

Chapter 7

NAPIER TEMPERATURE SENSING ELEMENTS

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LEADING PARTICULARS

Temperature sensing element Mk. 1, Napier Pt. No. NC00600/A

<i>Thermistor type</i>	M52
<i>Nominal resistance (at 20 deg. C)...</i>	500 ohms
<i>Associated Thermal controllers, Teddington types</i>	FLM/A/27

Temperature sensing element Mk. 2, Napier Pt. No. NC00600/B

<i>Thermistor type</i>	M53
<i>Nominal resistance (at 20 deg. C)...</i>	5000 ohms
<i>Associated Thermal controllers, Napier</i>	Mk. 1, 1A and 1B Mk. 3 and Mk. 5

Temperature sensing element Mk. 3, Napier Pt. No. NC0075/198

<i>Thermistor type</i>	M52
<i>Nominal resistance (at 20 deg. C)...</i>	500 ohms
<i>Identifying sleeve colour</i>	Yellow
<i>Associated Thermal controllers, Teddington types</i>	FLM/A/907
<i>(Napier Mk. 4, 4A and 4B)</i>	FLM/A/910 FLM/A/912 FLM/A/917

Temperature sensing element Mk. 4, Napier Pt. No. NC0075/199

<i>Thermistor type</i>	M53
<i>Nominal resistance (at 20 deg. C)...</i>	5000 ohms
<i>Identifying sleeve colour</i>	Red
<i>Associated Thermal controllers, Napier</i>	Mk. 1, 1A and 1B Mk. 3 and Mk. 5

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Temperature sensing element Mk. 5, Napier Pt. No. NC0075/220

Thermistor type	M53
Nominal resistance (at 20 deg. C)	...	...	...	...	...	...	...	5000 ohms
Identifying colour	...	...	...	...	...	...	...	Black
Associated Thermal controllers, Napier	...	...	...	...	...	...	...	Mk. 1, 1A and 1B Mk. 3 and Mk. 5

Temperature sensing element Mk. 6, Napier Pt. No. NC0075/221

Thermistor type	...	...	...	...	...	...	...	M52
Nominal resistance (at 20 deg. C)	...	...	...	...	...	...	...	500 ohms
Identifying colour	...	...	...	...	...	...	...	Mottled brown
Associated Thermal controllers, Teddington types	...	...	...	...	...	...	...	FLM/A/907
(Napier Mk. 4, 4A and 4B)	...	...	...	...	...	...	...	FLM/A/910 FLM/A/912 FLM/A/917

Introduction

1. The Napier temperature sensing elements are used in the Napier Spraymat de-icing system in conjunction with a Spraymat thermal controller to sense and control the heat of the surface heaters. A sensing element houses a thermistor, which has a negative temperature coefficient (i.e. the resistance falls with increase of temperature and rises with decrease in temperature) and is built into the

Spraymat heater on the airframe surface.

2. This chapter deals only with the sensing elements, details of the surface heaters each of which is designed for a particular application in individual aircraft may be found in the relevant Aircraft Handbook. General information and repair instructions for surface heaters may be found in A.P.1464D, Vol. 1, Sect. 4. The thermal controllers are dealt with elsewhere in this Section.

