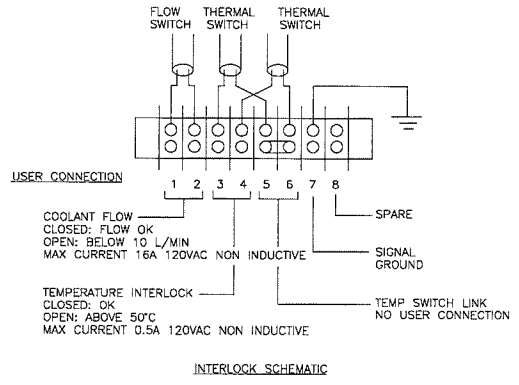
52		DELETED
51	16	M4 X 8 SHCS BUTTON DH S/S.[For Probe Mount]
50		DELETED
49	1	10900370 LABEL, WATER CONNECTIONS
48	1	10900390 LABEL, GROUND
47	2	M33 WASHER S/S
46	6	NEOPRENE WASHER 16 O.D X 4 I.D X 4 THK
45	1	10900360 LABEL CAUTION, RH SIDE
44	1	10900350 LABEL MAGNET SPECIFICATIONS, LH SIDE
43	1	CABLE CLAMP T & B 3307
42	1	F61 KB JOHNSTON CONTROLS FLOW SWITCH, BRASS
41	5	M6 LOCK WASHER S/S
40		DELETED
39	6	3450G611-1 SENSOR, ELWOOD 50°C, SCREW TYPE
38	2	M33 LIFTING EYE
37	A/R	NEOPRENE 1.6 mm
36	6	M8 WASHER, S/S
35	8	M8 X 50 HEX BOLT, S/S
34	4	M6 X 80 SHCS, S/S
33	2	M30 NUT, S/S
32	2	M6 X 16 PAN HD SCREW S/S
31	12	M12 X 50 SHCS, S/S
30	5	M6 WASHER, S/S
29	4	M6 X 12 HEX HD BOLT, S/S
28	12	M4 X 10 PAN HD SCREW, S/S
27	6	SELF ADHESIVE SCREW TIE PAD
26	4	M3 WASHER, S/S
25	4	M3 X 16 PAN HD SCREW, S/S
24	1	MS B-140 MARKER STRIP, CINCH
23	1	8-140 TERMINAL BLOCK, CINCH
22	A/R	8768 IF RUBBER COVERED HOSE 1/2" I.D
21	6	KA-08-06-MB IF PUSH ON HOSE COUPLING 1/2" HOSE 3/8NPT
20	4	124-B-06 IF STREET ELBOW 45° 3/8 NPT
19	1	17802840 WRENCH
18	1	17801781 BRACKET, TERMINAL COVER, BLANK END
17	2	WASHER, 31MM ID X 2MM THICK S/S
16	1	17801754 LINK, COIL
15		DELETED
14	1	17801782 BRACKET, TERMINAL COVER, WITH HOLE
13	6	M3 X 30 SHCS S/S
12	1	17801780 TERMINAL COVER
11	1	17801680 WATER INLET/OUTLET MANIFOLD
10	4	17801640 CLAMP, COIL
9	2	11801652 COIL ASSEMBLY [2 TERMINAL]
8	6	DELETED
7	6	17904150 SHIM PAD (VARIOUS)
6	2	17801761 POLE BOLT
5	2	17801720 POLE MOUNTING PLATE RETAINER
4	2	17904130 POLE MOUNTING PLATE
3	2	17801710 POLE CAP (VARIOUS)
2	2	17904120 POLE CORE
1	1	17801610 YOKE



VIEW FROM REAR OF MAGNET



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



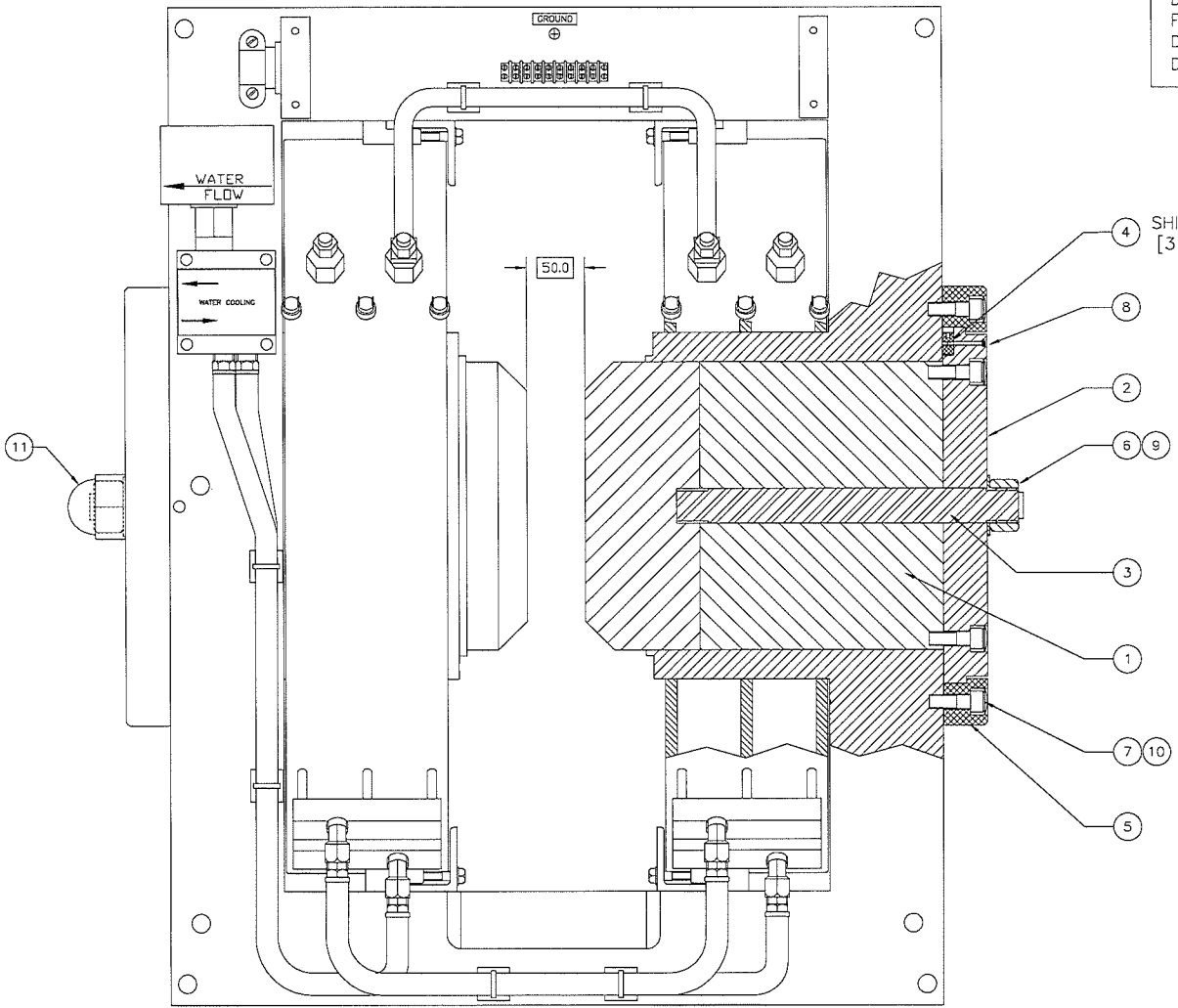
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
DRAWN: G.DOUGLAS DATE: 08/21/00				
CHECK: DATE: DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)				
ENGINEERING: DATE: LINEAR DIMENSIONS: mm				
X.XXX ±.002 ±.003				
X.X ±.03 ±.01				
X ±.06 ±1				
DEC. 7.5 ±.03				
Finish: 81 1.6				
NEXT ASSY SYSTEM THIRD ANGLE PROJECTION				
SOFTWARE AUTOCAD 2000				
PARTS LIST			GMW	
			935 Industrial Rd, San Carlos, CA 94070	
			Tel: (650)802-8292 Fax: (650)802-8298.	
			TITLE	
			MAGNET ASSEMBLY	
			MODEL: 3474-140FG	
			SIZE: DRAWING NO.	
			A1 11801603	
			SCALE: 1:4 Wt kg	
			SHEET 1 OF 1	

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/28/00	G.DOUGLAS

MODEL: 3474FG ELECTROMAGNET

*****WARNING*****
DO NOT DISTURB ANY SCREWS SECURING THE
FIXED GAP ASSEMBLY AFTER MAGNET SHIMMING.
DISTURBING THE FIXED GAP ASSEMBLY MAY
DEGRADE THE MAGNET FIELD UNIFORMITY.



④ SHIM FOR FIELD UNIFORMITY ADJUSTMENT
[3 PLACES, ON EACH END OF MAGNET]

MODEL: 3474FG
SELECTION TABLE

FIXED GAP	ASSEMBLY NO
50mm	11901430
72mm	11901431
-	-
-	-
-	-
-	-
-	-
-	-
-	-

NOTE: 1 PARTS FITTED AT GMW

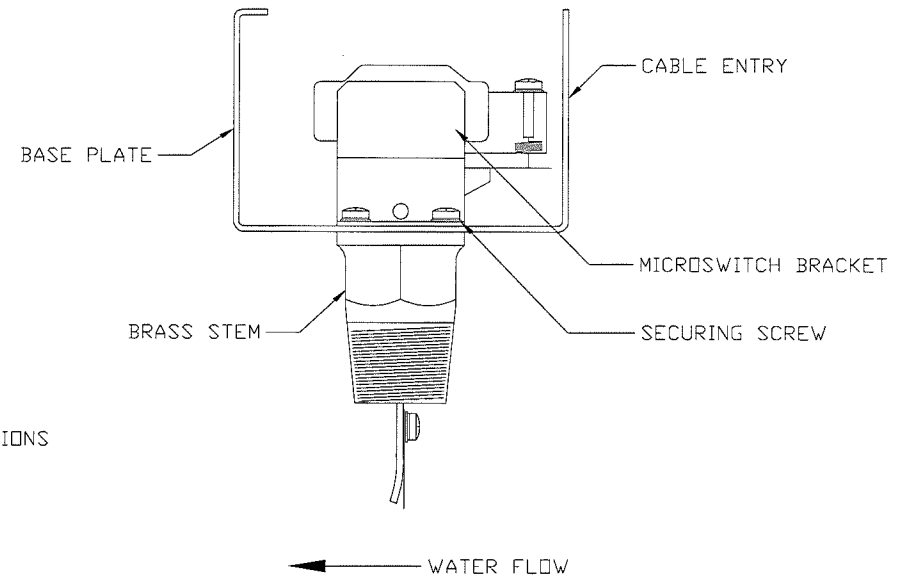
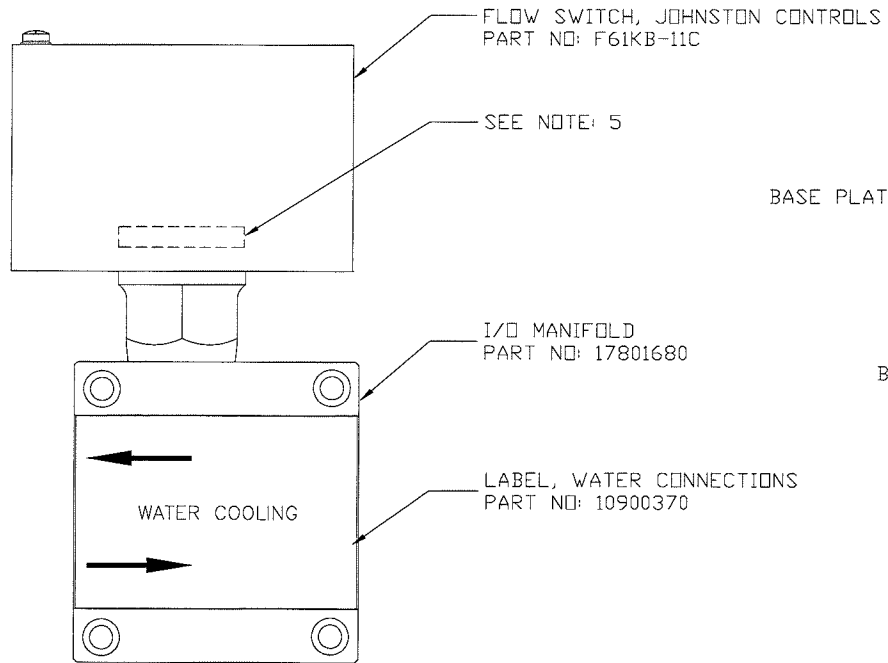
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
11	2	BN 1094	COVERS M30 NEX NUT, BLACK PLASTIC	1
10	24	BN 1064	COVERS, M12 SHCS, GRAY PLASTIC	1
9	2	BN 735	WASHER, M30 X 2 THICK FLAT S/S	
8	6	DIN 912	SHCS, M3 X 30 S/S	
7	24	DIN 912	SHCS, M12 X 50 S/S	
6	2	DIN 934	NUT, M30 S/S	
5	2	17904160	POLE RETAINER	
4	6	17904151	SHIM PAD	
3	2	17904140	POLE BOLT [for 50mm gap]	
2	2	17904130	POLE MOUNTING PLATE	
1	2	17904120	POLE CORE [for 50mm gap]	

REAR VIEW

DRAWN G.DOUGLAS	DATE 08/28/00	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		
ENGINEERING	DATE	LINEAR INCHES MILLIMETERS XXXX ±.005 ±0.03 XXX ±.01 ±0.1 XX ±.03 ±0.3 X ±.08 ±1 DEC. ±.25 ±0.5 FINISH 63 1.6	TITL FIXED GAP POLE GA MODEL: 3474FG
11801603	3474FG	SIZE DRAWING NO.	REV
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	A1 11901430 A
SOFTWARE AUTOCAD 2000		SCALE 1:2 WF kg	SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		04/26/99	G.DOUGLAS
B	ADD LABEL PART NUMBER		08/27/07	G.DOUGLAS



INSTRUCTIONS ON MODIFICATION AND FITTING OF FLOW SWITCH

1. REMOVE FLOW SWITCH COVER.
2. REMOVE FOUR SECURING SCREWS AND ROTATE BASE PLATE 180 DEG.
3. REASSEMBLE MICROSWITCH BRACKET AND BASE PLATE ONTO BRASS STEM.
4. APPLY THREAD SEAL TAPE TO BASE STEM THREADED AREA.
5. REMOVE FLOW DIRECTION LABELS FROM FLOW SWITCH COVER [x2].
6. ASSEMBLE FLOW SWITCH ONTO WATER I/O MANIFOLD.
7. FIT COMPLETED FLOW SWITCH/WATER I/O MANIFOLD ASSEMBLY ONTO MAGNET.

