



Techniques of Water-Resources Investigations of the United States Geological Survey

Book 8 Chapter A2

INSTALLATION AND SERVICE MANUAL FOR U.S. GEOLOGICAL SURVEY MANOMETERS

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**Book 8
Instrumentation**

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- d. Connect Tygon tube from the manometer to the manometer shut-off valve after cutting tubing to correct length. Make certain that there is a stainless-steel insert in each end of this tube before connecting. The inserts are necessary with this soft flexible tubing to insure that it does not collapse under the pressure of the tube fitting or blow completely out of the fitting.
- e. To flush orifice, follow details in figure 21.

Manometer Assembly

Unpack manometer and other components. The manometer is complete, except for assembling the float switch. Power supply (batteries, solar system, and so forth) and control unit do not come with the manometer and must be supplied by the installer.

Assembly of float switch

The armature and float assembly will be found wrapped and taped between the carriage track. The armature assembly is too heavy to be shipped mounted in place on the jeweled bearings, which might severely damage the bearings.

The procedure for assembling of the float switch (fig. 22) is as follows:

- a. Position the movable pressure cup manually to the approximate level of the float-switch reservoir.
- b. Remove the terminal connectors.
- c. Remove the float-switch stack by removing the three screws holding it in place on the

reservoir and set aside with care.

- d. Unwrap float and assemble into float stack. Use caution in assembly by positioning the armature center contact (FS-120) between the two contacts (FS-11) at the top of the stack.
- e. Engage the pivot shaft (FS-17) of the armature between the jeweled bearings (FS-18) to finger tightness. Some looseness of the jewel screws is desirable to prevent damage to the pivot points (fig. 23). By trial and error adjustment, center the armature in the stack with no binding of the bearing points. The jewel screws should finally be adjusted so that slight lateral movement of the armature can be detected but not so much as to allow the armature to fall from the jeweled bearings.
- f. Test freedom by tilting the stack and observing that the center contact is free to oscillate between the two contacts. No holdup in the oscillation should occur; if it does, the jeweled bearings are too tight.
- g. Reassemble the stack on the reservoir. The stack (with float and armature) should now be replaced temporarily on the reservoir, and the mercury-contact roll pin should be adjusted, if necessary, so that it does not touch the bottom of the reservoir but will contact the small pool of mercury that will be trapped in the bottom by the reentrant stainless-steel tube fitting. The float switch can now be loosely reassembled

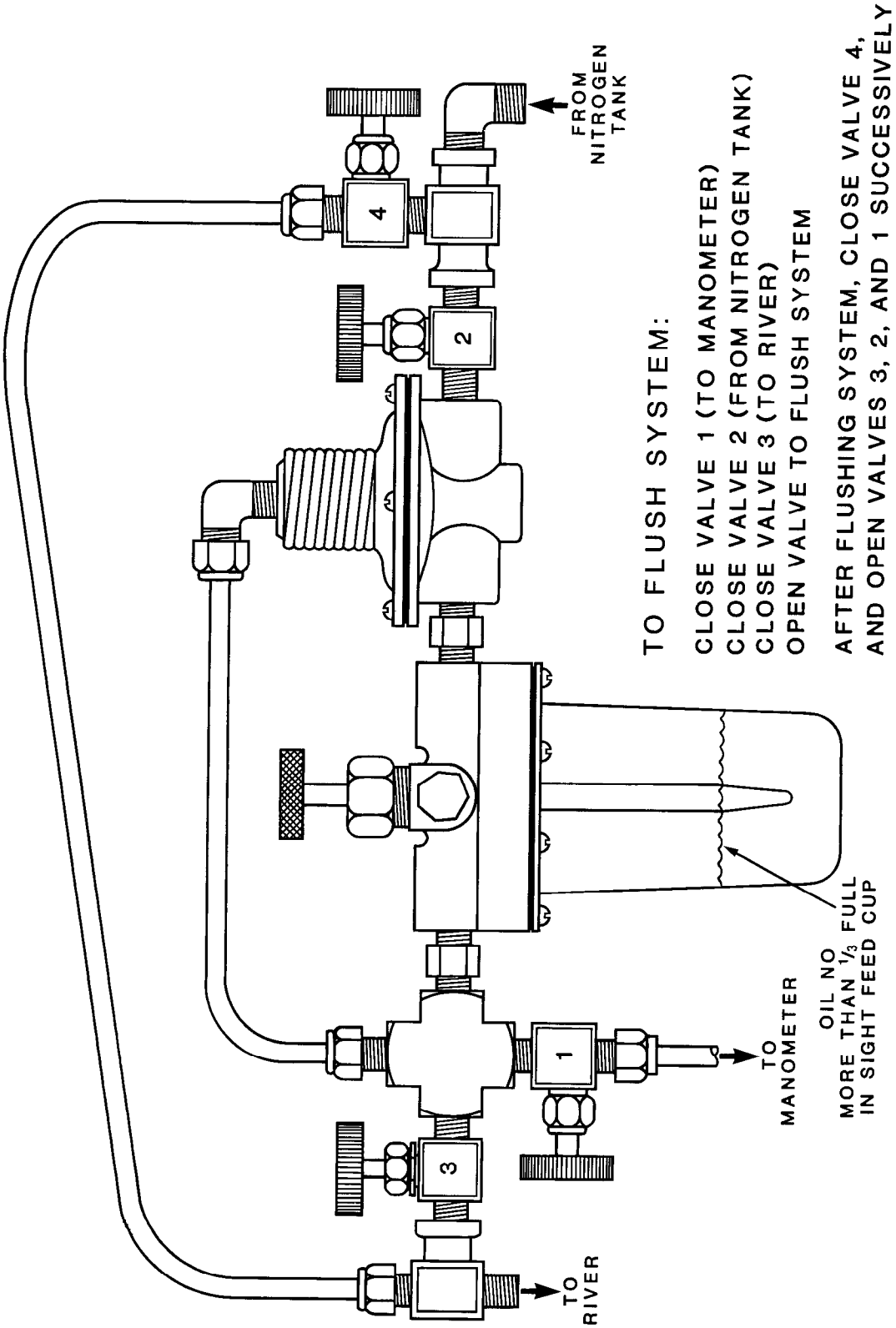


Figure 21.--Procedure for purging the orifice line.

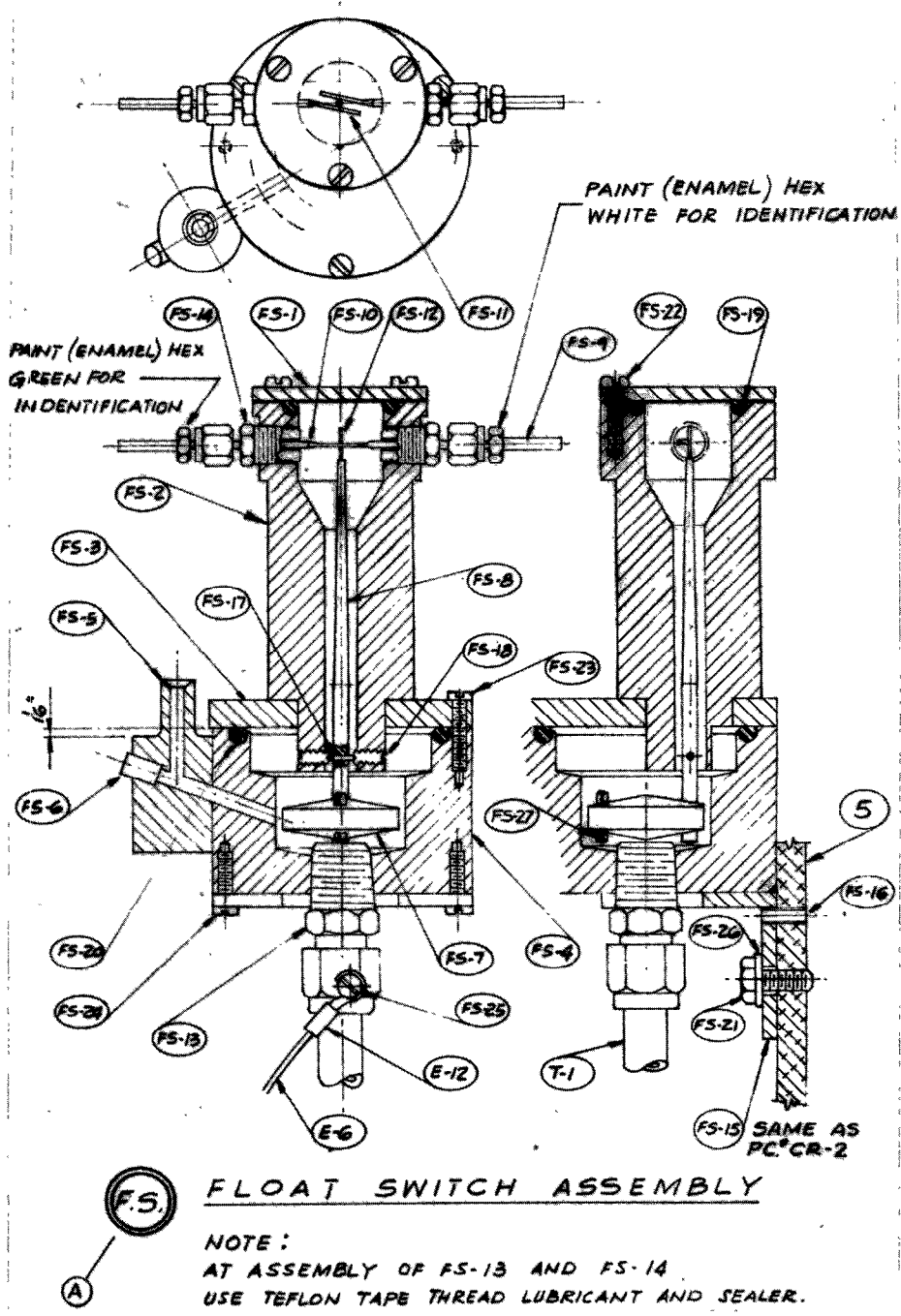
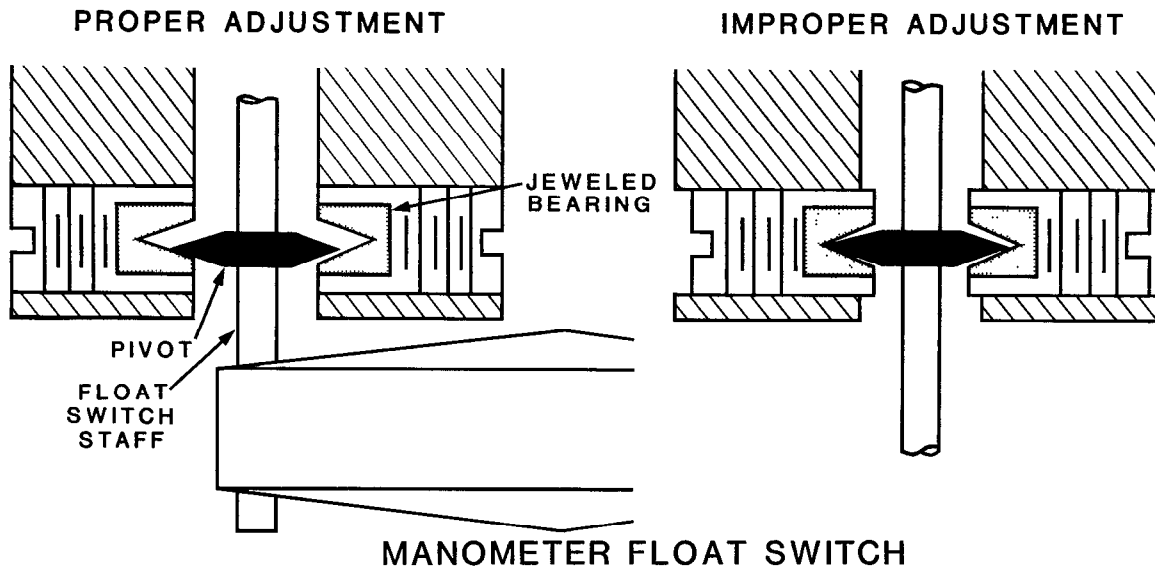


Figure 22.--Float-switch assembly.