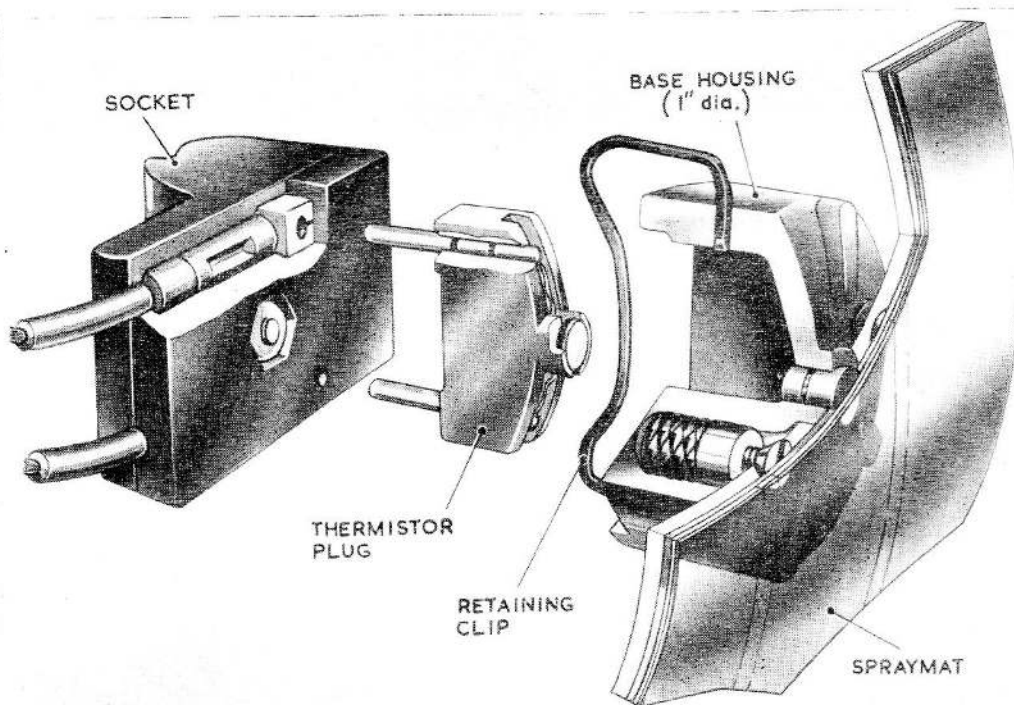


Fig. 1. Sensing element Mk. 1 and Mk. 2 showing installation details

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DESCRIPTION

3. The sensing elements are identical in operation but differ in the type of housing used to accommodate two types of thermistor. The thermistors are physically similar but have a different resistance at 20 deg. C. the Type M52 thermistor has a nominal resistance of 500 ohms, the Type M53 thermistor has a nominal resistance of 5,000 ohms. The thermistors consist of a particle of a metallic oxide semi-conductor, connected between the ends of two fine platinum wires, sealed into a glass bead and fused to the surface of a copper disc.

4. The three housings used are suited to the particular surface heater in which the sensing element is to be incorporated, that of the Mk. 5 and Mk. 6 sensing elements being particularly suitable for applications where space to the rear of the surface heater is limited. The details of each sensing element showing the six different combinations of housings and thermistors are given in the leading particulars.

Sensing elements Mk. 1 and Mk. 2

5. These are the early types of sensing

elements, shown in fig. 1, and consist of a base housing, a thermistor plug, a socket and a protective, moulded rubber, shroud. They are readily identifiable to type by shape and by the Part No. impressed in the moulding. The moulded Bakelite base is secured to the base insulation of the Spraymat surface heater by two 6 B.A. screws and incorporates a silver-copper (92.5Ag/7.5Cu) button and a spring saddle-clip.

6. The thermistor plug consists of the thermistor bead fused to a copper disc and housed in a recess in the moulding with the platinum wires soldered to the two plug pins. The plug fits into the base housing, and heat from the Spraymat element passes through a Bakelite disc fitted over the silver button and through the button to the copper disc of the thermistor bead and so to the thermistor itself.

7. The thermistor socket has two brass ferrules into which the cables to the thermal controller are connected and in which are housed two phosphor bronze spring-sockets. The moulded body of the socket is made in two halves which are secured together by a

