

WATERS CORPORATION
ENGINEERING TEST SPECIFICATION AND PROCEDURE
COMPANY CONFIDENTIAL

SYSTEM/ASSEMBLY NAME: **TEMPERATURE CONTROL MODULE**

PART NUMBER AFFECTED: **038000**

TEST EQUIPMENT NAME: **COLUMN HEATER SIMULATOR**

TEST EQUIPMENT NUMBER: **82905**

TEST EQUIPMENT LOCATION:

DOCUMENT NUMBER: **735001271**

AUTHOR(S): **JASON IRR**

DATE: **5/19/2006**

REVISED BY:

REV:

DATE:

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EQUIPMENT REQUIRED

Quantity	Part Number	Description
1		220 VAC/50 HZ Power source
1		CHM simulator Test fixture
1		DVM

REFERENCE DOCUMENTATION

Document Number	Description
038005	Electrical Safety Test Procedure
038170	Assy, TCM control (Assy Wiring DWG)
038001	Performance spec. TCM
038044	Performance spec. CHM
038172	Test spec. column heater module

1. VISUAL INSPECTION

- 1.1. Visually inspect TCM unit for obvious defects. Check PASS/FAIL on Instrument Final Test Record.

2. ELECTRICAL SAFETY TEST

- 2.1. Perform Electrical Safety Test per procedure number 046538. Check PASS/FAIL on Instrument Final Test
- 2.2. Record.

3. TEST SETUP

- 3.1. Plug DVM into a 220 volt AC outlet.
- 3.2. Plug TCM into a 220 volt AC outlet. Set line select switch to 220 volt position.

4. POWER SUPPLY CHECK TEST

- 4.1. Plug TCM line cord into a 220 AC/volt 50 HZ outlet or a Pacific Power Supply (or equivalent). Set power supply to 220 AC/volt 50 HZ.
- 4.2. Set DVM to 20 volt DC range, then switch DVM and TCM power on.
- 4.3. Connect positive lead of DVM to TP4 and negative lead to TP2.
- 4.4. Power up the TCM. When turned on, display should read "VC" meaning no heater is connected to TCM rear panel.
- 4.5. DVM should read +15 volts. (+14.25 VDC to +15.75 VDC).
- 4.6. Move positive DVM lead to TP3. DVM should read -15 volts. (-14.25 VDC to -15.75 VDC).
- 4.7. Move DVM RED lead to TP1. DVM should read +5 volts. (+4.85 VDC to +5.25 VDC).
- 4.8. Turn power off on TCM and DVM, enter results on Instrument Final Test Record.
- 4.9. Disconnect DVM. Turn off power on DVM and TCM.

5. TEMPERATURE ACCURACY TEST

- 5.1. Connect the 3 simulator test boxes (TE# 81379) labeled 1, 2, 3 into the back of the TCM input/output connectors labeled 1, 2, 3.
- 5.2. Turn TCM power on.
- 5.3. Set all simulator(s) toggle switches as follows:
1 UP 2 DOWN 3 DOWN

- 5.4. All channels should read between 100°to 104°C. The led above numbers 1, 2, or 3 lights to indicate which channel is displayed. Record highest reading for each channel onto Instrument Final Test Record, then check PASS/FAIL.

6. TEMPERATURE VARIATION TEST

- 6.1. Enter the highest and lowest readings of the 3 channels on the space provided. Subtract the low reading from the high and enter the result. Result should be less than or equal to .5°C.

7. OVER AND UNDER DEFAULT TEST

- 7.1. Set all 3 Channel #1 switches in the UP position and all #2 and #3 switches in the DOWN position. Press SELECT 1 OVER (display should read 150.5). Press SELECT 1 UNDER (display should read 0). Repeat steps for 2 and 3 by pressing SELECT 2 or SELECT 3. Visually check that the TCM alternates display from Channel 1 to Channel 3. Also check that the 3 corresponding LEDS laminate alternate while displaying the simulated temperatures for all 3 channels/simulators. Check box on instrument Final Test Record.
- 7.2. Set all 3 channels, #2 switches in the UP position and all of the #1 and #3 switches in the DOWN position. Press SELECT 1 OVER (should read 75.0). Press SELECT 1 UNDER (should read 0) Repeat steps for channels 2 and 3. Check box on Instrument Final Test Record.
- 7.3. Set all 3 channels, #3 switches in the UP position and all of the #1 and #2 switches in the DOWN position. Press SELECT 1 OVER (should read 150.0). Press SELECT 1 UNDER (should read 0). Repeat steps for channels 2 and 3. Check the box on Instrument Final Test Record.

8. KEYPAD RESPONSE TEST

- 8.1. Alternately press each front panel push-button listening for a "CHIRPING" sound as each one is pushed. Check box on Instrument Final Test Record.

9. FRONT PANEL LED ILLUMINATION

- 9.1. Press SELECT 99, ENTER. Press SELECT 1, ENTER. Make sure all lights come on. Turn power OFF. Check box on Instrument Final Test Record.

