

PART 3

CHAPTER 4 — HANDLING IN MANUAL CONTROL

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Selecting Manual Control

1. If necessary, the elevators may be unlocked at airspeeds up to 400 knots or 0.85M with the feel trim position indicator anywhere in the safe or ideal sectors. Until experience is gained, it is recommended that the aircraft is trimmed to the ideal sector and the in-trim speed attained before unlocking the elevators and cutting off hydraulic power. Initially, carry out the exercise above 5000 feet. When experience is gained, the simulated hydraulic failure drill in para 3 may be practised.

2. *Practice Manual Selection*

- a. Feel trim to the ideal sector and attain the in-trim speed.
- b. Unlock the elevators (below 400 knots/0.85M).
- c. Turn off the hydraulic selector.
- d. Raise the guard on the standby trim or transfer standby trim to the stick switches.
- e. Exhaust the tailplane accumulator at 1° to 2° nose-up undercarriage up, 5° to 6° undercarriage down.

3. *Simulated Hydraulic Failure*

When experienced, at any stage of flight above 2000 feet:

- a. Turn off the hydraulic selector.
- b. Continue until the SWS operates.
- c. Carry out the **Hydraulic Failure** drill.

4. a. When feel trimming to the ideal sector, the control column should be kept still unless an attitude change is required. Before unlocking, stick forces should be eliminated by either adjusting to the in-trim speed or relaxing pressure on the control column and accepting the resulting manoeuvre. Unlocking while out of trim results in a sharp pitch change proportional to the stick load.

b. After cutting the hydraulic supply to the controls, the tailplane and ailerons remain in power for a limited period until their accumulators are exhausted (1350 and 1500 PSI respectively). This period may be reduced by movement of the control column. To ensure that both ailerons revert to manual simultaneously, the aileron accumulator should be exhausted completely by coarse and rapid lateral stick movements. If the ailerons are allowed to revert to manual in their own time, a slight wing-drop and pitch-up may occur.

WARNING: If, after selecting manual a heavier than normal force is needed to move the ailerons, it is possible that servodyne cold soaking has delayed the full opening of the free stroking valves. Exercising the ailerons through two or three cycles should restore aileron operating forces to those normally felt in manual control. If this is not successful reselect power, if possible, and land as soon as practicable to have the fault investigated.

c. The SWS operates when the hydraulic pressure falls below 1850 PSI. The hydraulic warning (HYD) caption remains on after the audio warning and attention lights have been cancelled.

d. To unlock the elevators, the ELEV UNLOCK lever must be pulled slowly rearwards to the full extent of its travel, ensuring that two clicks are felt. The ELEV secondary warning caption comes on as soon as the elevators cease to be *fully locked*; thereafter it gives no indication of the unlocking process.

e. After unlocking:

(1) In full manual, check that the aircraft responds to rearward control column movement.

(2) In the circuit, either in manual or follow-up, recheck that the handle is fully aft.

5. The following services are lost:

a. *Feel Trim*: this becomes inoperative on unlocking or when the tailplane accumulator pressure falls below 1200 PSI. The tailplane can then be trimmed only by the standby trim system.

b. *Automatic Datum Shift*: this becomes inoperative when the tailplane accumulator pressure is exhausted.

c. *Q-Gearing*: at 1850 PSI the q-gearing hydraulic supply is isolated from the tailplane accumulator and the gearing reverts to the 'below 200 knots' condition.

Note: When the standby trim is operated, the TRIM caption comes on, indicating that normal control column/tailplane relationship has been disturbed.

Flying in Manual Control

6. *Elevators*. The aerodynamic loads transmitted to the control column are light. With the tailplane set at 2° nose-up, longitudinal control extends from about 150 knots to 400 knots. Below 200 knots, full elevator deflection is needed for even moderate manoeuvres. Almost full elevator deflection is also required to counteract undercarriage lowering trim changes. It is, therefore essential to use the standby trim as the primary control during protracted manoeuvres (above 2g it is possible to stall the standby trim motor). The aircraft should be re-trimmed during speed or configuration changes to maintain a load-free stick position (see paras 11 to 14 for trimming technique in the circuit). Although 12° of nose-up standby trim movements are available, it is seldom necessary to use more than half of this for a let-down and flapless landing.

WARNING 1: If the elevators are unlocked with the trim indicator outside the ideal sector, full elevator movement is not available.

WARNING 2: The control column restriction mentioned in Part 3, Chapter 3, para 6b may be clearly felt if the control column is moved almost fully back; further backward pressure moves the control column through the restriction, giving increased up-elevator. This should not be necessary if the aircraft is properly trimmed.