PIVOT ADJUSTMENT:

THE FLOAT SWITCH STAFF COULD TIP BACK AND FORTH ON SIMPLE KNIFE EDGES BUT FOR PRACTICAL REASONS OF CONTAINMENT, DURABILITY AND EASE OF PROCUREMENT THE JEWELLED BEARINGS AND PIVOTS ARE USED

THE JEWELLED BEARINGS MUST BE ADJUSTED WITH CARE SO AS NOT TO JAM AND DEFORM THE VERY DELICATE PIVOT POINTS. A VERY LOOSE ADJUSTMENT OF THE JEWELLED BEARINGS IS PREFERRED AS ANY DRAG ON THE PIVOT WILL CAUSE SYSTEM INSENSITIVITY

Figure 23.--Pivot adjustment.

until the mercury is installed in the manometer. The two contacts should now be bent slightly, as required to center them and to make them parallel, with a spacing that will allow a movement of the armature of about 1/32-inch.

- h. Connect electrical terminals, following the color coding.
- i. Hook up pressure lines to pressure cup--two ferrules front and back.

Connecting pressure tube

This soft-type tube should be passed through the tube fitting in the manometer backplate. Pull the tube through the fitting until only enough remains on the inside of the manometer to nicely reach the pressure reservoir at both limits of its travel.

Mounting manometer on shelf

Temporarily place the recorder that will be used on the shelf. Place the manometer-mounting casting on the front of the shelf and as far back on the shelf as the downward-projecting part of the casting will allow. Fasten the casting securely to the shelf with the four stainless-steel screws provided.

Connect the pressure tube projecting from the back of the manometer to the manometer shut-off valve after cutting the tube to a convenient length. If the tube is shortened, be sure that the stainless-steel insert is replaced in the end before the tube is connected to the shut-off valve.

Placing mercury in manometer

The amount of triple-distilled mercury supplied with

this equipment is a little more than is actually required. It is more convenient to place only about 3/4 pound in the manometer at this time, adding more (about 1/4 pound to 35 feet and 3/4 pound to 50 feet) when the equipment is placed in operation. To place mercury, proceed as follows:

- a. Remove stack from float-switch reservoir.
- b. Grasp mercury-transfer tube about a foot below the float-switch reservoir and lift tube a little higher than the reservoir.
- c. Pour about 3/4 pound of mercury into the reservoir.
- d. Lower mercury-transfer tube slowly, allowing mercury to flow through it to the pressure reservoir without trapping air in the tube or fittings. If any small bubbles remain in the mercury-transfer tube, they can be dislodged by gently tapping the mercury-filled tube with the fingers. Continue to add the proper amount of mercury as indicated above.
- e. Replace stack and tighten screws snugly to seal the O ring.

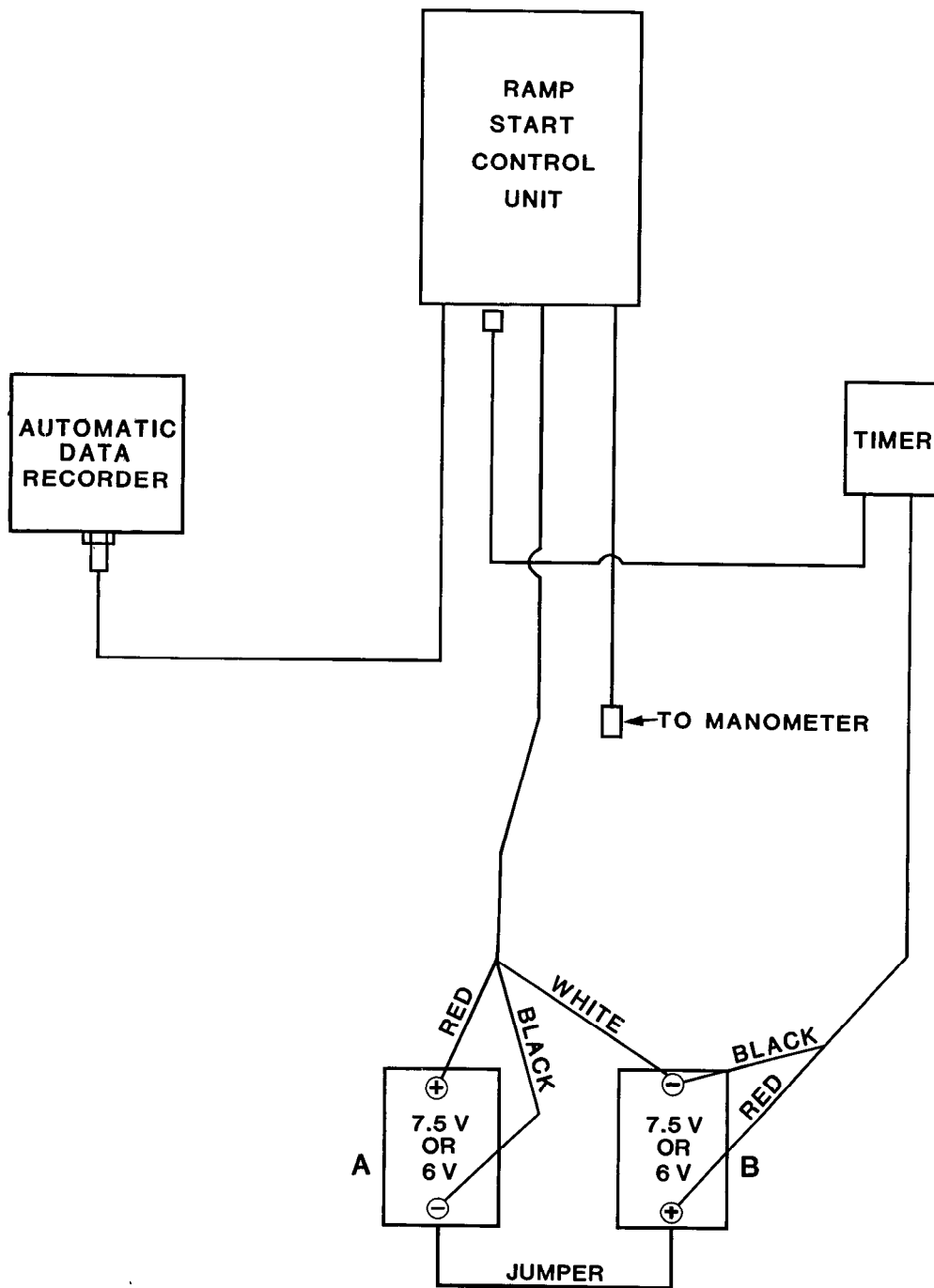
Check of connections

At this point, all tube and electrical connections on the manometer unit should be checked to make sure that they have not worked loose in transit.

Servo-Control Unit

Battery connections

Connect battery leads from the servo-control unit to 6-volt (or 7 1/2-volt) batteries, as indicated in figures 24 and 25,



- NOTES: (1) REPLACE BOTH BATTERIES IN OCTOBER AND TIMER SIDE BATTERY (B) AGAIN IN MARCH
 (2) TIMER MUST BE CONNECTED TO THE NEGATIVE SIDE OF BATTERY

Figure 24.--Wiring diagram for use with ramp-start control.

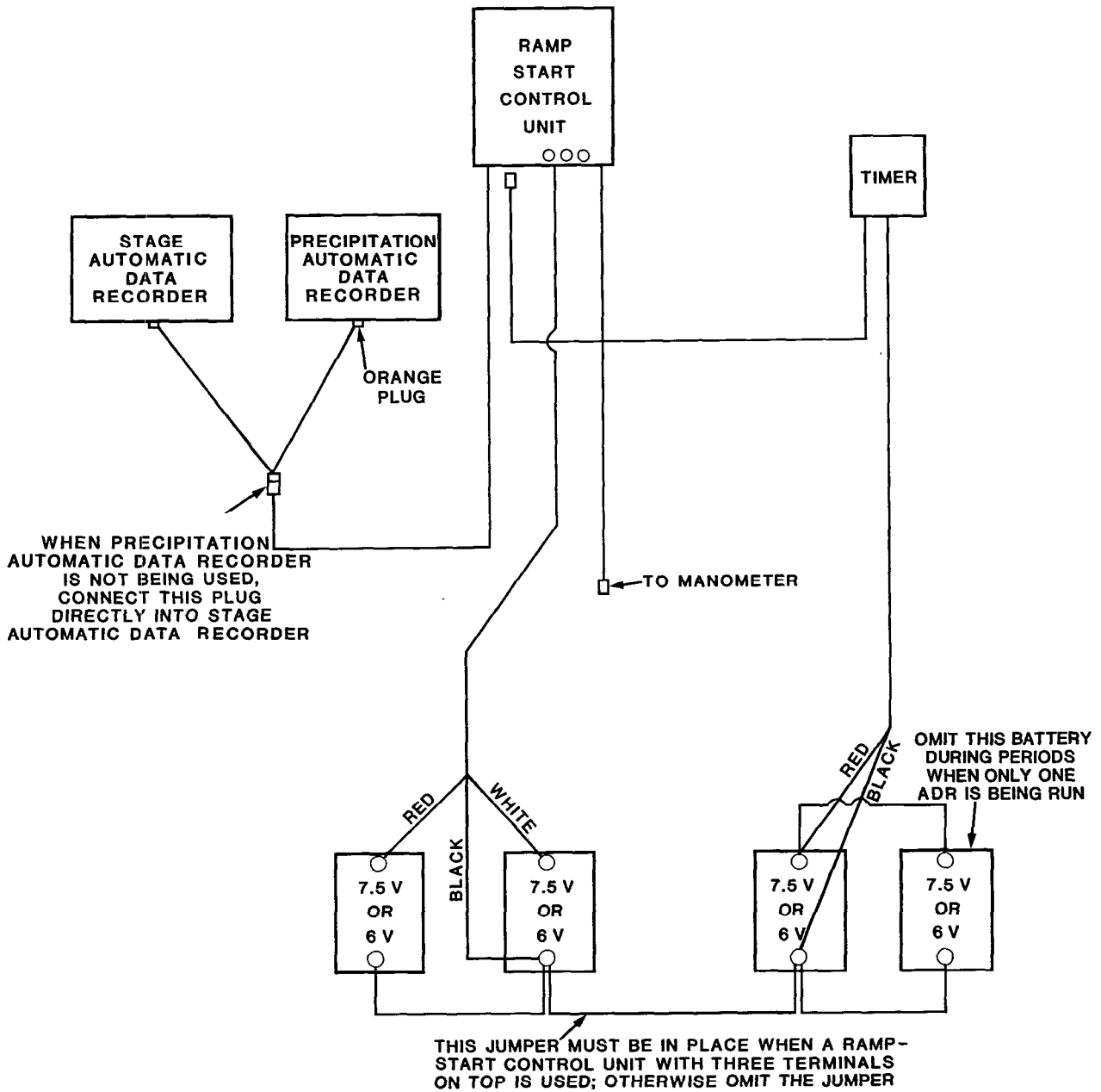


Figure 25.--Wiring diagram for use with ramp-start control and precipitation automatic data recorder.

carefully observing the color coding of the wires. The manometer will not operate if the polarity of the batteries is reversed. The servo-control unit should not be connected to the manometer at this time.

Recorder

Drive sprocket.--Place the desired sprocket (see section on operation with graphic recorder) on the float-wheel shaft of the graphic or digital recorder in place of the float wheel. (Note that, by loosening the right-hand and left-hand screws in the retaining disc, the float-wheel shaft of the recorder can be rotated in the usual manner to check reversal points and to set pen.) Connect the ends of the $\frac{1}{2}$ -inch ladder drive chain and place the chain over the sprockets. With the graphic recorder and 1 to 12 gage-height ratio, a 22-inch length of chain is used; with the 1 to 16 ratio, the chain can be shortened if desired. For the ADR, the chain lengths are 31 inches and 23 inches with the jack shaft and 37 $\frac{1}{2}$ inches without.

Placement and leveling.--Level the recorder on the shelf. Move the recorder into place to properly line up and tighten the drive chain, leaving a little slack in the chain. When the chain is properly tightened, check the recorder leveling and secure the recorder in place with foot screws as usual.

A step-by-step procedure for smooth and fast installation of the gagehouse equipment follows:

1. Install battery box (if used) and batteries.
2. Drill holes in floor for bubble- orifice tubes.
3. Install Conoflow regulator assembly. Note arrow on

regulator showing direction of gas flow.

