



# WESTINGHOUSE

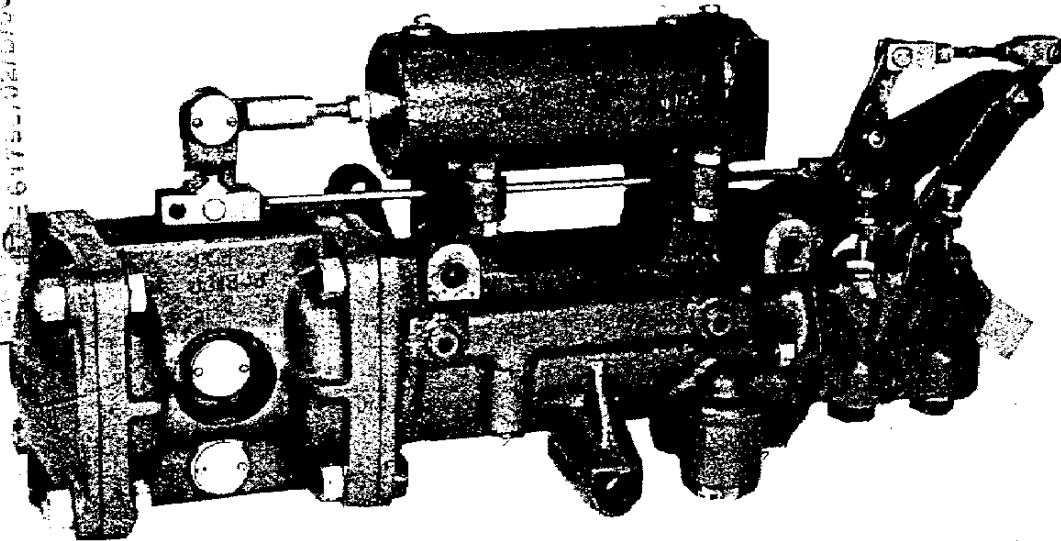


Marine and Industrial Controls Division

C56/1

Issue: 3

## WESTINGHOUSE "PNEUDYNE" POSITIONERS



A typical Pneudyne Positioner, Type B-2A

### SPECIAL FEATURES

A POWER CYLINDER WITH CONTROLLED VARIABLE STROKE -  
POSSESSING THE FOLLOWING CHARACTERISTICS:-

- \* Sensitivity with low hysteresis.
- \* Versatility in application - 3 standard types:-
  - Type B-2A - Fully retracted to fully extended.
  - Type B-2B - Fully extended to fully retracted.
  - Type B-2 - Mid position to fully extended and fully retracted.
- \* Conversion between the three versions a simple process.
- \* Precision in operation maintained over wide range of power rating requirements.
- \* Robust construction of mainly non-ferrous materials.
- \* Easily maintained - service and repair kits readily available.

**WESTINGHOUSE BRAKE AND SIGNAL CO., LTD.**

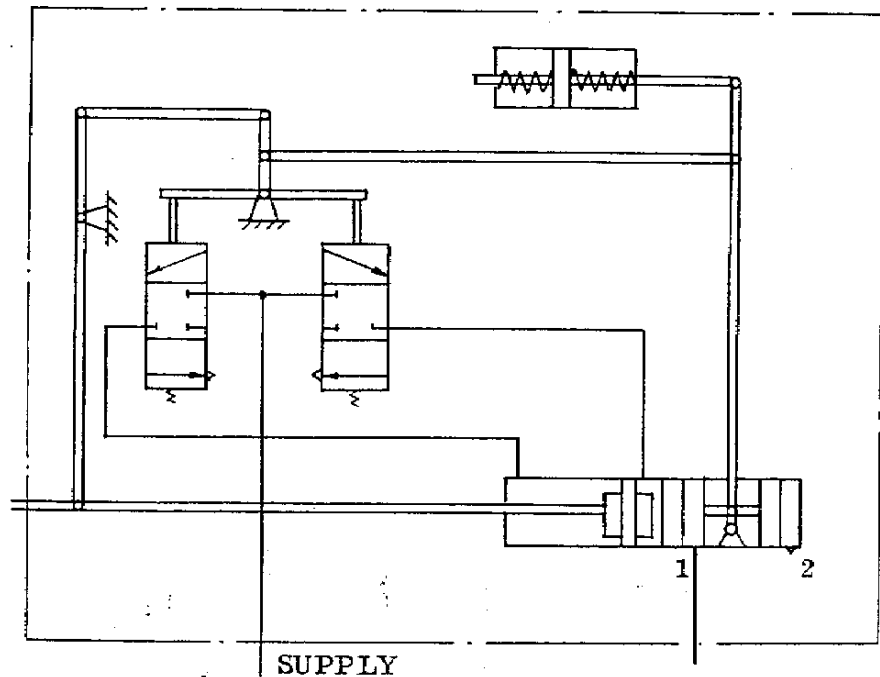
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CETOP SYMBOL :

TYPE B-2A PNEUDYNE



### PNEUDYNE POSITIONERS TYPES B-2, B-2A AND B-2B

#### INTRODUCTION

The Pneudyne Positioners have been designed to provide an accurate method of power positioning. For example for the remote positioning of governors on marine diesel engines.

The B-2 Pneudyne positioner is fundamentally a double-acting servo cylinder combined with control features to make possible the accurate positioning of the power piston and controlled by the differential air pressure between two control lines. The B-2A and B-2B Pneudyne Positioners require only one control line.

The control of the Pneudyne Positioner is most effectively governed by a suitable 'WESTINGHOUSE' Controlair valve providing a regulated pressure output signal to the diaphragm control portion of the Pneudyne.

