

MOD-TRONIC PTC Thermistors



Installation Guidelines



Assumptions

Conventional machine-wound manufacturing process :

- single or three phase windings
- pre- and/or final end coil forming (blocking)
- preassembled PTC harness

Selection of PTC Thermistor Response Temperature and Location

Determine PTC response temperature

Identify hot spots

- The motor manufacturer will conduct a series of temperature tests on prototype stators to determine optimal PTC thermistor response temperature to comply, for example, with the UL MCC and Locked Rotor requirements.
- These tests will also identify the optimal location (hot spots) of the single or triple thermistors in the end coils. In motors cooled by a fluid (e.g. a refrigeration compressor or a pump) this is influenced in part by the direction of gas or liquid flow.

Applications

PWS stators

- On PWS stators (part winding), some manufacturers may decide to install one or two thermistors of a triple in the start winding, and the remaining two or one in the second winding to give enhanced protection on single phase starting.

Large stators (Two triple PTCs)

- On larger stators where locked rotor conditions are most critical, the manufacturer may decide to install two triple sets of thermistors; one with a lower response temperature on the more effectively cooled side and one with a higher response temperature for normal overload protection on the other side. In a refrigeration compressor the more effectively cooled side is the suction side and the hotter side of the winding is the compressor side. These two sets of thermistors will typically be connected in series within the motor endcoils. It is important when feeding the opposite-lead-end thermistor leads thru the slot to the lead-end, that both leads of the thermistor harness, preferably lightly twisted, are laid in one slot. This minimizes induction voltages, which can lead to spurious trips, particularly at start.

PTC Thermistor Harness

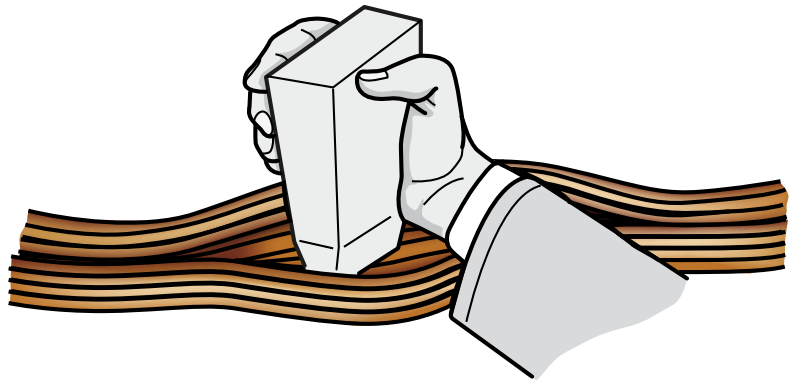
Specification of leads

Once location of the PTC thermistors in the end coils has been determined, the lead lengths and the transition to heavier (#18 or #20 gauge) lead wire can be specified for harness preassembly.

Insertion

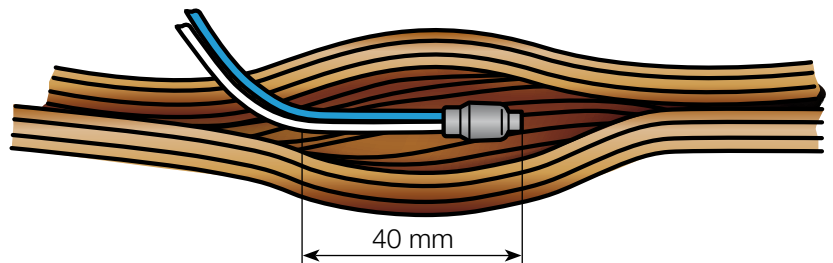
The thermistors should be **installed in the end coils prior to final blocking**, since insertion after blocking would necessitate opening up at least one of the end coils resulting almost certainly in end coil clearance problems within the motor.

Open end coil to receive PTC thermistor, using smooth metal or nylon tool



- For optimal thermal transfer from winding to thermistor, the thermistor(s) must be installed **in the centre of the end coil cross-section**, and the #26 leads should lie **parallel to the lay of the magnet wire** for approx. 40 mm.

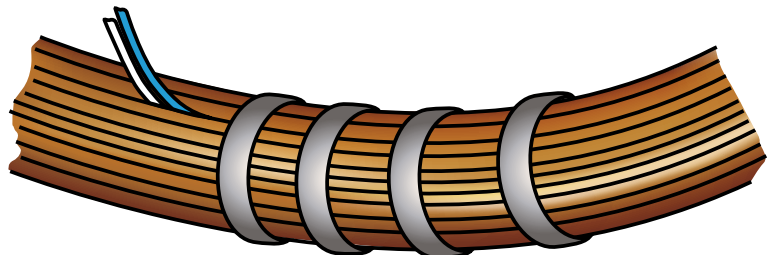
Place PTC thermistor approx. 40 mm parallel to winding lay, in center of coil



- The **transition to the heavier lead wire should take place within the end coil lacing**, since mechanical stress during manufacture and final assembly ("robust" handling) or vibration during compressor running could lead to an open circuit.

Exit PTC leads at non-stressed location of end coil, wherever possible

Lace end coil to comply with internal clearance requirements



Testing

Check for continuity

- The preassembled PTC harness should be checked for continuity before insertion.

Hipot test

- After final blocking and lacing of the end coils, the stators will normally be checked for winding symmetry, iron losses etc. and will undergo a hipot test (prior to varnish impregnation if this is part of manufacturing process). The thermistor circuit should also be tested at this stage again for continuity, and be included in the stator winding hipot test. Damaged thermistors can still be replaced by skilled operators at this stage.

Repeat after baking

The same procedure should be repeated after baking, whereby damaged stators at this stage must be scrapped out.

Consider PTC temperature limits for baking process

When selecting the temperature of the baking process it needs to be taken into account that the PTC assembly might be limiting for this temperature. In addition to the temperature class of the copper wire in the winding and the slot/phase insulation, also the maximum allowed temperature for the PTC (see datasheet) is important.

