

Department **PHYSICS**
Subject **WANG DIPOLE**
Name **SCOT L. SPIEGEL**
Address **CEBAF / HALL A**

National® Brand

Computation Notebook

11 3/4" x 9 1/4", 4 x 4 Quad., 75 Sheets

43-648



0 73333 43648 8



**AVERY
DENNISON**

Office Products
Chicopee, MA 01022

WANG CIRCUIT CARD VOLTAGE CONDITIONER

1)	V LAI +	0.5 VDC	V LA =	+ 5.00
	V LAI -	0 VDC	V LAO =	+ 5.00
	V LAI +	0 VDC	V LA =	- 5.00
	V LAI -	0.5 VDC	V LAO =	- 5.00
2)	V LBI +	0.5 VDC	V LB =	+ 5.00
	V LBI -	0 VDC	V LBO =	+ 5.00
	V LBI +	0 VDC	V LB =	- 5.00
	V LBI -	0.5 VDC	V LBO =	- 5.00

CLAUDE LAMONT
SACLO.

011-33-169084466

WANG CIRCUIT CARD VOLTAGE CONDITIONER

1)	VMBI+	2.5VDC	VMD+	=	-4.78
			VMT0	=	-2.61
	VMBI-	0VDC	VMD-	=	+4.79
			VMD0	=	-4.78
	VMBI+	0VDC	VMD+	=	+5.27
			VMT0	=	+2.35
	VMBI-	2.5VDC	VMD-	=	-5.28
			VMD0	=	+5.27
2)	VMAI+	2.5VDC	VMD+	=	+4.82
			VMT0	=	-2.50
	VMAI-	0VDC	VMD-	=	-4.80
			VMD0	=	+4.79
	VMAI+	0VDC	VMD+	=	-4.86
			VMT0	=	+2.48
	VMAI-	2.5VDC	VMD-	=	+4.87
			VMD0	=	-4.86

WANG QUENCH PROTECTION

INPUT SIGNALS AT J11

PIN 5	VLAP	70mV	+ LEAD voltage (QUENCH)
PIN 4	VLAN	0V	
PIN 9	VLBP	70mV	- LEAD voltage (QUENCH)
PIN 8	VLBN	0V	
PIN 13	VMAP	1.125V	QUENCH A
PIN 12	VMAN	0V	
PIN 17	VMBP	1.125V	QUENCH B
PIN 16	VMBN	0V	

WANG
INTERLOCKS
CHASSIS

4/2/96

NOTE: (DYNAPOWER)

THE "CROW-BAR" OVER-CURRENT PROTECTION CIRCUIT WAS SET AT .174 VDC. WE RESET THE "SET" VOLTAGE TO .05 VDC.

Reset to 4V after supply turned on.

- 1040 checking power supply over current trip.
Tripped at 500A
- 1120 disconnected connection at magnet cable inter-lab trip and a fast clump
- 1120 Leads are polarity sensitive. They do not work in a bipolar way.

If you ever change polarity of magnet the lead voltage detector polarity must be changed at the same time.

4/3/96

Emergency trip check # PD 171

9.00 Put test voltage at back J1
coil A plug term. 12 ϵ 13⁺ 1.25 V trip $\checkmark$
B 16 ϵ 17⁺ 1.1 " "
B 17⁺ ϵ 16⁻ 1.28 " "
A 12⁺ ϵ 13⁻ 1.20 " $\checkmark$

Repeat trip check

Yumpok 12 to 17

coil A plug term 12 ϵ 13⁺ 0.737 V trip $\checkmark$
B 12 ϵ 16 1.29 " "
Coil A 0.70 V trip
B 1.1 V trip