#### THRUST/FORCE RATING

The Pneudyne Positioner is fundamentally a pneumatic power cylinder and capable of a thrust of 1,200 lb. (545 Kg.) in extending and 1,100 lb. (495 Kg.) retracting, assuming a power air supply of 100 p.s.i. (7.031 Kg/cm<sup>2</sup>). As a positioning device however, it can be expected to remain sensitive and to provide low hysteresis features when subjected to loads of up to 625 lb. (281 Kg.).

#### CONSTRUCTION

The robust construction of these positioners consist of 4 main sub-assemblies of which the body castings are brass.

The 4 sub-assemblies comprising the Pneudyne Positioner consist of the 4" dia. x 6" servo cylinder, the diaphragm control portion, the control spring and control valve portion which are interconnected by mechanical linkages. The servo cylinder forms the basis of the unit, the other portions being secured to it.

Diaphragms, seals etc. are synthetic rubber, resistant to mineral oils. These items normally renewed in the process of servicing, are accessible and available as Service Kits, please see page 8.

DATA - GENERAL CHARACTERISTICS

- INSTALLATION POSITION - may be mounted in any convenient position providing access to mechanical linkage.
- METHOD OF MOUNTING - 3 pairs of mounting pads each with a 17/32" dia. hole.
- TYPE OF CONNECTION - 2 tapped control ports in Diaphragm Control Portion, and 1 air supply port in cylinder body. Additionally two tappings are provided one at each end of the power cylinder. These are normally blanked but are available for test purposes or the fitting of test gauges as may be required.
- SIZE OF PORT CONNECTIONS - 1/4" B.S.P. (Parallel).

PNEUMATIC CHARACTERISTICS

- MEDIUM - Clean compressed air, dry or lubricated or inert gas.
- CONTROL OPERATING PRESSURE RANGE - 10-60 p.s.i. (0.70 - 4.22 Kg/cm<sup>2</sup>).
- POWER OPERATING MAXIMUM SUPPLY PRESSURE - 120 p.s.i. (8.5 Kg/cm<sup>2</sup>) max.

PRINCIPLE OF OPERATION (Types B-2, B-2A and B-2B)

The Pneudyne Positioner is controlled by the differential air pressure across two diaphragms linked to a spring loaded lever so that the movement of the lever is directly proportional to the pressure differential. The lever is connected through linkage to the valve operating lever and also to the power piston rod. Application of control air pressure thus operates the inlet and exhaust valves, admitting air pressure to one end of the power cylinder and exhausting the other end. The resulting movement of the power piston and rod returns the valve operating lever to the neutral position to terminate the stroke, the extent of which depends upon the control pressure applied.

The B-2 Pneudyne requires two variable pressure control connections (ports 1 and 2) and in normal operation one or other of these is at atmospheric pressure. A suitable valve to control the B-2 Pneudyne may be selected from the Type HC-2 series of Control-air Valves.

The B-2A Pneudyne requires one variable pressure control connection (port 2).

The B-2B Pneudyne requires one variable pressure control connection (port 1).

Suitable valves to control both the B-2A and B-2B Pneudynes may be selected from the H1, H2, H3, H4 and "fine control" ranges of Controlair Valves.

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PNEUDYNE POSITIONER - TYPE B-2

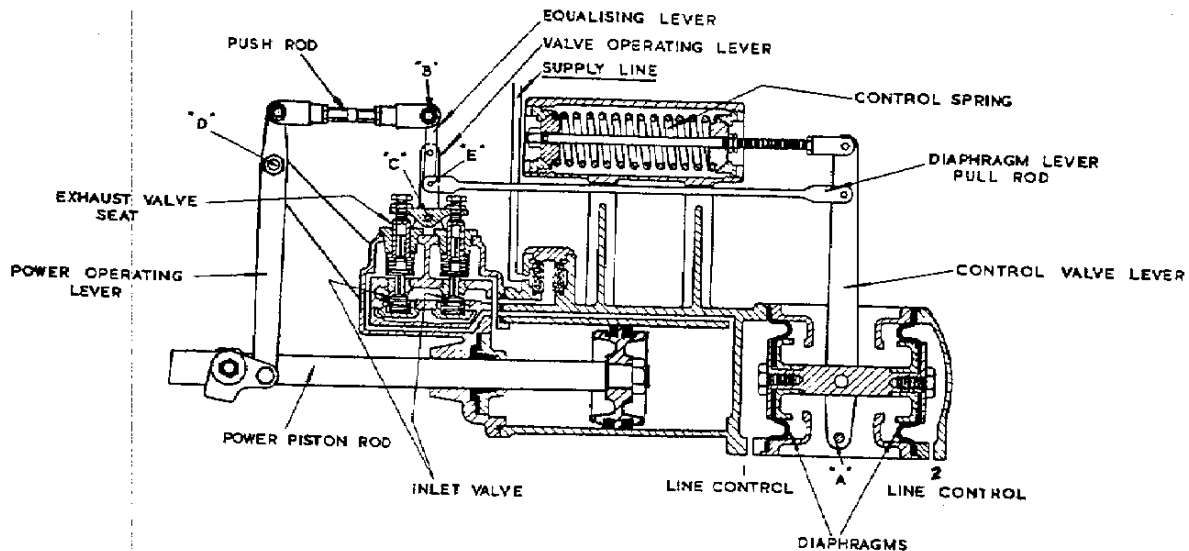


FIG.1. DIAGRAMMATIC

Detailed Operation - Type B-2

In the following detailed description, reference is made to the diagrammatic illustration fig.1. It is assumed that a Westinghouse Controlair valve is being used to effect operation of a particular circuit or unit.

