



SERVICE BULLETIN

Title: Calibration of Furnas Solid State Overloads

Models Affected: Centrifugal Water Chillers

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Purpose:

The purpose of this bulletin is to provide information on the operating characteristics and calibration procedure of the Furnas 948L108939 overload which has been approved for use in starters for Carrier centrifugal water chillers.

This revision consists of a 2.2% increase in the calibration current, step 5, page 2 and page 6. We have had no reports of premature overload tripping, recalibration of overloads is not required.

File: Controls–Wiring

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Background:

The Furnas Electric Company has developed a three phase, solid state overload relay which is suitable for use with Carrier centrifugal water chillers. This relay is smaller and easier to install than magnetic overloads and has the advantage of being easier to adjust in the field. There is just one three phase adjustment for overload trip current and one three phase adjustment for locked rotor current.

The overload trip current rating of Carrier hermetic motors is 108% of rated load amps. The 32MP control limits motor current at 105% of rated load amps. It is therefore necessary that each overload be calibrated for the exact required overload trip current to avoid nuisance tripping.

Since the Furnas relay has a fixed relationship between locked rotor Y and locked rotor D trip times, it is essential that the overload current transformers sense line current and not phase current. It should also be noted that if power factor correction capacitors are used and are located between the current transformers and the motor, the capacitor leads must be routed backwards through the current transformers.

Recommendations:

The relay is used with current transformers. The CT secondaries pass through the sensing loops on the overload 4, 3, 2 or 1 times, depending on the CT ratio and the motor rated load amperes. **Table 1** provides guidance on the selection of CT ratio and number of turns for given rated load amps. In order to use the same CT's for the overloads and ammeters, it is recommended to use 4 or 3 turns. All three phases must pass through the current sensing loops on the relay in the same direction. CT primaries and secondaries must be marked for polarity. The power wiring must go through all three CT's in the same direction with respect to the polarity marking on the CT primary and the CT secondary leads of like polarity must go through the overload relay loops in the same direction. If the relay is properly calibrated and then installed with improper lead routing, the relay will trip when the current is 5% too high.

It is acceptable to calibrate the overload using a single phase AC current source provided that the wire is routed through the overload relay loops as shown on **Figure 1**. If the relay is calibrated with incorrect routing of the wire and then installed with proper routing of the wire, the relay will trip when the current is 5% too low.

The following example illustrates a recommended procedure for calibrating the overload:

1. The motor is a 460 Volt, 60 Hz, CD motor with rated load amps of 276. The overload trip amps are 298 (1.08×276). The locked rotor amps in Y are 486 and the locked rotor amps in Delta are 1519.
2. Appropriate combinations of current transformer ratio and number of turns through the overload relay loops can be determined from Table 1, based on rated load amps. The best combination would be 4 turns and a 400:5 current transformer, CT ratio of 80.
3. Set the Locked Rotor Amps knob to 125%, (fully counter clockwise, use black knob).
4. Set the Must Hold Amps to an approximate initial setting of $1.06 \times \text{RLA} \times \text{No Turns} / \text{CT Ratio} = 14.6$, use the black knob for 60 Hz (use the red knob for 50 Hz).
5. Apply a calibration current to the overload, single phase, of $1.278 \times \text{OLTA} / \text{CT Ratio} = 4.76$ amps, 60 Hz (must use 50 Hz for 50 Hz applications). For a 3 phase calibration current use $1.25 \times \text{OLTA} / \text{CT Ratio}$.
6. The relay must trip in 36.8 to 37.7 seconds.
 - A. If the relay trips in less than 36.8 seconds, increase the Must Hold Amps setting slightly and retest after a 1 minute off time. (If the calibration current is not turned off at the same time the relay trips, retest after a 2 minute off time.)
 - B. If the relay trips in more than 37.7 seconds, decrease the Must Hold amps setting slightly and retest after a 1 minute off time. (If the calibration current is not turned off at the same time the relay trips, retest after a 2 minute off time.)