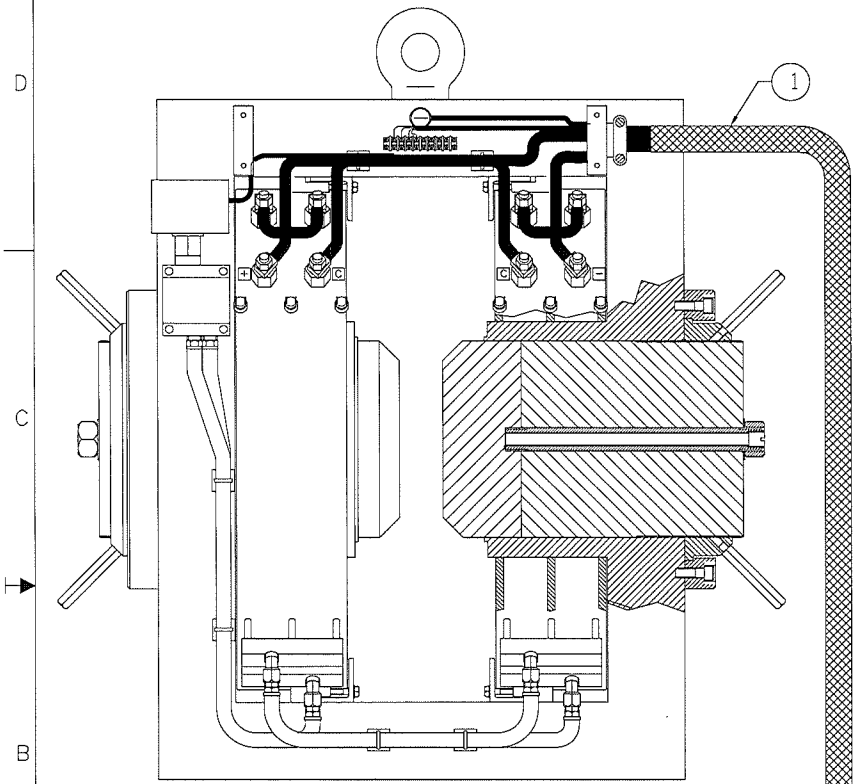
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN G.DOUGLAS	DATE 04/26/99	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.
CHECK	DATE	LINEAR	INCHES / mm	
ENGINEERING	DATE	X.XXX	±.009 / ±0.03	TITLE
		X.XX	±.01 / ±0.1	I/O MANIFOLD ASSEMBLY MODEL: 3474/5503
		X.X	±.03 / ±0.3	
		X	±.06 / ±1	SIZE
		DEG.	±.5 / ±0.5	A2
11801600	3474	FINISH	B3 / 1.6	DRAWING NO.
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		11901360
SOFTWARE AUTOCAD 2000				REV B
SCALE 1:1			WT kg	SHEET 1 OF 1

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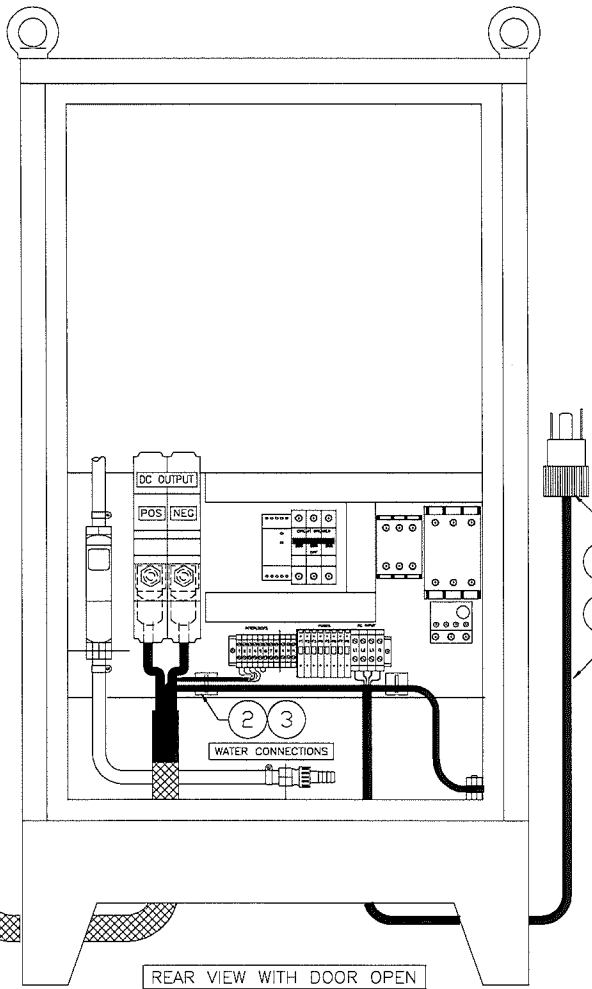
MODEL: 3474 ELECTROMAGNET

DANFYSIK POWER SUPPLY MODEL: 853

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/24/96	G.DOUGLAS



REAR VIEW TERMINAL COVER REMOVED



REAR VIEW WITH DOOR OPEN

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

DANFYSIK MODEL: 853 GPIB SWITCH SETTINGS			
POWER SUPPLY MOTHER BOARD		GPIB INTERFACE BOARD	
DIP SWITCH SW3	DIP SWITCH SW4	DIP SWITCH SW1	DIP SWITCH SW2
1 OFF	1 OFF	1 OFF	1 OFF
2 ON	2 OFF	2 ON	2 OFF
3 ON	3 OFF	3 OFF	3 ON
	4 ON	4 ON	4 OFF
	5 OFF	5 ON	5 ON
	6 OFF	6 OFF	6 ON
	7 ON	7 OFF	7 ON
	8 OFF	8 OFF	8 ON

LSB ADDRESS SWITCHES MSB

DIP SW1 AND SW2 LOCATED ON M/B NOT USED FOR GPIB INTERFACE
SW3/SW4 USE NORMAL LOGIC OFF=0

DIP SW1 SHOWN SET TO ADDRESS 1 [Default]
SW1 1-5 USES INVERSE LOGIC OFF=1
SW2 USES NORMAL LOGIC OFF=0

NOTE

1. POWER SUPPLY SHOWN WITH 3 PHASE 208V AC INPUT
2. REFER TO TABLE ON DWG 13900030 FOR AC INPUT RATINGS OTHER THAN 3 PHASE 208V
3. MAGNET SHOWN WITH 140 AMP CURRENT CONNECTIONS
4. MAGNET SHOWN WITH LH CABLE ENTRY, RH ENTRY OPTIONAL

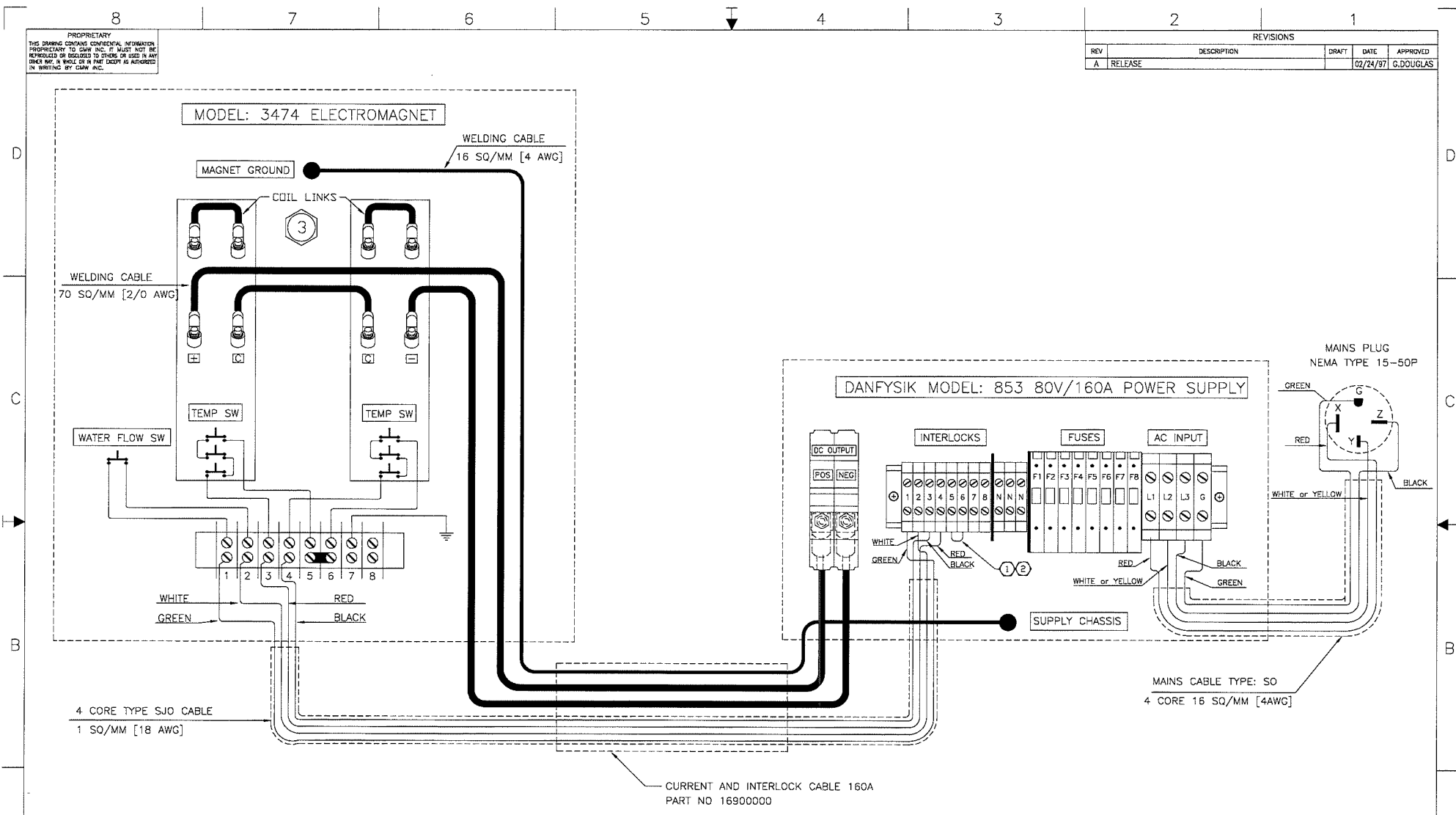
N/S = NOT SUPPLIED

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
5	1	4A-0404	CABLE, TYPE SO 4 CORE 4AWG, ANIXTERN/S	
4	1	B450NP	PLUG 3PHASE/50A, BRYANT	N/S
3	4	08461	CABLE TIE ADHESIVE MTG, NYL BAR-LOK	
2	3	10364	CABLE TIE, NYLON 5mm WIDE, BAR-LOK	
1	1	16900000	CURRENT & INTERLOCK CABLE 160A	

DESIGN G.DOUGLAS CHECK ENGINEERING	DATE 02/21/96	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	GMW P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8292, Fax: (650)802-8298.
NEXT ASSY SOFTWARE AUTOCAD 13	SYSTEM THIRD ANGLE PROJECTION	TITLE ELECTRICAL ASSEM 3474/DF 853	SIZE A1 SCALE NTS SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/24/97	G.DOUGLAS



- NOTE:
- REMOVE LINK BETWEEN TERM 1 & TERM 2 AND TERM 3 & TERM 4 ON POWER SUPPLY AND CONNECT INTERLOCKS WIRES AS SHOWN
 - DO NOT REMOVE LINK BETWEEN TERM 5 & TERM 6 UNLESS EMERGENCY STOP CONTROL IS CONNECTED TO THESE TERMINALS.
 - COIL LINKS SHOWN WITH SERIES CONNECTION. SEE DWG NO 11801600 FOR DETAILS

ELECTROMAGNET SYSTEM ELECTRICAL REQUIREMENTS			
AC INPUT POWER 3 PHASE, 48 to 62HZ	208V	400V	440V
AC INPUT FULL LOAD CURRENT	48	25A	23A
RECOMMENDED MAIN AC BREAKER	50	30	30
RECOMMENDED AC POWER OUTLET	15-SOP	-	-
RECOMMENDED AC CABLE SIZE	16 SQ/MM	8 SQ/MM	8 SQ/MM

NOTE: DRAWING SHOWS POWER SUPPLY FOR US 3 PHASE 208V AC POWER

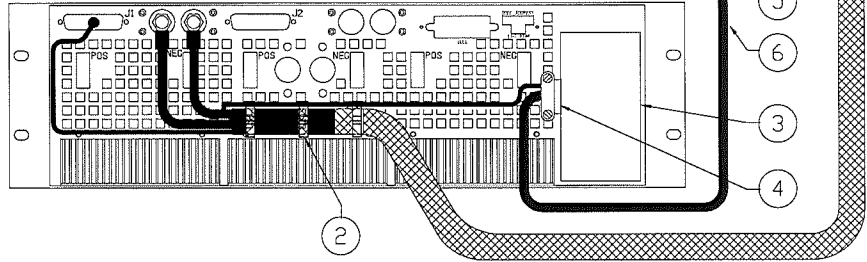
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN G.DOUGLAS		DATE 02/24/97	DO NOT SCALE FROM DRAWING (DIMENSIONS & TOLERANCES UNLESS OTHERWISE SPECIFIED)	
CHECK		DATE	955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.	
ENGINEERING		DATE	TITLE ELECTRICAL WIRING 3474/DF 853	
NEXT ASSY		SYSTEM	THIRD ANGLE PROJECTION	SIZE A1
SOFTWARE AUTOCAD 13		DRAWING NO. 13900030		REV A
SCALE NTS		WT kg	SHEET 1 OF 1	

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		10/02/98	G.DOUGLAS

MODEL: 3474 ELECTROMAGNET

POWER TEN MODEL: P83C-100150A POWER SUPPLY



POWER SUPPLY REAR VIEW

REAR VIEW TERMINAL COVER REMOVED

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

NOTE

1. POWER SUPPLY SHOWN WITH 3 PHASE 208V AC INPUT
2. REFER TO TABLE ON DWG 13900380 FOR AC INPUT RATINGS OTHER THAN 3 PHASE 208V
3. MAGNET SHOWN WITH 140 AMP CURRENT CONNECTIONS
4. MAGNET SHOWN WITH LH CABLE ENTRY, RH ENTRY OPTIONAL

N/S = NOT SUPPLIED

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
5	1	4A-0404	CABLE, TYPE SO 4 CORE 4AWG, ANIXTERN/S	
4	1	8450NP	PLUG 3PHASE/50A, BRYANT	N/S
3	4	08461	CABLE TIE ADHESIVE MTC, NYL BAR-LOK	
2	3	10364	CABLE TIE, NYLON 5mm WIDE, BAR-LOK	
1	1	16900000	CURRENT & INTERLOCK CABLE 160A	

