Appendix 1 HYDROSTATIC WEIGHING

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ILLUSTRATION

LIST OF TABLES

Equipment check

1. Before weighing, a check should be made to ensure that all the equipment is installed as called for in the modification standard in Sect. 2, Chap. 3, para. 6, and any divergencies from this standard must be noted. General information on hydrostatic weighing machines is given in A.P.1464G, Vol. 1, Part 2, Sect. 5, Chap. 7.

Fuel

2. The aircraft should be weighed without fuel. The drain plug of the fuselage tank and those of the fore-and-aft compartments of the wing-tip tanks must be left open until the aircraft has been levelled. After draining, the aircraft will have six gallons of fuel trapped in the tanks and system; allowance should be made in the final weight and C.G. calculations for a weight of 48 lb. and a moment of 96 lb. ft. to cover this fuel quantity.

Aircraft configuration

3. The aircraft should be weighed in the following configuration:—

(1) Flaps up

(2) Radome closed

(3) Canopy closed

(4) Arresting hook up

(5) All blanks and guards removed

(6) The cannon doors should be laid on the wings to simulate, as nearly as possible, their fore-and-aft positions when they are properly fitted. This can be achieved by opening the ammunition doors and placing the cannon doors on the wings at the wing root, convex side up, with the forward inboard corner resting in the ammunition door opening and against the forward edge of the door.

Preparation for weighing

4. The weighing should be carried out under cover with the hangar doors closed, and upon a firm, smooth and level surface. The procedure is as follows:—

(1) Remove all pressure from the nose undercarriage compression strut; if a Turner gauge is used, an extension pipe must be fitted as otherwise there is a danger of the gauge being trapped by the wheel when the leg folds under as the pressure is released. It is important that no pressure remains in the strut. If, when the nose is jacked up, it is found to be impossible to lift the wheel clear of the floor, this would indicate either that there is pressure remaining in the strut or that the compression strut is faulty.

(2) To fit the nose wheel weighing adapter (*Item* 9, *Table* 1), first withdraw the pins and tube from the bottom of the adapter and loosen the wingnut at the top of the adapter; it will now be possible to fit the adapter without having to remove the pressure block. Pass the tube through the adapter plates and through the hole in the nose wheel fork, and fit the pins; position the pressure block to bear against the undercarriage leg and secure the wingnut on the stud assembly.

(3) Using standard main jacks and adapters or, alternatively, wheel change jacks and adapters, lift the main wheels just clear of the floor.

(4) Remove the wheel lock pins, lock-nuts and lock plates. Unscrew and remove the special hub bushes (*Item* 3, *Table* 1), fit the main undercarriage weighing adapters (*Item* 1, *Table* 1) and secure with the weighing adapter bushes (*Item* 4, *Table* 1); adjust the position of the pads at the tops of the weighing adapters, so that they bear on the faces of the wheel rims when the load is picked up. When secured, the weighing adapters should be free to rotate on the adapter bushes, thus avoiding any side thrust on the weighing units.

(5) Lower the aircraft and remove the jacks and their adapters. Check that the main undercarriage compression struts are at their normal static closure by rocking the aircraft laterally; this is important, particularly as the main jacks have been employed during the fitting of the weighing adapters, causing the compression struts to extend fully. Should a compression strut stick and suddenly release during the weighing, damage could be done to the weighing units. The aircraft should now be approximately level (*zero* incidence at wing rib No. 3) and all drainable fuel should have passed through the open drain plugs.

Main wheel jacking

5. To jack the main wheels, proceed as follows:—

(1) Fit the jack adapters (*Item* 5, *Table* 1) to the rams of the 8-ton jacks and position the 10-ton hydrostatic weighing machines on the adapters. Tap the dials of the machines lightly and record the 'no load' readings.

Note . . .

If the reading is positive it should be deducted from the 'under load' reading, and if negative it must be added to the 'under load' reading (*Table* 2).

(2) Position the jacks and weighing machines under the jacking beams of the weighing adapters with the jack handles pointing forward. Raise the jacks until a load is just recording on the weighing machines and, using a spirit level, check that the jacking beams are level in both lateral and fore-and-aft positions; this is important to avoid any side thrust on the weighing units. When both main jacks are satisfactorily positioned, jack the main wheels simultaneously until the wheels are just clear of the floor; the aircraft should now be in a slightly nose-down attitude.