$$V = L \frac{dI}{dt}$$

$$1 \text{ volt} = 2.5 \text{ H} \cdot \frac{dI}{dt}$$

$$\frac{1}{2.5 \text{ H}} = \frac{dI}{dt}$$

$V = L$

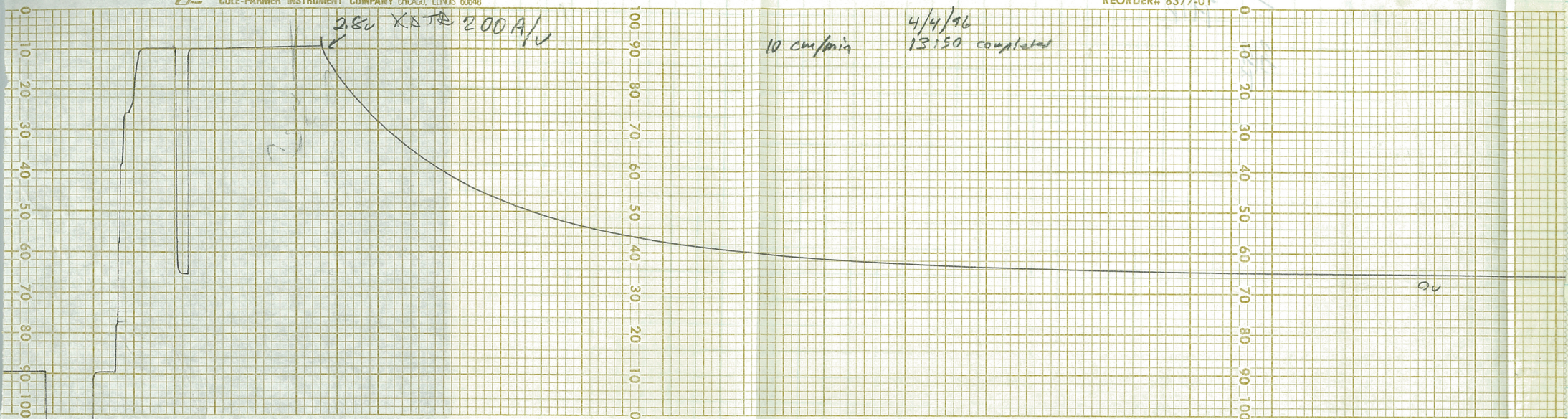
$1 \text{ mlt} = 2.5$

$2.5 \text{ H} =$

REORDER# 8377-01

4/4/96
13:50 completed

10 cm/min



Lee

1200

1230

1240

1300

13:20

14:30 A.D.

1550

Wednesday. 4/3/96

Lead A - 72 mV. Trip
Lead B - 73 mV.

Thursday.

1200 Connected up leads.
set up lead flow.
90 SLPM A 175 SLPM B.
1 1/2 turns. 3/4 mins

level 40% Trip actual 60%.
all interlocks cleared.

Commenced pouring magnet.
removed jumper on cryo
set ground interlock to supply
to off.

1230 Started pouring. Charging at
1V ~ 3A / Silicon.

1240 Set charging voltage to 2V.

1300 Controlling at ~ 480 A
going to 600 A.

1320 @ 560 A, $V = 0.45$ Regularly

1430 A-lead flow trip $\rightarrow$ fast dump full 1K
reset and start again to 600 A

1550 made artificial fast dump by
removing interlock connection
on power supply.

max voltage ~ 6V.? @ 562 A.

Lead A fault noted - probably
due to fast dump.

4-5-96 Friday

PD171 1050

Turned on deple-
2V to charging 200 A
set load flow trip to 30 SCRM.
running at 50+ SCRM.
load about 60%.

Changed switch to "on" which puts
in the precision transducer. The remote
current sense is a misnomer. Had to
change name plate. Also 10 turn pot not
agreed with current settings.

Continuing at 200 A.

1202. Installed slow dump by
charging local to remote switch.

1205. Installed fast dump by removing
interlock cable connector.

1340 Turned on deple
2V charging 300 A.

1440 Set for 400 A.

1745 Tripped on load A flow.
Reset set point to 60 SCRM trip.
Fast dump. System works.

Reset flow trip back to 30 SCRM trip
on loads A & B. Looked out panel.

4/5/96

11.15AM

Q3

Megger AC in ∞ V

DC out + magnet lolol
 all electronics modules out at
 250 VDC ~~PS~~ + magnet $\approx 20k\Omega$ V
 water on, dump $\frac{1}{2}$ in.

