CONOCO
TENSION PILE STUDY

PLAN FOR PERFORMING OFFSHORE LONG-TERM SMALL-DIAMETER PILE SEGMENT TESTS AND LARGE-DIAMETER PILE LOAD TESTS

By
The Earth Technology Corporation
Houston, Texas

March, 1984

INTRODUCTION

This report presents information concerning the long-term small-diameter pile segment test program and the 30-in. diameter pile load test program to be performed at the WD58A CAGC platform. The information contained in this report is intended to provide a brief documentation of the test system, including the instrument design and the data acquisition system, and to outline the operational plan for performing the small-diameter pile segment tests and the large-diameter pile load tests. The loading procedures on performing the large-scale pile test are also presented in this planning report.

SCHEDULE AND OPERATIONAL PLAN

A meeting was held with Conoco representatives to plan the large-scale pile load test on March 13, 1984. A schedule was set with Conoco representatives during the meeting. The schedule is shown on Plate 1. The Earth Technology Corporation's personnel will mobilize in Houston on March 26, 1984. Transportation of equipment and personnel to and from the platform will be provided by a self-propelled, self-elevating barge. The barge will also provide living accommodations for the personnel offshore. The Earth Technology Corporation will provide test equipment and personnel associated with the load test program. A hydraulic power unit will be supplied by MCS. Conoco will coordinate the necessary supplies on the platform. An organization chart for the testing program is given on Plate 2.

SMALL-DIAMETER PILE SEGMENT TESTS

Four small-diameter pile segment instruments have been developed for use in this program. Each instrument is capable of measuring shear transfer, displacement of the instrument relative to the soil at test depth, total lateral pressure and pore water pressure. A diagram of the assembled pile segment instrument is shown on Plate 3. Also shown are enlargements of the load cells, pressure transducers, and displacement transducer. A specially designed loading

system (shown on Plate 4) is used to conduct the test. The data acquisition system, shown schematically on Plate 5, consists of a DEC computer system, an HP-3497A scanner digitizer, a printer and two analog plotters. Digital data will be recorded as raw voltages on disc for later processing and analysis. Real-time analog plots will be made using the two x-y-y plotters. The entire system is housed in a waterproof, air-conditioned portable building.

Test Plan

Testing was performed at three depths in each of three borings for the previous program in December, 1983. The three depths were approximately 45.1 m (148 ft), 54.3 m (178 ft) and 63.4 m (208 ft) below the seafloor. The previous performed testing program is shown on Plate 6. After the desired consolidation time, the major load testing program for each installation at each of the depths was as follows:

1. Quasi-static (slow continuous) load test to failure in tension.

2. Two-directional large-displacement cycling to achieve minimum friction.

3. Quasi-static load test to failure in tension.

In some cases retests were performed. Retests are defined as tests performed after a major load test program and an additional consolidation period. All three tools were left implanted at a depth of 63.4 m (208 ft) below the seafloor to allow full consolidation prior to retesting after a long period of setup time.

The current test plan is to perform large-displacement cyclic load tests on those three 3-in. pile segments at 208 ft penetration. The resulting consolidation time is approximately 100 days (to be retested on March 29, 1984).

LARGE-DIAMETER PILE LOAD TESTS

The 76.2-cm (30-in.) test pile was successfully installed in December, 1983. An immediate load test was performed both in tension and in compression on the pile immediately after driving. After immediate test, the pile was redriven about 6 in. to the final grade. A detailed loading procedure for this test was presented in a previous report. The measurements were recorded using both analog and digital data acquisition systems. A schematic of this system for the load test is presented on Plate 7.

Since completion of the immediate load test, The Earth Technology Corporation's personnel has periodically conducted the measurements onboard the WD58A platform from the large test pile as well as the small-diameter pile segments to obtain the consolidation time history of soil-pile interaction following installation.

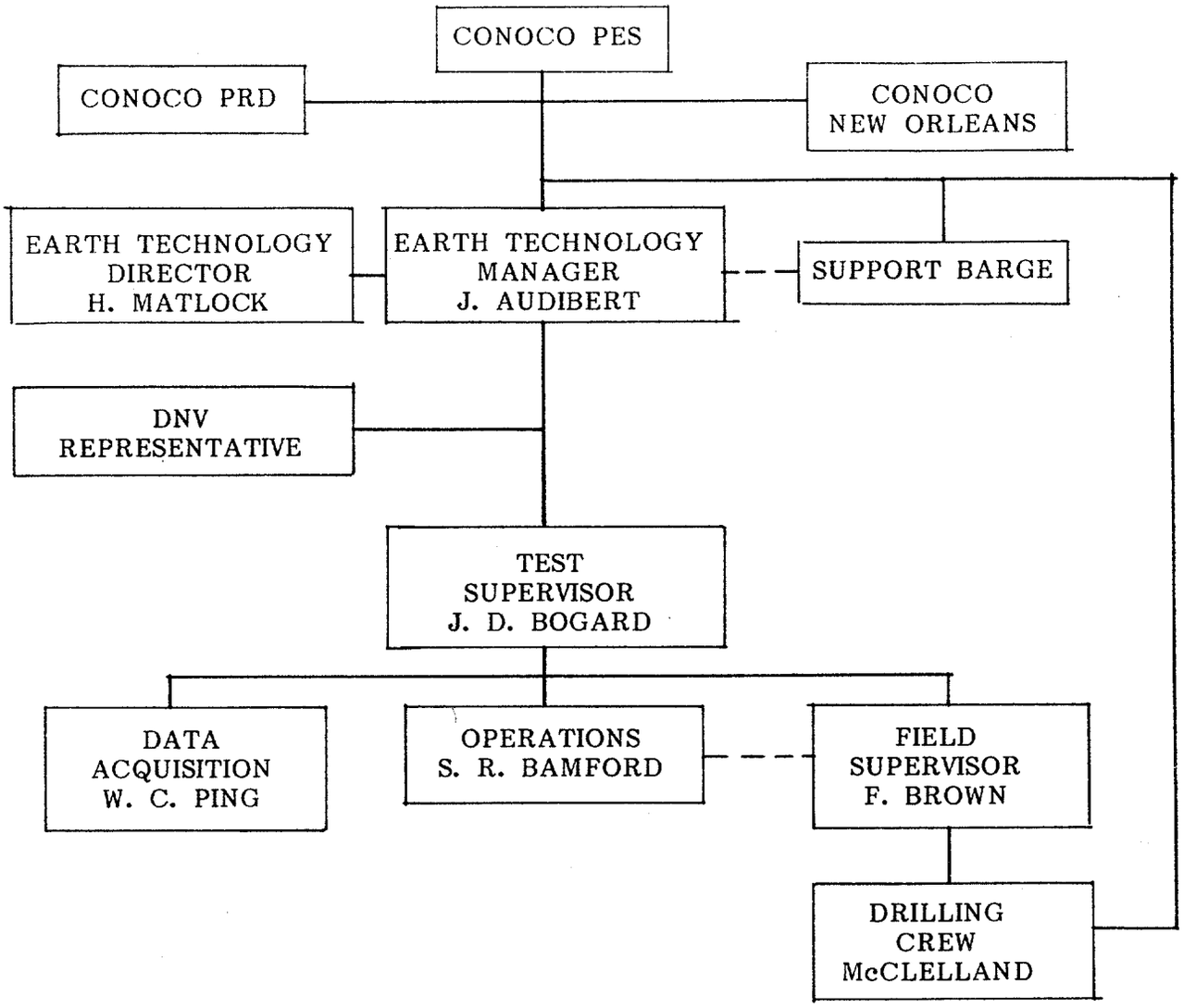
For the incoming load test program, a reference beam will be built along the test pile (Plate 8). The test pile setup is shown on Plate 9. Instrument locations on the test pile are illustrated on Plate 10. A complete list of all the instrument types, channel numbers, and instrument locations is given on Plate 11. The load test program is shown schematically on Plates 12 and 13 for Day 1 and Day 2 activities, respectively. Prior to performing any load test, a pretest check will be performed to ensure that all instruments and personnel are ready. This pretest check list is presented on Plate 14. The loading procedure for the Day 1 test is given on Plate 15. The support staff to perform the load test is given in an organizational chart on Plate 16.

