

**SPARE PARTS &
SERVICE MANUAL**



STEERING GEARS

MATHWAY STEERING GEARS SPARE PARTS AND SERVICE MANUAL

EDITION Nº 2

Series XL	Maximum rudder torque loading 700 lb. feet
Series LS	" " " " 1680 lb. feet or $\frac{3}{4}$ Ton ft.
Series LS	with NAE type Aft End Reduction gearbox - Maximum rudder torque loading 2240 lb. feet or 1 Ton ft.
Series ES	Maximum rudder torque loading 3360 lb. feet or $1\frac{1}{2}$ Ton ft. or a special application by using a large steering wheel a larger type universal joint 3 Ton ft. can be achieved with a greater effort on the steering wheel.
Series LPS	Maximum rudder torque loading 22,400 lb. feet - 10 Ton ft.

MATHWAY marine limited

AN ASSOCIATED BRITISH ENGINEERING COMPANY

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CGM & CO.

MATHWAY MANUAL STEERING

The Mathway manual steering gear is simple and straightforward. There are several types of gear available as indicated above to suit various tonnages and performance. The mechanical system incorporates the use of a steering bowl with helm indicator, right angle bevel boxes, and an aft end reduction gear box which is connected to the tiller lever by means of a ball jointed drag link. The system is connected together by means of universally jointed shafts. Where a shaft passed through a bulkhead, a bulkhead bearing is used which incorporates a self aligning bearing.

MATHWAY LIGHTWEIGHT POWER STEERING GEAR

The MATHWAY Power - manual Steering Gear is a unit affording power operation and manual operation by a completely separate means. This characteristic affords a valuable assurance against breakdown at sea, for in the event of a power failure or other untoward incident, the ship remains under full control from the bridge, manually. As it is a requirement that the steering gear under power should have a high ratio of rudder movement to wheel movement, yet the gear should permit the boat to be handled manually at relatively high speed, double ratio gearing in the bowl has been provided.

Electro-hydraulic power is used to give a light wheel movement for normal operation but a mechanical connection between the wheel and the rudder provide full manual control continuously. One and two thirds turn of the wheel suffice to put the helm hard-over from midships, the tiller being held in any desired position by a finger-light pressure on a wheel spoke. When released the wheel will spin back to midships and so facilitate rapid manoeuvring of the ship.

The complete gear comprises a bridge unit, a transmission system and a steering engine with tiller connection in the steering flat. In the wheel - house, a bowl supports the wheel shaft, the turning effort being transmitted via a pair of bevel gears, universally jointed tubular shafting and bevel boxes aft, to the steering engine.

OPERATION OF THE STEERING ENGINE

The manually operated shaft from the bridge is connected to a special bevel pinion carrying the hydraulic control mechanism and thence, via a crown wheel, to a large spur pinion and quadrant, the vertical shaft of which carries at its upper extremity a lever whose movements are transferred to the tiller by a pin - jointed connector. The arrangement incorporates a "sine-bar" linkage, designed to give virtually an increasing reduction ratio as full helm is approached, thus compensating to some considerable extent the increased rudder force and torque at large angles. A relatively small number of turns of the steering wheel is required, therefore, to move the rudder from amidships to hard-over, without the penalty of excessive effort at large rudder angles, say from 25 to 35 deg., being incurred.

The hydraulic servo-system operates as follows:- On the application of torque to the pinion on the input shaft, a springloaded nut meshing with a splined scroll, moves in a direction and to a position determined by the intensity and rotational direction of the turning effort. A lever is connected to the scroll through a ball thrust bearing and the resultant thrust operates a hydraulic reversing valve with which are associated ports communicating with a hydraulic articulating cylinder, the piston rod which is connected to the tiller lever. The manual reduction gearing, oil filter, reversing valve and cut-off valve are contained in the main casing which also forms the oil reservoir.

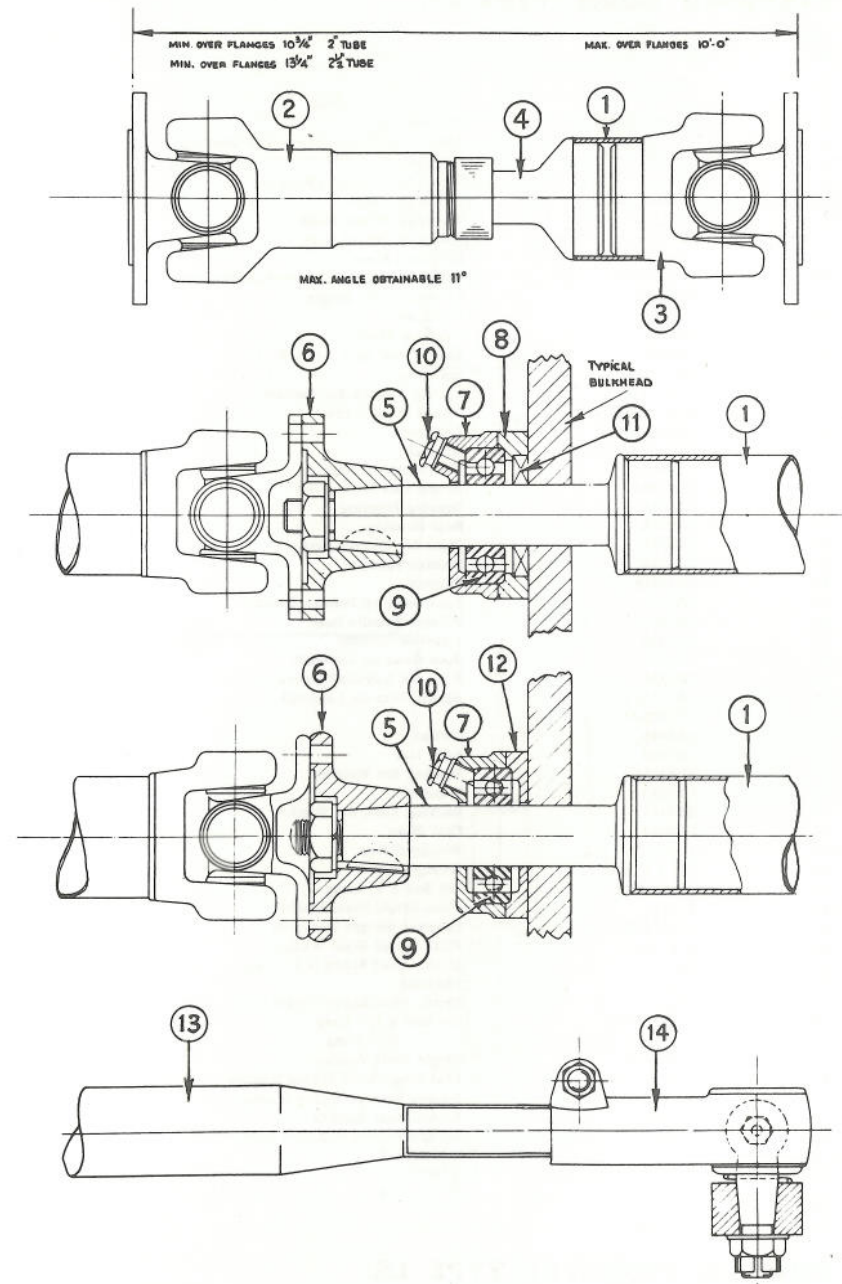
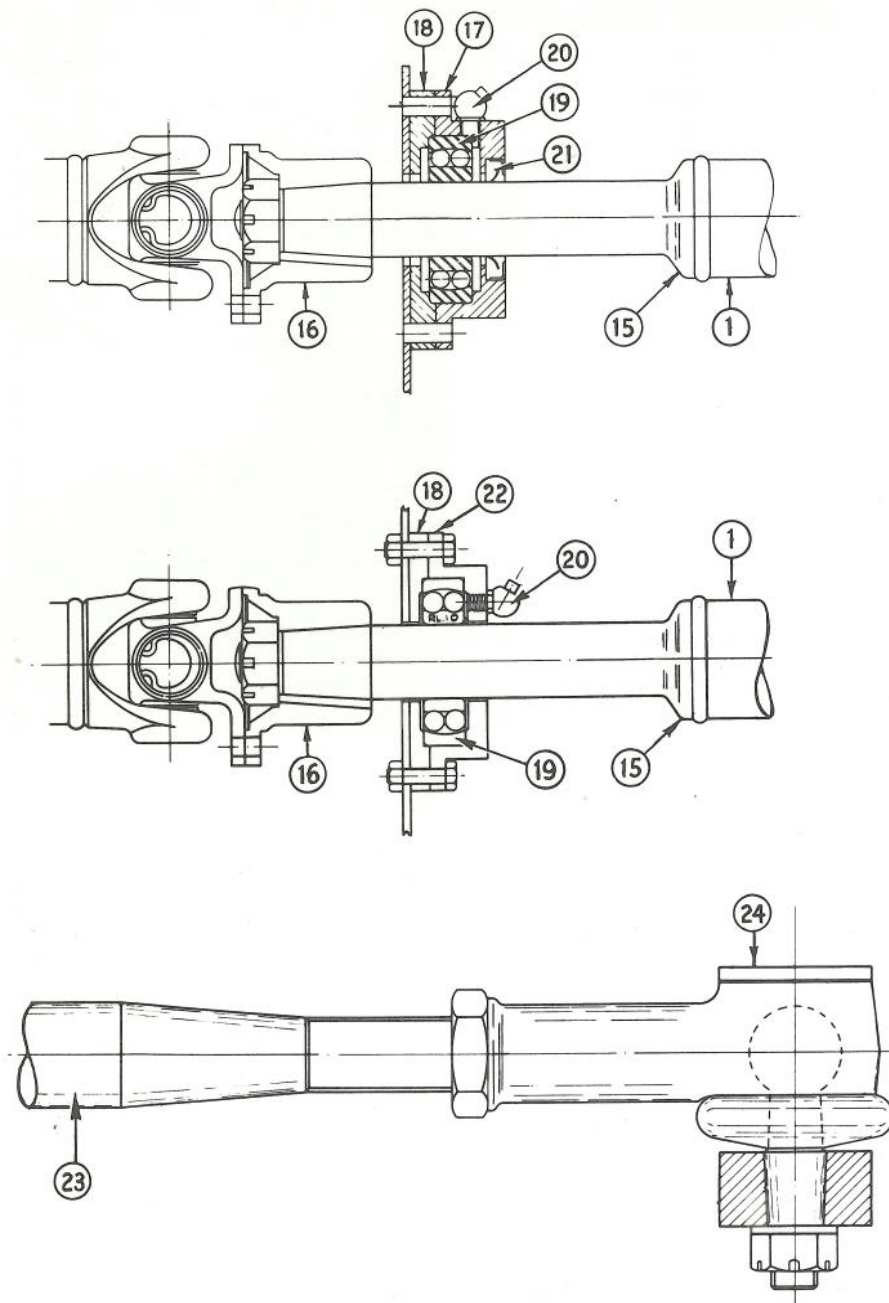
From the foregoing it will be seen that the pressure in the hydraulic system is dependent upon the rudder load and not a fixed pressure determined by a relief valve. This is a very important point, as during normal progress of a ship, steering is usually confined to tiller movements of under 10 degrees aside, up to which point, the rudder loads are light and in consequence the hydraulic pressures required are slight. It follows, therefore, that the working temperature of the fluid will remain lower than with other types of steering gear where a high pressure is maintained.

