AD-A167 840 OPERATION AND MAINTENANCE MANUAL FOR DRAW-OFF HOLDBACK (DOHB) CONTROL CONSOLE(U) WESTERN GEAR MACHINERY COS MO EVERTT WA DEC 82 CHES/NAVFAC-FPO-8241 1/2

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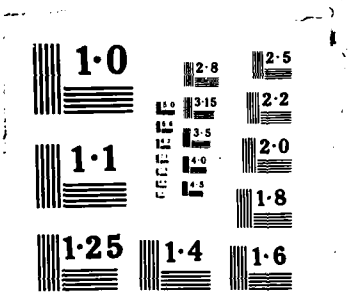
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OPERATION AND MAINTENANCE MANUAL

for

DRAW OFF-HOLDBACK (DOHB) CONTROL CONSOLE

MANUFACTURED FOR USE WITH

CABLE LAYING SYSTEM

MANUFACTURED FOR

OCEAN CONSTRUCTION EQUIPMENT INVENTORY
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

MANUFACTURED BY

western GEAR CORPORATION
Western Gear Machinery Co.
A Subsidiary of Western Gear Corporation
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WGSO 42816

DECEMBER 1982

ADA 167840

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION AVAILABILITY OF REP. Approved for public release; distribution is unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER WGSO 42816	5. MONITORING ORGANIZATION REPORT # FPO 8241
6a. NAME OF PERFORM. ORG. 6b. OFFICE SYM Western Gear Machinery Co.	7a. NAME OF MONITORING ORGANIZATION Ocean Engineering & Construction Project Office CHESNAVFACENGCOM
6c. ADDRESS (City, State, and Zip Code) 2100 Norton Ave. Everett, WA 98201	7b. ADDRESS (City, State, and Zip BLDG. 212, Washington Navy Yard Washington, D.C. 20374-2121
8a. NAME OF FUNDING ORG. 8b. OFFICE SYM	9. PROCUREMENT INSTRUMENT INDENT #
8c. ADDRESS (City, State & Zip)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT # / PROJECT # / TASK # / WORK UNIT ACCESS #
11. TITLE (Including Security Classification) Operation & Maintenance Manual for Draw Off-Holdback (DOHB) Control Console	
12. PERSONAL AUTHOR(S)	
13a. TYPE OF REPORT 13b. TIME COVERED FROM TO	14. DATE OF REP. (YYMMDD) 82-12 / 15. PAGE 184
16. SUPPLEMENTARY NOTATION	
17. COSATI CODES FIELD GROUP SUB-GROUP	18. SUBJECT TERMS (Continue on reverse if nec. Cable installation, retrieval & repair,

19. ABSTRACT (Continue on reverse if necessary & identify by block number)
This manual provides description, installation, operation, troubleshooting, maintenance and repair, and parts list information for the operators Control Console used with the DOHB Tensioner System.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT SAME AS RPT.	21. ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL Jacqueline B. Riley	22b. TELEPHONE 22c. OFFICE SYMBOL 202-433-3881

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SAFETY SUMMARY

The following are general safety precautions that may not be related to any specific procedures and therefore may not appear elsewhere in this manual. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

Operation of the machinery for this equipment is potentially dangerous. Keep away from the machinery when it is in operation. Use caution when it is not in operation.

To prevent an accidental startup which could result in injury to personnel or damage to the equipment, shut down the equipment and tag controls when performing maintenance actions or repairs.

Keep away from live circuits.

Do not attempt to perform corrective maintenance actions or repairs to hydraulic, pneumatic, or electrical components without first making sure that power is off and the circuits are deenergized. Bleed off the pressure in hydraulic and pneumatic circuits before making disconnections.

Under no circumstances reach into or enter an electrical enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid. Do not service or adjust alone.

When working with or near high voltages, be familiar with modern methods of resuscitation.

Keep work areas and areas around the machinery clean and free from grease, oil, loose hoses, wires, and other debris. Do not work around moving equipment when wearing loose clothing.

Observe all safety precautions at all times.

WARNING

Western Gear Machinery Co. has taken every reasonable precaution to ensure personnel safety by installing appropriate guards, covers, interlocks, and other safety devices. It is the responsibility of the user to review the operation and maintenance procedures with regard to safety requirements, and to exercise reasonable caution and observance of those requirements. It is incumbent upon the user to ensure that this equipment has been installed safely by providing guard rails beside walkways, around moving machinery, and around hazardous electrical sources; by providing safety lines and attaching points for use while working on elevated equipment; by posting signs alerting personnel to safety requirements, and by initiating procedures required to prevent injury or death to personnel.

SECTION I

DESCRIPTION

1-1. INTRODUCTION.

1-2. This manual contains a description, installation, troubleshooting, maintenance and repair, and parts list information for the operators Control Console used with the DOHB Tensioner System.

1-3. EQUIPMENT PURPOSE.

1-4. The Control Console houses the electrical and pneumatic devices used for controlling and monitoring the functions of the Draw Off-Holdback (DOHB) Tension Machine and its electrohydraulic power unit. It also houses the hydraulic pressure gages for monitoring the DOHB hydraulic system.

1-5. GENERAL OPERATIONAL DESCRIPTION.

1-6. The DOHB tension machine is a hydraulically powered, pneumatically operated machine capable of applying 2,250 pounds of tension at a cable speed of 304 fpm. Power to drive the machine is provided by an individual electrohydraulic power unit. Air for operation of the pneumatic controls is supplied through the control console from ship's air supply. For high speed operation (600 fpm), tension is reduced to 1,125 pounds.

1-7. The major components of the DOHB tension machine are:

1. Bedplate, upper frame, and lower frame assemblies.

2. Upper and lower track assemblies, each with four sprockets, a drive shaft, idler shaft, two pair of pillow blocks with a track support roller connected between each pair, three roller frames with four pressure rollers each, and three rocker shafts.

3. Two reducer gearboxes, one for each track assembly, with a hydraulic drive motor each.

4. A main pressure (lift and squeeze) cylinder.

5. Three track cylinders located within the lower track loop.

6. Two sets of dragboards with one air power cylinder each.

1-8. The major components of the power unit are:

1. One 120 gallon tank.

2. One 30 hp electric drive motor.

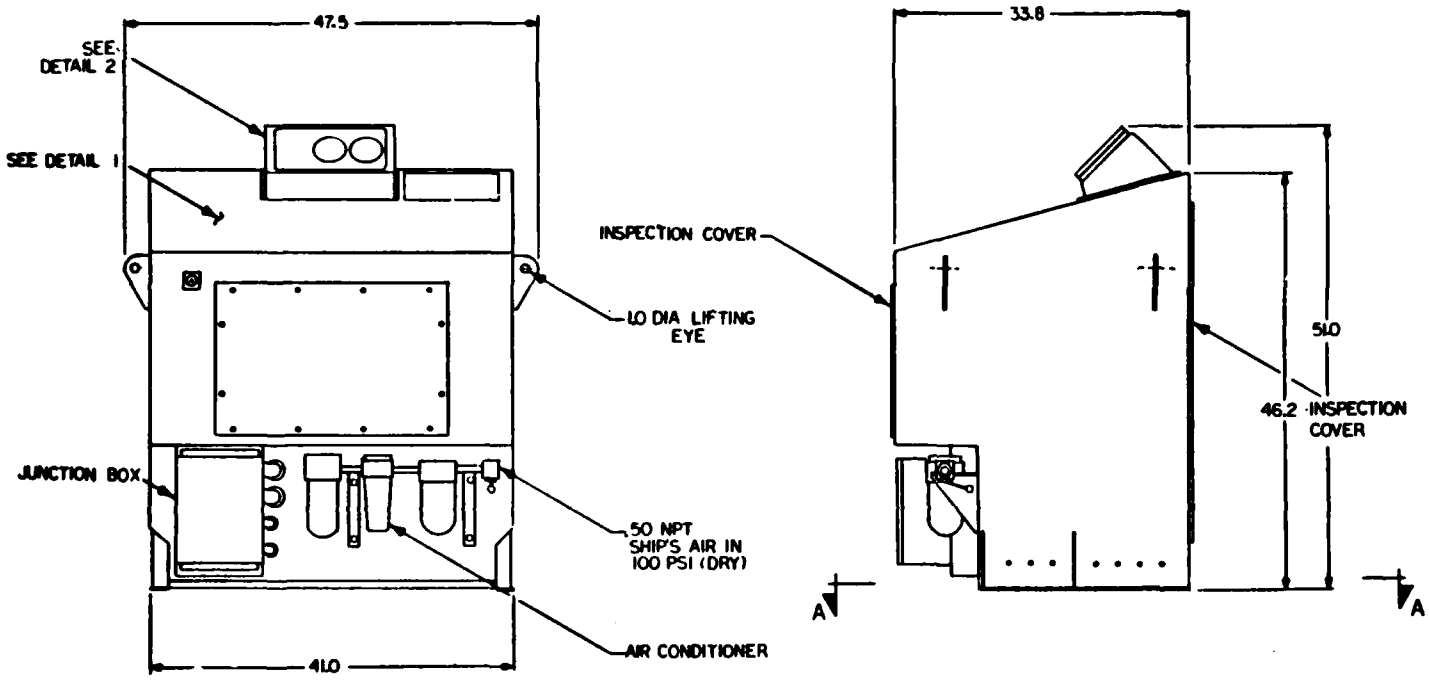
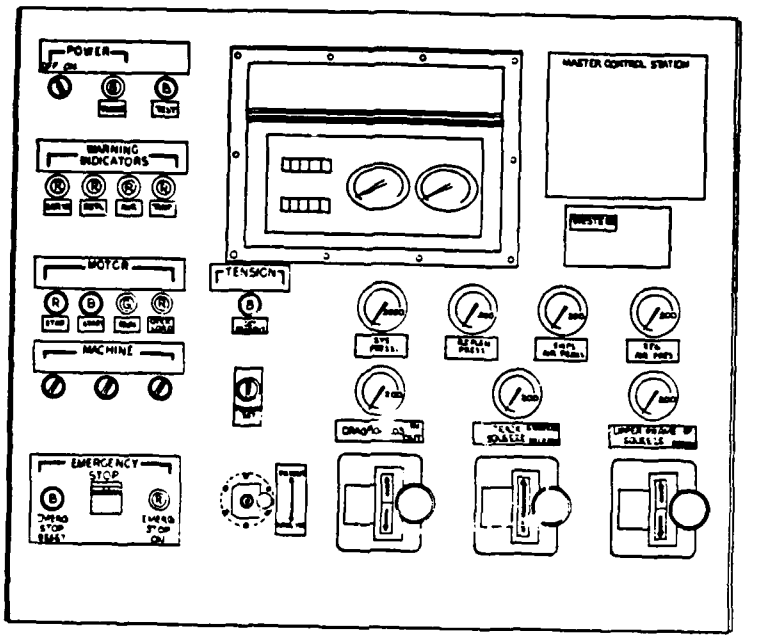
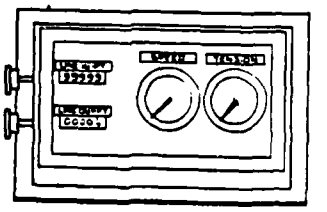


Figure 1-1. Outline - Control Console (Sheet 1 of 2)



DETAIL 1



DETAIL 2

D316405

Figure 1-1. Outline - Control Console (Sheet 2 of 2)

3. One variable delivery pump with integral replenishing pump.

4. One hydroelectric actuator.

5. One heat exchanger.

6. One dual relief valve assembly.

7. One bypass and brake control valve.

8. One motor controller.

1-9. A functional description of the DOHB tension machine and power unit as they relate to the control console is contained in section IV.

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains precautions and procedures for the initial installation and checkout of the Control Console.

2-3. SAFETY SUMMARY.

WARNING

Use extreme care when handling, moving or lifting to avoid injury to personnel or damage to equipment.

CAUTION

Use a sling to lift the control console at the two lifting points.

2-4. INSTALLATION.

WARNING

Western Gear Machinery Co. has taken every reasonable precaution to ensure personnel safety by installing appropriate guards, covers, interlocks, and other safety devices. It is the responsibility of the user to review the operation and maintenance procedures with regard to safety requirements, and to exercise reasonable caution and observance of those requirements. It is incumbent upon the user to ensure that this equipment has been installed safely by providing guard rails beside walkways, around moving machinery, and around hazardous electrical sources; by providing safety lines and attaching points for use while working on elevated equipment; by posting signs alerting personnel to safety requirements, and by initiating procedures required to prevent injury or death to personnel.

2-5. CONTROL CONSOLE. See figure 2-1 for the mounting pattern of the control console base. Refer to ship's plans for the location of the control console.

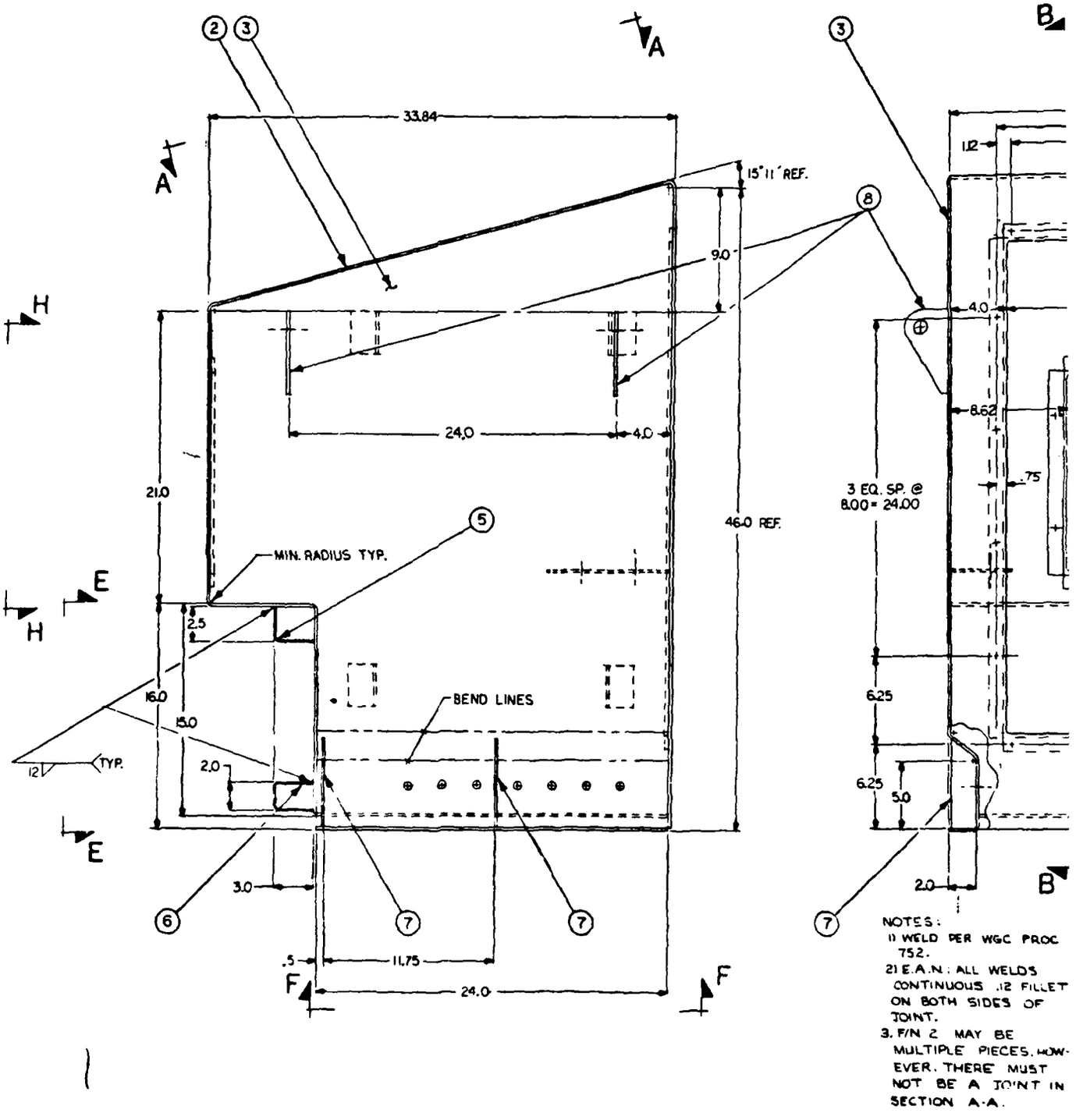
2-6. PNEUMATIC PIPING. See figure 6-2 for pneumatic interconnection. A compressed air system of nominally 100 psi is required. After the control

console has been located and installed, make the interconnecting hose connections in accordance with figure 6-2.

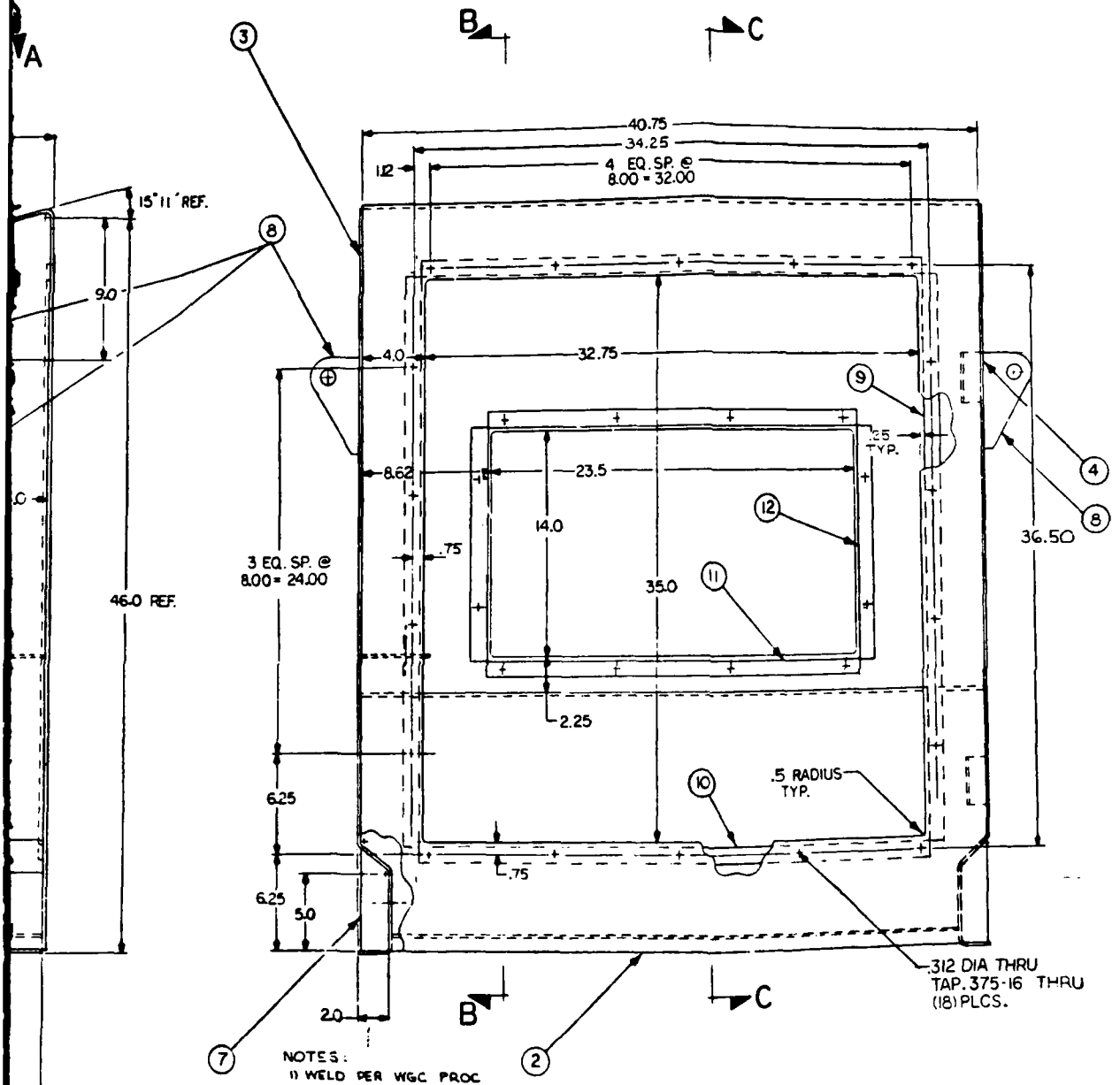
2-7. ELECTRICAL CONNECTIONS. See figure 2-2 for electrical wiring connections and cabling interconnections.

2-8. DOHB ELECTRONICS CONSTANT TENSION CONTROL CIRCUITS.

2-9. On initial installation of the DOHB system or upon removal and reinstallation of the PC card, the load cell, power supply or tachometer-generator perform the calibration procedure given in figure 2-6 on both systems (A and B).



NOTES:
1) WELD PER WGC PROC 752.
2) E.A.N.: ALL WELDS CONTINUOUS .12 FILLET ON BOTH SIDES OF JOINT.
3. F/N 2 MAY BE MULTIPLE PIECES, HOWEVER, THERE MUST NOT BE A JOINT IN SECTION A-A.



NOTES:
1) WELD PER WGC PROC 752.
2) E.A.N. ALL WELDS CONTINUOUS .12 FILLET ON BOTH SIDES OF JOINT.
3. F/N 2 MAY BE MULTIPLE PIECES. HOWEVER, THERE MUST NOT BE A JOINT IN SECTION A-A.

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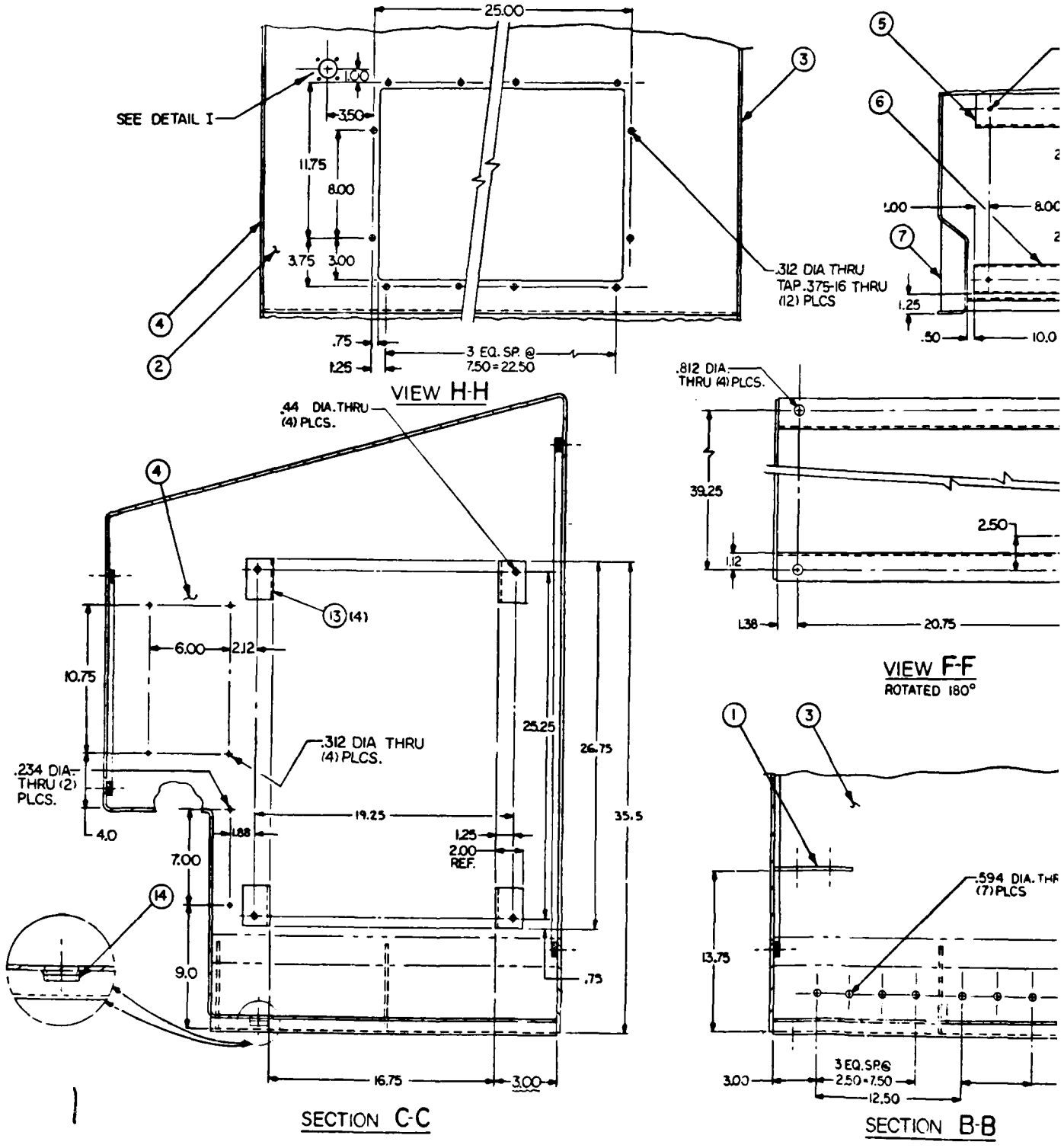
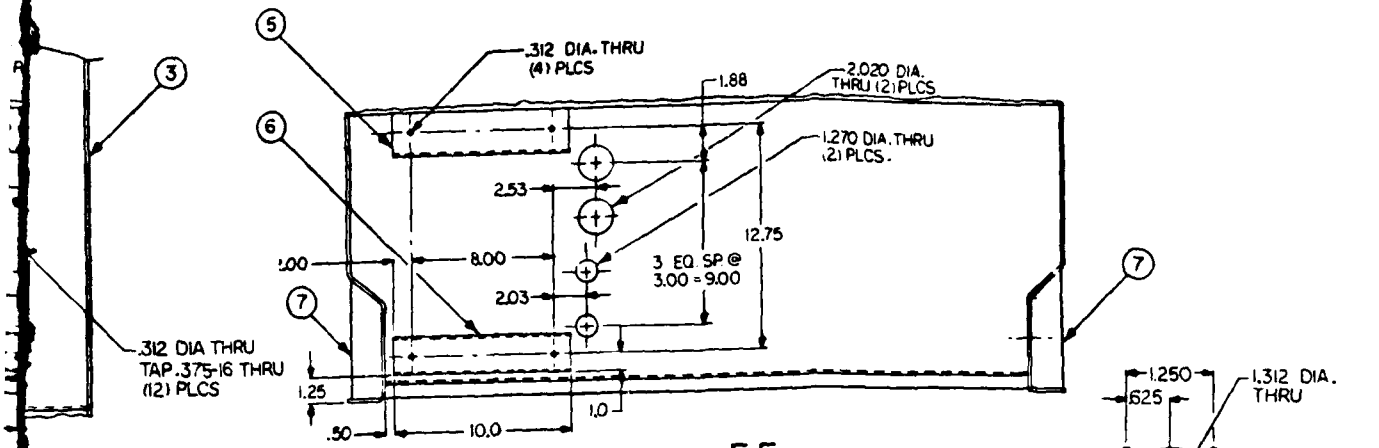
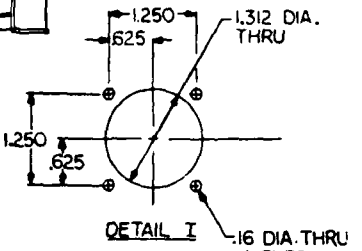
Figure 2-1. Control Console Fabrication
(Sheet 1 of 3)


25.00
SEE DETAIL I
1.00
3.50
11.75
8.00
3.75
3.00
.75
1.25
3 EQ. SP. @
7.50 = 22.50
.312 DIA THRU
TAP .375-16 THRU
(12) PLCS
VIEW H-H
.44 DIA. THRU
(4) PLCS.
6.00
2.12
10.75
.312 DIA THRU
(4) PLCS.
.234 DIA.
THRU (2)
PLCS.
4.0
1.88
19.25
1.25
2.00
REF.
7.00
9.0
25.25
26.75
35.5
.75
16.75
3.00
SECTION C-C
.812 DIA.
THRU (4) PLCS.
39.25
2.50
1.12
1.38
20.75
VIEW F-F
ROTATED 180°
.594 DIA. THR
(7) PLCS
13.75
3 EQ. SPCS
2.50 = 7.50
3.00
12.50
SECTION B-B



VIEW E-E



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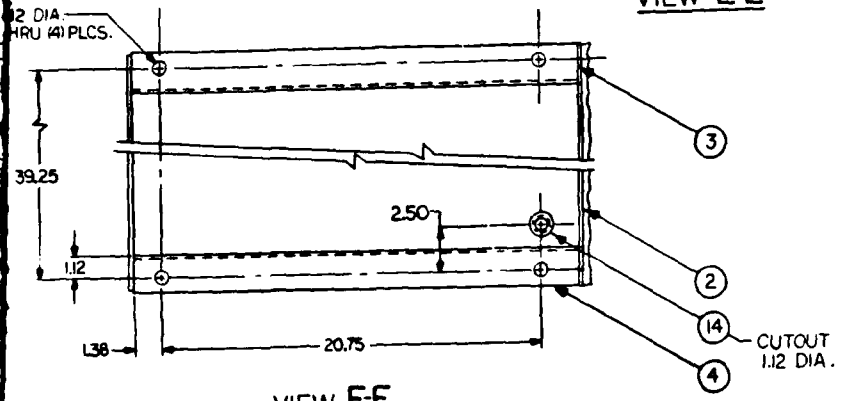
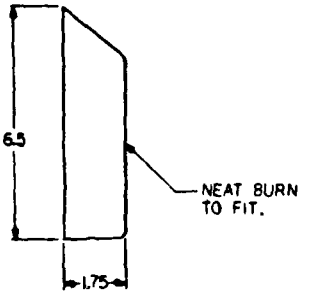


VIEW F-F
ROTATED 180°



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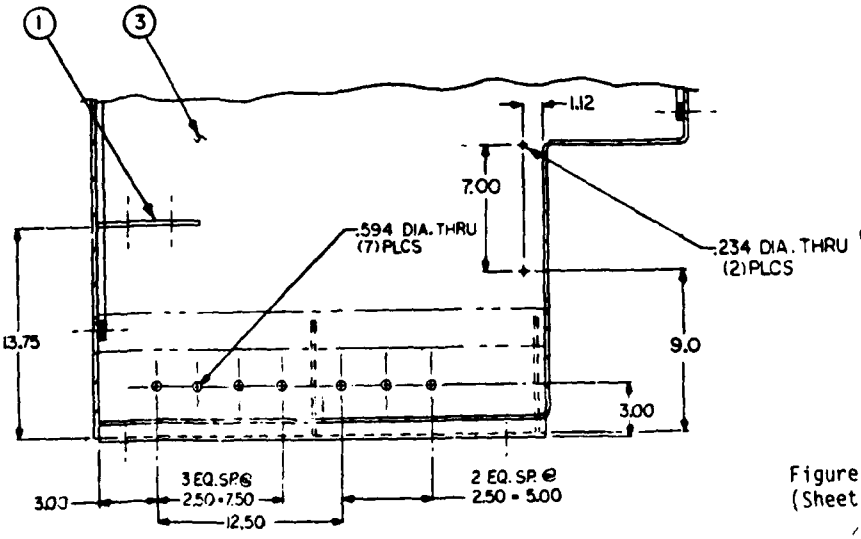
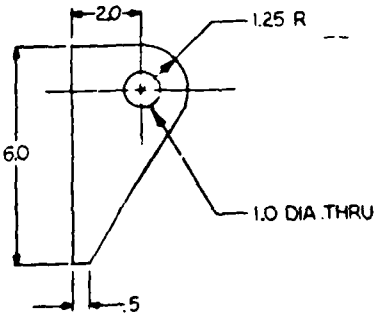


SECTION B-B



DETAIL F/N 8

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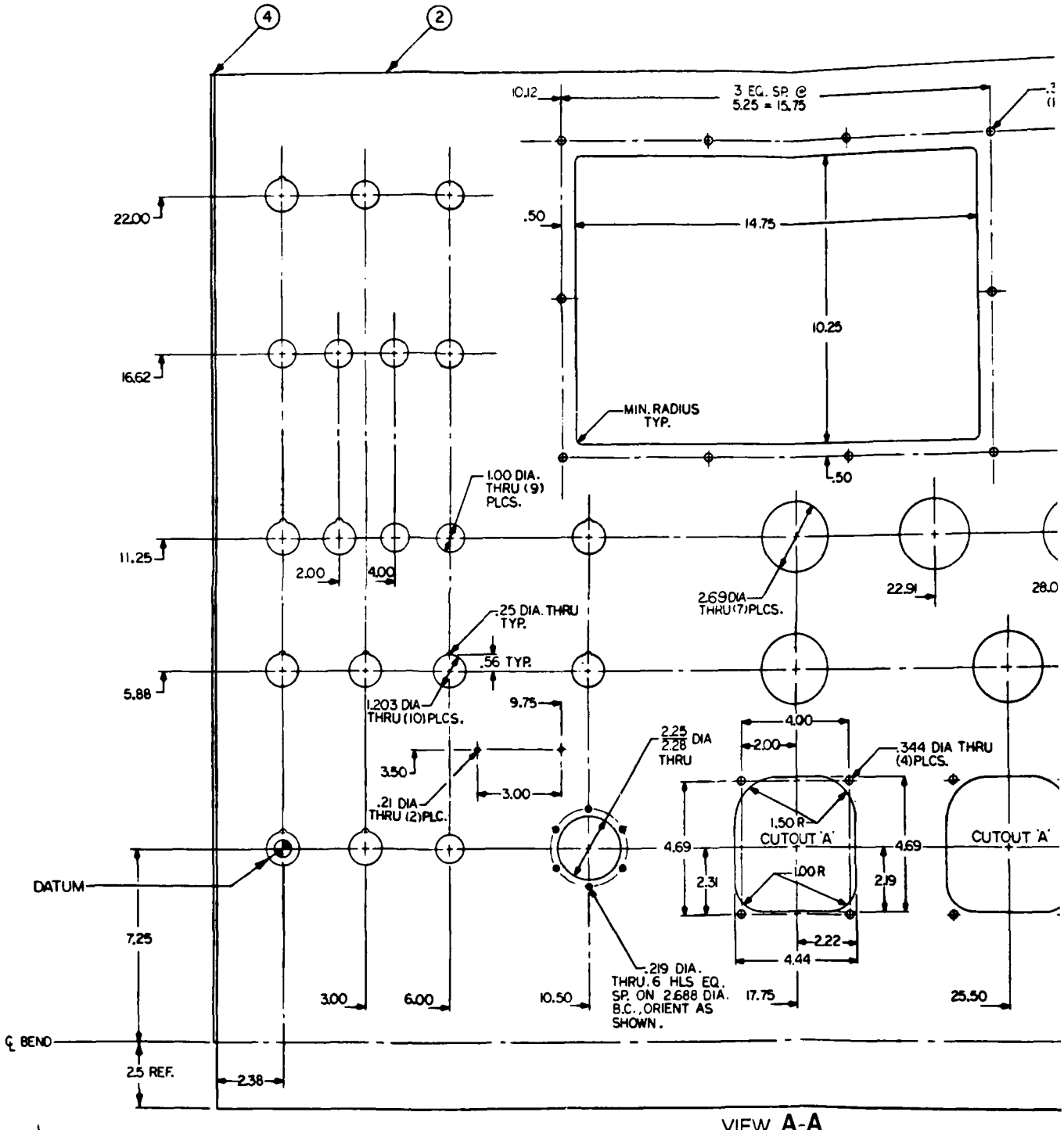
Figure 2-1. Control Console Fabrication
(Sheet 2 of 3)



VIEW A-A
FROM SHT 1

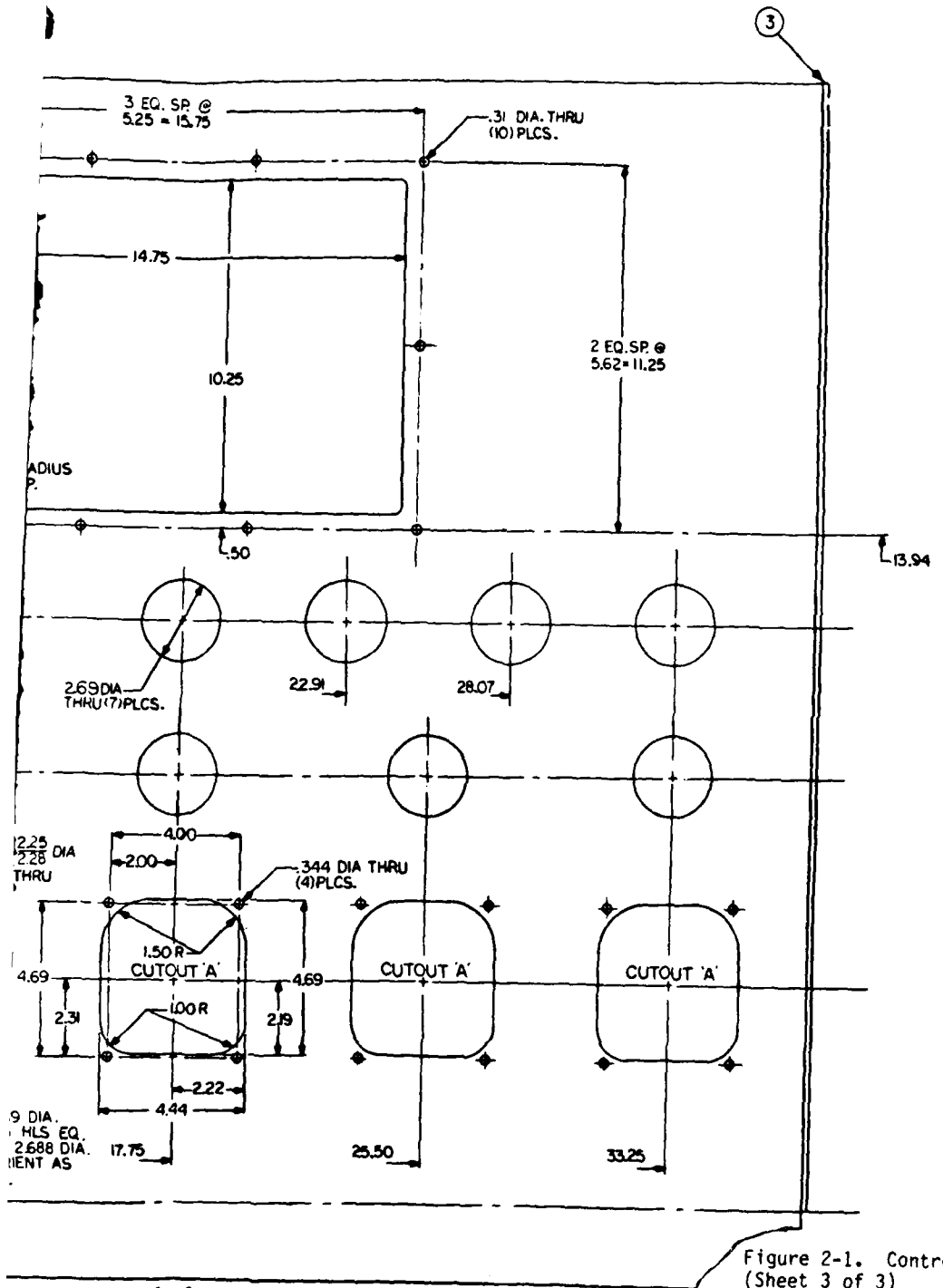


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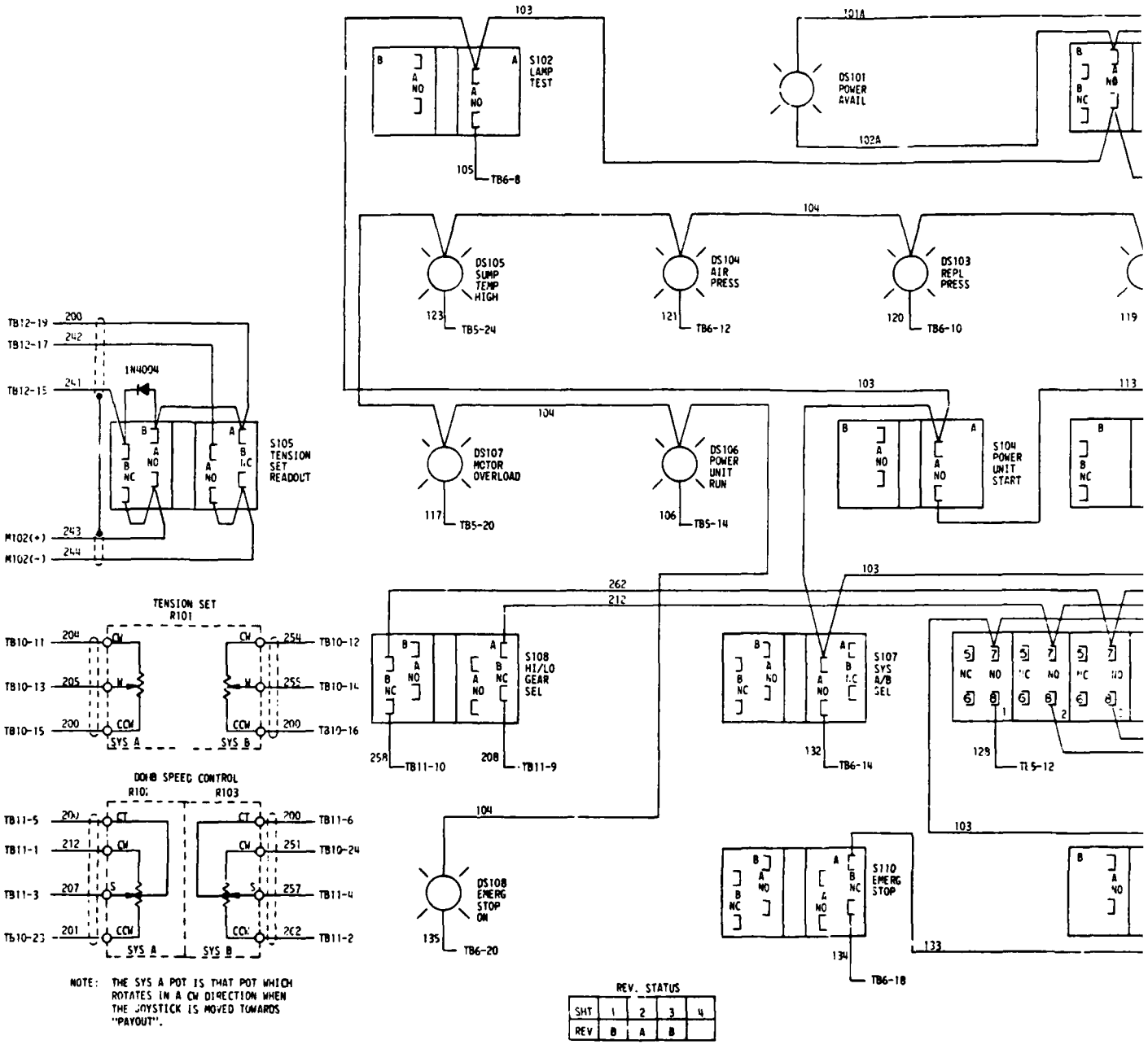
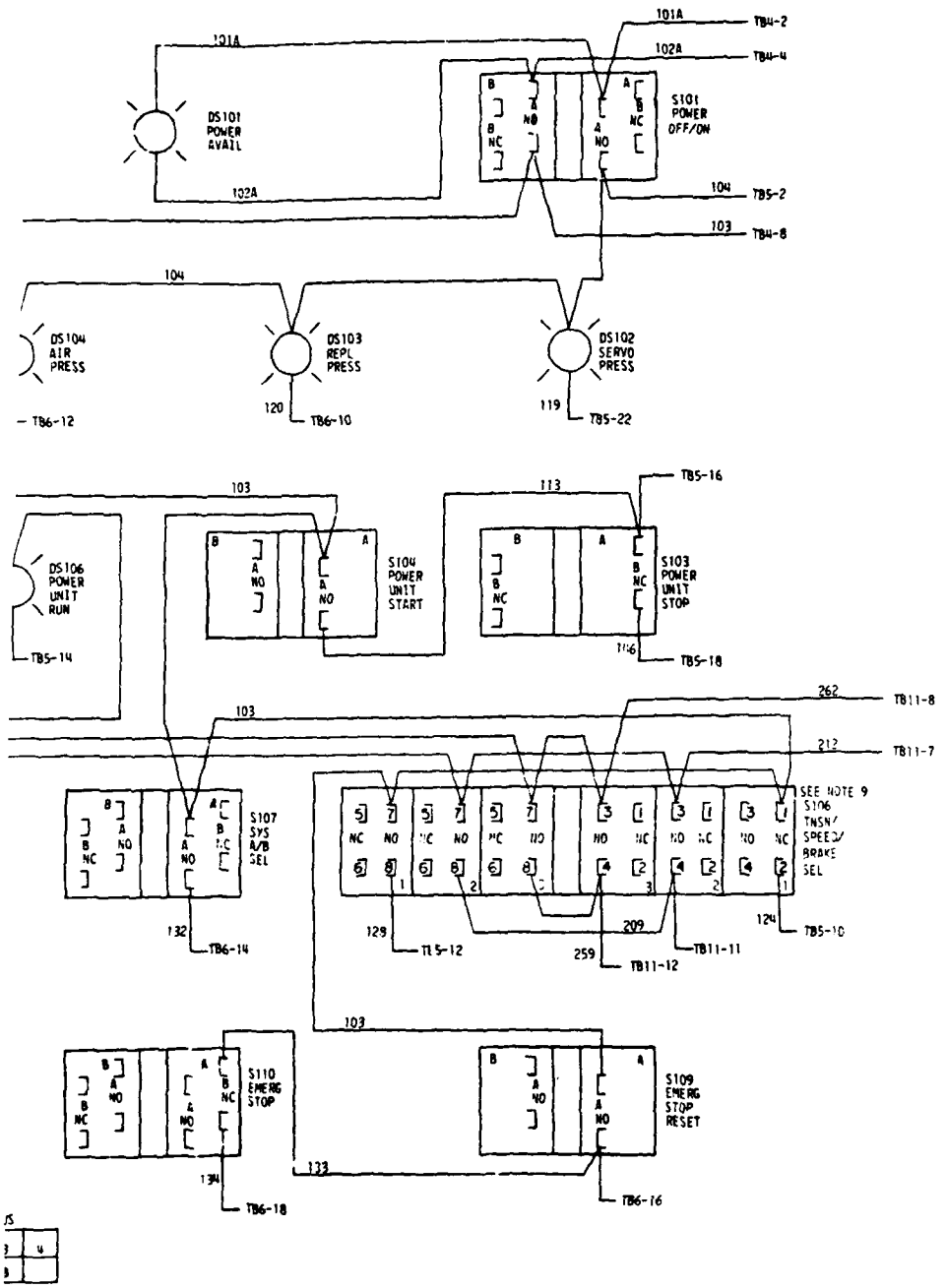
Figure 2-1. Control Console Fabrication
(Sheet 3 of 3)

VIEW A-A
FROM SHT 1



NOTE: THE SYS A POT IS THAT POT WHICH ROTATES IN A CW DIRECTION WHEN THE JOYSTICK IS MOVED TOWARDS "PAYOUT".

REV. STATUS				
SHT	1	2	3	4
REV	B	A	B	



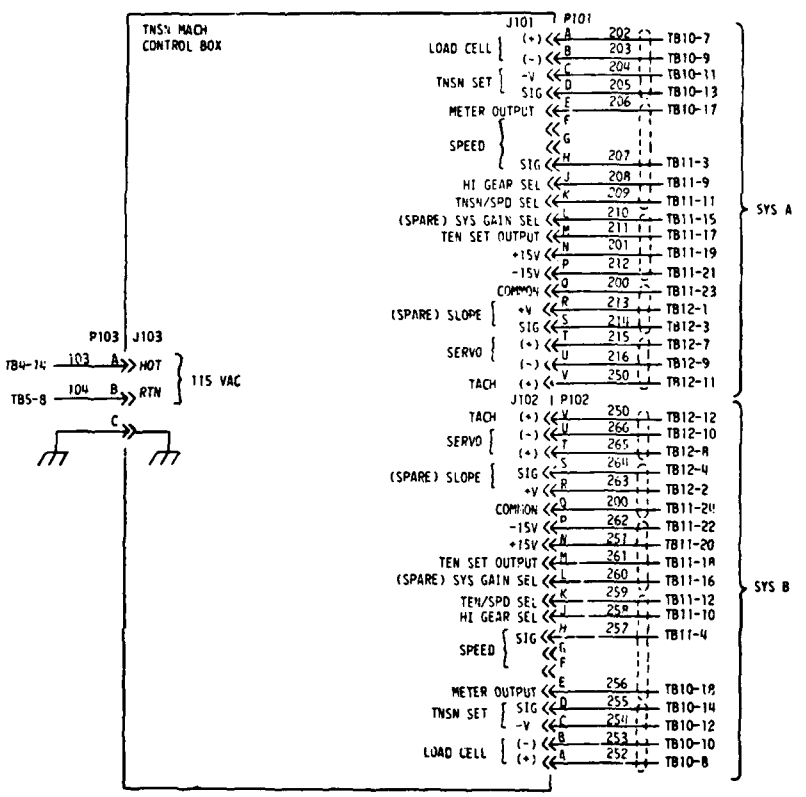
NOTES:

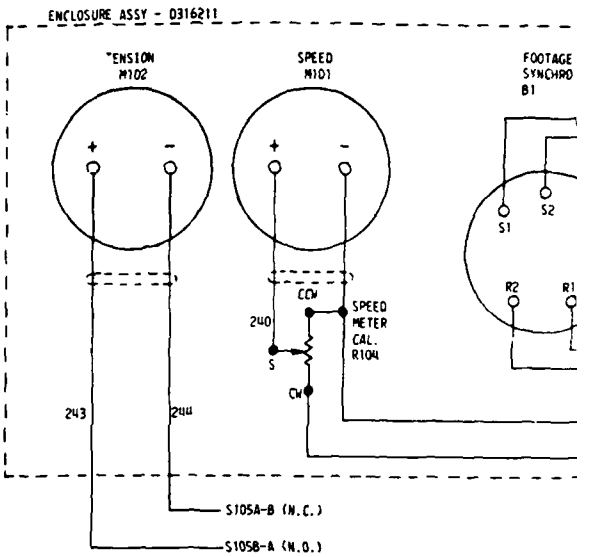
1. AC AND DC WIRE BUNDLES RUNNING IN PARALLEL SHALL BE A MINIMUM OF 3 INCHES CENTER TO CENTER. IF THERE IS A REQUIREMENT FOR DC WIRES TO CROSS AC WIRES, WIRES SHALL CROSS AT 90° ANGLES.
2. AC WIRES SHALL BE 14 AWG THWN RED (F/N 74 ON D316131).
3. DC WIRES SHALL BE 4 CONDUCTOR SHLD. (F/N 75 ON D316131)
4. DC JUMPER WIRES TO BE 14 AWG THWN BLUE. (F/N 74 ON D316131)
5. DC COMMON WIRES TO BE 14 AWG THWN WHITE. (F/N 74 ON D316131)
6. TAG EACH WIRE WITH WIRE NUMBER.
7. WIRE NUMBER DESIGNATIONS:
   100 SERIES - AC SIGNALS
   200 SERIES - DC SIGNALS
8. SWITCHES ARE SHOWN IN "FOLD-OUT" AS IF VIEWED FROM THE REAR.
9. S106 CONTROLS BOTH AC & DC SIGNALS. DURING WIRING CAUTION SHOULD BE USED TO INSURE THAT AC & DC CIRCUITS DO NOT BECOME INTERCONNECTED ON S106.
10. ELECTRICAL SCHEMATIC D316126,
    CONSOLE ASSEMBLY D316131,
    JUNCTION BOX ASSEMBLY C312861,
    ENCLOSURE ASSEMBLY D316211,
    TERMINAL PANEL ASSY D316223.
11. SEE WEC DWG NO. D316125, SH 2, FOR J-BOX 1 DETAIL SHOWING ASSEMBLY OF QUICK DISCONNECT ELECTRICAL FITTINGS ON CONSOLE J-BOX. (J-BOX 1)
12. SEE WEC DWG NO. A307881 FOR J-BOX 1 QUICK DISCONNECT FITTING WIRING.

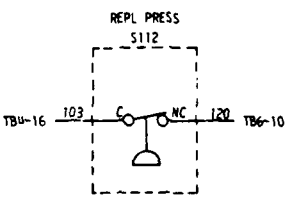
SWITCH PANEL WIRING

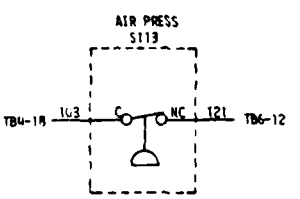
D316130B

Figure 2-2. Control Console Wiring Diagram (Sheet 1 of 4)


TNSN MACH
CONTROL BOX
J101
P101
LOAD CELL
TNSN SET
METER OUTPUT
SPEED
HI GEAR SEL
TNSN/SPD SEL
(SPARE) SYS GAIN SEL
TEN SET OUTPUT
COMMON
SERVO
TACH
SYS A
SYS B
P103
J103
HOT
RTN
115 VAC


ENCLOSURE ASSY - D316211
TENSION
M102
SPEED
M101
FOOTAGE
SYNCHRO
B1
SPEED
METER
CAL.
R104
CCW
CW
240
243
244
S105A-B (N.C.)
S105B-A (N.O.)