The procedure to operate the hydraulic power unit is presented in the appendix.

SCHEDULE

Day 1	Mobilization at Houston.
Day 2	Personnel and equipment mobilize to Venice, Louisiana.
Day 3	Jack-up vessel with personnel and equipment on site.
Day 4 & 5	3-in. long-term pile segment tests and rigging up hydraulic rams for the 30-in. pile test.
Day 6	Preparation for the 30-in. pile test.
Day 7 & 8	Perform 30-in. pile tests.
Day 9	Demobilization.

PLATE 1



ORGANIZATIONAL CHART FOR
OFFSHORE TESTING PROGRAM

PLATE 2

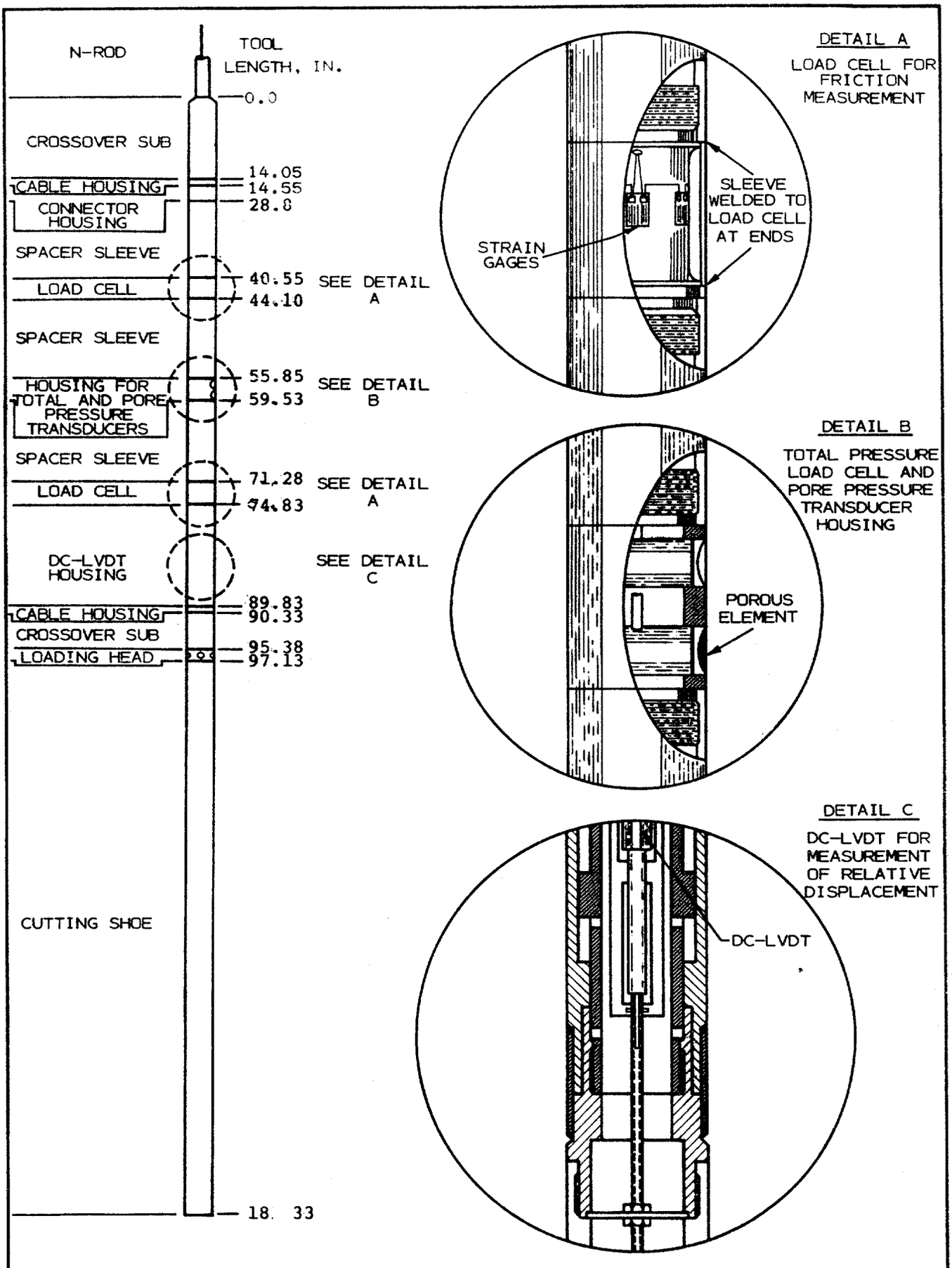


DIAGRAM OF SMALL DIAMETER PILE SEGMENT

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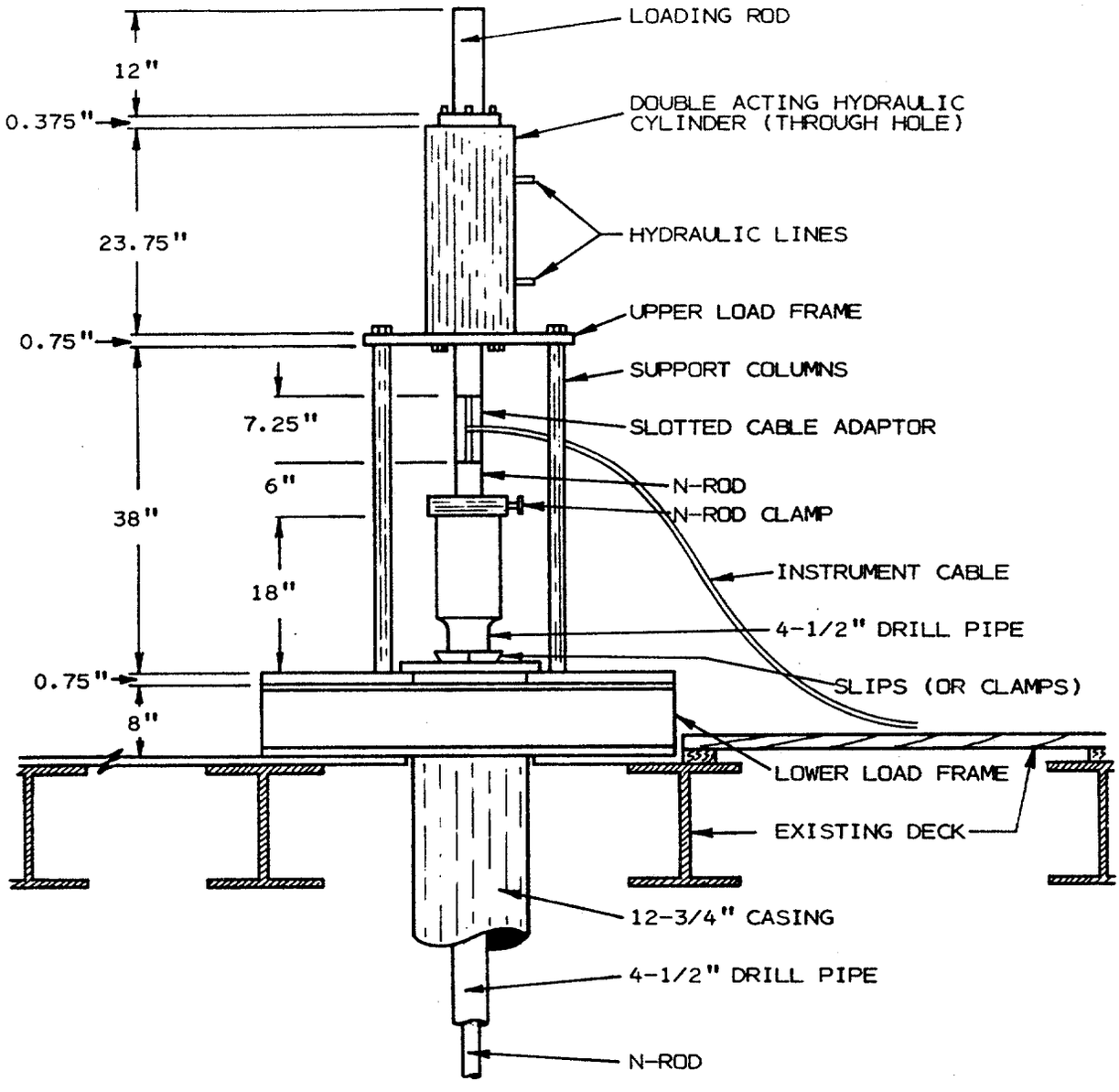
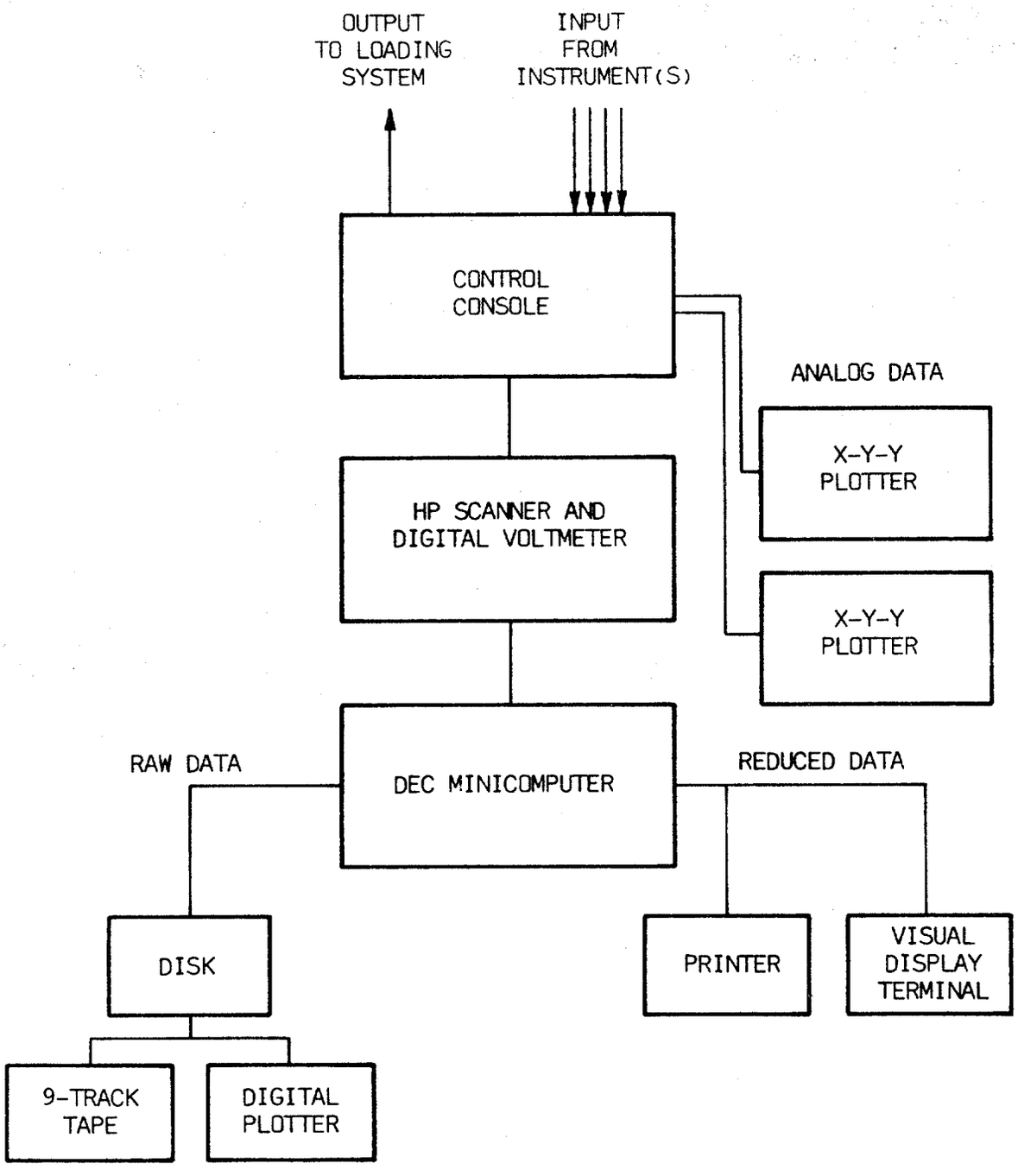
PLATE 3



SCHEMATIC DIAGRAM OF TESTING ARRANGEMENT
FOR 3-INCH DIAMETER PILE SEGMENT TESTS



SCHEMATIC DIAGRAM OF
DATA ACQUISITION SYSTEM
FOR SMALL-DIAMETER PILE SEGMENT TESTS

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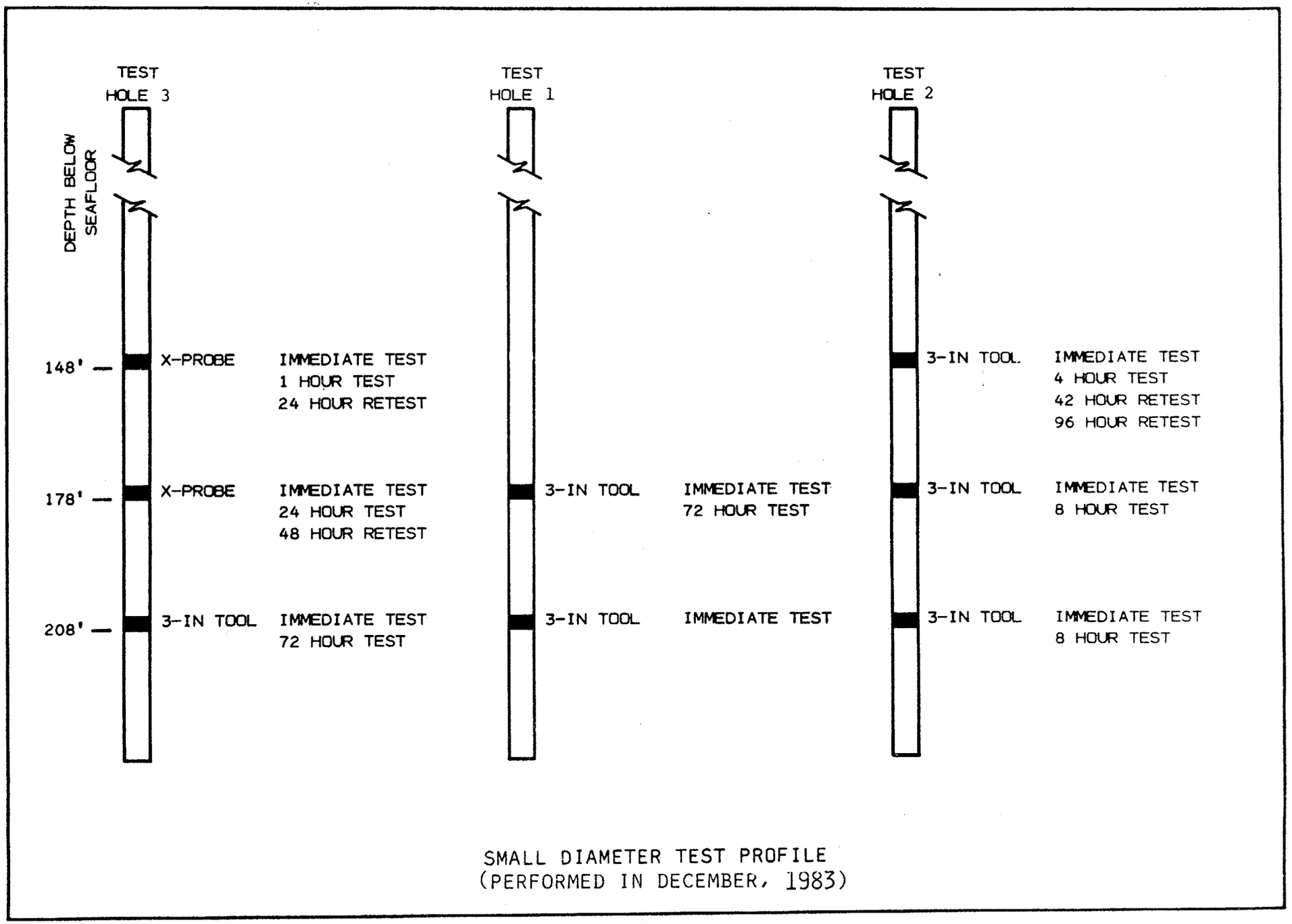
PLATE 5