Nose wheel jacking

6. To jack the nose wheel, proceed as follows:—

(1) Ensure that the 4-ton nose jack is fully released and fit the nose jack adapter (*Item* 10, *Table* 1) to the ram. Position the 6¼-ton hydrostatic machine on the jack adapter, lightly tap the dial of the machine to obtain the 'no load' reading and record (*para.* 5(1), *Note*).

(2) Position the jack and weighing machine under the jacking beam of the weighing adapter with the jack handle pointing forward. The jack should be packed up on a suitable wooden base plate (approximately 1 in. thick) to obtain full advantage of the jack travel. The base plate must be positioned so that its edge on the aircraft port side does not project more than 5 in. from the aircraft centre line to avoid interference with the taking of dimensions after the aircraft is levelled finally.

(3) Raise the jack until the load is just being taken and ensure that the jack is centred by gently swivelling the jack through lateral movement of the jack handle.

(4) Raise the jack until the nose wheel is just free to turn; refer to para. 4(1) should any difficulty be experienced.

Levelling

7. Using a clinometer and incidence board (*Item* 14 *and* 13, *Table* 1) at wing rib No. 3, as marked on the wing at 73·33 in. from the aircraft centre-line, the nose wheel jacking procedure should be continued until a *zero* reading is obtained on the clinometer.

Measurements

8. Before weighing, the following measurements must be taken:—

(1) Chalk the floor immediately under the end of the nose wheel adapter jacking beam at the port side, and, using the plumb bob (*Item* 15, *Table* 1) and line at the indicated centre of the jacking beam as a datum, mark a cross on the chalked area with a hard pencil.

(2) Chalk the floor immediately below the datum peg on the port side of the fuselage, plumb down from the datum peg and mark the spot with a hard pencil.

(3) Fit the plumb line bar assembly (*Item* 6, *Table* 1) to each of the main wheel

