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CHAPTER 7

SYSTEMS

CHAP.

7

RESTRICTED

Chapter 7 SYSTEMS

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Introduction

701. A comprehensive detailed list of all components, illustrations of systems, together with a list of raw material for the manufacture and repair of pipe details is contained in A.P.4505A, Vol. 3, Part 1, 2, 3 and 4.

PIPING

702. Pipes which fail or are damaged in the various systems will only be repairable by replacement, excepting in the case of a long length of pipe, when an insertion can be made using standard couplings, and providing that no fouls will occur at the newly made joint. Provision for the repair of metal

fuel pipes in the outer wings by insertion, is provided for by the use of a special tool, Ref. No. Z.9865. With this tool, beading the ends of the pipes can be accomplished in situ. Refer to fig. 701.

PIPE BENDING

703. All pipes made for replacement must be bent to one of the radii quoted in the tables. No intermediate radii is permissible. Preference should always be given to the largest bend radii. The smaller radii should only be used when their use is unavoidable. Free hand bending of pipes must not be resorted to. Use the approved standard pipe bending tools, which will ensure that ovality

of the pipe at bends is kept to a minimum. After completion of pipe bending, fitting of couplings, sleeves, and of beading, the pipe should be replated for a distance of approximately four inches from each end to prevent corrosion. The plating applies only to the pipe. Couplings and sleeves should be secured at a distance from the end of the pipe which will allow plating to take place.

General

704. Reference for bend radii, and minimum straight length requirements for pipes, are contained in fig. 702, 703, and key tables. For additional information refer to A.P.1464D, Vol. 1, and A.P.1464B, Vol. 1.

REPAIR INSTRUCTIONS

END OF PIPE TO BE MADE CIRCUMFERENTIALLY SQUARE TO CENTRE-LINE OF PIPE.

RELEASE CONE-ADJUSTER SO THAT THE BALL BEARING FALLS BELOW THE OUTER SURFACE OF THE INNER BODY.

ENTER THE PIPE UP TO THE STOP ON THE INNER BODY.

APPLY LOAD ON THE BALL BEARING BY MEANS OF THE CONE ADJUSTER, RELEASE AND TIGHTEN LOCKNUT ACCORDINGLY.

ROTATE FOR BEADING BY TURNING THE INNER BODY WITH SPANNER MAKE SURE THE PIPE IS AGAINST THE STOP DURING THIS OPERATION.

AFTER COMPLETION OF BEADING, RELEASE LOCKNUT AND SCREW IN CONE ADJUSTER UNTIL BALL BEARING IS BELOW OUTER SURFACE OF INNER BODY.

REMOVE LOCKING RING FROM BODY WHICH WILL NOW SEPARATE FOR REMOVAL FROM PIPE.

CHECK BEADING FOR CORRECT SIZE.

ENSURE THAT THE PIPES ARE SCRUPULOUSLY CLEAN BEFORE REMAKING JOINT.

NOTE - THIS TOOL IS DESIGNED FOR BEADING LONG PIPES WHICH CANNOT BE REMOVED FROM THE AIRCRAFT WHEN A REPAIR IS NECESSARY BY INSERTION OF A SHORT LENGTH OF NEW PIPE.