REPL PRESS
S112
TB4-16
103
C
NC
120
TB6-10


AIR PRESS
S113
TB4-18
103
C
NC
121
TB6-12

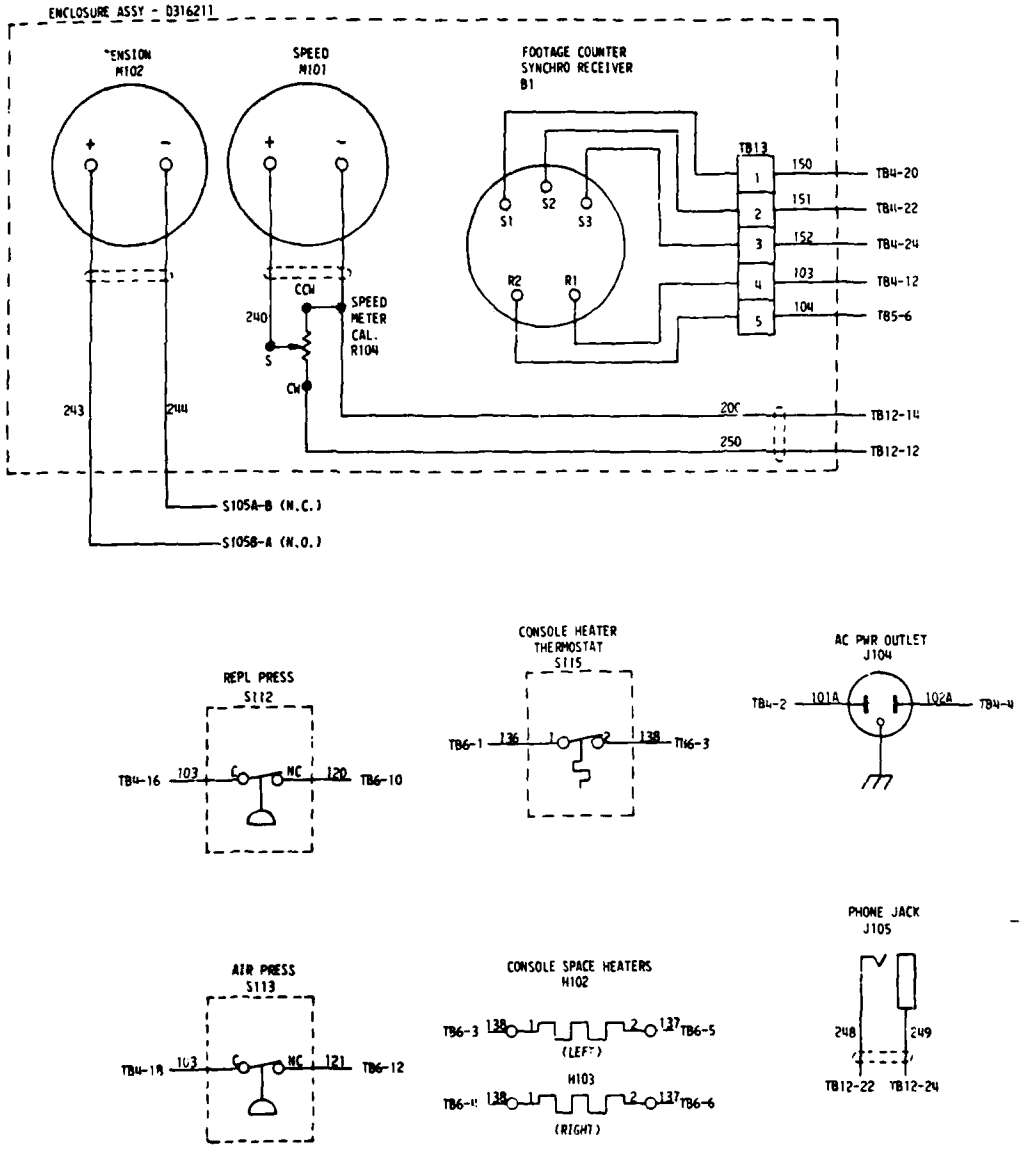


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Figure 2-2. Control Console Wiring Diagram (Sheet 2 of 4)

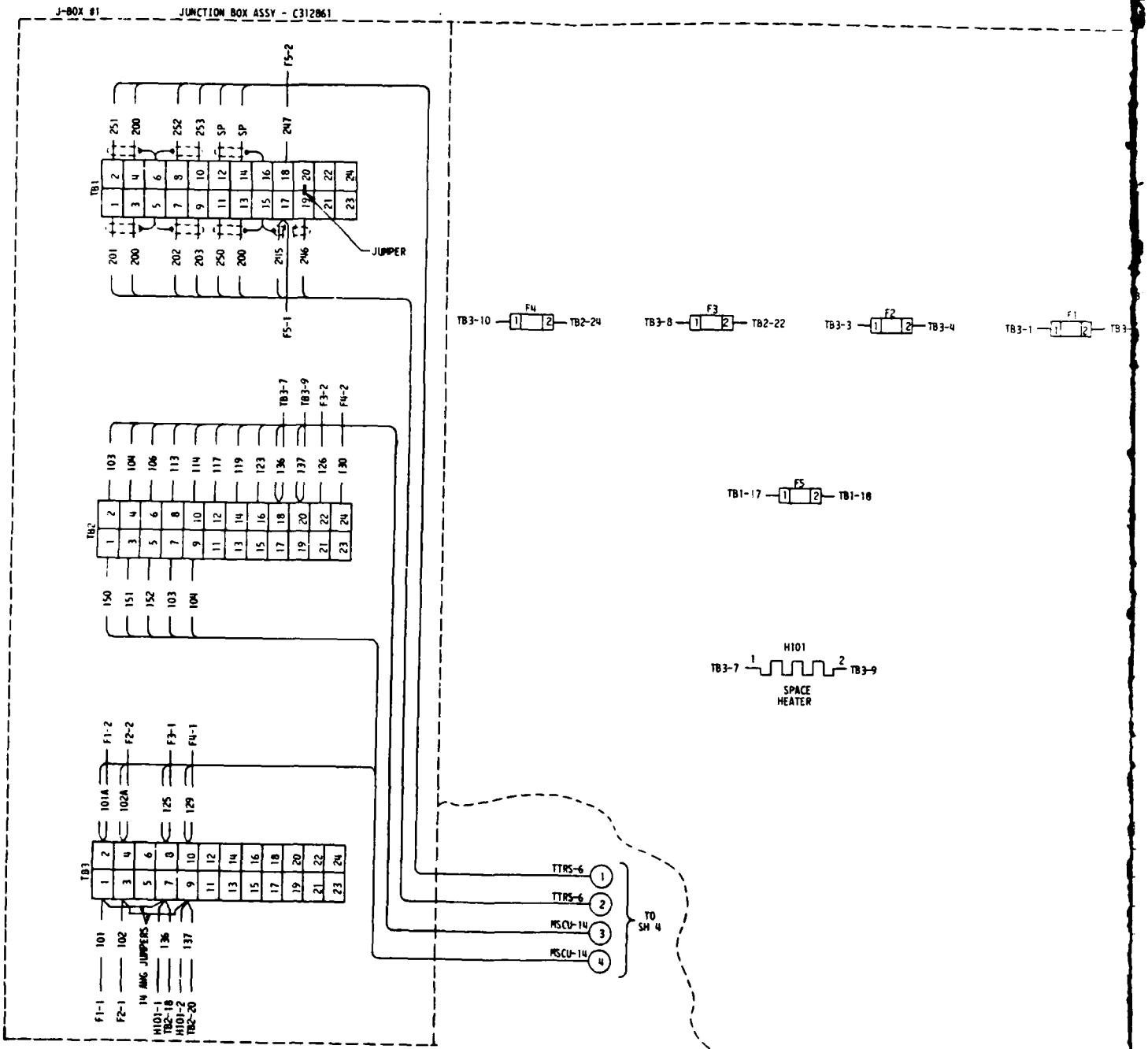

Figure
(Sheet

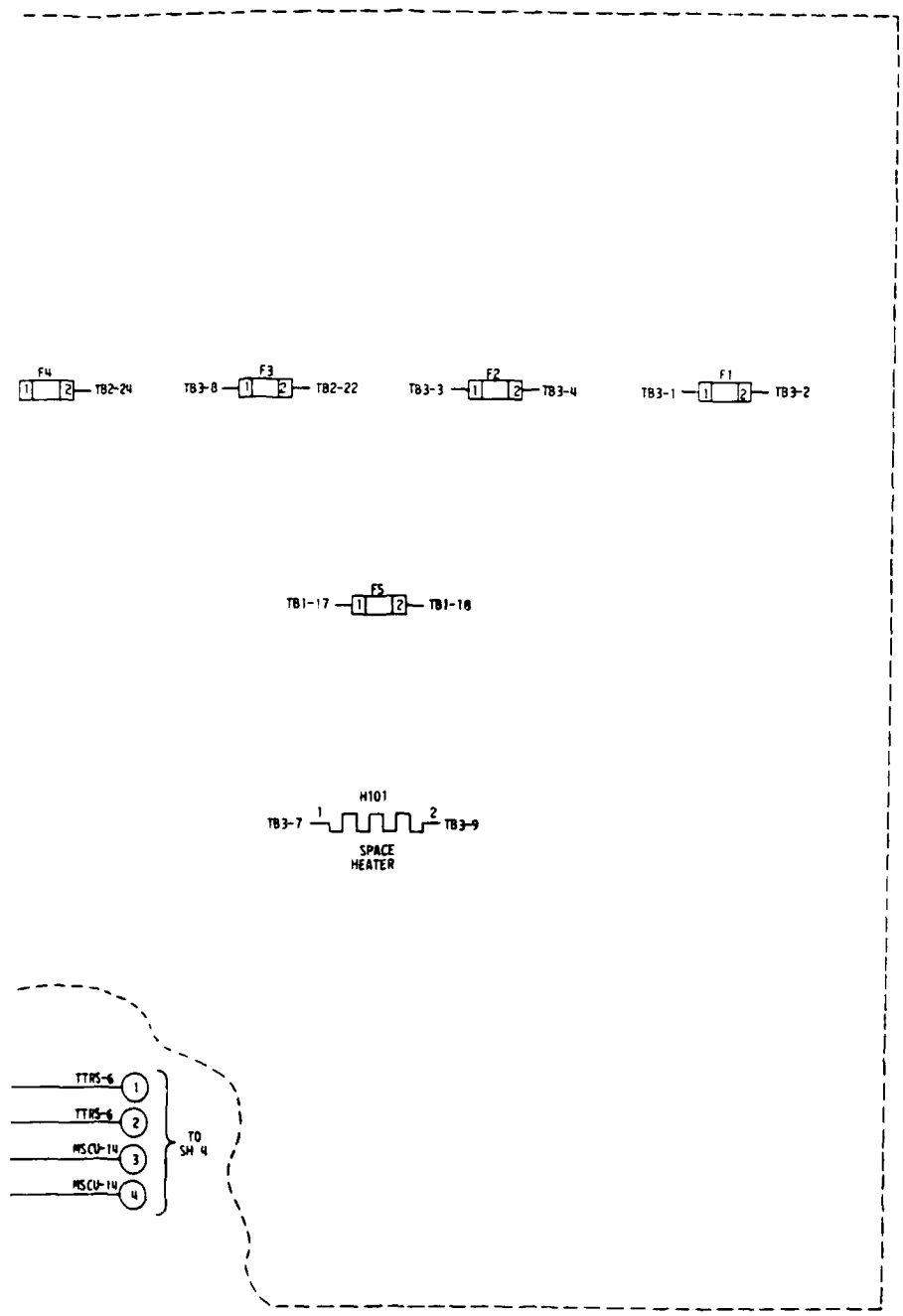

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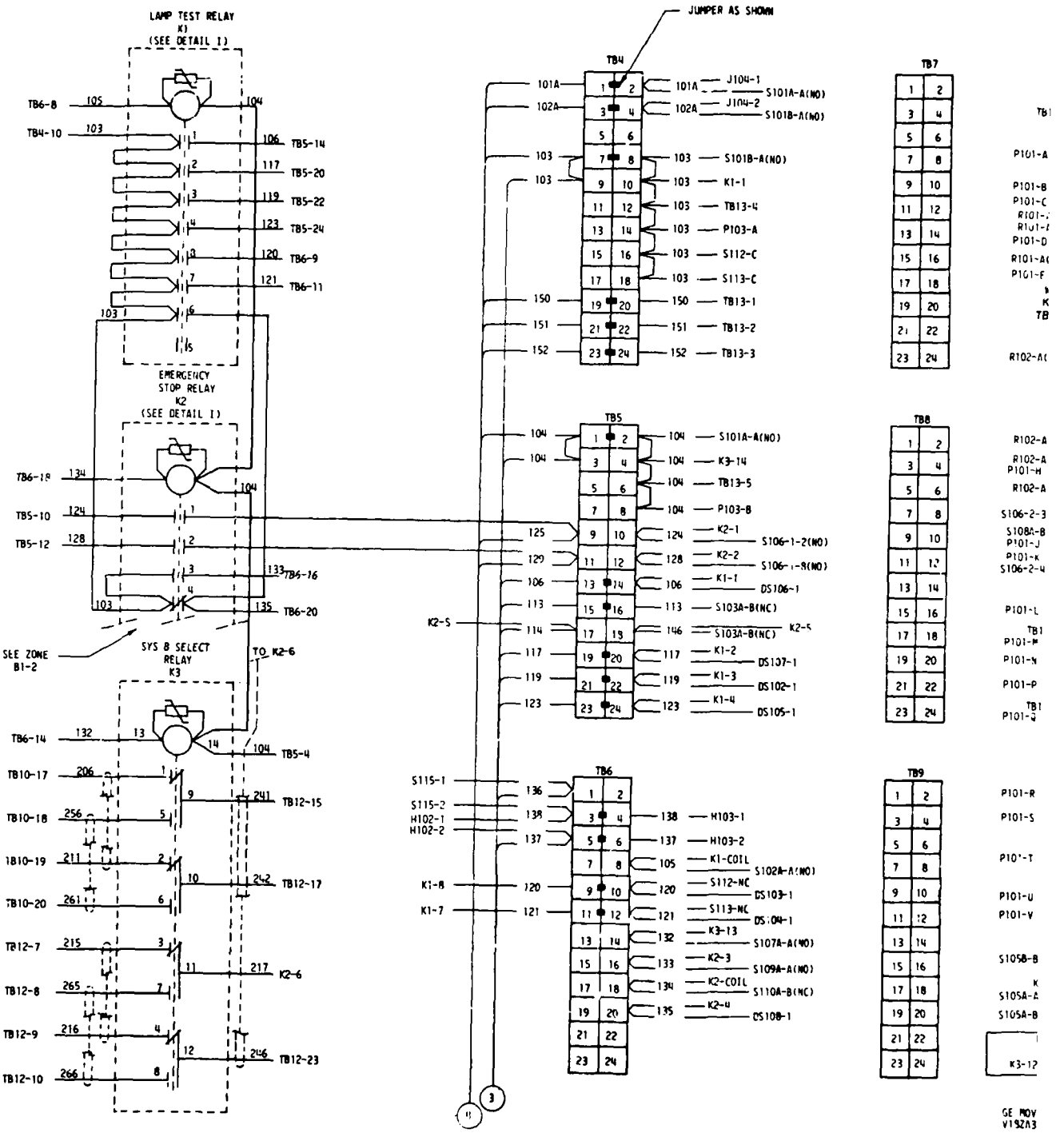
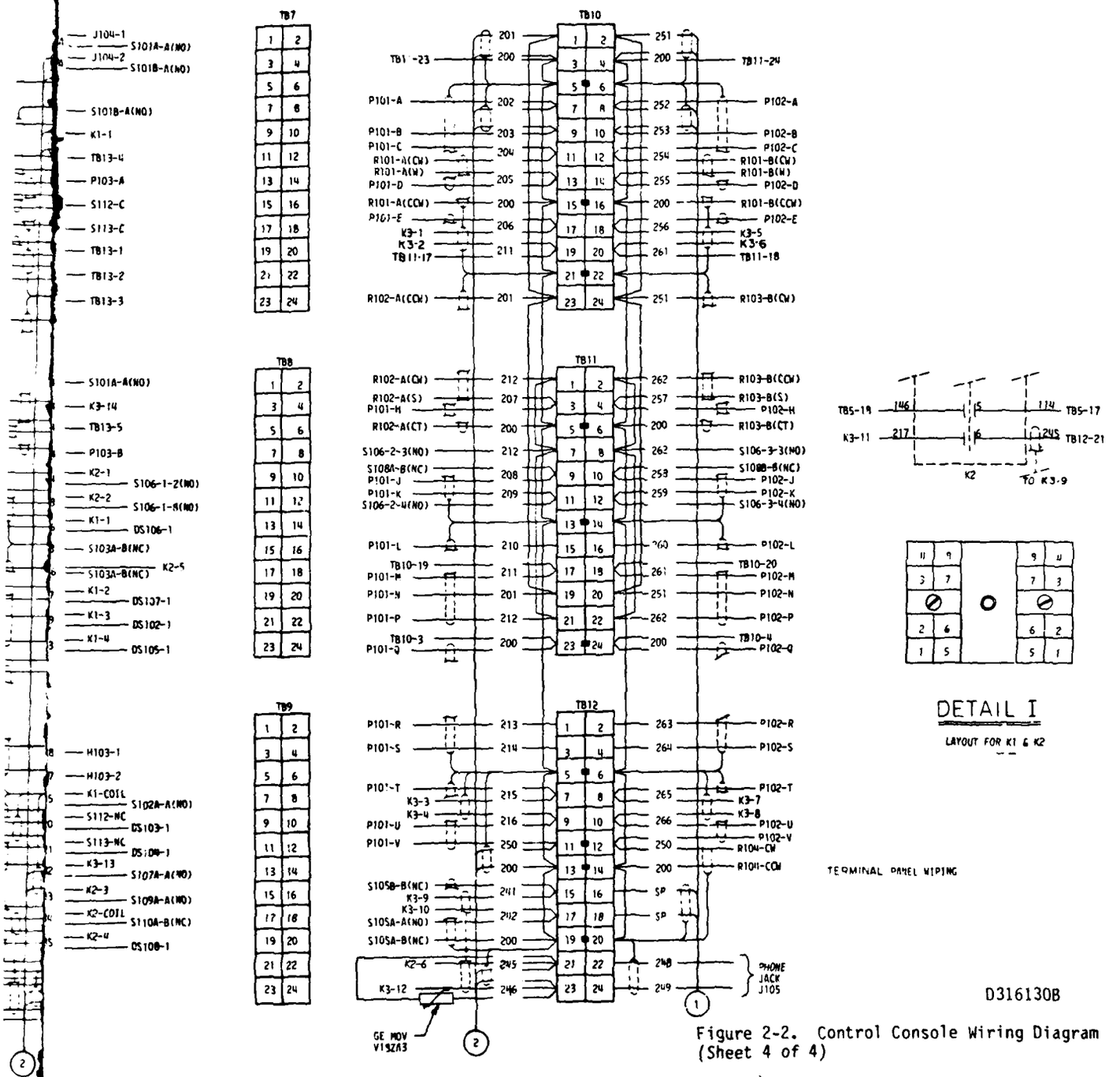
Figure 2-2. Control Console Wiring Diagram
(Sheet 3 of 4)



GE MOV
V1SZA3

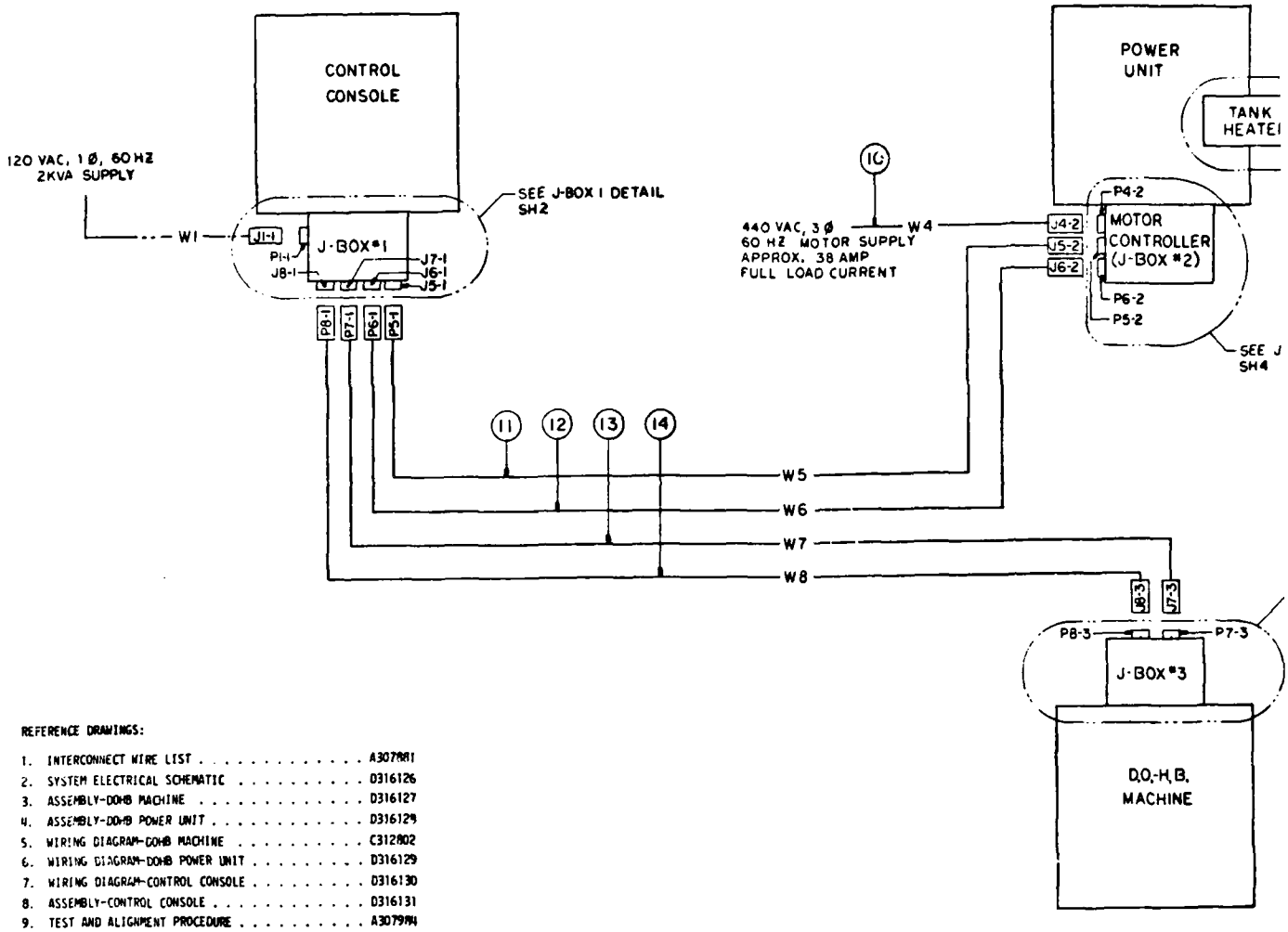


DETAIL I

LAYOUT FOR K1 & K2

D316130B

Figure 2-2. Control Console Wiring Diagram (Sheet 4 of 4)

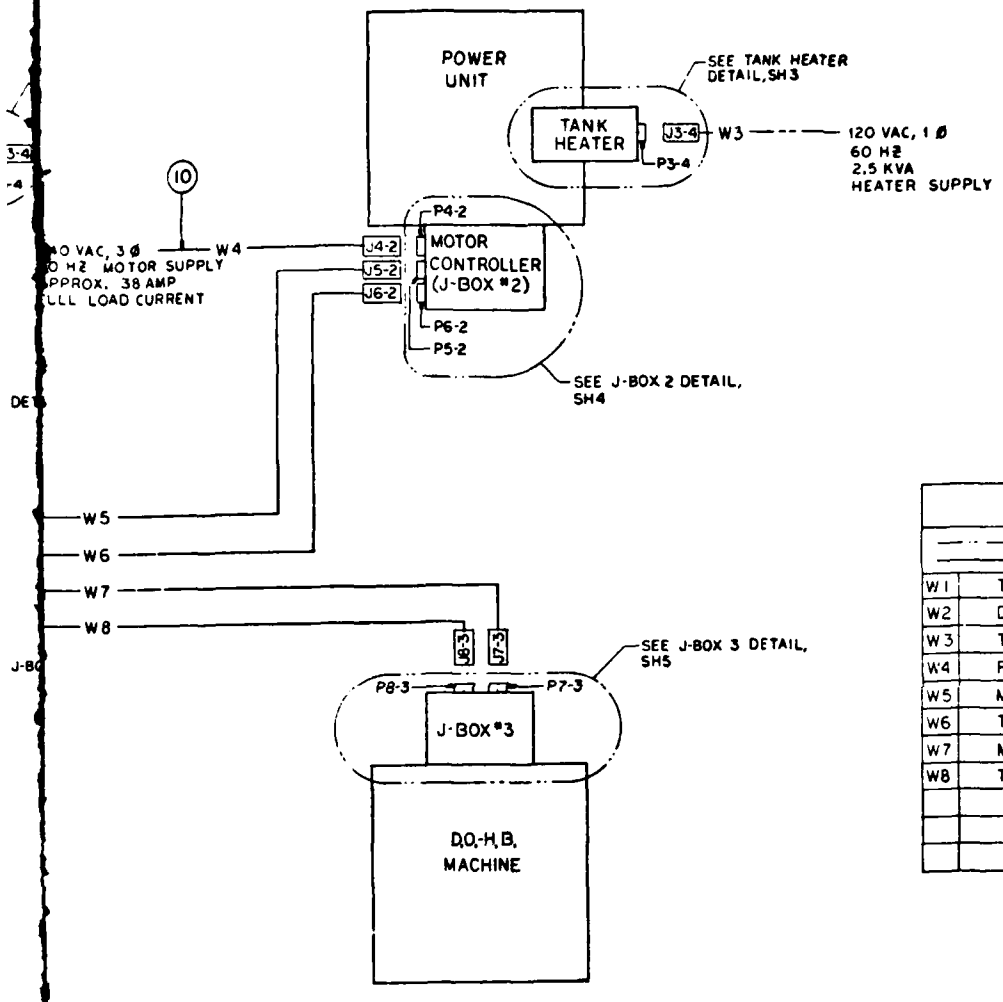


REFERENCE DRAWINGS:

1. INTERCONNECT WIRE LIST A307881
2. SYSTEM ELECTRICAL SCHEMATIC D316126
3. ASSEMBLY-DOHB MACHINE D316127
4. ASSEMBLY-DOHB POWER UNIT D316128
5. WIRING DIAGRAM-DOHB MACHINE C312802
6. WIRING DIAGRAM-DOHB POWER UNIT D316129
7. WIRING DIAGRAM-CONTROL CONSOLE D316130
8. ASSEMBLY-CONTROL CONSOLE D316131
9. TEST AND ALIGNMENT PROCEDURE A307984

REVISION STATUS

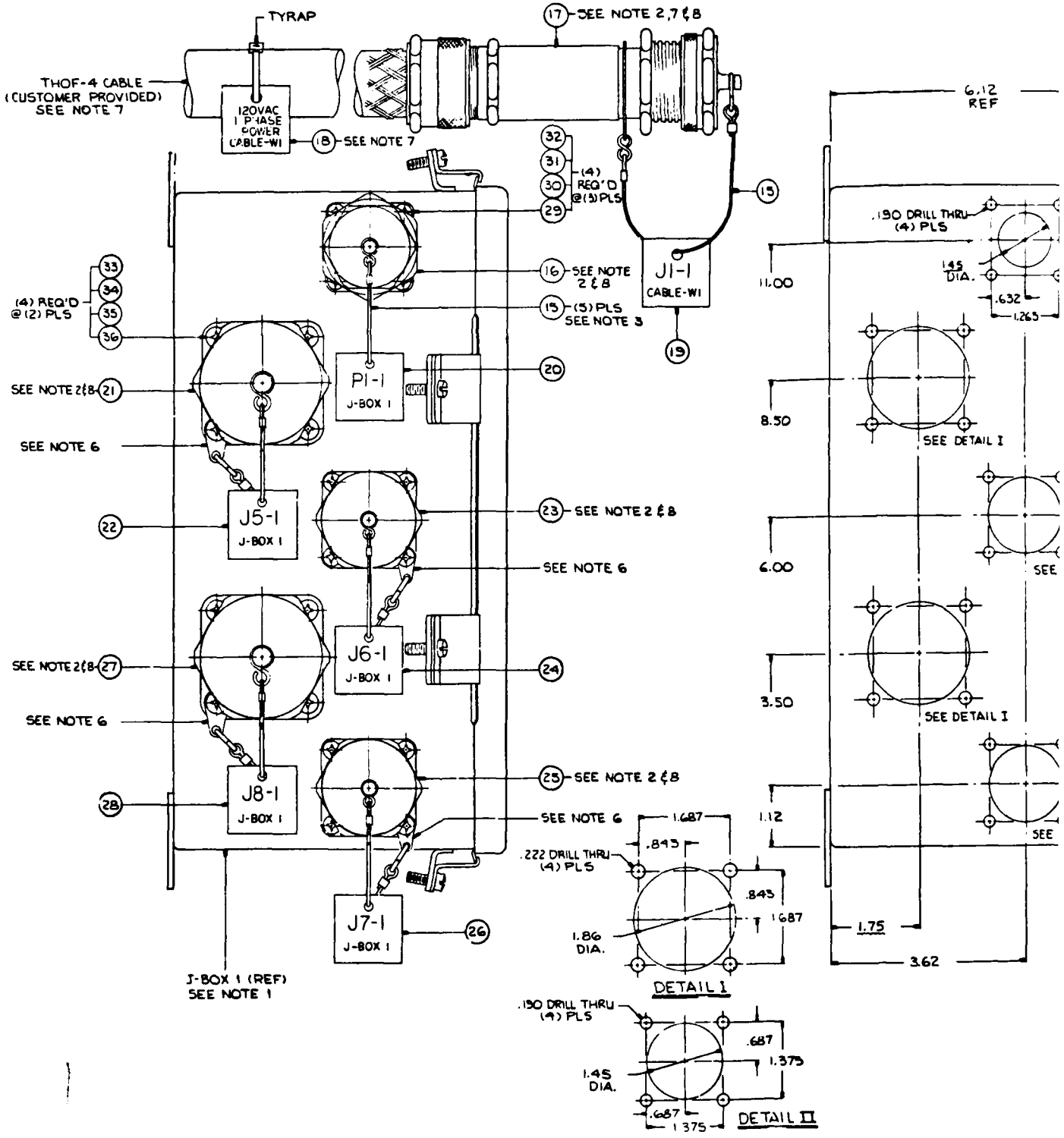
SHT	1	2	3	4	5
REV	B	B	B	B	B

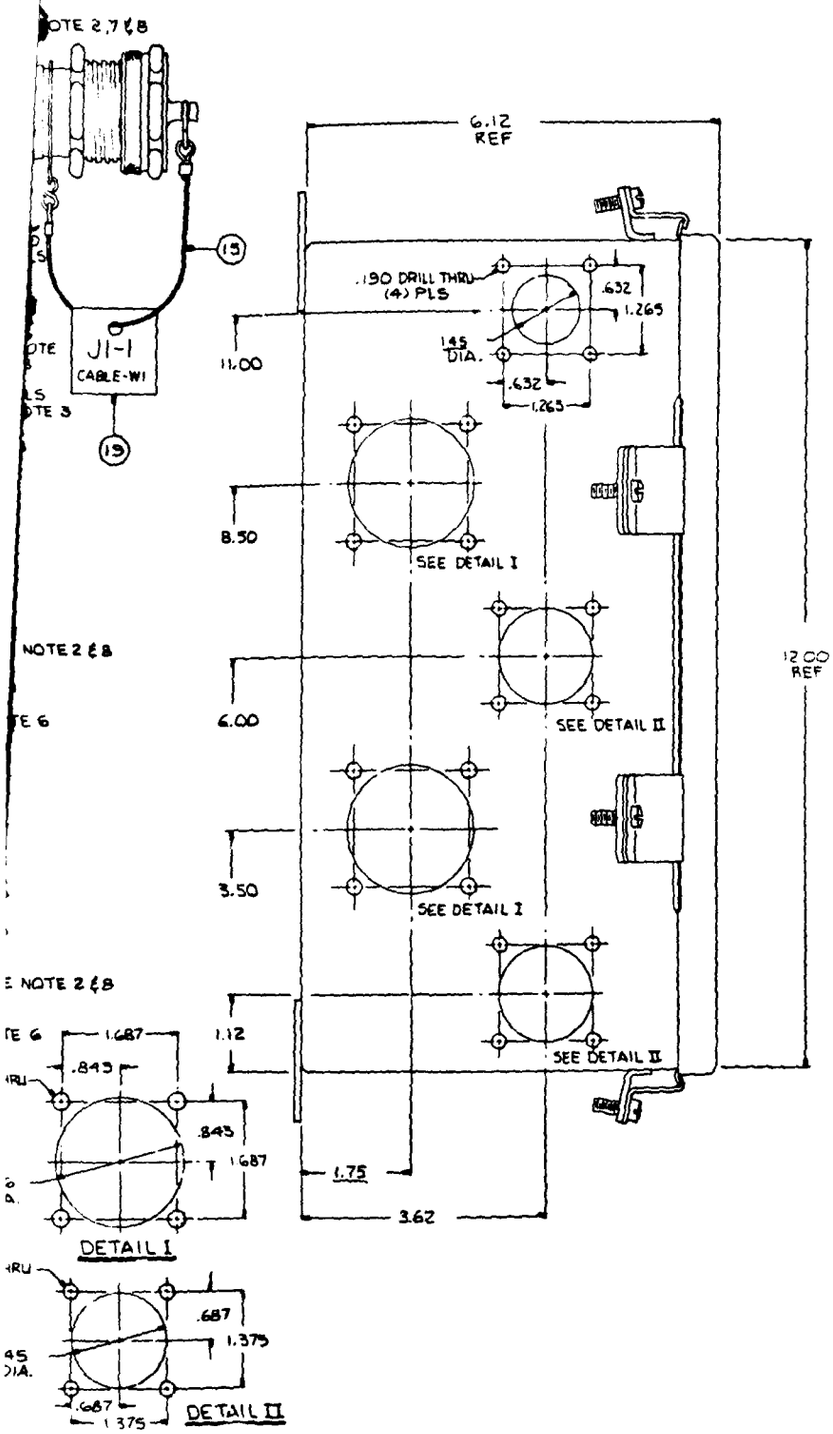


INTERCONNECT CABLES		
— · — · — CUSTOMER FURNISHED ——— WGC FURNISHED		
W1	THOF-4	
W2	DELETED	
W3	THOF-4	
W4	FHOF-42	F/N 10
W5	MHOF-14	F/N 11
W6	TTRS-2	F/N 12
W7	MHOF-7	F/N 13
W8	TTRS-6	F/N 14

D316125B

Figure 2-3. Electrical General Arrangement (Sheet 1 of 5)


TYRAP
THOF-4 CABLE (CUSTOMER PROVIDED) SEE NOTE 7
120VAC 1 PHASE POWER CABLE-W1
18 SEE NOTE 7
17 SEE NOTE 2,7 & 8
32
31
30
(4) REQ'D @ (1) PLS
29
15
J1-1 CABLE-W1
19
16 SEE NOTE 2 & 8
15 (5) PLS SEE NOTE 3
33
34
35
36
(4) REQ'D @ (2) PLS
P1-1 J-BOX 1
20
SEE NOTE 2 & 8 21
SEE NOTE 6
J5-1 J-BOX 1
22
23 SEE NOTE 2 & 8
SEE NOTE 6
J6-1 J-BOX 1
SEE NOTE 2 & 8 27
24
SEE NOTE 6
J8-1 J-BOX 1
28
25 SEE NOTE 2 & 8
SEE NOTE 6
J7-1 J-BOX 1
26
J-BOX 1 (REF) SEE NOTE 1
6.12 REF
.190 DRILL THRU (4) PLS
.145 DIA.
.632
1.265
11.00
8.50
SEE DETAIL I
6.00
3.50
SEE DETAIL I
1.12
1.75
3.62
1.687
.843
.222 DRILL THRU (4) PLS
.843
1.687
1.86 DIA.
DETAIL I
.190 DRILL THRU (4) PLS
.687
1.375
1.45 DIA.
.687
1.375
DETAIL II



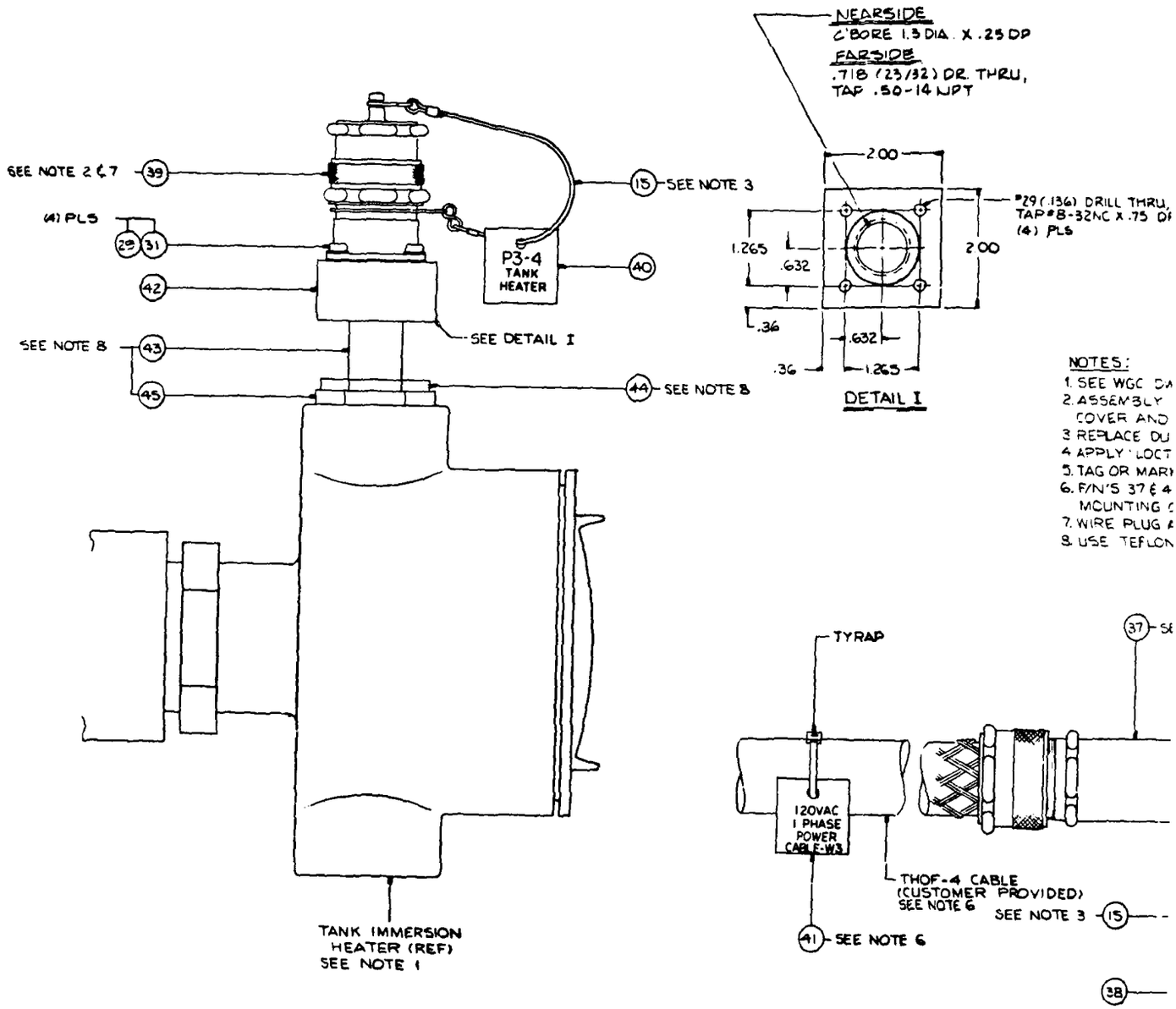
NOTES:

1. SEE WGC DWG NO. C312861 FOR J-BOX 1 ASSY.
2. ASSEMBLY INCLUDES PLUG, CONTACT INSERT, DUST COVER AND CABLE GRIP WHEN APPLICABLE.
3. REPLACE DUST COVER CHAIN WITH CABLE ASSY, F/N 15.
4. APPLY "LOCTITE" 242 TO ALL THREADS AT ASSY.
5. TAG OR MARK WIRES WITH WIRE NUMBERS.
6. DUST COVER CABLE ASSY EYELET TO BE ATTACHED AT ONE FLANGE AS SHOWN USING MOUNTING HARDWARE.
7. F/N'S 17 & 18 TO BE SHIPPED LOOSE FOR CUSTOMER MOUNTING ON CUSTOMER PROVIDED CABLE.
8. WIRE PLUGS AND RECEPTACLES PER WGC DWG NO. A307881.

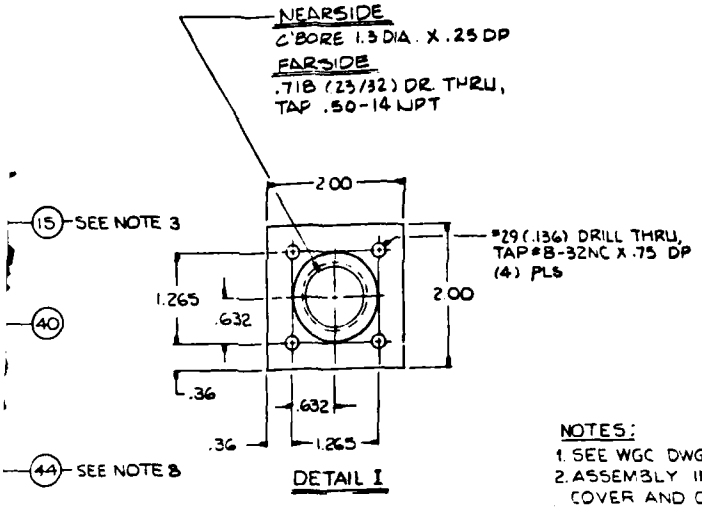
J-BOX 1 DETAIL

D316125B

Figure 2-3. Electrical General Arrangement (Sheet 2 of 5)

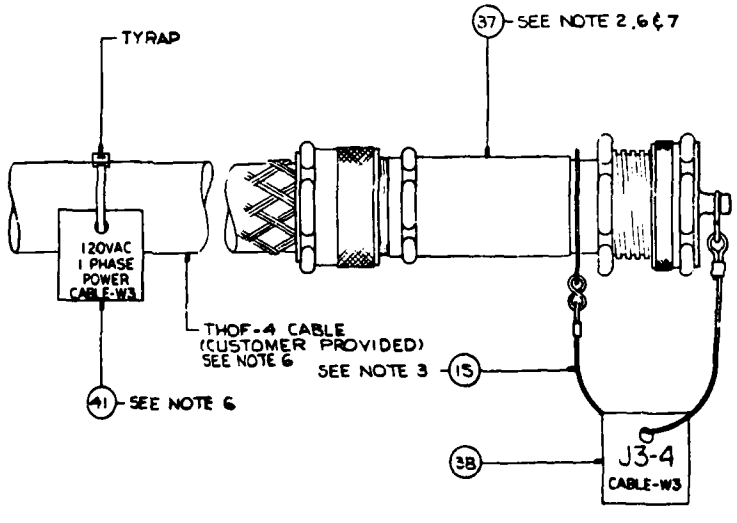


TANK HEATER DETAIL



NOTES:

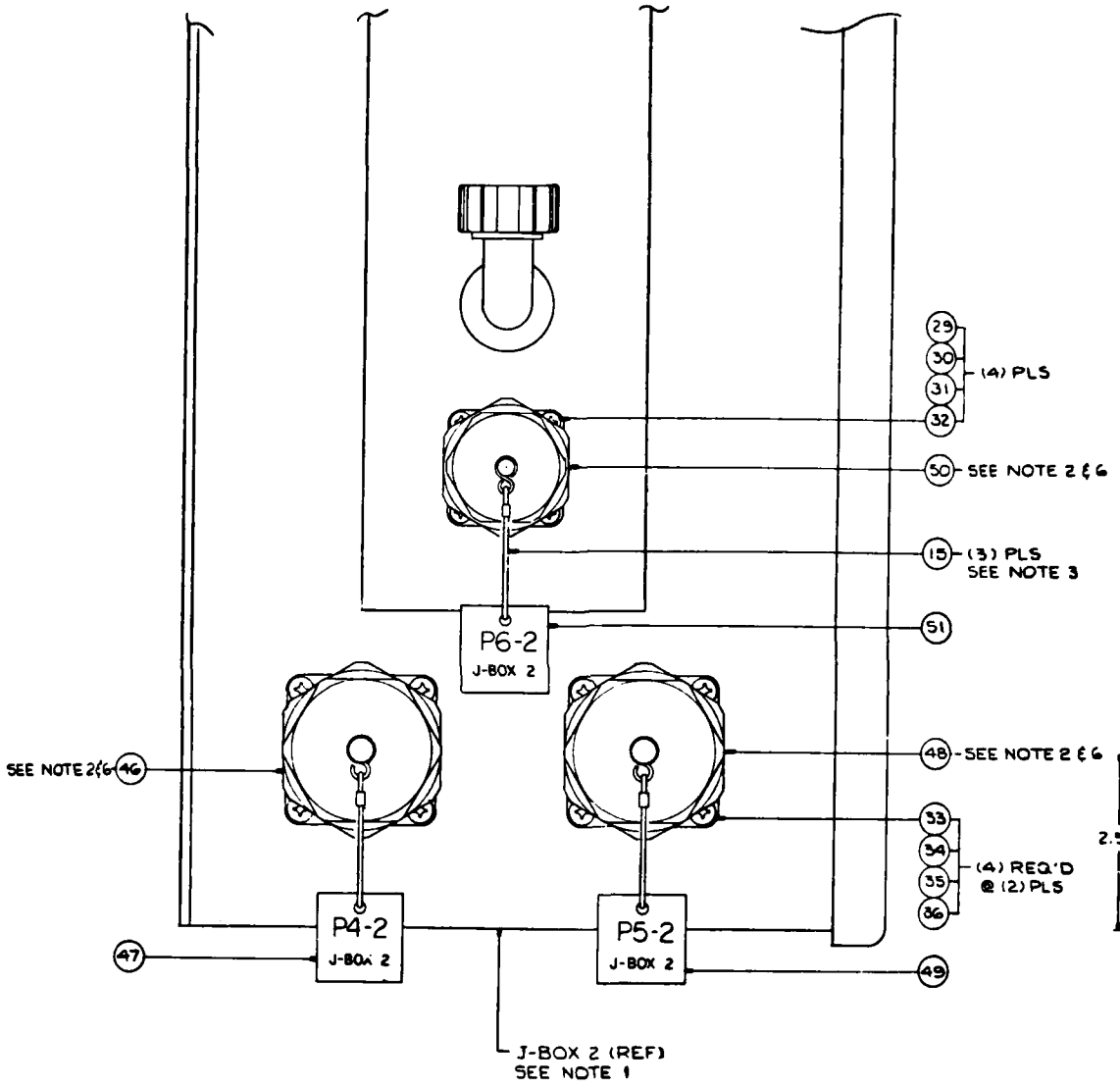
1. SEE WGC DWG NO. D316128, F/N 15, FOR TANK HEATER.
2. ASSEMBLY INCLUDES PLUG, CONTACT INSERT, DUST COVER AND CABLE GRIP. WHEN APPLICABLE.
3. REPLACE DUST COVER CHAIN WITH CABLE ASSY, F/N 15.
4. APPLY "LOCTITE" 242 TO ALL THREADS AT ASSY.
5. TAG OR MARK WIRES WITH WIRE NUMBERS.
6. F/N'S 37 & 41 TO BE SHIPPED LOOSE FOR CUSTOMER MOUNTING ON CUSTOMER PROVIDED CABLE.
7. WIRE PLUG AND RECEPTACLE PER WGC DWG NO. A307881.
8. USE TEFLON TAPE ON PIPE THREADS.

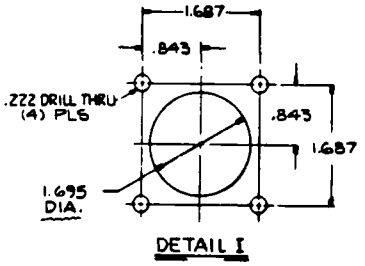


TANK HEATER DETAIL

D316125B

Figure 2-3. Electrical General Arrangement (Sheet 3 of 5)



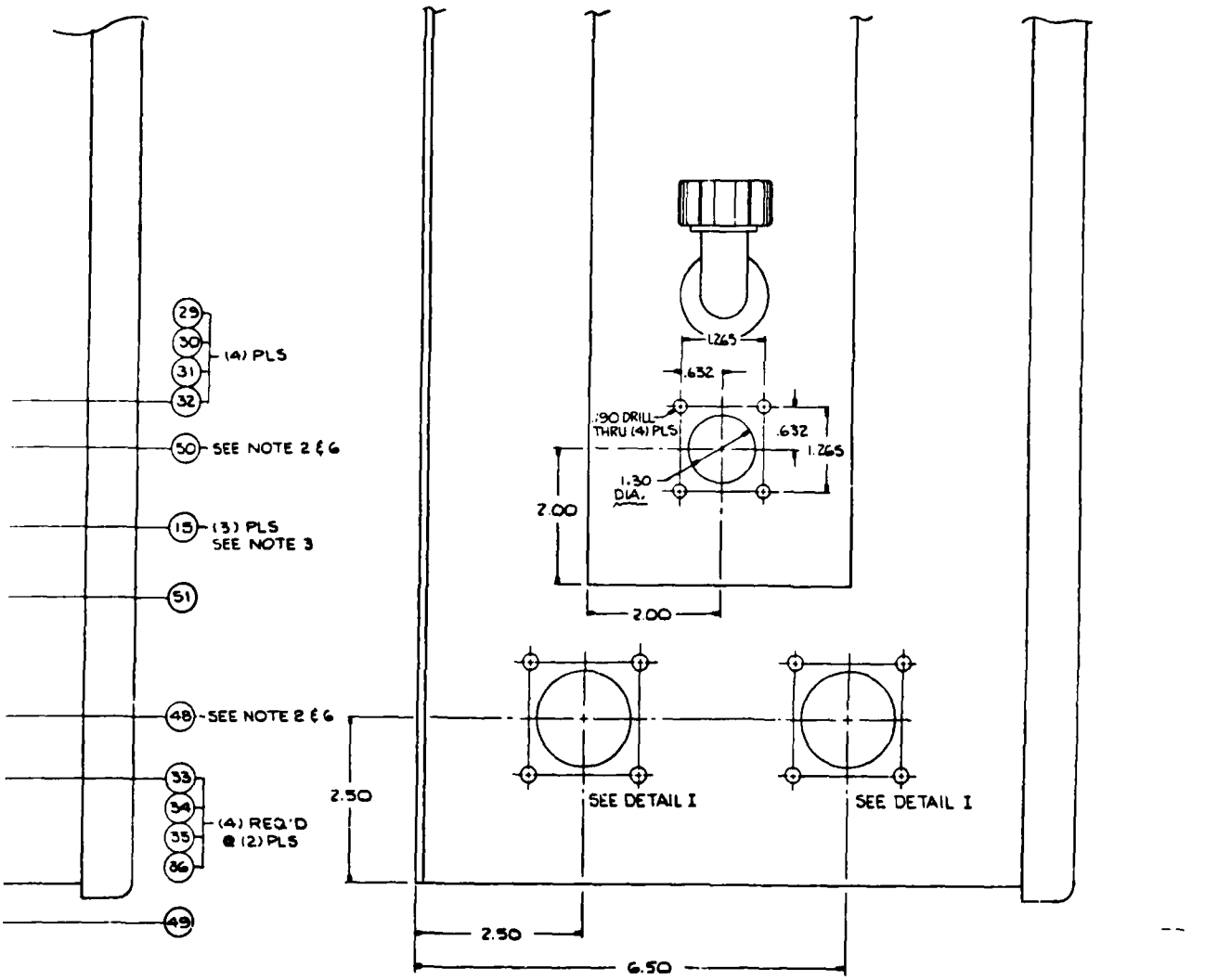


DETAIL I

J-BOX 2 DETAIL

NOTES:

1. SEE WGC DWG D316128, SH3
   J-BOX 2 ASSEMBLY.
2. ASSEMBLY INCLUDES PLUG,
   INSERT AND DUST COVER.
3. REPLACE DUST COVER CHAIN
   ASSY, F/N 15.
4. APPLY "LOCTITE" 242 TO AL
   AT ASSY.
5. TAG OR MARK WIRES WITH
   NUMBERS.
6. WIRE PLUGS PER WGC DWG



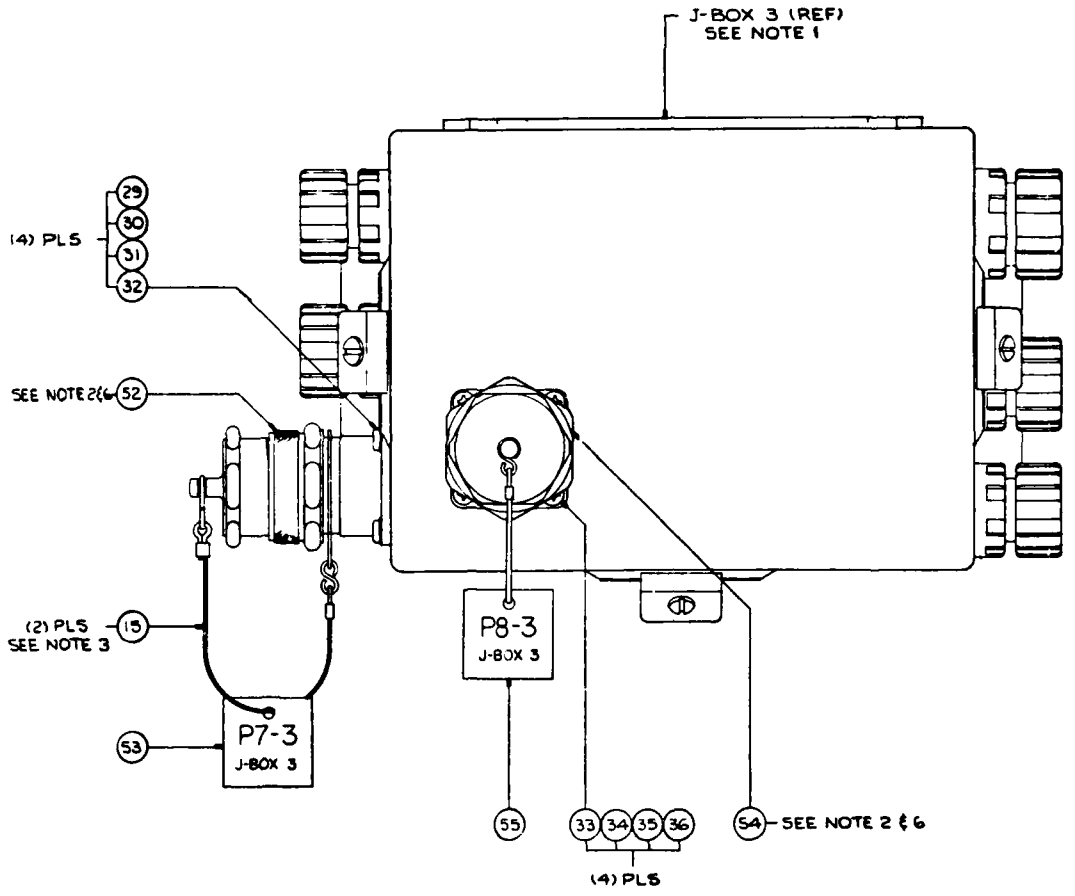
NOTES:

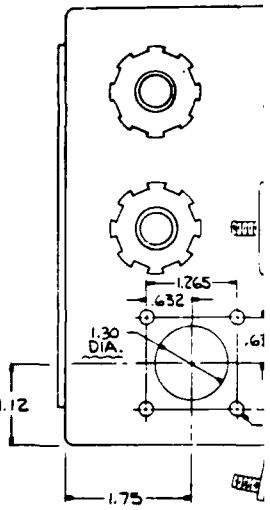
1. SEE WGC DWG D316128, SH3 AND F/N 27, J-BOX 2 ASSEMBLY.
2. ASSEMBLY INCLUDES PLUG, CONTACT INSERT AND DUST COVER.
3. REPLACE DUST COVER CHAIN WITH CABLE ASSY, F/N 15.
4. APPLY "LOCTITE" 242 TO ALL THREADS AT ASSY.
5. TAG OR MARK WIRES WITH WIRE NUMBERS.
6. WIRE PLUGS PER WGC DWG NO. A307881.

OX 2 DETAIL

D316125B

Figure 2-3. Electrical General Arrangement (Sheet 4 of 5)

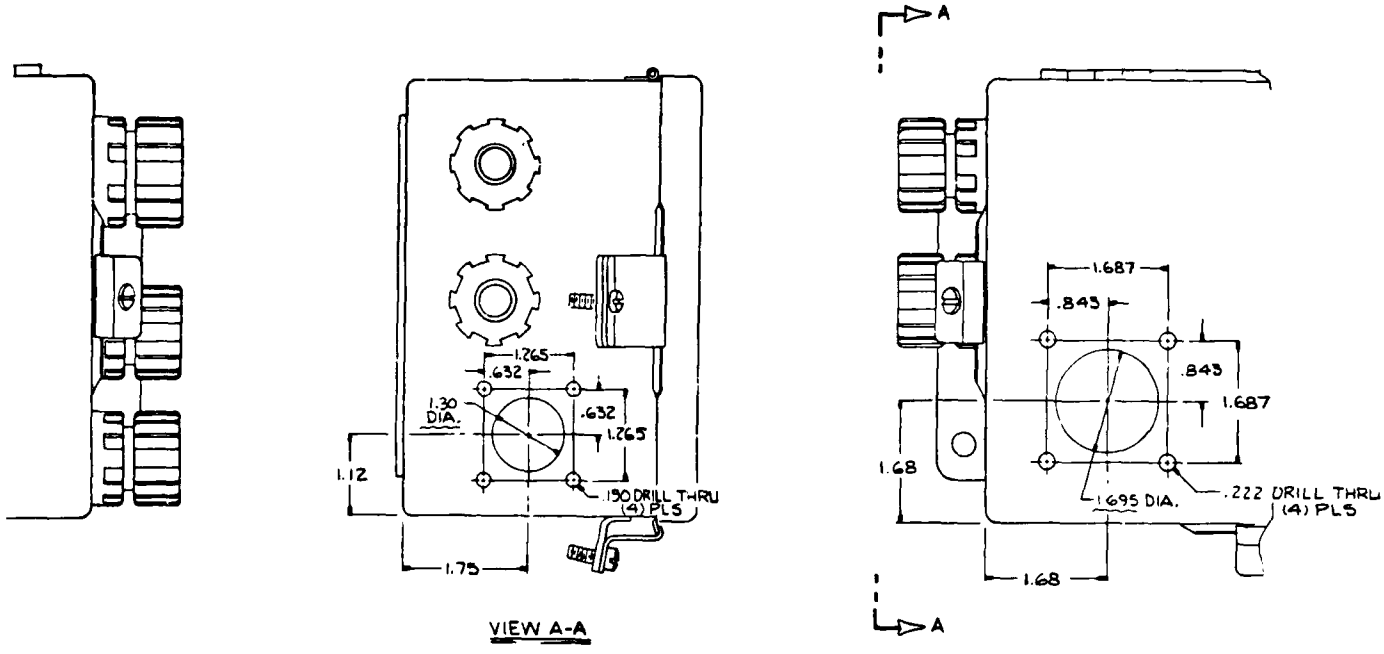




VIEW A-A

NOTES:

1. SEE WGC DWG NO. D316127, SHB, FOR
2. ASSEMBLY INCLUDES PLUG, CONTACT
3. REPLACE DUST COVER CHAIN WITH C
4. APPLY "LOCTITE" 242 TO ALL THREA
5. TAG OR MARK WIRES WITH WIRE
6. WIRE PLUGS PER WGC DWG NO.



VIEW A-A

NOTES:

1. SEE WGC DWG NO. D316127, SH8, FOR J-BOX 3 ASSEMBLY.
2. ASSEMBLY INCLUDES PLUG, CONTACT INSERT, AND DUST COVER.
3. REPLACE DUST COVER CHAIN WITH CABLE ASSY, F/N 15.
4. APPLY "LOCTITE" 242 TO ALL THREADS AT ASSY.
5. TAG OR MARK WIRES WITH WIRE NUMBERS.
6. WIRE PLUGS PER WGC DWG NO. A307881.

