M.O.T. 5.9 – 01
TEMPERATURE HAZARDS (Cont'd)

NOTE: Parts in this category include control panel fascia, side panels, panels adjacent to door handles and edges of doors when opened.

(d) Bodies of gas valves, thermostats, etc.: the temperature for which they have been approved.

(e) Components containing non-metallic diaphragms, 45°C above ambient, unless specifically approved for higher temperatures and so marked permanently.

(f) Body of clock or timer: the maximum specified by the manufacturer.

(g) Main gas and pilot lines of materials susceptible to sulphide attack, eg. copper: 50°C above ambient.

(h) Electric motors: winding temperatures shall not exceed the Standards Australia rating for the class of motor fitted (see Method of Test 5.9.9).

(i) Flexible hoses: the maximum temperature for that class of hose.

(j) Joints sealed with jointing compound or similar materials: the maximum temperature recommended by the manufacturers of the materials, under the conditions of use.

(k) Electrical wiring: maximum temperature specified for wiring insulation.

(l) Delivered air: 93°C.

(m) Floor and wall temperatures measured in Step 16: 75°C above ambient.

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M.O.T. 5.9.9 – 01
TEMPERATURE HAZARDS - ELECTRIC MOTORS

SCOPE

This test applies to all appliances fitted with electrically driven motors.

METHOD

The average temperature rise of motor windings is determined (based on AS 3300/NZS 6300) with the appliance operating at normal test gas pressure. This test is carried out as part of Method of Test 5.9.

APPARATUS

1 A double pole/double throw (d.p.d.t.) switch of adequate electrical rating for the load, mounted in a suitable earthed and protected enclosure with appropriate connections and terminals to enable the resistance of the motor windings to be measured quickly without electrical hazard.

2 A calibrated resistance meter with a measuring accuracy of at least 1.0%.

3 Temperature recorder with an accuracy of ± 2ºC.

4 Suitable timing device.

MATERIALS

1 Refer to Method of Test 5.9.

PREPARATION OF APPARATUS

1 Refer to Method of Test 5.9.

2 Connect the d.p.d.t. switch in series with the electric motor winding to be tested (see connection diagram in Figure 8).

PROCEDURE

1 With the test appliance at room temperature, measure the electrical resistance of the motor windings under test.

NOTE: The windings shall be at room temperature at the beginning of the test.

2 Turn on gas and light the burner(s).

3 Do not energise any electric motors if it is possible to operate the appliance in this mode.

4 Operate the appliance for not less than one hour, with normal test gas pressure at appliance inlet with the thermostat, if fitted, set at maximum or until thermal equilibrium is reached.

In the testing of ducted heaters, the room or return air thermostat sensor shall not be allowed to reduce input.

M.O.T. 5.9.9 – 01
TEMPERATURE HAZARDS - ELECTRIC MOTORS (Cont'd)

5 Measure the resistance of any motor windings using the d.p.d.t. switch, and record.

NOTE: It is recommended that the resistance of windings at the end of the test be determined by taking resistance measurements as soon as possible after switching off and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

6 Repeat Step 4 with motors energised.

7 Measure the resistance of any motor windings using the d.p.d.t. switch, and record.

CALCULATIONS

1 The value of the temperature rise of a winding is calculated from the following formulae:

(a) For a copper winding -

$$\Delta t = \frac{R_2 - R_1}{R_1}(234.5 + t_1) - (t_2 - t_1)$$

(b) For an aluminium winding -

$$\Delta t = \frac{R_2 - R_1}{R_1}(228 + t_1) - (t_2 - t_1)$$

where Δt = temperature rise

R_1 = resistance at the beginning of the test

R_2 = resistance at the end of the test

t_1 = room temperature at the beginning of the test

t_2 = room temperature at the end of the test

RESULT

The appliance complies with the requirement if the limiting average temperature does not exceed the rating for the class of motor fitted as specified in AS 3300/NZS 6300 (see following table):

M.O.T. 5.9.9 – 01
TEMPERATURE HAZARDS - ELECTRIC MOTORS (Cont'd)

Winding material	Temperature rise °C
If the winding* insulation is of	
(a) Class A material+	75 (65)
(b) Class E material+	90 (80)
(c) Class B material+	95 (85)
(d) Class F material+	115
(e) Class H material+	140
(f) Class C material+	180

* To allow for the fact that the temperature of windings of universal motors, relays, solenoids, etc. is usually below the average at the points where thermocouples are placed, the figures without parentheses apply when the resistance method is used and those in parentheses apply when thermocouples are used. For windings of vibrator coils and a.c. motors, the figures without parentheses apply in both cases.