4. Install holders and strap to hold nitrogen tank.
5. Install nitrogen tank and tank regulator.
6. Complete tube hookup from tank regulator to Conoflow regulator and attach orifice tube to Conoflow regulator.
7. Start nitrogen flow, and let gas continue to bubble through bubble tube and orifice to clean and dry system. Check for gas leaks.
8. Install manometer mounting bracket and manometer, and adjust level.
9. Hook up pressure tube from Conoflow regulator manifold to pressure cup on manometer.
10. Install mercury and float switch; adjust jewels and points. Mercury level should be about $\frac{1}{8}$ -inch above bottom of pressure cup, which takes a total of about 1 $\frac{1}{2}$ pounds of mercury. The amount varies depending on the model of manometer used.
11. Install control unit, and connect to batteries and manometer.
12. Install graphic recorder (if used).
13. Install digital recorder and timer.
14. Install Telemark (if used).
15. Make final gas test, including high pressure, and check all electrical connections.

OPERATION AND MAINTENANCE

Manometers are more complex than most other water-stage-recording devices. Successful

operation requires alertness and the ability to recognize and diagnose malfunctions, some of which may be subtle. Familiarity with these instruments leads to instinctive recognition of common trouble symptoms. The general procedure described below is intended as an aid in developing this instinct.

Observation

The first and most important step in manometer operation is observation. Items that should always be given attention during routine manometer inspection are listed below:

1. Relation between outside and inside gage readings.
2. Relation of mercury surfaces in pressure reservoir and in float-switch reservoir.
3. Quantity of mercury in pressure reservoir and stability of surface.
4. Appearance of recorder chart.
 - a. Magnitude of steps.
 - b. Painting of pen trace (surge).
 - c. Flattened crests and troughs.
 - d. Intermittent failure of manometer to follow stage.
 - e. Sudden breaks in continuity of record.
 - f. Frequent "inspection marks."
 - g. Sags in pen trace for short periods.
 - h. Rapid rise to limit during cold weather.
 - i. One-way operation (up or down only).
5. Bubble rate.
6. Gas pressure.

Electrical Malfunction

If no abnormalities are evident, good operation may be

assumed, and no further attention is needed. If electrical malfunctions are indicated by chart appearance, the following items should be considered:

1. Condition of float-switch points, jewels, and float.
2. Motor performance.
3. Servo-control unit response.
4. Battery voltage.

Common Problems and Suggestions

If performance of the manometer is not satisfactory, as judged from the above observations, steps should be taken to improve it. Factors causing poor operation and suggestions for correcting them are listed below.

1. A stage reading on the counter that is higher than the outside-gage reading and is not due to orifice movement is common and serious. Obstructions in the bubble tube, usually oil or water, cause the difference between the inside and outside gage readings to increase slowly over a period of months. If the obstruction is not removed, operation of the gage will become increasingly unreliable, eventually causing severe painting or hunting. The oil or water can be removed by forcing a solvent, which itself can be easily removed, through the tubing. One quart of n-hexane (available from bulk-petroleum distributors) can be forced through the tubing by use of a pressure-tank garden sprayer. The spray nozzle is replaced by a fitting that connects the bubble tube to the sprayer hose. The pressure pump

will force the solvent through the line easily if the orifice is only a few feet under water. After the line is purged, it should be flushed with nitrogen to remove the heavy solvent fumes which otherwise would affect gage operation for a few days. The flushing nitrogen should be taken from the bypass system or the regulator, not from the sight-feed outlet. The source of contaminating oil is usually the sight-feed valve when the bubble rate is too fast.

A low inside-gagereading is unusual and is generally caused by orifice movement or a gas leak. The orifice anchorage and all fittings in the gas line should be checked. If the counter reads low only during high stages, drawdown or incorrect setting of the manometer angle is likely. The angle should be changed only after a careful analysis of variation versus stage to insure that the relation is linear.

Orifices in highly mineralized water often become obstructed or completely closed by mineral deposits that build up at the river end of the orifice. This can be corrected by using a short length of larger ID tube at the river end. A $\frac{1}{4}$ -inch ID copper tube orifice fitting can be reamed periodically to remove any buildup. Gas other than nitrogen may also correct this condition.

2. The vertical displacement of mercury in the manometer

should indicate the distance of the orifice below water surface. Lack of displacement shows that the orifice may be above water. Negative displacement shows a vacuum, which, though uncommon, may be highly significant. This condition is relieved by venting the float-switch reservoir to the atmosphere.

3. Mercury in the pressure reservoir should just cover the reservoir surface at lowest operating temperature. Less mercury causes erratic operation. Excess mercury is much less harmful.

Pulsation of the mercury surface indicates orifice trouble unless the orifice is in rough water. This pulsation causes either stepped or painted pen tracings, depending on the delay circuit. Amplitude of the surge can sometimes be minimized by slowing the bubble rate to the lowest value that other conditions will permit. Better operation may be obtained by cleaning the orifice, moving it to quiet water, or pointing the tube vertically downward.

4. Appearance of the graphic-recorder chart is the prime indicator of manometer performance. The symptoms of malperformance are much more difficult to find on a digital tape than on a graphic chart. The careful scanning of a digital record can be better done after it has been translated, but the best field analysis possible is well worth the effort.

- a. The size of step is not related to contact-point spacing at all. It is a function of motor speed, electrical resistance through the float-switch contacts (affected by cleanliness), water-surface surge, bubble rate, and delay-circuit characteristics. Stepping can often be minimized by use of a 1-rpm motor instead of the standard 5-rpm motor on the screw-type manometer. In the STACOM, a gear change (M-7) may be used to control speed of the manometer. This will permit the unit to follow only stage changes slower than 3 feet per hour. The delay circuit changes surge into steps. The step size is usually equal to the amplitude of the surge. Sometimes careful location of the orifice in quiet water will minimize steps. The slowest permissible bubble rate will minimize some stepping. Large steps may also be due to servo-control malfunction. The servo-control unit should be replaced, and the one thought to be malfunctioning should be brought in for tests and repairs.
- b. Painting at low stages is almost always due to an obstruction in the gas line or at the orifice. (See figure 21 for procedure to flush gas line.) If the orifice is horizontal, the painting may be stopped by pointing the orifice down. Float-switch jewels that are faulty or too tight or float-switch contacts that are set too closely may cause painting. Welding of the contact points will cause the recorder to paint, but welding also indicates other electrical difficulties.
- c. Float-switch contacts that are too far apart cause long flat spots at the tops of rises or at troughs.
- d. Intermittent malfunctions might be corrected by replacing the entire servo-control unit and motor. Field repairs are impractical.
- e. Debris catching on or being washed off the orifice will cause sudden breaks in the record. Swimmers or animals stepping on or lifting a lightly anchored orifice will have the same effect. Clean and reanchor the orifice if necessary.
- f. Inspection marks not made intentionally are usually made by sticking points (tight jewels) or sticking relays. Adjust jewels, or replace control unit. Some combinations of control units and certain motors cause unintentional inspection marks by frequent overrun.
- g. Gas leaks are most frequent when the temperature is changing rapidly. Scratching in the tubing under the

Swagelock fittings is a prolific source of leaks. A light coating of black Permatex on the tubing and under the ferrule will prevent leaks due to scratches. Some sight-feed components were furnished with brass ferrules, which should be replaced with nylon ferrules. Intermittent leaks are very difficult to find unless the joint is leaking when the hydrographer is present.

- h. A frozen orifice or ice in the bubble tube causes the pressure reservoir to rise as high as the gas pressure or limit switch will allow. This causes the mercury to blow out at times. If this has occurred and the orifice has thawed, install fresh mercury or recover mercury from the overflow reservoir. (Do not sweep up and reuse the spilled mercury, as it will have a lower specific gravity than new mercury.) Set the bubble rate and line pressure as low as practicable during cold weather. Check all soldered joints carefully, as the blown mercury may have rotted them.
- i. The set screw on the float may have vibrated out of adjustment so that the armature does not touch one of the contacts. A fitting under the mercury may have vibrated up to interfere with the float and armature. Re-

pairs are obvious in these cases. A tripped circuit breaker or blown fuse may cause one-way operation only. The control unit may be faulty.

5. Bubble rates higher than 60 per minute may contaminate the orifice tube with silicon oil from the sight feed and cause poor operation. Rates too low can cause the record to lag during rapid rises in stage, which will show as a straight line instead of a curve on the rising limb of a flood hydrograph. A sight-feed valve in good operation will hold its rate within close limits. Rapid changes in rate or inability to hold settings are usually due to lint in the needle valve. Lint is easily removed, but extensive repairs are impractical in the field.
6. Tank pressure should fall about 100 psi per month (112 cubic-foot cylinder, 60 bubbles per minute). A more rapid pressure loss indicates leaks. Changes in temperature between successive readings will affect pressure loss. Line pressure of 22 psi will operate a 50-foot bubble gage throughout its range, and 15 psi will suffice for a 35-foot model. Low line pressure limits operating range.
7. Float-switch jewels that are too tight or too loose cause erratic operation (fig. 22.) They should be on the loose side when set during most normal opera-

ting conditions. However, they should be set as tightly as operation permits during cold weather. The screw (roll pin) on the float should just touch the mercury surface when all the mercury that will drain has been drained. Any deeper submergence may impede the armature. The contact points should be scraped from time to time with a burnishing tool or a sharp-edged tool.

8. A motor in excellent adjustment will run from one fresh flashlight D cell. A motor that will not start with two cells should be replaced. Field cleaning of motors is not generally practical but can be done as a last resort.
9. The response should be quick and clean when the servo-control unit delay switch is off. The up and down delay times should be about the same. If the responses are not satisfactory, try a jumper wire from mercury ground to each contact point head (in turn) to rule out float-switch troubles. The float-switch armature must be in null position while the jumper is connected. Also check voltage at motor leads before replacing the control unit.
10. Batteries go dead quickly in cold weather if the motor becomes too stiff to start. Painting is especially hard on batteries. If voltage is found to be low for no obvious reason, the mechanical parts of the

manometer should be checked for binding bearings or gears.

Complex testing devices are available that can pinpoint a faulty relay or diode and can measure float-switch resistance. However, these are rarely needed. The best testing apparatus is the graphic recorder. With this, a simple voltmeter, and the procedure suggested above, almost all malfunctions can be corrected or prevented by the hydrographer on a routine trip. Once the hydrographer is familiar with the general procedure, it need take no more time than servicing the water-stage recorder. Without alert observation and troubleshooting, high-quality records of stage from manometers (or any other gage) are impossible to obtain. With skillful maintenance, an excellent stage record can be collected at less expense and with less effort with the STACOM manometer than with any other type of gage at most locations.

PROCEDURE FOR CHANGING GAS CYLINDER

1. Refer to figure 21. Turn off valve to manometer. (1)
2. Turn off valve at cylinder.
3. Close Conoflow sight-feed valve. (2)
4. Close river line. (3)
5. Remove regulator screw.
6. Remove old cylinder and secure new cylinder in place. Open valve of new cylinder for a second or so to blow

- out any dirt or dust before connecting regulator.
7. Open cylinder valve slowly until tank pressure gage shows full tank pressure. Open valve completely.
 8. Close cylinder valve and watch tank pressure gage. If it returns slowly to zero, either the inlet connection nut or the cylinder valve-stem packing is leaking. If the connection nut is leaking, the condition must be corrected.
 9. Open cylinder valve slowly and completely.
 10. Open bypass valve. (4)
 11. Replace backout screw in regulator and adjust to desired pressure.
 12. Close bypass valve. (4)
 13. Open Conoflow sight feed. (2)
 14. Open river line. (3)
 15. Open valve to manometer. Gage should now be back in operation.

