Phenolic Motor Protectors from Texas Instruments

- Normally closed “make or break” KLIXON contact system, which is operated by a snap action disc, is sensitive to both temperature and current.
- Precision calibration – temperature calibrated and inspected under controlled conditions for dependable performance.
- Automatic or manual reset series available
- Easy to install
- UL recognized E15962
- CSA certified LR11372
- VDE certificate with production surveillance, overheating protector. 37 amperes maximum locked rotor 230 VAC, File 4464.4-4510-1013, License No. 3938 UG for 3 1/16" M.P. only.
- Inherent protection devices for approximately 1/2 to 5 h.p. motors used in applications such as industrial motors, agricultural equipment, well and sump pumps, fans, air conditioners, refrigerators, home appliances, etc.
- When properly applied, protector shuts off motor when temperature exceeds maximum safe level due to an overload or stalled (locked rotor) condition.

Why Protect Motors?
Overheating of motor insulation causes reduction in dielectric strength which can result in motor insulation damage or failure. The following are causes of motor overheating for which KLIXON motor protectors can be applied to achieve protection:
- Prolonged running overload
- Locked rotor – mechanical/electrical failure to start
- Low line voltage
- High ambient temperature and lack of ventilation

KLIXON Phenolic Motor Protectors are equipped with a bimetallic snap acting disc, on which the contacts are mounted, and through which the current flows. If overheating conditions occur, the heating effect of the current flow through the KLIXON disc and the influence of motor heat will cause the disc temperature to rise.

When the disc reaches the calibrated setpoint, the KLIXON protector automatically opens and shuts down the motor, limiting the winding and shell temperature.

When the motor has cooled to an acceptable operating level, allowing the protector to cool to its reset temperature, the KLIXON protector resets automatically to a closed contact position allowing the motor to restart.

Manual reset versions are also available for applications where automatic restarting may be hazardous to equipment or operations.
DIMENSIONAL DRAWING
(Single Phase Types)

Round Base

Eared Base

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E Max.</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR</td>
<td>3/4</td>
<td>1.031 ± 0.010</td>
<td>.970 ± 0.006</td>
<td>.125 ± 0.006</td>
<td>.225 ± 0.010</td>
<td>171</td>
<td>.375 ± 0.006</td>
<td></td>
</tr>
<tr>
<td>CR</td>
<td>1</td>
<td>1.312 ± 0.010</td>
<td>1.218 ± 0.010</td>
<td>.125 ± 0.005</td>
<td>.240 ± 0.010</td>
<td>218</td>
<td>.442 ± 0.006</td>
<td></td>
</tr>
<tr>
<td>BR</td>
<td>1½</td>
<td>1.640 ± 0.010</td>
<td>1.555 ± 0.010</td>
<td>.156 ± 0.010</td>
<td>.390 ± 0.015</td>
<td>313</td>
<td>.442 ± 0.006</td>
<td></td>
</tr>
<tr>
<td>LR</td>
<td>1½</td>
<td>1.983 ± 0.010</td>
<td>1.881 ± 0.010</td>
<td>.184 ± 0.010</td>
<td>.830 ± 0.015</td>
<td>375</td>
<td>.781 ± 0.006</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>3/4</td>
<td>970 ± 0.010</td>
<td>1.390 ± 0.015</td>
<td>175 ± 0.010</td>
<td>450 ± 0.015</td>
<td>354</td>
<td>438 ± 0.007</td>
<td>.625 ± 0.010</td>
</tr>
<tr>
<td>CE</td>
<td>1</td>
<td>1.187 ± 0.010</td>
<td>1.390 ± 0.015</td>
<td>175 ± 0.010</td>
<td>464 ± 0.015</td>
<td>406</td>
<td>440 ± 0.008</td>
<td>.625 ± 0.010</td>
</tr>
<tr>
<td>BE</td>
<td>1½</td>
<td>1.594 ± 0.010</td>
<td>2.125 ± 0.010</td>
<td>223 ± 0.010</td>
<td>715 ± 0.010</td>
<td>552</td>
<td>332 ± 0.010</td>
<td>.440 ± 0.008</td>
</tr>
<tr>
<td>LE</td>
<td>1½</td>
<td>1.875 ± 0.010</td>
<td>2.125 ± 0.020</td>
<td>267 ± 0.010</td>
<td>890 ± 0.010</td>
<td>683</td>
<td>517 ± 0.010</td>
<td>.781 ± 0.006</td>
</tr>
</tbody>
</table>