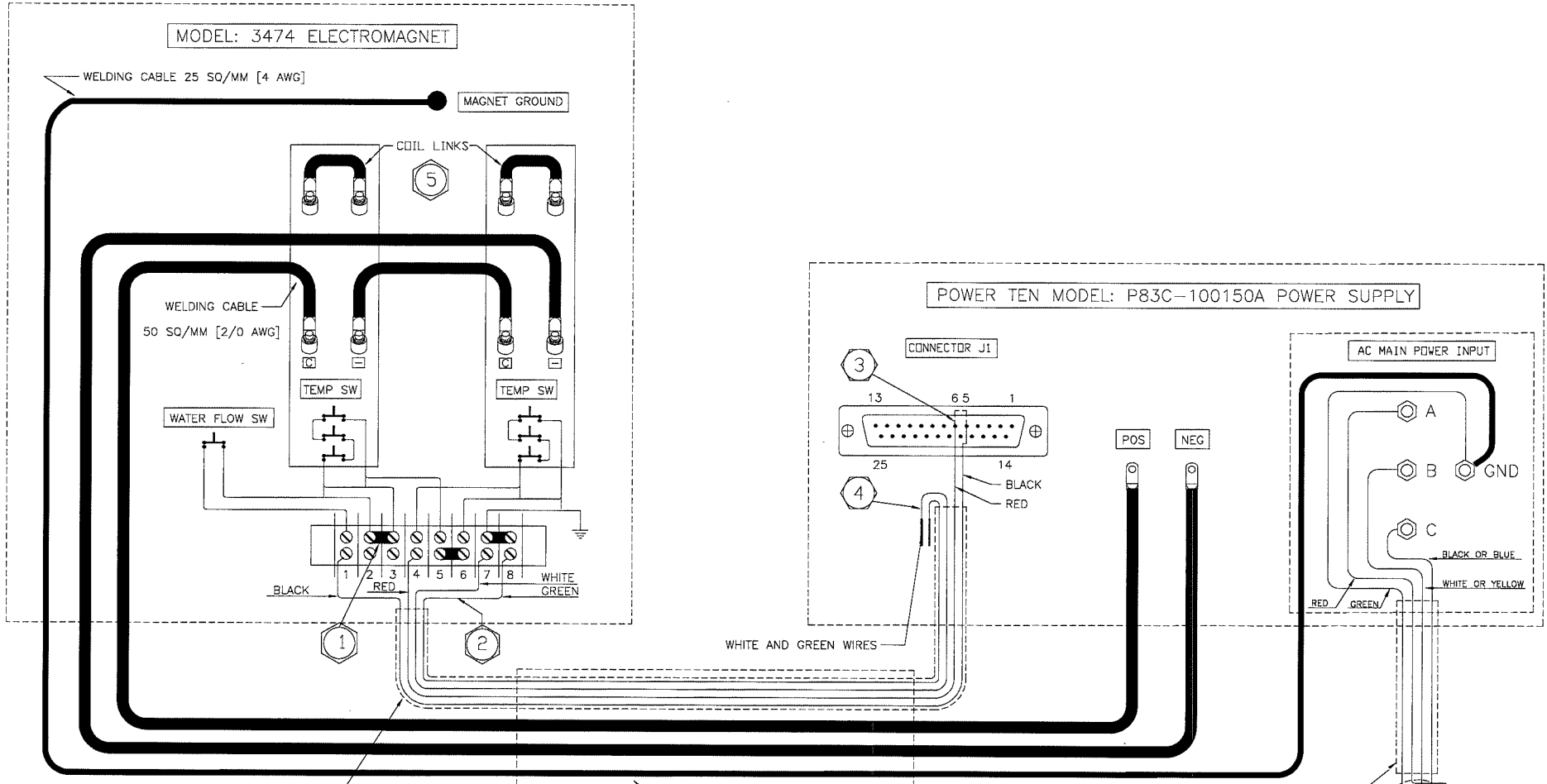
DRAWN		DATE		DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		GMW	
G.DOUGLAS	10/02/98					955 Industrial Rd, San Carlos, CA 94070	
CHECK						Tel: (650)802-8292, Fax: (650)802-8298.	
ENGINEERING						TITLE	
						ELECTRICAL ASSEM	
						3474/P83C-100150A	
						SIZE	
						A1	
						11901310	
						SCALE	
						NTS	
						WT	
						kg	
						SHEET	
						1 of 1	

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		10/03/98	G.DOUGLAS

MODEL: 3474 ELECTROMAGNET

POWER TEN MODEL: P83C-100150A POWER SUPPLY



4 CORE TYPE SJO CABLE 1 SQ/MM [18 AWG]

CURRENT AND INTERLOCK CABLE 160A
PART NO 16900000

MAINS CABLE TYPE: SO 4 CORE 16 SQ/MM [4 AWG]

MAINS PLUG NEMA TYPE 15-50P

NOTE:

- ① MAGNET WATER FLOW AND TEMP INTERLOCKS LINKED IN SERIES ON MAGNET.
- ② WHITE AND GREEN WATER FLOW INTERLOCK WIRES TIED TO TERM 7 & TERM 8.
- ③ REMOVE LINK BETWEEN PIN 5 & PIN 6 ON POWER SUPPLY AT J1, AND CONNECT INTERLOCKS WIRES AS SHOWN.
- ④ INSULATE WHITE AND GREEN WIRES WITH HEAT SHRINK SLEEVING [not used].
- ⑤ COIL LINKS SHOWN WITH SERIES CONNECTION. SEE DWG NO 11801600 FOR DETAILS

ELECTROMAGNET SYSTEM ELECTRICAL REQUIREMENTS			
AC INPUT POWER 3 PHASE, 48 to 62HZ	208V	400V	440V
AC INPUT FULL LOAD CURRENT	48A	25A	23A
RECOMMENDED MAIN AC BREAKER	50A	30A	30A
RECOMMENDED AC POWER OUTLET	15-50P	-	-
RECOMMENDED AC CABLE SIZE	16 SQ/MM	8 SQ/MM	8 SQ/MM

NOTE: DRAWING SHOWS POWER SUPPLY FOR US 3 PHASE 208V AC POWER

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN: G.DOUGLAS CHECK: G.DOUGLAS DATE: 10/03/98 ENGINEERING: DATE:				
DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED) LINEAR: INCHES: ±.005 MILL: ±.01 ANG: ±.01 HOLE: ±.01 TYP: ±.01 FINISH: 83 THIRD ANGLE PROJECTION				
NEXT ASSY: SYSTEM: THIRD ANGLE PROJECTION SOFTWARE: AUTOCAD 2000				
TITLE: GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.			REV: A	
DRAWING NO: 3474/P83C-100150A			SCALE: NTS WT kg SHEET 1 of 1	

ASSEMBLY SEQUENCE MODEL: 3474 ELECTROMAGNET ON TO 45° MOUNTING AND ROLLING/ROTATING BASE

FIGURE 1

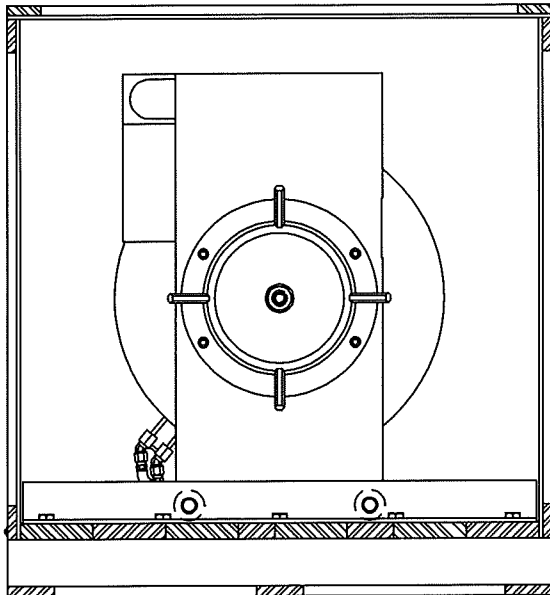


FIGURE 2

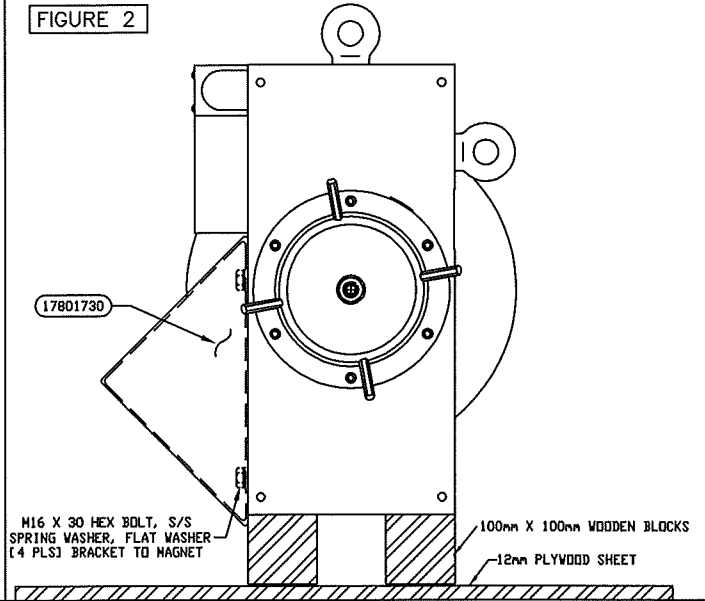


FIGURE 3

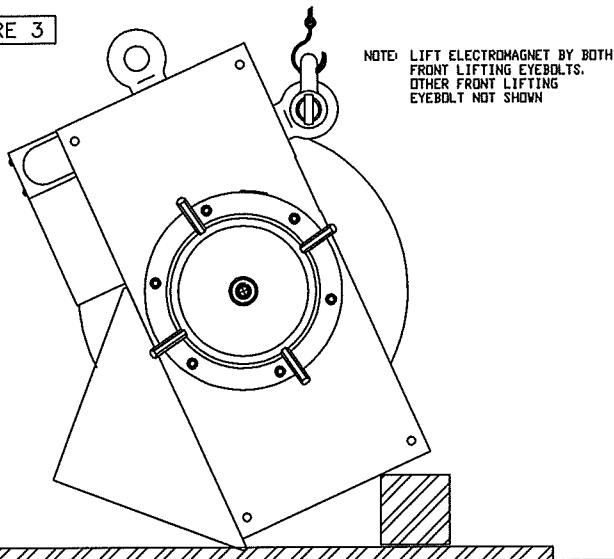


FIGURE 4

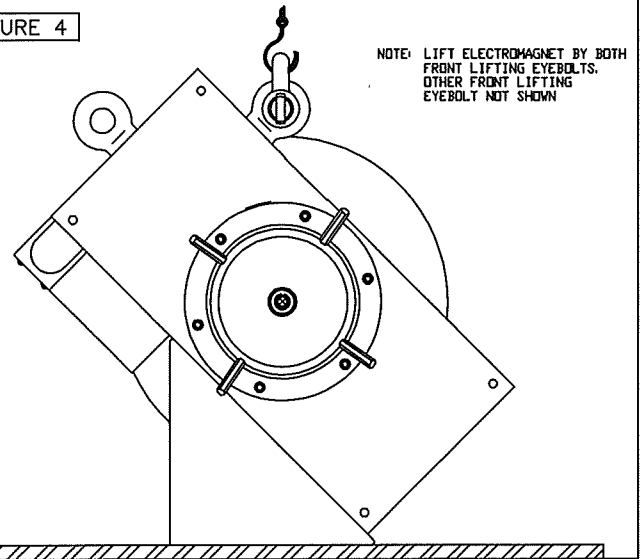


FIGURE 5

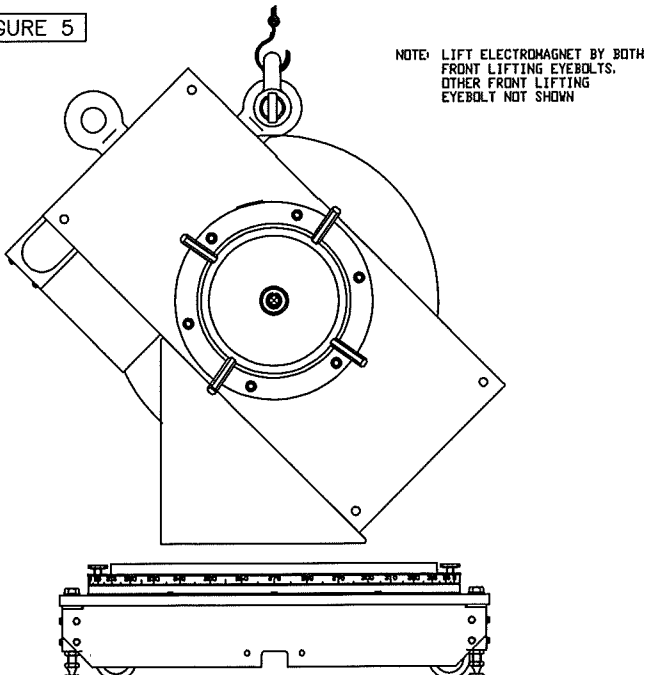
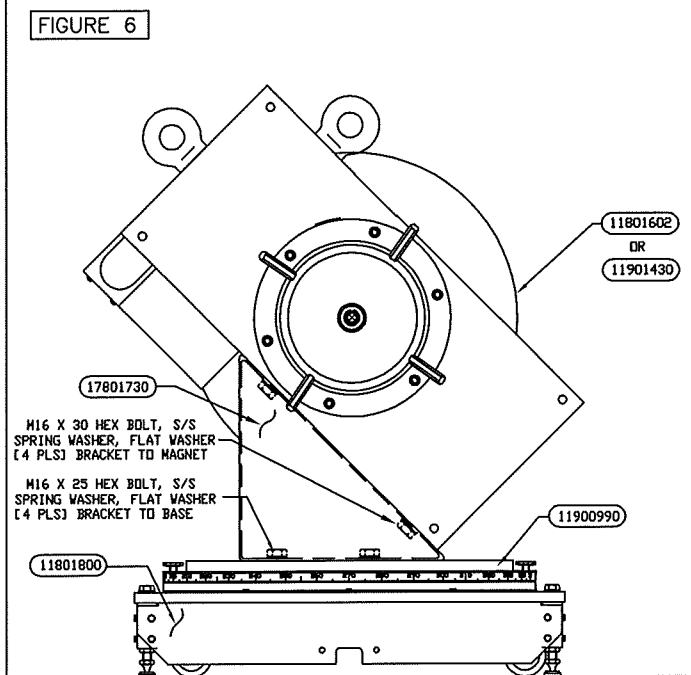
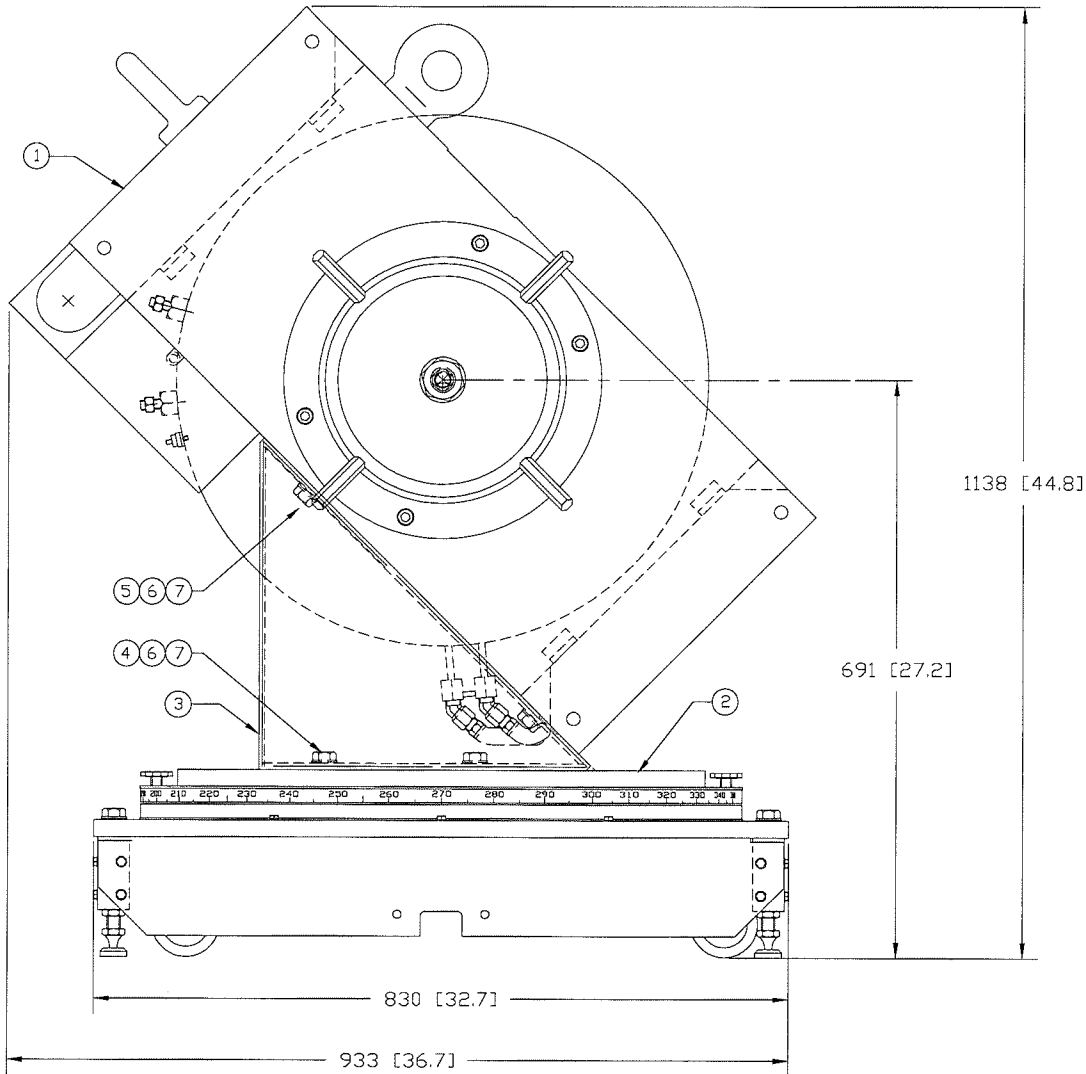