SERVICE & MAINTENANCE

1. Steering Bowls are to be filled with oil to the level of the wheel shaft. This is done by removing the bowl lid which exposes a plug in the pointer carrier plate. Remove this plug and fill with SAE 30 oil. After filling, providing the oil seals are working properly the oil should remain in the container indefinitely.
2. Bevel Boxes XL type must be packed with a soft grease and should only require checking once a year. If extra grease is required a plug is located on the side of the Bevel Box. LS and ES type Bevel Boxes which are also used in the LPS system are to be filled with SAE 30 oil. These also only require limited attention providing the oil seals are doing their work properly.
3. The XL Aft End Reduction Gear Box is filled with a soft grease, checked once a year and replenished as required, through the plug hole provided. The LS, NAE and ES Aft End Reduction Gear Boxes are to be filled with SAE 30 oil and should be checked once every six months and replenished as necessary. It also applies if the oil seals are operating properly - the oil level should remain constant.
4. The LPS Aft End Reduction Gear Box should be filled with TELUS 27, the same oil is used in the electrical hydraulic pump unit and hydraulic ram. As these items are in the hydraulics circuit a total of approximately 10 gallons is required to fill the steering system.
5. The Universal joints, ball joints, bulkhead bearings are loaded with soft grease. These should be checked every six months and given a shot with a grease gun as required.
6. After initial installation, no maintenance is required other than six monthly visual inspection to ascertain that all oil seals are free from leaks. No adjustment is required providing the steering gear has not been damaged.

SHAFTS & BEARINGS TYPE LS & ES.

Item No.	Part No.	Description	Qty. fitted
1	2" dia	Tube	1
2	1110 series	Sliding Universal Joint	1
3	1110 series	Fixed Universal Joint	1
4	1110 series	Stub Shaft (splined)	1
5	LS406A	Blk. Hd. Shaft	1
6	LS504A	Companion Flange	1
7	LS409A	Bearing Housing	1
8	LS397A	Seal Housing	1
9	RL8	Bearing	1
10	5/16" BSF	Grease Nipple	1
11	W200100025	Gland (oil seal)	1
12	LS410A	Bearing Cap	1
13	LS41A	Drag Link Shaft	1
14	J2631	Ball Joint End	2
15	ES1230A	Blk. Hd. Shaft	1
16	ES3261A	Companion Flange	1
17	ES5245A	Bearing Housing	1
18	ES1067A	Bearing Cap	1
19	RL10	Bearing	1
20	1/4" BSF	Grease Nipple	1
21	W200125031	Gland (oil seal)	1
22	ES1066A	Bearing Housing	1
23	1 3/4" dia	Drag Link Shaft 1 1/4" thread	1
24	J2280	Ball Joint End	2



STEERING BOWL TYPE LS.

Item No.	Part No.	Description	Qty. fitted
1	LS325C	Bowl Casing	1
2	LS404A	Steering Wheel Shaft	1
3	1 3/8"x2 1/2"x 1/2"	Oilseal	1
4	1 1/8" x 2 1/2" x 5/8"	Single Row Deep Groove Ball Bearing	1
5	LS335A	Distance Piece	1
6	LS305A	Bevel Pinion ALT LS110 1:1	1
7	LS336A	Distance Piece	2
8	LS337A/1	Worm on Wheel Shaft	1
8	LS337A/2	Worm on Wheel Shaft	1
9	LS338A	Distance Piece	1
10	1"x2 1/2"x5/8"	Single Row Deep Groove Ball Bearing	3
11	5/8" BSF	Locknut M.S. Bright	1
12	LS108A	End Cap	1
13	LS101A	Vertical Shaft	1
14	LS306A	Bevel Gear ALT. LS.110. 1:1	1
15	1/8" dia	Split Pin	2
16	5/16" dia	Spring Washer Sq. Section	10
17	3/16" Whit. x 1/2"	Round Head Screw	3
18	LS341A	Locknut	1
19	7/8"x 1 3/8"x 3/8"	Oilseal	1
20	LS405A	Companion Flange	1
21	5/8" BSF	Bright Hex Slotted Nut	1
22	LS319A	Bearing Housing	1
23	LS107A	Seal Housing	1
24	LS313A	Plate for Pointer Gear	1
25	LS329A	Pointer Spindle	1
26	ES3107A	Pointer	1
27	LS304A	Spur Gear on Pointer Spindle	1
28	LS328A	Pointer Spindle Bush	1
29	LS330A	Layshaft Spindle	1
30	LS331A	Spur Gear on Layshaft	1
31	LS332A	Boss for Layshaft Gears	1
32	LS333A/1	Spiral Gear on Layshaft	1
32	LS333A/2	" " " "	1
33	LS334A	Collar	1
34	LS314B	Bowl Lid	1
35	ES4735A	Washer for Window	1
36	ES703A	Window	1
37	ES3417	Backing Plate for Window	1
38	ES3083	Dial Plate	1
39	1 1/8" dia. x 1/4"	Woodruff Key	3
40	1 3/4" x 1/4" x 1/4"	Straight Key	1
41	1/4" dia. Whit	Set Bolt x 1" Long	4
42	1/4" dia.	Plain Bright Steel Washer	4
43	5/16" BSF	Locknut (Bright Hexagon)	2
44	5/8" dia.	Plain Bright Steel Washer	1
45	2BA	C/sk. Head Screw x 1/2" Long	7
46	2BA	Locknut	7
47	4BA	C/sk. Head Screw 3/16" Long	3
48	1/2" dia. Whit.	Set Bolt x 1 1/4" Long	1
49	5/16" dia. Whit.	" " x 1" Long	8
50	5/16" dia.	Bright Steel Washer	8
51	5/8" dia.	Flat Single Coil Spring Washer	1
52	1/2" dia.	Square Section Spring Washer	1
53	LS681A	Bright Steel Washer	1
54	1/4" dia.	Square Section Spring Washer	4
55		See Item 7	
56	3/16" Whit x 1/2"	C/sk Screw	4
57	1/4" BSP	Filler Plug	1
58	1/4" BSP	Washer	1
59	ES3106A	Washer	1

BOWL & PEDESTAL TYPE LS.

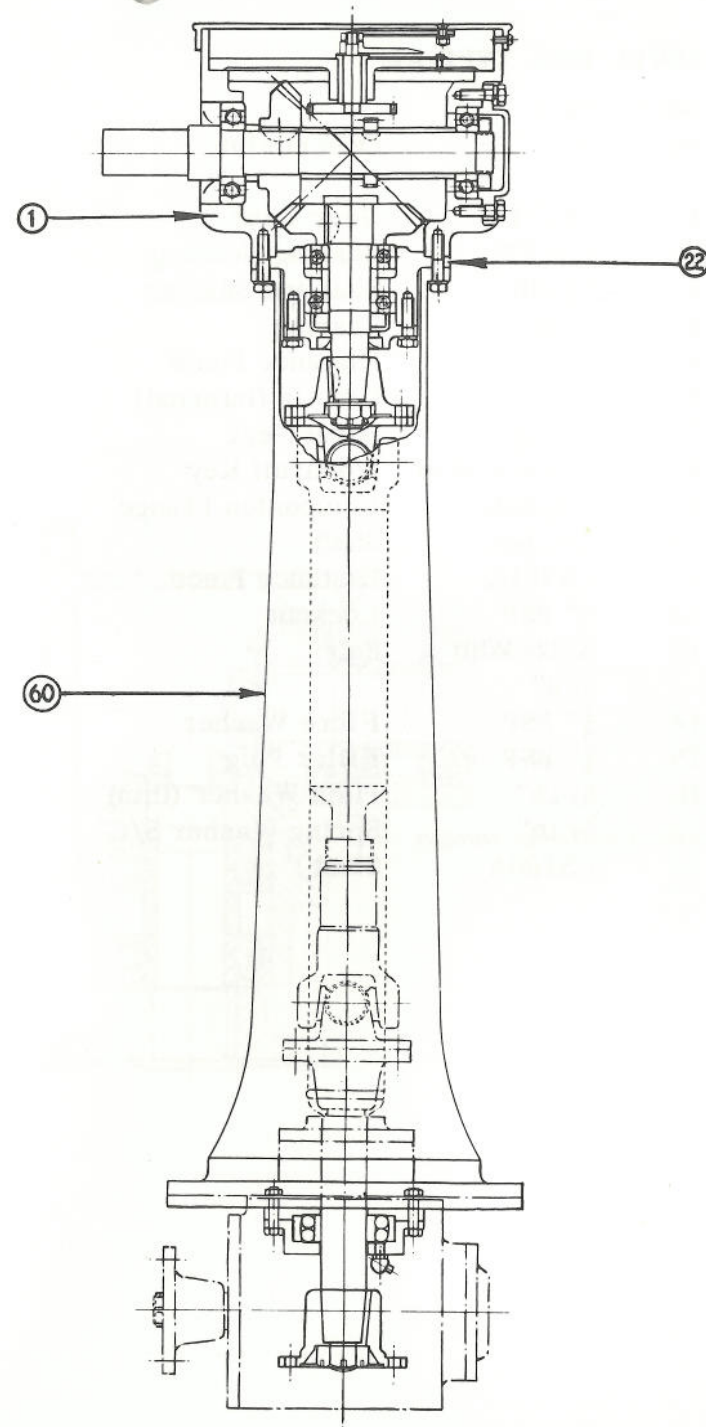
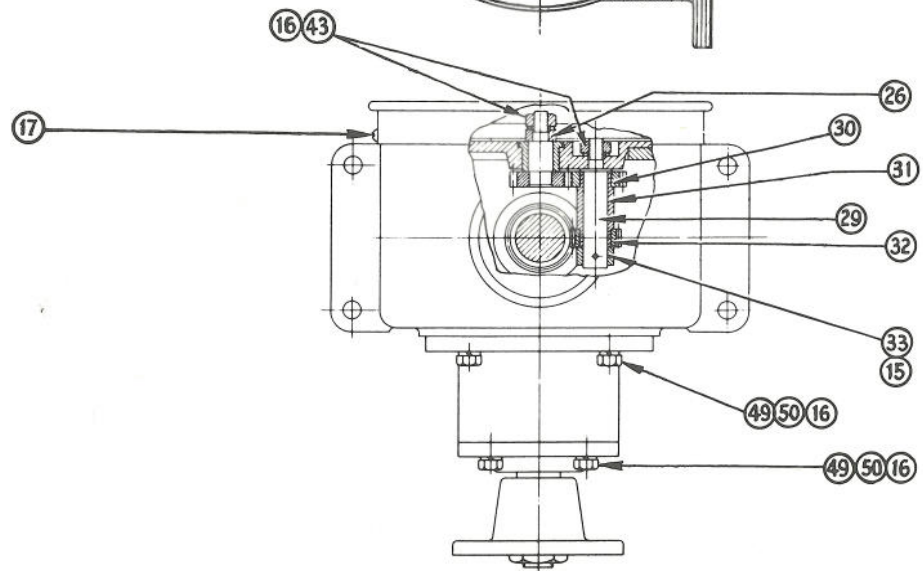
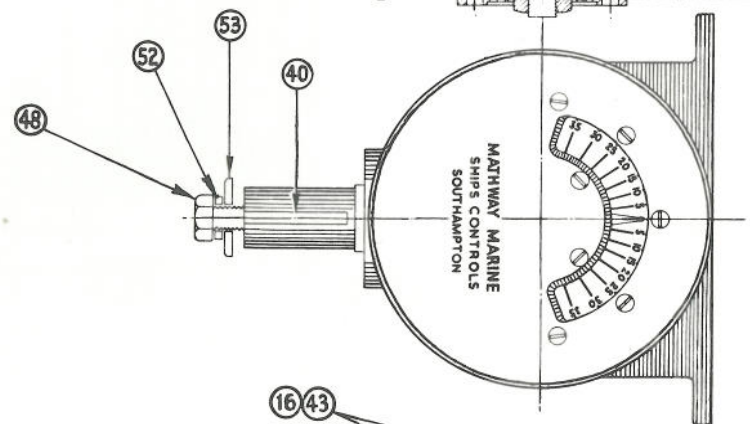
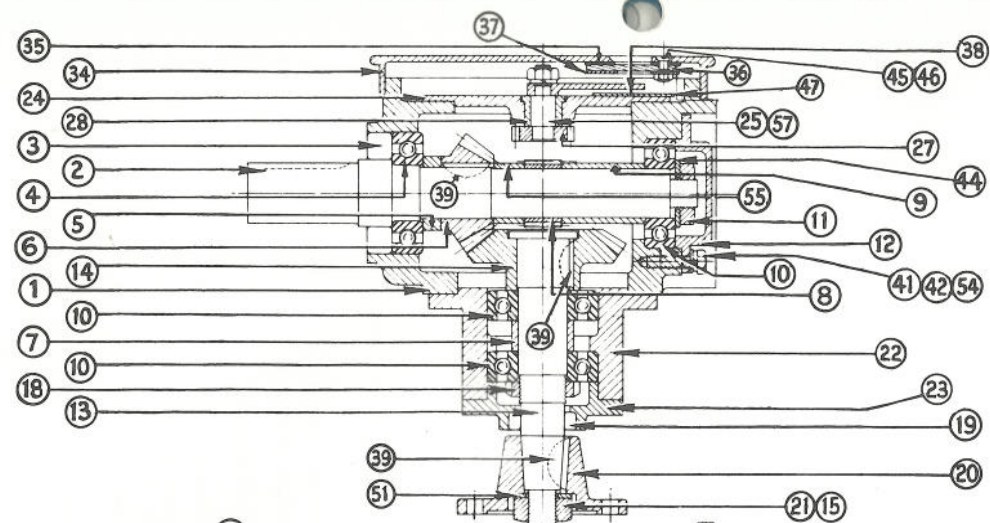
1	LS401C	Bowl Case	1
22	LS669A	Bearing Housing	1
60	ES4728F	Pedestal	1