SMALL DIAMETER TEST PROFILE
(PERFORMED IN DECEMBER, 1983)

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PLATE 6

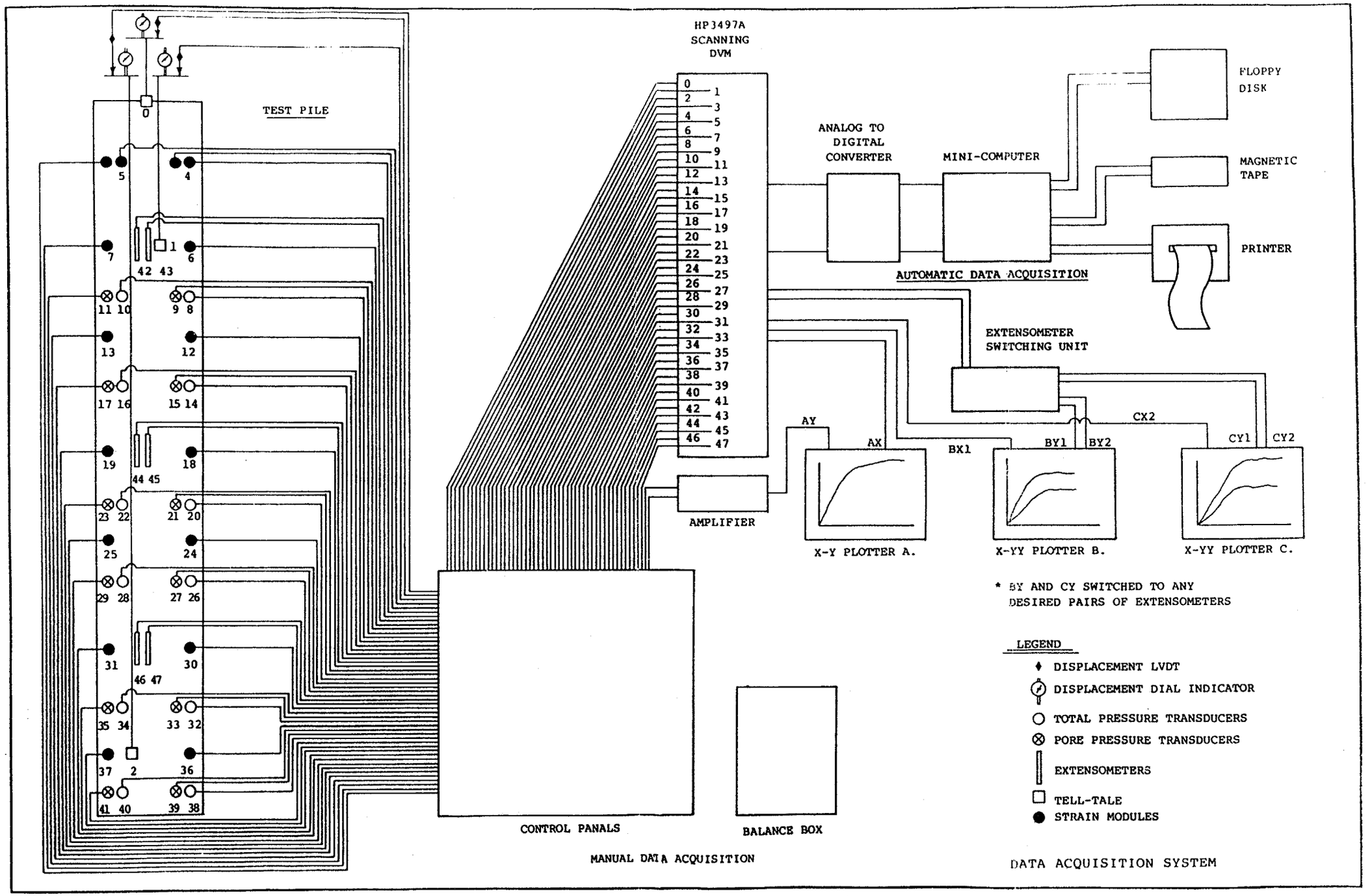

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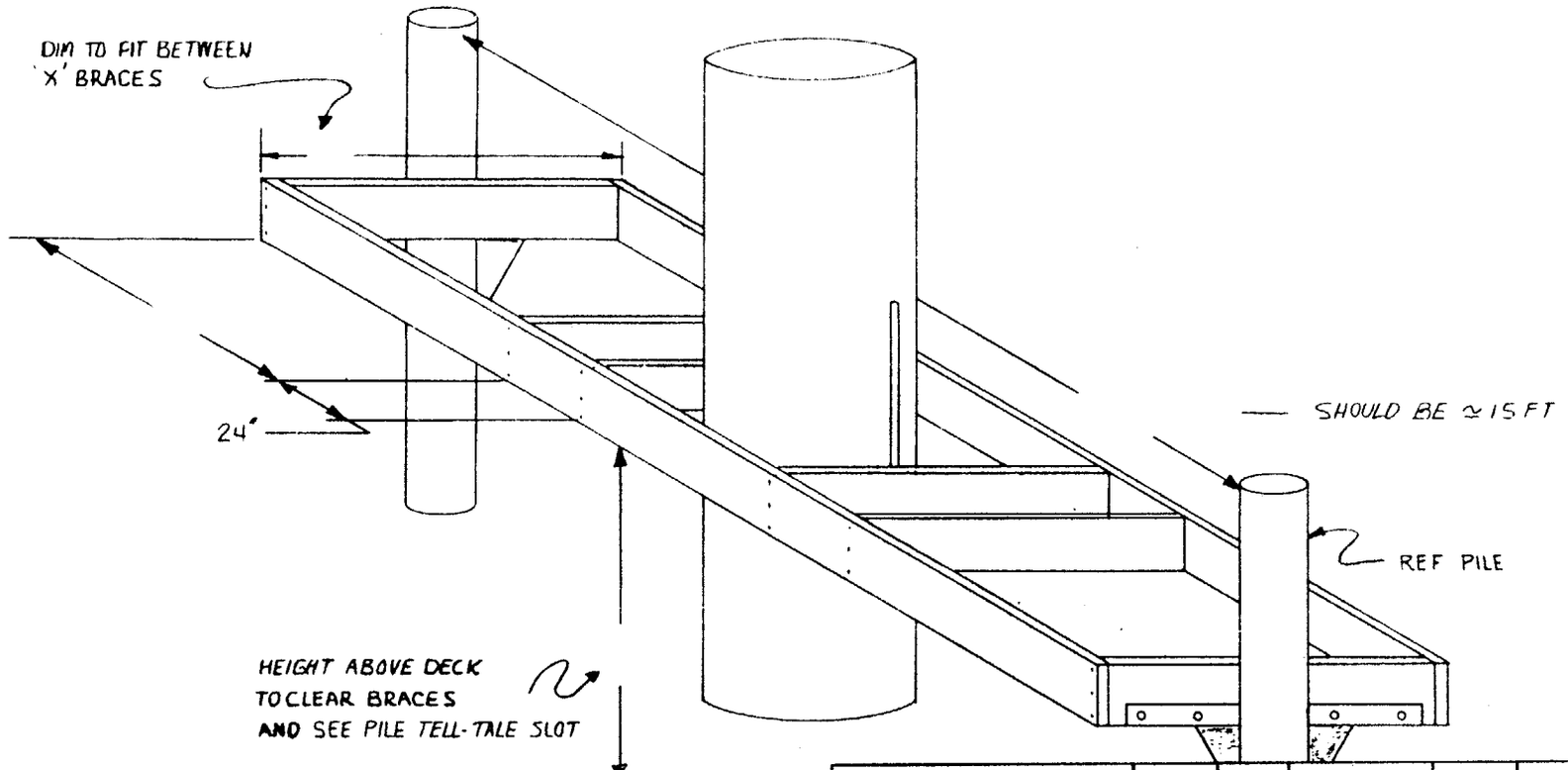
PLATE 7



