INSTRUCTIONS

GEK-13599-2

INVERTER COMPONENT TEST EQUIPMENT

GENERAL ELECTRIC COMPANY
CUSTOM POWER EQUIPMENT DEPARTMENT
PHILADELPHIA, PA.
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CONTENTS

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

LIST OF REFERENCE DRAWINGS

DESCRIPTION	DRAWING NUMBER
SUMMARY	0204A4817
FRONT VIEW	0106D5279
ELEMENTARY DIAGRAM	0138B6031
CONNECTION DIAGRAM	0106D8914
CABLE ASSEMBLY	0106D8913

LIST OF DEVICE INSTRUCTIONS

DEVICE	PUBLICATION NUMBER
TRANSFORMER	GEH-230
DO-91 & DW-91 VOLTMETER AND AMMETER	GEH-1554 & GEH-1563
HGA11J RELAY	GEH-1793
HFA51A RELAY	GEH-2024
BREAKER TYPE TEF	GEA-7403
NGV RELAY	GEI-90804

TEST CABINET

This test equipment is designed to test inverter power modules (0137B8174 G100), Control Tray (138F0695 G1), Master Pulse Tray (0103D5414 G4), Inverter Pulse Tray (0103D5414 G1).

ELECTRICAL CHARACTERISTICS

Input - 208 a-c, 3-phase, 60 cycles
- 120 volts a-c, 1-phase, 60 cycles

Output - 0-420 volts d-c, 30 volts d-c, 51 volts d-c, 115 volts a-c, 16 volts d-c 0-10 volts d-c
oscillator frequency 20 to 145 cycles per second.

GENERAL

Provided in this test cabinet are various circuits for supplying control power and control signals for testing inverter power modules as well as the various control trays associated with an inverter. Supplied with this equipment are all the necessary control and power cables for connecting the function under test to the test cabinet.

In using this test equipment there are a few rules and procedures which must be followed.

1. Power module test is performed at no load only.

2. Only one (1) power module is to be tested at any one time.

3. No control tray is to be tested or connected to the test cabinet during the testing of a power module.

4. The test equipment control breaker (52) must be in the open position before connecting or disconnecting any power or control cables.

5. The following additional test equipment is required to perform any test on the power modules or control trays.

   (a) Oscilloscope tektronic H. P.

   (b) Volt-ohm - milliammeter

   (c) A fluke or Digitec meter with a voltage range 0-1, 0-10, and 0-100 d-c volts.

OPERATION

A. Power Module Test

(1) Check that the a-c auxiliary power switch (8) is open.

(2) Observing the proper polarities, connect the d-c power cables to the module under test and insert them in the test panel's test jacks corresponding to the type module under test. The module SCR Gate Signal Cable is not to be connect at this time.

(3) Set the Volt Pac voltage adjustment in the zero output position and close the a-c auxiliary power switch (8).

(4) Close the (52-0) breaker and slowly increase the volt pack output that controls the d-c voltage output.

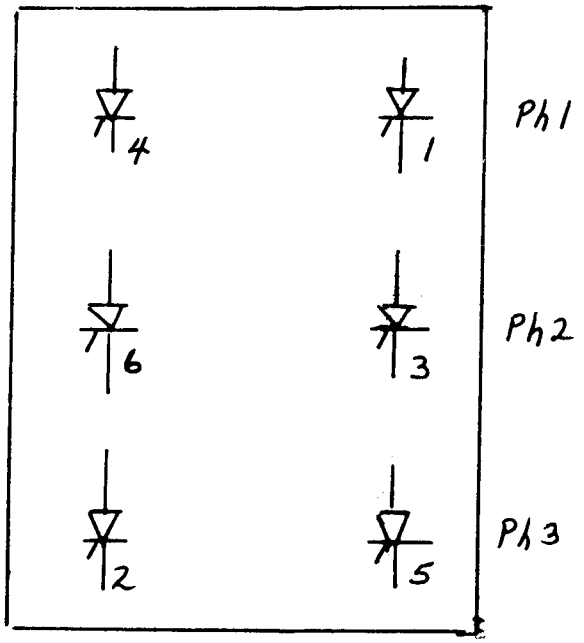
If excessive d-c current is being observed, open breaker (52) and look for shorts across SCR's. If a short is present there is a shorted feed back diode or an SCR.

