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PIPE CONNECTORS

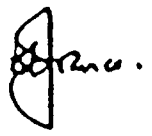
(STANDARD)

FLIGHT REFUELLING LTD

GENERAL AND TECHNICAL INFORMATION

PARTS CATALOGUE AND RELATED INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL



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AMENDMENT RECORD

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MODIFICATION RECORD

The following record confirms that this publication incorporates all technical changes necessitated by the modifications listed below.

Mod No	Brief details	Class

WARNINGS

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

MAKE SURE YOU KNOW THE SAFETY PRECAUTIONS AND FIRST AID INSTRUCTIONS BEFORE YOU USE A HAZARDOUS SUBSTANCE

READ THE LABEL ON THE CONTAINER IN WHICH THE SUBSTANCE IS SUPPLIED

READ THE DATA SHEET APPLICABLE TO THE SUBSTANCE

OBEY THE LOCAL ORDERS AND REGULATIONS

Chapter 1

TECHNICAL DESCRIPTION - GENERAL

PIPE CONNECTORS (STANDARD)

CONTENTS

ILLUSTRATIONS

TABLE

Introduction

1 This publication deals with the 'standard' range of pipe connectors, bulkhead connectors and termination connectors, and covers the varying types of each series. The connectors are made for pipes from ⅝in o/d to 4in o/d, the size being identified by the Part No suffixed by a stroke and letter identification. The connector is suitable for use with a variety of aircraft systems (see Table 4), the only variable being the flexible rubber seal. The type and size of connector to be employed in any one particular system is therefore identified by the Part No, a stroke and letter suffix followed by a stroke and a Series Number to identify the type of seal applicable to the system.

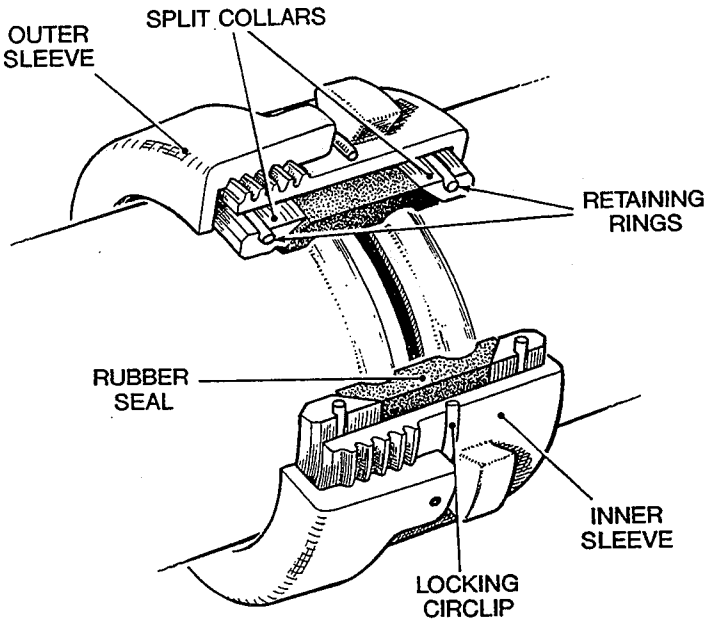

Fig 1 Pipe connector, FRS 110

DESCRIPTION

In-line connectors

Connector, Part No FRS 110 (fig 1)

2 The standard pipe connector consists of an inner and outer sleeve, a flexible rubber seal and two split collars. A pressure-tight coupling between two pipes is established by the rubber seal which is chamfered at each end, and has two U-section grooves moulded in the bore; the grooves each fit over a bead formed near the end of each pipe to the dimensions shown in fig 2.

CAUTION

It is essential that the beading dimensions given in fig 2 are strictly adhered to, and that the pipes after beading conform to the diameter shown in BSSL 100, otherwise the security of the joint will be impaired.

3 A split collar, retained by a circlip and having a conical shaped seating machined on one face, is fitted at each end of the seal. Each of these collars is assembled so that the conical face abuts the chamfer at the end of the rubber seal.

4 The inner and outer sleeves are screwed together on assembly. Each sleeve has a shoulder formed on one end which abuts the outer face of the adjacent split collar, so that when the sleeves are tightened pressure is applied to the split collars and in consequence to the rubber seal, thus making an effective joint.

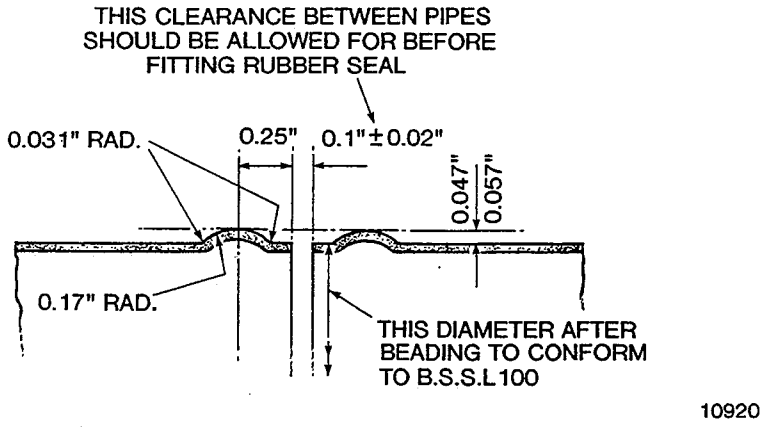

Fig 2 Pipe beading dimensions

5 Except for the ⅝in and ¾in connectors, which have hexagonal inner and outer sleeves,the outer sleeve is castellated and the inner sleeve has four lugs on its outer surface which form locating pegs for the universal C-spanner, Part No FRS 124, or special spanner, Part No FRS 58/size ident. The complete assembly is secured with a locking circlip fitted in the gap formed between the castellations and lugs. A 4BA hole is tapped in alternative castellations of the outer sleeve and provides an attachment for an earthing wire or clip. Electrical continuity is maintained through the connector because the threads of the sleeves are free from anti-corrosive treatment; these threads are, however, coated with collodial graphite on assembly.

Connector, Part No FRS 325 (fig 3)

6 The standard pipe connector, Part No FRS 325, is identical in principle to the connector previously described but is fitted with two additional backing rings one at each end of the connector, between the sleeve and split collar, which limit the extension of the gap between the pipes when under pressure to 0·225in maximum. The split collars at each side of the rubber seal are chamfered on their outer faces to provide a seating for the backing ring. Thus when the inner and outer sleeves are tightened on assembly, the shoulder formed at the end of each sleeve abuts the outer faces of the backing rings which seat over and apply pressure to the split collars and consequently to the rubber seal. The rubber seal fitted in this connector is shorter in length than that fitted in connector, Part No FRS 110, and is therefore not interchangeable.

Connector (fire-resistant), Part No FRS 594 and 595

7 The fire-resistant connectors, manufactured in the E to S range of sizes, are similar in all respects to the standard connectors except that the split collars are made of Ferrobestos LA 4 material

8 Sizes E and F carry the Part No FRS 595 and are similar to Part No FRS 132, in that the inner and outer sleeves are hexagonal. Sizes H to S are identified FRS 594 and are similar to Part No FRS 110.

Connector, Part No FRS 895

9 The pipe connectors, Part No FRS 895, manufactured in the H to N range of sizes, vary from the basic connector, Part No FRS 110, in that the inner and outer sleeves are knurled for hand-tightening the assembly instead of being lugged and castellated for spanner attachment. Thus the internal components are arranged as in the basic connector and the application to the aircraft system is identical.

10 To lock the connector, the inner and outer sleeves are secured together against rotation by locking wire.

TABLE 1

In-line Connectors

FRS	Size ident	Pipe o/d in	Outer sleeve o/d in	Length in	Weight lb
110	H	1	1·95	1·7	0·25
110	J	1¼	2·18	1·7	0·28
110	K	1½	2·42	1·7	0·31
110	L	1¾	2·89	1·7	0·47
110	M	2	2·97	1·7	0·42
110	N	2¼	3·26	1·7	0·47
132	E	⅝	1·38	1·60	0·12
132	F	¾	1·50	1·65	0·14
325	L	1¾	2·89	–	–
325	M	2	2·97	–	–
325	N	2¼	3·26	–	0·47
325	P	2½	3·51	–	0·50
325	Q	2¾	3·76	–	0·58
325	R	3	4·00	–	0·63
325	S	3¼	4·23	–	–
325	T	3½	4·49	–	0·63
325	V	4	5·00	–	0·90
325	Z	5	5·90	–	–
594	H	1	1·95	1·7	0·25
594	J	1¼	2·18	1·7	0·28
594	K	1½	2·42	1·7	0·31
594	L	1¾	2·89	1·7	0·47
594	M	2	2·97	1·7	0·42
594	N	2¼	3·26	1·7	0·47
595	E	⅝	1·38	1·60	0·12
595	F	¾	1·50	1·65	0·14
895	H	1	1·81	–	–
895	J	1¼	2·06	–	–
895	K	1½	2·31	–	–
895	L	1¾	2·60	–	–
895	M	2	2·86	–	–
895	N	2¼	3·11	–	–
895	P	2½	3·36	–	–
895	R	3	3·89	–	–
1102	H	1	1·81	–	–
1102	J	1¼	2·06	–	–
1102	K	1½	2·31	–	–
1102	L	1¾	2·60	–	–
1102	M	2	2·86	–	–
1102	N	2¼	3·11	–	–
1102	P	2½	3·36	–	–

