CHAPTER 8

FLY-IN REPAIRS

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WARNING . . .

The information in this chapter is provided for the sole purpose of preparing a damaged aircraft for a flight to base or depot where the repair facilities necessary to restore the aircraft to a fully serviceable condition are available.

Temporary repairs and extended negligible damage quoted in this chapter MUST NOT be applied to aircraft required to perform normal flights. The fly-in flight must take place in calm weather conditions, and the aircraft must be flown in gentle manoeuvres only. The all-up weight of the aircraft and its maximum speeds in flight must not exceed those quoted in this chapter under the heading of FLIGHT CONDITIONS.

Chapter 8

FLY-IN REPAIRS

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Introduction

801. It is emphasised that the contents of this chapter are to be used only as stipulated in the WARNING on the marker card, and as defined in A.P.2662B, Sect.1, Chap.1.6. The extent of the application of the repair schemes will be decided by the engineer officer on site and, in addition to this chapter, his sources of additional information can be obtained from the TYPE RECORD, AV.P.970 and the list of publications appended below.

The following VULCAN Mk.1 and Mk.1A publications are essential for use in conjunction with the fly-in repair schemes included in this chapter.

GENERAL and TECHNICAL INFORMATION
A.P.4505A & C, Vol.1, Book 1

GENERAL and TECHNICAL INFORMATION - ELECTRICAL
A.P.4505A & C, Vol.1, Book 2

SCHEDULE OF SPARE PARTS
A.P.4505A, Vol.3, Part 1
and
A.P.4505C, Vol.3, Part 1

PILOTS NOTES VULCAN MK.1
A.P.4505A - P.N.

PILOTS NOTES VULCAN MK.1A
A.P.4505C - P.N.

Temporary repairs should be kept to the minimum possible size to ensure that a minimum amount of work will be required when making permanent repairs.

FLIGHT CONDITIONS

All-up weight

802. This is the stressing weight for all relaxed repair conditions, and aircraft with extended negligible damage concessions. Temporary repairs MUST be accorded the restricted flight conditions contained in this chapter.

(1) THE MAXIMUM PERMISSIBLE ALL-UP WEIGHT IS 127,000 lb. BEFORE TAKE-OFF and is attainable without the need for C.G. calculations or ballasting.

The basic weight of an aircraft with fuel loading is given as an example for Mk.1 and Mk.1A aircraft.

The maximum ALL-UP-WEIGHT respectively, would be as follows:-

	Mk.1.Wt.lb.
Basic aircraft weight	83,867
Fuel loading (Table 2)	42,000
Crew - 5 with dinghies	1,133
	127,000

	Mk.1A.Wt.lb.
Basic aircraft weight	87,867
Fuel loading (Table 2A)	38,000
Crew - 5 with dinghies	1,133
	127,000

NOTE...
The above basic aircraft weights are nominal; the existing BASIC weights must be obtained from FORM 4908 when these conditions are applied.

(2) Landing weights for normal or emergency requirements are given in Table 3 under STRENGTH CONCESSIONS.

Speed

803. The maximum permissible speeds must not exceed those given for the following conditions for Mk.1 and Mk.1A aircraft.

Condition	I.A.S. (KNOTS)
(1) Undercarriage retracted and airbrakes in.	250
(2) Airbrakes locked in the 'MED. DRAG' position.	220
(3) Main and nose undercarriages locked down.	180
(4) Bomb doors open or removed.	240
(5) Main and nose wheel doors removed.	220
(6) Canopy removed.	220

Airspeed and ranges to cover the above conditions are given in Table 1.

TABLE 1

AIRSPEED AND RANGES
(i) 4 Engines operating

AT MAX. PERMISSIBLE - ALL UP WEIGHT 127,000 lb.

		ALTITUDE (FEET)													
		10,000		15,000		20,000		25,000		30,000		35,000			
		RANGE IN NAUTICAL MILES												I.A.S. (KNOTS)	
CASE	CONDITION	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A
1	Wheel units retracted Airbrakes in.	1,274	1,139	1,472	1,312	1,651	1,471	1,798	1,600	1,901	1,691	1,975	1,750	250	250
2	Airbrakes locked in the 'MED. DRAG' position.	732	654	892	796	995	885	1,064	940	1,105	963	1,132	955	220	220
3	Main and Nose-wheel units locked down.	564	500	638	560	683	595	692	595	666	566	600	515	180	180
4	Bomb doors open or removed.	798	715	950	853	1,074	954	1,164	1,025	1,228	1,077	1,273	1,113	240	240
5	Main and Nose-wheel doors removed.	743	665	908	807	1,061	941	1,205	1,065	1,332	1,172	1,440	1,262	220	220
6	Canopy removed.	732	654	892	796	995	885	1,064	940	1,105	963	1,132	955	220	220

TABLE 1A

AIRSPEED AND RANGES

(ii) One engine out of action

AT MAX. PERMISSIBLE ALL-UP WEIGHT 127,000 lb.		ALTITUDE (FEET)													
		10,000		15,000		20,000		25,000		30,000		35,000			
		RANGE IN NAUTICAL MILES												I.A.S. (KNOTS)	
CASE	CONDITION	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A	Mk.1	Mk.1A
7	Wheel units retracted Airbrakes in.	1,400	1,250	1,560	1,388	1,776	1,576	2,038	1,805	2,347	2,077	2,700	2,380	250	250
8	Airbrakes locked in the 'MED. DRAG' position.	889	797	1,035	930	1,118	996	1,130	1,002	1,071	935	947	795	200	200
9	Main and Nose-wheel units locked down.	655	580	707	635	706	621	640	540	-	-	-	-	175	175
10	Bomb doors open or removed.	932	835	1,090	970	1,184	1,048	1,220	1,075	1,193	1,043	1,110	957	205	205
11	Main and Nose-wheel doors removed.	948	851	1,117	990	1,215	1,079	1,250	1,104	1,223	1,073	1,150	1,000	210	210
12	Canopy removed.	889	797	1,035	930	1,118	996	1,130	1,002	1,071	935	947	795	200	200

Fuel loading

804. To maintain the aircraft C.G. the tank corresponding to a damaged tank not in use MUST be drained to residual level and isolated, in accordance with instructions given in para.813. All fuel loading must be as given in Table 2 and 2A. It should be noted that the fuel tank loading figures quoted in Tables 2 and 2A are the combined loading for the fuel in the port and starboard tanks, therefore, when refuelling the individual tanks, the weight of fuel put into the tank should be half the quantity shown in the columns under cases 1 to 7 and Normal.