When considering the operation of the Pneudyne Positioner, it is necessary to appreciate how the pivot or fulcrum points change depending on the stage of operation. The cycle of operations commences with the positioner in its mid or balanced position, with equal pressure (would normally be atmospheric) in control lines 1 and 2. The inlet and exhaust valve assemblies are arranged so that the exhaust from both ends of the double acting cylinder are closed, and both inlet valves permit a slow build up of supply pressure on both sides of the power piston. The control valve lever and the double acting power piston are in their mid-positions.

Operation of the Controlair valve causes a pressure differential to be created between control lines 1 and 2 and thus on the faces of the diaphragms. Assuming that line 1 has the higher pressure, the control valve lever, pivoted at "A", moves to the right against the action of the control spring. When the pressure differential across the diaphragms becomes balanced by the effort of the control spring, the movement of the control valve lever ceases. A greater pressure differential across the diaphragm results in a greater movement of the control lever - and so on until the limit of travel is reached. Thus it is seen that the lever movement, being spring loaded, is proportional to the pressure differential. Having moved the control valve lever to the right, the diaphragm lever pull rod causes the equalising lever to pivot about pin "B" (held stationary by the power piston rod and its linkage) with the result that the valve operating lever also pivots clockwise about shaft "C".

The clockwise movement of the valve operating lever presses the right hand exhaust valve seat downwards which in turn carries the right hand inlet valve further off its seat. This action has no effect on the air pressure supply from this inlet valve as it was already partially open in the neutral position. However, with the clockwise movement of the valve operating lever, the left hand exhaust valve seat rises allowing the left hand inlet valve to close and then the exhaust to open. Air from the right hand side of the piston can now discharge to atmos-

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phere, with the result that due to the pressure differential, the piston and rod move to the right.

It will now be seen that as the piston and rod move to the right the power operating lever is turned in an anti-clockwise direction about pin "D". This movement takes the push rod to the left and due to the diaphragm lever pull rod being held stationary by the control valve lever, the equalising lever now pivots about pin "E".

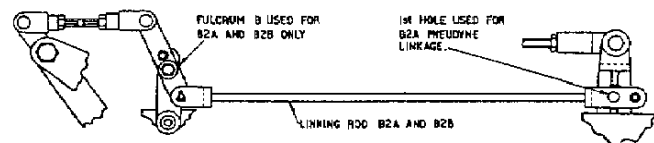
The valve operating lever is now moved back anti-clockwise towards its original position until the left hand exhaust valve closes. Depending on the load on the piston rod at this stage in the operation, the power piston may continue to move, thus slightly opening the left hand inlet valve until there is sufficient increase of pressure on the right hand side of the power piston to arrest its movement. The pressure on both faces of the power piston then equalises.

Alternatively, when the exhaust valve closes, the load on the piston rod may be sufficient to arrest its movement immediately. Thus the pressure differential between the two faces of the power piston is maintained and the inlet valve remains closed.

A similar sequence of events occurs in the reverse direction when the Controlair valve is moved to the other position; the pressure differential is then changed to make line 2 the higher pressure line.

#### B-2A Pneudyne Positioner

This type of positioner is similar in operation to the B-2 model. Control pressure is supplied through port 2, and port 1 is vented to atmosphere through a strainer plug. The piston is normally fully retracted and upon application of control line pressure, the piston moves out a distance proportional to the control pressure applied.

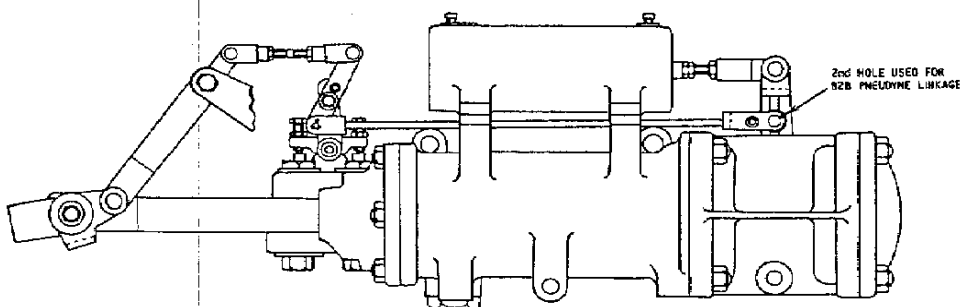


DIAGRAMMATIC  
LINKAGE ARRANGEMENT FOR TYPE B-2A  
(PISTON IN)

FIG. 2.

#### B-2B Pneudyne Positioner

This positioner is also similar in operation to the B-2 model. Control line pressure is supplied through port 1, and port 2 is vented to atmosphere through a strainer plug. The power piston is normally in the fully extended position and application of control line pressure causes the piston to retract.



DIAGRAMMATIC  
GENERAL ARRANGEMENT  
OF TYPE B-2B (PISTON  
OUT)

FIG. 3.

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ORDERING A PNEUDYNE POSITIONER

Enquiries for any specific application should include full details of the proposed installation and operating conditions.

WHEN ORDERING - please refer to the table below, select the Pneumdyne to suit your requirements, and quote part number and type.

ORDERING TABLE

Pt. No.	Type	Diaphragm Lever Pull Rod	Air Strainer J30266/1	Neutral position of Power Piston
U30302/1	B2	Pc.521430	Not required	Central
U30302/2	B2A	J31751/1	Fitted Port 1	Retracted
U30302/3	B2B	J31751/1	Fitted Port 2	Extended

INTERCHANGE ABILITY - CONVERSION BETWEEN TYPES

From the parts list and exploded view of pages 12, 13 and 14 it will be observed that the parts contained in three types of Pneumdyne Positioner described in this pamphlet are almost entirely interchangeable.