FIGURE 6



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A	RELEASE		10/01/97	G.DOUGLAS

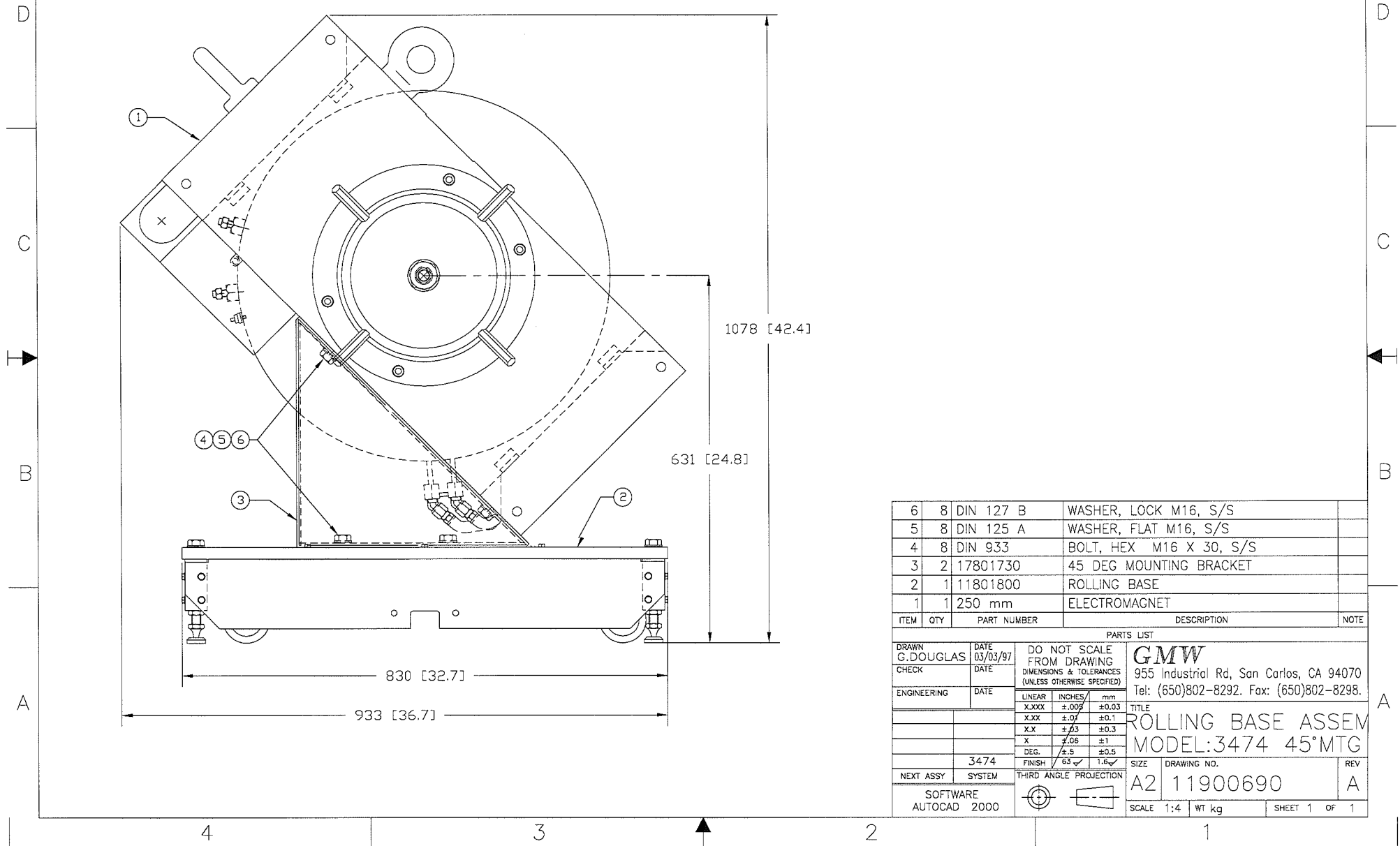


ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
7	8	DIN 127 B	WASHER, LOCK M16, S/S	
6	8	DIN 125 A	WASHER, FLAT M16, S/S	
5	4	DIN 933	BOLT, HEX M16 X 30, S/S	
4	4	DIN 933	BOLT, HEX M16 X 25, S/S	
3	2	17801730	45 DEG MOUNTING BRACKET	
2	1	11900980	ROLLING/ROTATING BASE	
1	1	250 mm	ELECTROMAGNET	

DRAWN		DATE	DO NOT SCALE		TITLE
G.DOUGLAS	10/01/97		FROM DRAWING		
CHECK			DIMENSIONS & TOLERANCES		
ENGINEERING			(UNLESS OTHERWISE SPECIFIED)		ROL/ROT BASE ASSY MODEL:3474 45° MTG
			LINEAR	INCHES/mm	SIZE
			X.XXX	±.008 ±0.03	DRAWING NO.
			X.XX	±.01 ±0.1	
			X.X	±.05 ±0.3	REV
			X	±.06 ±1	
			DEG.	±.5 ±0.5	A2 11900930 A
			FINISH	63 ✓ 1.6 ✓	
NEXT ASSY	SYSTEM		THIRD ANGLE PROJECTION		SCALE 1:4
SOFTWARE					WT kg
AUTOCAD 2000					SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		03/03/97	G.DOUGLAS



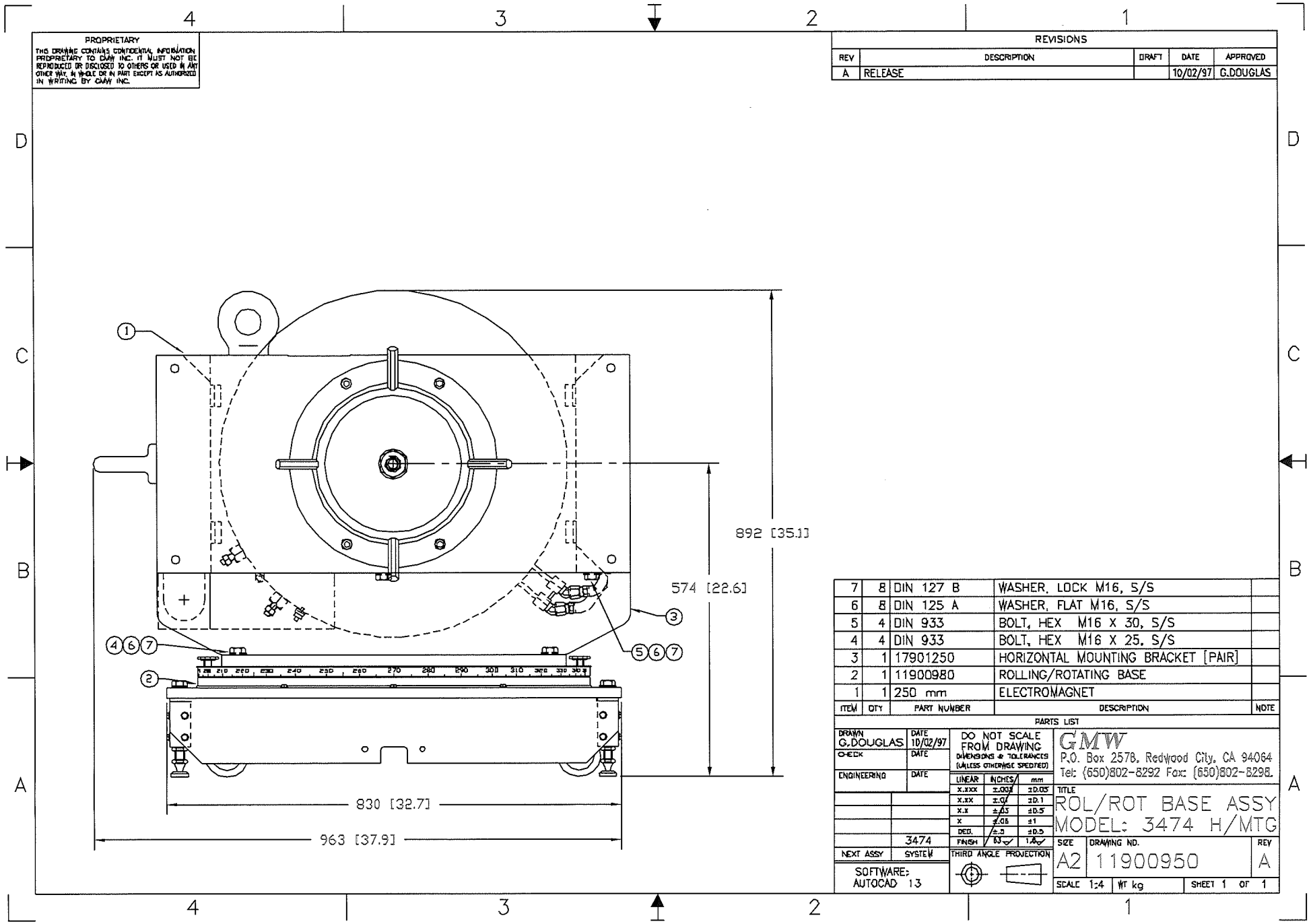
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
6	8	DIN 127 B	WASHER, LOCK M16, S/S	
5	8	DIN 125 A	WASHER, FLAT M16, S/S	
4	8	DIN 933	BOLT, HEX M16 X 30, S/S	
3	2	17801730	45 DEG MOUNTING BRACKET	
2	1	11801800	ROLLING BASE	
1	1	250 mm	ELECTROMAGNET	

PARTS LIST		DRAWN		DATE		DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		TITLE	
ENGINEERING	DATE	G.DOUGLAS	03/03/97	CHECK		DATE		ROLLING BASE ASSEM	
								MODEL:3474 45°MTG	
								SIZE	
								DRAWING NO.	
								REV	
								A2 11900690	
								SCALE 1:4 WT kg SHEET 1 OF 1	

SOFTWARE AUTOCAD 2000

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A	RELEASE		10/02/97	G.DOUGLAS

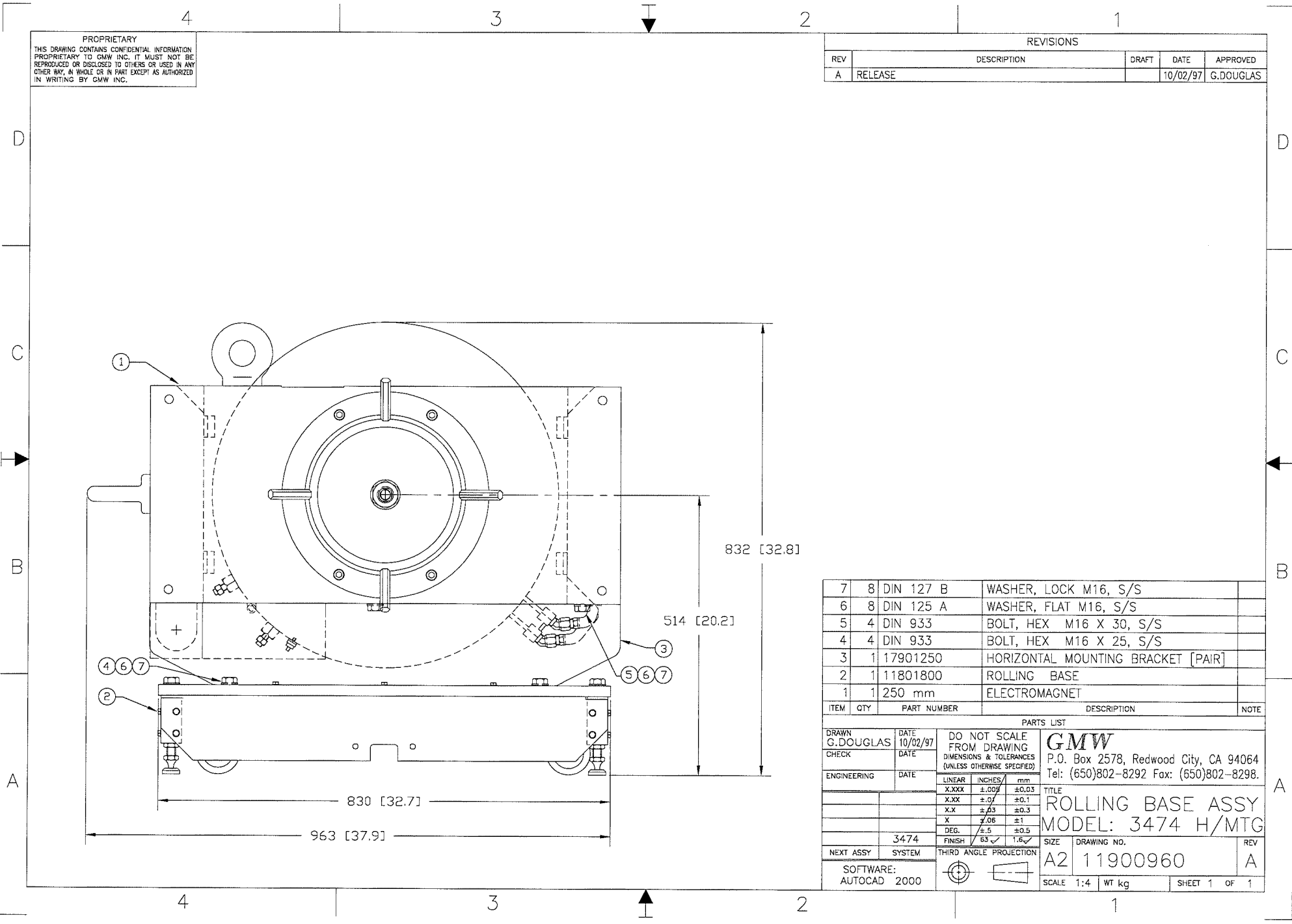


ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
7	8	DIN 127 B	WASHER, LOCK M16, S/S	
6	8	DIN 125 A	WASHER, FLAT M16, S/S	
5	4	DIN 933	BOLT, HEX M16 X 30, S/S	
4	4	DIN 933	BOLT, HEX M16 X 25, S/S	
3	1	17901250	HORIZONTAL MOUNTING BRACKET [PAIR]	
2	1	11900980	ROLLING/ROTATING BASE	
1	1	250 mm	ELECTROMAGNET	

DRAWN		DATE	DO NOT SCALE FROM DRAWING		 P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8292 Fax: (650)802-8298.
G.DOUGLAS		10/02/97	DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		
ENGINEERING	DATE		LINEAR	NICHES/mm	TITLE ROL/ROT BASE ASSY MODEL: 3474 H/MTG SIZE DRAWING NO. A2 11900950 SCALE 1:4 WT kg SHEET 1 OF 1
			X.XXX	±.008 / ±.005	
			X.XX	±.01 / ±.01	
			X.X	±.03 / ±.03	
			X	±.08 / ±.1	
			DEC.	±.5 / ±.5	
	3474		FINISH	1.6 / 1.6	
NEXT ASSY	SYSTEM		THIRD ANGLE PROJECTION		
SOFTWARE: AUTOCAD 13					