TABLE 2

Fuel Load Distribution for 42,000 lb. (Vulcan B Mk.1)

Tank No. Port and Stbd.	*Weight of Fuel in lb.*							
		Cases						
	Normal	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1	5,696	–	9,702	9,702	9.702	9,702	9,702	9,400
2	8,591	14,630	–	4,683	2,917	1,615	398	302
3	5,696	7,533	9,702	–	9,702	9,702	9,702	9,702
4	5,696	9,702	9,702	9,702	–	9,702	9,702	9,702
5	4,638	2,000	7,727	7,727	7,727	–	7,727	7,727
6	6,664	2,000	4,298	4,298	4,298	4,298	–	5,167
7	5,019	6,135	869	5,888	7,654	6,981	4,769	–
Total	42,000	12,000	42,000	42,000	42,000	42,000	42,000	42,000

TABLE 2A

Fuel Load Distribution for 38,000 lb. (Vulcan B Mk.1A)

Tank No. Port and Stbd.	Weight of Fuel in lb. Cases							
	Normal	1	2	3	4	5	6	7
1	5,153		9,217	5,162	5,152	5,152	5,152	5,152
2	7,773	13,900		10,250	7,769	7,769	7,769	7,275
3	5,153	5,858	9,217		7,916	5,152	5,152	5,152
4	5,153	5,152	7,529	5,150		7,533	5,151	5,151
5	4,198	4,190	4,195	4,195	4,195		6,900	4,487
6	6,029	6,000	6,028	6,028	8,428	7,855		10,783
7	4,541	2,900	1,814	7,215	4,539	4,539	7,876	
Total	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000

NOTE...
The following instructions apply to Tables 2 and 2A. Manual operation of the switching on the refuelling panel in the undercarriage bay will be required for fuel loading in Cases 1 to 7 and Normal. For additional information refer to para.813.

All cross feed cocks must be open.

All cases give fuel C.G. 146·143 in.

Strength concessions

805. Flight strength concessions and conditions for this repair chapter, in accordance with Av.P.970, Vol.1, Leaflet 804/2, are given in Table 3. Extended negligible damage limits for the purpose of 'Fly-in' flights, and repair instructions for damage in excess, are tabulated in Tables 8, 9 and 10. Structure and components should retain 75 per cent of the original design strength, and for members for which no specific extended negligible damage is given in Tables 8, 9 and 10, reference should be made to fig.801 which gives a method of estimating the percentage strength relative to damage.

TABLE 3

Strength Concessions Mk.1 and Mk.1A

		Fly-in Standards	
Case	*Condition*	*Strength*	*Weight in lb.*
1	Flight	Max. normal.	Max. A.U.W.127,000.
2	Take-off	See para.805 and Table 5.	Max. Take-off weight 127,000.
3	Landing	Vertical velocity of descent not to exceed 500 ft. per min.	Max. permissible landing weight 95,000.
4	Gust	Gust speed 24 ft. per sec. at 250 knots I.A.S.	All weights up to 127,000.
5	Limiting Speed	250 knots I.A.S. or 0.89M. (Aircraft clean). For other conditions see Table 1.	All weights up to 127,000.
6	C.G. Range	C.G. range to be within specified normal limits. Refer to A.P.4505A & C, Vol.1, Book 1.	

Normal Flight Standards			
Strength			*Weight in lb.*
Max. Normal Acceleration Negligible Aileron		Airspeed (M)	
Bomb Bay Load < 2,000 lb.	Bomb Bay Load > 2,000 lb.		
2 G.	1·75 G.	< 0·89	138,000
1·75 G.	1·5 G.	> 0·89	138,000
1·75 G.	1·5 G.	< 0·98	138,000
Unstick Speed	120 Knots		120,000
	125 Knots		130,000
	130 Knots		140,000
	135 Knots		150,000
	140 Knots		160,000
	145 Knots		170,000
Vertical velocity of descent not to exceed 600 ft. per min.			Max. permissible landing weight 109,000.
Max. design gust speed 36 ft. per sec. at 332 knots E.A.S.			All weights up to max. permissible A.U.W.
Sea level to 20,000 ft. .....250 knots. 20,000 ft. to 30,000 ft.....300 knots. Above 30,000 ft.....300 knots/0.98M.			All weights up to max. permissible A.U.W.

Key to symbols.
< .....Less than
> .....More than

TABLE 4

Runway Requirements

At Maximum Permissible A.U.W. (127,000 lb.)

Condition	*Take-Off Ground Run (Yds.)*	*Take-Off distance to 50 ft. height. (Climb away speed 123-125 knots I.A.S.). Yds.*
Sea level, no wind on level concrete. Temperature up to 15°C.	890	1,200
1,000 ft. Temp. I.S.A. +15°C.	1,110	1,455
2,000 ft. Temp. I.S.A. +15°C.	1,200	1,550
4,000 ft. Temp. I.S.A. +15°C.	1,400	1,755
6,000 ft. Temp. I.S.A. +15°C.	1,640	2,000
8,000 ft. Temp. I.S.A. +15°C.	1,900	2,280
Increase in distance for each 5°C. above I.S.A. +15°C.	+60	+67
For each additional 5 knots of Headwind.	-78	-91
Three engined Take-off.	1,505	1,815

NOTE...
This table is to be used in conjunction with the Pilot's Notes, A.P.4505A, Part 4, and A.P.4505C, Part 3, Chap.1, particularly for climb away speeds for weights below the Maximum Permissible A.U.W.

TABLE 5

FULL STRENGTH ASSESSMENT

Item	Fig. No. Ref.	Description	Repair Instruction
1	202 202A	Toggle mounting assemblies for attachment of radome.	Renewal or repair to full strength.
2	204	Toggle mounting assemblies for attachment of radome to metal nose.	Renewal or repair to full strength.
3	207	Windscreen (Pressurised flight).	Renewal.
4	212, 504	Nose-wheel attachment brackets and beams.	Renewal.
5	205, 206 206A, 213	Front fuselage skins, stringers and formers. (Pressurised flight.)	Repair to full strength or renewal.
6	216	Brake parachute compartment structure and all attachments.	Repair to full strength.
7	306	Wing root joint forgings (front spar).	Renewal if damage is above allowances in Table 8.
8	306	Spar booms (front spar).	Repair to full strength or renewal.
9		Main plane wing root shackles and bolts. (front and rear spars).	Renewal.
10	310	Wing root joint forgings (rear spar).	Renewal if damage is above allowances in Table 8.
11	310	Spar booms (rear spar).	Repair to full strength or renewal.
12	310	Forward fin post support member.	Renewal.
13	311B	Rear fin post support member.	Renewal.
14	313	Nose rib casting (Stn.162.5).	Renewal.
15	316	Air intake tunnel skins.	Repair to full strength.
16	317	Engine bay fireproof skins.	Repair to full strength.

Table 5 - (Cont'd)

Item	Fig.No. Ref.	Description	Repair Instruction
17	320, 321	Engine trunnion bearings and brackets.	Renewal.
18	320, 321	Engine trunnion mountings.	Repair to full strength.
19	317B	Engine bay intercostals.	Repair to full strength.
20	324	Nose casting.	Renewal.
21	324	Leading edge structure - ribs and stringers.	Repair to full strength.
22	328A	Wing structure between spars - aileron power unit ribs.	Repair to full strength or renewal.
23	324A	Leading edge skins above and below chord line - transport rib to rib 520.	Repair to full strength. Corrugated inner skins need not be repaired.
24	332	Wing top surface skins - transport rib to rib 380.	Repair to full strength.
25	332	Wing top surface stringers - transport rib to rib 380.	Repair to full strength.
26	334, 334A, 334B, 335, 335A, 335B	Ailerons and elevators.	Repair to full strength or renewal.
27	402	Front fin post fitting.	Renewal.
28	403A	Fin post joint fitting.	Renewal.
29	403B	Rudder hinge ribs.	Renewal or repair to full strength.
30	405A, 405B	Rudder hinges and bottom shaft assembly.	Renewal or repair to full strength.
31	405D	Rudder skinning.	Repair to full strength or renewal.
32	502, 503	Main undercarriage beams.	Renewal.
33		Main undercarriage assemblies.	Renewal.