(5) Connect the proper module gate signal cable to the module and to its corresponding receptacle on the test panel.

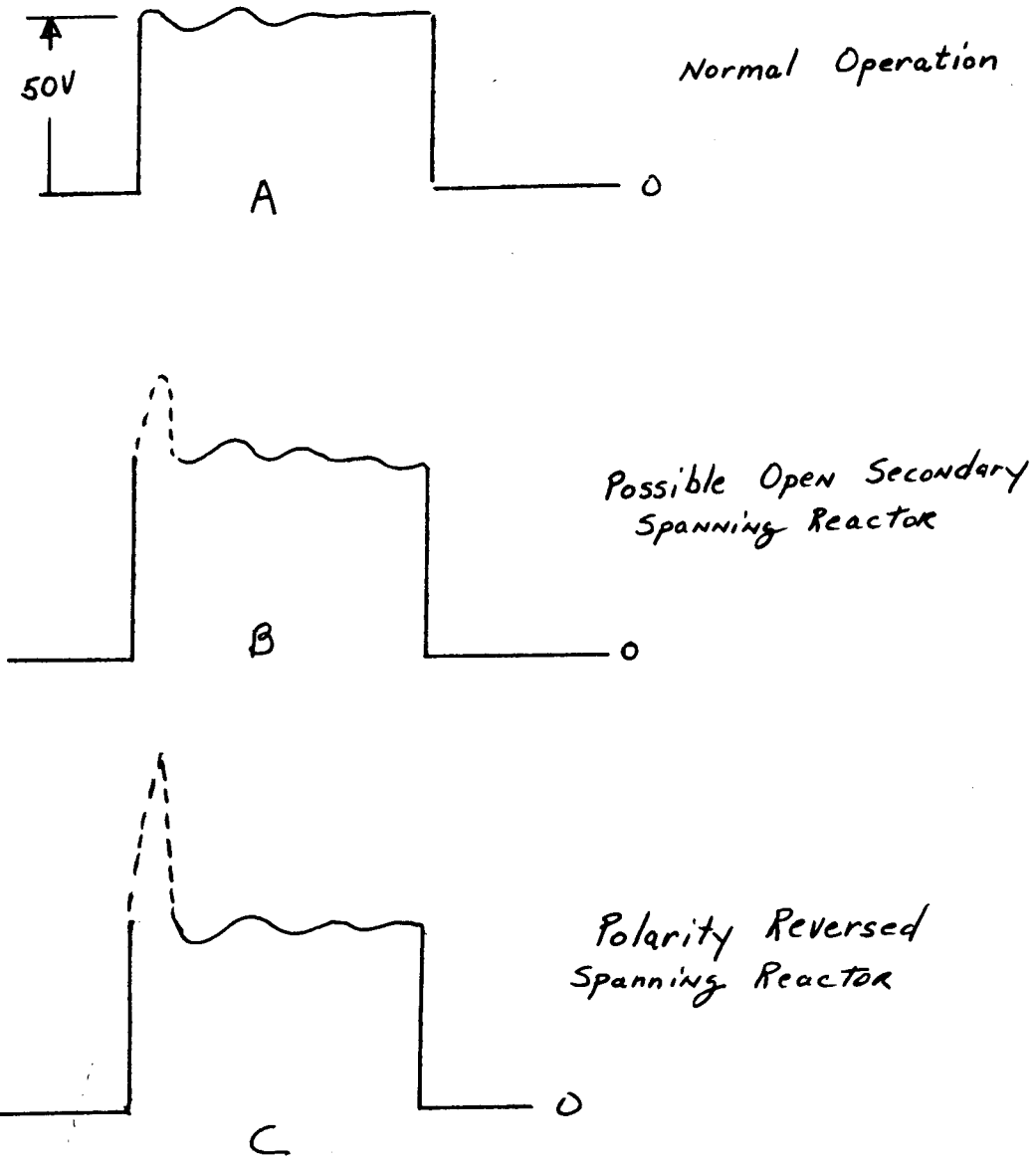
(6) Close breaker (52) and observe the SCR Gate Signals and their displacement on the CRO per the following:

