Cancelled - now obsolete. AL/142

Do not destroy.

Chapter 6

PUMPS, FUEL, SPE. 1200 SERIES

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Introduction

1. Reconditioning instructions are given in this chapter for a typical pump in the SPE.1200 series and any detailed instructions given will apply to all 112V pumps in the series. Instructions which apply only to a particular type of pump will be given in one of the appended chapters which have a suffix letter following the chapter number, and details applicable to different marks of each type will be given as appendices to the relevant chapter. A general description of SPE.1200 series 112V pumps is given in A.P.4343D, Vol. 1, Book 2, Sect. 8, Chap. 6 and variant types are given as appendices to the chapter.

RECONDITIONING

General

2. Instructions on the general procedure for reconditioning airborne pumps is given in A.P.4343, Vol. 6, Sect. 16 and will not be repeated in the chapters on this series of pumps. Numbers which appear in brackets, in the text, apply to item numbers annotated on illustrations whose figure reference will be quoted following the paragraph heading. Particulars and data given under tables in this chapter will apply generally to all types of 112V pumps in the SPE.1200 series. If, however the information relates to a particular type only, an entry will be made in the Remarks column to denote the particular type of pump to which the information applies.

Tools and test equipment

3. In addition to the test equipment and standard type of bench tools, a list of special tools is given in Table 1. These special tools are required for use on all types of pumps in the series. Tools which are special only to a particular type of pump will be given in the appended chapter for the pump. The Universal fuel pump test rig. (Ref. No. 5G/3494) should be used to test fuel pumps: details of this test rig will be found in A.P. 4343S, Vol. 1, Book 2, Sect. 10.

TABLE 1

Special tools and equipment

Nomenclature	Part No.	Fig. No.
Gear wheel extractor	SPE.17370	3
Gear wheel key	SPE.17371	
Impeller gauge	SPE.17372	
Bellows seal body extractor	SPE.17373	
Helix shroud spanner	SPE.17374	
Calibrated fan	SPE.17375	
Bush — Pump unit carbon bearing	SPE.17376	
Guide collar — Pump unit carbon bearing	SPE.17377	
Reamer for lower bearing — Pump unit carbon bearing	SPE.17378	
Grease gauge	SPE.17379	
Hand press for general use	SPE.10143	—
Base plate — Bellows gland removal from housing	SPE.19489	9
Location block — Bellows gland removal from housing	SPE.19490	
Punch — Bellows gland removal from housing	SPE.19491	
Spigot — Commutator-end bearing sleeve removal and re-assembly	SPE.10761	7
Collar — Commutator-end bearing sleeve removal and re-assembly	SPE.10762	
Pad — Commutator-end bearing sleeve removal and re-assembly	SPE.10763	
Base plate	SPE.10766	
Weight — Bellows loading fixtures	SPE.17388	11
Support fixture — Bellows loading fixtures	SPE.17389	
Pump unit disc — Bevel pinion shimming	SPE.17390	12
Motor unit disc — Bevel pinion shimming	SPE.17391	
Motor unit clamp ring — Bevel pinion shimming	SPE.17392	
Casing — Backlash checking	SPE.17393	13
Indexing clamp — Backlash checking	SPE.17394	
Clamp screw — Backlash checking	SPE.17395	
Star wheel — Backlash checking	SPE.17396	

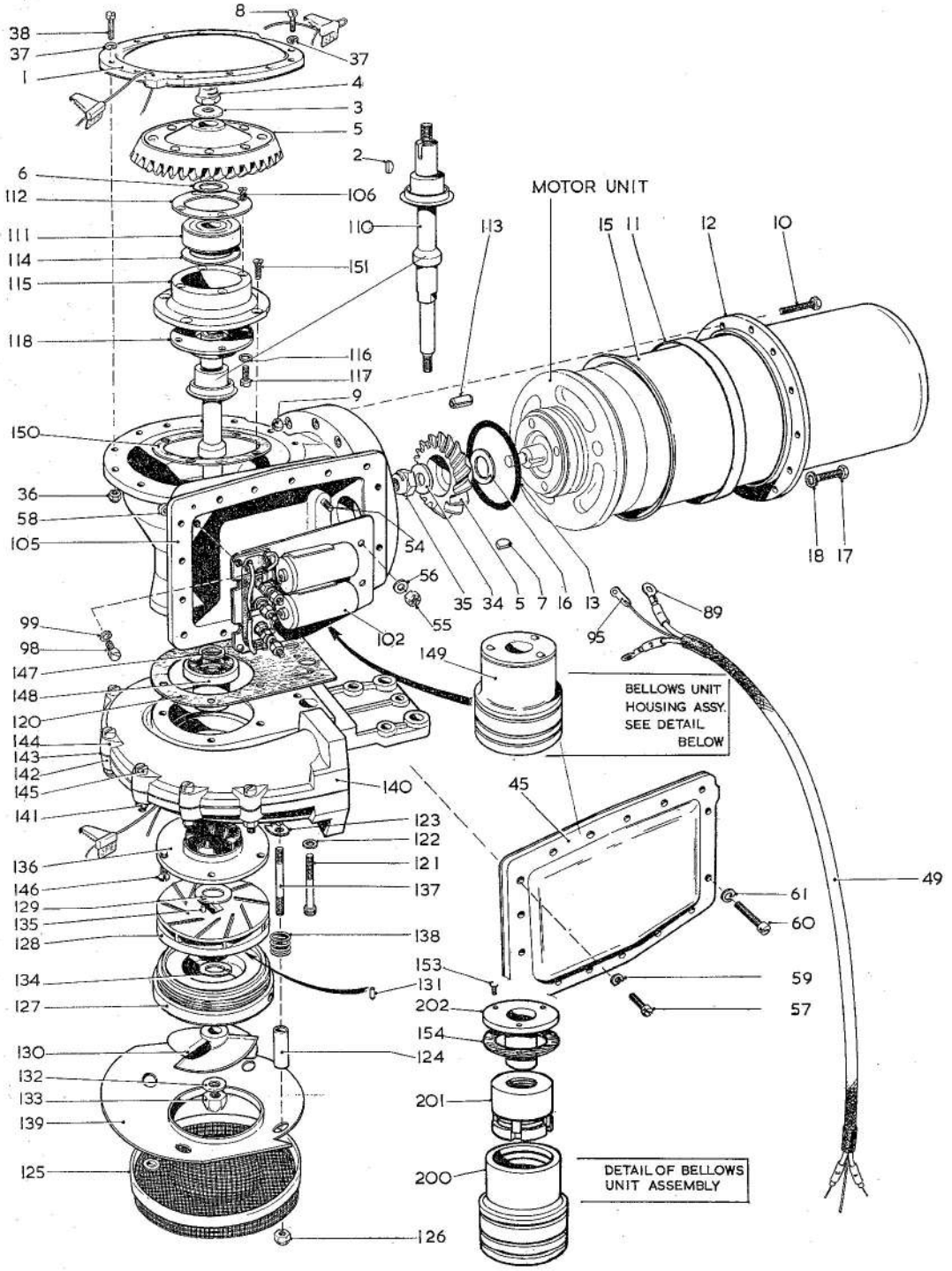


Fig. 1. Exploded view of pump assembly

Key to fig. 1

1 GEAR BOX COVER (INTEGRAL GASKET)
2 DRIVE KEY (GEAR)
3 CLAMP WASHER
4 BEVEL GEAR SELF-LOCKING NUT
5 BEVEL GEAR AND PINION (PAIRED)
6 BEVEL GEAR ADJUSTING SHIM
7 DRIVE KEY (PINION)
8 CH. HD. SCREW (GEAR BOX COVER)
9 SELF-LOCKING NUT (MOTOR CLAMPING)
10 HEX.HD. BOLT (OR CH.HD. SCREW)
11 SEAL RING (OUTER CASING JOINT)
12 BOLT RING
13 SEAL RING (MOTOR TO PUMP UNIT)
15 OUTER MOTOR CASING
16 BEVEL PINION ADJUSTING SHIM
17 HEX. HD. BOLT (OR CH. HD. SCREW)
18 SHAKEPROOF WASHER (MOTOR CLAMPING)
34 CLAMP WASHER
35 PINION SELF-LOCKING NUT
36 SELF-LOCKING NUT
37 SPRING WASHER
38 CH. HD. SCREW
} GEAR BOX COVER FIXING
45 CAPACITOR COVER ASSEMBLY
49 ELECTRICAL LEAD ASSEMBLY
54 STUD
55 LOCKNUT
56 PLAIN WASHER
} CAPACITOR PANEL FIXING
57 CH. HD. SCREW (6 B.A.)
58 SELF-LOCKING NUT
59 SPRING WASHER
60 CH. HD. SCREW (4 B.A.)
61 SPRING WASHER
} CAPACITOR COVER FIXING
98 CH HD. SCREW
99 SPRING WASHER
} CAPACITOR PANEL FIXING
102 CAPACITOR PANEL ASSEMBLY COMPLETE
105 PUMP CASTING
106 C/SK. HD. SCREW (RETAINER PLATE FIXING)
110 PUMP SHAFT ASSEMBLY
111 BALL BEARING
112 BEARING RETAINER PLATE
113 DOWEL PIN
114 BEARING DUST SHIELD
115 BEARING HOUSING
116 SHAKEPROOF WASHER
117 CH. HD. SCREW
} THROWER FLANGE SECURING
118 THROWER FLANGE
120 GASKET (VOLUTE/PUMP BODY)
121 SOCKET HEAD SCREW
122 SHAKEPROOF WASHER
} VOLUTE/PUMP BODY SECURING
123 LOCKING TAB (HELIX SHROUD)
124 PILLAR (FILTER SUPPORT)
125 FILTER
126 SELF-LOCKING NUT (FILTER SECURING)
127 HELIX SHROUD
128 CENTRIFUGAL IMPELLER
129 IMPELLER ADJUSTING SHIM
130 HELIX
131 DOWEL (IMPELLER TO HELIX)
132 CLAMP WASHER
133 SHAFT NUT
134 HELIX ADJUSTING SHIM
135 DOWEL (IMPELLER TO SEAL BODY)
136 LOWER BEARING HOUSING ASSEMBLY
137 VOLUTE STUD
138 SPRING
139 VAPOUR GUIDE CONE
140 VOLUTE ASSEMBLY
141 SELF-LOCKING NUT (VOLUTE ASSEMBLY)
142 LOWER VOLUTE ASSEMBLY
143 VOLUTE GASKET
144 UPPER VOLUTE CASTINGS
145 CH. HD. SCREW (VOLUTE ASSEMBLY)
146 C/SK. HD. SCREW (LOWER BEARING HOUSING)
147 BELLOWS GLAND LOADING SHIM
148 BELLOWS GLAND SEAL BODY ASSEMBLY
149 BELLOWS GLAND HOUSING ASSEMBLY
150 SEAL WASHER (BEARING HOUSING/PUMP BODY)
151 C/SK. HD. SCREW (BEARING HOUSING FIXING)
153 SELF-TAPPING SCREW
154 PAPER GASKET
200 BELLOWS GLAND HOUSING
201 METALLIC BELLOWS GLAND
202 BELLOWS SLEEVE

DISMANTLING

Separating the pump unit from the mounting plate

4. The mounting plates differ for each type of pump in the SPE.1200 series, and reference must be made to the relevant chapter (6A, 6B, 6C et seq.) at the end of this chapter for details of the procedure for separating a pump from a mounting plate.