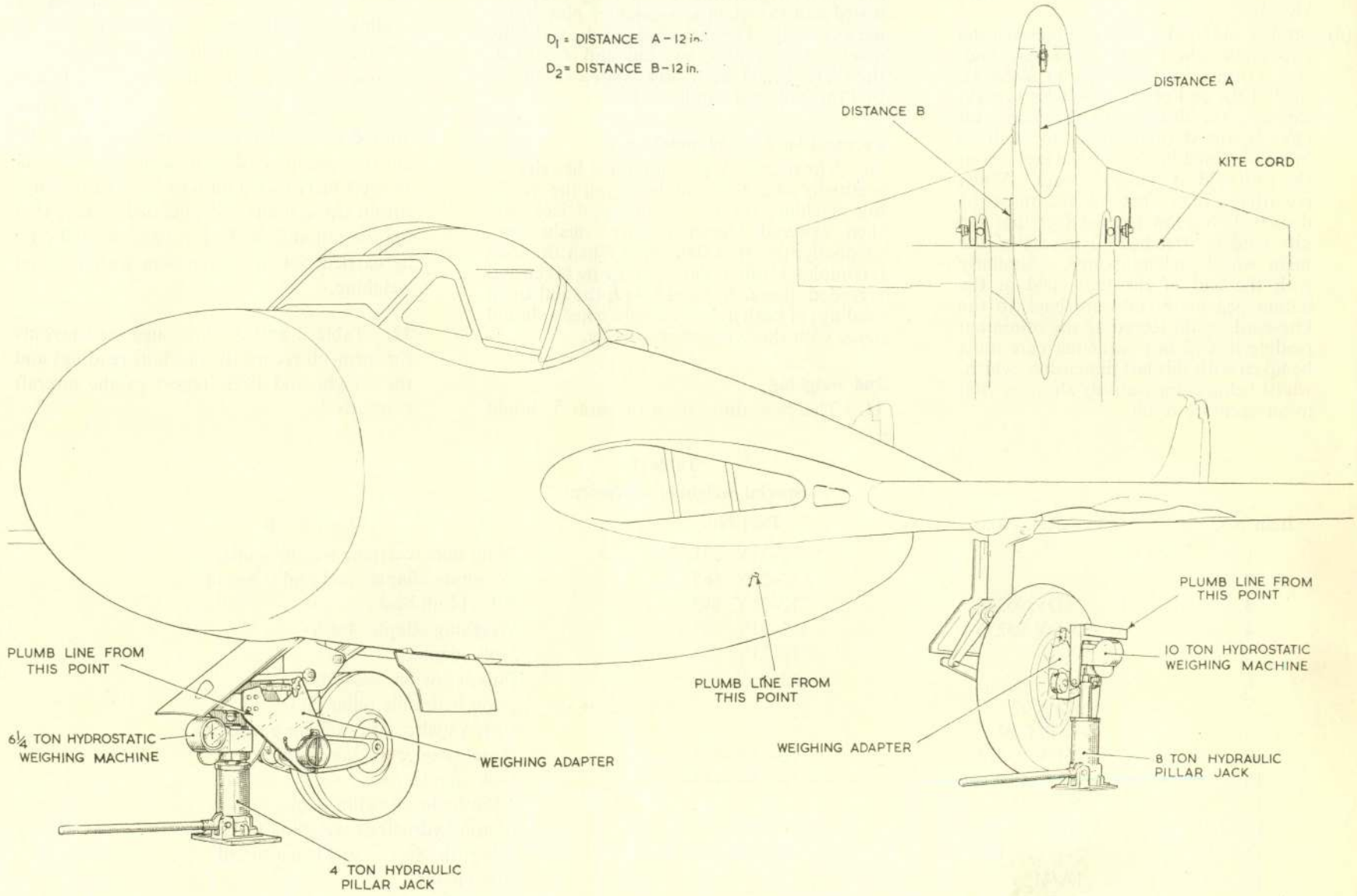

Fig. 1. Hydrostatic weighing

weighing adapters in turn, with the bar projecting aft. Chalk the floor under the after end of the bar and plumb down there from marking the floor as previously.

(4) Stretch and hold a kite cord between the two main wheel floor markings, and, with a measuring tape (*Item* 17, *Table* 1), held at the end of the nose wheel mark, measure the distance to the kite cord (*fig.* 1), the desired minimum readings being obtained by slewing the tape about the end held at the nose mark. When recording, note that 12 in. must be deducted to allow for the fact that the kite cord is stretched 12 in. aft of the main wheel jacking points. Similarly with the end of the tape held at the datum peg mark, measure back to the kite cord, again recording the minimum reading less 12 in.; particular care must be taken with this last dimension, which, whilst being comparatively short, is vital to an accurate result.

1st weighing

9. Before weighing, it must be ensured that all extraneous gear has been removed from the aircraft, particularly the wing incidence board and the main jack adapter plumb line bar assembly. The three hydrostatic weighing machines may now be read and recorded; the dials should be lightly tapped to ensure that the indicator hands are free.

Preparation for 2nd weighing

10. The nose jack pressure must be released gradually so as to avoid damaging the weighing machine; the two main wheel jacks are then lowered simultaneously, again very gradually, to avoid damage. When the load is completely off, initial readings are taken and recorded (para. 5(1) and 6(1)); the unloaded readings of both nose and main wheels should agree with those taken previously.

2nd weighing

11. The procedure given in para. 5 should be repeated, again checking the jacking beams on the adapters with the spirit level, and then the procedure in para. 6, 7 and 9 repeated and the readings recorded; this second set of readings should agree with those previously obtained within the following limits:—

Sum of readings at main jacks	± 3 units
Nose readings	± 2 units

Should the readings differ by more than the above, operations described in para. 10 and 11 must be repeated until two sets of readings within these limits are obtained. Note that the operation described in para. 8 need only be carried out in conjunction with the first weighing.

12. Table 2 and 3 show suggested layouts for forms to record the machine readings and the weight and C.G. report of the aircraft respectively.