13.40

PQ371

Control Pwd on.

4/6/96

NOTE - DO NOT TURN ON Q2 OR Q3 POWER SUPPLIES!

I STARTED CHECKING THE PROTECTION CIRCUITS ON Q3 BY DOUBLE CHECKING THE INTERCABLING AND OUR SOURCE JUMPERS AT THE CRYOSTAT. I FOUND AN ERROR IN OUR CABLES - (IT IS MY FAULT) - THE VOLTAGE TAPS VT1 AND VT5, WHICH COME THROUGH THE FLAG HEATER CABLES/CONNECTORS, ARE CONNECTED TO THE ISOLATED HEATER BLOCKS RATHER THAN TO THE LEAD FLAGS. THE CRYOSTAT WIRING ON THE LEAD FLAG HEATERS, WHICH IS AN EXTERNAL HARNESS, MUST BE RE-WIRED TO BRING THE VOLTAGE TAPS VT1 AND VT5 AWAY FROM THE HEATER BLOCKS AND TO THE LEAD FLAGS. ALSO, THE HEATER BLOCK ON VT-5 IS NOT ISOLATED FROM THE FLAG AND THE ELECTRICALLY INSULATING/THERMALLY CONDUCTIVE MATERIAL WRAPPING THE HEATER BLOCK MUST BE REPAIRED.

OUR JUMPER HARNESS ON THE CRYOSTAT CONNECTOR WAS INVERTED ON THE CABLE-END PLUG. ^{AND 1 WIRE WAS TOUCHING $\frac{1}{2}$} THE INTERLOCK WIRE, WHICH IS ON PIN 4, WAS SWAPPED WITH PIN 1, AND PINS 2 AND 3 WERE ALSO SWAPPED. IF YOU HAVE THIS CONFIGURATION YOU WILL SEE 120~140 K Ω BETWEEN VT3 AND VT4 ON THE INSTRUMENTATION RACK TEST POINTS, WHICH APPEARS CORRECT; BUT READING FROM VT3 TO VT2 YOU WILL SEE AN OPEN CIRCUIT, AND THE "INTERLOCK" FAULT LIGHT ON THE FUG WILL NOT EXTINGUISH.

WHEN I CORRECTED THE JUMPER HARNESS, THE "INTERLOCK" LIGHT EXTINGUISHED AND THE "CURRENT LEADS" LIGHT ON QME10 AND THE "QUENCH" LIGHT ON SE20 EXTINGUISHED ON INITIAL FUG POWER-UP. BUT IF YOU WAIT 10 MINUTES, BOTH LIGHTS COME BACK ON.

(OVER)

4/6/96 (cont'd)

I PUT MY FLUKE ON DC VOLTS AND WATCHED THE "LEAD VOLTAGE DROP" TEST POINT ON QME10 FLOAT UP TO $\approx 200mV$ OR MORE, TRIGGERING A FAULT. I THEN PUT JUMPERS BETWEEN VT1 THRU VT5 AT THE INSTRUMENT RACK TEST POINTS AND REPEATED THE TEST, WITH THE SAME RESULTS.

REALIZING NOW THAT I PROBABLY HAVE A PROBLEM INTERNAL TO THE FUG, I BEGAN TESTING VOLTAGES AND FUSES ON THE FUG FRONT PANEL. I FOUND THAT FUSE E2 ON TMRE10/15 WAS PARTIALLY MELTED (BUT STILL READ O.K. WITH FLUKE METER), SO I REPLACED IT. I ALSO FOUND FUSE E1 ON UNE10 WAS OPEN, AND REPLACED IT. ALL OTHER FUSES WERE GOOD, AND $\pm 15V$ WAS THERE.

I POWERED UP (TURNED ON SUPPLY AND CONTROL CIRCUIT BREAKERS) AND IMMEDIATELY HEARD A 60HZ BUZZ COMING FROM THE AREA OF UNE10, AND I SMELLED SOMETHING GETTING HOT. I IMMEDIATELY SECURED POWER. NONE OF THE FUG POWER SUPPLIES SHOULD BE TURNED ON UNTIL WE KNOW THE CAUSE OF THIS PROBLEM.