---

(type ME 4-Holes. Type CE 2-Holes at #1 Terminal End only. Other types 0 Holes.)
TYPE CODE STRUCTURE for Single Phase Phenolic Motor Protectors

The following is an explanation of the type code which appears on each standard KLIXON Phenolic motor protector. By using this code, it is possible to determine the following: size, type of base, terminals, heater, disc and contacts type and operating temperature.

**SIZE**
- M = 1/4''
- C = 1''
- B = 1 1/4''
- L = 1 1/2''

**BASE**
- E = Eared commercial
- R = Round commercial
- C* = Round comm. cut down and cover
- G* = Eared comm. and cover
- S* = Round commercial and cover

**TERMINALS**
- F = 2 solder low cap
- H = 2 solder high cap
- K = 2 std screw low cap
- M = 2 std screw high cap
- P = 2 stub low cap
- T = 2 stub high cap
- G = 3 solder low cap
- J = 3 solder high cap
- L = 3 std screw low cap
- O = 3 std screw high cap
- P = 3 stub low cap
- T = 3 stub high cap

*Except 1/4" size which always has cover. E&R designate this.
*Only 1/2" applications.

**HEATER**
Selected to satisfy application requirements

**DISC & CONTACT**

<table>
<thead>
<tr>
<th>Size</th>
<th>High Cap</th>
<th>Low Cap</th>
<th>High Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4''</td>
<td>A AC</td>
<td>F C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>B AD</td>
<td>G D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C AE</td>
<td>J E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D AF</td>
<td>H L</td>
<td>K</td>
</tr>
<tr>
<td></td>
<td>E AG</td>
<td>O I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F AH</td>
<td>AB K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G AK</td>
<td>AE W</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H AL</td>
<td>AF X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I AM</td>
<td>AG Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>J AP</td>
<td>AL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>K NO</td>
<td>AO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L NS</td>
<td>AK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M OR</td>
<td>AL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R ST</td>
<td>AM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S T U</td>
<td>AN</td>
<td></td>
</tr>
</tbody>
</table>

**OPERATING TEMPERATURE**

<table>
<thead>
<tr>
<th>Size</th>
<th>High Cap</th>
<th>Low Cap</th>
<th>High Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>J 90</td>
<td>K 65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L 105</td>
<td>Y 78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z 120</td>
<td>N 69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X 120</td>
<td>Y 92</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W 135</td>
<td>U 69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 135</td>
<td>S 102</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R 135</td>
<td>H 150</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S 135</td>
<td>F 150</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T 150</td>
<td>O 150</td>
<td></td>
</tr>
</tbody>
</table>

* 1-Phase Protectors only.
** Special temperatures. Consult net additions.
*** 3-Phase Protectors only.

**MAXIMUM RECOMMENDED PROTECTOR CONTACT RATINGS**

This chart is used to determine protector size needed when making an application.