J-BOX 3 DETAIL

D316125B

Figure 2-3. Electrical General Arrangement
(Sheet 5 of 5)

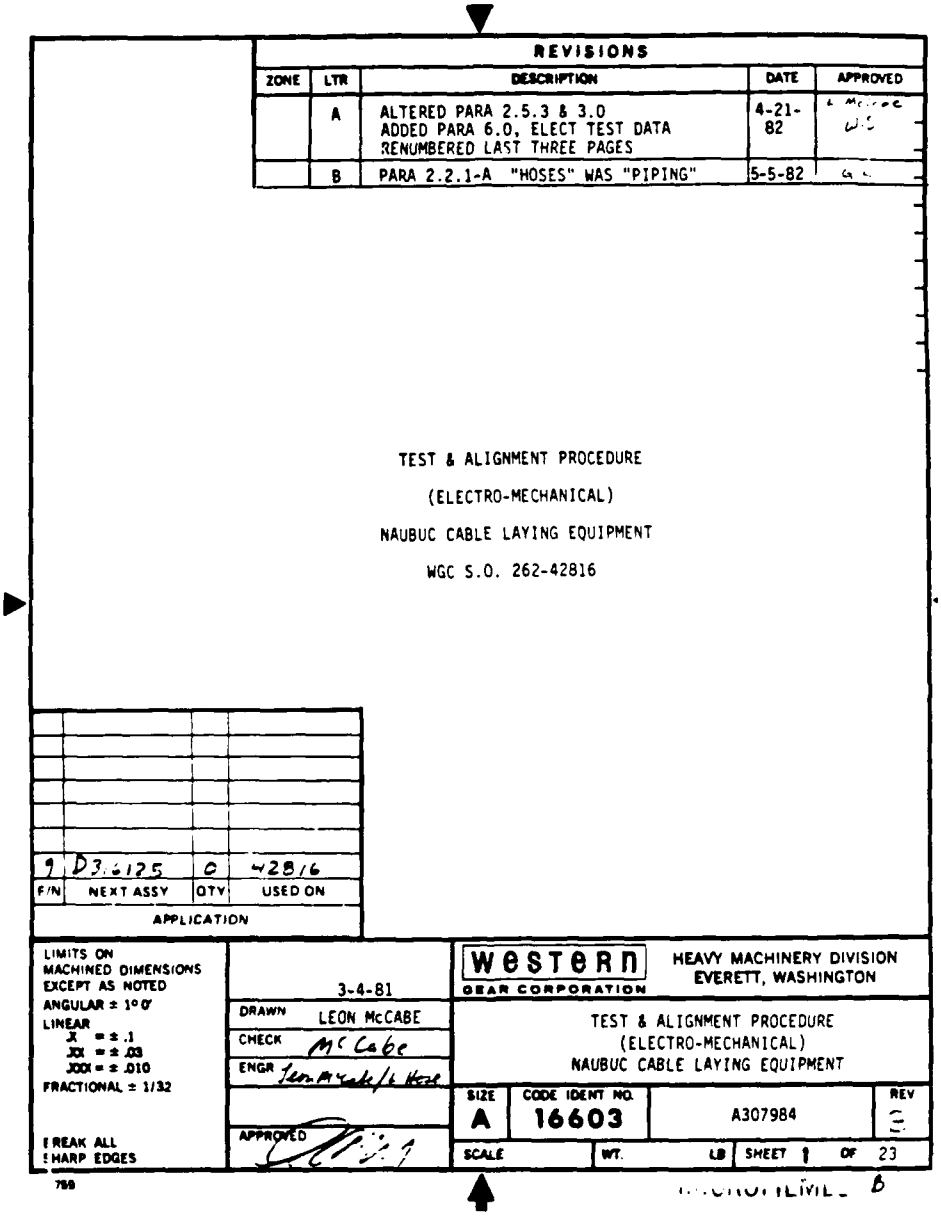


Figure 2-4. Test and Alignment Procedure (Sheet 1 of 23)

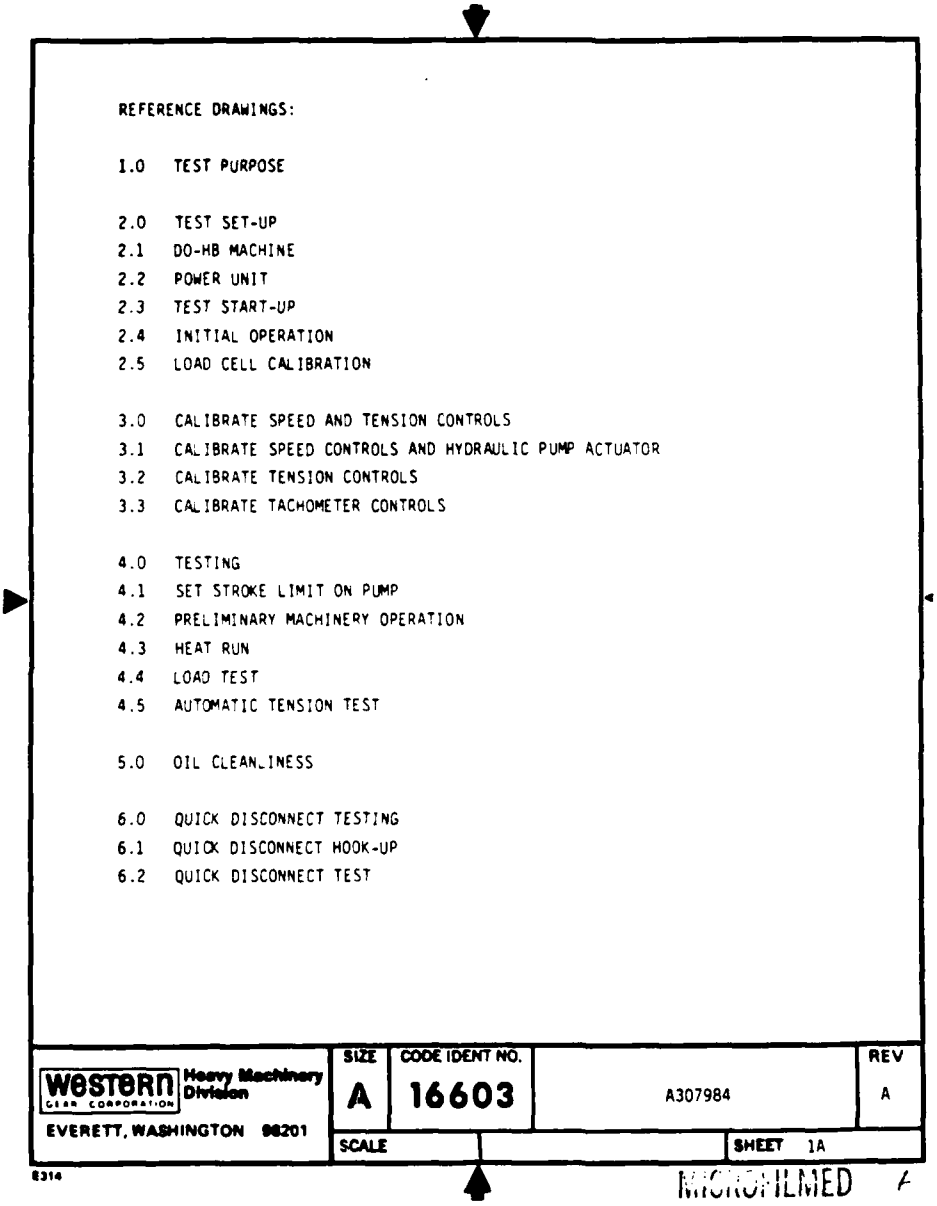


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Figure 2-4. Test and Alignment Procedure (Sheet 2 of 23)

REFERENCE DRAWINGS:

1	OUTLINE AND GENERAL ARRANGEMENT NAUBUC	D316405
2	HYDRAULIC SCHEMATIC	D316371
3	PNEUMATIC SCHEMATIC	D316383
4	INTERCONNECTING PIPING DIAGRAM	D316407
5	HOSE BUNDLE ASSY	C313737
6	HOSE BUNDLE ASSY	C313738
7	HOSE BUNDLE ASSY	C313739
8	LUBRICATION DIAGRAM	D316406
9	CONTROL CONSOLE ASSY	D316131
10	CONTROL CONSOLE PIPING ASSY	D316203
11	POWER UNIT ASSY	D316128
12	POWER UNIT PIPING ASSY	D316464
13	DO-HB ASSY	D316127
14	DO-HB PIPING ASSY	E106791
15	SUPPLEMENTAL JOB DATA SHEET	A307982
16	ELECTRICAL SCHEMATIC	D316126
17	ELECTRICAL GENERAL ARRANGEMENT	D316125
18	INTERCONNECT WIRE LIST	A307881

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	SCALE			SHEET 2

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Figure 2-4. Test and Alignment Procedure (Sheet 3 of 23)

1.0 TEST PURPOSE

The purpose of this test is to confirm that the components of the system have been restored to serviceable condition and that the components will operate as required to form an integrated cable handling system. This system consists of the DO-HB machine, the power unit, and the control console.

2.0 TEST SET-UP

Set up the DO-HB machine, the power unit and the control console as shown in Figure 1. The control console should have been tested prior to this set-up for integrity of tubing systems. (See Dwg A307923.) See reference drawing list on Sh 2 for equipment interconnect documents. Lubricate the equipment and fill reservoir per Ref. 5.

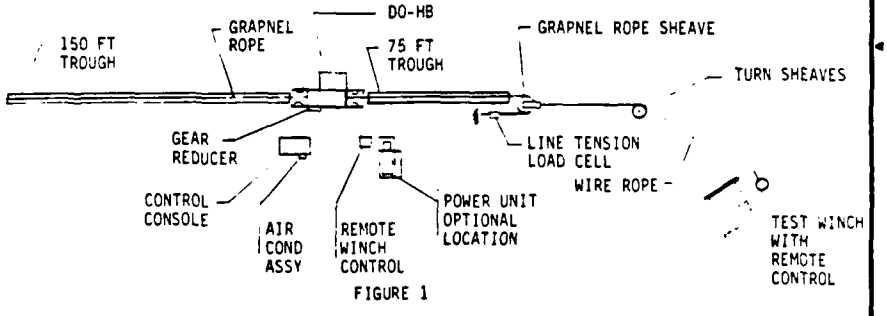

FIGURE 1

2.1 DO-HB MACHINE

2.1.1 Manipulate the following assemblies to ensure that no interferences exist:

A. Both upper and lower idler assemblies.

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Figure 2-4. Test and Alignment Procedure (Sheet 4 of 23)

B. Lower track suspension assembly. Check that all roller modules are free to flex in relation to each other. _____

C. Both gear boxes can be hand rotated and shifted from high to low gear ratio. _____

D. Raise and lower the upper frame through its full range. _____

E. Both forward and aft dragboard assemblies. _____

F. All track rollers. _____

2.1.2 Hydraulic piping to be hydrostatically tested per the following:

A. Main loop/hydraulic motor piping at 3375 psi. _____

B. Do not hydrostat test drain piping. _____

C. Hydraulic brake and its piping at 800 psi. _____

2.1.3 Pneumatic piping and air cylinders are to be tested for leaks and functional movement by applying shop air (90 to 125 psi). When testing the upper frame lift cylinder, (10 dia. ref.), allow frame to move, do not restrain by means of locking pin. _____

2.1.4 Apply shop air (90 to 125 psi) to lower track air cylinders and rotate both tracks for one complete revolution or more. Rotate tracks by connection of an external hydraulic power source or manually. Use high and low gears and note variations in torque required. _____

Comments _____

_____

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Figure 2-4. Test and Alignment Procedure (Sheet 5 of 23)

2.2 POWER UNIT

2.2.1 Hydraulic piping and hoses to be hydrostatically tested.

A. High pressure interconnect hoses to be tested at 3375 psi. _____

B. High pressure gauge piping to be tested at 3375 psi. _____

C. Servo filter and connected tubing to be tested at 800 psi. _____

2.2.2 Fill the reservoir with filtered hydraulic fluid. Use Shell Turbo 46 filtered to a cleanliness level of NAS 1638 Class 7. _____

2.2.3 Fill the Denison pump case with filtered fluid. Set Denison pump pressure compensator at 2250 psig (system pressure). _____

A. Replenish pressure is factory set at 200-250 psig.

B. Servo pressure is factory set at 335-550 psig.

NOTE: To stroke pump manually, the servo pressure line must be disconnected from the stroker.

2.2.4 Manually shift the brake release control solenoid valve to confirm that it pressurizes the proper ports. _____

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Figure 2-4. Test and Alignment Procedure (Sheet 6 of 23)

2.3 TEST START-UP

2.3.1 Perform the necessary start-up adjustments and equipment servicing as required to bring the system into preliminary operation.

A. Adjust F/N 19, Ref. 2 to 1 gpm. _____
B. Fill hydraulic motor cases with filtered fluid. _____
C. Bleed air from hydraulic lines. _____

2.4 INITIAL OPERATION

2.4.1 Check operation of all control console control items to verify that all hydraulic, pneumatic, and electrical items are functioning properly. Check that all control end functions concur with console labeling. _____

2.4.2 Adjust the ±15 VDC power supplies in machine electronics control box for an output of 14.9V ± .1V. _____

2.5 LOAD CELL CALIBRATION

2.5.1 Turn console POWER switch to ON. With no load on DO-HB machine, use a digital voltmeter (DVM) to measure the voltage at TP10 on system A's PC3 control card in machine electronics control box (located inside console). Adjust R13 on card for a reading of 0.0V ± .05V on DVM. Adjust R13 on system B's PC3 card for a reading of 0.0 ± .05V at its TP10. _____

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Figure 2-4. Test and Alignment Procedure (Sheet 7 of 23)

2.5.2 *Install an in-line electronic type load cell with readout as shown in Figure 2. Note orientation of tension direction to DO-HB gear reducers.*

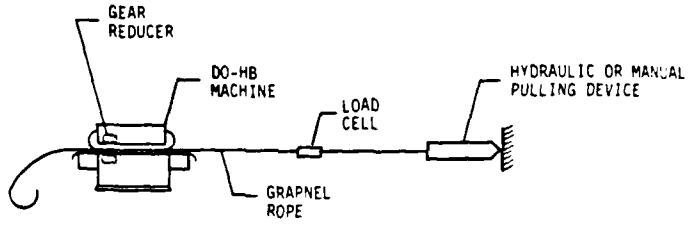

FIGURE 2

2.5.3 Ensure that DO-HB gear reducer brakes are set and that lower track squeeze pressure is set at 80 psi. Apply a static pull of 2250 lbs. Turn console POWER switch to ON and console MACHINE system select switch to SYS A. Adjust R12 on system A's PC3 control card for a reading of 2250 lbs. on console TENSION meter. Turn MACHINE system select switch to SYS B and adjust R12 on system B's PC3 card for a reading of 2250 lbs. on console TENSION meter. Return static load to zero and readjust R13 on the PC3 cards for a reading of 0 lbs. on the TENSION meter for both system A & system B, if necessary. Repeat step 2.5.3 as necessary until TENSION meter reads correctly for a static pull of both 2250 lbs. and 0 lbs.

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Figure 2-4. Test and Alignment Procedure (Sheet 8 of 23)

2.5.4 Vary the static line pull in 500 lb increments and check accuracy of console readout.

	ACTUAL LINE PULL	CONSOLE READOUT	
Zero lbs	_____	_____	____
500 lbs	_____	_____	____
1000 lbs	_____	_____	____
1500 lbs	_____	_____	____
2000 lbs	_____	_____	____

2.5.5 After final calibration, increase line pull to 2250 lbs and measure input and output voltages of the load cell amplifier. Calculate and record amplifier gain setting on gain data sheet.

COMMENTS _____

_____

_____ ____

3.0 CALIBRATE SPEED AND TENSION CONTROLS

DO-HB machine is to be tested at varying tension and speed settings to allow adjustment and checking of the automatic tension and speed control systems.

3.1 CALIBRATE SPEED CONTROLS AND HYDRAULIC PUMP ACTUATOR

Speed controls and hydraulic pump actuator to be calibrated with the DO-HB in low gear, air squeeze at 80 psi, and no cable between the tracks.

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Figure 2-4. Test and Alignment Procedure (Sheet 9 of 23)

3.1.1 SET ELECTRICAL LIMITS

3.1.1.1 Adjust R58 on system A & system B PC3 cards to the center of its travel. Set the console MACHINE system select switch to SYS A. Turn console POWER switch to ON. Press the console EMERG STOP RESET switch and observe that the EMERG STOP ON light goes out. ____

3.1.1.2 Turn console MACHINE mode select switch to SPEED. Using a DVM, measure voltage at system A's PC3 card TP1. Voltage should be 0.0V ± .01V. If specification is not met, loosen the system A speed pot mounting screws and physically rotate pot until voltage reading at TP1 is correct. Tighten pot mounting screws, taking care to keep voltge reading within specifications. Repeat step for system B's PC3 card, adjusting system B speed pot, if necessary. ____

3.1.1.3 Lift wire to actuator at TB12-21 and install DVM in series with actuator command. Place DVM in AMP mode and move console speed control joystick to full PAYOUT. Adjust R58 on system A's PC3 card for a reading of 350 milliamp on the DVM. Move speed control joystick to full HAUL IN and verify a reading of approximately -350 milliamp on DVM. ____

3.1.1.4 Set the console MACHINE system select switch to SYS B. Repeat step 3.1.1.3, adjusting R58 on system B's PC3 card instead of system A's PC3 card. Remove DVM and reconnect wire to TB12-21. ____

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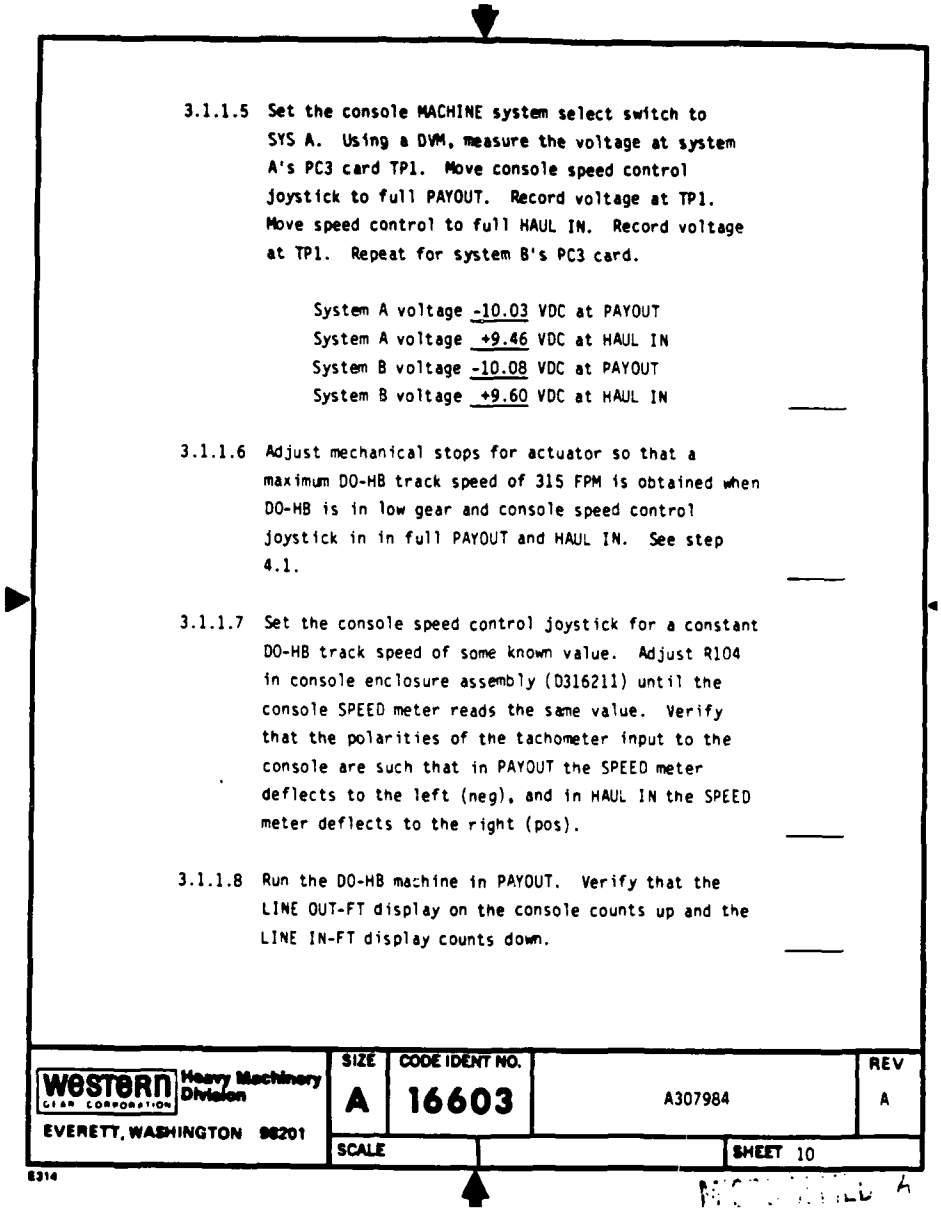
Figure 2-4. Test and Alignment Procedure (Sheet 10 of 23)



3.1.1.5 Set the console MACHINE system select switch to SYS A. Using a DVM, measure the voltage at system A's PC3 card TP1. Move console speed control joystick to full PAYOUT. Record voltage at TP1. Move speed control to full HAUL IN. Record voltage at TP1. Repeat for system B's PC3 card.

System A voltage -10.03 VDC at PAYOUT
System A voltage +9.46 VDC at HAUL IN
System B voltage -10.08 VDC at PAYOUT
System B voltage +9.60 VDC at HAUL IN

3.1.1.6 Adjust mechanical stops for actuator so that a maximum DO-HB track speed of 315 FPM is obtained when DO-HB is in low gear and console speed control joystick in in full PAYOUT and HAUL IN. See step 4.1.

3.1.1.7 Set the console speed control joystick for a constant DO-HB track speed of some known value. Adjust R104 in console enclosure assembly (D316211) until the console SPEED meter reads the same value. Verify that the polarities of the tachometer input to the console are such that in PAYOUT the SPEED meter deflects to the left (neg), and in HAUL IN the SPEED meter deflects to the right (pos).

3.1.1.8 Run the DO-HB machine in PAYOUT. Verify that the LINE OUT-FT display on the console counts up and the LINE IN-FT display counts down.

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Figure 2-4. Test and Alignment Procedure (Sheet 11 of 23)

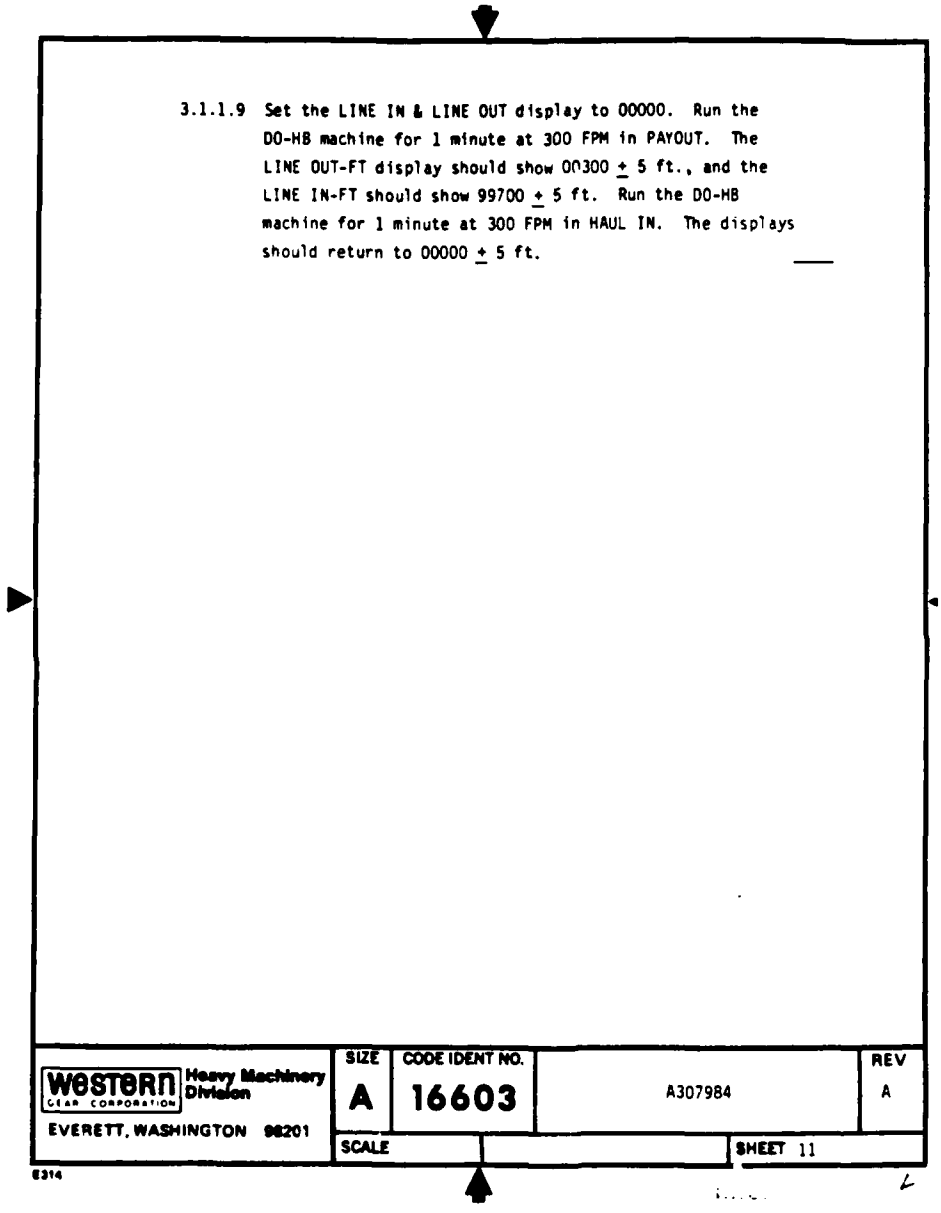

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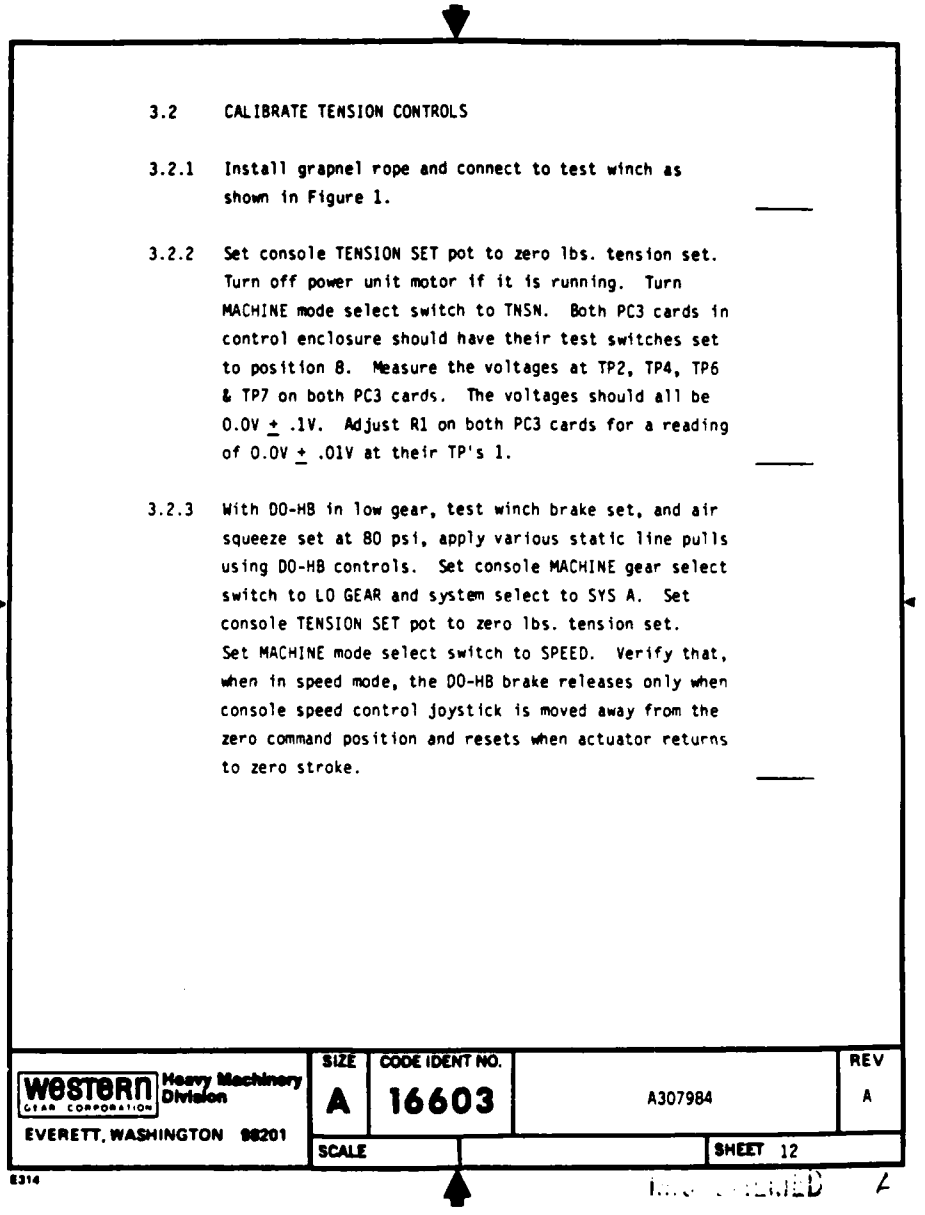
Figure 2-4. Test and Alignment Procedure (Sheet 12 of 23)



3.2 CALIBRATE TENSION CONTROLS

3.2.1 Install grapnel rope and connect to test winch as shown in Figure 1. ____

3.2.2 Set console TENSION SET pot to zero lbs. tension set. Turn off power unit motor if it is running. Turn MACHINE mode select switch to TNSN. Both PC3 cards in control enclosure should have their test switches set to position 8. Measure the voltages at TP2, TP4, TP6 & TP7 on both PC3 cards. The voltages should all be 0.0V ± .1V. Adjust R1 on both PC3 cards for a reading of 0.0V ± .01V at their TP's 1. ____

3.2.3 With DO-HB in low gear, test winch brake set, and air squeeze set at 80 psi, apply various static line pulls using DO-HB controls. Set console MACHINE gear select switch to LO GEAR and system select to SYS A. Set console TENSION SET pot to zero lbs. tension set. Set MACHINE mode select switch to SPEED. Verify that, when in speed mode, the DO-HB brake releases only when console speed control joystick is moved away from the zero command position and resets when actuator returns to zero stroke. ____

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Figure 2-4. Test and Alignment Procedure (Sheet 13 of 23)

3.2.4 Adjust R7 & R8 on system A and system B PC3 cards fully CCW for a reading of 0.0V ± .1V at TP5 & TP8 respectively. These adjustments set the system's deadband circuits to zero deadband. R7 & R8 may be adjusted in a CW direction later, if necessary, to improve system performance. _____

3.2.5 Apply a static line pull of 600 lbs. using DO-HB controls. Use a DVM to monitor the voltages at various test points as given in the following steps. Verify that tension set is at zero. Measure the voltage at TP9 and adjust R9 on system A's PC3 card until DVM reads -2.0V ± .01V. (G=-1) _____

3.2.6 Turn power unit off and turn MACHINE mode select switch to TNSN. The voltage at TP6 should be +2.0V ± .1V. Verify 0.0V ± .1V at TP2, TP4, & TP7. Adjust R2 for a reading of -2.0V ± .1V at TP1. (G=-1) _____

3.2.7 Set console MACHINE gear select switch to HI GEAR. With static tension still at 600 lbs. adjust R10 on system A's PC3 card for -1.6V ± .01V at TP9. (G=-.8) _____

3.2.8 Turn console MACHINE system select switch to SYS B. Repeat steps 3.2.3, 3.2.5, 3.2.6 & 3.2.7 for system B's PC3 card. _____

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Figure 2-4. Test and Alignment Procedure (Sheet 14 of 23)

3.3 CALIBRATE TACHOMETER CONTROLS

The DO-HB controls use a voltage from the tachometer mounted on the DO-HB machine to help develop the actuator stroke command. The tach signal is combined with the tension error signal in such a manner that at full speed a high percentage of the actuator stroke command is derived from the tach signal while only a small percentage is derived from the tension error signal. The gains of the tachometer circuits will be set up so that at full speed the tension error should remain very small. There are calculated values for the tach voltages at various speeds, and these values will be used in determining the tach gain adjustments. The final adjustments to the tach gain circuits will be made during fine tuning of the controls for optimum system performance.

3.3.1 Temporarily remove grapnel rope from DO-HB machine. Select SPEED mode. Using the console speed control joystick run the DO-HB machine tracks at 300 FPM. The tachometer voltage at 300 FPM has been calculated to be 7.94 VDC. Measure and record the tach voltage that appears between TB12-11 & TB12-13 when DO-HB machine tracks are moving at 300 FPM.

Tachometer Voltage at 300 FPM ± 8.51 VDC _____

3.3.2 Put DO-HB machine in high gear and repeat step 3.3.1, running the DO-HB machine tracks at 672 FPM. The tachometer voltage at this speed has been calculated to be 17.78 VDC. Return speed control to zero.

Tachometer Voltage at 672 FPM ± 19.04 VDC _____

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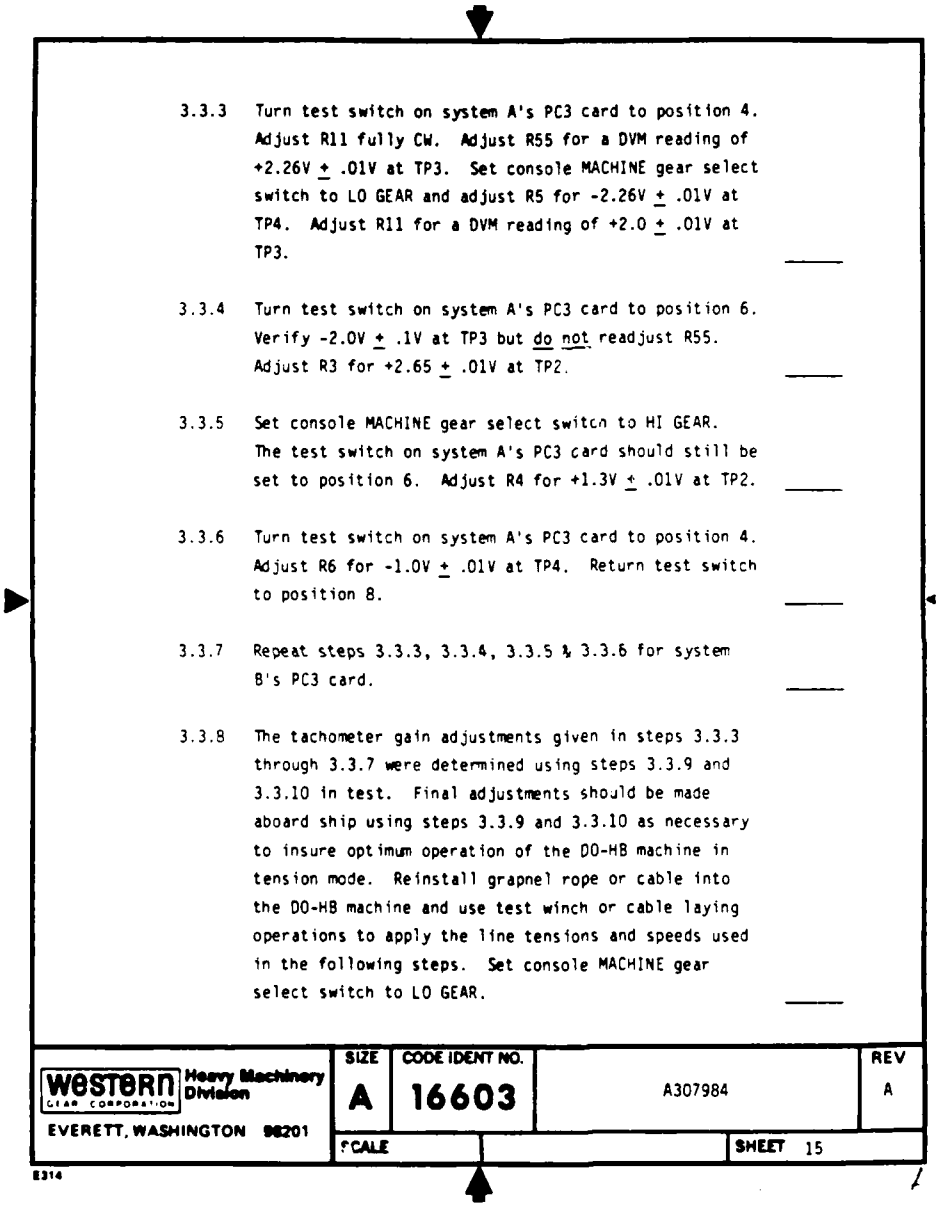
Figure 2-4. Test and Alignment Procedure (Sheet 15 of 23)



3.3.3 Turn test switch on system A's PC3 card to position 4. Adjust R11 fully CW. Adjust R55 for a DVM reading of +2.26V ± .01V at TP3. Set console MACHINE gear select switch to LO GEAR and adjust R5 for -2.26V ± .01V at TP4. Adjust R11 for a DVM reading of +2.0 ± .01V at TP3. _____

3.3.4 Turn test switch on system A's PC3 card to position 6. Verify -2.0V ± .1V at TP3 but do not readjust R55. Adjust R3 for +2.65 ± .01V at TP2. _____

3.3.5 Set console MACHINE gear select switch to HI GEAR. The test switch on system A's PC3 card should still be set to position 6. Adjust R4 for +1.3V ± .01V at TP2. _____

3.3.6 Turn test switch on system A's PC3 card to position 4. Adjust R6 for -1.0V ± .01V at TP4. Return test switch to position 8. _____

3.3.7 Repeat steps 3.3.3, 3.3.4, 3.3.5 & 3.3.6 for system B's PC3 card. _____

3.3.8 The tachometer gain adjustments given in steps 3.3.3 through 3.3.7 were determined using steps 3.3.9 and 3.3.10 in test. Final adjustments should be made aboard ship using steps 3.3.9 and 3.3.10 as necessary to insure optimum operation of the DO-HB machine in tension mode. Reinstall grapnel rope or cable into the DO-HB machine and use test winch or cable laying operations to apply the line tensions and speeds used in the following steps. Set console MACHINE gear select switch to LO GEAR. _____

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Figure 2-4. Test and Alignment Procedure (Sheet 16 of 23)

3.3.9 With DO-HB in low gear, air squeeze set at 80 psi, set DO-HB controls for 2000 lbs. tension. Operate DO-HB machine in inhaul and payout directions at low, medium and 250 fpm line speeds. Adjust R5 (inhaul) and R3 (payout) on system A and system B PC3 cards as necessary to optimize machine performance. Measure, calculate, and record these new tachometer gain settings on gain data sheet. ____

3.3.10 With DO-HB in high gear, air squeeze set at 40 psi, set DO-HB controls for 1000 lbs. tension. Operate DO-HB machine in inhaul and payout directions at low, medium and 670 fpm line speeds. Set console MACHINE gear select switch to HI GEAR and adjust R6 (inhaul) and R4 (payout) on system A and system B PC3 cards as necessary to optimize machine performance. Measure, calculate, and record these new tachometer gain settings on gain data sheet. ____

3.3.11 Return DO-HB to low gear and air squeeze to 80 psi. Set console MACHINE gear select to LO GEAR. Set DO-HB controls for 2250 lbs. tension. Use controls to apply a static line pull of 2250 lbs. tension and turn the console MACHINE mode select switch to TNSN. The console TENSION meter will probably read somewhat less than the 2250 lbs. tension set value. Slowly adjust R1 on system A's PC3 card in a CCW direction until TENSION meter reads 2250 lbs. tension. Repeat for system B. This procedure sets up the leakage offset circuit so that just enough stroke is produced in the haul in direction to compensate for the leakage that occurs in the DO-HB high pressure hydraulic system. ____

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Figure 2-4. Test and Alignment Procedure (Sheet 17 of 23)

3.3.12 Remove grapnel rope from DO-HB machine. Set console MACHINE mode select switch to SPEED and run DO-HB machine at 300 FPM in PAYOUT. Press console EMERGENCY STOP pushbutton and verify that power unit shuts down and DO-HB machine stops moving. Repeat for HAUL IN after pressing console EMERG STOP RESET pushbutton.

4.0 TESTING

Preliminary electrical checkout per Section 3.1 to be accomplished prior to preliminary machinery operation.

4.1. SET STROKE LIMIT ON PUMP

Use manual speed control to operate DO-HB at 315 FPM in low gear (speed to be determined by watching track). When the track is traveling at 315 FPM, set the stroke stops on the pump to limit the speed. Reverse the machine and set stops in other direction. _____

4.2 PRELIMINARY MACHINERY OPERATION

Use manual speed control to operate DO-HB machine in both directions and both gear ratios from low to maximum speed of 315 FPM low gear and 670 FPM high gear. Operate at each gear and direction for approximately 10 minutes and observe for abnormal conditions.

COMMENTS: _____

_____

_____ _____

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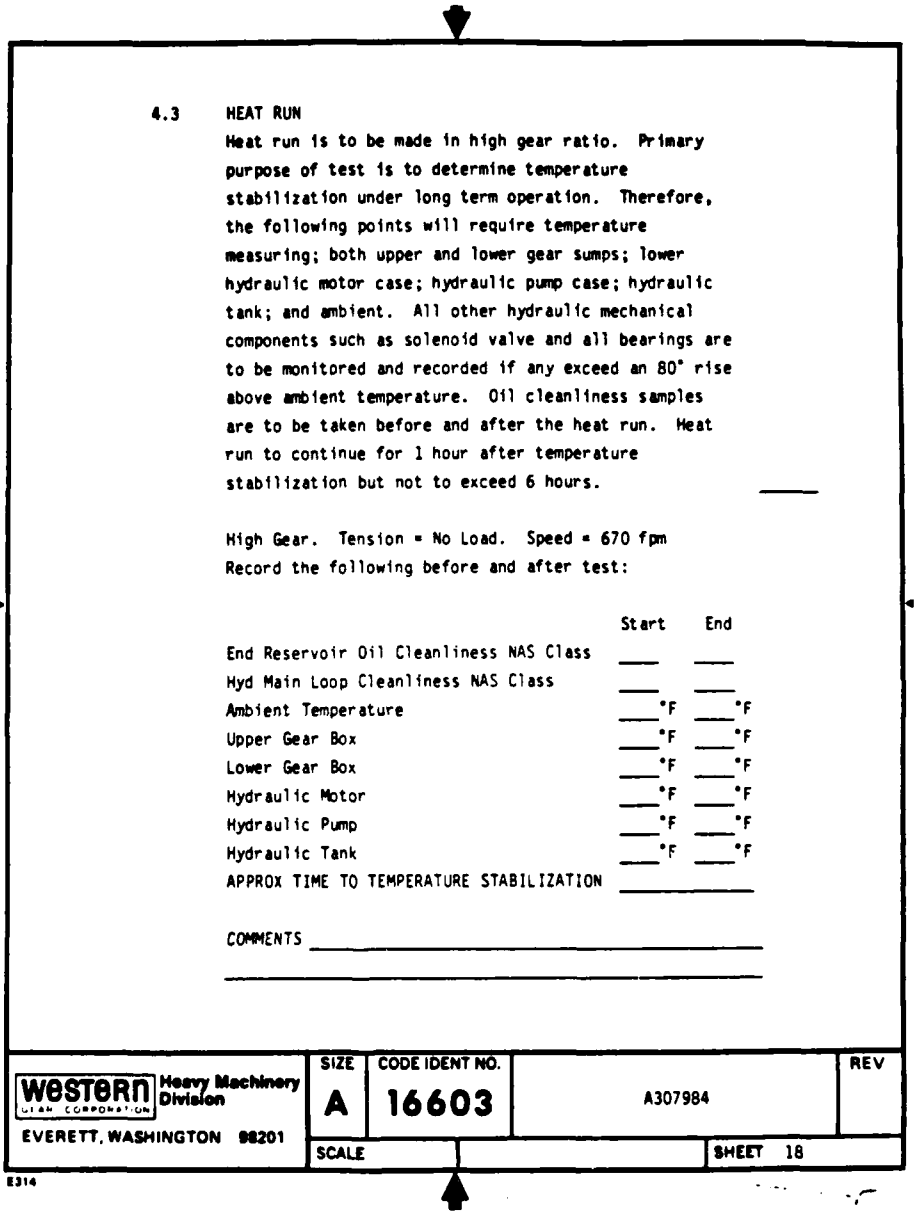
Figure 2-4. Test and Alignment Procedure (Sheet 18 of 23)



4.3 HEAT RUN

Heat run is to be made in high gear ratio. Primary purpose of test is to determine temperature stabilization under long term operation. Therefore, the following points will require temperature measuring; both upper and lower gear sumps; lower hydraulic motor case; hydraulic pump case; hydraulic tank; and ambient. All other hydraulic mechanical components such as solenoid valve and all bearings are to be monitored and recorded if any exceed an 80° rise above ambient temperature. Oil cleanliness samples are to be taken before and after the heat run. Heat run to continue for 1 hour after temperature stabilization but not to exceed 6 hours. ____

High Gear. Tension = No Load. Speed = 670 fpm
Record the following before and after test:

	Start	End
End Reservoir Oil Cleanliness NAS Class	____	____
Hyd Main Loop Cleanliness NAS Class	____	____
Ambient Temperature	____°F	____°F
Upper Gear Box	____°F	____°F
Lower Gear Box	____°F	____°F
Hydraulic Motor	____°F	____°F
Hydraulic Pump	____°F	____°F
Hydraulic Tank	____°F	____°F
APPROX TIME TO TEMPERATURE STABILIZATION	_____	

COMMENTS _____

_____

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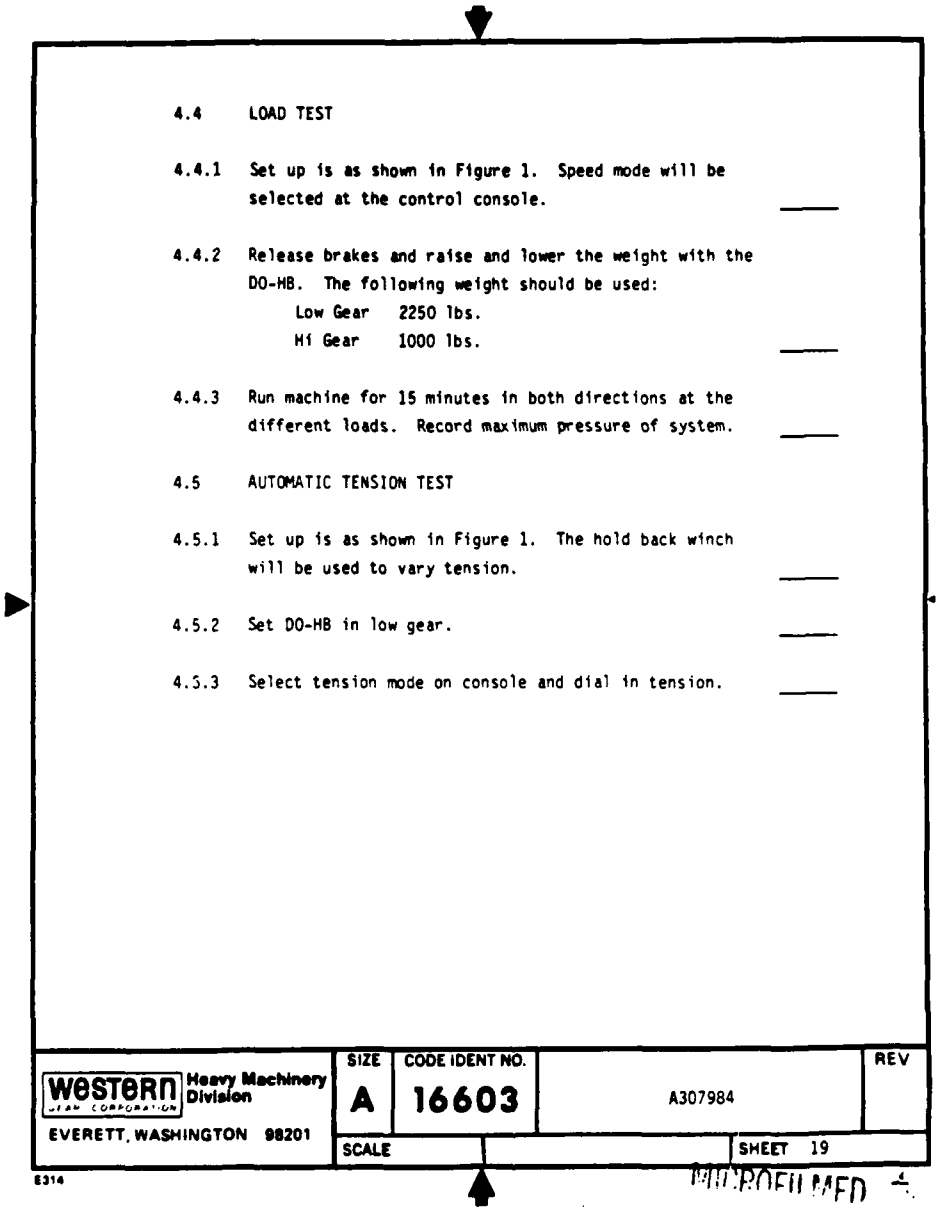
Figure 2-4. Test and Alignment Procedure (Sheet 19 of 23)



4.4 LOAD TEST

4.4.1 Set up is as shown in Figure 1. Speed mode will be selected at the control console. ____

4.4.2 Release brakes and raise and lower the weight with the DO-HB. The following weight should be used:
Low Gear 2250 lbs.
Hi Gear 1000 lbs. ____

4.4.3 Run machine for 15 minutes in both directions at the different loads. Record maximum pressure of system. ____

4.5 AUTOMATIC TENSION TEST

4.5.1 Set up is as shown in Figure 1. The hold back winch will be used to vary tension. ____

4.5.2 Set DO-HB in low gear. ____

4.5.3 Select tension mode on console and dial in tension. ____

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Figure 2-4. Test and Alignment Procedure (Sheet 20 of 23)

4.5.4 Operate test winch so the DO-HB machine will haul in and payout line. ____

COMMENTS _____ ____

4.5.5 Select the following tension settings and run DO-HB at each tension setting for 5 minutes.

500 lbs. ____
1000 lbs. ____
1500 lbs. ____
2000 lbs. ____

5.0 OIL CLEANLINESS

Oil cleanliness samples to be taken from the main loop at the hydraulic motor and hydraulic reservoir on an 8 hour basis during the active testing period.

HYDRAULIC CLEANLINESS NAS CLASS

Date	Main Loop	Reservoir

Note location where sample taken _____ _____

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Figure 2-4. Test and Alignment Procedure (Sheet 21 of 23)

6.0 QUICK DISCONNECT TESTING

The purpose of this portion of the test is to insure that the system is operational after the addition of the quick disconnect interconnecting hoses and electrical cables.

6.1 QUICK DISCONNECT HOOK-UP

6.1.1 Refer to drawing D316125 and connect the system interconnect cable assemblies. ____

6.1.2 Using drawing A307881, verify that the electrical cables and J-box plugs and jacks are wired correctly (ohms check). ____

6.1.3 Flush hydraulic hose assemblies, C313737 and C313738, to a cleanliness level of NAS 1638 Class 8. ____

6.1.4 Refer to drawings D316407, C313737, C313738 & C313739, (items 4, 5, 6 & 7 on Reference Drawing List, Sh 2), and connect the hose assemblies to the appropriate fittings on the equipment. ____

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Figure 2-4. Test and Alignment Procedure (Sheet 22 of 23)

6.2 QUICK DISCONNECT TEST

6.2.1 Apply electrical power of the appropriate voltages as shown on D316125. Apply air at 90 to 125 psi to the console. ____

6.2.2 Perform step 2.4.1 of this test procedure. ____

6.2.3 Hydrostatically test the hydraulic hose assemblies to the pressures shown in steps 2.1.2 & 2.2.1 of this test procedure. Check all pneumatic hoses for air leaks. ____

6.2.4 Tension Instrumentation Check. Temporarily disconnect load cell wiring at J-box 3, System A TB1-7,9 and System B TB1-8,10. Using a power supply vary the voltage from0 to 30mV D.C. for System A at TB1-7,9 and then System B at TB1-8,10; and verify that the tension meter varies with the applied voltage. (Note: Meter should vary between 0 and 2660 lbs.) Reconnect load cell wiring. ____

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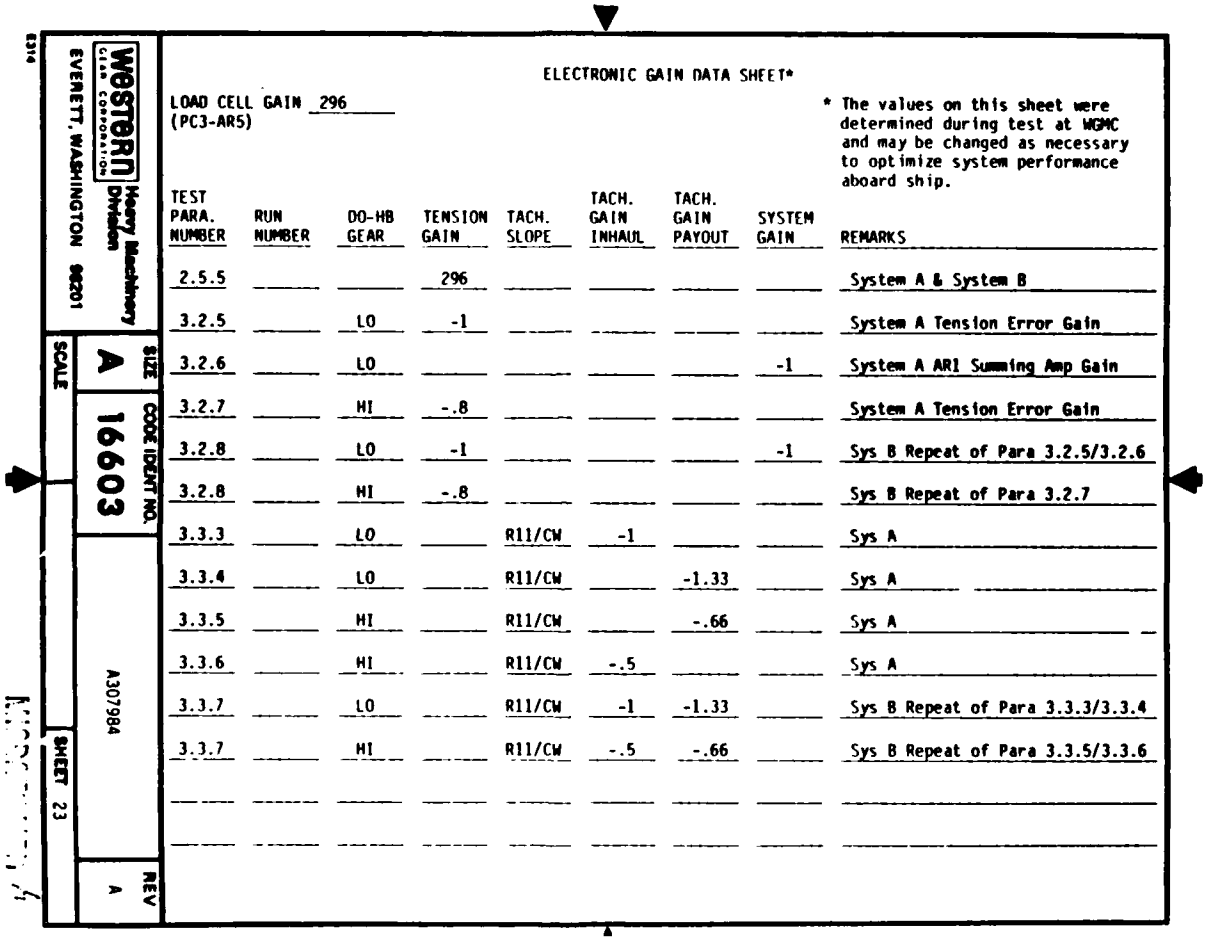
Figure 2-4. Test and Alignment Procedure (Sheet 23 of 23)



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SCALE

ELECTRONIC GAIN DATA SHEET*

LOAD CELL GAIN 296
(PC3-AR5)

* The values on this sheet were determined during test at WGMC and may be changed as necessary to optimize system performance aboard ship.

TEST PARA. NUMBER	RUN NUMBER	DO-HB GEAR	TENSION GAIN	TACH. SLOPE	TACH. GAIN INHAUL	TACH. GAIN PAYOUT	SYSTEM GAIN	REMARKS
2.5.5			296					System A & System B
3.2.5		LO	-1					System A Tension Error Gain
3.2.6		LO					-1	System A AR1 Summing Amp Gain
3.2.7		HI	-.8					System A Tension Error Gain
3.2.8		LO	-1				-1	Sys B Repeat of Para 3.2.5/3.2.6
3.2.8		HI	-.8					Sys B Repeat of Para 3.2.7
3.3.3		LO		R11/CW	-1			Sys A
3.3.4		LO		R11/CW		-1.33		Sys A
3.3.5		HI		R11/CW		-.66		Sys A
3.3.6		HI		R11/CW	-.5			Sys A
3.3.7		LO		R11/CW	-1	-1.33		Sys B Repeat of Para 3.3.3/3.3.4
3.3.7		HI		R11/CW	-.5	-.66		Sys B Repeat of Para 3.3.5/3.3.6

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section contains a safety summary, a description of the controls on the Control Console, procedures for machinery operation, and operator maintenance information.

3-3. SAFETY SUMMARY.

3-4. Operating personnel must observe the following safety WARNING and CAUTION when operating the cable machinery.

WARNING

Keep away from live electrical circuits. Never try to make repairs or to replace components when power is on. The power units for these machines contain lethal voltages.

Bleed off pneumatic pressure before disconnecting any lines.

CAUTION

Before operating the cable machinery, look around. Make sure that no stowed equipment or other material will interfere with the operation of the machinery.

3-5. CONTROLS AND INDICATORS.

3-6. Each unit of the cable machinery listed in paragraph 1-7 is controlled from the control console (see figure 6-1). The control panel is shown in figure 3-1 and the functions are described in table 3-1.

3-7. OPERATOR MAINTENANCE.

3-8. Operator maintenance includes inspecting, cleaning, and lubricating the equipment as described in the applicable table(s) of the Tension Machine manual. Operator shall be alert to detect malfunctions and shall secure the equipment as soon as possible to determine the cause and to have the malfunction(s) corrected.

3-9. The specific indications of trouble include:

1. Overheating of any part, smoking or discoloration of painted surfaces.

2. Excessive vibration.

3. Unusual noises.

4. Failure of a machine to respond to its control movements.

5. Cable slippage at within rated operating parameters.

6. Metal dust or shavings around moving parts.

3-10. Operators are not qualified by rating or training to repair units of the cable machinery. They shall report the exact indications they have observed but in no case shall they attempt repairs without responsible supervision. Unauthorized attempts at quick repairs may hide the true cause of malfunctions and cause severe damage.

3-11. OPERATING PROCEDURE.

3-12. GENERAL. The DOHB tension machine is not complex or difficult to operate; however, due care should be taken during operation to avoid the possibility of damaging the cable or the machine.

3-13. OPERATION. To operate the DOHB tension machine, proceed as follows (refer to figure 3-1 for the control console controls and indicators):

CAUTION

Ensure that no stowed equipment or other material will interfere with the operation of the DOHB machine.

1. Set DOHB upper and lower reducer gear levers to desired position (IN for low speed operation, or OUT for high speed operation). Refer to section III, Tension Machine manual.

2. Place MACHINE GEAR HI/LO switch in HI or LO position corresponding to reducer gear levers.

3. Set MACHINE TNSN/SPEED/BRAKE switch to BRAKE position.

4. Center PAYOUT/HAUL IN lever.

5. Set POWER switch to ON position.

NOTE

The EMERGENCY STOP RESET pushbutton must be depressed prior to initial startup and each time the EMERGENCY STOP pushbutton is utilized. If the EMERGENCY STOP ON indicator lamp (figure 3-1, item 17) is illuminuated, the EMERGENCY STOP RESET pushbutton must be depressed in order to start the power unit motor.

6. Depress EMERGENCY STOP RESET button.

7. Press and hold MOTOR START switch until green MOTOR RUN light illuminates.

8. Ensure that no red indicator lights are illuminated.

9. Raise upper track assembly by moving UPPER FRAME SQUEEZE lever to UP position.

10. Manually insert cable into DOHB machine.

11. Close dragboards by moving DRAGBOARDS lever to the IN position. Set dragboard pressure at 10 psi.

12. Lower upper track assembly and set UPPER FRAME SQUEEZE pressure at 60 psi.

13. Set MACHINE SYS A/SYS B switch to desired position.

14. Check the REPLENISH PRESSURE gage for a reading of 300 psi.

15. Check the SYSTEM PRESSURE gage for a reading of 2,100 psi.

NOTE

When DOHB brake is released, SYSTEM PRESSURE will rise to between 300 and 3,000 psi.