\+ The classification is in accordance with AS 2768.

Examples of Class A material are -

(a) impregnated cotton, silk, artificial silk and paper

(b) enamels based on oleo or polyamide resins.

Examples of Class B material are glass fibre, melamine formaldehyde and phenol formaldehyde resins.

Examples of Class E material are -

(a) mouldings with cellulose fillers, cotton fabric laminates and paper laminates, bonded with melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins

(b) cross-linked polyester resins, cellulose triacetate films, polyethylene terephthalate films

(c) varnished polyethylene terephthalate textile bonded with oil-modified alkyd resin varnish

(d) enamels based on polyvinylformal, polyurethane or epoxy resins.

For totally enclosed motors the temperature rise limits for Class A, Class E, Class B, Class F, Class H and Class C may be increased by 5ºC. A totally enclosed motor is so constructed that the circulation of the air between the inside and the outside of the case is prevented but not necessarily sufficiently enclosed to be called airtight.

M.O.T. 5.10.1 – 86
HEAT RESISTANCE

SCOPE

This test applies to all ducted heaters.

METHOD

The ducted heater is operated continuously for 100 cycles of 2 hours on and 1 hour off at overload gas consumption and then checked for any deterioration.

APPARATUS

1 Equipment as set out in Clause 3.2.6.

2 Test rig as specified in Method of Test 5.9.

MATERIALS

1 Supply of appropriate test gas (see Clause 3.1.2) at a pressure to give overload gas consumption.

PREPARATION OF APPARATUS

1 Install the ducted heater as set out in Section 3.2.

2 Connect to gas.

3 Examine the ducted heater and ensure that it does not have any structural, mechanical or operational defects.

PROCEDURE

1 Light burner and adjust to overload input within two minutes from cold condition.

2 Set any thermostats or temperature limiting devices to maximum.

3 Allow heater to operate for 100 cycles of 2 hours on and 1 hour off.

4 Turn off gas. Disconnect and examine the heater.

M.O.T. 5.10.1 – 86
HEAT RESISTANCE (Cont'd)

RESULT

The appliance complies with this requirement provided:

(a) Doors and other movable fittings function correctly.

(b) Surface finishes of the appliance have not deteriorated.

(c) Controls, thermostats etc. do not leak, seize or fail.

(d) Refractories have not deteriorated seriously.

(e) Burners have not distorted or deteriorated sufficiently to affect normal operation.

(f) Belts, motors and fans have not shown any sign of deterioration.

(g) Wiring insulation has not scorched or melted.

M.O.T. 5.10.2 – 86
HEAT RESISTANCE - LIGHT BACK CONDITION

SCOPE

This test applies to all ducted heater burners in which a light back condition can be established.

METHOD

Each burner is tested to establish if it can be operated in the light back condition.

If a light back condition can be established, the burner is allowed to operate in this condition for one hour at the maximum gas rate at which the light back condition can be maintained but at no more than the nominal gas rate.

APPARATUS

1 Equipment as specified in Clause 3.2.6.

MATERIALS

1 Supply of appropriate test gas (see Clause 3.1.2).

PREPARATION OF APPARATUS

1 Connect the ducted heater to gas and adjust the burner pressure to that specified by the manufacturer.

2 Ascertain if a light back condition can be established by applying an ignition source at the burner injector. If a light back condition cannot be established initially, allow the burner to operate normally for 15 minutes and repeat the light back test.

3 If a light back condition is established allow the burner to operate in this condition for a period of one hour at the maximum gas rate at which the light back condition can be maintained but at no more than the nominal gas rate.

4 Allow the burner to cool and examine all components for evidence of melting or distortion.

RESULT

If a light back condition is established the burner complies with the requirement if, at the end of the test, all burner components show no evidence of melting or distortion.

M.O.T. 5.11.1/2 – 86
HEAT EXCHANGERS, MAXIMUM/MINIMUM TEMPERATURE TEST

SCOPE

This test applies to all ducted heaters.

METHOD

The appliance heat exchanger surfaces are explored to determine the approximate regions of maximum and minimum temperature and when these locations have been determined at least five No. 24 AWG bead type thermocouples are attached to the heat exchanger surface in each region. Attachment of thermocouples can be made by silver soldering to the sheet metal heating elements or peening into holes drilled into cast iron elements. The heater is then installed in each of the manufacturer's proposed installations and the maximum and minimum heat exchanger temperatures are determined.