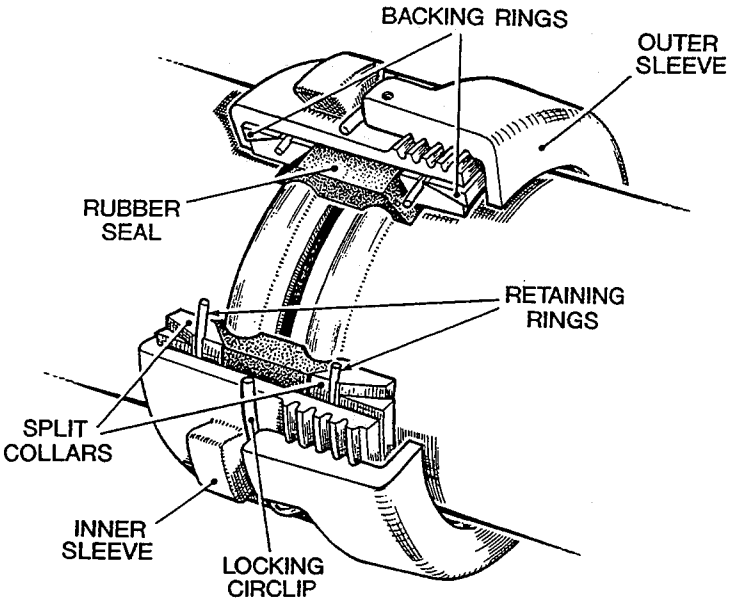

Fig 3 Pipe connector, FRS 325

Connector, Part No FRS 1102

11 The pipe connector, Part No FRS 1102, manufactured in the H to P range of sizes, is similar to the connector, Part No FRS 895, in that the inner and outer sleeves are knurled for hand-tightening. Locking the connector is effected by a peripheral circlip engaging each sleeve. This obviates the necessity of locking wire.

12 In all other respects this is a standard connector with similar applications to aircraft systems as the basic connector.

Bulkhead connectors

Bulkhead connector, Part No FRS 122 (fig 4)

13 The standard bulkhead connector, Part No FRS 122, consists of a flanged sleeve, an outer sleeve and internal components which are identical to those in the basic pipe connector, i.e. flexible rubber seal and two split collars, each split collar being retained by a circlip.

14 The flanged sleeve has a number of equally-spaced holes around the flange to accommodate attachment bolts by which the connector is secured to a bulkhead, and holes are also drilled at strategic points around the flange boss to provide a means for anchoring the circlip which locks the sleeves when they are screwed together. The connectors are manufactured in the H to S range of sizes.

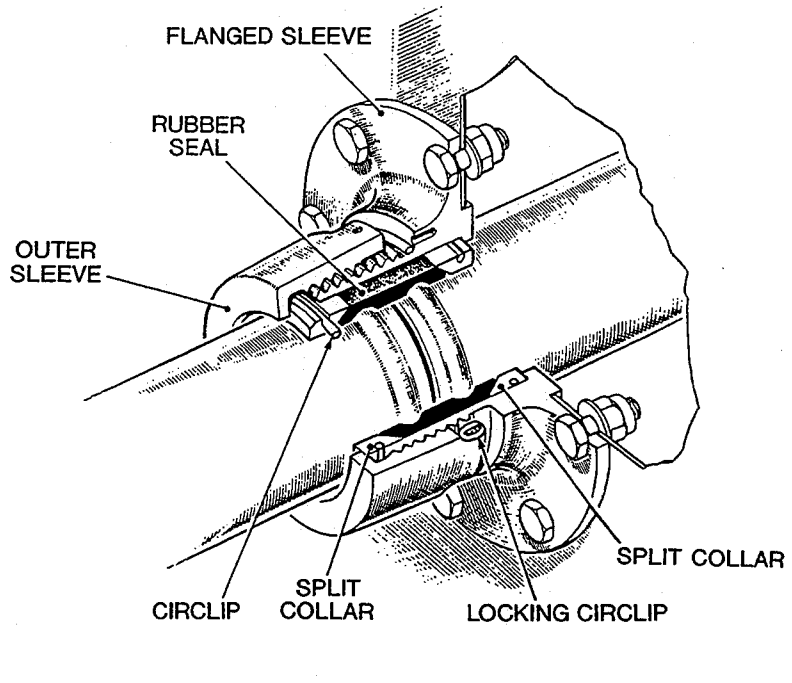

Fig 4 Bulkhead connector, FRS 122

TABLE 2
Bulkhead connectors

FRS	Size ident	Pipe o/d in	Flange dia in	Outer sleeve dia in	PCDxNo of flange holes in	Dia Flange holes in	Weight lb
122	H	1	3·45	1·95	2·95x8	0·1935	0·35
122	J	1¼	3·70	2·18	3·20x8	0·1935	0·40
122	K	1½	3·95	2·42	3·45x8	0·1935	0·45
122	L	1¾	4·45	2·89	3·95x10	0·1935	0·50
122	M	2	4·45	2·97	3·95x10	0·1935	0·53
122	N	2¼	4·70	3·26	4·20x10	0·1935	0·56
192	E	⅝	2·02	1·50	1·62x6	0·1562	0·06
192	F	¾	2·15	1·70	1·75x6	0·1562	0·07
400	L	1¾	4·45	2·89	3·95x10	0·1935	–
400	P	2½	4·95	3·51	4·45x10	0·1935	0·80
400	Q	2¾	5·20	3·76	4·70x12	0·1935	0·88
400	R	3	5·45	4·00	4·95x12	0·1935	0·96
400	T	3½	5·85	4·49	5·35x15	0·1935	1·15
400	V	4	6·35	5·00	5·85x15	0·1935	1·31
634	P	2½	4·95	3·51	3·85x12	0·1562	–
927	M	2	4·45	2·97	3·95x4	0·1935	0·51
1005	J	1¼	3·45	2·06	2·90x8	0·1935	–
1005	K	1½	3·65	2·31	3·15x8	0·1935	–
1005	L	1¾	4·15	2·60	3·65x8	0·1935	–
1005	M	2	4·15	2·86	3·65x8	0·1935	–
1005	N	2¼	4·40	3·11	3·90x10	0·1935	–
1005	P	2½	4·65	3·36	4·15x10	0·1935	–
1025	L	1¾	3·70	2·60	3·20x8	0·1930	0·405

TABLE 3

Termination connectors

FRS	Size ident	Pipe o/d in	Flange dia in	Outer sleeve dia in	PCDxNo of flange holes in	Dia Flange holes in	Weight lb
150	H	1	2·75	1·85	2·25x8	)	0·18
150	J	1¼	3·00	2·10	1·50x8	)	0·20
150	K	1½	3·25	2·35	2·75x8	)0·1890	0·23
150	L	1¾	3·50	1·75	3·00x8	)	0·26
150	M	2	3·75	2·85	3·25x8	)	0·30
150	N	2¼	4·00	3·10	3·50x8	)	0·34
230	E	⅝	1·90	1·30	1·59x6	0·1562	0·08
230	F	¾	2·00	1·48	1·71x6	0·1562	0·10
246	F	¾	–	1·48	–	–	0·12
260	P	2½	4·53	3·40	4·12x12	0·2187	0·56
350	H	1	2·75	1·95	2·25x8	)	0·16
355	J	1¼	3·00	2·18	2·50x8	)	0·20
355	K	1½	3·25	2·42	2·75x8	)0·1890	0·25
355	L	1¾	3·50	2·89	3·00x8	)	0·29
355	M	2	3·75	2·97	3·25x8	)	0·34
355	N	2¼	4·00	3·26	3·50x8	)	–
395	P	2½	4·25	3·51	3·75x8	)	0·51
395	Q	2¾	4·50	3·76	4·00x8	)0·1890	0·55
395	R	3	4·75	4·00	4·25x8	)	0·61
395	T	3½	5·40	4·49	4·90x12	)0·2187	0·71
395	V	4	3·90	5·00	5·40x14	)	0·82
516	M	2	3·75	2·85	3·25x12	0·1540	–
597	H	1	2·75	1·85	2·25x8	)	0·18
597	J	1¼	3·00	2·10	2·50x8	)	0·20
597	K	1½	3·25	2·35	2·75x8	)0·1890	0·23
597	L	1¾	3·50	2·75	3·00x8	)	0·26
597	M	2	3·75	2·85	3·25x8	)	0·30
597	N	2¼	4·00	3·10	3·50x8	)	0·34
1015	J	1¼	3·45	2·06	2·90x8	)	–
1015	K	1½	3·65	2·31	3·15x8	)	–
1015	L	1¾	4·15	2·60	3·65x8	)0·1930	–
1015	M	2	4·15	2·86	3·65x8	)	–
1015	N	2¼	4·40	3·11	3·90x10	)	–
1015	P	2½	4·65	3·36	4·15x10	)	–
1080	M	2	–	2·85	3·25x8	0·1890	–

Bulkhead connector, Part No FRS 400

15 The bulkhead connector, Part No FRS 400, is identical in principle to the connector described in the preceding paragraph but has two additional steel backing rings fitted, one at each end of the connector. Thus when the outer sleeve is screwed and tightened, on assembly, to the flanged sleeve, the backing rings are forced against the chamfered faces of the split collars and in consequence apply pressure to the rubber seal forming a tight, effective joint.

Bulkhead connector, Part No FRS 634

16 This bulkhead connector is similar in all respects to the bulkhead connector, Part No FRS 400/P, except that the mounting flange has twelve 5/32in dia holes equally spaced on a 3·85in PCD.

Bulkhead connector, Part No FRS 927

17 This bulkhead connector is similar to the basic bulkhead connector, Part No FRS 122/M, except that the flange is cropped on diametrically opposite sides.