7. Remove the Must Hold Amps setting knob and verify that the trip time is still within limits.
8. Set the Locked Rotor Amps knob to $(100 \times \text{LRAY} / \text{RLA} \times 1.06) = 166$. (For three-lead motors such as medium voltage or auto-transformer, set the Locked Rotor Amps knob to $(30 \times \text{LRA} / \text{RLA} \times 1.06)$).
9. Remove the Locked Rotor Amps knob and tape both knobs to the side of the relay for possible future use.

Field Calibration

Field calibration should not be necessary. If it ever does become necessary to recalibrate an overload because a starter is tripping too soon, the overload can be removed and recalibrated according to the above procedure or the Must Hold Amps setting can be increased to the following setting: $(\text{Desired Trip Current} / \text{Actual Trip Current}) \times \text{Original Must Hold Amps setting}$.

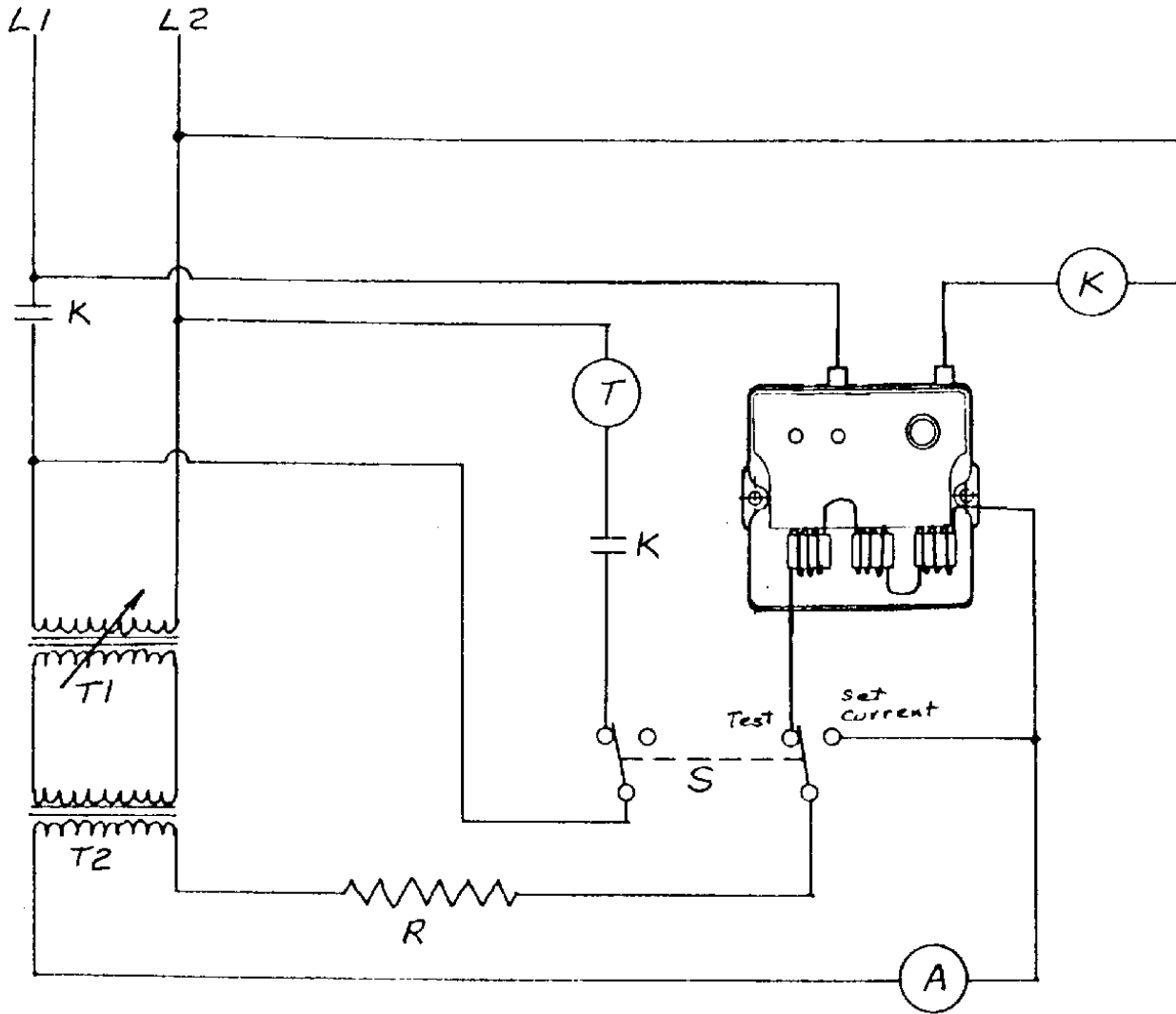
**Table 1 — Current Transformer Application Chart
Furnas 948L108939 Overload**