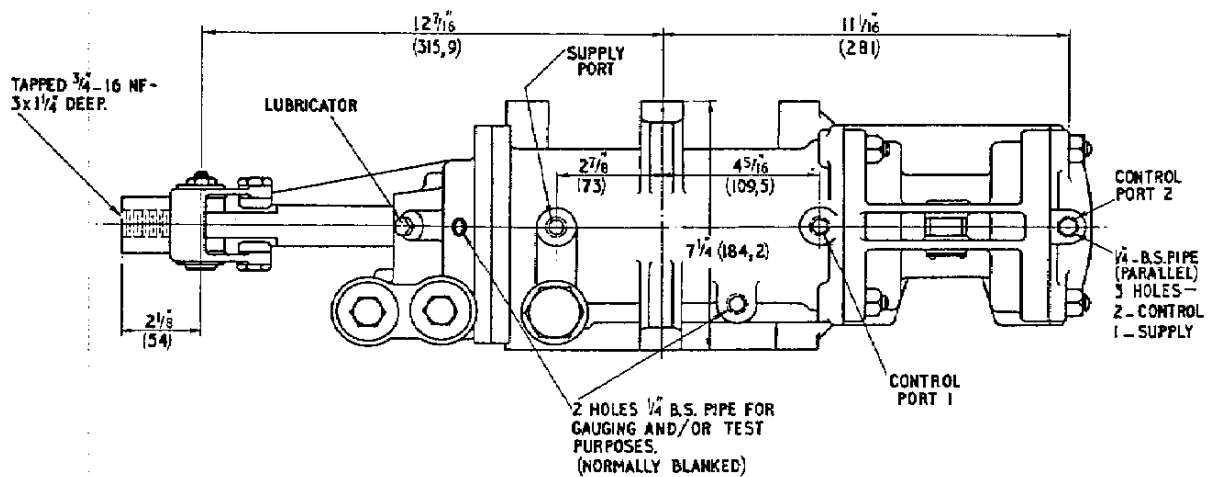
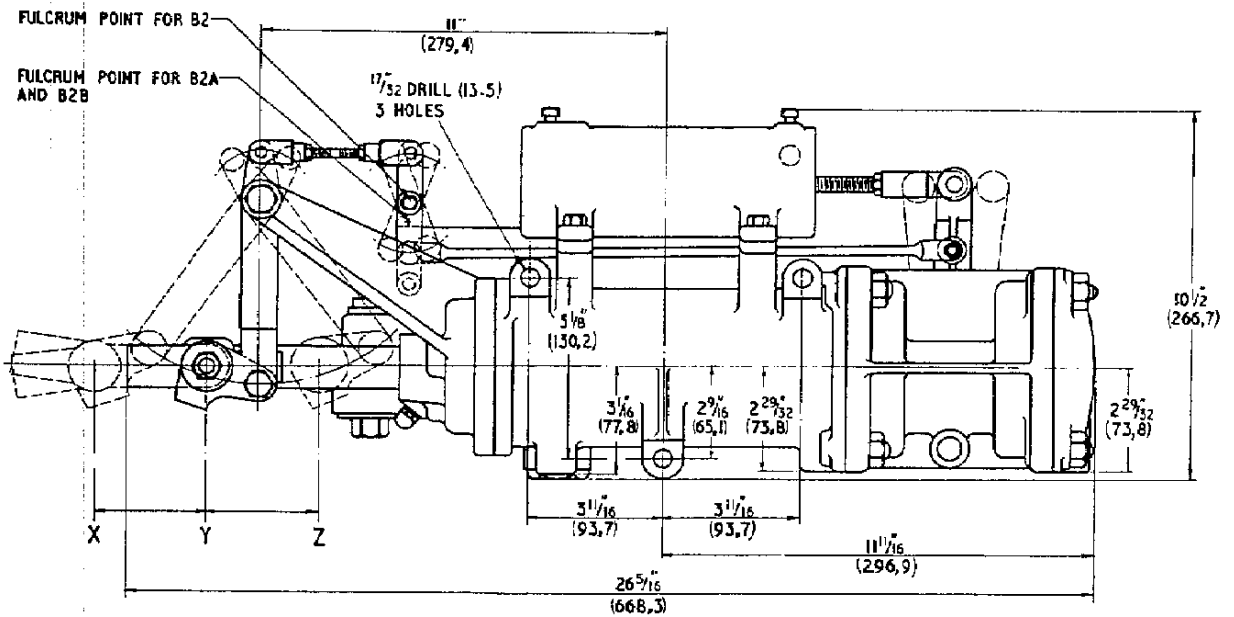
Diaphragm lever pull rod (Ref. No. 103) part number 521430 for type B2, and part number J31751/1 for types B2A and B2B are the only items not common to all three.

This feature renders conversion between types a simple matter - thus:-

To convert from type B-2 to B-2A and B-2B - replace diaphragm lever pull rod part number 521430 by rod part number J31751/1. Re-locate clevis pin (Ref. No.104) to lower fulcrum holes in equalising lever (Ref.No. 100) and valve operating lever (Ref. No.35). For type B-2A Pneumdyne Positioner, connect diaphragm lever pull rod to lever (Ref. No. 55) making use of the inner location hole in clevis (Ref.No. 79), and for type B-2B Positioner use the outer location hole in clevis (Ref.No. 79). Thus, conversion between types B-2A and B-2B is accomplished by changing the clevis pin from one location to another.

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**DIMENSIONAL DATA**



TYPE	NORMAL POSITION OF POWER PISTON	CONTROL PORT	STROKE
B2	Y	1 AND 2	3" (76,2) Y-Z 5" (76,2) Y-X
B2-A	Z	2	6" (152,4) Z-X
B2-B	X	1	6" (152,4) X-Z

APPROX. WEIGHT- 83 lbs  
 37,6Kg

FIG. 4. PNEUDYNE POSITIONER (TYPE B-2, B-2A AND B-2B)

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PNEUDYNE POSITIONERSSPARE PARTS - SERVICE AND REPAIR KITS

The following inexpensive kits are available. Each "SERVICE" Kit contains sufficient gaskets, diaphragms and seals etc., to service 1 Pneudyne. Each "REPAIR" kit includes spare parts, excluding those in the service kit, which are more appropriate to reconditioning requirements.