Bulkhead connector, Part No FRS 1005

18 This bulkhead connector manufactured in the J to P range of sizes, differs from the basic bulkhead connector, Part No FRS 122, in that the outer sleeve is knurled for hand-tightening on the flange sleeve instead of being lugged and castellated for spanner attachment. The internal components are arranged as in the basic connector and the application to the aircraft system is identical.

Bulkhead connector, Part No 1025

19 The bulkhead connector, Part No FRS 1025 is similar to the basic bulkhead connector, Part No FRS 122, except that a knurled outer sleeve is fitted in place of the castellated sleeve. The internal components are arranged as in the basic bulkhead connector. The connector is manufactured only in the L size ($1\frac{3}{4}$in pipe dia)and specifically for Series 1 application (fuel system).

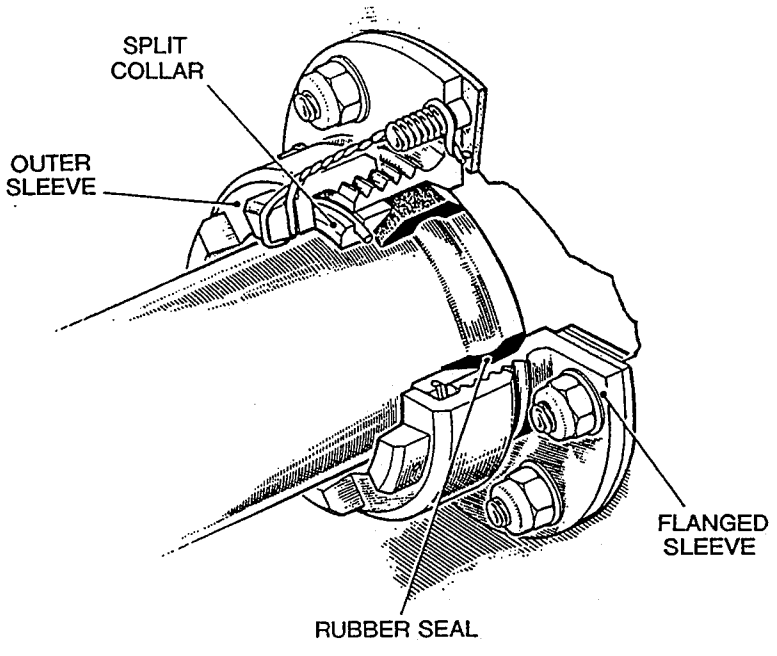

Fig 5 Termination connector, FRS 150

Termination connectors

Termination connector, Part No FRS 150 (fig 5)

20 The standard termination connector, Part No FRS 150, manufactured in the H to S Range of sizes, consists of a flanged sleeve, an outer sleeve, a flexible rubber seal and a split collar assembly. The flanged sleeve has a threaded boss, the bore of which is machined to form a chamfered seat for the rubber seal and equally-spaced holes are situated around the flange to accommodate the attachment bolts by which the connector is secured directly to a fuel tank or other similar component.

21 The rubber seal is chamfered at each end and has a single U-section groove moulded in the bore for fitment over the bead formed near the end of the pipe. The split collar is fitted at the pipe end of the rubber seal and is secured by a retaining ring. Thus when the outer sleeve is screwed on to the flange boss threads, the rubber seal is compressed between the split collar and the internal chamfer in the flange boss to form a fuel-tight joint.

22 The termination connector assembly includes a pipe blank, Part No FRS 360, which provides an effective seal for pipe ends at working pressures up to 75 lbf/in^2; the blank, when used with the applicable rubber seal, is suitable for use with the systems described in Table 4, the method of identification being the same as that for the termination connector. The range of pipe blanks is as follows:-

FRS No	Size Ident	Pipe o/d(in)	Wt lb
360	H	1	0·19
360	J	$1\frac{1}{4}$	0·22
360	K	$1\frac{1}{2}$	0·27
360	L	$1\frac{3}{4}$	0·30
360	M	2	0·36
360	N	$2\frac{1}{4}$	0·48
360	P	$2\frac{1}{2}$	0·52
360	Q	$2\frac{3}{4}$	0·57
360	R	3	0·62

Termination connector, 5/8in and 3/4in Part No FRS 230

23 This termination connector, manufactured only in the E and F range of sizes, differs from the connector described in the preceding paragraph only in that the outer sleeve is hexagonal.

Termination connector, 3/4in Part No FRS 246

24 The termination connector, Part No FRS 246, is similar to, and alternative to, the 3/4in connector, Part No FRS 230/F, but the flanged sleeve is replaced by a union adapter externally threaded 3/4in BSP.

Termination connector, 2½in Part No FRS 260

25 This termination connector is similar in all respects to the termination connector, Part No FRS 150/P, except that the mounting flange in this instance has twelve 2BA clearance holes. Further dimensional details are given in Table 3.

Termination connector, Part No FRS 355

26 The termination connector, Part No FRS 355 is similar to and interchangeable with termination connector, Part No FRS 150, but the sleeves are locked together by a circlip instead of locking wire. One end of the circlip is anchored in one of five equally-spaced 1/16in dia holes in the sleeve adjacent to the flange: the other end fits into the gap formed between the castellations of the outer sleeve, the outer sleeve of this connector being castellated in a similar manner to that of the pipe connector outer sleeve.

Termination connector, Part No FRS 395

27 The termination connector, Part No FRS 395, is identical in principle to the connector, Part No FRS 355, described in the previous paragraph, but has an additional steel backing ring fitted between the outer sleeve and split collar which limits, when under pressure, the extension of the gap between the end of the pipe and the surface to which it is connected.

28 The split collar is chamfered on its outer face to provide a seating for the backing ring, thus when the outer and flanged sleeves are tightened on assembly, the shoulder formed at the end of the outer sleeve abuts the outer face of the backing ring which seats over and applies pressure to the split collar and, consequently, the rubber seal.

29 The rubber seal fitted in this assembly is shorter in length than that fitted in connector Part No FRS 355, and is therefore not interchangeable.

Termination connector, Part No FRS 516

30 This termination connector is identical to the basic termination connector, Part No FRS 150/M, except that the mounting flange has twelve 0·154in dia holes equally spaced on a 3·25 in PCD.

Termination connector, (fire-resistant), Part No FRS 597

31 These fire-resistant termination connectors are similar in all respects to the basic termination connector, Part No FRS 150 except that the split collars are made of Ferrobestos L.A. 4 material. The connector is manufactured in the H to N range of sizes.

Termination connector, Part No FRS 1015

32 This termination connector, Part No FRS 1015, is similar to the termination connector, Part No FRS 150, but the outer sleeve is knurled for hand-tightening. The mounting flange is of greater overall diameter, for any specific pipe-size, from the flange of the basic connector, and all threads are unified. The connector is manufactured in the J to P range of sizes with Series 1 (fuel system) application only.

Termination connector, Part No FRS 1080

33 This termination connector, Part No FRS 1080, is similar to the basic termination connector, Part No FRS 150, except that the mounting flange is cropped at one point on its periphery to facilitate installation to the aircraft structure. The connector is manufactured only in the M size (2in pipe dia), and specifically for Series 1 application (fuel system).

Pipe blank, Part No FRS 360

34 The component parts of the pipe connector are similar to, and interchangeable with those comprising the termination connector, Part No FRS 355, except for the flanged sleeve and locking circlip. The flanged sleeve is replaced by an externally threaded blank provided with four equally-spaced lugs to facilitate tightening by the special spanner.

35 The assembly is locked by a circlip the ends of which fit into the gap formed between the lugs of the blank and the outer sleeve castellations.

TABLE 4

Seal identification

Series	Material	Our Spec	Application	Availability
1	Polysulphide rubber FDS1524	FDS1524	Water-methanol and fuel	Obsolete
2	Nitrile DTD 458 Grade A or Dowty 0270/AFS795	FDS1508	Hydraulic fluid (DTD 585)	Not in use
4	Nitrile DTD560 + DTD5509	FDS1501	Lubricating oil (high temp.)	Available
5	Silicone DTD5582GR60 or DTD818 L3 or N3		Air water and oil DERD 2487	Available
7	Fluorosilicone rubber		Hot air, fuel and Water-methanol	Available
8	Ethyl Propylene X533A (BOORN) DTD5597A		Hydraulic fluid (Skydrol)	70 IRHD - 70 Hard only
9	Fluoro carbon (FLUOREL)	FRS1226	Fuel (high temperature)	Available
10	Nitrile	FDS1501	(UK MoD ONLY) Aviation Fuel	Available

Chapter 2

MAINTENANCE

CONTENTS

Introduction

1 Under normal conditions, these connectors do not require any routine servicing, but if leakage is detected or a connector is damaged, the assembly must be dismantled and the damaged parts renewed.

Materials and equipment

2 The following materials and equipment will be required when servicing the pipe connectors.

(1) Colloidal graphite paste, ZX30 ... ... 34B/9440586

(2) C spanner, Part No FRS 124 (see note)

(3) C spanner, Part No FRS 58 (see note)

NOTE

The universal C-spanner, Part No FRS 124 fits all connectors from 1in to 3in.

The special spanner, Part No FRS 58, is manufactured in the 1in to 5in sizes applicable to the connector range, the Part No suffixed by a stroke and letter identifies the size of spanner, e. g.the spanner size required for a $3\frac{1}{2}$in connector is FRS 58/T (see Chapter 1, Tables 1 to 3, column 2).

