Chapter 1-0

TEMPERATURE INDICATORS, TYPE S149 SERIES

CONTENTS

Introduction

1 The information contained within this chapter deals with the basic Type S149 temperature indicators. Each instrument (Fig 1) has a manufacturer's code number which is made up of three parts. A typical code is S149.3.33, where S149 is the model number, 3 is the 'form' and 33, the suffix number, represents the application to which the instrument is adapted.

2 Details of each application are given separately in the sub-chapters for each suffix number. Dial presentation, circuit diagram and testing procedures are shown for each variant (eg S149.3.33, Chapter 1-1). ◄

3 Three forms of this indicator are in service use; form 1 is a ratiometer type movement measuring the ratio of two currents; forms 2 and 3 are standard moving coil voltmeters or ammeters depending upon the use to which they are applied.

Principle

Form 1 (Fig 2)

4 The principle employed in these indicators is that of the ratiometer, which measures the ratio of two currents. They differ from the normal design in that the magnetic circuits are so arranged that the field in the gap between the core and the pole-piece, in which the coils rotate, is not uniform. This non-uniformity is achieved by the shaping of the centre cores. Two coils mounted on a common former are connected so that the torques produced in each coil are in opposition.

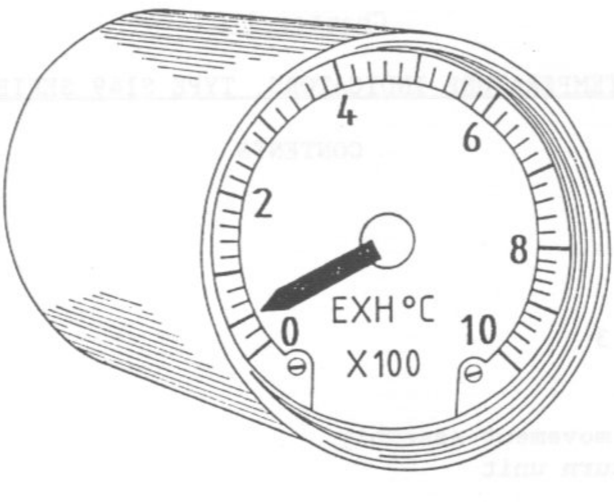

Fig 1 Indicator, Type S149 series

5 Due to the shaping of the centre cores, the coil in which the greater current flows is in a weaker part of the field than that in which the lesser current flows. Therefore, the assembly will always rotate until the coils are in that part of the field where the torques produced in the coil are equal and opposite. In this position a state of equilibrium is reached.

6 Theoretically, the instrument is substantially independent of the supply voltage, since any change in voltage will not alter the ratio of the currents in the two coils on the former. Assuming that the ligaments which conduct the current into and out of the coils exert no controlling torque, then no change in pointer indication will occur. In practice, the ligaments exert a small torque, but this has little effect on the pointer at operating voltages.

7 The current used in the operation of the indicator reaches a maximum of 20 or 40 mA depending upon the range of the instrument; this current is sufficient to operate an electromagnetic sweep-off mechanism designed to move the pointer off-scale when the circuit is de-energized; a description of this mechanism is given in para 13. The off-scale position of the pointer to the left or right depends upon the application of the indicator.

Form 2 and 3 (Fig 3)

8 In this form, the principle is that of the normal voltmeter or ammeter where the movement of the moving coil in relation to the field of the permanent magnet is proportional to the voltage or current applied to the coil. For currents or voltages in excess of the rating of the instrument, resistances in shunt or series connection are mounted internally. The pointer return unit is not required in these instruments.

DESCRIPTION

Form 1

9 The movement is enclosed within an hermetically sealed 2-inch casing terminated by a Mk.4 plug located in the back plate; the front of the casing is threaded to accommodate an adapter for conversion to SAE pattern.

