Red's Satellite Service

Satellite Automatic

Driller Manual

934 Oak Street
Abilene, Texas

(325)268-2895
Fax (325)676-0431
reds@redssatelliteservice.com
service@redssatelliteservice.com
www.redssatelliteservice.com

Basic Trouble Shooting

Check these items when it is dumping all weight on bit:

1. Plugged instrument box orifice. (See direction 1)
2. Plugged bleed off orifice.(air diaphragm satellite)
3. Diaphragm valve stuck open, leaking or not properly set. (See direction 2)
4. Make sure air supply hose goes to air valve on diaphragm.
5. Make sure brake handle has enough weight to stop drum.
6. Rubber tire unit hanging up causing it to dump weight. (Bad bearings or gears) Flat spots on tire indicate it is hanging up.

Uncontrollable weight setting, too much or not enough:

1. Rubber tire unit slipping. (greasy or oily drum glazed)
2. Diaphragm valve leaking not properly set or hole in membrane.
3. Proportional band adjustment is not all the way to the top for maximum sensitivity. (Inside instrument box door)
4. Hydraulic diaphragm not loaded and/or has air in diaphragm.
5. Rig air supply dropping below 80 PSI. No lubricator on air motor. No fluid in lubricator or lubricator not set for oil.

Not picking up brake handle:

1. Flex shaft core broken or set screws loose on either end of flex shaft.
2. Set screws loose on chain coupler on rubber tire unit. (Slipping inside)
3. Gearbox shifter all the way in (Regular Drlg.) or out (Hi-Speed Drlg.) There is not a neutral position.
4. Bad air motor.
5. Rubber tire unit slipping.
6. Plugged air motor hose.
7. Air cylinder not holding tire up against side of drum.
8. Clutch in lift cable reel bad.

DIRECTIONS:

1. Cleaning instrument box orifice:
    a. Disconnect lift cable from brake arm.
    b. Turn air on.
    c. Open instrument box door, with flapper away from orifice; top right hand gauge should not show any air pressure. If so, orifice is dirty. Take out and clean then go through this procedure again to check it.
2. Setting diaphragm air valve:
    a. With air valve out of diaphragm scribe mark on deflection plug even with plate. Deflection plug is on opposite side of the diaphragm air valve.

b. Plug air supply into valve, start screwing valve into diaphragm until the mark on the deflection plug comes out 3/32, or the width of a .50 piece.
c. Lock jam nut down snug.
d. If air valve is moved for any reason, repeat this procedure. **<u>This is a critical setting!</u>**

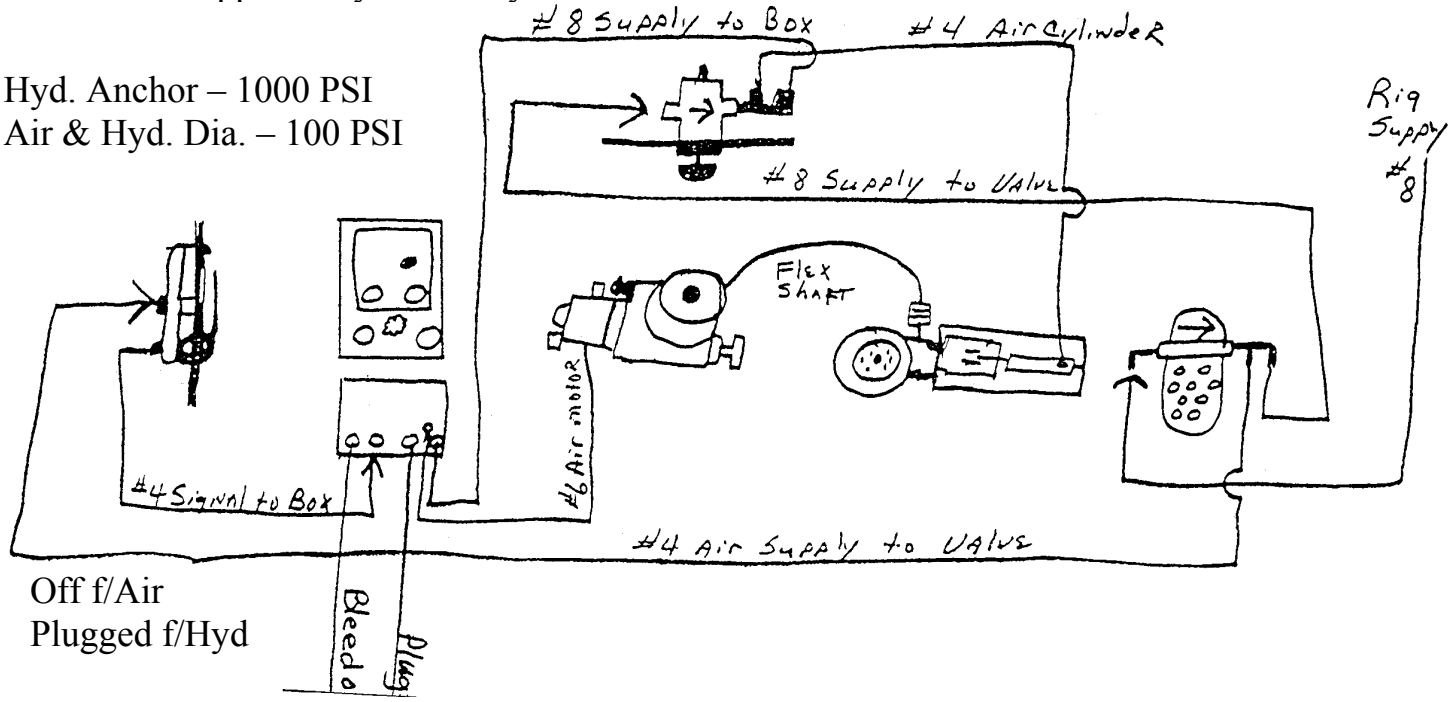
<u>ROUTINE MAINTENANCE:</u>

1. Change oil in gear box every six months. Fill 1 ½ quart 30 weight. Gearbox only takes 1 ½ qt oil; up to sight glass. **DO NOT OVERFILL!**
2. Air motor lubricator 10 weight oil only, **<u>IMPORTANT</u>**.
3. Grease chain coupler.
4. Grease flex shaft core and bearings.
5. Drain air tanks and filters daily.
6. Flush occasionally with alcohol then blow lines out.

<u>NOTE:</u>

This is designed with the intention of cutting costs. We hope this helps eliminate some unnecessary service calls and expenses. If **any** questions arise about the above mentioned, please don't hesitate to call us. We appreciate your business and the opportunity to serve you.

Hyd. Anchor – 1000 PSI
Air & Hyd. Dia. – 100 PSI



Off f/Air
Plugged f/Hyd

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LIST OF FIGURES

1.00 INTRODUCTION

1.01 This manual contains installation, operation, and maintenance instructions for the Satellite Automatic Drilling Control System. Read the appropriate section of this manual before performing the indicated installation, operation or maintenance procedures. Ensure that all personnel who will be performing these procedures have read the **Important Safety Notice**.

2.00 DESCRIPTION

2.01 The Satellite automatic driller is a control system for maintaining the optimum weight on the bit. Satellite operation is based on the relation between the weight on the bit and the deadline tension. As deadline tension increases from the value preset in the controller, the Satellite pays out the drilling line by raising the brake lever to release the drum, and then stops drum rotation by lowering the brake lever when the preset weight on the bit is reached. Figure 2-1 shows the general arrangement of the Satellites components.

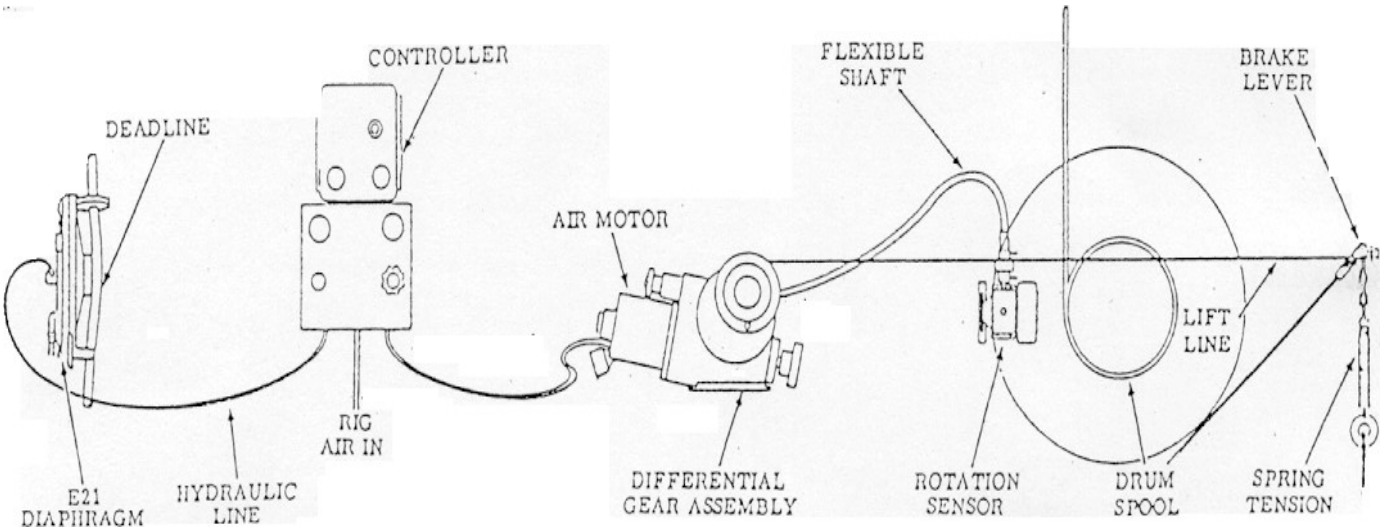


Figure 2-1

Satellite Automatic Drilling Control System

2.02 Component Description: The Satellites components consist of:

a. Deadline tension sensor
b. Controller assembly
c. Air motor
d. Differential gear assembly
e. Drum rotation sensor

2.03 Deadline Tension Sensor: The deadline tension senor is an optional accessory that operates on air and monitors changes in deadline tension only. The usual method of taking deadline tension measurement is installing a tee in the existing anchor weight indicating system hydraulic line. Whichever method is used, a signal is sent to a bourdon tube in the controller assembly.

