

PAT DS350C

TROUBLESHOOTING MANUAL



NOTE:

The content of this manual is subject to modifications without notice.

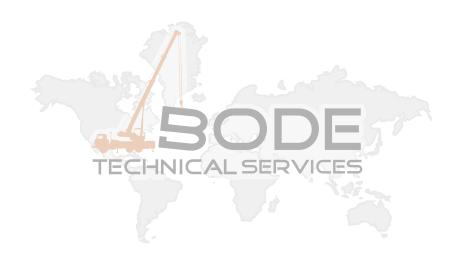
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GENERAL INFORMATION

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1 General Information

The PAT Load Moment Indicator ¹⁾ (LMI) DS 350 C has been designed to provide the crane operator with essential information indispensable for the operation of the crane within the preset design parameters.

Using various sensing devices, the PAT Load Moment Indicator monitors various crane functions and provides the operator with a continuous reading of the crane's performance data. The readings continuously change as the crane moves through the motions needed to make the lift.

The Load Moment Indicator provides the operator with information about length and angle of the boom, jib height, radius, nominal load and the total load lifted by the crane.

As soon as the crane reaches an unauthorised operating state, the Load Moment Indicator DS 350 C warns the crane operator by means of an audible alarm and a signal lamp and the cut-off of all movements that could aggravate the condition of the crane.

1) Load Moment: generally, it is the product of a force and its moment arm, specifically the product of load and load radius. Is used to determine the lifting capacity of the crane.

2 Important Notes

The PAT Load Moment Indicator PAT DS 350 C is an operational aid warning the crane operator of an imminent overload or an approaching overhoist condition in order to prevent possible damages of equipment and injury of persons.

The system cannot, and shall not, be a substitute for the good judgement or experience respectively of the crane operator or of the application of working methods in the utilisation of a crane which are proven to be safe.

The crane operator is solely responsible for the safe operation of the crane. He must observe and obey all warnings and instructions displayed.

Prior to operating a crane the operator must carefully and thoroughly read and understand the information in this manual to make sure that he knows the operation and limitations of the LMI and the crane.

Proper functioning depends on proper daily inspection and observance of the operating instructions set forth in this manual. Please confer chapter 5 of this manual.

Warning

The display (1) can only assist the crane operator if the LMI is correctly adjusted and the correct load chart and operating code for the respective operating configuration have been selected. In order to prevent damages of the equipment and serious or fatal injuries of persons the correct adjustment of the LMI has to be guaranteed before starting the crane work.

3 System description

The PAT DS 350 C load moment indicator consists of a central microprocessor unit, operator's console, a length/angle sensor, pressure transducers and anti-two-block switches.

The system operates according to the principle of reference/actual comparison. The actual values resulting from the force or pressure measurement are compared to the reference data stored in the central processor memory and evaluated in the microprocessor. When reaching the limits an overload warning signal is generated at the operator's console. Simultaneously, the dangerous crane movements such as hoist up, telescope out and boom down are cut-off.

The crane-specific data, i.e. load chart, boom weights, centers of gravity and dimensions are stored in the memory boards of the central unit. These data represent the reference values for the calculation of the operating conditions.

Boom length and boom angle are registered by the length/angle sensor installed inside of the cable reel mounted on the lateral side of the boom. The boom length is measured by the length sensor rope which also serves for the transmission of the anti two-block switch signal.

The crane load is measured by pressure transducers mounted to the piston and rod side of the hoist cylinder.

3.1 System Function

The PAT Load Moment Indicator (LMI) PAT DS350C has an operator's prompting simplifying the work with the crane and the LMI. After starting the engine the system executes an automatic test of the LMI-System, the lamps and the audible signals. In case of an error the respective error code is displayed on the console.

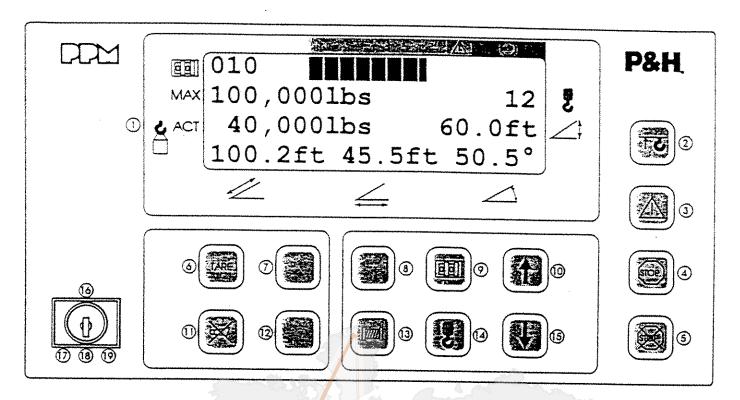
After the automatic test the crane operator has to select the operating mode corresponding to the operating condition of the crane. Then, the system is ready for operation.

3.2 Operator's console

The console has two functions:

- input of current crane configuration by the operator
- display of important data, information and instructions

Figure 1 illustrates the display and control elements of the console.



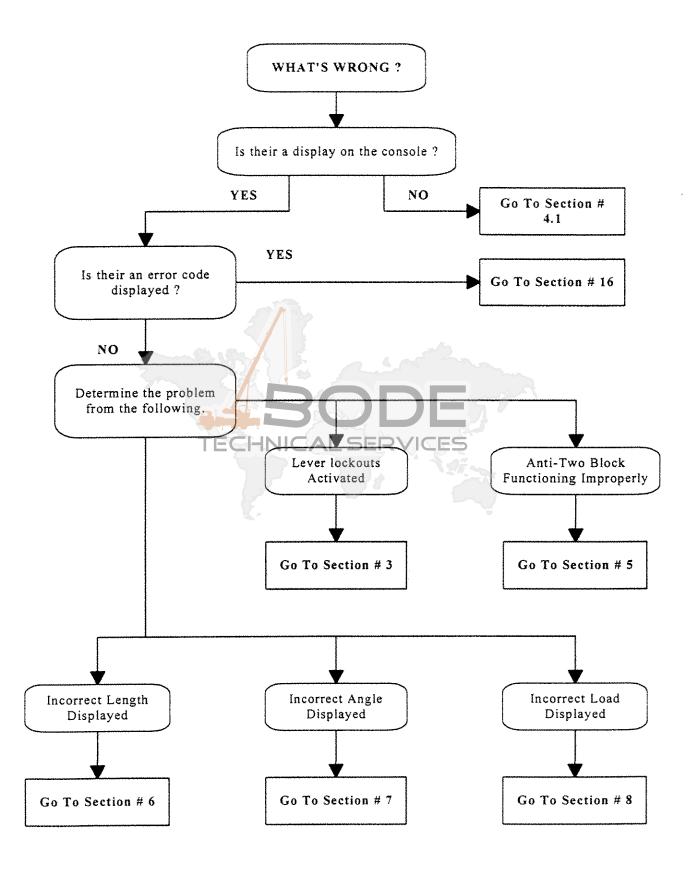
130DE TECHNICAL SERVICES

Fig. 1 Operator's console

- 1. Display
- 2. Anti Two-Block alarm light
- 3. Load moment pre-warning light
- 4. Overload alarm light
- 5. Warning light "By-passing"
- 6. Button "Tare"
- 7. Without function
- 8. Without function
- 9. Button "Operating Modes"
- 10. Button "Counting upwards"

- 11. Button "Horn off"
- 12. Without function
- 13. Button "Hoist Selection"
- 14. Button "Reevings"
- 15. Button "Counting downwards"
- 16. Key switch for by-passing
- 17. By-pass Anti 2-Block lockout
- 18. Normal operation
- 19. By-pass LMI lockout

1.1 GENERAL FLOW CHART



2.0 **DEFINITIONS**

1. Pressure Transducer: The pressure transducer transforms hydraulic pressure into an electric analogue voltage signal. Two pressure transducers are connected, one to the rod side of the lift cylinder and one to piston side of the lift cylinder. The pressure transducer is connected to the junction box with a four conductor double shielded cable.

The power supply voltage is +5 and -5 volts.

The output signal is 0.000V at 0 pressure, and 1.0V at maximum pressure (4410psi)

2. The Length-Angle Transducer: The length-angle sensor (LWG) is a combination of two sensors located in the cable reel housing, fitted at the base section of boom. They continuously measure the length and angle of the main boom.

A reeling drum drives a potentiometer, which is the length transducer. Part of the length transducer is the length cable, a two conductor cable (core and shield) securely fixed to the boom head. It is connected through a receptacle to the anti-two block switch located also on the boom head. On the opposite end it is connected to a slip ring assembly in the cable reel.

The angle transducer is a pendulum driven potentiometer located in the cable reel housing. The angle transducer is fitted in a small enclosure filled with oil.

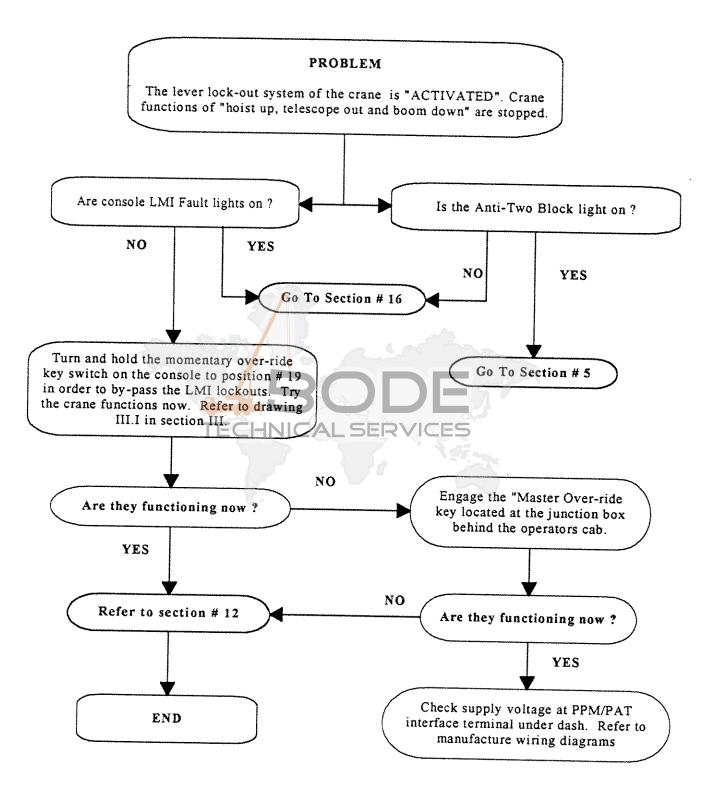
The power supply to both transducers is a common +5V.

The output signal for the length transducer is +.500MV completely retracted, and +4.5V at 10 turns of the potentiometer.

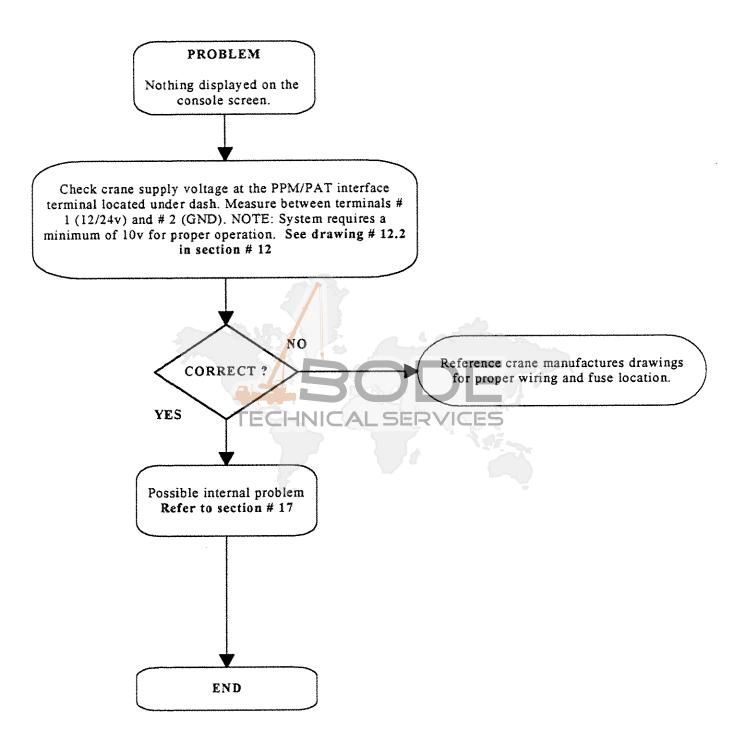
The output signal for the angle transducer is +3.125V at 0 degrees, and +1.875V at 90 degrees

- 3. Anti-Two Block Switch: The anti two-block switch stops the movement of hoisting up, telescoping out and boom down functions when the hook block comes in contact with the anti-two block weight. In working conditions the switch is closed when the hook block contacts the weight the switch opens. The switch transmits a 4.7k signal when in a closed position. The weight at the anti-two block switch keeps the switch closed until the hook block strikes it.
- 4. Console: The console serves two purposes. One, it serves as a complete processing center for all sensors located on the machine. Two it provides a display of all pertinent information within the LMI. All geometrical information, boom length, boom angle, radius and tip height is continuously displayed. It also provides the actual load and the maximum load permitted by the load chart. The bar graph provides a continuous display of percentage of total permissible moment. Furthermore it has an alarm horn and a warning light for overload, and a prewarning light when 90% of total permissible moment has been achieved. It has on operating mode selection switch enabling the operator to select various crane configurations. It has a reeving selection switch allowing the operator to select proper parts of line. It also has a warning light for anti-two block conditions and an override key switch for overload and anti-two block conditions.