Table 5 - (Cont'd)

Item	Fig.No. Ref.	Description	Repair Instruction
34		Nose undercarriage assembly.	Renewal.
35		Engine control systems.	Renewal or repair to full strength.
36		Flying control systems.	Renewal or repair to full strength.
37		Pitot head and mounting assembly.	Renewal or repair to full strength.

Special conditions
806. The aircraft may be flown under any of the special conditions as tabulated in Table 1, with fuel loading as in Table 2 or 2A whichever is applicable.

Removal of equipment
807. Basic equipment which has been removed to provide ease of access for carrying out structural repairs and is not essential for the Fly-in flight, may be omitted from the aircraft if the C.G. is not seriously affected. This can be ascertained by reference to A.P.4505A & C, Vol.1, Book 1, in which are tabulated the weights and moments of all removable equipment. C.G. disturbances caused by the removal of non-essential equipment should be corrected by the use of ballast or by fuel load displacement.

NOTE...
Equipment must not be removed collectively for the purpose of reducing the A.U.W. to that quoted under FLIGHT CONDITIONS.

(1) Precautions must also be taken to ensure that when equipment is removed from normal operational services not essential for the Fly-in Flight, any disconnected pipes are blanked off, and electrical cables, plugs etc. are insulated and correctly stowed.

SYSTEMS

Hydraulics
808. If, through damage or other causes, the bomb doors, main or nose undercarriage doors are removed for the Fly-in flight the service(s) MUST be made inoperative by disconnecting the electric power plug from the relevant control valve(s). Plugs and cables to be stowed safely and plugs blanked off. For information refer to A.P.4505A & C, Vol.1, Book 2.

(1) In the event of serious damage to the hydraulic system due to crash landing, or collapse of undercarriage, in addition to the Fly-in repairs required, full restoration MUST be made to the following services for the Fly-in Flight.

(a) Nose wheel centring jack.

(b) Main wheel unit brake system.

(2) Piping from inoperative services not essential for the Fly-in Flight may, if suitable, be used for restoring the essential services quoted in sub-para. (a) and (b) of sub-para. (1). Damaged or disconnected pipes which do not require repairing or reconnecting for the Fly-in Flight must be blanked off and made safe. Where necessary 'FEED' lines not required on non-essential services should be correctly connected to the 'RETURN' line on its particular part of the system. Information can be obtained from the system illustrations in A.P.4505A & C, Vol.1, Book 1.

NOTE...
Removal of piping for repair purposes must be recorded.

WARNING...

It is essential that, before any flight is made under any of the special conditions contained in this chapter, a check is made to ensure that the wheel brakes will operate with maximum efficiency. The brake parachute must be correctly installed, and ready for use if required on landing.

Cabin pressurisation and air conditioning

809. Unpressurised flight may be made up to 30,000 ft. if oxygen is available. Due to damage to the systems and/or the condition of the front fuselage, it may be necessary to render the systems inoperative by selecting the ENGINE AIR SWITCH to the 'SHUT' position. This should be done before flight and the electrical supply to the engine air supply cocks disconnected as a precaution against inadvertent selection to the 'OPEN' position. Electrical cables, plugs etc. should be blanked off and correctly stowed.

With the systems in the above condition, a circulation of air for cabin ventilation is obtained by setting the CABIN PRESSURE SELECTOR to the 'NO PRESSURE' position and the RAM AIR VALVE SWITCH to the 'OPEN' position.

Oxygen

810. Oxygen requirements will depend upon the engineer officer on the spot, and if not required, may remain in the aircraft without being made serviceable. In the event of any repairs being carried out on the system, a thorough check must be made to ensure absolute cleanliness, and freedom from contamination with oil or grease before the system is used.

Pneumatics

811. Certain ancillary services, listed below, are essential for flight and any damage that has occurred must be repaired, or items replaced where necessary, to give maximum efficiency of operation.

Essential Services

(1) Hydraulic reservoir air pressure supply.

(2) Hydraulic power pack air pressure supply.

(3) Fuel recuperator air pressure supply.

Restoration of other services will be dependent on the condition of the aircraft, e.g., the bomb door seal inflation system if damaged may be isolated and left unrepaired. Piping from non-essential services may, if suitable, be used for repairing the essential services.

NOTE...

Removal of piping for repair purposes must be recorded.

Air brakes

812. Function of the air brakes is not essential for a Fly-in Flight and, if damaged, the aircraft may be flown with the air brakes extended in the MED.DRAG position, or completely removed, with the apertures skinned over. In such circumstances the electrical supply cable to the two air brake actuating motors in the bomb bay MUST be disconnected, blanked off and stowed safely.

FUEL SYSTEM

WARNING...

Before removal or installation of a fuel tank on aircraft fitted with Mod.171 (i.e., explosion protection equipment), ensure that the power supply is switched off, and then remove the fuses from the explosion protection electrical circuits in panel 22P. To avoid a serious accident, the suppressor columns must not be removed or any work carried out in a tank, until the suppressor columns have been disconnected and the connection points covered with earthing caps.

Tank damage

813. In cases where a tank is damaged, as much fuel as possible should be drained at the sump drain, and the tank servicing cock for the damaged tank 'CLOSED'. If the damage is in a wing tank and is in such a position that residual fuel could leak at different attitudes of the aircraft in flight, (e.g., nose up or nose down), the damaged 'Hycatrol' fuel tank should be removed or alternatively emptied completely by any means available. The following precautions should be taken if a damaged tank is left in situ in order to isolate it from the remainder of the system.

(1) Disconnect the electrical power supply to the relevant refuelling valve and fuel pump, insulate and stow safely.

(2) 'CLOSE' the tank servicing cock.

If a tank is removed because of extensive damage and the aircraft is to fly without a replacement, in addition to carrying out sub-para. (1) and (2) the refuelling, engine feed and transfer pipes (if applicable) should be blanked off and made secure.

Damage to engine fuel feed pipe

814. If there is no tank damage, but the engine feed pipe from an individual tank is damaged beyond immediate repair, the tank should be drained at the sump drain to residual level, and the tank servicing cock closed. If the damaged pipe is situated downstream of the tank servicing cock, the piping should be blanked off at a coupling downstream of the damage. If the pipe is upstream of the tank servicing cock, the piping

should be blanked off upstream of the damage. The precautions as stated in sub-para.(1) and (2) of para.813 should be carried out to isolate the tank.

Precautions to take

815. If a tank has been drained due to any of the causes stated in para.813 and 814, the corresponding tank on the other side of the aircraft must also be drained to residual fuel level and isolated as stated in para.813. The remaining serviceable tanks should be refuelled to the quantities specified in Table 2 or 2A as applicable.

