

# PART I

## DESCRIPTIVE

NOTE.—The numbers quoted in brackets after items in the text refer to the illustrations in Part V.

### INTRODUCTION

1. The Tempest II is a single-seat low-wing monoplane fighter and fighter-bomber, powered by a Centaurus V engine driving a Rotol four-blade 35° constant speed propeller. The engine is fitted with a Bendix-Stromberg injection carburettor and a two-speed supercharger. There are considerable differences between temperate and tropical versions. These notes cover the tropical version. The appendix on page 39 describes those features peculiar to the temperate version.

### FUEL AND OIL SYSTEMS

#### 2. Fuel system

- (i) Fuel tanks.—Fuel is carried in four self-sealing tanks, one in the fuselage aft of the fireproof bulkhead and three in the wings. The fuel from the main tank is fed to the carburettor by an engine-driven pump. A float-valve in the main tank opens when the contents fall to 66 gallons, to allow the fuel from the wing tanks to be transferred to the main tank by air pressure from the exhaust side of the vacuum pump.

The capacities of the tanks are :

Main (fuselage) tank	...	...	...	76 gal.
2 Interspar (wing) tanks each	28 gal.	...	56	„
Nose (port wing) tank	...	...	28	„
Total				160
				„

A drop tank of 45 or 90 gallons capacity may be carried under each wing, the fuel from these tanks being trans-

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ferred to the main tank in the same way that the wing tank fuel is transferred. When necessary, these tanks can be jettisoned by means of the red lever (53) on the right-hand sloping panel above the K-40 priming pump.

~~NOTE.—The 90 gallon drop tanks are not yet cleared for service use.~~

- (ii) Fuel cocks.—There is no provision for isolating separate tanks, the wing tanks, or alternatively the drop tanks, being used as a group. The transfer of fuel from the wing or drop tanks to the main tank is controlled by a single selector lever (54) mounted on the right-hand sloping panel.

When this lever is moved forward to ON, fuel is transferred from the drop tanks, and the wing tanks are turned off and vented to atmosphere. When it is pulled back to OFF, fuel is transferred from the wing tanks, and the drop tanks are turned off and vented to atmosphere. The main tank is not pressurised and the flow of fuel from it is controlled by an ON-OFF cock (55) mounted on the shelf on the right-hand side of the cockpit. An air pressure gauge (18) marked TANK AIR on the right-hand side of the instrument panel shows the pressure available for transferring fuel. The gauge should read between  $3\frac{1}{2}$  and 5 lb./sq. in.

- (iii) Fuel booster pump.—An electric fuel booster pump is fitted in the sump of the main tank. It is switched on and off by the main tank cock. Should it fail, fuel can still be fed to the carburettor by the engine-driven pump.

NOTE.—On no account must the main fuel cock be ON with the fuel cut-off control at NORMAL unless the engine is running (*see* para. 34 (viii)).

- (iv) Fuel contents gauges.—Electrical fuel contents gauges (13) for all the permanent tanks are mounted together on the right-hand side of the instrument panel. They are switched on and off by the electrical master switch (39) which is interlinked with the ignition switches (40). There are no contents gauges for the drop tanks.

- (v) No-transfer warning light.—The warning light (11), mounted on the top right-hand side of the instrument panel comes on when the contents of the main tank have fallen to 65 gallons, thus indicating that fuel has ceased to transfer from the wing or drop tanks.

As the float valve in the main tank opens at approximately 66 gallons, the warning light may flicker at times before the wing tanks are empty. The incorporation of Mod. 369 prevents this happening, and the warning light then comes on when the contents of the main tank have fallen to 63 gallons, *but the light will probably come on also when the main tank is completely full, that is, when it contains 76 gallons.* However, when the contents fall to 74 gallons the light will go out and stay out until the wing tanks are empty and the contents of the main tank have fallen to 63 gallons. If the main tank is full (and the light is on) when the engine is started, the fuel level will fall to 74 gallons and the light will go out during the warming up and run up. The pilot should not take-off with the light showing, since this indication may mean a fault in the fuel transfer system.

- (vi) Fuel pressure warning light.—The warning light (19) on the right-hand side of the instrument panel comes on when fuel pressure drops appreciably below normal.
- (vii) Priming system.—A single K.40 priming pump (69) mounted at the bottom of the right-hand sloping panel draws fuel from a separate tank on the right-hand side of the main tank for priming the engine.