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		10/02/97	G.DOUGLAS

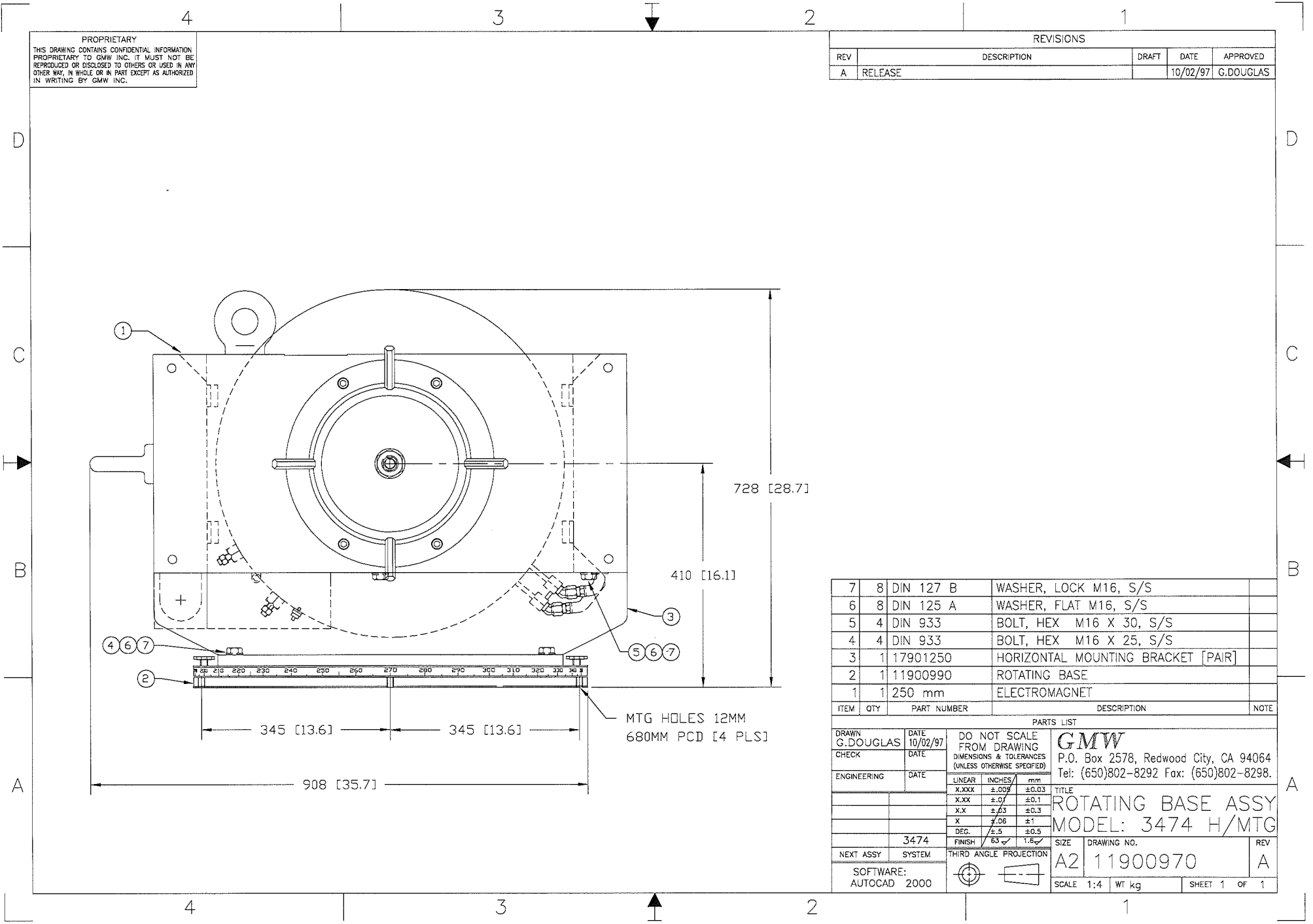


ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
7	8	DIN 127 B	WASHER, LOCK M16, S/S	
6	8	DIN 125 A	WASHER, FLAT M16, S/S	
5	4	DIN 933	BOLT, HEX M16 X 30, S/S	
4	4	DIN 933	BOLT, HEX M16 X 25, S/S	
3	1	17901250	HORIZONTAL MOUNTING BRACKET [PAIR]	
2	1	11801800	ROLLING BASE	
1	1	250 mm	ELECTROMAGNET	

DRAWN		DATE	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	GMW
G.DOUGLAS	10/02/97			
CHECK		DATE	TITLE	
			ROLLING BASE ASSY	
			MODEL: 3474 H/MTG	
ENGINEERING	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
	3474			
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		SIZE
				DRAWING NO.
				A2 11900960
				REV A
SOFTWARE: AUTOCAD 2000				SCALE 1:4 WT kg SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		10/02/97	G.DOUGLAS



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
7	8	DIN 127 B	WASHER, LOCK M16, S/S	
6	8	DIN 125 A	WASHER, FLAT M16, S/S	
5	4	DIN 933	BOLT, HEX M16 X 30, S/S	
4	4	DIN 933	BOLT, HEX M16 X 25, S/S	
3	1	17901250	HORIZONTAL MOUNTING BRACKET [PAIR]	
2	1	11900990	ROTATING BASE	
1	1	250 mm	ELECTROMAGNET	

DRAWN		DATE	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	GMW
G.DOUGLAS	10/02/97			
CHECK	DATE			TITLE
ENGINEERING	DATE			ROTATING BASE ASSY
				MODEL: 3474 H/MTG
				SIZE
				DRAWING NO.
				REV
				A2 11900970 A
				SCALE 1:4 WT kg SHEET 1 OF 1

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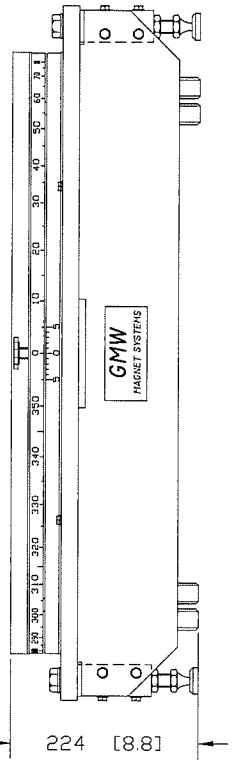
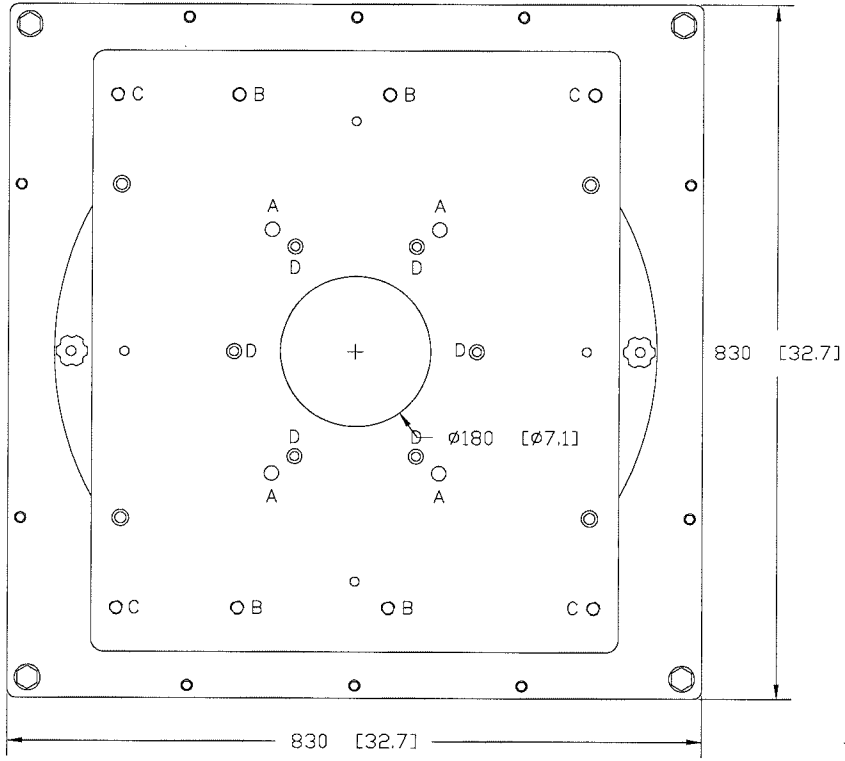
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TOP VIEW

FRONT VIEW

REVISIONS

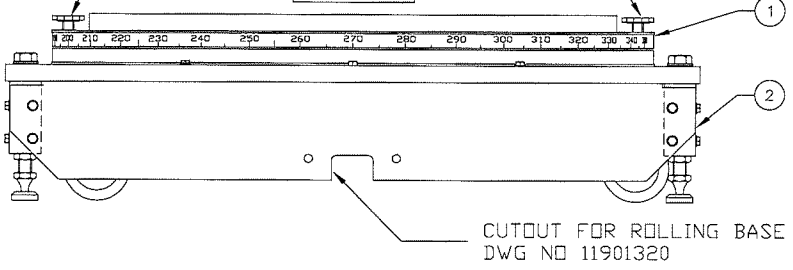
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		11/17/93	G.DOUGLAS
B	ADD NOTE ON ROTATION LOCKS @ B4		08/24/08	G.DOUGLAS



MOUNTING HOLES	
A=	3474 DIRECT MOUNTING
B=	3474 45 DEG MOUNTING
C=	3474 HORZ MOUNTING
D=	MRB SPOOL MOUNTS

ROTATION LOCKS
UNDO TO ALLOW ROTATION
TIGHTEN TO STOP ROTATION

SIDE VIEW

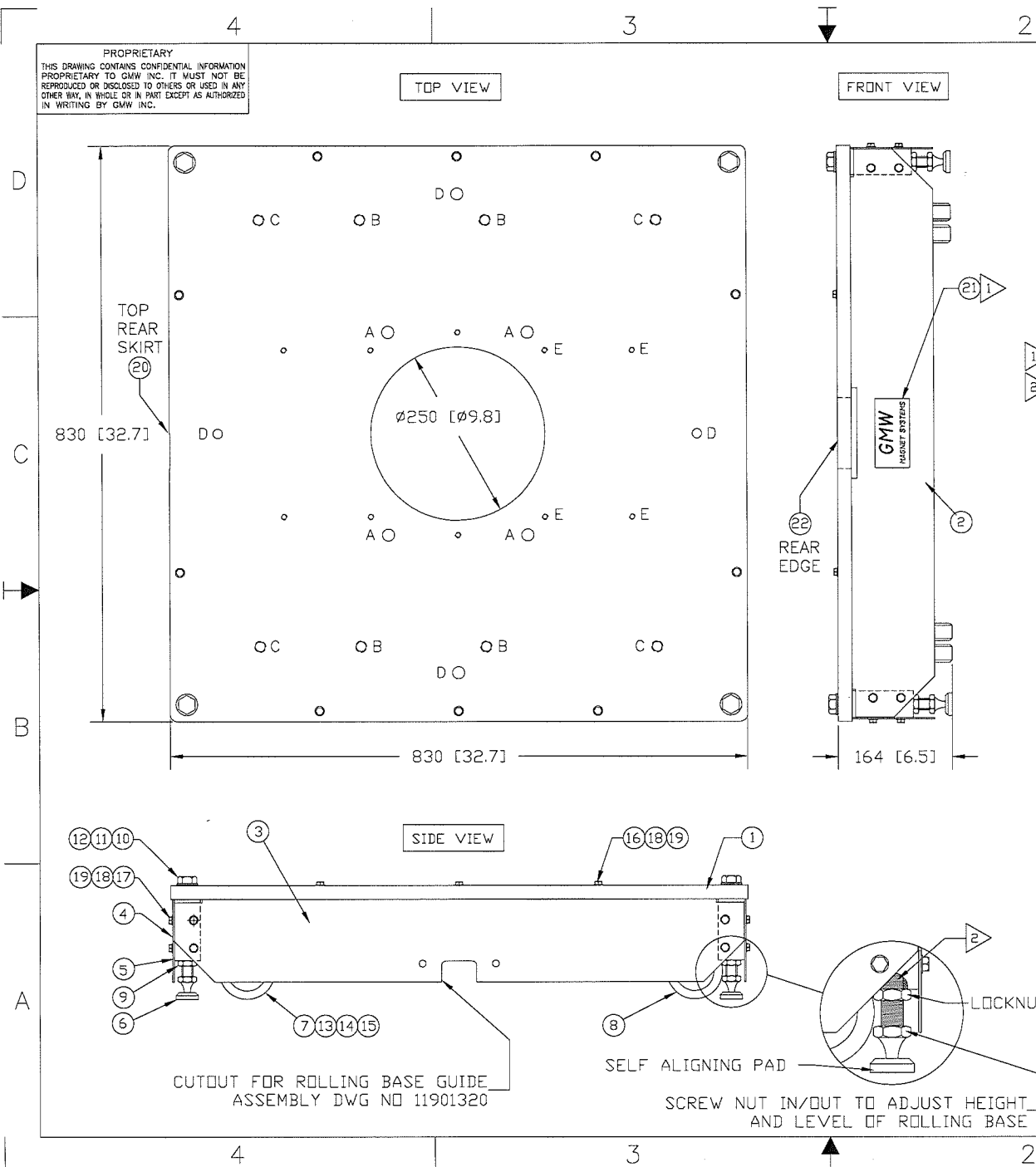


CUTOUT FOR ROLLING BASE GUIDE ASSEMBLY
DWG NO 11901320

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
2	1	11801800	ROLLING BASE ASSY	
1	1	11900990	ROTATING BASE ASSY	

DRAWN		DATE	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.	TITLE
G.DOUGLAS	11/17/93				
ENGINEERING	DATE	FINISH	DEC.	SIZE	DRAWING NO.
		83	1.6	A2	11900980
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	SCALE	WT	kg
SOFTWARE	AUTOCAD 2000		1:4		
				SHEET	1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
B	REDRAWN		12/06/92	A.MARTIN
C	ADD TOP VIEW, HORZ/MTG HOLES "C"		03/04/97	G.DOUGLAS
D	ADD MRD MOUNTING HOLES, CHG PARTS LIST		11/13/97	G.DOUGLAS
E	CHG POSITION OF ITEM 22, ITEMS 7 & 8 NOW FITTED AT B/S		07/21/03	G.DOUGLAS
F	ADD DETAIL @ A2, AND NOTE 2		09/29/08	G.DOUGLAS

MOUNTING HOLES	
A=	3474 DIRECT MOUNTING
B=	3474 45 DEG MOUNTING
C=	3474 HORZ MOUNTING
D=	ROTATING BASE MOUNTING
E=	MRD MOTOR DRIVE MOUNTS

- 1 FIT LABEL ON CENTER LINE 35mm UP FROM BOTTOM OF SKIRT
- 2 APPLY GENERAL PURPOSE GREASE TO INTERNAL THREAD [x4]