Refuelling

816. Each group should be refuelled separately by selecting 100 per cent on the percentage refueller. The most 'Forward' tank on the system, must then be refuelled to the quantity required as quoted in Table 2 or 2A and checked by the contents gauge. The over-ride switch on the refuelling panel in the undercarriage bay should then be operated to select the next most 'Forward' tank in the same group, and then refuelled to the quantity required as quoted in Table 2 or 2A. This procedure must be repeated for the remaining tanks in the group. Repeat for each of the other three groups.

Information

817. The engine and aircraft cross-feed cocks must be checked to ensure that they will operate correctly. During a 'Fly-in' flight it will be necessary to control all fuel booster pumps manually, and 'Open' cross-feed cocks as required, utilising the slide rule to keep the aircraft C.G. within acceptable limits. If the damage is to pipes only, and provided the two unusable tanks contain residual fuel only, and give zero fuel contents gauge readings the C.G. indicator may be used as an additional check on the fuel C.G., provided Mod.951 is embodied. In the case of a tank having been removed and the aircraft is going to fly in this condition, a 1500 M/fds. capacitor should be fitted in lieu of the tank contents condensor unit in order to simulate a zero reading on the fuel contents gauge.

NOTE...

Before any work is undertaken on the fuel system refer to A.P.4505A & C, Vol.1, Book 1, Sect.4, Chap.2. Relevant instructions contained therein are to be adhered to.

Fuel tank pressurisation

818. The fuel tank pressurisation system is not necessary for a 'Fly-in' flight and if it is desired to render it inoperative the following procedure must be followed:-

(1) Disconnect the servo air pipes from the 'Control' connections on all the Teddington Vent Valves (F.L.B/A/12) and fit gauze filters in place of the removed pipes. Blank off the open ends of the pipes. Each gauze filter assembly can be made up from an A.G.S. 1146A coupling, or an A.G.S. 1147A coupling with the cone removed. Place the gauze between a pair of 2 B.A. washers and assemble on the coupling using an A.G.S.904A outer sleeve.

(2) Disconnect the pipes,item 9.Z8994 on the port panel, and items 8.Z8994 on the starboard panel from the inlets to the bottom fuel traps. Blank off the open pipe ends and the fuel trap inlets. If no fuel traps are fitted the pipe items are 7 and 15.Z7684 on the port side, and 8 and 16.Z7684 on starboard side.

(3) Disconnect the engine air pipes item 133.Z7703 to the tank pressurisation panels in the port and starboard U/C. bays. Blank off the bulkhead adapters and the pipe open ends.

(4) Disconnect the pipes, item 31.Z8994 port, and 32.Z8994 starboard from the branch pipes items 61 and 63.Z7684 port, and 62 and 64.Z7684 starboard, which are fitted immediately above the air/gas valves on the tank pressurisation panels. Blank off all open pipe ends and branch pipe adapters. If no fuel traps are fitted (Mod.303) the pipe item numbers are 84 and 85.Z7684.

NOTE...

Failure to carry out the above procedure in full may result in the inadvertent closing of the vent valves and fuel contamination of the pressurisation panel components. All disconnected pipes must be stowed and secured safely. Refer to A.P.4505A & C, Vol.1, Book 1, Sect.4, Chap.6, for information concerning the system.

Fire protection

819. It is advisable that the fire protection system is restored to 100 per cent efficiency, particularly the engine bay section which requires cockpit control. Repair inserts to the engine bay methyl-bromide piping may be made from metal tubing T.58, T.55 or D.T.D.743. Refer to A.P.4505A & C, Vol.1, Book 1, Sect.4, Chap.5 for information relating to the system.

ELECTRICS

WARNING...

Before attempting any repairs, or servicing, qualified personnel should ensure that the electrical systems of the aircraft are safe. Voltage in excess of 100 volts A.C. or D.C. can be

very dangerous. Great care must be exercised when testing with the electrical power switched on.

Circuits required for flight

820. The minimum circuits required for flight under 'Fly-in' conditions are as follows:-

(1) 96-volt, and 28-volt batteries and battery ventilation.

(2) Three generators - allowing for one engine out of action.

(3) Two rotary transformers - No.1 and 2 or 3.

(4) Two inverters (Type 350) - No.1 and 2 or 3.

(5) Engine starting and H.E. ignition.

(6) Engine relight.

(7) Fuel pumps, fuel contents - main, transfer and secondary.

(8) Low pressure and cross-feed fuel cocks.

(9) Fuel, oil and hydraulic pressure indicators.

(10) J.P.T. indicators.

(11) R.P.M. indicators.

(12) Engine de-icing.

(13) Fire detecting and extinguishing systems.

(14) P.F.C. operation and indicators.

(15) Artificial feel.

(16) Trimmer controls.

(17) Emergency hydraulic power pack.

(18) Windscreen wipers, de-misting and de-icing systems.

(19) Pressure head heaters.

(20) Outside air temperature gauge.

(21) Artificial Horizon.

(22) Turn and Slip indicator.

(23) G.4.B. Compass.

(24) V.H.F. radio and inter-communication.

(25) A.D.F. Compass.

(26) I.L.S. installation.

(27) Cabin lights where required for flight.

(28) Canopy and entrance door warning.

(29) Ground refuelling.

(30) Indicators for air-brakes, if operational.

(31) Brake parachute stream and jettison.

(32) Abandon aircraft indicator.

INFORMATION

Alighting gear

821. Provided that the alighting gear is fully locked down, the aircraft can be flown in this condition and no repairs are necessary to the alighting gear circuits. To ensure that the circuit cannot be operated, remove the appropriate fuses.

L.P. engine fuel cocks

822. It is essential that the L.P. engine fuel cocks on all serviceable engines function correctly, because in the event of fire in an engine the L.P. cock MUST be 'CLOSED' immediately.

Circuit repairs

823. For all circuit repairs, reference MUST be made to A.P.4505A, Vol.1, Book 3, and A.P.4505A & C, Vol.1, Book 2, for circuit and cable identification, and A.P.4343C, Vol.6, for standard in-line crimp connections and repairs.

Broken or damaged cables must be renewed where possible. If renewal is not possible due to material shortage, repair should be effected by the in-line crimp method. All joints must be effectively insulated. The correct crimp sizes must be used for the particular cables being repaired, and where the crimp supply is limited, the important circuits should be given first consideration for this method of repair.

Emergency repairs

824. For emergency repairs, cables of the same load-carrying capacity may be used from non-essential circuits PROVIDED THAT A REMOVAL FOR THIS PURPOSE IS OFFICIALLY RECORDED.

Non-essential circuits

825. Where damaged looms are not required, the cable ends must be insulated, stowed safely, and the associated circuit fuses removed. This is essential, to prevent possible stray feeds on serviceable circuits.

NOTE...

Special care must be taken to avoid accidental explosion of detonators in the explosion protection circuits when making repairs to, or in the vicinity of fuel tanks.

Conduits and ducts

826. Slightly damaged conduits and ducts need not be repaired, but rough and

sharp edges must be dressed smooth to prevent chafing of cables. Extensively damaged conduits may be completely removed, provided that the cable looms are properly supported to prevent sagging, strain on end connections and cable repair joints. Where a number of cable repairs have been carried out in the same area, support should be provided on each side of that area. To prevent possible chafing a piece of rubber sheet secured in position by tape or string should be assembled where required.