I SUSPECT THAT THE BACKWARDS WIRING ON TRANSFORMER M2 DAMAGED THE 24V POWER SUPPLY U9, WHICH NOT ONLY CHARGES THE CAPACITOR BANK WHICH TRIPS Q1, BUT ALSO PROVIDES UTILITY 24VDC POWER. THERE MAY BE OTHER DAMAGE WHICH WE HAVE NOT DISCOVERED YET. I RECOMMEND A CAUTIOUS APPROACH FROM HERE — ALL CIRCUIT CARDS AND VOLTAGE-SENSITIVE COMPONENTS IN THE FUG SHOULD BE REMOVED, AND A BASE-LINE INSPECTION OF POWER WIRING AND VOLTAGES BE PERFORMED. THIS SHOULD INCLUDE A FUNCTIONAL TEST OF THE SEVERAL UTILITY POWER SUPPLIES INTERNAL TO THE FUG.

— Mark Stevens

4/10/96

Clear mass flow trip by turning on mass flow.

Checking quench threshold. Putting in 100 mV at magnet and watching power supply trip currents.

Trips on leads ~ 41.6 mV. @ 0 current. (lead CL1)

Trip on CL1 at + and - 42 mV @ 200 current

Trip on CL2 at + and - 42 mV @ 200 current

Signal applied VT2 to VT3 (quench) Trips at 136 mV but indicates 100 mV at monitor. Quencher was placed on current lead trip across transistor T2.

Reversed polarity and tripped at 100 mV (142 mV @ monitor)
Quench trips for voltage injected between VT2 and VT3 are identical for both polarities.

Quench voltage between VT3 and VT4 tripped at 94 mV (142 mV @ monitor)

Reverse polarity between VT3 and VT4 tripped at 100 mV (139 mV @ monitor)

Quench is bipolar between VT3 and VT4

Quench inputs are symmetrical (symmetry is balanced)

1725 Closed quencher switch.

Put on a few amps shut off mass flow magnet quenched. Quencher switch read tripped.

1810. Magnet was at 100 A shut it self off on a quench. Did not trip quencher switch. Reset and let come right back to 200 A current.

Found #4 pin bent on IC12. Continue.

Magnet repositioned to 100 A.

4/10/96

Tipped on lead flow.

4/11/96 Q3

Tixer Volt handback at P.S. back
 put Volt handback selector switch at
 position "FÜHLER AUS". (See Blatt #3) ✓

Q3

Chuck: Lead voltage signal at back of
 supply. Unplugged and power supply
 did NOT trip off. Didn't realize it
 lost track.
 Output drifts slowly up to trip (5 min.?)

Date 4/4, PQ 271

Megger P.D.C. output + loose
all electronic modules pulled out
water on, Dump R connected, magnet Q₂ cold $\sim 5^{\circ}\text{K}$
250VDC $\sim 5\text{k}\Omega$ ✓ (agrees with R_{Dump} monitor connection)
250VDC ∞ ✓ R_{Dump} monitor connection loose
from ground.

1615 Heaters were "shorting out" to
the leads inducing leakage
voltage. Shut off heaters board
is clear. Dump switch Q₁ works
properly unlike Q₃.

Sitting up to put $\sim 40\text{ mV}$ to check lead
threshold. Monitoring VT₁/VT₂ @ 0 A.
current. Trip at 40.6 mV . Change
polarity. Trip at 39.9 mV for (CL1, +) lead.

For (CL2, -) lead. Monitoring
VT₄/VT₅. Tripped at 40.8 mV . Change
polarity. Trip at 42.2 mV .