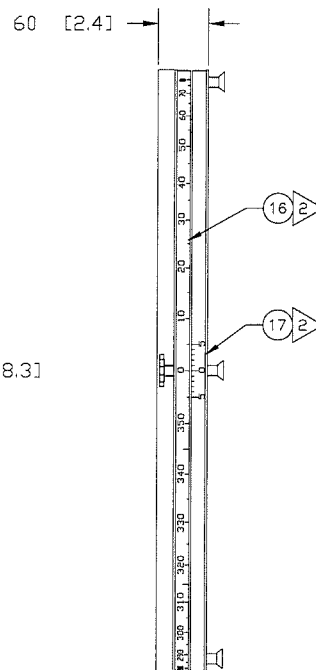
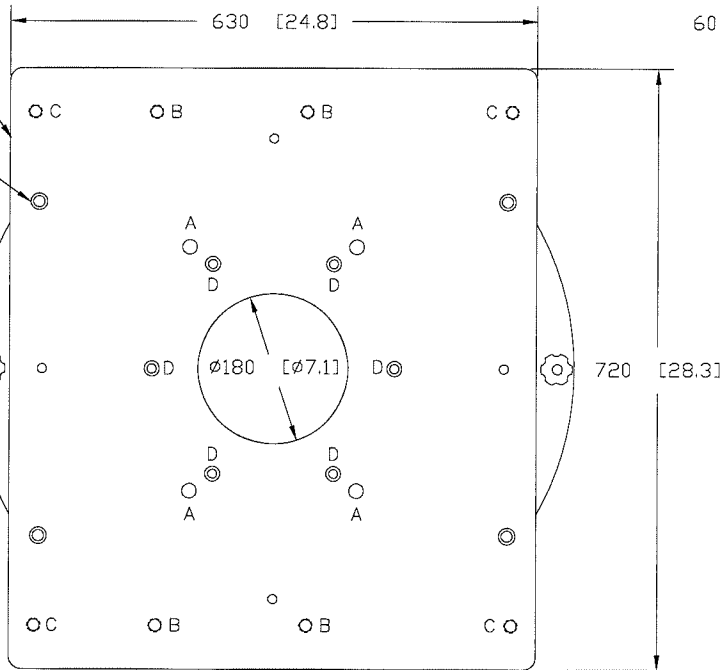
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
22	1	10900210	LABEL, IDENTIFICATION	
21	1	10900200	LABEL, GMW MAGNET SYSTEMS	
20	1	605-677	RUBBER PLUG, 30MM DIA OD R-S	
19	26	DIN 127 B	WASHER, SPRING M6, S/S	
18	26	DIN 125 A	WASHER, FLAT M6, S/S	
17	16	DIN 933	BOLT, HEX M6 X 12, S/S	
16	10	DIN 933	BOLT, HEX M6 X 30, S/S	
15	16	DIN 127 B	WASHER, LOCK M10, S/S	
14	16	DIN 125 A	WASHER, FLAT M10, S/S	
13	16	DIN 933	BOLT, HEX M10 X 20, S/S	
12	4	DIN 127 B	WASHER, LOCK M16, S/S	
11	4	DIN 125 A	WASHER, FLAT M16, S/S	
10	4	DIN 933	BOLT, HEX M16 x 30, S/S	
9	4	DIN 439 B	NUT, M16 HALF S/S	
8	2		CASTER, SWIVEL ALBION 2-72-TM-03101-S	
7	2		CASTER, FIXED ALBION 2-72-TM-013101-R	
6	4	17904540	LEVELING FOOT	
5	4	17801820	SUPPORT LEG	
4	1	17801793	SKIRT PANEL, REAR	
3	2	17801792	SKIRT PANEL, LH & RH SIDE	
2	1	17801791	SKIRT PANEL, FRONT SIDE	
1	1	17801810	BASE PLATE	

PARTS LIST		DRAWING INFORMATION																						
DRAWN	A.MARTIN	DATE	12/06/92																					
CHECK		DATE																						
ENGINEERING		DATE																						
NEXT ASSY		SYSTEM	3474																					
SOFTWARE		AUTOCAD 2000																						
DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		<table border="1"> <tr> <th>LINEAR</th> <th>INCHES</th> <th>mm</th> </tr> <tr> <td>X.XXX</td> <td>±.005</td> <td>±0.13</td> </tr> <tr> <td>X.XX</td> <td>±.01</td> <td>±0.25</td> </tr> <tr> <td>X.X</td> <td>±.03</td> <td>±0.76</td> </tr> <tr> <td>X</td> <td>±.06</td> <td>±1.52</td> </tr> <tr> <td>DEG.</td> <td>±.5</td> <td>±0.13</td> </tr> <tr> <td>FINISH</td> <td>63</td> <td>1.6</td> </tr> </table>		LINEAR	INCHES	mm	X.XXX	±.005	±0.13	X.XX	±.01	±0.25	X.X	±.03	±0.76	X	±.06	±1.52	DEG.	±.5	±0.13	FINISH	63	1.6
LINEAR	INCHES	mm																						
X.XXX	±.005	±0.13																						
X.XX	±.01	±0.25																						
X.X	±.03	±0.76																						
X	±.06	±1.52																						
DEG.	±.5	±0.13																						
FINISH	63	1.6																						
THIRD ANGLE PROJECTION																								
TITLE		GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.																						
TITLE		ROLLING BASE ASSY MODEL: 3474																						
SIZE	A2	DRAWING NO.	11801800																					
SCALE	1:4	WT kg																						
SHEET	1	OF	1																					

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TOP VIEW

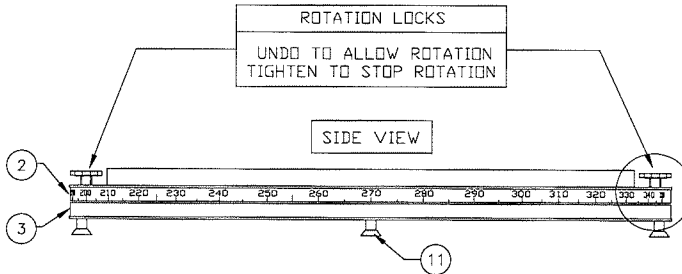
FRONT VIEW



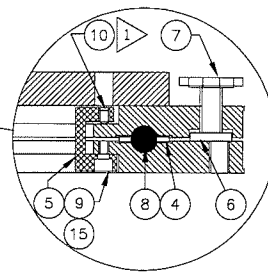
ROTATION LOCKS

UNDO TO ALLOW ROTATION
TIGHTEN TO STOP ROTATION

SIDE VIEW



DETAILED VIEW



SCALE 2:1

NOTES:

- 1 ▷ ADJUST SET SCREW FOR MINIMUM CLEARANCE.
ALLOW FOR ROTATION WITHOUT BINDING, THEN LOCTITE SHSC.
- 2 ▷ FORM LABEL TO RING DIA, CLEAN SURFACE BEFORE FITTING.
- 3 ▷ FIT ITEM 18 DIRECTLY OPPOSITE ITEM 17 ON LOWER THRUST RING.
4. APPLY GREASE TO BEARING SURFACES BEFORE ASSEMBLY.

REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		11/15/93	G.DOUGLAS
B	CHG BALL GROVE AND ITEM 8 FROM 15.00 TO 15.88		07/28/98	G.DOUGLAS
C	ADD ROTATION LOCK NOTE @ B4, DELETE ITEM 14		08/29/08	G.DOUGLAS

MOUNTING HOLES

- A=3474 DIRECT MOUNTING
- B=3474 45 DEG MOUNTING
- C=3474 HORZ MOUNTING
- D= MRB SPOOL MOUNTS

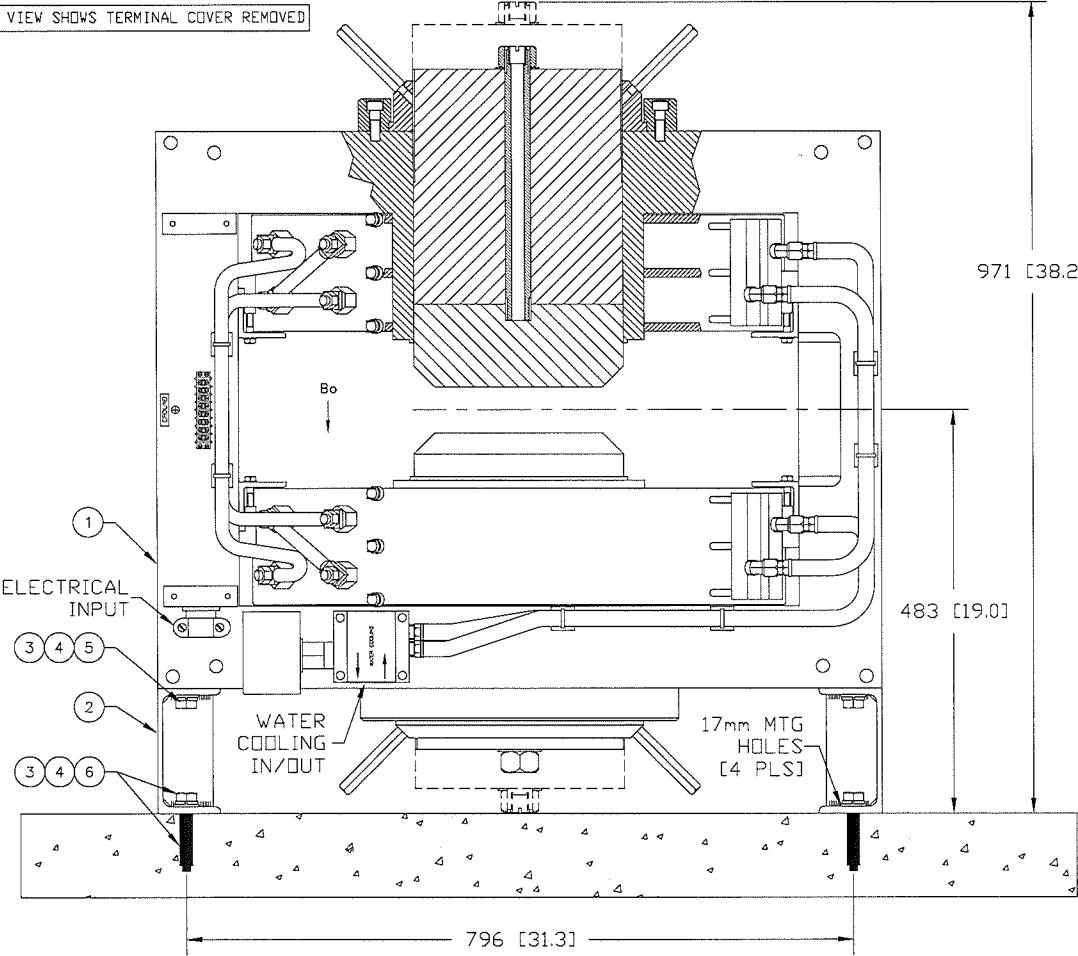
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
18	1	10900140	LABEL, IDENTIFICATION	
17	1	10900130	LABEL, INDEX	2
16	1	10900120	LABEL, GRADUATIONS 0-360°	2
15	4	BN 792	WASHER, M6 INT RIBBED LOCK SP/S	
14			DELETED	
13	4	BN 792	WASHER, M12 INT RIBBED LOCK SP/S	
12	4	DIN 912	SHCS, M12 X 25 S/S	
11	4	DIN 7991	SHCS, M12 X 35 FLAT HEAD S/S	
10	4	DIN 916 A2	SHSS, M6 X 8 OVAL POINT S/S	1
9	4	DIN 912	SHCS, M6 X 10 S/S	
8	64	RB-15.875	BALL BEARING, 15.88MM DIA, [5/8"]SKF	
7	2	17802170	HANDWHEEL, M10	
6	2	17901330	CLAMP PAD	
5	4	17802150	RETAINING CLAMP	
4	1	17901320	BEARING SPACER	
3	1	17901312	LOWER THRUST RING	
2	1	17901311	UPPER THRUST RING	
1	1	17901300	TRANSITION PLATE	

PARTS LIST		PARTS LIST	
DRAWN G.DOUGLAS	DATE 11/15/93	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	TITLE GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.
CHECK	DATE	LINEAR	INCHES
ENGINEERING	DATE	X.XXX	±.008
		X.XX	±.01
		X.X	±.03
		X	±.08
		DEC.	±.5
		FINISH	8.3
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	SIZE
SOFTWARE AUTOCAD 2000			DRAWING NO. A2 11900990
			SCALE 1:4 WT kg
			SHEET 1 OF 1

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ELECTROMAGNET REAR VIEW

VIEW SHOWS TERMINAL COVER REMOVED



HOLE PATTERN
FOR
VERTICAL MOUNTING

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/27/97	G.DOUGLAS
B	ADD REAR YOKE CUTOUT, MOVE WATER HOSES		08/25/99	G.DOUGLAS

6	4		BOLT, M16 or 5/8" EXPANSION	
5	4	DIN 933	BOLT, M16 x 35 HEX HD S/S	
4	8	DIN 127 B	WASHER, M16 SPRING LOCK, S/S	
3	8	DIN 125 A	WASHER, M16 FLAT, S/S	
2	2	17802690	VERTICAL MOUNTING BRACKET	
1	1	3474	ELECTROMAGNET, 250 mm	

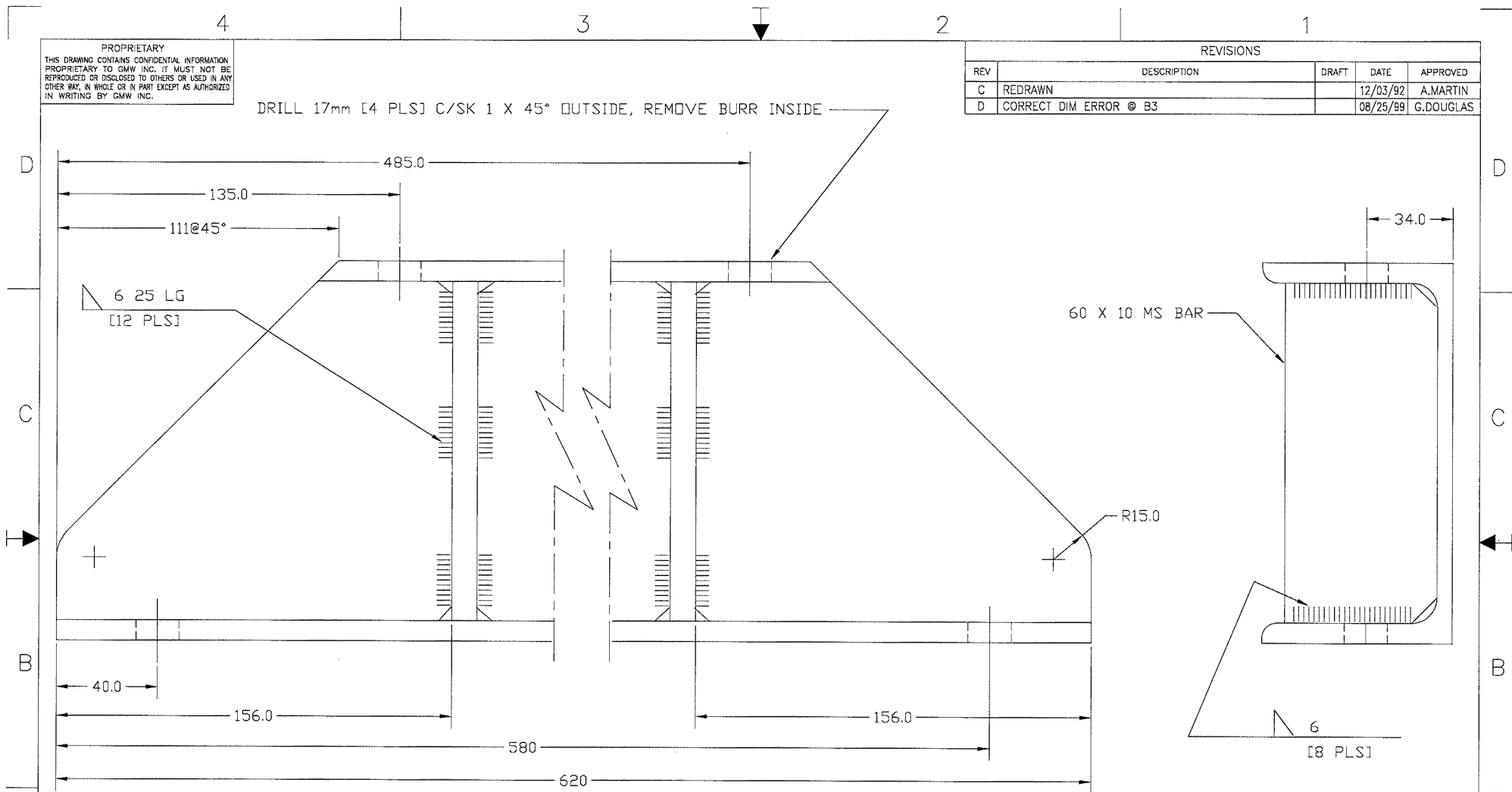
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN G.DOUGLAS	DATE 02/27/97	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		
CHECK	DATE	GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802-8292. Fax: (650)802-8298.		
ENGINEERING	DATE	TITLE VERTICAL MTG ASSY MODEL: 3474		
		3474	SIZE A2	DRAWING NO. 11900490
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		
SOFTWARE AUTOCAD 2000		SCALE 1:4 WT kg SHEET 1 OF 1		