7. *Ailerons*. Approximately 100° of aileron movement is necessary to exhaust the aileron accumulator; when this happens, the ailerons suddenly become heavier as manual reversion occurs. Indication is given by the aileron hydraulic pressure approaching 1500 PSI. Stick forces are

large at high airspeeds, reducing as the aircraft decelerates. At circuit speeds, lateral control requires little effort.

8. *Trim Changes.* A slight pitch-up may be noted when the aileron accumulator exhausts. The automatic datum shift is inoperative when the undercarriage is selected up or down. The trim change is large and should be counteracted during rather than after the cycle. All other trim changes are normal.

9. *Speed Limitations.* The maximum speed in manual control or with the elevators caption on is 400 knots below and 0.85M above 20,000 feet.

10. In manual, particularly with the undercarriage down, stall/spin prone situations and coarse control movements near the stall or in buffet must be avoided. However, should loss of control occur the following actions should, where possible, be taken:

- a. Select hydraulic selector to ALL ON.
- b. Select undercarriage UP, if Down.
- c. Centralise the controls (AP1 neutral TP1 3° to 6° nose-up).
- d. If a recognisable spin develops carry out the consolidated spin recovery actions in Part 3, Chapter 2, paras 38 to 43.

Landing in Manual Control

11. Before practising manual landings, it is recommended that pilots become familiar with simulated circuits at a safe height. Note particularly:

- a. The marked lack of aircraft response to large, rapid elevator movements.
- b. The in-trim TPI setting at key points in the circuit.
- c. The need to trim during undercarriage operation.
- d. That the undercarriage and flaps operate on the normal hydraulic system.

12. Steep approaches must be avoided.

13. a. If the landing is to be flapless, the provisions of Part 3, Chapter 3, para 17, apply. A tailplane setting of at least 8° nose-up is needed for round-out and touchdown. To avoid constant use of the standby trim, the desired touchdown trim setting should be applied early in the final turn. The resultant slight push-force is normal. A tailplane position of at least 6° nose-up can be preset while lowering the undercarriage, to ensure that the aircraft is in trim at the end of the downwind leg.

b. Flap may be used for landing but it is not available after total hydraulic failure. When flap is used, pay particular attention to trimming on the approach. Normal threshold speeds may be used but the round-out is easier if the speed is increased by 5 knots. Tailplane incidence is between 10° and 12.5° nose-up at round-out.

14. *Overshoot*

a. The decision to overshoot from the approach should be made, if possible, before reducing speed below 150 knots. If another circuit is intended, the undercarriage must be left down. Increase power to 100% until the speed reaches 160 to 170 knots, then reduce to 90% and trim.

b. For practice purposes, leave the undercarriage down if making another circuit or postpone retraction until a safe height is reached. If raising the undercarriage, re-trim as the wheels retract. The flaps (if used) should then be raised and the aircraft re-trimmed.

WARNING: If the aircraft is allowed to accelerate rapidly and the undercarriage and flaps are raised together, a considerable nose-up change of trim occurs. Even with the control column fully forward, it may not be possible to stop the nose rising, nor may the standby trim be immediately effective. Initially, the rate of change of trim may be faster than the rate at which the relatively slow operation of the standby trim can counter it. Applying bank until the standby trim becomes effective prevents an involuntary climb.

Reselecting Powered Control

15. Powered control may be reselected by reproducing the flight and trim conditions which obtained when the tailplane accumulator was exhausted. When reselecting powered control:

- a. Ensure that the undercarriage is in the same position as it was when manual control was selected.
- b. Ensure that the aircraft is in trim.
- c. Above 1000 feet, move the hydraulic selector lever to **ALL ON**.
- d. Check immediately that the tailplane responds correctly to stick movements.
- e. Check that the red **HYD** warning caption is out and that the aileron accumulator pressure gauge is fluctuating between 2470 and 3050 PSI.
- f. Above 2000 feet, with the control column free, relock the elevators by pushing the unlock lever *fully* forward, checking that the **ELEV** caption goes out. If necessary, operate the standby trim until the **TRIM** caption goes out. Lower the guard over the trim switches or return the transfer switches to **NORMAL**; check the operation of the feel trim.
- g. If the elevator caption does not go out, move the control column slightly fore and aft. If this does not put out the **ELEV** caption, pull the elevator unlocking lever fully aft and continue the flight in follow-up tailplane as in para 16.

WARNING: If tailplane response is not restored when the hydraulic selector is turned on, select **TAIL & AILN OFF** and remain in manual control.

16. When powered control has been re-selected, all the flying controls and trims revert to normal. If the elevators fail to relock, only the following are restored.

- a. Aileron powered control.
- b. Q-gear change with airspeed.
- c. Automatic tailplane datum shift.
- d. 'Follow-up' tailplane. Longitudinal control is now by a combination of manual elevator and hydraulically-powered 'follow-up' tailplane. In this condition control is more sensitive.

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