APPENDIX

STACOM Manometer Parts List,
p. 48-53

Screw-Type Manometer Parts List,
p. 54-57

PC NO	NAME	MAT	QUAN	NOTES	DETAIL DWS. NO.	PC NO.	NAME	MAT	QUAN	NOTES	DETAIL DWS. NO.
	BASE PLATE - COMPONENTS & FITTINGS										
1-35	BASE PLATE (MODEL 35)	CAST AL. TOOLING	1	3/8 x 9 x 4 1/2	ETCH & CLEAR ANODIZE	8	MOUNTING BRACKET ASSEMBLY	BRASSALLOY	1	CASTING	5
1-50	BASE PLATE (MODEL 50)	CAST AL. TOOLING	1	3/8 x 9 x 6 5/8	ETCH & CLEAR ANODIZE	8	BRACKET	BRASSALLOY	1	CASTING	11
2-35	SUPPORT, TRACK (MODEL 35)	2024 T4 AL	2	1/2 x 1 x 3 3/8	ETCH & CLEAR ANODIZE	9	CAP SCR. HEX HD	STAIN STL	1	3/8 - 24 NF - 2 x 1 1/4	5
2-50	SUPPORT, TRACK (MODEL 50)	2024 T4 AL	2	1/2 x 1 x 5 1/4	ETCH & CLEAR ANODIZE	9	WASHER PLAIN	STAIN STL	1	3/8 SIZE	5
3-35	TRACK, RIGHT (MODEL 35)	BRASS	1	1/8 x 3/4 x 3 3/8	CHROME PLATE	9	MACH SCR. RD HD.	STAIN STL	1	10 - 32 NF - 2 x 1 1/4	5
3-50	TRACK, RIGHT (MODEL 50)	BRASS	1	1/8 x 3/4 x 5 1/4	CHROME PLATE	9					
4-35	TRACK, LEFT (MODEL 35)	BRASS	1	1/8 x 3/4 x 4 0	CHROME PLATE	9					
4-50	TRACK, LEFT (MODEL 50)	BRASS	1	1/8 x 3/4 x 5 6 1/8	CHROME PLATE	9	UPPER PROCKET SHAFT ASSEMBLY				12
5	FLOAT SWITCH PLATFORM	2024 T4 AL	1	ETCH & CLEAR ANODIZE		10	BEARING HOUSING	2024 T4 AL	1	ETCH & CLEAR ANODISE	12
6	STAND - OFF	2024 T4 AL	3	ETCH & CLEAR ANODIZE		10	SPROCKET	STAIN STL	1	BERG # 25SP175-20	12
7	ADAPTER PLATE, CHASSIS MOUNT	2024 T4 AL	1	ETCH & CLEAR ANODIZE		10	GEAR	AL/STAIN HUB	1	DYNACO # 151 - 270	12
8	STOP, ADJUSTMENT SCREEN	2024 T4 AL	1	ETCH & CLEAR ANODIZE		10	KNURLED KNOB	STAIN STL	1	BERG # CM1 - 1/3 ALTERED	12
9	BRACKET, UPPER LIMIT SWITCH	2024 T4 AL	1	ETCH & CLEAR ANODIZE		10	SHAFT	303 STAIN STL	1	BERG # 56 - 91 ALTERED	12
10	BRACKET, LOWER LIMIT SWITCH	2024 T4 AL	1	ETCH & CLEAR ANODIZE		10	SPACER	303 STAIN STL	1	3/8 I.D. x 3/16 O.D. x .359 .3625 LG.	12
11	SPACER, LOCK KEEPER	2024 T4 AL	0	ETCH & CLEAR ANODIZE		10	SPACER	303 STAIN STL	1	BERG # 552 - 43	12
12	KEEPER, LOCK	STL CAD PLATED	4	SIMMONS PASTER CORP. FOR LINK-LOCK		5	BEARING		2	N.D. # 77 R6	12
13	HOLE PLUG, SNAP-ACTION	STEEL	1	1/2 HOLE SIZE, NICKEL PLATED		5	SPRING PIN (ROLL PIN)	STAIN STL	2	3/32 x 3/4	12
14	HOLE PLUG, SNAP-ACTION	STEEL	3	1/4 HOLE SIZE, NICKEL PLATED		5	MACH SCR., PAN HD	STAIN STL	2	8 - 32 NC - 2 x 1/2	12
15	CABLE CLAMP	PLASTIC	1	1/8 SIZE		7	SET SCR., SOC. HD.	STAIN STL	2	1/4 - 20 NC - 2 x 1/4, CUP PT	12
16	CABLE CLAMP	PLASTIC	3	3/16 SIZE		5	LOCK WASHER	STAIN STL	2	# 8 SIZE	12
17	CABLE CLAMP	PLASTIC	1	3/8 SIZE		7	HUB	STAIN STL	1		12
18	TUBE FITTING, MALE CONNECTOR	BRASS ZYTEL FERRULES	1	CRAWFORD # 500-1-4 1/4 O.D. TUBE - KMP REDRILL BODY LET. TO (.323 DIA) DRILL		5					
19	LIMIT SWITCH		2	MICRO # V3-1		5	PRESSURE CUP ASSEMBLY				
20-35	ROLLER CHAIN	304 STAIN STL	348 476 PITCHES	DAIDO # RC2555 1/4 PITCH (7-3)		5	CUP	ACRYLIC	1	WELD TO PC-2	19
20-50	ROLLER CHAIN	304 STAIN STL	304 476 PITCHES	DAIDO # RC2555 1/4 PITCH (9-11)		5	CUP BOTTOM	ACRYLIC	1		21
21	CONNECTOR CABLE BOLT		1	BERG # 500-4-7		5	TUBE FITTING, MALE CONN	ZYTEL	1	CRAWFORD # ZY500-1-4 1/4 O.D. TUBE - JNP	19
22	MACH SCR., FL HD	STAIN STL	6	4 - 20 NC - 2 x 1		7	TUBE FITTING, MALE ELBOW	ZYTEL	1	SMAGELOK # ZY500-2-2	19
23	MACH SCR., PAN HD	STAIN STL	14 22 MACH SCR.	8 - 32 NC - 2 x 1 1/2		5	MACH SCR. PAN HD.	STAIN STL	2	4 - 40 NC - 2 x 3/8	19
24	MACH SCR. FL. HD	STAIN STL	2	6 - 32 NC - 2 x 1/2		5					
25	MACH SCR. PAN HD	STAIN STL	9	6 - 32 NC - 2 x 1/2		5					
26	MACH SCR. PAN HD	STAIN STL	4	4 - 40 NC - 2 x 1/2		5					
27	MACH SCR. PAN HD	STAIN STL	2	4 - 40 NC - 2 x 1/2		5					
28	MACH SCR. PAN HD	STAIN STL	6	4 - 40 NC - 2 x 3/8		5					
29	MACH SCR., PAN HD	STAIN STL	4	4 - 40 NC - 2 x 1/4		5					
30	SET SCR., SOFT TIP	STAIN STL	2	BERG # 500-12-0 - 32 NC - 2 x 3/8		6					
31	WASHER, PLAIN	STAIN STL	5	# 6 SIZE		5					
32	WASHER, LOCK	STAIN STL	4	# 6 SIZE		5					
33	WASHER, LOCK	STAIN STL	6	# 4 SIZE		5					
34	LEVEL BUBBLE ASSEMBLY		1	DAIDO # 1							
35	BRACKET, BUREAU VIAL	STAIN STL	1	0046 032							
36	SCREEN, PAN HD.	STAIN STL	2	# 8 - 32 UNF - 2, 1 - 3/8 IN. LB.							

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 STACOM MANOMETER - PARTS LIST
 SCALE 1" = 1/2"

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES ON FRACTIONS
 DECIMALS ±.010 ANGLE (10-30)
 DO NOT SCALE THIS DRAWING

PC-NO	NAME	MAT	QUAN	NOTES	RC NO	NAME	MAT	QUAN	NOTES	DETAIL DWG NO	DETAIL DWG NO
	OUTPUT & PIVOT SHAFT ASSEMBLY					COUNTER ASSEMBLY					
PS-1	PIVOT	2024 T4 AL	1	ETCH & CLEAR ANODIZE	CA-1	BASE PLATE	2024 T4 AL	1	ETCH & CLEAR ANODIZE		14
PS-2	RETAINER	2024 T4 AL	1	ETCH & CLEAR ANODIZE	CA-2	OUTBOARD PLATE	2024 T4 AL	1	ETCH & CLEAR ANODIZE		16
PS-3	SHAFT	303 STAIN STL	1	BERG # 56-45 ALTERED	CA-3	COUNTER SUPPORT	6063-T32 AL	1	MAKE FROM ALCOA SPEC BY TECH FCL.AMD.		16
PS-4	SPROCKET HUB	BRASS	1	CHROME PLATE AFTER ASSEMBLY	CA-4	SHAFT	303 STAIN	1	PIC # A3-30 ALTERED		16
PS-5	SPROCKET, BOT	BRASS	1	CHROME PLATE AFTER ASSEMBLY	CA-5	GEAR, COUNTER DRIVE	AL	1	PIC # 64-105		14
PS-6	SPROCKET, 1ST	BRASS	1	CHROME PLATE AFTER ASSEMBLY	CA-6	GEAR, COUNTER	AL	1	PIC # G62-E1 ALTERED		14
PS-7	BEARING		2	N D # T1 R6	CA-7	GEAR, JACK SHAFT DRIVE	STAIN	1	PIC # G3-25		14
PS-8	BEARING, PLAIN CYLINDRICAL FORBIS BRONZE	FORBIS BRONZE	1	BOSTON # B-2024-10	CA-8	BEARING, FLANGED	FORBIS BRONZE	1	BOSTON # FB-46-3		14
PS-9	BEARING, THRUST	FORBIS BRONZE	2	BOSTON # TB-2028	CA-9	BEARING, FLANGED	FORBIS BRONZE	1	BOSTON # FB-46-2		14
PS-10	GEAR	STAIN STL	1	PIC # G3-75	CA-10	COUNTER		1	DURANT # 4-Y-40592-402-R-CL		14
PS-11	SPACER	STAIN STL	1	BERG # 552-43	CA-11	COLLAR	STAIN	1	PIC # C1-3		14
PS-12	SPRING PIN	STAIN STL	1	1/8" x 1/2" LG	CA-12	SPACER POST	STAIN	4	PIC # AT-4		14
PS-13	MACH SCR, PAN HD	STAIN STL	3	B-32NF-2 x 1/2	CA-13	SHOULDER SCR	STAIN	1	PIC # 2315		14
PS-14	SET SCR, SOC HD	STAIN STL	2	10-24NC-2 x 1/4 CUP PT	CA-14	MACH SCR PAN HD	STAIN	4	4-40NC-2 x 1/4		14
PS-15	SET SCR, SOC HD	STAIN STL	1	B-32NC-2 x 1/4 CUP PT	CA-15	MACH SCR P.H.	STAIN	4	4-40NC-2 x 1/2		14
PS-16	LOCKWASHER	STAIN STL	3	#8 SIZE	CA-16	MACH SCR PAN HD	STAIN	4	4-40NC-2 x 1/2		14
	LOWER SPROCKET ASSEMBLY										
LS-1	BEARING HOUSING	2024 T4 AL	1	ETCH & CLEAR ANODIZE	CA-17	MACH SCR PAN HD	STAIN	1	6-32NC-2 x 3/8		14
LS-2	SHAFT	303 STAIN STL	1	BERG # 56-33 ALTERED.	CA-18	MACH SCR PAN HD	STAIN	2	B-32NC-2 x 3/8		14
LS-3	SPROCKET, 20 TEETH	STAIN STL	1	BERG # 25SP175-20	CA-19	SET SCR	STAIN	1	4-40NC-2 x 3/8 SOC CUP PT.		14
LS-4	COLLAR	STAIN STL	1	BERG # CS-9	CA-20	SET SCR	STAIN	1	6-32NC-2 x 3/8 SOC CUP PT.		14
LS-5	SPACER	2024 T4 AL	1	ETCH & CLEAR ANODIZE	CA-21	WASHER PLAIN	STAIN	1	#6		14
LS-6	BEARING		2	N D # T1 R6	CA-22	WASHER, LOCK	STAIN	4	#4		14
LS-7	SPRING PIN	STAIN STL	1	3/32" x 3/4"	CA-23	WASHER, LOCK	STAIN	2	#8		14
LS-8	CAP SCR, HEX HD.	STAIN STL	2	B-32NC-2 x 3/4	CA-24	ROLL PIN	STAIN	2	1/8" DIA x 1/2" LG		14
LS-9	SET SCR, SOC	STAIN STL	1	10-24NC-2 x 1/4 CUP PT		OVERFLOW CHAMBER ASSEMBLY					
LS-10	WASHER, PLAIN	STAIN STL	2	#8 SIZE	OC-1	CAP	ACRYLIC	1			22
LS-11	PIVOT ARM	2024 T4 AL	1	ETCH & CLEAR ANODIZE	OC-2	BOTTOM	ACRYLIC	1			22
LS-12	SHOULDER SCREW	STAIN STL	1	#10-92	OC-3	BODY	ACRYLIC	1			22
LS-13	SHOULDER SCREW	STAIN STL	1	#10-92	OC-4	VENT	ACRYLIC	1			22
LS-14	SPRING ANCHOR	STAIN STL	1	#10-92	OC-5	PLATE	ACRYLIC	1			22
LS-15	SPACER	STAIN STL	1	ETCH & CLEAR ANODIZE	OC-6	CLAMP, 3/8" I.D.	BRASS	2	NICKLE PLATED CINCH-JONES SC-161-6		5/17
LS-16	IDLER	2024 T4 AL	1	ETCH & CLEAR ANODIZE	OC-7	TUBING	TYGON	21"	CLEAR 5/16" O.D. x 3/16" I.D.		5/17
LS-17	SPRING	STAIN STL	1	OIL IMPREGNATED							
LS-18	BEARING	BRONZE	1								
LS-19	HUB	STAIN STL	1								