16. Move MACHINE TNSN/SPEED/BRAKE switch from BRAKE position to SPEED position.

17. Adjust TRACK SQUEEZE pressure (60 psi for low speed operation or 30 psi for high speed operation as required).

18. Place PAYOUT/HAUL IN lever in PAYOUT position and pay out cable as required.

3-14. AUTOMATIC CONSTANT TENSION OPERATION. To place the DOHB tension machine in the automatic constant tension (TNSN) mode, complete steps 1-18; above and proceed as follows:

1. Take up any excessive cable slack using the PAYOUT/HAUL IN lever.

2. Press TENSION SET READOUT and set a small amount of tension into the constant tension control circuit with the TENSION SET dial.

3. Move the MACHINE TNSN/SPEED/BRAKE switch from the SPEED position to the TNSN position and adjust the TENSION SET dial for the desired tension and speed appropriate to the GEAR mode of operation previously selected in paragraph 3-13, step 1.

Table 3-1. Control Console Controls and Indicators

ITEM NO.	NOMENCLATURE	POSITIONS	FUNCTION
1	POWER switch	ON/OFF	In the ON position, supplies electrical power to the control console.
2	POWER AVAIL light	Illuminated	Gives a green light when ships power is available to the control console and the junction box 115 vac power fuses are intact.
3	LAMP TEST button	Depressed/Not Depressed	Illuminates all indicators when depressed.
4	SERVO PRESS light	Illuminated	Gives a RED light when servo-pressure falls below 300 psi.
5	REPL PRESS light	Illuminated	Gives a RED light when DOHB power unit hydraulic pump replenish pressure falls below 180 psi.
6	AIR PRESS	Illuminated	Gives a RED light when 100 psi regulated air into control console drops below 90 psi.
7	SUMP TEMP HIGH light	Illuminated	Gives a RED light when temperature of hydraulic fluid in DOHB power unit sump exceeds 170°F.
8	MOTOR STOP button	Depressed/Not Depressed	When depressed, removes operating voltage from DOHB power unit electric motor starters coil.
9	MOTOR START button	Depressed/Not Depressed	When depressed, provides operating voltage to DOHB power unit electric motor starters coil.
10	MOTOR RUN light	Illuminated	Gives a GREEN light when DOHB power unit motor is running.
11	MOTOR OVERLOAD light	Illuminated	Gives a RED light when the DOHB power unit electric motor overload relay trips.

Table 3-1. Control Console Controls and Indicators (Cont)

ITEM NO.	NOMENCLATURE	POSITIONS	FUNCTION
12	MACHINE TNSN/ SPEED/BRAKE switch	TNSN/SPEED/BRAKE	In TNSN position, causes signals to the DOHB power unit pump actuator to be provided by the automatic tension control circuitry. Also causes brake release solenoid to be energized. In SPEED position, causes above signals to be provided by manually positioning the PAYOUT/ HAUL IN lever. Also causes brake release stroke ≠ 0 solenoid to be energized. In BRAKE position, removes 115 vac from brake release solenoids (closing off flow of fluid to the spring set, hydraulically released brakes) thereby setting the brakes.
13	MACHINE SYS A/ SYS B switch	SYS A/SYS B	When TNSN/SPEED/BRAKE switch is in TNSN position, positioning of this switch selects either of two electronic DOHB constant tension control circuits.
14	MACHINE HI GEAR/ LO GEAR switch	HI GEAR/LO GEAR	Positioning of this switch controls the gain of operational amplifiers in tension control circuits. Switch position should coincide with position of gear levers on upper and lower DOHB reducers.
15	EMERGENCY STOP RESET button	Depressed/Not Depressed	When depressed, resets emergency stop relay (K-2) to allow initial start up or restart from emergency stop condition.
16	EMERGENCY STOP button	Depressed/Not Depressed	When depressed, applies brakes on DOHB tension machine and removes operating voltage from power unit electric motor starters coil.
17	EMERGENCY STOP ON light	Illuminated	Gives RED light when EMERGENCY STOP relay (K2) is energized.

Table 3-1. Control Console Controls and Indicators (Cont)

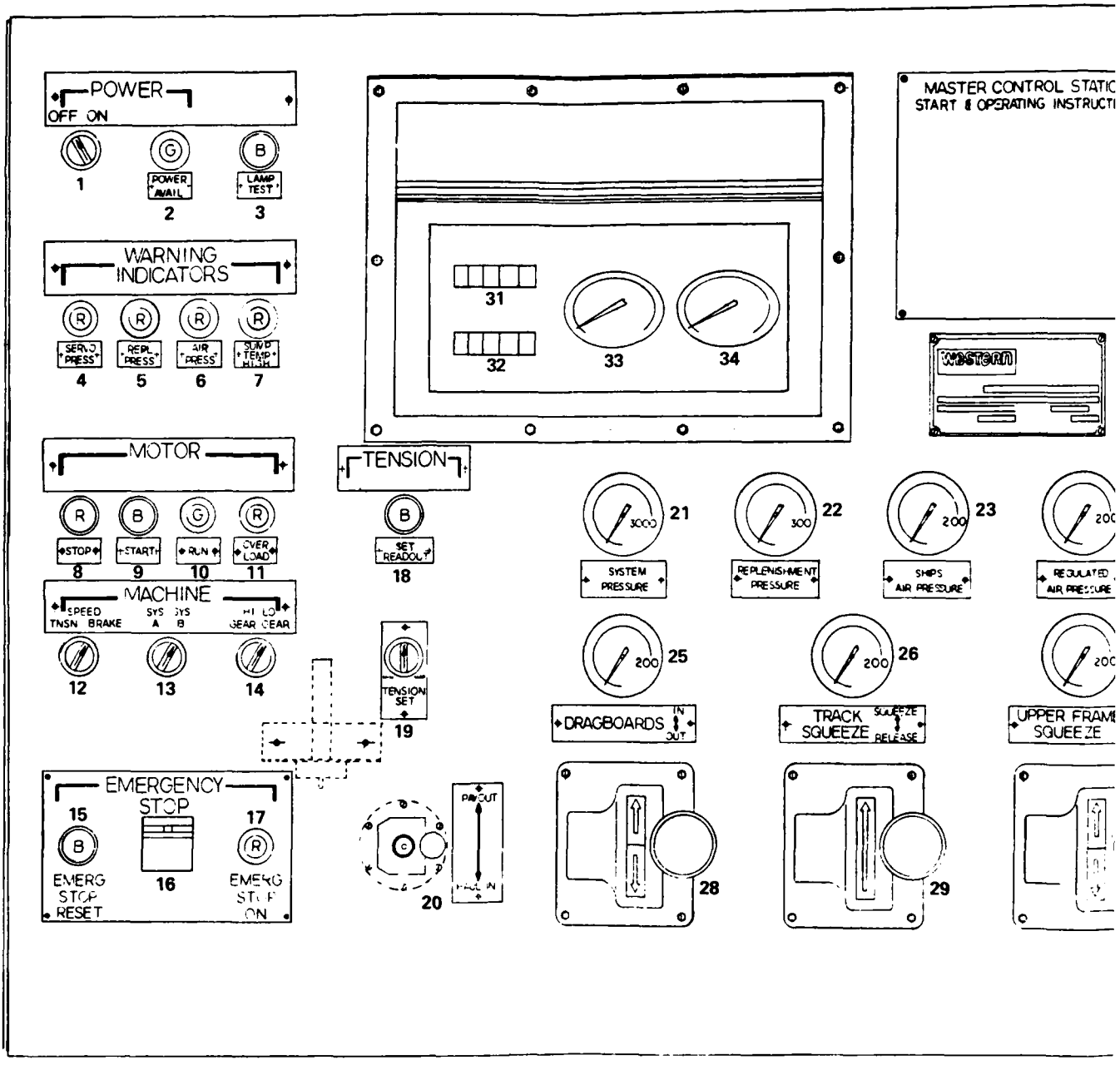
ITEM NO.	NOMENCLATURE	POSITIONS	FUNCTION
18	TENSION SET READOUT button	Depressed/Not Depressed	When depressed, causes TENSION gage to indicate the amount of tension preset into electronic DOHB constant tension control circuit. When not depressed, cable TENSION meter indicates actual tension on cable.
19	TENSION SET knob	As Desired	Sets desired tension to be automatically maintained when TNSN/SPEED/BRAKE switch is in TNSN position.
20	PAYOUT/HAUL IN lever	PAYOUT/HAUL IN	Controls DOHB track speed and direction when TNSN/SPEED/BRAKE switch is in SPEED position.
21	SYSTEM PRESSURE gage	0-3,000 psi	Monitors pressure of fluid output from DOHB power unit main hydraulic pump.
22	REPLENISHMENT PRESSURE gage	0-300 psi	Monitors pressure of fluid output from DOHB power unit main hydraulic pumps internal replenishment pump.
23	SHIPS AIR PRESSURE gage	0-200 psi	Monitors input air pressure to the control console pneumatic system.
24	REGULATED AIR PRESSURE gage	0-200 psi	Monitors air pressure after it has been filtered, lubricated, and regulated for use by the control console pneumatic system.
25	DRAGBOARDS pressure gage	0-200 psi	Indicates amount of air pressure applied to dragboard cylinders by DRAGBOARDS control lever.
26	TRACK SQUEEZE pressure gage	0-200 psi	Indicates amount of air pressure applied to lower track squeeze cylinders by TRACK SQUEEZE control lever.

Table 3-1. Control Console Controls and Indicators (Cont)

ITEM NO.	NOMENCLATURE	POSITIONS	FUNCTION
27	UPPER FRAME SQUEEZE pressure gage	0-200 psi	Indicates amount of air pressure applied to main pressure cylinder by UPPER FRAME SQUEEZE control lever.
28	DRAGBOARDS control lever	IN/OUT	Applies operating air pressure to dragboard cylinders.
29	TRACK SQUEEZE control lever	SQUEEZE/RELEASE	Applies operating air pressure to lower track squeeze cylinders.
30	UPPER FRAME SQUEEZE control lever	UP/DOWN	Applies operating air pressure to main pressure cylinder to develop force necessary to grip cable.
31	LINE IN-FT digital counter	N/A	Indicates feet of cable hauled in.
32	LINE OUT-FT digital counter	N/A	Indicates feet of cable payed out.
33	SPEED gage	0-800 fpm	Indicates rate of cable travel through tension machine in fpm.
34	TENSION gage	0-3000 lbs	Indicates amount of tension detected by tension machine load cells. When TENSION SET READOUT button is depressed, indicates amount of tension preset into electronic DOHB constant tension control circuitry.

Table 3-2. DOHB Machine Operating Parameters

GEAR	TENSION	SPEED
LOW	2,250 LBS	315 FPM
HIGH	1,125 LBS	670 FPM


POWER
OFF ON
1
POWER AVAIL
2
LAMP TEST
3
WARNING INDICATORS
SERVO PRESS
4
REPL PRESS
5
AIR PRESS
6
SUMP TEMP HIGH
7
MOTOR
STOP
8
START
9
RUN
10
OVER LOAD
11
MACHINE
SPEED TNSN
BRAKE
SYS A
SYS B
HI LO GEAR
12
13
14
TENSION
SET READOUT
18
TENSION SET
19
EMERGENCY STOP
15
EMERG STOP RESET
16
17
EMERG STOP ON
20
PAY OUT
HAUL IN
31
32
33
34
MASTER CONTROL STATIC
START & OPERATING INSTRUCTI
WESTERN
21
SYSTEM PRESSURE
22
REPLENISHMENT PRESSURE
23
SHIPS AIR PRESSURE
REGULATED AIR PRESSURE
25
DRAGBOARDS IN OUT
26
TRACK SQUEEZE SQUEEZE RELEASE
UPPER FRAME SQUEEZE
28
29

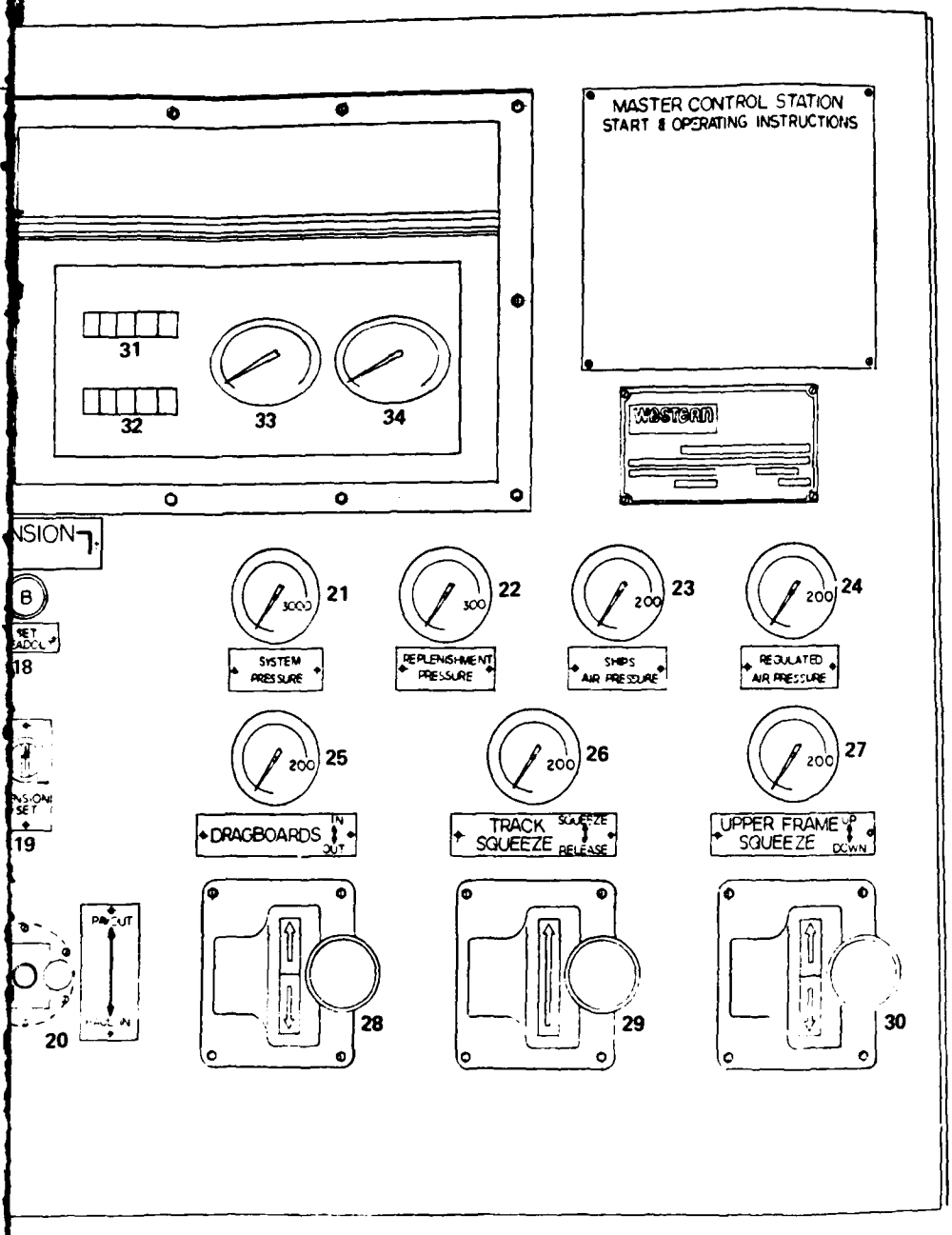


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Figure 3-1. Control Console Panel

SECTION IV

TROUBLESHOOTING

4-1. INTRODUCTION.

4-2. This section contains a functional description of the control and monitoring devices and the DOHB constant tension circuit housed by the Control Console. Troubleshooting tables for the DOHB machine controlled by the control console may be found in the DOHB Tension Machine manual.

4-3. FUNCTIONAL DESCRIPTION.

4-4. GENERAL. The control console is designed to house the operator controls and monitoring devices which control and provide operating information to the operator of the cable machinery. Three kinds of control and monitoring devices are used: pneumatic, electrical, and hydraulic. The principal machine of the cable machinery system is the DOHB tensioner machine which functions under the control of the control console to pay-out or haul-in cable. The operating parameters of the tension machine are given in table 3-2. The DOHB machines are hydraulically powered, pneumatically operated, and employ an electronic constant tension circuit which is designed to maintain the proper holdback tension on the cable during cable laying or cable retrieving operations.

4-5. PNEUMATIC CONTROLS (figure 4-1). The DOHB pneumatic control system consists of an air pressure source of not less than 100 psi (supplied by the ship), a shutoff valve, an air filter, a pressure regulator, an air lubricator, three manually operated, control valves (15A, 15B, and 18); a pressure regulator (17), and five pneumatic pressure gages (14A, 14B, 14C, 14D, and 14E).

4-6. TRACK SQUEEZE CONTROL VALVE. The TRACK SQUEEZE control valve (18) is a three-way pressure regulating valve which controls both pressure and air flow for one air circuit: the three track squeeze cylinders. It is designed to remain in position when released and to maintain outlet air pressure at the valve for that position. Air pressure at the outlet port may be increased or decreased by positioning the hand lever. Maximum air pressure that can be set by the valve is limited to 80 psi as set by the pressure regulator. When the TRACK SQUEEZE control valve (18) handle is moved to the SQUEEZE position, the track cylinders extend to press pressure rollers along the underside of the upper span of track of the lower track assembly. The track cylinders are operated at low pressure to allow the track to be forced down by cable repeaters as they pass through the tensioner machine. When the handle of control valve (18) is positioned to the RELEASE position, the air circuit is vented to atmosphere and the track cylinders retract.

4-7. UPPER FRAME SQUEEZE CONTROL VALVE. The UPPER FRAME SQUEEZE control valve (15B) has two positions: UP and DOWN. It is a four-way pressure regulating valve which controls both pressure and air flow for two air circuits. The valve consists of two three-way directional sections and a three-way pressure regulating section. Each directional section has its own out port. Initial movement

of the hand lever selects the out port to be activated. Further movement of the lever in the same direction increases outlet pressure. The lever stays in any position to which it is placed. The holding friction is adjustable. When the valve handle is moved to the UP position, a maximum of 60 psi is applied to the upper track raise mechanism. The squeeze/lift cylinder rod extends and the entire upper track assembly raises a maximum of 18 inches.

4-8. DRAGBOARDS CONTROL VALVE. The control valve (15A) for the dragboards is the same type as used for control of the upper frame squeeze cylinder. This valve is used to position the dragboards so that they bear against the cable to keep it centered on the tensioner machine. During operations when the control handle is positioned to the IN position, a pressure of 5 to 10 psi is indicated on the dragboards gage (14A). This low pressure allows cable repeaters to force the boards open for passage.

4-9. ELECTRICAL/ELECTRONIC CONTROLS. The following paragraphs deal with controls and circuits shown in figure 4-3, Electrical System Schematic.

4-10. MACHINE TNSN/SPEED/BRAKE SWITCH. When an operator positions the TNSN/SPEED/BRAKE switch in the TNSN position, the brake release solenoid (figure 4-3, sheet 1) is energized. This allows the flow of hydraulic fluid to the spring set/hydraulically released brakes, thereby releasing the brakes and allowing the DOHB to operate. Relay K1 (figure 4-3, sheet 3) is deenergized, applying the output of the automatic constant tension circuit to the input of the output driver amplifier (AR6), and consequently to the power unit servoactuator coil.

4-11. When placed in the SPEED position, relay K1 (figure 4-3, sheet 3) is energized, removing the automatic constant tension input from amplifier AR6 and replacing it with the output from the manually positioned PAYOUT/HAUL IN lever (R102 in system A or R103 in system B). The brake release stroke ≠ 0 solenoid (figure 4-3, sheet 1) is energized, releasing the brakes when the hydraulic power unit pump goes off zero stroke in either PAYOUT or HAUL IN direction.

4-12. When placed in the BRAKE position, the brake release and brake release stroke ≠ 0 solenoids (figure 4-3, sheet 1) are deenergized. This closes off the flow of hydraulic fluid to the spring set/hydraulically released brakes, thereby setting the brakes and stopping the DOHB.

4-13. PAYOUT/HAUL IN CONTROL LEVER. Speed and direction of DOHB track movement may be manually controlled by an operator positioned PAYOUT/HAUL IN lever on the control console. When the TNSN/SPEED/BRAKE switch is in the SPEED position (brake release stroke ≠ 0 solenoid and relay K1 energized) and the operator positions the PAYOUT/HAUL IN lever to either the PAYOUT or HAUL IN position, an electrical signal is produced and applied to the output driver amplifier (AR6, figure 4-3, sheet 3). After the signal passes through the driver amplifier, it is applied to the coil of a servoactuator. Here, the magnitude and polarity of current through the coil controls the positioning of a spool in the hydraulic pump servoactuator. When the actuator pilot spool is repositioned, it causes the actuator output rod to move the control arm on the hydraulic pump of the power unit. Thus, the displacement of the main hydraulic pump is reset in accordance with the direction and degree of current through the coil. DOHB track speed and direction is thus controlled by controlling the stroking of the hydraulic pump.

4-14. MACHINE GEAR HI/LO SELECT SWITCH (see figure 4-3). When an operator positions this switch to the HI position, relays K2 and K3 are energized. When these relays are energized, adjustable feedback resistors R3, R5 and R9 are switched out and adjustable feedback resistors R4, R6, and R10 are switched in. These adjustable resistors control the gain of operational amplifiers, AR4B, AR2A and AR2B. The gain of these amplifiers is changed for HI gear operation.

4-15. DOHB SYSTEM SELECT SWITCH (figure 4-3, sheet 1). The constant tension electronic control system is a redundant system (A and B) which is designed to automatically maintain the TENSION SET when an operator moves the TENSION SET dial to some value. The SYSTEM SELECT switch enables an operator to select either of the two systems.

4-16. DOHB CONSTANT TENSION CONTROL CIRCUIT (figure 4-3, sheet 3). When the DOHB is operating, a signal generator is driven through a belt drive arrangement and produces a voltage output. This signal voltage may be positive or negative depending upon the direction of rotation and is applied through a passive filter and developed across SLOPE potentiometer, R11. Adjustment of this potentiometer controls the magnitude of signal applied to the bidirectional circuit. At the same time, operation of the DOHB machine produces a signal voltage of some value as cable pull actuates the DOHB load cell. This voltage represents the actual tailing tension acting on the cable as produced by the DOHB machine and is always positive. Since the amount of tailing tension required for different operating conditions varies, a method of providing tailing TENSION SET is required. The method used in the DOHB system is to sum a tension set signal with the amplified load cell signal. When the amplified load cell signal is equal in magnitude but opposite in polarity to the tension set signal (zero tension differential), no further signal is produced and sent to the actuator pump stroking control mechanism. The machine, thus, maintains the tension set. However, in addition to maintaining the desired tension set, a signal must also be produced to provide for cable movement (speed). This signal results when the tachometer-generator signal is summed with the tension differential signal.

4-17. The automatic constant tension circuit is designed to perform two principal functions. These are to maintain the selected tailing tension and to respond to tensioner speed requirements and changes. Thus, the tachometer-generator signal becomes the primary command signal when the tensioner is operating and the tension differential signal acts as a vernier command signal. Since the load cell signal is always positive, the tension set signal must be always negative. Therefore, under ideal operating conditions, the tension differential circuit produces a zero signal to be summed with the tachometer-generator signal. The tachometer-generator signal is the speed control signal and it is positive for PAYOUT and negative for INHAUL. If the tension differential signal becomes positive, the tension is too high and a destroke signal is produced. If the tension differential signal becomes negative, the tension is too low and a stroke signal is produced. Components of the constant tension control circuit which perform these functions are discussed in the following paragraphs.

4-18. BIDIRECTIONAL CIRCUIT (figure 4-1, sheet 3). Positive or negative tachometer- generator signals from the tensioner are applied simultaneously to two operational amplifiers; however, each responds to only one polarity of

signal. Since the tachometer-generator is installed to produce negative signals on an INHAUL cycle, amplifier, AR2A is designated the INHAUL member of the circuit and the other (AR2B) is the PAYOUT amplifier. During an INHAUL cycle, when cable is being picked-up and pulled aboard the ship, the tensioner machine must work harder and therefore requires more tailing tension than the DOHB produces at the same speed on an PAYOUT cycle. Consequently, the inhaul amplifier of the circuit is designed to be adjusted to produce greater signal gain. Output from the bidirectional circuit is applied at the summing junction of the next stage. This stage is a unity gain inverting amplifier and passes on the algebraic sum of the tachometer-generator signal and the tension differential signal to the output drive amplifier (AR6).

4-19. LOAD CELL AMPLIFIER/TENSION SET CIRCUIT (figure 4-3, sheet 3). Since signal voltages produced by the strain gage of the load cell are relatively small, ie, in the millivolts, a specially designed operational amplifier (AR5) is used to condition the signal. This amplifier is an instrumentation amplifier and has two main purposes: to provide electrical noise rejection and to provide precision voltage gain. In this application, the gain is approximately 296. Output from the load cell amplifier is applied to the next stage, a summing inverting amplifier. Here, the load cell signal is summed at an input summing junction with a calibrated voltage signal. This signal is produced when an operator positions the TENSION SET knob on the control console. Gain of the summing amplifier is adjustable and determined by the position of the MACHINE HI GEAR/LO GEAR switch. When this switch is in the HI GEAR position, relay K3 is energized and the feedback resistor R10 is switched into the circuit. When this resistor is switched into the circuit, the gain of the amplifier is -.8. When relay K3 is deenergized, R10 is switched out and R9 is switched in and the gain is changed to -1.

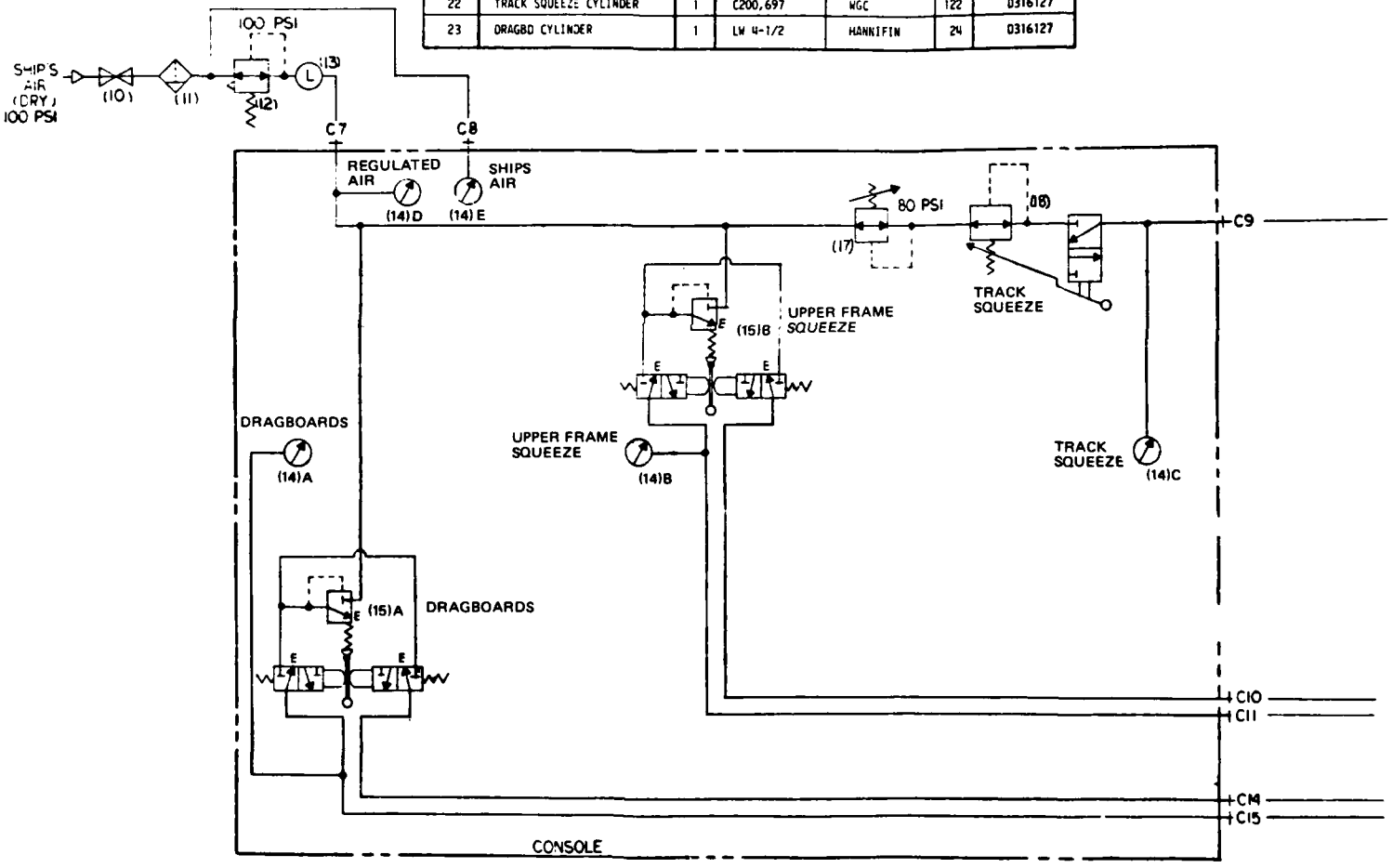
4-20. LOAD CELL-TENSION SET/TACHOMETER-GENERATOR SUMMING AMPLIFIER CIRCUIT (figure 4-3, sheet 3). The summing junction of the summing amplifier sums signals from four possible sources: tachometer-generator inhaul (TP4), load cell-tension set inhaul (TP7); tachometer-generator payout (TP2) and load cell-tension set payout (TP6). Direction of tensioner operation determines which pair of signals are summed. The amplifier is an adjustable gain inverting amplifier with a gain of 1 (R-2) and an offset adjustment (R-1). This adjustment is used to compensate for any leakage which may develop in the hydraulic system. Output from the amplifier is applied through the normally closed contacts of K1 to the output driver amplifier. When K1 is energized by the positioning of the TNSN/SPEED/BRAKE switch to the SPEED position, the automatic constant tension circuit is disconnected and a circuit which produces signals with the movement of the PAYOUT/HAUL IN lever is applied to the output driver amplifier instead.

4-21. OUTPUT DRIVER AMPLIFIER (figure 4-3, sheet 3). The output driver amplifier (AR6) is a power amplifier which is designed to provide the driver current to the servoactuator coil. By controlling the magnitude of servodrive current, the power amplifier controls the degree of servovalve opening and thereby the flow of hydraulic power to the DOHB hydraulic drive system. With input signals that swing from positive to negative 8 vdc, output current can vary up to $\pm$350 milliamperes. Feedback for the amplifier is through a 2,000 ohm

adjustable resistor (set at 875 ohms) and is developed across a 2 ohm, 2 watt resistor by the current flow after it has passed through the servoactuator coil. The voltage gain of this amplifier is .0875.

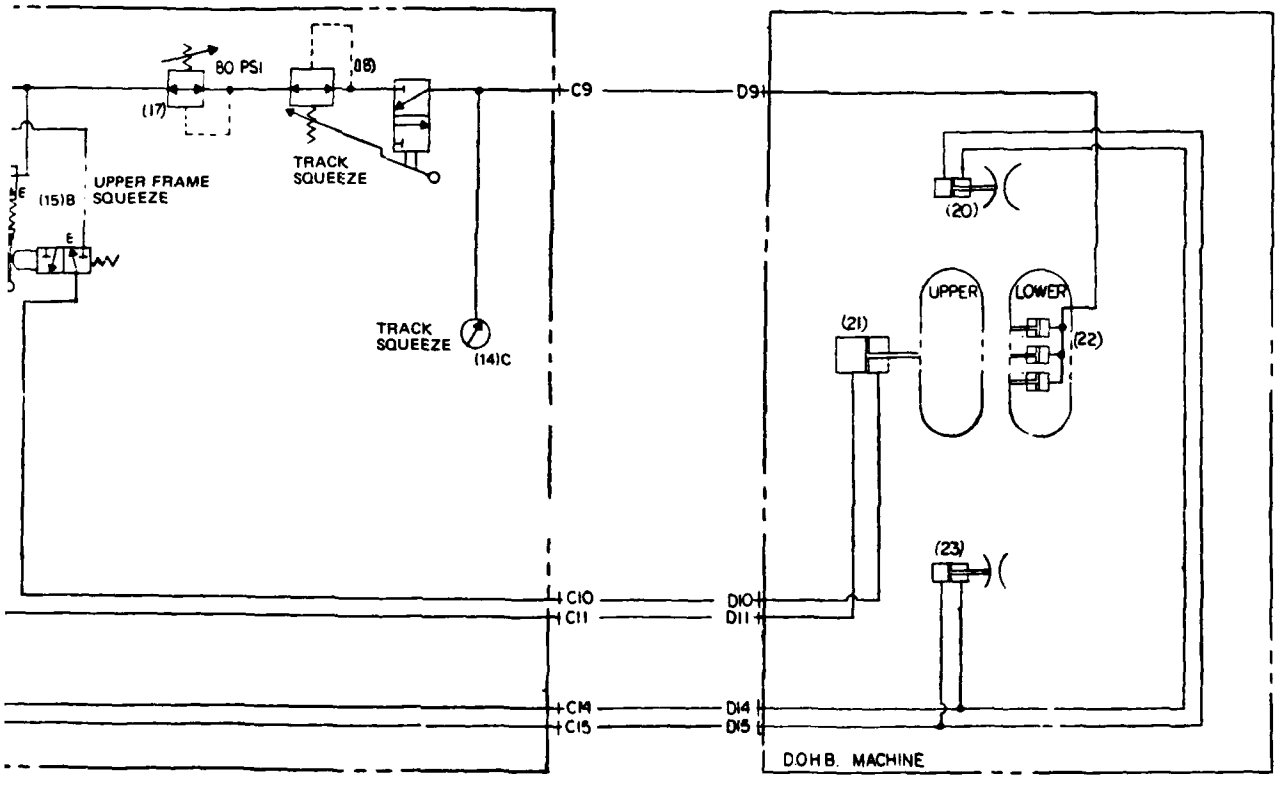
4-22. DEADBAND CIRCUIT (figure 4-3, sheet 3). The deadband circuit consists of two operational amplifiers, AR3A and AR3B, and two potentiometers, R7 and R8. At present these adjustments are turned to the fully counterclockwise position and make the deadband circuit functionally inoperative. However, the purpose of the deadband circuit is to provide a region of inactive tension differential signal response to prevent the cable laying machinery from hunting or oscillating around a tension setting. Each amplifier, AR3A and AR3B, is designed to respond to only one polarity of signal. To set the region of inactive signal response, a technician must adjust the screwdriver adjustments, R7 and R8, for a value of threshold voltage to be applied to each amplifier. When the threshold voltage is set, input tension differential signals must be of sufficient magnitude to overcome the threshold setting before the signal can be passed to the next stage.

ITEM NO.	NOMENCLATURE	QTY	PART OR DWG. NO.	NAME	F/N	USED ON
10	SHUT OFF VALVE	1	9259B-4PP	CIRCLE SEAL	1	D316203
11	FILTER	1	PF7502-11004	WABCO	1	D316203
12	REGULATOR	1	PR7564-31004	WABCO	1	D316203
13	LUBRICATOR	1	PG7602-24004	WABCO	1	D316203
14	GUAGE	5	J7754P	MARSH	37	D316131
15	CONTROLAIR VALVE MODEL HC-2-FX	2	P50976-0002	WABCO	14	D316131
17	REGULATOR	1	PR7564-31003	WABCO	11	D316131
18	CONTROLAIR VALVE MODEL H-2-FX	1	P50494-0002	WABCO	13	D316131
20	DRAGBD CYLINDER	1	LW 4-1/2	HANNIFIN	24	D316127
21	UPPER FRAME SQUEEZE CYLINDER	1	D200,537	WGC	98	D316127
22	TRACK SQUEEZE CYLINDER	1	C200,697	WGC	122	D316127
23	DRAGBD CYLINDER	1	LW 4-1/2	HANNIFIN	24	D316127



REFERENCE DRAWINGS:
1. WGC. DWG. NO. D316405 OUTLINE & GENERAL ARRANGEMENT NAUBUC
2. WGC. DWG. NO. D316371 HYDRAULIC SCHEMATIC NAUBUC

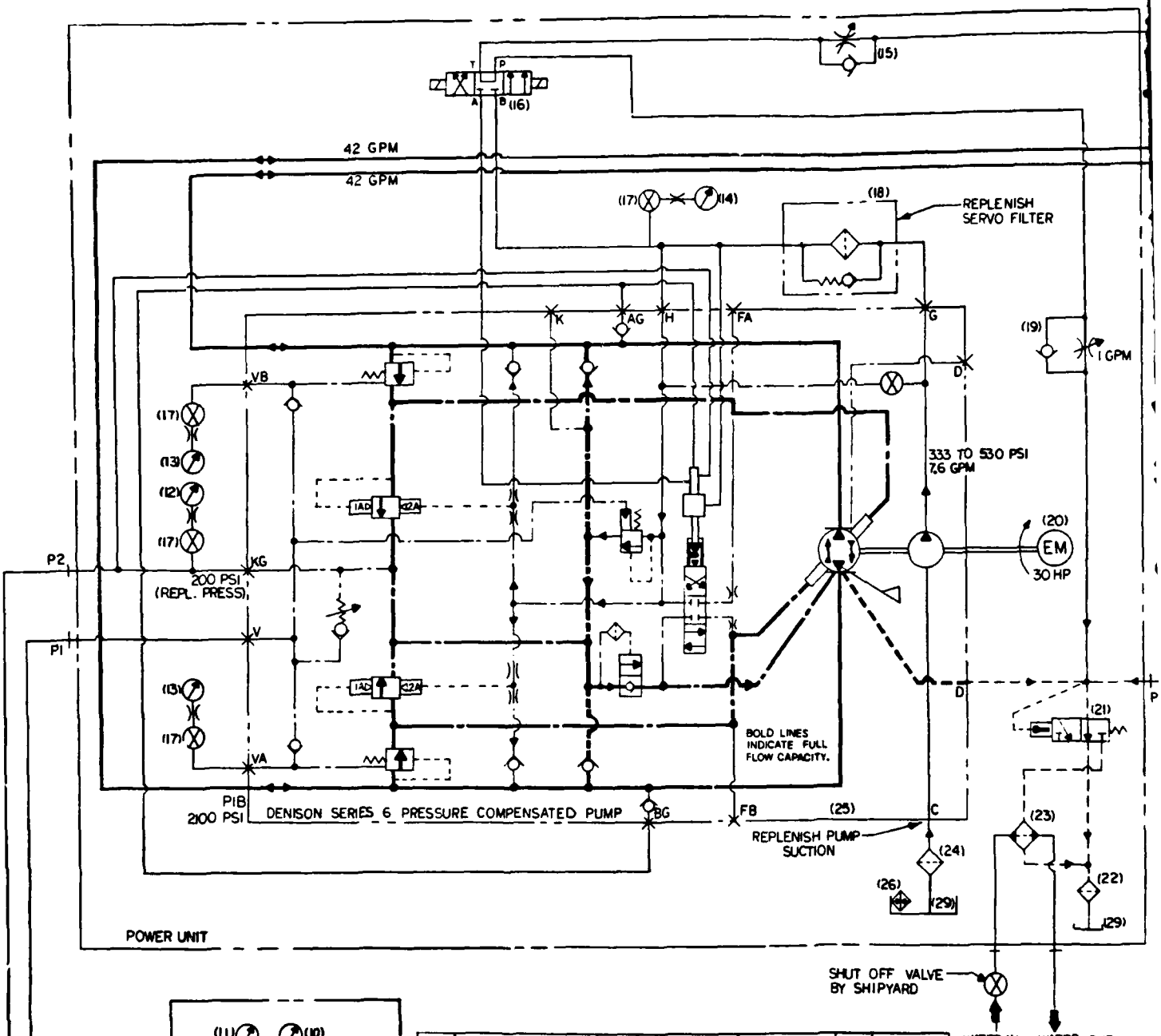
PART OR DWG. NO.	NAME	F/N	USED ON
92598-4PP	CIRCLE SEAL	1	D316203
PF7502-11004	WABCO	1	D316203
PR7564-31004	WABCO	1	D316203
PG7602-24004	WABCO	1	D316203
J7754P	MARSH	37	D316131
PS0976-0002	WABCO	14	D316131
PR7564-31003	WABCO	11	D316131
PS0494-0002	WABCO	13	D316131
LW 4-1/2	HANNIFIN	24	D316127
D200,537	WGC	98	D316127
C200,697	WGC	122	D316127
LW 4-1/2	HANNIFIN	24	D316127



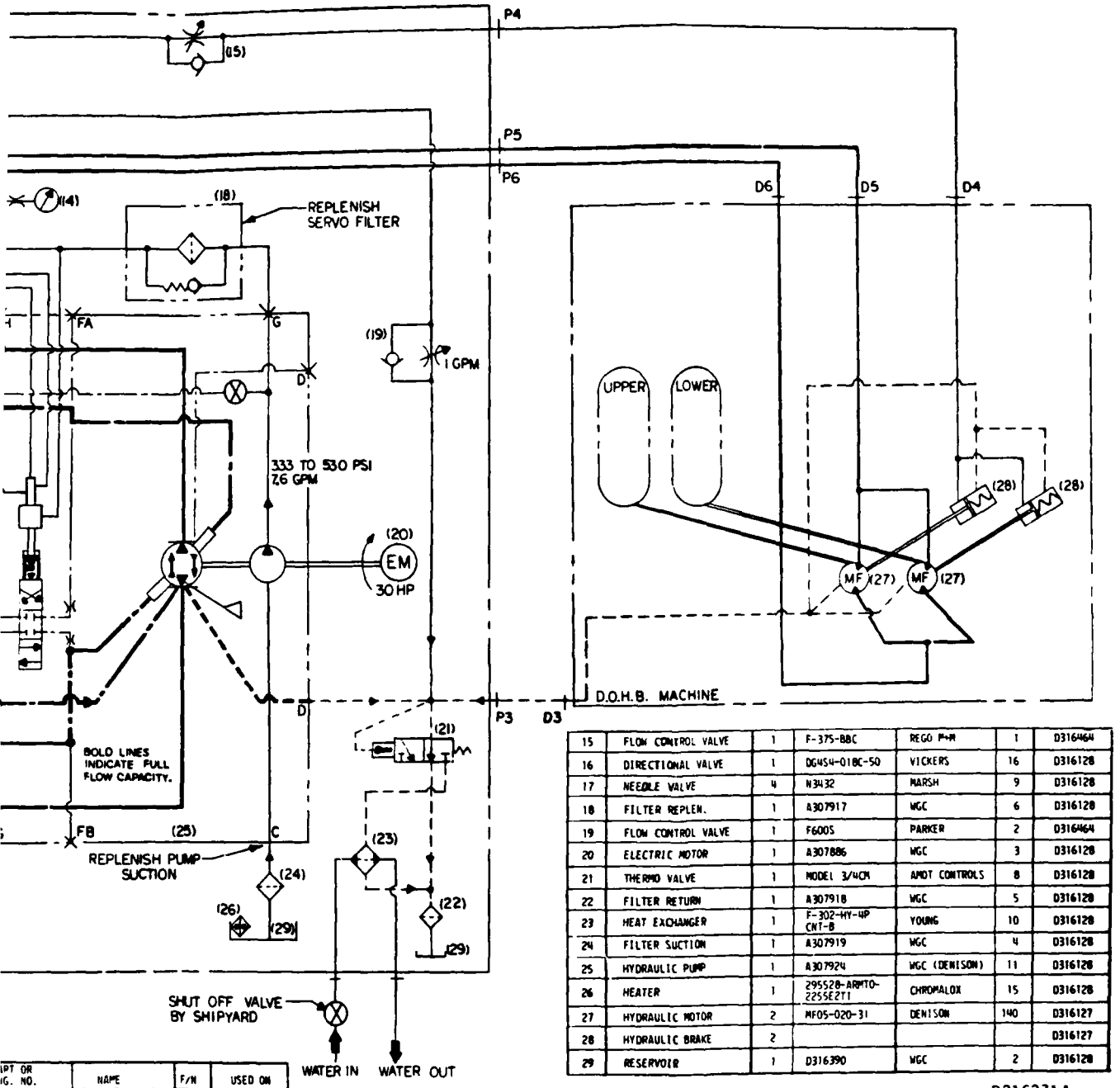
REFERENCE DRAWINGS:
1. WGC. DWG. NO. D316405 OUTLINE & GENERAL ARRANGEMENT NAUBUC
2. WGC. DWG. NO. D316371 HYDRAULIC SCHEMATIC NAUBUC

D316383

Figure 4-1. Pneumatic Schematic



ITEM NO.	NOMENCLATURE	QTY	PART OR DWG. NO.	NAME	F/N	USED ON
10	GUAGE 300 PSI	1	J7758P	MARSH	38	0316131
11	GUAGE 3000 PSI	1	J7778P	MARSH	39	0316131
12	GUAGE 300 PSI	1	J7758	MARSH	14	0316128
13	GUAGE 3000 PSI	2	J7178	MARSH	12	0316128
14	GUAGE 3000 PSI	1	J7572	MARSH	13	0316128

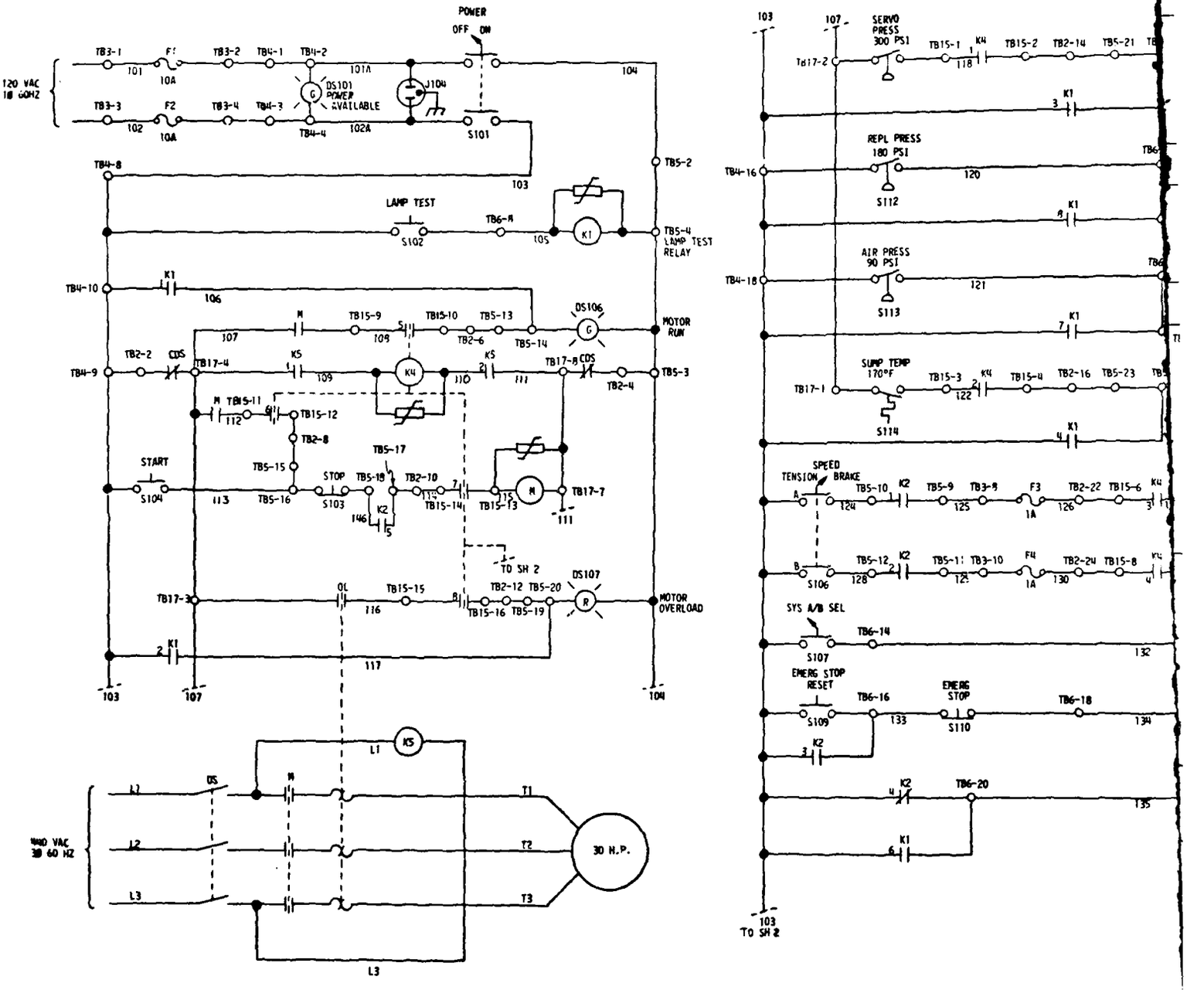


15	FLOW CONTROL VALVE	1	F-375-BBC	REGO P+R	1	D316464
16	DIRECTIONAL VALVE	1	DG4S4-018C-50	VICKERS	16	D316128
17	NEEDLE VALVE	4	N3432	MARSH	9	D316128
18	FILTER REPLEN.	1	A307917	WGC	6	D316128
19	FLOW CONTROL VALVE	1	F600S	PARKER	2	D316464
20	ELECTRIC MOTOR	1	A307886	WGC	3	D316128
21	THERMO VALVE	1	MODEL 3/4CM	AMOT CONTROLS	8	D316128
22	FILTER RETURN	1	A307918	WGC	5	D316128
23	HEAT EXCHANGER	1	F-302-HY-4P CNT-8	YOUNG	10	D316128
24	FILTER SUCTION	1	A307919	WGC	4	D316128
25	HYDRAULIC PUMP	1	A307924	WGC (DENISON)	11	D316128
26	HEATER	1	295528-ARMTO-2255E2T1	CHROMALOX	15	D316128
27	HYDRAULIC MOTOR	2	MF05-020-31	DENISON	140	D316127
28	HYDRAULIC BRAKE	2				D316127
29	RESERVOIR	1	D316390	WGC	2	D316128

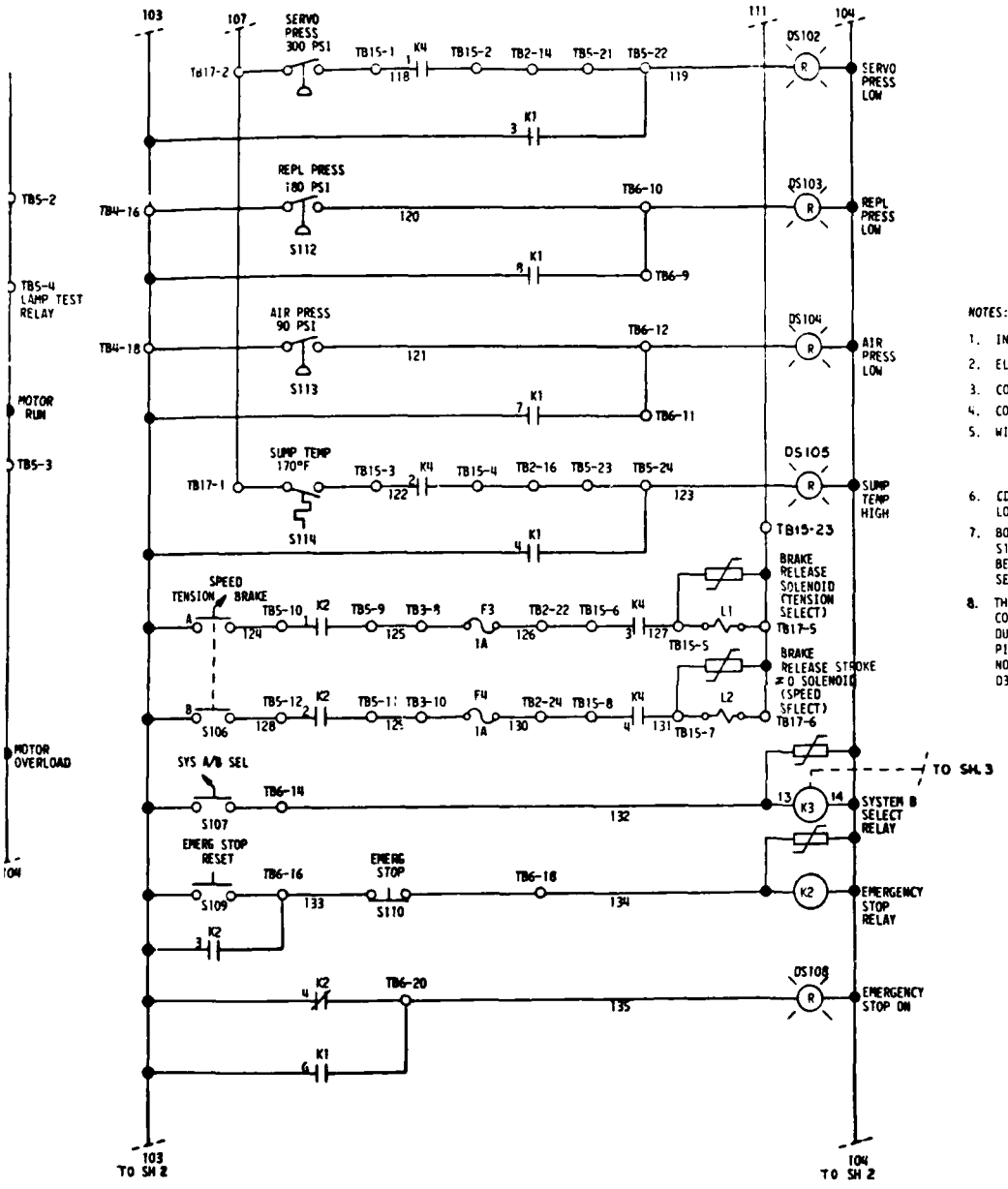
IPT OR IG. NO.	NAME	F/N	USED ON
6P	MARSH	38	D316131
7P	MARSH	39	D316131
8	MARSH	14	D316128
8	MARSH	12	D316128
2	MARSH	13	D316128

D316371A

Figure 4-2. Hydraulic Schematic



REV. STATUS			
SHT	1	2	3
REV	B	A	A



NOTES:

1. INTERCONNECT WIRE LIST A307881.
2. ELECT. GENERAL ARRANGEMENT D316125.
3. CONSOLE WIRING DIAGRAM D316130.
4. CONSOLE ASSEMBLY D316131.
5. WIRE NUMBER DESIGNATIONS:
   100 SERIES - AC SIGNALS
   200 SERIES - DC SIGNALS
6. CDS CONTACTS ARE DOOR SWITCH INTERLOCKS LOCATED ON POWER UNIT MOTOR CONTROLLER.
7. BOTH AC & DC CIRCUITS ARE CONNECTED TO S106. WHEN WIRING AND TROUBLESHOOTING, BE CAREFUL TO KEEP AC & DC CIRCUITS SEPARATED FROM EACH OTHER.
8. THIS SYSTEM'S ELECTRICAL INTERCONNECT HAS BEEN CONVERTED TO CABLES WITH QUICK DISCONNECT FITTINGS. DUE TO SPACE LIMITATIONS PLUG, RECEPTACLE, AND PIN NUMBER IDENTIFICATION FOR THESE FITTINGS IS NOT SHOWN ON THIS DRAWING. REFER TO WGC DWGS D316125 AND A307881 FOR THESE IDENTITIES.