DISMANTLING

In-line connectors

3 Remove the locking circlip from its groove and slide it over the sleeve and on to one of the pipes.

4 Using one of the special spanners (para. 2) unscrew the outer sleeve from the inner sleeve.

5 Ease the sleeves clear of the rubber seal and split collars.

6 Remove the circlip from each split collar and remove the collars.

7 Remove the rubber seal, backing rings (if fitted), and inner and outer sleeves from the pipe ends.

Bulkhead connectors

8 Remove the locking circlip and slide it back over the outer sleeve and on to the pipe.

9 Unscrew the outer sleeve from the flanged sleeve with one of the special spanners. (Refer to the note, para. 2).

10 Ease the outer sleeve clear of the adjacent split collar and the rubber seal.

11 Remove the circlip from the split collar and detach the two halves of the collar.

12 Push the pipes from behind the flanged sleeve until access can be gained to the rubber seal and the other split collar. Remove the circlip and then detach the two halves of the collar.

13 Ease the rubber seal from the pipe ends and withdraw the backing rings (if fitted), and the outer sleeve.

Termination connectors

14 Remove the locking wire or circlip securing the outer sleeve.

15 Using one of the special spanners on the outer sleeve (or blank connector, Part No FRS 360) unscrew the outer sleeve from the flanged sleeve. (Refer to the note para. 2).

16 Ease the outer sleeve clear of the rubber seal and split collar.

17 Remove the retaining ring from the split collar and detach the two halves of the collar.

18 Withdraw the pipe from the flanged sleeve and ease the rubber seal from the end of the pipe. Remove the backing ring (if fitted) and the outer sleeve.

EXAMINING

19 After the connector has been dismantled, examine the pipe beads for damage. If the pipe beads are serviceable, examine the rubber seal for signs of chafing or distortion; should there be any doubt as to the serviceability of the seal, it must be renewed.

Ensure that all metal parts of the connector are free from damage and corrosion.

ASSEMBLING

20 Before final assembly, it is important to ensure that the internal and external threads of the connector are coated with colloidal graphite ZX 30, this will obviate thread 'pick-up'.

In-line connectors

21 Pass the inner and outer sleeves over the respective pipe ends so that both sleeves are over and clear of the pipe beadings.

22 Place a backing ring (if incorporated in the assembly) over and clear of each of the pipe beadings, flat edge towards the sleeve.

23 Pair off the four split collars and secure with retaining rings. Lightly spring these assemblies apart and ease them over each of the pipe beadings.

NOTE
The chamfered face of each split collar must mate with that of the backing ring.

24 Fit the rubber seal over the pipe beadings and ensure that the grooves in the seal fit snugly over the beadings.

25 Ease the inner sleeve over the assembly then screw the outer sleeve on to the inner. This method is essential since one function of the split collar is to prevent rotation and consequent distortion of the seal.

Bulkhead connectors

26 Slide the outer sleeve and flanged sleeve over and clear of the beading of the respective pipe ends.

27 Place a backing ring (if incorporated in the assembly) over the pipe beadings on to the pipes.

28 Pair off the four split collars and secure with retaining rings. Lightly spring these assemblies apart and ease them over each of the pipe beadings. (See note, para. 23).

29 Fit the rubber seal over the pipe beadings and ensure that the grooves in the seal fit snugly over the beadings.

30 Ease the flanged sleeve over the assembly then taking care not to rotate the flanged sleeve, screw on the outer sleeve.

Termination connectors

31 Pass the outer sleeve and backing ring (if fitted) over and clear of the beading of the pipe end.

32 Join the split collar pair and secure with the retaining ring. Lightly spring the assembly apart and ease over the pipe. (See note, para. 23).

33 Fit the rubber seal over the pipe and ensuring that the groove in the seal fits snugly over the beading.

34 Insert the pipe end and assemble into the boss of the flanged sleeve then screw the outer sleeve on to the external thread of the flanged sleeve boss.

Final installation and tightening

35 Ensure that the two pipes are in alignment, (or that the pipe is in alignment with the flanged sleeve). Although the connector has a certain amount of flexibility, an attempt to make a connection which is out of alignment may distort the rubber seal and result in a leaking joint.

36 When the pipes have been correctly aligned, screw the outer sleeve on to the inner (or flanged) sleeve hand-tight (use both hands for hand-tightness).

37 If more than one connector is to be re-assembled, couple the second connector hand-tight to the termination or fixed point. Assemble any subsequent connectors in a similar manner and check for correct alignment of pipe ends at the final connector, and the position of the line in relation to any support brackets. No adjustment of pipe position should be made at this stage because the radial flexibility of the connector is applicable only after final tightening.

38 Finally, when the pipes have been correctly aligned, tighten the connectors progressively with the special C-spanners. The correct degree of tightness is obtained by tightening one quarter to one half-turn maximum from hand-tightness.

NOTE

Take care when tightening the connector. Over tightening will not only distort the rubber seal and cause leakage but may also damage the pipe end, particularly if the pipe is manufactured from thin gauge material.

39 Lock the connectors with the circlip or locking wire as applicable. When a circlip is used, to ensure positive locking, the locking circlip should fit tightly around the inner or flanged sleeve. Final tightening therefore, should be carried out in conjunction with the fitting of the circlip.

40 After being refitted, the connector must be pressure tested in accordance with the test schedule laid down for the system in which it is fitted.

STORAGE AND TRANSIT

41 If the connectors are not required for immediate use they must be wrapped in a grease- and moisture-proof material and stored in a cool, dry place.

ILLUSTRATED PARTS CATALOGUE AND RELATED INFORMATION

MEMORANDUM OF INSTRUCTIONS

Contents

1 Any unsatisfactory feature found in this publication is to be reported on MOD Form 765 in accordance with the appropriate service procedure outlined in

Naval Aircraft Maintenance Manual (RN)
EMER Aircraft A040 (Army)
AP100B-01 Order 0504 (RAF)

Demands

2 Requirements for demands are:

2.1 The demand must quote the appropriate Reference Number for each item. Unreferenced parts are not normally provisioned as spares and demands for such items must quote Maker's Part Number, and the name and type of equipment. The location of each part within the equipment should be clearly indicated.

2.2 Demands are to be prepared in accordance with the procedure laid down in AP830 Volume 1 or BR4.

Local manufacture

3 Parts annotated "LM" are to be manufactured from local resources. If the manufacture of such items is beyond the capacity of the Unit, the demand is to be endorsed "Unable to manufacture locally".

Major repair

4 "MR" indicates that an item is required for major repair purposes only and will not normally be held in store by Units other than those authorised to undertake major repair of the equipment.

Units per assembly

5 The number quoted is the quantity required per next higher assembly in the position shown except "attaching parts" which quote the quantity required to attach one item. The letters "AR" in the "Units per Assy" column indicate that the quantity is "as required". Where applicable the quantity normally fitted is shown as a nominal figure, eg (Nom 3). Where an item is listed only for reference purposes the letters "RF" are quoted.

Classification of equipment

6 The Class of Store is indicated by a single letter as laid down in AP830 Volume 1 or BR4.

Fitting code (FC)

7 The FC is indicated by one of the following letters and is only quoted against parts which are not directly interchangeable.

V	Open up holes on assembly
W	Partially assembled
X	Ream or machine on assembly
Y	Drill or drill and tap on assembly
Z	Trim on assembly

Obsolescent stock

8 An asterisk in the "Part No" column indicates that no further purchases of the item will be made but the part is to be used until stocks are exhausted.

Modifications

9 When items are affected by a modification the "Mod No" is quoted in the description. Modifications incorporated in the catalogue are listed in the Modification Record.

Amendments

10 Amendments to the catalogue will be published as and when necessary. They will be numbered consecutively and the Amendment Record Sheet is to be completed for each amendment embodied. A summary of amendments distributed is published in the CS(PS)4 Newsletter.

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ILLUSTRATED PARTS LIST
FLIGHT REFUELLING LIMITED
PIPE CONNECTORS
(STANDARD)