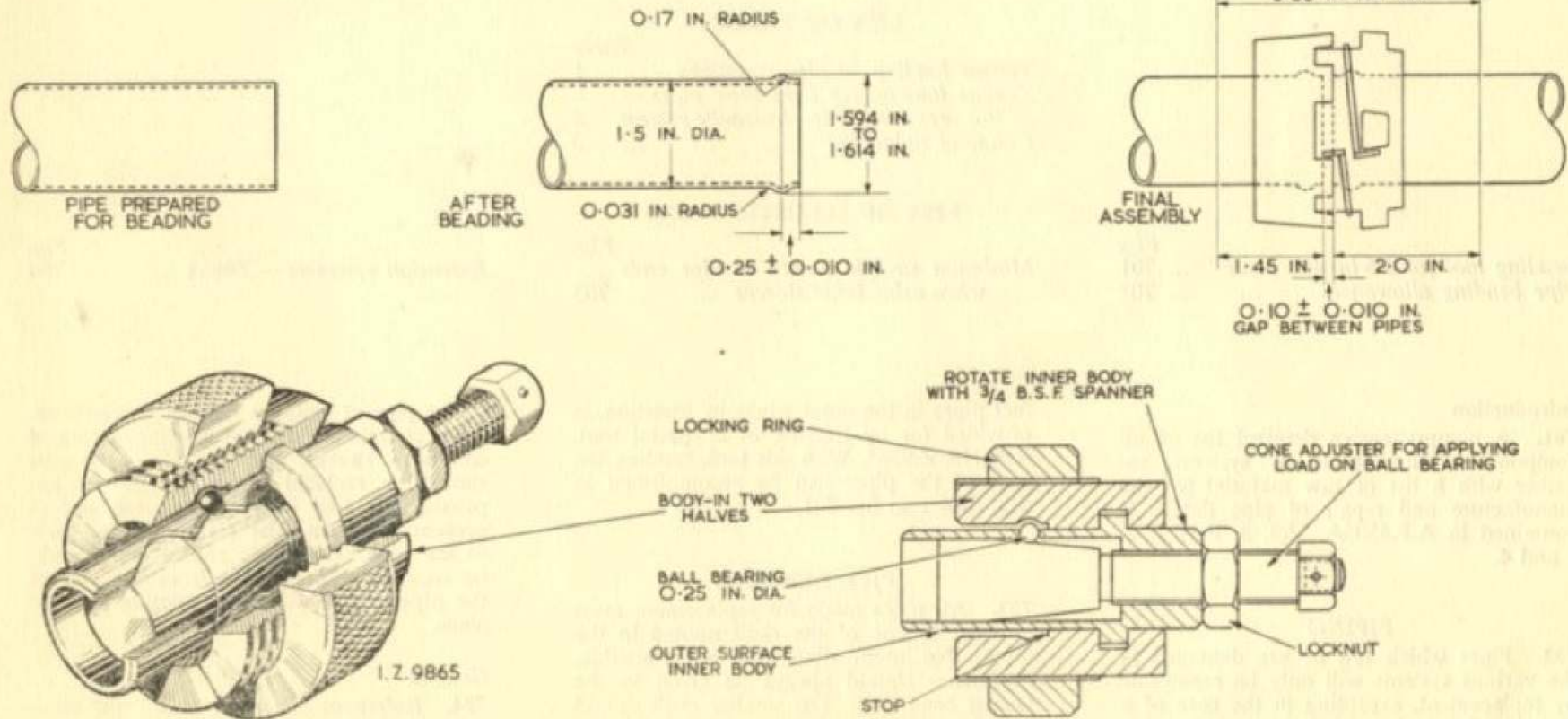


Fig. 701. Beading tool for 1.5 in. dia. pipes (using F.R.S.110/K type couplings)

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Outside dia. of pipe in.	"A" minimum straight length in.	"B" minimum straight length in.	"R" BEND RADIUS		
			First choice in.	Smaller alternative in.	Absolute minimum in.
0-187	1-0	2-0	2-0	1-25	0-75
0-25	1-0	2-0	2-0	1-50	1-0
0-312	1-0	2-0	2-5	1-75	1-25
0-375	1-0	2-0	2-5	2-0	1-50
0-437	1-5	2-0	3-0	2-50	1-75
0-50	1-5	2-0	6-0/4-0	3-0	2-0
0-625	1-5	2-0	6-0/4-0	3-0	2-0
0-75	1-5	2-0	6-0	4-0	3-0
0-875	1-5	2-0	6-0	4-0	3-0
1-0	1-5	2-0	6-0	4-0	3-0
1-25	1-5	2-5	8-0/6-0	4-0	3-0
1-50	1-5	3-0	8-0/6-0	5-0	4-0
2-0	1-75	4-0	10-0	8-0	6-0
2-50	1-75	5-0	10-0	8-0	6-0

