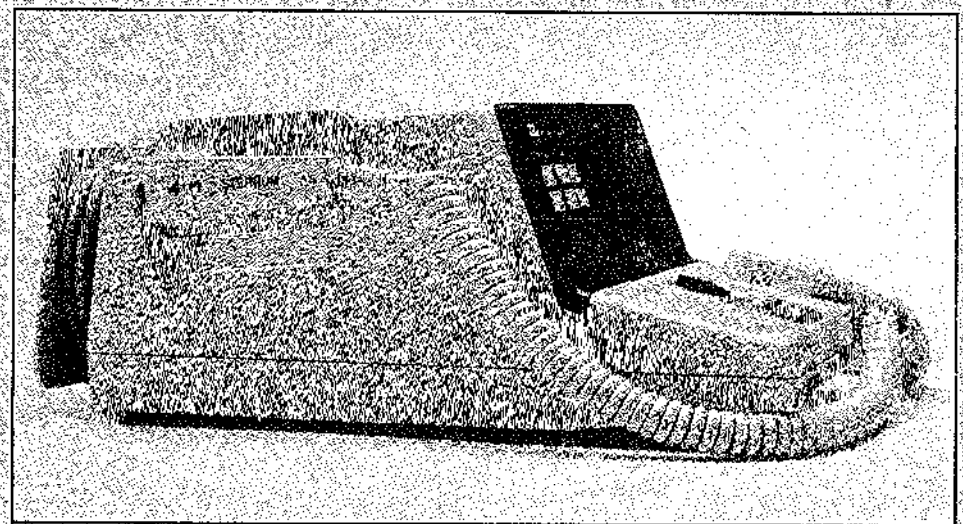
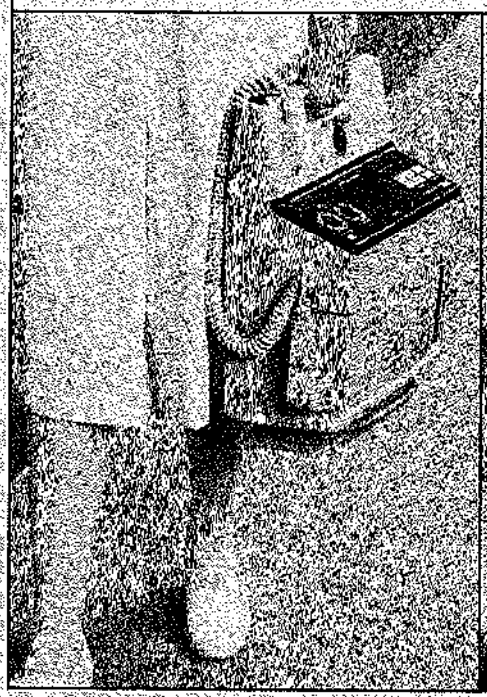
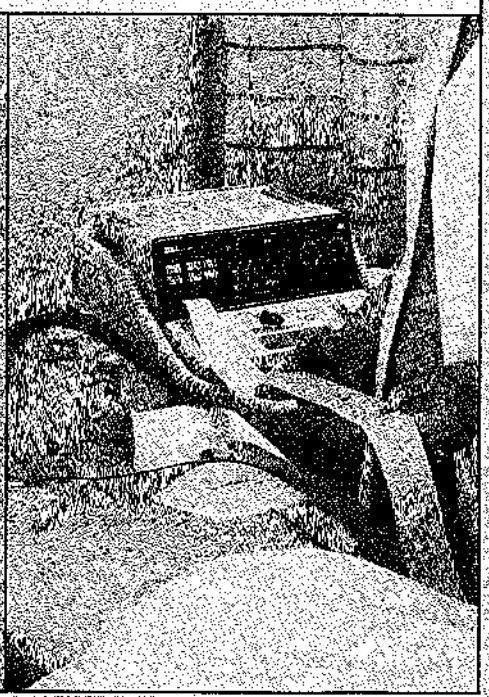
ZOLL PD™ 1200

Pacemaker/Defibrillator







Operator's Guide

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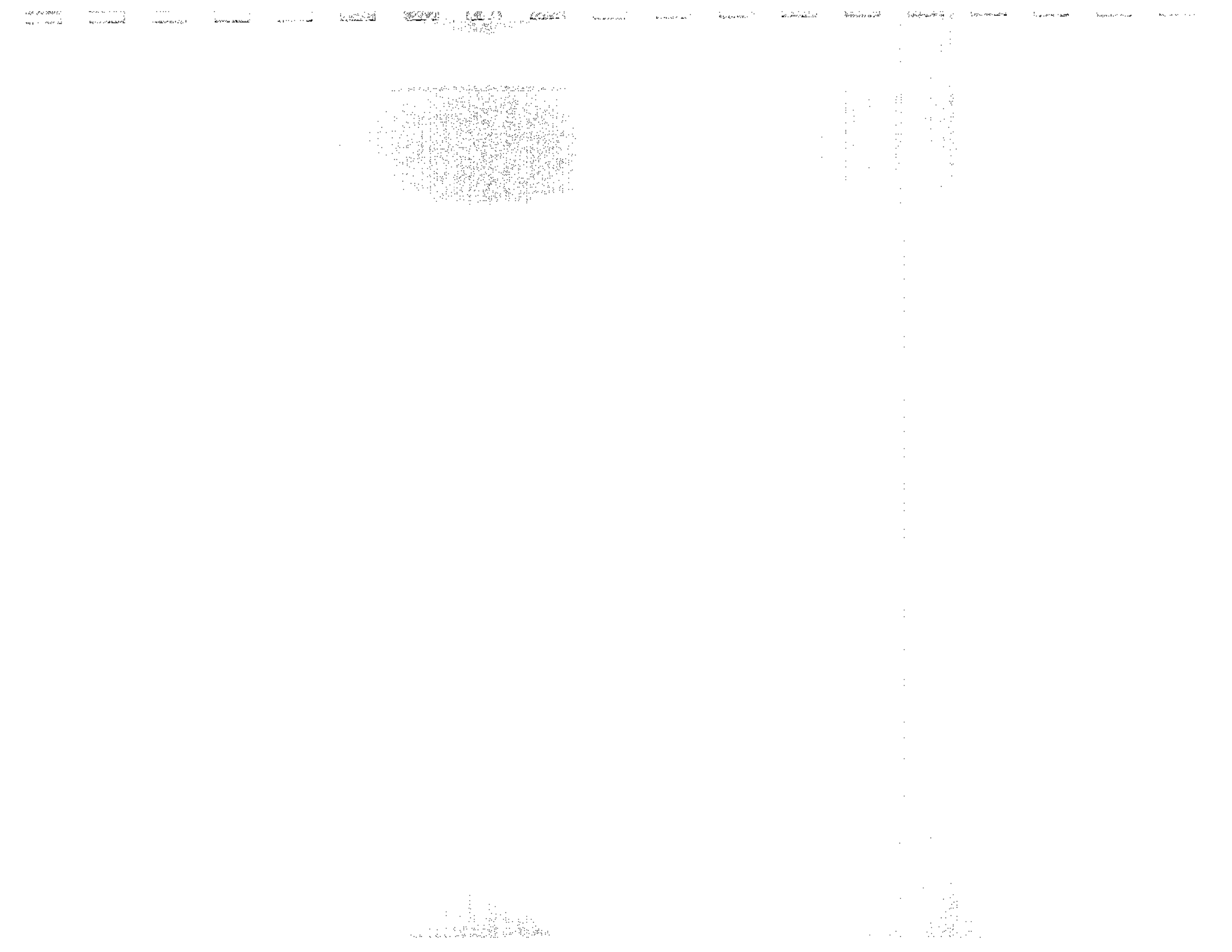

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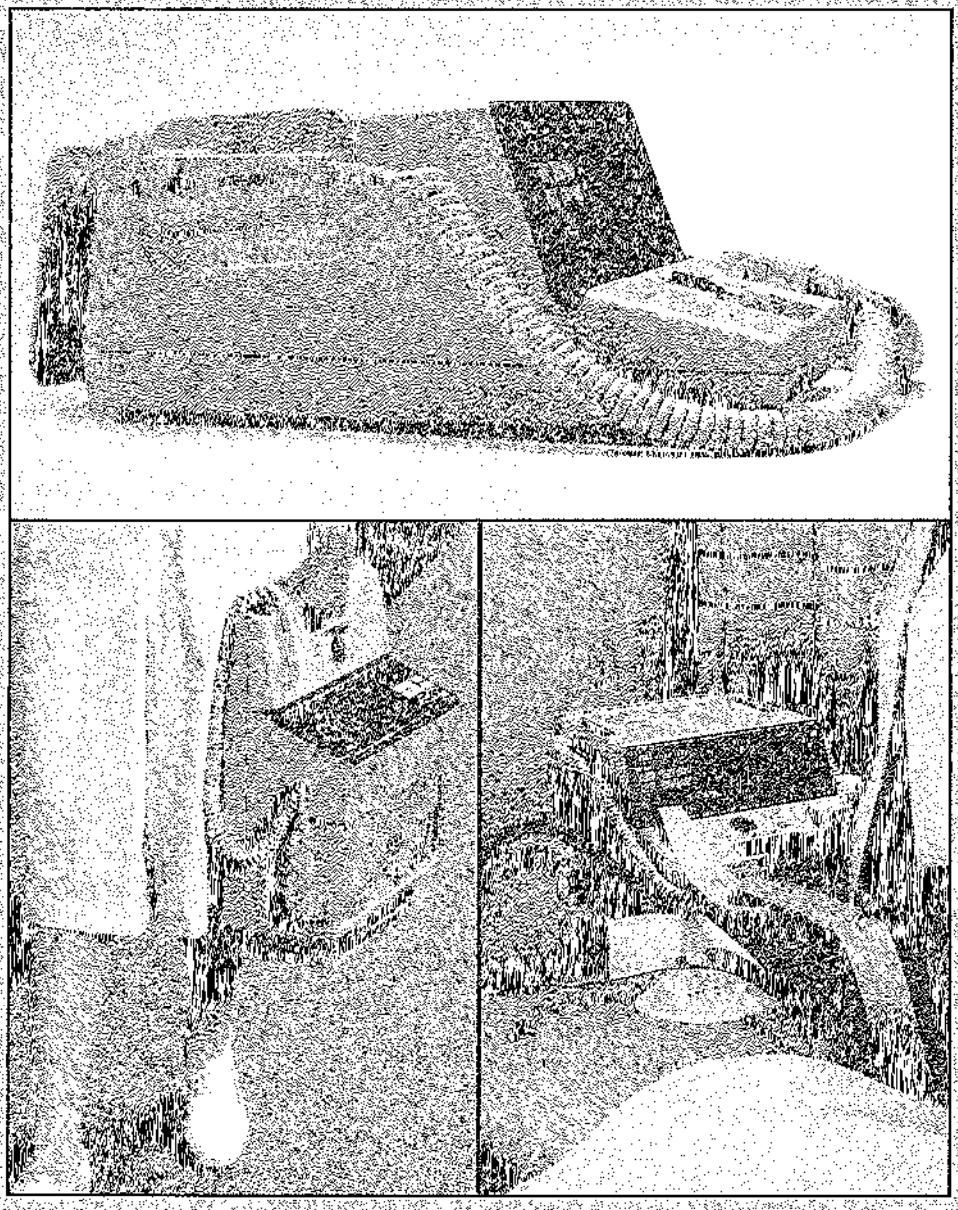

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SECTION I

GENERAL INFORMATION

This operating guide provides instructions for the safe use and proper care of the ZOLL PD 1200 Pacemaker/Defibrillator (PD). **Before using the instrument, CAREFULLY read this entire manual.**

SAFETY CONSIDERATIONS

The ZOLL PD is a high energy device and is capable of delivering up to 360 joules. Disconnecting the line cord of an operating PD from an AC power outlet will not remove power since the instrument is battery-powered. To completely deactivate the PD, you must turn the **SELECTOR SWITCH** to the **OFF** position.

In order to disarm a charged defibrillator:

- Turn the **SELECTOR SWITCH** at least one position in either direction.

  or

- If using paddles, place them in their holders and depress both **DISCHARGE** buttons.

As a safety feature, the ZOLL PD will automatically discharge internally if it has been left charged for more than 60 seconds.

WARNINGS

- **This instrument is for use by authorized personnel only.**
- **Do not use the ZOLL PD in the presence of flammable agents (such as gasoline) or anesthetics. Using the instrument near the site of a gasoline spill may cause an explosion.**
- **Do not discharge with paddles shorted together or in open air. Stand clear of patient when defibrillating.**
- **Do not discharge into multi-function electrodes that are not properly placed on a patient.**
- **Using the device near or within puddles of water is a shock hazard to the operator, patient, and nearby personnel.**
- **Internal pacemakers may cause the heart rate meter to count the pacemaker rate during incidences of cardiac arrest or other arrhythmias. Pacemaker patients should be carefully observed. Do not rely solely on heart rate meters.**

PRODUCT DESCRIPTION

The ZOLL PD 1200 Pacemaker/Defibrillator combines a patented noninvasive temporary pacemaker, a DC defibrillator, a non-fade monitor, and an annotating strip chart recorder in an integral, self-contained instrument. The PD 1200 is lightweight, compact, and can be transported with a patient. It can be operated by either an AC line or batteries. Built-in batteries are kept at full charge when the unit is connected to line power. The batteries are rechargeable and can be easily replaced by the user.

PACEMAKER FUNCTION

Noninvasive temporary pacing (NTP)* is an established and proven technique. This therapy is safe and is easily and rapidly applied in both emergency and non-emergency situations when temporary cardiac stimulation is indicated.

The ZOLL Pacemaker/Defibrillator (PD) contains a demand pacemaker consisting of a pulse generator and ECG sensing circuitry. The output current of the pacemaker is continuously variable up to 140 mA and the rate is continuously variable from 30 to 180 pulses per minute (ppm).