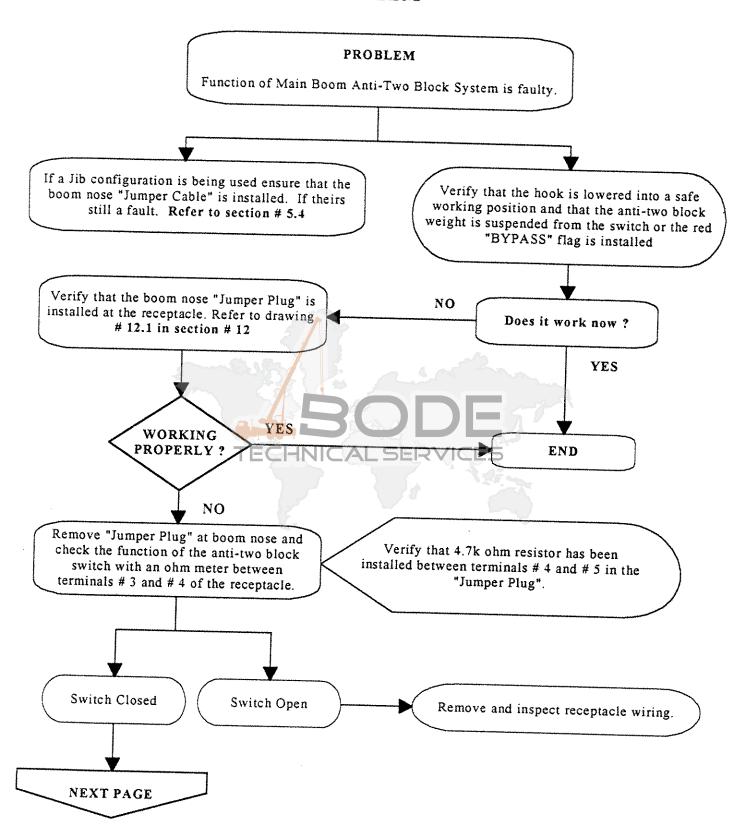
3.1 LEVER LOCKOUTS ACTIVATED



4.1 BLANK CONSOLE DISPLAY

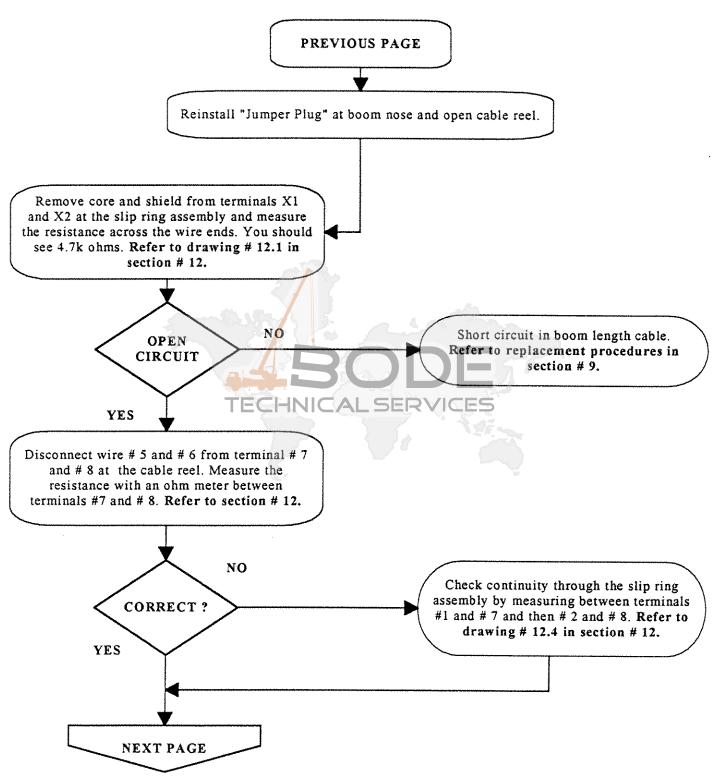


5.1 ANTI-TWO BLOCK PROBLEM

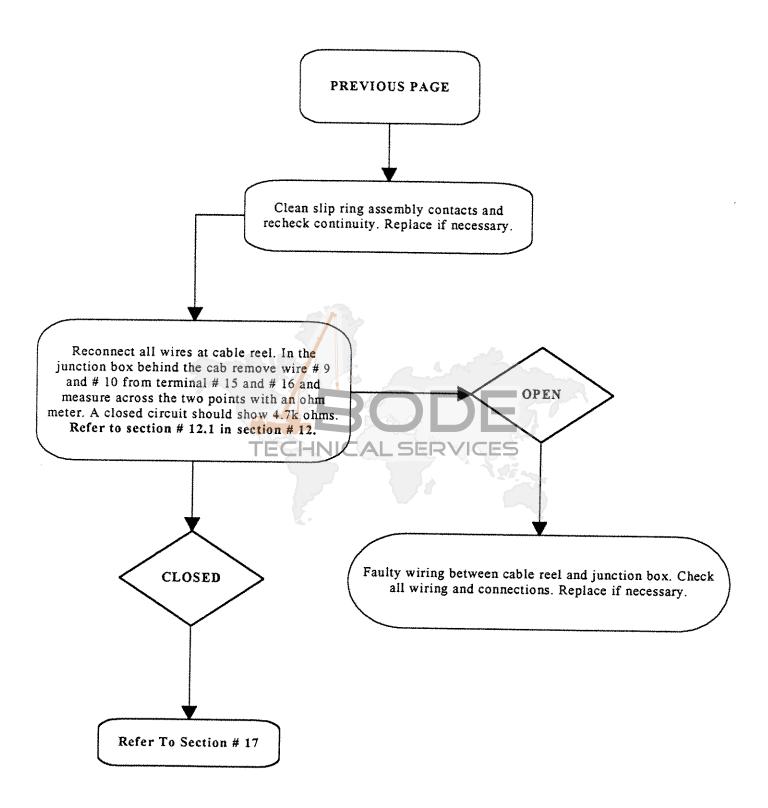


5.2 ANTI-TWO BLOCK PROBLEM

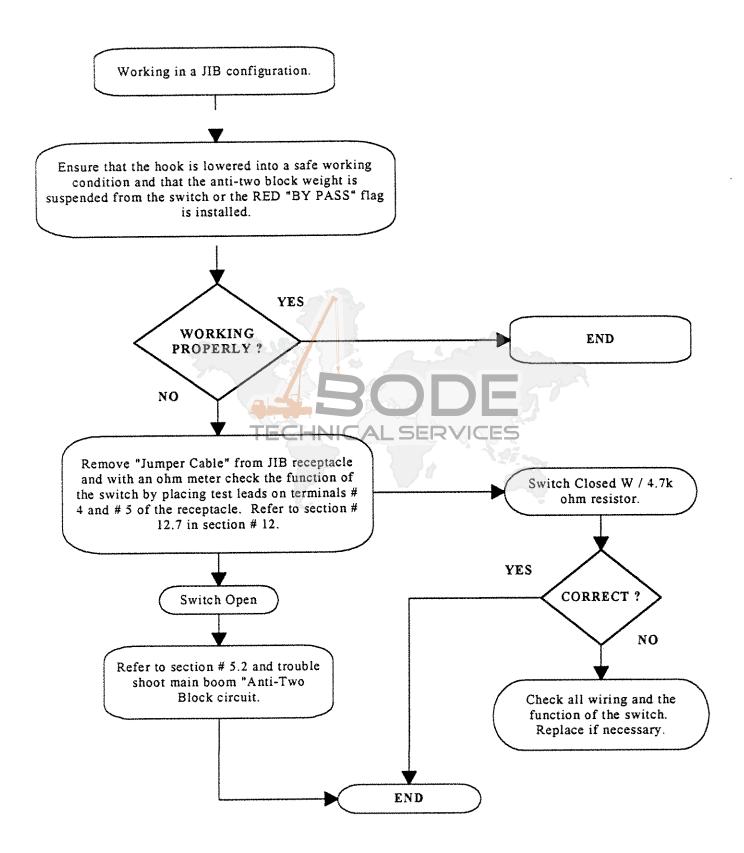
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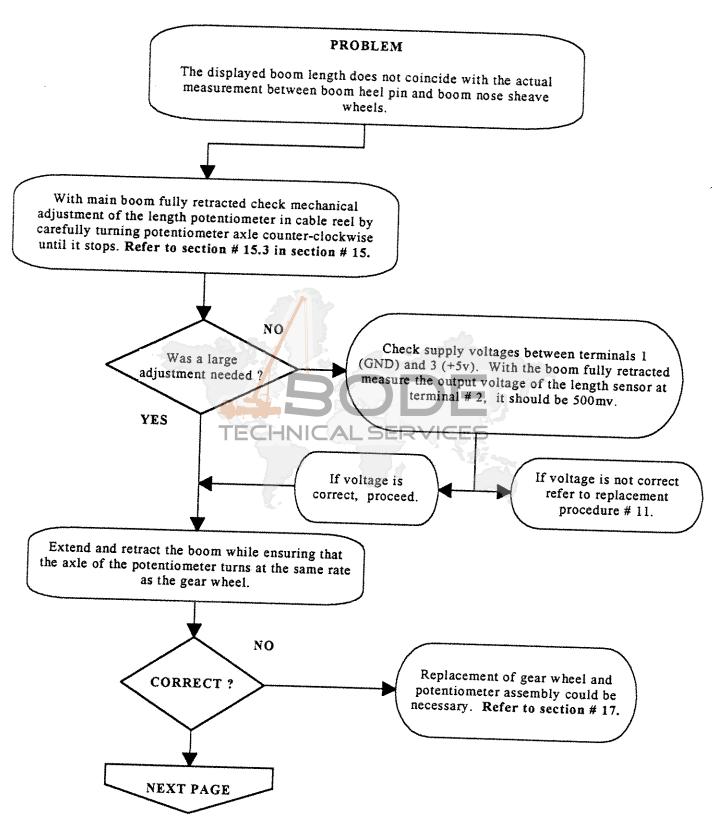
5.3 ANTI-TWO BLOCK PROBLEM



5.4 ANTI-TWO BLOCK PROBLEM

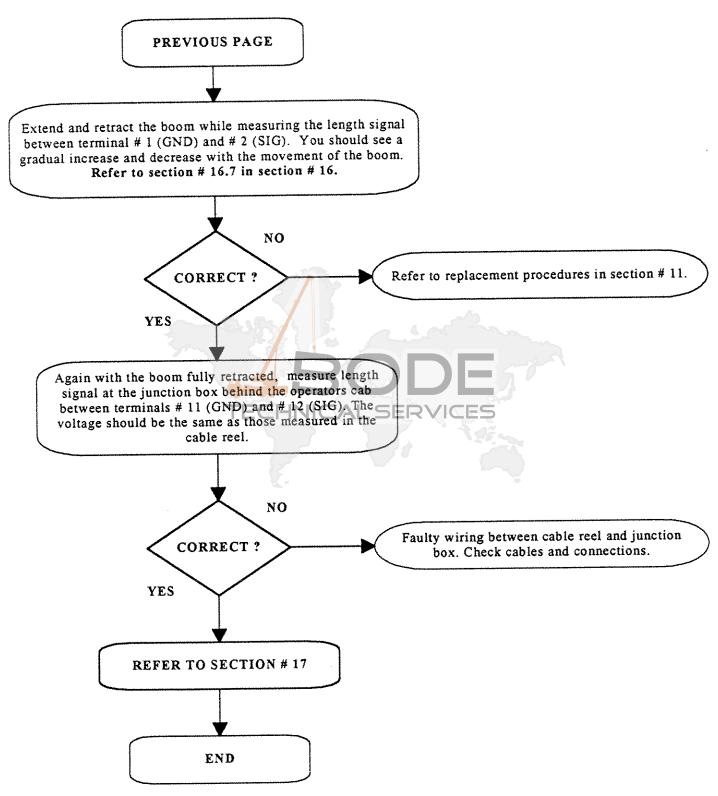


6.1 LENGTH INDICATION PROBLEM

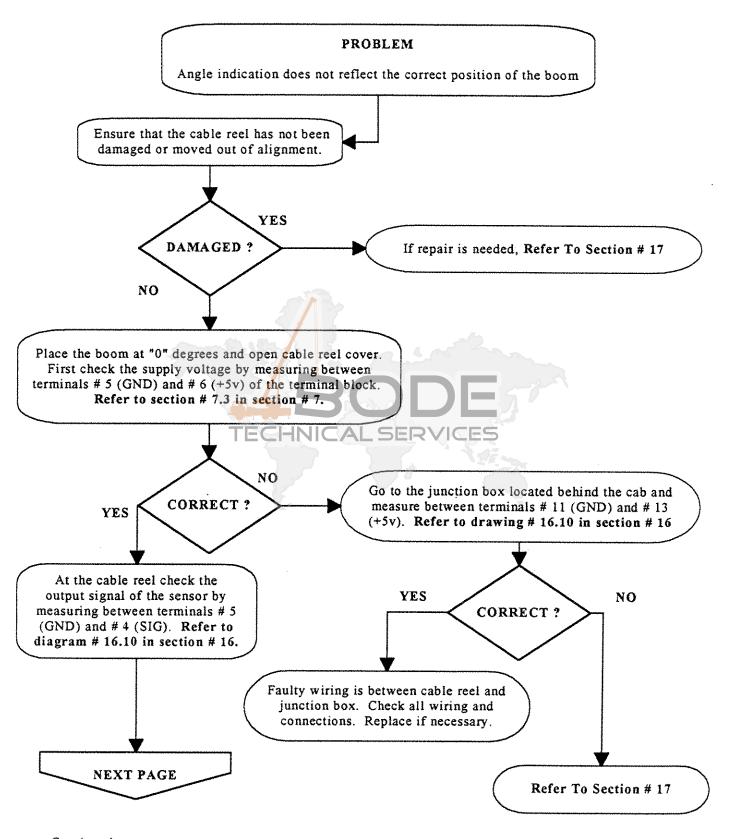


6.2 LENGTH INDICATION PROBLEM

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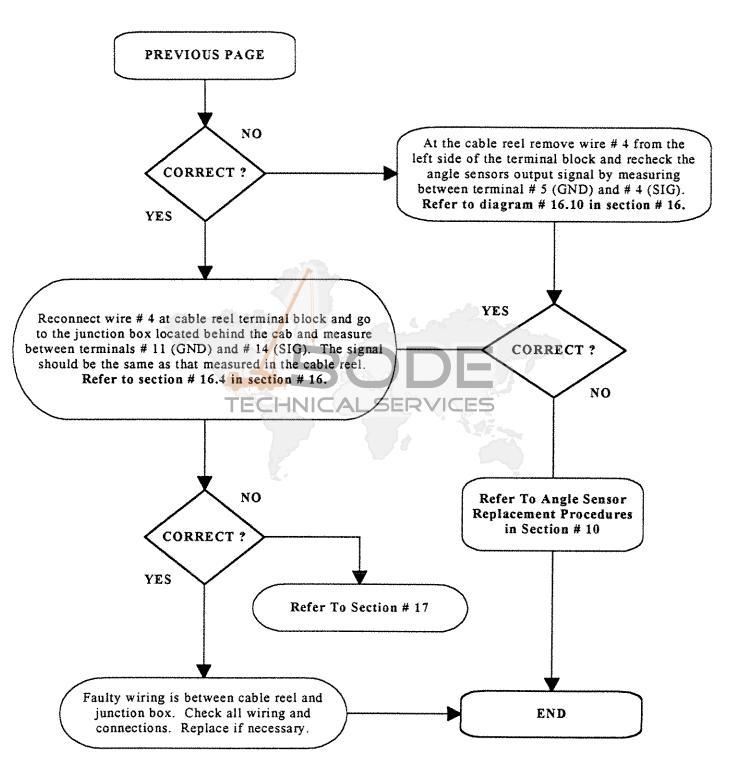


7.1 ANGLE INDICATION PROBLEM



7.2 ANGLE INDICATION PROBLEM

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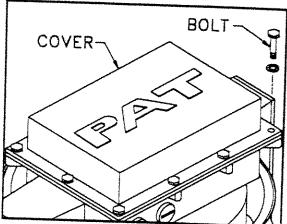


FIGURE 1: Remove cover.

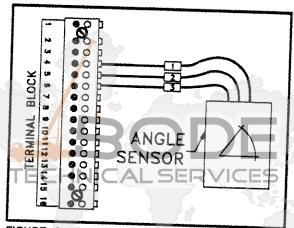


FIGURE 2: Terminal Block wiring.