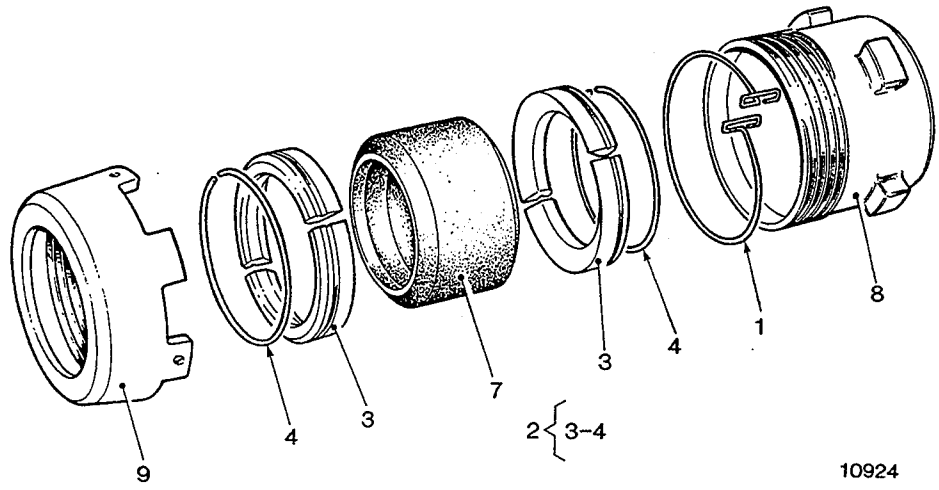

Fig 1 Pipe Connector

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	FRS110H7	Connector assembly, pipe, 1 in., Series 7	B	RF
	FRS110J1	Connector assembly, pipe, 1¼ in., Series 1	C	RF
	FRS110K1	Connector assembly, pipe, 1½ in., Series 1	D	RF
	FRS110K5	Connector assembly, pipe, 1½ in., Series 5	E	RF
	FRS110L1	Connector assembly, pipe, 1¾ in., Series 1	F	RF
	FRS110L7	Connector assembly, pipe, 1¾ in., Series 7	G	RF
	FRS110M1	Connector assembly, pipe, 2 in., Series 1	H	RF
	FRS110M5	Connector assembly, pipe, 2 in., Series 5	J	RF
	FRS110M7	Connector assembly, pipe, 2 in., Series 7	K	RF
	FRS110N1	Connector assembly, pipe, 2¼ in., Series 1	L	RF
1	FRS949H	. Circlip	A,B	1
	FRS949J	. Circlip	C	1
	FRS949K	. Circlip	D,E	1
	FRS949L	. Circlip	F,G	1
	FRS949M	. Circlip	H,J,K	1
	FRS949N	. Circlip	L	1
2	FRS73H	. Collar assembly, split	A,B	2
	FRS73J	. Collar assembly, split	C	2
	FRS73K	. Collar assembly, split	D,E	2
	FRS73L	. Collar assembly, split	F,G	2
	FRS73M	. Collar assembly, split	H,J,K	2
	FRS73N	. Collar assembly, split	L	2
3	FRS65H	. . Collar, split	A,B	2
	FRS65J	. . Collar, split	C	2
	FRS65K	. . Collar, split	D,E	2
	FRS65L	. . Collar, split	F,G	2
	FRS65M	. . Collar, split	H,J,K	2
	FRS65N	. . Collar, split	L	2
4	FRS66H	. . Ring, retaining	A,B	1
	FRS66J	. . Ring, retaining	C	1
	FRS66K	. . Ring, retaining	D,E	1
	FRS66L	. . Ring, retaining	F,G	1
	FRS66M	. . Ring, retaining	H,J,K	1
	FRS66N	. . Ring, retaining	L	1
5	Not Used			
6	Not Used			
7	FRS54H1	. Seal, Series 1	A	1
	FRS54H7	. Seal, Series 7	B	1
	FRS54J1	. Seal, Series 1	C	1

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
1 - -	FRS54K1	. Seal, Series 1	D	1
	FRS54K5	. Seal, Series 5	E	1
	FRS54L1	. Seal, Series 1	F	1
	FRS54L7	. Seal, Series 7	G	1
	FRS54M1	. Seal, Series 1	H	1
	FRS54M5	. Seal, Series 5	J	1
	FRS54M7	. Seal, Series 7	K	1
>	FRS54N1	. Seal, Series 1	L	1 <
8	FRS109H	. Sleeve, inner	A,B	1
	FRS109J	. Sleeve, inner	C	1
	FRS109K	. Sleeve, inner	D,E	1
	FRS109L	. Sleeve, inner	F,G	1
	FRS109M	. Sleeve, inner	H,J,K	1
	FRS109N	. Sleeve, inner	L	1
9	FRS111H	. Sleeve, outer	A,B	1
	FRS111J	. Sleeve, outer	C	1
	FRS111K	. Sleeve, outer	D,E	1
	FRS111L	. Sleeve, outer	F,G	1
	FRS111M	. Sleeve, outer	H,J,K	1
	FRS111N	. Sleeve, outer	L	1

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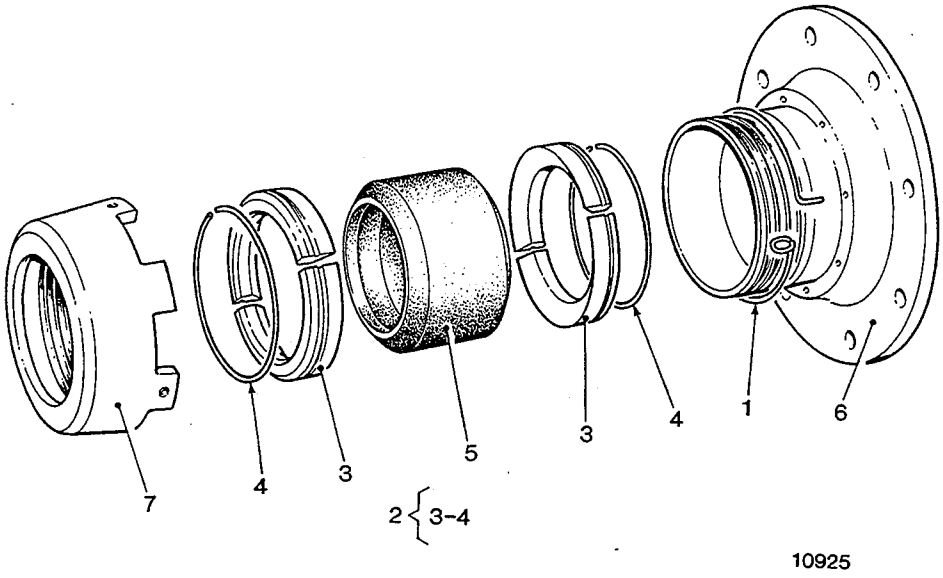

Fig 2 Pipe Connector (Bulkhead)

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
2- -	FRS122J7	Connector assembly, bulkhead $1\frac{1}{4}$ in., Series 7	A	RF
	FRS122K1	Connector assembly, bulkhead $1\frac{1}{2}$ in., Series 1	B	RF
	FRS122K7	Connector assembly, bulkhead $1\frac{1}{2}$ in., Series 7	C	RF
	FRS122L1	Connector assembly, bulkhead $1\frac{3}{4}$ in., Series 1	D	RF
	FRS122L7	Connector assembly, bulkhead $1\frac{3}{4}$ in., Series 7	E	RF
	FRS122M1	Connector assembly, bulkhead 2 in., Series 1	F	RF
	FRS122M7	Connector assembly, bulkhead 2 in., Series 7	G	RF
1	FRS299J	. Circlip	A	1
	FRS299K	. Circlip	B,C	1
	FRS299L	. Circlip	D,E	1
	FRS299M	. Circlip	F,G	1
2	FRS73J	. Collar assembly, split	A	2
	FRS73K	. Collar assembly, split	B,C	2
	FRS73L	. Collar assembly, split	D,E	2
	FRS73M	. Collar assembly, split	F,G	2
3	FRS65J	. . Collar, split	A	2
	FRS65K	. . Collar, split	B,C	2
	FRS65L	. . Collar, split	D,E	2
	FRS65M	. . Collar, split	F,G	2
4	FRS66J	. . Ring, retaining	A	1
	FRS66K	. . Ring, retaining	B,C	1
	FRS66L	. . Ring, retaining	D,E	1
	FRS66M	. . Ring, retaining	F,G	1
5	FRS54J7	. Seal, Series 7	A	1
	FRS54K1	. Seal, Series 1	B	1
	FRS54K7	. Seal, Series 7	C	1
	FRS54L1	. Seal, Series 1	D	1
	FRS54L7	. Seal, Series 7	E	1
	FRS54M1	. Seal, Series 1	F	1
	FRS54M7	. Seal, Series 7	G	1
6	FRS121J	. Sleeve, flanged	A	1
	FRS121K	. Sleeve, flanged	B,C	1
	FRS121L	. Sleeve, flanged	D,E	1
	FRS121M	. Sleeve, flanged	F,G	1
7	FRS111J	. Sleeve, outer	A	1
	FRS111K	. Sleeve, outer	B,C	1
	FRS111L	. Sleeve, outer	D,E	1
	FRS111M	. Sleeve, outer	F,G	1

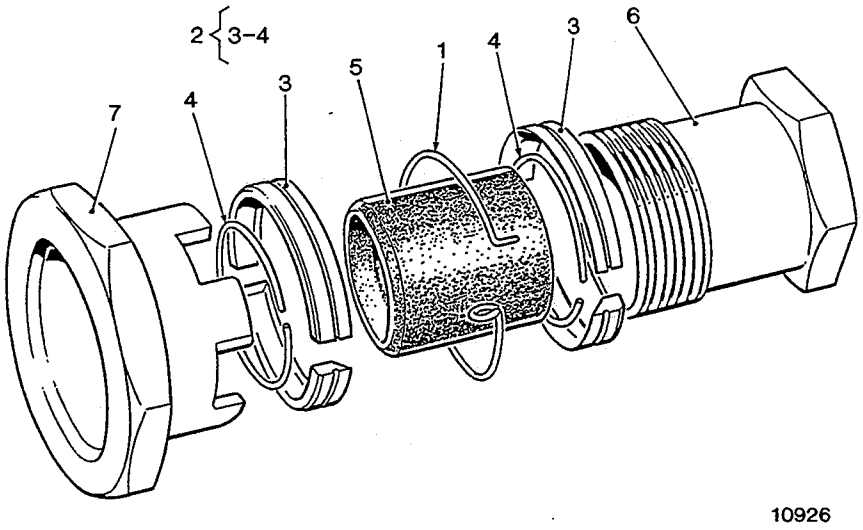

Fig 3 Pipe Connector

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
3- -	FRS132E1	Connector assembly, pipe ⅝ in. , Series 1	A	RF
	FRS132E5	Connector assembly, pipe ⅝ in. , Series 5	B	RF
	FRS132F1	Connector assembly, pipe ¾ in. , Series 1	C	RF
	FRS132F5	Connector assembly, pipe ¾ in. , Series 5	D	RF
	FRS132F7	Connector assembly, pipe ¾ in. , Series 7	E	RF
1	FRS180E	. Circlip	A,B	1
	FRS180F	. Circlip	C,D,E	1
2	FRS138E	. Collar assembly, split	A,B	1
	FRS138F	. Collar assembly, split	C,D,E	1
3	FRS136E	. . Collar, split	A,B	2
	FRS136F	. . Collar, split	C,D,E	2
4	FRS137E	. . Ring, retaining	A,B	1
	FRS137F	. . Ring, retaining	C,D,E	1
5	FRS135E1	. Seal, Series 1	A	1
	FRS135E5	. Seal, Series 5	B	1
	FRS135F1	. Seal, Series 1	C	1
	FRS135F5	. Seal, Series 5	D	1
	FRS135F7	. Seal, Series 7	E	1
6	FRS133E	. Sleeve, inner	A,B	1
	FRS133F	. Sleeve, inner	C,D,E	1
7	FRS134E	. Sleeve, outer	A,B	1
	FRS134F	. Sleeve, outer	C,D,E	1