The pacing output pulse is delivered to the heart by specially designed ZOLL NTP pacing electrodes or ZOLL PD multi-function electrodes placed on the back and the precordium. Only ZOLL NTP or ZOLL PD electrodes should be connected to this instrument.

The characteristics of the output pulse, together with the design and placement of the electrodes, minimize cutaneous nerve stimulation, lower cardiac stimulation thresholds, and reduce discomfort due to skeletal muscle contraction.

The unique design of the ZOLL PD allows clear viewing and interpretation of the electrocardiogram (ECG) on the monitor during external pacing, without offset or distortion.

Intended Use -- Pacemaker

This product may be used for cardiac pacing for any purpose in conscious or unconscious patients for up to a few hours duration as an alternative to endocardial stimulation. The purposes of pacing include:

1. **Resuscitation from standstill or bradycardia of any etiology**

   Noninvasive pacing has been used for resuscitation from standstill or temporary acceleration of bradycardia in Stokes-Adams disease, sick-sinus syndrome, reflex vagal standstill and drug-induced standstill (due to procainamide, quinidine, digitalis, b-blockers, verapamil, etc.), and unexpected circulatory arrest (due to anesthesia, surgery, angiography, and other therapeutic or diagnostic procedures). It is safer, more reliable, and more rapidly applied in an emergency than endocardial or other temporary electrodes.

2. **As a standby when standstill or bradycardia might be expected**

   As a stand-by when arrest or symptomatic bradycardia might be expected, the external pacer is used especially in pacemaker procedures (e.g., acute myocardial infarction, drug toxicity, anesthesia, or surgery, especially when disturbances of rhythmicity or

---

* May also be referred to as "transcutaneous pacing", "noninvasive external pacing", or "transcutaneous cardiac stimulation".

conduction are present). Prophylactic placement of endocardial electrode, which carries risks of displacement, infection, hemorrhage, embolization, perforation, phlebitis, and mechanical or electrical stimulation of ventricular tachycardia and fibrillation, can be avoided.

3. **Suppression of tachycardia**

   An increase in heart rate from external pacing often suppresses ventricular ectopic activity and may prevent tachycardia.

Pacemaker Complications

Ventricular fibrillation will not respond to pacing and requires immediate defibrillation. (See Section III: Emergency Defibrillation Procedure.) The patient's dysryhthmia must therefore be determined immediately, so that appropriate therapy can be employed. If the patient is in ventricular fibrillation and defibrillation is successful, but cardiac standstill ensues (asystole), the pacemaker should be used.

Ventricular or supraventricular tachycardias may be interrupted with pacing but in emergency or circulatory collapse, synchronized cardioversion is faster and more certain. (See Section IV: Synchronized Cardioversion.)

Electromechanical dissociation may occur following prolonged cardiac arrest or in other disease states with myocardial depression. Pacing may then produce ECG responses without effective mechanical contractions, and other treatment is required.

Pacing may evoke repetitive responses, tachycardia, or fibrillation in the presence of generalized hypoxia, myocardial ischemia, cardiac drug toxicity, electrolyte imbalance, and other cardiac diseases.

Pacing by any method tends to inhibit intrinsic rhythmicity. Abrupt cessation of pacing, particularly at rapid rates, can cause ventricular standstill and should be avoided.

The Noninvasive Temporary Pacemaker may cause discomfort of varying intensity, which may occasionally be severe and preclude its continued use in conscious patients. Similarly, unavoidable skeletal muscle contraction may be troublesome in very sick patients and may limit continuous use to a few hours. Erythema of the skin under the electrodes often occurs but is inconsequential.

There are reports of transient inhibition of spontaneous respiration in unconscious patients with previously available units when the anterior electrode was placed too low on the abdomen.

Pacing can be performed on pediatric patients using special electrodes (ZMI Part No. NTP 2100). Prolonged pacing (in excess of 30 minutes), particularly in neonates, could cause burns. Caution and periodic inspection of the underlying skin are recommended.

This device may not be connected to internal pacemaker electrodes in contact with the myocardium. Only electrodes supplied by ZMI Corporation should be used.

There have been rare reports of burns under the anterior electrode when pacing adult patients with severely restricted blood flow to the skin. Prolonged pacing should be avoided in these cases and periodic inspection of the skin is advised.

DEFIBRILLATOR FUNCTION

The ZOLL Pacemaker/Defibrillator (PD) contains a standard DC defibrillator capable of delivering up to 360 joules of energy. It may be used in synchronized mode for performance of synchronized cardioversion by using the R-wave of the patient's ECG as a timing reference. The ZOLL PD uses conventional paddles or disposable, pre-gelled, multi-function electrodes for defibrillation.

Intended Use - Defibrillator

This product is to be used only by qualified medical personnel for the purposes of converting ventricular fibrillation (VF), a cardiac rhythm incompatible with life, to sinus rhythm or other cardiac rhythms capable of producing hemodynamically significant heart beats.

In addition, this product may be used in the synchronized mode to terminate certain atrial and ventricular tachycardias and other arrhythmias resistant to drug therapy. A qualified physician must decide when synchronized cardioversion is appropriate.

Defibrillator Complications

Inappropriate defibrillation or cardioversion on a patient (e.g., with no malignant arrhythmia) may precipitate ventricular fibrillation, asystole, or other dangerous arrhythmias. Defibrillation without proper application of paddle electrolyte gel may be ineffective and cause burns, particularly when repeated shocks are necessary.

Defibrillator Output Energy

The ZOLL PD delivers up to 360 joules into a 50 ohm impedance. The energy delivered through the chest wall, however, is controlled by skin impedances. An adequate amount of electrolyte gel must be applied to the paddles and a force of 10-12 kilograms must be applied to each paddle in order to minimize skin impedance. If multi-function electrodes are used, make sure that they are properly applied. (See Section VII.)

MONITOR AND RECORDER FUNCTION

This product contains a non-fade monitor for observation of the patient's cardiac rhythm. The monitor displays the ECG in moving trace mode at 25 mm/sec for a period of 4 seconds.

Also displayed on the monitor are:

- heart rate, derived from measuring R to R intervals
- lead selections - I, II, III, PADDLES, or ELECTRODES*
- ECG size - 0.5cm/mV, 1cm/mV, 2cm/mV
- pacemaker output in milliamps
- defibrillator output in joules
- other operational prompts, messages, and diagnostic codes

The hard copy recorder is used to document events. The recorder normally operates in the delay mode (4 seconds) to insure capture of critical ECG information. It may be activated manually by pressing the recorder **START/STOP** or **MARK** buttons. It will also be activated automatically whenever the defibrillator **DISCHARGE** buttons have been pressed or a Heart Rate Alarm goes off.

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* "ELECTRODES" replaces PADDLES when the multi-function electrode cable is connected.

BATTERIES

The ZOLL PD uses special medical grade, sealed, lead-acid batteries that, when fully charged, can provide up to two hours of monitoring. Use of the defibrillator, pacemaker, and recorder will reduce this time. A "**LOW BATTERY**" message appears on the monitor when the instrument must be plugged into an AC power source to ensure continued proper operation.

INSTRUMENT DIAGNOSTICS

The computer contained within the ZOLL PD performs self-diagnostic tests on critical circuits when the instrument is initially turned on and periodically during operation. The "**READY**" message that appears briefly on the monitor during initial power-up verifies proper operation of these circuits. During operation, an "**ERROR**" message will indicate if a problem has been detected. If this occurs, contact authorized service personnel. In the U.S.A., contact ZMI service, telephone 1-800-348-9011.

Special tests are also available through an extended diagnostic mode (see Section IX).

INITIAL INSPECTION

Carefully inspect each container for damage. If the shipping container or cushion material is damaged, it should be kept until the contents have been checked for completeness and the instrument has been checked for mechanical and electrical integrity. The contents of the shipment should be as shown on the following pages. Procedures for installation and initial checks are presented in Section VIII.

If the contents are incomplete, there is mechanical damage, or the instrument does not pass its electrical self-test, U.S.A. customers should call ZMI Corporation (1-800-348-9011). International customers should contact the nearest ZMI authorized representative. If the shipping container is damaged, also notify the carrier.

SERVICE

The ZOLL Pacemaker/Defibrillator will provide trouble free operation without periodic recalibration or adjustment. However, it is suggested that the hospital biomedical engineering department perform a routine test of the device to verify proper operation. (See Section VIII.)

U.S.A. customers
Should the ZOLL PD require service, it should be returned, in its original container, to:

ZMI Corporation, 500 West Cummings Park, Woburn, MA 01801, Attn: Service Manager

Loan instruments are available for use while repairs are being completed. To request loan equipment, contact ZMI at 1-800-348-9011 (in Mass. 1-617-933-9150). Please try to have the following information available to expedite service:

- A description of the problem
- Department where equipment is in use
- Sample ECG strips documenting problem (if available)
- A hospital Purchase Order to allow tracking of loan equipment

International customers
Should the Zoll PD require service, it should be returned, in its original container, to the nearest authorized ZMI service center.

SPECIFICATIONS

General

Size:	18 cm high x 32 cm wide x 42 cm long (7 in. x 12.6 in x 16.5 in)
Weight:	12 kg (27 lbs.)
Power:	115 VAC, 60 HZ input. Maximum consumption - 50 watts (North American version)
Warranty:	In North America: 5 years, including use of a loaner. Outside North America: consult ZMI authorized representative.
Design Standards:	Meets or exceeds all AAMI specifications for defibrillators Meets UL 544 and CSA standards for medical equipment
Patient Safety:	ECG patient connection is electrically isolated
Environmental:	Temperature: 0°C to 55°C (operating) -40°C to 75°C (storage and shipping) Humidity: 5% to 95% relative humidity

Accessories (standard)

- Standard Apex/Sternum defibrillator paddles
- 1 ECG cable
- 1 pacer cable
- 1 set adult pacer electrodes
- 1 set pediatric pacer electrodes
- 1 roll recorder paper
- 2 Operator's Guides
- Service Manual (not included in shipment - supplied on request)

Other Accessories

NTP-2000	Adult pacing electrodes (12 pair/box)
NTP-2100	Pediatric pacing electrodes (6 pair/box)
NTP-3002	Pacer output cable
NTP-3007	External interface cable
NTP-4450	Test Load for Noninvasive Pacer
PD-2200	Multi-function pacing/defibrillation electrodes (12 pair/box)
PD-3201	Standard Apex/Sternum defibrillator paddles
PD-3202	Electrophysiology external interface cable
PD-3300	Multi-function cable assembly for pacing/defibrillation electrodes
9145-0003	Battery Pack
9500-0002	AAMI Standard 3-wire ECG cable

Pacemaker

Type:	VVI demand; asynchronous when used without ECG leads
Pulse Type:	Rectilinear, constant current
Pulse Duration:	40 milliseconds
Pulse Amplitude:	Variable to 140 mA
Pacing Rate:	Variable from 30 to 180 ppm
Output Protection:	Fully defibrillator protected and isolated
Pacer Electrodes:	Specifically designed anterior/posterior pre-gelled ZOLL NTP or ZOLL PD multi-function pacing/defibrillation electrodes, packaged in pairs. Pediatric electrodes are available.

Defibrillator

Waveform:	Damped sinusoid
Output Energy (delivered):	Selectable at 2, 3, 5, 7, 10, 20, 30, 50, 100, 150, 200, 300, 360 joules
Charge Time:	Less than 10 seconds. Depleted batteries will result in a longer defibrillator charge time
Delivered Energy Display:	Monitor displays energy
Synchronized Mode:	Synchronizes defibrillator pulse to patient's R-wave. "SYNC" message displayed on monitor. Marker on monitor and on recorder identifies R-wave.
Charge Control:	Control on apex paddle and on front panel.
Paddles:	Standard paddles are anterior/anterior adult and pediatric. Adult paddles slide off to expose pediatric paddles.
Defib Electrodes:	Specifically designed anterior/posterior or anterior/anterior pre-gelled ZOLL PD multi-function pacing/defibrillation electrodes, packaged in pairs.
Integral Defibrillator Tester:	Integral circuitry allows complete test of defibrillator charge and discharge without removing paddles from storage wells. Identical circuitry allows complete test of unit configured with multi-function electrode cable.

Monitor and Display

Patient Connection:	Via 3 lead ECG cable and paddles/electrodes. Selectable by front panel switch.
Input Protection:	Fully defibrillator protected. Special circuit prevents distortion of ECG by pacer pulse.
Bandwidth:	0.3-40 HZ (-3dB) standard
Display Format:	Non-fade, moving trace, with freeze capability.
Screen Size:	5 inches diagonally (108 mm x 85 mm, viewing area)
Sweep Speed:	25 mm/sec
Viewing Time:	4 seconds
Heart Rate:	Digital display on monitor 0-300 BPM
Output Current:	Digital display on monitor 0-140 mA
Lead Selection:	Display on monitor
ECG Size:	.5x, 1x, 2x - display on monitor
Alarm On/Off Status:	Display on monitor
ECG Lead Fault:	Message display on monitor
Pacer Electrode Fault:	Message display on monitor
Defibrillator Paddle Fault:	Message display on monitor
Defibrillator Electrode Fault:	Message display on monitor
Recorder Paper Out:	Message display on monitor
Low Battery Voltage:	Message display on monitor
Battery Charger Operational:	(Extended info - Self test mode)
Defibrillator Charge Time:	(Extended info - Self test mode)
Peak Delivered Defib Current:	(Extended info - Self test mode)
Pace Rate and Output:	(Extended info - Self test mode)

Recorder

Type:	Single wave form channel
Paper:	Standard 40 mm thermal (grid width). 50 mm (paper width)
Speed:	25 mm/sec
Delay:	4 seconds
Annotations:	Time, date, energy, heart rate, pacer output, sync, event marker, ECG size, lead, alarm, defib test OK/Fail
Writing Method:	High resolution, thermal array print head
Print-out Modes:	Manual, automatic
Automatic Function:	15 second recording initiated by alarm conditions and defibrillator discharge

Batteries

Type:	Rechargeable, sealed lead acid, medical grade
Voltage:	2.5 V/cell; 6 cells
Recharge Time:	Two (2) hours for depleted pack to 90% of battery capacity (Unit off and plugged into AC power).
Charger:	Integral to instrument; no separate charger unit required.
Service:	Battery pack is easily removed as a unit.
Low Battery Indicator:	Message displayed on monitor. The time from display of the LOW BATTERY message until the instrument shuts down will vary depending on the battery condition. For a battery in good condition (fully charged prior to initiating battery operation), the message display-to-shut down time will be approximately 20 minutes. The instrument will operate on AC when batteries are depleted. Defibrillator charge time may be extended when batteries are depleted.
Operating Time:	50 Defibrillator chargings to maximum energy (360J), or 2 hours of continuous monitoring, or 1.5 hours of continuous monitoring/pacing at 60 mA, 80 beats/min.