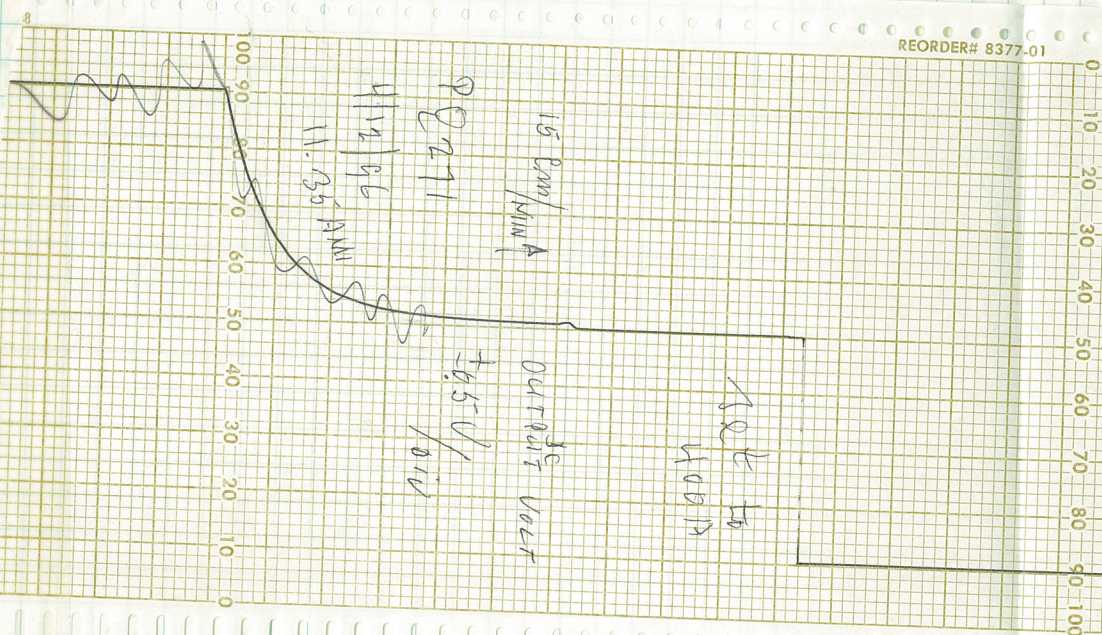
1645 Checking quench trip points
VT₂/VT₃ monitoring. Magnet
leads jumped out at V₁/V₂ and V₄/V₅.
 114 mV trip point. Reverse polarity
trips at 109 mV .

Checking other coil half. V₃/V₄.
with leads jumped out. Trip + polarity
 108 mV Reverse polarity. 112 mV trip.

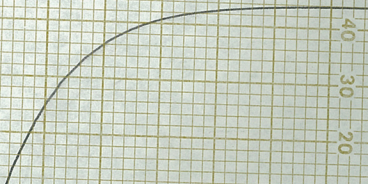
1710 All set for powering all interlocks
OK. Q₂ armed.