Each kit is supplied in a polythene bag and packed in a carton. When ordering please state the type of kit required together with the Shop No. and quantity.

SERVICE KIT - S. L. K302/2G comprises:

Qty	Description	Part No.	Ref. No.	Qty	Description	Pt. No.	Ref. No.
2	Piston packing	A82331/14	10	2	Grommet	J31885/1	30
2	Gasket	550992	14	2	Diaphragm	518462	49
1	Rod packing	Gaco.H112	17	1	Gasket	J31885/2	15

REPAIR KIT - S. L. K302/1 comprises:

Qty	Description	Part No.	Ref. No.	Qty	Description	Pt. No.	Ref. No.
1	Strainer complete	J31748/1	6	1	Needle Bearing	Torrington Cat.No. MH681	61
2	Inlet Valve Spring	5 21369	24	1	Push Rod	521439	106
2	Exhaust Valve Spring	521372	27	2	Hex.HD-Round end screw $\frac{1}{4}$ " - 28 UNF-2A x 1" long.	A89099/20	38
1	Needle Bearing	Torrington Cat.No. B45	56	3	Locknut R/H thread $\frac{1}{4}$ " -28 UNF-2B	-	109
1	Needle Bearing	Torrington Cat.No. M451	57	1	Locknut L/H thread $\frac{1}{4}$ " -28 UNF-2B	-	110
1	Needle Bearing	Torrington Cat.No. B88	58	2	Exhaust Valve & Seat (matched)	J31193/1	26 & 28
1	Needle Bearing	Torrington Cat.No. M881	59	2	Inlet Valve & Seat (matched)	J31194/1	22 & 23
1	Needle Bearing	Torrington Cat.No. BH68	60	1	Clevis (L/H)	521442	107
				*1	Link Block	J31880/1	-

\* This link block together with components reference numbers - 106, 107, 109 and 110 form an appliance for inlet/exhaust valve adjustment purposes. See "Inspection and Maintenance"  
- Page 10.



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We recommend that "SERVICE" and "REPAIR" kits be held at the following levels in relation to the quantity of Pneudynes ordered.

No. of Pneudynes	1	2 - 5	6 or over
Service Kit	1	2	Approx. 25%
Repair Kit	1	1	Approx. 10%
Complete Pneudyne	-	-	1 or approx. 5%

These kits should be ordered for delivery at the same time as complete valves, and we advise that rubber based materials with a limited storage life should be replenished at 2 yearly intervals. This will ensure that your "WESTINGHOUSE" equipment is always maintained in peak condition.

#### SPARES ORDERING

When ordering spares other than "SPARES KITS", please quote the pamphlet number, i.e. C56/1, the illustration reference number, the part number, the name of part together with the complete part number and serial number of the Pneudyne for which required.

PLEASE REFER TO EXPLODED VIEW AND PARTS LIST ON PAGES 12 AND 13.

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INSPECTION AND MAINTENANCEINSPECTION AT OVERHAUL PERIODS

The actual frequency of maintenance naturally depends upon the operational requirements and the type of service conditions to which the Pneudyne Positioner is subjected. However, as a guide the following recommendations are made.

- (1) The Positioner should be dismantled periodically for inspection, cleaning and lubrication.
- (2) Parts that are worn or defective should be replaced. All rubber packing rings, gaskets and rod packings should be carefully inspected and replaced if cracked or worn. Particular attention should be given to the control diaphragm (49) and the piston packings (10) for hardening or cracking at the sealing beads. Leaking or pitted valves may be lapped with a fine grade of valve grinding compound. NOTE: Particular care should be taken to check that all traces of the grinding compound are removed after reseating operations are complete.

NOTE: A good quality wide temperature range grease such as John Etheringtons Paragon "Arctic" should be used for all lubrication points on the positioner.

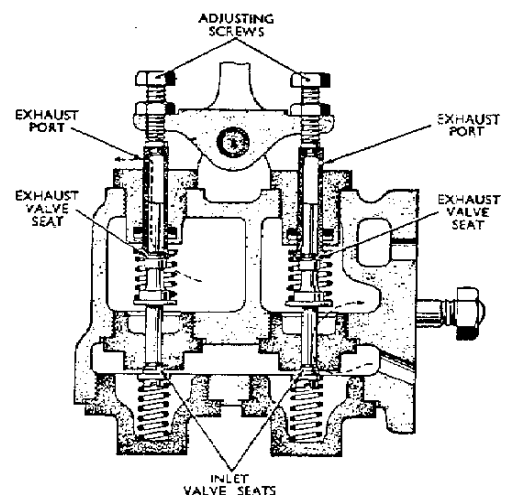
Adjustment after Repair or Servicing - Types B-2, B-2A and B-2B

In the event of inlet and exhaust valves having been lapped in or disturbed for any reason, resetting of the adjusting screws (38) may well be necessary.

This operation is most satisfactorily carried out as follows:-

- (1) Remove studs (113) and (101), thus releasing levers (111) and (100).
- (2) Using these same studs (113 and 101), secure valve operating lever (35) in mid or neutral position by means of the special appliance assembled from items included in the marine repair kit K302/1. This special appliance is secured at one end to the extended arm of the pressure head, and at the other to the valve operating lever (35), using the upper tapped hole provided. The threaded link of the appliance having been adjusted to locate the valve operating lever in the neutral position, secure rigidly by means of the locknuts provided.
- (3) Unscrew both adjusting screws (38) clear of the exhaust valve seat stems and remove the two 1/4" pipe plugs fitted one at each end of the power cylinder.
- (4) Admit pressure air supply to the valve portion of the Pneudyne.