### 3. Oil system

- (i) Oil is supplied from a tank mounted aft of the main fuel tank, having a capacity of 14 gallons of oil and 4 gallons air space.
- (ii) The oil cooler in the starboard wing root is by-passed at low oil temperatures.
- (iii) The oil cooler shutter is thermostatically operated and no control lever is fitted. The operation of the shutter can be verified by pressing and releasing the push-button in the starboard wheel-well, marked OIL COOLER FLAP TEST SWITCH. The electrical master switch must be on and hydraulic pressure available.

## MAIN SERVICES

### 4. Hydraulic system

An engine-driven pump which maintains a pressure of 1,800 lb./sq. in. in the system operates the

Flaps  
Oil cooler shutter  
Undercarriage and  
Wheel doors.

In the event of failure of the engine-driven pump a handpump (26) on the left of the pilot's seat can be used to operate all the services.

### 5. Pneumatic system

An engine-driven compressor charges an air bottle at 450 lb./sq. in. for the operation of the

Brakes  
Gun firing mechanism and  
Undercarriage assister

A triple pressure gauge (24) is mounted at the bottom left-hand side of the instrument panel.

### 6. Electrical system

A 24-volt engine-driven generator supplies two 12-volt batteries in series for the operation of the whole electrical system. A power failure warning light (21) on the lower right-hand side of the instrument panel comes on when the generator is not charging the batteries. Most of the electrical switches are grouped on a panel on the right-hand side of the cockpit.

## AIRCRAFT CONTROLS

### 7. Flying controls

- (i) The control column is of the spade-grip pattern and incorporates the brake-lever, the gun and camera gun firing control and the gun-sight gyro-caging pushbutton.
- (ii) The rudder bar is fitted with two-position rudder pedals and can be adjusted for reach by a foot-operated wheel in the centre of the bar.

**8. Flying controls locking gear**

The gear is stowed in a bag on the left-hand side of the cockpit and comprises a hinged clamp and 4 cables. The clamp is fitted to the control column with the projecting lugs in contact with the fork-end nuts of the aileron tie-rods, and the front 2 cables are hooked on to the rudder pedals. With the seat-adjusting lever (65) in the third notch from the top, the rear cables are hooked to each side of the seat and the cables tensioned by adjusting the rudder bar and then raising the seat.

**9. Trimming Tabs**

The trimming tab control box is mounted on the left-hand side of the cockpit. The elevator tabs are controlled by the large handwheel (51) on the inboard side of the box, and the rudder tab is controlled by the smaller handwheel (50) at the top of the box. Both handwheels work in the natural sense, and tab position indicators are fitted between them.

**10. Undercarriage control**

The undercarriage selector lever (45) moves in a quadrant on the left-hand sloping panel, marked UP in the forward and DOWN in the aft position; the knob of the lever has to be turned clockwise before the lever can be moved. A safety catch, outboard of the quadrant, must be pushed to FREE before the lever can be moved to UP, and during the movement to the UP position, as the selector lever passes the safety catch, the latter is returned from FREE to LOCK.

**11. Undercarriage position indicators**

- (i) The electrical visual indicator (5) on the left-hand side of the instrument panel has three green lights (for main wheels and tail-wheel) and two red lights (for main wheels only). The indicator lights show :—

Green—corresponding wheel locked down.

Red—corresponding main wheel between locks.

No lights—main wheels locked up and fairing doors closed.

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The central knob is pulled out to bring the reserve set of green lights into operation, and rotated to operate the dimmer screen for night flying. The indicator ON-OFF switch (39), which is also the electrical master-switch, is interlocked with the ignition switches so that these cannot be operated unless the indicator switch is ON.

- (ii) When the undercarriage main wheels are down, a small rod protrudes through the upper surface of each wing.

### 12. Undercarriage warning light

A red light (3) on the left-hand side of the instrument panel comes on if the throttle lever is less than one-third open and the wheels are not locked down.

### 13. Undercarriage emergency release pedals

In the event of complete hydraulic failure the undercarriage main wheel up-locks may be released by the red emergency pedals (44) and (70) outboard of each rudder pedal, and then locked down by the action of a pneumatic assister which is controlled by a lever (37) marked UNDERCARRIAGE EMERGENCY RELEASE forward of the engine control box (*see* para. 56).