STEERING BOWL TYPE ES.

Item No.	Part No.	Description	Qty. fitted
1	ES4736C	Bowl Casing	1
2	ES4730A	Steering Wheel Shaft	1
3	W27515050R4	Oil Seal	1
4	LS12	Bearing	1
5	ES4731A	Distance Piece	1
6	ES3406A	Bevel Pinion	2
7	ES4807A	Distance Piece	1
8	ES5318A/1	Worm on Wheel Shaft	1
8	N/A		
9	ES4732A	Distance Piece	1
10	LS11	Bearing	3
11	ES4804A	Locknut	2
12	LS8A	End Cap	1
13	ES4805A	Vertical Shaft	1
14		See Item 6	
15	1/8" x 1 1/2"	Split Pin	2
16	5/16"	Spring Washer S/C	18
17	3/16" Whit. x 1/2"	Round Hd. Screw	3
18		See Item 11	
19	W175100037R4	Oil Seal	1
20	LS504A	Companion Flange	1
21	5/8" BSF	Castle Nut	1
22	ES4806A	Bearing Housing	1
23	ES4808A	Seal Housing	1
24	ES3099A	Plate for Pointer Gear	1
25	ES3413A	Pointer Spindle	1
26	ES3107A	Pointer	1
27	ES3408A	Spur Gear on Pointer Sp.	1
28	ES3102A	Pointer Sp. Bush	1
29	ES3414A	Lay Shaft Spindle	1
30	ES3089A	Spur Gear on Lay Shaft	1
31	ES3089A	Boss for Lay Shaft Gears	1
32	ES3089A	Spiral Gear on Lay Shaft	1
33	ES3115A	Collar	1
34	ES3096A	Bowl Lid	1
35	ES4735A	Washer for Window	1
36	ES703A	Window	1
37	ES3417A	Backing Plate Window	1
38	ES3083A	Dial Plate	1
39	1 1/8" dia. x 1/4"	Woodruff Key	3
40	1 3/4" x 1/4" x 1 1/2"	Straight Key	1
41	5/16" Whit. x 1"	Set Bolt	18
42	5/16"	Plain Washer	18
43	5/16" BSF	Locknut	2
44	N/A		
45	2BA x 5/8"	C/S Hd.Screw	7
46	2BA	Locknut	7
47	4BA x 1/4"	C/S Hd.Screw	3
48	1/2" Whit x 1 1/4"	Set Bolt	1
49		See Item 41	
50		See Item 42	
51	5/8"	Spring Washer S/C	1
52	1/2"	Spring Washer S/C	1
53	LS681A	Plain Washer	1
54		See Item 16	
55	ES4733A	Distance Piece	1
56	N/A		
57	ES3106A	Washer	1
58	2BA x 5/8"	C/sk Screw	6
59	1/4" BSP	Filler Plug	1
60	1/4" BSP	Washer	1

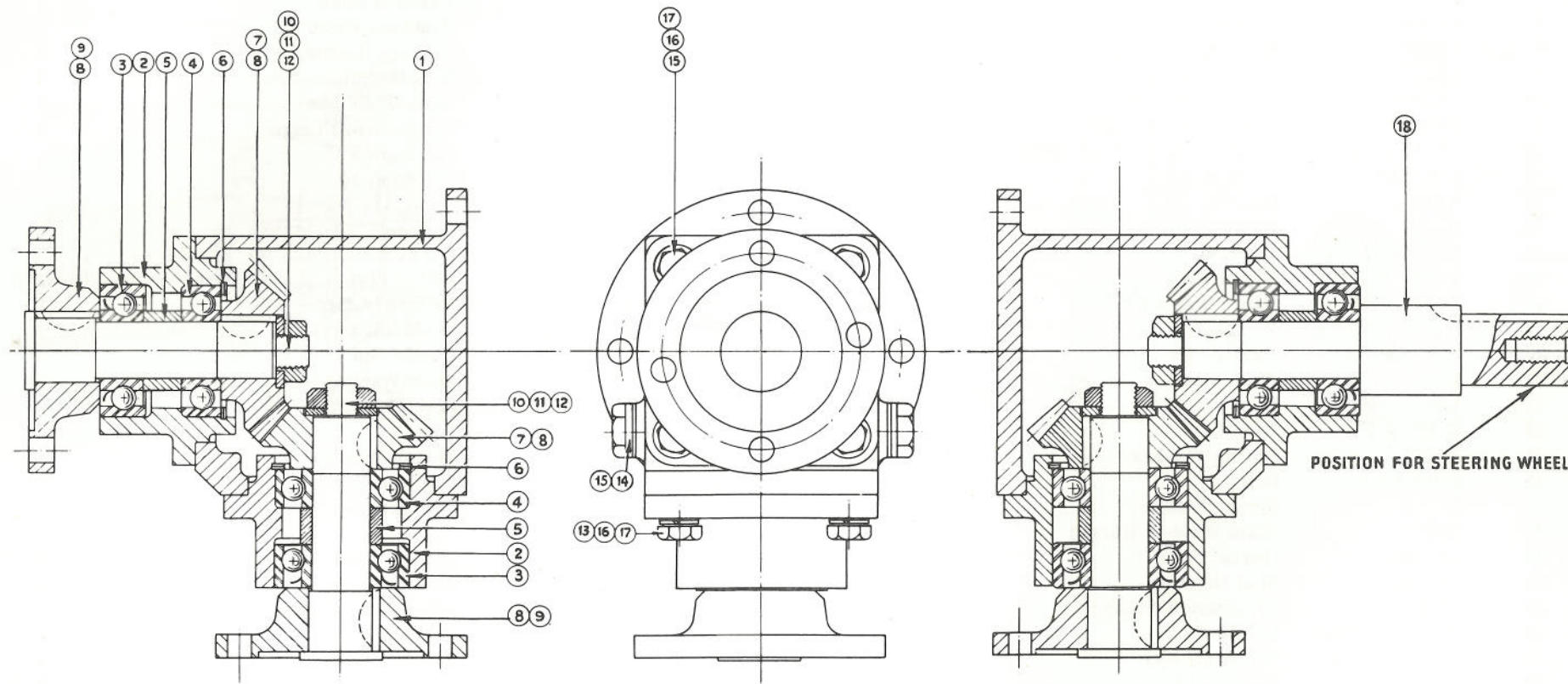
BOWL & PEDESTAL TYPE ES.

1	ES4727C	Bowl Case	1
60	ES4728F	Pedestal	1



BEVEL BOX TYPE XL.