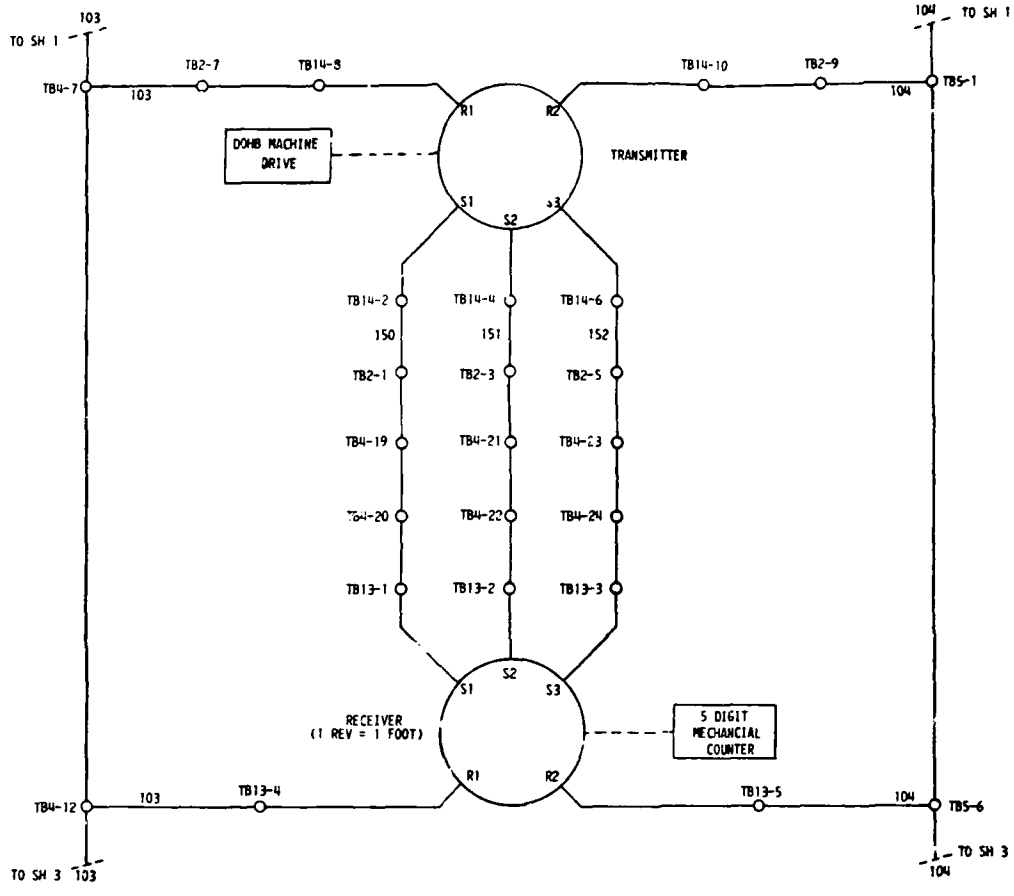
SEE NOTE 7

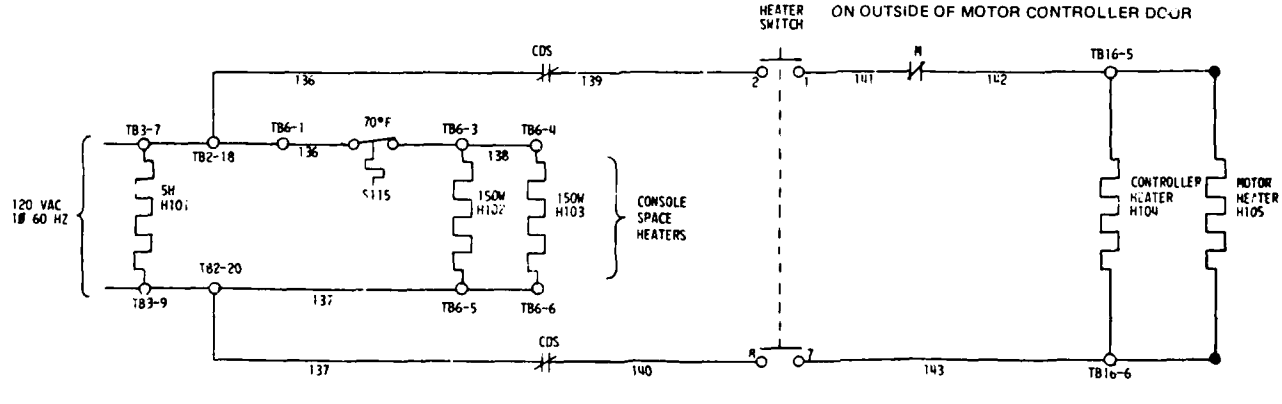
S106		
MODE	CONTACTS	
	A	B
TENSION	X	
SPEED		X
BRAKE		

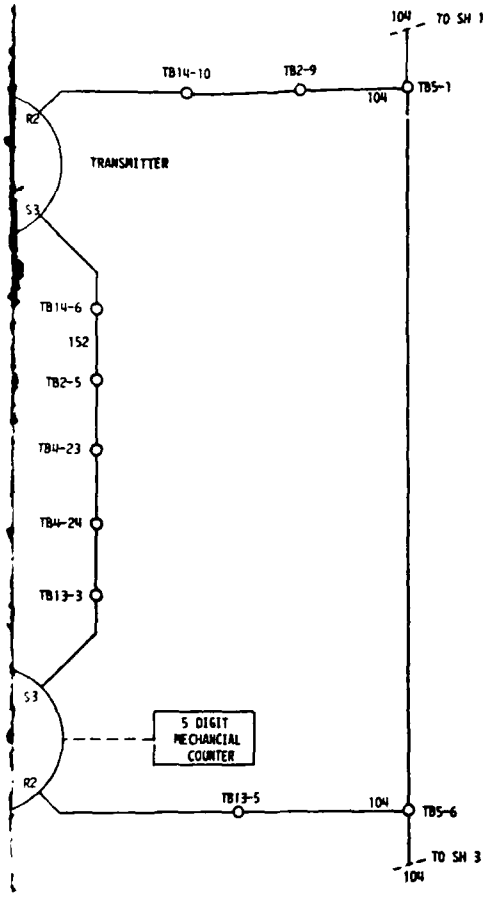
REV. STATUS			
SHT	1	2	3
REV	B	A	A

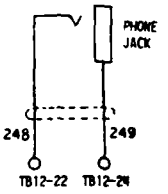
D316126B

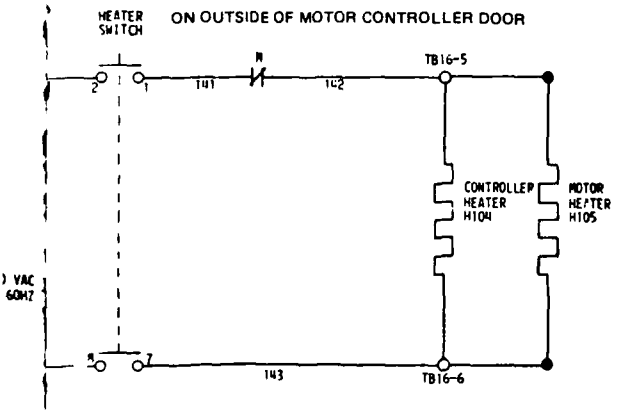
Figure 4-3. Electrical System Schematic (Sheet 1 of 3)


103
TO SH 1
TB4-7
TB2-7
TB14-8
103
R1
R2
DOHB MACHINE DRIVE
TRANSMITTER
S1
S2
S3
TB14-10
TB2-9
104
TO SH 1
TB5-1
TB14-2
TB14-4
TB14-6
150
151
152
TB2-1
TB2-3
TB2-5
TB4-19
TB4-21
TB4-23
TB4-20
TB4-22
TB4-24
TB13-1
TB13-2
TB13-3
S1
S2
S3
RECEIVER
(1 REV = 1 FOOT)
5 DIGIT MECHANCIAL COUNTER
R1
R2
TB4-12
103
TB13-4
TB13-5
104
TB5-6
TO SH 3
103
TO SH 3
104


HEATER SWITCH
ON OUTSIDE OF MOTOR CONTROLLER DOOR
CDS
136
139
2
1
141
142
TB16-5
TB3-7
TB2-18
TB6-1
136
70°F
TB6-3
TB6-4
138
120 VAC 1Ø 60 HZ
SH H101
S115
150W H102
150W H103
CONSOLE SPACE HEATERS
CONTROLLER HEATER H104
MOTOR HEATER H105
TB2-20
TB3-9
137
TB6-5
TB6-6
CDS
137
140
143
TB16-6







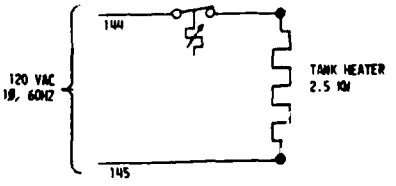


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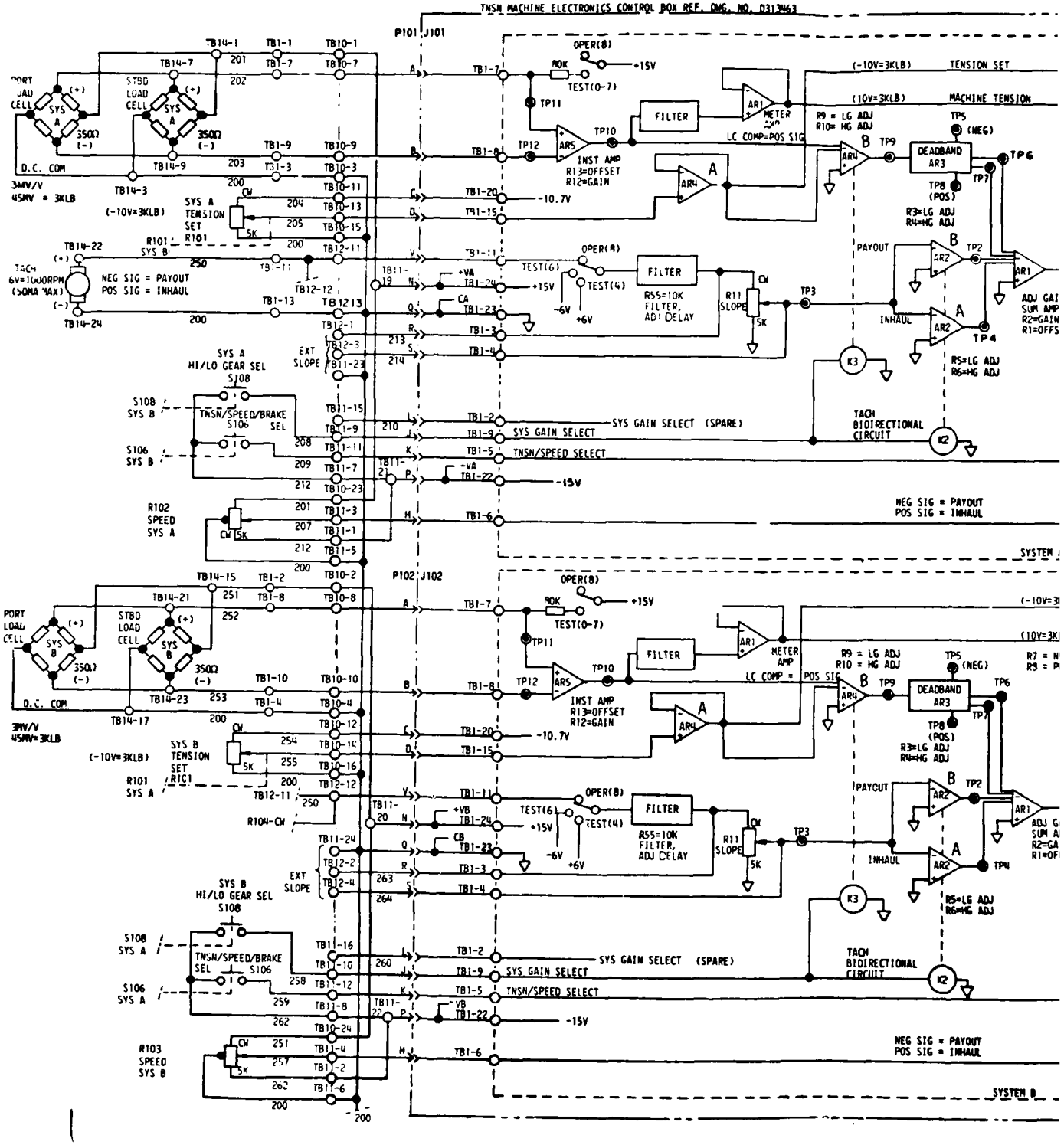
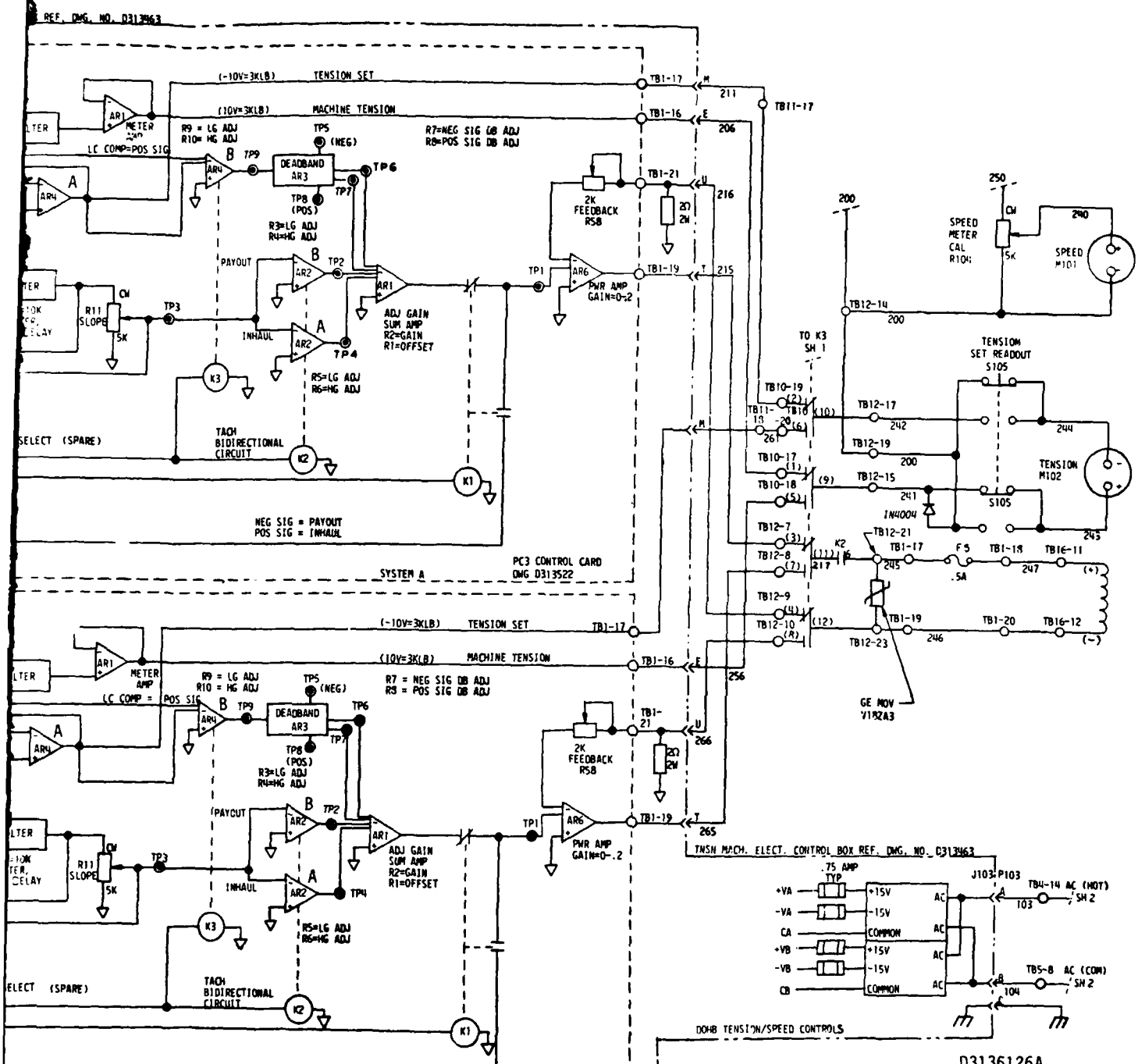
Figure 4-3. Electrical System Schematic (Sheet 2 of 3)


TNSN MACHINE ELECTRONICS CONTROL BOX REF. DWG. NO. 0313463
P101 J101
P102 J102
PORT LOAD CELL
STBD LOAD CELL
SYS A
SYS B
350Ω
D.C. COM
3MV/V
45MV = 3KLB
(-10V=3KLB)
SYS A TENSION SET R101
SYS B TENSION SET R101
R101 SYS A
R101 SYS B
TACH
6V=1000RPM (50MA MAX)
NEG SIG = PAYOUT
POS SIG = INHAUL
SYS A HI/LO GEAR SEL S108
SYS B HI/LO GEAR SEL S108
EXT SLOPE
S108 SYS A
S108 SYS B
TNSN/SPEED/BRAKE SEL S106
S106 SYS A
S106 SYS B
R102 SPEED SYS A
R103 SPEED SYS B
R104-CW
OPER(A)
OPER(B)
ROK
TEST(0-7)
TEST(6)
TEST(4)
+15V
-15V
+6V
-6V
+VA
-VA
+VB
-VB
CA
CB
-10.7V
FILTER
R55=10K FILTER, ADJ DELAY
R11 SLOPE
5K
CW
METER AMP
LC COMP=POS SIG
INST AMP
R13=OFFSET
R12=GAIN
R9 = LG ADJ
R10= HG ADJ
DEADBAND AR3
R3=LG ADJ
R4=HG ADJ
R5=LG ADJ
R6=HG ADJ
PAYOUT
INHAUL
ADJ GAIN
SUM AMP
R2=GAIN
R1=OFFS
TACH BIDIRECTIONAL CIRCUIT
K2
K3
SYS GAIN SELECT (SPARE)
SYS GAIN SELECT
TNSN/SPEED SELECT
(-10V=3KLB) TENSION SET
(10V=3KLB) MACHINE TENSION
(NEG)
(POS)
SYSTEM A
SYSTEM B



D3136126A

Figure 4-3. Electrical System Schematic (Sheet 3 of 3)

SECTION V

MAINTENANCE AND REPAIR

5-1. INTRODUCTION.

5-2. This section of the manual contains instructions for preventive and corrective maintenance of the Control Console components. Refer to the appendix at the back of the manual for maintenance procedures relating to vendor supplied components.

5-3. SAFETY PRECAUTIONS.

WARNING

Voltage in the control console is sufficient to cause death.

Bleed off hydraulic and pneumatic pressure before disconnecting any hydraulic and pneumatic lines.

1. Follow standard safety precautions when working on electrical, pneumatic, hydraulic, and mechanical components.

2. Before repairing electrical components, ensure that electrical power source is OFF and tagged. If absolutely necessary to have the power applied, use instruments rated for high voltage.

3. Tag the power units, motor controller, motor starter, and other equipment power sources DO NOT ENERGIZE when performing maintenance actions.

4. Ensure that the work area is safe and clear of unnecessary personnel and equipment.

5-4. PREVENTIVE MAINTENANCE.

5-5. Preventive maintenance consists of maintaining the equipment in clean, ready-to-operate condition. A good preventive maintenance program can reduce the frequency of unscheduled repairs and down time caused by equipment failure. Therefore, to ensure trouble-free service of the control console, a scheduled maintenance procedure SHALL be followed. Thus potential malfunctions and defective parts can be found before they cause trouble and/or equipment breakdown.

5-6. CLEANING. Periodically open the control console enclosure and inspect for mechanical and electrical integrity. If dust, lint, or other foreign matter is present, deenergize the equipment and remove the foreign matter. Use a vacuum cleaner if available.

5-7. LUBRICATION. Refer to DOHB Tension Machine manual, section V for lubrication chart.

5-8. PRINTED CIRCUIT (PC) CARD HANDLING PROCEDURES. When handling PC cards, the following procedures SHALL be observed.

1. Never remove or install a PC card when power is applied to the control console.

2. When removing or installing cards, handle each by the edge of the card only.

3. Never touch card contacts or pins with the bare hands. Perspiration from the skin can cause galvanic action to be introduced and lead to noisy or faulty operation.

5-9. CORRECTIVE MAINTENANCE.

5-10. FIELD REPAIR. Field repair to the hydraulic, pneumatic, electrical, and electronic components of the control console should be limited to replacement of gages, pneumatic control valves, electrical switches, circuit breakers, power supplies, PC cards, and other hardware components listed in section VI. Maintenance procedures for the care of vendor supplied components is contained in the appendix at the back of the manual. When handling PC cards, observe the procedure given in paragraph 5-8.

SECTION VI

PARTS LISTS

6-1. INTRODUCTION.

6-2. This section contains assembly drawings and parts lists for the major components of the equipment covered by this manual.

6-3. ASSEMBLY DRAWINGS.

6-4. The assembly drawings are annotated with callout numbers which are keyed to the item number column of the parts lists. The callout numbers facilitate locating and identifying individual parts for each major component.

6-5. PARTS LISTS.

6-6. The parts lists are divided into columns as follows:

1. ITEM NUMBER. Lists in numerical order, the callout or find number for individual items of each major component.

2. DESCRIPTION. Contains a descriptive title or phrase for each item assigned a find number.

3. QUANTITY. Lists the number of items per major component.

4. PART NUMBER (P/N). Lists the manufacturer's number for the item.

5. VENDOR CODE. Lists the name of the manufacturer for the item. If the abbreviation COML appears in this column, it means that the item is a common commercially available item.

6. REMARKS. Lists pertinent information not contained in other columns.

6-7. HOW TO ORDER PARTS.

6-8. Western Gear Corporation recognizes the need for expeditious service and endeavors to provide the best service possible in filling your order. To avoid error and possible delay in the delivery of parts, it is important that we receive complete and accurate identification of the part(s) ordered.

6-9. Parts may be ordered by mail, telephone, or telex. An order form is provided for ordering parts by mail. If the order is placed by telephone or telex, use the order form as a guide to help ensure that adequate information is provided. When possible, mail a completed order form as a followup for orders placed by telephone or telex.

6-10. The following instructions for completing the order form are keyed to the numbered blocks in the sample Customer Parts Order form. Copies of the Customer Parts Order form are provided immediately following the sample.

1.	ORDERED BY:	Name, title, and phone number of individual placing the order. This must be legible.
2.	DATE:	Date the order is written.
3.	FROM:	Name and address of ordering firm.
4.	P.O. NO.:	Your purchase order number.
5.	SHIP TO:	Give complete address for shipment of parts.
6.	SHIP VIA:	Specify preferred method of shipment; i.e., air freight, UPS, most economical method, etc.
7.	EQUIPMENT NOMENCLATURE:	Provide complete nomenclature of the basic equipment as provided on the title page (first page inside the front cover) of the manual. (Include model number, type number, part number, etc., if given.)
8.	MANUAL NO.:	The manual number is shown in the lower left corner of the title page and the date is shown in the lower right corner.
9.	MANUAL CHANGE NO. AND DATE:	Change number and change date are shown in the lower right corner of the title page.
10.	FIG. NO.:	Enter the number of the figure that illustrates the part.
11.	PAGE NO.:	Enter the page number of the table that lists the part.
12.	ITEM NO.:	Enter the item number for the part from the FIND NO. column.
13.	DESCRIPTION:	Enter the complete description as shown in the NOMENCLATURE column of the parts list table.
14.	PART NO.:	Enter the part number as shown in the PART NO. or DWG. NO. column.

15. VENDOR CODE: Enter either the five-digit number if shown in the CODE IDENT. column or the manufacturer's name as shown in the NAME column.

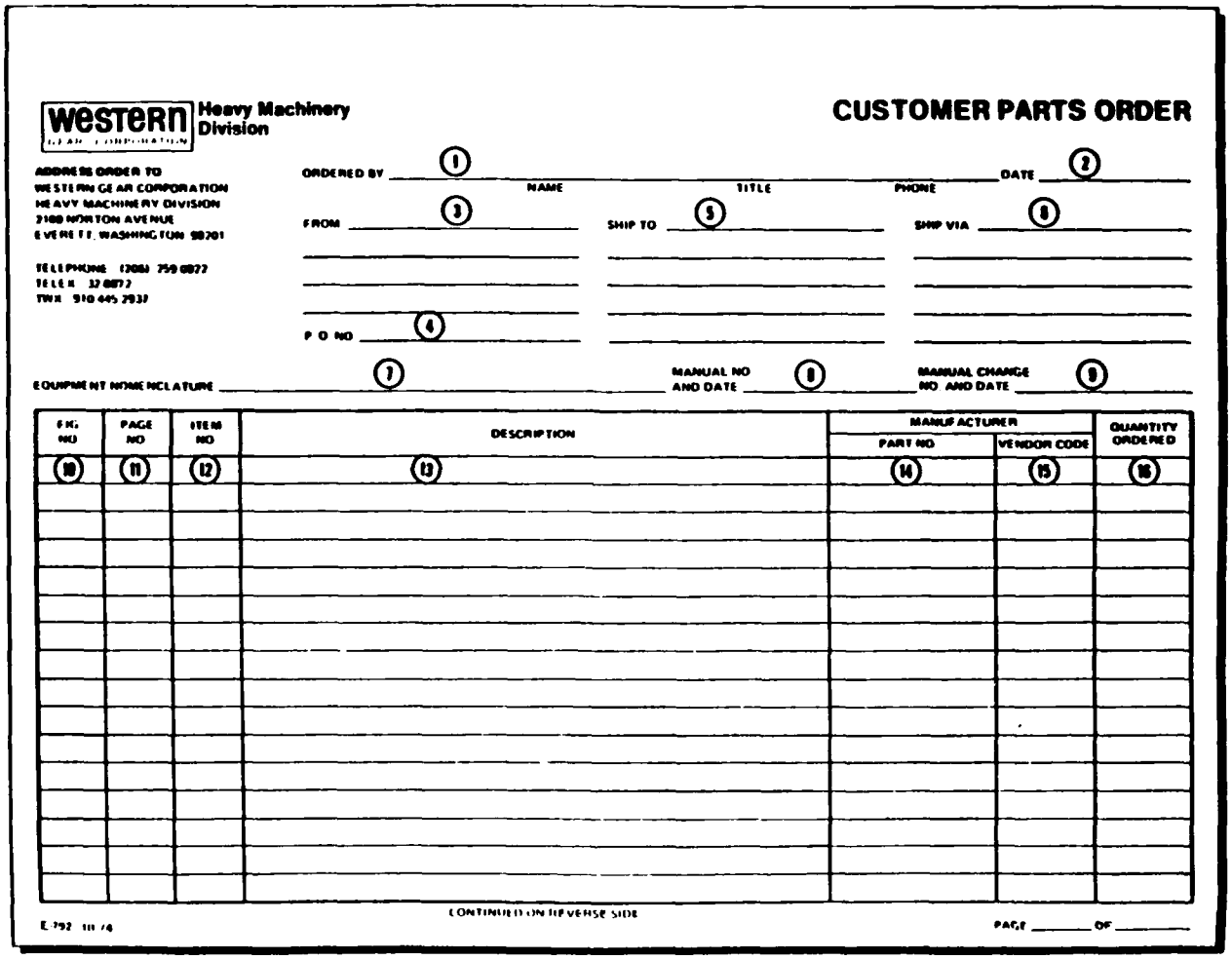
16. QUANTITY ORDERED: Enter the total quantity ordered.

NOTE

For those items listed under vendor data (located in the appendix) provide as complete an identification of the item as possible using the above procedures.

NOTE

All nuts, bolts, lockwashers, and capscrews (except stainless) must be cadmium or zinc plated.



western Heavy Machinery Division

CUSTOMER PARTS ORDER

ADDRESS ORDER TO
WESTERN GEAR CORPORATION
HEAVY MACHINERY DIVISION
3100 NORTON AVENUE
EVERETT, WASHINGTON 98201

TELEPHONE (206) 259 8822
TELEX 32 8872
TWX 910 445 2937

ORDERED BY (1) _____ NAME _____ TITLE _____ PHONE _____ DATE (2) _____

FROM (3) _____ SHIP TO (5) _____ SHIP VIA (6) _____

P O NO (4) _____

EQUIPMENT NOMENCLATURE (7) _____ MANUAL NO AND DATE (8) _____ MANUAL CHANGE NO AND DATE (9) _____

ENG NO	PAGE NO	ITEM NO	DESCRIPTION	MANUFACTURER PART NO	MANUFACTURER VENDOR CODE	QUANTITY ORDERED
(10)	(11)	(12)	(13)	(14)	(15)	(16)

E 792 10 74

CONTINUED ON REVERSE SIDE

PAGE _____ OF _____

Western Gear Machinery Co.
A Subsidiary of Western Gear Corporation

CUSTOMER PARTS ORDER

ADDRESS ORDER TO:

WESTERN GEAR MACHINERY CO.
2100 NORTON AVENUE
EVERETT, WASHINGTON 98201

TELEPHONE: (206) 259-0922
TELEX: 32-8872
TWX: 910-445-2937

ORDERED BY _____ (NAME) _____ (TITLE) _____ (PHONE) DATE _____

FROM: _____

SHIP TO: _____

SHIP VIA: _____

P. O. NO. _____

EQUIPMENT NOMENCLATURE _____

MANUAL NO. AND DATE _____

MANUAL CHANGE NO. AND DATE _____

FIG. NO.	PAGE NO.	ITEM NO.	DESCRIPTION	MANUFACTURER		QUANTITY ORDERED
				PART NO.	VENDOR CODE	

CONTINUED ON REVERSE SIDE

CUSTOMER PARTS ORDER
(Continued)

CONTINUED FROM REVERSE SIDE

FIG. NO.	PAGE NO.	ITEM NO.	DESCRIPTION	MANUFACTURER		QUANTITY ORDERED
				PART NO.	VENDOR CODE	

western GEAR CORPORATION **Western Gear Machinery Co.**
A Subsidiary of Western Gear Corporation

CUSTOMER PARTS ORDER

ADDRESS ORDER TO:

WESTERN GEAR MACHINERY CO.
2100 NORTON AVENUE
EVERETT, WASHINGTON 98201

TELEPHONE: (206) 259-0922
TELEX: 32-8872
TWX: 910-445-2937

ORDERED BY _____ DATE _____
NAME TITLE PHONE

FROM: _____ SHIP TO _____ SHIP VIA: _____

P. O. NO. _____

EQUIPMENT NOMENCLATURE _____ MANUAL NO. AND DATE _____ MANUAL CHANGE NO. AND DATE _____

FIG. NO.	PAGE NO.	ITEM NO.	DESCRIPTION	MANUFACTURER		QUANTITY ORDERED
				PART NO.	VENDOR CODE	

E792/10-74 (Revised 3-82)

CONTINUED ON REVERSE SIDE

PAGE _____ OF _____

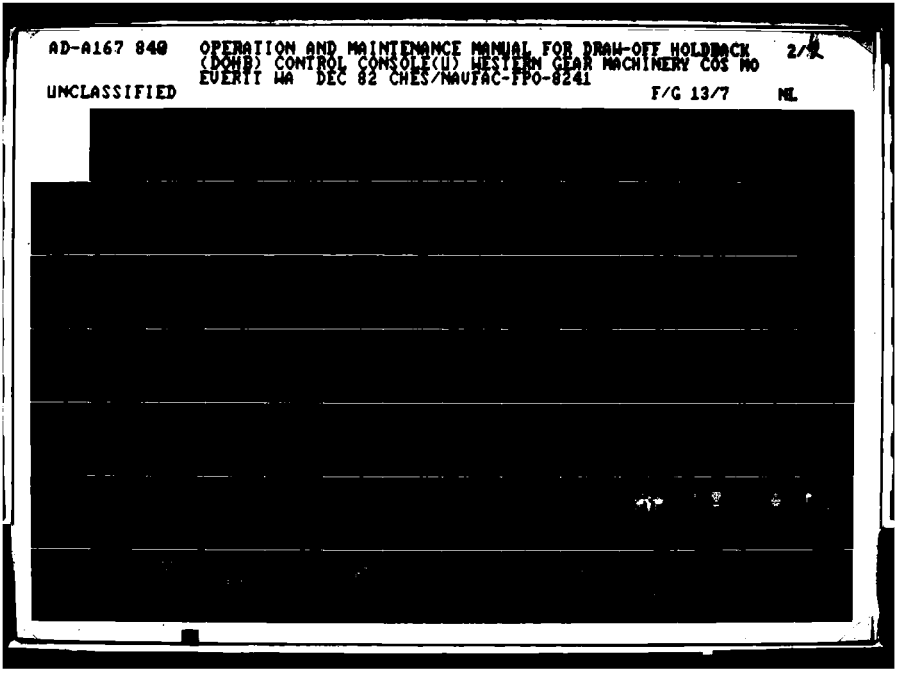
CUSTOMER PARTS ORDER
(Continued)

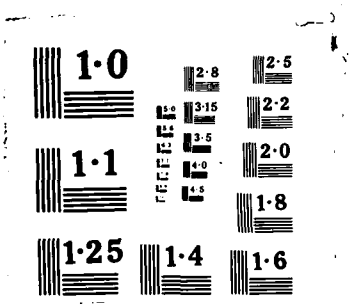
CONTINUED FROM REVERSE SIDE

FIG. NO	PAGE NO.	ITEM NO	DESCRIPTION	MANUFACTURER		QUANTITY ORDERED
				PART NO.	VENDOR CODE	

AD-A167 840 OPERATION AND MAINTENANCE MANUAL FOR DRAW-OFF HOLDBACK (DOHB) CONTROL CONSOLE(U) WESTERN GEAR MACHINERY CO5 WO EVERIT WA DEC 82 CHES/NAVFAC-FPO-8241 2/2

UNCLASSIFIED F/G 13/7 NL




1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
1·4
2·5
2·2
2·0
1·8
1·6

Western Gear Machinery Co.
A Subsidiary of Western Gear Corporation

CUSTOMER PARTS ORDER

ORDERED BY _____ (NAME) _____ (TITLE) _____ (PHONE) DATE _____

ADDRESS ORDER TO:

WESTERN GEAR MACHINERY CO.
2100 NORTON AVENUE
EVERETT, WASHINGTON 98201

TELEPHONE: (206) 259-0922
TELEX: 32-8872
TWX: 910-445-2937

FROM: _____

SHIP TO: _____

SHIP VIA: _____

P. O. NO. _____

EQUIPMENT NOMENCLATURE _____ MANUAL NO. AND DATE _____ MANUAL CHANGE NO. AND DATE _____

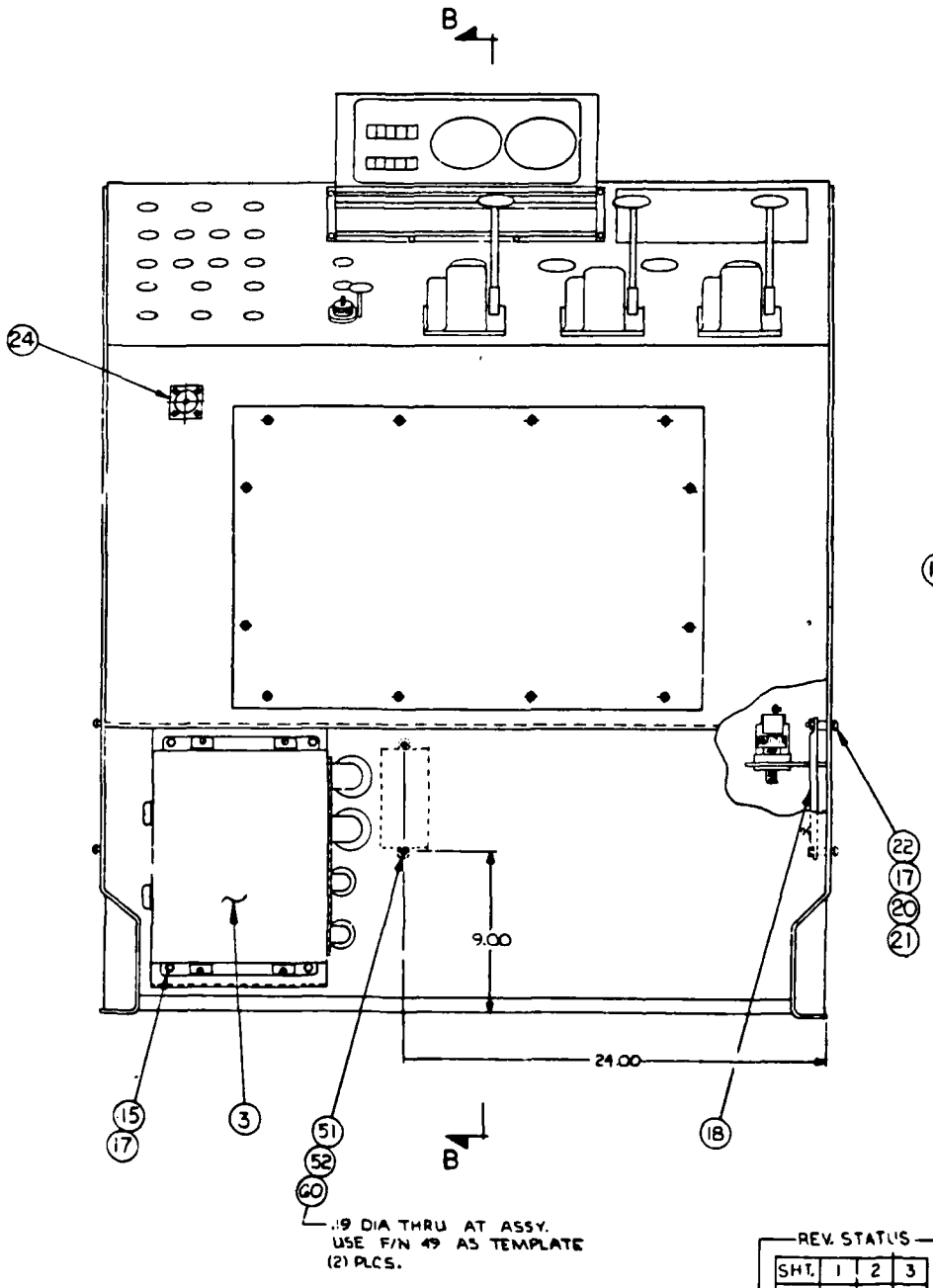
FIG. NO.	PAGE NO.	ITEM NO.	DESCRIPTION	MANUFACTURER		QUANTITY ORDERED
				PART NO.	VENDOR CODE	

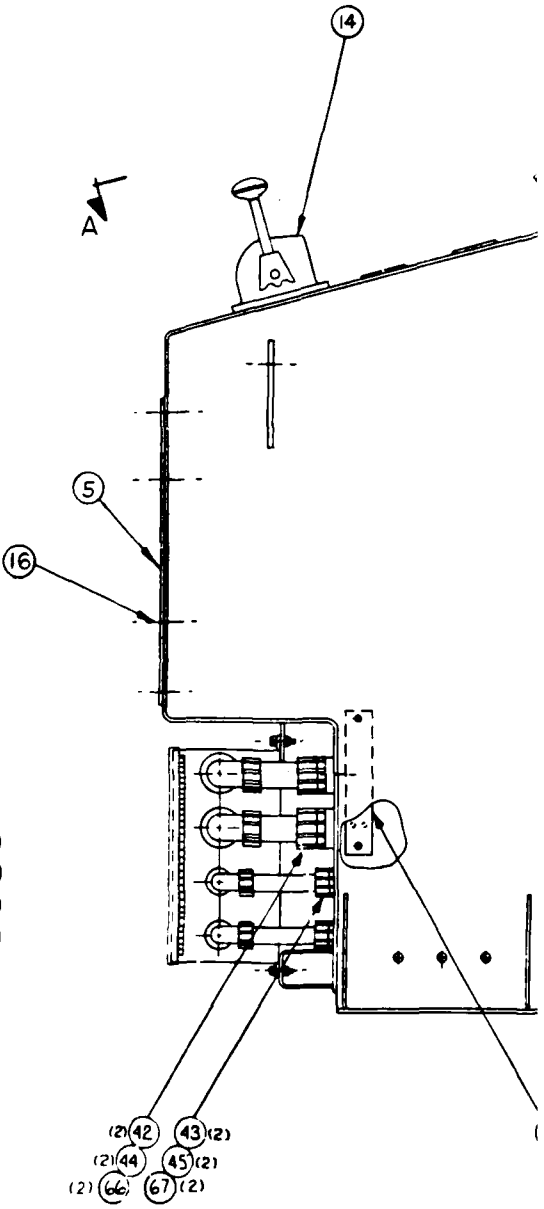
CONTINUED ON REVERSE SIDE

CUSTOMER PARTS ORDER
(Continued)

CONTINUED FROM REVERSE SIDE

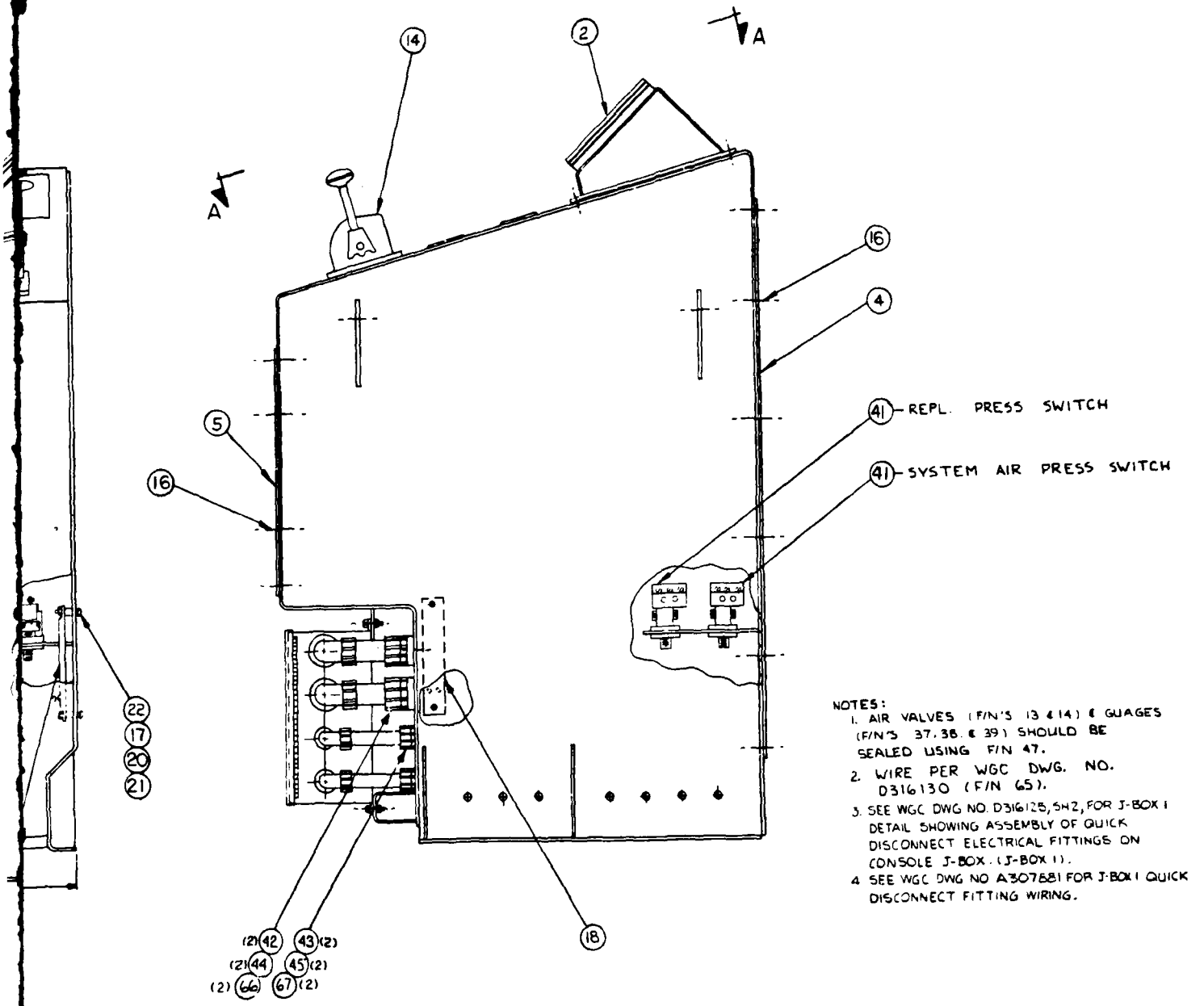
FIG. NO.	PAGE NO.	ITEM NO.	DESCRIPTION	MANUFACTURER		QUANTITY ORDERED
				PART NO.	VENDOR CODE	





REV. STATUS

SHT.	1	2	3
REV	B	A	A



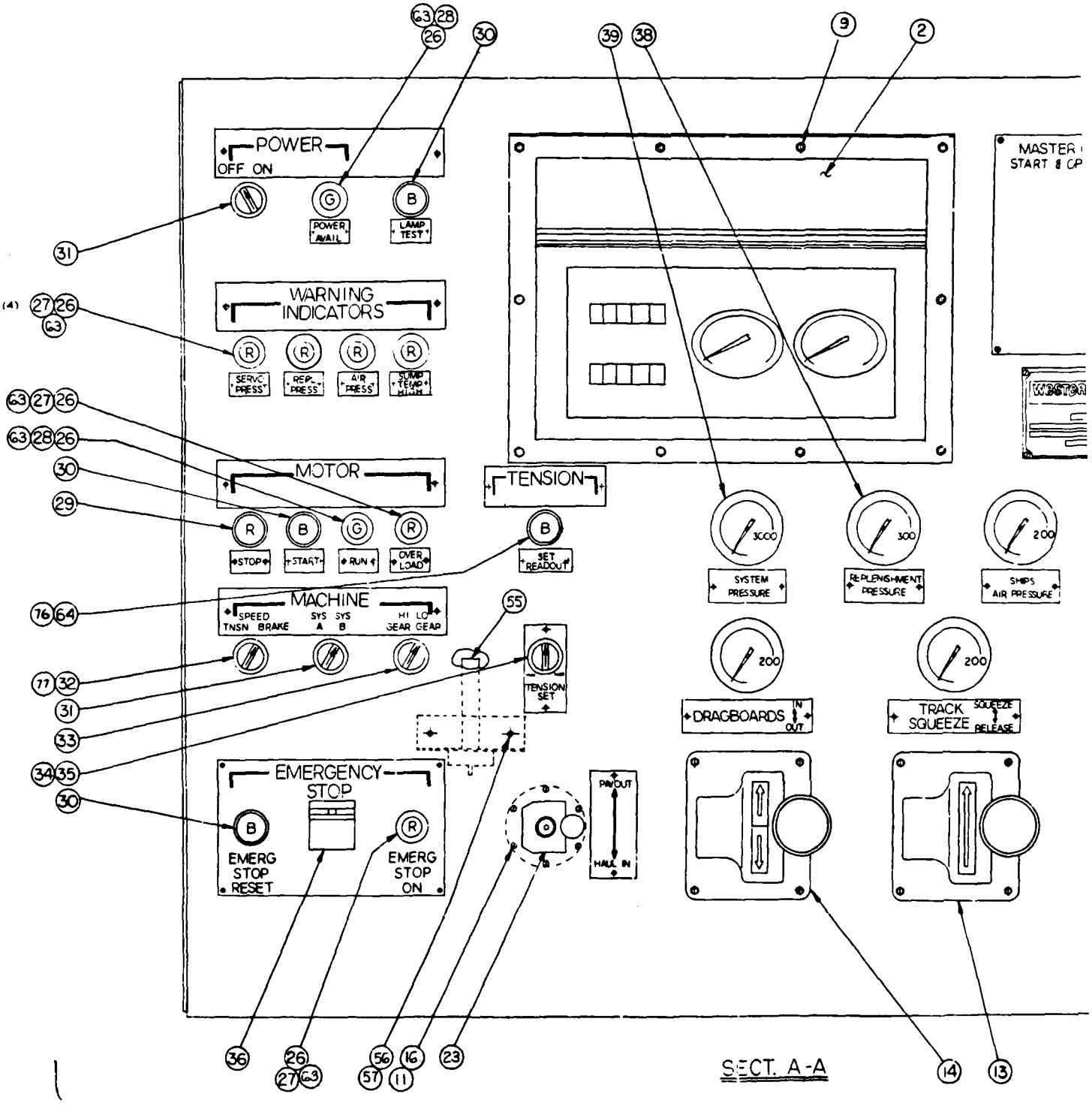
NOTES:
1. AIR VALVES (F/N'S 13 & 14) & GUAGES (F/N'S 37, 38, & 39) SHOULD BE SEALED USING F/N 47.
2. WIRE PER WGC DWG. NO. D316130 (F/N 65).
3. SEE WGC DWG NO. D316128, SH2, FOR J-BOX 1 DETAIL SHOWING ASSEMBLY OF QUICK DISCONNECT ELECTRICAL FITTINGS ON CONSOLE J-BOX. (J-BOX 1).
4. SEE WGC DWG NO A307881 FOR J-BOX 1 QUICK DISCONNECT FITTING WIRING.

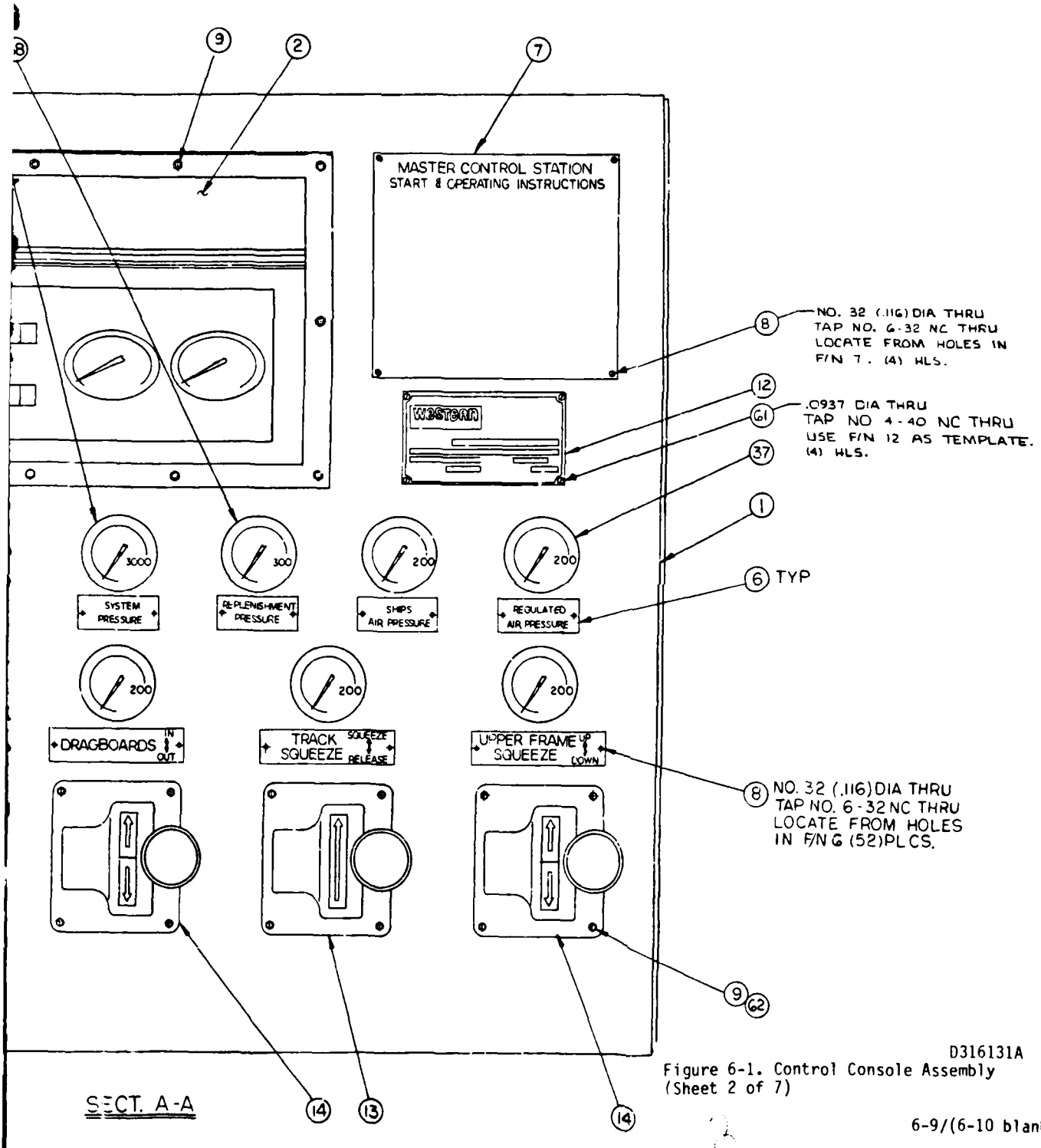
REV. STATUS

SHT.	1	2	3
REV	B	A	A

D316131B

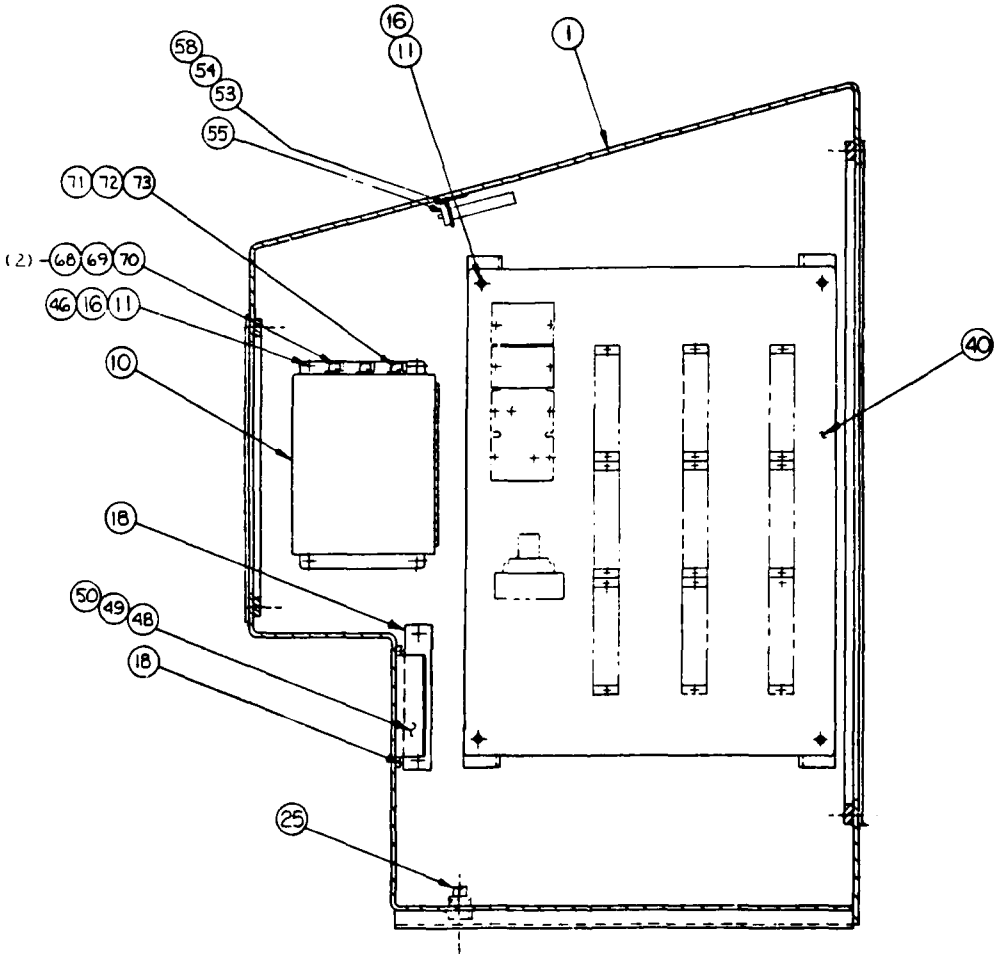
Figure 6-1. Control Console Assembly (Sheet 1 of 7)


POWER
OFF ON
POWER AVAIL
LAMP TEST
WARNING INDICATORS
SERVC PRESS
REP PRESS
AIR PRESS
SUMP TEMP
MOTOR
STOP
START
RUN
OVER LOAD
TENSION
SET READOUT
MACHINE
SPEED TNSN BRAKE
SYS A
SYS B
HI LO GEAR GEAR
TENSION SET
EMERGENCY STOP
EMERG STOP RESET
EMERG STOP ON
SYSTEM PRESSURE
REPLENISHMENT PRESSURE
SHIPS AIR PRESSURE
DRAGBOARDS IN OUT
TRACK SQUEEZE SQUEEZE RELEASE
PAYOUT
HAUL IN
MASTER
START & OP
SECT. A-A



D316131A

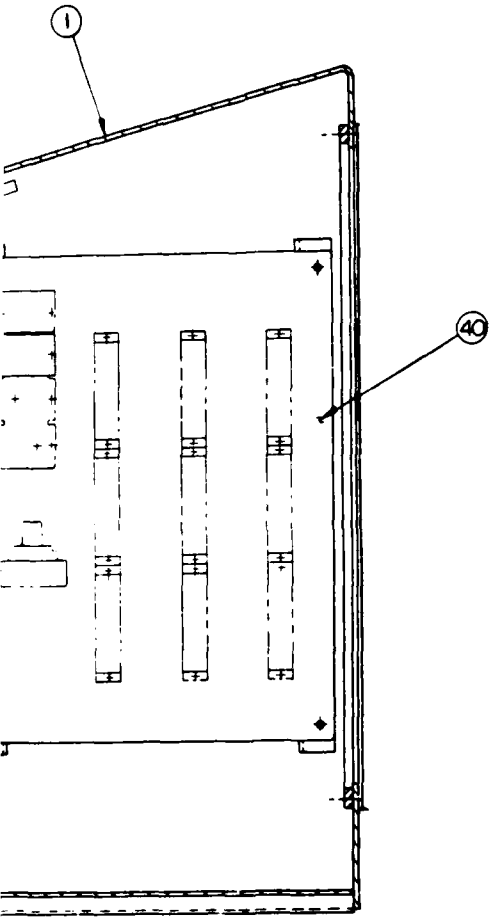
Figure 6-1. Control Console Assembly
(Sheet 2 of 7)



SECT. B-B

FROM SHT 1.
F/NS 2 & 3 DELETED

Figure 6-1. Contr
(Sheet 3 of 7)

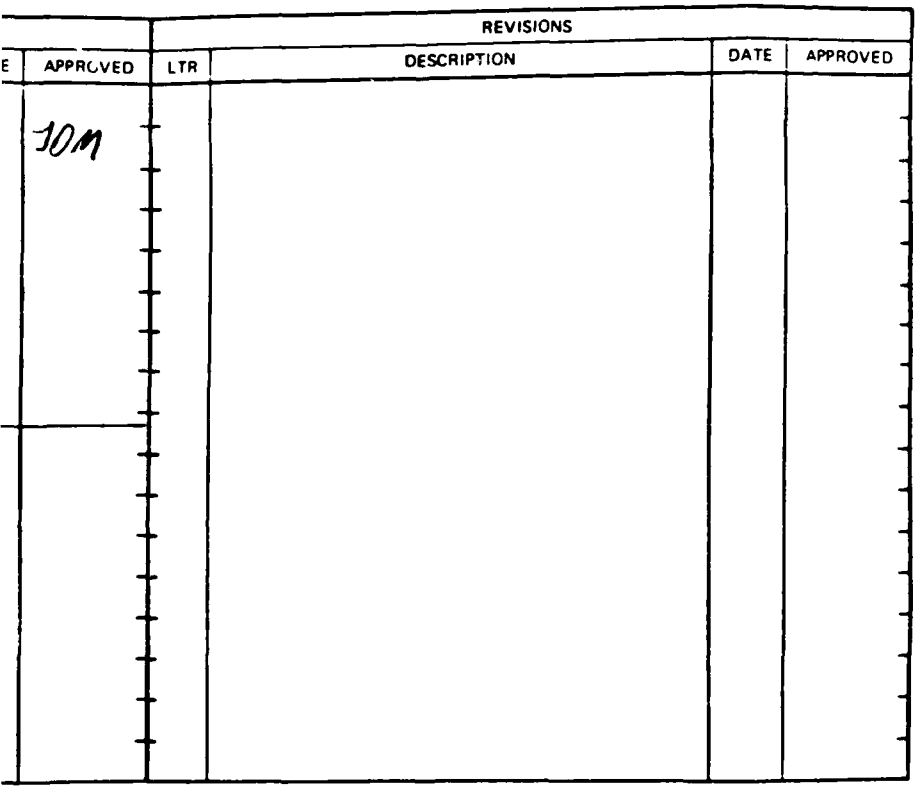


SECT. B-B
FROM SHT 1.
PNS 2 & 3 DELETED

D316131A

Figure 6-1. Control Console Assembly
(Sheet 3 of 7)

REVISIONS				REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED	LTR	DESCRIPTION	DATE	AP
A	SH. 1 : REVISED REV. STATUS. SH. 2 : F/N 18, P/N WAS PT-512. F/N 26, P/N WAS 3202-05-103. SH. 3 : F/N 30, QTY WAS (3). F/N 32, P/N WAS 800H-HRE2B. F/N 45, P/N WAS M19622/19-0005. F/N 53, P/N WAS 116165. F/N 54, P/N WAS 108973. SH. 4 : F/N 64, QTY WAS (4), P/N WAS 800T-XAR. ADDED F/N'S 66 THRU 77.	1-14-81	JDM				



D316131A

Figure 6-1. Control Console Assembly
(Sheet 4 of 7)

FIND NO.	ZONE	NOMENCLATURE	QTY.	CODE IDENT.	MANUFACTURER		MATL	MATL SPEC	REQ'D CERTS							ALTERNATE SPEC FOR GOVT REFERENCE
					PART OR DWG NO.	NAME			C	P	H	C/C	N/D	N		
1		CONTROL CONSOLE FAB	1		D316244	WGC										
2		ENCLOEURE ASSY	1		D316211											
3		JUNCTION BOX ASSY	1		C312861											
4		COVER	1		C312924											
5		COVER	1		C312920											
6		NAME PLATES CONTROL CONSOLE ASSY	1		A307941											
7		NAME ALATE MASTER CONTROL STA	1		C312969											
8		SCR MACH PAN HD # 6-32 X.25	58		116276											
9		SCR MACH DAN HD .31-18 X.88	22													
10		DOHB TENSION/ SPEED CONTROL ASSY.	1		D313463											
11		HEX NUT STD. .38-16	14		105257											
12		WGC NAME PLATE	1		C311904											
13		CONTROL AIR VALVE MODEL H-2-EX	1		P50494-0002	WABCO										
14		CONTROL AIR VALVE MODEL HC-2-EX	2		P50176-0002	WABCO										
15		SCR MACH PAN HD .25-20 X.67 LG	4		116340	WGC										
16		SCR MACH PAN HD 38-16 x .75 LG.	46		128982	WGC										
17		HEX NUT STD .25-20 NC	8		105255	WGC										
18		HEATER 150W, 115V	2		CI8157	HOTWATT										
20		SPACER	4		A306275	WGC										
21		NYLON ROLLED WASHER	4		25 W	NYLTITE										
22		PAN HD MACH SCR .25-20 X1.50 LG.	4			WGC										
23		CONTROL QUADRANT ASSY.	1		D315221	WGC										
24		TELEPHONE JACK	1		702003-453	STROMBERG CARLSON										
25		PIPE PLUG SQ HD (.38-SHP-B PARKER)	1		111381	WGC										
26		LAMP BASE	8		103-3202-05-103	DIALCO										
27		LENS (RED)	6		103-1331-403	DIALCO										

	MATL	MATL SPEC	REQ'D CERTS C	P	H	C/C	N/D	N		ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	REMARKS	MATL CLASS			
											315					
											40					
											35					
											53					
											18					
											6					
											18					
T																
G																

SIZE	CODE IDENT NO.		REV
B	16603	PL D316131	A
SCALE	WT — LB	SHEET 2 of 4	

D316131A

Figure 6-1. Control Console Assembly (Sheet 5 of 7)

FIND NO.	ZONE	NOMENCLATURE	QTY.	CODE IDENT.	MANUFACTURER		MATL	MATL SPEC	REQ'D CERTS						
					PART OR DWG NO.	NAME			C	P	M	C/C	N/D	N	
28		LENS (GRN)	2		103-1332-403	DIALCO									
29		PUSH BUTTON (RED)	1		800H-R6A4	ALLEN BRADLEY									
30		PUSH BUTTON (BLK)	3		800H-R2A2	ALLEN BRADLEY									
31		2 POS SEL SW (BLK)	2		800H-HR2B	ALLEN BRADLEY									
32		3 POS SEL. SW (YEL)	1		PTSEL201CC6	MICRO-SWITCH									
33		2 POS SEL. SW (BLU)	1		800H-HRC2A	ALLEN BRADLEY									
34		POTENTIOMETER OPERATOR	1		800H-UR	ALLEN BRADLEY									
35		POTENTIOMETER	1		3505S-135-502	BOURNS									
36		PUSH BUTTON UNIT	1		800H-WK6B	ALLEN BRADLEY									
37		GUAGE 200 PSI	5		J7754P	MARCH									
38		GUAGE 300 PSI	1		J7758P	MARSH									
39		GUAGE 3,000 PSI	1		J7778P	MARSH									
40		TERMINAL PANEL	1		D316223	WGC									
41		PRESSURE SWITCH	2		E1S-R250	PARKSDALE									
42		STUFFING TUBE SIZE 5	2		M19622/1-006	DORN-DANCO OR EQUIV.									
43		STUFFING TUBE SIZE 4	2		M19622/1-004	DORN. DANCO OR EQUIV.									
44		PACKING ASS'Y 5A	2		M19622/20-0032	DORN DANCO OR EQUIV.									
45		PACKING ASS'Y 4D	2		M19622/19-0004	DORN DANCO OR EQUIV.									
46		NYLON ROLLED WASHER	4		38W	NYLTITE									
47		#732 CL-11 SEALANT CLEAR	1		732 CL-1	DOW									
48		WEATHERDROOF COVER	1		WR B1 C	PREFECT LINE									
49		WEATHERDROOF BOX	1		T11-L	PREFECT LINE									
50		OUTLET	1		A305099	WGC									
51		8-32 x .75 PAN HD SCREW	2			WGC									
52		ROLLED NYLON WASHER	2		8W	NYLTITE									
53		PH. HD MACH SCR. #8-32 x .50	3		116310	WGC									
54		FLAT WASHER #8	3		108974	WGC.									