Table 1

Special weighing equipment

Item No.	Ref. No.	Part No.	Description
1		12–21Y. 691A	Main undercarriage weighing adapter
2		12–21Y. 685	Weighing adapter pad and wingnut
3	26DV/95274	12–21Y. 695A	Wheel hub bush
4	26DV/95275	12–21Y. 687A	Weighing adapter bush
5		12–21Y. 693	Jack adapter
6		12–21Y. 697	Plumb line bar assembly
7	4Q/2667		8-ton hydraulic pillar jack
8	4GB/4894		10-ton hydrostatic weighing machine
9	26DV/95273	12–21Y. 621A	Nose wheel weighing adapter
10		12–21Y. 713	Jack adapter
11	4Q/2604		4-ton hydraulic pillar jack
12	4GB/N.I.V.		6¼-ton hydrostatic weighing machine
13	26DV/95183	12–20Y. 2293A	Wing rib No. 3—Incidence Board
14	1A/4124		Clinometer
15	1A/825		Plumb bob
16	32A/107		Kite cord (as required)
17	1C/2441		50 ft. steel measuring tape (ft. ins. $\frac{1}{10}$ in.)
			Chalk (white)
			Spirit level

Table 2

Proposed layout for weighing record

Registration No..... Date.....

Instrument readings

Port main Unit Serial No.....

	1st Lift	2nd Lift	3rd Lift	4th Lift
1. Reading 'under load'	.....	.....	.....	.....
2. 'No load' reading (±)	.....	.....	.....	.....
P Net reading, Port				

Starboard main Unit Serial No.....

	1st Lift	2nd Lift	3rd Lift	4th Lift
3. Reading 'under load'	.....	.....	.....	.....
4. 'No load' reading (±)	.....	.....	.....	.....
S Net reading, Starboard				
*Total (Net port and Net starboard)				

*For reference only. Required only to establish acceptable readings.

	1st Lift	2nd Lift	3rd Lift	4th Lift
5. Reading 'under load'	.....	.....	.....	.....
6. 'No load' reading (±)	.....	.....	.....	.....
N Net reading, Nose				

Note . . .

(1) *The actual instrument readings taken during weighing are to be recorded at* 1, 2, 3, 4, 5 *and* 6 *above.*

(2) *The net readings at P, S and N are the algebraic differences between readings 'under load' and 'no load' readings.*

e.g.	Reading under load	1094·5	1094·5
	No load reading	+2·5	−2·5
		1092·0	1097·0

Table 3
Proposed weight and C.G. report

Registration No..... Date.....

Acceptable net instrument readings

Port Main Unit Serial No.....

Net reading 1st acceptable lift	=	.....		
Net reading 2nd acceptable lift	=	.....		
Total 1st + 2nd	=	.....		
Mean of 1st and 2nd	=	..... Units		lb.
Deduct weight of weighing adapter assembly, wheel hub bush and weighing adapter bush			=	19 lb.
W_P = Mean weight port			=	lb.

Starboard Main Unit Serial No.....

Net reading 1st acceptable lift	=	.....		
Net reading 2nd acceptable lift	=	.....		
Total 1st + 2nd	=	.....		
Mean of 1st and 2nd	=	..... Units		lb.
Deduct weight of weighing adapter assembly, wheel hub bush and weighing adapter bush			=	19 lb.
W_S = Mean weight, starboard			=	lb.
$W_M = W_P + W_S$ = Total Main Reactions			=	lb.

RESTRICTED

Table 3—*continued*

Nose Unit Serial No.....

Net reading 1st acceptable lift = ...

Net reading 2nd acceptable lift = ...

Total 1st + 2nd = ...

Mean of 1st and 2nd = ... Units .....lb.

Deduct weight of weighing adapter = 23 lb.

W_N = Mean weight, Nose = lb.

$W_W = W_M + W_N$ = Total as weighed = lb.

Dimensions

D_1 = Distance between nose and main wheel supports — Ft. In. Ft. (decimal)

D_2 = C.G. datum to main wheel support

C.G. Position

$$\bar{x} = D_2 - \frac{D_1 \times W_N}{W_W} = \ldots\ldots - \left(\frac{\ldots\ldots \times \ldots\ldots}{\ldots\ldots}\right) = \ldots\ldots - \ldots\ldots = \ldots\ldots \text{ ft. aft of C.G. datum}$$

Moment as weighed = $W_W \times \bar{x}$ = ...lb. ft.

	Weight lb.	Arm ft.	Moment lb. ft.
Aircraft as weighed			
Deduct 6 gall. undrainable fuel	−48	+2·00	−96
Aircraft as weighed (no fuel)			

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