APPARATUS

1 Pressure gauge of range 0 - 3 kPa ± 10 Pa.

2 Suitable 24 AWG thermocouples with an accuracy of ± 2ºC or better for attachment to the heat exchanger, and a multipoint recorder having an accuracy of ± 2ºC.

3 Suitable test walls for the heater to be installed into or against.

4 Suitable ducts and plenums (see Appendix H).

5 For room sealed ducted heaters, suitable lengths of flue to suit the manufacturer's intended installations together with the intended flue terminal.

6 Suitable timing device.

MATERIALS

1 Supply of appropriate test gas (see Clause 3.1.2) at normal test gas pressure.

2 Electricity supply at the required voltage.

PREPARATION OF APPARATUS

1 Set up and examine the ducted heater in accordance with Section 3.2.

2 Ensure that the thermostat or any other variable restriction in the gas line will not vary the gas flow rate during the test.

3 Connect the ducted heater to gas.

4 Where the ducted heater is of the room sealed type the appliance should be installed to give the normal resistance to flow.

NOTE: The flue terminal must be fitted

M.O.T. 5.11.1/2 – 86
HEAT EXCHANGERS, MAXIMUM/MINIMUM TEMPERATURE TEST (Cont'd)

5 Where the ducted heater has a fan assisted flue system the voltage into the ducted heater should be controlled at 240 volts.

6 Install the heater with plenums and ducts according to Appendix H.

7 Set the air flow to give the normal temperature rise specified in the rating plate.

8 Where ducted heaters are equipped with selectable or modulating heat inputs the tests shall be performed at the lowest gas consumption for the minimum temperature test, and at the highest gas consumption for the maximum temperature test, with normal test point pressure at the appliance inlet.

PROCEDURE

1 With the heater in normal operation, the heat exchanger surface shall be explored to determine approximately the regions of maximum and minimum temperatures.

2 Attach at least five thermocouples to the external surface of the heat exchanger at each of the regions of maximum and minimum temperature determined in Step 1 above.

3 Reassemble the ducted heater taking care not to disturb any of the attached thermocouples.

4 With all parts at room temperature light the pilot.

NOTE: Room temperature shall exceed 16ºC during the test period.

5 Connect the thermocouples to the temperature recorder.

6 Switch on the temperature recorder and start the timing device.

7 Light the burner and operate the heater at normal test gas pressure until equilibrium is reached.

8 Continually examine the recording temperatures and note the time taken for the heat exchanger temperature to reach the temperature determined from the clause requirement.

9 Record the time and temperature readings, until the heat exchanger temperatures stabilise.

RESULT

The ducted heater complies with the requirement if its external heat exchanger surface:

(a) reaches the required minimum temperature within the time specified in Table 5.11.1

and

(b) does not exceed the temperatures specified in Table 5.11.2.

M.O.T. 5.11.3 – 93
DURABILITY OF HEAT EXCHANGERS

SCOPE

These alternative test methods apply to all ducted air heaters.

METHOD A

The ducted air heater is installed with suitable ducts and plenum, as detailed in Appendix H, and operated at 11% overload input with the controls rewired to an external timer and all integral limit thermostats disconnected.

In cases where the heat exchanger temperature exceeds the temperatures listed in Table 5.11.2 plus 110ºC, the 3.5 minute burner on/fan off cycle time shall be reduced to give a heat exchanger temperature of 110ºC over the heat exchanger material temperature given in Table 5.11.2. This is to prevent premature failure of the heat exchanger.

The appliance is operated through 10 000 cycles of 3.5 minutes gas on/fan off followed by 3.5 minutes of gas off/fan on, and the heat exchanger inspected every 2 000 cycles for evidence of failure.

METHOD B

The ducted heater is installed with suitable ducts and plenum, as detailed in Appendix H, and operated at nominal gas consumption with the fan control operating at its maximum setting and an external control incorporated into the wiring circuit to turn the gas off when the fan switches on, and turn the gas on when the fan turns off.

In cases where the fan is turned on by a timer or before the heat exchanger is fully warmed up, the turning off of the gas shall be delayed until the heat exchanger has reached 90% of the warmed up temperature.

The appliance is subjected to 100 000 cycles of heating and cooling, with the heat exchanger being inspected every 10 000 cycles for evidence of failure.

APPARATUS (METHODS A & B)

1 Equipment as specified in Clause 3.2.6.

2 Suitable ducts and plenum (see Appendix H).

3 For conventionally flued heaters - 0.6 m length of flue.

4 For room sealed heaters - the flue terminal specified in the manufacturer's instructions.

5 Cycle controller.

6 Safety shut-off controls for

(a) burner ignition failure

(b) overheat protection for fan.