DATE	REV	BY	DATE	REV	BY
UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY STAGOM MANOMETER - PARTS LIST SCALE SHEET 2 OF 29					

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/16" DECIMALS ± 0.010 ANGLES ± 0°30'

DO NOT SCALE THIS DRAWING

PC NO.	NAME	MAT	QUAN	NOTES	PC NO.	NAME	MAT	QUAN	NOTES	DETAIL DMG NO.
M-1	MOTOR ASSEMBLY				15	FLOAT SWITCH ASSEMBLY				19
M-2	MOTOR PLATE	2084-T4-AL	1	ETCH & CLEAR ANODIZE	16	FS-1 CAP	ACRYLIC	1		20
M-3	BASE PLATE	2084-T4-AL	1	ETCH & CLEAR ANODIZE	17	FS-2 STACK	ACRYLIC	1	WELD TO FS-3	20
M-4	SPACER MOTOR PLATE	2084-T4-AL	2	ETCH & CLEAR ANODIZE	17	FS-3 COVER, FLOAT CUP	ACRYLIC	1		20
M-5	FINGER TAB	6063-T52-AL	1	ALCOA SEC #1944 ETCH & CLEAR ANODIZE	17	FS-4 FLOAT CUP	ACRYLIC	1		20
M-6	JACK BRACKET	EPOXY BOARD	1		17	FS-5 OVER FLOW PORT	ACRYLIC	1	WELD TO FS-4	20
M-7	MOTOR GV D C		1	BARBER-COLMAN #CYQM-23/10-7	17	FS-6 PLUG	ACRYLIC	1	WELD TO FS-5	20
M-8	GEAR, MOTOR	STAIN	1	DYNACO #154-20 (ALTERED ADDITIONAL SETSC)	15	FS-7 FLOAT	303 STAIN STL	1		20
M-9	SHOULDER SCREW	STAIN	1	PIC. # 4328	15	FS-8 MAST	303 STAIN STL	1	MAKE FROM PIC #AB-6 PREC. SHAFTING	21
M-10	MACH SCR. PAN HD	STAIN	1	B-32 NC-2 x 1/8	15	FS-9 CONTACT HOLDER	303 STAIN STL	2	1/4" HEX STOCK	21
M-11	MACH SCR. PAN HD	STAIN	2	B-32 NC-2 x 1/2	15	FS-10 CONTACT HOLDER EXTENSION	303 STAIN STL	2	MAKE FROM PIC #AB-24 PREC. SHAFTING	21
M-12	MACH SCR. F.H	STAIN	4	4-40 NC-2 x 1/2	15	FS-11 CONTACT	90% PLATINUM 10% IRIIDIUM	2		21
M-13	MACH SCR. PAN HD	STAIN	2	4-40 NC-2 x 9/16	15	FS-12 CONTACT	90% PLATINUM 10% IRIIDIUM	1	.025 DIA WIRE	21
M-14	MACH SCR. PAN HD	STAIN	2	4-40 NC-2 x 1/2	15	FS-13 TUBE FITTING, MALE CONNECTOR	ZYTEL	1	CRAWFORD #500-1-4-316 ALTERED	21
M-15	MACH SCR. PAN HD	STAIN	2	4-40 NC-2 x 1/4	15	FS-14 TUBE FITTING, MALE CONNECTOR	ZYTEL	2	SMAGELOR #ZY-100-1-1, BODY REAMED TO 1/16 DIA	19
M-16	SET SCR	STAIN	2	G-32 NC-2 x 1/8 SOG CUP PT	15	FS-15 BRACKET	BRASS CHROME PLATE	1	PIC #D5-375 DONEL PIN.	19
M-17	WASHER, LOCK	STAIN	2	#8	15	FS-16 PIVOT, BRACKET	STAIN STL	1	1.080 DIA x 1/4 L6 DUTONE CO	19
M-18	WASHER, PLAIN	STAIN	6	#4	15	FS-17 PIVOT, MAST	STAIN STL	1	.080 DIA x 1/4 L6 DUTONE CO	19
M-19	JACK	STAIN	1	#8	15	FS-18 BEARING, JEWEL		2	BRASS - SAPPHIRE, V TYPE, G-40NF-2 x 1/8 LG	19
M-20	PLUG	STAIN	1	SWITCHCRAFT #QJ JAX	15	FS-19 SEAL "O" RING	NEOPRENE	1	NOM 3/16 I.D x 1/8 DIA SEC	19
				SWITCHCRAFT #755	15	FS-20 SEAL "O" RING	NEOPRENE	1	NOM 1/8 I.D x 1/8 DIA SEC	19
						FS-21 MACH SCR HEX HD	STAIN STL	1	10-32NF-2 x 1/16 HEX HD	19
						FS-22 MACH SCR PAN HD	STAIN STL	3	4-40NC-2 x 1/2	19
						FS-23 MACH. SCR PAN HD	STAIN STL	3	4-40NC-2 x 1/2	19
						FS-24 MACH. SCR PAN HD	STAIN STL	2	4-40NC-2 x 3/8	19
						FS-25 MACH. SCR PAN HD	STAIN STL	1	4-40NC-2 x 1/8	19
						FS-26 WASHER, PLAIN	STAIN STL	1	#10 SIZE.	19
						FS-27 SPRING PIN (ROLL)	STAIN STL	1	3/64 DIA. x 3/16 LONG	19
E-1	WIRING & ELECTRICAL COMPONENTS...									
E-2	CABLE, LIMIT SWITCH									
E-3	HOOK-UP WIRE	#22 STRANDED COPPER	1	RED & WHITE 3" LG	23					
E-4	HOOK-UP WIRE	#22 STRANDED COPPER	1	YELLOW 3" LG	23					
E-5	HOOK-UP WIRE	#22 STRANDED COPPER	1	WHITE 15" LG	23					
E-6	HOOK-UP WIRE	#22 STRANDED COPPER	1	GREEN 9" LG	23					
E-7	DIODE		1	BLACK 12" LG	23					
E-8	JACK & SLEEVE ASSEMBLY		1	GE IN 91	23					
E-9	JACK & SLEEVE ASSEMBLY		1	E F JOHNSON #105-701 (WHITE)	23					
E-10	CHASSIS PLUG, 5 TERM		1	E F JOHNSON #106-704 (GREEN)	23					
E-11	TERMINAL, SOLDERLESS		8	AMPHENOL OR CANNON MS 3102AMS-SP	23					
E-12	TERMINAL, SOLDERLESS		1	AMP # 31880 RING TYPE	23					
E-13	INSULATION SLEEVE	PLASTIC	5	AMP # 34313 HOOK TYPE	23					
E-14	BATTERY, 6 VOLT		2	#604 (106 I/D) WALSCO FLEXITUBE 1/2 LG	23					
E-15	SS SERVO CONTROL (US G S. SPEC)		1	EVEREADY HOTSHOT #1461 OR EQUAL	23					
				NOT FURNISHED BY CONTRACTOR	23					

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS:
DECIMALS ±0.01 ANGLES ±0.30
DO NOT SCALE THIS DRAWING

REV. NO.	DATE	APPROVED	NO.	DATE	APPROVED	NO.
UNITED STATES			DEPARTMENT OF THE INTERIOR			
GEOLOGICAL SURVEY			STACOM MANOMETER - PARTS LIST			
Drawn By: G. AZILES			Scale: 1" = 10'-0"			
Checked By:			Date: 10-22-71			
Approved By:			SHEET 3 of 29			

00-6003-0047003

PC NO.	NAME	MAT.	QUAN.	NOTES	PC NO.	NAME	MAT.	QUAN.	NOTES	PC NO.	NAME	MAT.	QUAN.	NOTES	PC NO.	NAME	MAT.	QUAN.	NOTES	
CR-1	PRESSURE CUP CARRIAGE ASSEMBLY.				15	PROTRACTOR ASSEMBLY														
CR-1	CARRIAGE PLATE	2024 T4 AL	1	ETCH & CLEAR ANODIZE	18	LEVEL INDICATOR ARM	2024 T4 AL	1	ETCH & CLEAR ANODIZE	17	LEVEL INDICATOR ARM	2024 T4 AL	1	ETCH & CLEAR ANODIZE	17	LEVEL INDICATOR ARM	2024 T4 AL	1	ETCH & CLEAR ANODIZE	17
CR-2	CUP BRACKET	BRASS CHROME FINISH	1	ONE ALSO REQD. IN FLOAT SWITCH ASSEMBLY. IDENTIFIED P.S. 15 ON SHIT. P. 19	18	PIN, PLUMB BOB	2024 T4 AL	1	ETCH & CLEAR ANODIZE	17	PIN, PLUMB BOB	2024 T4 AL	1	ETCH & CLEAR ANODIZE	17	PIN, PLUMB BOB	2024 T4 AL	1	ETCH & CLEAR ANODIZE	17
CR-3	CARRIAGE PIVOT ARM	2024 T4 AL	1	ETCH & CLEAR ANODIZE	18	KEEPER		1		17	KEEPER		1		17	KEEPER		1		17
CR-4	ROLLER, PIVOTED	DELFIN	1		18	SPACER		1		17	SPACER	NYLON	1		17	SPACER	NYLON	1		17
CR-5	ROLLER, FIXED	DELFIN	2		18	INDEX PLATE, PF		1		17	INDEX PLATE, PF	ALUMINUM	1		17	INDEX PLATE, PF	ALUMINUM	1		17
CR-6	BELT ANCHOR, UPPER	2024 T4 AL	1	ETCH & CLEAR ANODIZE	18	LEVEL VIAL, 310 DIA. x 1 1/4		1		6	LEVEL VIAL, 310 DIA. x 1 1/4		1		6	LEVEL VIAL, 310 DIA. x 1 1/4		1		6
CR-7	BELT ANCHOR, LOWER	2024 T4 AL	1	ETCH & CLEAR ANODIZE	18	SHOULDER SCREW		1		6	SHOULDER SCREW	STAIN STL	1		6	SHOULDER SCREW	STAIN STL	1		6
CR-8	SPRING ANCHOR, SHORT	303 STAIN	1	MAKE FROM PIC. SH SCR # 4310	18	KNURLED THUMB SCREEN		1		6	KNURLED THUMB SCREEN	BRASS	1		6	KNURLED THUMB SCREEN	BRASS	1		6
CR-9	SPRING ANCHOR, LONG	303 STAIN	1	MAKE FROM PIC. SH SCR # 4313	18	MACH SCR, F. H		1		6	MACH SCR, F. H	STAIN STL	1		6	MACH SCR, F. H	STAIN STL	1		6
CR-10	SPRING	STAIN	1	MAKE FROM PIC. # AZ-3	18	MACH SCR, BIND HD.		2		6	MACH SCR, BIND HD.	STAIN STL	2		6	MACH SCR, BIND HD.	STAIN STL	2		6
CR-11	SHOULDER SCR	STAIN	1	PIC # 4329 ALTERED (PHOTED ROLLER)	15															
CR-12	SHOULDER SCR	STAIN	2	PIC # 4331 (FIXED ROLLER)	15															
CR-13	SHOULDER SCR	STAIN	1	PIC # 4316	15															
CR-14	PIN	STAIN	1	PIC # D5-375	15															
CR-15	MACH SCR HEX HD	STAIN	1	10-32NF-2 x 1 1/2	15															
CR-16	MACH SCR PAN HD	STAIN	4	8-32NC-2 x 1 1/2	15															
CR-17	SET SCR	STAIN	2	6-32NC-2 x 1 1/2	15															
CR-18	WASHER, PLAIN	STAIN	1	#10	15															
ACCESSORIES																				
A-1	WOOD SCR, RD HD SLOTTED	STAIN STL	4	90 x 1/2 (FOR SHELF MFG OF BRACKET B1B-1)																
A-2	LAG BOLTS	STEEL	2	1/2 x 1 1/4 (FOR MFG REGULATOR ASSEMBLY)																
A-3	HEX KEY WRENCH	STEEL	1	#4 SIZE																
A-4	HEX KEY WRENCH	STEEL	1	#6 SIZE																
A-5	HEX KEY WRENCH	STEEL	1	#8 SIZE																
A-6	HEX KEY WRENCH	STEEL	1	#10 SIZE																
A-7	MERCURY, TRIPLE DISTILLED		1 1/2	LB. SHIP IN PLASTIC BOTTLE CONTAINER																
A-8	SILICON FLUID, DOW CORNING		1 LB	VISCOSITY @ 25°C, 50 CS																