2.04 Controller Assembly: The controller assembly operates the 3 to 1 air valve which controls the air motor. (A bourdon tube reacts to changes in deadline tension and operates a flapper valve that controls air flow thru an orifice. The air flow opens the 3 to 1 valve providing air to operate the air motor.) A **BIT WEIGHT** knob is used to adjust the controller to maintain the optimum weight on the bit. The **DRILL KNOB** is used to start and stop the Satellite; in the **OUT** position air pressure holds the drum rotation sensor against the inside of the drum spool, and controlling

and operating pressures are available to drive the air motor. The **SPEED PENETRATION CONTROL** knob is used to control the rate of penetration (**ROP**).

2.05 Air motor: The air motor, thru the differential gear assembly, winds up the lift line to release the draw-works brake. The air motor is mounted on the differential gear assembly.

2.06 Differential Gear Assembly: The differential gear assembly starts winding up the lift line when air pressure is applied to the air motor. As the main drum starts to turn, the drum rotation sensor, thru the flexible shaft, feeds a counter rotational force into the differential gear assembly. The gear assembly responds differentially to the two forces being fed into it and stops winding up the lift line. A shaft knob provides the gear assembly with two-speed capability (For fast or slow drilling) and a hand wheel allows it to be rotated by hand as necessary for minor adjustment to the brake lever. The differential gear assembly, with air motor, is mounted on the drum guard.

2.07 Drum Rotation Sensor: The drum rotation sensor consists of an air cylinder, a right angle drive and a rubber friction wheel. The air cylinder forces the friction wheel against the inside of the drum spool to sense rotation of the drum. The friction wheel drives a right angle gear assembly, which in turn, rotates a flexible shaft connected to the differential gear assembly.

3.00 INSTALLATION

3.01 Before installation, place the various components in their approximate locations to ensure that the flexible shaft has a single, smooth curve and that the lift line reel will give a straight pull on the brake lever.

3.02 Deadline Tension Sensor Installation: The air deadline tension sensor assembly is an optional accessory to be used when a weight indicator is not available, or not convenient to use. Refer to Figure 2-1 for installation if using the air sensor. The usual method, however, is to tee into the hydraulic line of the anchor weight indicator. This tee should be close to the indicator. This tee should be close to the indicator to keep the hose as short as possible. Another location for deadline tension signal pickoff is to tee into the hydraulic line to the weight channel of the drilling recorder, or other hydraulic recorder.

3.03 Controller Assembly Installation: If a console mount Satellite (SA102) has been ordered with a Drill-Central console, the controller assembly will be installed and will only require hookup. The bourdon tube will be vacuum pumped and filled at the same time as the weight indicator. The unitized Satellite (SA100) controller assembly will require installation as well as hookup. The unitized controller is supplied mounted on a plywood board with all of the integral tubing connections made up. Figure 3-1 gives the overall dimensions for mounting the unitized controller assembly. Mount the controller assembly near the driller's position protected from the weather, preferably in the doghouse close to the door. Fill bourdon tube and all hydraulic plumbing leading to it with **Instrument** hydraulic fluid (W15) Paragraph 7.02.

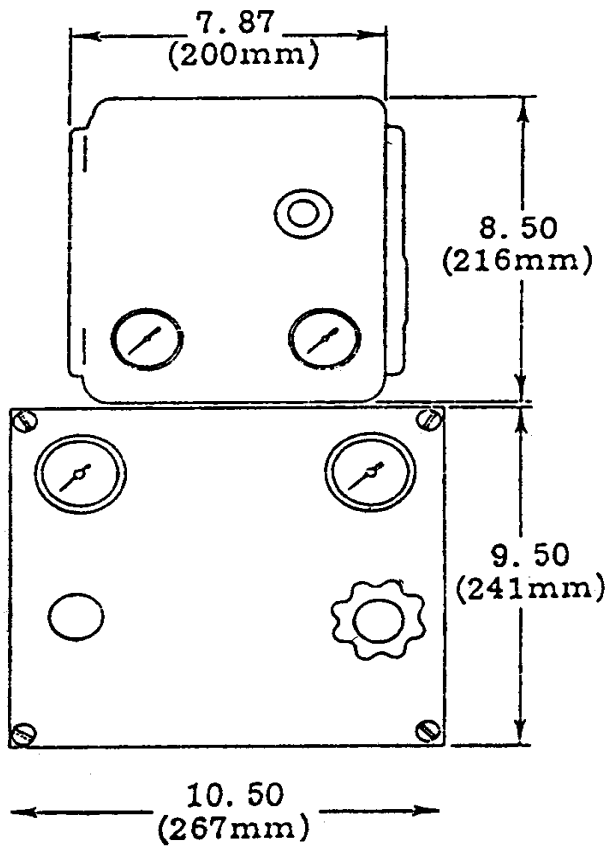


Figure 3-1
Controller Assembly Overall Dimensions

3.04 Drum Rotation Sensor Installation: Locate the drum rotation sensor inside the drum guard in a position to allow the flexible shaft a smooth curve to the differential gear assembly. In locating the drum rotation sensor consideration must be given to two requirements: The flexible shaft must form a smooth curve to the differential gear assembly and the rubber tired friction wheel must be .75 inch (19mm) l from the drum spool flange, as close as possible to the rim. Refer to Figure 3-2 for overall mounting dimensions.

a. Hold the completely assembled drum rotation sensor inside the drum guard to determine the best location.

NOTE: The friction wheel mounting bolt is offset to a allow a one inch variation in locating the friction wheel closer to the rim of the drum spool flange.

b. When the drum rotation sensor is located, draw a line around the base plate. Remove the sensor.
c. Remove air cylinder and slide from base plate.
d. Weld base plate to drum guard at location determined in steps **a** and **b**.
e. Apply a liberal amount of grease to the slide area of the base plate.
f. Slip friction wheel slide into place and attach air cylinder to the base plate.
g. Align friction wheel so it will roll true on drum spool flange. Tighten wheel mount locknut.
h. Connect air hose from **DRILL KNOB** valve to air cylinder.

i. Cut hole thru top cover of drum guard to provide passage of the flexible shaft from the drum rotation sensor to the differential gear assembly.
j. Install one end of the flexible shaft to the right angle drive shaft.

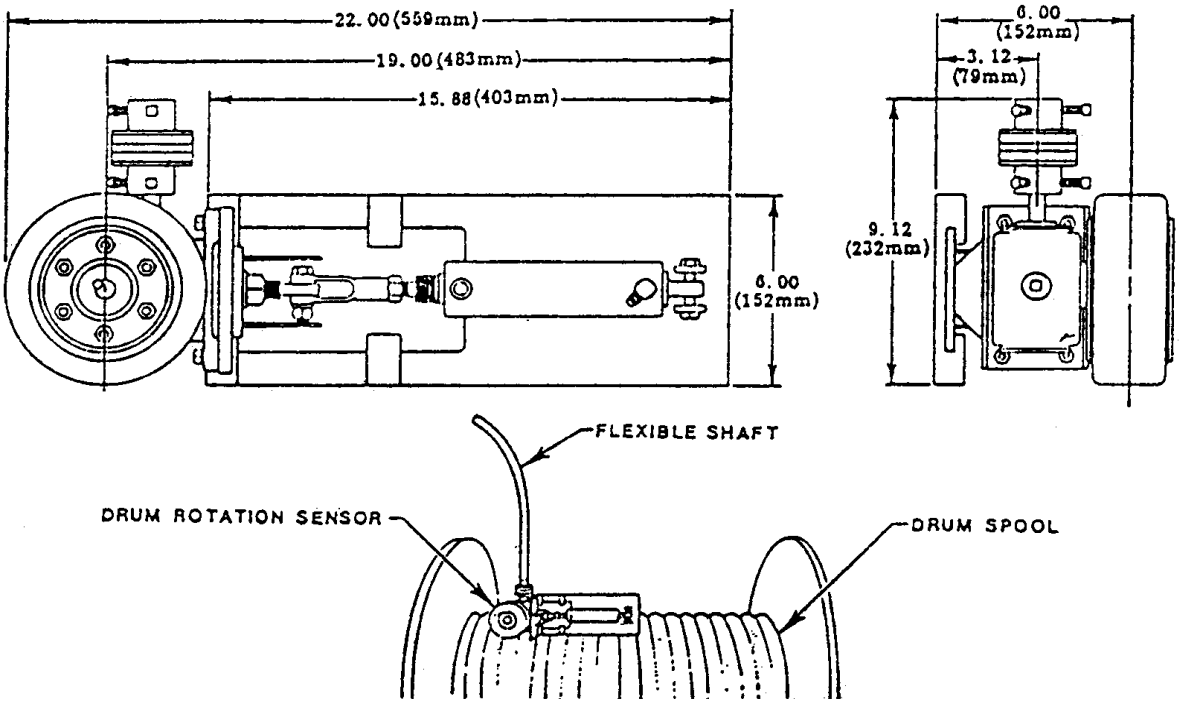


Figure 3-2
Drum Rotation Sensor Typical Installation and Overall Dimensions

3.05 Air Motor and Differential Gear Assembly Installation: Locate the air motor and differential gear assembly on the top cover of the drum guard so that the flexible shaft has a smooth curve and the lift line reel has a straight pull on the brake lever. The gear assembly must be mounted level, fabricate a bracket as necessary to attain level mounting. Refer to Figure 3-3 for overall mounting dimensions.