POWER CART GATE FIRING SEQUENCE

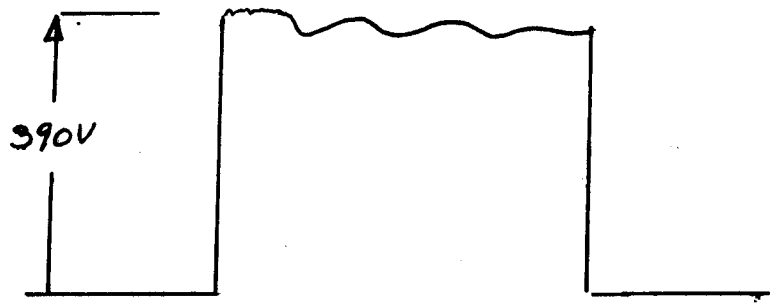
100 KVA CARTS



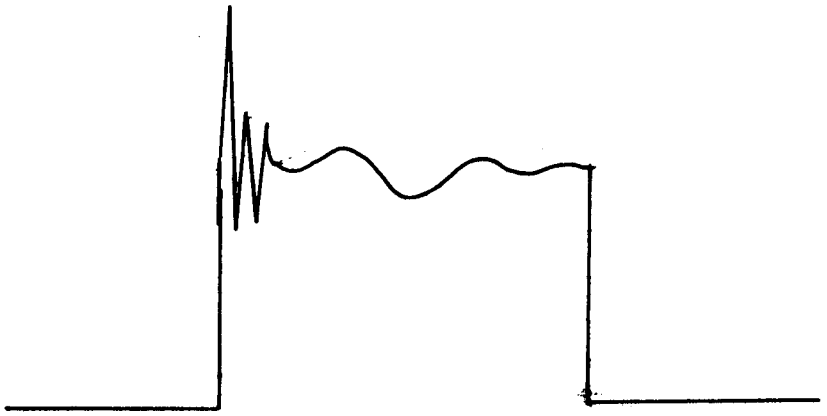
(7) Apply approximately 50 volts DC to the module and observe the voltage wave shapes appearing across the SCR's and compare them with the following curves.



(8) **Raise the voltage up to 390 volts D-C and observe the voltage wave shapes appearing across the SCR's and compare with the following curves.**



Normal Operation



Faulty Snubber circuit

B. Control Tray - 0138F0695

Elementary - 0138B2256

Conn. Diag. - 103D7385

1. OSCILLATOR AND MONO STABLE BOARD TEST

a. Remove all component boards except the two oscillator boards 0207A1404 and the mono stable board 0207A1405.

b. Install relays 12-14A and 12-14B.

c. Connect the proper control cables to the control tray input.

d. Place a temporary jumper on pin 39 and 33, both oscillator boards.

e. Set freq. pot. on front of tray to its mid position.

f. Close the (52) breaker and (8) switch and set the DC voltage for 390 V DC.

g. Check to see that there is 51 VDC at TJ1, TJ3, TJ5 common (-) TJ6.

h. Check to see that there is 10 V_{dc} at TJ7(+) and TJ6(-).

i. Place scope across pin 35(+) and 31(-) on oscillator board (A) and check for a frequency of 1388.8 u sec. Repeat the above on oscillator board (B).

j. Remove temporary jumper from pins 39 and 33.

k. Place scope across pin 3 (+) and 7 (-) on the mono stable board 0207A1405. The pulses should be at a frequency of 1388.8 u sec. and be approximately 8 volt high and 10 u sec. long.

