

File E232824
Project 10CA64028

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REPORT

on

UNLISTED COMPONENT - LIMIT CONTROLS

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Houston, TX

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DESCRIPTION:

PRODUCT COVERED:

USU, CNU - Hot water heater control, model **SZ1C7K2H** with 277Vac power supply model SZ2771A.

GENERAL:

This is a water heater temperature limit control. It utilizes a microprocessor which runs non-safety software, and implements all safety functions using discrete, single fault tolerant hardware components. Input to the control board is rated 5 Vdc.

The water temperature thermistor inputs (TH-IN [**J4**], TH-OUT [**J9**]) are safety circuits, and are suitable for reliable temperature limiting at a fixed setpoint (**see Fig. 1, Item 6 for details**), and evaluated to comply as a Water Heater Limit.

The Level Detector input was evaluated as a safety circuit as a Water-Level Limit.

USU indicates conformance to the United States Standard for Limit Controls, UL 353, 5th Edition.

CNU indicates conformance to the Canadian Standard for Temperature-Indicating and -Regulating Equipment, CAN/CSA C22.2 No 24, 8th Edition.

WIRING DIAGRAM: See Ill. 1 for 240Vac control and Ill. 2 for 277Vac control.
(For Engineering Use Only)

RATINGS:

Ambient - 34°F to 149°F (1°C to 65°C)

Input - 120-240 V ac, 60 Hz w/Mean Well PS-05-5 Power Supply
(File E232834, Vol. X1, Sec. 1)
120-277 V ac, 60 Hz w/Seisco SZ2771A Power Supply (Fig. 2)

Output - 120-277 V ac, 60 Hz, 30 A Resistive, 100k cycles.
120-240 V ac, 60 Hz, 37.5 A Resistive, 100k cycles.

TESTS TO BE CONDUCTED BY MANUFACTURER:

1. Each control chassis is subjected to a dielectric potential of 1480 V ac for 240 V ac models or 1554 V ac for 277 V ac models for a period of 1 min between line voltage current-carrying parts and low voltage and dead metal parts. The test time may be reduced to 1 s if the test potential is increased to 1776 V ac for 240 V ac models or 1865 V ac for 277 V ac models.
2. Each control shall be operated at 85% of the rated supply voltage to assure proper operation.

ENGINEERING CONSIDERATIONS:

1. The control is not suitable for field wiring.
2. The control shall be placed in a suitable electrical enclosure.
3. Power supplies considered include Unlisted Component Mean Well PS-05-5 covered in E232834, Vol. X1, Sec. 1 and Seisco Part No. SZ2771A covered in Fig. 2 of this Report. Alternate supplies are to be evaluated with the following tests:
 - a. Voltage Dips and Interruptions, UL 353 Sec. 31B.2
 - b. Ramp Voltage Test, UL 353 Sec. 31B.3
 - c. Voltage/Current Surge Test, UL 353 Sec. 31B.4
 - d. Ring Wave Test, UL 353 Sec. 31B.5
 - e. Electrostatic Discharge Test, UL 353 Sec. 31B.6
 - f. Thermal Cycling, UL 353 Sec. 31C
 - g. Dielectric Withstand Test, UL 353 Sec. 32
 - h. Component Failure Analysis Test, UL 353 Sec. 31A
 - i. Timing Test for Liquid Level Limit Control, UL 353 Sec. 29.1.11
 - j. Radiated Electromagnetic Field, UL353 Sec. 31B.7
4. The end product investigation shall consider the suitability of the thermistor and the suitability of the setpoint. The control has been evaluated with a maximum drift of +0.6%, and in order to meet UL 353 Table 29.1, for a variation of 10°F (5.5°C) for a setpoint of 120°F (49°C), this corresponds to a max. allowable +7.7% endurance test variation from initial operating temperature (R/C XGPU2/8 Class C4 or better for PTC/NTC sensing thermistor; Class C1 for PTC control thermistor).
5. The triac temperature shall be monitored in the end product and verified not to exceed the max. allowable board temperature of 130°C or triac case temperature as stated in the manufacturer part specification.
6. An investigation of the software was not conducted. Functions in software are not to be relied upon for safety control (incl. reliable regulation, water temperature limiting, and/or low water cutoff).