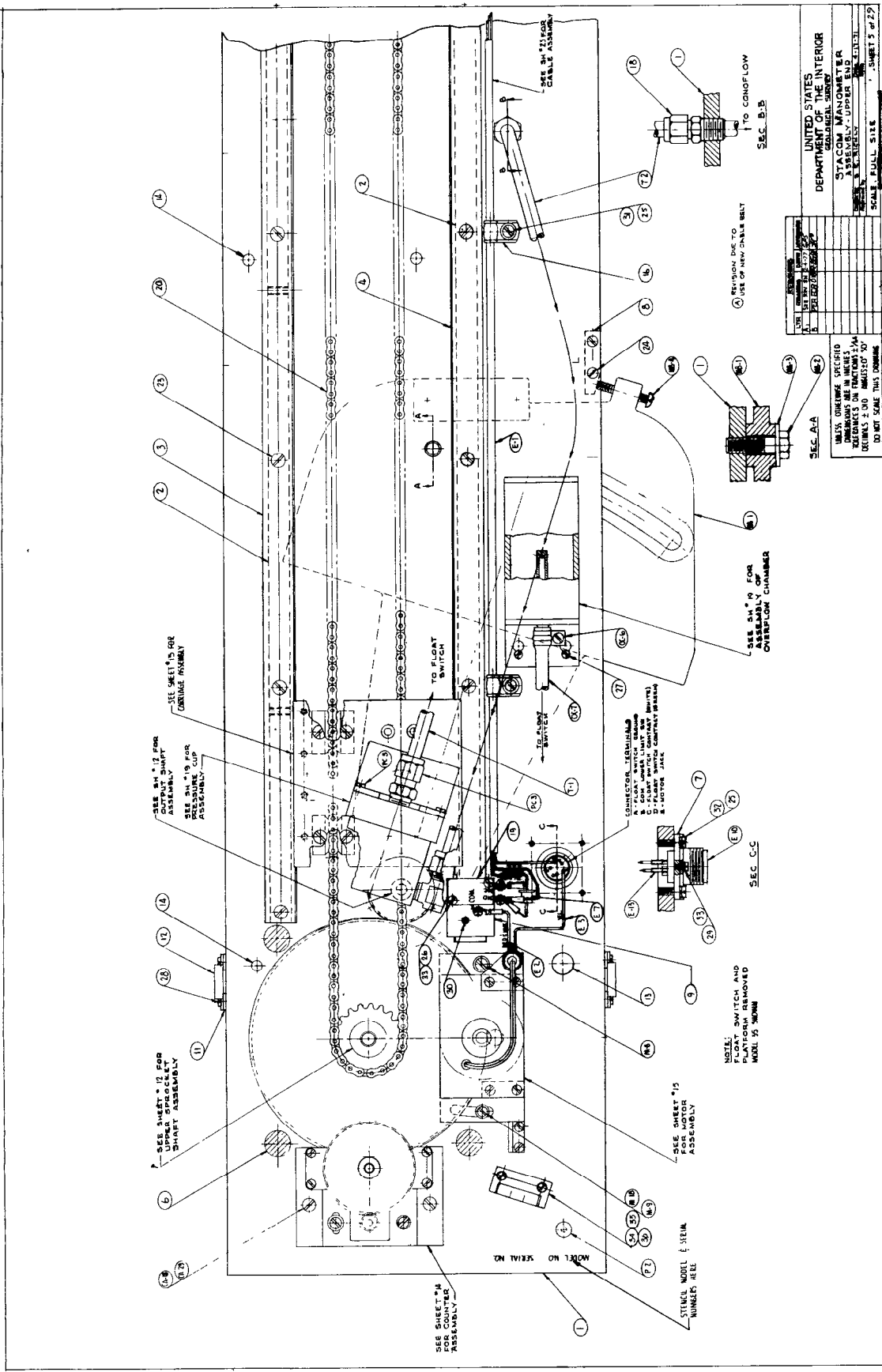
NOTE: ITEMS A-1 THRU A-6 TO BE SHIPPED IN 3x6 MANILA ENVELOPE PROPERLY IDENTIFIED.

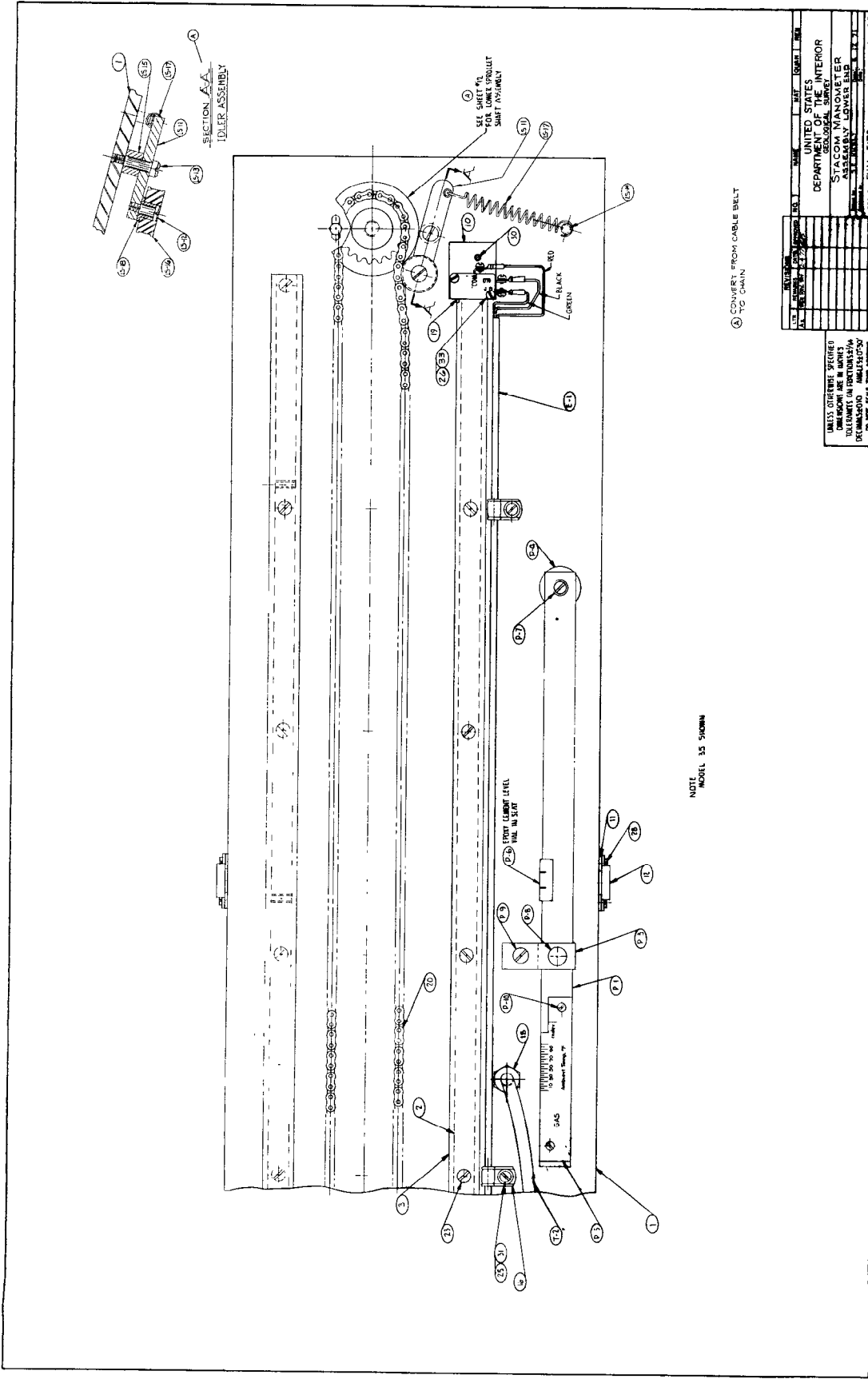
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS 1/4 DECIMALS ±0.01 ANGLE ±0.30 DO NOT SCALE THIS DRAWING

DATE	REVISIONS	DATE APPROVED	BY
	1	08-17-77	CS
NAME	MAT.	QUAN.	REL.
UNITED STATES			
DEPARTMENT OF THE INTERIOR			
GEOLOGICAL SURVEY			
STACOM MANOMETER - PARTS LIST			
Drawn by	DATE	DATE	SCALE
CS	10-22-71		
Checked by	DATE	DATE	SCALE

0046000-0047004

SHEET 4 of 29





PC NO.	NAME	MAT.	QUAN. MOULDED	NOTES	DETAIL DWS. NO.	PC NO.	NAME	MAT.	QUAN. MOULDED	NOTES	DETAIL DWS. NO.
1-1	BASE (MODEL 45)	2024 T4 AL	1	FINISH - GRAY ANODIZE	5	39	SCALE	ALUMINUM	1	RAISED NUMERALS & GRADUATIONS BLACK BACKGROUND	12
1-2	BASE (MODEL 60)	2024 T4 AL	1	FINISH - GRAY ANODIZE	6	40	NAME PLATE	ALUMINUM	1	RAISED LETTERS-BLK BACKGROUND	12
2	HOUSING, BEARING	BRASS	1	CHROME PLATE	7	41	POINTER	356-T6 AL	1	FINISH - GRAY ANODIZE	12
3	NUT, WRM	BRASS	1	CHROME PLATE	7	42	MOUNTING BRACKET	356-T6 AL	1	DA	13
4	WASHER, FLAT	BRASS	1	CHROME PLATE	7	43	MERCURY CUP	PXENGLASS	1		14
5	SPROCKET HUB	BRASS	1	CHROME PLATE	7	44	MERCURY CUP BOTTOM	DO.	1		14
6	STANDARD SCREW BEARING	BRASS	1	CHROME PLATE	7	45	FLOAT SWITCH CUP	DO.	1		14
7	INSULATING SLEEVE (E) ^{ALUMINUM}	3/8 I.D. x .025 WALL x 1/8 L.G.	2	3/8 I.D. x .025 WALL x 1/8 L.G.	314	46	FLOAT CUP COVER	DO.	1		14
8	NUT, CARTRIDGE	BRASS	1	OIL IMPREGNATED	7	47	FLOAT STACK	DO.	1		14
9	BEARING, SCREEN LWR	BRASS	1	CHROME PLATE	7	48	CONTACT CAP	DO.	1		14
10	PIN	303 STAIN. STL	1		7	49	CONTACT HOLDER	BRASS	2		14
11	WRENCH	303 STAIN. STL	1		7	50	FLOAT	303 STAIN. STL	1		14
12	SHAFT	303 STAIN. STL	1		7	51	FLOAT MAST	DO	1	PIC # 98-76 PRECISION SHAFTHING	14
13	MOTOR MOUNT	BRASS	1	CHROME PLATE	8	52	CONTACT	90% PLATINUM 10% IRIDIUM	1	.025 DIA. x 1/8 LG	14
14	GEAR, MOTOR	303 STAIN. STL	1	PIC-DESIGN CORP # 63-32	8	53	CONTACT	DO	1	.025 DIA. x 1/8 LG	4
15	GEAR, COUNTER	BRASS	1	CHROME PLATE	8	54	CONTACT	DO	1	.025 DIA. x 1/8 LG.	4
16	GEAR, SCREW	BRASS	1	CHROME PLATE	8	55-1	COVER BODY (MODEL 45)	3003-H14 AL	1		15
17	COLLAR	BRASS	1	CHROME PLATE	8	55-2	DO (MODEL 60)	DO.	1		15
18	WORM	STEEL	1	BOSTON "HOUH-CHROME PL.	8	56	COVER TOP PLATE	DO.	1		16
19	WORM GEAR	BRONZE	1	BOSTON "D1137 - CHROME PL.	8	57	COVER BOTTOM PLATE	DO.	1		16
20	SPROCKET	BRASS	1	SILVER SOLDERED TO PC # 5 BEFORE PLATING	8	58	COVER WINDOW	PXENGLASS	1	1 THICK	13
21	SPROCKET	BRASS	1	SILVER SOLDERED TO PC # 5 BEFORE PLATING	8	59-1	COVER ANGLE LEFT (MODEL 45)	6063 T5 AL.	1	ALCOA SECTION "1944 OF EQUAL	16
22	CLAMP SCREW	303 STAIN. STL	1		8	59-2	DO (MODEL 60)	DO	1	DO	16
23	SPRINGS	303 STAIN. STL	1	.020 SPRING WIRE	8	60-1	COVER ANGLE-RIGHT (MODEL 45)	DO	1	DO	16
24	SCREW, POINTER PIVOT	303 STAIN. STL	1		8	60-2	DO (MODEL 60)	DO	1	DO	16
25	CARRIAGE BASE	BRASS	1	CHROME FINISH	9	61	COVER ANGLE - TOP	DO	1	DO	17
26	CARRIAGE PIVOT ARM	BRASS	1	CHROME FINISH	9	61A	DO - BOTTOM	DO	1	DO.	17
27	ROLLER SHAFT	303 STAIN. STL	2		9	62	BEARINGS		2	NEW DEPARTURE # 77R6	3
28	ROLLER BRACKET	DO.	1		9	63	BEARING		2	DO # 77R6	3
29	ROLLER	BRASS	3	CHROME FINISH	9	64	WASHER, PLAIN	BRASS	3	FOR # 5 SCREW	9
30	BUSHING	BRASS	1	CHROME FINISH	9	65	MICRO SWITCH		2	# V-3-1	314
31	EXTENSION SPRING	303 STAIN. STL	2	1.030 DIA SPRINGS WIRE	9	66	LEVEL VIOL. 3/8 x 1/8 LG.		1	150-300 SECONDS TO GRADUATION W.A. MOVER & SONS	3
32	SPRING ANCHOR	303 STAIN. STL	2	EACH OF 2 SIZES	9	67	COUNTER		1	PRODUCT NUMBER # 77-38-06 DUREANT MFG. CO.	3
33-1	LEFT TRACK (MODEL 45)	BRASS	1	CHROME FINISH	10	68	MOTOR, 5 RPM, 6 VOLT DC		1	BARBER COLMAN CO. PART NO. FLYM 1310-1. .250 IAH	3
33-2	RIGHT TRACK (MODEL 45)	BRASS	1	CHROME FINISH	10	69	CHASSIS PLUS, 5 TERMINAL		1	AMPHENOL OR CANNON MS SIZE 14-3-SP	3
34-1	LEFT TRACK (MODEL 60)	BRASS	1	CHROME FINISH	11	70	BANANA JACK		2	1-RED # 108 745-1 F. F. JOHNSON	3
34-2	RIGHT TRACK (MODEL 60)	BRASS	1	CHROME FINISH	11	71	BANANA JACK (MOTOR LEADS)		2	1-RED # 108 745-1 F. F. JOHNSON	3
35-1	RIGHT TRACK (MODEL 45)	BRASS	1	CHROME FINISH	10	72	PIN JACK (FLOAT SWITCH) H.K. SMITH # 402, BODY ALTERED		4	2 REQD WITH HEX LOCK NUT 2 REQD WITH PLASTIC NOT USED BIBLE	11
35-2	RIGHT TRACK (MODEL 60)	BRASS	1	CHROME FINISH	10	73	PIN PLUG (FLOAT SWITCH)		2	200 H.K. SMITH ALTERED 6 WITHOUT NUT & PLASTIC HANDLE	13
36-1	TRACK BASE (MODEL 45)	2024 T4 AL.	2	FINISH - GRAY ANODIZE	10						
36-2	TRACK BASE (MODEL 60)	DO.	2	DO	11						
37	SCREW	903 STAIN. STL.	1	3/16 LG. (MODEL 45) SUFFICIENT TO	10						
38	MICRO SWITCH PLATE	BRASS	2	1 AS SHOWN, 1 OPP. HAND - PHASE	11						