Check the operation of relay 12-14A and 12-14B. With both oscillator boards firing, both relay should be picked up. Temporarily jumper capacitor C2 on oscillator board "A" and note relay 12-14A dropping out. Repeat the above on oscillator board "B", but this time note relay 12-14B dropping out. Remove temporary jumper.

2. REGULATOR BOARD 0207A1307 TEST

a. Turn down the volt-pac and shut off the 52 breaker.

b. Install the regulator board. Set the voltage adj. pot located on the front of tray at its min position.

c. Close (52) breaker, and turn up the volt-pac to 390 V DC.

d. Observe the regulator output with the scope. Adjust the output pins 15(+) and 1(-) for 7 V by R6, RK pot and adjust R21, 1K pot at its midpoint.

e. Turn the pot on the test cabinet (0-10 volt DC supply) to approximately 4.5 volts, and observe the regulator output going up and down.

f. Turn off (52) breaker and (8) switch and then plug in a complete set of component boards.

3. FLIP-FLOP CIRCUIT 0207A2000-01

a. Turn (8) switch on, then close (52) breaker and turn up the volt pac slowly to 390 V DC.

b. Check to see that oscillator pulses are present on pins 11, 29, 45 to pin 3 located on the 0° + 30° master flip flop board.

c. Check 0° master flip-flop board.
Read sq. wave 16V peak to Neg. pin 3.

Pin 47 @ 0°	41 @ 180°
Pin 31 @ 60°	23 @ 240°
Pin 17 @ 120°	7 @ 300°

d. Check 0° master and 30° master flip-flop boards read Sw. wave 16V peak to neg. pin 3.

0° Pin 47 @ 0°	0° Pin 41 @ 180°
30° Pin 47 @ 30°	30° Pin 41 @ 210°
0° Pin 31 @ 60°	0° Pin 23 @ 240°
30° Pin 31 @ 90°	30° Pin 23 @ 270°
0° Pin 17 @ 120°	0° Pin 7 @ 300°
30° Pin 17 @ 150°	30° Pin 7 @ 330°

e. Slave flip-flop boards (on all slave boards).

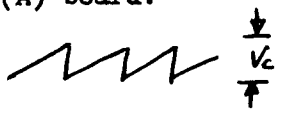
Read squarewave, 16V peak to Neg. (pin 3).

Pin 51, 39, 35, 23, 19 and 7.

4. PHASE CONTROL BOARD

a. Set frequency at 60 cycle with pot on front of panel.

b. Check 0° phase (A) board.

Observe ramp  on pin 33 of board. Adjust voltage peak

for V_c for approximately 7 V peak by setting R16 at mid range

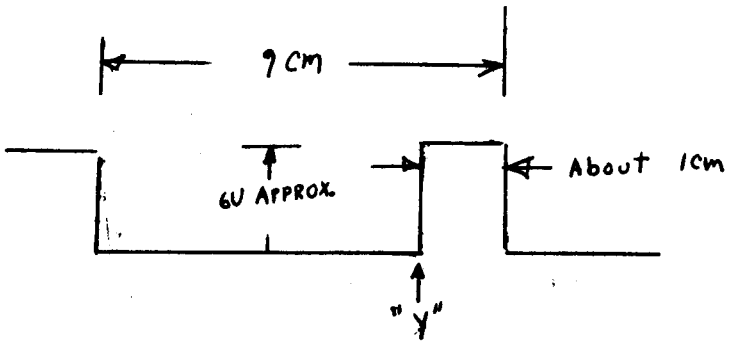
and adjusting pot R1.

c. Line up all other Phase Control Boards

Use Alternate sweeps scope 1.
Use negative internal triggering.
Connect Neg. of scope to (-) Pin 9.
Connect "A" beam on Pin 13 of Board aligned in (b) above.