SECTION II

OPERATING CONTROLS AND INDICATORS

1. SELECTOR SWITCH

The SELECTOR SWITCH allows selection of any of the three operating modes:

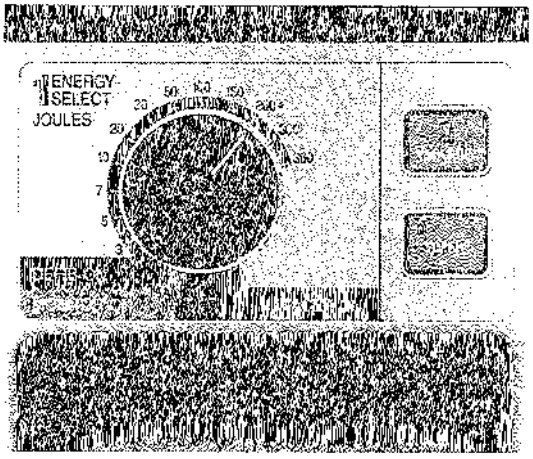
1. **MONITOR ON,**
2. **DEFIB ON** (with various energy selections), and
3. **PACER ON.**

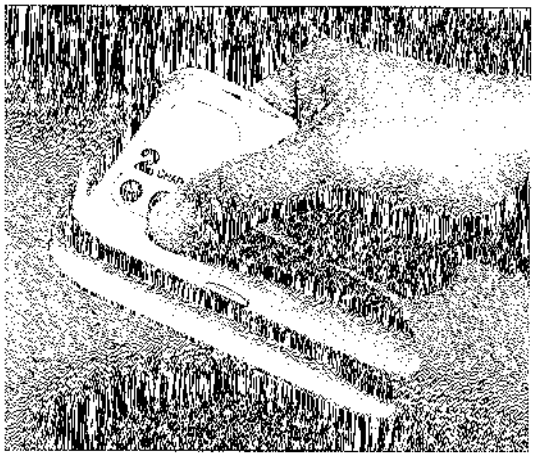
It also turns the power off. The monitor is always on except in the OFF position.

2. CHARGE

Press the **CHARGE** button on the front panel or, if using paddles, on the apex paddle handle, to charge the defibrillator to the energy level selected with the **SELECTOR SWITCH** control. When the **CHARGE** button is pressed, the defibrillator charges to the selected energy level in 10 seconds or less when the batteries are fully charged.

To change the selected energy level after the **CHARGE** button has been pressed, simply reposition the **SELECTOR SWITCH**, and press **CHARGE** again.





3. CHARGE INDICATOR LIGHT

Located on the apex paddle, this light turns on when the defibrillator is charged and ready. When using the multi-function electrode cable, the indicator light is located on the cable connector.

4. DISCHARGE

Each paddle has a DISCHARGE button located near the forward end of the handle. Press and briefly hold both buttons simultaneously to discharge the defibrillator. The multi-function electrode cable (not shown) has two DISCHARGE buttons mounted in the instrument connector. Both must be pressed to discharge the defibrillator. (See Section VII.)

5. SYNC

In SYNC mode, the unit synchronizes defibrillator discharge with the first detected R-wave after both DISCHARGE buttons are pressed and held down. This mode is typically used for cardioversion procedures.

The SYNC button can be used in the DEFIB ON or the MONITOR ON mode.

For synchronized operation, press the SYNC button once; the "SYNC DEFIB" or "SYNC MONITOR" message appears on the display and the light within the SYNC button is illuminated. A distinctive marker appears on the monitor with each detected R-wave.

To return to standard defibrillation mode for instant discharge, press the SYNC button again.

The ZOLL PD is designed to leave SYNC mode and revert to standard defibrillation mode after discharge.

6. OUTPUT mA (PACEMAKER OUTPUT)

This switch is used to control the amount of current to the pacemaker electrodes. For conscious patients it should be gradually increased until capture is recognized. The output is displayed digitally on the monitor.

7. RATE ppm

When pacing is selected, this control sets the rate at which the pacemaker will operate. It must be set above the patient's intrinsic rate in order for the pacemaker to provide stimulation.

8. 4:1 BUTTON

This control is used optionally to test for threshold or to determine the underlying rhythm. When depressed, approximately every 4th beat is a paced beat. Releasing the control will cause the instrument to resume normal operation.

9. LEAD

Selection of the ECG source is accomplished through the **LEAD** button. Pressing the button will sequentially select and display each option on the monitor - I, II, III, "PADDLES" (defibrillator paddles), or "ELECTRODES" (multi-function electrodes). "PADDLES" or "ELECTRODES" is automatically selected when the instrument powers up in **DEFIB ON** or **MONITOR ON**. Lead II is automatically selected when the instrument powers up in **PACER ON**. ECG monitoring through the paddles is accomplished by selecting "PADDLES." "PADDLES" monitoring may not be used in **PACER ON** mode or, with the optional PD 1210, in "**EXT TRIG**" mode. ECG monitoring through multi-function electrodes is accomplished by selecting "ELECTRODES".

Note: When using multi-function electrodes, the word "PADDLES" is replaced with the word "ELECTRODES."

10. ALARM ON

The **ALARM ON** button is used to activate and deactivate the Heart Rate Alarm. A bell symbol appears on the monitor when the alarms are activated and the light within the button is illuminated. When the **ALARM ON** is deactivated, the bell symbol disappears and the light within the button goes off. When the **ALARM ON** is active and an alarm condition is detected, an audible alarm sounds and the bell symbol flashes. To avoid possible confusion with the "**DEFIBRILLATOR CHARGED**" tone, **the Heart Rate Alarm tone is suppressed** when the defibrillator is on (**SELECTOR SWITCH** is turned to any of the defib settings).

11. ECG SIZE

This control allows the operator to vary the size of the ECG signal at .5, 1.0, and 2.0 cm/mV and is indicated on the monitor in the upper left center of the display.

12. FREEZE

The freeze control allows the operator to capture and hold on the display a full four (4) seconds of ECG trace for viewing important or interesting ECG morphology. Normal monitoring is continued when the control is released.

13. START/STOP (RECORDER)

This pushbutton starts and stops the hard copy recorder.

14. MARK (RECORDER)

The **MARK** control places a distinctive mark on the recorder margin the instant the button is pressed. **MARK** also triggers a 15 second recorder run if the recorder had been off.

15. ECG BEEPER VOLUME

The **VOLUME** control at the left front of the instrument (below the recorder) allows manual adjustment of the systole beeper tone from maximum volume to inaudible. (The Heart Rate Alarm and Charge-Ready volumes are not adjustable.)

16. ECG OUT

The ECG out phone jack provides a high-level 1-volt ECG signal from the Pacemaker/Defibrillator and is configured to provide the analog ECG signal on the jack "tip," with the jack "sleeve" as signal ground reference. (ECG jack is located on the back panel.)

17. PAPER COMPARTMENT

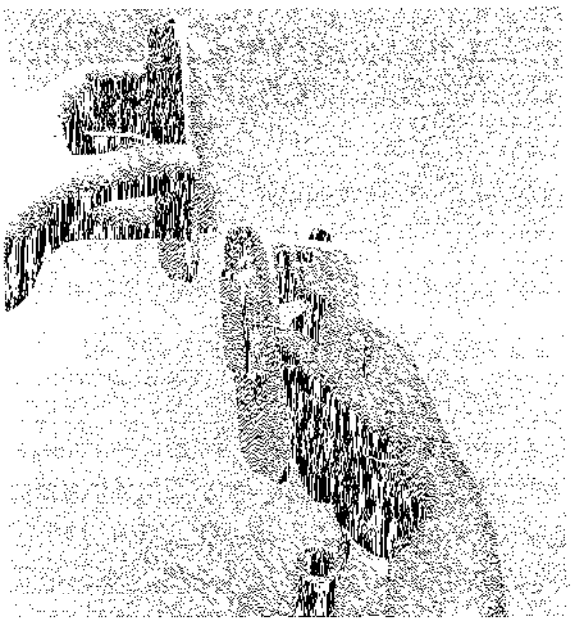
Opens recorder paper storage. Heart Rate Alarm adjustment controls are located within the paper compartment.

18. ALARM SET

This control allows the user to change the High Heart Rate Alarm setting (pre-set at 150) and Low Heart Rate Alarm setting (pre-set at 30). The Δ button increments the displayed value. The ▽ button decrements the displayed value. (Alarm set button is located inside the recorder paper compartment.)

19. PEDIATRIC PADDLES

Pediatric size paddles are built into the paddle assembly. They lie directly under the adult electrode surface and are accessed by pushing the **PEDI** button on the side of each paddle and sliding the adult surface forward.



Adult paddles slide off to expose pediatric paddles.

20. BATTERY CHARGING INDICATOR LIGHT

This light indicates that the batteries are charging. It should always be lit when the unit is connected to an AC power source.

21. TEST LOAD PORT

The test port is used to test the defibrillator output circuitry when using the multi-function electrode cable.

SECTION III

EMERGENCY DEFIBRILLATION PROCEDURE

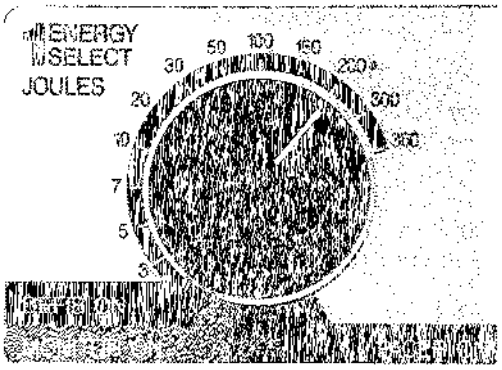
WARNINGS

Before proceeding, **CAREFULLY** read the following:

- **Emergency defibrillation should only be attempted by skilled personnel trained in advanced cardiac life support (ACLS) and familiar with equipment operation. The precise cardiac arrhythmia (e.g., ventricular fibrillation) must be determined before attempting defibrillation.**
- **Do not touch the bed, patient, or any equipment connected to the patient during defibrillation.**
- **All persons in attendance of the patient must be warned to "STAND CLEAR" prior to defibrillator discharge.**
- **In order to maintain battery charge, keep instrument plugged in when not in use.**

1. SELECT ENERGY

- Turn the **SELECTOR SWITCH** to the desired energy level. This action automatically turns the power ON.



Note: Defibrillator "PADDLES" or "ELECTRODES", when using multi-function electrodes, is selected as the ECG source when the instrument is turned to **MONITOR ON** or **DEFIB ON**. You may then select any of the ECG leads - I, II, III.

Prepare Paddles (For multi-function electrodes, see note below or Section VII.)

- Remove the paddles from their holders by grasping the handles and lifting the paddles straight up.
- Apply a liberal amount of electrolyte gel to the electrode surface of each paddle. **To avoid risk of electrical shock to the operator, do not allow electrolyte gel to accumulate on hands or paddle handles.**
- Rub the electrode surfaces together to evenly distribute the applied gel.

Apply Paddles to Chest

- Apply the paddles firmly to the anterior wall of the chest. The sternum paddle should be placed to the right (patient's right) of the sternum, just below the clavicle. The apex paddle should be placed on the chest wall, just below and to the left of the patient's left nipple, along the anterior-axillary line.
- If external pacing electrodes are applied, **it is not necessary to remove them.** Simply ensure that the paddles contact skin. There should be ample room for the apex paddle.
- Rub the paddles against the skin to maximize the paddle-to-patient contact. **Do not permit gel to accumulate between the paddle electrodes on the chest wall – This could cause burns and reduce the amount of energy delivered to the heart.**
- The paddles may be used for ECG monitoring. Use of paddles for ECG monitoring is for emergency situations when time does not allow connection of monitoring electrodes. The unit automatically pre-selects "PADDLES" when it is initially turned on. Pressing the LEAD button will allow selection of the desired ECG source (I, II, III, PADDLES, ELECTRODES). Paddles monitoring is NOT possible when in PACING mode.

Note: If you are using multi-function electrodes, do the following:

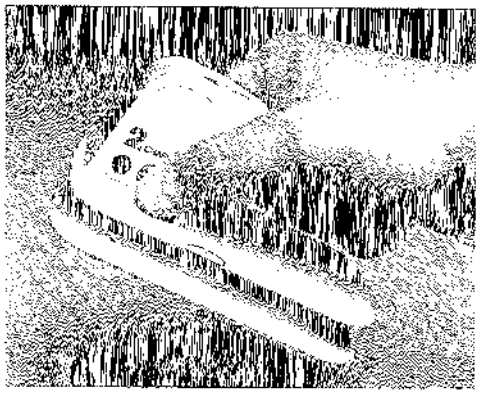
- Remove electrodes from the storage pouch and place the round one marked "**FRONT**" directly over the cardiac apex, as shown on the diagram on the pouch.
- Place the rectangular electrode marked "**BACK**" on the back between the patient's left scapula and the spine at heart level (see diagram on pouch).