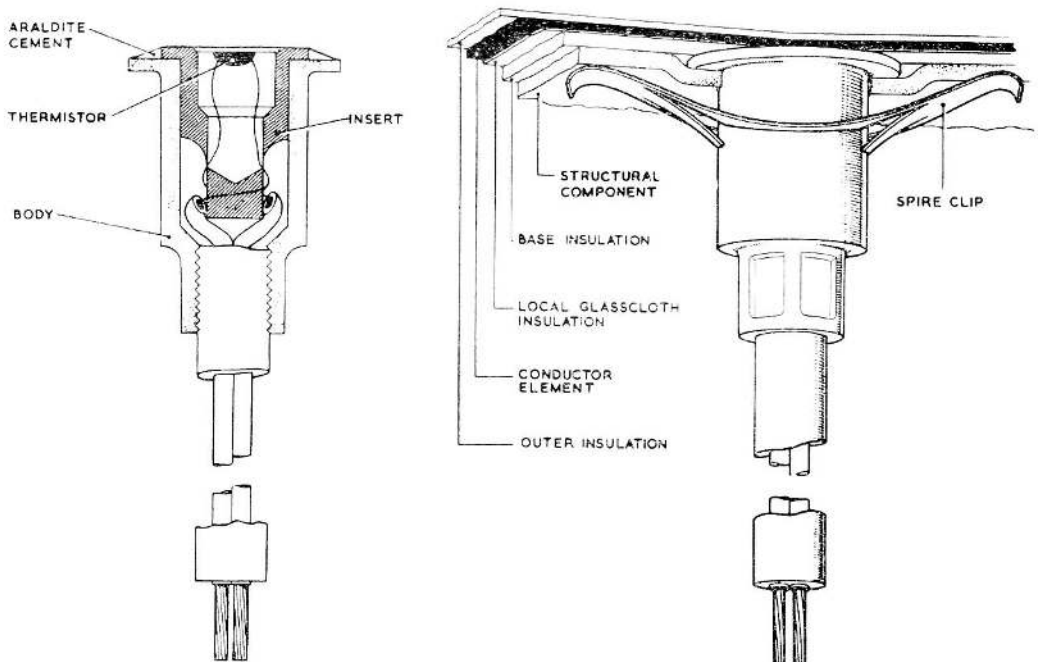


Fig. 2. Sensing elements Mk. 3 and Mk. 4 showing installation details

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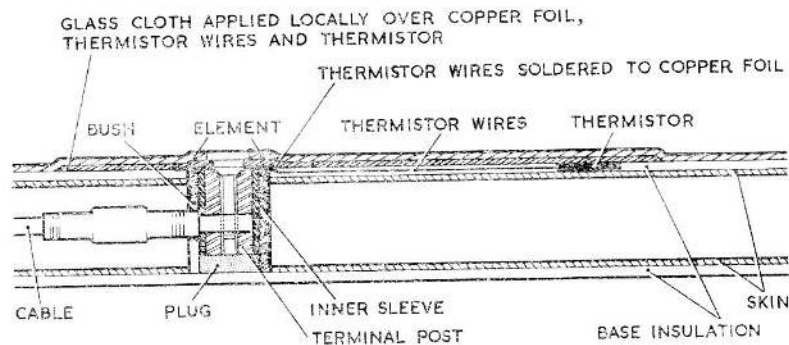
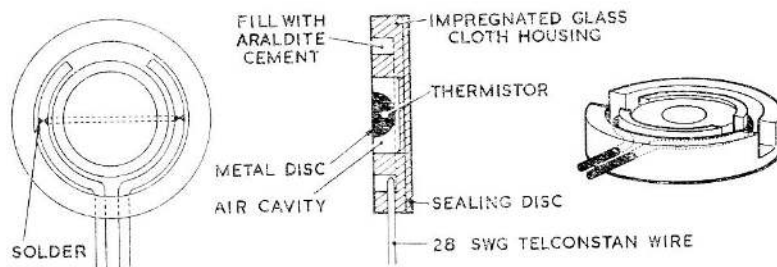


Fig. 3. Sensing elements Mk. 5 and Mk. 6 showing installation details

6 B.A. screw and nut clamping the ferrules in position. The thermistor plug pins fit into the sockets and the assembly is retained in position by the spring saddle-clip of the base housing. The moulded rubber shroud is fitted over the thermistor socket and the base housing sealing the element against the ingress of moisture.