Screw down adjusting screws (38) to provide a slight blow of air from the threaded apertures from which the 1/4" pipe plugs were removed. As a guide in making this adjustment, satisfactory Pneudyne performance is normally achieved when, by blanking off these openings in turn by means of a thumb or finger, a fully piston stroke is effected by the pressure thus building up in 4.1/2 - 5.1/2 seconds, with power air supply at



DIAGRAMMATIC  
FIG. 5. INLET/EXHAUST VALVE  
ASSEMBLY

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100 p.s.i. and locknuts (39) secured.

It is necessary during this process to ensure that all disengaged linkage is clear and does not foul moving parts during stroke.

Note the dimensions of full piston stroke.

- (5) Shut off and vent power air supply to the Pneudyne. Remove special appliance and re-connect levers (111) and (100).

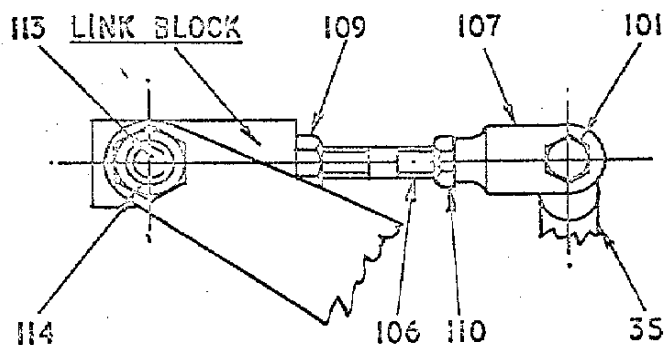
Replace 1/4" pipe plugs one at each end of power cylinder.

- (6) Open power air supply to Pneudyne.

Admit control air pressure and check Pneudyne stroke against control air pressure.

Location of stroke limit is normally varied by adjustment to link (106), but when making this adjustment it is necessary to bear in mind the dimensions noted in (4) above, in order to ensure a cylinder "bumping clearance" in both fully extended and retracted conditions.

- (7) Operating Pressures. The preloading of control spring (84) is normally such that the power piston stroke commences at a control pressure of 10 p.s.i., and completes a full stroke (6" for types B-2A and B-2B, and 3" for type B-2), at 60 p.s.i. control pressure. Adjustment can be made by screwing adjusting nuts (88) inwards to increase and outwards to decrease starting pressure. Such adjustment, however, must be followed up by similar adjustment to the control spring rod locking nuts (80) and rod end (79). It is most important that for correct setting of control spring, spring seats (82), adjusting nuts (88) and rod nuts (80) and (87) are effectively seated with diaphragm operated lever in mid-position of the diaphragm limits of travel and that no end play or slackness exists in the control spring portion.



VALVE SETTING APPLIANCE

1UP...

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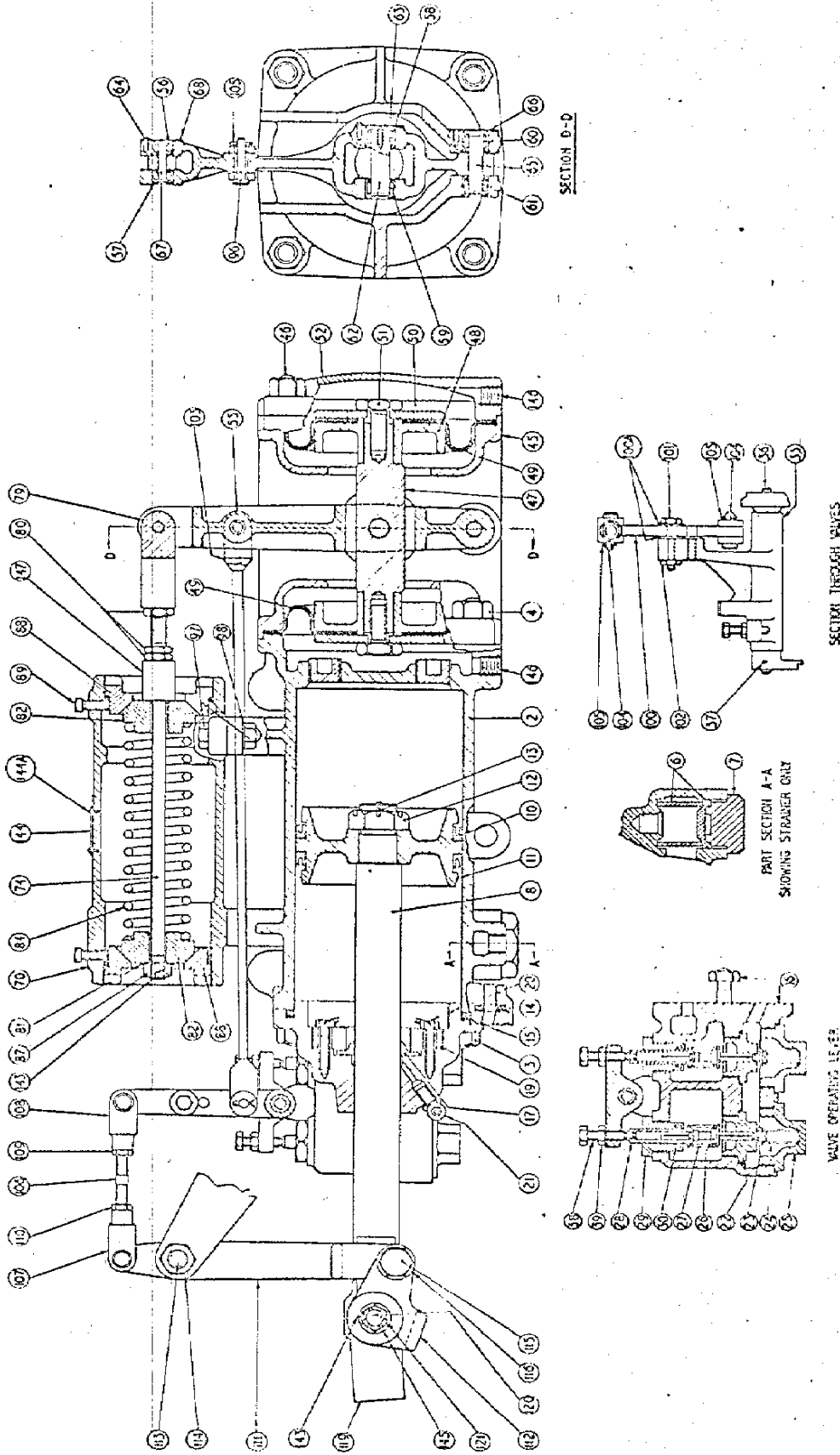