1815 Lead trip. Blowed wiring, fix it

REORDER# 8377-01



DC Voltage & Temp
0.29 Vdc
21.7 mK



4/12/96

0900

1200



0 10 20 30 40 50 60 70 80 90 100

Net OA

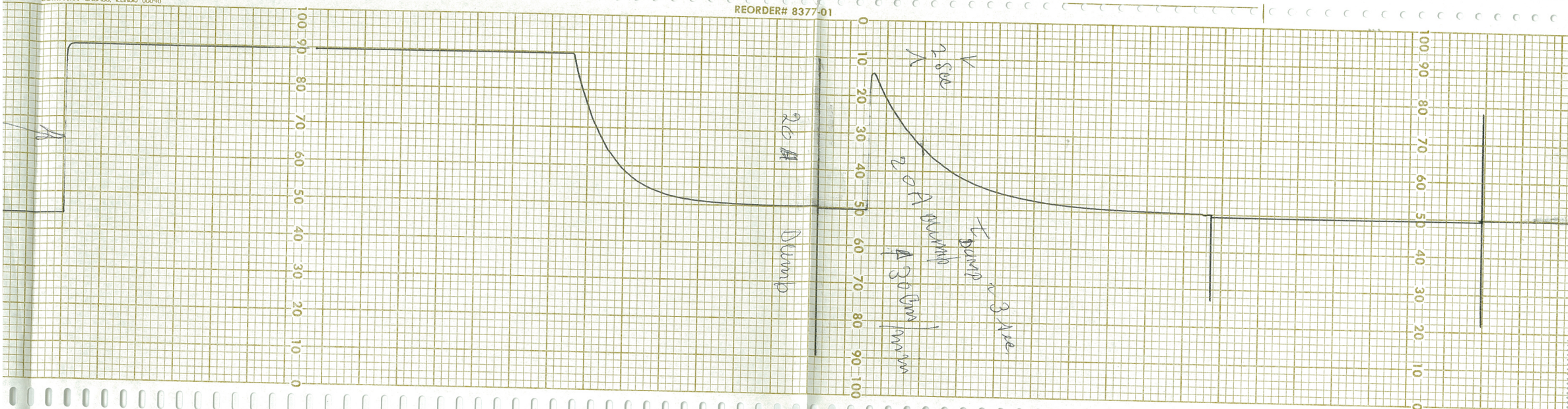
1

100 90 80 70 60 50 40 30 20 10 0

26 A

Dump

0 10 20 30 40 50 60 70 80 90 100



4/12/96 PQ271 12 April 1996

0900 Fixed closed wires at magnet leads.
Ran P.S. temporarily to ~ 50 A, 1V limit. OK
Now shut down and check lead voltage
trip level setting to make sure nothing changes.

Checked magnet lead voltage VT1/VT2
Trip +42mV. Trips agrees with
yesterdays results. Had -40.3mV
on other polarity. on CL1.

Now looking at other lead. CL2
VT4/VT5. First Trip +39.7mV.

and other -40.2mV.

Turned out leads. To check quench.

Checked quench voltage trips
+189mV. Found pot loose. set too high.
Probably drifted. Reset quench

trip to 100mV. Trips at 119mV.
VT2/VT3. monitoring voltage.

Checking other half of coil. With.

VT3/VT4. monitoring. 119.3mV.

trip. Checked other polarity -138mV

1200 Ran at 400 A

Did dump at 20A + other test

T₁ $\sim$ 3 sec

to see short leg. sheet

checked Rev. Switch ✓

Will not loose with PS on, $\alpha I_D \neq 0$ ✓

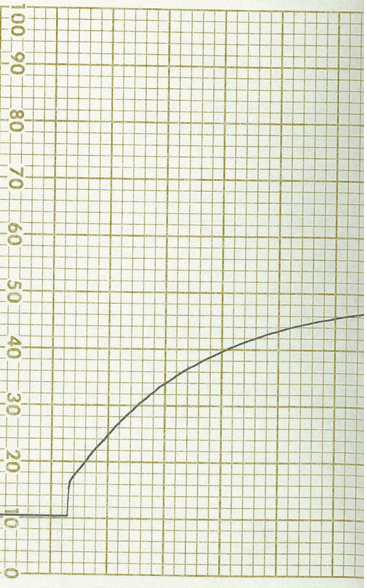
TIME

(Mnemonic)