Item No.	Part No.	Description	Qty. fitted
1	LS171B	Gear Case	1
2	LS172B	Bearing Housing	2
3	LJ20R	Seal and Bearing	2
4	LJ20	Bearing	2
5	LS175A	Distance Piece	2
6	47mm	Circlip (internal)	2
7	LS173A	Bevel Gear	2
8	$\frac{3}{4}$ " dia x 3/16"	Woodruff Key	4
9	LS182A	Companion Flange	2
10	LS174A	Shaft	2
11	LS181A	Distance Piece	2
12	$\frac{1}{2}$ " BSF	Locknut	2
13	5/16" Whit x 7/8"	Bolt	8
14	$\frac{1}{4}$ " BSP	Fibre Washer	2
15	$\frac{1}{4}$ " BSP	Filler Plug	2
16	5/16"	Plain Washer (thin)	8
17	5/16"	Spring Washer S/C	8
18	LS180A	Shaft	1

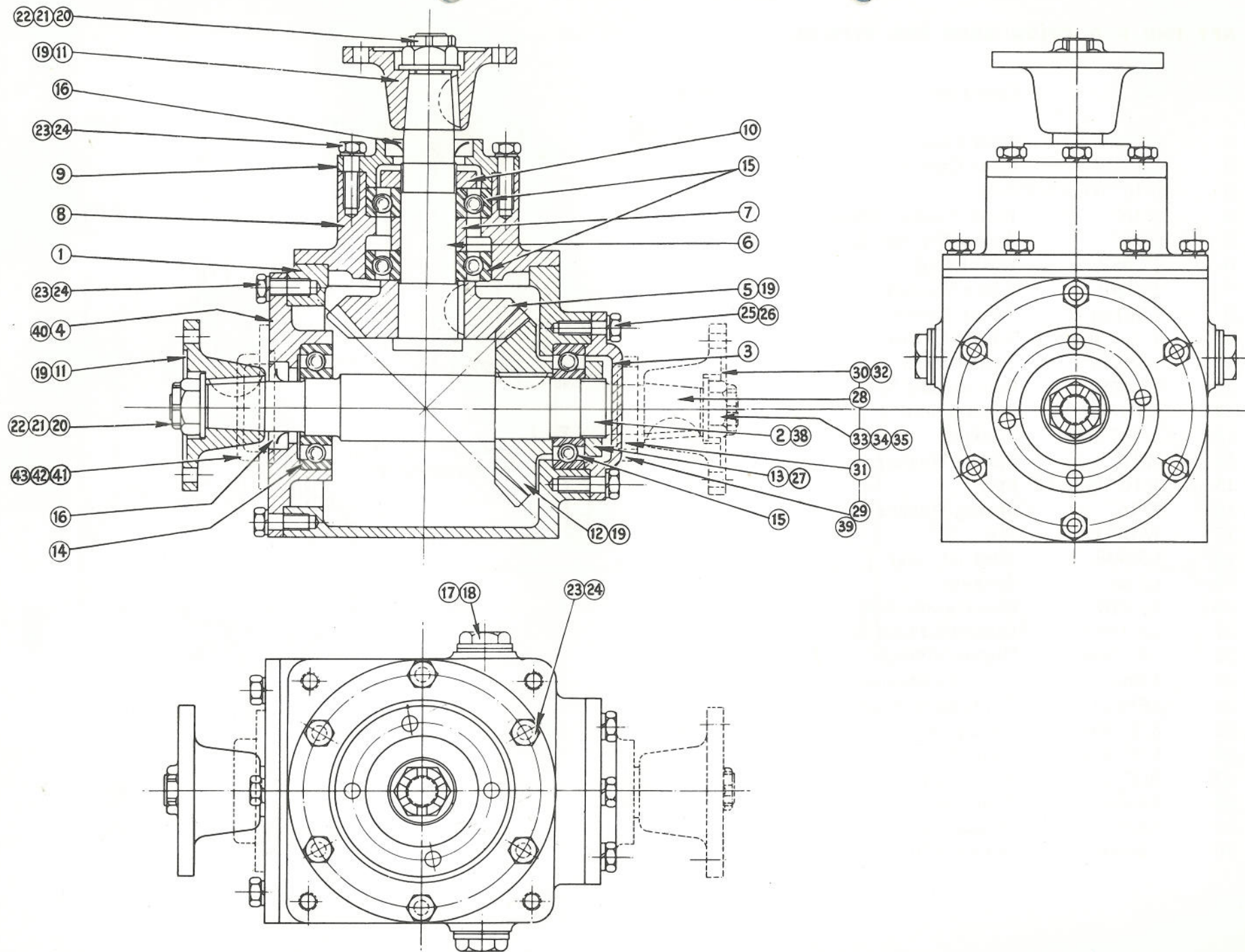


BEVEL BOX TYPE LS.

Item No.	Part No.	Description	Qty. fitted
1	LS111C	Gear Case	1
2	LS102A	Horiz. Shaft	1
3	LS108A	Bearing Cap	1
4	LS104A	Bearing Hsg.	1
5	LS110A	Bevel Gear ALT. LS306A 1½:1	12
6	LS101A	Vertical Shaft	1
7	LS105A	Distance Piece	1
8	LS319A	Bearing Housing	1
9	LS107A	Seal Housing	1
10	LS341A	Main Shaft Nut	1
11	LS405A	Companion Flange	1
12	LS110A	Bevel Gear ALT. LS 305A 1½:1	1
13	5/8" BSF	Lock Nut	1
14	RLS7	Bearing	1
15	RLS8	Bearing	3
16	W13708737R4	Oil Seal	2
17	½ BSP	Filler Plug	2
18	½ BSP	Fibre Washer	2
19	1 1/8" dia. x ¼"	Woodruff Key	4
20	5/8" BSF	Castle Nut	2
21	5/8"	Plain Washer	2
22	1/8" x 1½"	Split Pin	2
23	5/16" x 1"	Bolt	12
24	5/16"	Spring Washer	12
25	¼" Whit. x 1"	Bolt	4
26	¼"	Spring Washer	4
27	5/8"	Plain Washer (large)	1
28	LS112A	Horiz. Shaft	1
29	LS113A	Seal Housing	1
30	LS405A	Companion Flange	1
31	W137087037R4	Oil Seal	1
32	1 1/8" dia x ¼"	Woodruff Key	1
33	5/8" BSF	Castle Nut	1
34	5/8"	Plain Washer	1
35	1/8" x 1½"	Split Pin	1

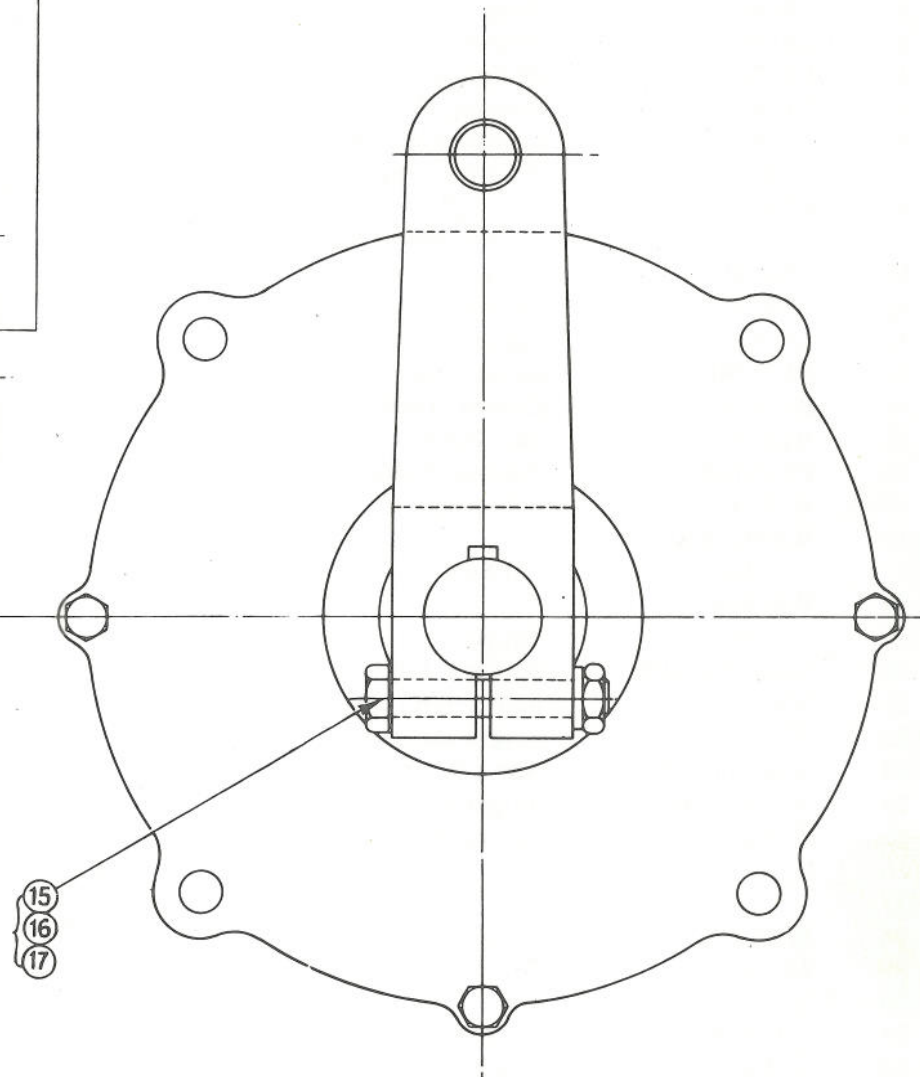
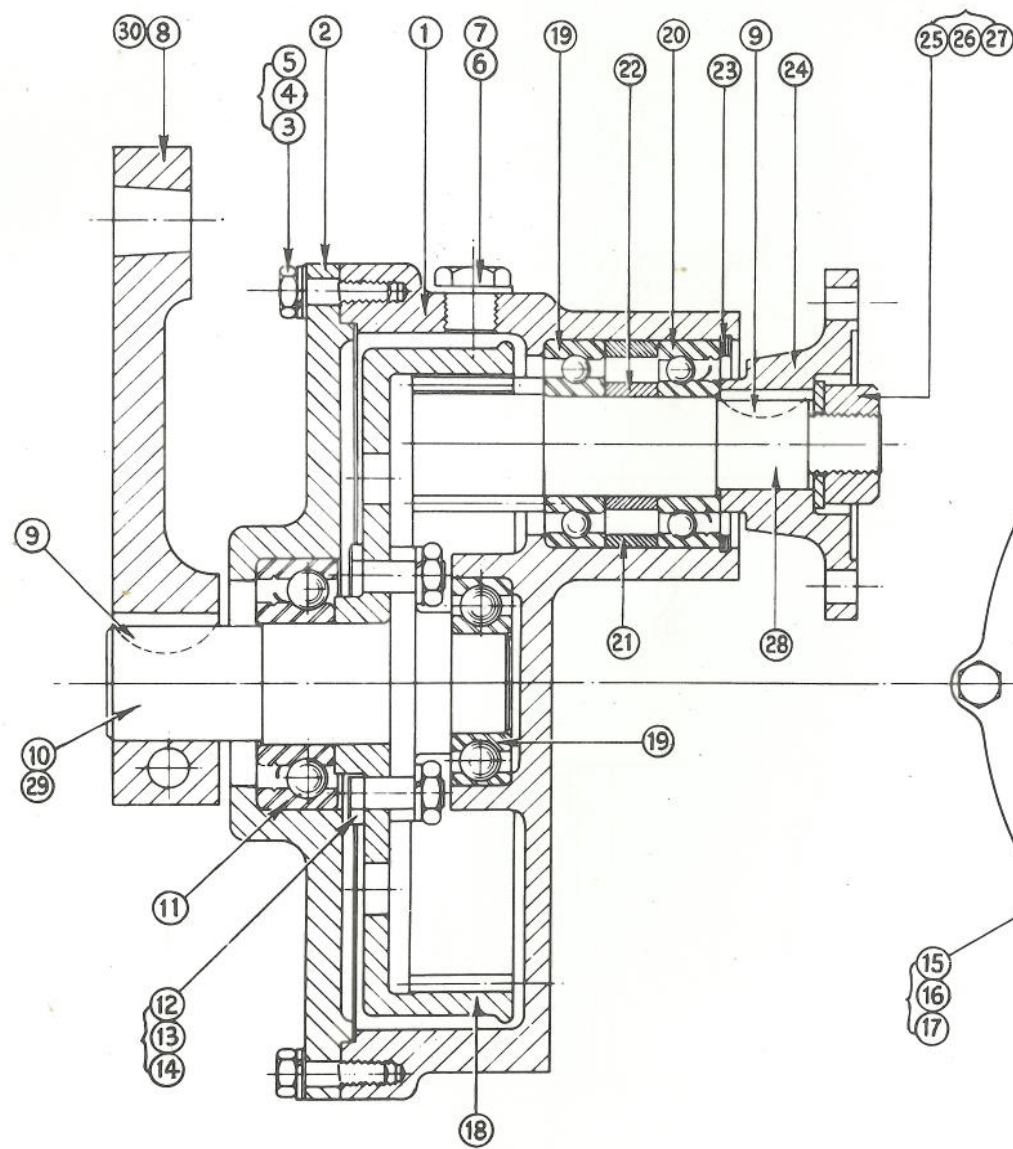
BEVEL BOX TYPE ES.