*** WARNING ***
WHEN THE 3474 ELECTROMAGNET IS VERTICALLY MOUNTED
IT MUST BE BOLTED TO THE FLOOR SECURELY AS SHOWN.

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
C	REDRAWN		12/03/92	A.MARTIN
D	CORRECT DIM ERROR @ B3		08/25/99	G.DOUGLAS

DRILL 17mm [4 PLS] C/SK 1 X 45° OUTSIDE, REMOVE BURR INSIDE



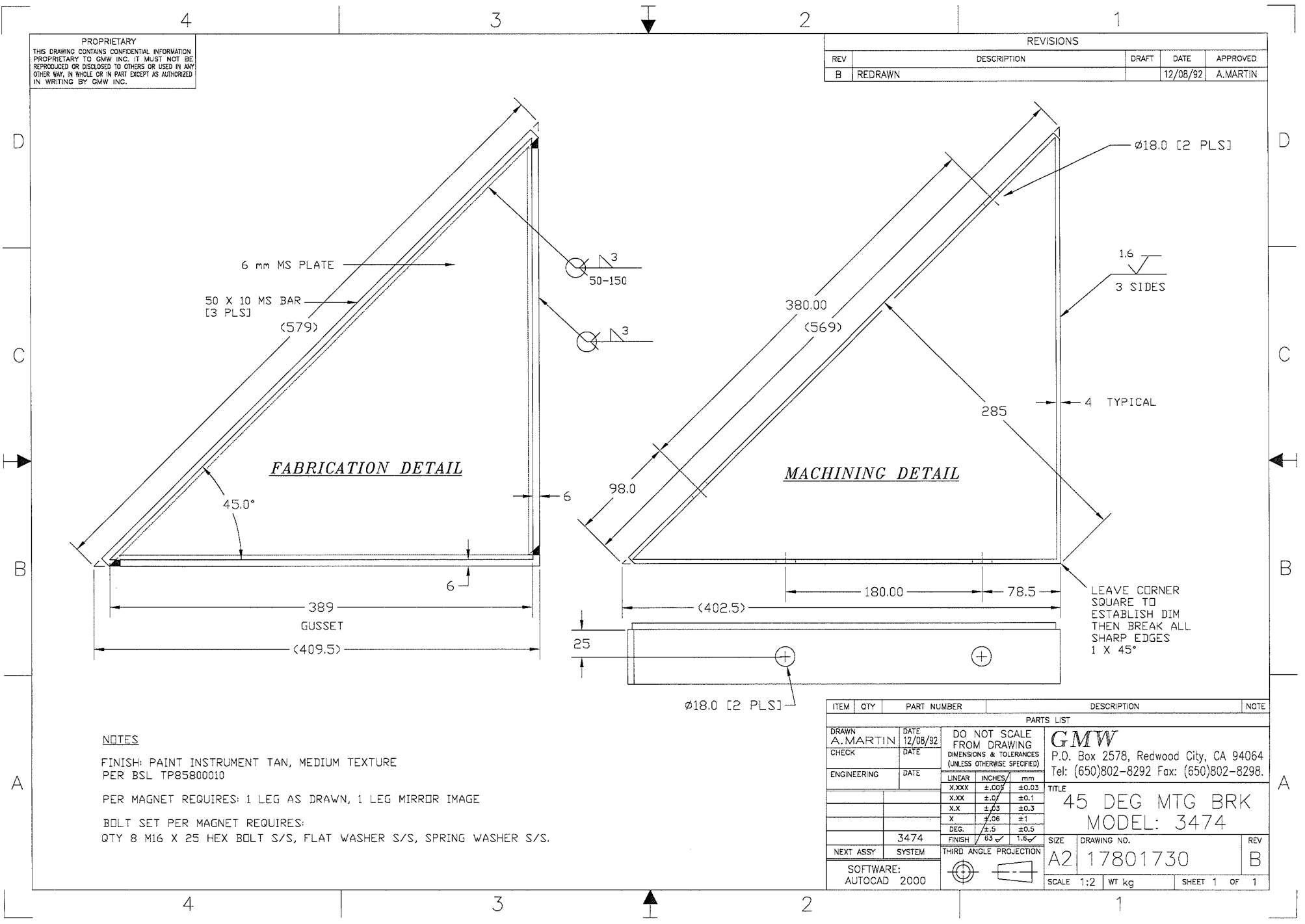
NOTE:

1. MATL. 150 x 75 M.S CHANNEL
2. BREAK ALL SHARP EDGES 0.2mm
3. PAINT 2 COATS POLANE T INSTRUMENT TAN, MEDIUM TEXTURE TO BSL TP85800010
4. TWO BRACKETS REQD PER MAGNET

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN A.MARTIN		DATE 12/03/92	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
CHECK		DATE		
ENGINEERING		DATE	GMW P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8292 Fax: (650)802-8298.	
LINEAR		INCHES/ mm		
X.XXX		±.005 ±0.03		
X.XX		±.01 ±0.1		
X.X		±.03 ±0.3		
X		±.08 ±1		
DEC.		±.5 ±0.5		
FINISH		63 ✓ 1.6 ✓		
NEXT ASSY		SYSTEM	THIRD ANGLE PROJECTION	
SOFTWARE: AUTOCAD 13		TITLE VERT MTG BRACKET MODEL: 3474		REV D
SCALE 1:1		WT kg	SHEET 1 OF 1	

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
B	REDRAWN		12/08/92	A.MARTIN



FABRICATION DETAIL

MACHINING DETAIL

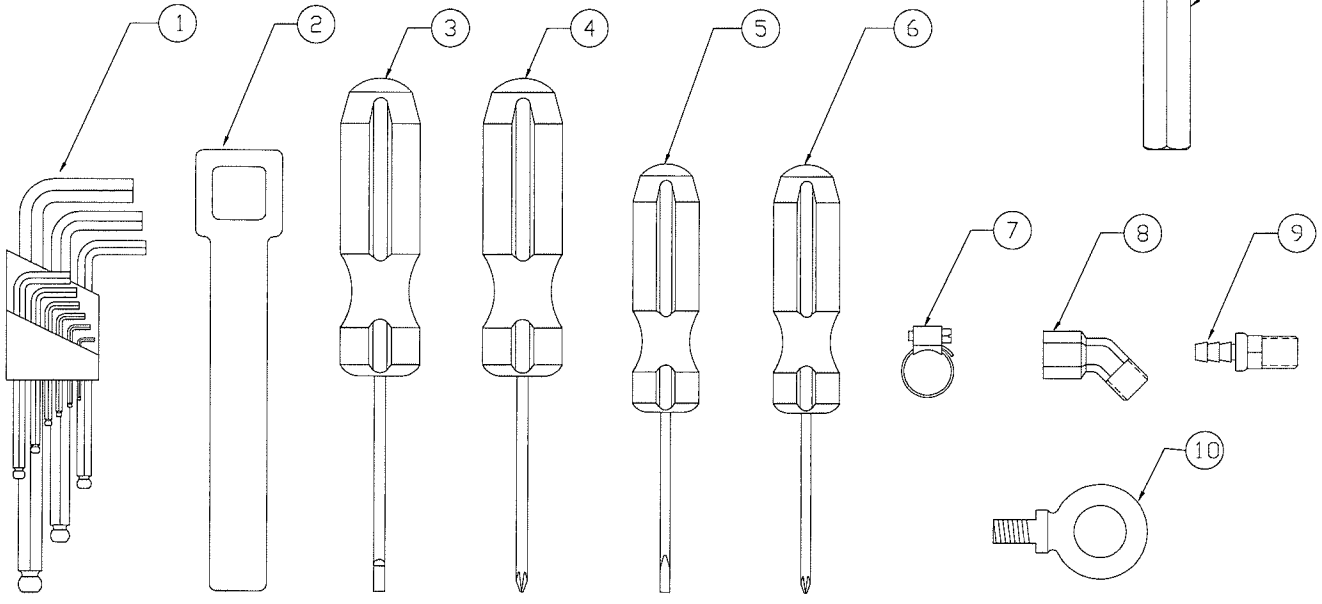
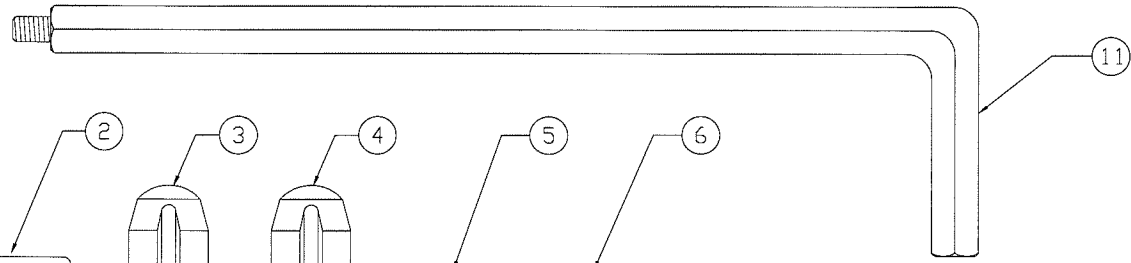
NOTES
 FINISH: PAINT INSTRUMENT TAN, MEDIUM TEXTURE
 PER BSL TP85800010
 PER MAGNET REQUIRES: 1 LEG AS DRAWN, 1 LEG MIRROR IMAGE
 BOLT SET PER MAGNET REQUIRES:
 QTY 8 M16 X 25 HEX BOLT S/S, FLAT WASHER S/S, SPRING WASHER S/S.

LEAVE CORNER
 SQUARE TO
 ESTABLISH DIM
 THEN BREAK ALL
 SHARP EDGES
 1 X 45°

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN A.MARTIN	DATE 12/08/92	DO NOT SCALE FROM DRAWING		GMW P.O. Box 2578, Redwood City, CA 94064 Tel: (650)802-8292 Fax: (650)802-8298.
CHECK	DATE	DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		
ENGINEERING	DATE	LINEAR	INCHES / mm	TITLE
		X.XXX	±.005 / ±0.03	45 DEG MTG BRK MODEL: 3474
		X.XX	±.07 / ±0.1	
		X.X	±.03 / ±0.3	
		X	±.06 / ±1	
		DEG.	±.5 / ±0.5	
		FINISH	63 / 1.6	SIZE
	3474	SYSTEM	THIRD ANGLE PROJECTION	DRAWING NO.
NEXT ASSY				A2 17801730
SOFTWARE: AUTOCAD 2000				REV B
				SCALE 1:2 WT kg SHEET 1 OF 1

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		02/25/97	G.DOUGLAS

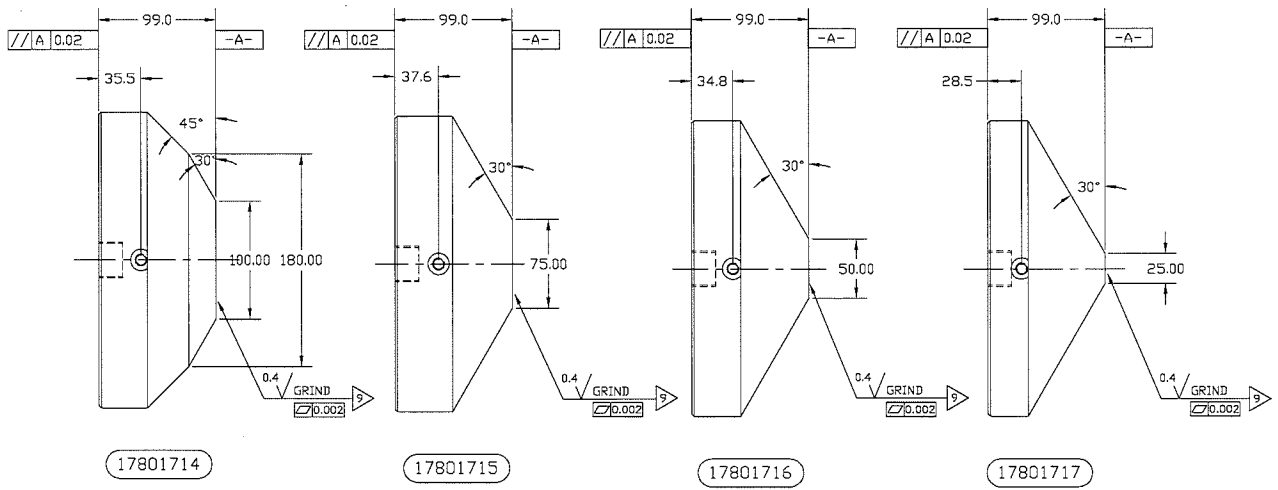
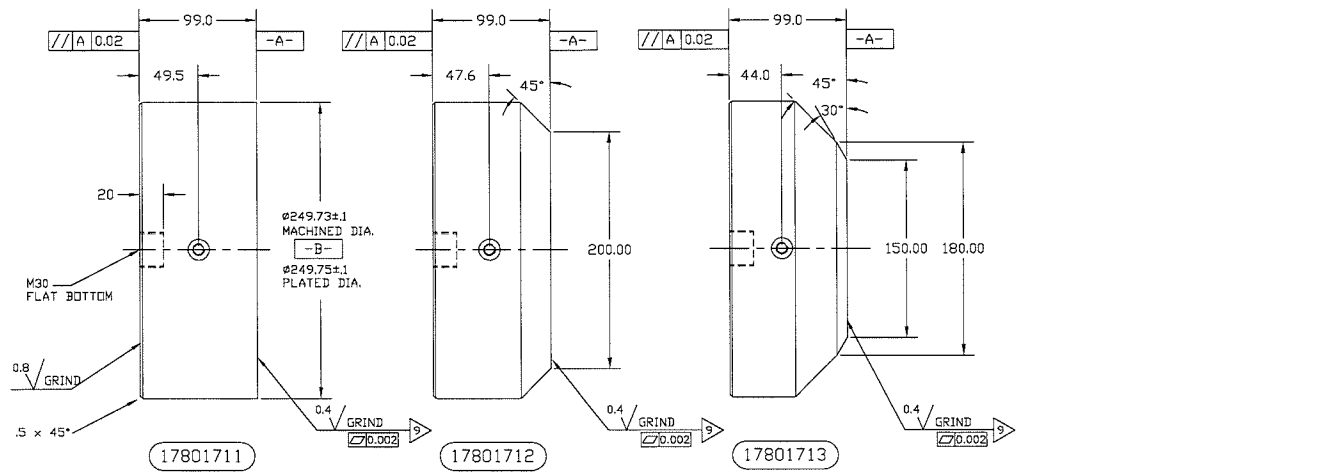
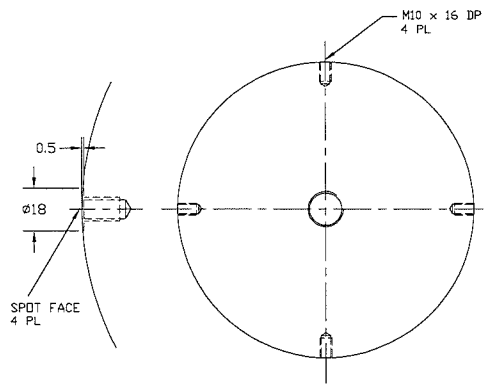


ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
13	1	V701	STORAGE BOX, PLASTIC. FLAMBEAU	
12	1		LABEL, TOOL KIT	
11	2	17900010	POLE CAP REMOVAL TOOL	
10	2	DIN 580	EYE BOLT, M33	
9	2	KA08-06MB	HOSE COUPLING, 1/2"ID, BRASS, 3/8NPT	
8	2	124-B-06	ELBOW, 45°, BRASS 3/8NPT. IE	
7	2	350-006	HOSE CLIP, TRIDON	
6	1	62-021	SCREWDRIVER, PHILLIPS, STANLEY	
5	1	62-133	SCREWDRIVER, SLOTTED, STANLEY	
4	1	62-022	SCREWDRIVER, PHILLIPS, STANLEY	
3	1	62-036	SCREWDRIVER, SLOTTED, STANLEY	
2	1	117802840	WRENCH, POLE CAP RETAINING BOLT	
1	1	BLX 9mm	HEX KEY WRENCH SET, BONDHUS	

DRAWN		DATE		DO NOT SCALE		GMW	
G.DOUGLAS	02/25/97	FROM DRAWING		955 Industrial Rd, San Carlos, CA 94070			
CHECK		DATE		Tel: (650)802-8292, Fax: (650)802-8298.			
ENGINEERING		DATE		TITLE			
				TOOL KIT			
				MODEL: 3474			
11801602	3474			SIZE	DRAWING NO.	REV	
11801601	3474			A1	18900010	A	
11801600	3474			SCALE	1:1	WT kg	SHEET 1 OF 1
NEXT ASSY							
SOFTWARE							
AUTOCAD 13							

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REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
E	REDRAWN		12/06/92	A.MARTIN
F	CHG SURFACE FINISH, TOLERANCE AND NOTES.		10/26/00	G.DOUGLAS



- NOTES**
1. MATERIAL: 1006 LOW CARBON STEEL PLATE.
 2. POLE PIECES FOR EACH PRODUCTION RUN ARE TO BE CUT FROM THE SAME RAW PLATE AND SAME PROXIMITY
 3. ROUGH MACHINE TO $\phi 255$ PRIOR TO HEAT TREATMENT.
 4. ANY VOID, LAMINATION, OR OTHER SUCH DEFECT WHICH BECOME APPARENT DURING MACHINING WILL BE CAUSE TO REJECT THE PART.
 5. ANNEAL TO BSL TP85800040.
 6. BREAK ALL SHARP CORNERS 0.2 MAX UNLESS OTHERWISE STATED.
 7. STAMP BACK FACE WITH S/NO AS DIRECTED.
 8. SURFACE GRIND BOTH POLE FACES. GRIND POLE FRONT FACE LAST, TO AVOID SCRATCHING, OR SURFACE DAMAGE.
 9. "ELECTROCLEAN ONLY AFTER GRINDING" TO BSL 85800120 DO NOT BEAD BLAST, OR ORBITAL SAND SURFACES.
 10. FINISH: EN PLATE 0.01 THICK TO BSL TP85800120.

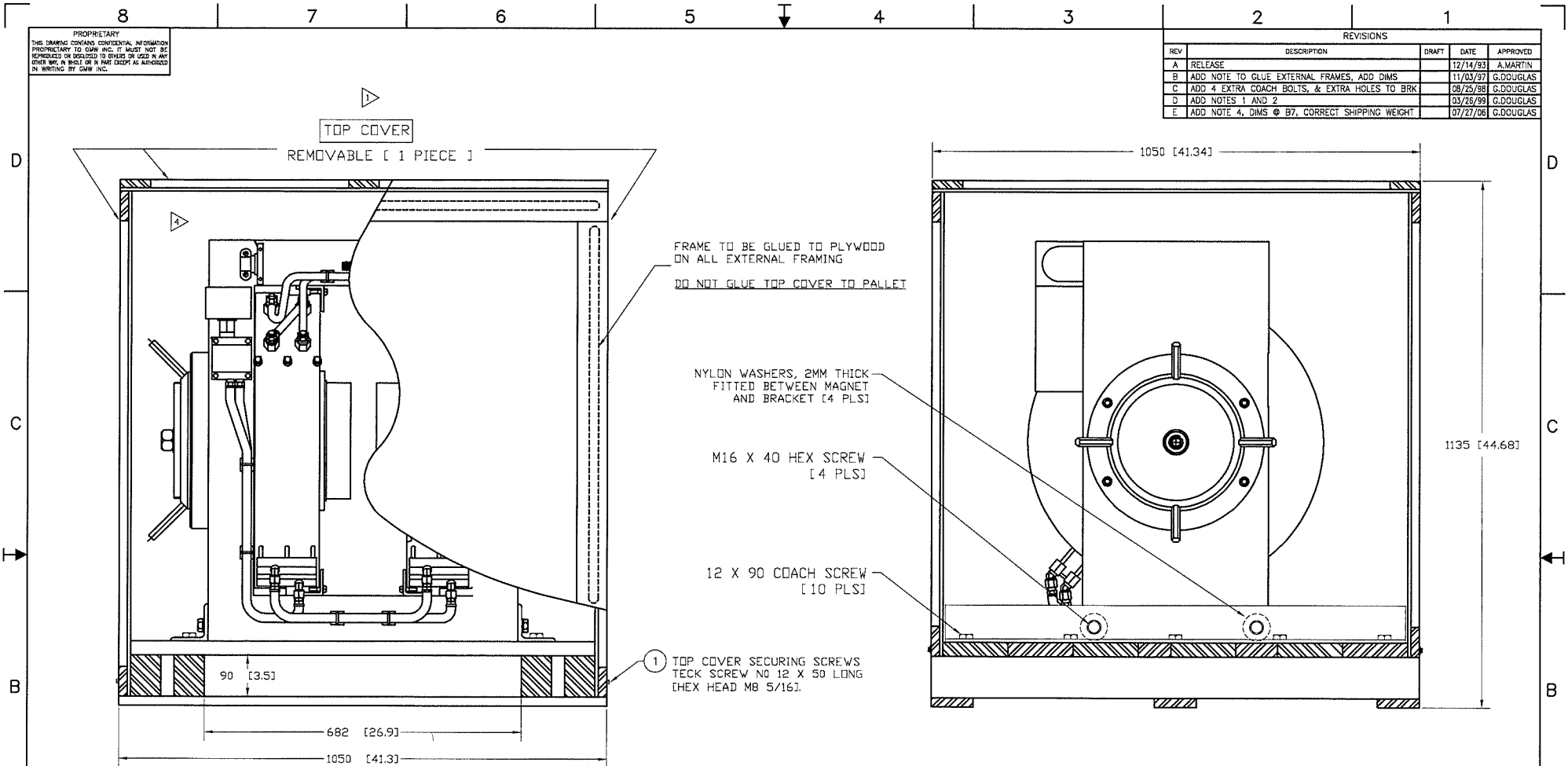
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN A.MARTIN		DATE 12/05/92	DO NOT SCALE FROM DRAWING	
CHECK		DATE	ENGINEERING & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
ENGINEERING		DATE	TITLE	
			LINEAR	ANGLES
			XXX ±.02	±0.03
			XXX ±.03	±0.1
			X ±.03	±0.3
			X ±.08	±1
			FINISH	83
11801600	3474		SIZE	DRAWING NO.
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	A1	17801710
SOFTWARE AUTOCAD 2000			SCALE 1:2	WT kg
			SHEET 1	OF 1

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

**POLE CAPS
MODEL: 3474**

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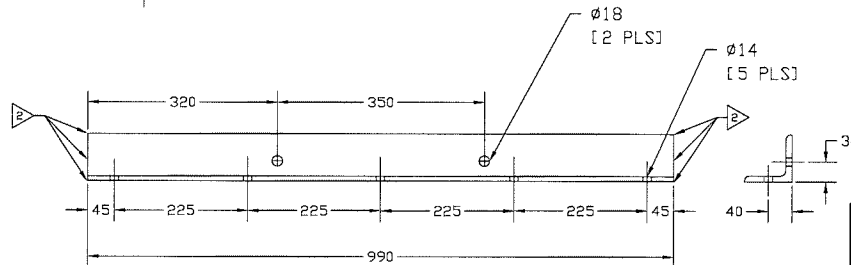
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		12/14/93	A.MARTIN
B	ADD NOTE TO GLUE EXTERNAL FRAMES, ADD DIMS		11/03/97	G.DOUGLAS
C	ADD 4 EXTRA COACH BOLTS, & EXTRA HOLES TO BRK		08/25/98	G.DOUGLAS
D	ADD NOTES 1 AND 2		03/28/99	G.DOUGLAS
E	ADD NOTE 4, DIMS @ B7, CORRECT SHIPPING WEIGHT		07/27/06	G.DOUGLAS



- NOTE:
- 1 THE 3474 SHIPPING CRATE HAS A ONE PIECE TOP COVER
 - 2 REMOVE ALL SHARP EDGES 0.5mm
 - 3 MAGNET VIEW & WEIGHT GIVEN FOR 250mm POLE CAPS FITTED.
 - 4 WRAP MAGNET WITH 0.125mm THICK PLASTIC SHEET
PLACE SILICA GEL PACK NORDIC DESICCANT BAG
250-NPD-2501001141 INSIDE PLASTIC WRAP, SEAL SIDES
SEAMS OF PLASTIC WRAP WITH HEAT GUN SO THAT MAGNET
AND SILICA GEL PACK IS COMPLETELY SEALED INSIDE.

TOP COVER REMOVAL

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



MAGNET MOUNTING BRACKET [2 REQ]

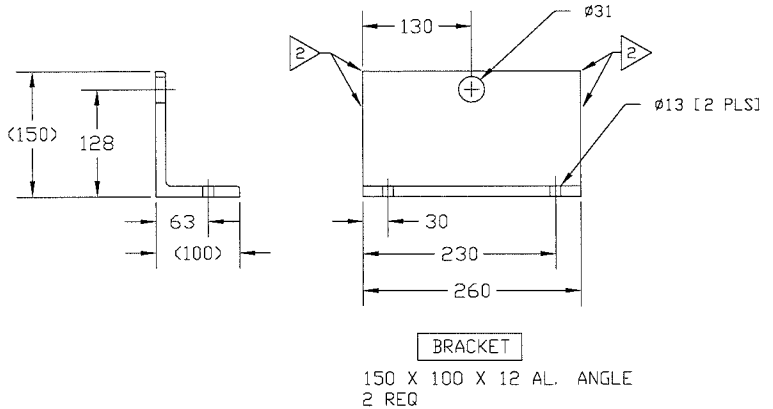
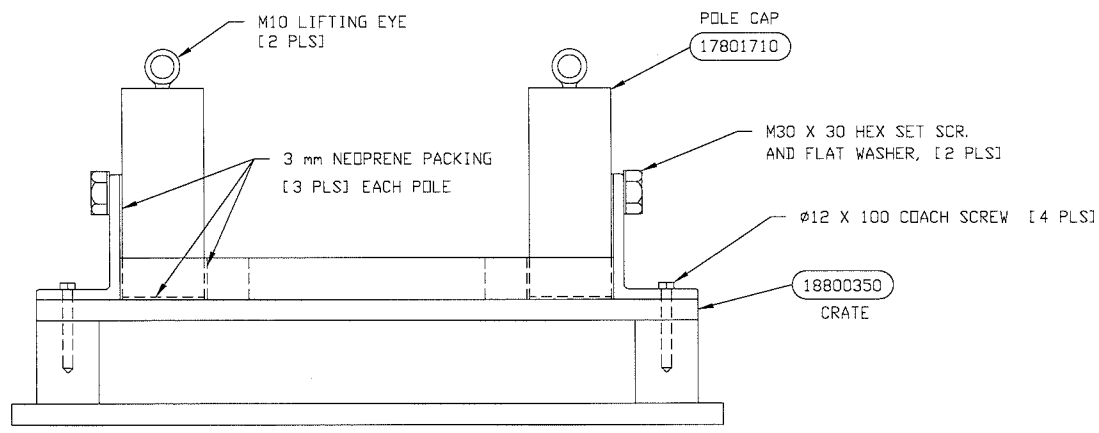
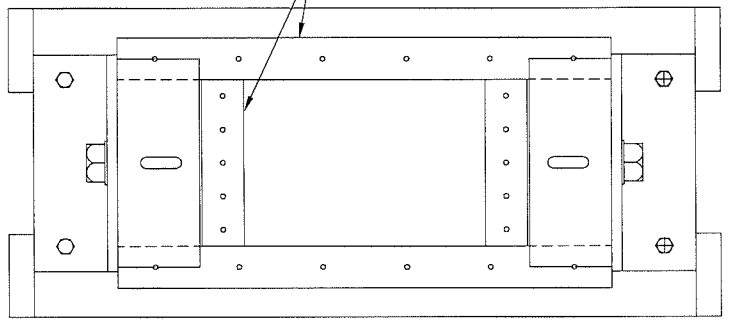
SHIPPING WEIGHT: 1675 kg (3685 lb) ③

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN		DATE	DO NOT SCALE FROM DRAWING	
A.MARTIN		12/14/93	DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
CHECK		DATE		
ENGINEERING		DATE		
		LINEAR	ANGLES	FINISH
		XXX	±.01	Ø.03
		XXX	±.02	Ø.03
		X	±.05	Ø.03
		DEL	±.05	Ø.03
		FINISH	Ø.03	Ø.03
NEXT ASSY		SYSTEM	THIRD ANGLE PROJECTION	
SOFTWARE				
AUTOCAD 2000				
TITLE		SIZE	DRAWING NO.	REV
GMW		A1	18800191	E
955 Industrial Rd, San Carlos, CA 94070		SCALE 1:4 WT kg SHEET 1 OF 1		
Tel: (650)802-8292. Fax: (650)802-8298.				
MODEL: 3474				

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50 X 50 TIMBER
[4 PLS] NAIL TO PALLET

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		11/01/94	A.MARTIN
B	ADD NOTE 2		08/23/99	G.DOUGLAS



NOTE:
1 THE 3474 POLE PACKING CRATE HAS A ONE PIECE COVER
2 REMOVE ALL SHARP EDGES 0.2mm

COVER REMOVAL:
1. REMOVE THE COVER SECURING SCREWS [NOT SHOWN]
2. GRIP THE COVER AT THE TOP LH AND RH CORNERS [NOT SHOWN]
3. LIFT THE COVER VERTICALLY HIGH ENOUGH TO CLEAR THE POLE CAPS
4. MOVE THE COVER SIDWAYS AND PLACE ON FLOOR

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DRAWN A.MARTIN	DATE 11/01/94	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			
ENGINEERING	DATE			TITLE PACKING CRATE 3474 POLE CAP PAIR
		LINEAR	INCHES/mm	SIZE A2 18800430
		X.XXX	±.005 ±0.03	REV B
		X.XX	±.01 ±0.1	SCALE 1:4 WT kg SHEET 1 OF 1
		X.X	±.03 ±0.3	
		X	±.08 ±1	
		DEC	±.5 ±0.5	
	3474	FINISH	63 ✓ 1.6 ✓	
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION		
SOFTWARE AUTOCAD 2000				