### 14. Flaps control and position indicator

- (i) The flaps are controlled by a three-position selector lever (47) at the bottom of the left-hand sloping panel. Intermediate flap settings can be obtained by returning the lever to the VALVE SHUT (neutral) position when the desired setting is reached. The lever must be returned to the VALVE SHUT position after any operation.
- (ii) The setting of the flaps is shown on an indicator (23) on the left-hand side of the instrument panel.

### 15. Wheel brakes

The control lever for the pneumatic brakes is on the control column spade grip. A parking catch is provided. Differential control of the brakes is provided by a relay valve connected to the rudder bar. The triple pressure gauge (24) on the bottom left-hand side of the instrument panel shows the air pressure in the storage cylinder and at each brake.

## ENGINE CONTROLS

### 16. Throttle and mixture control

- (i) The throttle quadrant in the engine control box is gated at the climbing and economical cruising boost positions. A friction damping control is fitted.
- (ii) Mixture control is entirely automatic and is governed by the setting of the throttle lever (31); an economical mixture strength is obtained only when this is at or behind the rearmost gate in the quadrant.

### 17. Propeller speed control

- (i) The lever (41) on the engine control box moves forward to **OVERRIDE** and back to **AUTO**.

With the lever at **AUTO**, r.p.m. are controlled automatically by the setting of the throttle lever, but with it at **OVERRIDE** the interconnection device is overridden and r.p.m. are then governed at 2,700.

With the lever at **AUTO** the corresponding r.p.m. for a given throttle setting are :

Throttle set to give

Boost lb./sq. in.	r.p.m.
—4 to 0 ... ..	1,600
+2 (economical cruising gate)	2,100–2,200
+6 (climbing gate) ... ..	2,380–2,460
Full throttle ... ..	2,700

The lever can be used in the same way as the conventional propeller speed control lever to enable the pilot to select higher r.p.m. than those given by "interconnection." Automatic control of r.p.m. is only effected when the lever is at **AUTO** and indiscriminate use of it in any other position will increase fuel consumption considerably.

- (ii) At certain r.p.m. (1,650–1,950) the engine runs very roughly. Throttle settings which give these r.p.m. should, therefore, be avoided whenever possible. Where this is found to be difficult, as when climbing in formation, the propeller speed control lever should be advanced to give not less than 2,050 r.p.m. This will incur a slight loss in range.

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- (iii) The friction damping control for the throttle also serves the propeller speed control lever.

### **18. Fuel cut-off control**

The red-topped lever (46) at the rear of the engine control box cuts off the supply of fuel to the carburettor when it is in the down (CUT-OFF) position. It is connected with the throttle lever and cannot be moved to CUT-OFF until the throttle is nearly closed. Similarly the throttle cannot be opened beyond the correct position for starting until the lever is set to NORMAL.

### **19. Supercharger control**

The black-topped lever (30) on the engine control box is moved down for high and up for low gear.

NOTE.—The lever must always be moved smartly and without pause.

### **20. Carburettor air-intake filter control**

A combined air-intake filter and heat control is fitted and is electrically controlled by a switch (10) on the right-hand side of the instrument panel. It has three positions : FILTER, COLD and HOT. The filter is automatically brought into operation when the undercarriage is lowered, irrespective of the position of the switch ; and unless the switch is at FILTER, the filter will be withdrawn from operation when the undercarriage is retracted. This is undesirable because the aircraft may still be in a dust-laden atmosphere and also because faulty operation of the filter may cause engine cutting, so the switch should always be placed in the FILTER position before take-off and also before landing (in case of a mislanding, when the undercarriage will be retracted).

The micro-switch (in the starboard wheel well), which is normally operated by the movement of the undercarriage leg, can be depressed (when Mod. 381 is incorporated) by a small strip of metal, hinged at one end, so that it is then possible to take off in ram air.



## 21. Cowling gills control

- (i) On early aircraft the cowling gills are controlled by a three-position switch (33) on the left-hand cockpit wall above the engine control box. When the electrical master switch is turned on the gills take up the position selected on the three-position switch, but will open irrespective of the setting when the master switch is turned off.
- (ii) On later aircraft the gills are thermostatically controlled and the three-position switch is deleted. The gills will, therefore, close fully when the electrical master switch is turned on, if the engine is cold.
- (iii) No gill position indicator is fitted.