Item No.	Part No.	Description	Qty. fitted
1	ES4801C	Gear Case	1
2	ES4802A	Horiz. Shaft	1
3	LS8A	Bearing Cap	1
4	ES4803A	Bearing Hsg.	1
5	ES3406A	Bevel Gear	2
6	ES4805A	Vertical Shaft	1
7	ES4807A	Distance Piece	1
8	ES4806A	Bearing Housing	1
9	ES4808A	Seal Housing	1
10	ES4804A	Main Shaft Nut	2
11	LS504A	Companion Flange	2
12		See Item 5	
13		See Item 10	
14	N/A		
15	RLS9	Bearing	4
16	W175100037R4	Oil Seal	2
17	½ BSP	Filler Plug	2
18	½" BSP	Fibre Washer	2
19	1 1/8" dia x ¼"	Woodruff Key	4
20	5/8" BSF	Castle Nut	2
21	5/8"	Plain Washer	2
22	1/8" x 1½"	Split Pin	2
23	5/16" Whit x 1"	Bolt	24
24	5/16"	Spring Washer	24
25		See Item 23	
26		See Item 24	
27	N/A		
28	ES4811A	Horiz. Shaft	1
29	ES4810A	Seal Housing	1
30	LS504A	Companion Flange	1
31	W175100037R4	Oil Seal	1
32	1 1/8" dia x ¼"	Woodruff Key	1
33	5/8" BSF	Castle Nut	1
34	5/8"	Plain Washer	1
35	1/8" x 1½"	Split Pin	1
38	ES4809A	Horiz. Shaft	1
39	ES4810A	Seal Housing	1
40	ES4812A	Bearing Housing	1
41	LS108A	End Cap	1
42	¼" Whit. x ¾"	Bolts	4
43	¼"	Spring Washer	4



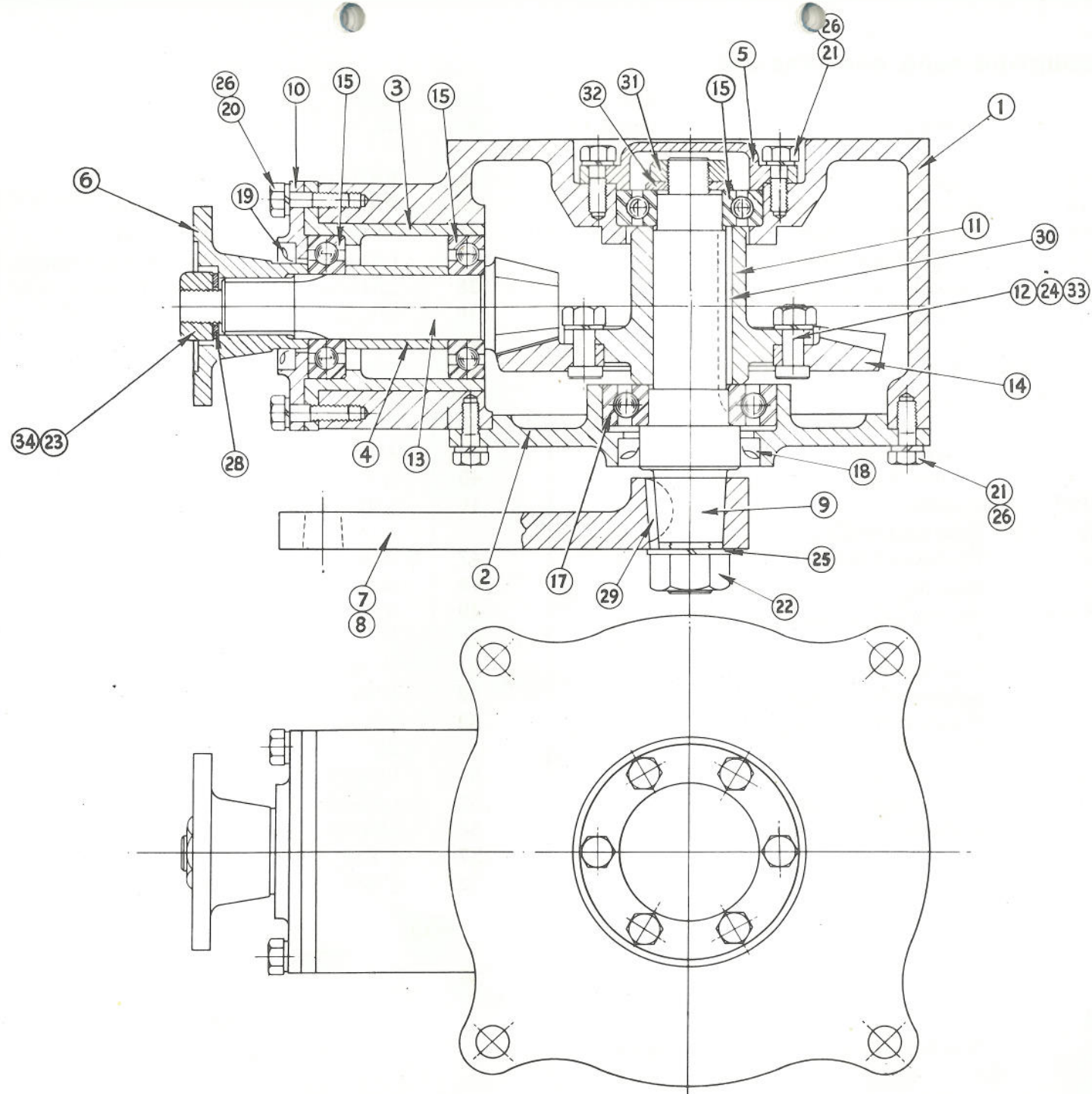
AFT END REDUCTION GEAR BOX TYPE XL.

Item No.	Part No.	Description	Qty. fitted
1	LS820B	Gear Case	1
2	LS821B	Gear Case Cover	1
3	5/16" Wh.x7/8"	Bolt	4
4	5/16"	Plain Washer (thin)	4
5	5/16"	Spring Washer S/C	4
6	1/4" BSP	Filler Plug	1
7	1/4" BSP	Fibre Washer	1
8	LS818A	Tiller Lever	1
9	1 1/8"dia x 1/4"	Woodruff Key	2
10	LS819A	Output Shaft	1
11	LJ 30R	Bearing and Seal	1
12	LS 188A	Special Bolt	6
13	5/16" BSF	Locknut	6
14	5/16"	Spring Washer	6
15	7/16"BSFx2 3/8"	Bolt	1
16	7/16"	Spring Washer	1
17	7/16" BSF	Nut	1
18	LS884B	Internal Gear	1
19	LJ 25	Bearing	2
20	LJ 25R	Bearing and Seal	1
21	LS 189A	Distance Piece	1
22	LS 176A	Distance Piece	1
23	52mm	Circlip (internal)	1
24	LS822A	Companion Flange	1
25	5/8" BSF	Castle Nut	1
26	1/8" x 1 1/4"	Split Pin	1
27	5/8"	Plain Washer	1
28	LS823	Pinion Shaft	1
29	LS687A	Output Shaft	1
30	LS686A	Output Flange	1



AFT END REDUCTION GEAR BOX TYPE LS.