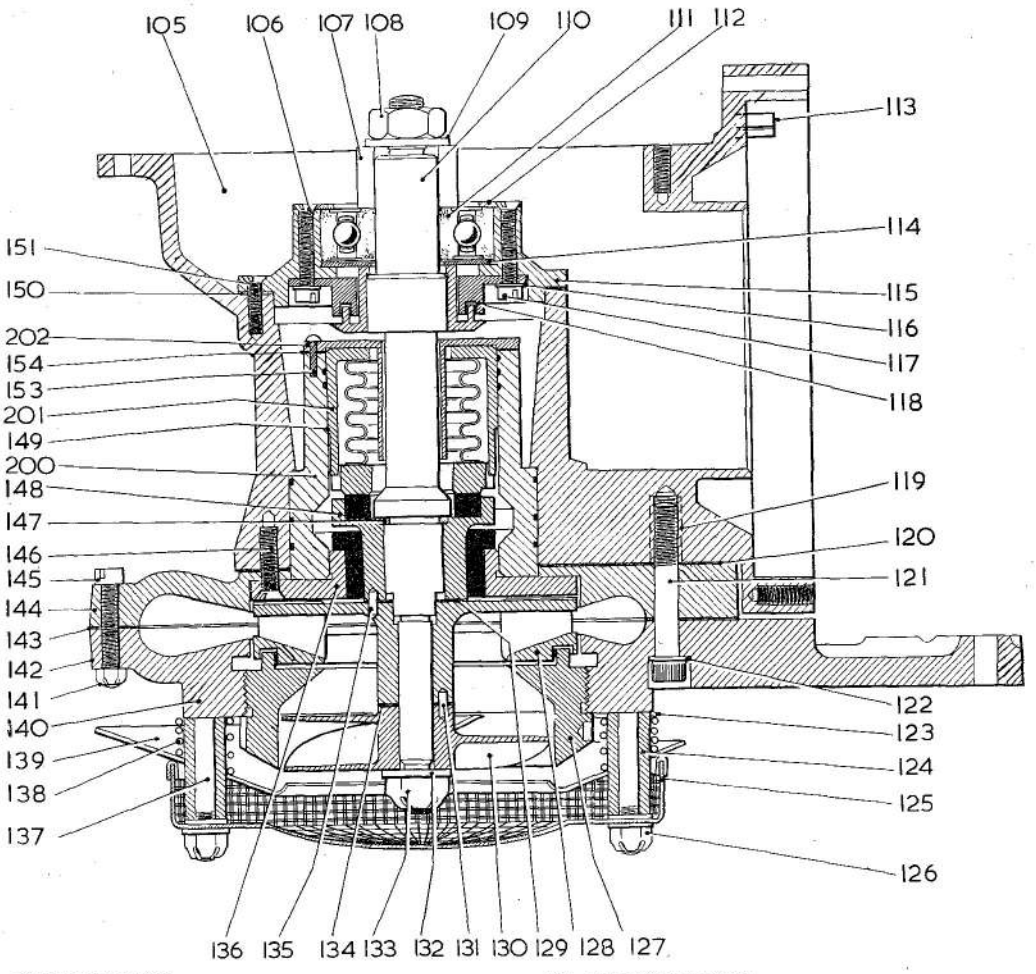
Separating the motor and pump unit (fig. 1)

5. After dismantling the pump mounting plate, by-pass ducting and outlet connections, which may differ according to type, proceed as follows:—

(1) Remove the screws (57) spring washer (59) and nuts (58) and remove the screws (60) and spring washers (61), if applicable, then remove the capacitor cover (45).

(2) Remove the screw (98) spring washer (99) locknuts (55) and washers (56) to free the capacitor panel. Withdraw the panel as far as the field and electrical connection leads will allow.

(3) Disconnect the field and plug connections from the block terminals by removing the nuts (92), shakeproof washers (91) and plain washers (90).



105 PUMP CASTING
106 C/SK. HD. SCREW (RETAINER PLATE FIXING)
107 SPACING BUSH (TEMPORARY FITTING)
108 LOCKNUT
109 CLAMP WASHER
110 PUMP SHAFT ASSEMBLY
111 BALL BEARING
112 BEARING RETAINER PLATE
113 DOWEL PIN
114 BEARING DUST SHIELD
115 BEARING HOUSING
116 SHAKEPROOF WASHER } THROWER FLANGE
117 CH. HD. SCREW } SECURING
118 THROWER FLANGE
119 THREAD INSERT
120 GASKET (VOLUTE/PUMP BODY)
121 SOCKET HEAD SCREW } VOLUTE/PUMP BODY
122 SHAKEPROOF WASHER } SECURING
123 LOCKING TAB (HELIX SHROUD)
124 PILLAR (FILTER SUPPORT)
125 FILTER
126 SELF-LOCKING NUT (FILTER SECURING)
127 HELIX SHROUD
128 CENTRIFUGAL IMPELLER
129 IMPELLER ADJUSTING SHIM
130 HELIX
131 DOWEL (IMPELLER TO HELIX)
132 CLAMP WASHER
133 SHAFT NUT
134 HELIX ADJUSTING SHIM
135 DOWEL (IMPELLER TO SEAL BODY)
136 LOWER BEARING HOUSING ASSEMBLING
137 VOLUTE STUD
138 SPRING
139 VAPOUR GUIDE CONE
140 VOLUTE ASSEMBLY
141 SELF-LOCKING NUT (VOLUTE ASSEMBLY)
142 LOWER VOLUTE CASTING
143 VOLUTE GASKET
144 UPPER VOLUTE CASTING
145 CH. HD. SCREW (VOLUTE ASSEMBLY)
146 C/SK. HD. SCREW (LOWER BEARING HOUSING)
147 BELLOWS GLAND LOADING SHIM
148 BELLOWS GLAND SEAL BODY ASSEMBLY
149 BELLOWS GLAND HOUSING ASSEMBLY
150 SEAL WASHER (BEARING HOUSING/PUMP BODY)
151 C/SK. HD. SCREW (BEARING HOUSING FIXING)
152 DOWEL (UPPER AND LOWER VOLUTE CASTING LOCATION)
153 SELF-TAPPING SCREW
154 PAPER GASKET
200 BELLOWS GLAND HOUSING
201 METALLIC BELLOWS GLAND
202 BELLOWS SLEEVE

Fig. 2. Section through pump unit

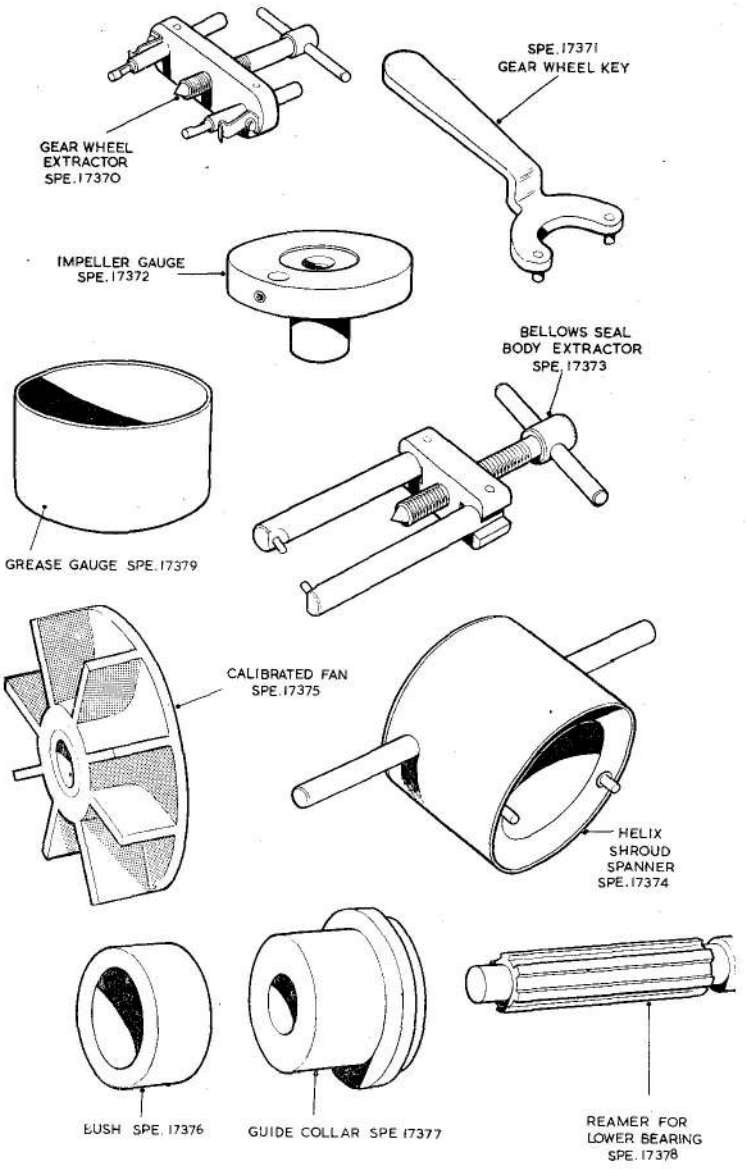


Fig. 3. General tools

(4) Remove the nuts (36) and spring washers (37) and withdraw the gear box cover screws (8 and 38). Break the the gear box cover seal. Remove as much grease as possible from the gear box without using solvents.

(5) Remove the nuts (9), screws (10 and 17) and washers (18) securing the bolt ring (12). Withdraw the outer motor casing (15) together with the seal ring (11). Support the motor unit, which is now free, in the pump casting.

Note . . .

It is strongly recommended that a new gear and pinion are fitted during reconditioning. These parts are paired prior to assembly and if the

original set is to be re-used, the meshing point of the gear and pinion should be marked before dismantling and the two components should be marked with a common identification symbol. This is to ensure that on re-assembly both components can be built into the same unit with identical meshing to that of the original assembly.

(6) Ease the motor unit assembly out of the pump casting, taking care not to damage the field leads when pulling them back through the casting conduit. The pump unit and motor unit can now be dismantled separately.

Dismantling the pump unit

Removing the inlet filter and impellers (fig. 1)

6. (1) Remove the locknuts (126) securing the filter assembly (125) then withdraw the filter together with the pillars (124), vapour guide cone (139) springs (138) and helix shroud locking tab (123).

Note . . .

On some types of pumps, mushroom headed screws are used instead of the locknuts (126) *to secure the filter.*

(2) Hold the bevel gear (5) with the special key SPE.17371 (fig. 3), then unscrew the lower spindle and nut (133) and remove the washer (132). Withdraw the helix (130) together with any adjusting shims (134) that may be fitted.

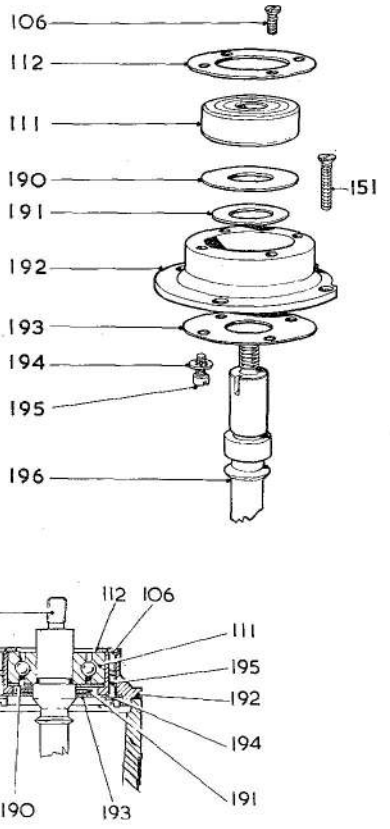
(3) Use the special spanner SPE.17374 (fig. 3) to remove the helix shroud (127) from the volute assembly (140). Withdraw the centrifugal impeller (128) from the spindle together with any shims (129) that may be fitted.