MINIMUM POWER SUPPLY REQUIREMENTS

Introduction

827. With the introduction of Mod.697 a minimum of three serviceable engine driven generators is required to provide the main power supplies in addition to the 96-volt and 28-volt batteries. This will satisfy the following requirements:-

(1) Starting three serviceable engines without ground power supply.

(2) Providing a source of generator power on all main bus-bars thus ensuring that all loads necessary for safe flight are supplied.

(3) Allowing for a further generator failure during flight.

Engine starting

828. In the absence of a ground power supply, the first engine started, which in each case MUST be either No.1 or No.2 engine, will be by the aircraft batteries, which must be fully charged. The next engine should be started by battery, and the output of the No.1 or No.2 generators whichever engine is running. No.3 and No.4 generators MUST NOT be used for engine starting, and are NOT to be switched 'ON' until all engines are running. Refer to A.P.4505A - P.N. and A.P.4505C - P.N. for internal battery starting.

NOTE...

(1) When the first engine is started No.3 inverter should automatically switch 'ON'. No.1 inverter and No.1 rotary transformer should be switched 'ON' before starting the second engine.

(2) The load on the bus-bar of the unserviceable generator will be transferred to the battery bus-bar, and carried by the No.1 or No.2 generator (or both) and the battery.

Engines running

829. With the engines running, the generators and rotary transformers switched 'ON', the load ammeters on the navigator's panel must be observed to ensure that no undue loads are being imposed on the bus-bars, due to unserviceable equipment, or damaged wiring on non-essential circuits. With all services necessary for a safe 'Fly-in' flight switched 'ON', the approximate loading on the main bus-bars MUST be as follows:-

No.1 and 2 generator bus bar, battery bus-bar, and No.3 generator bus-bar.	) 170 amps
No.4 generator bus-bar.	) 90 amps
or No.1 and No.2 generator bus-bar, battery bus-bar and No.4 generator bus-bar.	) 190 amps
No.3 generator bus-bar.	) 70 amps

Generator failure

830. In the event of a further generator failure on 'Fly-in' flight; e.g., No.1 or No.2 generator, the associated loads will be borne by the serviceable generator and the battery. Should the failure occur on No.3 or No.4 generator, the total load will be borne by the No.1 and No.2 generators and the battery.

For the 28-volt D.C. and 115-volt A.C. consumer circuits, a minimum of two rotary transformers and two inverters Type 350 is required. In each case, these should be No.1 and 2 or 3 as previously stated. Unserviceable components on these systems, therefore, must be renewed or replaced with serviceable items in order to meet the conditions as outlined. Should it be necessary to remove a damaged rotary transformer, or inverter, the associated cool air ducting must be blanked off, where the component has been removed.

Pitot static requirements

831. Both pitot static systems will be required for the 'Fly-in' flight, though a number of instrument services may remain inoperative if damaged and do not interfere with the operation of the essential instruments. The services considered as a minimum essential for the 'Fly-in' flight are as follows:-

Port Pressure Head	Starboard Pressure Head
1st Pilot's instruments	2nd Pilot's instruments
Warning Transmitters	Nav/Plotter's instruments, A.M.U., Artificial Feel Unit Transmitters.

Piping from the remaining services may be used for repair purposes, provided that PIPE REMOVAL FOR REPAIR ACTION IS RECORDED.

AREAS OR COMPONENTS TO WHICH FULL STRENGTH STANDARDS MUST BE APPLIED

Introduction

832. The components and areas indicated in Table 4 are not permitted any repair relaxations. Damaged components referenced in this table should be repaired or renewed as per instructions quoted, if the negligible damage limits listed in Chap.2 to 6 of this Volume are exceeded.

Repair instructions

833. Any repairs carried out to the engine controls and flying control circuits MUST be repaired to full strength standards and effected without interference to the ranges and freedom of movement. Refer to Tables 1 and 3 in Chap.3, for 'repair allowances' on flying control surfaces when carrying out repairs.

Alternative repair materials

834. Where material supplies are limited it is permissible in some cases, to carry out repairs with an alternative material. The contents of Table 6 are listed in order of proof stress. For repair purposes any material listed below another one in Table 6, may be used as an alternative. For example, when an existing component made from material specification L.72 requires repairing, any material of higher proof stress values up to and including D.T.D.687 may be used for the repair, without increasing the gauge thickness.

TABLE 6

Proof stresses

Material	*Spec.*	*Proof Stress Tons per sq.in.*
Light alloy sheet	L.72	15
Light alloy sheet	L.73	21
Light alloy sheet	D.T.D.687	27
Light alloy tube	L.62	16
Light alloy tube	L.63	23
S.Steel sheet	S.521	15
S.Steel sheet	S.520	42
S.Steel tube	T.55	18
S.Steel tube	T.58	45

In cases where an alternative repair material has to be used, it will be necessary to use a material with a S.W.G. of corresponding proof stress. This may be done by using the formula as in the following example:-

Assume that it is necessary to make a channel section insert 0·5 in. x 2·0 in. x 0·5 in. originally made from 20 S.W.G. D.T.D.687, and the material available is L.72.

(a) Approximate cross sectional area = (0·5 + 2·0 + 0·5) x 0·036 = 0·108 sq. in.

(b) Multiply (a) by the proof stress of D.T.D.687 = 0·108 x 27 = 2·916.

(c) Divide (b) by the proof stress of L.72 = 2·196 ÷ 15 = 0·1944.

(d) Divide (c) by the projected width (3·0 in.) = 0·1944 ÷ 3 = 0·0648.

Thus 16 S.W.G. (0·064 in.) would be the nearest gauge suitable for the repair.

Decimal equivalents
835. Refer to Table 7 for decimal equivalents of S.W.G.

TABLE 7

Decimal Equivalents

S.W.G.	Inches
1	0·3
4	0·232
5	0·212
6	0·192
8	0·16
9	0·144
10	0·128
11	0·116
12	0·104
13	0·092
14	0·08
16	0·064
17	0·056
18	0·048
19	0·04
20	0·036
22	0·028
24	0·022

Extended negligible and repairable damage
836. Extended negligible damage is damage in excess of the negligible damage limits laid down in Chapters 2 to 6 of this volume. Components within the limits of extended negligible damage may be left unrepaired for a 'Fly-in' flight. Refer to Tables 8, 9 and 10 for extended negligible damage limitations. Reference to repair illustrations will be added to the above tables when available.

TABLE 8

FUSELAGE

Location	Extended negligible damage	Repairs
(1) Stn.510F. to 372F.		
(a) Metal nose upper portion	Dents and buckles not exceeding 0·5 in. deep and 6·0 in. long in free areas between stringers and formers without rivet loosening. Dents and buckles not exceeding 0·5 in. deep and 6·0 in. long at stringer, former and frame positions with loss of one stringer. Skin cracks not exceeding 6·0 in. long stop-drilled 0·375 in. dia. Cleaned-out holes not exceeding 6·0 in. dia. in free areas.	Holes should be blanked off using a doped fabric patch, or an aluminium patch plate attached by rivets. Chamfer edges of metal patch plate.
(b) Nose radome	Nil	
(2) Stn. 372F. to 204F.		
(a) Front pressure bulkhead (unpressurised).	Dents, buckles and ripples in dome segments. Holes not exceeding 6·0 in. dia. in segments.	Holes may be blanked off using a doped fabric patch.
(b) Former 372F. Box structure. (unpressurised)	Damage in the area of the bomb aimer's window support will be governed by the extent of the damage to bomb aimer's blister.	
(c) Bomb aimer's blister (unpressurised).	In outer skin, dents and buckles not exceeding 0·5 in. deep and 12·0 in. long without fracture. Cracks not exceeding 4·0 in. long stop-drilled 0·375 in. dia. Damage to diaphragms to Fig.801 limits.	
(d) Cabin frames Stn. 358F. to 330F.	Local buckling of frames if 75 per cent of original strength is maintained. Holes in frame webs up to 1·0 in. dia.	

