

RAM AIR TURBINE1. Introduction

The ram air turbine consists of an air turbine and a 22 kVA alternator combined. The complete assembly is mounted on a platform and is normally retracted inside the port mainplane just below the engine air intakes. RAT is brought into operation by being ejected into the airstream. Ejection is effected by operation of a T toggle release fitted above the coaming of 1P.

Operationally, the RAT is ejected when at least two primary alternators have failed, but until all four primary alternators have failed the RAT alternator output is held off the synchronising network by the effect of the SVFU (see Section 2 Part 3).

2. RAT Test Switch

A push switch labelled RAT - TEST is fitted to 1OP and when operated, the RAT frequency and voltage can be checked on the oncoming alternator meters, also fitted to 1OP.

3. RAT Micro Switches

Two Dowty type micro switches operated by the RAT mechanism on ejection complete the following operations.

No 1 micro switch.

- (a) trips the load shedding contactor in 15P thus isolating 28V DC non essential loads from the essential bus bar.

No 2 micro switch.

- (a) trips the load shedding contactor in 16P, with results similar to those of No 1 micro switch.
- (b) Provides 28V DC for the RAT alternator exciter field flashing.

4. RAT Breaker (Relay 15)

The output from the RAT alternator is transferred to the synchronising network via the contacts of this breaker. It is of the latched type and is therefore equipped with close and trip operating coils. The close coil is operated through the proving circuits of the synchronising network interlocks.

5. Field Initiation Resistors

Three 6.8 Ohm 180 watt Berco resistors are provided for the alternator field flashing circuit. The alternator field being initially excited from 28V DC supplied via fuse 813 and the three resistors. The resistors ensure a steady build up of alternator output.

6. Control Unit (Field Initiation)

When the RAT is ejected No 2 micro switch closes to feed 28V DC from fuse 813 to energise the Field Shorting relay inside the control unit. The energising of this relay removes an earth from the alternator field and allows the 28V DC from fuse 813 to feed via the three resistors the undervolt relay, field shorting relay to 'flash' the alternator field.

As the output of the alternator builds up so it is applied to transducer ITD4, which when the output reaches 180V approx, will cause the undervolt relay to energise. This in energising removes field flashing and feeds 28V DC from fuse 813 to the interlock circuit for the closing of the RAT breaker.

7. Control Unit (Voltage Controller)

Voltage control is achieved by transducers in the following manner. (It is assumed alternator field initiation has taken place and that the control unit relays have assumed their operating position.)

The primary windings of the excitation transformer ITR2 are supplied from the alternator lines A, B, C, via windings of an excitation transducer ITD 1. The amount of AC current flowing through the windings is determined by the amount of DC current passing through ITD 1's bias winding. This DC current is derived from a supply and reference transformer rectifier ITR 3.

The control of ITD 1 is provided from the output of ITD2, and is in opposition to the bias of ITD 1. Voltage sensing is done by the two control windings of ITD 2 fed from the output of ITR 3. One winding is fed via a barretter tube and is therefore of a fixed current value, while the other is fed via a resistance network and current varies with change of voltage. These windings are in opposition to each other.

At 200V output of the alternator the amount of control current in the windings of ITD2 are such that the output will just maintain ITD 1 at the required current level.

With an increase of output the current of the resistive control winding of ITD2 increases, while it remains constant in the barretter tube control winding. In increasing it produces a greater control current on ITD 1. As the control winding of ITD1 is in opposition to the bias, then increasing control current will cause the output of ITD 1 to reduce. This in turn reduces field strength of the alternator and the voltage is returned to 200V.