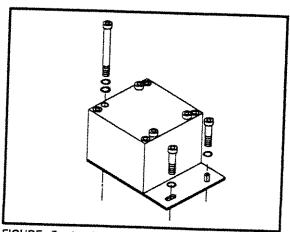
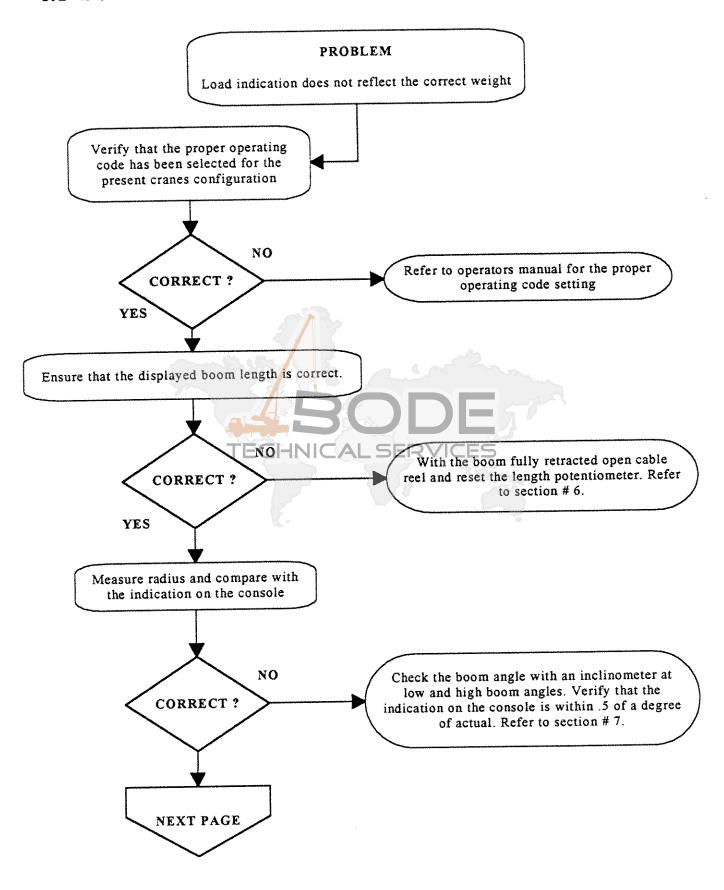
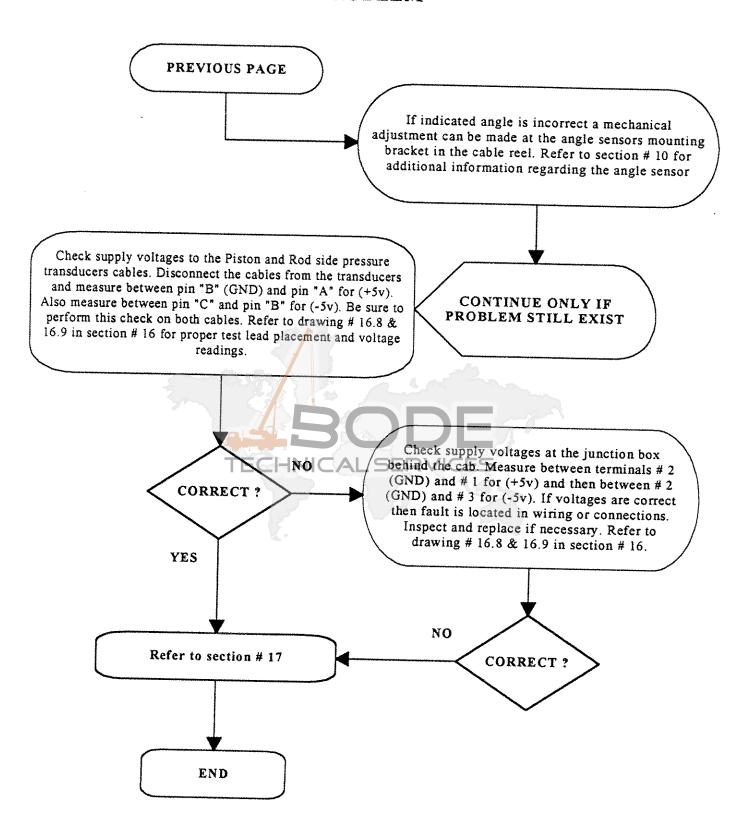


FIGURE 3: Angle Sensor breakout.

8.1 LOAD INDICATION PROBLEM



8.2 LOAD INDICATION PROBLEM



9 LENGTH CABLE REPLACEMENT PROCEDURE

STEP ACTION

- 1. Remove damaged cable from the reel.
- Using a 10mm socket or wrench open the reel cover and disconnect all wiring from the left side of the terminal block. Loosen and remove the strain relief with the cable from the bottom of the reel.
- Remove the reel from its mounting brackets.
- Disconnect the wire ends on terminals X1 and X2 at the slip-ring assembly.
- On the back side of the reel remove the strain relief at center axle of the drum and pull the remaining cable out of the reel.
- 6. At the boom nose remove the remaining cable from the anchor poll and receptacle.
- 7. Start installing the new cable at the reel by pulling it through the hole and pipe on the side of the reel. Install a new strain relief and feed approximately one foot of cable through the center axle to the slip ring.
- 8. Dismantle the cable near the slip ring and reconnect the shield to terminal X1 (Shield must be covered with shrink wrap or electrical tape) and center core to terminal X2 (Core has a protective covering that needs to be removed a 1/4" at the end for proper contact with wire end).
- Install cable reel back to the boom mounts. By turning the drum clockwise continue to load the remaining cable.
- 10. Set cable reel pretension by turning the drum counter-clockwise 5 to 8 turns.
 - 11. Reconnect cable at the anchor poll and boom nose receptacle.

9 LENGTH CABLE REPLACEMENT PROCEDURE

Continued from previous page

STEP ACTION

- 12. With the boom fully retracted reset the length potentiometer by carefully turning the axle at the gear wheel counter-clockwise until it stops. Check to see that the length, angle and radius display correctly. Verify that the Anti-Two Block works properly.
- 13. Minor adjustments to the mounting bolts may be needed to ensure proper spooling and angle indication. (Uneven layers can cause improper length indication)

Suggested Equipment For This Task:



- 1. 10mm socket or wrench
- 2. Small flat tip screw driver
- 3. Wire strippers
- 4. Side cutters
- 5. Needle nose pliers
- 6. Electrical tape / plastic tie straps

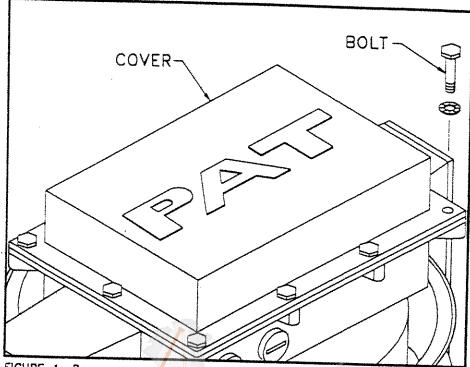
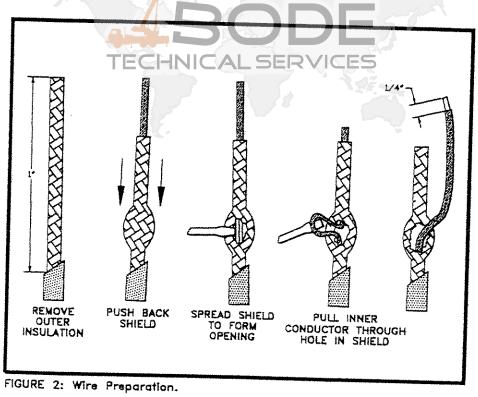


FIGURE 1: Remove cover.



10 ANGLE SENSOR REPLACEMENT PROCEDURE

STEP ACTION

- 1. Using a 10mm socket or wrench open cable reel cover. Refer to figure # 1 in section # 10.3.
- 2. Desolder wires # 4, 5 and 6 from their same corresponding numbers on the right side of the terminal block. Refer to figure # 2 in section # 10.3.
- 3. Remove any plastic tie straps that may be securing the wires.
- 4. Using a 5mm allen wrench remove both bottom bolts from the angle sensor bracket. Take hold of the sensor and remove the top left bolt which extends through the sensor to the cable reel housing. Refer to figure # 3 in section # 10.3.
- 5. Install new sensor with previously removed bolts. (Thread damage could occur if bolts are over tightened. Care should also be taken to ensure that the wires extending from the rear of the sensor do not get pinched during this process).
- 6. Feed wiring around center axle to the terminal strip and secure with plastic tie straps to avoid any possible contact with gear assembly.
- 7. Resolder the new wires to the terminal strip. Wires are numbered 4, 5, 6, and are to be attached to the same terminal numbers on the right side of the terminal block.
- 8. Turn the system on and check angle indication at the console display.
- 9. With an inclinometer measure the boom angle and compare with console indication.
- 10. If actual and indicated angle indications are not the same make adjustments to the angle sensor bracket by loosening the three bolts that secure it and rotating the assembly left or right. (Indication should be with in a tolerance of plus or minus 5 tenths of a degree).
- Reinstall cable reel cover. (Thread damage can occur if cover bolts are over tightened).

10 ANGLE SENSOR REPLACEMENT PROCEDURE

Continued from previous page

STEP **ACTION**

If angle indication is still not correct refer to section # 16.1. 12.



- 1. 10mm socket or wrench
- 2. 5mm allen wrench
- 3. Small flat tip screw driver
- 4. Soldering iron
- 5. Inclinometer

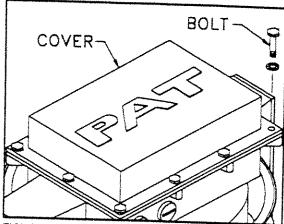


FIGURE 1: Ramove cover.

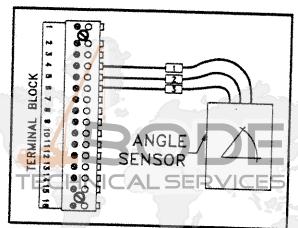


FIGURE 2: Terminal Block wiring.

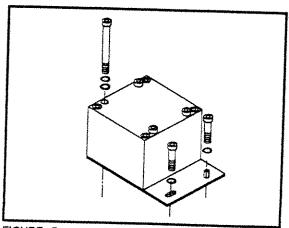


FIGURE 3: Angle Sensor breakout.

11 LENGTH POTENTIOMETER REPLACEMENT PROCEDURE

STEP ACTION

- 1. With a 10mm socket or wrench remove cable reel face cover. See figure # 1 in section # 11.3.
- 2. Using a phillips screw driver, remove the retainer bracket which secures the gear wheel. Refer to figure # 2 in section # 11.3.
- 3. Remove the gear wheel from the potentiometer axle by pulling it straight out with your fingers. Refer to figure # 3 in section # 11.3.
- 4. At the slip ring assembly, remove the wire ends from terminals # 1 and # 2.
- 5. Now remove the retainer ring at the center of the slip ring assembly. (This will allow you to remove both sides of the slip ring from the axle). Refer to figure # 4 in section # 11.3.
- 6. With a phillips screw driver, remove the four screws that secure the mounting plate. Refer to figure # 3 in section # 11.3.
- 7. Using a soldiering iron, remove wires # 1, 2 and 3 from the same corresponding terminal block numbers. (These wires are the last thing holding the assembly in place). Refer to figure # 5 in section # 11.3.
- 8. Install the new length potentiometer assembly by securing the mounting plate with the four phillips screws. (Ensure that the grounding wire is also reconnected at the lower right mounting screw).
- 9. Resolder wires # 1, 2 and 3 to the same corresponding pins at the terminal block. (Be sure that wires are secured in a way that they cannot become caught in the gear wheel). Refer to figure # 5 in section #11.3.
- 10. Install gear wheel onto potentiometer axle. (Care should be taken when aligning the drive gear and potentiometer axle. Damage to the clutch assembly or gear wheels can lead to an incorrect length indication). Refer to figure # 3 in section # 11.3.

11 LENGTH POTENTIOMETER REPLACEMENT PROCEDURE

Continued from previous page.

STEP

ACTION

- 11. Secure the gear wheel retainer bracket with the remaining two phillips screws.
- 12. Feed length cable wires through both top and bottom slip ring assembly while aligning bottom slip ring stop post with hole located in length potentiometer mounting bracket. Refer to figure # 4 in section # 11.3.
- 13. Reconnect core to terminal # 1 and shield to terminal # 2 on the top slip ring contacts. Refer to figure # 6 in section # 11.3.
- 14. With the boom fully retracted, use a small screw driver and turn potentiometer center axle screw counter clock wise until it stops. This is the zero point setting. Refer to figure # 5 in section # 11.3.
- TECHNICAL SERVICES

 15. Verify that the console displays the proper length indication.
- 16. Boom length should be measured from the boom heel pin to the boom nose center sheave wheel pin.
- 17. If length indication is not correct refer to section # 17.

Suggested Equipment For This Task:

- 1. 10mm socket or wrench
- 2. Small flat tip screw driver
- 3. Small phillips head screw driver
- 4. Digital multimeter
- 5. Retainer ring pliers
- 6. Soldering iron
- 7. Needle nose pliers

FIGURE 1: Remove cover.

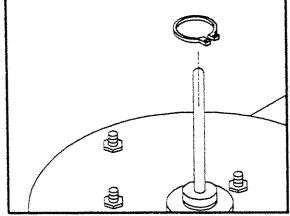


FIGURE 4: Snap-Ring.

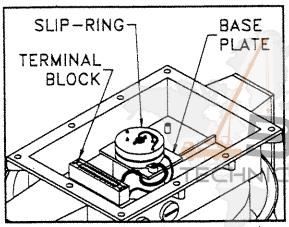


FIGURE 2: Locate the various components, of the Cable Reel.

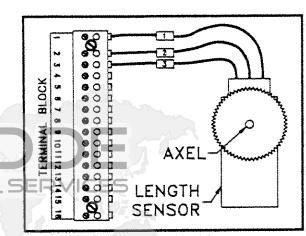


FIGURE 5: Terminal Block wiring.

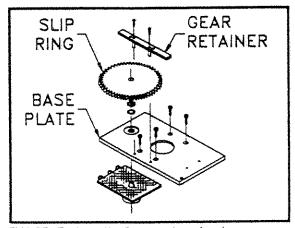


FIGURE 3: Length Sensor breakout.