## 22. Coffman starter re-indexing control

The toggle (43) at the top of the left-hand sloping panel is pulled out and returned gently to re-index the Coffman starter breech.

# COCKPIT EQUIPMENT

## 23. Sliding hood controls

- (i) *Operation.*—To operate the winding gear the spring-loaded knob on the crank lever (32) should be pulled out while the crank lever is rotated in the required direction. When the knob is released the hood is automatically locked in position.

Before leaving the cockpit, the knob on the crank lever should be pulled out as far as possible and turned until a projection on the knob engages in a small recess in the crank lever ; this permits the hood to be moved from the outside by hand.

- (ii) *Locking from outside.* If it is desired to lock the hood shut from the outside, the knob should first be set as in sub-para. (i), and the hood closed by hand. A hand grip is fitted at the back of the sliding hood to help in closing it. The spring-loaded locking bolt in the side of

the fuselage should then be engaged with the slot in the starboard side of the hood framing.

NOTE.—One end of this spring-loaded locking bolt engages in the sliding hood, and the other end, incorporating a pin, lies in a deep slot when in the hood-locking position, and in a shallow slot when not in use. Before flight, the bolt must be positioned so that the pin is properly home in the shallow slot. With the pin in any intermediate position, vibration may cause it to rotate and fall into the deep slot, locking the hood, or preventing it shutting fully, if it is open when this occurs. Accidental locking of this nature in flight with the hood closed will prevent its normal opening, and may prevent its emergency release.

- (iii) *Opening the hood from outside.* If the hood has been locked in the closed position, the spring-loaded locking bolt must first be pushed in and rotated a quarter turn. The hood may then be pushed back by hand.
- (iv) In emergency, the hood may be jettisoned from both inside and outside the aircraft (*see para. 57*).

#### 24. Cockpit lighting

Two lights are fitted just beneath the coaming and are controlled by two rheostat switches mounted on the top centre of the instrument panel.

A third light above the trimming tab control box is controlled by a rheostat switch at the top of the left-hand sloping panel, and a fourth light above the electrical panel on the right-hand side of the cockpit is controlled by a rheostat switch at the forward end of the panel. The compass light is controlled by the lower right-hand rheostat switch on the top centre of the instrument panel.

#### 25. Cockpit heating and ventilation

The cockpit heating control (7) is on the top centre of the instrument panel. Cold air is supplied through four ventilators, one on each side of the instrument panel (17) and (25), and two under the coaming.

26. **Retracting footstep.** A retracting footstep in the starboard side of the fuselage behind the wing is connected by an elastic cord to a hand-hold behind the cockpit. When the footstep is pulled down, the cover over the hand-hold opens and sets a trigger so that, by closing the hand-hold cover, the footstep automatically retracts. Care must be taken to ensure that the footstep is correctly retracted before flight ; otherwise, engine fumes may be drawn into the cockpit.

## OPERATIONAL CONTROLS

### 27. Guns

The guns are fired electro-pneumatically by the push-button on the control column spade-grip. The compressed air supply is taken from the same source as the brake supply and the available pressure is shown on the triple pressure gauge (24).

### 28. R.P. controls

A master ON-OFF switch (36) and a switch (35) for selecting PAIRS or SALVO are mounted on the left-hand side of the cockpit. The bomb release push-button in the throttle lever is used for firing the rockets.

### 29. Gyro gunsight

A gyro gunsight is mounted above the instrument panel, the master switch (29) being mounted on the left-hand side of the cockpit together with a dimmer and selector control (27). The ranging control is incorporated in the top of the throttle lever, and the control (8) to enable the sight to be used in conjunction with R.P. is at the top right-hand of the instrument panel. A switch for caging the gyro during violent manoeuvres is on the control column.

### 30. Camera gun

The camera gun is mounted in the leading edge of the starboard wing, outboard of the oil cooler, and is operated by the gun-firing pushbutton on the control column spade-grip. A footage indicator and an aperture switch

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are on the shelf on the right-hand side of the cockpit : the camera master switch (62) is on the electrical panel. A separate pushbutton on the control column operates the camera gun independently of the guns. When not in use, the plug to the footage indicator should be put in the dummy socket on the shelf.

### **31. Bomb controls**

The bomb selector and fuzing switches are mounted together on a panel on the right-hand cockpit wall above the main fuel cock. The bomb release pushbutton is in the top of the throttle lever and there is an emergency release (48) outboard of the left-hand sloping panel.