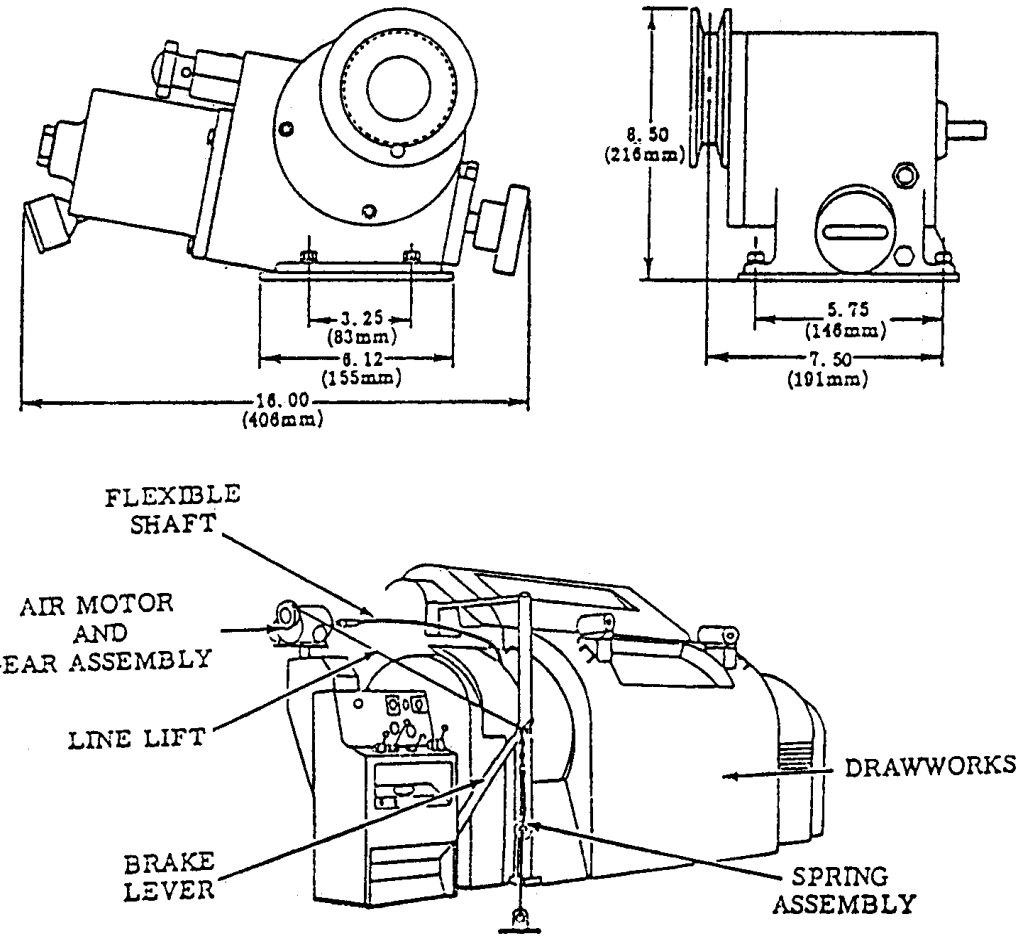


Figure 3-3

Air Motor and Gear Assembly Typical Installation and Overall Dimensions

NOTE: On some draw-works it may be necessary to use an intermediate sheave to route the lift line around obstacles.

a. Install the free end of the flexible shaft to the differential gear assembly.
b. Locate the gear assembly on the top of the draw-works with the lift line reel in line with the brake lever, or intermediate sheave. Fabricate a bracket as necessary to maintain level mounting and weld in place.
c. Bolt gear assembly in place.
d. Unreel full length of lift line from reel.
e. Hook end of line to brake lever.
f. Take up slack at reel by pulling line thru hole in reel. Brake lever must remain all the way down.
g. Loosen clamp and slide to within 3 feet of reel (approximately 3 or 4 wraps). Tight clamp
h. Cut off excess line.
i. Reel lift line clockwise around reel, facing side of reel.
j. Connect air line from air motor to air motor valve on back of controller assembly.
k. Connect rig air, thru the filter, to the **DRILL KNOB**.

4.00 OPERATION

4.1 Satellite is operated only during actual drilling operation. Pulling the **DRILL KNOB** out engages, and pushing in disengages, the Satellite. Refer to Table 4-1 for the controls and indicators.

4.2

α. Manually feed off to desired bit weight.

β. Attach a weight to brake lever so that some effort is required to lift it by hand. Weight should be just enough to stop the drum feed off.

χ. Attach lift line to brake lever.

δ. For initial use only; rotate **BIT WEIGHT** knob fully clockwise. This will avoid excessive weight on the bit at first engagement.

ε. **PUL DRILL KNOB** out.

φ. Adjust **SPEED PENETRATION CONTROL** until **SPEED REGULATOR** indicates 30 to 40 psi for normal operation. Increase pressure to increase speed.

γ. Rotate **BIT WEIGHT** knob counterclockwise until Satellite maintains weight on bit.

η.

NOTE: The differential gear assembly has two speeds. To shift to either speed perform steps h, i, and j.

ι. **PUSH DRILL KNOB** in to disengage Satellite.

φ. **PULL SHIFT KNOB,** on differential gear assembly, out to shift to higher speed, or push in for lower speed. Rotate hand wheel as necessary to accomplish shift.

κ. **PULL DRILL KNOB** out to engage Satellite

λ.

CAUTION: Always disengage Satellite when not actually drilling as damage to equipment may result.

NOTE: When the Satellite is engaged, the ratio of **SUPPLY** to **OUTPUT** pressure will be approximately the same as the ratio of **SPEED REGULATOR** to **AIR MOTOR** pressure. This is an indication that the Satellite is operating properly.

Table 4-1

Satellite Controls and Indicators

CONTROL/INDICATOR	TYPE	FUNCTION
BIT WEIGHT	Adjusting Screw	Sets weight on bit to be maintained by Satellite
SUPPLY	0-30 psi Gauge	Indicates input controlling pressure controller assembly. Factory preset to 20 psi.
OUTPUT	0-30 psi Gauge (Best operation is in the 3 – 5 psi range	Indicates control pressure from orifice to operate air motor valve, which sends operating pressure to air motor. Will show a proportion of SUPPLY pressure.
SPEED REGULATOR	0-100 psi Gauge	Shows input air pressure available to operate air motor. Normally set at 30 - 40 psi. Adjusted by SPEED PENETRATION CONTROL knob.
AIR MOTOR	0-100 psi Gauge	Indicates air pressure used to drive air motor. Will show a proportion of SPEED REGULATOR pressure.
DRILL KNOB	PULL/PUSH Valve	Engages Satellite to control drilling.
SPEED PENETRATION CONTROL	Manual Air Valve	Controls operating pressure to air motor, and therefore, controls speed during feed off.

5.00 MAINTENANCE

5.01 Preventive maintenance for the Satellite includes:

a. Daily, open air filter drain cock to blow out accumulated moisture and sediment.
b. Controller assembly, keep free of dirt and moisture. Clean door and panel with any commercially available cleaner and a clean, lint free cloth.
c. Remove differential gear assembly oil filter plug. Oil level should be visible, if not, replenish with 10W motor oil, replace plug.
d. Inspect air lines for possible wear, damage, or loose fittings.
e. Ensure that drum rotation sensor slide is well greased.
f. Check flexible shaft coupler setscrews for tightness.
g. Ensure friction wheel rolls true on drum spool flange.
h. Air deadline diaphragm assembly only, check constant air bleed connection and air line for possible obstructions.

6.00 TROUBLESHOOTING

6.01 If system malfunction is observed, refer to Table 6-1 for a list of probable causes and their corrective actions.

Table 6-1

Malfunction Isolation

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
Feed off continues after bit weight achieved	**a.** Controller orifice dirty **b.** Brake lever weight not heavy enough **c.** Friction wheel jammed or stuck **d.** 3 to 1 valve leaking	α. Check for dirty orifice (para. 6.02) β. Increase weight χ. Clean friction wheel to rotate δ. Tighten fittings, if it still leaks, change out
Sluggish or no response to deadline tension changes	a. Controller assembly proportional band knob off minimum setting b. Air in hydraulic system c. Insufficient system charge d. Hose plugged e. Faulty air motor	a. Move knob to top of proportional band (minimum setting) b. Bleed air from system (para. 7-02) c. Fill system (para. 7.02) d. Clean or change hose e. Change air motor
Erratic feed off	a. Friction wheel slipping intermittently b. Worn flexible shaft c. Faulty air motor d. Faulty 3 to 1 valve	a. Clean friction wheel tread b. Repair shaft (Figure 7-7) c. Change air motor d. Change 3 to 1 valve

6.02 Controller Orifice Check: If the Satellite will not stop feeding off:

a. **PUSH DRILL KNOB** in and disconnect lift line from brake lever.
b. **PULL DRILL KNOB out.**
c. Rotate **BIT WEIGHT KNOB** until flapper is clear of the orifice.
d. Observe **OUTPUT** gauge. If **OUTPUT** is 3-5 psi with 10 psi on **SUPPLY** orifice is dirty.
e. **PUSH DRILL KNOB** in.
f. Clean orifice with WD 40 or equivalent.
g. **PULL DRILL KNOB** out. Observe **OUTPUT** gauge, it should indicate zero. **PUSH DRILL KNOB** in.
h. Attach lift line to brake lever and resume drilling (**PUSH DRILL KNOB** out).

7.00 REPAIR

7.01 Illustrated parts breakdowns are included in this section to aid in parts identification of the separate components.

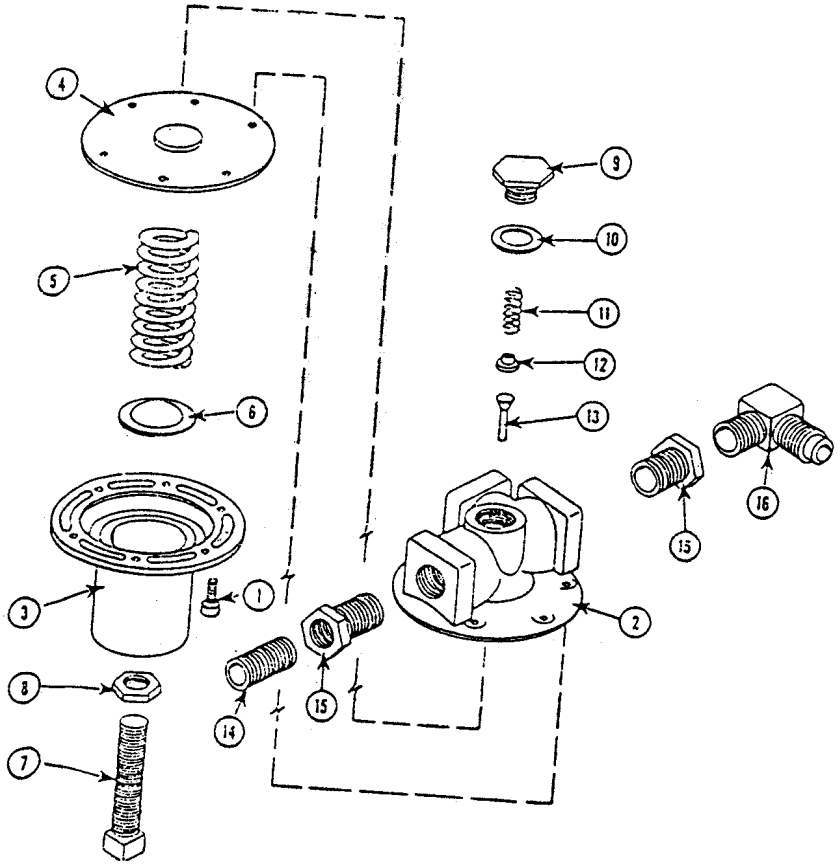
Figure 7-1 Air Pressure Regulator Assembly
Figure 7-2 Micro Flow Valve Assembly
Figure 7-3 Control Valve Assembly
Figure 7-4 Differential Gear Assembly (less Air Motor)
Figure 7-5 Drum Rotation Sensor (less Right Angle Gear)
Figure 7-6 Right Angle Gear Assembly
Figure 7-7 Flexible Shaft Assembly
Figure 7-8 Deadline Diaphragm Assembly (Air)
Figure 7-9 Instrument Control
Figure 7-10 Hose Assembly
Figure 7-11 Speed Penetration Control Regulator
Figure 7-12 Air Filter Assembly
Figure 7-13 Lubricator Assembly

7.02 Filling Controller Assembly with Hydraulic Fluid

CAUTION: This procedure is for hydraulic sensor systems only. Do not attempt to charge air sensor systems with hydraulic fluid or damage to equipment will result.