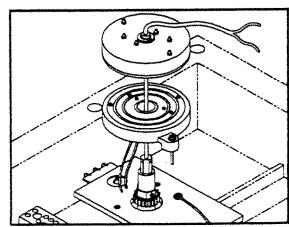
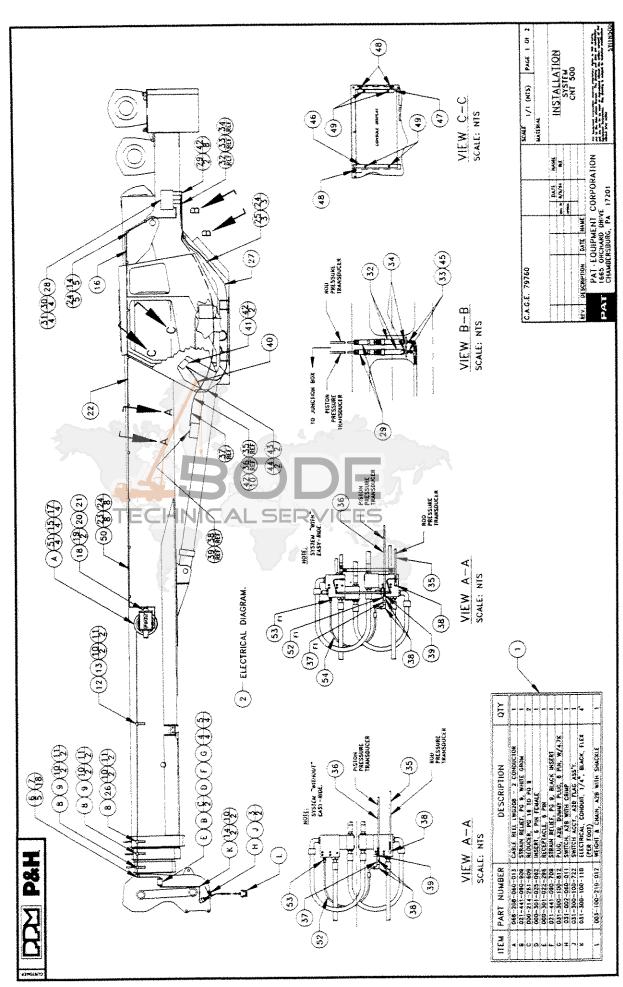
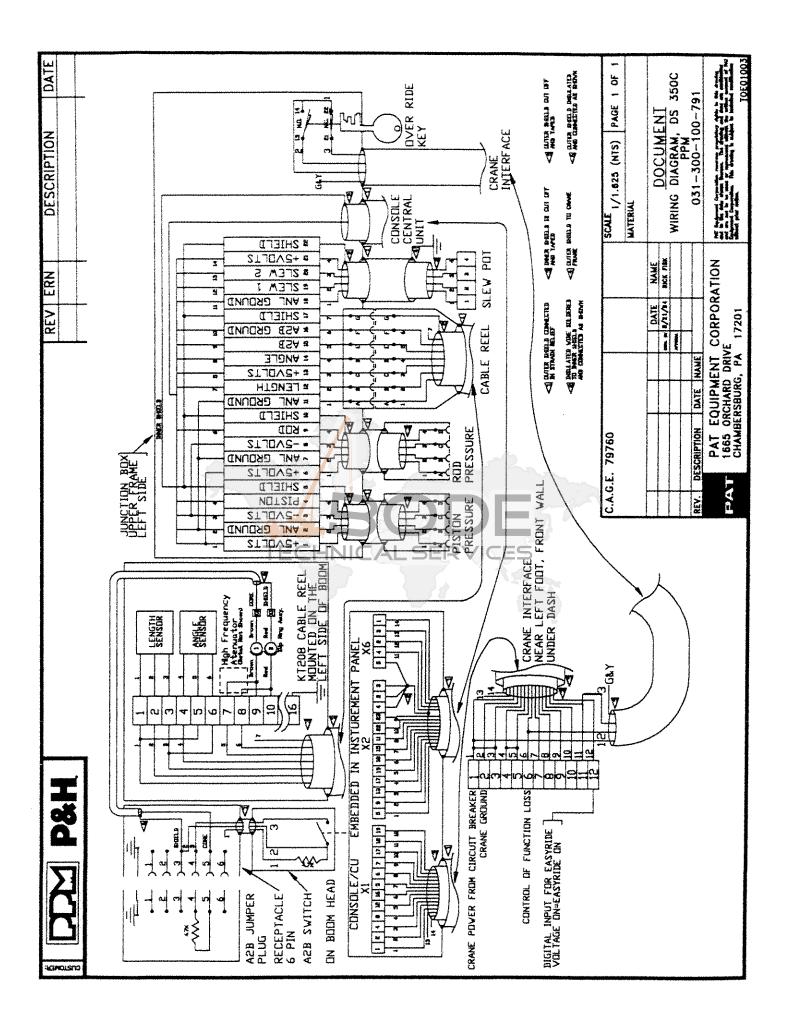
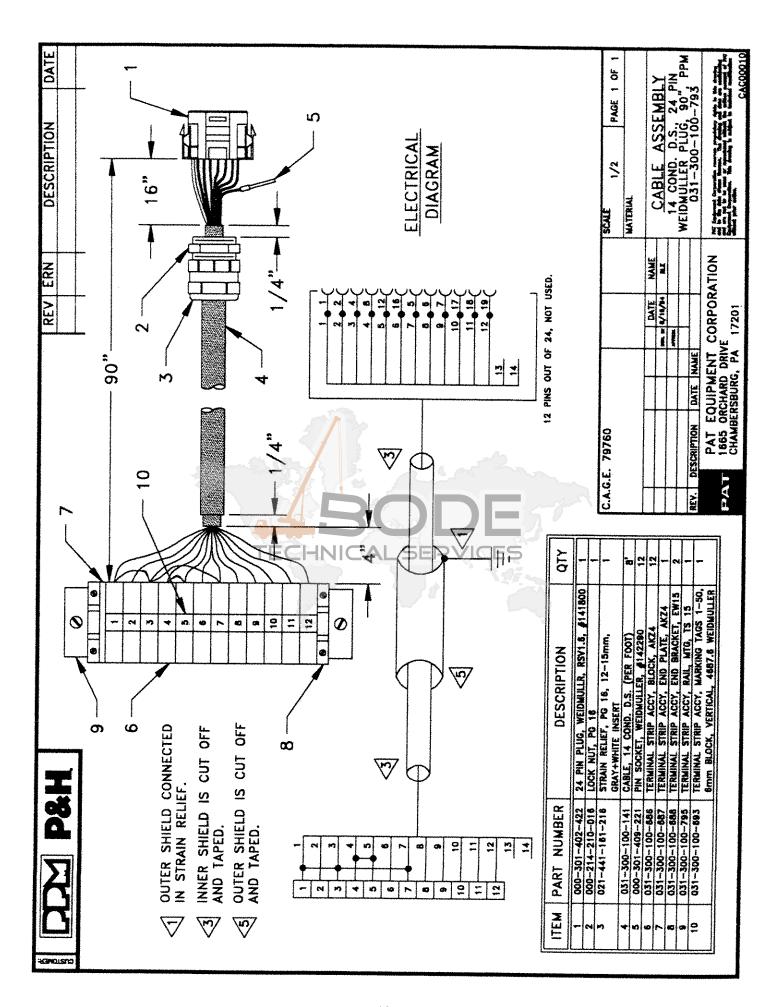
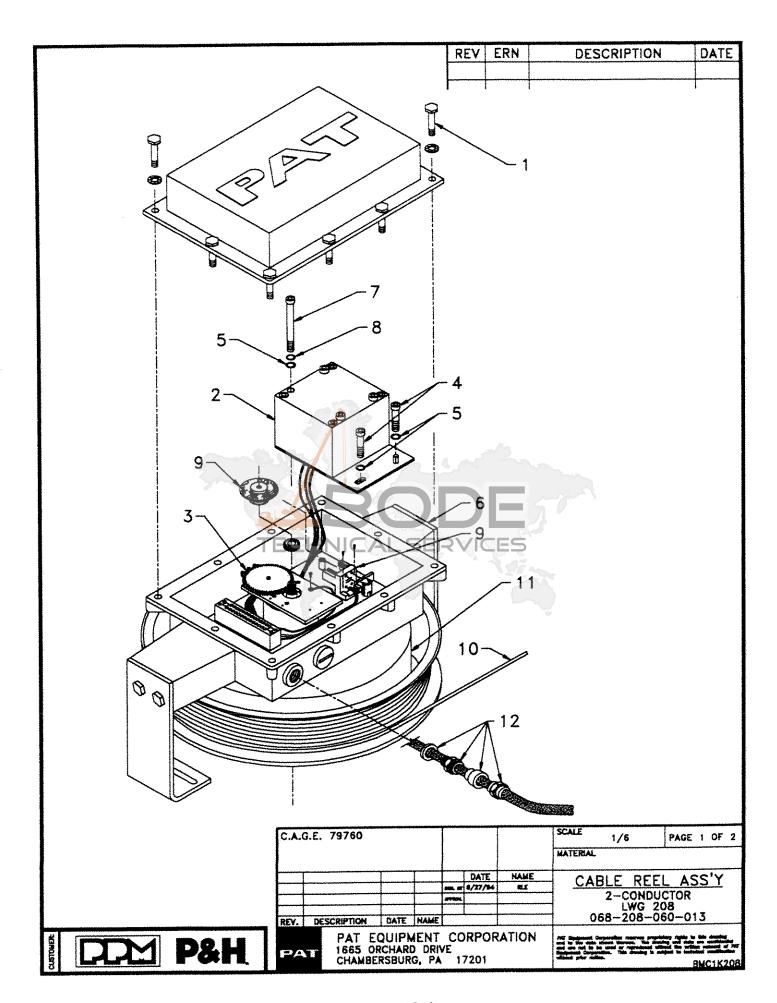


FIGURE 6: Slip-Ring bracket.



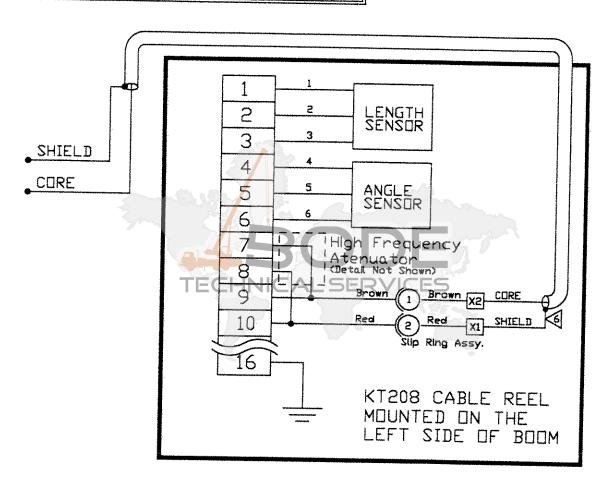






TEM	PART NUMBER	DESCRIPTION	QT
1	068-000-110-031	CABLE REEL ACCY. SCREW/CAPTIVE	10
2	064-103-060-002	SENSOR, ANGLE WG 103	1
3	006-710-006-002	SENSOR, LENGTH TRANSDUCER LGE 100	1
4	002-050-208-012	SCREW, MB X 12 HEX SOCKET CAP (FOR ANGLE SENSOR)	2
5	000-207-010-064	WASHER, FLAT 6mm	3
6	006-820-005-002		1 3
7	031-300-100-358	SCREW, 6mm X 1 X 110	+ :
8	000-208-040-084	WASHER, LOCK, 8mm	+ :
9	068-000-110-013	SLIP-RING, 2 CONDUCTOR	+ :
10	000-673-020-002	CABLE, LENGTH SENSOR, 1 CORE WITH SCREEN (PER FOOT)	139
11	068-000-110-010		•
12	021-441-161-213	STRAIN RELIEF, PG 13.5, 12-15mm GRAY+WHITE INSERT	1

 REV	ERN	DESCRIPTION	DATE

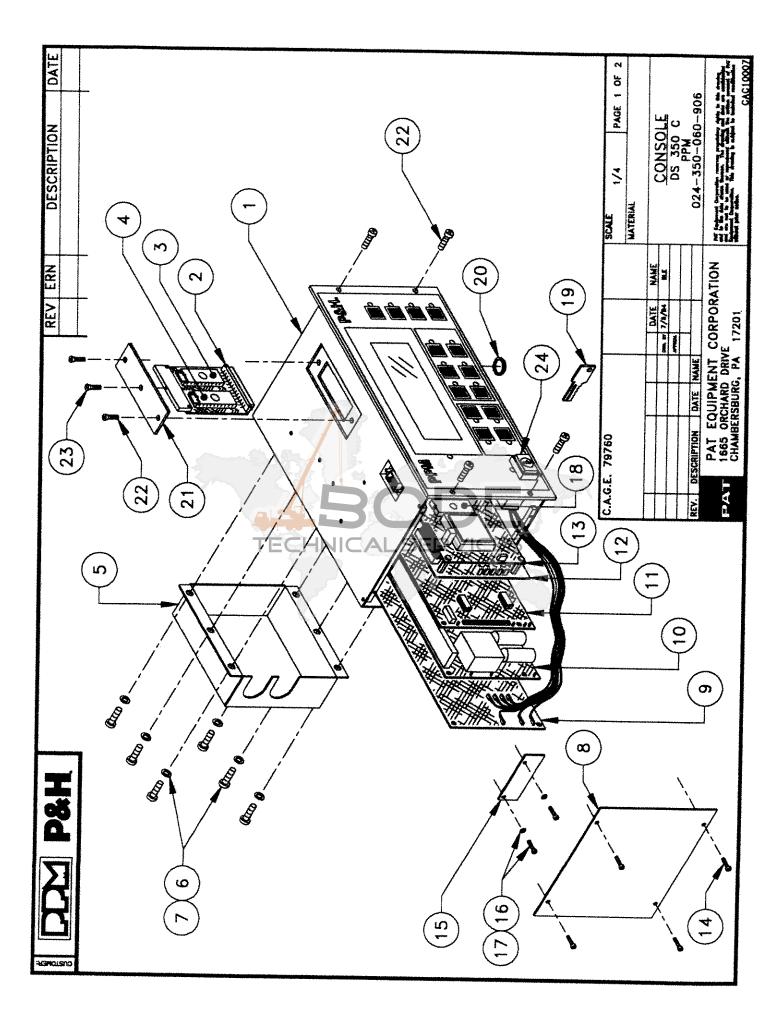


ELECTRICAL DIAGRAM

OUTER SHIELD INSULATED AND CONNECTED AS SHOWN.