MACHINE STANDARDS							
EXCEPT AS OTHERWISE SHOWN							
MACHINE FINISH TO BE 63 .0005		Pc MK	QTY	MATERIAL	SPEC	DESCRIPTION	
DIMENSIONAL TOLERANCE	ANGLE TOLERANCE	LIST OF MATERIAL					
0.000 ±.002	XX° ±1°	REFERENCE BEAM LARGE SCALE PILE TEST					
0.00 ±.01	XX° XX' ±1'						
FRACT ±1/64	XX° XX' XX" ±1"						
CORNER RADIUS .010 TO .020							
LATHE CUT THREADS CLASS 2							
REMOVE ALL BURRS AND BREAK ALL SHARP CORNERS							
PROJECTION							

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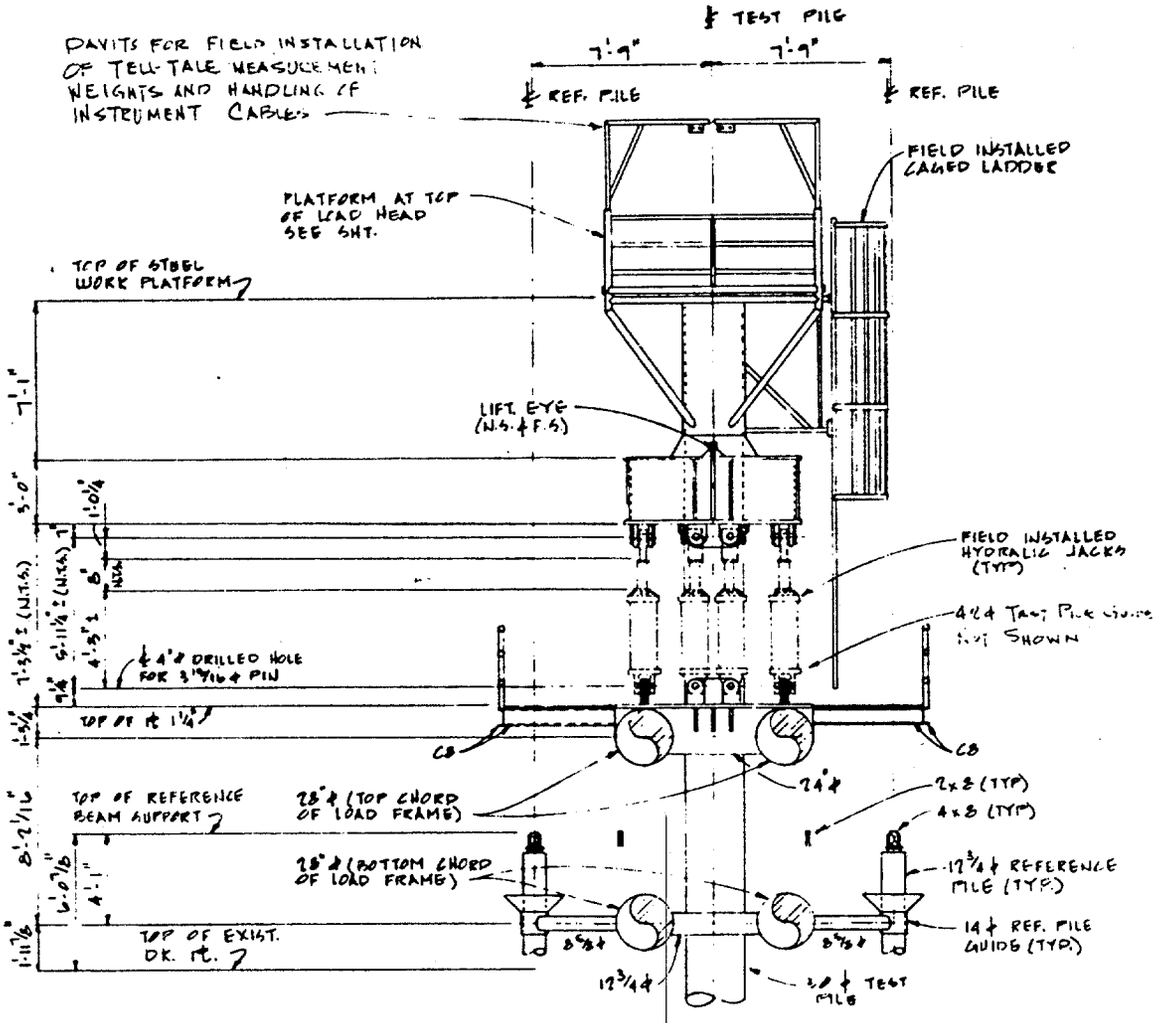
SCALE:	DRAWN BY:
APVD BY:	DATE:
DRAWING NUMBER B-	REV. NO.

PLATE 8



ELEVATION OF TEST PILE POSITION FOR LONG TERM TEST

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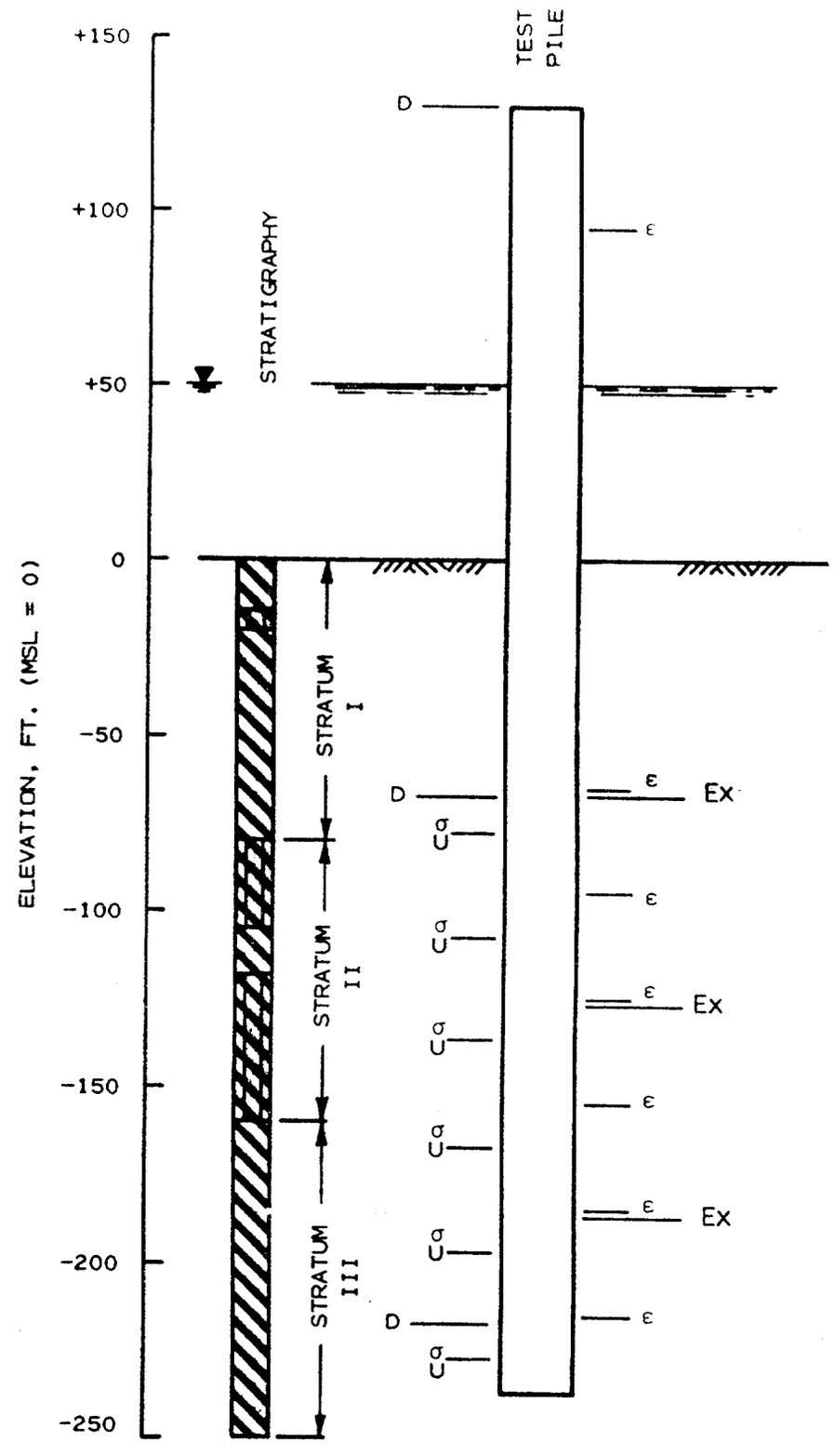
PLATE 9