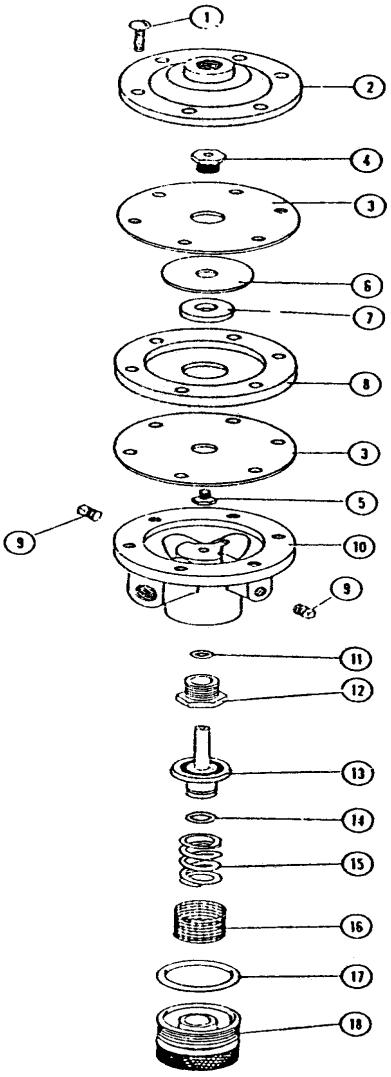
For accurate deadline tension measurement the controller assembly bourdon tube must be filled with hydraulic fluid (RW15). After the controller assembly bourdon tube has been connected into the hydraulic weight indicator system, and without any tension on the deadline, charge the system per procedure in the applicable weight indicator system manual. Loosen fitting at base of controller assembly bourdon tube as necessary to bleed air out of the system. Tighten when procedure I completed.

Figure 7-1
Air Pressure Regulator Assembly



ITEM #	PART #	DESCRIPTION	QTY REQ'D
	1275	Regulator Complete	1
1	1276	Cap Screw	6
2	1277	Body - Regulator	1
3	1278	Case	1
4	1279	Diaphragm	1
5	1280	Spring - Diaphragm	1
6	1281	Spacer	1
7	1282	Screw – Pressure Regulating	1
8	1283	Locknut – Screw	1
9	1284	Cap	1
10	N/A	Gasket – Cap Use 1285	1
11	N/A	Spring – Valve Use 1285	1
12	N/A	Pad – Spring Use 1285	1
13	N/A	Valve Use 1285	1
14	1344	Nipple – Close Pipe	1
15	1351	Reducer – Pipe	2
16	1338	Adapter – Ell, Mall to Male Copper Tubing	11
	1285	Repair Kit	

Figure 7-2



Micro Flow Valve Assembly

Item #	Part #	Description	Qty Req'd
	1310	Micro-Flo Valve Complete	1
1	1311	Bonnet Screws (Set of 6)	1 Set
2	1312	Bonnet	1
3	1313	Diaphragm (Set of 2)	1 Set
4	1314	Diaphragm Bolt	1
5	1315	Set Screw	1
6	1316	Upper Pressure Plate	1
7	1317	Lower Pressure Plate (State Ratio)	1
8	1318	Plate Spacer (State Ratio)	1
9	1362	1/8 NPT Plug	2
10	1299	Body	1
11	N/A	O-Ring Use 1303	1
12	1300	Seat	1
13	N/A	Valve w/# 14 O-Ring Use 1303	1
14	N/A	O-Ring Use 1303	1
15	N/A	Spring Use 1303	1
16	1319	Screen	1
17	N/A	O-Ring Use 1303	1
18	1301	Cap	1
	1303MV	Repair Kit – no diaphragm	1
	1310RK	Repair kit w/diaphragm	

MAINTENANCE for Micro Flow Valve Assembly

If gums or varnishes condense from the air compression it will be necessary to disassemble and thoroughly clean with solvents. During assembly it is recommended to lubricate O'ring (14) as well as dampener chamber in which it seals inside plug (18) with grease. The valve parts must be clean to function properly. During assembly be sure to install PRESSURE PLATE (6) toward bonnet (2) as well as (8) positioned as shown.

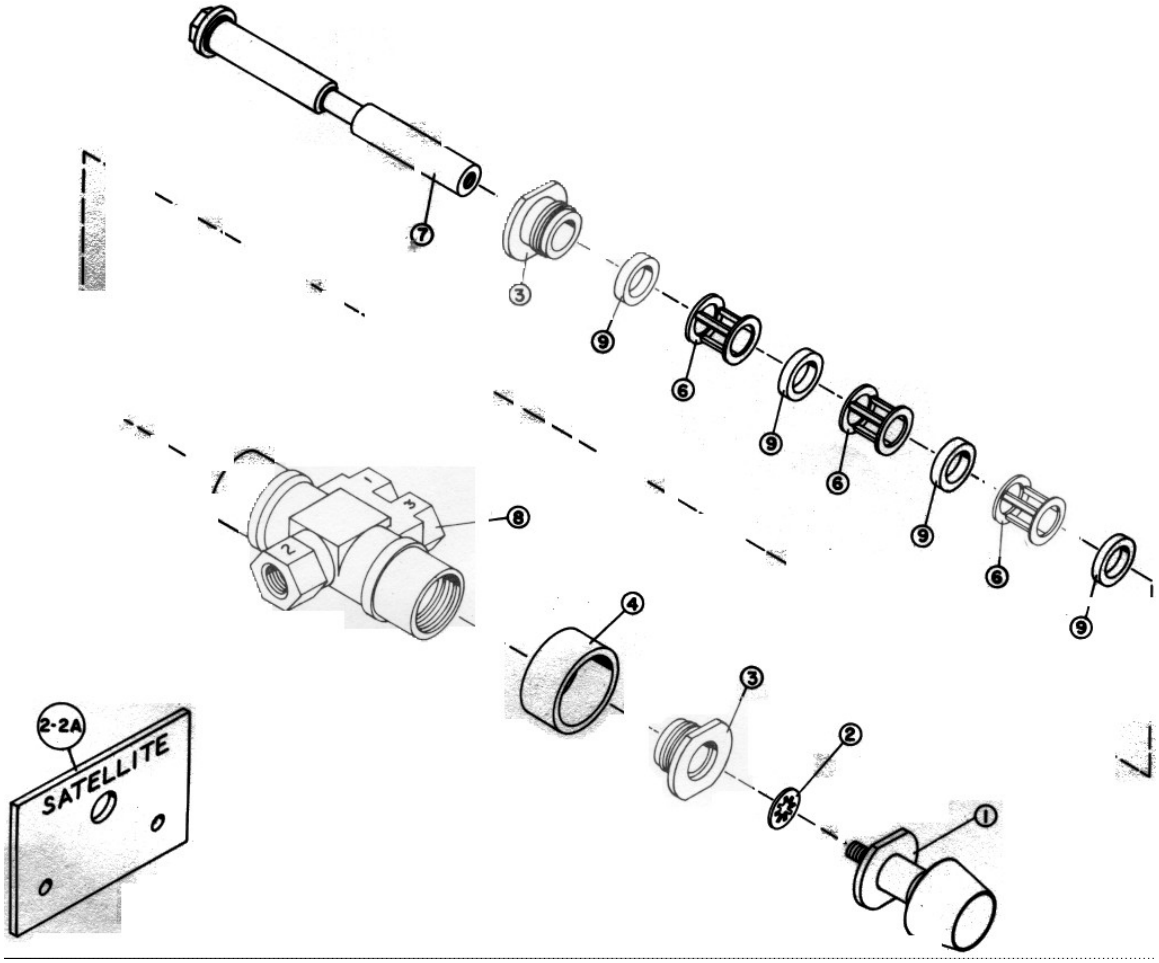


Figure 7-3 Control Valve

Figure #	Part #	Description	Qty Required
	1000	Control Valve Complete	1
	1001	Control Valve	1
2-2A	1002	Control Valve Panel	1
N/S	1357	1/4 Tee Connection	1
N/S	1372	1/4 Swivel Connection	1
N/S	1371	#8-1/4 E11 Connection	2
1	1303	Knob	1
2	1004	Star Lock Washer	1
3	1005	Seal Retaining Nut	1
4	1006	Spacer 1/4"	1
	1007	Spacer 1/8"	A/R
6	1008	Cage	1
7	1009	Shaft	1
8	1010	Body	1
9	1011	O-Ring Seals	4
7 & 9	1012	Repair Kit (kit shaft & o-rings)	A/R