  Note: *The "BACK" electrode may be placed over the patient's right sternal area if it is not possible to access the patient's posterior. Effective defibrillation will result, but pacing will usually be less effective.*

- When placing electrodes, be sure to press firmly on the adhesive area around the electrode periphery. Gently press the gel area to remove any trapped air. This ensures good skin coupling.
- Connect the electrodes to the multi-function cable.

2. CHARGE DEFIBRILLATOR

- Press the **CHARGE** button on the front panel, or if using paddles, on the apex paddle handle.



- To increase or decrease the selected energy after the **CHARGE** button has been pressed, move the **SELECTOR SWITCH** to the new energy level, and press **CHARGE** again.
- After 6-10 seconds of charging to the selected level, the **CHARGE INDICATOR LIGHT** will light on the apex paddle or the multi-function cable connector. A distinctive audible tone will go on and the energy selected will be displayed on the monitor. The defibrillator is now ready. **All persons attending patient should be warned to STAND CLEAR.**

3. DISCHARGE DEFIBRILLATOR

- Verify that no one is in contact with the patient, monitoring cable or leads, bed rails, or any other potential current pathway.
- Simultaneously press and briefly hold both **DISCHARGE** buttons (one on each paddle) to deliver energy to the patient.
- If you are using multi-function electrodes, simultaneously press and briefly hold both **DISCHARGE** buttons located on the cable connector assembly.

NOTES:

- *If the defibrillator is not discharged within 60 seconds of reaching the selected energy level, it will automatically dump the stored energy internally.*
- *During the ten seconds prior to this internal dump, the "CHARGE READY" tone will beep intermittently. When the internal dump is complete, the "CHARGE READY" tone will stop, the CHARGE INDICATOR LIGHT will go off, and the monitor delivered energy display will go off.*
- *Should you need to disarm the defibrillator when it is charged, simply turn the SELECTOR SWITCH to MONITOR ON or any other energy setting. This will cause the defibrillator to dump its charge internally.*

- *A "PADDLE FAULT" message will appear on the monitor whenever the paddles or multi-function cable are not connected or are improperly seated in the instrument. The instrument will also disarm itself if such a fault occurs during charge or after the charge is ready.*
- *An "ELECTRODES OFF" message will appear on the monitor if, on an attempt to discharge with multi-function electrodes, the electrodes are not connected or contact with the patient is poor.*
- *CAUTION: The unit does not disarm itself for an "ELECTRODES OFF" failure. As a safety feature, the operator must press the DISCHARGE buttons again after correcting the "ELECTRODES OFF" condition to discharge the defibrillator.*
- *Paddle Cleaning: Paddle plates and handles must be thoroughly cleaned after each use.*

SECTION IV

SYNCHRONIZED CARDIOVERSION

WARNINGS

Before proceeding, **CAREFULLY** read the following:

- **Synchronized cardioversion should only be attempted by skilled personnel trained in advanced cardiac life support (ACLS) and familiar with equipment operation. The precise cardiac arrhythmia must be determined before attempting defibrillation.**
- **Do not touch the bed, patient, or any equipment connected to the patient during defibrillation.**
- **All persons in attendance of the patient must be warned to "STAND CLEAR" prior to defibrillator discharge.**
- **In order to maintain battery charge, keep unit plugged in when not in use.**

Certain arrhythmias, such as Ventricular Tachycardia (VT), atrial fibrillation, and atrial flutter, require synchronizing the defibrillator discharge with the ECG R-wave to prevent the induction of ventricular fibrillation. In this case, a synchronizing ("**SYNC**") circuit within the instrument detects the patient's R-waves. When the **DISCHARGE** buttons are pressed and held, the unit will discharge with the next detected R-wave, thus avoiding the vulnerable T-wave segment of the cardiac cycle.

During "**SYNC**", the ZOLL PD places a marker pulse on the ECG as it appears on the monitor to indicate the point in the cardiac cycle where discharge will occur. This marker pulse appears as an intensified "dot" or "line" on the ECG waveform. For documentation, a (-) marker also designates this discharge point above the waveform on the ECG recorder strip.

Select Monitor On

- Connect ECG leads. Select desired ECG lead by pressing **LEAD** button.

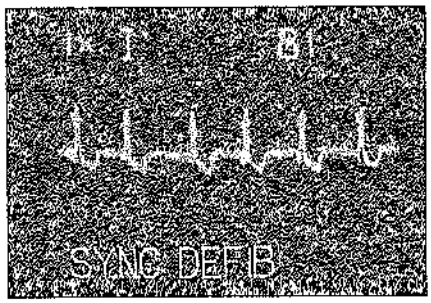
Note: The warning "**USE LEADS**" will briefly appear whenever **PADDLES** or **ELECTRODES** is selected as the ECG source during cardioversion. Standard ECG leads are recommended during cardioversion since they provide signal quality that is typically superior to that of paddles. Multi-function electrodes may be used as ECG source and signal quality will be equal to that of standard ECG leads except immediately following a discharge when there may be more noise due to muscle tremors, especially if an electrode is not in complete contact with the skin. The use of ECG leads also provides the choice of three leads for ECG source; multi-function electrodes provide only one.

Press SYNC Button

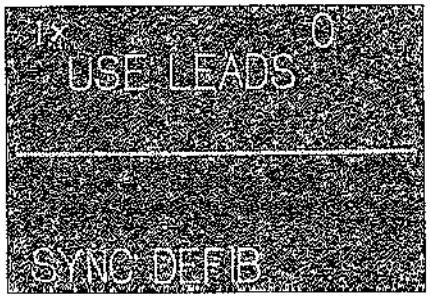
- An intensified dot or line will appear on the monitor at each detected R-wave to indicate where discharge will occur.
- Verify that the intensified dot or line marker is clearly visible on the monitor and is consistent from beat to beat. If necessary, use the **LEAD** button to select the lead which yields the best display.

1. SELECT ENERGY

- Select the desired energy level with the **SELECTOR SWITCH**.
- A "**SYNC DEFIB**" message will appear on the monitor. If "**DEFIB ON**" appears, press the **SYNC** button.



- A "**USE LEADS**" message will briefly appear if "**PADDLES**" or "**ELECTRODES**" has been selected as the ECG source.



- Synchronized discharge with "**PADDLES**" as ECG source is discouraged since artifacts induced by moving the paddles may resemble an R-wave and trigger defibrillator discharge at the wrong time.
- An "**ECG LEAD OFF**" condition (if standard leads are selected as ECG source) will prevent synchronized discharge.

Note: *This does not prevent the use of the defibrillator; it simply prevents use in a synchronized manner.*

- The unit automatically goes out of sync mode after:
  1. Each discharge.
  2. the **SELECTOR SWITCH** has been moved to **PACER ON**.

After each discharge, the unit reverts to "**DEFIB ON**" where standard (non-synchronized) defibrillation is always available. To reactivate **SYNC** mode, press the **SYNC** button again.

Prepare Paddles (For multi-function electrodes, see note below or Section VII.)

- Remove paddles from their holders by grasping the handles and lifting the paddles straight up.

- Apply a liberal amount of electrolyte gel to the electrode surface on each paddle. **To avoid risk of electrical shock to the operator, do not allow electrolyte to accumulate on the hands or the paddle handles.**
- Rub the electrode surfaces together to evenly distribute the applied gel.

Apply Paddles to Chest

- Apply the paddles firmly to the anterior wall of the chest. The sternum paddle should be placed to the right (patient's right) of the sternum, just below the clavicle. The apex paddle should be placed on the chest wall, just below and to the patient's left of the left nipple, along the anterior-axillary line.
- If external pacing electrodes are in place, **it is not necessary to remove them.** Simply ensure that the paddles contact skin and not the electrode's external surfaces.
- Rub the paddles against the skin to maximize the paddle-to-patient contact. **Do not permit gel to accumulate between the paddles (gel bridge) on the chest wall -- this could cause burns and reduce the amount of energy delivered to the heart.**

Note: If you are using multi-function electrodes, do the following:

- Remove electrodes from the storage pouch and place the round one marked "FRONT" directly over the cardiac apex, as shown on the diagram on the pouch.
- Place the rectangular electrode marked "BACK" on the back between the patient's left scapula and the spine at heart level (see diagram on pouch).

  Note: *The "BACK" electrode may be placed over the patient's right sternal area if it is not possible to access the patient's posterior. Effective defibrillation will result, but pacing will usually be less effective.*
- When placing electrodes, be sure to press firmly on the adhesive area around the electrode periphery. Gently press the gel area to remove any trapped air. This ensures good skin coupling.
- Connect the electrodes to the multi-function cable.

2. CHARGE DEFIBRILLATOR

- Press the **CHARGE** button on the front panel, or if using paddles, on the apex paddle handle.
- To increase or decrease the selected energy after the **CHARGE** button has been pressed, move the **SELECTOR SWITCH** to the new energy level, and press **CHARGE** again.
- After 6-10 seconds of charging to the selected energy level, the **CHARGE INDICATOR LIGHT** will illuminate on the apex paddle or on the multi-function cable connector. A distinctive audible tone will go on and the energy selected will be displayed on the monitor. The defibrillator is now ready. **All persons attending the patient should be warned to STAND CLEAR.**

3. DISCHARGE DEFIBRILLATOR

- Verify again that the ECG waveform is stable, and that a marker pulse appears ONLY with each R-wave of the cardiac cycle.
- Verify that no one is in contact with the patient, monitoring cable or leads, bed rails, or any other potential current pathway.

- Press and hold both **DISCHARGE** buttons (one on each paddle) simultaneously. The defibrillator will discharge with the next detected R-wave.
- If you are using multi-function electrodes, simultaneously press and hold both **DISCHARGE** buttons located on the cable connector assembly.
- If additional countershocks are necessary, readjust the energy level as necessary and repeat. Note that SYNC must be selected after each discharge.

NOTES:

- *Should you need to disarm the charged defibrillator (if countershock is not needed), turn the SELECTOR SWITCH to MONITOR ON or any other position. Any stored energy will be dumped internally and the monitor delivered energy display will disappear.*
- *If the defibrillator is not discharged within 60 seconds of reaching the selected energy level, it will automatically dump the stored energy internally.*
- *During the ten seconds just prior to this internal disarm, the "CHARGE READY" tone will beep intermittently. When the internal dump is complete, the "CHARGE READY" tone will terminate, the CHARGE INDICATOR LIGHT will go off, and the monitor delivered energy display will go off.*
- *A "PADDLE FAULT" message will appear on the monitor whenever the paddles or multi-function cable are not connected or are improperly seated in the unit. The unit will disarm itself if such a fault occurs.*

  Note: The "ELECTRODES OFF" message, which indicates whether the multi-function electrodes are actually connected and making good contact, will not appear during synchronized cardioversion.
- *Paddle Cleaning: Paddle plates and handles must be thoroughly cleaned after each use.*

SECTION V

NONINVASIVE TEMPORARY PACING (NTP)

WARNINGS

Before proceeding, CAREFULLY read the following:

Noninvasive pacing can be accomplished by using either the standard NTP 2000 electrodes and pacing cable or PD 2200 multi-function pacing/defibrillation electrodes and multi-function cable. Anatomical placement of either type is identical. Operation with either type is identical.

Multi-function electrodes should be used no longer than eight (8) hours for continuous pacing.

Standard pacing electrodes (NTP 2000) use high impedance gel and cannot be used for defibrillation. The connector will only mate with the pacing cable. For continuous pacing that exceeds eight (8) hours, this type of pacing electrode is recommended.

The PD 1200 is designed to allow either standard pacing or pacing with multi-function electrodes, but not both. When the multi-function electrode cable is connected to the instrument, you cannot do standard pacing as the standard pacing connector is covered by the multi-function cable connector. Removing the multi-function cable allows use of standard pacing electrodes.

- **Both pacing electrodes should be attached to the patient before connecting the output cable.**
- **Avoid touching the gelled area of the electrode while pacing. A minor electrical shock hazard exists.**
- **The ZOLL Pacemaker/Defibrillator and NTP 2000 electrodes (or PD-2200 multi-function electrodes) are intended for use as a system. Do not connect any other device to the output connector.**
- **In order to maintain battery charge, keep unit plugged in when not in use.**

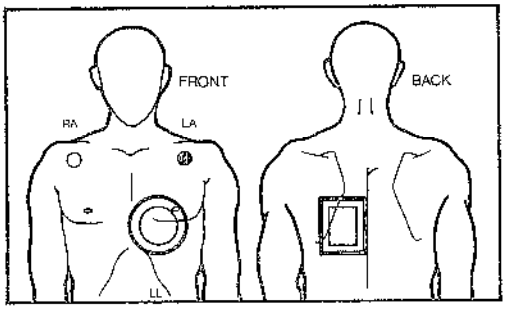
SELECT MONITOR ON

- Set output to 0 mA

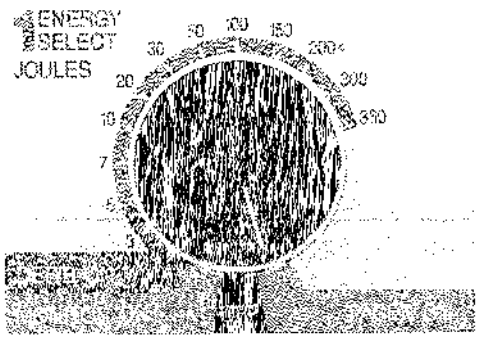
APPLY ELECTRODES

- Apply ECG electrodes (see Section VI). Connect to ECG cable. Adjust ECG size and lead for a convenient waveform display. Verify proper R-wave detection. The heart-shaped R-wave detector flashes on the monitor when proper detection of R-wave is taking place.
- Apply back pacer electrodes between scapula and spine at level of heart. (See diagram below.)