TABLE 8 - (Cont'd.)

Location	Extended negligible damage	Repairs
(e) Frames at Stn.316F. to 218F.	Local buckling and holes up to 1·0 in. dia. in webs provided the adjacent frames are undamaged.	
(f) Cabin floors (unpressurised)	Damaged members or intercostals to Fig.801 limits. Cracks not exceeding 1·5 in. long when stop-drilled.	
(g) Main entrance door (unpressurised).	Small holes cleaned out. Dents and buckles not exceeding 0·5 in. deep and 12·0 in. long. Skin cracks not exceeding 4·0 in. long, when stop-drilled.	Holes should be covered with a doped fabric patch, or an aluminium patch plate attached by rivets. Chamfer edges of metal patch plate.
(h) Cockpit rail (unpressurised)	Dents in the 10 and 12 S.W.G. skin not exceeding 0·25 in. deep and 1·5 in. long. Cracks in skin heels not exceeding 1·5 in. long when stop-drilled. Cleaned out holes up to 1·0 in. dia.	
(j) Canopy (unpressurised)	Skin indentations and buckling, skin cracks 4·0 in. long when stop-drilled. Damaged flanges to fig.801 limits. Heel line cracks 1·5 in. long when stop-drilled.	
(k) Windscreen structure (unpressurised)	Scores and dents in the windscreen pillars 0·1 in. deep and blended out over 0·75 in.	
(l) Windscreen (unpressurised)		
(3) REAR PRESSURE BULKHEAD	Skin buckles and dents 0·5 in. deep and holes up to 3·0 in. dia.	Holes should be blanked off using a doped fabric patch, or an aluminium patch plate attached by rivets.

TABLE 8 - (Cont'd.)

Location	Extended negligible damage	Repairs
(a) Vertical nose wheel beams	Holes in webs 0·5 in. dia. with minimum landing of 0·5 in. from any flange or heel line. Damage to free flanges 0·25 in. deep blended out over 2·0 in. Cracks in beam reinforcing plates 1·5 in. long when stop-drilled. Damage of attachment flanges to fig.801 limits.	
(b) Top-hat stiffeners	Loss of any one stiffener with one undamaged or repaired stiffener either side.	Fig.224A, and 224C.
(c) Nose wheel support beams	2·0 in. dia. holes in webs. 0·25 in. damage to free flanges blended out over 2·0 in. Attachment angles to fig.801 limits.	
(d) Horizontal channel stiffeners	Free flanges 0·25 in. damage, blended out over 2·0 in. No buckling. Attachment flanges to fig.801 limits.	
(4) Stn.372F. to 204F		
(a) Front pressure bulkhead (Pressurised)	Nil	
(b) Cabin skins, stringers, frames. (Pressurised)	Nil	
(c) Cockpit rail (Pressurised)	Dents internally not exceeding 0·125 in. deep and not more than 2·0 in. long. Heel cracks up to 1·5 in. when stop-drilled 0·25 in. dia. Edge cracks blended out over 0·5 in.	

TABLE 8 - (Cont'd.)

	Location	Extended negligible damage	Repairs
	Canopy (Pressurised)	External skin dents 0·25 in. deep in free areas. Damage to flanges if blended out over 0·5 in. with 0·3 in. minimum landing from any heel line.	
(e)	Windscreen structure (Pressurised)	Internal dents in pillars not exceeding 0·05 in. deep and blended out over 0·5 in.	
(f)	Windscreen (Pressurised)		
(g)	Pilot's and Crews' floors (Pressurised)	75 per cent original strength to be maintained on all cross-members and intercostals. Flange cracks 1·5 in. long when stop-drilled. 1·0 in. dia. holes in intercostal and cross member webs.	
(h)	Entrance door (Pressurised)	As item 2(g)	
(j)	Entrance door surrounding structure (Pressurised)	To fig.801 limits	

TABLE 9

WING

Location	Extended negligible damage	Repairs
(1) NOSE WHEEL BAY	Dents and buckles 0·5 in. deep x 6·0 in.long in free areas between formers and stringers without rivet loosening. Dents and buckles 0·5 in. deep x 6·0 in. long in stringer, former or frame positions with loss of one stringer. Skin cracks 6·0 in. long when stop-drilled 0·375 in. dia.. Cleaned-out holes not exceeding 6·0 in. dia. in free areas.	Holes should be blanked off using a doped fabric patch, or an aluminium patch plate attached by rivets. Chamfer edges of metal patch plate.
(2) NOSE WHEEL BAY LONGERONS	Dents 0·25 in. deep x 4·0 in. long in webs. Nicks and cracks in extruded angles, 0·125 in. deep blended out over 0·5 in. Holes in webs 1·0 in. dia.	
(3) NO.1 TANK BAY STRUCTURE		
(a) Support frames (Tank in use)	Holes 0·5 in. dia. in frame webs with 0·3 in. minimum landing from any heel line. 0·25 in. damage to flanges blended out over 1·5 in. Heel line cracks 1·5 in. when stop-drilled.	
(b) Fireproof skins	Dents any dimension without fracture.	
(c) Support frames. (Tank not in use)	Local buckling, cracks and holes provided that when cleaned up not more than 30 per cent of the structure is lost.	
(d) Tank bay skins	Dents which may damage tank bags to be beaten out.	

TABLE 9 - (Cont'd.)

Location	Extended negligible damage	Repairs
(4) NO.2 TANK BAY STRUCTURE		
(a) Bulkhead former 72·75F	Damage to flanges of No.1 tank transport attachment angle not exceeding 0·125 in. deep at the edges blended out over 0·75 in. Holes in areas other than forward bulkhead web up to 3·0 in. when cleaned out with a minimum landing of 0·5 in. from rivet line. Loss of any bulkhead channel provided there are two undamaged channels either side. Other damage to fig.801 limits.	Holes should be blanked off using a doped fabric patch.
(b) Tank bay skins	Dents which may damage tank bags to be beaten out.	
(c) Floor, roof and centre wall intercostals	Loss of one intercostal with two undamaged either side.	
(d) Centre wall vertical formers	1·0 in. holes in webs. 0·125 in. damage in edges of strengthening angles blended out over 0·5 in. Heel line cracks not exceeding 1·5 in. long when stop-drilled.	
(e) Tank structure booms.	Nicks and scores 0·05 in. deep blended out over 0·5 in. long in the edges only.	
(f) Fairing under tank bay	Dents and holes in outer skin 0·5 in. deep in free areas. 3·0 in. cracks in skin when stop-drilled. Structure damage to fig.801 limits.	
(g) Fairing above tank	Dents and buckles 0·5 in. deep x 6·0 in. long in free areas between stringers and formers without rivet loosening. Skin cracks not exceeding 6·0 in. long when stop-drilled 0·375 in. dia. Cleaned-out holes not exceeding 6·0 in. dia. free areas.	Holes should be blanked off using a doped fabric patch, or an aluminium patch plate attached by rivets. Chamfer edges of metal patch plate.