Sensing elements Mk. 3 and Mk. 4

8. The construction and typical installation of the Mk. 3 and Mk. 4 sensing elements is shown in fig. 2. The flanged aluminium alloy body of the housing accommodates the cast synthetic resin insert in the end of which is secured a copper disc carrying the thermistor bead. The insert is sealed in the housing by an epoxy resin cement (Araldite) and the two platinum wires from the thermistor are soldered to the cores of an appropriate length of twin-core cable. The cable is crimped into the base of the housing and an identifying coloured sleeve fitted.

Sensing elements Mk. 5 and Mk. 6

9. The Mk. 5 and Mk. 6 sensing elements and a typical installation are shown in fig. 3.

The copper disc carrying the thermistor bead is secured in the centre well of the flat circular housing which is built-up of resin impregnated glass cloth. The platinum wires from the thermistor are soldered to two 28 S.W.G. Telconstan wires which are sealed in an annular groove around the centre well by epoxy resin cement and taken out to suitable terminals. A sealing disc at the rear of the sensing element is used to insulate it from the airframe component on which it is mounted.

INSTALLATION

10. The sensing elements are installed with the surface of the thermistor carrying disc flush with the upper surface of the Spraymat base insulation and directly beneath one of the heating strips. This ensures that the element is directly monitoring the heat generated by the heater, a layer of glass cloth or a Bakelite disc over the sensing element electrically insulates the element from the heater. The Spire clip fitted to the Mk. 3 and Mk. 4 elements anchors the element to the airframe member and prevents movement of the element. In installations other than