Connect "B" beam on Pin 13 of Board to be aligned.
Adjust sweep so it appears as below:

(Reg. Voltag near 6.5V point)



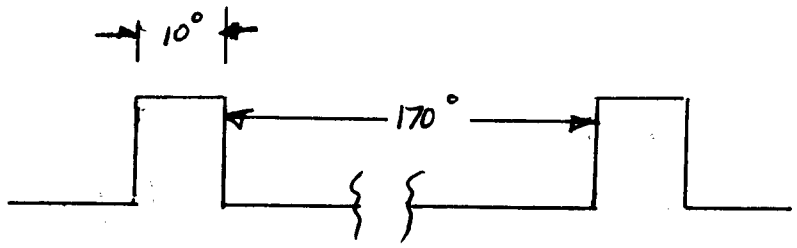
"Y" will move to right as regulator output is increased. Adjust R1 pot on board to be aligned till both "Y" points line up.

5. REGULATOR-PHASE CONTROL ADJUSTMENT

a. Turn regulator voltage input (on control door) to zero.

b. Put scope on output of phase control board (Pin 13).

c. Adjust pot R6 on regulator until the pulse of the output of phase control board is 10^{o} wide.



PHASE CONTROL OUTPUT

6. AMPLIFIER OUTPUT AND PHASING

a. Turn off all power and connect load cable from control tray to test cab.

b. Turn switch (8) on.

c. Turn regulator voltage pot to 5 V_{dc} on test cabinet front panel.

d. Slowly turn the volt pac up to 390 V_{dc}.

e. Check phasing on load resistors. Use chopped display on scope.

f. 0° amplifier

	Sig. At Connector	Pin On Ampl. Board	Phase Angle Elec. Degrees
Neg. of Scope at Pin 5 (C-C)	C-H	34	0°
	C-F	23	60°
	C-D	9	120°
	C-J	41	180°
	C-G	29	240°
	C-E	17	300°

g. 30° amplifier

	Sig. At Connector	Pin On Ampl. Board	Phase Angle
Neg. of scope at Pin 5 (B-C)	B-J	35	0°
	B-F	23	60°
	B-D	9	120°
	B-K	41	180°
	B-H	29	240°
	B-E	17	300°

h. Adjust the regulator reference voltage (Test Cabinet) to see if approx. 100° can be found between the following points:

		0° Master From Pin	0° Slave To Pin
Neg. Pin 5 (C-C)	(C-H)	35	35 (C-R)
	(C-F)	23	23 (C-H)
	(C-D)	9	9 (C-L)
	(C-J)	41	41 (C-S)
	(C-G)	29	29 (C-P)
	(C-E)	17	17 (C-M)

i. Check to see if there is a 30° difference between pin 35 (C-H) and pin 35° of (B-J), with C-C (pin 5) comm. There should be no adjustment between these two points.

j. Adjust the regulator reference voltage (Test Cabinet) to see if approx. 100° can be found between the following points:

30° Amplifier

Neg. of scope
at Pin 5 (B-C)

Master 30° Pin		Slave 30° Pin	
(B-J)	35	(A-F)	35
(B-F)	23	(A-D)	23
(B-D)	9	(A-B)	9
(B-K)	41	(A-G)	41
(B-H)	29	(A-E)	29
(B-E)	17	(A-C)	17

C. Control Pulse Tray - 0103D5414 G4

Elementary - 0138B2256

Conn. Diag. - 0103D7351

1. A tested control tray (0138F0695) and associated cables are needed and connected as in Figure 1. Use the 0° (C plug) on the control tray output.