Note . . .

Do not remove the impeller dowels unless they are damaged.

Removing the bevel gear and upper bearing assembly

7. Hold the gear with the special key SPE.17371 (fig. 3) then unscrew and remove the self-locking nut (4) and clamp washer (3) securing the bevel gear (5) to the shaft. Using the extractor tool SPE.17370 (fig. 3) withdraw the gear. Remove any shims (6) that may be fitted and retain the drive key (7).



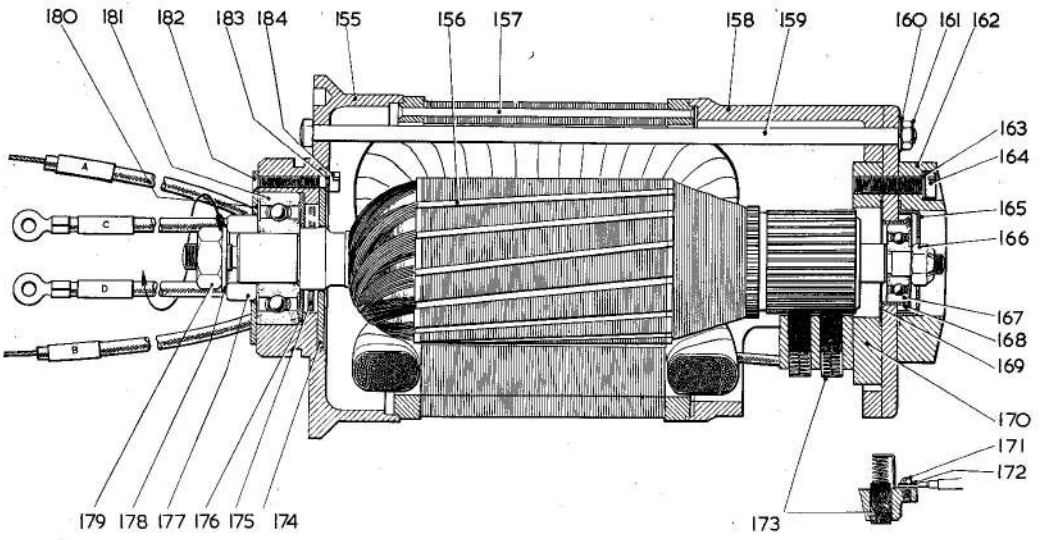
106 C/SK. HD. SCREW (RETAINER PLATE FIXING)
111 BALL BEARING
112 BEARING RETAINER PLATE
151 C/SK. HD. SCREW (BEARING HOUSING FIXING)
190 BEARING SHIELD
191 FLOATING WASHER
192 UPPER BEARING HOUSING
193 SEAL WASHER
194 SHAKEPROOF WASHER } SEAL WASHER ATTACHING
195 CH. HD. SCREW }
196 PUMP SHAFT

Fig. 4. Mk. 1, upper bearing housing assembly

Note . . .

If it is intended to re-use the gear, it must be paired with the pinion of the motor unit originally fitted to the pump unit being dismantled.

8. Mk. 1 pumps have an early type of pump shaft and upper bearing housing, and the dismantling instructions are slightly different to the procedure used for later pumps. After removing the bevel gear proceed according to the appropriate mark of pump as follows:—



155 DRIVE-END MOTOR CASING
156 ARMATURE ASSEMBLY
157 STATOR ASSEMBLY
158 COMMUTATOR-END MOTOR CASING
159 TIE-BOLT
160 SPRING WASHER
161 LOCKNUT
162 BRUSH BOX RETAINER
163 SPRING WASHER
164 BRUSH BOX SECURING SCREW
165 BEARING COVER PLATE
166 SELF-LOCKING NUT
167 BALL BEARING (COMMUTATOR-END)
168 BEARING SLEEVE
169 DUST SHIELD
170 BRUSH BOX ASSEMBLY
171 RD. HD. SCREW
172 SHAKEPROOF WASHER } BRUSH SECURING
173 BRUSH AND TAG ASSEMBLY
174 SEAL WASHER
175 FLOATING WASHER
176 DUST SHIELD
177 SPACING BUSH (TEMPORARY FITTING)
178 CLAMP WASHER
179 LOCKNUT
180 RETAINER PLATE
181 BALL BEARING (DRIVE END)
182 C/SK. HD. SCREW (RETAINER PLATE FIXING)
183 SPRING WASHER
184 CH. HD. SCREW } SEAL WASHER RETAINING

Fig. 5. Section through motor unit

Mk. 1 *pumps only* (fig. 4)

(1) Remove the four screws (151) securing the upper ball race housing assembly to the pump casting, break the seal washer, and withdraw the housing sub-assembly complete with the pump shaft.

(2) Withdraw the shaft from the bearing (196), tapping gently with a hide-faced hammer, if necessary.

(3) Remove the four screws (195) and shakeproof washers (194) then release the seal washers (193) and the floating washer (191).

(4) Press out the bearing (111) and dust shield (190).

Mk. 2 *and later pumps* (fig. 1)

(1) Remove the four screws (151) securing the upper ball race housing assembly to the pump casting. Break the seal washer (150) and withdraw the housing sub-assembly complete with the pump shaft in position. Take care not to damage the bellows unit when withdrawing the shaft through it.

(2) Withdraw the shaft from the bearing tapping gently with a hide-faced hammer if necessary. Do not attempt to remove the thrower collar from the shaft.

(3) Remove the four screws (106) securing the bearing retainer plate (112)

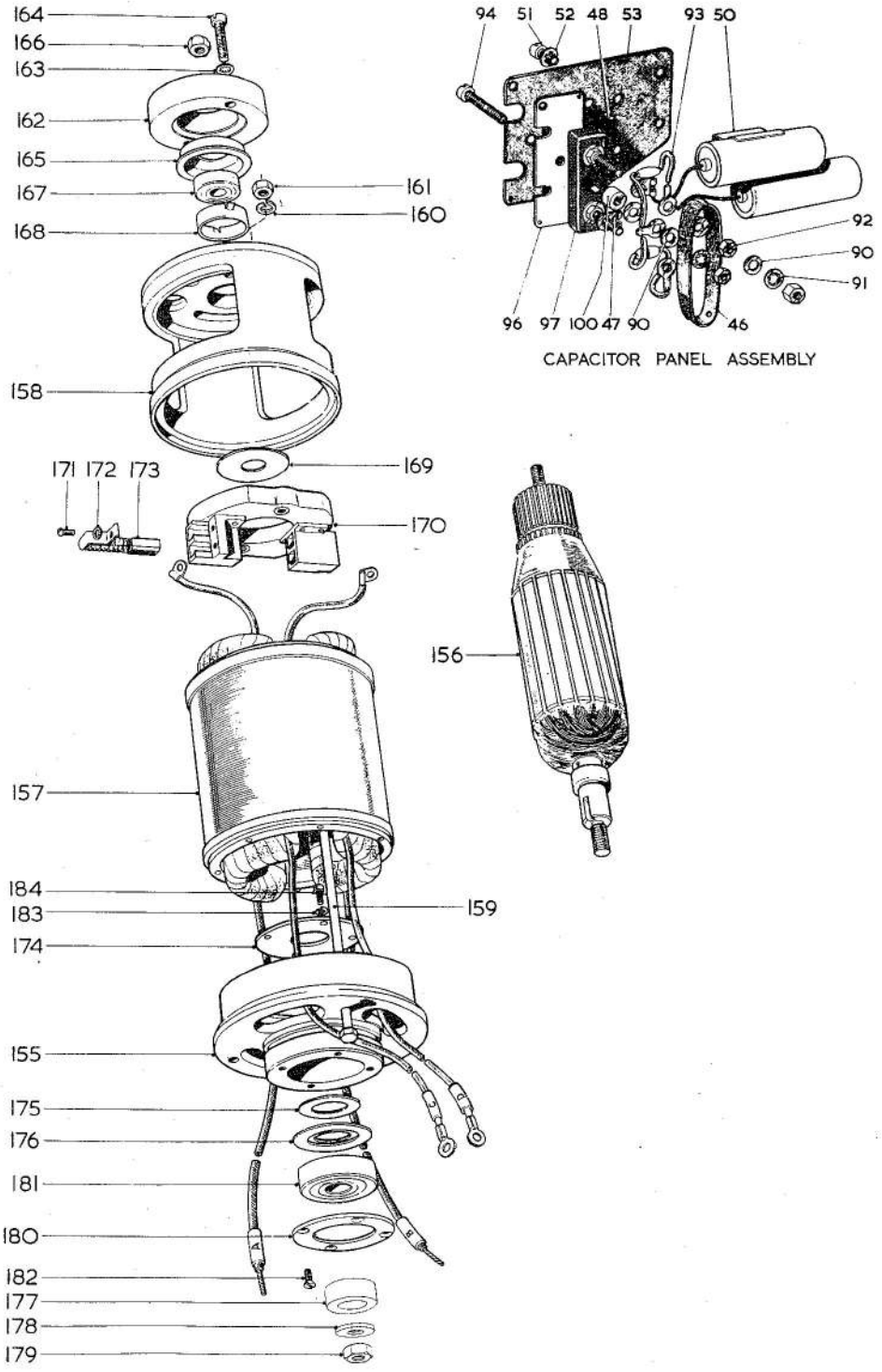


Fig. 6. Exploded view of motor and suppressor panel

and remove the four screws (117) with the shakeproof washers (116) securing the thrower flange (118) to the housing.

(4) Press the bearing (111), together with the dust shield (114), out of its housing.

Lower bearing assembly, bellows housing assembly, and the volute assembly

9. The procedure for removing a lower bearing assembly, the bellows housing assembly and the volute assembly will differ for different types of pump, and reference must be made to the appropriate appended chapter for the particular type of pump to obtain the dismantling instructions.

Key to fig. 6

46	CONDENSER RETAINER BAND
47	CAPACITOR TAG
48	RIVET (PANEL ASSEMBLY)
50	CAPACITOR
51	CH. HD. SCREW } CAPACITOR FIXING
52	SHAKEPROOF WASHER } CAPACITOR FIXING
53	CAPACITOR MOUNTING PANEL
90	PLAIN WASHER } TERMINAL ASSEMBLIES
91	SHAKEPROOF WASHER } TERMINAL ASSEMBLIES
92	LOCKNUT } TERMINAL ASSEMBLIES
93	CONDENSER ASSEMBLY
94	CH. HD. SCREW (TERMINAL BLOCK FIXING)
96	INSULATION PLATE
97	TERMINAL BLOCK (INCLUDING TERMINALS)
100	DISTANCE COLLAR (TERMINAL BLOCK FIXING)
155	DRIVE-END MOTOR CASING
156	ARMATURE ASSEMBLY
157	STATOR ASSEMBLY
158	COMMUTATOR-END MOTOR CASING
159	TIE-BOLT
160	SPRING WASHER
161	LOCKNUT
162	BRUSH BOX RETAINER
163	SPRING WASHER
164	BRUSH BOX SECURING SCREW
165	BEARING COVER PLATE
166	SELF-LOCKING NUT
167	BALL BEARING (COMMUTATOR END)
168	BEARING SLEEVE
169	DUST SHIELD
170	BRUSH BOX ASSEMBLY
171	RD. HD. SCREW } BRUSH SECURING
172	SHAKEPROOF WASHER } BRUSH SECURING
173	BRUSH AND TAG ASSEMBLY
174	SEAL WASHER
175	FLOATING WASHER
176	DUST SHIELD
177	SPACING BUSH (TEMPORARY FITTING)
178	CLAMP WASHER
179	LOCKNUT
180	RETAINER PLATE
181	BALL BEARING (DRIVE END)
182	C/SK. HD. SCREW (RETAINER PLATE FIXING)
183	SPRING WASHER } SEAL WASHER RETAINER
184	CH. HD. SCREW } SEAL WASHER RETAINER

Dismantling the motor unit (fig. 5 and 6)

Disconnecting the field leads and removing the brushes

10. (1) Remove the four screws (171) and shakeproof washers (172) securing the brush assemblies (173). Release the field leads and remove the brushes after identifying each with its corresponding brush box. This will ensure that the brushes, if refitted for a further period of service, are returned to their original boxes.