from $I_{DC} = 100$
to $I_{DC} = 0$

switch

A



2V

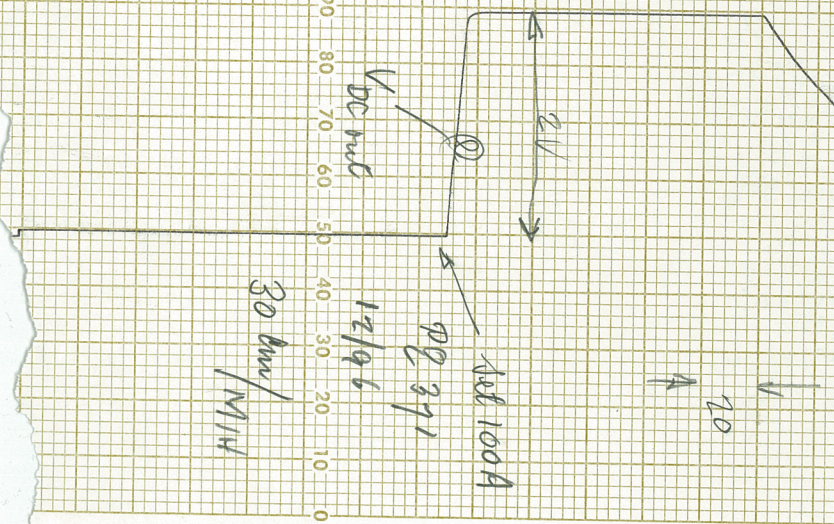
Set 100A

90 371

12/96

30 mm/MIN

1/DC out



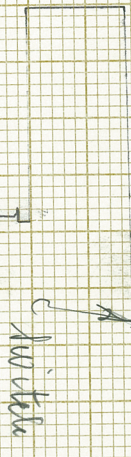


COLE-PARMER INSTRUMENT COMPANY CHICAGO, ILLINOIS 60648

REORDER# 8377-01

TIME

(No dump)
from $I_{DC} = 100$
to $I_{DC} = 0$



100 90 80 70 60 50 40 30 20 10 0

90

80

70

60

50

40

30

20

10

0

0

10

20

30

40

50

60

70

80

90

100

100 90 80 70 60 50 40 30 20 10 0

90

80

70

60

50

40

30

20

10

0

0

10

20

30

40

50

60

70

80

90

100

100 90 80 70 60 50 40 30 20 10 0

90

80

70

60

50

40

30

20

10

0

0

10

20

30

40

50

60

70

80

90

100

20 A
fast response
manually damped

1/8
damp
3 sec

100 90 80 70 60 50 40 30 20 10 0

90

80

70

60

50

40

30

20

10

0

0

10

20

30

40

50

60

70

80

90

100

4/12/76

1400 ~ PD 171 → 400 A. on way.
 PQ 371 - 100 A
 PQ 271 400 A

all supplies proved Semaltaneous G!

1430 Set 100 A with 2Vdc out limit
 Run P.S. UP/DOWN see Chart.

Set 20 A - Manual fast dump $I \approx 3$ sec.
 $R_s \approx 1/8 \Omega$

Exercise Rev. Pol.

P.S. will not reverse with PS on $I_{dc} \neq 0$

1600 PQ3

Try to fix dump switch malfunction

found UV relay welded along giving
 false indication of presence of 2Vdc
 Measured cap $V = 0$ V, blown input fuse.
 Remove power supply board
 changed P.S. board. Same fuse blowing
 problems.

I think the 400mA fuse is marginal.
 suggest to install a 1 AMP slo
 fuse.?

1730

Suppose dipole PD171 on - load
 flow. Power supply dumped energy
 and shut down.

Connected 28V DC power supply
 to Q1 on PQ371. Put 40A
 on magnet. Shutdown mass flow.
 Switch Q1, tripped correctly.
 Problem is in 28V DC power supply.

4-18-96

PQ271

Run Q2 for colloidal measurements

He level 18.4% N₂ level 53.3%

He lead flow 34.3 SLPm. - negative polarity. -

1448 Turned on power.

2V charging coming up to 400 A.

1502 going to 500 A.

1507 going to 600 A. Taking data.

1545 dropped current down to 0.

1550 raised current up to 600 A.

1610 raised current to 700 A.

1602 dropping current to zero.

1610 raised current to 600 A.

1625 RETURNED CURRENT TO ZERO. TURNED OFF POWER.

May 18 1996

1045. Turning on dipole remotely

Various miscommunication problems
Do not know if it is a loose
wire. Only way to test is to
shut off power.

head flow 1056 PM trip. here at 60%
upper probe flows 26 plus 41 minus.
Checked flaps all appear okay.

1330 Set 2V @ 100A remotely.
Supply is ramping up.

1335 Regulating @ 100A going to 200A.

1340 Regulating @ 200A.

1405 Set 2V @ 400A Power Supply
responding.

2000 TURNED OFF.

MAY 19

1530 TURNING ON DIPOLE REMOTELY. TESTING SOFTWARE
UPDATES AND REMOTE VOLTAGE AND CURRENT READBACKS