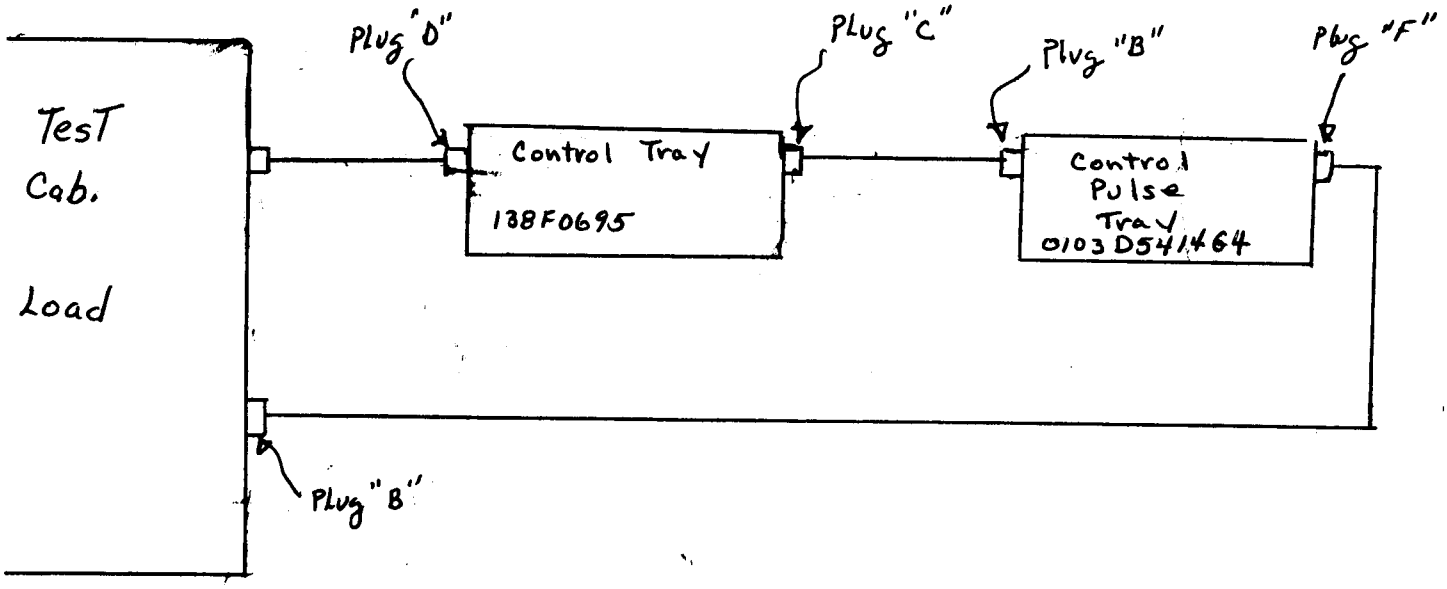


FIGURE 1

2. Close (8) switch, then close the (52) breaker and slowly turn the volt-pac to 390 V_{dc}.

3. Observe square wave pulse for proper phasing of the following pins:

3a. Regulator Reference voltage set at 6 V_{dc} (Test Cabinet)

(1) 0^{o} Master

SCOPE IN CHOPPED MODE

SCOPE LEADS CHANNEL A	SCOPE LEADS CHANNEL B
FA-FB @ 0^{o}	EA-EB @ 0^{o}
	DA-DB @ 0^{o}
	CA-CB @ 0^{o}
FA-FB @ 0^{o}	FC-FD @ 60^{o}
	BD-ED @ 60^{o}
	DC-DD @ 60^{o}
	CC-CD @ 60^{o}
FA-FB @ 0^{o}	FE-FF @ 120^{o}
	EE-EF @ 120^{o}
	DE-DF @ 120^{o}
	CE-CF @ 120^{o}

(2) 0^{o} Slave

FA-FB @ 0^{o}	FG-FH @ 180^{o} Approx.
	EG-EH @ 180^{o} Approx.
	DG-DH @ 180^{o} Approx.
	CG-CH @ 180^{o} Approx.
FC-FD @ 0^{o}	FJ-FK @ 180^{o} Approx.
	EJ-EK @ 180^{o} Approx.
	DJ-DK @ 180^{o} Approx.
	CJ-CK @ 180^{o} Approx.
FE-FF @ 0^{o}	FL-FN @ 180^{o} Approx.
	EL-EN @ 180^{o} Approx.
	DL-DN @ 180^{o} Approx.
	CL-CN @ 180^{o} Approx.