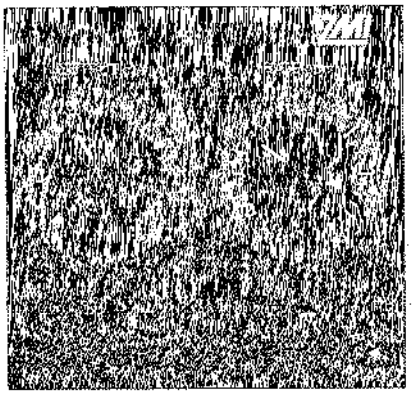
- Apply front pacer electrode to precordium (beneath breast on females). Anatomical position is identical for either NTP 2000 or multi-function electrodes.
- Connect pacer electrodes to output cable, i.e., either the standard pacing cable or multi-function cable.



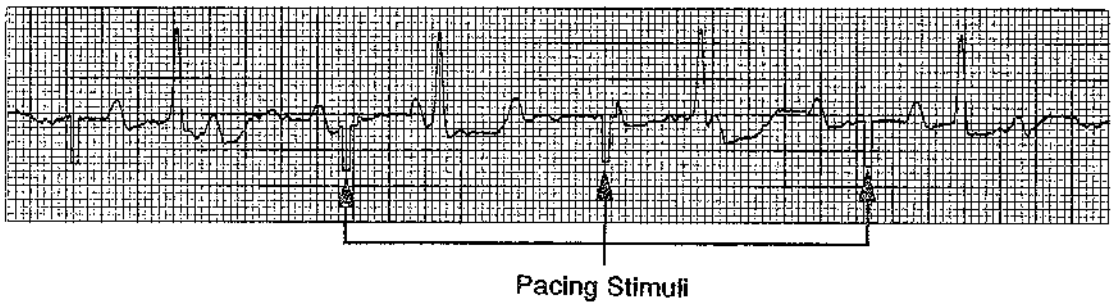
SELECT PACER ON



- Set pacing rate to a value 10-20 ppm higher than patient's intrinsic rate. If no intrinsic rate exists, use 60 ppm.

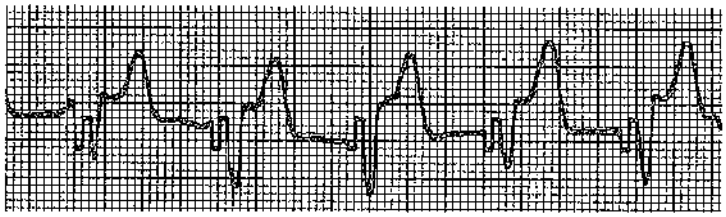


- Observe the pacing artifact (stimulus markers ⊓) and verify that it is well positioned in diastole.



Pacing below threshold

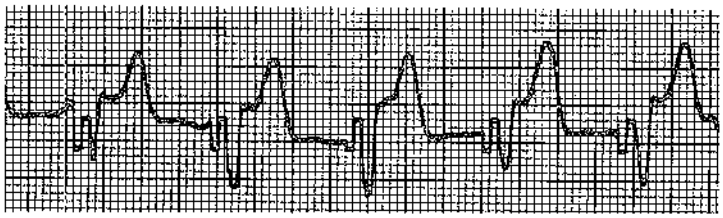
- Increase output mA until stimulation is effective (capture).



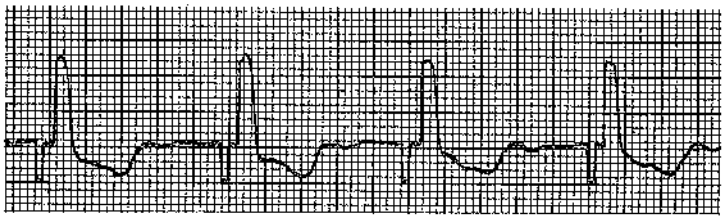
Pacing above threshold: Effective Pacing

DETERMINING CAPTURE

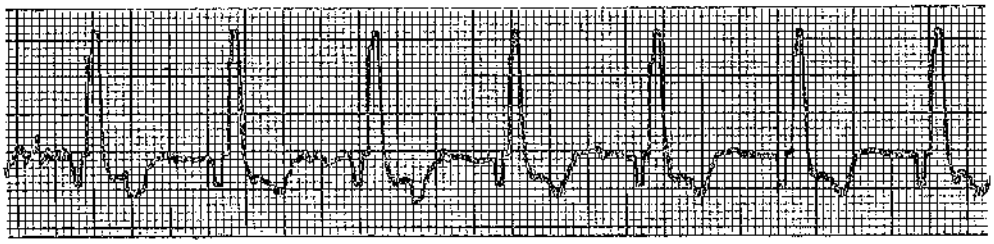
- It is important to recognize when stimulation has produced a ventricular response. Ventricular response is normally characterized by suppression of the intrinsic QRS complex. The following tracings are typical.



Effective Pacing: Note negative R-wave and large T-waves



Effective Pacing: Note the widened positive QRS which looks like an ectopic beat -- A paced beat is by definition an ectopic beat.



Effective Pacing: Note the inverted T-waves and absence of P-waves

- Changing leads can sometimes be helpful in determining capture.

Note: *Shape and size of the stimulated waveforms can vary depending on lead chosen; variation from patient to patient can be expected.*

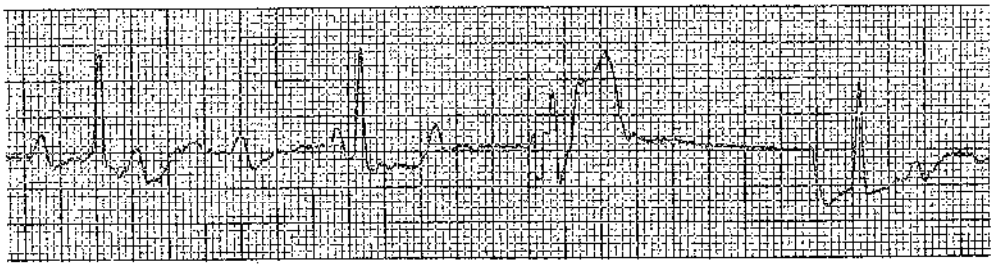
DETERMINING OPTIMUM THRESHOLD

The ideal output current is the lowest value that will maintain capture. This is usually about 10% above threshold. Typical threshold currents are usually between 40 and 80 mA. The electrode placement that offers the most direct current pathway to the heart while avoiding large chest muscles will usually produce the lowest threshold. Low stimulation currents produce less skeletal muscle contraction and are better tolerated. Placement of the electrodes will affect the current required to obtain ventricular capture.

Testing for optimum electrode location may be done with electrodes with a two-part protective cap. Remove the center cap from the front electrode to expose the gelled area while keeping the adhesive covered. Once the best location has been determined, the electrode should be removed and the area cleansed of salt or other conductive materials (such as defibrillator gel). The electrode may then be secured after removing the adhesive backing.

4:1 TEST MODE

The 4:1 test mode can be used optionally to test for threshold. In this mode a stimulus is delivered to the patient approximately every fourth pace beat. (The stimulus is demand-synchronized to the patient's intrinsic beat). Releasing the control will cause the instrument to resume normal operation.



PACER LEAD FAULT

The message "PACER LEAD OFF" appears on the monitor (when in PACER mode) whenever:

- the pacer cable is not connected
- there is a defect in the cable
- the pacer electrodes do not make good skin contact

STANDBY PACING

For certain patients at risk of developing symptomatic bradycardia it may be advisable to use the ZOLL PD in standby. When used in standby mode the ZOLL PD will automatically provide a pacing stimulus whenever the patient's heart rate drops below a predetermined level. To use the ZOLL PD in standby mode:

1. Establish effective pacing (see instructions on previous pages). Note the mA output at capture and run an ECG strip to document ECG morphology at capture.
2. Set the mA output 10% higher than the minimum mA output necessary to effect consistent ventricular capture.
3. Turn the pacing rate below the patient's heart rate. This will suppress pacing unless the patient's own rate drops below the set pacing rate. The pacing rate should be set at a level needed for adequate cardiac output.
4. Check the threshold periodically.

SPECIAL PACING APPLICATIONS

Noninvasive Temporary Pacing may be performed in the Cardiac Cath Lab, either for emergency pacing or in standby mode. The pacing electrodes are essentially radiotransparent except for steep imaging angulations where slight shadows may be observed.

Noninvasive Temporary Pacing may also be performed in the Operating Room, provided the electrodes do not interfere with the surgical field. While the ZOLL PD exceeds industry standards for resistance to interference from electrosurgical apparatus, under certain conditions it may not be possible to properly monitor or pace while electrosurgical apparatus is operating.

ASYNCHRONOUS PACING

The ZOLL PD is a VVI demand pacemaker, the safest and most effective design for Noninvasive Temporary Pacemakers. Proper demand pacing requires a reliable high quality surface ECG. If ECG electrodes are not available or there is some circumstance which prevents or interferes with the surface ECG, it may be necessary to operate the pacemaker asynchronously.

To pace asynchronously, simply detach the surface ECG electrodes or remove the ECG cable and set the rate and the mA at the known capture level or high enough (100mA) to presume capture. You should be aware that there will be no ECG activity on the ZOLL PD monitor and other means of determining capture such as the patient's pulse will be necessary. Asynchronous pacing should only be performed in emergency situations where there are no other alternatives.

PEDIATRIC PACING

Noninvasive pacing on pediatric patients is done in an identical manner to adult pacing. Smaller size pediatric pacing electrodes (Part No. NTP 2100) are available for patients less than 15 kg. Continuous pacing of neonates can cause burns. If it is necessary to pace for more than 30 minutes, caution and periodic inspection of the underlying skin is strongly advised.

SECTION VI

ECG MONITORING

The ZOLL PD Pacemaker/Defibrillator can be used for either short-term or long-term cardiac monitoring. A fully charged battery pack provides 2 hours of continuous monitoring. The power cord may be connected to AC power at any time for indefinite periods of monitoring.

The ZOLL PD has built-in protection circuitry to allow patient monitoring to continue during a defibrillation attempt. Monitoring electrodes may become polarized during defibrillation discharge, causing the ECG waveform to briefly go off-scale. High quality silver/silver chloride (Ag/AgCl) electrodes minimize this effect, and circuitry in the instrument will return the trace to the monitor display within a few seconds. ECG monitoring may be accomplished through paddle electrodes or through multi-function electrodes. However, this is typically done only for emergency evaluation of patient condition, when ECG leads are not attached to the patient.

PREPARATIONS

Proper application and placement of electrodes is essential for quality ECG monitoring. Good contact between the electrode and skin minimizes the negative effects of motion artifacts and signal interference.

ELECTRODE PLACEMENT

RA/White Electrode Place near right mid-clavicular line, directly below clavicle.

LA/Black Electrode Place near left mid-clavicular line, directly below clavicle.

LL/Red Electrode Place between 6th and 7th intercostal space on left mid-clavicular line.

LEAD CONFIGURATIONS

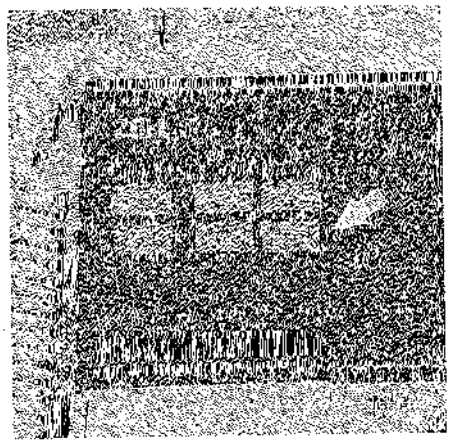
LEAD	(+)	(-)	Ref
I	LA	RA	LL
II	LL	RA	LA
III	LL	LA	RA

ATTACH DISPOSABLE MONITORING ELECTRODES

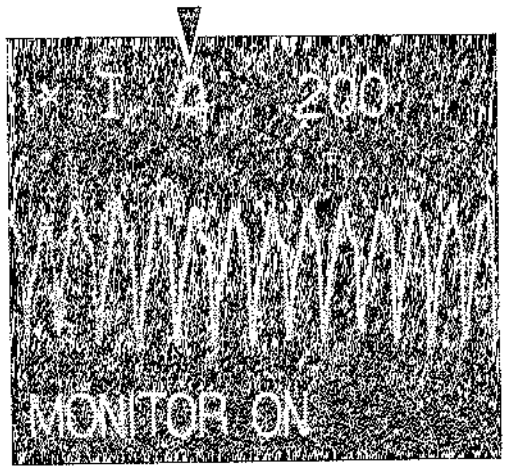
- Peel the protective backing from the electrode. Be careful to keep adhesive surface free of electrolyte gel.
- Apply the electrodes firmly to the patient's skin, pressing around the entire perimeter of the electrodes.
- Attach snap-on leads and check for good contact between the electrode and the lead termination.
- Plug the patient cable connector into the ECG input connector (located at the front right of the instrument).

SET THE CONTROLS

- Set **SELECTOR SWITCH** to the **MONITOR ON** position; inspect the electrodes, patient cable, lead wires, and associated connections.
- Press the **LEAD** button until the desired lead is selected (selected lead is indicated at upper left monitor).
- If the "**ECG LEAD OFF**" message appears on the monitor, inspect the electrodes, patient cable, lead wires, and associated connections.
- Press the **ECG SIZE** button until the desired waveform size is displayed.
- Adjust R-wave beeper volume to suitable level.
- Activate Heart Rate Alarm by pressing the **ALARM ON** button. (Refer to the next page for instructions on changing preset settings.) When the alarm is activated, the switch will light and a bell-shaped character will be displayed on the monitor.