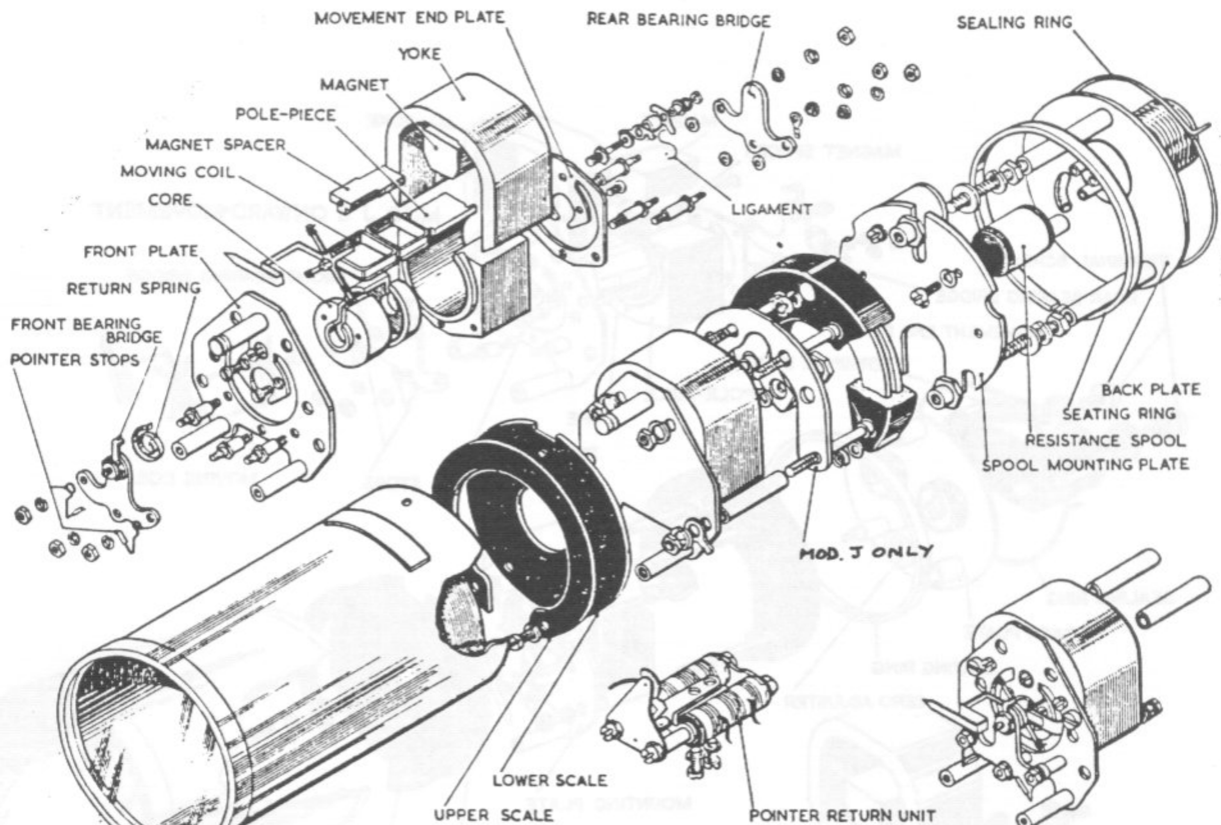

Fig 2 Indicator, Type S149.1 (detail view)

Magnet and movement assembly

10 This assembly (Fig 2) consists of a permanent magnet and yoke, two moving coils mounted on a common former, a rear bearing bridge, front bearing bridge, and a pointer return unit. The block magnet, over which is fitted the U-shaped soft iron yoke is of high field strength, the north pole face of the magnet being in contact with the yoke.

11 Each of the two bearing bridges are supported by three pillars secured to the soft iron pole-piece. The coils are pivotally mounted between spring-loaded jewel screws located in the bridges. The pointer attached to the coil former, is balanced by two weights and limit of travel is governed in both directions by spring stops set at approximately 0.07 in. beyond the scale limits.

12 The scale is secured in position by the pillar riveted to the front plate and also by two screws at the bottom of the scale. At the rear of the movement the current is transferred from the two cables to the moving coils by two ligaments which exert a small torque on the pointer assembly. The common return circuit is conducted by a single ligament at the front of the assembly in instruments where a pointer return unit is incorporated, or, in the absence of a pointer return unit, a hairspring is fitted which also functions as a pointer return spring.

