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P3K-AL-0330-A01	TEST INSTRUCTIONS FOR SPEED CONTROL LOGIC
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REVISION

REV. #1

I. SCOPE

This instruction outlines the specifications for testing the Speed Control Logic board 1S2-A001.

CIRCUIT BOARD 117D7318.

II. CIRCUIT DESCRIPTION

The speed control logic is designed to incorporate the following features:

1. When the power to the EHC control system is initially turned on, the unit will be in a TRIPPED condition. The speed reference will be in CLOSE VLAVES mode.

2. The EHC Speed Control System must be RESET in order to activate the speed reference switches on the operating control panel. Note that the power for the switching bus is routed through the Plant Communication (PC) Circuitry. The speed reference will remain in the CLOSE VALVES mode when the system is RESET.

3. Selecting anyone of the following SPEED SET switches on the operating control panel will seal in the selected circuit and drop out the previous mode.

   a. CLOSE VALVES
   b. LOW SPEED HOLD
   c. MEDIUM SPEED HOLD
   d. HIGH SPEED HOLD
   e. RATED SPEED HOLD

   There is no mandatory sequence of selection; the system can be in only one speed hold at a time. The speed reference logic will normally be in the CLOSE VALVES mode when the EHC system is TRIPPED or RESET. The purpose for the SPEED set logic is to switch the selected speed reference signal, to both LVG's and also to turn on the corresponding indicating light on the control panel.

4. When a new speed hold is selected which would call for an <u>increase</u> in speed, the acceleration amplifier of the primary LVG will normally come out of saturation and provide a constant rate of acceleration until the desired speed is reached. If the acceleration amplifier failed to come out of saturation, the turbine would accelerate up to the desired speed hold at an uncontrolled rate. This is referred to as a slingshot start. Therefore, whenever an <u>increasing</u> speed hold is selected, the speed control logic activates the antislingshot start circuit. When the speed hold switch is selected, a pulse is sent to the time delay relay K12 and to relay K10 which seals in the circuit. If the acceleration amplifier of the PRIMARY LVG, fails to come out

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II. CIRCUIT DESCRIPTION (continued)

4. (continued)

of saturation before the time delay relay (K12) picks-up, the speed control logic will switch back to CLOSE VALVES. The antislingshot circuit is activated at all speed holds including OVERSPEED TEST. In otherwords, the antislingshot circuit is activated whenever the turbine is commanded to accelerate, and is disarmed when the turbine is commanded to decelerate.

5. The OVERSPEED TEST is possible only when the turbine is running at rated speed, and the circuit breaker is open (turbine not synchronized to the line). The overspeed circuit does not seal-in, and the button must be held down in order to increase turbine speed. The antislingshot circuit is automatically energized whenever the overspeed test is performed.

6. When the circuit breaker is closed and the turbine is synchronized to the line, the RATED SPEED set will be sealed in. Note that all speed set circuits including the overspeed test are disarmed (locked-out) as soon as the breaker is closed.

7. When the control system is at rated speed, all of the speed logic relays are de-energized except one (K9). If this relay should malfunction while the turbine is on line, it would probably go undetected since its loss would not affect the loaded turbine. However, when the unit is taken off line, this relay will be required to operate the RATED SPEED circuit, and the loss of K9 would automatically cause the control logic to revert back to the CLOSE VALVES mode.

8. On tripping of the emergency trip system, the logic is de-energized and the CLOSE VALVES circuit is activated through an alternate +24 V source.

9. When the HIGH SPEED HOLD mode is selected, the relay logic switches the wobbulator circuit to both the primary and back-up LVG's.

10. The relay logic prevents the primary LVG from being removed prior to the turbine being synchronized to the line. Since the primary LVG contains the only acceleration amplifier, it cannot be removed as long as the speed control system is in an operating mode which might call for the acceleration amplifier. If the LVG is pulled before the circuit breaker is closed, the speed control logic will return to the CLOSE VALVES mode.

11. Upon decrease of the speed reference, the unit will coast down to the new speed hold with valves closed. The valves will reopen when the new set speed is reached; there is no decelerating rate limit in the EHC speed control system.

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II. CIRCUIT DESCRIPTION (continued)

12. The power to the Speed Reference switching bus is routed through the PC circuitry in order to control the Speed Hold circuits from either the operating control panel (MANUAL), or by the customers via REMOTE OPERATION. Relays are provided in the PC circuit to accomodate both operating modes. However, the LOW SPEED HOLD cannot be operated remotely.

13. The LAMP TEST diodes and resistors are included on the relay logic cards. These logic circuits permit all the lamps to be tested while the EHC system is in operation. A momentary pushbutton switch labeled LAMP TEST is located on the operating panel for checking the lamps.

III. CIRCUIT SPECIFICATIONS

1. Before the board is coated, each diode of the 26 pairs should be checked (using an ohmmeter) both in the forward and reverse direction to insure that redundancy is effective.