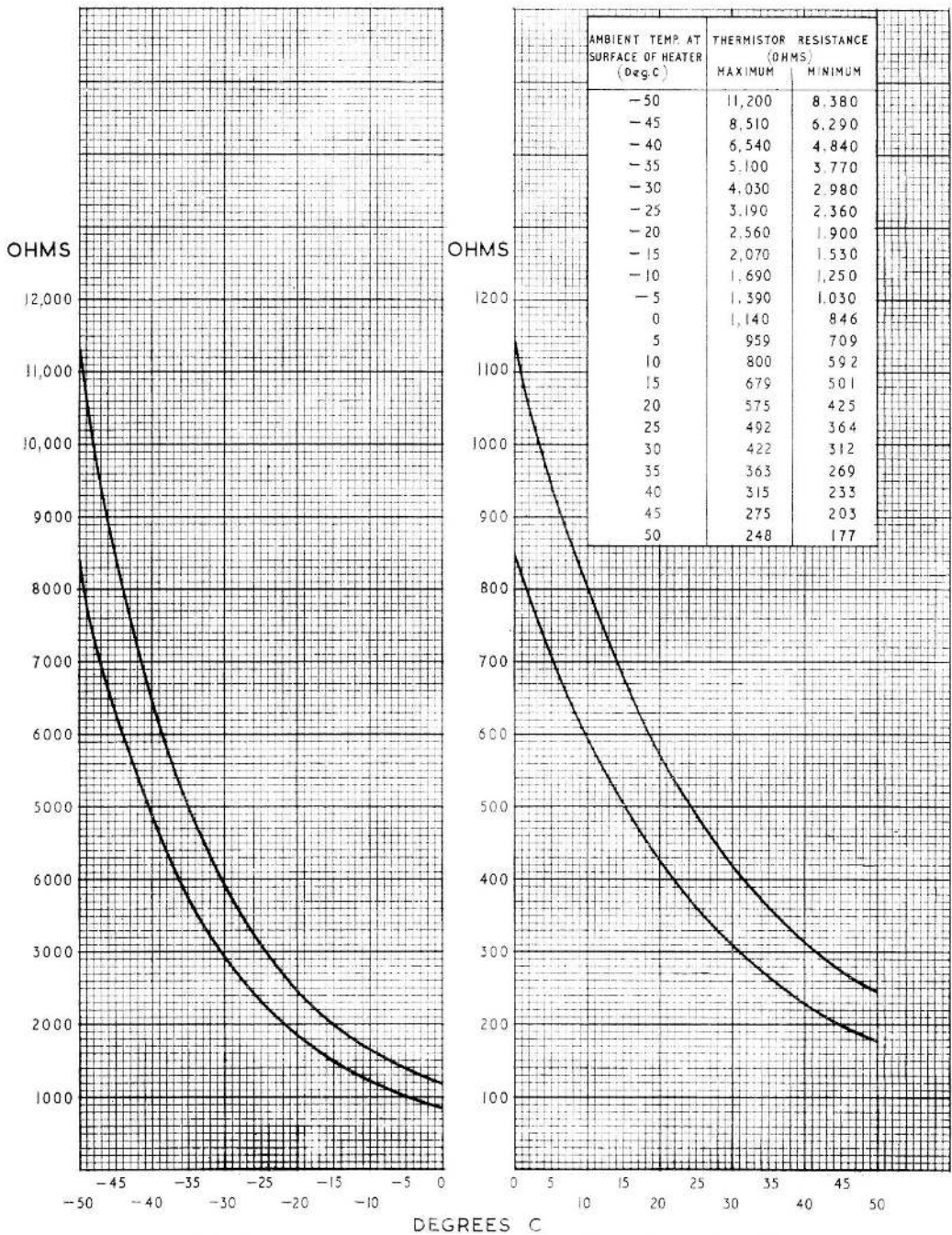


Fig. 4. Resistance-temperature curve for Mk. 1, 3 and 6

those using the Mk. 1 and Mk. 2 elements, two elements are normally fitted in adjacent positions on each heater, one connected to the thermal controller, one provided as a stand-by unit.

OPERATION

11. The sensing elements are used in continuously heated Spraymat systems in which the heaters are selected to operate and will continue to do until either the conducting