REVISIONS	
LTR	DATE
C	11-18-60
D	11-18-60
E	11-18-60

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS - 1/64 UNLESS OTHERWISE SPECIFIED DO NOT SCALE THIS DRAWING

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY RESEARCH SECTION (SW) COLUMBUS, OHIO

MANOMETER-SERVO

DRAWN BY S.E.R. 9-1-59 SH. 1 OF 20

PC NO.	NAME	MAT.	QUAN. ORDERED	NOTES	AC NO.	NAME	MAT.	QUAN. ORDERED	NOTES	AC NO.	NAME	MAT.	QUAN. ORDERED	NOTES	REV. CHG. BY
74	WIRE CLAMPS	NYLON	4	5	BIANBACH #226 OR EQUAL	34	MACH SCR., RD HD.	7	6-32NC-2 x 1/2 LG	115	MACH SCR., RD HD.	STAIN STL.	7	6-32NC-2 x 1/2 LG	364
75	TERMINAL LUG (SOLDERLESS)		8	8	RING TYPE AMP #31800	116	DO.	4	6-32NC-2 x 1/2 LG	116	DO.	DO.	5	6-32NC-2 x 1/2 LG	364
76	DIODE		1	1	6.6 1N91	117	DO.	1	5-40NC-2 x 1/2 LG	117	DO.	DO.	1	5-40NC-2 x 1/2 LG	3
77	TUBING	PLASTIC	33"	45"	#4 TEMFLEX 105	364	DO.	11	4-80NC-2 x 1/2 LG	118	DO.	DO.	11	4-80NC-2 x 1/2 LG	364
78	COVER LOCK	STEEL LAD PLATED	4	6	3/4 LIME-LOCK, SIMMONS FASTENER CORP.	17	DO.	1	4-40NC-2 x 1/2 LG	119	DO.	DO.	12	4-40NC-2 x 1/2 LG	364
79	KEEPER PLATE COVER LOCK	STEEL LAD PLATED	4	6	SIMMONS FASTENER CORP. FOR #3	34611	DO.	1	3/8 LIME-LOCK, ALTERED	120	WASHER, PLAIN	DO.	1	3/8 LIME-LOCK, ALTERED	3
80	COVER SEAL	SPONGE RUBBER	104	134"	1/2 SECTION	17	DO.	2	1/2 O.D. x 1/4 LG	121	WASHER, PLAIN	STAIN STL.	2	1/2 O.D. x 1/4 LG	369
81	PIVOT	STAIN STL.	1	1	.030 D. x 1/2 LG - DUOTONE CO.	4614	DO.	1	WOOD	122	SHIPPING BOX	WOOD	1	WOOD	18
82	JEWEL BEARING		2	2	BRASS-SAPPHIRE V-TYPE	4	DO.	1	ROLL PIN	123	ROLL PIN	STAIN STL.	1	ROLL PIN	3
83	RIN PLUG (FLOAT SWITCH)		2	2	M.M. SMITH #203 1-RED 1-BLACK	34619	DO.	1	DO.	124	DO.	DO.	1	DO.	3
84	BLEEVIE, FLEXIBLE	PLASTIC	2	2	1/2 TO FIT #22 HOOD-UP WIRE, 3/8 O.D. x 1/2 LG	4619	DO.	1	DO.	125	DO.	DO.	1	DO.	3
85	HOOD-UP WIRE #22 STRANDED VINYL INSULATION	COPPER	1	1	COLOR CODED GREEN 14' LG.	19	DO.	1	SET SCR., SOC	126	SET SCR., SOC	DO.	1	0-32NC-2 x 1/2 CUP PT.	3
86	DO.	DO.	1	1	DO	19	DO.	1	DO.	127	DO.	DO.	1	4-40NC-2 x 1/2 CUP PT.	3
87	HEX NUT (SPECIAL)	BRASS	2	2	CHROME FINISH	13	DO.	1	WOOD SCR., RD. HD.	128	WOOD SCR., RD. HD.	DO.	4	10 x 1/2 LG. SLOTTED	3
88	TERMINAL LUG (SOLDERLESS)		1	1	HOOK TYPE AMP #34313	4619	DO.	1	FL. HD.	129	DO., FL. HD.	BRASS	18	8 x 2 LG. SLOTTED	18
89	HOOD-UP WIRE #22 STRANDED VINYL INSULATION	COPPER	1	1	COLOR CODED BLACK 5' LG	19	DO.	1	MACH. SCR., PHILLIP #HW LG	130	MACH. SCR., PHILLIP #HW LG	STAIN STL.	19	6-32NC-2 x 1/2 LG	17
90	DO.	DO.	1	1	DO.	19	DO.	1	NUT, HEX.	131	NUT, HEX.	DO.	19	6-32NC-2	17
91	DO.	DO.	1	1	DO.	19	DO.	1	RIVET, TRUSS HD	132	RIVET, TRUSS HD	ALUMINUM	68	8 O.A. x 1/2 LG	17
92	DO.	DO.	1	1	DO.	19	DO.	1	SET SCR., SOC	133	SET SCR., SOC	STAIN STL.	2	6-32NC-2 x 1/2 CUP PT.	3
93	DO.	DO.	1	1	DO.	19	DO.	1	MRENKNS, ALLEN	134	MRENKNS, ALLEN	STEEL	3	1-P.A. FOR #4, 1/2" SETSCREW	
94	DO.	DO.	1	1	DO.	19	DO.	1	MACH. SCR., RD. HD.	135	MACH. SCR., RD. HD.	STAIN STL.	1	4-40NC-2 x 1/2 LG.	4
95	SERVO CONTROL UNIT (USGS SPEC.)		1	1	DO	19	DO.	1	DO	136	DO	PLASTIC	5	WITH 2# FINE SNAKE #12 WIRE LAD	3
96	BATTERY, 6 VOLT		2	2	EVEREADY HOTSHOT #4610860M	19	DO.	1	DO	137	DO	1	1/2 LG.	1/2 LG.	
97	MANOMETER TUBING	*TYGON WITH VINYL INSULATION	1	1	NOT FURNISHED BY CONTRACTOR	19	DO.	1	DO	138	DO	1	1/2 LG.	1/2 LG.	
98	MANOMETER TUBING	*TYGON	1	1	EVEREADY HOTSHOT #4610860M	19	DO.	1	DO	139	DO	1	1/2 LG.	1/2 LG.	
99	TUBE FITTING (ALTERED, REF. DRILL BODY LET. #1, 3220A)	*TYGON	1	1	125 I.D. x 312 O.D. x 84" LG.	36220	DO.	1	DO	140	DO	1	1/2 LG.	1/2 LG.	
100	TUBE FITTING (ALTERED)	*BRASS	1	1	*500-1-4 CRAWFORD MALE CONNECTOR - 1/2 O.D. TIME # NOT	3	DO.	1	DO	141	DO	1	1/2 LG.	1/2 LG.	
101	TUBE FITTING	*STAIN STL.	1	1	*500-1-4/16 CRAWFORD MALE CONNECTOR - 1/2 O.D. TIME # NOT	3	DO.	1	DO	142	DO	1	1/2 LG.	1/2 LG.	
102	TUBE FITTING	ZYTEL	1	1	*500-1-2 CRAWFORD MALE CONNECTOR - 1/2 O.D. TIME # NOT	3	DO.	1	DO	143	DO	1	1/2 LG.	1/2 LG.	
103	TUBE INSERT (FOR PC #93)	DO.	1	1	*500-1-2 CRAWFORD MALE CONNECTOR - 1/2 O.D. TIME # NOT	3	DO.	1	DO	144	DO	1	1/2 LG.	1/2 LG.	
103-1	TUBE INSERT (FOR PC #91)	STAIN STL.	2	2	CRAWFORD FITTING CO. #405-2-316		DO.	1	DO	145	DO	1	1/2 LG.	1/2 LG.	
103-1	TUBE INSERT (FOR PC #91)	STAIN STL.	2	2	CRAWFORD FITTING CO. #405-2-316		DO.	1	DO	146	DO	1	1/2 LG.	1/2 LG.	
104	CAP SCR., HEX HD.	DO.	1	1	10-32NF-2 x 1/2 LG	3	DO.	1	DO	147	DO	1	1/2 LG.	1/2 LG.	
105	MACH SCR., HEX HD	DO.	1	1	10-32NF-2 x 1/2 LG	3	DO.	1	DO	148	DO	1	1/2 LG.	1/2 LG.	
106	DO.	DO.	1	1	10-32NF-2 x 1/2 LG	9	DO.	1	DO	149	DO	1	1/2 LG.	1/2 LG.	
107	MACH SCR., SOC HD.	DO.	6	6	10-32NF-2 x 1/2 LG	364	DO.	6	DO	150	DO	1	1/2 LG.	1/2 LG.	
108	DO.	DO.	1	1	6-32NC-2 x 1/2 LG	3	DO.	1	DO	151	DO	1	1/2 LG.	1/2 LG.	
109	MACH SCR., FIL HD	DO.	2	2	5-40NC-2 x 1/2 LG	9	DO.	2	DO	152	DO	1	1/2 LG.	1/2 LG.	
110	DO.	DO.	1	1	5-40NC-2 x 1/2 LG	9	DO.	1	DO	153	DO	1	1/2 LG.	1/2 LG.	
111	DO.	DO.	1	1	5-40NC-2 x 1/2 LG	9	DO.	1	DO	154	DO	1	1/2 LG.	1/2 LG.	
112	MACH SCR., FL. HD.	DO.	4	4	4-40NC-2 x 1/2 LG	4	DO.	4	DO	155	DO	1	1/2 LG.	1/2 LG.	
113	MACH SCR., RD. HD	DO.	2	2	10-32NF-2 x 1/2 LG	9	DO.	2	DO	156	DO	1	1/2 LG.	1/2 LG.	
114	DO	DO.	16	22	6-32NC-2 x 1/2 LG	3643	DO.	16	DO	157	DO	1	1/2 LG.	1/2 LG.	