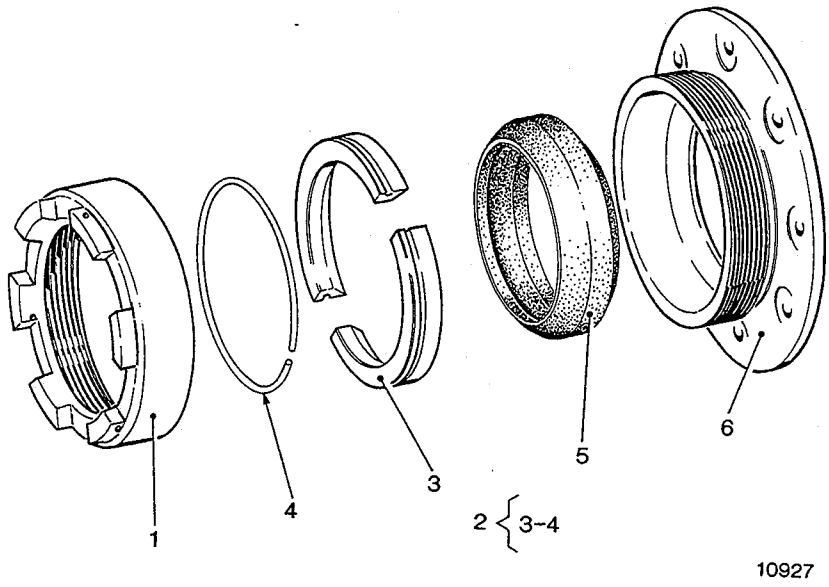

Fig 4 Pipe Connector (Termination)

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
4- -	FRS150J1	Connector assembly, pipe, Termination, $1\frac{1}{4}$ in.Series 1	A	RF
	FRS150K1	Connector assembly, pipe, Termination, $1\frac{1}{2}$ in.Series 1	B	RF
	FRS150L1	Connector assembly, pipe Termination, $1\frac{3}{4}$ in.Series 1	C	RF
1	FRS152J	. Sleeve, outer	A	1
	FRS152K	. Sleeve, outer	B	1
	FRS152L	. Sleeve, outer	C	1
2	FRS73J	. Collar assembly, split	A	1
	FRS73K	. Collar assembly, split	B	1
	FRS73L	. Collar assembly, split	C	1
3	FRS65J	. . Collar, split	A	2
	FRS65K	. . Collar, split	B	2
	FRS65L	. . Collar, split	C	2
4	FRS66J	. . Ring, retaining	A	1
	FRS66K	. . Ring, retaining	B	1
	FRS66L	. . Ring, retaining	C	1
5	FRS151J1	. Seal, Series 1	A	1
	FRS151K1	. Seal, Series 1	B	1
	FRS151L1	. Seal, Series 1	C	1
6	FRS292J	. Flange, mounting	A	1
	FRS292K	. Flange, mounting	B	1
	FRS292L	. Flange, mounting	C	1

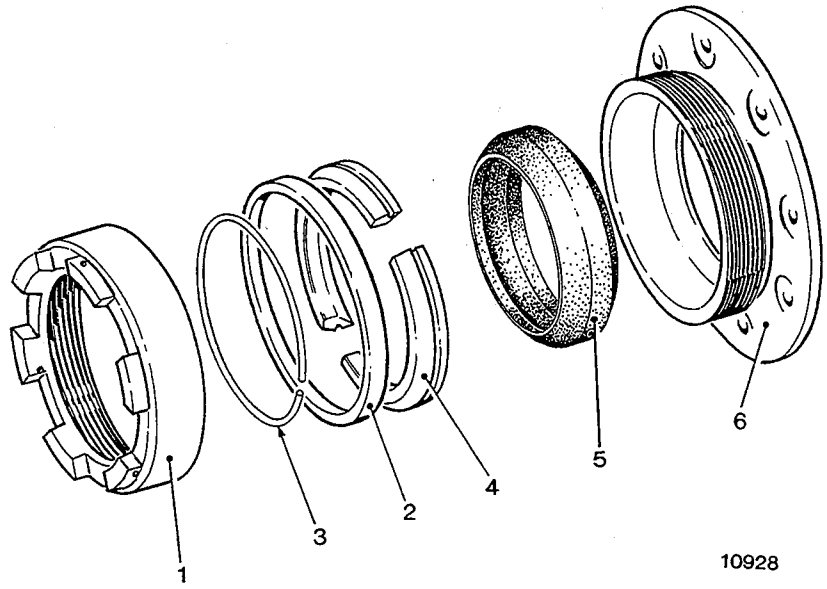

Fig 5 Pipe Connector (Termination)

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
5- -	FRS260	Connector assembly, pipe, Termination, 2½ in.Series 1		RF
1	FRS152P	. Sleeve, outer		1
2	FRS321P	. Ring		1
3	FRS66P	. Ring, retaining,		1
4	FRS323P	. Ring, split (2 halves)		1
5	FRS394P	. Seal, Series 1		1
6	FRS259	. Flange, mounting		1

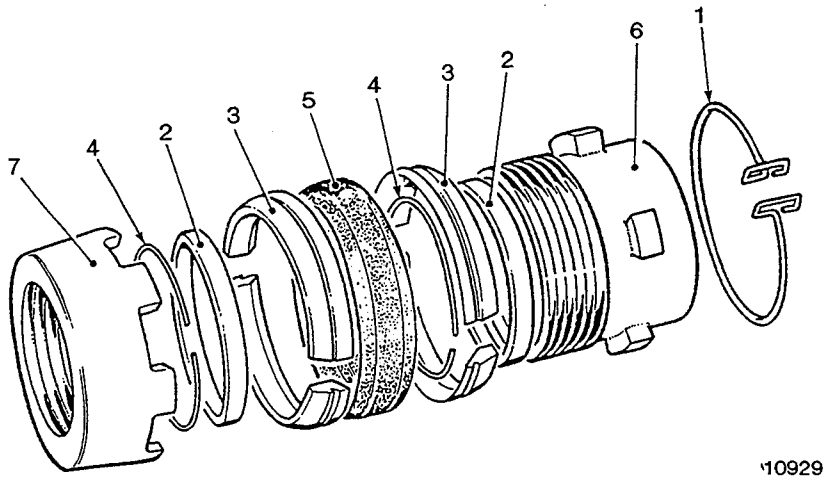

Fig 6 Pipe Connector

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
6- -	FRS325P1	Connector assembly, pipe, $2\frac{1}{2}$ in., Series 1	A	RF
	FRS325Q1	Connector assembly, pipe, $2\frac{3}{4}$ in., Series 1	B	RF
	FRS325R1	Connector assembly, pipe, 3 in., Series 1	C	RF
	FRS325S1	Connector assembly, pipe, $3\frac{1}{4}$ in., Series 1	D	RF
	FRS325T1	Connector assembly, pipe, $3\frac{1}{2}$ in., Series 1	E	RF
	FRS325V1	Connector assembly, pipe, 4 in., Series 1	F	RF
1	FRS949P	. Circlip	A	1
	FRS949Q	. Circlip	B	1
	FRS949R	. Circlip	C	1
	FRS949S	. Circlip	D	1
	FRS949T	. Circlip	E	1
	FRS949V	. Circlip	F	1
2	FRS321P	. Ring	A	2
	FRS321Q	. Ring	B	2
	FRS321R	. Ring	C	2
	FRS321S	. Ring	D	2
	FRS321T	. Ring	E	2
	FRS321V	. Ring	F	2
3	FRS323P	. Ring, split (2 halves)	A	2
	FRS323Q	. Ring, split (2 halves)	B	2
	FRS323R	. Ring, split (2 halves)	C	2
	FRS323S	. Ring, split (2 halves)	D	2
	FRS323T	. Ring, split (2 halves)	E	2
	FRS323V	. Ring, split (2 halves)	F	2
4	FRS66P	. Ring, retaining	A	2
	FRS66Q	. Ring, retaining	B	2
	FRS66R	. Ring, retaining	C	2
	FRS66S	. Ring, retaining	D	2
	FRS401	. Ring, retaining	E	2
	FRS66V	. Ring, retaining	F	2
5	FRS322P1	. Seal, Series 1	A	1
	FRS322Q1	. Seal, Series 1	B	1
	FRS322R1	. Seal, Series 1	C	1
	FRS322S1	. Seal, Series 1	D	1
	FRS322T1	. Seal, Series 1	E	1
	FRS322V1	. Seal, Series 1	F	1
6	FRS109P	. Sleeve, inner	A	1
	FRS109Q	. Sleeve, inner	B	1
	FRS109R	. Sleeve, inner	C	1
	FRS109S	. Sleeve, inner	D	1
	FRS398	. Sleeve, inner	E	1
	FRS412	. Sleeve, inner	F	1
7	FRS111P	. Sleeve, outer	A	1
	FRS111Q	. Sleeve, outer	B	1
	FRS111R	. Sleeve, outer	C	1
	FRS111S	. Sleeve, outer	D	1
	FRS397	. Sleeve, outer	E	1
	FRS411	. Sleeve, outer	F	1