REV. DE	PAT EC	QUIPN	HAME	CC	RPOR	ATION	LWG 208 068-208-060-013
				A******			2-CONDUCTOR
		 	 		DATE 6/27/94	NAME	CABLE REEL
	79760						SCALE 1/1 (NTS) PAGE 2 OF :





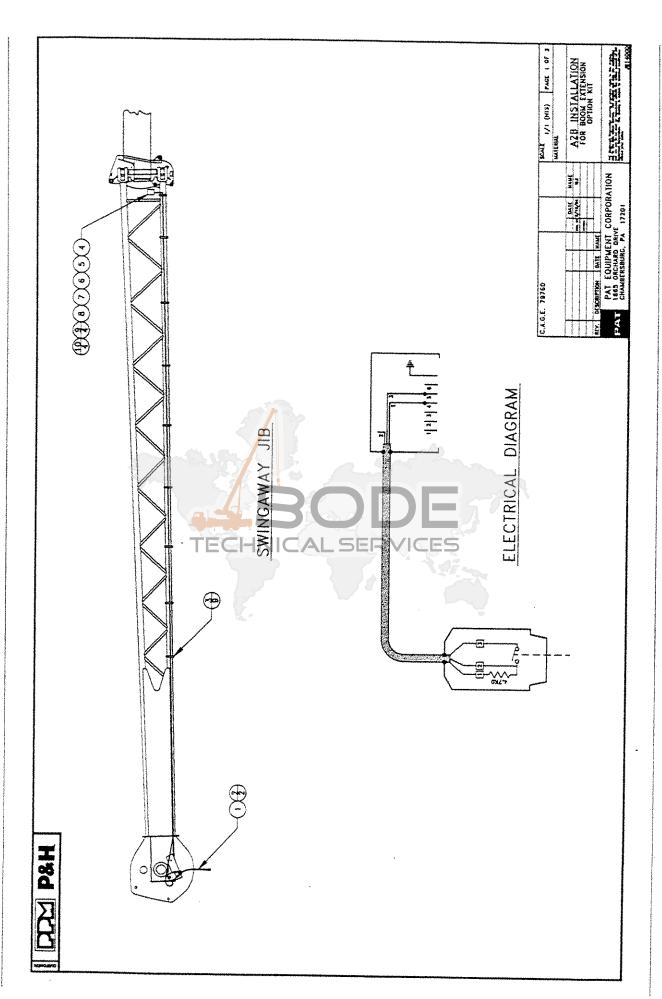
Engineering Bill Date: 12/08/94 17:15:55 F/N:CAC20007

:CAC20007 :B.O.M. FOR CONSOLE DS 350 C :ALL MODELS

Number Title Model Revision ECO Number

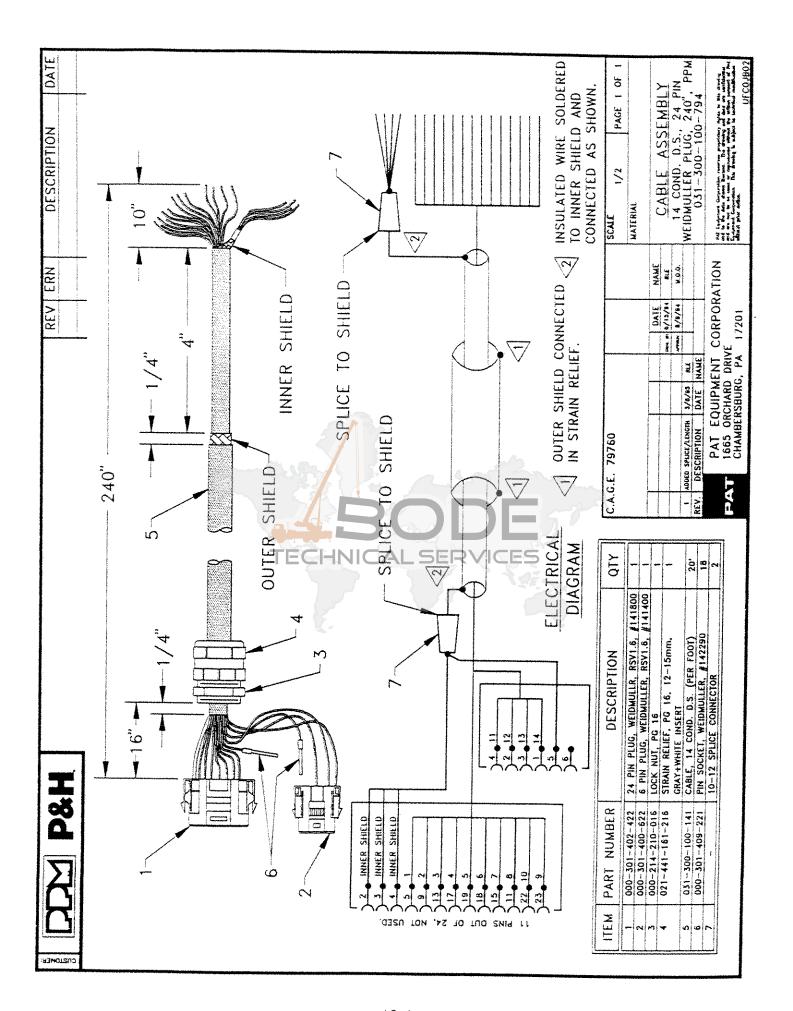
Date of Last ECO Basic List No Similar To Similar To Similar To :
Drawn By :ROD EAVES
Checked By :
Approved By :RICK FISK (PAT)
Revised By :
Tree Number :

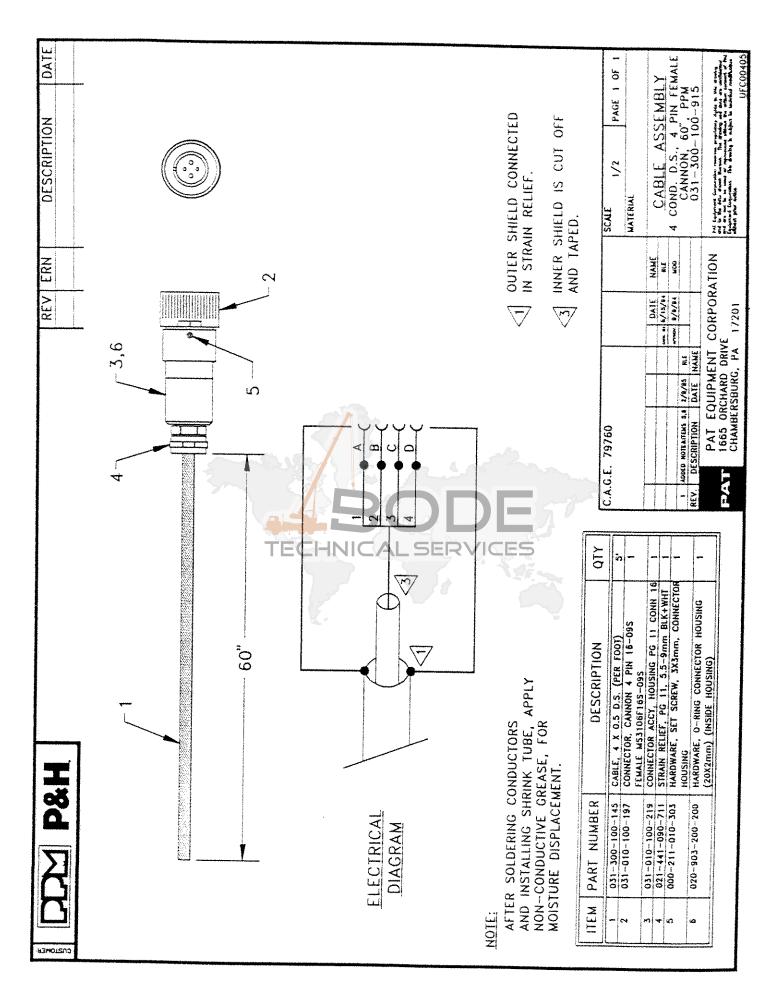
ITEM	PART NUMBER	DESCRIPTION	====== MAT'L	===== WGT	==== OTY
 1 2	024-000-100-078 024-351-300-010	HOUSING, CONSOLE/CU, DS350C BOARD, DS350C, DATA PROM MODUL	1	Makes order makes there are a subject to	==== 1 1
3 4 5	024-000-100-080	HOUSING, DS350C, BACK COVER	TENERAL PROPERTY AND ADMINISTRAL PROPERTY ADMIN	į	<u>.</u>
6 7		FOR STRAIN RELIEF & TERM. MTG.	Advision and provided in the control of the control		1
8	024-000-050-223	COVER, DS350C, SIDE PANEL FOR CIRCUIT BOARD ACCESS		-	
9	024-351-300-103	BOARD, DS350C CONNECTION, 8- DIGITAL INPUTS, 3+1+1 RELAYS			1
10	024-351-300-040	BOARD, DS350C POWER SUPPLY			1 1
11		BOARD, DS350@ANALOG? VICES		į	1
12	024-351-300-001	BOARD, DS350C PROCESSOR		-	1
13	024-351-300-002	BOARD, DS350C CPU		1	1
14 15	000-205-270-308	SCREW, 3mm X 8mm, FLATHEAD		-	4
16	024-000-050-226 000-205-370-308	RETAINING PLATE, BOARDS	4		1
17	000-208-030-030	SCREW, 3mm X 8mm			2
18	000-208-030-030	WASHER, 3mm			2
19	050-350-100-001	KEY DESERVE & DESERVE COVERS			
20	050-350-110-049	KEY, DS350G & DS350C CONSOLE ALARM, BUZZER, DS150 & DS350C			1
21	024-000-050-174	COVER, DS350C, PANEL TO ACCESS DATA PROM MODULE	Article data de la constitución de		1
22	000-205-270-308	SCREW, 3mm X 8mm, FLATHEAD			1
23	000-205-270-312	SCREW, 3mm X 12mm, DS350C- DATA PROM COVER MTG.			2
24	050-350-110-213	SWITCH, KEY, DS350C CONSOLE/CU		***************************************	1
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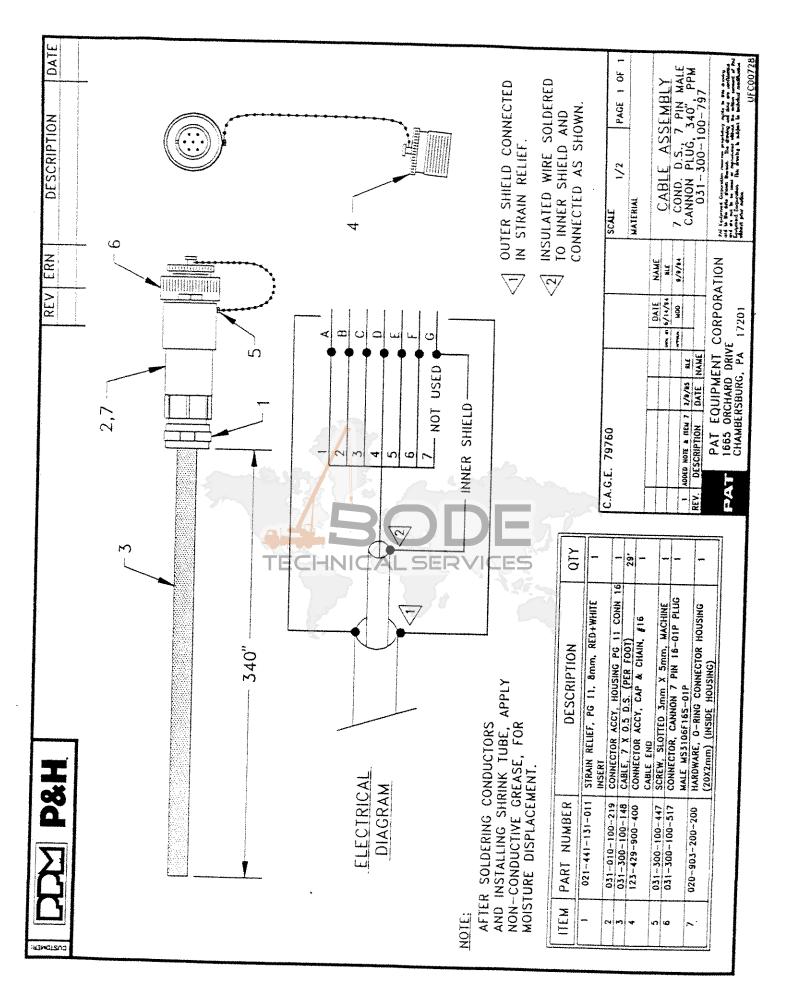