Select The Largest Available Number Of Turns For Ammeter Compatibility									
	Rated Load Amperes								
	4 Turns			3 Turns		2 Turns		1 Turn	
60HZ C.T.	Ratio	Min	Max	Min	Max	Min	Max	Min	Max
100:5	20	66	90	89	120	133	180	266	360
150:5	30	100	135	133	180	200	270	399	540
200:5	40	133	180	177	240	266	360	532	720
250:5	50	166	225	222	300	333	450	665	900
300:5	60	200	270	266	360	399	540	798	1080
400:5	80	266	360	355	480	532	720	1064	1440
500:5	100	333	450	233	599	665	900	1330	1800
600:5	120	399	540	532	720	798	1080	1596	2160
800:5	160	532	720	709	959	1064	1440	2128	2880

**Table 1 — Current Transformer Application Chart
Furnas 948L108939 Overload (Continued)**

Select The Largest Available Number Of Turns For Ammeter Compatibility									
	Rated Load Amperes								
	4 Turns			3 Turns		2 Turns		1 Turn	
50 HZ C.T.	RATIO	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
100:5	20	74	99	98	132	147	198	294	396
150:5	30	110	148	147	198	220	297	441	594
200:5	40	147	198	196	264	294	396	588	792
250:5	50	184	248	245	330	368	495	735	990
300:5	60	220	297	294	396	441	594	882	1188
400:5	80	294	396	392	528	588	792	1176	1584
500:5	100	367	495	490	660	735	990	1470	1980
600:5	120	441	594	588	792	882	1188	1764	2376
800:5	160	588	792	784	1056	1176	1584	2352	3168

FIGURE 1



- T - Resettable timer, seconds and tenths of seconds, 9999.9
- T1 - Variable Transformer, 0 to 120 V
- T2 - Stepdown Transformer 120 to 19V
- A - Digital Ammeter, .5% Accuracy
- R - 0.5 Ohm Resistor, 250 Watt
- K - Relay

FIGURE 2

OVERLOAD CALIBRATION DATA SHEET
SINGLE PHASE TEST CURRENT

Starter Serial Number _____

Job Name _____

Rated Load Amps _____

Locked Rotor Amps, Y _____

Overload Trip Amps, RLA x 1.08 _____

Number of Turns _____

Current Transformer _____

CT Ratio _____

Initial Locked Rotor Amps setting 125 %

Approx. Init. Must Hold Amps Setting, $1.06 \times \text{RLA} \times \text{No Turns} / \text{CT Ratio}$ _____

Calibration Current, $1.278 \times \text{OLTA} / \text{CT Ratio}$ _____

Trip Time limits, 36.8 to 37.7 seconds at Test Current

Final Locked Rotor Amps setting, $(100 \times \text{LRA} / \text{RLA} \times 1.06)$ _____

For 3-Lead Motors use, $(30 \times \text{LRA} / \text{RLA} \times 1.06)$ _____

Data Sheet Prepared By _____ Date / /

Overload Calibrated By _____ Date / /