FACTURER	MATL	MATL SPEC	REQ'D CERTS							ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS
NAME			C	P	H	C/C	N/D	N			
CIALCO											
ALLEN BRADLEY											
ALLEN BRADLEY											
ALLEN BRADLEY											
MICRO-SWITCH											
ALLEN BRADLEY											
ALLEN ERADLEY											
BOURNS											
ALLEN BRADLEY											
MARCH											
MARSH											
MARSH											
WGC											
PARKSDALE											
DORN-DANCO OR EQUIV.											
DORN. DANCO OR EQUIV.											
DORN DANCO OR EQUIV.											
DORN DANCO OR EQUIV.											
NYLTITE											
DOW											
PREFECT LINE											
PREFECT LINE											
WGC											
WGC											
NYLTITE											
WGC											
WGC.											

D316131A

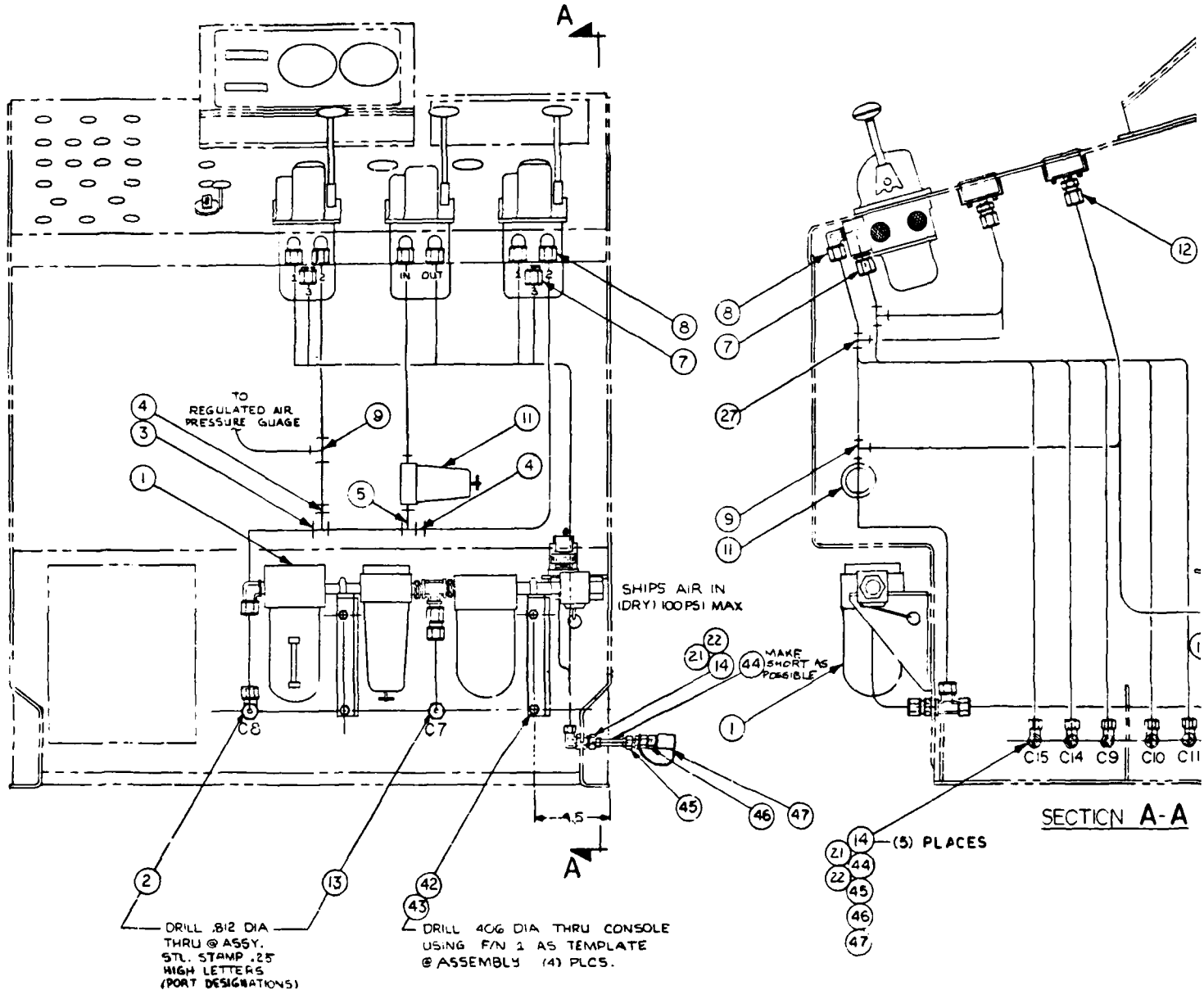
Figure 6-1. Control Console Assembly
(Sheet 6 of 7)

FIND NO.	ZONE	NOMENCLATURE	QTY.	CODE IDENT.	MANUFACTURER		MATL	MATL SPEC	REQ'D CERTS						
					PART OR DWG NO.	NAME			C	P	M	C/C	M/D	N	
55		THERMAL SWITCH	1		17300-070	FENWAL									
56		ROLLER NYLON WASHER	2		10W	NYLTITE									
57		PAN HD MACH. SCR. 10-32 x .50 LG	2		116275	WGC									
58		MOUNTING BRACKET	1		B309789	WGC									
59		CONTROL CONSOLE PIPING	1		D316203	WGC.									
60		HX HD NUT #8-32	2			WGC									
61		PAN HD MECH. SCREW #4-40 x .75 LG	4			WGC									
62		NUT HX HD .31-13	22			WG C									
63		LAMP	8		656 DC/120V	DIALCO									
64		PUSHBUTTON (BLK)	1		800H-R2B	ALLEN-BRADLEY									
65		WIRING DIAGRAM CONTRO- CONSOLE	1		D316130	WGC									
66		CABLE (6 PAIR SHLD)	1		TTRS-6	ANIXTER									
67		CABLE (14 COND)	1		MSCU-14	ANIXTER									
68		CABLE CONNECTOR	2		MS3108B-28-16P	CANNON OR EQ									
69		CABLE CLAMP	2		MS3057-16A	CANNON OR EQ									
70		TELESCOPING BUSHING	2		MS3420-16	CANNON OR EQ									
71		CABLE CONNECTOR	1		MS3108B-14S-1S	CANNON OR EQ									
72		CABLE CLAMP	1		MS3057-6A	CANNON OR EQ									
73		TELESCOPING BUSHING	1		MS3420-6	CANNON OR EQ									
74		HOOK-UP WIRE (14AWG)	1		1869/19	ALPHA OR EQ									
75		SHIELDED CABLE	1		9968	BELDEN OR EQ									
76		DIODE	1		IN4004	MOTOROLA OR EQ.									
77		SELECTOR KNOB (YEL)	1		PT215	MICRO-SWITCH									

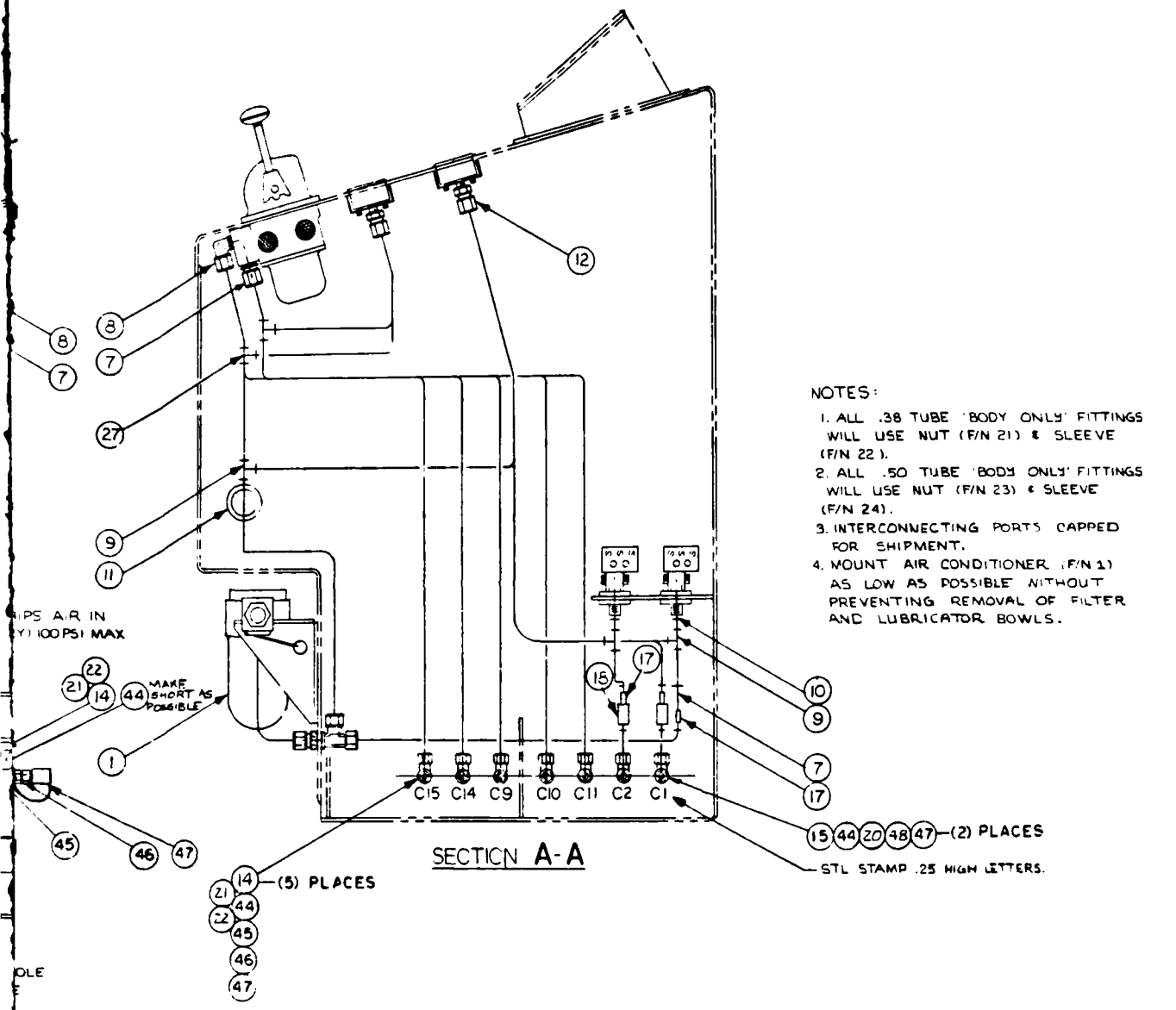
NAME	MATL	MATL SPEC	REQ'D CERTS C	P	H	C/C	N/D	N		ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	REMARKS	MFTL CLASS			
WAL																
TITE																
C																
C																
C.											20					
C																
GC																
C																
O																
BRADLEY																
C																
TER												12 FT.				
TER												12 FT.				
N OR EQ																
N OR EQ																
N OR EQ																
N OR EQ																
N OR EQ																
ON OR EQ																
OR EQ												500 FT. ELECT. SHOP STOCK				
N OR EQ												100 FT.				
ROLA OR																
KH																

D316131A

Figure 6-1. Control Console Assembly
(Sheet 7 of 7)

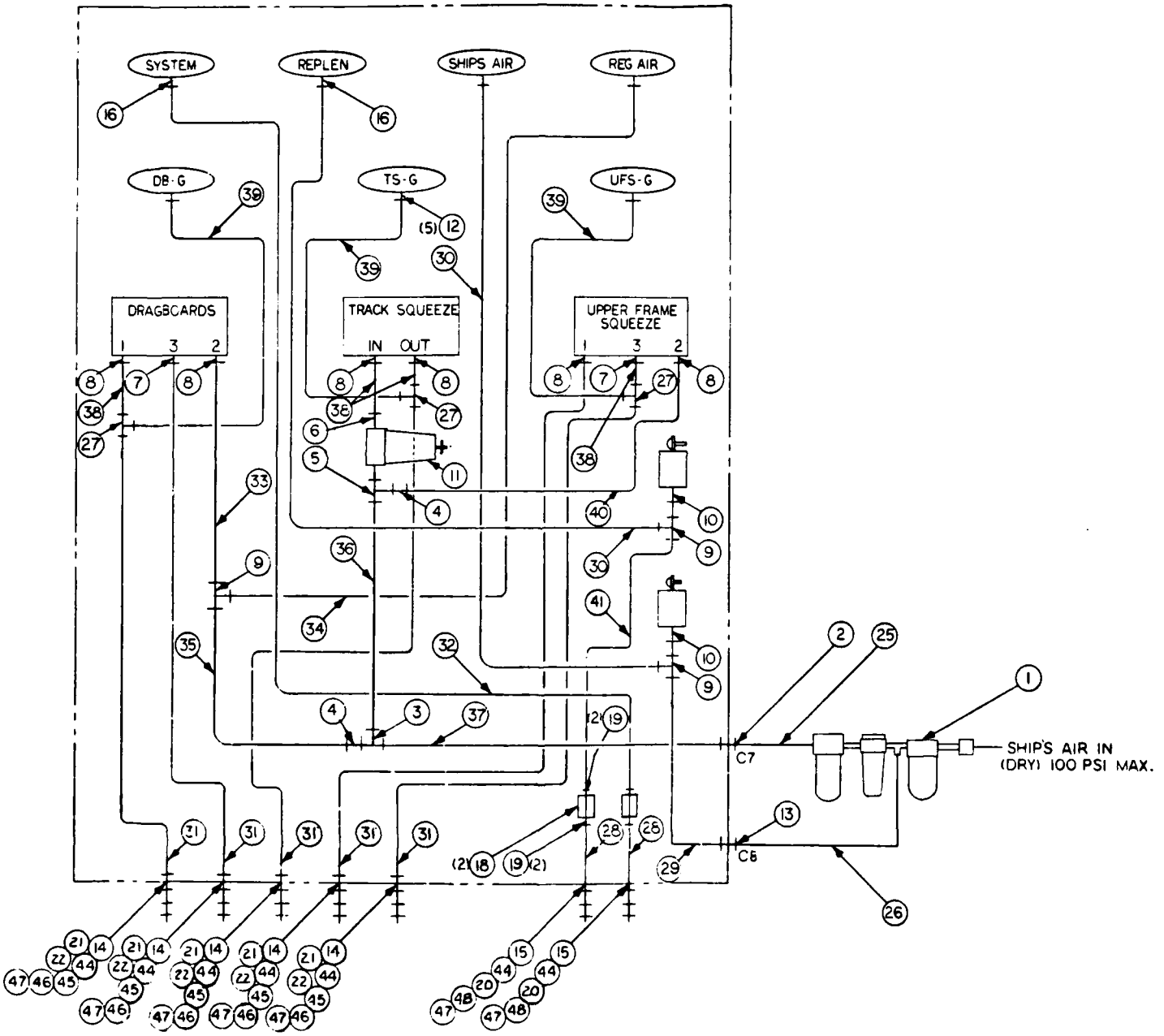

A
A
IN
OUT
TO REGULATED AIR PRESSURE GUAGE
SHIPS AIR IN (DRY) 100PSI MAX
MAKE SHORT AS POSSIBLE
C8
C7
C15
C14
C9
C10
C11
4.5
(5) PLACES
DRILL .812 DIA THRU @ ASSY. STL. STAMP .25 HIGH LETTERS (PORT DESIGNATIONS)
DRILL .406 DIA THRU CONSOLE USING F/N 1 AS TEMPLATE @ ASSEMBLY (4) PLCS.

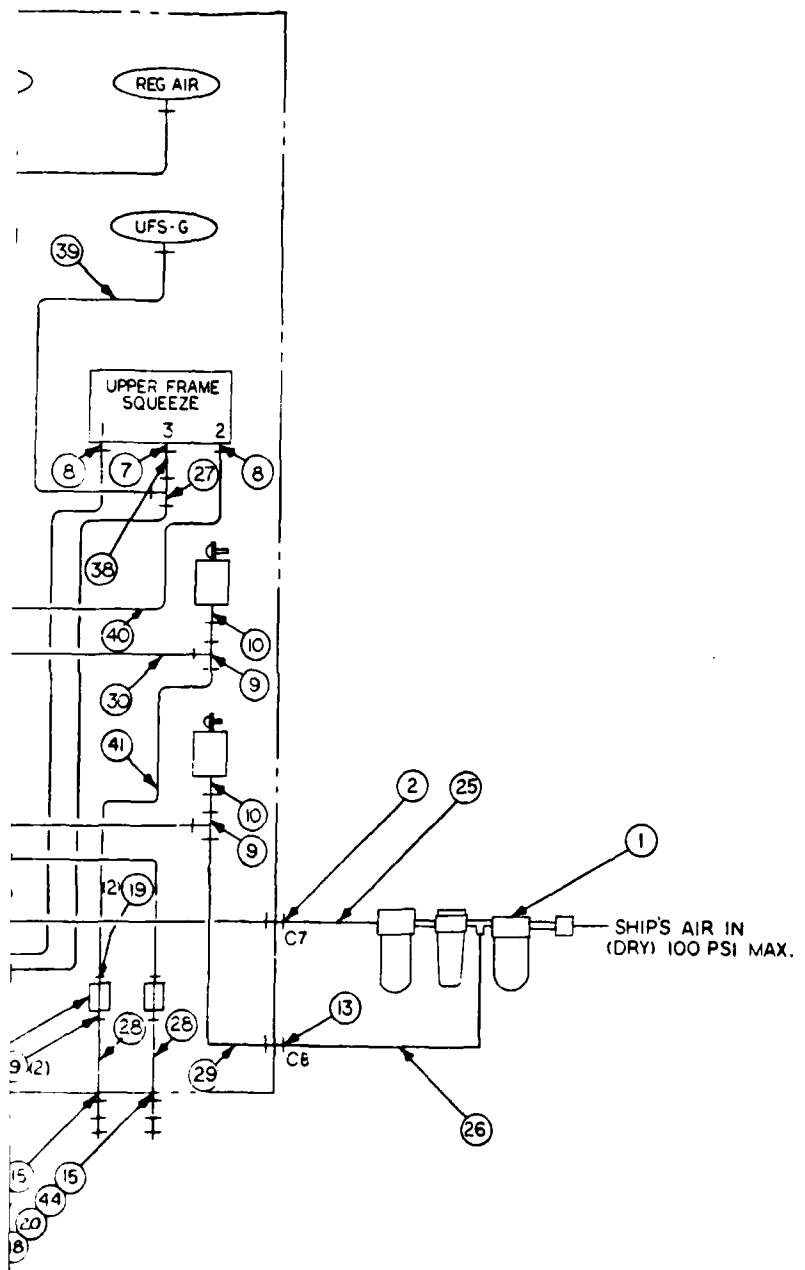
SECTION A-A



D316203C

Figure 6-2. Control Console Piping Assembly (Sheet 1 of 4)


SYSTEM
REPLEN
SHIPS AIR
REG AIR
DB-G
TS-G
UFS-G
DRAGSCARDS
1 3 2
TRACK SQUEEZE
IN OUT
UPPER FRAME SQUEEZE
1 3 2
C7
C8
SHIP'S AIR IN
(DRY) 100 PSI MAX.



D316203C

Figure 6-2. Control Console Piping Assembly (Sheet 2 of 4)

FIND NO.	ZONE	NOMENCLATURE	QTY.	CODE IDENT.	MANUFACTURER		MATL	MATL SPEC	REQ'D CERTS							ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	REMA
					PART OR DWG NO.	NAME			C	P	H	C/E	M/D	N				
1		AIR CONDITIONER ASSY	1		C312837	WGC	—										10	
2		BULKHEAD UNION ELBOW -BODY-	1		8-WETX-SS	PARKER	SST											
3		UNION TEE -BODY-	1		8-JTX-SS	"	"											
4		TUBE END REDUCER	2		8-6-TRBTX-SS	"	"											
5		MALE RUN TEE -BODY-	1		8-RTX-SS	"	"											
6		MALE CONNECTOR -BODY-	1		6-8-FTX-SS	"	"											
7		MALE CONNECTOR -BODY-	2		6-FTX-SS	"	"											
8		MALE ELBOW -BODY-	6		6-CTX-SS	"	"											
9		SWIVEL NUT RUN TEE BODY	2		6-RGX-SS	"	"											
10		MALE CONNECTOR -BODY-	2		6-2-FTX-SS	"	"											
11		REGULATOR	1		PR7564-31004	WABCO											2	
12		FEMALE CONNECTOR BODY	5		6-GTX-SS	PARKER	SST.											
13		BULKHD UNION BODY	1		6-WTX-SS	"	"											
14		BULKHD UNION ELBOW BODY	5		6-WETX-SS	"	"											
15		BULKHD UNION ELBOW	2		8-WEBTX-S	"	STL											
16		FEMALE CONNECTOR	2		6-GBTX-S	"	STL											
					"													
18		NEEDLE VALVE	2		10M-0-1-3	DRAGON												
19		MALE CONNECTOR	4		6-FBTX-S	PARKER	STL											
20		MALE CONNECTOR	2		6-6FBTX-S	PARKER	STL											
21		NUT	AR		6-BTX	PARKER	STL											
22		SLEEVE	AR		6-TX	"	"											
23		NUT	15		8-BTX	"	"											
24		SLEEVE	15		8-TX	"	"											
25		TUBE .500 x .049 THK WALL x 10.0 LG	1				SST	A-269 304 S.D ANNEALED										
26		TUBE .380 O.D. x .049 WALL x 9.0 LG	1				"	"										
27		UNION TEE BODY -	3		6-JTX-SS	PARKER	SST											

CTURER NAME	MATL	MATL SPEC	REQ'D CERTS C	P	H	C/C	M/D	N	ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	REMARKS	MAT'L CLASS
W&C	—									10		
PARKER	SST											
"	"											
"	"											
"	"											
"	"											
"	"											
"	"											
"	"											
"	"											
WABCO										2		
PARKER	SST.											
"	"											
"	"											
"	STL											
"	STL											
DRAGON												
PARKER	STL											
PARKER	STL											
PARKER	STL											
"	"											
"	"											
"	"											
	SST	A-269 304 S.D ANNEALED										
	"	"										
PARKER	SST											

D316203C

Figure 6-1. Control Console Assembly
(Sheet 3 of 4)

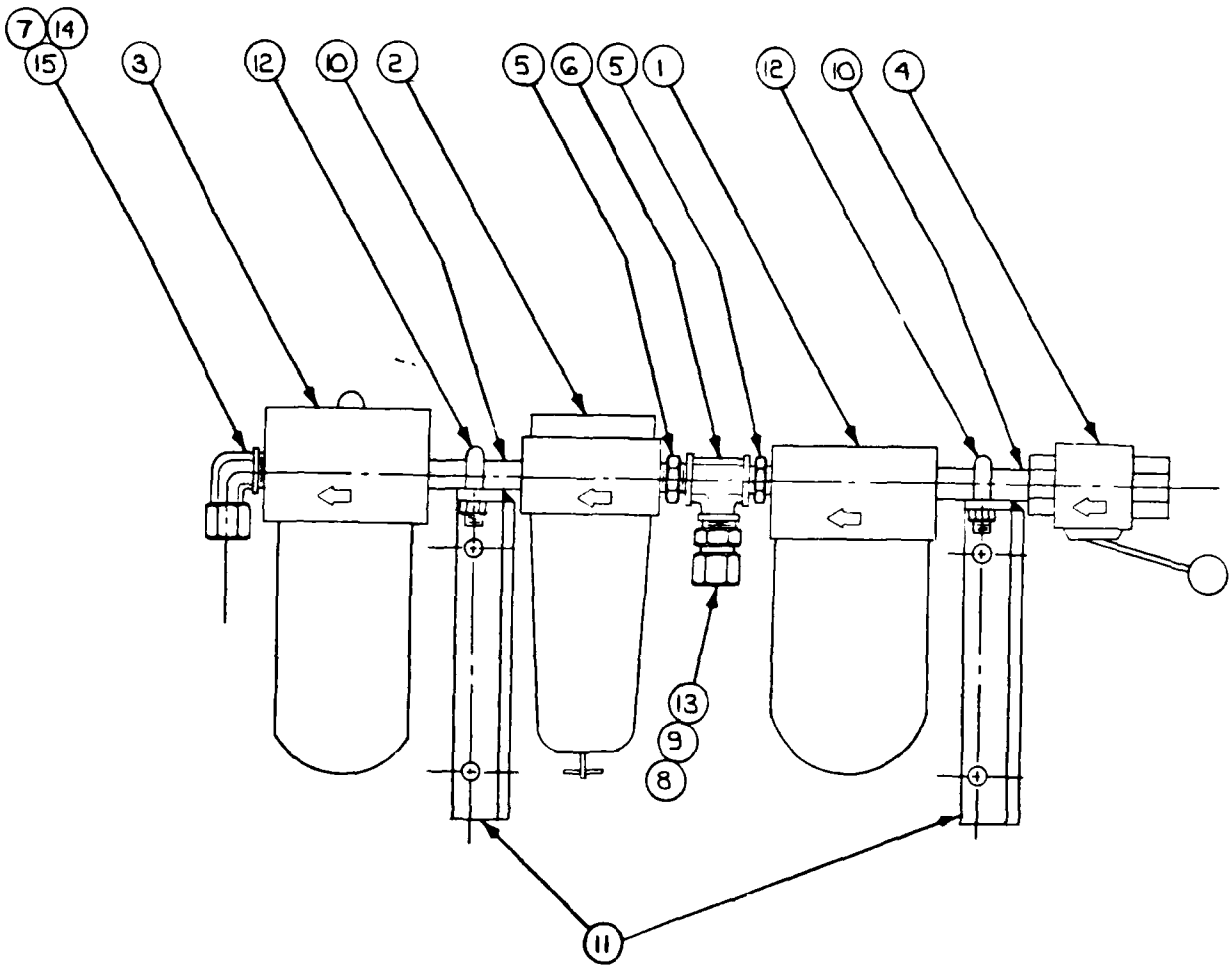
FIND NO.	ZONE	NOMENCLATURE	QTY.	CODE IDENT.	MANUFACTURER PART OR DWG NO.	MANUFACTURER NAME	MATL	MATL SPEC	REQ'D CERTS C	P	H	C/E	M/D	N	ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	R
28		TUBE .38 OD x .049 WL x 6.0 LG	2														
29		TUBE .38 O.D x .049 WL x 93.6 LG.	1				SST	A-269 304 C.D. ANNEALED									
30		TUBE .38 O.D x .049 WL x 72.0 LG	2				"	"									
31		TUBE .38 O.D x .049 WL x 80.0 IN	5				"										
32		TUBE .38 OD x .049 WL x 84.0 IN	1				"	"									
33		TUBE .38 O.D x .049 WL x 12.0 LG	1				"	"									
34		TUBE .38 O.D x .049 WL x 56.0 LG	1				"	"									
35		TUBE .38 O.D x .049 x 60.0	1				"	"									
36		TUBE .50 O.D x .049 x 36.0	1				"	"									
37		TUBE .50 O.D x .049 x 30.0 LG.	1				"	"									
38		TUBE .38 O.D x .049 WL x 8.0	3				"	"									
39		TUBE .38 O.D x .049 WL x 24.0 LG	3				"	"									
40		TUBE .38 O.D x .049 x 30.0	1				"	"									
41		TUBE .38 O.D. x .049 x 24.0	1				"	"									
42		CAP SCREW .38-16 x 1.0 GR 5 HX HD	4				PLTD	SAE J249									
43		NUT PLTD .38-16	4				PLTD										
44		TUBE .38 OD x .049 W. x 2.5 LG	7				SST	A-269-304 C.D. ANNEALED									
45		STR. THD. CONNECTOR	5		6F5BX-SS	PARKER	S. STL.										
46		QUICK DISCONNECT NIPPLE	5		SVHN6-6EF	SNAP-TITE	S. STL.	316 S. STL									
47		DUST CAP	7		PDC-6	SNAPTITE	PLASTIC										
48		QUICK DISCONNECT NIPPLE	2		SVHN 6-6 F	SNAP TITE	S. STL	316 S.STL									

Figu
Asse

RER NAME	MATL	MATL SPEC	REQ'D CERTS C	P	H	C/C	M/D	N	ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	REMARKS	MATL CLASS
	SST	A-269 304 C.O. ANNEALED										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	"	"										
	PLTD	SAE J249										
	PLTD											
	SST	A-269-304 C.O. ANNEALED										
ARKER	S. STL.											
AP-TITE	S. STL.	316 S. STL										
APTITE	PLASTIC											
AP TITE	S. STL	316 S. STL										

D316203C

Figure 6-2. Control Console Piping Assembly (Sheet 4 of 4)



C312837

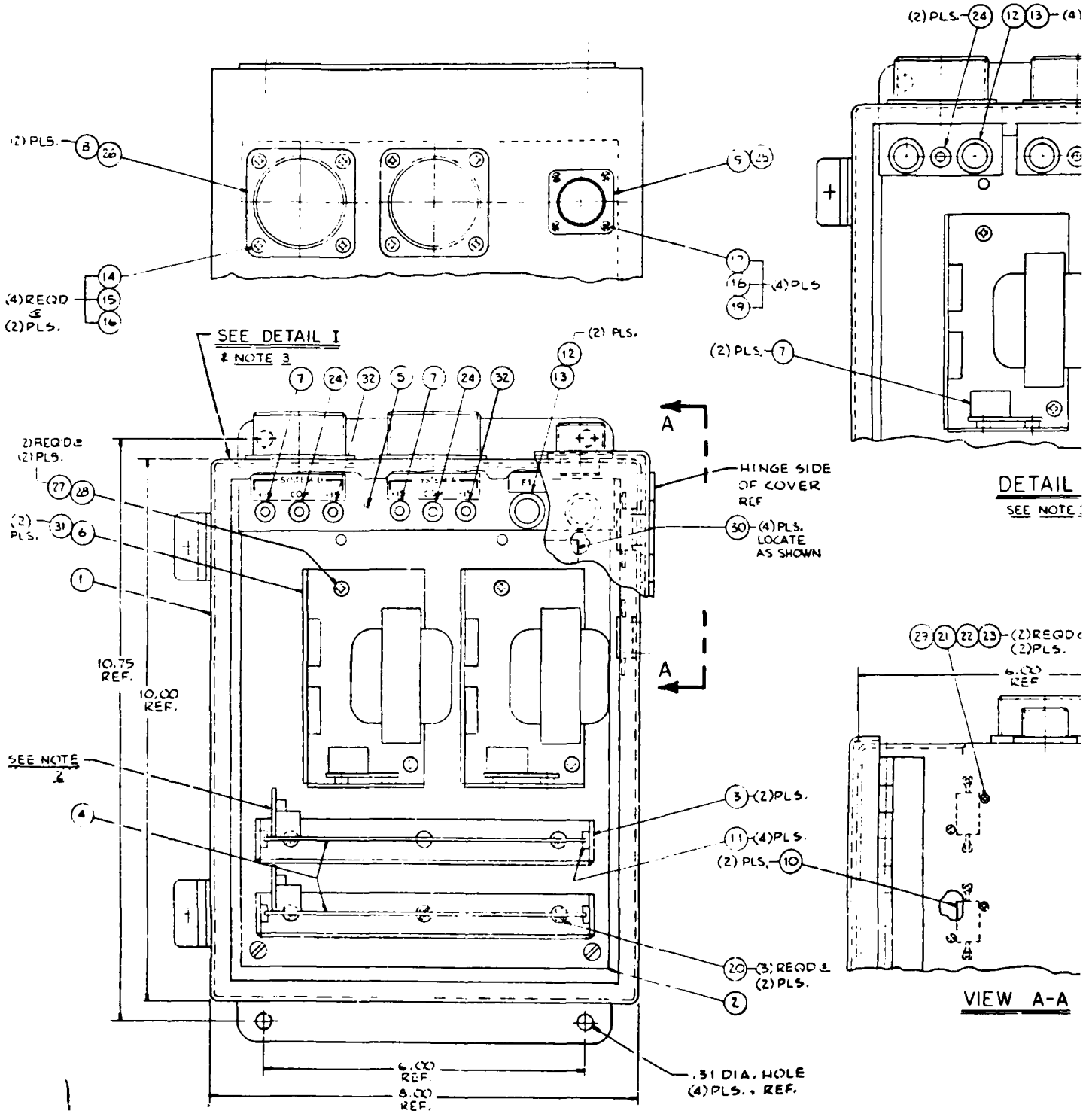
Figure 6-3. Air Conditioner Assembly
(Sheet 1 of 2)

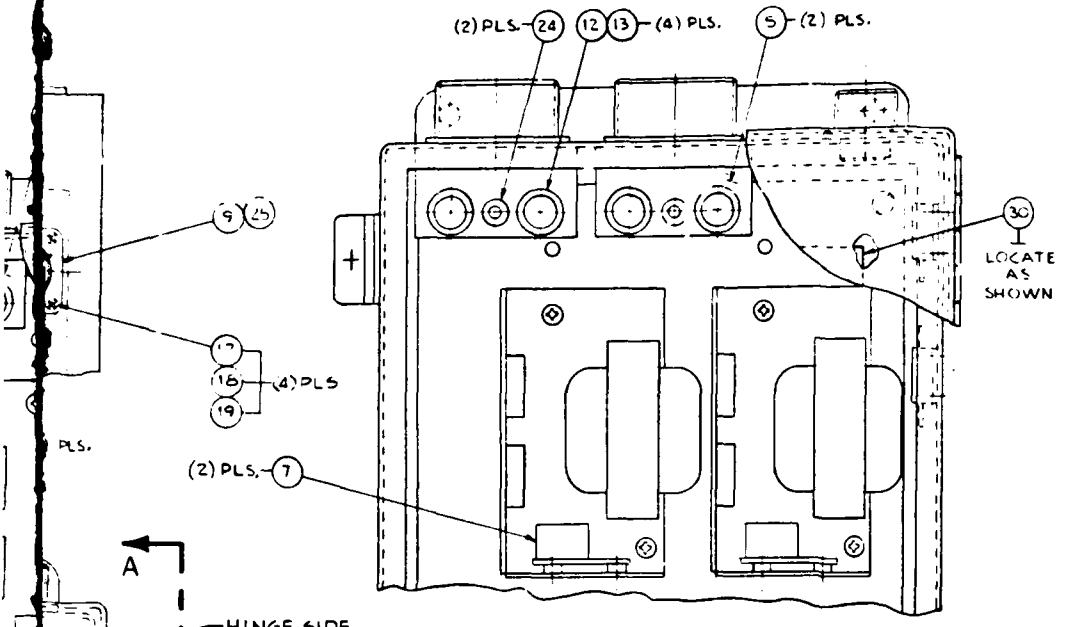
FIND NO.	ZONE	NOMENCLATURE	QTY.	CODE IDENT.	MANUFACTURER		MATL	MATL SPEC	REQ'D CERTS							ALTERNATE SPEC FOR GOVT REFERENCE
					PART OR DWG NO.	NAME			C	P	H	C/E	N/D	M		
1		FILTER	1		PF7502-11004	WABCO										
2		REGULATOR	1		PR7564-31004	WABCO										
3		LUBRICATOR	1		PG7602-24004	WABCO										
4		SHUT OFF VALVE	1		92598-4PPQ	CIRCLE SEAL										
5		PIPE NIPPLE	2		1/2-FF-SS	PARKER										
6		FEMALE PIPE TEE	1		1/2-MMO-SS	PARKER										
7		MALE ELBOW	1		8-CTX-SS	PARKER										
8		SLEEVE	1		6-TX-S	PARKER										
9		NUT	1		6-BTX-S	PARKER										
10		NIPPLE .50 NPTF x 2.5 LG SST SCH 40	2		—	—	SST									
11		BRACKET	2		C312838	WGC										
12		U BOLT .50 IPS .25-20 x 1.75 LG	2		3043T13	McMASTER.										
13		MALE CONNECTOR	1		6-8 FTX-SS	PARKER										
14		SLEEVE	1		8-TX-S	PARKER										
15		NUT	1		8-BTX-S	PARKER										

NUFACTURER		MATL	MATL SPEC	REQ'D CERTS							ALTERNATE SPEC FOR GOVT REFERENCE	WT LBS	REMARKS	MATL CLASS			
	NAME			C	P	H	C/E	M/D	N								
004	WABCO												1/2 IPS				
04	WABCO																
04	WABCO												1/2 IPS				
GL	CIRCLE SEAL																
-	PARKER																
5	PARKER																
	PARKER																
	PARKER																
	PARKER																
	—	SST															
	WGC																
	MCMASTER.												INCLUDES NUTS				
5	PARKER																
	PARKER																
	PARKER																

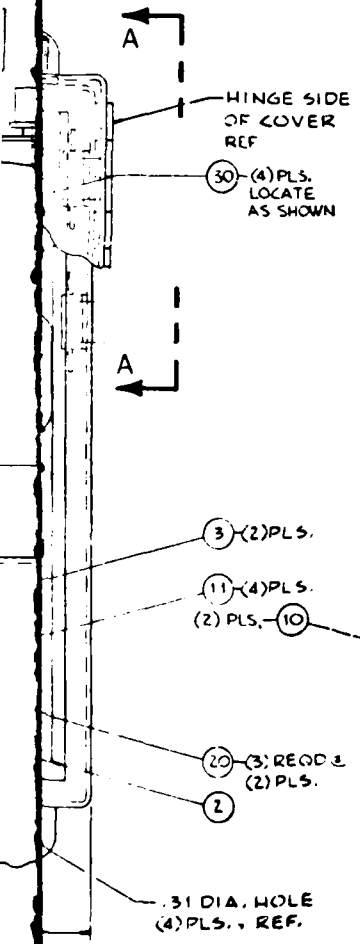
C312837

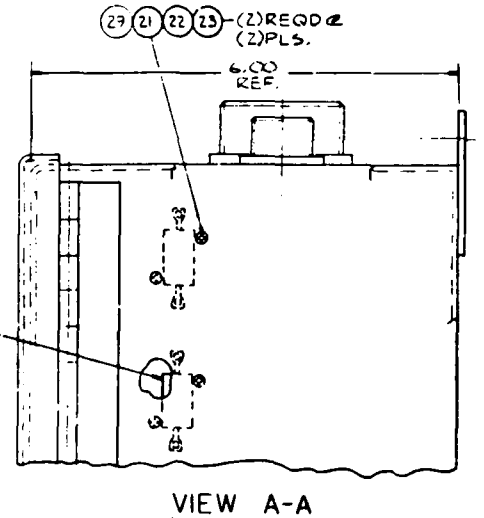
Figure 6-3. Air Conditioner Assembly
(Sheet 2 of 2)


(2) PLS.
(4) REQD & (2) PLS.
(4) PLS
SEE DETAIL I & NOTE 3
(2) PLS.
(2) PLS.
HINGE SIDE OF COVER REF
(4) PLS. LOCATE AS SHOWN
A
A
10.75 REF.
10.00 REF.
SEE NOTE 2
(2) PLS.
(4) PLS.
(2) PLS.
(3) REQD & (2) PLS.
6.00 REF
6.00 REF
.31 DIA. HOLE (4) PLS., REF.
DETAIL
SEE NOTE
VIEW A-A



DETAIL I
SEE NOTE 3





VIEW A-A

SEE COMPUTER PARTS LIST

FOR REVISIONS "C" & EARLIER OF D313463, SEE MIS PLD313463.
FOR REVISIONS "D" & LATER OF D313463, SEE MIS PLD317549.

NOTES:

1. APPLY "LOCTITE" 242 TO ALL THREADS.
2. TERMINAL PLUG ON P.C. BOARD ASSY (F/N 4) SHOWN FOR ORIENTATION. ALL OTHER COMPONENTS NOT SHOWN FOR CLARITY.
3. ASSEMBLY CONFIGURATION FOR REVISIONS "C" & EARLIER SHOWN IN DETAIL I; SEE MIS PLD313463. WIRE PER WGC DWG. D313630 (F/N 33 ON D313463.)
4. WIRE REVISIONS "D" & LATER PER WGC DWG. D317552, F/N 33 ON MIS PLD317549.

D313463E

Figure 6-4. DOHB Tension/Speed Control Assembly (Sheet 1 of 3)

P/L NUMBER	ENG REV	P/L NOMENCLATURE	CODE IDENT
D313463	D	DOHB TENSION/SPEED ASSY	16603

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
1	D313507	-	ENCLOSURE CUTOUT	1 EA
2	C311259	B	PANEL CONTROL ASSY	1 EA
3	C311260	C	BRACKET-PC CARD	2 EA
4	D313522	F	PCB ASSY-PC3 CONSTANT TENSION CONTROL	2 EA
5	C311271	C	BRACKET-FUSE	2 EA
6	SPS30D-12/15		POWER SUPPLY 15VDC STANDARD INC	2 EA
7	OVP-21		OVERVOLTAGE PROTECTION DEVICE STANDARD INC	2 EA
8	MS3102E-28-16S		BOX MOUNTING RECEPTACLE ITT CANNON OR EQUIV	2 EA
9	MS3102E-14S-1P		BOX MOUNTING RECEPTACLE ITT CANNON OR EQUIV	1 EA
10	900376		RH-10 2 OHMS POWER RESISTER DALE	2 EA
11	23071-3		SNAP-IN CARD GUIDE SCANBE	4 EA
12	HLD		FUSE HOLDER BUSSMANN	4 EA
13	AGC-3/4		FUSE-3/4 AMP BUSSMANN	4 EA
14	116296		SCREW MACH PAN HD PLTD CROSS REC 6-32 X .62	8 EA
15	108471		WASH PLAIN TYPE B REGULAR STL PLTD .14 NOMINAL	8 EA

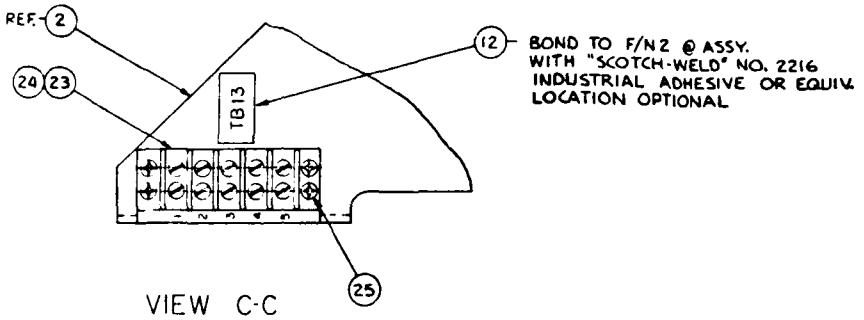
D313463E

Figure 6-4. DOHB Tension Speed Control Assembly (Sheet 2 of 3)

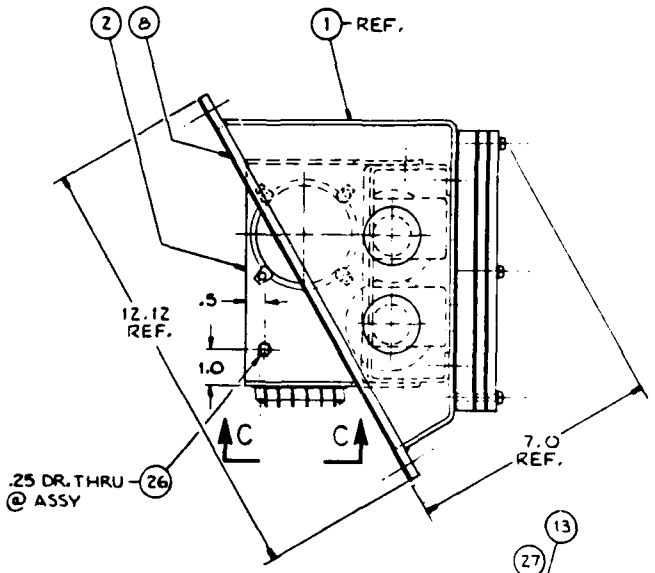
FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
16	108476		NUT HEX LT ELASTIC STOP NO 6	8 EA
17	116135		SCR MACH PAN HD PLTD 4-40X.50LG	4 EA
18	108470		WASH PLAIN TYPE B REGULAR STL PLTD .11 NOMINAL	4 EA
19	108475		NUT HEX LT ELASTIC STOP STL .112-40 ESNA 22NM-40	4 EA
20	137337		SCREW MACH FH SST 100 DEG CROSS REC 6-32 X .62	6 EA
21	130095		SCR MACH PAN HD #2-56X.50 CROSS RECESSED PLTD	4 EA
22	108469		WASH PLAIN TYPE B REGULAR STL PLTD .09 NOMINAL	4 EA
23	130096		NUT STL LT ELASTIC STOP #2 PLTD ESNA 22NM-26	4 EA
24	1502-BLACK		TIP JACK HH SMITH	2 EA
25	10-40450-14		GASKET BENDIX	1 EA
26	10-40450-26		GASKET RECEPTICAL RADAR ELECT (BENDIX)	2 EA
27	116312		SCREW MACH PAN HD PLTD CROSS REC 8-32 X .62	4 EA
28	108472		WASH PLAIN TYPE B REGULAR NO 6	4 EA
29	2W		NYLON ROLLED WASHER NYLTITE	4 EA
30	A307734	B	TENSION/SPEED ASSY DIAGRAM	1 EA
31	V130LA10A		VARISTOR GE MOV	2 EA
33	D313630	F	WIRING DIAGRAM-DOHB SPEED CONTROL	0 EA

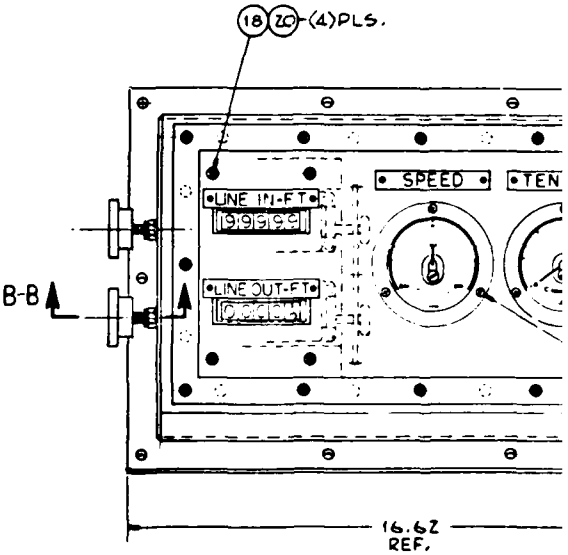
D313463E

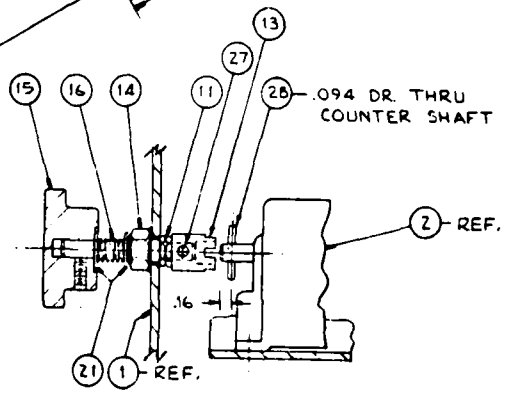
Figure 6-4. DOHB Tension Speed Control Assembly (Sheet 3 of 3)



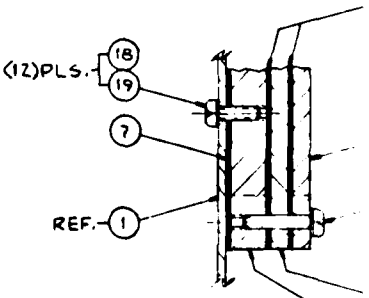
VIEW C-C





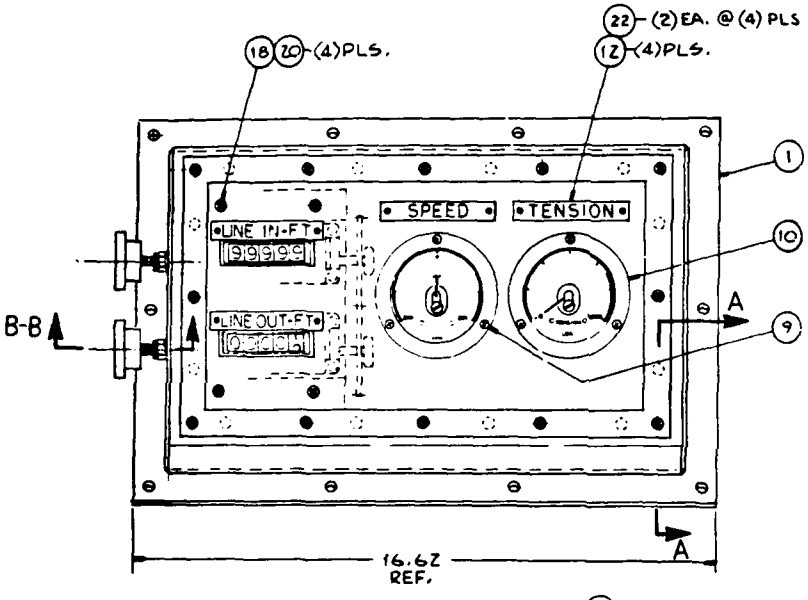


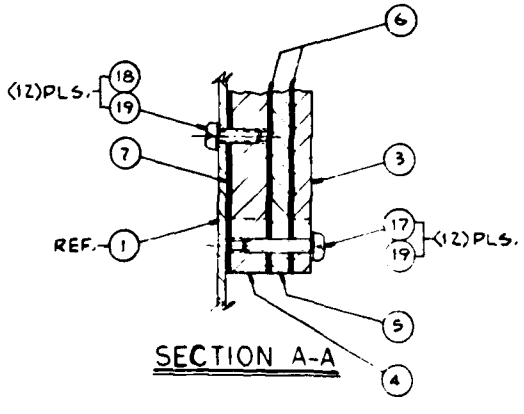
SECTION B-B
TYPICAL (2)PLS.



SECTION A-A

(12) BOND TO F/N 2 @ ASSY.
WITH "SCOTCH-WELD" NO. 2216
INDUSTRIAL ADHESIVE OR EQUIV.
LOCATION OPTIONAL





SECTION A-A

THRU
R SHAFT

(2) REF.

NOTES:
1. APPLY "LOCTITE" 242 TO ALL THREADS.