10.LIMIT TESTS

NOTE: COLUMN HEATER SIMULATORS SIMULATE 94°C.

- 10.1. Set simulator boxes to 1 UP, 2 and 3 DOWN. Set the temperature of all 3 channels to 150°C using the following sequences. TCM power on.

Press - SELECT 1 SET 1500 ENTER
LED ON SIMULATOR BOX #1 SHOULD LIGHT.

Press - SELECT 2 SET 1500 ENTER
LED ON SIMULATOR BOX #2 SHOULD LIGHT.

Press - SELECT 3 SET 1500 ENTER
LED ON SIMULATOR BOX #3 SHOULD LIGHT.

OVER TEMPERATURE LIMIT TEST

- 10.2. Set the OVER TEMPERATURE LIMIT on all 3 channels to 98°C using the following sequences.
NOTE: Hold ENTER long enough to hear alarm.

Press SELECT 1 OVER 980 ENTER
Press SELECT 2 OVER 980 ENTER
Press SELECT 3 OVER 980 ENTER

- 10.3. Verify that all 3 LEDs on the simulators go off and the alarm sounds for each channel. Verify that the OVER TEMPERATURE led indicator on TCM flashes.
- 10.4. Switch TCM power OFF , then ON again.

UNDER TEMPERATURE LIMIT TEST

- 10.5. Set the temperature of all 3 channels to 150°C using the following sequences.

Press SELECT 1 SET 1500 ENTER
Press SELECT 2 SET 1500 ENTER
Press SELECT 3 SET 1500 ENTER

- 10.6. Verify that all 3 LEDs on simulators light.
- 10.7. Set the UNDER TEMPERATURE limit on all 3 channels to 105°C using the following sequences.

NOTE: Hold ENTER long enough to hear alarm.

Press SELECT 1	UNDER 1050 ENTER
Press SELECT 2	UNDER 1050 ENTER
Press SELECT 3	UNDER 1050 ENTER

- 10.8. Verify that all 3 LEDs on the simulators stay on and the alarm sounds for all 3 channels. Verify that the UNDER TEMPERATURE led indicator on TCM flashes.
- 10.9. Disconnect TCM simulator boxes. Switch TCM power OFF. Check PASS/FAIL boxes on Instrument Final Test Record, for LIMIT TESTS.

END OF TEST

WATERS CORPORATION
INSTRUMENT-FINAL TEST RECORD

Part Number: _____

Description: _____

Tested By: _____

Date: ____ / ____ / ____

Serial Number: _____

Control Number: _____

Software Revision: _____

Factory Order: _____

1.0 Visual Inspection

PASS ☐ FAIL ☐ see note # ____ PASS ☐

2.0 Electrical Safety Testing

Hi-Pot(≥ 1350 VAC for ≥ 2 seconds)

PASS ☐ FAIL ☐ see note # ____ PASS ☐

Ground Continuity ($\leq 0.1 \Omega$)

PASS ☐ FAIL ☐ see note # ____ PASS ☐

4.0 Power Supply @ 220 Vac 50 Hz

+15volts(14.25 - 15.75)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

-15volts(14.25 - 15.75)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

+5volts(4.85 - 5.25)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

Power Supply @ 220 Vac 50 Hz

+15volts(14.25 - 15.75)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

-15volts(14.25 - 15.75)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

+5volts(4.85 - 5.25)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

5.0 Temperature Accuracy

Chan1 (93°C - 95°C)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

Chan2 (93°C - 95°C)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

Chan3 (93°C - 95°C)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

6.0 Temperature Variation

High (95°C)Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

Low (93°C) Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

Variation ($\leq 5^\circ\text{C}$) Actual: _____

PASS ☐ FAIL ☐ see note # ____ PASS ☐

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WATERS CORPORATION
INSTRUMENT-FINAL TEST RECORD

Part Number: _____ Serial Number: _____

7.0 Over & Under Default Values (switch settings = 1 up, 2 and 3 down)

Chan1 (Over = 150.5°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐
Chan2 (Over = 150.5°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐
Chan3 (Over = 150.5°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐

Over & Under Default Values (switch settings = 3 up, 1 and 2 down)

Chan1 (Over = 150.0°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐
Chan2 (Over = 150.0°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐
Chan3 (Over = 150.0°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐

Over & Under Default Values (switch settings = 2 up, 1 and 3 down)

Chan1 (Over = 75.0°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐
Chan2 (Over = 75.0°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐
Chan3 (Over = 75.0°C) (Under = 0°C)	PASS ☐	FAIL ☐	see note #__	PASS ☐

8.0 Key Pad Response

PASS ☐ FAIL ☐ see note #__ PASS ☐

9.0 Front Panel Illumination

PASS ☐ FAIL ☐ see note#__ PASS ☐

10.0 Limit Tests

Over Temperature	PASS ☐	FAIL ☐	see note #__	PASS ☐
Under Temperature	PASS ☐	FAIL ☐	see note #__	PASS ☐

Notes:

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