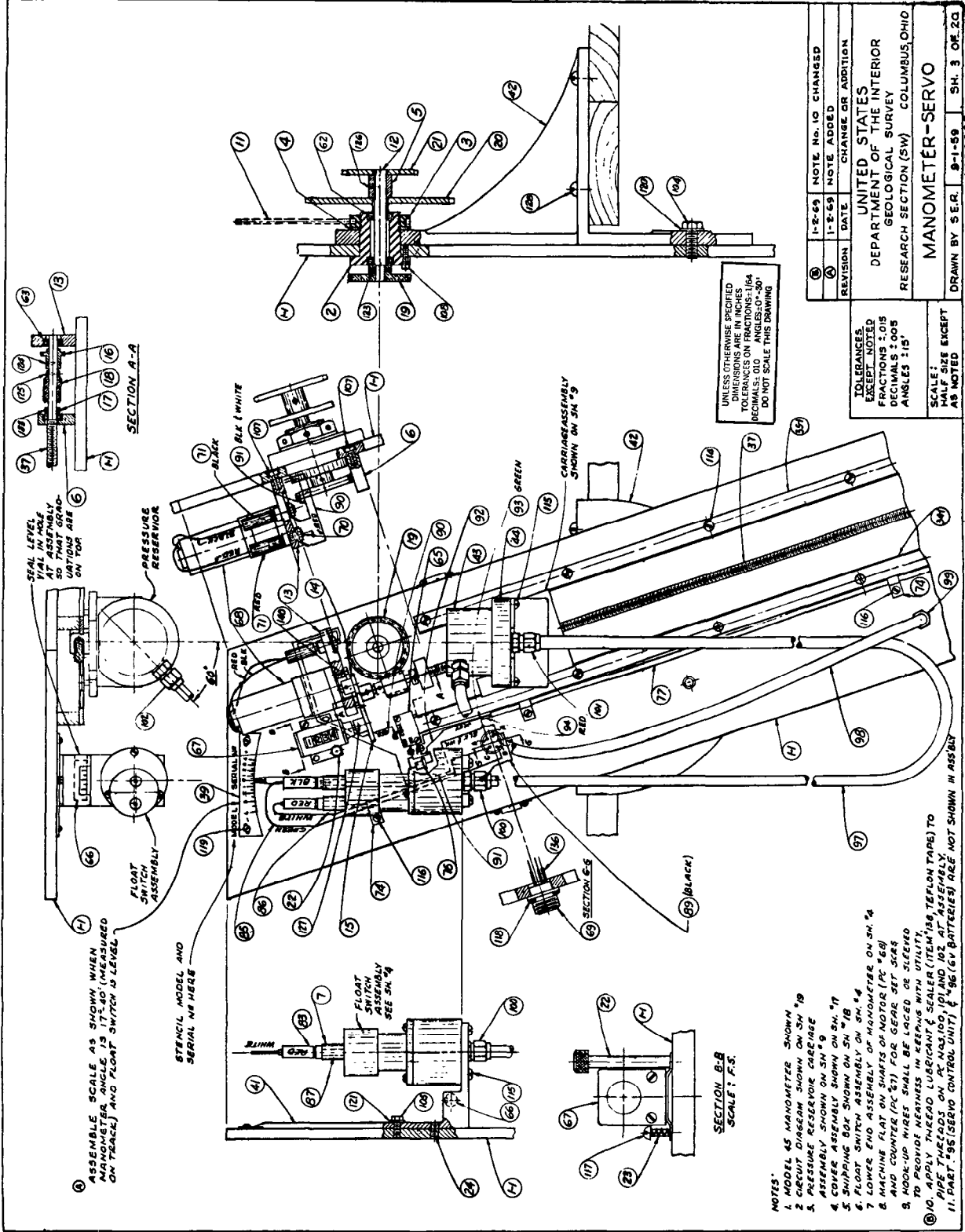
REV. 4-65, 1-69

UNLESS OTHERWISE SPECIFIED
TOLERANCES ON FRACTIONS: 1/64
DECIMALS: 0.10 ANGLES: 0°-30'
DO NOT SCALE THIS DRAWING

REV. NO.	DATE	BY	REVISIONS
1	1-2-69	PC*158	GAS-PURGE ACCESSORIES RE-MOVED, NOW SHOWN ON SH. 20
2	1-2-69	PC*105-1	MATERIAL SPEC. CHANGED
3	1-2-69	PC*105-1	NEW PART ADDED
4	1-2-69	PC*105-1	QUANTITY REDUCED WAS 4
5	1-2-69	PC*105-1	MATERIAL SPEC. CHANGED
6	1-2-69	PC*105-1	DATE CHANGE OR ADDITION

FITTINGS TO HAVE AXON PERMANENT FORMULATION #2303 LABORATORY TUBING MANUFACTURED BY PLASTICS & SYNTHETIC DIV. THE UNITED STATES STOWENHAWK CO., AKRON, OHIO. FOR STOWENHAWK CO'S LABORATORY TUBING ENDS IMMERSION WELDED WITH CYCLO-HEXANONE SOLVENT (CUT BACK DACKRON THERM. BEFORE WELDING)

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY RESEARCH SECTION (ISM) COLUMBUS, OHIO
MANOMETER-SERVO
DRAWN BY SER 9-1-59 SH. 2 OF 20
0280002



REVISION	DATE	CHANGE OR ADDITION
②	1-2-59	NOTE NO. 10 CHANGED
①	1-2-59	NOTE ADDED

TOLERANCES:
 EXCEPT NOTED
 FRACTIONS : .015
 DECIMALS : .005
 ANGLES : 15°

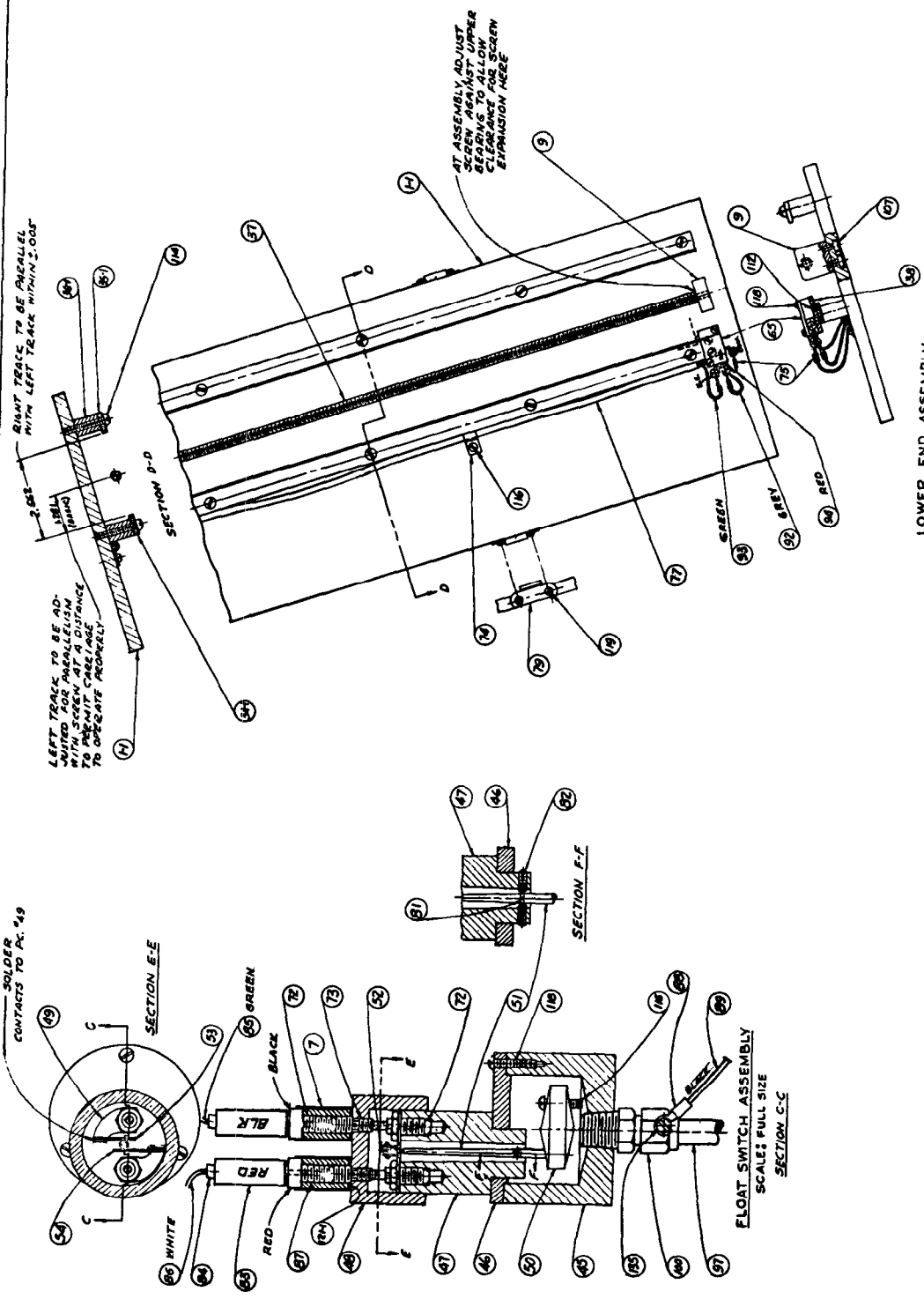
SCALE:
 HALF SIZE EXCEPT
 AS NOTED

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 RESEARCH SECTION (SW) COLUMBUS, OHIO

MANOMETER-SERVO
 DRAWN BY S.E.R. 8-1-59 SH. 3 OF 20
 0280003

- NOTES:
1. MODEL 45 MANOMETER SHOWN
 2. GEAR/DIAPHRAGM SHOWN ON SH. 10
 3. PRESSURE RESERVOIR CARTRIDGE ASSEMBLY SHOWN ON SH. 9
 4. COVER ASSEMBLY SHOWN ON SH. 11
 5. SHIPPING BOX SHOWN ON SH. 11
 6. FLOAT SWITCH ASSEMBLY ON SH. 4
 7. LOWER END ASSEMBLY OF MANOMETER ON SH. 4
 8. MACHINE FLAT ON SHAFTS OF MOTOR (PC #68) AND COUNTER (PC #7) FOR GEAR SET SCRS
 9. HOOK-UP WIRES SHALL BE LACED OR SLEEVED TO PROVIDE TIGHTNESS IN KEEPING WITH UTILITY.
 10. APPLY THERMO LUBRICANT & SEALER (ITEM 158, TEFLON TAPE) TO WIRE CONTACTS ON NO. 100, 101 AND 102 AT ASSEMBLY
 11. PART #98 (SERVO CONTROL UNIT) & #96 (6V BATTERY) ARE NOT SHOWN IN ASS'Y

SECTION B-B
SCALE 1/2 F.S.



LOWER END ASSEMBLY
SCALE: 1/2" = 1" SIZE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
RESEARCH SECTION (SW) COLUMBUS OHIO

TOLERANCES
EXCEPT NOTED
FRACTIONS: ±.015
DECIMALS: ±.005
ANGLES: ±.15°

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS: ±.164
DECIMALS: 0°-30'
DO NOT SCALE THIS DRAWING

MANOMETER-SERVO
DRAWN BY SER. 9-1-59 SH. 4 OF 20

SCALE: 1/2" = 1" SIZE

NOTED

REV. 1-69