D316211A

Figure 6-5. Enclosure Assembly
(Sheet 1 of 3)

P/L NUMBER	ENG REV	P/L NOMENCLATURE	CODE IDENT
D316211	-	ENCLOSURE ASSY	16603

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
1	D316212	-	ENCLOSURE	1 EA
2	D314371	B	SYNCHRO/COUNTER ASSY	1 EA
3	C311692	B	UPPER FRAME ST STL.25THKX7.75X14.00	1 EA
4	C311693	A	LOWER FRAME ST STL .38X7.75X14.00	1 EA
5	C311694	-	WINDOW LUCITE AR .25X7.75X14.00	1 EA
6	C311695	-	GASKET-WINDOW SPEC CONTL	1 EA
7	C311696	-	GASKET-LWR FRAME	1 EA
8	C312646	-	GASKET-ENCLOSURE CORK/NEOP .06X12.12X16.6	1 EA
9	A307895	-	PANEL METER-SPEED	1 EA
10	A307897	-	PANEL METER-TENSION	1 EA
11	A307903	-	PANEL BEARING-ALTERED H H SMITH NO 14F	1 EA
12	A307923	-	LABELS-ENCLOSURE	1 EA
13	MS-3		MULTI-JAWED COUPLING PIC OR EQUIV	1 EA
14	N-9030-1/4		SEAL NUT AMF-HEXSEAL	2 EA
15	4102		KNOB FLUTED DAVIES DAVIES	2 EA

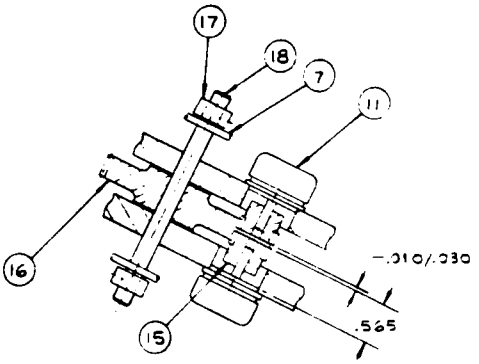
D316211

Figure 6-5. Enclosure Assembly (Sheet 2 of 3)

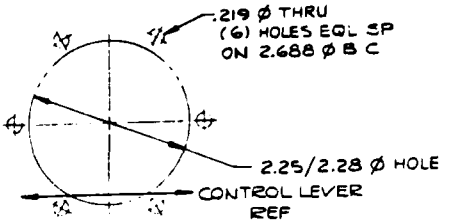
FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
16	LC-0220-00		COMPRESSION SPRING LEE	2 EA
17	116411		SCREW MACH PAN HD SST CROSS REC 10-32 X 1.00	10 EA
18	116409		SCREW MACH PAN HD SST CROSS REC 10-32 X .62	10 EA
19	10A		ROLLED WASHER NYLTITE	24 EA
20	137765		WSHR PL SST 18-8/316 #10 .203 IDX.38 ODX.050 THK	4 EA
21	107361		WASHER FLAT .25 NOM 18-8 OR 316 SST	4 EA
22	116350		SCREW MACH PAN HD SST CROSS REC 4-40 X .38	8 EA
23	37765		TERMINAL STRIP KULKA	1 EA
24	MS37Th-XXXF-1C		MARKER STRIP KULKA	1 EA
25	116363		SCREW MACH PAN HD SST CROSS REC 6-32 X .62	4 EA
26	5695WRCK		TRIMPOT 5K BECKMAN	1 EA

D316211

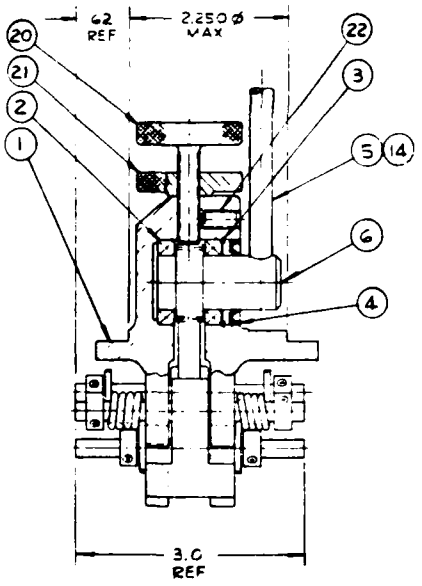
Figure 6-5. Enclosure Assembly (Sheet 3 of 3)

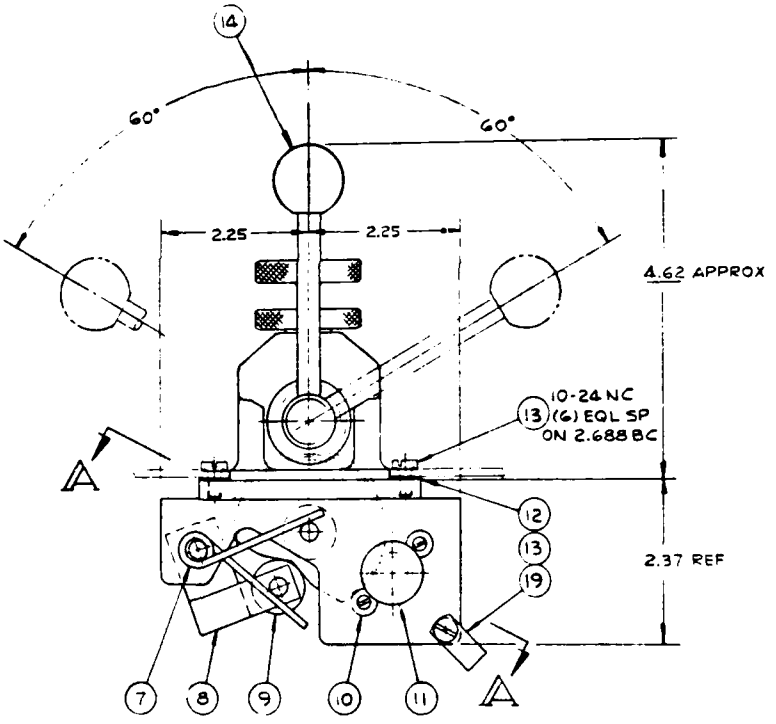


SECT. A=A



MOUNTING HOLE PATTERN



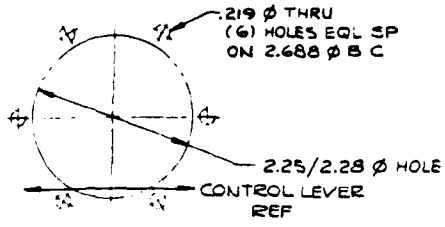


NOTE :
F/N 17 OMITTED IN THIS VIEW FOR CLARITY

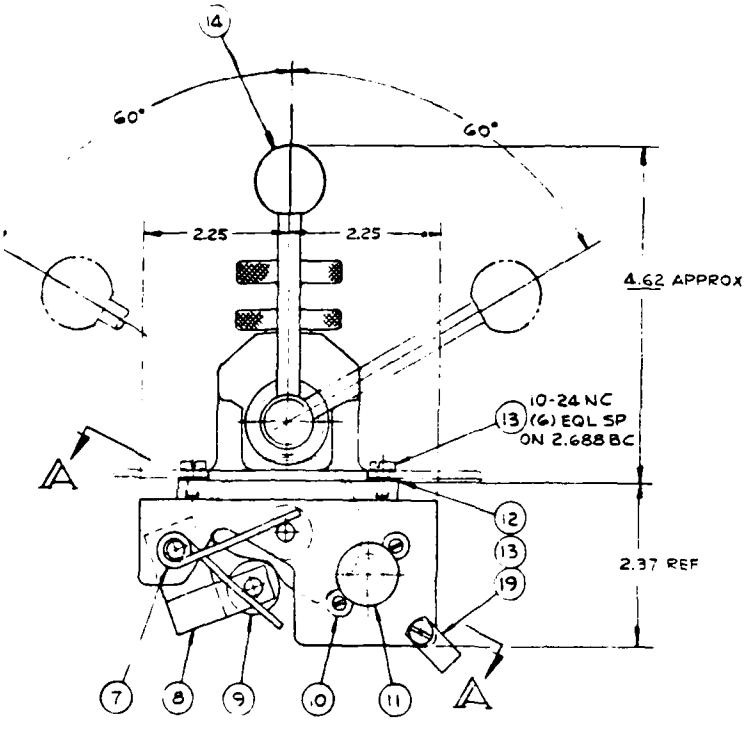
NOTES :

1. APPLY LOCT
OUND N BC
ATED BY SE
ENDS OF F/
2. LUBE GEARS
(P/N 64078)
3 CAN BE MA
DRILLING &
ADDING F/

Figure 6-6. Contr
(Sheet 1 of 3)



MOUNTING HOLE PATTERN



NOTE:
F/N 17 OMITTED IN THIS VIEW FOR CLARITY

NOTES:

1. APPLY LOCTITE 242 RETAINING COMPOUND IN BORE OF F/N 5 AFTER LOCATED BY SET SCREW, AND ON THREADED ENDS OF F/N 5 PRIOR TO ASSEM.
2. LUBE GEARS WITH MOBILPLEX EP24 (P/N 64078) OR EQUAL
3. CAN BE MADE FROM D315002 BY DRILLING & TAPPING F/N 1 AND ADDING F/N'S 20, 21, 22

D315221

Figure 6-6. Control Quadrant Assembly
(Sheet 1 of 3)

P/L NUMBER	ENG REV	P/L NOMENCLATURE	CODE IDENT
D315221	-	CONTROL QUADRANT ASSY	16603

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
1	C312334	A	HOUSING	1 EA
2	A307443	-	BEARING	2 EA
3	JR118	-	RETAINING RING SPIROLOX	1 EA
4	71X7031	-	DUST SEAL GARLOC	1 EA
5	P311237	-	HANDLE AISI-304SS .312DIA X 3.00 LG	1 EA
6	P311234	-	PINION AISI-304SS 1.12 DIA X 1.75 LG	1 EA
7	P311235	-	SPRING PAIR	1 EA
8	C311107	-	CENTERING ASY 6061-T6511 1.25X1.50X.25	1 EA
9	YCFC-12		CAMROLL BRG TORRINGTON	2 EA
10	L3-3		CLEAT MTG MOUNT PIC	4 EA
11	6153-104-3		POTENTIOMETER-14 DEG CTR DEADBAND-HELIPOT	2 EA
12	P300394	-	GASKET	1 EA
13	124115		SEEL SCREWS TYPE10-24X.34 SEE CATALOG	4 EA
14	AC4-45070		BALL KYON AMER OR BSHG 1.00 DIA	1 EA
15	G43-16-.124F		SPUR GEAR PIC .125 FACE	2 EA

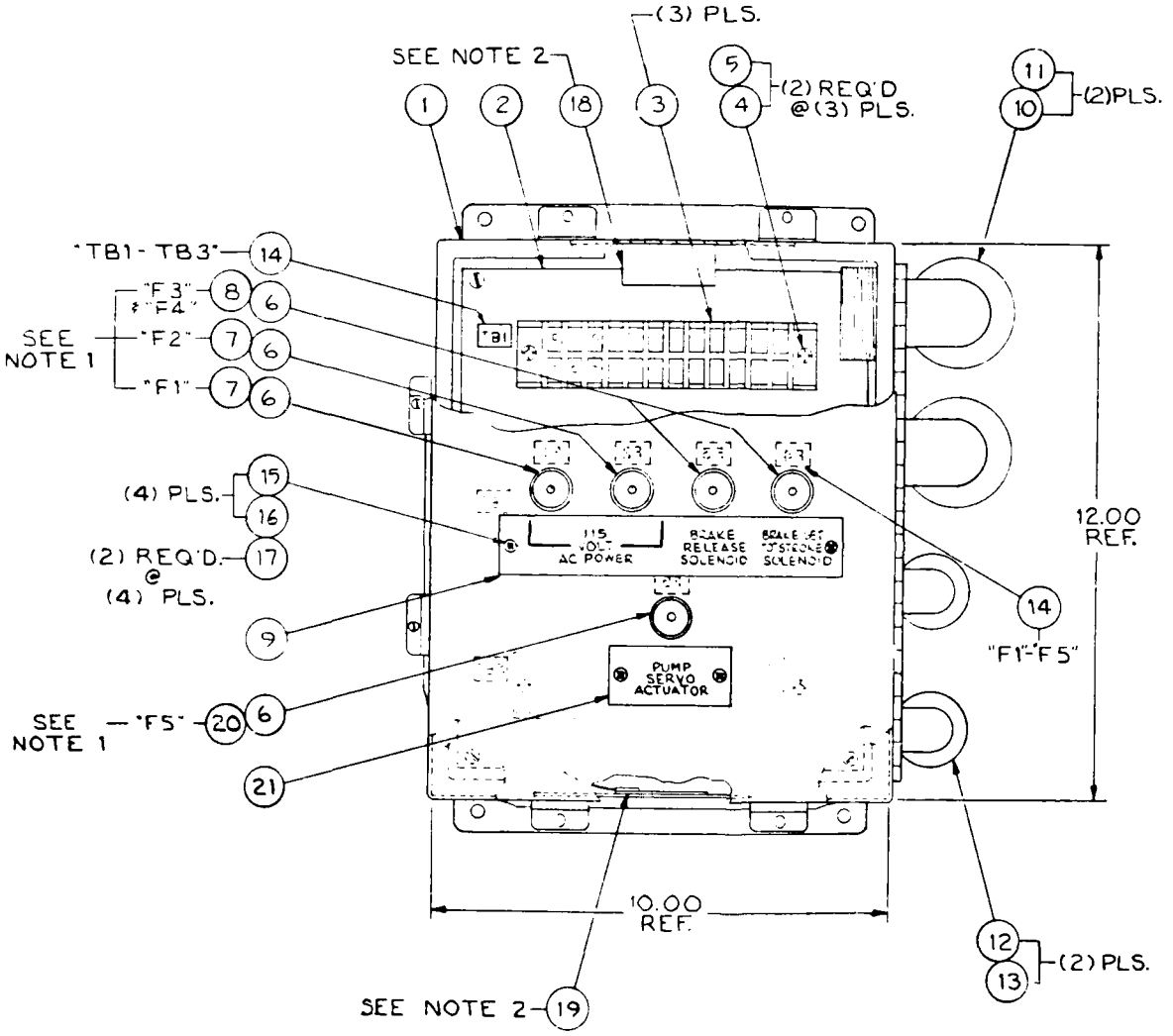
D315221

Figure 6-6. Control Quadrant Assembly (Sheet 2 of 3)

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
16	C312101	-	GEAR 2.250 DIA EVERDUR	1 EA
17	C1-3	-	COLLAR PIC	6 EA
18	A3-30	-	SHAFTING .2497 DIA X 3.0 LG PIC	3 EA
19	112100		CLAMP,TUBE,CUSHND .25 XTA1718S4TA MFG PLTD	2 EA
20	B311401	-	LOCK SCREW 304 S S 1.50 O BAR	1 EA
21	B311402	-	LOCK NUT	1 EA
22	CC-17		PIC SOC SETSCREW 10-24X27/64 LG	1 EA

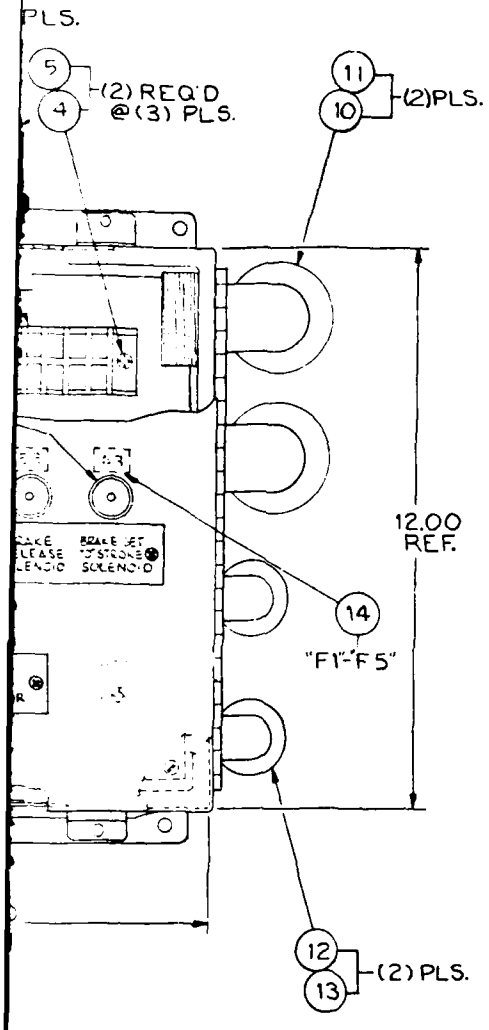
D315221

Figure 6-6. Control Quadrant Assembly (Sheet 3 of 3)



NOTES:

1. APPLY LABE "F5" ONLY OF FRONT
2. LOCATE F/N AS SHOWN.
3. APPLY "LOC THREADS.
4. SEE WGC DWG J-BOX I DETA QUICK DISCONN ON THIS J-BOX
5. SEE WGC DWG QUICK DISCONN



NOTES:

1. APPLY LABELS (F/N 14: "F1" THRU "F5" ONLY) TO REVERSE SIDE OF FRONT PANEL AS SHOWN.
2. LOCATE F/N'S 18 & 19 APPROX. AS SHOWN.
3. APPLY "LOCTITE" 242 TO ALL THREADS.
4. SEE WGC DWG NO. D316125, SH2 FOR J-BOX 1 DETAIL SHOWING ASSEMBLY OF QUICK DISCONNECT ELECTRICAL FITTINGS ON THIS J-BOX.
5. SEE WGC DWG NO. A307881 FOR J-BOX 1 QUICK DISCONNECT FITTING WIRING.

C312861B

Figure 6-7. Junction Box Assembly
(Sheet 1 of 3)

P/L NUMBER	ENG REV	P/L NOMENCLATURE	CODE IDENT
C312861	B	JUNCTION BOX ASSY	16603

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
1	C312862	A	ENCLOSURE CUTOUT	1 EA
2	C312863	-	PANEL CUTOUT	1 EA
3	6TB24		TERMINAL BLOCK KULKA	3 EA
4	116408		SCREW MACH PAN HD SST CROSS REC 10-32 X .62	6 EA
5	137765		WSHR PL SST 18-8/316 #10 .203 IDx.38 ODx.050 THK	6 EA
6	340-255		PANEL FUSE HOLDER LITTELFUSE	5 EA
7	900383		312010 FUSE 10 AMP LITTELFUSE OR EQUIV	2 EA
8	900312		313001 FUSE 1 AMP SLO-BLO LITTELFUSE OR EQUAL	2 EA
9	B311883	A	NAMEPLATE SST SH 22 GA X 1.25 X7.50	1 EA
10	M19622/2-006		STFG TUBE SIZE 5 90 DEG DORN-DANCO OR EQUIV	2 EA
11	M19622/20-0002		PKNG ASSY 5A DORN DANCO OR EQUIV	2 EA
12	M19622/2-004		STUFFING TUBE ANGLE DORN-DANCO OR EQUIV	2 EA
13	M19622/19-0005		PKNG ASSY 4E DORN DANCO OR EQUIV	2 EA
14	A307913	A	LABELS	1 EA
15	116362		SCREW MACH PAN HD SST CROSS REC 6-32 X .50	4 EA

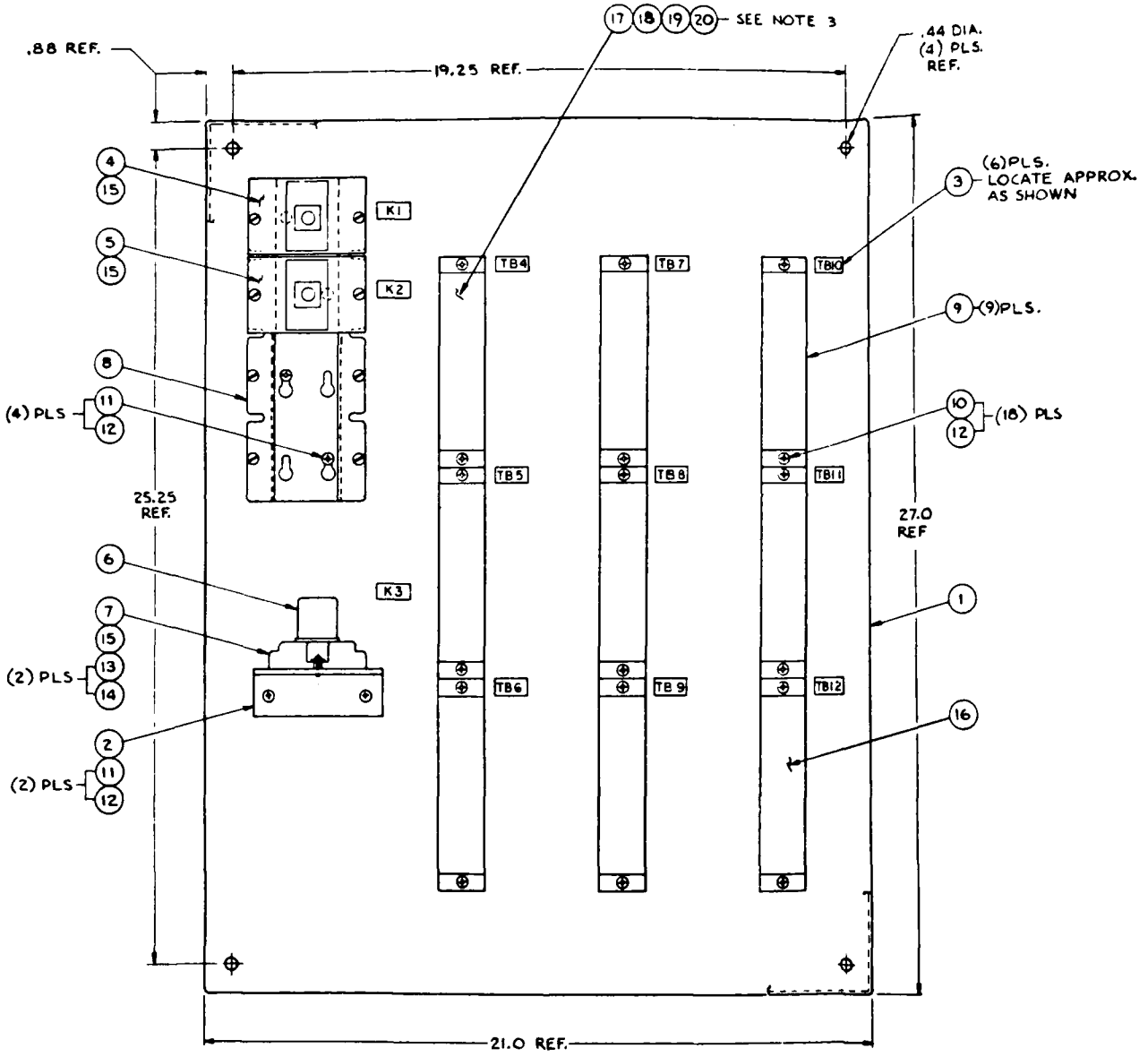
C312861B

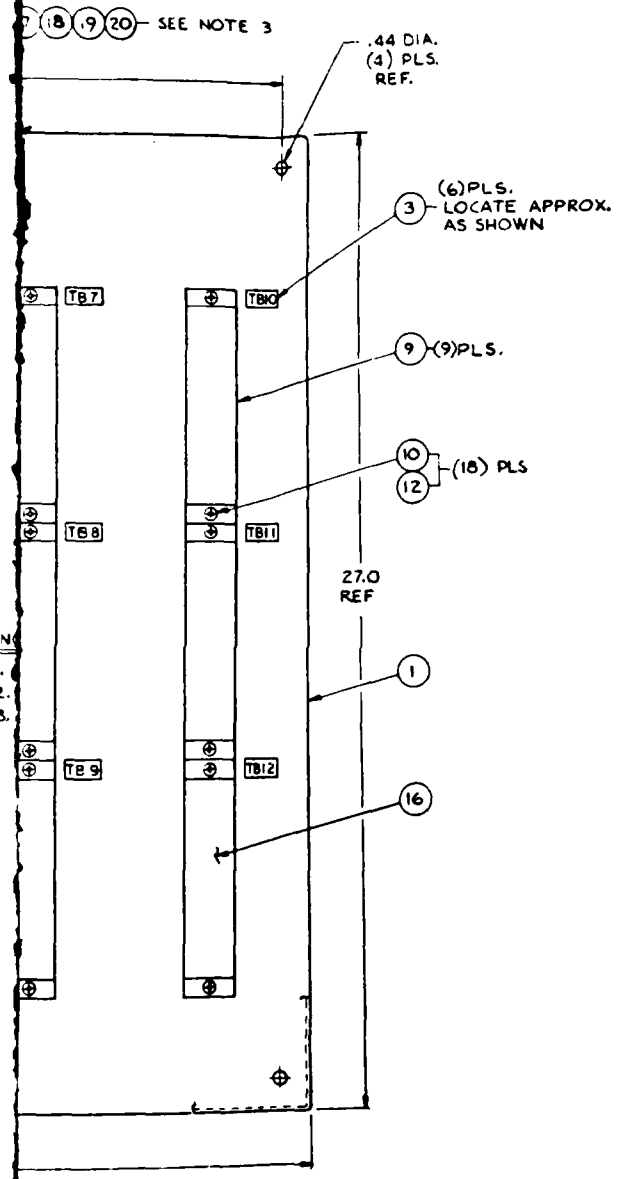
Figure 6-7. Junction Box Assembly (Sheet 2 of 3)

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
16	108486		NUT HEXLT THIN STOP PLTD #6 .138-32 ESNA 22NTM-62	4 EA
17	6W		ROLLED WASHER NYLTITE	8 EA
18	A-HCI-1		CORROSION INHIBITOR HOFFMAN	1 EA
19	01002051		HEATER WATLOW	1 EA
20	900428		312.750 FUSE .75 AMP LITTELFUSE OR EQUIV	1 EA
21	B312041	-	NAMEPLATE SST SH 22 GA X 1.25 X2.62	1 EA

C312861B

Figure 6-7. Junction Box Assembly (Sheet 3 of 3)


.88 REF.
19.25 REF.
17 18 19 20 SEE NOTE 3
.44 DIA. (4) PLS. REF.
(6)PLS. LOCATE APPROX. AS SHOWN
4 15
5 15
8
(4) PLS 11 12
K1
K2
K3
TB4
TB5
TB6
TB7
TB8
TB9
TB10
TB11
TB12
9 (9)PLS.
10 12 (18) PLS
25.25 REF.
27.0 REF
6
7 15
(2) PLS 13 14
2
(2) PLS 11 12
1
16
21.0 REF.



NOTES:

1. APPLY "LOCTITE" 242 TO ALL THREADS.
2. WIRE PER D316130, CONSOLE WIRING DIAGRAM.
3. JUMPERS (F/N'S 17, 18, 19 & 20) TO BE INSTALLED AS PER D316130.

D316223A

Figure 6-8. Terminal Panel Assembly
(Sheet 1 of 3)

P/L NUMBER	ENG REV	P/L NOMENCLATURE	CODE IDENT
D316223	C	TERMINAL PANEL ASSY	16603

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
1	D316234	-	PANEL-ALTERED	1 EA
2	C312860	-	RELAY MOUNTING ANGLE STL .19 X 1.50 X 2.0 X4.0	1 EA
3	A307912	-	LABELS-TERM PANEL	1 EA
4	D26MR80A		RELAY CUTLER-HAMMER	1 EA
5	D26MR51A		RELAY CUTLER-HAMMER	1 EA
6	KHS17A11-120		RELAY POTTER & BRUMFIELD	1 EA
7	27E166		SCREW TERMINAL SOCKET POTTER & BRUMFIELD	1 EA
8	D26MC4		MOUNTING CHANNEL CUTLER-HAMMER	1 EA
9	6TB24		TERMINAL BLOCK KULKA	9 EA
10	116274		SCREW MACH PAN HD PLTD 10-32NF X .75 LG	18 EA
11	116275		SCREW MACH PAN HD PLTD CROSS REC 10-32 X .50	6 EA
12	108474		WASH PLAIN TYPE B REGULAR STL PLTD .22 NOMINAL	24 EA
13	116165		SCR MACH PAN HD PLTD 6-32NCX.50	2 EA
14	108472		WASH PLAIN TYPE B REGULAR NO 6	2 EA
15	V130LA10A		VARISTOR GE MOV	3 EA

D316223A

Figure 6-8. Technical Panel Assembly (Sheet 2 of 3)

FIND NO	ITEM NUMBER	ENG REV	ITEM NOMENCLATURE	QUANTITY REQUIRED
16	V18ZA3		VARISTOR GE MOV	1 EA
17	A308433		JUMPER FOR KULKA 6TB AND 15TB TERMINAL BLOCKS	26 EA
18	6TBJ-2		JUMPER (2 POS) KULKA	4 EA
19	6TBJ-4		JUMPER (4 POS) KULKA	1 EA
20	6TBJ-6		JUMPER (6 POS) KULKA	1 EA

D316223A

Figure 6-8. Technical Panel Assembly (Sheet 3 of 3)

APPENDIX A

PNEUMATIC AND HYDRAULIC PIPING

FABRICATION AND INSTALLATION PROCEDURES

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	Add time limit to 4-3, 66 page 17	6-9-77	
	B	Sht 17: Para 4-4. Added to PICKLING--- "AND CLEANING". After "steel pipe" added "Corrosion resistant..."	3-4-81	
	C	Eliminated socket weld fittings; revised Sht 5, 8, 10, 12, & 13; deleted Sht 9 & 14.	7-30-81	
	D	Revised Sht 6,8,10,11,12,&13 to reflect new welding procedure as described in Note 2A, sht 6.	2-2-82	
	E	Added Rev status to Sht 1. Clarified Sht 9 and 14.	3-22-82	

PNEUMATIC AND HYDRAULIC PIPING

RECOMMENDED FABRICATION, CLEANING, TESTING AND INSTALLATION PROCEDURES

FOR INTERCONNECTION OF WESTERN GEAR SUPPLIED EQUIPMENT.

F/N	NEXT ASSY	QTY	USED ON
APPLICATION			

REV	-	-	-	-	-	-	-	-	-	-										
SHT	19	20	21	22	23	24	25	26	27	28	29									
REV	E	-	-	-	-	D	-	D	E	D	D	D	D	E	-	-	B	-		
SHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		

LIMITS ON MACHINED DIMENSIONS EXCEPT AS NOTED
ANGULAR ± 1°0'
LINEAR
X = ± .1
.XX = ± .03
.XXX = ± .010
FRACTIONAL ± 1/32

BREAK ALL SHARP EDGES

2-2-77

DRAWN C. LARSEN
CHECK C. LARSEN
ENGR C. LARSEN

APPROVED

WESTERN GEAR CORPORATION
HEAVY MACHINERY DIVISION
EVERETT, WASHINGTON

PNEUMATIC AND HYDRAULIC PIPING

SIZE	CODE IDENT NO.		REV
A	16603	A305765	E
SCALE	WT.	LB	SHEET 1 OF 23

MICROFILMED

APPROVAL SHEET

		DATE
QUALITY CONTROL MANAGER	E. C. [illegible]	3-12-77
PRODUCT SERVICES MANAGER	[illegible]	3-3-77
ENGINEERING MANAGER	John H. Short	2-14-77
PRODUCT SAFETY COMMITTEE CHAIRMAN	R T Hanley	3-1-77

Western Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765
	SCALE		SHEET 2

TABLE OF CONTENTS

Western Utah Corporation — Heavy Machinery Division
EVERETT, WASHINGTON 98201

SIZE	CODE IDENT NO.	
A	16603	A305765
SCALE		SHEET 3

1-0. INTRODUCTION

The purpose of this document is to provide guidance for construction and cleaning of Customer Supplied interconnecting piping for Western Gear Corporation (WGC) equipment, thus reducing the potential for contamination problems affecting WGC supplied components.

Satisfactory performance of a hydraulic or pneumatic piping system can be attained only by following proper procedures and methods throughout the construction process. Improper cleaning eventually results in particles of mill scale, sand, and other foreign material being forced into the system. These particles will damage critical parts and impair the operation of the equipment, causing costly component and equipment failures and shutdowns of entire systems.

It is imperative that the end product provide clean and structurally sound piping systems. This objective can be attained by following the basic requirements of this document.

Failure of WGC customers and their customers, in turn, to continually monitor the cleanliness of the entire hydraulic system and to periodically cleanse the system following initial installation and during subsequent operation of the equipment will cause premature and costly equipment failures and shutdowns of entire systems which are not the responsibility of WGC and for which WGC disclaims all liability.

The utilization of the procedures outlined herein can involve certain safety hazards for which certain precautions must be employed, either as expressly set forth herein or as may be customary and usual in the industry. WGC expressly disclaims any responsibility for injury to person or property resulting from the use of the procedures outlined herein.

western Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765	REV
	SCALE		SHEET 4	

2-0. PIPING DESIGN AND ARRANGEMENT

1. Piping sizes, allowable stresses and other physical design features must be as dictated by contractual requirements: Codes, ANSI, USCG, USN, ABS, etc. No responsibility for structural design is assumed or intended in these specifications.

2. When cleanliness of the piping system affects the warranty of equipment provided by WGC, it is mandatory that the piping design provide for completely demountable systems.

3. The most practical and widely used material for high pressure hydraulic piping is cold-drawn seamless steel pipe of low or medium carbon content ASTM A 106 GR. B, or MIL-T-20157, Type E. This material is smoother and far easier to clean than hot-drawn seamless or welded steel pipe, which often contains deep pits or scratches in the interior, and usually is coated with mill scale. Other grades of pipe and tubing may also be used if surface finishes are of comparable nature and if all conditions such as factors of safety and material certifications satisfy the applicable job specifications.

4. The most commonly used piping material for high pressure pneumatic service is seamless copper, copper-nickle (70-30 alloy), or stainless steel piping Piping of this material is easy to clean and will not corrode due to condensation and moisture in the air supply system.

5. Except for watertight deck and bulkhead penetrations, each length of pipe must be so constructed and arranged that it can be removed for pickling and cleaning after fabrication.

6. Air vents should be installed in high points of hydraulic piping runs Air pockets in the lines may cause erratic response and operation

7. Provision for temporary jumpers at ends of the pipe runs must be provided to facilitate flushing of the lines and pressure testing prior to operation

western Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765	REV
	SCALE			SHEET 5

3-0. FABRICATION

1. The equipment and components should be finally located and fixed in place before fabrication of the interconnecting piping is started. All case breathers and shaft seals should be tightly masked, no units disassembled nor opened for inspection nor any hydraulic piping attempted while welding, chipping, sandblasting or painting is being done in the immediate area.

2. Welding and brazing must be performed by qualified welders using Customer Specification procedures. These procedures, if properly followed, shall produce welds which are free of defects that would adversely affect the service of the weld joint.

2A. It is required that the pipe be purged with inert gas during the root pass. This practice reduces the possibility of root pass embrittlement due to atmospheric contamination.

3. All inside edges of pipe and tubing must be reamed or deburred to remove all sharp or feather edges remaining after cutting the pipe to length.

4. All stress relieving if required must be done after fabrication and prior to the cleaning process.

5. It is desirable to have not more than one bend in each length of pipe. The entire length of pipe should be visible for inspection. Flange or union joints must be provided in pipe runs which include more than one bend (see figure 1).

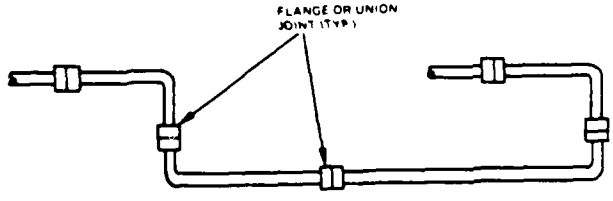
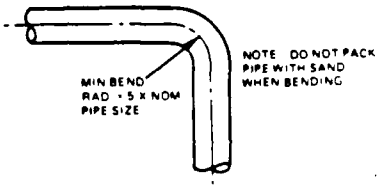


FIG 1

western GEAR CORPORATION Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765 REV D
	SCALE		SHEET 6

3-0. (Cont)

6. Cold bends in the piping are preferable to welded elbows. The bend radius should be a minimum of five times the nominal pipe size as shown in figure 2 However, any contract specifications relating to minimum bend radius, flattening at bends, thinning of walls at bends, etc., must be adhered to



PREFERRED METHOD

FIG 2

western Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765	REV
	SCALE			SHEET 7

3-0. (Cont)

7. When elbows must be used due to space limitations, use long radius butt weld elbows of the same size and wall thickness (schedule) as the piping. Do not use socket weld elbows.

Butt welded elbows with backup rings are to be avoided unless the rings are completely removed after welding. The backup rings catch foreign material that cannot be dislodged during cleaning, yet often will be dislodged during hydrostatic testing or when operating the equipment (figure 3).

Butt welded elbows without backup rings can be welded successfully by using gas tungsten arc welding (heliarc welding) for the first pass with inert gas purging as previously described.

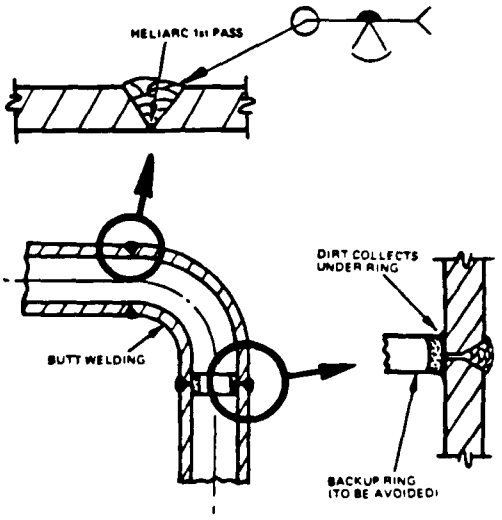


FIG 3

western GEAR CORPORATION Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765 REV D
	SCALE		SHEET 8

3-0 (continued)

8. DELETED

WESTERN GEAR CORPORATION Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765	REV E
	SCALE			SHEET 9

8314

3-0. (Cont)

9. Water tight deck or bulkhead penetrations should be straight lengths of pipe or tubing not more than 18 inches in length, with a flange or fitting on each end. See figures 7 and 8 for suggested design details. These methods will allow pickling of the pipe assembly prior to final installation, permitting visual inspection and cleaning if required after installation.

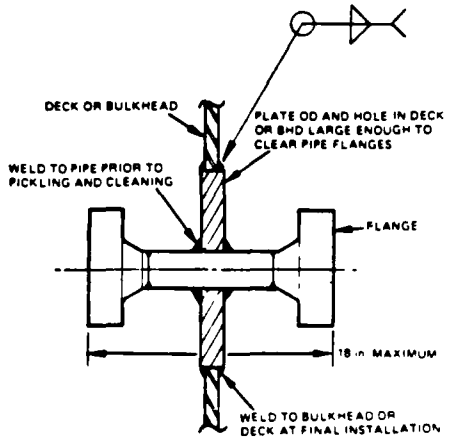


FIG 7

western Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765 REV D
	SCALE		SHEET 10

MICROFILMED

3-0. (Cont)

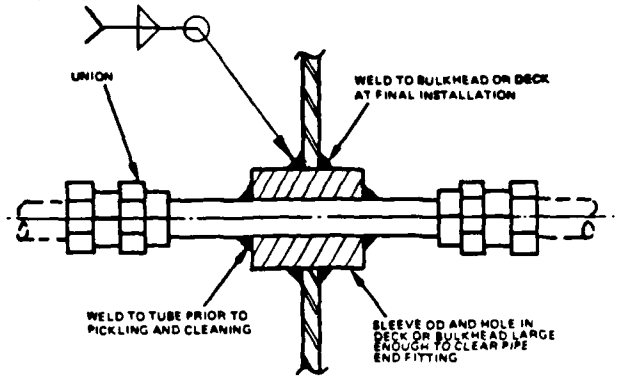


FIG 8

10. Non-watertight deck or bulkhead penetration methods are suggested in figures 9 and 10. All piping components must be pickled and cleaned prior to final installation.

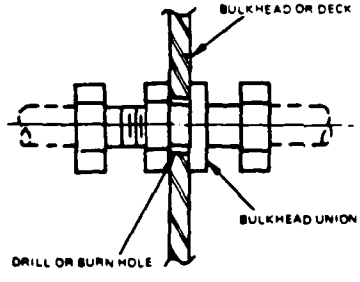


FIG 9

western HEAVY CORPORATION Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765 REV D
	SCALE		SHEET 11

MICROFILMED

3-0. (Cont)

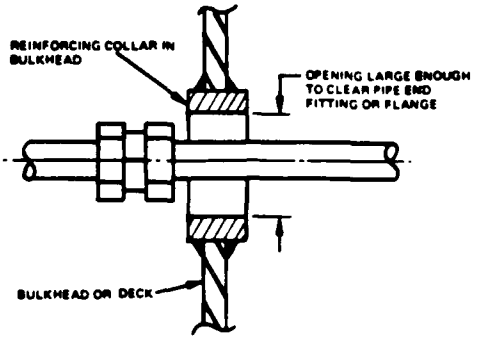


FIG 10

11. Flange connections, O-ring unions, or Grayloc type couplings must be used to join all high pressure assemblies. The flanges must fit squarely on the mounting face and be drawn up evenly to avoid distortion or uneven compression of the sealing elements, and to prevent the formation of pockets that will hinder the flushing operation.

12. Use butt weld (weld neck) flanges instead of the socket weld type. Butt weld flanges provide a more uniform transition between pipe and flange as compared to socket weld fittings, and thus avoiding stress concentrations at the joint. The interior of the pipe and flanges must be carefully cleaned to remove all welding slag or spatter, brazing flux, scale under a surface weld, and other contaminants. If backing rings are used with butt welds to attach flanges, the backing rings should be completely removed after welding (figure 11). Butt-welded joints without backup rings may be welded successfully by using heliarc (GTAW) welding for the first pass (figure 12) and inert gas purging as noted earlier.

Western Gear Corporation Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765 REV D
	SCALE		SHEET 12

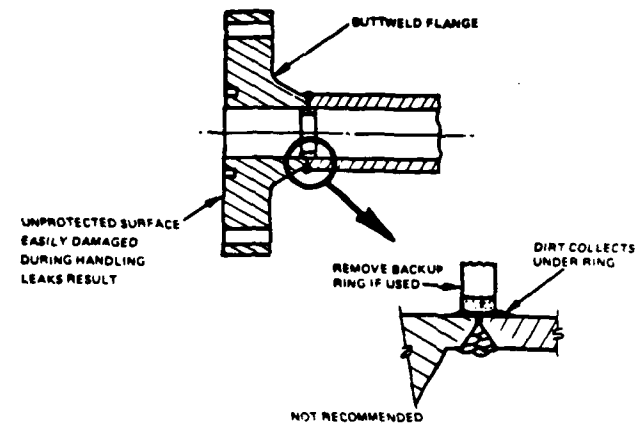


FIG 11

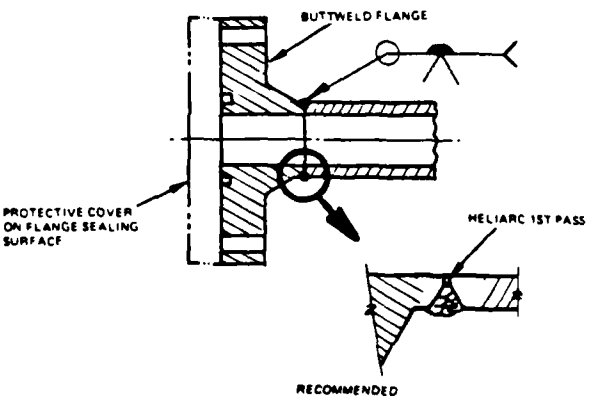


FIG 12

Western Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765	REV D
	SCALE			SHEET 13

3-0 (continued)

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Western Gear Corporation Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765	REV E
	SCALE		SHEET 14	

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3-0. (Cont)

13. It is imperative that blanking material be installed between pump or motor openings and their respective flanges during the pipe fabricating process to keep weld spatter and other contaminants out of the previously cleaned hydraulic system components. All pump, motor or valve ports and ends of all completed piping must be kept closed and protected at all times except when fitters are making final joints at assembly.

14. All piping should be fitted so that when each section of pipe is in place, all fittings and connectors align with their corresponding fittings and connectors without forcing. This will reduce stress on the pipe and the possibility of damage to components.

15. After the piping is fabricated, fitted, and supported in place, each pipe section should be identified prior to cleaning and inspection. The inspector should keep record of the pipe assemblies as they are processed through cleaning and final installation to assure conformance to all cleaning, installation and hydrostatic testing procedures for all piping components.

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4-0. CLEANING AND PICKLING

4-1. Cleaning and pickling of interconnecting piping is required to fully remove foreign substances such as oil, grease, paint, soil, mill scale, etc., which would otherwise cause damage to equipment components. These components have undergone a similar cleaning and pickling process at the factory and must not be contaminated by dirty piping.

The pickling process for interconnecting piping should be accomplished immediately prior to hydrostatic testing, installation and charging of the system.

Many different products and processes are available which will effectively clean and pickle pipe, provided the manufacturers' instructions are followed. No preference for a given product is implied; however, the following basic steps must be taken to ensure that the piping is cleaned and is kept clean.

4-2. CLEANING. Prior to fabrication the piping should be cleaned by wire brushing, including the interior, and blasted with high pressure air to remove loose particles. Boiler tube brushes or commercial cleaning apparatus may be used for this purpose.

4-3. PICKLING CARBON STEEL PIPE. See appendix A for suggested makeup and temperature of cleaning and pickling solutions.

WARNING

Face shield, protective gloves and other protective clothing must be worn when working with pickling solutions to prevent injury to personnel.

1. Immerse in a caustic bath solution for 15 minutes or longer to remove paint, varnish, grease, etc.
2. Rinse in clean water.
3. Immerse in acid solution and exercise caution with respect to duration of immersion. Leave pipe in bath only long enough to permit adequate pickling as determined visually. This caution is necessary to ensure and protect the mechanical properties of the pipe, tubing, and end fittings.
4. Rinse in a clean water bath immediatly following completion of the previous step.
5. Immerse in a hot water neutralizer bath for several minutes.
6. Rinse in a clean water bath.
7. Allow to drain and dry. Drying by air blasting is not recommended because it will contaminate the piping

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4-3 (Cont)

8. Inspect the pipe for cleanliness. One suggested method is to pull a clean, lint-free cloth soaked in kerosene through the pipe. Another method, especially if the pipe is not straight, is to tape the ends closed and with the taped end down, tap the pipe with a hammer in various places. If foreign material is found on the cloth or tape, the pipe must be repickled. Inspection tion and preservation should be completed with a maximum time delay of one hour.

9. Coat the inside of ferrous piping with clean preservative fluid (solution determined by consideration of the fluid used in the system.) Cap the ends and wrap the end fittings (flanges) with protective material.

4-4 PICKLING AND CLEANING CORROSION-RESISTANT STEEL PIPE. Corrosion-resistant steel pipe that is not to be welded may require only steam cleaning, and where adherent contaminants persist, interior and exterior steel wire brushing and blasting with high pressure air is required. See Appendix B for suggested makeup and temperature of cleaning and pickling solutions.

WARNING

Face shield, protective gloves and other protective clothing must be worn when working with pickling solutions to prevent injury to personnel.

1. Immerse in a caustic bath solution for 15 minutes or longer to remove paint, varnish, grease, etc.

2. Rinse in clean warm water.

3. Immerse the piping assembly for 10 to 15 minutes in the acid solution and rinse in a clean warm water bath immediately following.

4. Allow to drain and dry. Drying by air blasting is not recommended because it will contaminate the piping.

4-5 PICKLING NONFERROUS PIPING (copper, copper-nickel, bronze). See Appendix C for suggested makeup and temperatures of cleaning and pickling solutions.

WARNING

Face shield, protective gloves and other protective clothing must be worn when working with pickling solutions to prevent injury to personnel.

1. Immerse in a caustic bath solution for 15 minutes or longer.

2. Rinse in clean warm water bath.

3. Immerse in acid solution at room temperature.

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8-5. *(Cont)*

4. Rinse in a clean warm water bath.
5. Immerse in a neutralizer solution for several minutes.
6. Rinse in a clean warm water bath.
7. Allow to drain and dry. Drying by air blasting is not recommended because it will contaminate the piping.
8. Additional flushing of the assembled equipment is required to remove the brazing fluxes. Suggested solutions for this are given in Appendix C

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5-0. HYDROSTATIC TESTING PRIOR TO INSTALLATION.

WARNING

Observe appropriate safety precautions to prevent injury to personnel and damage to equipment during testing procedures.

A hydrostatic test should be performed prior to installation using clean filtered preservative fluid for hydraulic lines and water for corrosion-resistant pneumatic lines.

The pipe assemblies may be tested individually or in groups. If leaks occur, they must be repaired and the pipe recleaned, repickled and retested. After the hydrostatic test, drain the lines and cap the ends, being careful to avoid introducing contamination. Allow pneumatic piping to dry before capping the ends.

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6-0. INSTALLATION

1. The piping should be installed as soon as possible after pickling and hydrostatic testing. Hydraulic piping should be filled with the recommended operating fluid within one week after installation. A shorter period is preferred in especially humid areas.

2. No abrasive blasting, chipping, grinding or use of air tools may be permitted in the area during installation. Airborne dust must not be permitted in the area while the clean pipes are uncapped and installed.

3. No turning, drilling, tapping, welding (except deck or bulkhead penetrations) nor heating of pipe, will be allowed. If any rework of the pipe is necessary during installation, the pipe sections must be cleaned, pickled and hydrostatic tested again before final installation.

4. When welding deck or bulkhead penetration sections in place, make sure that the openings are covered and that the end fittings are protected from weld spatter.

5. When installing and joining pipe sections make sure that the sealing surfaces are clean, free from nicks and scratches and that O-rings and gaskets are new and compatible with the fluid to be used in the system.

6. Tighten flange bolts evenly.

7-0. HYDROSTATIC TESTING AND FLUSHING AFTER INSTALLATION.

7-1. GENERAL. The entire piping system must be pressure tested before connecting to WGC equipment. The opening of and connecting to WGC components should take place in the presence of customer inspection personnel and a WGC representative.

7-2. HYDRAULIC PIPING. The pressure test and flushing operation should be accomplished using a separate (commercially available) hydraulic power unit. The pump must have adequate capacity to provide at least 20 feet per second flow velocity in the lines when flushing. Use the same fluid that will be used in operation of the hydraulic system.

When practicable, more than one pipe run may be tested and subsequently flushed at the same time. See figure 15.

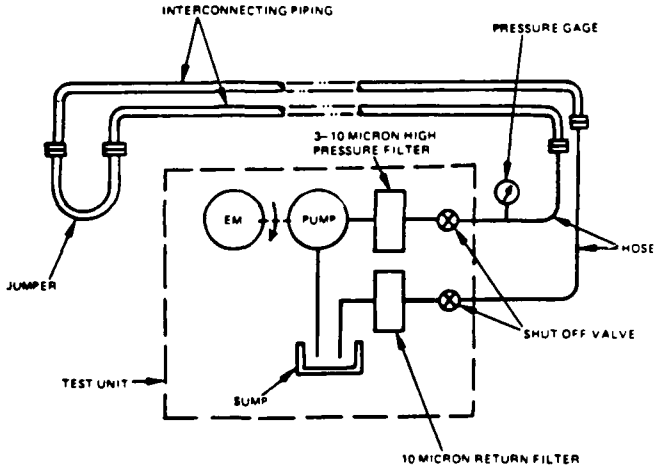

FIG 15

western GEAR CORPORATION Heavy Machinery Division EVERETT, WASHINGTON 98201	SIZE A	CODE IDENT NO. 16603	A305765
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7-2. (Cont)

Inspect the return filter element frequently and replace elements as required. When the elements appear clean and free of particles, take a fluid sample from the return end of the piping. A particle count of the sample should meet NAS Class 7* (noted below) for piping that serves piston pumps. For piping serving vane pumps and gear pumps the cleanliness level should be Class 9*. Keep flushing until the cleanliness level is met. When flushing hydraulic lines it is good practice to switch the supply and return hoses from the test unit at least once, thus reversing the flow in the pipe runs.

TABLE 1. MAXIMUM CONTAMINATION LIMITS PER NAS 1638 (BASED ON A 100 ML SAMPLE SIZE)

Particle Size Range (Microns)	CLASSES							
	5	6	7*	8	9*	10	11	12
5 to 15	8,000	16,000	32,000	64,000	128,000	256,000	512,000	1,024,000
15 to 25	1,425	2,850	5,700	11,400	22,800	45,600	91,200	182,400
25 to 50	253	506	1,012	2,025	4,050	8,100	16,200	32,400
50 to 100	45	90	180	360	720	1,440	2,880	5,760
Over 100	8	16	32	64	128	256	512	1,024

*unless otherwise specified on system drawings or specifications.

7-3. PNEUMATIC PIPING. The hydrostatic pressure test and flushing of corrosion resistant steel piping should be accomplished using clean fresh water and dried with clean filtered air.

Flushing of nonferrous piping (copper, copper-nickel, bronze) is required to remove all brazing fluxes. Suggested solutions for this are given in Appendix C

When hydrostatic testing and flushing operations are complete, connect the piping to respective components. When opening the port or any component, first clean the immediate area around the port. Use extreme caution when connecting to a previously cleaned system to prevent foreign material from entering the system

8-0. Charging Hydraulic System.

1. To repeat, the purpose of this document is to provide guidance for construction and cleaning of customer supplied interconnecting piping for Western Gear Corporation equipment, thus reducing the potential for contamination problems affecting WGC supplied components.

2. Where WGC supplied components are not shipped charged with appropriate fluid they must also be flushed and inspected prior to charging.

3. Customer supplied reservoirs where used must be similarly prepared.

4. When the system interconnecting piping has been properly assembled, hydrostatic tested and flushed and all other components prepared as noted in steps 2 and 3 above, the equipment can be plumbed and system charging begun.

5. All hydraulic fluid added to the system must be filtered through a 3-10 micron filter. Good housekeeping procedures must be followed to minimize all potential contamination problems in transferring fluid from the shipping containers to the hydraulic reservoir.

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APPENDICES

Appendix A - Carbon Steel Pipe Pickling and Treatment

Appendix B - Corrosion Resistant Steel Pipe Pickling and Treatment

Appendix C - Nonferrous Pipe Pickling and Treatment (copper, copper-nickel, bronze)

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APPENDIX A

Carbon Steel Pipe Pickling & Treatment

1. Caustic Bath (Grease and Paint Removal)

Solution:	Roprepp R (R. O. Hull Co.	2 Pounds
	Water:	1 gallon
Temperature:	180 ± 5 degrees (82 ± 3 degrees C)	
Time:	15 minutes or longer, depending upon degree of contamination.	
Neutralizer:	Rinse in clean water.	

2. *Acid Solution Pickling (Scale and Rust Removal)*

CAUTION

The acid should always be added carefully to the water. Do not add the water to the acid.

Solution:	Hydrochloric Acid (35 to 36.5 % assay) with commercial inhibitor.	.43 gallons
Water.		1 gallon
Temperature	Ambient	

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MICROFILMED

Leave pipe in bath only long enough to permit adequate pickling as determined visually.

Time: As visually determined by removal of scale and rust.

3. Treatment Following Pickling

Solution:	Soda Ash (as required to maintain a 9 to 10 P_h)	2 - 4 ounces
	Non-ionic wetting agent VWR9N9 (VanWaters and Rogers Co.)	3.8 ml
	Water.	1 gallon

Temperature: Ambient

Caution: The maintenance of the P_h value noted above is critical and must be frequently monitored. The product of neutralization of acid carry-over from the pickling tank is common salt (NACL) which if allowed to accumulate will promote flash rusting of the pickled pipe.

APPENDIX B

Corrosion Resistant Steel Pipe Pickling & Treatment

1. Caustic Bath (Grease and Paint Removal)

Solution:	Trisodium Phosphate (TSP) or Sodium Hydroxide (lye):	7-10 ounces
	Detergent, nonionic (Polyethylene-glycol Monoalkylaryl ether)	1 fluid ounce
	Water	1 gallon
Temperature:	200 ± 10 degrees F (94 ± 6 degrees C)	
Time:	15 minutes or longer, depending upon degree of contamination.	
Neutralizer:	Rinse in clean warm water, 120 degrees F (48 degrees C) or higher	

2. Acid Solution-Pickling (Passivation)

CAUTION

The acid should always be added carefully to the water. Do not add the water to the acid.

Solution	Nitric Acid	13-20 Fluid Ounces
	Hydrofluoric Acid (60%)	1-2 Fluid Ounces
	Water	1 gallon
Temperature:	130 ± 10 degrees F (55 ± 6 degrees C)	
Time:	10 to 15 minutes	
Neutralizer:	Rinse in a clean warm water bath	

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APPENDIX C

Nonferrous Pipe Pickling and Treatment (Copper, Copper-nickel, Bronze)

1. Caustic Bath (Grease and Paint Removal)

Solution:	Trisodium Phosphate (TSP) or Sodium Hydroxide (lye)	7-10 ounces
	Detergent, nonionic (Polyethylene-glycol Monoalkylaryl ether)	1 fluid ounce
	Water:	1 gallon
Temperature:	200 ± 10 degrees F (94 ± 6 degrees C)	
Time:	15 minutes or longer, depending upon degree of contamination.	
Neutralizer:	Rinse in clean warm water, 120 degrees F (48 degrees C) or higher	

2. Acid Solution - Pickling

CAUTION

The acid should always be added carefully to the water. Do not add the water to the acid.

Solution:	Sulfuric Acid, 66 degrees Baume, Specific Gravity 1.83	7-14 fluid ounces
	Water.	1 gallon
	Note If red stains appear add 2-4 ounces per gallon of water of sodium dichromate to above solution	
Temperature:	Room Temperature	
Time.	As visually determined by removal of surface contaminants.	

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Appendix C (Cont)

3. Treatment Following Pickling

   a. Rinse in clean water bath

   b. Immerse for several minutes in an alkaline bath containing four ounces (per gallon of water) of soda ash

   c. Rinse in clean warm water bath

4. Flushing of installed system for removal of brazing fluxes

Solution:	Glacial Acetic Acid	5 gallons
	Water	95 gallons
Temperature:	120-140 degrees F (49-60 Degrees C)	
Time:	Circulate for one hour	
Neutralizer:	Flush with warm water. Repeat flushing procedure as necessary. Drain and dry piping upon completion.	

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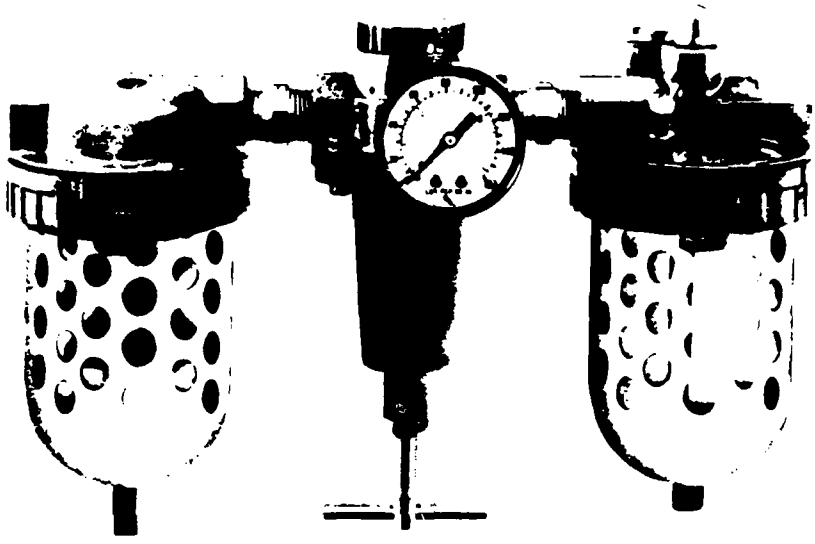
APPENDIX B

VENDOR PNEUMATIC EQUIPMENT

WABCO FLUID POWER DIVISION

AMERICAN-STANDARD

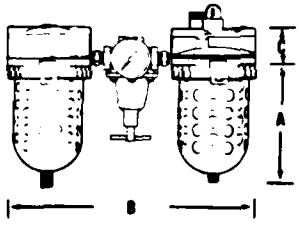
STANDARD INDUSTRIAL FILTER



ORDERING INFORMATION—Specify pipe size and combination unit piece number

Pipe Size (Inches)	Air Flow* (SCFM)	Combination Unit Piece Numbers		Consists of Necessary Pipe Nipples Plus			Dimensions (Inches)		
		Unassembled	Assembled	Filter Pc. No	Regulator W/Gauge Pc. No	Lubricator Pc. No	A	B	C
¼	28	PS7265-0005	PS7265-0003	PF7502-13602	PR7563-52002	PG7602-23402	6¾	11½	1¾
⅜	50	PS7266-0005	PS7266-0003	PF7502-13603	PR7563-52003	PG7602-23403			
½	90	PS7267-0005	PS7267-0003	PF7502-13604	PR7564-32004	PG7602-23404		12¾	
¾	170	PS7268-0005	PS7268-0003	PF7503-23605	PR7564-32005	PG7603-25405	8⅞	14½	2
1	340	PS7269-0005	PS7269-0003	PF7503-23606	PR7565-22006	PG7603-25406		15⅞	
¼	28	PS7270-0005	PS7270-0003	PF7502-13602	–	PG7602-23402	6¾	8¾	1¾
⅜	50	PS7271-0005	PS7271-0003	PF7502-13603	–	PG7602-23403			
½	90	PS7272-0005	PS7272-0003	PF7502-13604	–	PG7602-23404			
¾	170	PS7273-0005	PS7273-0003	PF7503-23605	–	PG7603-25405	9	10¾	2
1	340	PS7274-0005	PS7274-0003	PF7503-23606	–	PG7603-25406			
¼	57	PS7275-0005	PS7275-0003	PF7502-13602	PR7563-52002	–	6¼	7	1¾
⅜	90	PS7276-0005	PS7276-0003	PF7502-13603	PR7563-52003	–			
½	115	PS7277-0005	PS7277-0003	PF7502-13604	PR7564-32004	–		7½	1¾
¾	266	PS7278-0005	PS7278-0003	PF7503-23605	PR7564-32005	–	8½	8¼	
1	340	PS7279-0005	PS7279-0003	PF7503-23606	PR7565-22006	–		10¼	1¾

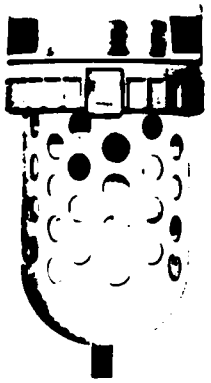
*At 100 psig and a 5 psi pressure drop across the lubricator



STANDARD INDUSTRIAL FILTER

Combinations of units listed are shipped unassembled, but the individual components, gauges and nipples are all packed in a single box for each unit ordered. Orders for units in quantities of fifteen (15) or more can be shipped assembled, just change the suffix of the unit piece number from -0005 to -0003.