2. All functional tests shown in the Logic Testing Table can be made with the board coated as well as uncoated.

3. The symbols used on the Logic Testing Table are as follows:

TABLE SYMBOLS

0 = No Voltage applied or absence of voltage at output pins and test points or light off.

1 = +24 VDC applied to PWR input pins or presence of +24V at output pins and test points or light on.

M = +24 VDC momentarily applied.

P = +24 VDC pulse to pickup relay K10 and seal in time delay relay circuit.

H = Hold +24 VDC (> 10 Sec.) on momentary input to insure that time delay relay K12 will not retime.

4. Apply +24V to pin 38 (TP11) and common to pin 40 (TP10) for all steps in the Logic Testing Table.

5. Before applying +24V to circuit board, perform the following continuity checks:

Continuity:	Pins 35 to 36
	Pins 31 to 34
Open Ckt:	Pins 31 to 32

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TITLE
TEST INSTRUCTIONS FOR SPEED CONTROL LOGIC

FIRST MADE FOR EHC MARK II (SPEED CONTROL UNIT)

REVISION

PREPARED BY E. S. Andrejko DATE FEB 27, 1973

E. S. Andrejko
EHC DESIGN ENGINEEERING

APPROVED BY P C Callan DATE 9-6-77

P.C. Callan - MANAGER
EHC DESIGN ENGINEERING

TEST PROCEDURE
REVIEWED BY R Debertolis DATE 9/6/77

R. Debertolis
EHC TEST ENGINEER

PRINTS T

MADE BY J. Polacek Sept. 14, 1977 APPROVALS

ISSUED SEP 15 1977

Steam Turbine - DIV OR DEPT.
Schenectady, N.Y. LOCATION

PF-803-WA (11-72)
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CODE IDENT

SPEED CONTROL LOGIC TESTING TABLE (TEST IN SEQUENCE SHOWN)

STEP NO.	FUNCTION UNDER TEST	PWR INPUTS AT PINS: +24V when tripped (6)	+24V when LVG out (21)	+24V when LVG in (28)	+24V when sys. reset (24)	Lamp Test (1)	MOMENTARY INPUTS AT PINS: Close Valves (5)	Low (9)	Medium (11)	Hi (13)	Over (26)	Rated (25)	PWR OUTPUTS AT PINS: 24V TO SPEED MONITOR (30)	Close Valves (8)	Low (10)	Medium (12)	Hi (14)	Over (27)	Below Rated (15)	LIGHTS AT PINS: Close Valves (20)	Low (19)	Med (18)	Hi (17)	Rated (16)	CONTINUITY PIN 35 TO 36	CONTINUITY PIN 34 TO 31	CONTINUITY PIN 32 TO 31	TEST POINTS: TP1 (1)	TP2 (2)	TP3 (3)	TP4 (4)	TP5 (5)	TP6 (6)	TP7 (7)	TP8 (8)	TP9 (9)	Pin 2 jumpered to Pin 7	Pin 4 jumpered to Pin 22	COMMENTS	Step No.
1	Close Valves (Sys Tripped)	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	Close Valves Achieved	1
2	Close Valves (Sys Reset)	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	Close Valves Achieved	2
3	Close Valves	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	Close Valves Achieved	3
4	Low Speed Hold Selected	0	0	1	1	0	0	M	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	P	1	1	0	1	1	1	Time Delay Relay Returns Sys. To Close Valves	4
5	Low Speed Hold Achieved	0	0	1	1	0	0	M	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	1	P	1	1	0	1	0	0	---	5
6	Overspeed Selected	0	0	1	1	0	0	0	0	0	H	0	1	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	1	0	1	1	0	1	1	1	No Change Occurs	6
7	Med. Speed Hold Selected	0	0	1	1	0	0	0	M	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	P	1	1	0	1	1	1	Time Delay Relay Returns Sys. to Close Valves	7
8	Med. Speed Hold Achieved	0	0	1	1	0	0	0	M	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	P	1	1	(1)	1	0	0	---	8
9	Overspeed Selected	0	0	1	1	0	0	0	0	0	H	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	(1)	1	1	1	No Change Occurs	9
10	HI Speed Hold Selected	0	0	1	1	0	0	0	0	M	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	P	1	1	0	1	1	1	Time Delay Relay Returns Sys. To Close Valves	10
11	HI Speed Hold Achieved	0	0	1	1	0	0	0	0	M	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	P	0	1	1	0	0	0	---	11

SPEED CONTROL LOGIC TESTING TABLE (TEST IN SEQUENCE SHOWN)

SPEED CONTROL LOGIC TESTING TABLE (TEST IN SEQUENCE SHOWN)