TABLE 9 - (Cont'd.)

Location	Extended negligible damage	Repairs
(h) Tank structure outer skins	Dents 0·2 in. deep in free areas. Skin cracks not exceeding 4 in. long when stop-drilled 0·375 in. dia. Holes up to 4·0 in. dia. in areas not subject to airflow conditions.	Holes should be blanked off using a doped fabric patch, or an aluminium patch plate attached by rivets. Chamfer edges of metal patch plate.
(5) CENTRE SECTION FRONT SPAR		
(a) Wing root joint forgings	Dents, nicks, scores and abrasions 0·05 in. deep blended out over 0·5 in.	
(b) Booms	Nil	
(c) Web	Dents 0·25 in. deep. 4·0 in. dia. holes when cleaned out with a minimum landing of 0·5 in. from any row of rivets. In areas of double web, one web must be repaired, preferably the one of thickest gauge.	
(d) Angles, stiffeners and channels	To fig. 801 limits.	
(e) Air intake reinforcing rings	Dents, scores and other small damage 0·05 in. deep blended out over 0·5 in. and polished.	
(f) Bomb door mechanism support beams	Damage with 30 per cent area loss if the flight is made without bomb doors. Otherwise nicks, dents or scores 0·05 in. deep blended out over 1·0 in. at the edges of extruded angles and forged brackets. Web cracks 1·5 in. long when stop-drilled. Holes in web 1·0 in. dia. when cleaned out.	
(1) WING TOP SURFACE BETWEEN SPARS		
(a) Skins, transport rib to rib 380	Nil	

TABLE 9 - (Cont'd.)

Location	Extended negligible damage	Repairs
(b) Stringers, transport rib to rib 380	Nil	
(c) Skins, rib 380 to tip	Dents and buckles 0·25 in. deep x 4·0 in. long and no more than one between any two stringers.	
(d) Stringers, rib 380 to tip	One in any four 'Z' stringers may be left unrepaired. Loss of stringer area not to exceed 25 per cent.	Damage to be blended out and cracks stop-drilled 3/16 in. dia.
(2) WING, BOTTOM SURFACE BETWEEN SPARS		
(a) Skin, transport rib to tip	Dents and buckles 0·25 in. deep x 4·0 in. long and not more than one between any two stringers.	
(b) Stringers, transport rib to tip	Any one in four 'Z' stringers may be left unrepaired provided it is not adjacent to a cut-out. Loss of stringer area not to exceed 25 per cent.	Damage to be blended out and cracks stop-drilled 3/16 in. dia.
(3) LEADING EDGE SKIN Above chord line	Nil. Corrugated skins need not be repaired.	
(a) Transport rib to rib 520 (b) Rib 520 to wing tip	Dents and buckles 0·25 in. deep x 4·0 in. long at least 0·6 in. apart.	
(c) Below chord line	Nil. Corrugated skins need not be repaired.	
(4) TRAILING EDGE PANELS	Dents 0·2 in. deep, 2·5 in. apart. All holes and edge members to be repaired.	

TABLE 9 - (Cont'd.)

Location	Extended negligible damage	Repairs
(5) OUTER WING STRUCTURE BETWEEN SPARS		
(a) Elevator hinge ribs	Dents 0·1 in. deep, 3·0 in. apart. 2·0 in. dia. holes cleaned out, 6·0 in. apart, and 3·0 in. away from boom to web and web joint riveting. No holes allowed in the confines of the tank ends.	
(b) Aileron hinge ribs	Rib 780:- Forward of the bearing housing reinforcing plate web, dents 0·1 in. deep, and 3·0 in. apart. Holes cleaned out to 2·0 in. dia., 6 in. apart and 3·0 in. away from any row of rivets. Rib 786:- Web dents 0·1 in. deep, 3·0 in. apart. Holes cleaned out to 2·0 in. dia., 6·0 in. apart and 3·0 in. away from any row of rivets. Rib 588:- Web dents 0·1 in. deep, 3·0 in. apart.	
(c) Aileron power unit ribs	Nil	
(d) Tank ribs	Holes 2·0 in. dia. when cleaned out, 6·0 in. apart and 3·0 in. from any row of rivets. One in any three stiffeners may be left unrepaired.	
(e) Outer, outer wing ribs	Loss of boom area not to exceed 25 per cent. Damage to be blended out and cracks stop-drilled 0·375 in. dia.	
(f) Tank skins	Any dents which may damage the tank bag, to be beaten out.	
(6) LEADING EDGE STRUCTURE		
(a) Ribs and stringers	Nil	

TABLE 9 - (Cont'd.)

Location	Extended negligible damage	Repairs
(b) Front spar, centre line to rib 618	Loss of boom area not to exceed 25 per cent, blended out over 6·0 in.	
Rib 618 to tip	As item 6 (b)	
(7) TRAILING EDGE STRUCTURE		
(a) Hinge ribs	Nil	
(b) Intermediate ribs	Any one rib between two adjacent hinge ribs may be left unrepaired, as long as the shroud panel is repaired.	
(c) Rear spar, centre line to rib 618	Loss of boom area not to exceed 25 per cent, blended out over 6·0 in.	
Rib 618 to tip	As item 7 (c)	
(8) WING TIP	Dents up to 6 in. long x 0·5 in. deep. Cracks up to 6 in. long, stop-drilled 0·375 in. dia. . Holes up to 1·5 in. dia. cleaned out.	All holes MUST be blanked off.
(9) ENGINE RIBS		
(a) Outboard engine rib 162·5	Dents 0·2 in. deep, 2·5 in. apart. Holes 1·0 in. dia., at least 1·0 in. from any riveting, and only one per stringer pitch.	Holes to be blanked off with aluminium patch plate attached by rivets.
(b) Centre engine rib 113·3	As item 9 (a)	
(c) Inboard engine rib 63·5	As item 9 (a)	
(d) Engine mounting structure	Nil	

TABLE 9 - (Cont'd)

Location	Extended negligible damage	Repairs
(e) Engine bay fire proofing	Dents 0·5 in. deep, 3·0 in. apart.	
(10) ENGINE ACCESS DOORS	Dents 0·25 in. deep at 2·5 in. pitch.	
(11) ENGINE BAY INTERCOSTALS	Nil	
(a) Engine bay skins	Dents and buckles 0·25 in. deep x 4·0 in. long, no more than one between intercostals.	
(12) STRUCTURE AFT OF REAR SPAR BETWEEN TRANSPORT RIBS	One damaged top-hat or 'Z' stringer in four may be left unrepaired. On secondary structure (fig.311) web dents 0·10 in. deep, 3·0 in. pitch. Holes cleaned out to 2·0 in. dia., 6 in. apart and 3·0 in. from any row of rivets. Loss of boom area not to exceed 25 per cent blended out over 6·0 in.	
(13) AIR INTAKE STRUCTURE		
(a) Leading edge	Dents 0·25 in. deep x 3·0 in. long in skin provided they are not sharp dents. 1·0 in. dia. holes at least 3·0 in. from any line of riveting and 6·0 in. apart.	Holes to be blanked off with aluminium patch plate attached by rivets. Edges of patch plate to be chamfered.
(b) Intake structure between front and rear false spar	Holes in webs 2·0 in. dia. when cleaned out and a minimum of 6·0 in. apart, and 3·0 in. from any line of rivets. Dents in intake tunnel skins 0·25 in. deep x 3·0 in. long. Dents and buckles in wing skins 0·25 in. deep x 4·0 in. long, only one between any two stringers. Loss of stringer or boom area not to exceed 25 per cent damage after blending out. Cracks to be stop-drilled 0·375 in. dia.	