Press ALARM ON switch to activate heart alarms



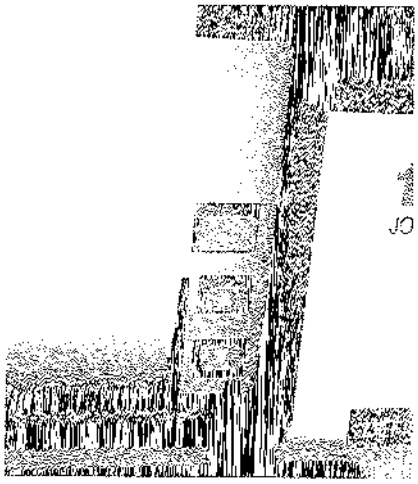
Heart rate alarms activated

- When an alarm occurs the recorder will automatically run for 15 seconds, the bell-shaped character will flash (the heart character freezes for easier identification), and the audible alarm tone will sound. Deactivating the alarms turns off the tone and the flashing bell and reactivates the heart character to flash with a detected R-wave.

SETTING ALARMS

Heart rate alarms have been preset at 30 (low) and 150 (high).

To change the lower or upper alarm set points:



1. Lift the recorder paper latch. The alarm set controls are located in the lower right portion of the recorder paper space.
2. Push **ALARM SET**. Cursor flashes under low alarm limit.
   To change, push ▲ to raise
   ▼ to lower
3. Push **ALARM SET**. Cursor flashes under high alarm limit.
   To change, push ▲ to raise
   ▼ to lower
4. Push **ALARM SET** to return to **ALARM MONITORING** mode.

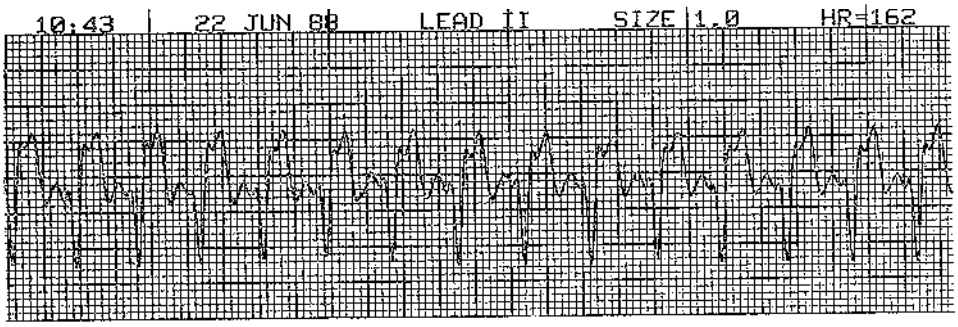
FREEZE

Pressing this control momentarily stops the trace on the screen. When this is done the real time ECG trace is no longer visible, but the R-wave indicator (heart symbol) and Heart Rate Meter continue to operate. Pressing the recorder **START** button when **FREEZE** is depressed will result in a non-delay (real-time) recording. Releasing the **FREEZE** control resumes normal monitoring. If the recorder is running when the **FREEZE** control is released, the real-time recording will be followed by the 4-second frozen section, followed by the normal delayed recording.

RECORDER

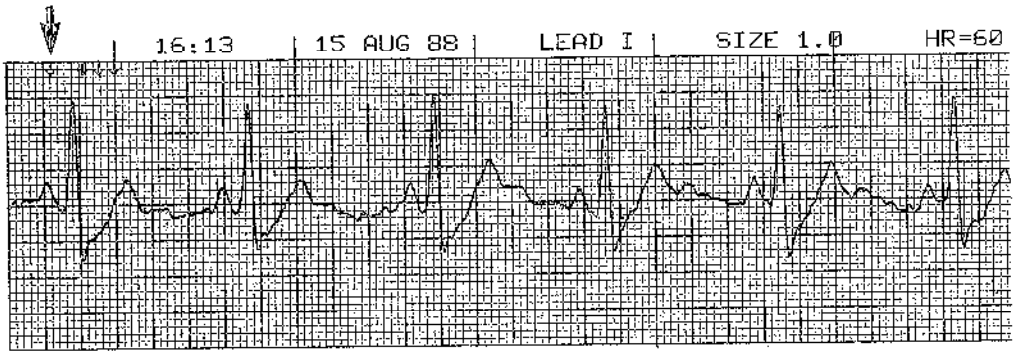
Operation

- The Recorder will document the ECG trace with a 4-second delay at all times, unless **FREEZE** is activated.
- To start the recorder, press the **START/STOP** button on the front panel. The recorder will run continuously until the button is pressed again.
- The recorder will automatically run for 15 seconds when Heart Rate Alarms have been violated or the defibrillator has been discharged or when **MARK** has been depressed when the recorder is not running.
- Each time the recorder is started the time, date, ECG lead, size, and heart rate are printed on the top part of the paper. If the pacer is operating, the output current will also be printed. Similarly, if the defibrillator has been discharged, the delivered energy will be printed.



Recording shows annotations during monitoring

Marker Symbol



Recording shows MARK operation

- The **MARK** button is an event marker control that places a distinct mark on the trace each time it is pressed.

Notes:

- *The paper supply should be checked at the beginning of each shift and the end of each use to ensure adequate recording capability. A red stripe on the paper means that the paper supply is low and should be replaced.*
- *A "NO PAPER" message appears on the monitor when the recorder is activated without paper.*

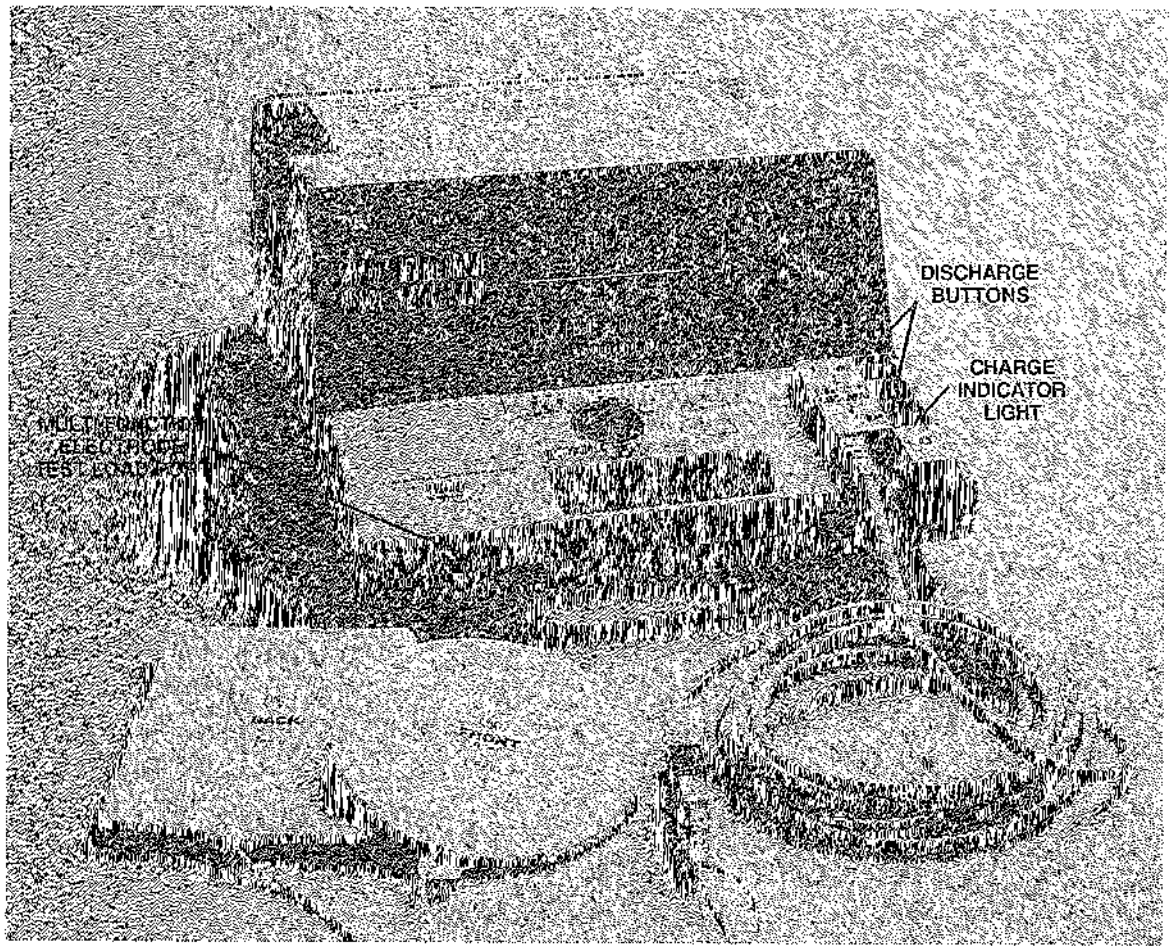
SECTION VII

OPERATION WITH MULTI-FUNCTION ELECTRODES

This section provides condensed instructions for the safe use of ZOLL PD 2200 Multi-Function Pacing/Defibrillation Electrodes. It is intended to be an update for operators already experienced with the use of the PD 1200, paddle defibrillation, and NTP 2000 electrode pacing. If you are not completely familiar with the operation of the PD 1200, read the complete operator's guide before proceeding.

ZOLL PD multi-function electrodes allow the operator to defibrillate, to do noninvasive pacing, and to ECG monitor with the use of only two electrodes.

The PD 1200 has been designed to perform either paddle defibrillation and NTP 2000 electrode pacing, or defibrillation and pacing with multi-function electrodes. The method available is determined by the use of the multi-function electrode cable. When connected to the PD 1200, it restricts access to both the NTP pacing cable connector and the standard paddles connector. To change pacing/defibrillation methods, simply change cables.



MULTI-FUNCTION CABLE

The ZOLL PD 3300 Multi-Function Cable connects to the standard paddles receptacle on the right front of the unit.

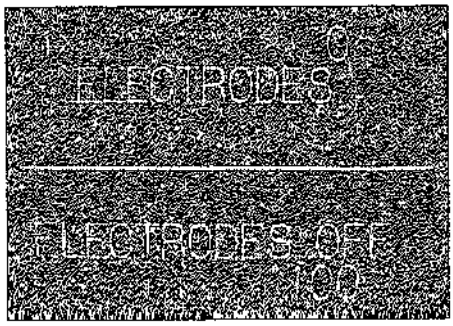
CAUTION: Remove the NTP pacing cable before installing the multi-function cable.

There is a defibrillator **CHARGE INDICATOR LIGHT** located on the top of the multi-function cable connector. The light illuminates as soon as the defibrillator has charged to the energy level set by the **SELECTOR SWITCH.**

Also located on the multi-function cable connector are two orange **DISCHARGE** buttons. When pressed simultaneously, they will discharge the defibrillator.

"ELECTRODES OFF" Message

If the operator attempts to defibrillate with multi-function electrodes and the electrodes are not properly installed, an "**ELECTRODES OFF**" message will appear on the monitor. Check to see that all connections have been properly made before continuing.



OPERATIONAL CHECKS WITH THE MULTI-FUNCTION CABLE

To test the defibrillator delivered energy and charge time while using the multi-function cable, connect the electrode end of the cable to the **TEST LOAD** port located on the front left bottom of the unit. This is the equivalent of placing the standard paddles in their holders. It is now possible to safely discharge the defibrillator as necessary to perform all required instrument checks. See Section VIII for recommended tests and procedures.

MULTI-FUNCTION ELECTRODES

ZOLL PD 2200 Multi-Function Pacing/Defibrillation Electrodes are anterior/posterior, pre-gelled, disposable electrodes. They are applied to the patient in the same manner and location as ZOLL NTP 2000 electrodes. The multi-function electrodes can only be used with a multi-function cable. (ZOLL NTP 2000 pacing electrodes can only be used with a standard pacing cable.)

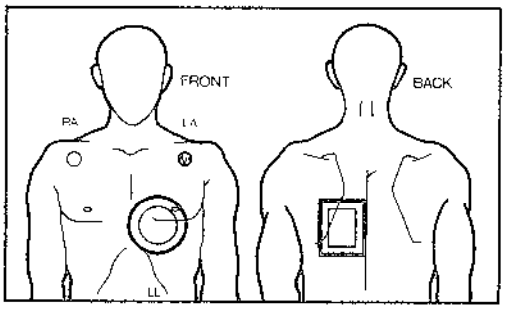
When using a multi-function cable, it is important that the operator check to be sure that the electrode packaging says "**Pacing/Defibrillation Electrodes**". The labels on the electrodes themselves must have the words "**PACE**" printed in green and "**DEFIB**" printed in red.

Note: The ZOLL PD 1200, cables, and electrodes are designed and tested as a unit to provide maximum patient safety and comfort. **Use of electrodes and/or cables other than those supplied by ZMI could compromise patient safety and void ZMI's warranty.**

PLACEMENT

Anatomical placement of the multi-function electrodes is identical to placement of ZOLL NTP 2000 pacing electrodes.

- Remove the electrodes from the storage pouch. Remove the protective cover, exposing the gel area and adhesive.
- Place the round electrode labelled "**FRONT**" directly over the cardiac apex (beneath the breast on females). See the diagram on the package.
- Place the rectangular electrode labelled "**BACK**" on the back between the patient's left scapula and spine at heart level.



Note: *The back electrode may be placed over the patient's right sternal area if it is not possible to access the patient's posterior. Effective defibrillation will result, but pacing will usually be less effective.*

- When placing the electrodes, be sure to press firmly on the adhesive area around the electrode periphery. Gently press the gel area to remove any trapped air. This ensures good skin coupling.
- **If placing both electrodes on the chest (back of patient is not accessible), do not allow electrode gel to accumulate on the chest wall. This could produce a gel bridge and cause burns or reduce the amount of energy delivered to the heart.**

DEFIBRILLATION WITH MULTI-FUNCTION ELECTRODES

(For more detailed information, see Section III.)

WARNING

- **Do not discharge the defibrillator if the electrodes are attached to the multi-function cable and are not properly applied to a patient.**

- Attach electrodes to patient.
- Connect electrode connector to multi-function cable.