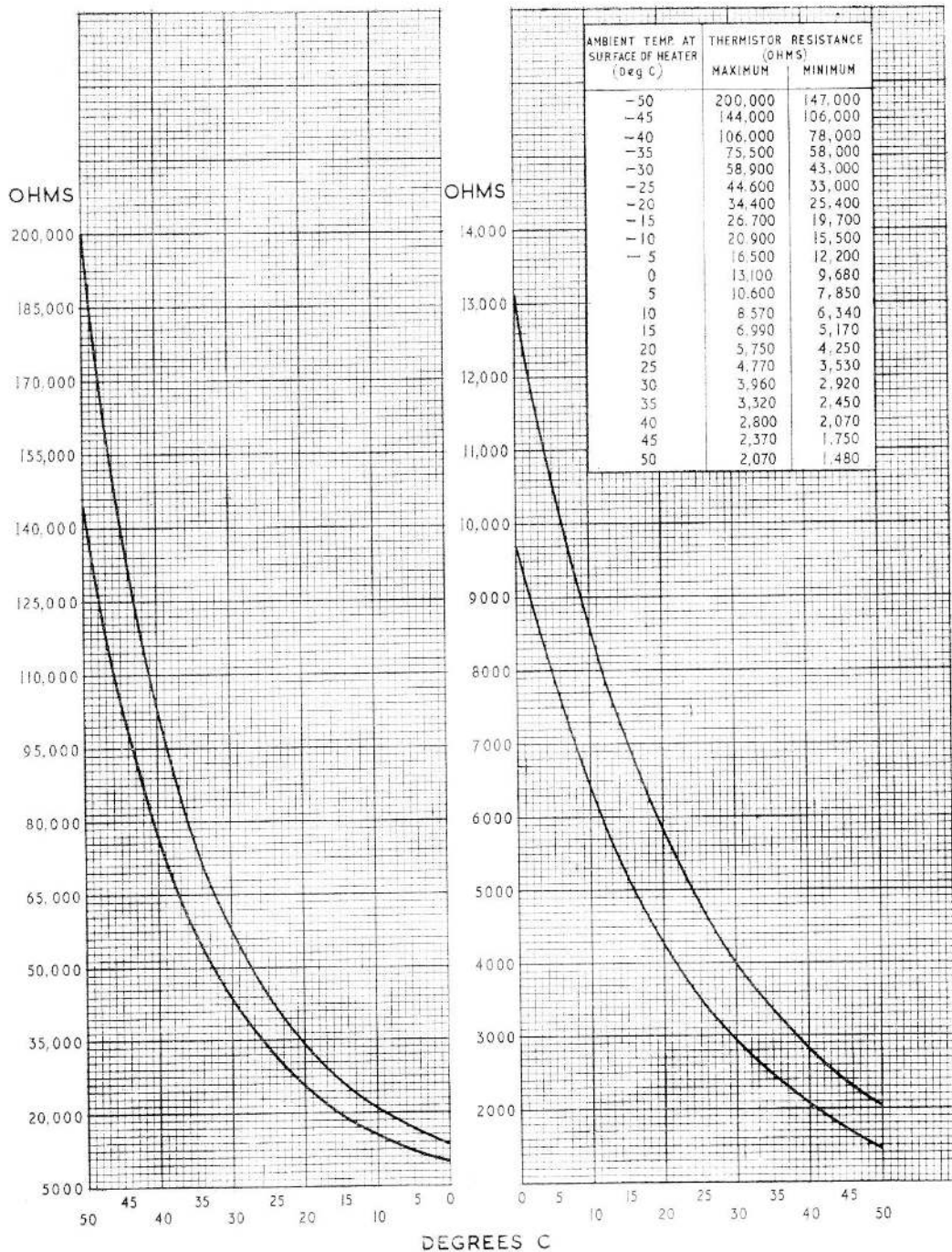


Fig. 5. Resistance-temperature curve for Mks. 2, 4 and 5

heater strips of the Spraymat surface heater attains full heat or the selection is cancelled. The sensing element monitors the heat of the heating strips and should the temperature exceed a preset value (determined by the operating temperature of the associated

controller) the decreased resistance of the thermistor passes a signal of sufficient strength to cause the controller to de-energize the heater supply contactor. The supply to the heater is then broken allowing the strip to cool.

12. As the temperature of the heating strip falls the resistance of the thermistor increases until it reaches a value sufficient to cancel the overheat signal. The thermal controller will then re-energize the heater supply contactor. The duration of the HEAT ON and HEAT OFF periods will depend upon the rate of heat dissipation in the surface heater. Under severe icing conditions the frequency and duration of the HEAT ON periods will be greater than under less severe icing conditions.

SERVICING

13. The sensing elements should be examined where possible for security of attachment and except in the case of the Mk. 5 and Mk. 6 elements the connecting cables should be examined for deterioration or contamination by oil or other fluids. Little servicing of the sensing elements, which other than the Mk. 1 and Mk. 2 elements, are sealed units is possible. The component part of the Mk. 1 and Mk. 2 elements other than the base housing can be renewed, but should an element in the later Spraymats fail the stand-by element should be connected for use. Failure of both thermistors will necessitate changing the Spraymat assembly.

Continuity resistance test

14. The continuity resistance of the sensing element thermistor may be measured using a Multimeter Type F, Ref. No. 5QP/1, or any other type of resistance measuring instrument provided that not more than 1V is applied to the thermistor. Prior to measuring the continuity resistance the ambient temperature at the surface of the Spraymat in the region of the sensing element must be measured. The location of the sensing element can be determined from the appropriate Aircraft Handbook.

15. The resistance of the sensing element may then be measured from a convenient junction or terminal block. The resistance of the connecting leads may be ignored, being negligible when compared with that of the thermistor. The reading obtained should be within the limits determined from the appropriate resistance-temperature curve, fig. 4 or fig. 5, at the ambient temperature previously recorded (i.e. for a Mk. 3 sensing element, at an ambient surface temperature of 15 deg. C the resistance should be within the limits 501—678 ohms).

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