TABLE 9 - (Cont'd)

Location	*Extended negligible damage*	*Repairs*
(14) BOMB DOORS	Skin dents 0·20 in. deep at 2·5 in. pitch. Loss of former area not to exceed 25 per cent. Cracks 4·0 in. long, stop-drilled 0·375 in. dia.	
(15) BOMB ARCHES	Dents 0·2 in. deep at 2·5 in. pitch. 1·0 in. dia. holes, minimum distance of 3·0 in. from any row of riveting and 6·0 in. apart.	
(16) UNDERCARRIAGE DOORS		
(a) Main door	Skin dents 0·2 in. deep at 2·5 in. pitch. No holes in external skin. 0·5 in. dia. holes at 4·0 in. pitch in inner skin. Any one of the tertiary intercostals between any two hinge ribs (refer to fig.327) may be left unrepaired.	
(b) Subsidiary door	Skin dents 0·20 in. deep at 2·5 in. pitch. No holes.	

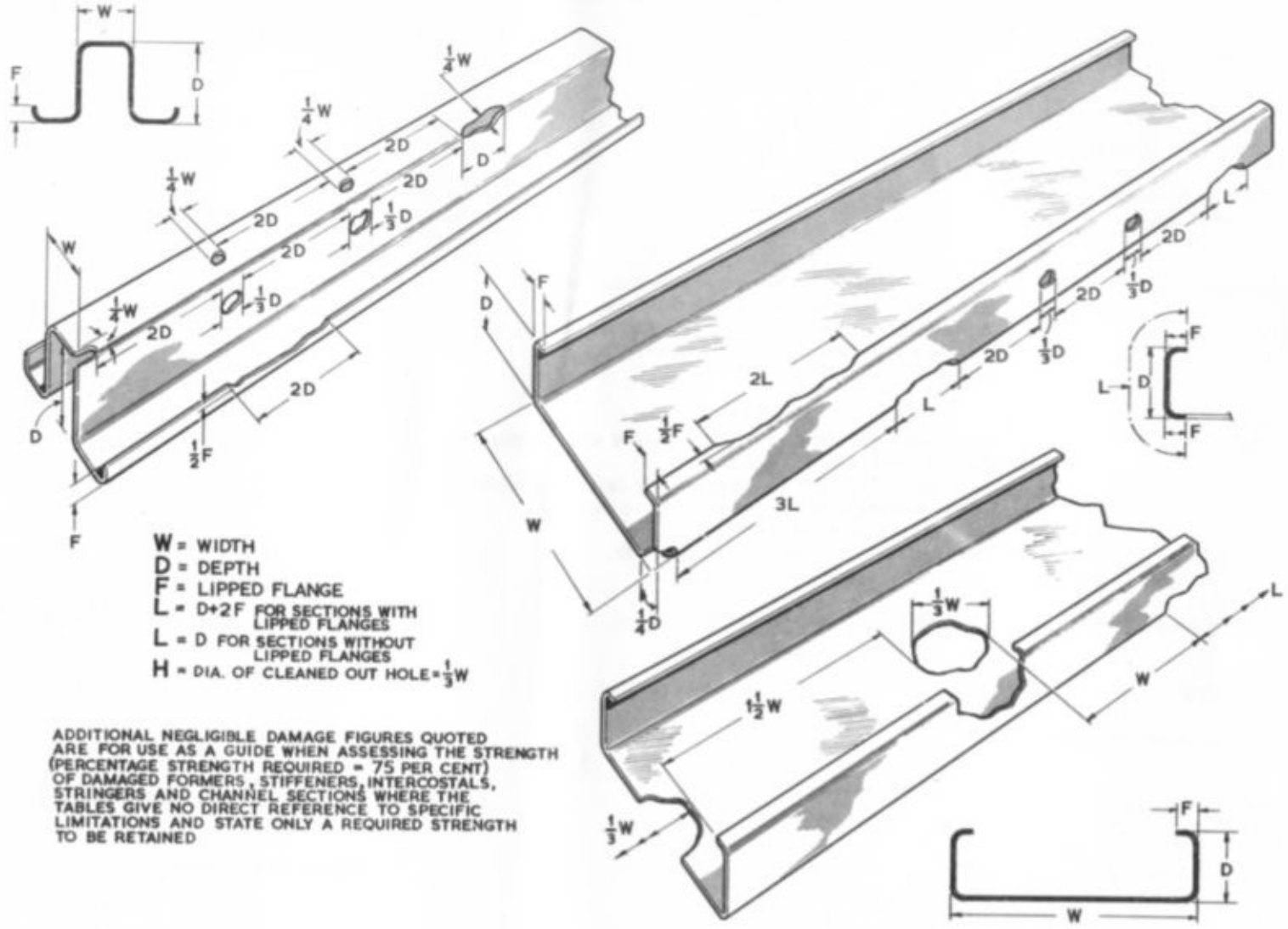

Fig. 801. Structure strength assessment

TABLE 10

TAIL UNIT AND FLYING CONTROLS

Location	*Extended negligible damage*	*Repairs*
(1) CONTROL SURFACES		
Rudder, Elevator and Ailerons	Nil	
(2) DORSAL FIN	Any one in three diaphragms, other than fuselage attachment diaphragms (see fig.309) may be left unrepaired. Skin dents 0·25 in. deep x 4·0 in. long and a minimum of 6·0 in. apart. No holes.	
(3) FIN	Skin dents and buckles 0·25 in. deep x 4·0 in. long and not less than 6·0 in. apart. Any one in four 'Z' stringers may be left unrepaired. Loss of stringer and boom area not to exceed 25 per cent blended out over 6·0 in. Web dents 0·5 in. deep at 4·0 in. pitch.	
(a) Rudder hinge ribs	Dents 0·1 in. deep at least 3 in. apart.	Renewal or repair to full strength
(4) RUDDER		
(a) Bottom shaft assembly	Nil	Renewal
(b) Rudder hinges	Nil	Renewal or repair to full strength
(c) Rudder skinning	Nil	Repair to full strength

Structure strenth assessment
837. Fig.801 is issued as a guide for assessing a strength percentage value of 75 per cent, when Tables 8, 9 and 10 (Extended negligible damage) give no direct reference to specific limitations.