Removing and dismantling the commutator-end motor casing

11. (1) Hold the bevel pinion to prevent the motor spindle turning then unscrew and remove the commutator-end bearing nut (166). Unscrew and remove the tie-bolt nuts (161) and plain washers (160). Withdraw the tie-bolts (159) through the motor assembly.

(2) Carefully detach the commutator-end casing (158) from the stator assembly. Use a hide-faced hammer to gently tap the casing free if necessary. Take care not to scratch the commutator on the brush holder when withdrawing the casting assembly. Separate the stator assembly (157) from the front motor casing (155) by withdrawing it carefully over the armature.

Note . . .

Do not attempt to remove the field coils from the stator assembly.

(3) Unscrew and remove the two brush box securing screws (164) and spring washers (163). Remove the brush box assembly (170), retainer (162), bearing cover plate (165) and dust shield (169). Press the bearing (167) and sleeve (168) out of the casing and separate the bearing from the sleeve, using the special tools illustrated in fig. 7.

Dismantling the drive-end motor casing (fig. 1)

12. (1) Remove the pinion securing nut (35) together with the clamp washer (34) bevel pinion (5), shims (16), and driving key (7).

Note . . .

If the pinion is to be re-used, ensure that it is paired with the gear removed from the associated pump unit.

TABLE 2

Detailed examination of components

Item	Examination	Action if faulty
Armature	Lamination and end windings for signs of fouling or other damage.	Reject armature for re-winding.
	Commutator for loose conductors.	Reject for re-winding
	Local discolouration of the commutator.	Suspect faulty windings. Check using voltage drop method.
	Insulation resistance between armature and shaft. Use a 500-volt insulation resistance tester. Resistance must be not less than 50 megohms.	Clean armature thoroughly in white spirit to remove every trace of dust from the windings. Dry for a prolonged period at 93°C in a ventilated oven. Allow armature to cool. Re-check insulation resistance. If below this figure continue drying process. Cool and re-check.
	Commutator for eccentricity-total indicator reading must not exceed 0·001 in.	If excessive, reject. Check for protruding mica and raised commutator segments. Difference in height between adjacent segments is not to exceed 0·001 in.
	Commutator for scoring.	Skim commutator. Minimum permissible diameter for further use is 24·0mm. (0·945in.). Surface finish must be free of all machine marks. Undercut mica 0·5mm. deep × 0·036in. wide. Check that no copper burrs are shorting across the segments—remove by gentle application of the finest steel wool. Check concentricity of commutator with shaft bearings. Maximum eccentricity permissible—0·001in. total indicator reading.
	Short or open-circuited conductors. Use voltage drop tester or growler.	Clean undercutting of mica between commutator segments (see above). Remove copper burrs or slivers of mica. If still unsatisfactory, reject the armature.
	Check that the width of the keyway is within limit 0·928in./ 0·938in. and that it is undamaged.	Reject armature
Field	Charring or other evidence of overheating.	Renew complete assembly.
	Connections and insulation coverings of windings and leads to be secure and undamaged.	Replace damaged lead. Cut back old lead, bare old and new lead for $\frac{5}{16}$in. minimum and clean wires. Twist bared wires together and solder using solder Ref. No. 30B/9105043. Bind joint with silk tape and cover with "Systoflex" sleeving 3mm. i/dia. Varnish with air drying varnish Ref. No. 33B/9433454. If more than one lead has to be repaired, stagger the joints to facilitate passage of the leads through the casting channels.

TABLE 2—*continued*

Item	Examination	Action if faulty
Field (continued)	Total resistance of windings measured at 20°C. 515-570 ohms.	Renew complete assembly.
	Insulation resistance of coils to frame.	Clean thoroughly using white spirit. Dry for prolonged period at 93°C in a ventilated oven. Allow to cool. Check that the insulation resistance reading is not less than 50 megohms. If below this figure, continue drying process. Cool. Re-check.
Brush gear	Brushes for wear.	See Fits and Clearances (Table 3).
	Examine brush pigtail leads for fraying and looseness in brush carbon.	Renew the brush.
	Fit of brush in brush box.	Brushes should slide freely in the brush boxes. Carbon dust should be removed.
	Spring pressure—4·5oz. at length 6·7 to 9·5mm.	Renew brush assembly.
Bearings	It is recommended that new ball bearings are fitted at each overhaul of the pump.	
Metallic bellows gland	Scoring of seal faces.	If slight, relap to a mirror finish. If excessive, renew gland.
	Damage to bellows unit convolutions.	Renew gland.
Bellows gland housing	Examine for broken self-tapping screws used to secure the fuel trap.	See relevant appended chapter according to type of pump.
Plain carbon bearing (pump unit)	Damaged or cracked carbon.	Renew bearing housing assembly complete.
	Excessive wear (see Fits and Clearance, Table 3).	Renew bearing housing assembly complete.
Gaskets and joint rings	Discard.	Renew.
By-pass flap valve	Scored or damaged seal face.	If slight, relap. If excessive, renew.
Seal body	Scoring of carbon seal face and wear.	If slight, relap to a mirror finish. If excessive, renew.
	Examine carbon, for signs of cracks, damage or specks of metal, indicating partial seizure on sealing face.	Renew assembly.
Filters (pump and by-pass duct)	Damaged wire mesh.	Renew.
Suppressor units	Each suppressor should be individually checked with a 250-volt constant pressure insulation resistance tester. The insulation resistance between terminal and earth must not be less than 50 megohms.	Renew.

TABLE 2—*continued*

Item	Examination	Action if faulty
Bevel gear and pinion (paired assembly)	Damaged teeth.	Renew both gear and pinion. If either one is damaged, replace both components with a new paired assembly. Excessive wear on gear or pinion teeth will show during assembly (Gear alignment, para. 38).
Commutator end casing assembly	Security of stainless steel end frame.	Renew casing assembly.
Condenser assembly	Visual examination for damage.	Renew assembly.
	Check capacitance on suitable bridge. Two (TCC.CTH.310) each 1500/2000pF. Two (STC. 335/64/A1) each 0·5mF±15%.	Renew assembly.

(2) Remove the four screws (182, fig. 5) securing the bearing retainer plate to the casing (155), and remove the four screws (184) and spring washers (183) attaching the seal washer (174). Press the bearing, together with the floating washer (175) and the dust shield (176), out of the housing.

Dismantling the capacitor panel assembly (fig. 6)

Note . . .

If the terminal block is in a reasonably clean and undamaged condition, there is no necessity to dismantle it completely.

13. (1) Disconnect the capacitor tags, and the condenser tags from the terminal block terminal screws.

(2) Remove the distance collar (100) withdraw the central terminal screw (94), then separate the terminal block from the panel assembly.

(3) The condenser assembly (93) can be removed from the terminal block by withdrawing the rubber retention band (46). Do not dismantle the condenser assembly further to renew any tags.

(4) Remove the two screws (51) and shakeproof washers (52) securing each capacitor (50) to the panel.

EXAMINATION AND REPAIR

General

14. All seal rings, bonded seal washers, and synthetic rubber components must be renewed during the assembling operations. It is also recommended that bearings are renewed whenever a motor or pump unit is being reconditioned. If any bearing is considered to be suitable for further service, it must not be immersed in a cleaning solvent; the bearings are pre-packed with grease during manufacture and cannot be re-lubricated.

Detailed procedure

15. Parts must be examined in accordance with Table 2 and must be checked for conformity with the Schedule of Fits, Clearances and Repair tolerances given in Table 3.

ASSEMBLING

General

16. Maintain absolute cleanliness of the work-bench and tools throughout the assembly of the pump. Retain the bearings in their wrappings until they are required for assembling. Use special tools whenever specified.

Motor unit

Assembling the drive-end motor casing (fig. 6)

17. (1) Pre-select a new bearing (181) that is a firm slide fit under thumb pressure both on the armature spindle (156) and in the motor casing (155). Retain the armature assembly and end casing and suitably mark both so that they can be paired with the selected bearing at a later assembly stage. Check that the selected bearing is smooth running with no roughness when the inner race is rotated by hand.

(2) Check that the bearing housing in the end-casing (155) is perfectly clean and that the wall surface is smooth and

TABLE 3

Schedule of fits, clearances and repair tolerances

Parts and description		Dimensions new	Permissible worn dimensions for re-use	Clearance new	Permissible worn clearance for re-use	Remarks
MOTOR UNIT						
BRUSH LENGTH TO CENTRE OF RADIUS		11·8 mm. (0·465 in.)	10·6 mm. (0·417 in.)	—	—	
COMMUTATOR	diameter	25·1 mm. / 24·9 mm. (0·988 in.) / (0·980 in.)	24·0 mm. (0·945 in.)	—	—	
ARMATURE END FLOAT		—	—	0·125 mm. (0·005 in.) max.	0·2 mm. (0·008 in.) max.	
ARMATURE SPINDLE IN DRIVE-END BALL RACE	diameter	11·995 mm. / 11·985 mm. (0·4723 in.) / (0·4719 in.)	—	—	—	Inner race clamped to spindle on both faces. Selective assembly.
	bore	12·0 mm. / 11·990 mm. (0·4724 in.) / (0·4721 in.)	—	—	—	Inner race clamped to spindle on both faces. Selective assembly.

TABLE 3—*continued*

Parts and description		Dimensions new	Permissible worn dimensions for re-use	Clearance new	Permissible worn clearance for re-use	Remarks
ARMATURE SPINDLE IN COMMUTATOR-END BALL RACE	diameter	5·995 mm. 5·985 mm. (0·236 in.) (0·2356 in.)	—	—	—	Inner race clamped to spindle on both faces. Selective assembly.
	bore	6·0 mm. 5·990 mm. (0·2362 in.) (0·2358 in.)	—	—	—	
COMMUTATOR-END BEARING SLEEVE IN MOTOR CASING	diameter	20·59 mm. 20·58 mm. (0·8106 in.) (0·8102 in.)	—	—	—	
	bore	20·62 mm. 20·61 mm. (0·8118 in.) (0·8114 in.)	—	0·02 mm. 0·04 mm. (0·0008 in.) (0·0016 in.)	0·04 mm. (0·0016 in.)	

PUMP UNIT						
PUMP SHAFT IN UPPER BALL RACE	diameter	11·995 mm. 11·985 mm. (0·4723 in.) (0·4719 in.)	—	—	—	Inner race clamped to spindle on both faces. Selective assembly.
	bore	12·0 mm. 11·990 mm. (0·4724 in.) (0·4721 in.)	—	—	—	
BELLOWS SEAL BODY IN CARBON BEARING	diameter	18·987 mm. 18·974 mm. (0·7475 in.) (0·747 in.)	18·974 mm. (0·747 in.)	0·063 mm. 0·101 mm. (0·0025 in.) (0·004 in.)	0·101 mm. (0·004 in.)	Free running shaft component in supported bearing
	bore	19·075 mm. 19·05 mm. (0·751 in.) (0·750 in.)	19·075 mm. (0·751 in.)			
BELLOWS SEAL ASSEMBLY	overall length (Types 1214 and 1204 only)	29·32 mm. 29·22 mm. (1·153 in.) (1·150 in.)	29·12 mm. (1·146 in.)	—	—	Types 1214 and 1204 only. Face must be re-lapped to a mirror finish—square with axis to ±0·025 mm. (0·001 in.)