1. SELECT ENERGY

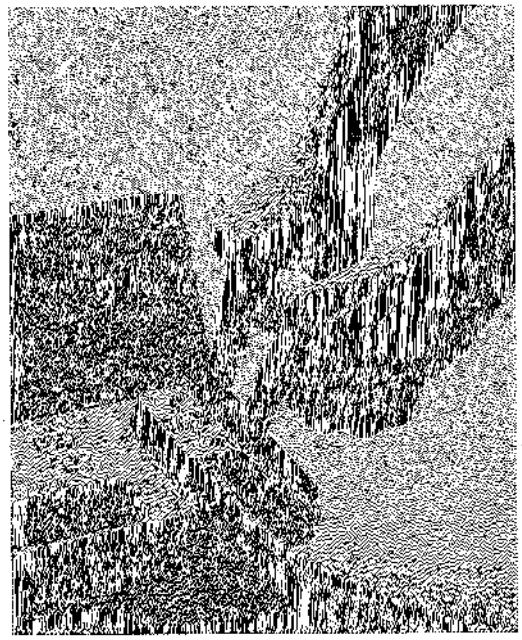
- Turn SELECTOR SWITCH to desired energy level.

2. CHARGE THE DEFIBRILLATOR

- Press the CHARGE button on the front panel.
- After 6-10 seconds, the CHARGE INDICATOR LIGHT will illuminate and the Charge Ready tone will sound.
- All persons attending the patient should be warned to stand clear.

3. DISCHARGE THE DEFIBRILLATOR

- Simultaneously press and briefly hold the two orange DISCHARGE buttons located where the multi-function cable connects to the PD 1200.



PACING WITH MULTI-FUNCTION ELECTRODES

(See Section V for more detailed information.)

WARNINGS

- **Multi-function electrodes should not be used for continuous pacing longer than eight (8) hours. For continuous pacing longer than eight (8) hours, change electrodes or use ZOLL NTP 2000 pacing electrodes.**
- **Avoid touching the gelled area of the electrode while pacing. A minor electrical shock hazard exists.**

Note: The procedure for applying and pacing with multi-function electrodes is identical to the NTP 2000 electrode pacing procedure.

SELECT MONITOR ON

- Set output to 0 mA.

APPLY ELECTRODES

- Apply ECG and multi-function electrodes to patient.
- Connect electrodes to appropriate cables.

Note: The instrument will pace asynchronously when ECG leads are not connected. The instrument will not monitor through the multi-function electrodes in PACER ON mode.

SELECT PACER ON

- Set pacing rate.
- Increase output mA until stimulation is effective.

MONITORING WITH MULTI-FUNCTION ELECTRODES

(See Section VI for more detailed information)

ECG monitoring can be easily accomplished through the multi-function electrodes. The following key points should be observed:

- Monitoring through the multi-function electrodes is available during monitor or defib operation.
- When multi-function electrodes are selected as the ECG source the message "ELECTRODES" will appear on the screen in place of LEAD I, II, or III.
- During pacer operation, if ECG leads are not connected the monitor screen will display a flat line and the message "ECG LEADS OFF" will be displayed. The PD will pace asynchronously in this condition but no ECG can be displayed until the ECG leads are connected.

SECTION VIII

OPERATIONAL CHECKS AND PROCEDURES

Resuscitation equipment must be maintained at peak performance. The following operational checks should be performed periodically (once a day to once a week) to ensure proper equipment operation.

INSPECTION

- Assure that the unit is clean (with no fluid spills) and nothing is stored on the unit.
- Check that paddle surfaces are clean.
- Inspect all cables, cords, and connectors for good condition.
- Verify presence and proper condition of all disposable supplies (electrode gel, monitor electrodes, recorder paper, alcohol swabs, razors, antiperspirant).
- Assure that two sets of pacing or multi-function electrodes are available in sealed packages.

POWER-UP SEQUENCE CHECK

With unit plugged in and **SELECTOR SWITCH** in the **OFF** position, observe the following:

- Battery charging light is lit. As long as the power cord is connected to AC and the battery is in place, this light should remain lit, even when the unit is operating.

Turn the **SELECTOR SWITCH** to the **MONITOR ON** position and observe the following:

- A 3-beep tone indicates the power-up sequence.
- Simultaneously, the **ALARM ON**, recorder **START/STOP**, paddle **CHARGE**, and **SYNC** indicator lights should briefly go on and then off again.
- The word "**READY**" will be briefly displayed followed by "**MONITOR ON**" in the lower left of the display screen.
- The ECG size should be 1x.
- "**PADDLES**" or "**ELECTRODES**" should be displayed in upper left of display screen.
- The message "**ECG LEAD OFF**" will be displayed anytime leads I, II, or III have been selected and no ECG cable has been connected, or the lead wires are not attached to a patient.

PACER OPERATION (BASIC)

- Turn the **SELECTOR SWITCH** to **PACER ON**.
- Turn **RATE** knob to 150 ppm and press the **MARK** button to generate a strip.
- Verify that the pace pulses occur approximately every 10 small divisions (2 large divisions, 1 cm).
- Press the **4:1** button and verify that the frequency of pulses decreases (8 large divisions, 4 cm per pulse).
- Turn the **OUTPUT** knob to 0 mA. There should be no "**PACE LEAD OFF**" message.
- Slowly turn the knob up to 15 mA. The "**PACE LEAD OFF**" message should appear.

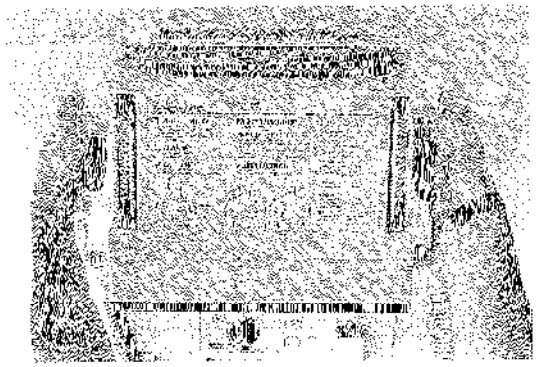
The above tests quickly verify basic pacer functions. If you have ZMI's **PACEMAKER TEST LOAD** (Part No. NTP 4450), you can further test the pacer output cable and verify pacer calibration.

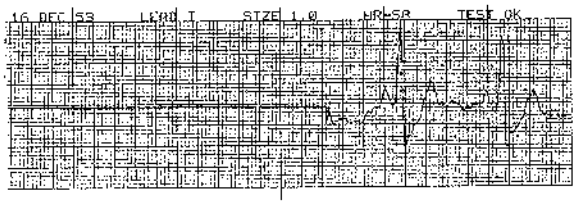
DELIVERED ENERGY AND DISCHARGE BUTTONS CHECK

- Perform this check once a week.
- Place the **SELECTOR SWITCH** in the 200 joules position.
- Verify that the adult paddle electrodes or multi-function electrode cable is installed.
- Leaving the paddles in their holders or, as appropriate, plugging the multi-function electrode cable into its test jack, press either **CHARGE** button. Wait for the "**CHARGE READY**" tone to sound and the **CHARGE INDICATOR LIGHT** to light and verify that the **DELIVERED ENERGY** display on the monitor registers 200 joules.

> **WARNING**
>
> **When performing this check using paddles, place hands on the paddle handles as shown in the picture below. Use your thumbs to operate the discharge switches. No portion of the hand should be on the top surface of the unit near the paddle plates.**

- Press each **DISCHARGE** button individually and verify that the unit does not discharge.



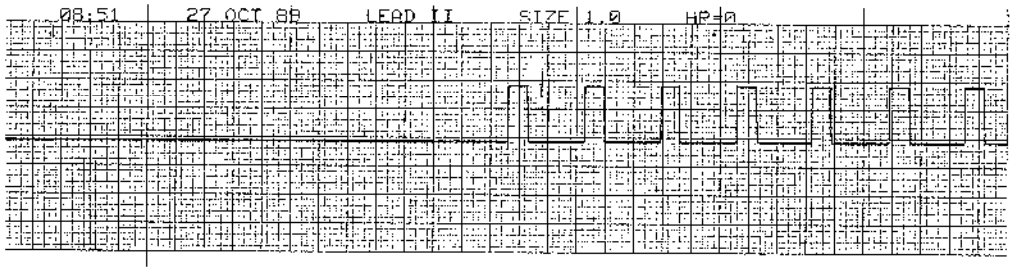


- Press and briefly hold both **DISCHARGE** buttons simultaneously. The message "**TEST OK**" or "**TEST FAILED**" should appear on the display. A brief automatic recorder run also provides documentation of the test indicated by "**TEST OK**" if the unit is providing delivered energy within specifications.

  If "**TEST FAILED**" appears, contact your hospital's technical personnel or ZMI immediately.

RECORDER CHECK

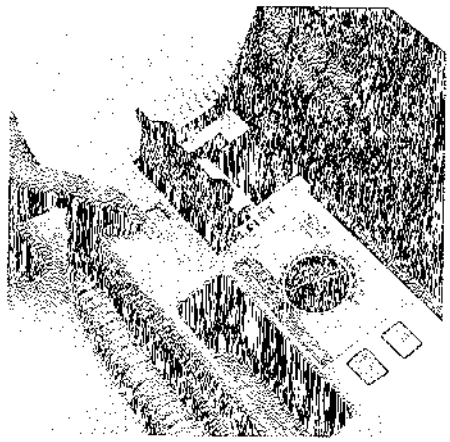
- Press the **MARK** button. The recorder will run for 15 seconds.
- While the recorder is running, press and hold the **UP** and **DOWN ARROWS** located inside the paper compartment. This will generate calibration pulses.
- Inspect the recorder waveform for uniformity and darkness.
- Inspect for uniformity of annotation characters and completeness of words.
- Check for down arrow printed below annotation.
- Check recorder speed by verifying that a new calibration pulse appears approximately every 13 small divisions (1.3 cm).



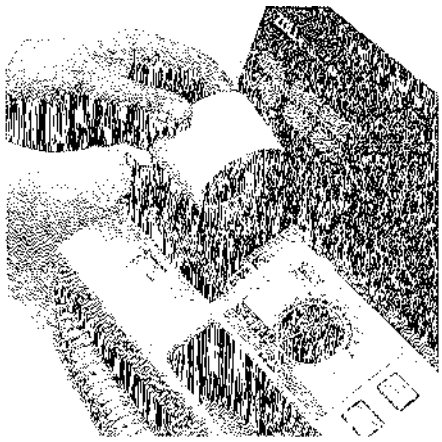
- Check for adequate supply of paper.

CHANGING PAPER

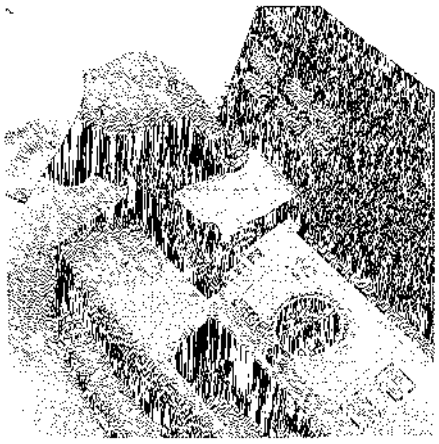
- Press the recorder release button (the door and paper carriage will tilt up).
- Remove the empty or low paper roll from the spindle.



- Place a new roll of thermal paper on the spindle with the paper coming off the top of the roll and the grid facing down.
- Drop the new roll on the spindle down into the paper cavity.
- Press recorder START so that the light within the switch goes on. (Note that the recorder motor will not start until the paper is inserted.)



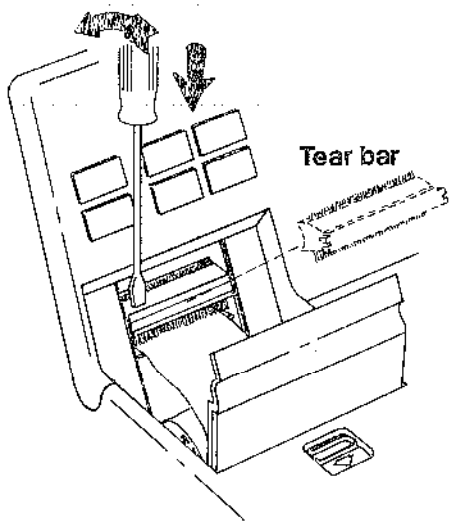
- Insert the paper (grid face down) into the lower slot until the motor starts and the paper begins to pull through. The paper will soon come through the top slot, grid facing up.
- Press STOP to stop the recorder.
- Close cover door.



RECORDER PAPER JAM

If the recorder stops printing and there is still paper on the spindle, the paper may be wrapped around the recorder feed roller. To correct this:

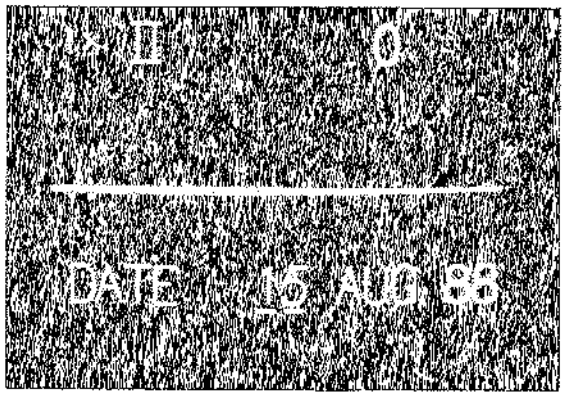
- Pry the paper tear bar out with a screw driver. Pry on one side then the other until the bar snaps out.
- Cut and remove all paper that may have wrapped around the feed roller.
- When paper path is clear, test feed approximately one foot of paper. If paper feeds properly, reinstall tear bar. (Flat edge of bar positioned to the bottom.)