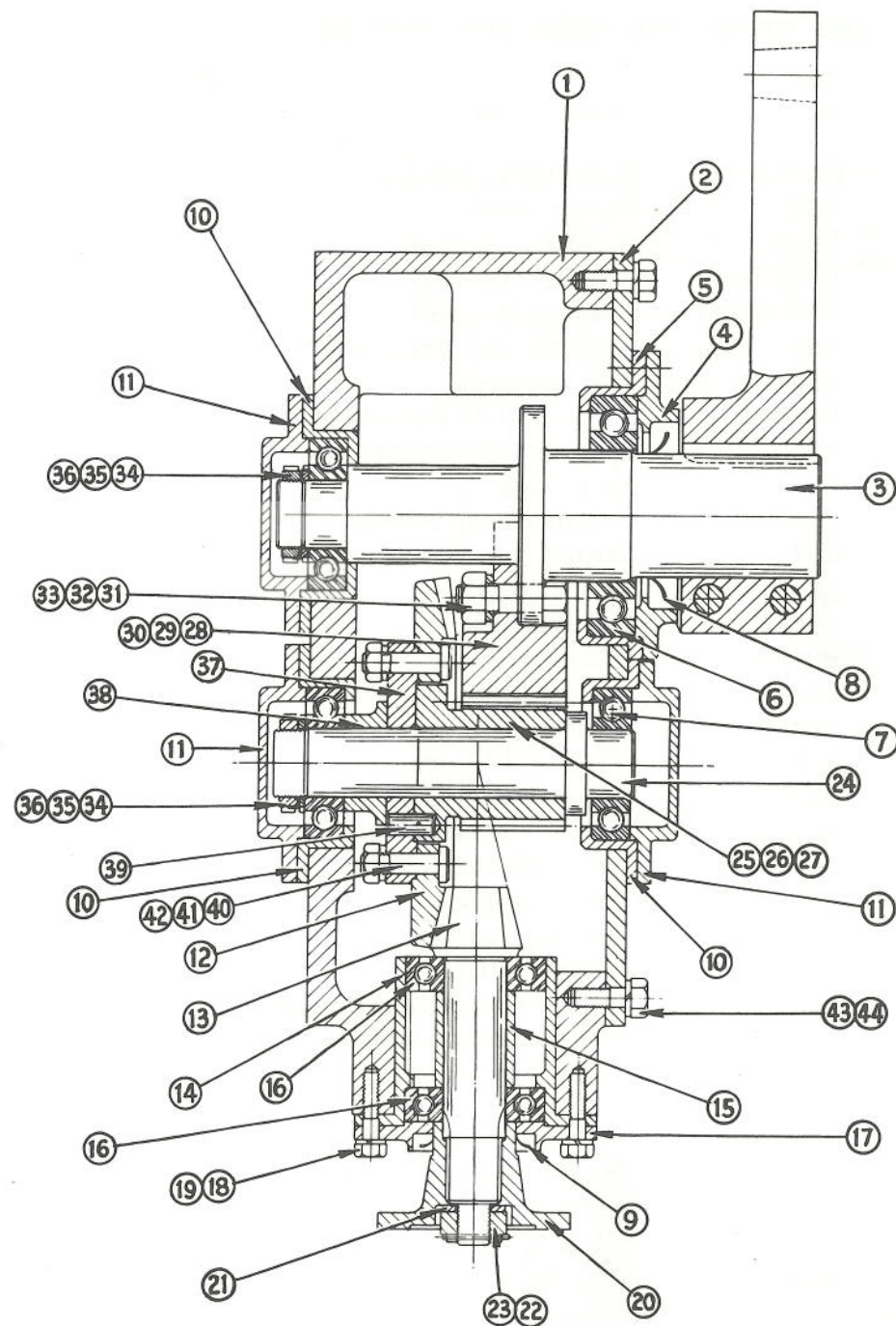
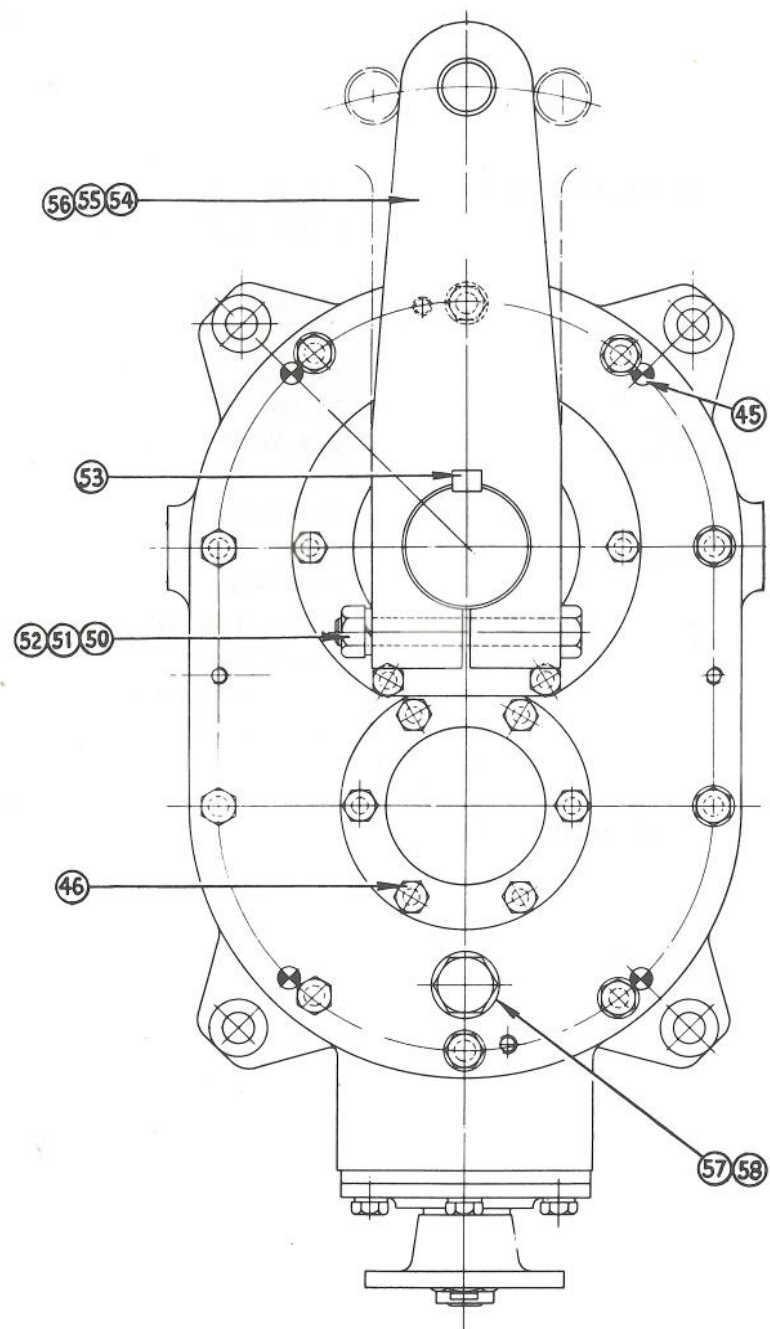
Item No.	Part No.	Description	Qty. fitted
1	LS 3C	Aft End Gear Case	1
2	LS 4C	Gear Case Cover	1
3	LS 6A	Bearing Housing	1
4	LS 7A	Distance Piece	1
5	LS 8A	Bearing Cover	1
6	LS14A	Companion Flange	1
7	LS27A	Tiller Lever	1
8	LS30A	" "	1
9	LS31A	Crown Wheel Spindle	1
10	ES4531A	Oil Seal Housing	1
11	LS52A	Crown Wheel Centre	1
12	LS15A	Special Bolt	8
13	RCWP48	Bevel Pinion	1
14	RCWP48	Crown Wheel	1
15	RLS 9	Ball Race	3
16	ES4532A	Splined Blank	1
17	RLS11	Ball Race	1
18	W25017550		
	R4	Oil Seal	1
19	W21915037		1
	R4	Oil Seal	1
20	5/16"dia.BSW	Bolt x 1 1/8" long	6
21	5/16"dia.BSW	Bolt x 7/8" long	12
22	3/4" dia. BSF	Bright Hex. Nut	1
23	5/8"dia.BSF	Nut x 9/16 thick	1
24	3/8"dia.BSF	Bright Hex. Nut	8
25	3/4"dia.	Spring Washer Sq. Section	1
26	5/16"dia.	" " " "	18
27			
28	5/8" dia.	Bright Steel Washer	1
29	No.809	Woodruff Key	1
30	1/4" x 1/4" x 2 3/4"	Key	1
31	3/4"dia.BSF	Locknut	1
32	3/4"dia.	Bright Steel Washer	1
33	3/8" dia.	Spring Washer Sq. Section	8
34	1/8" dia.	Split Pin x 1 1/2" long	1



AFT END REDUCTION GEAR BOX TYPE NAE.

Item No.	Part No.	Description	Qty. fitted
1	LS430F	Gear Case	1
2	LS431B	Gear Case Cover	1
3	LS439B	Final Drive Shaft	1
4	LS445A	Oil Seal Housing	1
5	LS444A	Bearing Housing (output)	1
6	6212	Bearing	1
7	RLS10	Bearing	3
8	W33722550R4	Oil Seal	1
9	W21915031R4	Oil Seal	1
10	LS443A	Bearing Housing	3
11	LS442A	Bearing Cap	3
12	RCWP48	Crown Wheel	1
13	RCWP48	Pinion	1
14	LS 6A	Bearing Housing	1
15	LS 7A	Distance Piece	1
16	RLS 9	Bearing	2
17	ES 4531A	Oil Seal Housing	1
18	5/16" x 1 3/8"	Bolt	18
19	5/16"	Washer Spring	30
20	LS14A	Companion Flange	1
21	5/8"	Washer Plain (std.)	1
22	1/8" x 1 1/2"	Split Pin	1
23	5/8" BSF	Castle Nut (9/16" thick)	1
24	LS449A	Crown Wheel Spindle	1
25	LS438A	Spur Gear 3 : 1 Ratio	1
26	LS436A	" " 2 : 1 "	1
27	LS434A	Spur Gear Segment 1.57 : 1	1
28	LS437A	" " " 3 : 1	1
29	LS435A	" " " 2 : 1	1
30	LS433A	" " " 1.57 : 1	1
31	1/2"BSF x 1 1/2"	Bolt	4
32	1/2"BSF	Nut	4
33	1/2"	Washer Spring	4