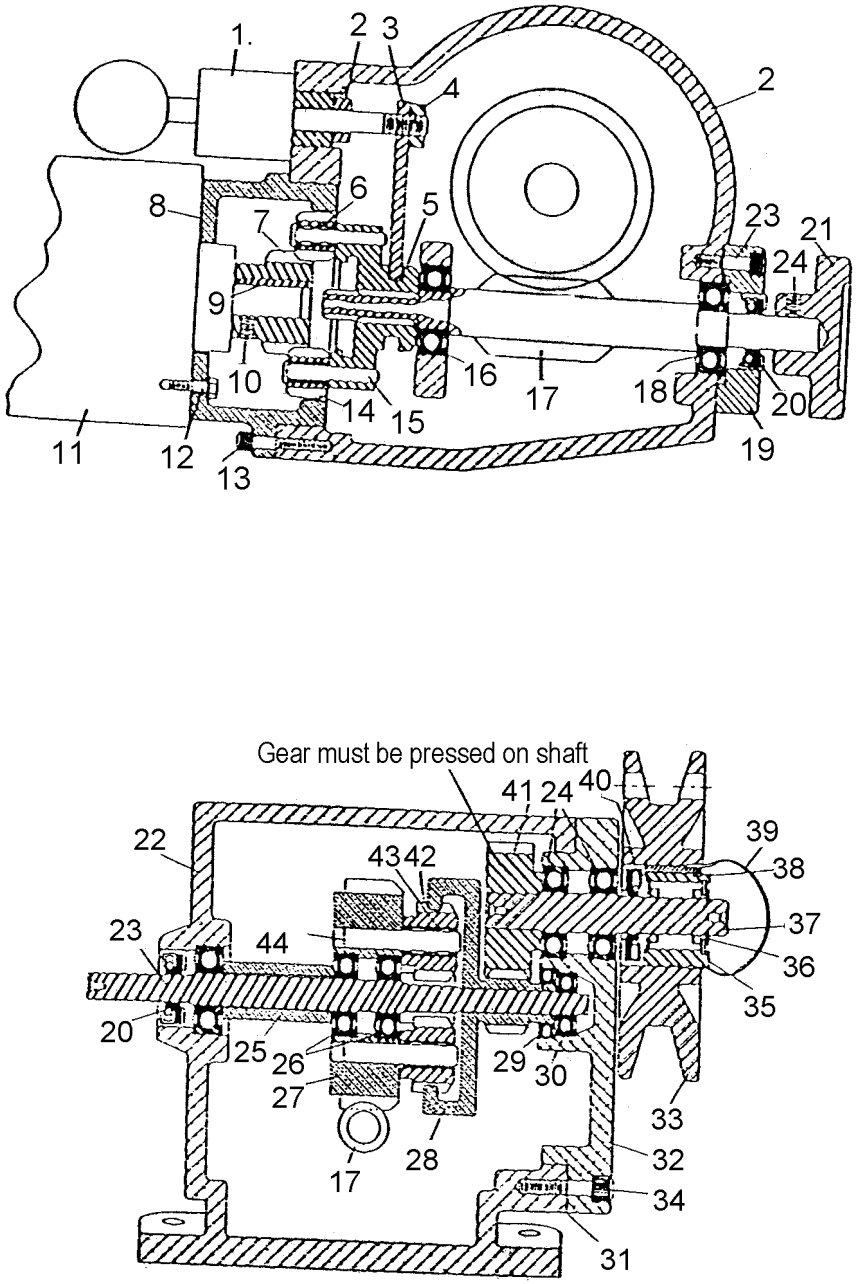


Figure 7-4 Differential Gear Assembly

Differential Gear Assembly

Item #	Part #	Description	Qty Req'd
	1060	2 Speed Gear Unit Complete	1
	1061	2 Speed Gear Unit Exchange	
	1062	Mounting Plate	1
	1426	Bolt - 5/16	4
	1428	Lock - 5/16	4
	1434	Nut – 5/16	4
1	1063	Manual Shifter Complete	1
	1064	Shifter Body	1
	1066	Shifter Shaft	1
	1067	Knob Set Screw	1
	1068	Shifter Locking Screw	1
2	1069	Oil Seal	
3	1070	Shifter Fork	1
4	1432	Nut – 3/8	1
	1429	Lock - 3/8	1
5	1071	Planet Carrier Assembly Complete	1
7	1072	Sun Motor Gear	1
8	1073	Motor Flange Mount Gear	1
	1074	Gasket – Motor Flange Mount Gear to Housing	1
9	1415	Gear Key	1
10	1076	Set Screw	1
11	1077	1 HP Air Motor	1
	1078	Gasket – Air Motor to Motor Flange Mount Gear	1
	1079	Muffler	1
	1356	Connection Elbow	1
12	1727	Steel Cap Screw ¾	3
	1424	Lock	3
13	1728	Steel Cap Screw ¾	3
	1424	Lock	3
16	1081	High Speed Bearing	1
17	1082	Worm Gear Shaft Assembly	1
18	1083	High Speed Bearing	1
19	1084	Oil Retainer Plate	1
	1085	Gasket – Oil Retainer Plate	1
20	1086	Oil Seal	1
21	1087	Hand Wheel	1

Item #	Part #	Description	Qty Req'd
22	1088	Main Gear Case Housing	1
22-1	1089	Oil Level Sight Glass	1
23	1090	Cross Pinion Shaft	1
24	1091	Bearing	2
25	1092	Spacer	1
26	1093	Bearing	1
27	1094	Worm Gear w/44 Pins	1
28	1095	Combination Gear Assembly	1
29	1096	Precision Bearing	1
30	1097	Bearing	1
31	1098	Gasket - Side Plate	1
32	1099	Side Plate	1
33	1100	Reel Wire Line	1
34	1727	Steel AH Cap Screws	4
35	1102	Overrunning Clutch	1
36	1103	Nut	1
37 & 41	1104	Gear Shaft w/gear (pressed and welded)	1
	1104G	Gear Only	
	1104S	Shaft Only	
38	1414	Clutch Key	1
39	1105	Reel Clutch Cover	1
40	1106	Seal	1
42	1107	Planet w/Needle Bearings	3
43	1108	Needle Bearings	6
	1109	1 QT. Oil	1 ½
	1364	¼ Plug	1
	1365	½ Plug	1
	1080	Muffler Pad	
	1110	One Brake Handle Spring	3
	1111	Springs Set Complete	1
	1112	Wire Line (Cable)	
	1113	Pulley (if required)	
	1114	Wire Line Clamp	2

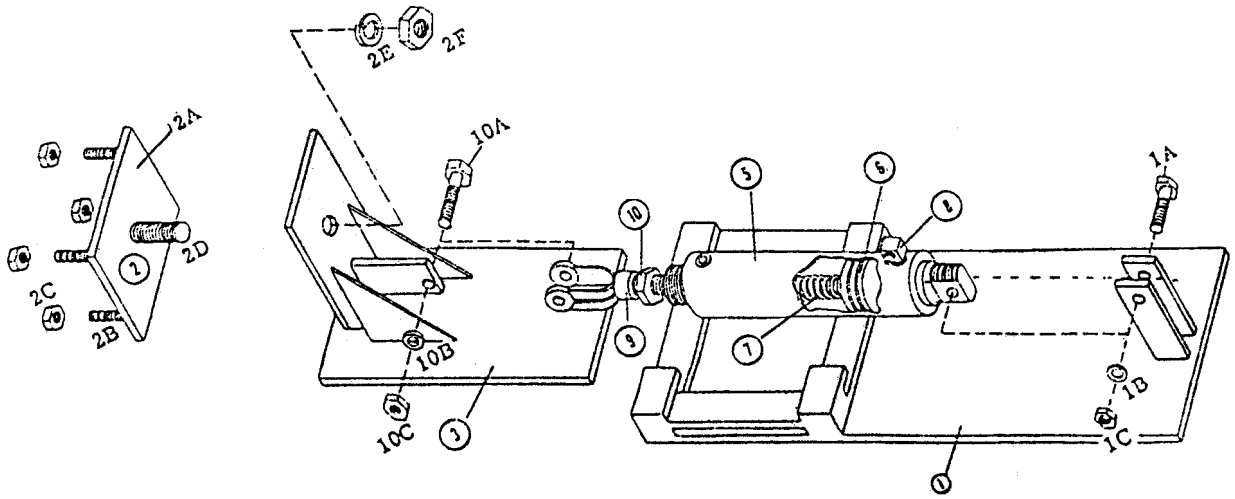


Figure 7-5 Drum Rotation Sensor

Item #	Part #	Description	Qty Req'd
	1015	Drum Rotation Sensing Unit Complete	
1	1016	Slide Base & Anchor	1
1A	1428	Bolt Anchor	1
1B		Lock Anchor	1
1C	1497	Nut Anchor	1
2	1017	Wheel Mount Complete w/Bolts	
2A	1018	Wheel Mount Base Only	1
2B	1420	Bolt	4
2C	1435	Nut	4
2D	1019	Bolt	1
2E	1020	Lock	1
2F	1021	Nut	1
3	1022	Cylinder Slide	1
5	1023	Air Cylinder	1
6	1024	O'Ring	1
7	1025	Cylinder Spring	1
8	1367	#4 Ell Connection	1
9	1026	Clevis	1
10	1027	Nut	1
10A	1427	Bolt Clevis	1
10B		Lock Clevis	1
10C	1497	Nut Clevis	1

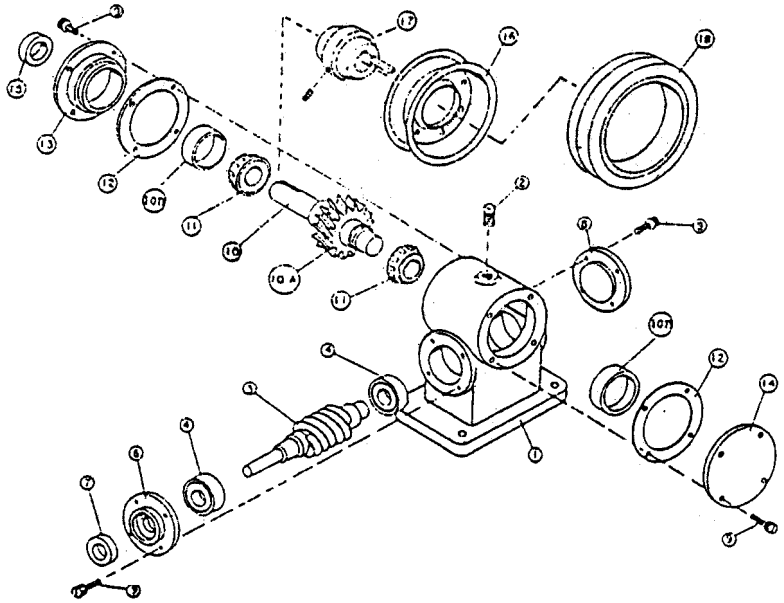


Figure 7-6 Right Angle Gear Assembly

Item #	Part #	Description	Qty Req'd
	1030	Gear Unit Complete	1
	1031	Gear Unit Complete Exchange	
1	1033	Housing	1
2	1367	Plug	1
	1034	Shim	A/R
3	1035	Worm	1
	1036	Repair Shaft for Worm	
4	1037	Ball Bearing	2
6	1038	Bearing Retainer (Lower)	1
7	1039	Seal	1
8	1040	Bearing Retainer (Lower)	1
9	1041	Screw (Fine)	16
	1042	Screw (Course)	16
	1043	Locks	16
10	1044	Worm Gear Shaft)Less Gear)	1
10A	1045	Worm Gear	1