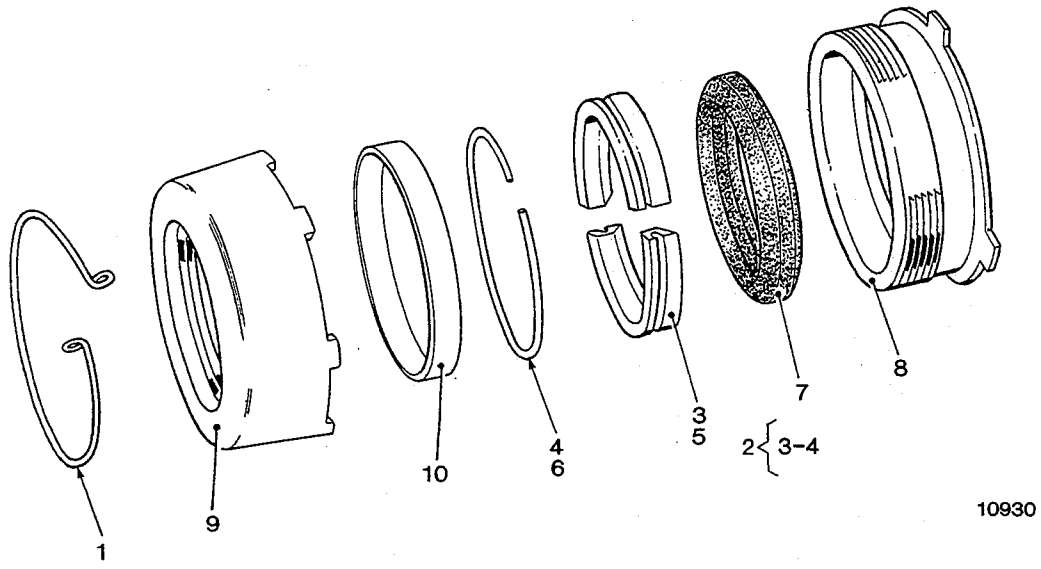

Fig 7 Pipe Connector (Blank)

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
7- -	FRS360H1	Blank assembly, pipe, 1 in., Series 1	A	RF
	FRS360K1	Blank assembly, pipe, 1½ in., Series 1	B	RF
	FRS360R1	Blank assembly, pipe, 3 in., Series 1	C	RF
1	FRS300H	. Circlip	A	1
	FRS300K	. Circlip	B	1
	FRS300R	. Circlip	C	1
2	FRS73H	. Collar assembly, split	A	2
	FRS73K	. Collar assembly, split	B	2
3	FRS65H	. . Collar, split	A	1
	FRS65K	. . Collar, split	B	1
4	FRS66H	. . Ring, retaining	A	1
	FRS66K	. . Ring, retaining	B	1
5	FRS323R	. Ring, split (2 halves)	C	1
6	FRS66R	. Ring, retaining	C	1
7	FRS151H1	. Seal, Series 1	A	1
	FRS151K1	. Seal, Series 1	B	1
	FRS394R1	. Seal, Series 1	C	1
8	FRS359H	. Blank	A	1
	FRS359K	. Blank	B	1
	FRS359R	. Blank	C	1
9	FRS353H	. Sleeve, outer	A	1
	FRS353K	. Sleeve, outer	B	1
	FRS353R	. Sleeve, outer	C	1
10	FRS321R	. Ring	C	1

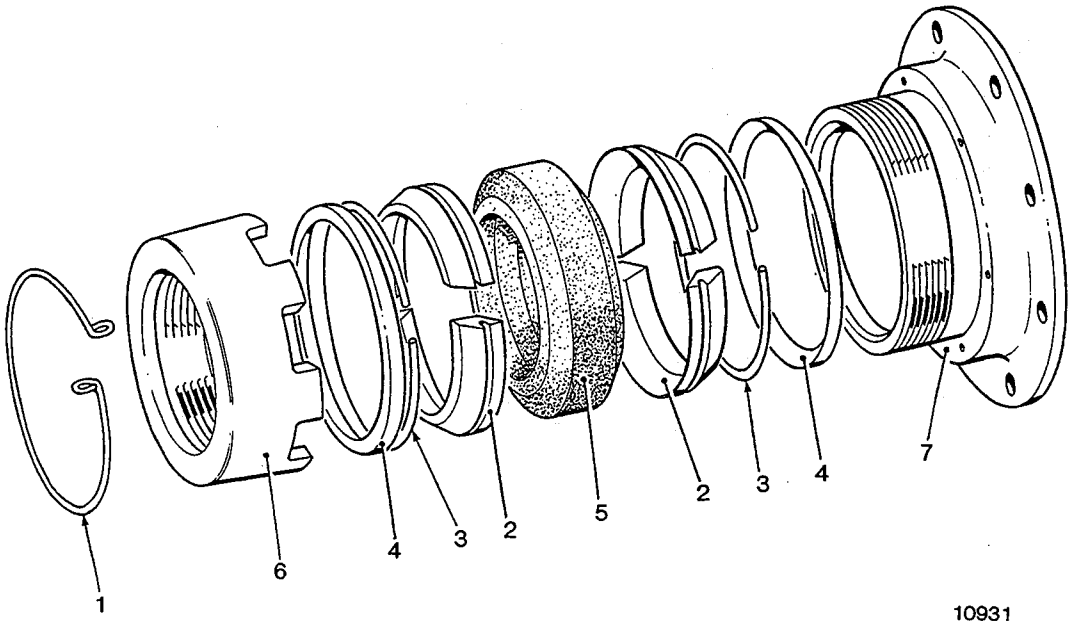

Fig 8 Bulkhead Connector

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
8- -	FRS400P1	Connector assembly, Bulkhead $2\frac{1}{2}$ in. , Series 1		RF
1	FRS299P	. Circlip		1
2	FRS323P	. Ring, split		2
3	FRS66P	. Ring, retaining		2
4	FRS321P	. Ring		2
5	FRS322P1	. Seal, Series 1		1
6	FRS111P	. Sleeve, outer		1
7	FRS121P	. Seal, Flanged		1

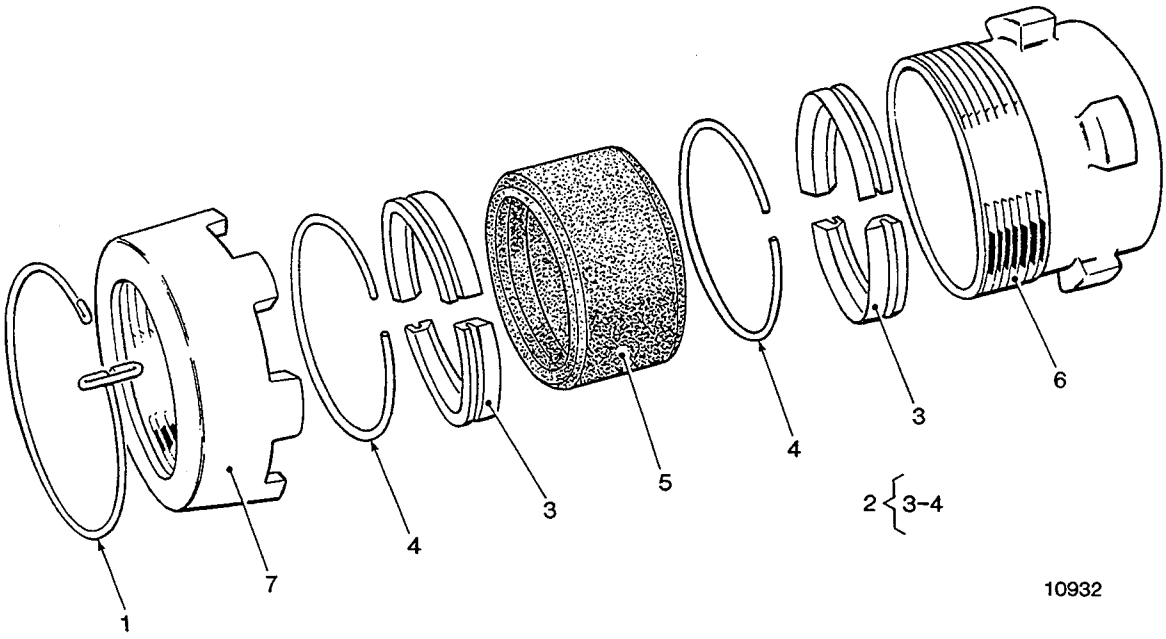

Fig 9 Pipe Connector

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
9- -	FRS480L1	Connector assembly, pipe, $1\frac{3}{4}$ in. Series 1		RF
1	FRS849	. Circlip (FRM 3512)		1
2	FRS73L	. Collar assembly, split		2
3	FRS65L	. . Collar, split		1
4	FRS66L	. . Ring, retaining		1
5	FRS54L1	. Seal, Series 1		1
6	FRS481	. Sleeve, inner		1
7	FRS482	. Sleeve, outer		1