SPEED CONTROL LOGIC TESTING TABLE (TEST IN SEQUENCE SHOWN) AT RATED SPEED, NO OVERSPEED TEST

STEP NO.	FUNCTION UNDER TEST	PWR INPUTS AT PINS: +24V when tripped (6)	+24V when LVG out (21)	+24V when LVG in (28)	+24V when sys. reset (24)	Lamp Test (1)	MOMENTARY INPUTS AT PINS: Close Valves (5)	Low (9)	Medium (11)	HI (13)	Over (26)	Rated (25)	PWR OUTPUTS AT PINS: 24V TO SPEED MONITOR (30)	Close Valves (8)	Low (10)	Medium (12)	HI (14)	Over (27)	Below Rated (15)	LIGHTS AT PINS: Close Valves (20)	Low (19)	Med (18)	HI (17)	Rated (16)	CONTINUITY PIN 35 TO 36	CONTINUITY PIN 34 TO 31	CONTINUITY PIN 32 TO 31	TEST POINTS: TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	Pin 2 jumpered to Pin 7	Pin 4 jumpered to Pin 22	COMMENTS	STEP NO.
12	Overspeed Selected	0	0	1	1	0	0	0	0	0	H	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	No Change Occurs	12
13	Rated Speed Hold Selected	0	0	1	1	0	0	0	0	0	0	M	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	1	P	1	1	0	1	1	1	Time Delay Relay Returns Sys. to Close Valves	13
14	Rated Speed Hold Achieved	0	0	1	1	0	0	0	0	0	0	M	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	P	0	0	0	0	0	0	---	14
15	Overspeed Selected	0	0	1	1	0	0	0	0	0	H	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	1	P	1	1	0	1	1	1	Time Delay Relay Return Sys. to Close Valves	15
16	Rated Speed Hold Achieved	0	0	1	1	0	0	0	0	0	0	M	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	P	0	0	0	0	0	0	----	16
17	Overspeed Achieved	0	0	1	1	0	0	0	0	0	H	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	NOTE: +24V must be held on during this test.	17
18	HI Speed Hold Achieved	0	0	1	1	0	0	0	0	M	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	1	1	No Pulse occurs to initiate time delay relay.	18
19	Med Speed Hold Achieved	0	0	1	1	0	0	0	M	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	1	1	1	1	No Pulse occurs to initiate time delay relay	19
20	Low Speed Hold Achieved	0	0	1	1	0	0	M	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	1	1	No Pulse occurs to initiate time delay relay	20
21	Close Valves Achieved	0	0	1	1	0	M	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	0	1	1	1	1	No Pulse occurs to initiate time delay relay	21
22	Lamp Test	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	22

SPEED CONTROL LOGIC TESTING TABLE (TEST IN SEQUENCE SHOWN)

STEP NO.	FUNCTION UNDER TEST	PWR INPUTS AT PINS: +24V when tripped (6)	+24V when LVG out (21)	+24V when LVG in (28)	+24V when Sys. reset (24)	Lamp Test (1)	MOMENTARY INPUTS AT PINS: Close Valves (5)	Low (9)	Medium (11)	HI (13)	Over (26)	Rated (25)	PWR OUTPUTS AT PINS: 24 V to SPEED MONITOR (30)	Close Valves (8)	Low (10)	Medium (12)	HI (14)	Over (27)	Below Rated (15)	LIGHTS AT PINS: Close Valves (20)	Low (19)	Med (18)	HI (17)	Rated (16)	CONTINUITY PIN 35 TO 36 (3)	CONTINUITY PIN 34 TO 31 (4)	CONTINUITY PIN 32 TO 31 (5)	TEST POINTS: TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	Pin 2 Jumpered to Pin 22	Pin 4 Jumpered to Pin 22	COMMENTS	STEP NO.
23	Rated Speed Hold Achieved	0	0	1	1	0	0	0	0	0	0	M	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	P	0	0	0	0	0	0	----	23
24	Rated Speed (Ckt. Bkr. Closed)	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	Sys remains at rated when +28V removed from Pin 28	24
25	Overspeed (Ckt. Bkr. Closed)	0	0	0	1	0	0	0	0	0	M	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	Sys remains at Rated Speed	25
26	HI Speed Hold (Ckt. Bkr. Closed)	0	0	0	1	0	0	0	0	M	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	Sys remains at Rated Speed	26
27	MED Speed Hold (Ckt. Bkr. Closed	0	0	0	1	0	0	0	M	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	Sys remains at Rated Speed	27
28	LO Speed Hold (Ckt. Bkr. Closed)	0	0	0	1	0	0	M	0	0	0		1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	Sys remains at Rated Speed	28
29	Close Valves (Ckt. Bkr. Closed)	0	0	0	1	0	M	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	Sys remains at Rated Speed	29
30	Close Valves Achieved (Sys Tripped)	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	-------	30
31	+24V CHECK	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	NOTE: +24V AT PIN 30 ONLY	31
32																																							32
33																																							33