TABLE 3—*continued*

Parts and description	Dimensions new	Permissible worn dimensions for re-use	Clearance new	Permissible worn clearance for re-use	Remarks
IMPELLER TO LOWER BEARING HOUSING ASSEMBLY (Dim. A, fig. 11)	—	—	0·1 mm. 0·2 mm. (0·004 in.) (0·008 in.)	—	Adjust clearance as detailed in para. 34
PROJECTION OF HELIX BLADES BELOW MOUTH OF HELIX SHROUD (Dim. B, fig. 11)	—	—	1·0 mm. (0·039 in.)		Adjust as detailed in para. 34
CLEARANCE BETWEEN TIPS OF HELIX BLADES AND MOUTH OF VAPOUR GUIDE CONE (Dim. C, fig. 11)	1·00 mm. 0·75 mm. (0·0394 in.) (0·0295 in.)	—	—	—	
BORE OF BELLOWS HOUSING AFTER SHRINKAGE INTO PUMP CASING (Dim. D, fig. 11)	1·2485 in. 1·2475 in.	—	—	—	Types 1207 and 1216 only
CENTRE LINE OF PUMP SHAFT TO REAR CLAMP FACE OF PINION (information only)	49·237 mm. 49·187 mm. (1·9385 in.) (1·9365 in.)	—	—	—	Dimension set by using special discs when shimming bevel pinion (para. 36)

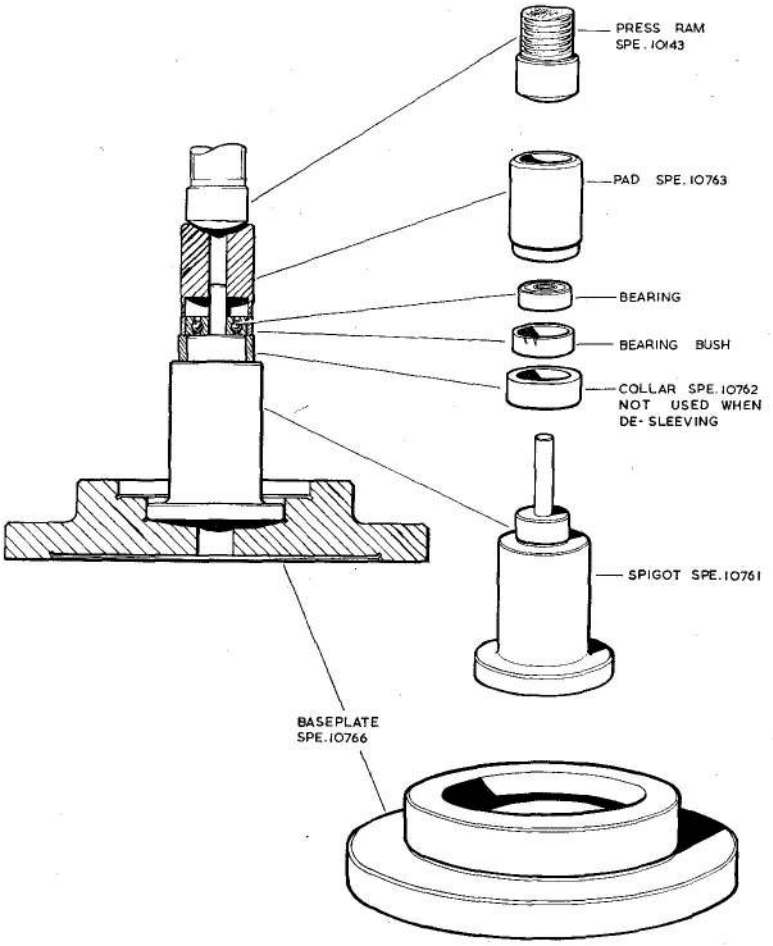


Fig. 7. Bearing sleeve removal and assembly

free of score marks, burrs and adhering swarf. Fit the dust shield (176), with its dished side uppermost, into the bearing housing, then insert the selected bearing.

(3) Fit the bearing retainer plate (180) over the bearing and secure the plate with four screws (182).

(4) Fit the floating washer (175) in the recess behind the bearing housing. Retain the washer by fitting the lower bearing seal washer (174), and secure the seal washer with screws (184) and spring washers (183).

Assembling the commutator-end bearing and sleeve (fig. 6)

18. (1) Pre-select bearing (167) which is a firm slide fit under thumb pressure on the selected armature spindle (para. 17). Check that the bearing is smooth running with no roughness when the inner race is rotated by hand.

(2) Assemble the selected bearing into the steel sleeve (168), using the special tools illustrated in fig. 7.

(3) Fit the bearing and sleeve assembly into the commutator-end motor casing (158). Ensure that the ears on the sleeve (168) locate in the motor casing slots, to prevent rotation of the assembly in its housing.

Assembling the brush box (fig. 6)

19. (1) Fit a dust shield (169) into the recess at the back of the brush box assembly (170) and retain it with a minimum

quantity of approved rubber cement. Wipe off any excess.

(2) Hold the brush box assembly in position inside the motor casing (158). Fit the bearing cover (165) over the upper bearing and replace the brush box retainer (162). Secure the retainer and brush box with two screws (164) and spring washers (163). Centralise the brush box assembly above the bearing and tighten the screws. A final adjustment will be made during the motor speed-setting operation.

Assembling the armature to the drive-end motor casing assembly

20. (1) Enter the armature (156), previously used to check the bearing fits, through the bore of the assembled drive-end bearing (para. 17).

(2) Retain the armature with the special spacer bush (177), washer (178) and nut (179). A scrap pinion (5, fig. 1) can be used in place of the spacer bush (177, fig. 6) if the latter is not available.

Fitting the drive-end motor casing and armature assembly to the stator and commutator-end casing assembly (fig. 6)

21. (1) Carefully insert the armature assembly through the bore of the stator assembly (157) from the longer lead end. Thread the tagged leads through the upper right-hand end casing slot and the untagged leads through the lower right-hand slot relative to the tie-bolt holes as indicated in fig. 8. Locate the motor end-casing on the spigot of the stator assembly, and engage the stator pin in the casing rim slot.

(2) Carefully position the commutator-end frame sub-assembly over the armature, guide the shaft into the upper bearing and locate the frame positively by engaging the stator pin in the casing rim slot.

Note . . .

Take great care not to scratch the commutator on the brush boxes when assembling.

(3) Insert the tie-bolts (159) through the drive-end casing, stator and commutator-end casing. Secure the bolts to the end frame with the nuts (161) and washers (160), tighten each bolt in turn by degrees, and tap round the casing joints, with a hide-faced hammer, to ensure a perfect seating with the stator assembly.

(4) Hold the drive-end spindle nut with a spanner and replace the spindle end-nut (166), securely tightening it against the inner race of the bearing.

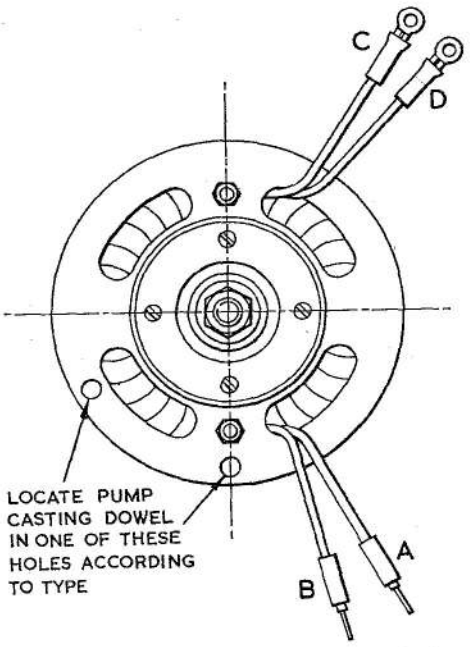


Fig. 8. Motor lead positioning

Pre-bedding the brushes

22. (1) Preferably using a slave motor, insert a brush (173) into each of the four brush boxes, retaining each with screws (171).

(2) Wrap a strip of fine grade (000) glass paper around the commutator, then turn the armature by hand until the brushes are bedded over their full width of arc.

Brush bedding motor run

23. (1) Remove the brushes from the brush boxes of the slave motor, clean the faces with a small brush and transfer them to the motor unit being assembled. If the original brushes are being re-fitted, insert them in their original boxes, as indicated by the marking made during dismantling.

(2) Secure the brushes with screws (171) and shakeproof washers (172), connecting a field lead tag to the first brush of each pair.

(3) Run the motor unit at 60V d.c. without load, set the brush gear in a position giving minimum sparking at

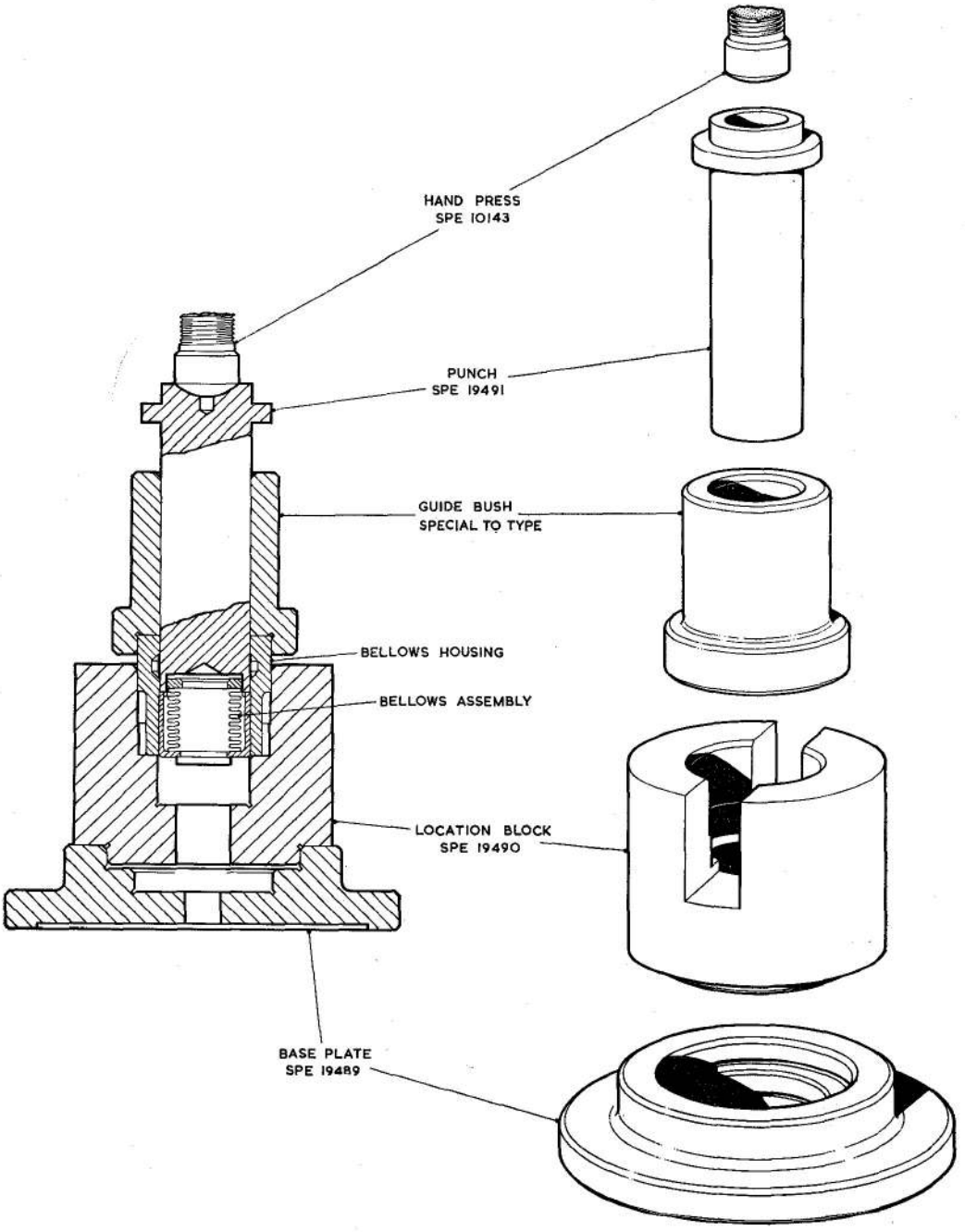


Fig. 9. Bellows gland removal from housing

the commutator, and continue running for at least 10 hours, or until the brushes bed over their full width of arc with at least 80 per cent of their face area making contact with the commutator. The running of the motor should be continued until this condition is achieved for all four brushes.