FIG. 6. TYPICAL B2 PNEUDYNE

# PARTS LIST

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Complete Pneudync  
Piece No.

	TYPE	Setting	
		p. s. i.	kg/cm <sup>2</sup>
U30302/1	B2	10-60	.70-4.22
U30302/2	B2A	"	"
U30302/3	B2B	"	"

Ref. No.	Part No.	Name of Part
	P.50478-1B	Power cylinder body complete (1)
	523286	3/8" stud - 16 U.N.C. x 1.3/8" long and nut (5)
	502674	1/2" stud - 13 U.N.C. x 1.7/8" long and nut (4)
RK	J31748/1	Strainer complete (1)
	521366	Strainer cap nut (1)
	521360	Piston rod bushed (1)
SK	A82331/14	Piston Packing (2)
	J31303/1	Piston (1)
	73002	Slotted hex. nut 7/8" - 20 U.N.E.F. (1)
	-	Split Pin 5/32" dia. x 1.3/4" long (1)
SK	550992	Gasket (2)
SK	J31885/2	Gasket (1)
	521358	Pressure head fitted with stud (1)
	16	3/8" hex. nut - 16 U.N.C. (1)
SK	17	H112 Rod Packing (1) Gaco
	19	J31304/1 Packing Follower (1)
	20	520995 Drilled cap screw (4)
	21	- 90° grease nipple 1/8" - 27 N.P.T., TECALEMIT NA.5802 (1)
RK	22	J31194/1 Inlet valve and seat (2) each comprising *:-
RK	23	*521367 Inlet valve seat
RK	24	*521368 Inlet valve
	25	521369 Inlet valve spring (2)
	26	521370 Inlet valve spring guide (2)
RK	27	J31193/1 Exhaust valve and seat (2) each comprising *:-
RK	28	*521371 Exhaust valve
RK	29	521372 Exhaust valve spring (2)
	30	*521373 Exhaust valve seat complete
SK	31	521376 Exhaust valve seat guide (2)
	32	J31885/1 Grommet (2)
	33	N30761/1 Valve operating lever complete (1)
	34	521485 Operating lever shaft (1)
RK	35	- Split pin 3/32" dia. x 1.1/4" long (1)
	36	A89099/20 Hex. hd. screw 1/4" - 28 U.N.F. - 2A x 1" long Rounded End (2)
	37	- 1/4" - 28 U.N.F. hex. locknut (2)
	38	521340B Diaphragm Control Portion complete (1) comprises: (Ref. Nos. 45 to 52 inclusive)
	45	521343 Control valve body (1)
	46	- Hex. bolt 1/2" - 13 U.N.C. x 1.3/4" long and nut (4)
	47	521349 Stem, control valve piston (1)
	48	521353 Piston (2)
SK	49	518462 Diaphragm (2)
	50	521354 Diaphragm follower (2)
	51	521355 Diaphragm lockscrew (2)
	52	521356B Control valve cover (1)
	53	521345 Lever complete (1)
RK	54	- Needle bearing Torrington B.45 (1)
RK	55	- Needle bearing Torrington M.451 (1)
RK	56	- Needle bearing Torrington B.88 (1)
RK	57	- Needle bearing Torrington M.881 (1)
RK	58	- Needle Bearing Torrington BH.68 (1)
RK	59	- Needle Bearing Torrington MH.681 (1)
RK	60	-
RK	61	-