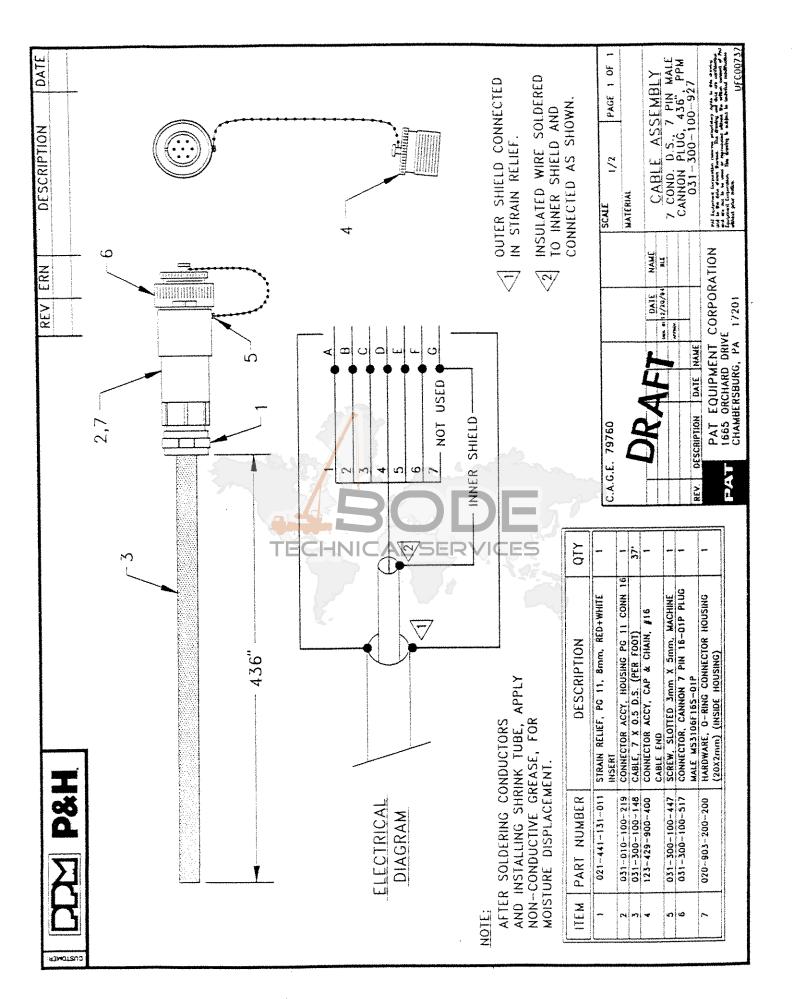
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Revised By	:		, ,
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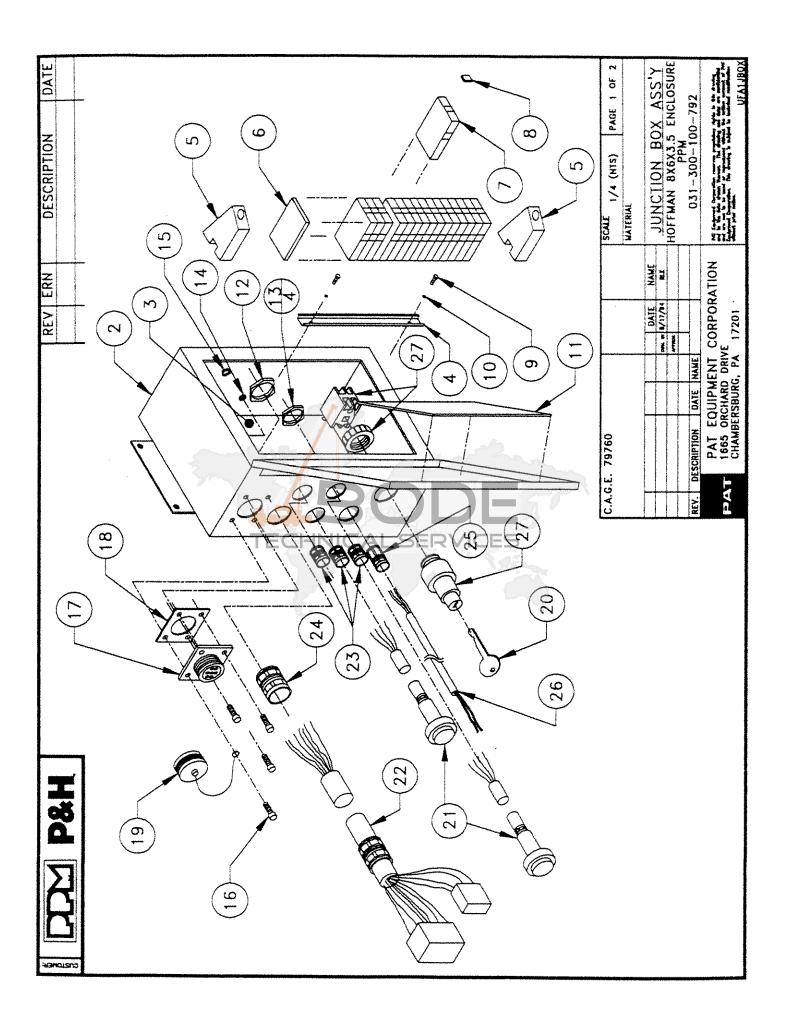
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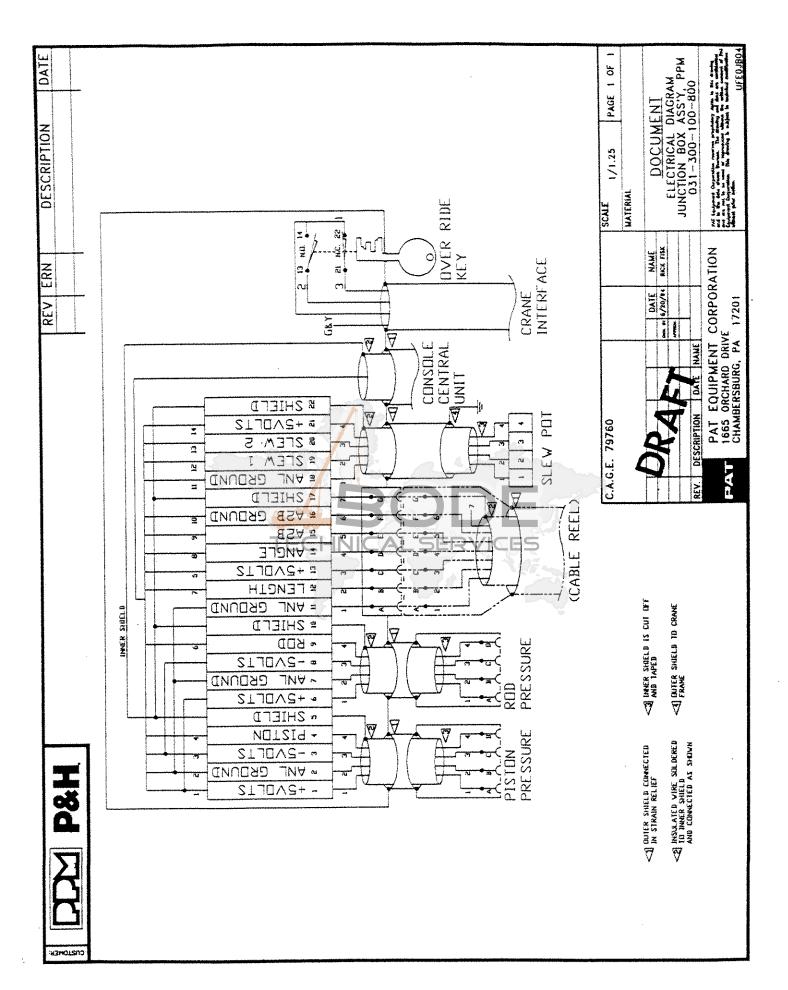


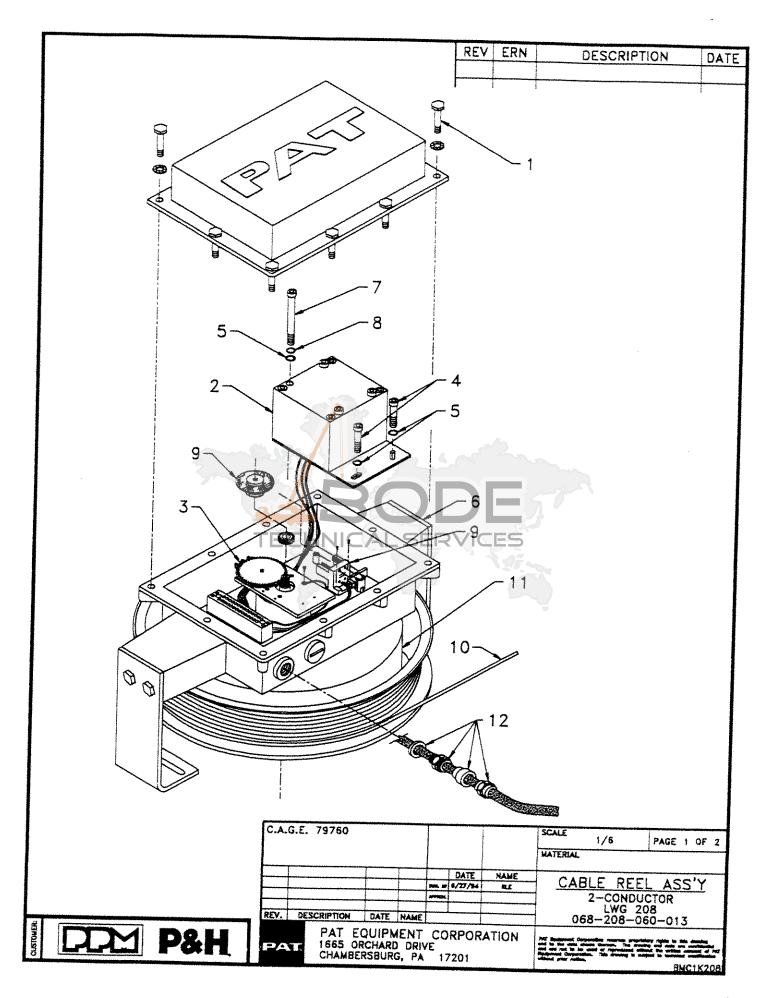




Engineering Bill Date	: 06/22/94 08:48:55 F/N:UFB0JBOX
Number Title Model Revision ECO Number Date of Last ECO Basic List No Similar To Drawn By Checked By Approved By Revised By Tree Number	:UFBOJBOX :B.O.M. FOR JUNCTION BOX : : : : : : : : : : : : : : : : : : :

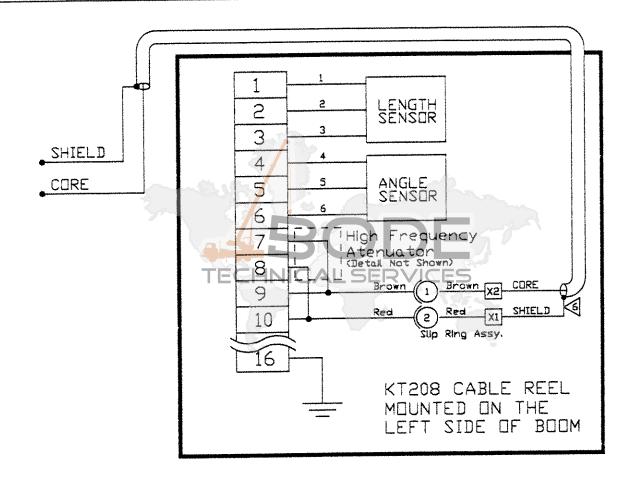
ITEM	PART NUMBER	DESCRIPTION	MAT'L	WGT	===== QTY
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	031-300-100-787 031-300-100-788 031-300-100-786 031-300-100-688 031-300-100-687 031-300-100-686 031-300-100-799 123-429-909-730 031-300-100-801 031-300-100-798 000-214-210-016 000-214-210-011 031-300-100-175 031-300-100-176 123-429-910-630 031-300-100-173 031-300-100-173 031-300-100-024 050-000-060-001 031-300-100-915 031-300-100-794 021-441-110-811	WIRING DIAGRAM, J.B. ASS'Y. JUNCTION BOX ASS'Y., U.F. ASS'Y., PANEL, 6 3/4 X 4 7/8 ASS'Y., TERMINAL RAIL 6 1/8 TERM. STRIP ACCY., END BLOCK TERM. STRIP ACCY., END PLATE TERM. STRIP ACCY., BLOCK, AK MARKING TAPE 1-50 (HORIZ.) SCREW, #8-32 X 1/2", PHILLIPS WASHER, LOCK, #8 DECAL, WIRING DIAGRAM, UF, JB NUT, PG 16 NUT, PG 11 WASHER, LOCK, #4 SERVICES CONNECTOR ASS'Y., 7 PIN FEMALE CONNECTOR ACCY., GASKET #16 CONNECTOR ACCY., COVER, DUST KEY, SET, A2B & C.U. KEYSET CABLE ASS'Y., PRESS. TRANS. 5' CABLE ASS'Y., 14 COND., 24 PIN STRAIN RELIEF, PG 11, 6mm STRAIN RELIEF, PG 16, 12-15mm STRAIN RELIEF, PG 11 CABLE, 4 X 1.5 S.S. (PER FOOT) SWITCH ASS'Y. W/KEY & CONTACT			1 1 1 1 1 2 1 2 2 1 1 4 4 4 4 4 1 1 1 1





TEM	PART NUMBER	DESCRIPTION	QTY
1	068-000-110-031	CABLE REEL ACCY. SCREW/CAPTIVE	10
2	064-103-060-002	SENSOR, ANGLE WG 103	1
3	006-710-008-002	SENSOR, LENGTH TRANSDUCER LGE 100	1
4	002-050-205-012	SCREW, W6 X 12 HEX SOCKET CAP (FOR ANGLE SENSOR)	2
5	000-207-010-064	WASHER, FLAT 6mm	3
6	006-820-006-002	CABLE REEL, KT 200, STANDARD	1
7	031-300-100-358	SCREW, 6mm X 1 X 110	1 1
	000-208-040-084	WASHER, LOCK, 8mm	1
g	068-000-110-013	SUP-RING, 2 CONDUCTOR	1
10	000-673-020-002	CABLE, LENGTH SENSOR, 1 CORE WITH SCREEN (PER FOOT)	139
11	068-000-110-010	SPRING PACK W/HOUSING, KT 200	1
12	021-441-161-213	STRAIN RELIEF, PG 13.5, 12-15mm GRAY+WHITE INSERT	1