CAUTION:
When using a unit with a transparent bowl beware of contaminants that will attack polycarbonate (See CAUTION statement



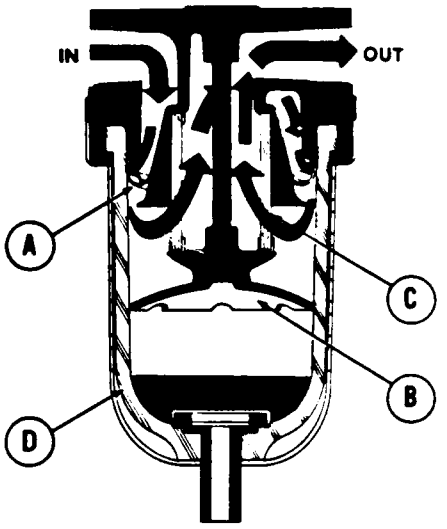
All applications of pneumatic fluid power equipment require clean air for long equipment life and low maintenance cost.

WABCO offers a complete line of filters to reliably collect and discharge liquid and solids common to compressed air.

OPERATION

Air enters the unit and passes through the fixed baffle (A) which causes the air to centrifugally whirl dirt and liquid particles outward against the sides of the bowl. The particles drop down past the quiet zone baffle (B) into the storage area.

The partially cleaned air passes through the filter element (C) where particles larger than 3 to 5 microns are removed (depending on the filter element used) before the air is delivered through the out port. The storage area in bowl (D) is drained to atmosphere to remove contaminants.



SPECIFICATIONS

Pressure Rating—w/Polycarbonate bowl = 200 psig Max
w/All metal bowls = 250 psig Max
w/Mechanical drain = 20 psig Min to 175 psig Max

Temperature Rating—w/Polycarbonate bowl = 130°F Max
w/All metal bowls = 200°F Max

Elements—5-micron felt w/permanent molded gaskets
3-micron cotton flannel (can be purchased and installed by the user)

Materials—Die castings are zinc alloy
Sand castings on sizes above 1" are aluminum
Transparent bowls are polycarbonate
Float on mechanical drain is nitrophyl, puncture proof, cellular rubber

Allowable Pressure Drop—20 psig Max

CAUTION:
When using a unit with a transparent bowl, beware of contaminants which will attack polycarbonate. (See CAUTION statement

STANDARD FEATURES

5-micron Felt Element—Permanent type that can be easily cleaned. Includes molded-on gaskets, at each end of ¼" thru 1" pipe sizes, to simplify maintenance

Baffle System—Large in size for high flow capabilities, designed to increase velocity of air to whirl and separate liquid and dirt particles before entry into the element. Lower baffle creates a quiet zone for storage prior to draining

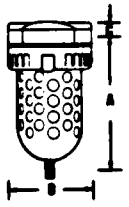
Polycarbonate Bowl—To provide maximum visibility to contents, thru a transparent material

Bowl Guard—Made from steel and used with all polycarbonate bowls for added measure of safety

Quick Disconnect Ring—Provided on ¼" thru 1" pipe sizes to save time on maintenance. No tools required for bowl removal which means no chance of stripped threads. Designed with a lock to help insure that bowl is secured before unit is pressurized.

Flexible Drain—For fast drainage with less air waste on polycarbonate bowls. Designed for easy draining in hard-to-reach places. Can't be left leaking because it shuts itself off. Simply push the rubber tip to one side to drain the bowl.

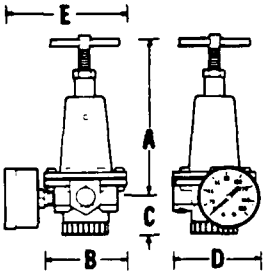
ORDERING INFORMATION—Specify pipe size, description and piece number. If 3-micron element is required, specify additional piece number.

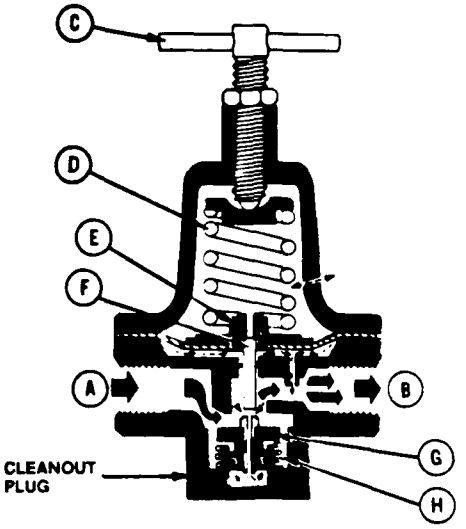


	Pipe Size (Inches)	Bowl Size	Airflow *(SCFM)	Piece Numbers: Plastic Bowl with Guard — With Flexible Drain	Plastic Bowl with Guard — With Mechanical Drain	Metal Bowl — With Petcock	Metal Bowl — With Mechanical Drain	Metal Bowl — W/Sight Gauge & Petcock	Dimensions (Inches) A	B	C
Compact	¼	5 oz	46	PF7500-13002	PF7500-13402	–	–	–	5⅝	2¼	½
	⅜		57	PF7500-13003	PF7500-13403	–	–	–			
Compact with Jumbo Bowl	¼	6 oz	46	–	–	PF7501-11002	PF7501-11402	PF7501-12002	6⅛	2¼	½
	⅜		57	–	–	PF7501-11003	PF7501-11403	PF7501-12003			
Standard Models	¼	11 oz	57	PF7502-13002	PF7502-13402	PF7502-11002	PF7502-11402	PF7502-12002	6¼	3⅝	¾
	⅜		90	PF7502-13003	PF7502-13403	PF7502-11003	PF7502-11403	PF7502-12003			
	½		115	PF7502-13004	PF7502-13404	PF7502-11004	PF7502-11404	PF7502-12004			
	¾	1 qt	266	PF7503-23005	PF7503-23405	PF7503-21005	PF7503-21405	PF7503-22005	9	4⅛	1
	1		331	PF7503-23006	PF7503-23406	PF7503-21006	PF7503-21406	PF7503-22006			
	1¼	11 oz	900	PF7504-23007	–	PF7504-21007	–	PF7504-23007	16⅛	8	1⅛
	1½		1008	PF7504-23008	–	PF7504-21008	–	PF7504-23008			
	2		1186	PF7504-23009	–	PF7504-21009	–	PF7504-23009			

*[illegible]

Pneumatic pressure control is essential in fluid power circuits to meet the demands of components and to reduce the cost of air. WABCO offers a complete line of Industrial Quality Air Regulators to provide constant working pressures and prevent waste.





FEATURES

Large Diaphragm—Accurately regulates pressure so your equipment receives the proper amount

Extra Large Main Valve—Allows air to flow at a high rate, avoiding excessive pressure drops

Cleanout Plug—Finger-tightened plug permits easy and quick removal for cleaning of air screen

Extra Outlet Ports—¼" NPT ports located on the front and back for additional low flow outlets or gauge ports

SPECIFICATIONS

Operating Pressure—300 psig Max

Temperature Rating—200° F Max

Relieving Pressure—Approx. 6 psig above setting under normal conditions

Materials—Die cast zinc bodies and bonnets, neoprene diaphragms and Buna-N valve seats

OPERATION

When an increase in pressure is called for downstream, air moves freely from the inlet port (A) to the outlet port (B). The adjusting screw (C) forces the spring (D) against the diaphragm disc (E) and, in turn, against the valve stem (F). When the spring's force is greater than the pressure beneath the diaphragm, it pushes hard enough against the valve (G) to open the valve and allow air to flow through the line.

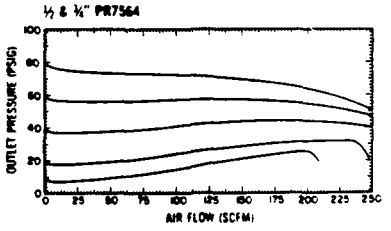
When the pressure downstream builds up in the chamber beneath the diaphragm enough to overcome the upper spring's force, that pressure plus the force of the lower spring (H) causes the diaphragm and the valve stem to rise. This closes the valve opening between the inlet and outlet ports.

In units with built-in relief, if pressure beneath the diaphragm goes over the desired psi, the diaphragm disc (E) *will rise and lift the disc seal from around the valve stem (F).* Excess pressure will bleed through the opening into the regulator bonnet and on to the atmosphere.

Model	Pipe Size (Inches)	Dimensions (Inches) A	B	C	D	E
Standard	¼	6¼	3	1⅜	3	4½
	⅜					
	½	6⅝				
	¾					

FLOW CHARACTERISTICS

100 psig supply pressure



STANDARD MODELS

Piece No. PR7564 – 3 1 0 0 2

SERIES DESIGN

PRESS RANGE & GAUGE
1 = 3-125 L/Gauge
2 = 3-125 W/Gauge P48788-0002
5 = 10-250 L/Gauge
6 = 10-250 W/Gauge P48788-0004

PORT SIZE (NPT)
2 = ¼"
3 = ⅜"
4 = ½"
6 = ¾"

OPTIONS
0 = Relieving
2 = Non-Relieving

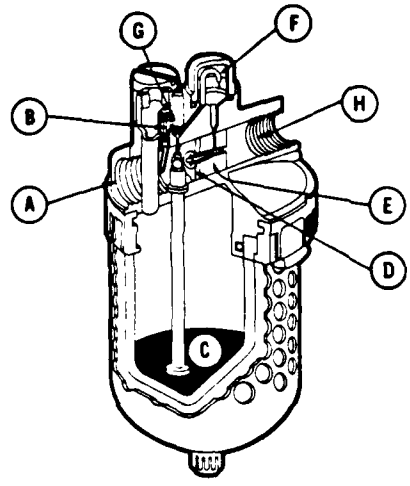
MOUNTING OPTIONS
0 = None (Std)
4 = Panel Mtg w/Plastic Knob (Panel hole ⅝" dia. Max. & 5/16" Max. panel thickness)

ORDERING INFORMATION

Specify the unit that meets the pipe size and flow requirements of your application. Review all models—Compact, Standard and High Flow—and complete the Piece Number suffix with the digits that cover the required options.

Pneumatic circuits transmit power through a fluid (gas) under pressure to produce a work force. Some devices used in these circuits, due to high flow and cycle rate, require continuous lubrication to insure long life and low maintenance cost.

WABCO offers the industrial quality lubricator to add oil, in fine mist form, to the flowing pressurized gas to provide lubrication for pneumatic devices connected downstream of the lubricator.



FEATURES

Automatic Oil to Air Ratio—A single needle valve adjustment regulates the oil mist per SCFM of air. Changes in airflow after manual adjustment automatically adjusts the oil-to-air balance to maintain correct mixture.

Easy Fill—Removal of fill cap removes air pressure from bowl without turning off airflow. Fill bowl completely full.

Polycarbonate Bowl—To provide maximum visibility of contents thru a transparent material. Uses a radio knob type drain.

Bowl Guard—Made from steel and used with all polycarbonate bowls for added measure of safety.

Quick Disconnect Ring—Designed to save maintenance time. No tools required for bowl removal, no chance of stripped threads. Includes a lock to help insure that bowl is secured *before unit is pressurized.*

OPTIONAL FEATURES

Metal Bowl w/Sight Gauge—to allow monitoring of liquid level through a pyrex sight gauge with added safety. Uses a petcock drain.

Oversize Oil Capacity—units ½" size and larger can be furnished with metal bowl and sight gauge oversized to increase time between refills.

SPECIFICATIONS

Operating Pressure—w/Polycarbonate bowl—200 psig Max.
w/metal bowl & sight gauge—
250 psig Max.

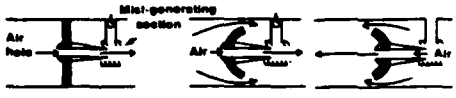
Temperature Rating—w/Polycarbonate bowl—130° F Max.
w/metal bowl & sight gauge—
200° F Max.

Materials—Die castings are zinc alloy. Flexible parts are of Buna-N or polyurethane.

CAUTION: When using a unit with a transparent bowl, beware of contaminants that will attack polycarbonate.
(See CAUTION statement on Page 20.)

OPERATION

A portion of the air entering through the inlet port (A) flows through a small tube leading to the pressurizing valve (B). This, in turn, applies pressure to the oil in the storage bowl (C). Meanwhile, most of the air flows through the hole in the center of the airflow regulator (D) and into the mist-generating section (E). The slight pressure differential between the mist section (H) and the oil bowl (C) causes oil to flow through the syphon tube from the bowl to the drip tube (F). A screw-adjusted needle-valved orifice (G) in the syphon tube regulates the amount of oil mist per cubic foot of air. The oil-to-air ratio is adjusted while the correct amount of air is flowing through the unit. Once set, the adjustment normally never needs to be reset unless a change is desired.



If increased airflow is called for downstream, the airflow regulator adjusts the rate, as illustrated. Increased airflow in the mist-generating section causes the pressure to drop slightly at that point, proportionately increasing the amount of oil drawn from the oil bowl and into the airstream.

The design of the mist-generating section breaks up the oil into fine particles which normally remain in suspension for at least 20 feet. Once the inside of the line is oil coated, it is possible for lubricated air to travel as far as 300 feet downstream, regardless of the line's path or changes in direction.

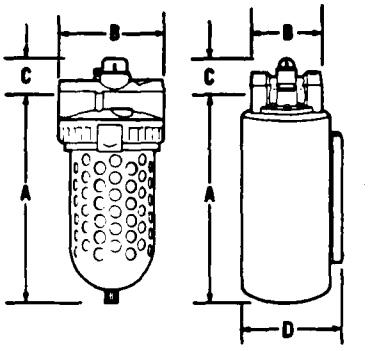
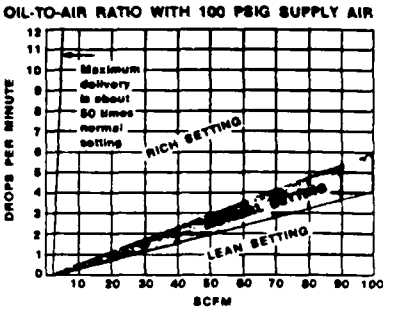


FIG. 1

FIG. 2



One drop per minute of oil per 20 cubic feet of air is considered ideal by many pneumatic tool makers

ORDERING INFORMATION—Specify pipe size and piece number.

Models	Pipe Size (Inches)	Usable Oil Capacity	Air-flow* (SCFM)	Piece Number		Dimensions (Inches)				
				Plastic Bowl w/Bowl Guard	Metal Bowl w/Sight Gauge	A	B	C	D	Fig No
Compact	¼	4.2 oz	28	PG7600-20402	–	5⅛	2⅛	1⅛	–	1
		6.7 oz		–	PG7601-29002					
	⅜	4.2 oz	50	PG7600-20403	–					
		6.7 oz		–	PG7601-29003					
Standard	¼	11.5 oz	28	PG7602-23402	–	6⅜	3⅛	1¼	–	1
		11.3 oz		–	PG7602-24002					
	⅜	11.5 oz	50	PG7602-23403	–					
		11.3 oz		–	PG7602-24003					
	½	11.5 oz	90	PG7602-23404	–					
		11.3 oz		–	PG7602-24004					
		28.0 oz		–	PG7602-26004	7⅛	3⅛	1¼	5⅛	2
		95.0 oz		–	PG7602-27004	9¼			7 1/16	
		275.0 oz		–	PG7602-28004	16			8 5/16	
	¾	23.3 oz	170	PG7603-25405	–	9	4⅛	2	4⅛	2
		30.0 oz		–	PG7603-26005	8⅛			4¼	
	1	23.3 oz	340	PG7603-25406	–	9			4⅛	
		30.0 oz		–	PG7603-26006	8⅛			4¼	
		95.0 oz		–	PG7603-27006	9¼			7 1/16	
		275.0 oz		–	PG7603-28006	16			8 5/16	
	1¼	30.0 oz	850	PG7604-15407	–	10	5⅛	2⅛	–	1
		36.0 oz		–	PG7604-16007				4¼	2
		95.0 oz		–	PG7604-17007	9⅛			7 1/16	
		275.0 oz		–	PG7604-18007	15⅞			8 5/16	
	1½	30.0 oz	850	PG7604-15408	–	10			–	1
		36.0 oz		–	PG7604-16008				4¼	2
		95.0 oz		–	PG7604-17008	9⅛			7 1/16	
		275.0 oz		–	PG7604-18008	15⅞			8 5/16	
	2	30.0 oz	1100	PG7605-15409	–	10¼	5½	2⅛	–	1
		36.0 oz		–	PG7605-16009				4 1/16	2
		95.0 oz		–	PG7605-17009	9⅛			7 1/16	
		275.0 oz		–	PG7605-18009	16⅛			8 5/16	

*At 100 psig inlet and a 5 psi pressure drop

CAUTION

DO NOT PLACE PLASTIC BOWL UNIT IN SERVICE WITHOUT METAL BOWL GUARD INSTALLED.

Plastic bowl units are sold only with metal bowl guards. To minimize the danger of flying fragments in the event of plastic bowl failure, the metal bowl guards should not be removed. If the unit is in service without the metal bowl guard installed, manufacturer's warranties are void, and the manufacturer assumes no responsibility for any resulting loss.

IF UNIT HAS BEEN IN SERVICE AND DOES NOT HAVE A METAL BOWL GUARD, ORDER ONE AND INSTALL BEFORE PLACING BACK IN SERVICE.

CAUTION

Certain compressor oils, chemicals, household cleaners, solvents, paints and fumes will attack plastic bowls and can cause bowl failure. Do not use near these materials. When bowl becomes dirty replace bowl or wipe only with a clean, dry cloth. Reinstall metal bowl guard or buy and install a metal bowl guard. *Immediately* replace any crazed, cracked, damaged or deteriorated plastic bowl with a metal bowl or a new plastic bowl and metal bowl guard.

CAUTION

Except as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss.

SOME OF THE MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS.

Acetaldehyde
Acetic acid (conc.)
Acetone
Acrylonitrile
Ammonia
Ammonium fluoride
Ammonium hydroxide
Ammonium sulfide
Antifreeze
Benzene
Benzoic acid
Benzyl alcohol
Brake fluids
Bromobenzene
Butyric acid
Carbolic acid
Carbon disulfide
Carbon tetrachloride
Caustic potash solution
Caustic soda solution
Chlorobenzene
Chloroform
Cresol
Cyclohexanol
Cyclohexanone
Cyclohexene
Dimethyl formamide
Dioxane
Ethane tetrachloride
Ethyl acetate
Ethyl ether
Ethylamine
Ethylene chlorohydrin
Ethlene dichloride
Ethlene glycol
Formic acid (conc.)
Freon (refrigerant & propellant)
Gasoline (high aromatic)
Halgard Co.'s hal-phene
Hydrazine
Hydrochloric acid (conc.)
Lacquer thinner
Methyl alcohol
Methylene chloride
Methylene salicylate
Milk of lime (CaOH)
Nitric acid (conc.)
Nitrobenzene
Nitrocellulose lacquer
Phenol
Phosphorous hydroxy chloride
Phosphorous trichloride
Propanoic acid
Pyridine
Sodium hydroxide
Sodium sulfide
Styrene
Sulfuric acid (conc.)
Sulphuryl chloride
Tannergas
Tetrahydronaphthalene
Thiophene
Toluene
Turpentine
Xylene
Perchlorethylene and others

TRADE NAMES OF SOME COMPRESSOR OILS, RUBBER COMPOUNDS AND OTHER MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS.

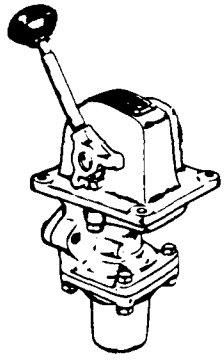
Atlas "Perma-Guard"
Cellulube #150 and #220
Crytex #5 cement
Eastman 910
Garlock #98403 (polyurethane)
Houghton & Co. oil #1120, #1130 and #1055
Houtosafe 1000
Kano Kroil
Keystone penetrating oil #2
Marvel Mystery Oil
Minn. Rubber 366Y
National Compound #N11
"Nylock" VC-3
Parco #1306 Neoprene
Petron PD287
Prestone
Pydraul AC
Sears Regular Motor Oil
Sinclair oil "Lily White"
Some Loctite Compounds
Stillman #SR 269-75 (polyurethane)
Stillman #SR 513-70 (neoprene)
Telar
Tenneco enderol #495 and #500 oils
Triton
Zerex

WE CANNOT POSSIBLY LIST ALL HARMFUL SUBSTANCES, SO CHECK WITH A MOBAY CHEMICAL OR GENERAL ELECTRIC OFFICE FOR FURTHER INFORMATION ON POLYCARBONATE PLASTIC.

WABCO WESTINGHOUSE AIR BRAKE COMPANY
FLUID POWER DIVISION • LEXINGTON, KENTUCKY

H-2 CONTROLAIR® VALVE

SERVICE INFORMATION



The H-2 Type CONTROLAIR Valve is a handle operated, three-way normally closed, open exhaust pressure control valve. There are three models of the H-2 Type CONTROLAIR Valve, identical in operation but differing in handle characteristics:

H-2-X CONTROLAIR Valve – Handle is self returning to minimum pressure position from all positions in the handle travel arc.

H-2-LX CONTROLAIR Valve – Handle latches in the maximum pressure position but is self returning to the minimum pressure position from all other positions in the handle travel arc.

H-2-FX CONTROLAIR Valve – Handle is equipped with a friction brake that will hold the handle in any position selected in the handle travel arc.

INSTALLATION

The H-2 Type CONTROLAIR Valve is designed for panel mounting, the complete assembly is installed and removed from the top of the panel. Refer to the outline view Fig. 7 for panel opening dimensions. Allow suitable clearance for pipe bracket cap screws which are 1-1/8" long.

CONTROLAIR Valves utilize a pipe bracket. Piping connection to the pipe bracket need not be disturbed when removing the operator portion for maintenance. A filter and lubricator should be installed in the line leading to the "IN" port.

MAINTENANCE

Maintenance periods should be scheduled in accordance with frequency of use and working environment of the CONTROLAIR Valves.

One complete CONTROLAIR Valve should be kept in stock for each four valves in service. During the maintenance period change out the complete valve with the "stand-by" unit. This will reduce production loss and afford inspection and replacement of worn parts at a more opportune time in a favorable location.

Notice that the operating portion of the valve can be removed without disturbing the pipe connections. Remove the valve from the pipe bracket by loosening studs 1 and lift the valve free.

No special tools are required to maintain the H-2 Type CONTROLAIR Valve.

Completely disassemble the CONTROLAIR Valve. Wash all metal parts in a non-flammable solvent and all rubber parts with soap and water. Rinse each part thoroughly and blow dry with a low pressure air jet. Arrange the parts on a clean white surface in the order of the exploded view.

Examine each part carefully. Flex the diaphragm and packing rings, if cracked or worn replace them. Replace all parts that may not provide satisfactory service until the next scheduled maintenance period.

As reassembly proceeds, lubricate each part. Use No. 107 Lubriplate on metal to metal surfaces and Cosmolube on all rubber parts, equivalent greases to those recommended can be used.

Store the reconditioned CONTROLAIR Valve in a moisture proof bag.

ADJUSTMENTS

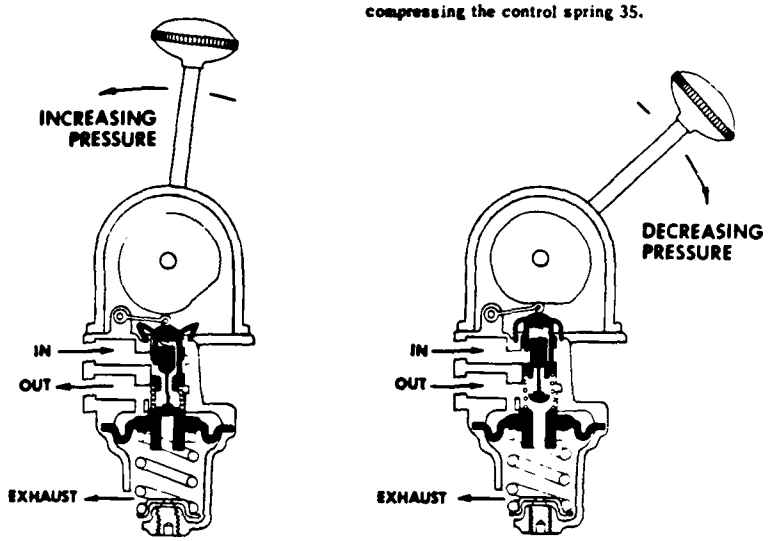
Two adjustments can be made to the H-2-X and H-2-LX CONTROLAIR Valves. Adjusting screw 32 changes the pressure setting and the handle yoke 6 can be reversed to effect the degrees of handle arc travel. The H-2-FX has an additional adjustment that can be made to the handle friction brake.

Pressure Setting Adjustment

Adjusting screw 32 varies the minimum and

maximum pressure setting a like amount without changing the range of pressure. Turning the adjusting screw in raises the maximum and minimum pressure setting, turning it out decreases the maximum and minimum pressure setting.

The pressure range can be changed only by changing the control spring 35 These springs are interchangeable.



DIAGRAMMATIC VIEW

Handle Travel Adjustment

The handle yoke 6 is designed to permit 92° of handle travel if installed in one position and 78° of handle travel if installed in the reverse position. Compensate for the effect on pressure setting by turning the adjusting screw in or out as desired.

Friction Brake Adjustment

The handle force of the H-2-FX CONTROLAIR® Valve can be varied by adjusting nut 17 This adjustment increases or decreases the manual force required to move and hold the handle in any desired position.

OPERATION

The operation of the H-2 Type CONTROLAIR Valve is illustrated by the diagrammatic views.

With the handle in normal or decreasing pressure position the "IN" port is closed and the "OUT" port is open to exhaust.

When the handle is moved to increase pressure, the inlet and exhaust valve unit 30 is forced downward by the rise in the cam 16. The exhaust port is closed and the "IN" port is connected to the "OUT" port. Air flows through the "OUT" port and also to the chamber above the diaphragm. Increasing pressure moves the diaphragm downward compressing the control spring 35.

The exhaust valve seat 39 moves with the diaphragm 38. As the downstream pressure increases, the diaphragm 38 deflects and the control spring 35 compresses. When air pressure at the "OUT" port equals the control spring setting the valve assumes a closed center position. The inlet valve closes while the exhaust valve remains closed.

With no change in mechanical force (handle movement) the inlet and exhaust valve unit 30 will automatically compensate for downstream air pressure changes. The air pressure changes can be caused by line leakage, temperature change, or load thrust. If air pressure at the "OUT" port increases over that called for by the handle position, the diaphragm 38 will deflect downward moving the exhaust valve seat 39 away from the inlet and exhaust valve unit 30 and vent the excess pressure.

If pressure drops below that called for by the handle position, the control spring 35 forces the diaphragm 38 upward, the exhaust valve seat 39 moves the inlet valve of the inlet and exhaust valve unit 30 from its seat opening the "IN" port to the *"OUT" port to restore the pressure called for.*

Air pressure at the "OUT" port is proportional to handle position. The position of the handle in the handle travel arc will determine the downstream pressure within the range of the control spring used.

H-2 TYPE CONTROLAIR® VALVE
IDENTITY

Model	Complete Piece Number		"C"** Handle Travel	Control Pressure Range (PSI)	Control Spring (Ref. 35)
	Obsolete*	Superseding			
H-2-X	850408	P50493-1	92°	0-65	P55442
	850409	P50493-2	92°	0-100	526749
	P50493	P50493-3	92°	0-125	540577
	850717	P50493-4	92°	0-150	P55441
	850410	P50493-11	78°	10-65	P55442
H-2-FX	850262	P50494-1	92°	0-65	P55442
	850263	P50494-2	92°	0-100	526749
	P50494	P50494-3	92°	0-125	540577
	850264	P50494-4	92°	0-150	P55441
	P55200-1	P50494-5	92°	0-15	99478
	P50634-1	P50494-7	92°	0-25	510722
	P52710	P50494-10	92°	0-80	531418
	850266	P50494-11	78°	10-65	P55442
	850267	P50494-12	78°	10-90	526749
	P54085	P50494-15	92°	0-175	P54159
	850446 (non-magnetic)	P51248-11 (non-magnetic)	78°	10-65	P55442
H-2-LX	850412	P50499-1	92°	0-65	P55442
	850413	P50499-2	92°	0-100	526749
	850414	P50499-3	92°	0-125	540577
	850415	P50499-4	92°	0-150	P55441
	P50499	P50499-9	92°	0-75	531418
	850416	P50499-11	78°	10-65	P55442
	850417	P50499-12	78°	10-90	526749

* Improved design to increase valve sensitivity necessitated obsoleting the former design. It is recommended that the obsolete valves be converted to the current vintage at the earliest convenient maintenance period.

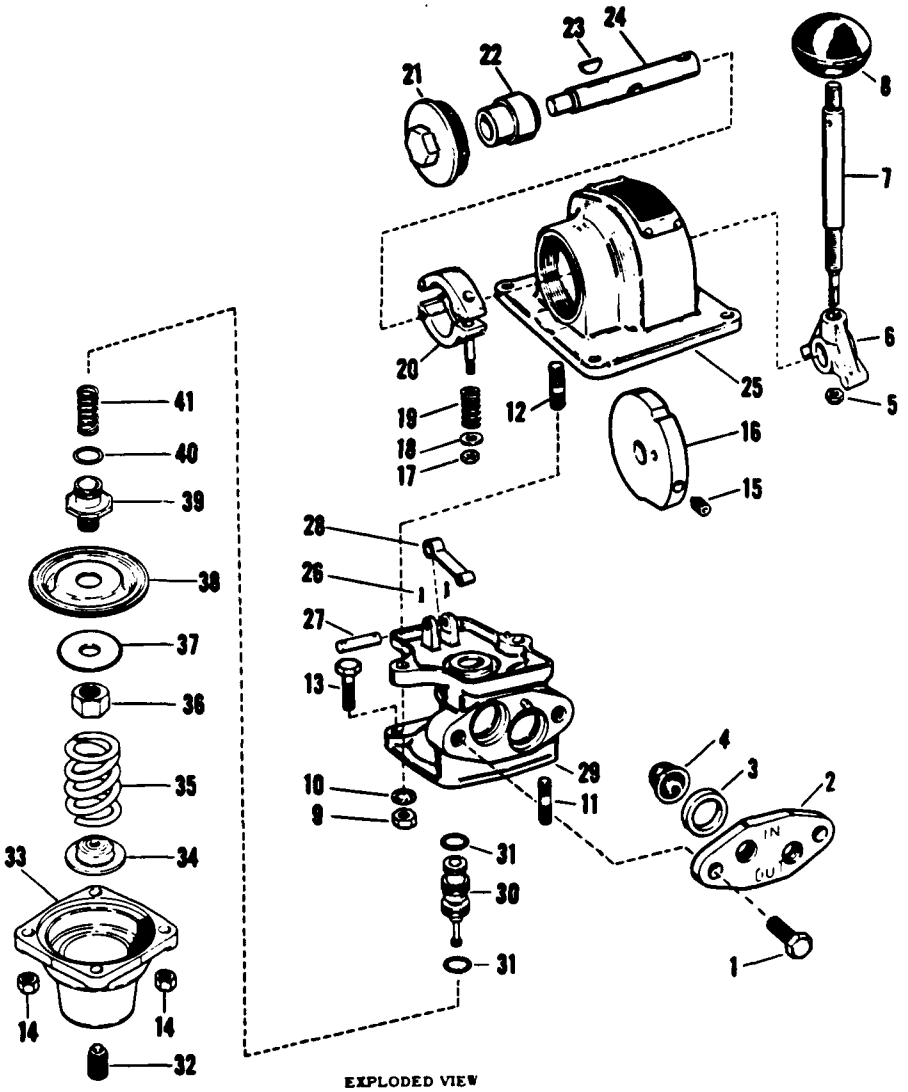
Convert As Follows:

REMOVE			REPLACE WITH	
Description	Pc. No.	Ref.	Description	Pc. No.
Inlet & Exhaust Valve Unit	520875	30	Inlet & Exhaust Valve Unit	545536
Exhaust Valve Seat	520487	30	Exhaust Valve Seat	P55484
----------	-----	40	3 4" O.D. "O" Ring	P49708-16

If additional conversion information is required, ask for SERVICE BULLETIN E4-65.00-1.

** See outline view, page 11

H-2-FX CONTROLAIR® VALVE



EXPLODED VIEW

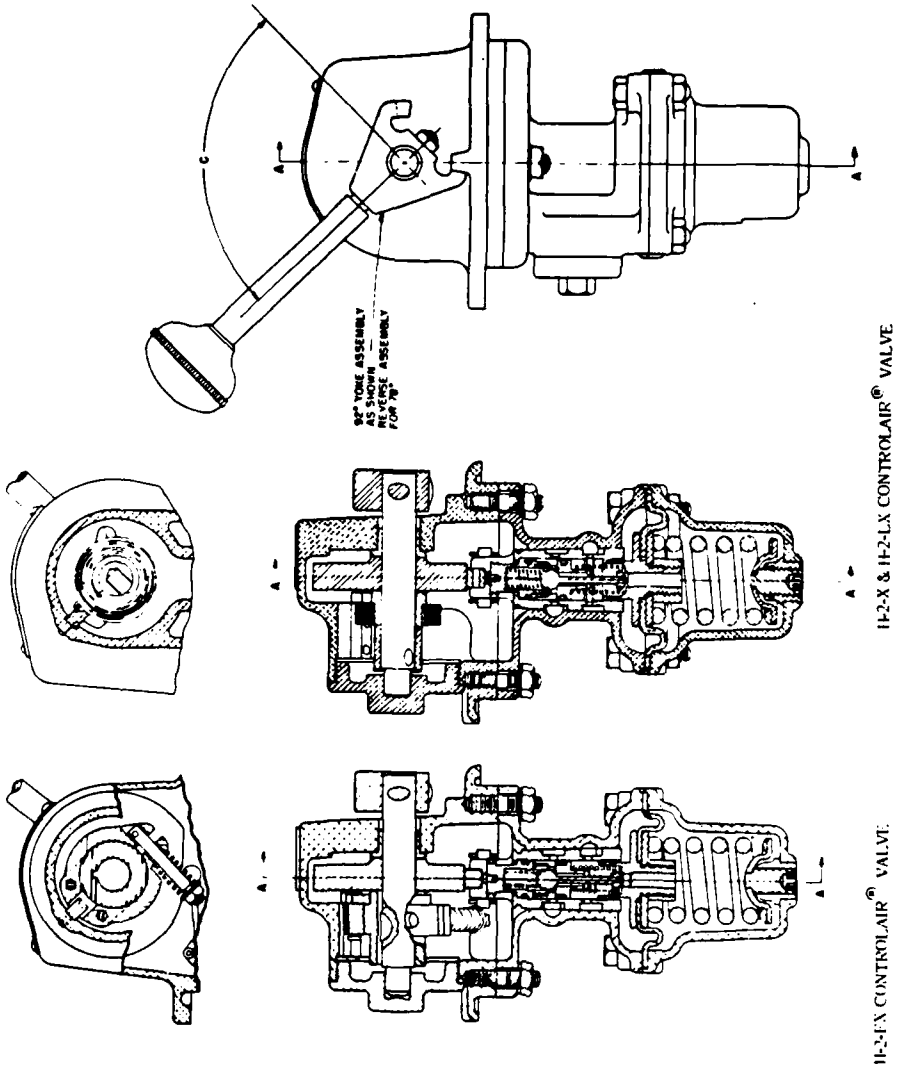
H-2-FX CONTROLAIR® VALVE

PARTS LIST

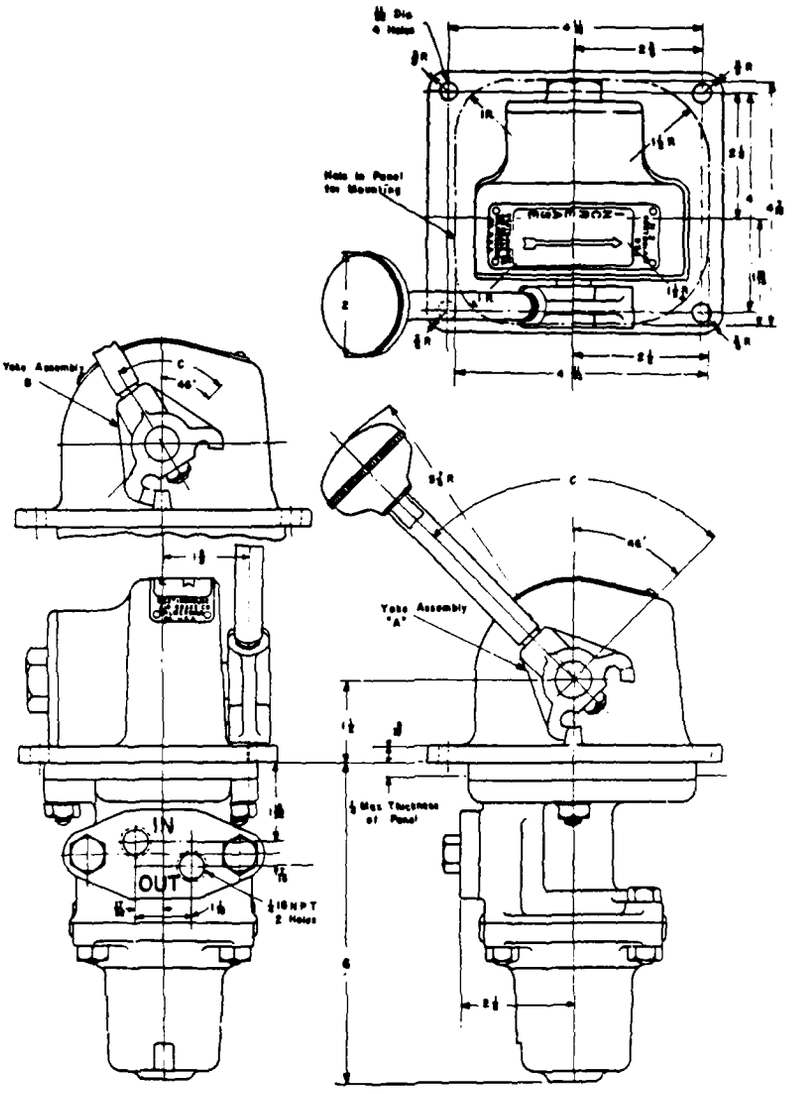
See IDENTITY schedule on page 3 for complete valve piece numbers.

Ref. No.	Description	Piece Number	
		Standard	Non-magnetic
1	SCREW, 3/8-16 x 1-1/8 Hex (2 req'd)	502415	P49902-13
2	BRACKET, Pipe	534497	850461
3*	GASKET (2 req'd)	558515	558515
4	STRAINER (2 req'd)	P55382	P55382
5	NUT, 1/4-28	519787	P49923
6	YOKE, Handle	534476	534477
7	SHAFT, Handle	534776	850460
8	BALL, Handle	517026	517026
9	NUT, 5/16-18 Hex (2 req'd)	96500	P49901-1
10	WASHER, 5/16 (2 req'd)	506602	P49911-3
11	STUD, 5/16-18 x 1-5/16 (2 req'd)	P49906-14	P49906-1
12	STUD, 5/16-18 x 1-1/8 (2 req'd)	P49906-16	P49906-11
13	SCREW, 5/16-18 x 1-1/8 Hex (2 req'd)	P49842	P49900-9
14	NUT, 5/16-18 (2 req'd)	96500	P49901-1
15	SCREW, Set	540187	850523
16	CAM	P50800	P50800-1
17	NUT, Hex	P49901-16	P49901-9
18	WASHER, No. 10	501831	6424
19*	SPRING, Brake	850537	850537
20	SHOE & HOLDER, Brake	850730	P50654
21	NUT, Cap	P55465	P55465
22	DRUM, Brake	850181	P50848
23	KEY, Woodruff	120840	120840
24	SHAFT, Cam	534488	P51251
25	HOUSING, Cam (Incl 22)	534496	P51250
	CONTROL PORTION, complete less Control Spring 35 (Incl. ref. 1, 2, 3, 4, 9, 11, 13, 14 and 26 thru 41).	P55510	P55512
26	PIN, Cotter (2 req'd)	93256	93256
27	PIN, Dog	P50686-9	P50686-9
28	DOG, Cam	P52835	P52835
29	BODY	534499	534499
30*	INLET & EXHAUST VALVE (Incl. 2 of 31)	545536	545536
31*	RING, 3/4" O.D. "O" (2 req'd)	531868	531868
32	SCREW, Spline Adjusting	536005	536005
33	HOUSING, Spring	545616	545616
34	SEAT, Spring	526347	851075
35*	SPRING, Control	(See Identity Schedule)	
36	NUT, 9/16-18 Hex	526489	P49976-1
37	FOLLOWER, Diaphragm	526345	526345
38*	DIAPHRAGM	526346	526346
39	SEAT, Exhaust Valve	P55484	P55484
40*	RING, 3/4" O.D. "O"	P49708-16	P49708-16
41*	SPRING, Exhaust Valve	P54653	P54653

* Recommend spare parts to be retained in stock at all times.



ASSEMBLY VIEW



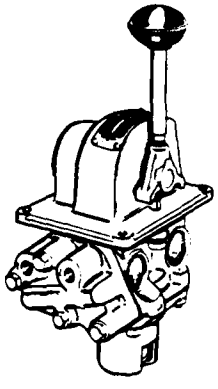
If dimensions are critical ask for their certification.

OUTLINE VIEW

WABCO FLUID POWER DIVISION
AMERICAN-STANDARD 1953 MERCER ROAD LEXINGTON, KENTUCKY 40505 (606)254-8031 TELEX 021-8426
POWER & CONTROLS GROUP

HC-2 CONTROLAIR® VALVE

SERVICE INFORMATION



The HC-2 Type CONTROLAIR Valve is a handle operated, graduating pressure control valve. It contains two PILOTAIR® three-way valves and a pressure regulating portion arranged to increase, decrease, or maintain air pressure in two control lines. The selection between the two control lines depends upon handle movement of 10° either side of the OFF position.

There are four models of the HC-2 Type CONTROLAIR Valve, identical in operation but differing in handle characteristics:

HC-2-X CONTROLAIR Valve – Handle is self returning to the OFF position from all positions in the handle travel arc.

HC-2-FX CONTROLAIR Valve – Handle is equipped with a friction brake that will hold the handle in any position selected in the handle travel arc.

HC-2-LX CONTROLAIR Valve – Handle latches in both maximum pressure positions but is self returning to the OFF position from all other positions in the handle travel arc.

HC-2-SX CONTROLAIR Valve – Handle latches in one maximum pressure position only (handle away from pipe bracket). The handle is self returning to the OFF position from all other positions in the handle travel arc.

INSTALLATION

The HC-2 Type CONTROLAIR Valve is designed for panel mounting. The complete assembly is installed and removed from the top of the panel.

Refer to outline view (fig. 8) for panel opening dimensions. Allow suitable clearance for the pipe bracket cap screws which are 2-1/8" long.

CONTROLAIR Valves utilize a pipe bracket. Piping connections to the pipe bracket need not be disturbed when removing the operator portion for maintenance. The IN and OUT ports have strainers in them. The strainers will protect the internal valve from large particles of foreign material in the lines but it is recommended that a filter and lubricator be installed in the IN port of the CONTROLAIR Valve.

MAINTENANCE

Maintenance periods should be scheduled in accordance with frequency of use and working environment of the CONTROLAIR Valve.

One complete CONTROLAIR Valve should be kept in stock for each four valves in service. During the maintenance period, replace the complete valve with the "stand-by" unit. This will reduce production time loss and afford inspection and replacement of worn parts at a more opportune time in a favorable location.

Notice that the operating portion of the valve can be removed without disturbing the pipe connections. Remove the valve from the pipe bracket by loosening studs 1 and lift the unit free.

No special tools are required to maintain the HC-2 Type CONTROLAIR Valve.

Completely disassemble the CONTROLAIR Valve. Wash all metal parts in a non-flammable solvent and all rubber parts with soap and water. Rinse each part thoroughly and blow dry with a low pressure air jet. Arrange the parts on a clean white surface in the order of the exploded view.

Examine each part carefully. Flex the diaphragm and packing rings. If cracked or worn, replace them. Replace all parts that may not provide satisfactory service until the next scheduled maintenance period.

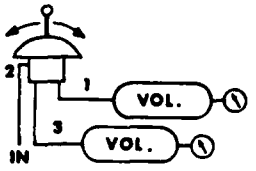
As reassembly proceeds, lubricate each part. Use No. 107 Lubriplate on metal to metal surfaces and Cosmolube on all rubber parts. Equivalent greases to those recommended can be used.

Store the reconditioned CONTROLAIR Valve in a moisture proof bag.

B4-65 05

ADJUSTMENTS

Three adjustments can be made to the HC-2-X, HC-2-SX and HC-2-LX models. Screw 24 varies the pressure setting, screw 44 alters the pick-up point of levers 41 and 45, and pin 38 alignes the dog 39 with cam 15. The HC-2-FX model has an adjustable friction brake.



(Inlet pressure, 10 psi higher than stamped on nameplate)

Fig. 2 ADJUSTMENT SET-UP

Pilot Valve Lever Adjustment

Use the adjustment set-up illustrated in fig. 2. Turn adjusting screw 24 in until control spring 27 is slightly compressed. Remove valve protectors 47. Move the CONTROLAIR Valve handle 7 back and forth, on both sides of the "OFF" position, observing the action of levers 41 and 45. The pilot valves should be fully open after the handle moves through the first 10° travel arc. If the pilot valve levers need adjusting, place the handle in a maximum increasing pressure position. With a 3/32" Allen Wrench, turn adjusting screw 44 of the activated lever (either 41 or 45) out, just far enough to crack the exhaust valve. The gage will show a drop in pressure. From this point, turn the adjusting screw in a full three (3) turns. This will open the inlet valve of the pilot valve to its maximum capacity.

Move the handle to the opposite extreme position and repeat the adjustment for the other pilot valve lever.

Cam Dog Adjustment

The accentric cam dog pin 38 alignes the cam dog 39 with the rise on cam 15. If pressure response is not identical to handle position in both quadrants, compensate this difference by turning the cam dog pin 38 either clock-wise or counter-clockwise.

Pressure Setting Adjustment

Use the adjustment set-up illustrated in Figure 2. Adjusting screw 24 varies the minimum and maximum pressure setting a like amount without changing the range of pressure. Turning the adjusting screw in raises the maximum and minimum pressure, turning it out decreases the maximum and minimum pressure. The pressure range can be changed only by changing the control spring 27. These springs are interchangeable.

No Preload Setting

This setting has the OUT ports open to exhaust and the IN port is closed in the normal position.

Place the handle 10° from OFF in either quadrant. Turn adjusting screw 24 in until a reading is obtained on the gage then turn it out by 1/4 turns until the gage reads zero. At zero pressure give the adjusting screw another 1/4 turn out to open the exhaust valve.

Move the handle to full increasing pressure position. The gage should read the pressure stamped on the nameplate. Related handle positions in both quadrants will have identical pressure readings.

Preload Setting

This setting calls for a predetermined downstream pressure when the handle is moved 10° from OFF position in either handle quadrant.

Place the handle 10° from OFF in either quadrant. Turn adjusting screw 24 in until the gage reads the desired preload pressure. Move the handle to the maximum pressure position. The gage should read the pressure on the nameplate plus the preload setting.

Friction Brake Adjustment

The handle force of the HC-2-FX CONTROLAIR® Valve can be varied by adjusting nut 19. This adjustment increases or decreases the manual force required to move or hold the handle in any desired position in the handle quadrant.

OPERATION

Refer to diagrammatic view.

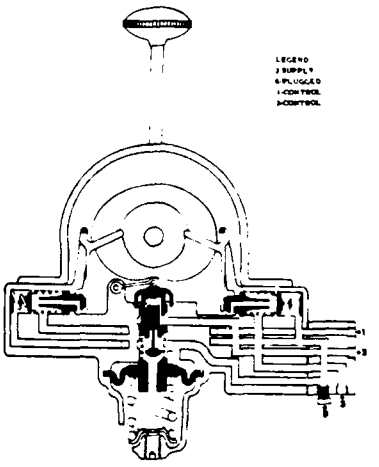


Fig. 3 DIAGRAMMATIC VIEW

With the handle in OFF position, both control lines, 1 and 3, are open to atmosphere through thei respective pilot valves in the HC-2 Type CONTROLAIR Valve.

The handle operates a dual cam. The peripheral surface of the larger section is contoured to provide minute positioning increments to the pressure

control portion. The smaller section moves the right and left hand levers to operate the pilot valves.

Movement of the handle in the first 10° of the 46° travel arc closes the exhaust valves of the pressure control portion (no preload setting) and one of the pilot valves. The other pilot valve is operated when the handle is moved into the opposite guadrant. Handle movement to or beyond the 10° position unseats the inlet valve in the control portion and the pilot valve. Controlled pressure from the unseated inlet valve of the pressure control portion flows through an internal passage to the inlet valve seats of the pilot valves. Depending upon the quadrant in which the handle is positioned, the controlled pressure will flow through the opened pilot valve to the OUT port (line 1 or 3).

The pressure at the OUT port is proportional to handle position in the handle travel arc.

The HC-2 Type CONTROLAIR® Valve will automatically compensate for downstream air pressure change. The air pressure changes can be caused by line leakage, temperature change, or load thrust. If air pressure at the OUT port increases over that called for by handle position, the diaphragm in the control portion will deflect downward. This moves the exhaust valve seat away from the inlet and exhaust valve unit and vents the excess pressure. If the pressure drops below that called for by the handle position, the control spring will force the diaphragm upward. The exhaust valve seat then moves the inlet valve of the inlet and exhaust valve unit from its seat to open the IN port to the OUT port and restore the pressure called for.

HC-2X CONTROLAIR VALVE
IDENTITY

Model	Complete Piece Number		Control Pressure Range (PSI)	Control Spring (Ref. 27)
	Obsolete*	Superseding		
HC-2-X	850233	P50975-1	0-65	P55442
	850234	P50975-2	0-100	526749
	P50529	P50975-3	0-125	540577
	F50975	P50975-4	0-150	P55441
	P52540	P52540-4 (Note 1)	0-150	P55441
	P52787	P52878-1 (Note 2)	0-65	P55442
HC-2-FX	850245	P50976-1	0-65	P55442
	850246	P50976-2	0-100	526749
	P50976	P50976-3	0-125	540577
	P50977	P50976-4	0-150	P55441
	P52943	P52943-1 (Note 3)	0-65	P55442
HC-2-LX	850420	P55582-1	0-65	P55442
	850421	P55582-2	0-100	526749
	850452	P55582-3	0-125	540577
	850655	P55582-4	0-150	P55441
HC-2-SX	P51206	P51206-2	0-100	526749
	P52023	P51206-3	0-125	540577
	P54789	P51206-4	0-150	P55441
	P54280	P52518-2 (Note 1)	0-100	526749
	P52518	P52518-3 (Note 1)	0-125	540577

NOTE: 1. Less the handle and yoke. Uses cam, Pc. No. P50575-11.
2. With handle shaft, Pc. No. P50979 - longer than standard.
3. Less the standard escutcheon plate.

*Improved design to increase valve sensitivity and flow capacity necessitated obsoleting the former design. It is recommended that the obsolete valves be converted to the current vintage at the earliest convenient maintenance period.

INCREASED VALVE SENSITIVITY CONVERSION

REMOVE			REPLACE WITH	
Description	Pc. No.	Ref.	Description	Pc. No.
Inlet & Exhaust Valve Unit	526875	34	Inlet & Exhaust Valve Unit	545536
Exhaust Valve Seat	526487	31	Exhaust Valve Seat	P55484
		32	3/4" O.D. "O" Ring	P49708-16

If additional conversion information is required, ask for SERVICE BULLETIN E4-65.00-1.

INCREASED FLOW CAPACITY CONVERSION

Remove obsoleted three-way valves and replace with items 46 through 60 as shown in the exploded views.

If additional conversion information is required, ask for SERVICE BULLETIN E4-65.00-3.

MODEL HC-2-FX CONTROLAIR® VALVE

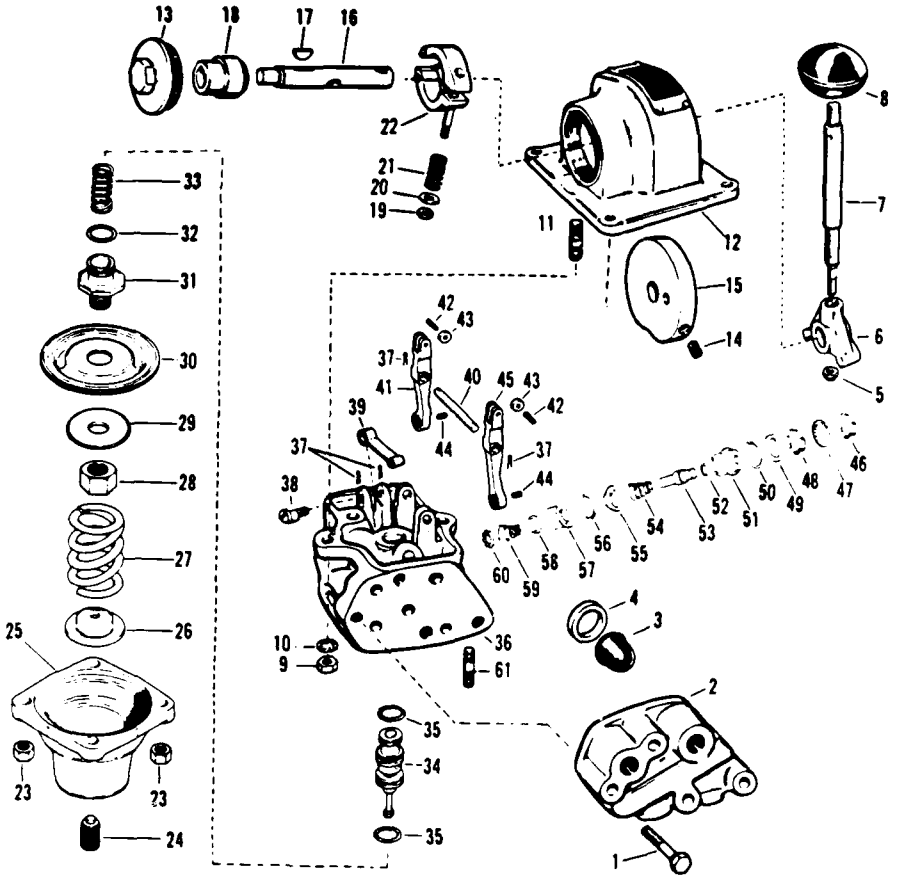


Fig. 5 EXPLODED VIEW

PARTS LIST

See IDENTITY schedule on page 3 for complete piece numbers

Ref.	Description	Pc. No.
1	SCREW, 5/16 x 2-1/8 (4 req'd)	P50235-1
2	PIPE BRACKET	850243
3	STRAINER, Port (5 req'd)	P55382
4*	GASKET, Port (5 req'd)	558515
5	NUT, 1/4-28	519787
6	YOKE, Handle	536913
7	SHAFT, Handle	534476
8	BALL, Handle	517026

MODEL HC-2-FX CONTROLAIR® VALVE (cont'd)

Ref.	Description	Pc. No.
9	NUT, 5/16-18 (2 req'd)	96500
10	WASHER, Lock (2 req'd)	506602
11	STUD, 5/16-18 x 1-1/8 (2 req'd)	P49906-16
12	HOUSING, Cam (Incl. 11)	538261
13	NUT, Cap	P55465
14	SCREW, Set	P49751-3
15	CAM	P50878-4
16	SHAFT, Cam	536912
17	KEY, Woodruff	120840
18	DRUM, Brake	850181
19	NUT, 10-32	P49901-16
20	WASHER	501831
21*	SPRING, Brake	850737
22	SHOE & HOLDER, BRAKE CONTROL PORTION, complete less Control Spring 27 (Incl. ref. 23 thru 61)	850730 P55583
23	NUT, 5/16-18 (4 req'd)	96500
24	SCREW, Spline Adjusting	536005
25	HOUSING, Spring	545616
26	SEAT, Spring	526347
27*	SPRING, Control	(See Identity Schedule)
28	NUT, 9/16-18	526489
29	FOLLOWER, Diaphragm	526345
30*	DIAPHRAGM	526346
31	SEAT, Exhaust Valve	P55484
32*	RING, 3/4 O.D. "O"	P49708-16
33*	SPRING, Exhaust Valve	P54653
34	INLET & EXHAUST VALVE, Unit (Incl 35)	545536
35*	RING, 3/4 O.D. "O" (2 req'd)	531868
36	BODY	P51082-6
37	PIN, Cotter (4 req'd)	93256
38	PIN, Cam Dog	P51856
39	DOG, Cam	P52835
40	PIN, Lever	536902
41	LEVER, Rt. Valve	P51489-2
42	PIN, Roll (2 req'd)	549915
43	ROLLER (2 req'd)	P51530
44	SCREW, Set (2 req'd)	P49828
45	LEVER, Lt. Valve	P51488-2
46	RING, Retaining (2 req'd)	850240
47	PROTECTOR, Valve (2 req'd)	850242
48	RING, Retaining (2 req'd)	850241
49	WASHER (2 req'd)	P53455-2
50*	RING, 15/16 O.D. "O" (2 req'd)	524614
51	GUIDE, Plunger (2 req'd)	P54147
52*	RING, 7/16 O.D. "O" (2 req'd)	532268
53	PLUNGER (2 req'd)	P54146
54*	SPRING, Exhaust Valve (2 req'd)	P54144
55	SEAT, Inlet Valve (2 req'd)	P54145
56*	RING, 7/8 O.D. "O" (2 req'd)	523734
57	SPACER, Valve (2 req'd)	P55099
58*	VALVE, Inlet (2 req'd)	P5125
59*	SPRING, Inlet Valve (2 req'd)	539115
60	RING, Retaining (2 req'd)	P49628
61	STUD, 5/16 x 1-5/16 (4 req'd)	P49906-14

* Recommended spare parts to be retained in stock at all times.

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