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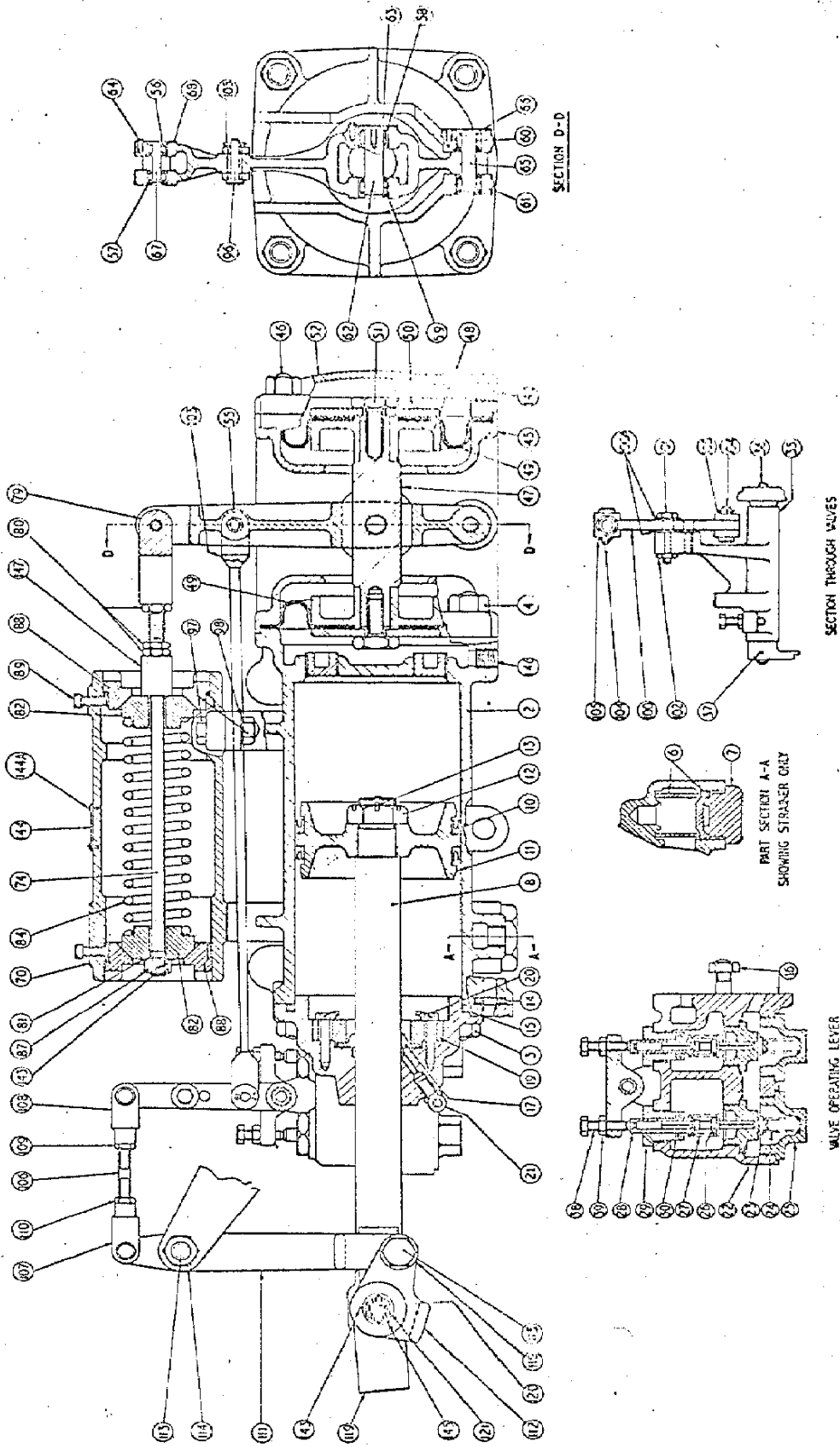


FIG. 6 (Repeated). TYPICAL B2 PNEUDYNE

70P...

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## PARTS LIST cont'd.

	62	521350	Pin, piston stem (1)
	63	521351	Cover, piston stem pin (1)
	64	-	Round head screw 4 x 40 N.C. x 1/4" long (2)
	65	521347	Lever fulcrum pin (1)
	66	521348	Fulcrum pin cover (1)
	67	521427	Pin control spring rod (1)
	68	521428	Cover, spring rod pin (1)
	-	522120	Control spring portion complete (1)
	70	522119	Control spring body (1)
	74	522117	Control spring rod (1)
	79	522116	Spring rod end (1)
	80	-	3/8" - 24 U.N.F. - 2B hex. lock nut (3)
	81	-	3/8" Plain washer (1)
	82	522118	Control spring seat (2)
	84	64613	Control spring (1)
	87	-	Slotted nut 3/8" - 24 U.N.F. 2B (1)
	88	521422	Adjusting nut (2)
	89	-	Set screw square head 1/4" 20 U.N.C. x 5/8" (2)
	96	521429	Clevis pin, push rod (1)
	97	-	Hex. head bolts and nuts 3/8" - 16 U.N.C. x 1 1/4" lg. (4)
	98	-	3/8" internal shakeproof washer (4)
	100	J31752/1	Equalising lever complete (1)
	100(A)	-	1/4" Plain washer (Brass) (2)
	101	P50612	Stud, equalising lever (1)
	102	-	Hex. nut 10 x 32 N.F. (1)
	103	521430 (B2)	Diaphragm lever pull rod complete (1)
	103	J31751/1 (B2A & B2B)	" " " " " "
	104	521437	Clevis pin (3)
	105	-	Split pin 1/16" dia. x 7/16" long (4)
RK	106	521439	Push rod (1)
	107	521442	Clevis with L.H. thread complete (1)
	108	521444	Clevis with R.H. thread complete (1)
RK	109	-	1/4" x 28 U.N.F. locknut R.H. thread (1)
RK	110	-	1/4" x 28 U.N.F. locknut L.H. thread (1)
	111	521446	Power operating lever complete (1)
	112	521450	Lever link complete (1)
	113	P50287-11	Stud, power operating lever (1)
	114	-	Locknut 7/16" - 20 U.N.F. (1)
	115	521456	Lever link screw (2)
	116	-	7/16" internal shakeproof washer (2)
	119	521462	Clevis link complete (1)
	120	521455	Stud lever link (1)
	121	-	Hex. slotted nut 7/16" - 20 U.N.F. (1)
	143	-	Split pin 3/32" dia. x 3/4" long (2)
	144	J71357/54	Name plate (state type when ordering)
	144A	-	Hammer drive screws type 'U' x 1/8" long (2)
	-	-	Plug 1/4" - 18 N.P.T.F. (3)
	145	-	7/16" dia. plain washer (clevis link) (2)
	146	J30266/1 (B2A & B2B)	1/4" BSP strainer complete
	147	A70021/104	Spacer

NOTE: SK DENOTES ITEMS SUPPLIED IN A SERVICE KIT  
 RK DENOTES ITEMS SUPPLIED IN A REPAIR KIT