Fig. #	Part #	Description	Qty Req'd
	1414	Key	1
10B	1046	Bearing Cup 157	2
10B	1047	Bearing Cup 162	
11	1049	Cone	2
12	1050	Gasket	2
13	1051	Output Bearing Retainer	1
14	1052	Output Bearing Cap	1
15	1053	Output Shaft Seal	1
16	1054	Wheel Assembly Bolts, Hub & Tire	1
	1055	Wheel Rims Only	2
	1425	Bolt – 5/16-18 x 3/4	
17	1056	Hub	1
	1415	Key	1
	1417	Set Screw	1
18	1057	Tire Replacement	1

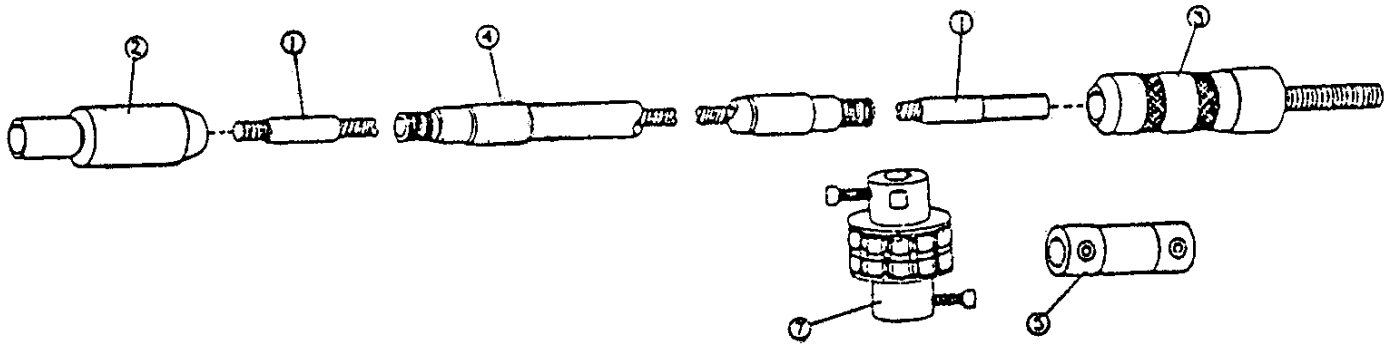


Figure 7-7 Flexible Shaft Assembly

Item #	Part #	Description	Qty Req'd
	1172	40" Flexible Shaft Complete	
	1173	50" Flexible Shaft Complete	
	1174	60" Flexible Shaft Complete	
	1175	72" Flexible Shaft Complete	
	1176	80" Flexible Shaft Complete	
2	1179-1	Female Bearing Assembly	1
	1179-2	Bearing Only	
3	1179-3	Male Bearing Assembly	1
1 & 4	1179-4	22" Core & Housing Extension	
	1172-1	40" Core & Housing	1
	1173-1	50" Core & Housing	
	1174-1	60" Core & Housing	
	1175-1	72" Core & Housing	
	1176-1	80" Core & Housing	
5	1179-5	Flexible Rubber Coupler	
7	1179-6	Flexible Chain Coupler	1
	1418	Coupler Set Screw	4

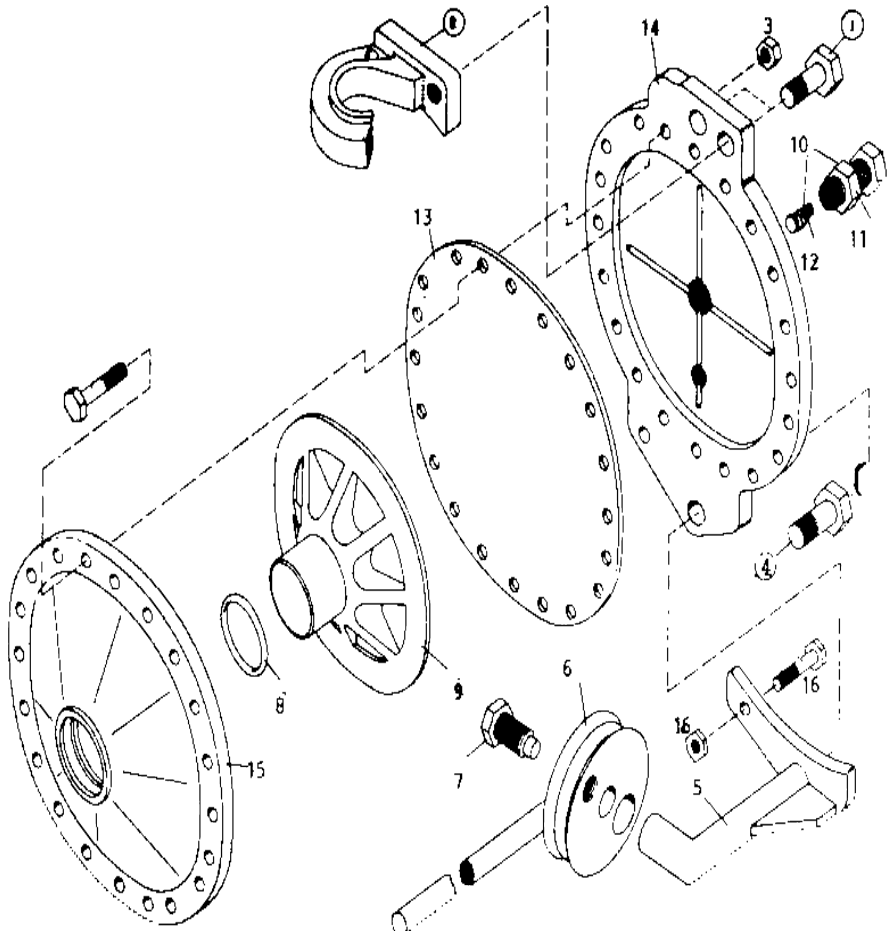
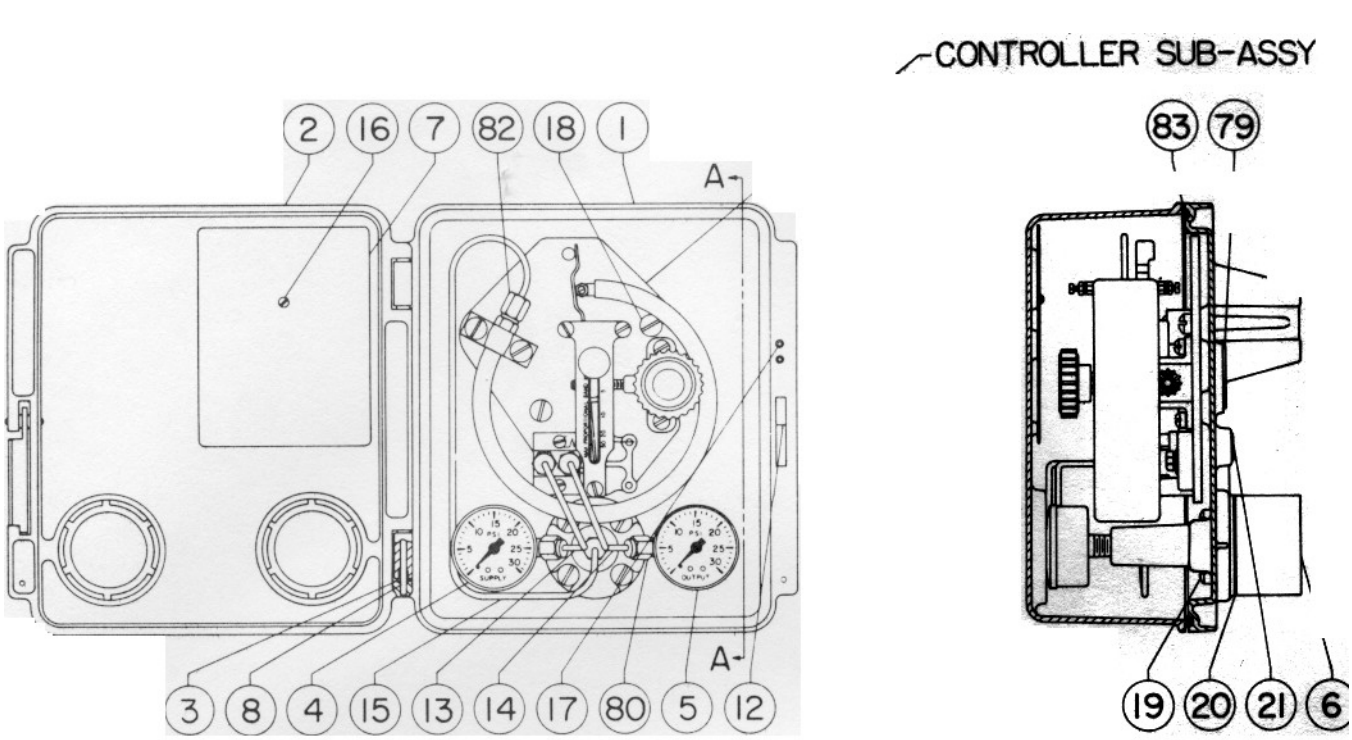


Figure 7-8

Deadline Diaphragm Assembly

Deadline Diaphragm Assembly

Figure #	Part #	Description	Qty Req'd
	1150	Deadline Diaphragm Complete	1
	1151	Deadline Diaphragm Exchange	
1	1152	Hook Retaining Bolts	2
	1153	Hook Retaining Locks	2
2	1154	Hook	1
	1155	Shims	
3	1421	Bolts	20
	1425	Locks	20
3	1428	Nuts	20
4	1156	Cam Retaining Bolt	1
	1157	Cam Retaining Lock	1
5	1158	Cam Lever Stand	1
6	1159	Cam Lever	1
7	1160	Cam Locking Stud	1
8	1161	Pressure Plate O ring	1
9	1162	Pressure Plate	1
10	1163	Valve Assembly Complete	1
11	1164	Valve Body Only	1
12	1165	Valve Only	1
13	1166	Diaphragm Membrane	1
14	1167	Back Plate Assy.	1
15	1168	Front Plate	1
	1169	Coupler ¼ Female	1
	1170	Coupler ¼ Male	1
	1171	Coupler Female	1
10	1163E	Valve Assy. Complete Exchange	
	Diaphragm kit	1166,bolt,nut,1161 o ring	