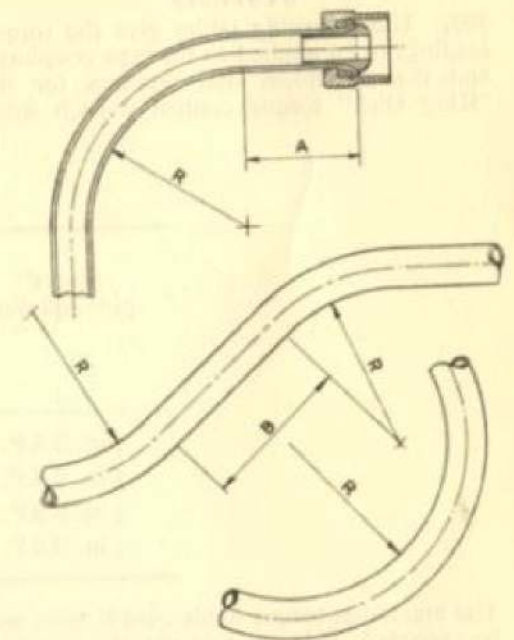


Fig. 702. Pipe bending allowances

Outside dia. of pipe in.	"C" minimum straight length in.	Outside dia. of pipe in.	"C" minimum straight length in.
0-187	5-0	0-75	5-0
0-25	5-0	0-875	5-50
0-312	5-0	1-0	5-50
0-375	5-0	1-25	5-50
0-437	5-0	1-50	5-50
0-50	5-0	2-0	5-50
0-625	5-0	2-50	5-50

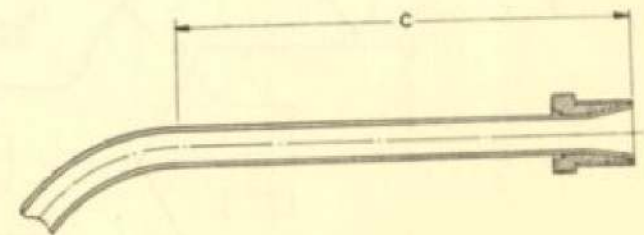


Fig. 703. Minimum straight length at pipe ends when using inner sleeves

TORQUE LOADS — HYDRAULIC SYSTEMS

705. The following tables give the torque loadings to be applied to the pipe couplings, and the equivalent dial readings for the "King Dick" torque control wrench fitted

with an extension spanner with a 2.0 in. arm. The figures quoted in Table 1 apply to the high pressure pipe lines made from steel and tungum.

Three columns of equivalent readings are quoted:—

- (1) Torque load to be applied to coupling nut.
- (2) With extension spanner in line with torque wrench centre-line.
- (3) With extension spanner set at 90 deg. to centre-line of torque wrench.

TABLE 1
Torque loadings on pipe couplings

Size of pipe coupling	Torque to be applied to coupling nut lb./in.	Equivalent torque readings on dial		Satisfactory for working pressure of up to:— p.s.i.
		Extension spanner in line lb./in.	Extension spanner set at 90 deg. to centre-line lb./in.	
½ in. B.S.P.	50 to 70	45 to 55	45 to 65	4,000
¾ in. B.S.P.	100 to 135	85 to 110	100 to 130	4,000
1 in. B.S.P.	175 to 225	150 to 185	175 to 220	4,000
1½ in. B.S.P.	350 to 425	300 to 355	345 to 415	4,000

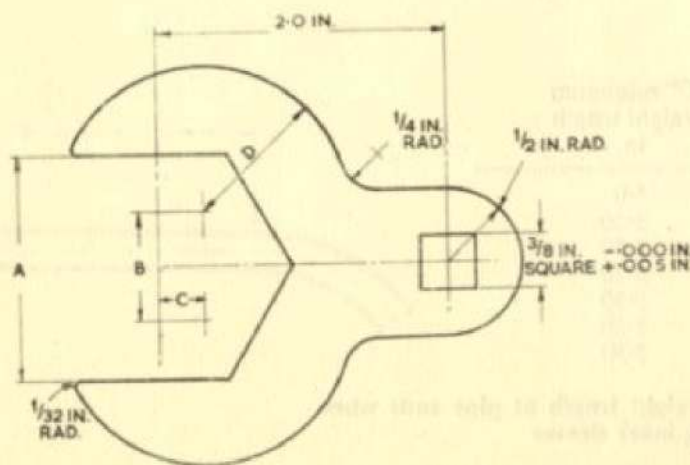
The maximum torque loads quoted must not be exceeded. If leakage occurs, the coupling

assembly should be checked to ensure that the pipe has been correctly belled, and also

to ascertain whether any of the coupling parts have been wrongly assembled or distorted.

Special tools:— Extension spanners Part No. Z.9862.

Material — Nickel-Chrome 0.25 in. thick, hardened and ground.