REV	ERN	DESCRIPTION	DATE

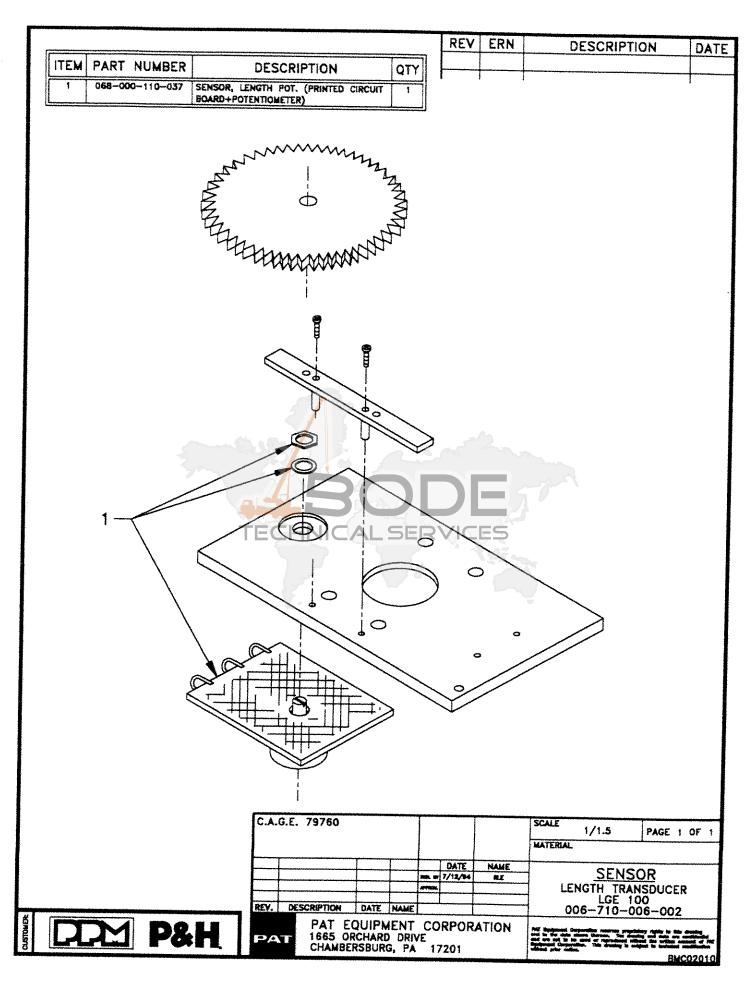


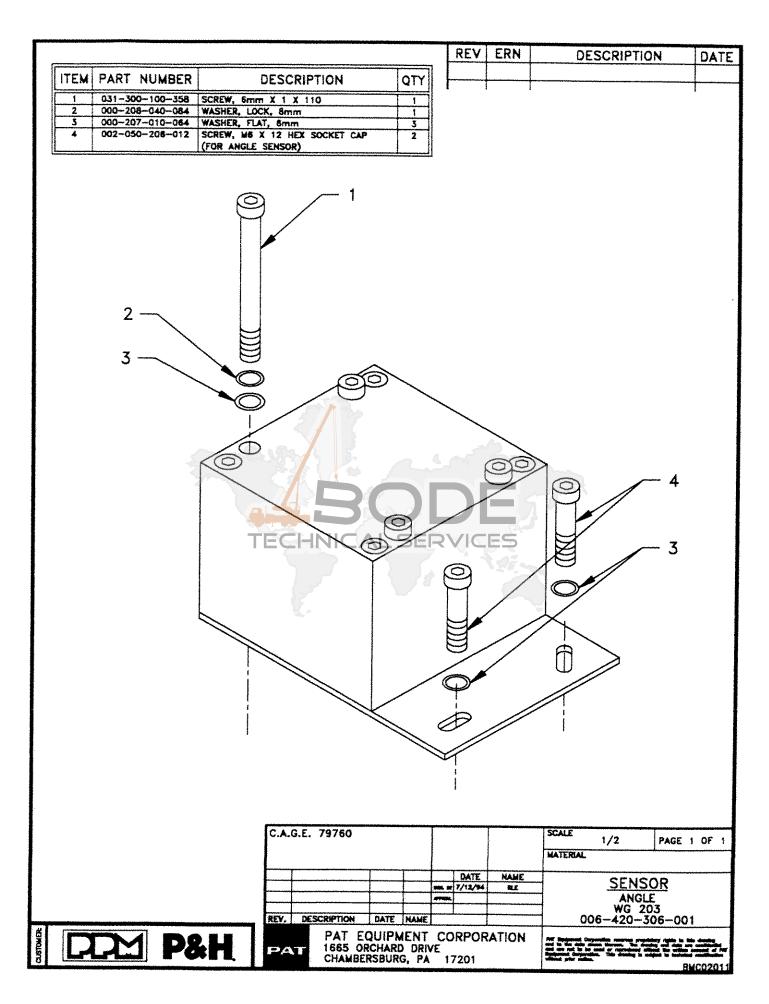
ELECTRICAL DIAGRAM

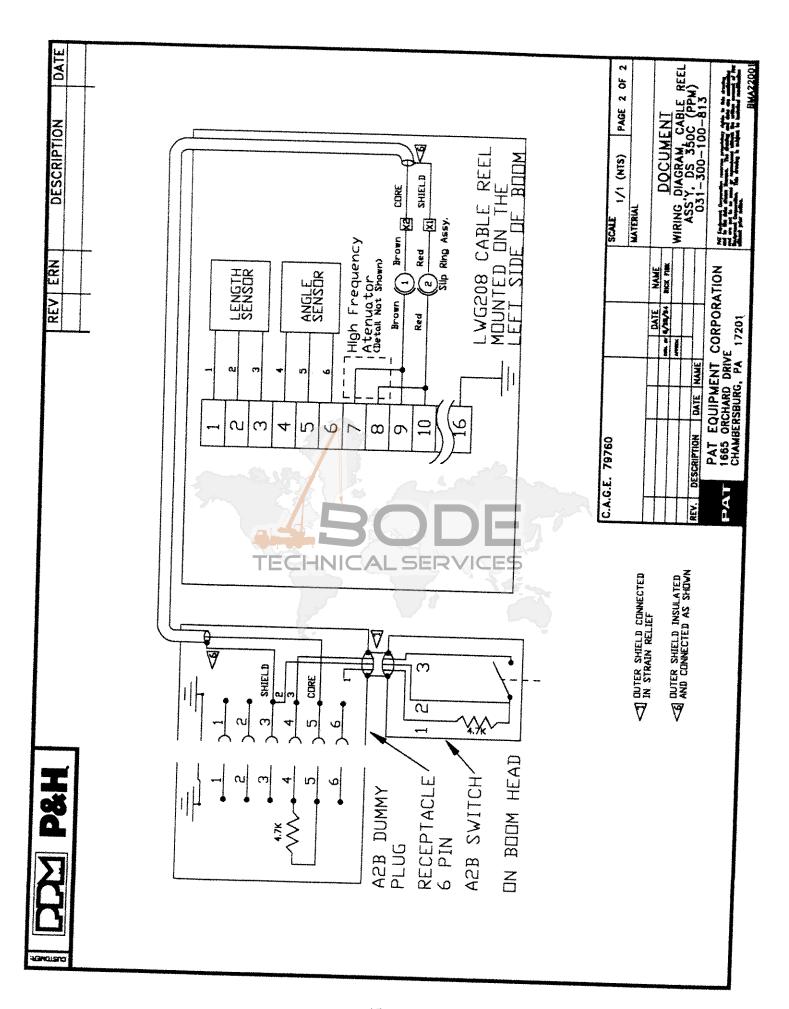
G GUTER SHIELD INSULATED AND CONNECTED AS SHOWN.

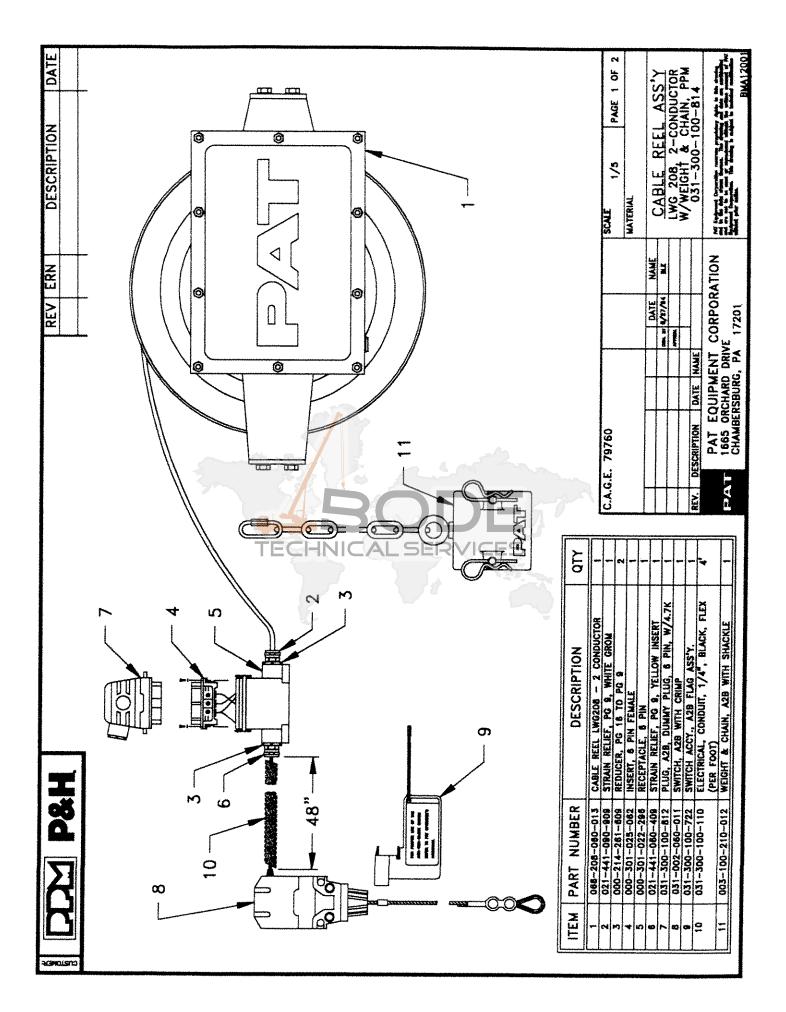
C.A.C	G.E. 79	9760						SCALE 1/1 (NTS) PAGE 2 OF 2 MATERIAL
т			T	T	_	DATE	NAME	CABLE REEL
			1	1		8/27/94	RLE	
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-		-			2-CONDUCTOR
REY.	DESC	HOTTON	DATE	NAME				068-208-060-013
PA			RCHAR	יואם כ	٧E		ATION	Not Bangament Corporables reserves projectolary rights to this diversity and to the other dress theretoe. The creating and other on contributions and one not to be used or reproduced effects the softent assumed of Parliament Corporations. This diversity is neighbor to include an extensional effects of the contribution of the

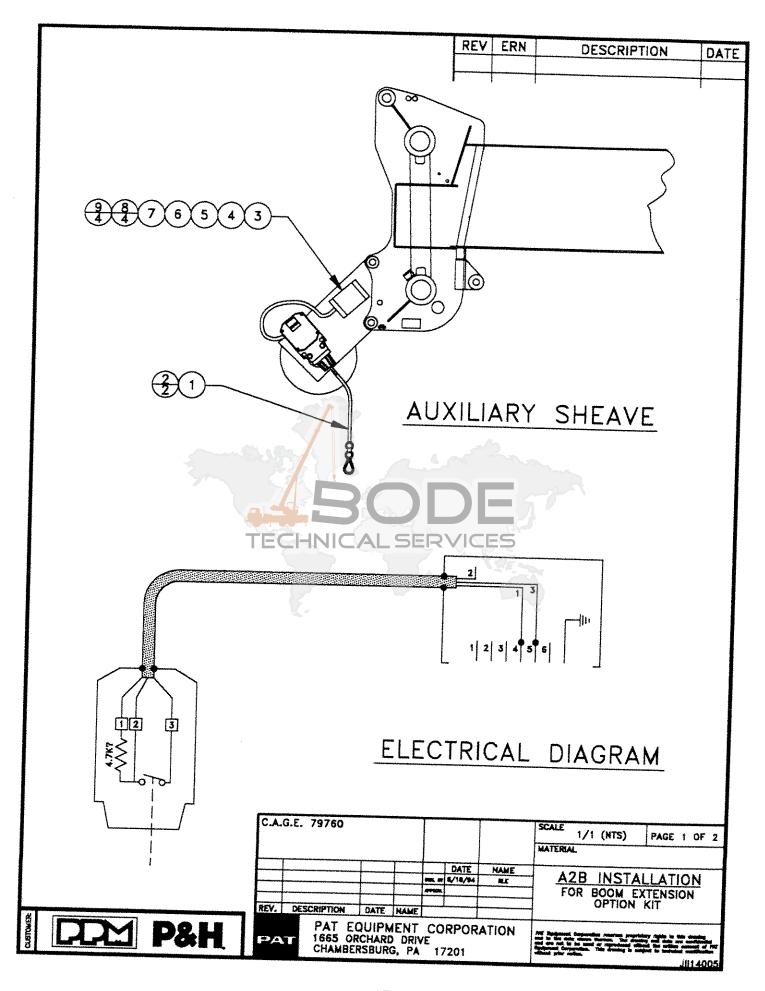












Engineering Bill Date: 08/18/94 17:00:00 F/N:JII24005

Number

:JII24005 :B.O.M. FOR AUXILIARY SHEAVE Title

Model :VARIOUS

Revision ECO Number Date of Last ECO : Basic List No Similar To

:ROD EAVES Drawn By

Checked By Approved By

:RICK FISK (PAT)

Revised By
Tree Number

16 Troubleshooting

General information

In case of a system malfunction, a code to identify the error source will be shown on the display.

The code numbers listed in the malfunctions table identify various malfunctions that might occur in the LMI system. In the malfunctions table each error will be explained and the steps to be taken for their correction will be described.

Malfunctions within the microprocessor have to be repaired by factory-trained specialist only. Please inform the competent service organisation in case of errors of this kind.

Operating faults

Malfunctions of the LMI-system caused by exceeding preset areas or operating faults of the crane operator are indicated and explained on the LCD display. These code numbers could be E01, E02, E03, E04, E05 and E6. Normally, the operator can repair these faults by himself.

Error code	Error	Cause	Elimination		
E01: MIN. RADIUS	Fallen below the radius range or angle range exceeded.	Fallen below the minimum radius or exceeding the maximum angle specified in the respective load chart due to luffing up the boom too far.	Luff down the boom to a radius or angle preset in the load chart.		
E02: MAX. RADIUS	The second secon		Luff up the boom to a radius or an angle preset the load chart.		
E04: ERROR OPERAT. MODE	Incorrect setting of operating mode	a) The selected operating mode is locked.	a) Set the operating mode in accordance with the assignment to the operating condition.		
		b) The selected operating mode is not included in the TLK-EPROM	b) Check the programmation in the TLK-EPROM		

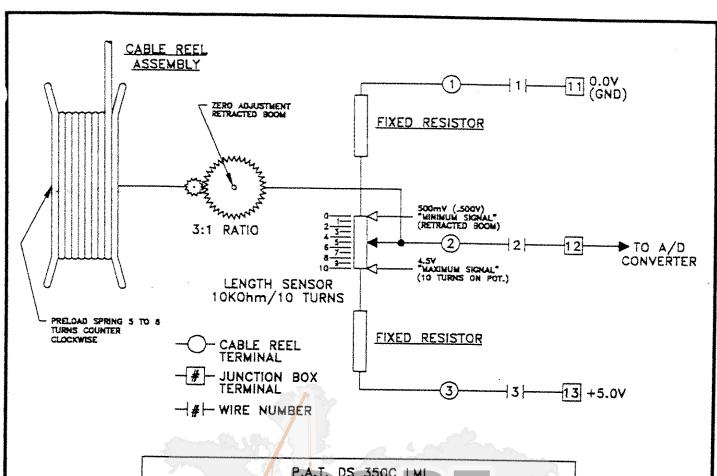
	1		
E05: PROHIBITED LENGTH	Prohibited length range	a.) Boom has been extended too far or not enough, e.g. if operation is only admitted up to a certain boom length or for load charts of jibs with the boom having to be extended to a certain length.	a.) Retract or extend boom to the correct length.
		b.) The length sensor adjustment was modified, e.g. rope slid off the length sensor reel.	b.) Retract the boom. Check the prestress of the cable reel (the rope has to be under traction). Open the length sensor and carefully turn the length pot counterclockwise to the detent by use of a screwdriver.
		c.) Clutch between length sensor pot and drive is defective	c.) Completely replace the clutch with the drive wheel and adjust length sensor pot as described at b.)
	450	d.) Failure of the -5V-supply for the analog part of the LMI-main board. e.) Cable between the central unit and the length sensor defective or	d.) Check -5V-voltage. If there is no voltage or break down at a charge of 50 ohm approximately, exchange main board. e.) Check cable as well as connector and exchange, if necessary.
	ECHNICAI	f.) Length potentiometer defective.	f.) Replace length potentiometer.
E07:ERROR OVERLOAD RELAY	No acknowledge- ment from the overload relay.	Overload relay is caught, defective or is not being driven.	Replace relay. If this replacement is not satisfactory, the connection board has to be replaced, too.
E08: ERROR A2B RELAY	No acknowledge- ment of the anti two-block switch relay.	A2B-relay is caught, defective or is not being driven.	Replace relay. If this replacement is not satisfactory, the connection board has to be replaced, too.
Ell: ERROR MB LENGTH MIN.	Fallen below limit for the measuring channel "Length telescopic boom".	a.) Cable between length sensor and central unit defective, not connected or water in the connectors.	a.) Check cable and connector as well and replace, if necessary.
		b.) Length sensor pot defective.	b.) Replace length sensor potentiometer.
		c.) Electronic board in the measuring channel defective.	c.) Replace main board or analog board.