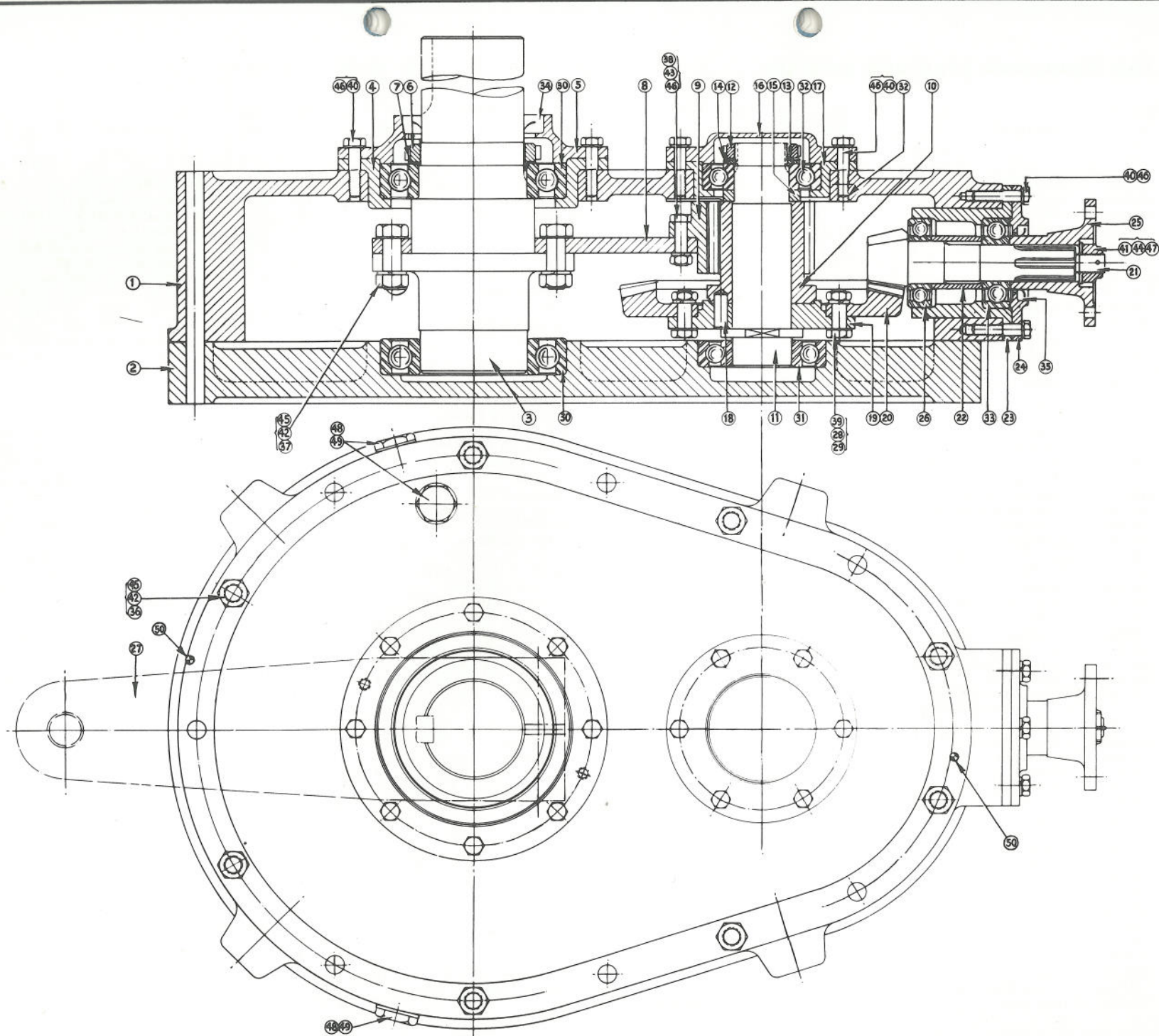
Item No.	Part No.	Description	Qty. fitted
34	RRD447A	Slotted Nut	2
35	RRD448A	Key Washer	2
36	RRD449A	Tab Washer	2
37	LS446A	Crown Wheel Centre	1
38	LS440A	Spacing Washer	1
39	3/8"diax7/8"	Dowel	6
40	LS16A	Bolt (special)	8
41	3/8 BSF	Nut	8
42	3/8"	Spring Washer	8
43	3/8" BSW x 1"	Bolt	10
44	3/8	Washer Spring	10
45	3/8"dia x 1"	Dowel	4
46	5/16"BSWx 1 1/8"	Bolt	12
47	N/A		
48	N/A		
49	N/A		
50	1/2"	Washer Plain (std.)	2
51	1/2" BSF	Nut	2
52	1/2"BSFx3 7/8"	Bolt	2
53	1/2"x 5/16" x 2 1/2"	Key	1
54	LS300B	Tiller Lever	
55	LS239B	Tiller Lever	
56	LS450B	Tiller Lever	1
57	1/2"BSP	Oil Filler Plug	3
58	1/2"BSP	Washer Plain	3



AFT END REDUCTION GEAR BOX TYPE ES.

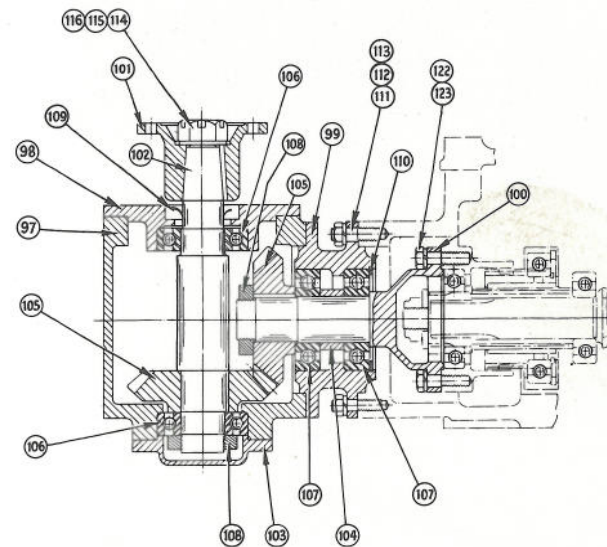
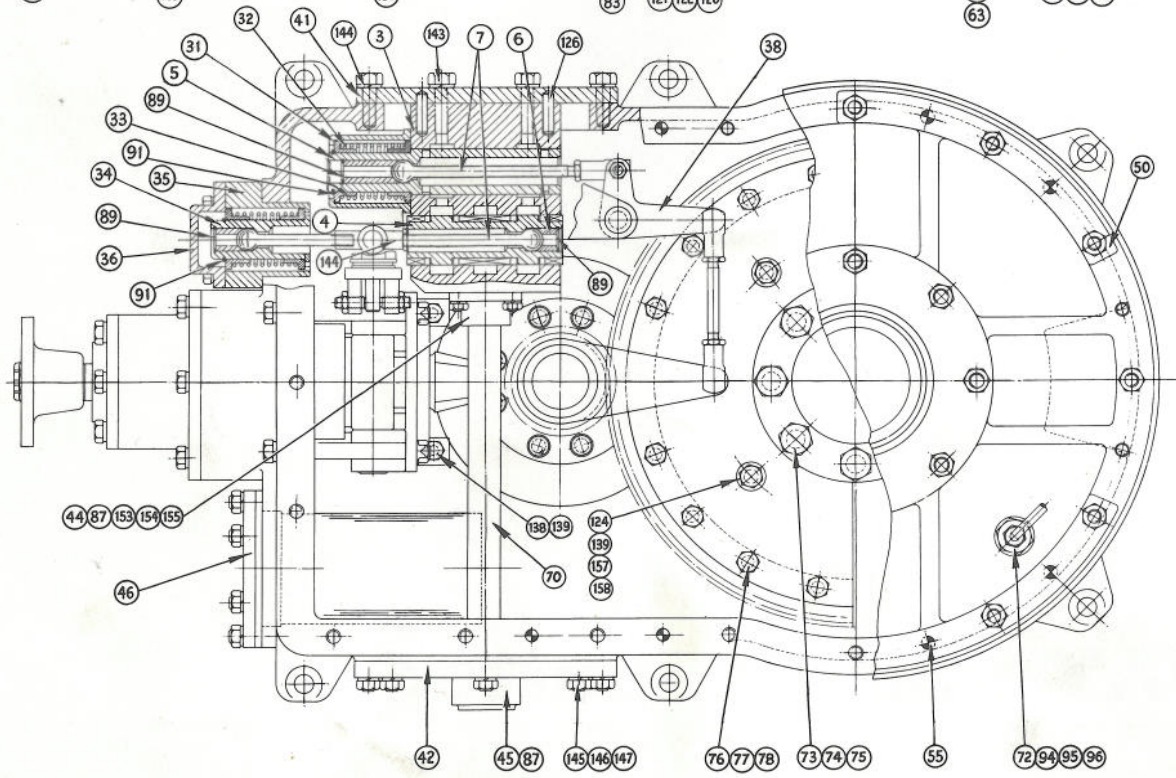
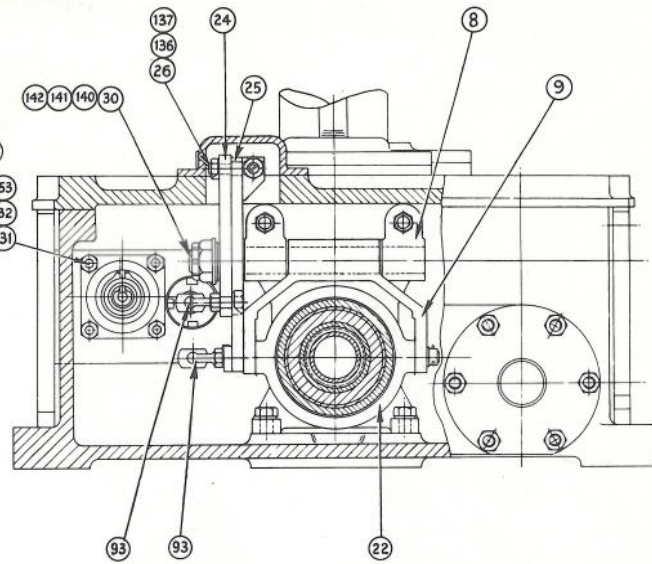
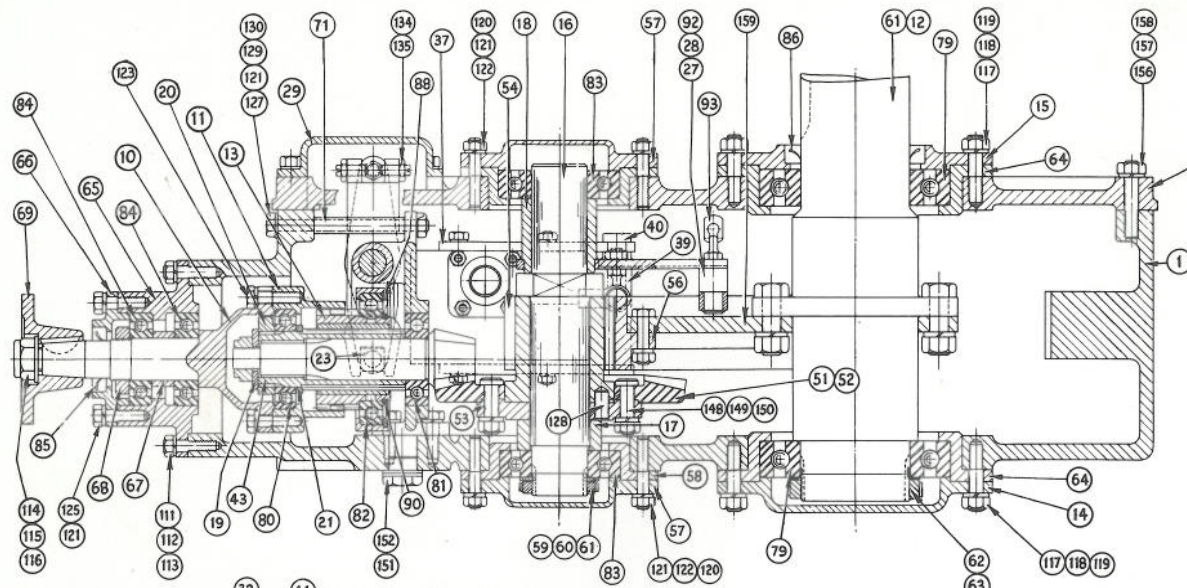
Item No.	Part No.	Description	Qty. fitted
1	ES4523F	Reduction Gear Casing	1
2	ES4512F	Casing Base	1
3	ES4701B	Final Drive Shaft	1
4	ES4703B	Bearing Housing	1
5	ES4702B	Bearing Retainer	1
6	ES4704A	Nut on Final Drive Shaft	1
7	ES4705A	Tab Washer	1
8	ES4708B	Support Plate Gear Segment	1
9	ES5057B	Spur Gear Segment	1
10	ES4515A	Spur Gear	1
11	ES4706A	Crown Wheel Spindle	1
12	CB127A	Slotted Nut	1
13	ES4831A	Tab Washer	1
14	ES4832A	Key Washer	1
15	ES4520A	Distance Piece	1
16	ES4707A	Bearing Retaining Cap	1
17	ES4505A	Bearing Housing	1
18	3/8" dia.	Dowel x 1" Long	3
19	ES4528A	Crown Wheel Centre	1
20	RCWP89A	Crown Wheel 43 Teeth 5 $\frac{1}{2}$ DP)	1
21	RCWP89A	Pinion (Bevel) 8 Teeth 5 $\frac{1}{2}$ DP)	1
22	ES4529A	Distance Piece	1
23	ES4530A	Bearing Housing	1
24	ES4531A	Seal Housing	1
25	ES4533A	Splined Companion Flange	1
26	6206	30mmx62mmx16mm Ball Race	1
27	ES4712C	Tiller Lever	1
28		3/8" B.S.F. Nut	8
29		3/8" dia. Spring Washer	8
30	6215	75mmx130mmx25mm Ball Race	2
31	RLS13	1 5/8" x 3 $\frac{1}{2}$ " x 3/4" Ball Race	1
32	LS13	1 $\frac{1}{2}$ " x 3 $\frac{1}{4}$ " x 3/4" " "	1
33	RMS8	1" x 2 $\frac{1}{2}$ " x 3/4" " "	1