7. The design of the control uses the same relay contacts for regulating and limiting functions. This is based upon typical end-use application where the heating element contactor is controlled by both the regulating and limiting controls.

CONSTRUCTION DETAILS:

Corrosion Protection - All parts are constructed of corrosion resistant material, or are painted or plated, etc. for protection against corrosion.

Spacings - Spacings were considered using UL 840, Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment.

Markings - Each board is provided with an adhesive backed paper or vinyl label, or is silk screened and includes the applicant's name, board model number, and revision. Additional markings on each part are as described for the particular item.

CONTROL BOARD, **SZ1C7K2H**, Rev. **A** - FIG. 1

General - The control consists of a printed circuit board mounted on standoffs directly to the polymeric water tank.

1. **Low Voltage** Connectors (J4, J5, J9) - R/C (**ECBT2/8.E28476**), Molex Series **MTA**, Model **640445-2** rated 250 V, 105C.

(J6) - R/C (**ECBT2/8.E28476**), Molex Series **MTA**, Model **640445-3** rated 250 V, 105C.

(J1) - R/C (**ECBT2/8.E28476**), Tyco Electronics Corp. Series **MTA**, Model 640454-4, rated 250 V, 105C.

Alternate - R/C (**XCFR2/8**), any use Group B, rated at least 5 V, 105C, 1A.

2. **High Voltage Connectors (P1-4) - Spade Terminal, male, 0.25"**
3. Relays (K1, K2) - R/C (**NRNT2/8.E93379**), Picker Components Corp. PTRD-1A-5SF-1-X, 5 Vdc coil, tested at:
240 Vac, 30A Resistive, 100k cycles, 74C ambient.
240 Vac, 37.5A Resistive, 100k cycles, 65C ambient.
4. Printed Wiring Boards - Any R/C (**ZPMV2/8**), rated minimum 94V-2, 130°C, PLC ≤ 3 (CTI ≥ 175), suitable for direct support of live parts.
5. Solid-State components - see the table below for Illustrations and drawing numbers of the schematic, bills of material and component layout diagram for the printed circuit board.

Item	Drawing	Rev.	Date	ILL
Schematic	SZ1C7K1H	H	2013-06-21	3
Bill of Materials	SZ1C7K2H	A	2013-08-23	4
Board Layout, incl. Silkscreen (w/Comp. Location) Trace Layout Solder Mask Drills	SZ1C7K2H	A	2013-07-22	5

6. **Setpoint Resistors - see the table below.**

Setpoint	R44, R52 Value	R51, R69 Value
140°F	5.11kΩ	10.0kΩ
126°F	5.11kΩ	7.68kΩ
120°F	7.68kΩ	10.0kΩ

277 Vac POWER SUPPLY, SZ2771A, Rev. A - FIG. 2

General - The power supply consists of a printed circuit board mounted on standoffs directly to the polymeric water tank.

1. Connectors (CN1) - R/C (ECBT2.E29179, CSA Certified LR19980), Molex Series KK, Model 26-60-4020 rated 250 V, 105C.

(CN2) - R/C (ECBT2.E29179, CSA Certified LR19980), Molex Series KK, Model 26-60-4020 rated 250 V, 105C.

Alternate - R/C (XCFR2/8), any use Group B, rated at least 250 V, 105C, 1A.

2. Printed Wiring Boards - Any R/C (ZPMV2/8), rated minimum 94V-2, 130°C, CTI 175 or greater, suitable for direct support of live parts.

3. Solid-State components - see the table below for Illustrations and drawing numbers of the schematic, bill of materials and component layout diagram for the printed circuit board.

Item	Drawing	Rev.	Date	ILL
Schematic	SZ2771A	A	2012-07-24	6
Bill of Materials	SZ2771A	A	2012-07-24	7
Board Layout, incl. Silkscreen (w/Comp. Location) Trace Layout Solder Mask Drills	SZ2771A	A	2012-07-24	8