<table>
<thead>
<tr>
<th>Size</th>
<th>Disc Contacts</th>
<th>Terminals</th>
<th>Max. Current V=120</th>
<th>Max. Current V=240</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>HC</td>
<td>LC</td>
<td>32</td>
<td>25</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>HC</td>
<td>HC</td>
<td>50</td>
<td>37</td>
</tr>
<tr>
<td>1&quot;</td>
<td>LC</td>
<td>LC</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>1&quot;</td>
<td>HC</td>
<td>LC</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>1&quot;</td>
<td>LC</td>
<td>HC</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>1&quot;</td>
<td>HC</td>
<td>HC</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>STD</td>
<td>STD</td>
<td>135</td>
<td>100</td>
</tr>
<tr>
<td>1&quot;</td>
<td>STD</td>
<td>STD</td>
<td>175</td>
<td>130</td>
</tr>
</tbody>
</table>

HC = High Capacity  LC = Low Capacity  STD = Standard

For reference only. Please contact TI for application assistance.
APPLICATION WORKSHEET

A sample worksheet provides the information needed for a proper application. It is not possible to apply a KLIXON protector based on horsepower, amperage, or name plate data only.

Motor Data

A. Locked Rotor Requirements
   1. Locked Rotor Current Cold: The current which exists the instant the motor is turned on.
   2. Locked Rotor Current Hot: The current level that exists at end of 1st cycle test. Typically 10 to 30 seconds after motor is first turned on.
   3. Time elapsed during above test to raise motor winding temperature from room temperature to around maximum allowed temperature for the UL class of motor insulation. An example would be, for a class A motor, 25°C to 175°C in 12.5 seconds.
   4. Ambient Temperature During Test: Room temperature (usually 25°C).

B. Running Overload Requirements
   1. Load Current: With the motor running, the load on the motor is to be increased in small increments until the motor winding has completely stabilized at approximately 10°C below the maximum allowed by the UL class of the motor. An example would be, for a class A motor, the maximum allowed is 140°C. The motor winding temperature was completely stabilized at 130°C and the current draw at that time would be recorded.

2&3. Protector Location Temperatures: These temperatures are taken at the conclusion of the above load current test while the motor is running under the above load.

4. Ambient Temperature: Room temperature (usually 25°C).

C. Abnormal Conditions for Protection
   1. Max/min Ambient Temperatures: Temperature in the surroundings of protector.
   2. Max/min Line Volts: The highest and lowest voltages for which protection should be effective.
   3. Other environmental considerations: i.e., exposed to agricultural weather conditions.

Name Plate Data

A. Horsepower
B. Voltage
C. Single or three phase
D. FLA (full load amps)
E. LRA (Locked Rotor amps)
F. Insulation class (UL/CSA)
   (indicate one)

A H P
V o l t s
P h a s e
A m p s
A m p s
A B F H

Protector Requirements

A. Automatic or manual reset
B. Round or cored base
C. Termination type

Motor Data Required

A. Locked rotor requirements
   1. Locked rotor current cold
   2. Locked rotor current hot
   3. Time required to raise motor winding to max. temperature
   4. Ambient temp. during test

B. Running overload requirements
   1. Load current required to stabilize main winding temp. at 10°C below maximum allowed
   2. Protector location temperature below protector surface
   3. Protector location temperature above protector (air temp)
   4. Ambient temp during test

C. Abnormal conditions for protection
   1. Max/min ambient temperatures
   2. Max/min line volts
   3. Other environmental considerations

Note: Application assistance available from TI.
EXAMPLE OF MOTOR PROTECTOR PERFORMANCE CURVES

NOTE: Other ratings available for single and three phase applications.
Computer software is available to assist in application.

For further information write or call:
Texas Instruments Incorporated
Motor Controls Marketing
34 Forest Street  MS 2-3
P.O. Box 2964
Attleboro, Massachusetts 02703-0964
Phone: (508) 699-1948
   (508) 236-1948 (effective 10/24/94)
Fax: (508) 699-1949
   (508) 236-1949 (effective 10/24/94)

Important Notice: Texas Instruments (TI) reserves the right to make changes to or to discontinue any product or service identified in this publication without notice. TI advises its customers to obtain the latest version of the relevant information to verify, before placing orders, that the information being relied upon is current. Texas Instruments assumes no responsibility for infringement of patents or rights of others based on Texas Instruments applications assistance or product specifications since TI does not possess full access concerning the use or application of customers' products. TI also assumes no responsibility for customers' product designs.