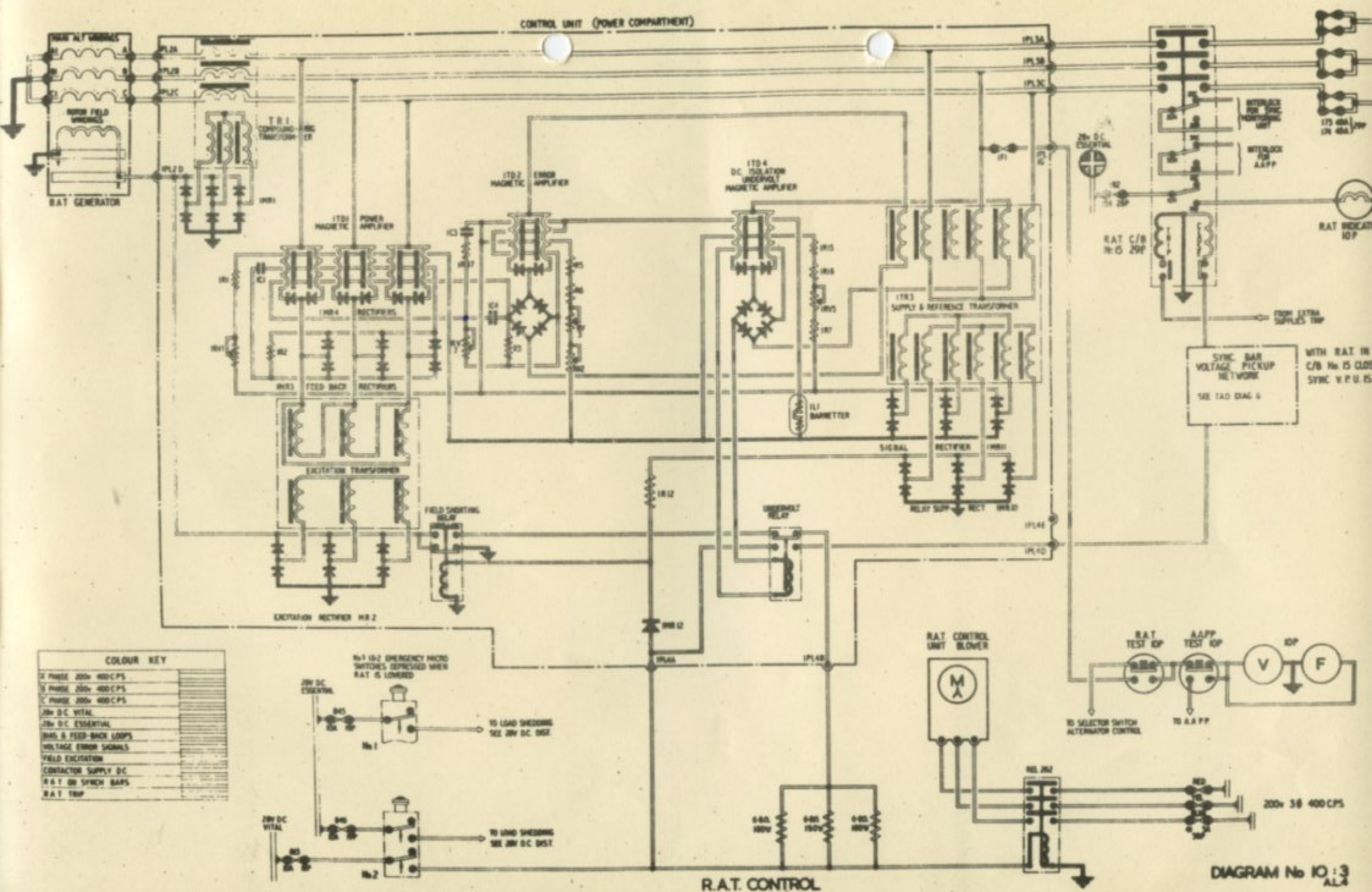
It should be noted that frequency control (described in paragraph 8) is coarse and since transducer operation is to some extent governed by frequency it follows that under some operating conditions the voltage control can become erratic.

8. Frequency Control (Turbine Speed Control)

The turbine speed is controlled by a mechanical bob weight type governor which consists of three equally spaced weights rotating around the turbine shaft. Should the turbine commence to overspeed, the bob weights act to move a drum which is connected by radially arranged arms connected to the turbine fixed guide vanes. The guide vanes thus re-direct the air to the turbine.

9. Circuit Components

<u>Component</u>	<u>No</u>	<u>Location</u>
Ram Air Turbine	1	Port Wing
RAT Alternator Rotax Type 157	1	Port Wing
RAT Micro Switches	2	Port Wing
Control Unit Rotax C 3702/2	1	Power compartment
RAT Breaker	1	29P (Power compartment)



COLOR KEY

Y	PHASE 200V 400CPS
B	PHASE 200V 400CPS
C	PHASE 200V 400CPS
20V DC VITAL	
20V DC ESSENTIAL	
20V DC FEED-BACK LOOPS	
VOLTAGE ERROR SIGNALS	
FIELD EXCITATION	
CONTACTOR SUPPLY DC	
RAT ON SYNC BARS	
RAT TRIP	