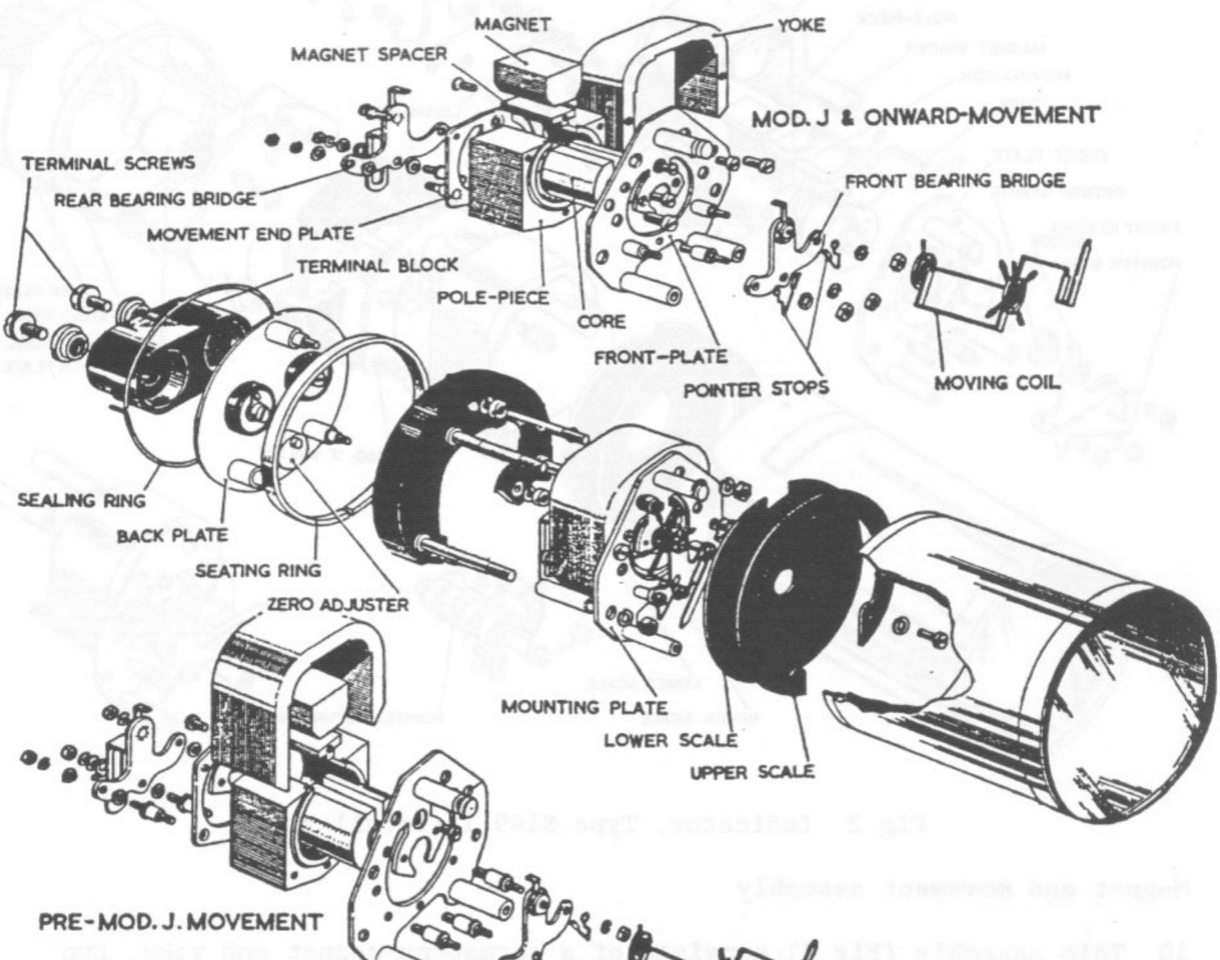

Fig 3 Indicator, Type S149.3 (detail view)

Pointer return unit

13 The pointer return unit consists of an electro-magnetic device incorporating two iron-cored coils (Fig 2), connected in series or parallel according to range, and a soft iron armature. The pivoted armature is connected by quadrant and pinion gearing to a fine copper-beryllium arm which bears against the vertical arm of the pointer when the unit is de-energized.

14 When the indicator is energized, the coils of the pointer return unit provide a field which attracts the armature thus withdrawing the copper-beryllium spring arm from contact with the pointer mechanism; the pointer is thus free to travel over the scale in response to current variations from the temperature sensitive equipment. When the indicator is de-energized (no current flows) the armature returns and the pointer is swept off the scale in a direction according to the application of the indicator.

Form 3 (Fig 3)

15 The casing in this form is identical with the form 1 model (except that the overall length of the casing is shorter by 0.97 in) but it differs in that connection is made by means of a terminal block attached to the back plate.

Magnet and movement assembly

16 This assembly (Fig 3) comprises a magnet, a soft iron pole-piece, a coil winding mounted upon a former, a rear bearing bridge and a front bearing bridge. Each bridge is supported by three pillars secured to the soft iron pole-piece. Pivots attached to the coil former are mounted between spring-loaded jewel screws which are located in the front and rear bridges. The pointer, attached to the coil former, is controlled by the interaction of the magnetic flux with the field surrounding the coil winding, and is positioned at zero when no current flows. Balance of the pointer is maintained by weights, and pointer travel is limited in both directions by spring stops.

17 The scale is secured in position by the pillar riveted to the front plate and also by two screws at the bottom of the scale. Connections to the moving coil system are made by one cable connected to the rear bearing bridge, which is insulated from the magnet assembly by bushes, and the second cable earthed to the front plate by a tag and securing screw. Final connection to the coil is made by two hairsprings.

Form 2

18 The form 2 instrument movement is identical with the form 3 but the casing is of greater length, being the same as that of form 1.

Suffix number

19 As stated in para 1, the suffix number represents the instrument application; each instrument will have a different number if used for more than one purpose. The relevant information is contained in the sub-chapters. It should be noted that where indicators have been provided by the aircraft manufacturer the relevant spare indicator provided by Service Stores will bear a different suffix number.

Servicing and testing

20 Each sub-chapter contains information for use in testing a particular indicator. The resistance values given in the calibration table include an additional amount of resistance to simulate actual conditions under which the indicator will operate; they are not the standard platinum law values.