(4) Identify each brush with the box to which it has been fitted. Remove each brush and clean all carbon dust from the boxes, using a jet of dry compressed air. Refit the brushes.

Motor speed setting

24. (1) Instal the motor unit in a tank recess surrounded by a suitable coolant maintained at 20/25°C. It is suggested that an outer motor casing (15, fig. 1) is set into the side wall of a small tank so that the motor unit can be clamped in position. The tank should be filled with kerosine or water until the motor casing is submerged. Using a calibrated fan SPE.17375 (fig. 3) or a suitable dynometer apply a torque loading of 30 oz. in. to the motor unit. Run the motor unit under load for 20 minutes at 112V d.c. input. Check that the speed is 10,000 ±100 rev./min. and that the current consumption does not exceed 3·3 amps. Adjust the brush box position as necessary to obtain these performance figures.

(2) When the speed is correctly set and the brush box screws have been tightened, apply air drying varnish to the brush box carrier inserts and to the ends of the carrier retainer screws (164, fig. 6).

(3) Remove the motor unit from the tank fixture, run the motor under load and check visually for sparking at the brushes. Either continuous or intermittent blue pin-point sparking is permissible but if occasional or continuous yellow flashes are observed, commutation is not satisfactory.

(4) Check the insulation resistance of the motor unit while it is warm using a 500-volt insulation resistance tester. The insulation resistance must not be less than 10 megohms.

Pump unit

Reaming the carbon bearing

25. The design of the lower bearing differs between types of pumps and the procedure for reaming the carbon bearing will be different for each type of pump. Reference must be made to the relevant appended chapter for details of the correct procedure.

Fitting the volute and outlet ducting

26. Differences in design of pulp casting, volute casing and the outlet ducting require different assembling procedures according to type and design, and reference must be made to the relevant appended chapter for the details of the correct procedure.

Assembling and fitting the bellows gland unit

27. SPE.1204 and 1214 have a different design of bellows gland unit to that used for types 1207 and 1216. The pump casting for the latter type is pre-heated before the bellows gland unit is fitted, but this procedure is not necessary for types 1204 and 1214. Reference must be made to the relevant appended chapters for the correct procedure for each type of pump.

Shaft component checking (fig. 1 and 2)

28. Pre-select a bearing (111) that is a firm sliding fit under thumb pressure on the pump shaft and also in the bearing housing. Check that the bearing runs smoothly and check that the bearing housing is clean, free of score marks, burrs and adhering swarf. Mark the three components to ensure that they will be assembled into the same pump at a later stage of assembling, then proceed as in para. 29 or 31 according to the mark of pump.

29. *Mk.* 1 *pumps only* (fig. 4). (1) Fit the bearing shield (190), recessed side uppermost, in the bearing housing and insert the selected bearing. Retain the bearing with the plate (112) and four screws (106). Peen metal into the screw slots to lock them.

(2) Place a floating washer (191) in the underside of the bearing housing and retain it with a seal washer (193) four screws (195) and shakeproof washers (194).

(3) Fit the bearing housing sub-assembly, the bellows seal body, (148, fig. 1), the centrifugal impeller (128) and the helix (130) to the selected shaft (para. 28) in their correct assembly positions. Check the fit of the components on the shaft and ensure that all the components will tighten flush against the shaft shoulders.

(4) Remove the components from the shaft and retain them for assembling into the same pump unit.

Assembling a Mk. 1 upper bearing housing (fig. 2 and 4)

30. (1) Locate the shaft (196) through the bore of the selected bearing. Smear the mating surfaces of the ball race housing and pump casting with Wellseal jointing compound, place a new gasket (150) into position, and carefully insert the shaft sub-assembly through the bellows unit.

(2) Secure the housing assembly with four screws (154) and peen metal into the screw slots to lock them.

(3) Retain the shaft with a temporary distance piece (107), washer (109) and locknut (108). If a distance piece is not available fit a scrap bevel gear (5).

31. *Mk. 2, and later pumps* (fig. 1 and 2) (1) Insert the selected bearing (111) and the dust shield (114) into the bearing housing and retain both with the plate (112); securing it with four screws (106). Peen metal into the screw slots to lock them.

(2) Fit the bearing housing sub-assembly, the bellows seal body (148) centrifugal impeller (128) and the helix (130) to the shaft in the correct assembly order. Check the fit of the components on the shaft and ensure that all the components will tighten flush against the shaft shoulders.

(3) Remove the components from the shaft and retain them for assembling into the same pump unit.

Assembling the upper bearing housing (Mk. 2 and later pumps)

32. (1) Secure the thrower flange (118) to the underside of the bearing housing with the four screws (117) and shakeproof washers (116).

(2) Locate the shaft through the bore of the selected bearing. Smear the mating surfaces of the ball race housing and pump casting with Wellseal jointing compound, place a new gasket (150) into position and carefully insert the shaft sub-assembly through the bellows gland. Secure the housing assembly with four screws (151). Peen metal into slot of each screw to lock it in position.

(3) Retain the shaft with a temporary distance piece (107), washer (109) and locknut (108). If the distance piece (107) is not available fit a scrap bevel gear (5).

Loading the bellows gland

33. (1) Place the bellows seal body assembly (148) in position on the pump shaft. Using the tools illustrated in fig. 10, determine the thickness of shims (147) required to give the bellows gland the correct loading of 18 ounces by proceeding as follows:—

(a) Place the 18-ounce weight SPE. 17888 over the shaft and locate about the seal body.

(b) Swing the clock gauge into position and register on a point close to the central hole through the weight. Set the gauge to zero.

(c) Fully depress the weight by finge pressure and note the new reading on the clock gauge. The difference between the two readings +0·020 in. to allow for compression on final assembly gives the thickness of shim required.

(d) Select shims (147) to the required total thickness. Lightly smear them with jointing compound and place them on the pump spindle. Lubricate the carbon seal face of the seal body (148) with a drop of kerosene and fit the seal.

(2) Lubricate the carbon bearing in the lower bearing housing assembly (136) with kerosene. Secure the bearing housing through the volute assembly to the pump casting with five screws (146). Peen metal into the screw slots to lock them, ensuring that none projects above the housing surface.

Assembling the centrifugal impeller and helix (fig. 1 and 2)

34. (1) Fit a number of shims (129) over the shaft. Fit the impeller gauge SPE. 17372 (fig. 3) and, using any suitable spacer fit a 2-B.A. nut to the spindle and tighten the nut to fully compress the

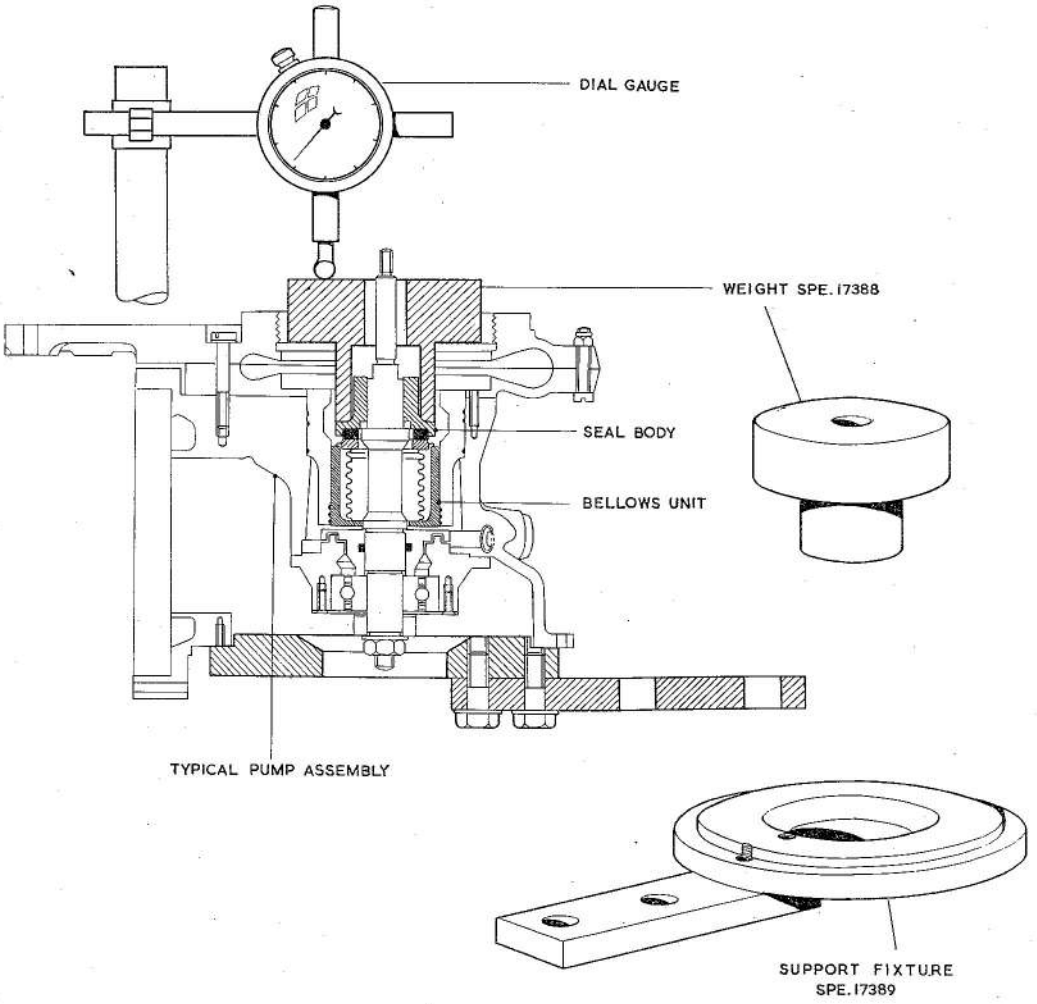


Fig. 10. Bellows gland loading fixture

soft aluminium shims (147). Depress the captive pin in the impeller gauge until it contacts the undersurface of the lower bearing housing (136). Remove the nut and spacer. Withdraw the gauge and determine the projection of the pin above the surface of the gauge. Progressively reduce the total thickness of shims (129) until the projection of this gauge pin is 0·008 in.

(2) Fit the impeller (128), locating the dowel (135) through the shims into the underside of the bellows seal body (148). Fit any suitable spacer giving clearance to the impeller dowel over the shaft and secure it with a 2-B.A. nut. Check by rotation that the impeller does not touch the underface of the lower bearing housing.