E12: ERROR PR. PISTON MIN	Failen below lowe limit value for the measuring channe *pressure transducer piston side*	central unit to the pressure transducers defective or water in the connectors.	connector as well and
		b.) Pressure transducer defective.	b.) Replace pressure transducer.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analogous board.
E13: ERROR PR. ROD MIN.	Fallen below lo- wer limit value for the measuring channel "pressure transducer rod side".	Cable leading from the central unit to the pressure transducers defective or water in the connector.	connectors as well and
		b.) Pressure transducer defective.	b.) Replace pressure transducer.
715		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E15: ERROR MIN. ANGLE	Fallen below lower limit value for the measuring channel "angle main boom".	central unit to the	Check cable as well as connectors and replace, if necessary.
	A Garage	b.) Angle sensor defective.	b.) Replace angle sensor.
3~	1/5	c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E19: ERROR REF.	Reference voltage defective.	a.) The total of the supply and the reference volt- ages is less than 2.7V.	a.) Check supply voltages.
ELA: ERR. MIN.		b.) A/D converter defective.	b.) Replace analog board.
SLEW. ANG. A	Fallen below lower limit value for the measuring channel "slewing angle A"	a) Cable leading from the central unit to the slew-ing angle sensor defective, loose or water in the connectors.	a.) Check cable and connector as well and replace, if necessary.
	The state of the s	 b) Slewing angle sensor defective. 	b) Replace slewing angle sensor
10		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
18: ERR. MIN. LEW. ANG. B	Fallen below lower limit value for the measuring channel "slewing angle 8"	cf. Error 1A	cf. Error 1A
20: NO REF. DLTAGE	No analog voltages	a.) The input voltages are too small.	a.) Check crane voltage.
	ŧ	c.) The voltage converter is defective.	b.) Replace power supply board.

E21: ERROR MB LENGTH MAX.	Upper limit value for measuring channel "length telescopic boom" exceeded.	a.) Cable leading from the central unit to the length/angle sensor de ective, not connected o water in the connectors	connectors as well and replace, if necessary.
	office our definition of the	b.) Length sensor pot defective.	b.) Replace length sensor pot.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E22: ERROR PRES PISTON MAX.	. Upper limit value for the measuring channel "pressure transducer piston side" exceeded.	a.) Cable leading from the central unit to the pressure transducers defective, not connected or water in the connectors.	Check cable as well as connectors and replace, if necessary.
		b.) Pressure transducer defective.	b.) Replace pressure transducer.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E23: ERROR PRES. ROD MAX.	Upper limit value for the measuring channel pressure transducer rod side exceeded.	a.) Cable leading from the central unit to the pressure transducers defective, not connected or water in the connectors.	a.) Check cable and connectors as well and replace, if necessary.
	450	b.) Pressure transducer defective c.) Electronic board in the	b.) Replace pressure transducer
	ECHNICA	measuring channel	c.) Replace CPU or analog board.
E25: ERROR MAX. ANGLE	Upper limit value for the measuring channel "angle main boom" exceeded.	a.) Cable leading from the central unit to the length-angle sensor defective, loose or water in the connectors.	a.) Check cable and connectors as well and replace, if necessary.
		b.) Angle sensor defective	b.) Replace angle sensor.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E29: ERROR REF. VOLT. MAX.	Reference voltage defective.	a.) The total of the supply and the reference volt- ages is more than 3.3V	a.) Check supply voltages.
		b.) A/D converter defective.	b.) Replace analog board.
E2A: ERR. MAX. SLEW. ANG. A	Upper limit value for the measuring channel "slewing angle A" exceeded.	a) Cable leading from the central unit to the slewing angle sensor defective, loose or water in the connectors.	a.) Check cable and connector as well and replace, if necessary.
Action to Commonwealth	No not to the state of the stat	b) Slewing angle sensor defective.	b) Replace slewing angle sensor
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.

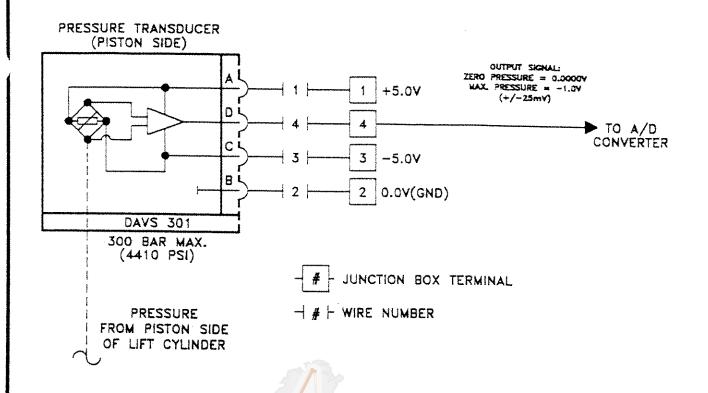
E2B: ERR. MAX. SLEW. ANG. B	Upper limit value for the measuring channel "slewing angle 8" exceeded.	cf. Error 2A	cf. Error 2A
E31: ERROR SYSTEM EPROM	Error in the system program.		Replace system program PROM
E38: WRONG SYSTPROM DAT	Wrong system program in the LMI.	The system program in the LMI does not correspond to the programmings in the data EPROM 1.	Replace EPROM 1 of the system program.
E39: WRONG SYSTPROM TLK	Wrong system program in the LMI.	The system program in the LMI does not correspond to the programming of the data EPROM 2.	Replace EPROM 2 of the system program.
E41: ERROR	Error in the internal RAM.		- Replace RAM
INTERNAL RAM	rain.		- Replace CPU-board.
E42: ERROR EXTERNAL RAM 1	Error in the first part of the external RAM.	· ·	- Replace CMOS-RAM - Replace CPU-board.
E43: ERROR	Error in the second		- Replace CMOS-RAM
EXTERNAL RAM 2	part of the external RAM.		- Replace CPU-board.
E45: ERROR RED. A/D CONVERTER	Redundancy error in the A/D conversion.	The A/D converter of the processor board and the redundant A/D converter in the CPU provide divergent results.	Replace CPU board.
E46: ERROR EXT. A/D CONVERTER	Error in the A/D converter uPD 7004	The A/D converter uPD 7004 of the CPU board does not provide an EOC signal	Replace CPU board.
E51: ERROR DATA EPROM	Errors in the crane data EPROM or in the EEPROM.	No valid data in the crane data EEPROM. Memory module incorrectly bypassed. Defective crane data PROM.	Load crane data EEPROM with valid data. Bridge memory module for the respective memory type. Re-place crane data EEPROM.
E52: ERR. LOAD CH. EPROM	Error in the load chart PROM.	Load chart PROM defective.	Restart LMI. Replace crane data PROM.
E56: ERROR EEPROM	Error in the crane data EEPROM.	Crane data EEPROM defective. Memory module incorrectly by-passed.	By-pass memory module according to memory type. Replace crane data EEPROM.
E57: ERROR SER. DEEPROM	Error in the serial crane data EEPROM.	No valid data on the serial crane data EEPROM. Memory module defective.	Write data on to the serial crane data EEPROM by means of the test program, then, restart the LMI. Load serial crane data EEPROM with valid data. Replace memory module.
E58: ERROR SER. ANEEPROM	Error in serial analog board EEPROM	No valid data in the serial analog board EEPROM. Analog board defective.	Write data onto the serial analog board EEPROM by means of the test program, then restart the LMI. Replace analog board.

E71: ERROR RELAY K1	incorrect acknowledgement of the 1. relay on the analog board.	relay or main board or connection board defective.	Replace 1. relay, main board or connection board.
E72: ERROR RELAY K2	incorrect acknowledgement of the 2, relay on the analog board.	relay or main board or connection board defective.	Replace 2. relay, main board or connection board.
E73: ERROR RELAY K3	Incorrect acknowledgement of the 3, relay on the analog board.	3. relay or main board or connection board defective.	Replace 3, relay, main board or connection board.
E74: ERROR RELAY K4	incorrect acknowledgement of the 4, relay on the analog board.	4. relay or main board or connection board defective.	Replace 4, relay, main board or connection board.
E80: ERROR SLEWING ANG:	The measuring channels "slewing angle A" and "slewing angle B have no distance	a) Cable leading from the central unit to the siewing angle sensor defective, loose or water in the connectors.	Check cable and connector as well and replace, if necessary.
	of 90 deg.	b) Slewing angle sensor defective.	b) Replace slewing angle sensor
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E81: ERROR CANT	Maximally admitted cant of the crane was exceeded.	Maximally admitted cant of the crane exceeded because of outriggers not having been correctly placed.	Check outriggers and modify their position, if necessary
	Error at outriggers ECHNICAL	At least one of the four outriggers is not completely extended or not fully ser onto the ground.	Completely extend the outriggers and/or correctly set the cylinders onto the ground.
E83: ERROR TELECOMBINATION	Error when telescoping	Combination of the boom elements does not correspond to the prescriptions.	Correct the combination of the boom elements.
E84: ERROR OPERAT. MODE	Error in operating mode	The selected operating mode is not includet in the DATA-(E)EPROM.	Check the programmation in the DATA-(E)EPROM.
E86: ERROR TELE PERCENT	Prohibited length range		cf. Error 05



No. of Turns	No. of Turns on Length	INPUT" Signal
on Cable Reel	Poteniometer	at Terminal #12 in Junction Box
0 02	0	0.50V
3 &	1	0.90V
6	2	1.30V
9	3	1.70V
12	4	2.10V
15	5	2.50V
- 18	6	2.90V
21	7	3.30V
24	8	3.70V
27	9	4.10V
30	10	4.50V

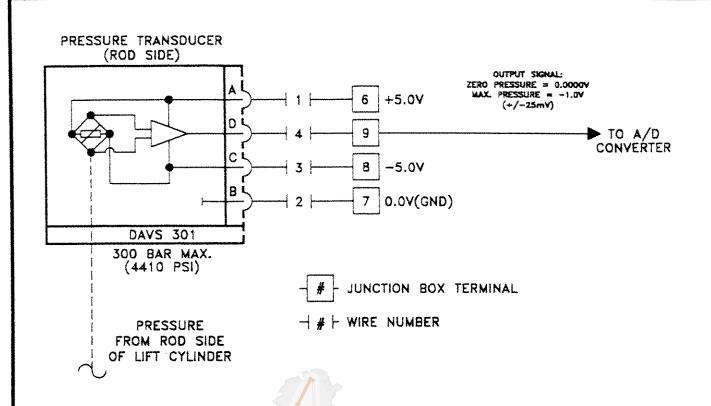
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		<u> </u>			4/7/96	T.	PAT DS 3	
				*****			BOOM LE	
							MEASURING (CHANNEL
REY.	DESCRIPTION	DATE	NAME				CHANNE	L #1
PAT	PAT E				RPOR	ATION		



P.A.T. DS 350C LMI PISTON PRESSURE TRANSDUCER SIGNAL VOLTAGE						
ressure)	Bar HNCAsignal of Terminal #4 in Junction Box					
0	0.0V*					
50	-0.16V					
100	-0.33V					
150	-0.50V					
200	-0.66V					
250	-0.83V					
- 300	-1.0V					

^{*} Zero Point (no pressure) input Signal should be less than 25mV.

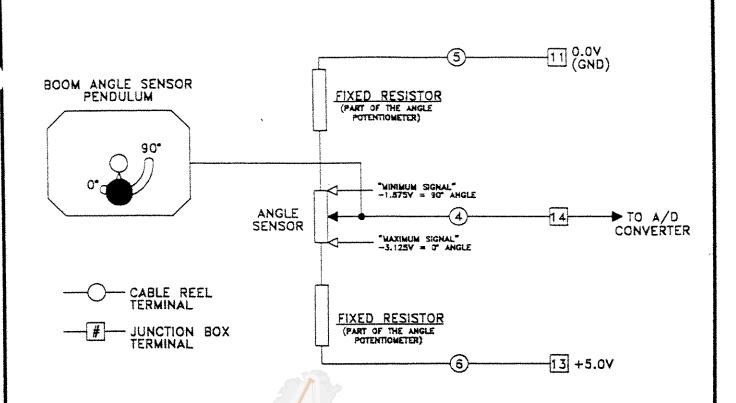
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					DATE	NAME	J GAT DE	7500 114
			İ	PM, 10	4/10/24	R.E		350C LMI
				arreck,			PISTON	PRESSURE
			I				MEASURIN	IG CHANNEL
REY.	DESCRIPTION	DATE	NAME				CHAN	NEL #2
PA	PAT E	CHAR) DRIN	Æ		ATION	All Designants Despurition recommends to the whole control for the control of the	PPM38-03



ROD PRESSU	P.A.T. DS 350C LMI RE TRANSDUCER SIGNAL VOLTAGE
Pressure Bar	"INPUT" ICA signal at terminal #9 in Junction Box
0	0.0 V*
50	-0.16V
100	-0.33V
150	-0.50V
200	-0.66V
250	-0.83V
300	-1.0V

^{*} Zero Point (no pressure) Input Signal should be less than 25mV.

C.A.	G.E. 79760						SCALE 1/1 PAGE 1 OF
							MATERIAL
	<u> </u>	Ţ	T	<u> </u>	DATE	NAME	PAT DS 350C LMI
					4/10/96	a.£	
*********	**************************************	T	T	-			T ROD PRESSURE
~~~~	<u> </u>		1	T-			MEASURING CHANNEL
REY.	DESCRIPTION	DATE	NAME	T		· · · · · · · · · · · · · · · · · · ·	CHANNEL #3
PA	PAT E 1665 OF CHAMBE	CHAR	DRI'	VΕ		ATION	ANT Badgement, Corporation reserves properties rights in this described and to the state stores thereon. The drasting and date on excellent and one retrieves and one retrieves are settlement of the properties of the properties of the drasting is surjoint to territories excellent affects of the properties.  PPMSS—



BOOM ANGLE SIGNAL VOLTAGE							
Actual Boom Angle	"INPUT" Signal at Terminal #14 in Junction Box						
90*	1.87						
85*	1.93						
80 <del>*</del>	2.00						
75 <b>°</b>	2.07						
70*	2.14						
65° -	2.21						
60°	2.28						
55*	2.35						
50°	2.41						
45°	2.49						

P.A.T. DS 350C LMP

BOOM ANGLE SIGNAL VOLTAGE							
Boom Angle	"INPUT" Signal at Terminal #14 in Junction Box						
40*	2.56						
35°	2.63						
30°	2.70						
25*	2.77						
20°	2.84						
15°	2.91						
10°	2.98						
5*	3.05						
0*	3.12						

P.A.T. DS 350C LMI

C.A.G.E. 79760						SCALE 1/1	PAGE 1 OF 1		
							MATERIAL.		
<b></b>			I			DATE	HAME	PAT DS 3	SOC LMI
						4/10/00	R.E		
					-			BOOM A	NGLE
								MEASURING	CHANNEL
REY.	DESCRIP	TION	DATE	NAME				CHANNE	_ #5
P/	PAT EQUIPMENT CORPORATION 1665 ORCHARD DRIVE CHAMBERSBURG, PA 17201							ANT Replacement Compared by Francisco proper and to the data places discrete. The de- aid very raft to be send or reproducted to Replacement Compared to. The develop to to without prior collects.	PPN38-02

## 17.0 CONTACTING PAT SERVICE DEPARTMENT

#### CONTACT PAT EQUIPMENT SERVICE DEPARTMENT

Monday thru Friday 8:00 am - 5:00 pm est.

OFFICE - 717 - 263 - 7655

FAX - 717 - 263 - 7845

TECHNICAL SERVICES