3b. Repeat test (3a.)-(2) except turn (0^{o} slave) Regulator Reference voltage to zero - (Test Cabinet).

Phase angle will now be approx. 0^{o}.

D. Inverter Pulse Tray - 0103D5414 G1

Elementary - 0138B2256

Conn. Diag. - 0103D7352

1. To test Inverter Pulse tray, the following tested trays and cables are needed:

Control tray - 0138F0695

Master Pulse tray - 0103D5414 G4

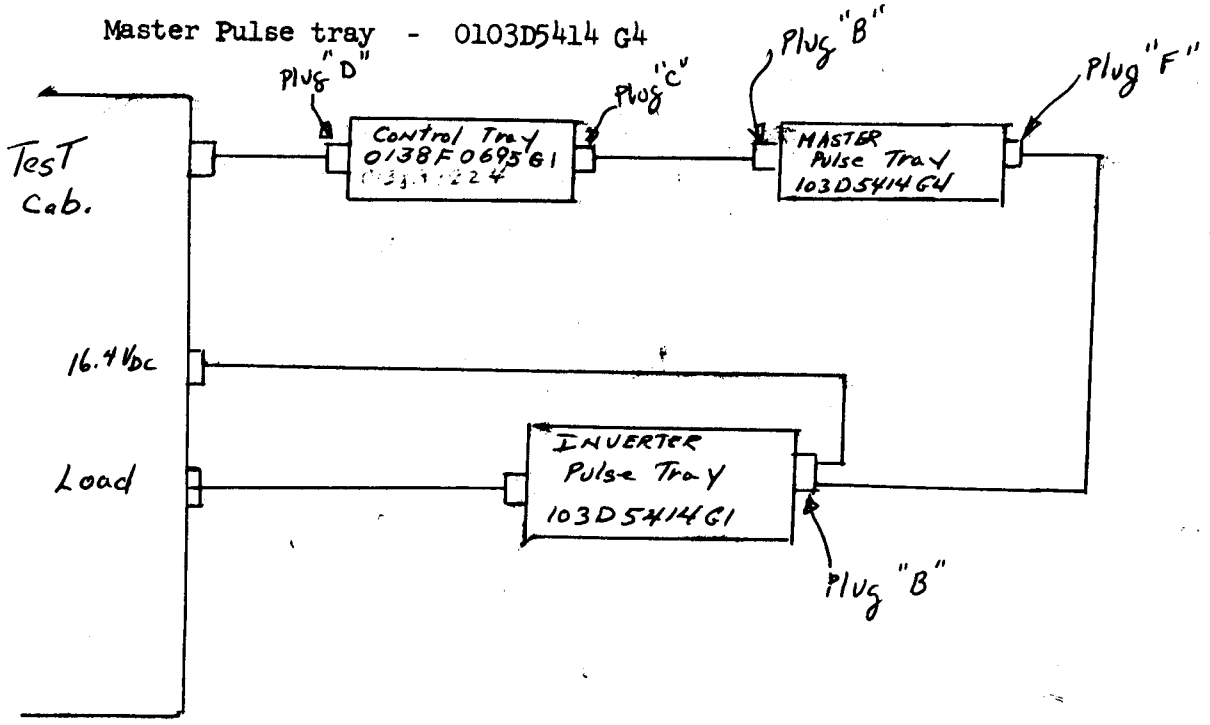


FIGURE 2

NOTE: Input cable to Inverter pulse tray must also be plugged into 16.4 V_{dc} power source on test cabinet.

2. Close (8) switch and (52) breaker, turn up volt-pac slowly to 390 V_{dc}.

3. Turn Regulator Reference Voltage pot on Front panel of Test Cabinet to 5 V_{dc}.

4. Check for square wave pulses at the input of the Inverter pulse tray (103D5414 G1) at the amplifier boards, from - Pin 3 (-) of scope to pins 43, 37, 31, 25, 19, 13 of the master and slave boards.