(3) Fit the helix shroud (127) and using the special spanner SPE.17374 (fig. 3) tighten the shroud until it just touches the impeller. Slacken the shroud approximately $\frac{1}{4}$ turn so that the vertical slot in the thread is adjacent to one of the studs in the volute assembly.

(4) Remove the nut and the spacer from the shaft and fit the helix (130) together with sufficient shims (134) to ensure that the helix blades project 1·0 mm (0·039 in.) beyond the rim of the shroud (127). Secure the helix to the shaft with a washer (132) and self-locking nut (133).

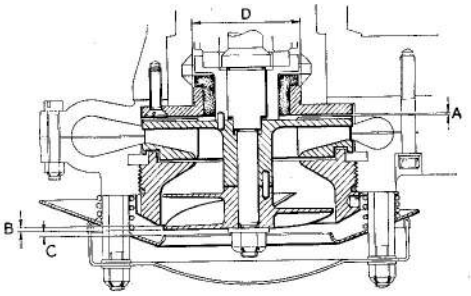


Fig. 11. Impeller helix and vapour guide cone assembly clearances

Assembling the inlet filter (fig. 1)

35. For pumps to which the inlet filter is secured by mushroom headed screws (Type 1214 and 1204), fit four 4 B.A. studs approximately 2 in. long to the four filter securing screw positions in the volute assembly; other types of pumps will have studs fitted in these positions.

(1) Position a pillar (124) on each of the studs, then fit the helix shroud locking tab (123) under one pillar so that the tab locates in the vertical groove in the shroud thread (para. 34). Fit a spring (138) over each pillar and place the vapour guide cone (139) into position.

(2) Assemble the filter (125) and hold it in position against the pressure of the springs. Check the clearance between the tips of the helix blades and the mouth of the vapour guide cone (Dim.C, fig. 11) and ensure that it agrees with the dimension given in Table 3.

(3) Thread a locking wire through the holes in the volute casting and the vapour guide cone, and bring the wire out through the mesh of the filter. Secure the filter assembly to the studs with self-locking nuts (126), attach an approved seal to the locking wire and position it as close to the filter as possible. On pumps which have been fitted with temporary studs, remove one stud at a time, and substitute a mushroom headed screw and a shakeproof washer, until all four screws have been fitted.

(4) Tighten the securing nuts, or the mushroom headed screws.

Fitting the motor unit to the pump unit

Bevel pinion shimming (fig. 12)

36. Before completing the motor unit assembly, determine the thickness of the shim (16) required to position the bevel pinion and obtain correct meshing with the pump shaft gear, as follows:—

(1) Remove the nut (179) and washer (178) securing the spacer or bevel gear to the pump shaft. If a gear is fitted, use the extractor SPE.17370 (fig. 3) to assist removal. Fit the special disc SPE.17391 and secure it to the pump shaft.

(2) Remove the distance piece or bevel pinion fitted to the motor unit. Fit the special disc SPE.17391 and secure it to the motor spindle.

(3) Locate the motor unit in the recessed housing of the pump casting and secure it in position with the special clamping ring SPE.17392. To facilitate location of the motor casing on the dowel in the pump casting, mark the end casing before inserting. Use 6-B.A. screws (10 and 18, fig. 1) in four positions only to securely clamp the motor unit in position.

(4) With feeler slip gauges measure the gap between the outer edge of the pump shaft disc and the front face of the motor spindle disc (fig. 12). This is the correct thickness of the shims required for assembling the pinion on the motor shaft.

(5) Separate the motor unit from the pump unit by removing the clamping ring, and remove the disc. Select shims (16), of correct total thickness, and check that they are free of edge burrs. With the drive key (7) in position, press on the bevel pinion (5); ensure that this pinion is marked so that it can be paired with the matched bevel gear as supplied. Secure the pinion with the clamp washer (34) and self-locking nut (35) and tighten the nut. Fit a new jointing ring (13) in the groove in the motor end casing.

(6) Examine the motor unit for cleanliness, and tightness of all screws (countersunk-head screws should be locked by peening metal into their slots unless specifically detailed otherwise).

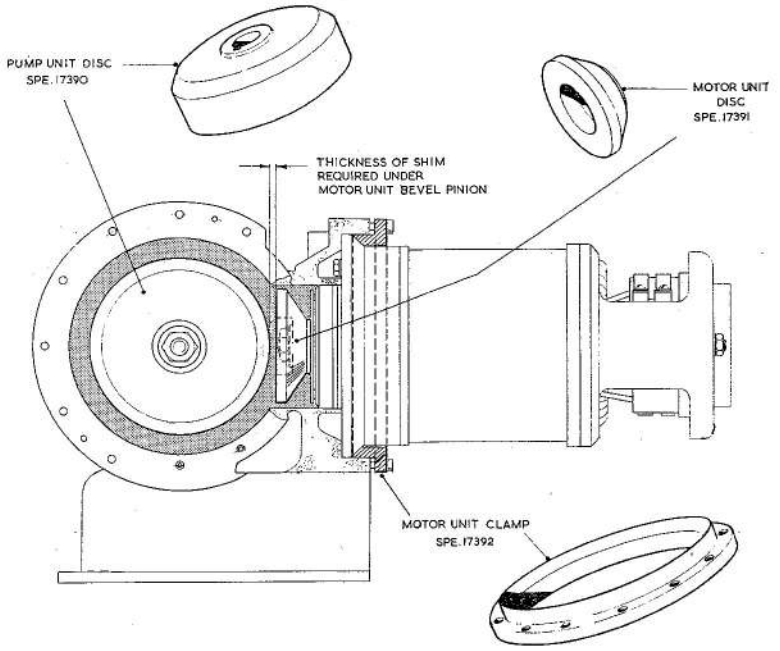


Fig. 12. Bevel pinion shimming tools

Examine the condition of the brush and field leads. The spindle thread should protrude through the nut securing the pinion. Check that the motor unit turn freely with no suspicion of "stickiness".

37. In the following sub-para. (1) and (2) it is assumed that a paired gear assembly with known backlash characteristics is being fitted. Unpaired gears, as fitted to early pumps in the series will not be engraved with meshing points. The bevel gear and pinion (5) should be painted on all except clamping surfaces with DAG.D.58 and allowed to dry before the motor unit is finally fitted to the pump unit.

(1) Remove the pump shaft disc and fit an excessive thickness of shim (6), the bevel gear key (2) and the paired gear (5). Place the special starwheel SPE.17396 (fig. 13) on top of the gear and align it so that one arm is between the markings X-X which will be found engraved on top adjacent gear teeth. Secure the starwheel with a $\frac{1}{4}$ in. B.S.F. nut.

(2) Lubricate the motor unit seal ring (13) with a smear of Silicon compound XG-250 (Ref. No. 33C/9424829). Ease the completed motor assembly into the pump casting, threading the motor unit leads through the channel leading to the suppressor chamber. Align the gears so that the pinion tooth marked X is meshed between the two gear teeth similarly engraved with an X. This alignment is important. Locate the motor unit by registering the pump casing dowel pin in the motor end casing hole, and hold the motor unit in position.

Gear alignment (fig. 13)

38. (1) Fit the casing SPE.17393 over the motor unit and secure it to the pump casting in six positions. Clamp the motor spindle end nut in the indexing clamp SPE.17394. If un-paired gears are being fitted, set the gears so that one arm of the starwheel is in line with the motor centre line and secure the indexing clamp. Mark the meshing gear and pinion teeth so that the starting point for the backlash check can be easily determined.

(2) Take up the backlash between the gear and note whether the reading on the angular contact dial gauge, which is graduated in 0·0005 in., indicates that it is within limits 0·005 in./0·009 in. or in accordance with the first backlash figure quoted on the label supplied with the paired gears under check. The ball

of the clock gauge should be located on the flat portion of the star point at a position close to its end. If the reading is outside specified limits, remove the starwheel, withdraw the bevel gear, using the extractor tool SPE.17370 (fig. 3), and reduce the thickness of the shims (6). Re-assemble and align the gear starwheel. Re-check the backlash, and continue to reduce the shim thickness until the reading on the dial gauge indicates that the backlash at the starting point is within the specified limits.

(3) Rotate the starwheel through 90 degrees in a clockwise direction and re-check. The backlash must be within 0·002 in. of the reading at the initial check point, and within the range 0·005 in./0·009 in. Adjust the thickness of shims (6) if the backlash is outside this limit and range, then re-check at the initial and second positions. Repeat the check after each of two further 90 degree movement of the gearwheel. Mark the meshing after the final check.

(4) Remove the pump shaft nut and and washer, withdraw the gearwheel using the extractor tool, rotate the gear 45 degrees in a clockwise direction and replace in mesh with the pinion. Check and record the backlash. Rotate the gearwheel a further 45 degrees revolution in a clockwise direction. Check and record the backlash. Repeat the operation a further seven times checking and recording the backlash after each movement of the gear. The backlash figures at all 13 check positions must be within 0·002 in. of one another and within the range 0·005 in./0·009 in. Any adjustment of the shimming will necessitate a re-check of the backlash figures at all previously completed check points.

(5) Remove the starwheel from the pump gear shaft, and refit the clamp washer (3) and self-locking nut (4). Hold the gear wheel with the special key SPE.17371 (fig. 3) and securely tighten the nut with a box spanner. Remove the pump from the fixture, carefully supporting the motor unit which is unsecured at this stage. Take care that the gear and pinion are not withdrawn from mesh.

Assembling the motor outer casing (fig. 1)

39. (1) Position a new sealing ring (11) over the outer motor casing (15) fit the casing over the motor unit and secure it with the bolt ring (12), screws (10) and (17), self-locking nuts (9), and shakeproof washers (18). Tighten diagonally opposite nuts or screws in turn by degrees to ensure even compression of the joint ring.

Assembling the gear box cover

40. (1) Fill up the grease measure SPE. 17379 (fig. 3) with Acheson Gredag graphited grease Grade ZV. Press the full amount of grease into the gear box, ensuring that some is forced into the teeth of the gear and pinion.

(2) Degrease the pump casting flange taking care not to let the solvent get into the grease. When dry, secure the gear box cover (1) with screws (38) and (8), spring washers (37) and self-locking nuts (36). Tighten diagonally opposite screws or nuts in turn by degrees to ensure even compression of the rubber gasket, which is integral with the cover; ensure that the spring washers are fitted under the nuts (36).

Assembling the capacitor units (fig. 6)

41. (1) Check the connections of the tags (47) to the capacitor units (50). If faulty, fit a new tag or if the capacitor lead is frayed, discard and fit a new unit.

(2) Secure the capacitor units (50) to the panel assembly (53 and 96) with the screws (51) and shakeproof washers (52).

(3) Fit the terminal block (97) to the panel assembly with the screw (94), the distance collar (100), two plain washers (90), a shakeproof washer (91) and the locknut (92).

(4) Position the condenser assembly (93) on the terminal block (97), so that one tag can be built into each of the three terminals of the block, then retain the condensers with the rubber band (46).