INSTRUMENT LOCATIONS

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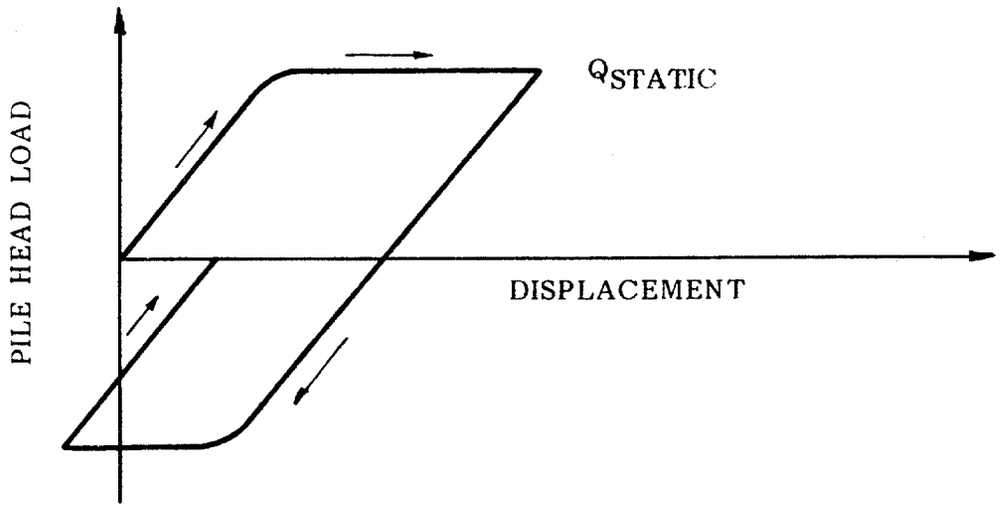
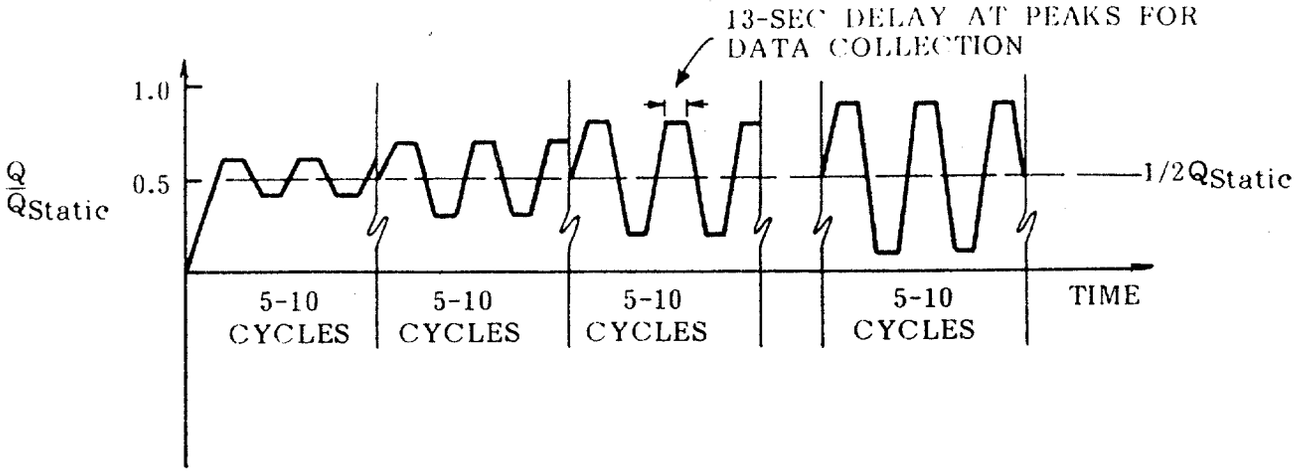
PLATE 10

INSTRUMENT CHANNEL NUMBERING SYSTEM

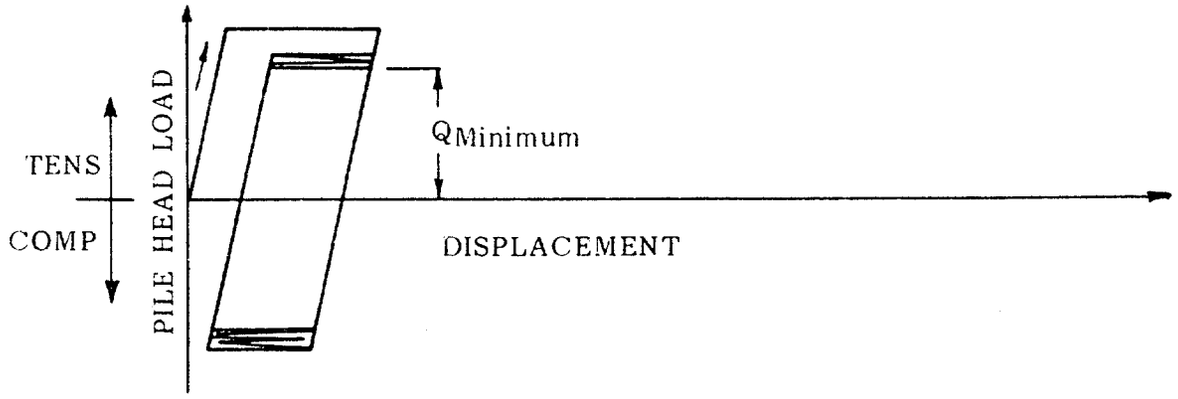
CHANNEL NUMBER	ELEVATION, FT. (MSL = 0)	INSTRUMENT TYPE
00	+ 73	DISPLACEMENT LVDT
01	- 116	DISPLACEMENT LVDT
02	- 266	DISPLACEMENT LVDT
03	+ 38	STRAIN MODULES A & B (TO ANALOG)
04	+ 38	STRAIN MODULE
05	+ 38	STRAIN MODULE
06	- 118	STRAIN MODULE
07	- 118	STRAIN MODULE
08	- 131	TOTAL PRESSURE
09	- 129	PORE PRESSURE
10	- 129	TOTAL PRESSURE
11	- 131	PORE PRESSURE
12	- 148	STRAIN MODULE
13	- 148	STRAIN MODULE
14	- 161	TOTAL PRESSURE
15	- 159	PORE PRESSURE
16	- 159	TOTAL PRESSURE
17	- 161	PORE PRESSURE
18	- 178	STRAIN MODULE
19	- 178	STRAIN MODULE
20	- 191	TOTAL PRESSURE
21	- 189	PORE PRESSURE
22	- 189	TOTAL PRESSURE
23	- 191	PORE PRESSURE
24	- 208	STRAIN MODULE
25	- 208	STRAIN MODULE
26	- 221	TOTAL PRESSURE
27	- 219	PORE PRESSURE
28	- 219	TOTAL PRESSURE
29	- 221	PORE PRESSURE
30	- 238	STRAIN MODULE
31	- 238	STRAIN MODULE
32	- 251	TOTAL PRESSURE
33	- 249	PORE PRESSURE
34	- 249	TOTAL PRESSURE
35	- 251	PORE PRESSURE
36	- 263	STRAIN MODULE
37	- 263	STRAIN MODULE
38	- 276	TOTAL PRESSURE
39	- 274	PORE PRESSURE
40	- 274	TOTAL PRESSURE
41	- 276	PORE PRESSURE
42	- 116	EXTENSOMETER
43	- 116	EXTENSOMETER
44	- 175	EXTENSOMETER
45	- 175	EXTENSOMETER
46	- 236	EXTENSOMETER
47	- 236	EXTENSOMETER