SA7A00 INSTRUMENT CONTROL

Figure 7-9

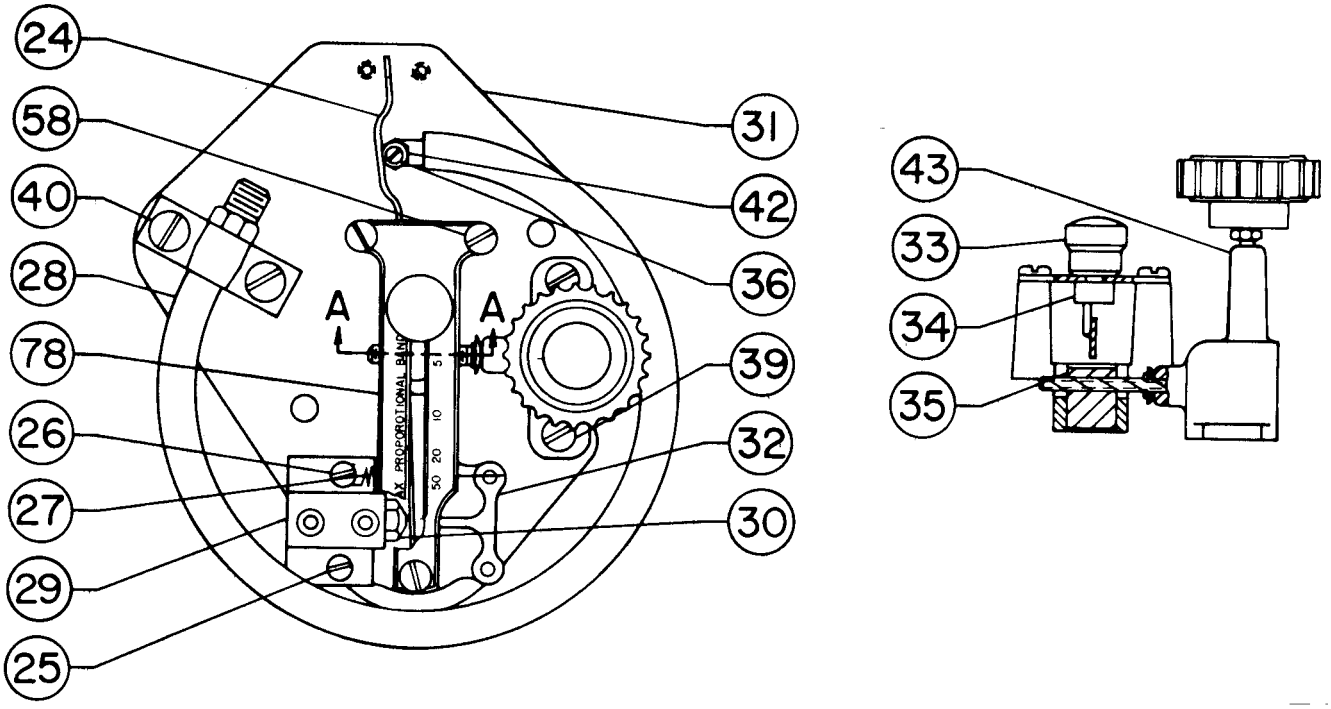


Figure 7-9

Fig. #	Part #	Description	Qty Req'd
	1200	2 Apollo Instrument Complete	1
	1201	Instrument Exchange	1
	1202	Controller Only	1
	1203	Apollo Plate	1
	1204	Door Glass	2
		Retainer – Door Glass	2
2	1205	Cover Assembly - Controller	1
		Base – Controller	1
3	1206	Flange Bearing	2
4	1207	Supply Gauge 0-30	1
5	1208	Output Gauge 0-30	1
6	1209	Control Pressure Block	1
7	1210	Instruction Plate	1
8	1211	Hinge Pin	2
	1212	Weight Control Knob	1
	1213	Set Screw – Weight Control Knob	2
	1214	Weight Control Stem	1
	1215	Weight Control Spring	1
	1216	Panel Bushing	1
		Spring Washer – Latch Arm	1
	1206W	Washer – Latch Flange Bearing (Nylon)	1
		Latch Arm – Cover	1
		Latch Pin – Cover	1
12	1217	Latch Spring - Cover	1
13, 80	1218	Supply Tubing w/Nut & Sleeve	1
14, 80	1219	Output Tubing w/Nut & Sleeve	1
15, 80, 82	1220	Control Tubing w/Nut & Sleeve	1
16	1221	Screw – Instruction Plate (4-40x1/4)	1
17	1222	Machine Screw – Latch Spring	2
18	1223	Machine Screw – Mounting Bracket (¼-28x½)	2
19	1224	Machine Screw – Control Pressure Block (¼-28x1)	4
20	1225	Gasket – Control Pressure Block	1
	1226	Controller Bracket (To Case)	1
	1227	Connector 1/16" NPT	1
	1228	Connector 1/8" NPT	1
24	1229	Flapper	1
25	1230	Machine Screw – Orifice Block (8-32x3/8)	1

Figure #	Part#	Description	Qty Req'd
26	1231	Spring Support (Orifice Block Machine Screw)	1
27	1232	Flapper Spring	1
28	1233	Bourdon Tube 100 lb	1
28	1234	Bourdon Tube 500 lb	1
28	1235	Bourdon Tube 1000 lb	1
29	1236	Orfice Block	1
30	1237	Orifice Assembly	1
31	1238	Mounting Bracket	1
32	1239	Fulcrum Beam Case	1
33	1240	Knob	1
34	1241	Sliding Block Assembly	1
35	1242	Pivot block brass	1
36	1243	Flapper Pivot Point	1
	1244	Base Pivot Screw - Fulcrum	1
	1245	Spring Washer – Fulcrum Base Pivot Screw	1
39	1246	Machine Screw - Pressure Adjustment (10-24x3/8)	2
40	1247	Machine Screw – Bourdon Tube (¼-28x1)	2
	1248	Nameplate (Satellite)	1
42	1249	Hex Nut – Flapper Pivot Point (4-48)	2
43	1250	Pressure Adjustment Assembly	1
	1251	Set Screw – Pressure Adjustment Knob	2
	1252	Knob (Red) – Pressure Adjustment	1
58	1253	Machine Screw – Proportional Band Plate	3
78	1254	Proportional Band Plate	1
	1255	Proportional Band Plate Non-adjustable	
83	1256	Cover Gasket	1

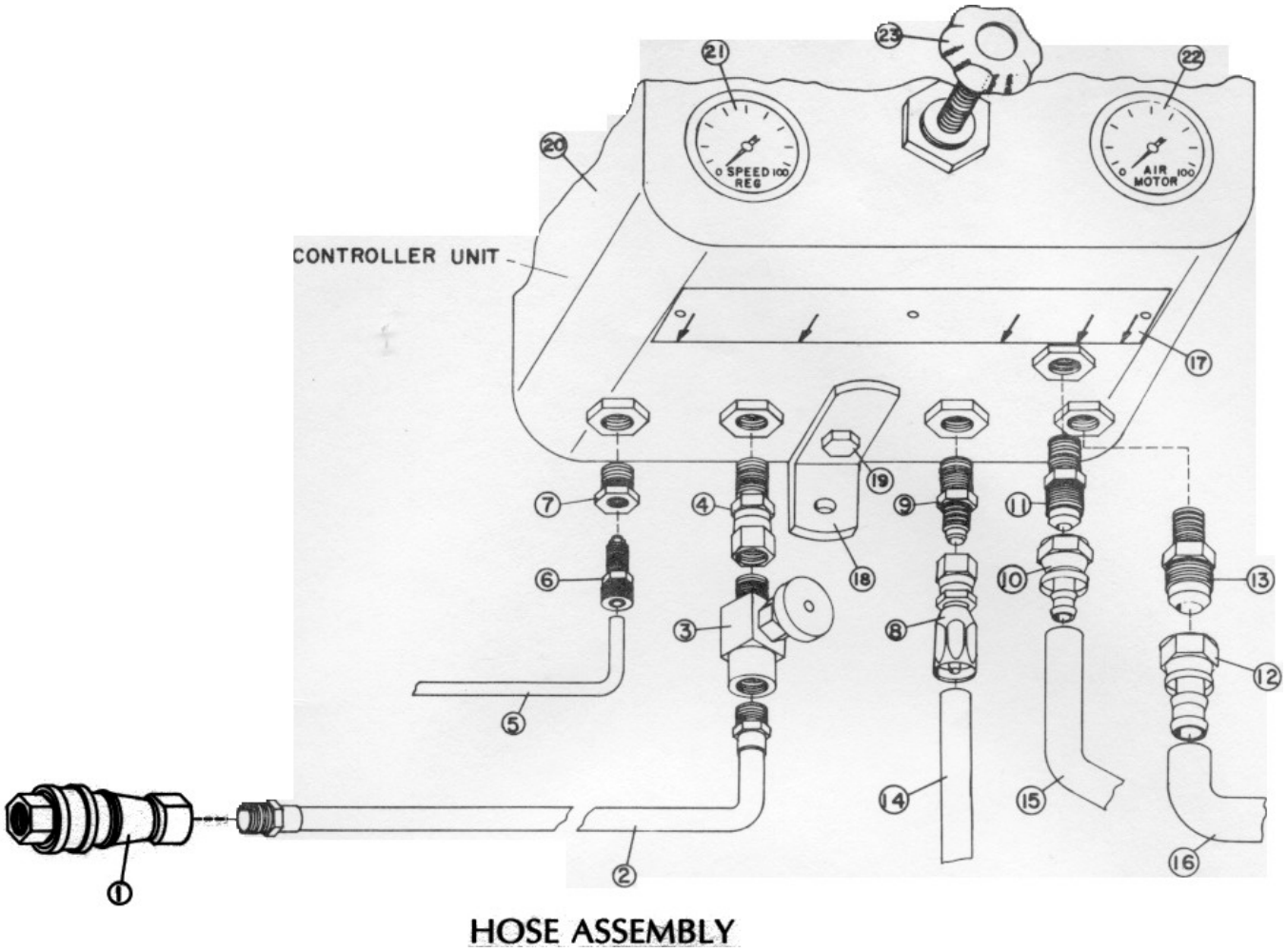
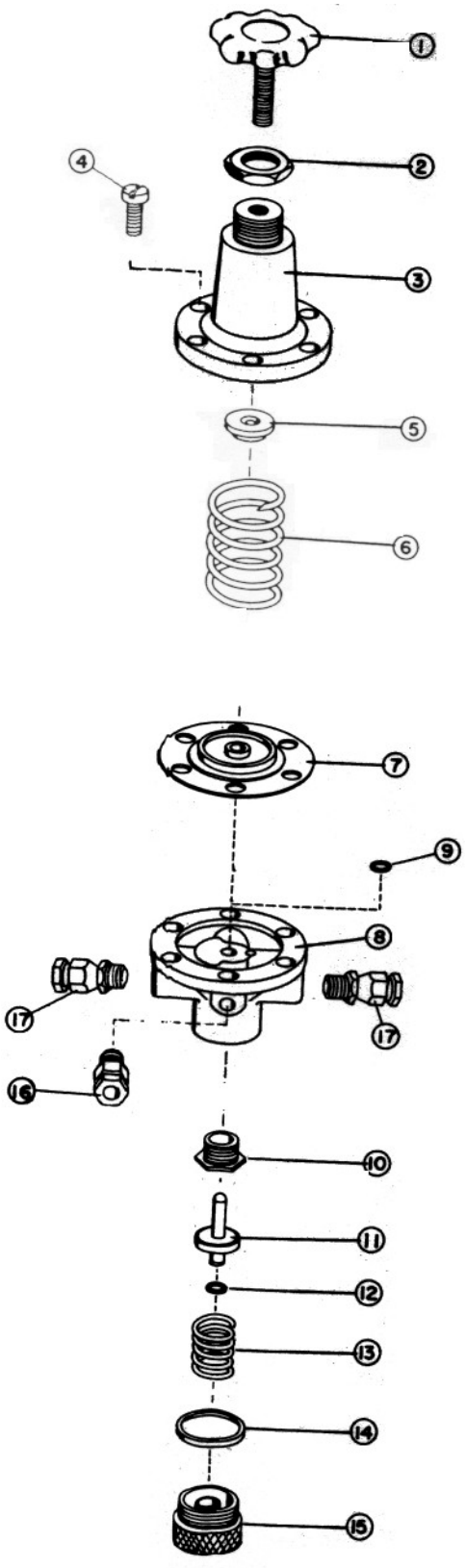