(5) Thread the electrical lead sub-assembly (49, fig. 1) through the pump casting channel so that the tagged ends are in the capacitor housing. Twist the two untagged motor leads together and

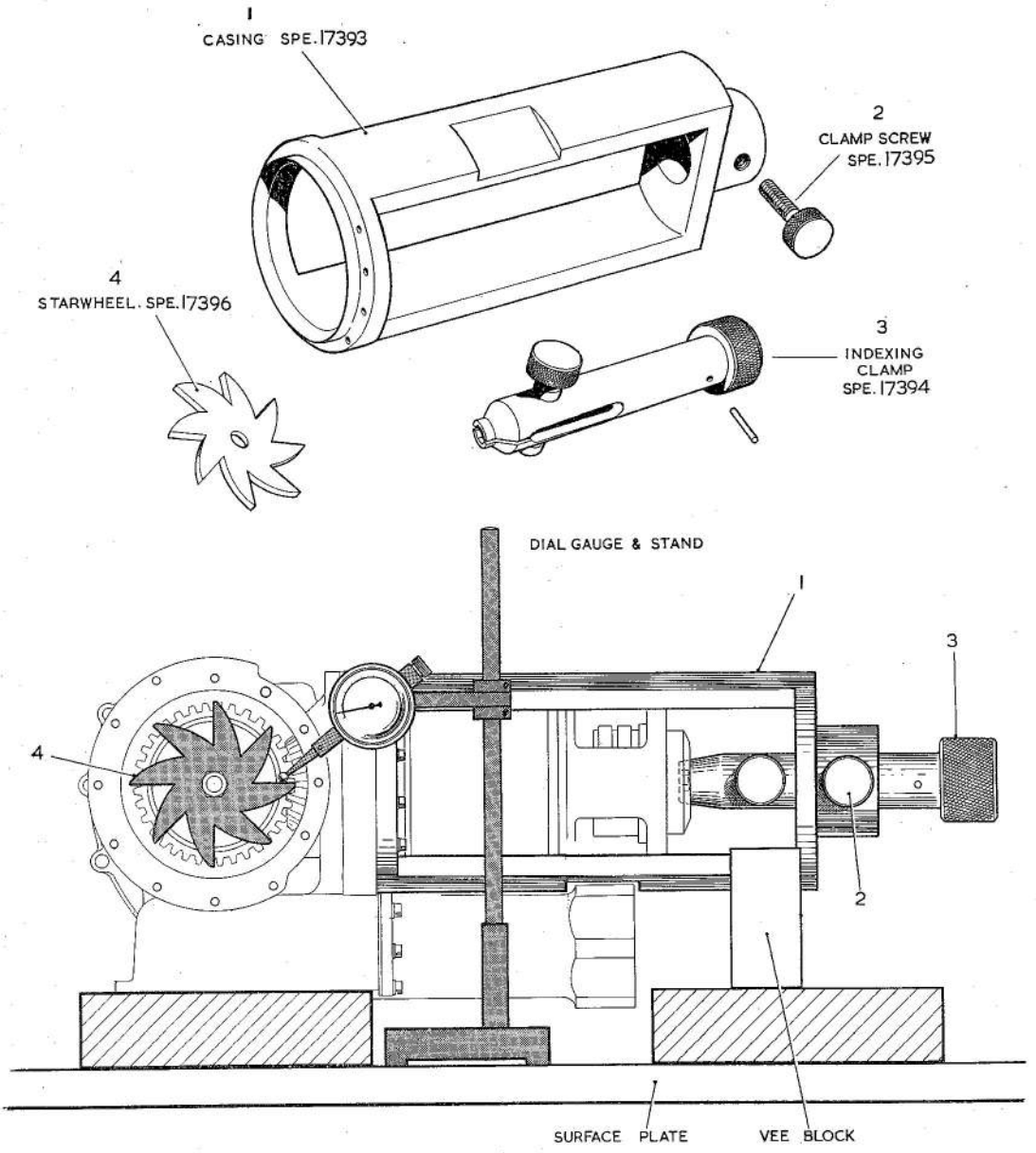


Fig. 13. Backlash checking tools

pass these through the same casting channel for eventual assembly to the electrical connections.

(6) Build up the two outer terminals of the terminal block in accordance with the sequence illustrated diagrammatically in fig. 14. Each terminal should comprise a capacitor lead tag and a condenser assembly tag clamped by a plain washer and locknut, and a supply lead tag and motor unit lead tag clamped by a plain washer, shakeproof washer and full nut. Ensure that all leads marked "C" are assembled to one terminal and those marked "D" to the other. Connect the earthing wire tag (95) of the armoured cable under the plain washer of the centre anchor terminal.

(7) Arrange the motor leads to the terminal block so that they are brought round the back of the capacitor panel (53) and locate in the slots on the left-hand edge.

(8) Retain the capacitor panel assembly with a screw (98) and spring washer (99) in the upper left hand position and with self-locking nuts (55) and plain washers (56) on the two studs. Examine all soldered connections for fractured leads or other faults which may have developed during the assembly process.

(9) Using a suitable testmeter, check for continuity between the mounting and the earthed pole of the condenser. Resistance indicated must be zero.

(10) Fit the capacitor housing cover.

Note . . .

Reference must be made to the appended chapters for particular types of pumps for the correct method of making electrical connections, and fitting leads.

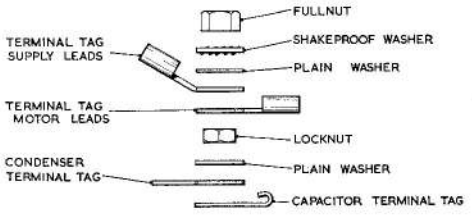


Fig. 14. Terminals, order of assembly

Pressure testing the pump assembly

42. Pressure test blanking plates are listed under the special tools appropriate to particular types of pumps in the appended chapter. Fit the test blanking plate according to the instructions for the type of pump and test as follows:—

(1) Apply air pressure to the tube of the test blanking plate, and gradually increase the pressure to 10 lb./in^2; maintain this pressure for five minutes.

(2) Immerse the pump unit in a small tank of kerosene and check for air bubbles, indicating leakage past a seal or the gland. Leakage is not permissible.

(3) If leakage past the metallic bellows gland is suspected, remove the pump from the tank and run at 112V d.c. input voltage for a minute. This will sometimes rectify any slight seal leakage in a new pump. Re-check. If still faulty the pump must be dismantled and the gland surfaces re-lapped.

(4) If leakage from a seal is suspected, the faulty seal must be dismantled and the seal ring must be renewed; dry the affected surfaces.

(5) Reassemble the pump and repeat the pressure test. If the test is satisfactory, remove the test blanking plate.

Assembling the mounting plate and fuel jacket

43. After pressure testing the pump, complete the assembling according to the instructions for the type of pump. Mounting plates are not always supplied by the pump manufacturers and may not be attached to a pump when it is returned for reconditioning. By-pass ducts, outlet connections and sump mounting plates, if applicable, vary for different types of pumps, and reference must be made to the appended chapters for the instructions applicable to the type of pump being reconditioned.

TESTING

General

44. The complete pump must be tested in accordance with the Schedule of Tests detailed in para. 46-52. The pump should be rejected if it fails to comply with these tests in any detail.

Test equipment

45. Pumps in this series can be tested on the universal fuel pump test rig; Avtur fuel maintained at a temperature of 20-25°C should be used for the tests. A description of the test rig and information on the method of mounting a pump to the rig are given in A.P.4343S, Vol. 1, Book 2, Sect. 10.

SCHEDULE OF TESTS

Brush bedding and motor test (motor unit only)

46. Full details on the procedure to be adopted are given at the appropriate stage in the assembly sequence. Conditions to be fulfilled are as follows:—

(1) The brushes must bed over their full width of arc, with at least 80 per cent of their face area in contact with the commutator.

(2) The motor is to be subjected to a torque of 30 oz. in. applied by means of the calibrated fan SPE.17375 (fig. 3) or by a suitable dynamometer. Run the motor unit under this load for 30 minutes at an input voltage of 112V d.c. Check with a stroboscope that motor speed is 10,000 ±100 rev./min. and that during the test the current consumption does not exceed 3·3 amps.

Insulation resistance test

47. The insulation resistance tests are to be carried out when the motor unit is warm, using a 250V constant pressure insulation tester for units fitted with suppressors, or a 500V tester for units not fitted with suppressors. The resistance must be measured at the following stages of assembling and testing:—

(1) Motor unit only, after brush bedding and motor torque test (para. 24). The insulation resistance must not be less than 10 megohm.

(2) Complete pump, before the pressure test (para. 48) and after the completion of the calibration test (para. 52). The insulation resistance must not be less than 2 megohm.

Pressure tests

48. (1) With the pump fully submerged in fuel, apply air internally through the gland drain and motor breather at a pressure of 10 lb/in². Maintain this pressure for 5 minutes. Observe for leakage of air bubbles into the fuel. A leakage attributable to the gland is permissible providing the pump complies with sub-para. 2(c) and (3). No other leakage is permissible.

(2) With the flow regulating valve closed and the pump fully submerged in fuel, run the pump fully on an input voltage of 116V d.c. for 15 minutes. Observe for

(a) External leakage of fuel. No leakage is permissible.

(b) Internal leakage of fuel. No leakage is permissible.

(c) Gland leakage. Allowable rate of leakage is two drops per minute with the pump running and one drop per minute when stationary.

(3) With the pump stationary and a 12-inch head of fuel over the mounting flange apply air pressure at 10 lb/in² for 15 minutes. Observe for fuel leakage as in sub-para. (2) above. The allowable rate of leakage past the gland is two drops per minute. No other leakage is permissible.

Starting test

49. With the pump fully submerged in fuel and the supply voltage adjusted to 75V d.c. operate the pump by switching on the supply. The pump should start immediately. Check the starting of the pump by operating the switch ten times.

Dry test

50. Mount the pump clear of fuel and run it dry for five minutes on an applied voltage of 116V d.c. The current consumption is to be observed during this test and must at no time be greater than 2·0 amps.

Note . . .

The dry test should be carried out as soon as possible after the starting test. If more than one hour has elapsed between the two tests, immerse the pump in fuel for a few seconds to lubricate the seal faces.

Proof test

51. With a 6-inch head of fuel over the pump inlet, run the pump for 1 hour under conditions (1) and (3) of Table 4, and check the pump for conformity to Table 4 under all conditions (1) to (4). The performance figures are to be recorded at the beginning and end of each hours run. The pump should be rejected if any appreciable change in performance is observed other than that caused by the initial warming up of the motor unit.

TABLE 4
Proof test

Volts d.c.	Flow g.p.h.	Delivery pressure lb/in²	Current—Amp. (max.)
(1) 100	1200	8·0 (min.)	3·0
(2) 112	1200	11·0 (min.)	3·3
(3) 116	1200	11·5 (min.)	3·5
(4) 116	0	21·0 (max.)	3·1

Calibration test

52. With a 6-inch head of fuel above the pump mounting flange, adjust the flow regulating valve to obtain flows of 1600, 1400, 1200, 1000, 800, 600, 400, 200, and zero gallons per hour. Record the delivery pressure and motor current at each flow stage. Apply the following voltages:—100V d.c., 112V d.c., and 116V d.c. Plot graphs of the flow in gal./h. against the delivery pressure in lb/in² for each voltage, and check for conformity with the acceptance performance figures at the ordinates given in Table 5.

TABLE 5

Calibration tests: acceptance performance

Volts d.c.	Flow g.p.h.	Delivery pressure lb/in² (min)	Current—Amp. (max)
(1) 100	1200	8·0	3·0
(2) 112	1200	11·0	3·3
(3) 116	1200	11·5	3·5

Bonding

53. Check the bonding between all parts of the pump casing. The resistance measured between any two points must not exceed 0·05 ohms. If the anodic finish is scratched at any point for the purpose of testing, the unprotected area must be treated with chromic acid solution.

Wire-locking

54. After satisfactory completion of tests the pump unit should be wire-locked and sealed at the following positions as applicable.

(1) Gearbox cover to capacitor housing (all types).

(2) Pump casing to capacitor cover (all types).

(3) Gearbox cover to motor bolt ring (all types).

(4) Drain plug to the plug fitted to the alternative delivery outlet (Types 1214 and 1204).

Repair depots should use their own seals for this purpose and the seals must be fitted as close to the components as possible.