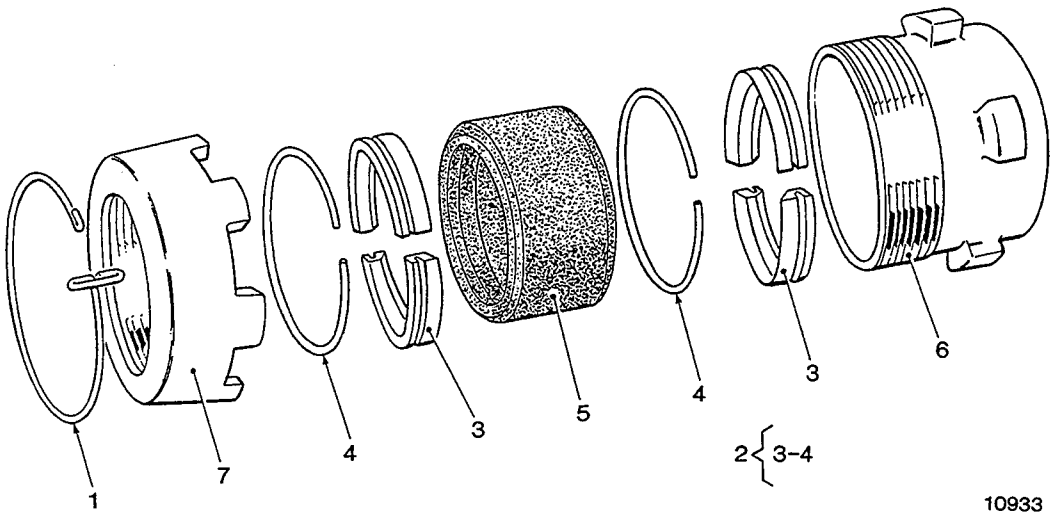

Fig 10 Pipe Connector

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
10- -	FRS594K1	Connector assembly, pipe, $1\frac{1}{2}$ in., Series 1		RF
1	FRS949K	. Circlip (FRM 3512)		1
2	FRS599K	. Collar assembly, split		2
3	FRS600K	. . Collar, split (2 halves)		2
4	FRS66K	. . Ring, retaining		1
5	FRS54K1	. Seal, Series 1		1
6	FRS109K	. Sleeve, inner		1
7	FRS111K	. Sleeve, outer		1

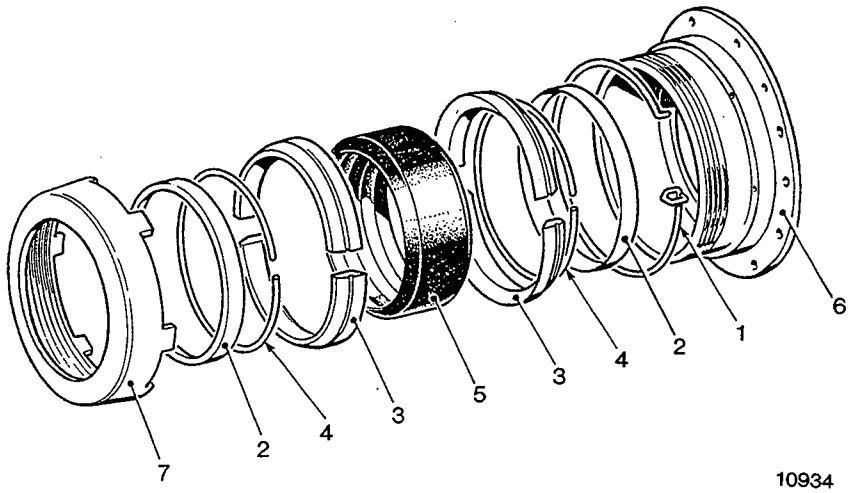

Fig 11 Pipe Connector (Bulkhead)

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
11- -	FRS634P1	Connector assembly, pipe, bulkhead, $2\frac{1}{2}$ in. Series 1		RF
1	FRS299P	. Circlip		1
2	FRS321P	. Ring		2
3	FRS323P	. Collar, split (pair)		2
4	FRS66P	. Ring, retaining		2
5	FRS322P1	. Seal, Series 1		1
6	FRS638	. Sleeve, flanged		1
7	FRS111P	. Sleeve, outer		1

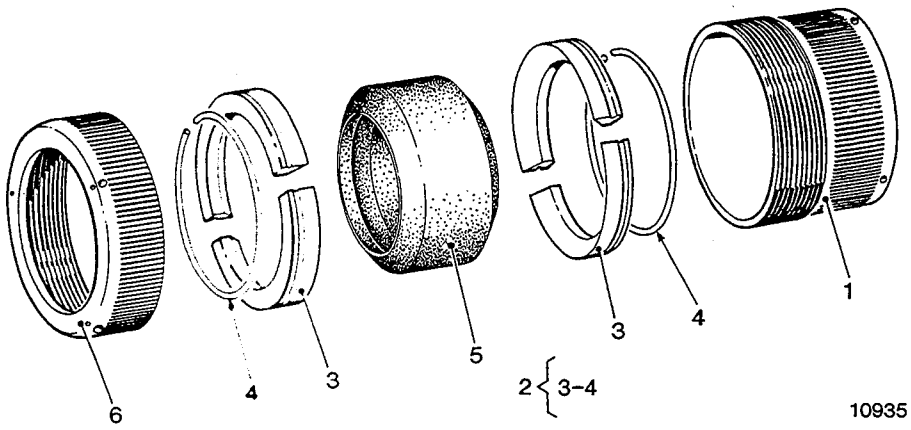

Fig 12 Pipe Connector

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
12- -	FRS895J1	Connector assembly, pipe, $1\frac{1}{4}$ in. Series 1	A	RF
	FRS895K1	Connector assembly, pipe, $1\frac{1}{2}$ in. Series 1	B	RF
	FRS895L1	Connector assembly, pipe, $1\frac{3}{4}$ in. Series 1	C	RF
	FRS895M1	Connector assembly, pipe, 2 in. Series 1	D	RF
1	FRS898J	. Sleeve, inner	A	1
	FRS898K	. Sleeve, inner	B	1
	FRS898L	. Sleeve, inner	C	1
	FRS898M	. Sleeve, inner	D	1
2	FRS902J	. Collar assembly, split	A	2
	FRS902K	. Collar assembly, split	B	2
	FRS902L	. Collar assembly, split	C	2
	FRS902M	. Collar assembly, split	D	2
3	FRS901J	. . Collar, split	A	2
	FRS901K	. . Collar, split	B	2
	FRS901L	. . Collar, split	C	2
	FRS901M	. . Collar, split	D	2
4	FRS66J	. . Ring, retaining	A	1
	FRS66K	. . Ring, retaining	B	1
	FRS66L	. . Ring, retaining	C	1
	FRS66M	. . Ring, retaining	D	1
5	FRS54J1	. Seal, Series 1	A	1
	FRS54K1	. Seal, Series 1	B	1
	FRS54L1	. Seal, Series 1	C	1
	FRS54M1	. Seal, Series 1	D	1
6	FRS899J	. Sleeve, outer	A	1
	FRS899K	. Sleeve, outer	B	1
	FRS899L	. Sleeve, outer	C	1
	FRS899M	. Sleeve, outer	D	1

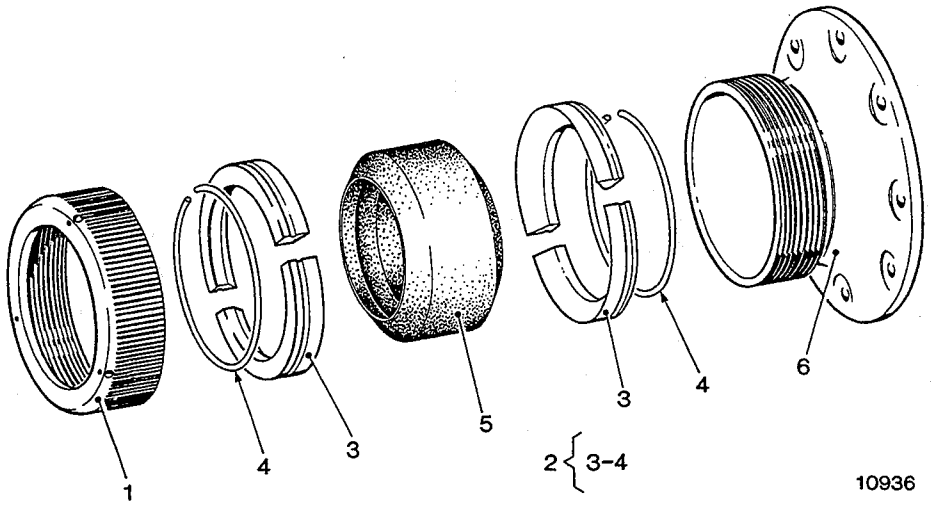

Fig 13 Pipe Connector (Bulkhead)

Fig and Index	Part No	NOMENCLATURE 1 2 3 4 5 6	Usage Code	Units per Assy
13- -	FRS1025	Connector assembly, pipe, $1\frac{3}{4}$ in., Series 1		RF
1	FRS899L	. Sleeve, outer		1
2	FRS902L	. Collar assembly, split		2
3	FRS901L	. . Collar, split (2 halves)		2
4	FRS66L	. . Ring, retaining		1
5	FRS54L1	. Seal, Series 1		1
6	FRS1026	. Sleeve, flanged		1

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MINISTRY OF DEFENCE

Amendment No.12

to

September 1992

AP 106D-4400-13

PIPE CONNECTORS
(STANDARD)
GENERAL AND TECHNICAL INFORMATION
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