Item	A in.	B in.	C in.	D in.
2. Z.9862	1.67	0.75	0.312	0.937
3. Z.9862	1.20	0.437	0.312	0.75
4. Z.9862	1.10	0.437	0.25	0.625
5. Z.9862	1.01	0.531	0.312	0.625
6. Z.9862	0.82	0.25	0.25	0.625
7. Z.9862	0.60	0.25	0.187	0.437
8. Z.9862	0.525	0.156	0.156	0.375
9. Z.9862	0.710	0.25	0.218	0.531

Fig. 704. Extension spanners — Z9862

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TABLE 2
Torque loadings for light alloy pipes on the low pressure joints of the hydraulic systems

Size of pipe coupling B.S.P.	Torque to be applied to coupling nut lb./in.	Equivalent torque readings on dial		Satisfactory for working pressure of up to:— p.s.i.
		Extension spanner in line lb./in.	Extension spanner set at 90 deg. to centre-line lb./in.	
$\frac{1}{8}$ in.	40 to 60	35 to 50	35 to 55	500
$\frac{1}{4}$ in.	100 to 125	85 to 100	100 to 120	500
$\frac{3}{8}$ in.	150 to 200	130 to 165	150 to 195	500
$\frac{1}{2}$ in.	200 to 275	170 to 230	195 to 270	500
$\frac{3}{4}$ in.	200 to 275	170 to 230	195 to 270	500
$\frac{7}{8}$ in.	250 to 375	210 to 310	245 to 370	500
1 in.	250 to 375	210 to 310	245 to 370	500

Instructions for the tightening of couplings on all systems excepting hydraulics, are defined in the following table.

TABLE 3
Coupling tightening

Outside dia. of pipe	Approximate fraction of turn after finger tightening	
	For a new joint	For a remade joint
$\frac{3}{16}$ in.	$\frac{3}{4}$	$\frac{1}{2}$
$\frac{1}{4}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{5}{16}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{3}{8}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{7}{16}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{1}{2}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{5}{8}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{3}{4}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
$\frac{7}{8}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
1 in.	$\frac{1}{2}$	$\frac{1}{2}$
1 $\frac{1}{4}$ in.	$\frac{1}{2}$	$\frac{1}{2}$
1 $\frac{1}{2}$ in.	$\frac{1}{2}$	$\frac{1}{2}$

INSTALLATION

706. It is very important before fitting a pipe or a new pipe insert, to check that the interior of the pipe is scrupulously clean, also great care should be taken that no swarf, etc., is left in the existing installation. Prior to torque loading of pipe joints, lightly grease all threads with anti-freeze grease ZX-13, Ref. 34B/9100528, N.A.T.O. Code No. S.720. This instruction applies to the following systems: Hydraulics, Emergency Air, De-icing, Fuel, Engine Oil, Pneumatics, and Nitrogen. For the oxygen system use Aqueous colloidal graphite grease ZX-24, Ref. 34B/9105066, N.A.T.O. Code No. S.718.

FUEL SYSTEM

707. The normal fuel carrying capacity of the aircraft is contained in fourteen flexible tanks which are positioned as follows: five in each outer wing, and four fitted above and aft of the nose-wheel bay. The wing tanks are made of Hycatrol H.P.257, 0.030 in. thick, reinforced with Terylene. Spec. D.T.D.1132. Fuselage tanks are made from Hycatrol H.P.257, 0.040 in. thick, reinforced with Terylene. Spec. D.T.D.1124. All the tanks which are crash-resistant, and suitable

for use at low temperatures, are coated on the outside surface with Polyfilm Lacquer D.T.D.900/4312. For tank removal instructions refer to A.P.4505A, Vol. 1, Book 1. General information and repair instructions for these tanks are given in A.P.4117B.

TESTING

708. Instructions for the pressure testing and functioning of systems after repair or replacement of components, are contained in the associated publications listed below:—

		A.P.
Hydraulics	...	4505A, Vol. 1, Book 1 1803, Vol. 1
Pneumatics	...	4505A, Vol. 1, Book 1 4303, Vol. 1
De-icing	...	4505A, Vol. 1, Book 1
Fuel	...	4505A, Vol. 1, Book 1
Engine oil	...	4501, Vol. 1
Nitrogen	...	4505A, Vol. 1, Book 1
Oxygen	...	4505A, Vol. 1, Book 1 1275, Vol. 1
Cabin air pressure and conditioning system	...	4505A, Vol. 1, Book 1
Flying controls	...	4505A, Vol. 1, Book 1
Engine controls	...	4505A, Vol. 1, Book 1

BALL RACES

709. A special tool kit Z.9306, Ref. No. 26DC/95300, is available for removing the various sizes of securing plates which retain the ball-race in the housing. After servicing, or renewal of ball-race, assemble a new securing plate with the appropriate tools from the above kit.

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