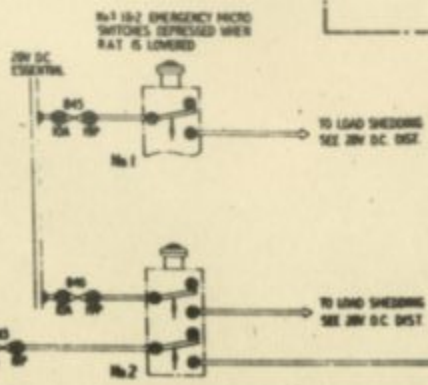
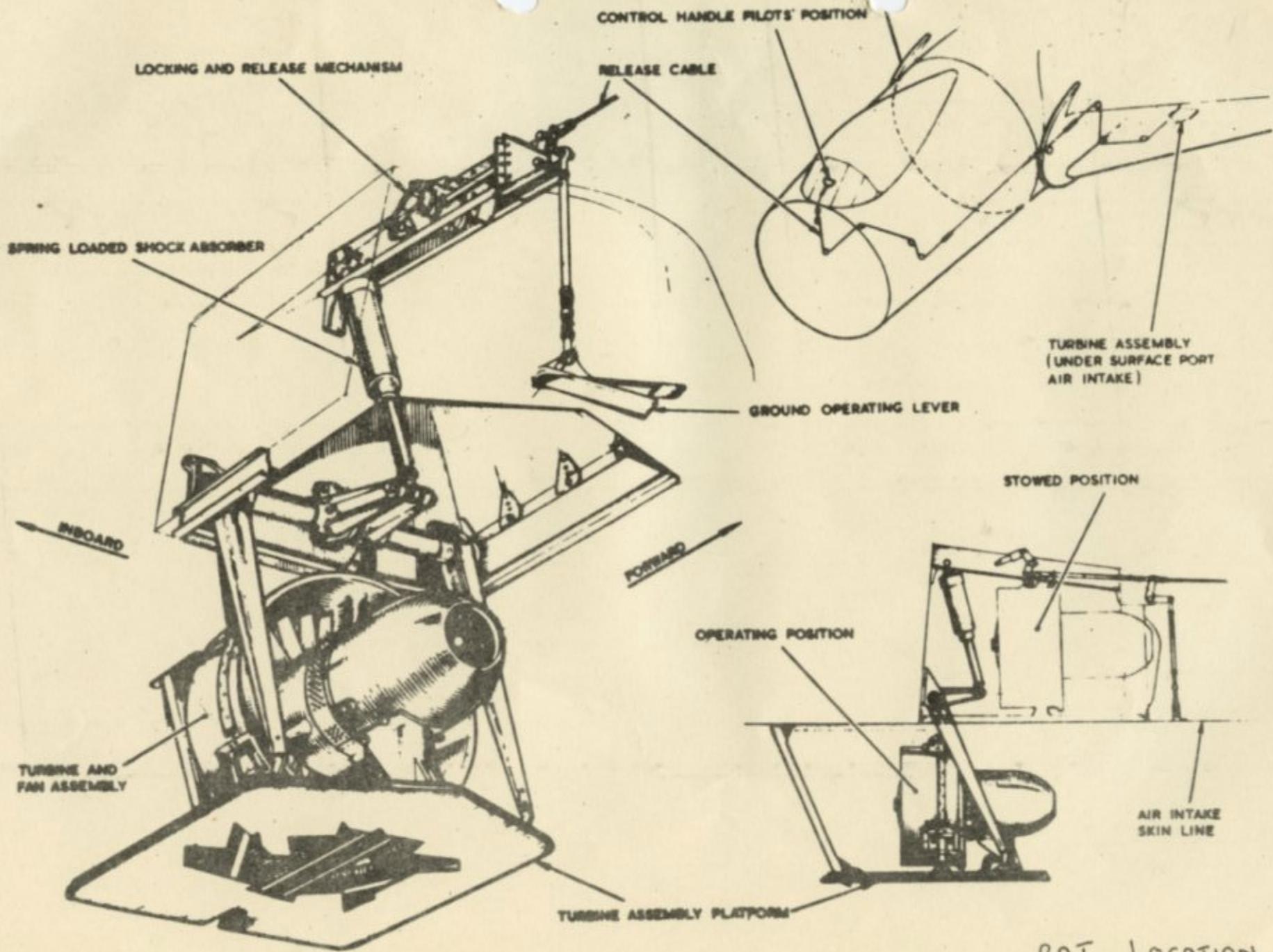


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ALA



RAT. LOCATION

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LIGHTNING MK. 1
COVER PITOT HEAD
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