Figure 7-10

Fig #	Part #	Description	Qty Req'd
1	1260	Hydraulic Coupler, Female	1
1A	1261	Hydraulic Coupler, Male	1
2	1324	#4 Tie Down Hose Double Wire Assembly	50'
3	1262	Dampener Valve Assembly	1
4	1372	Swivel	1
5	1263	Air Bleed Hose (Diaphragm Use Only)	5'
6	1264	Bleed Orfice (Diaphragm Use Only)	1
7	1351	Bushing	1
8	1322	#4 Hose End, Female	2
8	1323	#4 Hose End, Male	2
9	1366	Connection #4-1/4 Pipe	1
10	1327	Connection #6 Hose	2
11	1368	Connection #6-1/4 Pipe	1

Figure#	Part #	Description	Qty Req'd
12	1329	Connection #8 Hose	2
13	1370	Connection #8-14 Pipe	
14	1321	#4 Hose Diaphragm Assembly, Single Wire	100'
15	1326	#6 Air Motor Hose Assembly	40'
16	1328	#8 Rig Air Supply Hose Assembly	50'
17	1265	Instruction Plate Hose Hook-up	1
18	1266	Mounting Brackets	2
19	1422	Bolt	2
	1427	Locks	2
	1430	Nuts	2
20	1267	Main Instrument Case	1
21	1268	Speed Regulator Gauge	1
22	1269	Air Motor Gauge	1
23	1290	Speed Control Regulator	1
	1270	Bulkhead Fitting Bolt	5
	1271	Bulkhead Fitting Lock	5
	1272	Bulkhead Fitting Nut	5

Figure 7-11

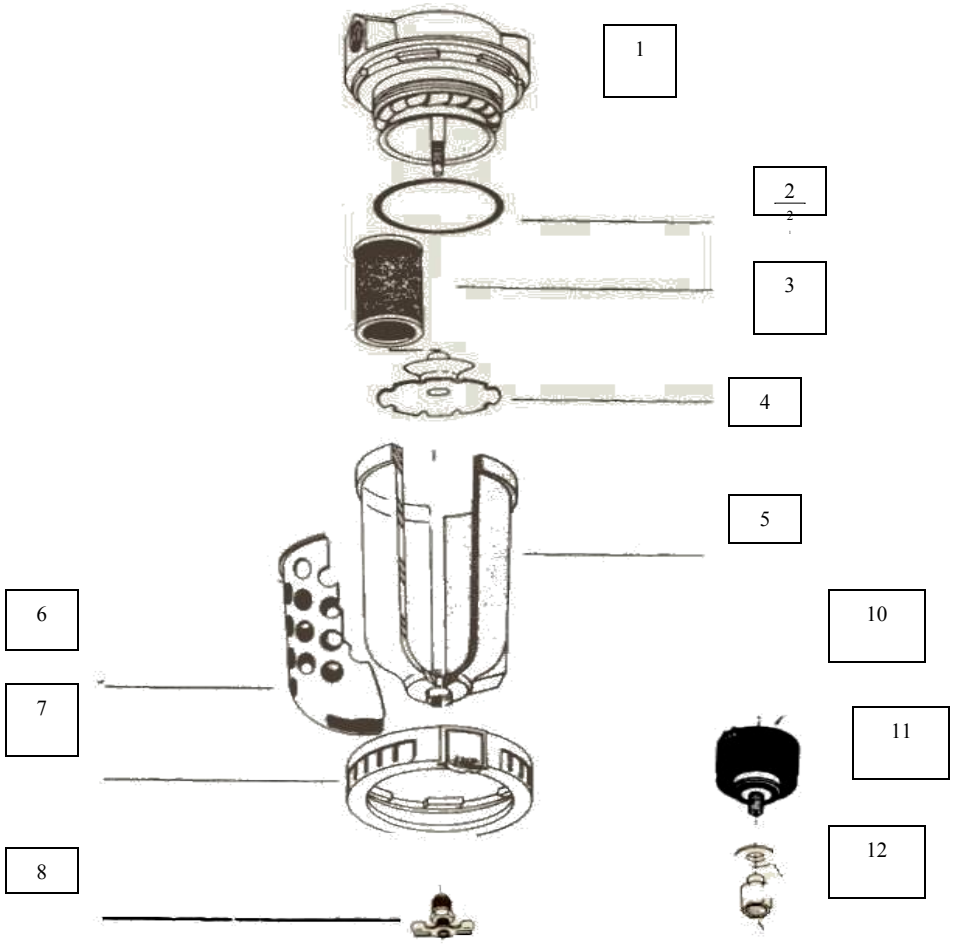


Speed Penetration Control Regulator

Fig #	Part #	Description	Qty Req'd
	1290	Speed Penetration Control Regulator	1
1	1292	Regulator Knob	1
2	1293	Panel Nut	1
3	1294	Bonnet	1
4	1295	Bonnet Screw	6
5	1296	Pivot Washer	1
6	1297	Spring	1
7	1298	Diaphragm	1
8	1299	Regulator Body	1
9		O'Ring Use 1303	1
10	1300	Valve Seat	1
11		Valve Use 1303	1
12		O'Ring Use 1303	1
13		Valve Spring Use 1303	1
14		Cap O'Ring Use 1303	1
15	1301	Cap	1
	1291	Speed Control Exchange	1
	1302	Washer, Brass	2
	1303	Repair Kit, speed pen reg.	

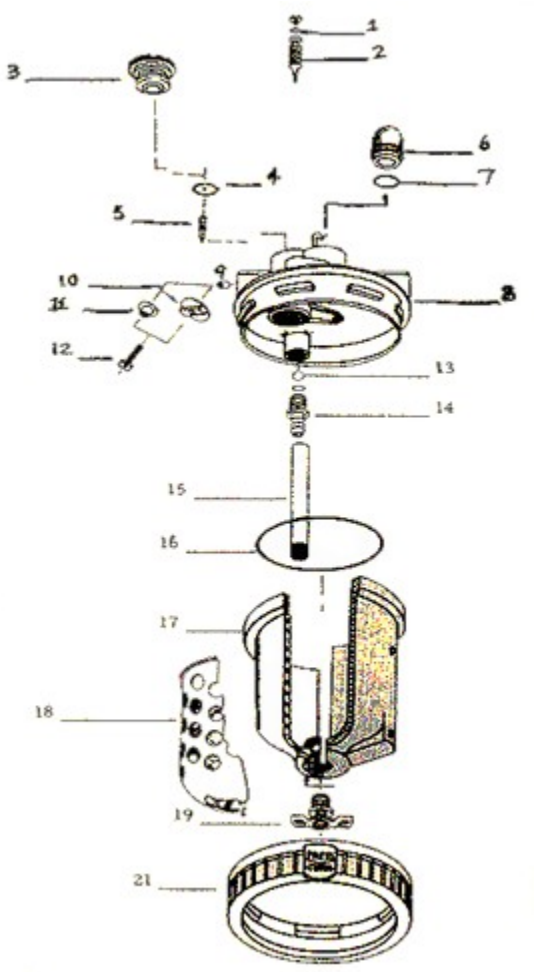
Air Filter Assembly

Figure 7-12



Air Filter Assembly

Figure #	Part #	Description	Qty Req'd
	1180A	Filter Assy., w/mount & connection	1
	1180	Filter Assy., Complete	1
	1181	Filter Assy. Mount	1
1	1182	Cover Body	1
2	1183	O Ring	1
3	1184	Filter Element (Fiber or Cloth)	1
	1185	Filter Element (Old Style)	
	1186	Filter Element Bronze	
4	1187	Baffle	1
5 & 6	1188	Bowl & Bowl Guard	1
5	1188B	Bowl, Only	1
7	1189	Clamp Ring	1
8	1190	Petcock	1
9	1191	Automatic Drain Complete	1
	1192	Rubber Dump	1
	1366	Connection #4	1
	1357	Connection Tee	1
	1371	Connection E11 #8	2
	1356	Connection E11	



Lubrication System

Figure 7-13

Figure #	Part #	Description	Qty Req'd
	1125	Lubricator Complete	1
1	1126	O Ring	1
2	1127	Adjusting Screw	1
3	1128	Fill Plug	1
4	1129	O Ring	1
5	1130	Check Valve	1
6	1131	Sight Dome	1
7	1132	O Ring	1
8	1133	Body	1
9	1134	Spacer Tube	1

Figure #	Part #	Description	Qty Req'd
10	1135	Flow Guide	1
11	1136	Flow Guide	1
12	1137	Flow Guide Screw	1
13	1138	Ball	1
14	1139	Adapter	1
15	1140	Siphon Tube	1
16	1141	O Ring	1
17 & 18	1142	Bowl & Guard	1
17	1142	Bowl, Only	1
19	1143	Pet Cock	1
20	1144	Plastic Drain	1
21	1145	Clamp Ring	1
N/S		ELL, #6-1/4 NPT	
N/S	1353	Nipple	

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