Item No.	Part No.	Description	Qty. fitted
34	W38828150R4	Oil Seal 2 13/16" dia. x 3.88" x 1/2"	1
35	W21915031R4	Oil Seal 1 $\frac{1}{2}$ "dia. x 2 3/16" x 5/16"	1
36		Bolt 1/2"dia. x 6 $\frac{1}{4}$ " Plain Length	8
37		Bolt 1/2"dia. BSF x 7/8" Plain "	8
38		Bolt 5/16"dia. BSF x 7/8" Plain "	9
39		Bolt 3/8"dia. BSF x 3/4" Plain "	8
40		Bolt 5/16"dia. Whit x 1 3/8" Long	20
41		9/16"dia. Castle Nut	1
42		1/2"dia. BSF Nut	16
43		5/16"dia. BSF Nut	9
44		9/16"dia. Plain Washer	1
45		1/2"dia. Spring Washer	16
46		5/16"dia. Spring Washer	29
47		Split Pin (1/8"dia. x 1 $\frac{1}{2}$ ")	1
48		1/2" BSP Plug	3
49		1/2" BSP Alum. Washer	3
50		5/16"dia. x 1" L Dowel	2



AFT END REDUCTION GEAR BOX TYPE LPS.

Item No.	Part No.	Description	Qty. fitted	Item No.	Part No.	Description	Qty. fitted	Item No.	Part No.	Description	Qty. fitted
1	LPS129F	Gearbox Casing	1	55		Dowel 3/8" dia. x 1 5/8" long	8	109		Oil Seal 1" x 1 3/4" x 1/2"	1
2	LPS130F	Gearbox Cover	1	56	ES5057C	Spur Gear Segment	1	110		Circlip (internal) 2 3/4"	1
3	LPS244C	Reversing Valve Block	1	57	ES4707A	Bearing Retaining Cap	2	111		Stud 5/16" BSF x 1 5/16" Long	6
4	LPS247A	Control Valve	1	58	ES4505A	Bearing Housing	2	112		Nut 5/16" BSF Std.	6
5	LPS246A	Unloading Valve	1	59	CB127A	Slotted Nut	1	113		Spring Washer 5/16" Std.	6
6	LPS248A	Ball End Cap	1	60	LPS417A	Tab Washer	1	114		Castle Nut 5/8" BSF	1
7	LPS124A	Push Rod	2	61	LPS232C	Tiller Lever	1	115		Washer Plain 5/8" Std.	1
8	LPS125B	Bearing and Shaft Bracket	1	62	ES4704A	Nut Final Drive Shaft	1	116		Split Pin 1/8" x 1 1/2" Long	1
9	LPS126A	Operating Fork	1	63	ES4705A	Tab Washer	1	117		Stud 3/8" BSF x 1 3/4" Long	16
10	LPS127B	Input Shaft	1	64	ES4703B	Bearing Housing Main Shaft	2	118		Nut 3/8" BSF Std.	16
11	LPS128A	Scroll Carrier	1	65	ES4806A	Bearing Housing	1	119		Washer Spring 3/8" Std.	16
12	LPS131C	Final Drive Shaft	1	66	ES4808A	Seal Housing	1	120		Stud 5/16" BSF x 1 7/8" Long	16
13	LPS135A	Scroll Housing	1	67	ES4807A	Distance Piece	1	121		Nut 5/16" BSF	24
14	LPS136B	Bearing Cap	1	68	ES4804A	Nut	1	122		Washer Spring 5/16" Std.	16
15	LPS137B	Bearing Retainer	1	69	LS504A	Companion Flange	1	123		Bolt 5/16 BSF x 1 1/8 Long	6
16	LPS138A	Crown Wheel Spindle	1	70	LPS230A	Internal Supply Pipe 3/4" Borex	1	124	LPS393A	Stop	2
17	LPS139A	Distance Piece	1	71	LPS231A	Distance Tube	2	125		Bolt 5/16" BSF x 1 1/8" Long	6
18	LPS140A	Unloading Lever	1	72		Union Adaptor 1/2" x 1/8" BSP	1	126		Dowel 5/16 dia x 11/16" Long	2
19	LPS141A	Washer on Pinion Shaft	1	73		Bolt 1/2" BSF x 1 5/8" Long	8	127		Bolt 5/16" BSF x 4 1/8" Long	2
20	LPS142A	Driving Dog	1	74		Nut 1/2" BSF Steel	8	128		Dowel 3/8 dia x 13/16" Long	6
21	LPS143A	Spacing Ring (Pinion)	1	75		Washer (Spring) 1/2" Std.	8	129	KB7107	Washer Tab	2
22	LPS144A	Yoke and Bearing Housing	1	76		Bolt 5/16" BSF x 1 5/16" Long	9	130		Washer Plain	2
23	LPS145A	Fork Sliding Block	2	77		Nut 5/16" BSF Std.	9	131		Stud 1/4" BSF x 1" Long	4
24	LPS146A	Lever (Reversing Valve)	1	78		Washer 5/16" Std. Spring	9	132		Nut 1/4" BSF Std.	4
25	LPS147A	Lever (Centralising Spring)	1	79	SKF 6215	Ball Race 75 x 130 x 25mm	2	134		Grub Screw 5/16" BSF x 13/16" Long	2
26	LPS148A	Pin (Rev: Valve Lever)	1	80	RandMXLJ. 1 1/2	Ball Race 1 1/2" x 2 11/16" x 9/16"	1	135		Nut 5/16" BSF (Lock)	2
27	LPS149A	Spindle for Roller	1	81	SKFRLS9	Ball Race 1 1/8" x 2 1/2" x 5/8"	1	136		Nut 5/8" BSF Std.	1
28	LPS150A	Roller (unloading lever)	1	82	RandMXLJ. 2 1/4	Ball Race 2 1/4" x 3 9/16" x 5/8"	1	137	KB7107	Washer Tab	1
29	LPS399A	Cover	1	83	SKFRLS12	Ball Race 1 1/2" x 3 1/4" x 3/4"	2	138		Bolt 5/16 BSF x 1 1/8" Long	4
30	LPS152A	Shaft (operating fork)	1	84	SKFRLS9	Ball Race 1 1/8" x 2 1/2" x 5/8"	2	139		Bolt 3/8" BSF x 1 1/2" Long	2
31	LPS153A	Spring Housing	1	85		Oil Seal 1" x 1 3/4" x 3/8"	1	140		Castle Nut 5/8" BSF	1
32	LPS154B	Spring Unloading Valve	2	86		Oil Seal 2 15/16 x 3 3/4 x 1/2	1	141		Washer 5/8" Std.	1
33	LPS155A	Spring Guide	4	87	R129	'O' Ring (Gaco)	4	142		Split Pin 1/8" Dia x 1 1/2" Long	1
34	LPS156A	Control Spring Plunger	1	88	3 9/16"	Circlip (internal)	1	143		Bolt 5/16" BSF x 1" Long	8
35	LPS157A	Control Spring Housing	1	89	5/8"	Circlip (internal)	3	144	LPS421A	Amal Joint (non stop)	4
36	LPS158A	Control Spring Cover	1	90	2 1/4"	Circlip (external)	1	145		Stud 5/16" BSF x 1 5/16" Long	8
37	LPS245A	Support Plate	2	91	1 1/16"	Circlip (external)	2	146		Nut 5/16 BSF	8
38	LPS268A	Connecting Lever	1	92	1/2"	Circlip (external)	1	148	LPS392A	Special Bolt	8
39	LPS267A	Distance Piece	1	93	5/16" BSF	Amal Joint	4	149		Nut 3/8" BSF Std.	8
40	LPS269A	Shaft Unloading Lever	1	94	1/2" BSP	Alum Washer	1	150		Washer Spring 3/8 Std.	8
41	LPS242A	Mtg. Block (Valve Block)	1	95	1/8" BSP	Outer Sleeve	1	151		Drain Plug	1
42	LPS164A	Side Plate	1	96	1/8" BSP	Breather Pipe	1	152		Sealing Washer	1
43	LPS165B	Splined Scroll	1	97	ES4801C	Bevel Box Casing	1	153		Stud 1/4" BSF x 1" Long	8
44	LPS166A	'O' Ring Housing	1	98	ES4803A	Bearing Housing	1	154		Nut 1/4" BSF Std.	4
45	LPS167A	'O' Ring Housing (side plate)	1	99	LPS239B	Bearing Housing	1	155		Washer Spring 1/4" Std.	4
46	LPS168A	Assy. Filter Unit	1	100	LPS241B	Input Shaft	1	156		Stud 3/8 BSF x 2 1/8" Long	18
47	LPS169A	Filter Mounting Plate	1	101	LS504A	Companion Flange	1	157		Nut 3/8" BSF Std.	19
48	LPS170A	Filter Shroud Flange	1	102	ES4802A	Horizontal Shaft	1	158		Washer Spring 3/8 Std.	19
49	LPS171A	Filter Shroud	1	103	LS 8A	Bearing Loc. Cover	1	159	ES4708B	Supporting Plate for Gear Segment	1
50	LPS172A	Dowel Retaining Plate	4	104	LPS240A	Distance Piece	1				
51	RCWP48	Crown Wheel	1	105	ES3406A	Bevel Gear	2				
52	RCWP48	Pinion	1	106	SKFRLS9	Ball Bearing 1 1/8" x 2 1/2" x 5/8"	2				
53	LPS390A	Crown Wheel Ctr.	1	107	RLS10	Ball Bearing 1 1/4" x 2 3/4" x 11/16"	2				
54	LPS391A	Spur Gear	1	108	ES4804A	Nut	2				



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