30-IN. PILE LOAD TEST PROGRAM - DAY 1



DAY 2 - PROGRESSIVE CYCLING IN TENSION
CONSTANT BIAS, INCREASING CYCLIC COMPONENT
UNTIL FAILURE OCCURS IN TENSION



DAY 2 - CYCLIC LOADING TO FAILURE, BOTH TENSION
AND COMPRESSION

30-IN. PILE LOAD TEST PROGRAM - DAY 2

PRE-TEST CHECK (ALL TESTS)

1. CHECK HYDRAULIC PUMPS AND RAMS FOR PROPER OPERATION AND CONTROL.

2. TAKE INITIAL ZERO READINGS OF ALL INSTRUMENTS WITH BALANCE BOX.

3. SET LVDT'S FOR PROPER DISPLACEMENT RANGE EXPECTED FROM TEST

4. ZERO DIAL GAGES AFTER SETTING LVDT'S FOR PROPER RANGE.

5. PREPARE X-Y-Y PLOTTERS

   A. ZERO AND SET SCALES
   B. PREMARK ANY GUIDES OR LIMITS
   C. RECHECK INPUTS TO PLOTTER

6. SET DATA SAMPLE INTERVAL FOR AUTOMATIC DATA ACQUISITION SYSTEM.

7. INITIALIZE DAS MICRO COMPUTER FOR PROPER LOAD TEST IDENTIFICATION.

8. POSITION PERSONNEL.

9. CALL FOR INITIAL INSTRUMENT READINGS.

10. CHECK COMMUNICATIONS SYSTEMS.

PILE LOADING PROCEDURE
STATIC TEST TO FAILURE
IN TENSION AND COMPRESSION

1. Accomplish "pre-test check".

2. Take manual readings at zero pile-head load.

3. Apply 25 kip load (tension), take manual readings.

4. Increase load to 100 kips (75 kip increment); take manual readings.

5. Increase load in ___ kips increments to failure.

6. Apply 2 inches of plastic slip, no manual recording during slip.

7. Stop rams, record "equilibrium" loads; take manual readings.

8. Unload in 500 kip increments; read manual data at each step.

9. At zero load, let system equilibriate and take final set of manual readings to record residual pile stresses.

10. Apply 25 kip load (compression), take manual readings.

11. Repeat steps 4 to 9.

12. Record the readings overnight.

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LOAD TEST ORGANIZATION

POSITION	LOCATION	FUNCTIONS	NAME
1. TECHNICAL COORDINATOR	DATA ACQUISITION BLDG.	OVERALL DIRECTION/LOAD CONTROL	H. MATLOCK
2. TEST MANAGER/ COMPUTER OPERATOR	DATA ACQUISITION BLDG.	CONTROL OF TEST OPERATIONS, OPERATES COMPUTER AND X-Y PLOTTERS	J.D. BOGARD/L.CHEANG
3. PANEL OPERATOR	DATA ACQUISITION BLDG.	OPERATE CONTROL PANEL AND BALANCE BOX	J.D. BOGARD
4. OUTSIDE COORDINATOR	PLATFORM DECK	COORDINATES ALL OUTSIDE ACTIVITIES UNDER INSTRUCTIONS FROM TEST MANAGER	W.C. PING
5. HYDRAULICS OPERATOR	HYDRAULIC PUMPS	OPERATES HYDRAULIC SYSTEM	MCS
6. DIAL GAGE READER	NEAR PILE	READS AND RECORDS PILE DISPLACEMENT DIAL GAGES	S. BAMFORD
7. LOGS AND RECORDS	DATA ACQUISITION BLDG.	RECORDS TEST NOTES	J.M.E. AUDIBERT

PLATE 16

APPENDIX

HYDRAULIC POWER UNIT
OPERATING PROCEDURES

HYDRAULIC POWER UNIT

OPERATING PROCEDURES

A. START-UP

1. Connect Power lead to 220/3/60, 20KW Power Source.

2. Turn power switch on electrical control box to "on" position.

3. If the oil temperature is less than 80 deg F the oil heater indicator light will glow, indicating that the heating circuit is engaged. The main pump motor will not start until the oil temperature reaches 80 deg F.

4. As the oil temperature reaches 80 deg F the heater circuit indicator light will go out, indicating that the oil is at proper temperature.

5. Prior to pushing the motor/pump start button, ensure that:
   a) The 2" ball valve start relief located behind the main hydraulic control panel is "open". This valve reduces the load on the motor/pump when starting up in a closed circuit.
   b) The pendant hydraulic controls are in the "off" position.

6. The motor/pump can now be started. Once the motor is up to speed, the start relief valve can be closed slowly, as the pump volume compensator adjusts to the low volume requirement.

B. OPERATION - This hydraulic power unit and its associated control panel is designed to control the flow of the low pressure returning fluid, when extending or retracting the hydraulic cylinders. This flow control ensures a constant rate of movement independant of cylinder load. A secondary circuit is also used to make-up fluid loses past the cylinder pistons and correspondingly adjust (hold, increase, decrease) cylinder pressure when taking instrument readings.

1. Directional & Flow Control Panel - Figure A

This control panel contains two (2) flow controls for regulating fluid flow, a 3/4" directional control valve for directing fluid to the piston or rod end of the cylinders and a 1/4" directional control valve for directing make-up/adjust fluid to either the piston or rod end of the cylinder. Figure A details the location and function of the above items.

2. Pendant Control - Figure B.

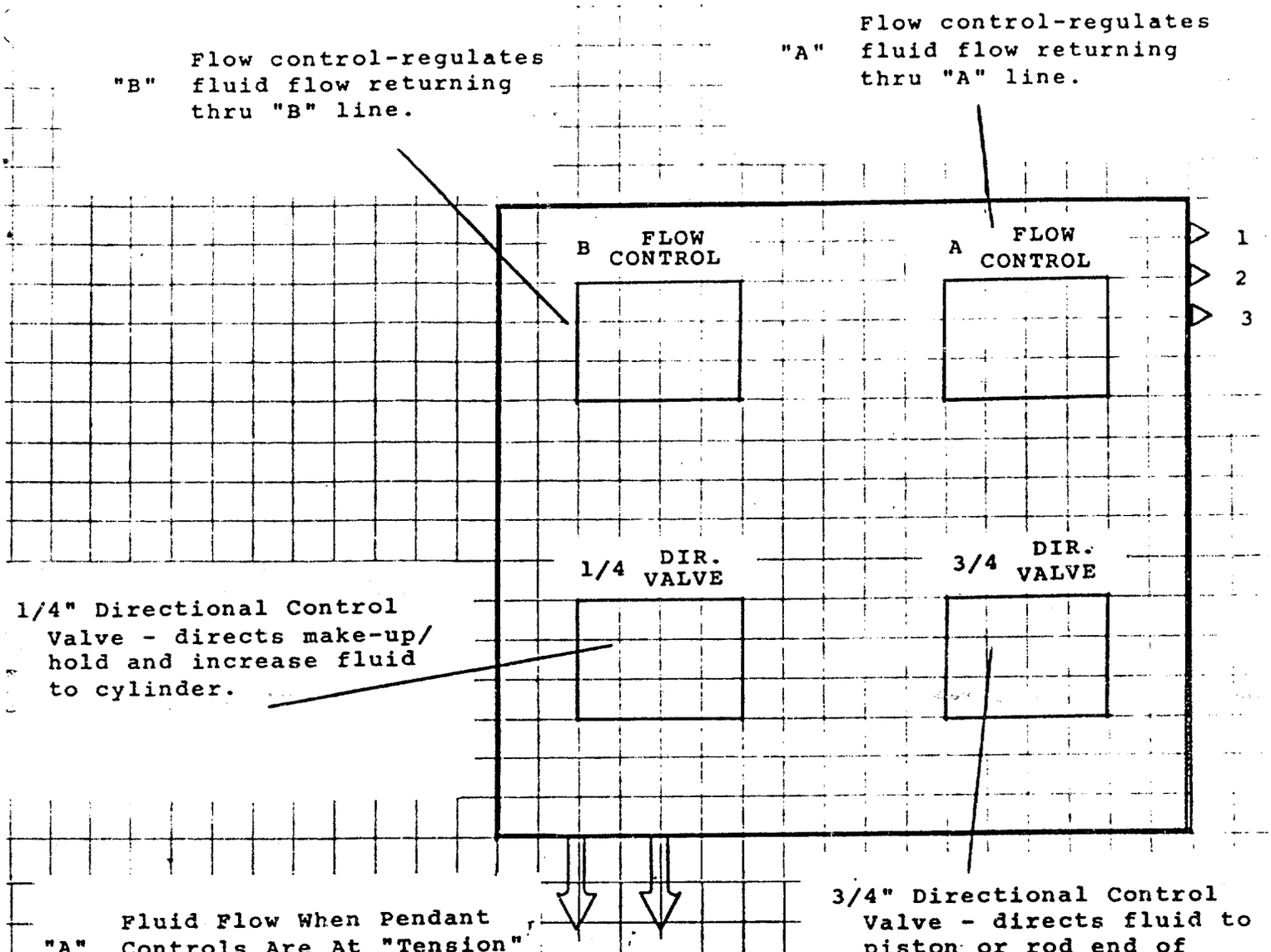
The pendant control allows remote actuation of the 3/4" and 1/4" directional control valves. The flow control valves are operated at the control panel only. The pendant control has the following features:

a) Indicator light for motor run.
b) Motor stop button
c) 1/4" directional control valve switch. (see figure B for operation)
d) 3/4" directional control valve switch. (see figure B for operation)

3. Make-up/Hold, Increase/Decrease Panel - Figure C

This panel is used with the 1/4" directional control valve for regulating the rate (quantity) of fluid required to;

a) be added to the rod end or piston end of the cylinder to hold a certain load due to leakage past the cylinder piston.
b) be added to the rod end or piston end of the cylinder to slowly increase the load in the cylinder.
c) to bleed off fluid in the rod end or pistn end of the cylinder to slowly decrease the load in the cylinder.

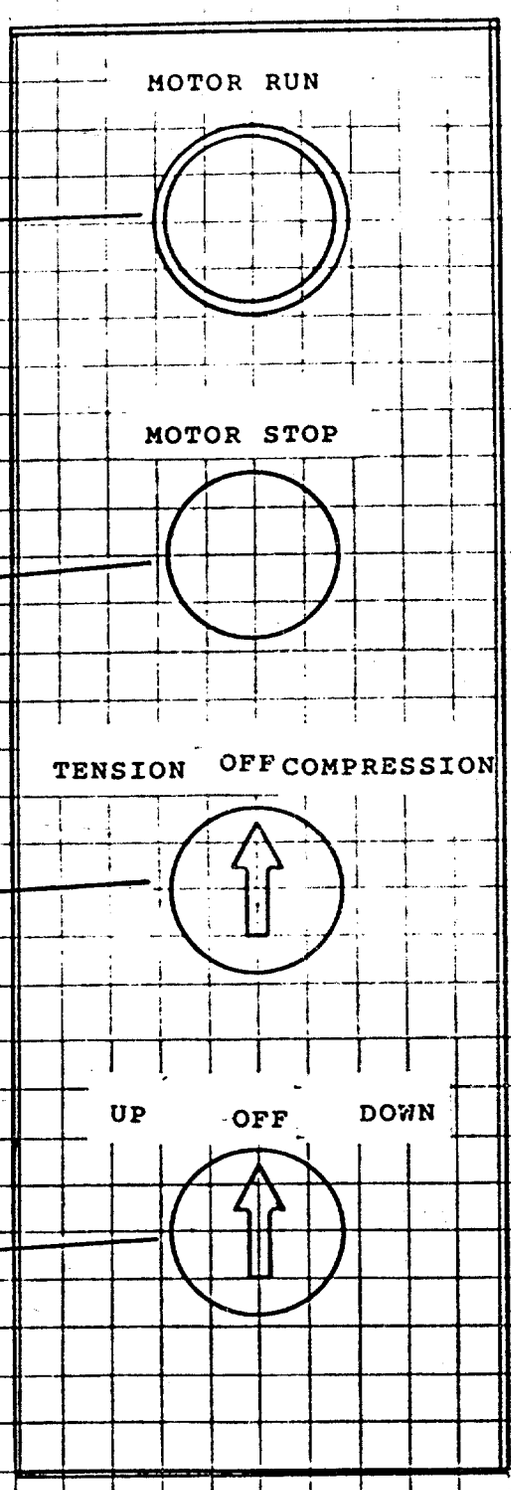


"A" Fluid Flow When Pendant Controls Are At "Tension" and/or "Up".

"B" Fluid Flow When Pendant Controls Are At "Compression" and/or "Down".

Directional and Flow Control Panel

FIG. A



INDICATES MOTOR/PUMP IS ON AND RUNNING

STOPS MOTOR/PUMP. MUST BE RESTARTED AT POWER UNIT

Directs 1/4" directional control valve to supply make-up/hold, increase fluid to cylinders. Set @ tension when operating in net tension. Set @ compression when operating in net Compression.

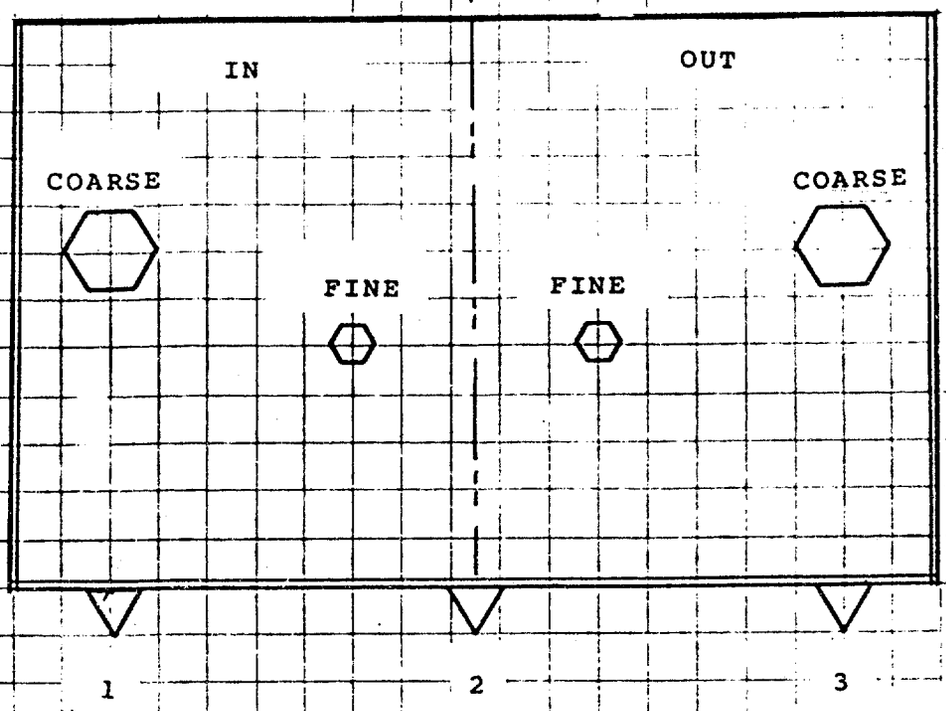
Directs 3/4" directional control valve to supply fluid to piston end of cylinders - "UP" position or rod end of cylinders - "DOWN" position.

Pendant Control

FIG. B

Coarse and Fine control of fluid into cylinders for leakage make-up/hold and increase.

Coarse and Fine control of fluid out of cylinders for decrease of cylinder load.



Make-up/Hold
Increase-Decrease
Panel

FIG. C