SETTING TIME AND DATE

Check the time and date on the recorder annotation. If it is not correct, set as follows:

- Turn the **SELECTOR SWITCH** to **OFF**.
- Open the recorder door by pressing the "paper" latch.
- Press and hold the **ALARM SET** button under the recorder door. With the **ALARM SET** button pushed, turn the **SELECTOR SWITCH** to the **MONITOR ON** position. When the date display appears on the monitor, release the **ALARM SET** button. Observe the "**DATE**" message on the lower portion of the screen with the current day, month, and year displayed, along with flashing cursors (_ _) under the value to be changed. The cursors appear beneath the current day.



- Use the ▲ switch to increase the value and use the ▼ switch to decrease the value. Observe that holding the ▲ switch will increment repeatedly while holding the ▼ switch will decrement repeatedly.
- The range of acceptable values is 1 through 31. Set the value to the current day.
- Press the **ALARM SET** button again and observe that the cursors now appear under the current month. Repeat above steps. The range of acceptable values are JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC. Set the value to the current month.
- Press the **ALARM SET** button again and observe that the cursors now appear under the current year. Repeat above steps. The range of acceptable values are 00 through 99. Set the value to the current year.
- Press the **ALARM SET** button again and observe that the **DATE** message has been replaced by a **TIME** message indicating the current hour and minute.
- Observe that cursors appear under the displayed hour. Repeat above steps. The range of acceptable values are 00 through 23. Set the value to the current hour.
- Press the **ALARM SET** button again and observe that the cursors now appear under the displayed minute. Repeat above steps. The range of acceptable values are 00 through 59.
- Press the **ALARM SET** button again and observe that the lower portion of the screen returns to the normal **MONITOR ON** display.

- Verify that the time and date have been correctly set by generating a strip chart recording. Press the **RECORDER START/STOP** button and observe that the strip chart is correctly annotated with the current time and date, PADDLES or ELECTRODES, size 1.0, HR = 0.
- Verify that the real-time clock is operating correctly by waiting for several minutes before running the recorder again.

Note: *Time and date may require resetting if batteries have been depleted.*

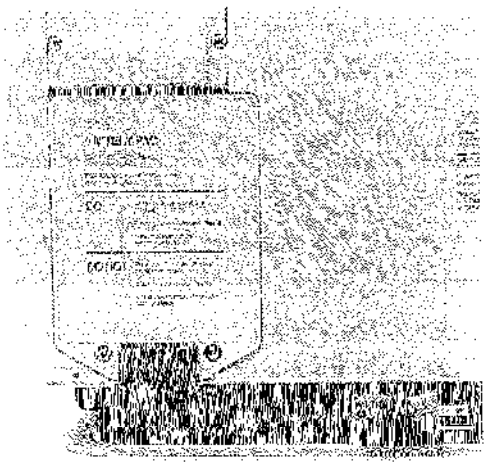
BATTERY CARE

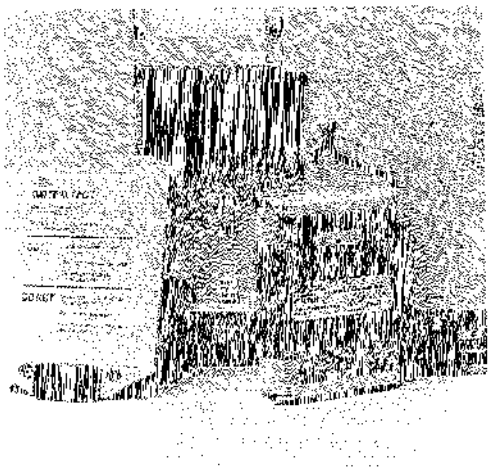
A medical grade, sealed lead-acid battery is used which, unlike nickel-cadmium (Nicad) batteries requires no periodic maintenance or charge cycling. In addition, it has no memory and can be recharged rapidly (2-3 hours). To ensure a fully charged battery, always keep the ZOLL PD 1200 plugged into AC power when not in use. Depleted batteries will result in slower defibrillator charging times. The monitor will display the message "**LOW BATTERY**" indicating the instrument must be plugged into AC power to ensure proper operation. Fully charged batteries will keep 80% of their charge for several weeks, with the instrument turned off and not plugged into AC.

Avoid periodic deep discharge cycling. A battery left uncharged for excessive periods (4 to 6 months) may become damaged and require replacement.

CHANGING THE BATTERY PACK

- Stand the instrument vertically on end. (So that it rests on the cord storage area.)
- Open the battery compartment door by removing the two screws at the bottom of the door on either side of the rubber support foot.
- Remove the old battery pack by "pinching" the lever on the white connector that attaches the battery pack to the unit.
- Replace with a new pack and close the compartment door, ensuring that no wires are crimped or pinched by the door.
- Check date and time.





BUTTONS AND LEDs (Light Emitting Diodes)

Check all remaining buttons and LEDs for basic functions:

ECG Size	- Display: 2x, .5x, 1x
LEAD	- Display: I, II, III, PADDLES, or ELECTRODES
FREEZE	- Monitor trace freezes.
ALARM ON	- Check LED
SYNC (MONITOR ON)	- Check LED
START/STOP	- Check LED

If using paddles, set the **SELECTOR SWITCH** to 2 joules and check the **CHARGE** button and LED on the apex paddle.

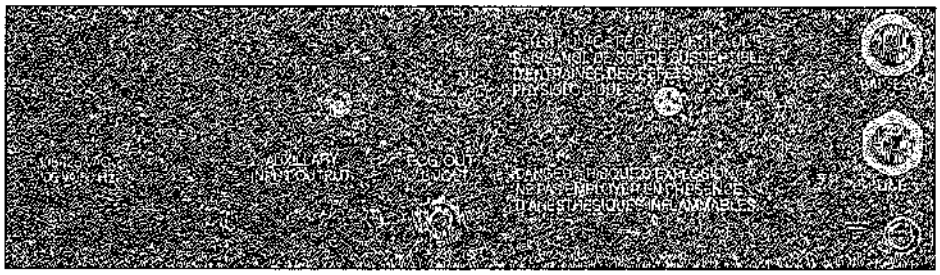
This concludes the basic PD 1200 functional checkout. For additional tests and calibration checks, refer to the **EXTENDED DIAGNOSTICS** found in Section IX in this Operator's Guide.

U.S.A. customers
If your instrument needs calibration adjustment, refer to the PD 1200 Service Manual or contact ZMI Service at 1-800-348-9011 (in Mass. 1-617-933-9150).

International customers
If your instrument needs calibration adjustment, refer to the PD 1200 service manual or contact your nearest authorized ZMI service center.

REAR PANEL

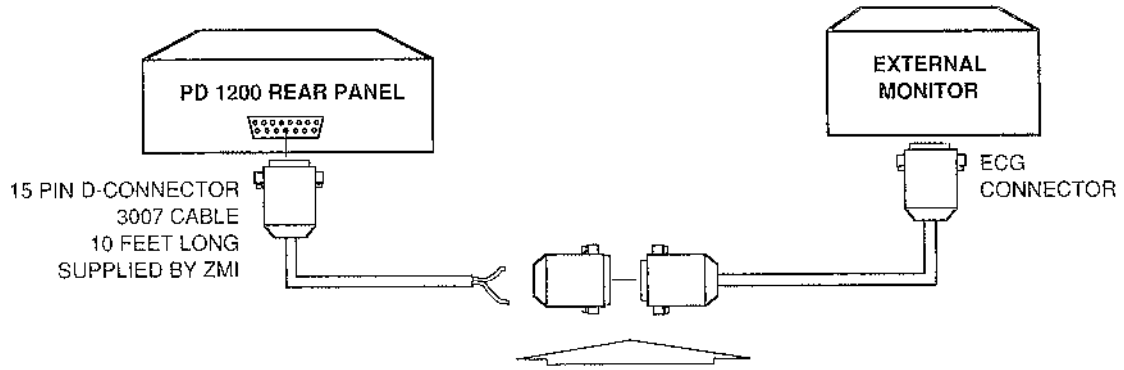
- The auxiliary input/output connector is located on the instrument's rear panel. This 15-pin connector provides an additional ECG signal (Pin 3).



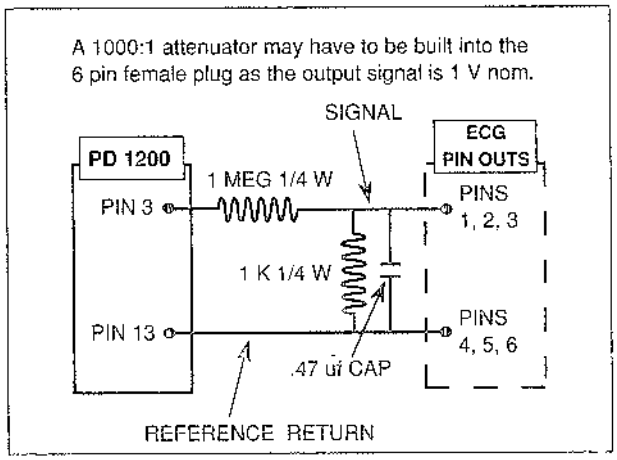
- The Line and Battery circuit breakers are located on the instrument's rear panel. These should be checked and reset as necessary, if any of the following conditions occurs:
  - The **CHARGE INDICATOR LIGHT** does not appear when connected to AC power
  - Unit does not turn on
  - Unit turns on, but there is no display on the monitor

- **LOW BATTERY** message is displayed when connected to AC power

- ZMI supplies an interface cable (Part No. NTP 3007) for the 15-pin connector. The opposite end of the cable is left unterminated (bare wires). It is the customer's responsibility to connect the interface cable to the ancillary monitor. Depending on the type of monitor it may be necessary to build a 1000:1 attenuator. (See the diagram on the next page.)



CUSTOMER RESPONSIBILITY
6 PIN CONNECTORS ARE RECOMMENDED



GENERAL INSTRUCTIONS

Connect leads from the ECG connector to the pins of the suggested 6-pin male connector/plug to give the desired presentation on the remote monitor. Some experimentation may be necessary to obtain the correct combination of leads. When correct presentation is obtained, solder the leads to the appropriate pins, and assemble the male connector to the ECG cable stub.

Note: *For recent HP monitors disregard the above. Purchase HP cable #14482A and wire a 1/4-inch phone jack to the NTP-3007.*

For further information in the U.S.A., please call 1-800-348-9011 and ask for Service.

Customers outside the US, please call 1-617-933-9150, FAX: 1-617-933-1807,
TELEX 95-1417 TX NETWORK BSN REF:EXCL

SECTION IX

EXTENDED DIAGNOSTICS

All PD 1200 units perform a thorough self-test upon power-up and continue to monitor critical components throughout normal operation. In addition, all units shipped after October 1989 offer an **EXTENDED DIAGNOSTICS MODE**. In the extended mode, the unit remains fully operational but presents information on the monitor which can be used to calibrate and otherwise verify proper operation of the unit. The type of information presented will vary depending on the setting of the **SELECTOR SWITCH**: MONITOR ON, PACER ON, or DEFIB ON.

ENTERING EXTENDED DIAGNOSTICS MODE

- Hold the **SYNC** button down for at least three (3) seconds while powering on the unit. The PD 1200 will acknowledge **EXTENDED DIAGNOSTICS MODE** by beeping an additional two times after the normal three "power-on" beeps.

BATTERY CHARGER OPERATIONAL CHECK (MONITOR ON)

With the **SELECTOR SWITCH** set to **MONITOR ON**, battery voltage is displayed on the monitor (e.g., "125V for 12.5 volts).

- Unplug the PD 1200 from the wall. Battery voltage will slowly drop and settle between 11.0 and 12.5 volts (110V - 125V).
- Plug the unit back into the AC wall outlet. The battery voltage display will begin to climb, eventually settling between 13.5 and 14.2 volts (135V - 142V). This indicates proper charger operation.

PACE RATE CHECK (PACER ON)

In **PACER ON** mode, the measured heart rate in the upper right corner of the monitor is replaced with the reading from the **RATE** knob. The number is clearly marked "ppm" and must match (within 5%) the printed value selected by the rate knob.

- Turn the rate knob and verify that the display changes.
- Turn the knob to 100. The monitor should read between 95 ppm and 105 ppm.

Note: The unit is still detecting heart beats (if connected to a patient or ECG simulator) as evidenced by the flashing heart and tone. Also, the actual measured heart rate will appear on the strip chart annotation.

PACE OUTPUT CHECK (PACER ON)

The number on the **OUTPUT** dial and the **mA** display at the lower right corner of the monitor must be within +/- 7 mA of each other at all settings.

- Turn the output knob to 0. Verify that the display reads 0 mA.
- Turn the knob to 70. Allowable display range = 63 to 77 mA.
- Turn the knob to 140. Allowable display range = 133 to 140 mA.

DEFIBRILLATOR CHARGE TIME (DEFIB ON)

With the unit charged and ready to fire, the display indicates the time (to the nearest half second) that it took to charge. Like the battery voltage display, there is an implied decimal point (i.e., 75S means 7.5 seconds).

Perform this test with the PD 1200 plugged into an AC wall outlet or with a fully charged battery. A depleted battery may extend defibrillator charge time.

- Select 360 joules and charge the defibrillator. When the ready tone sounds, the time should read less that 10 seconds.

  Typically, a PD 1200 with a fully charged battery will take 6.5 to 8.0 seconds (displayed as 65S to 80S) to charge to 360 joules.

Carefully discharge the unit into the paddle wells, or if using the multi-function cable, into the test connector located in the lower left front of the device.

PEAK DELIVERED DEFIBRILLATION CURRENT (DEFIB ON)

After a discharge into the PD 1200's own self-test circuit, the unit will measure and display a number for the peak current delivered.

- Select 200 joules. Charge and discharge the defibrillator into the paddle wells or multi-function test connector.
- The display should read approximately "100PEAK".

This feature works at all energy levels. Repeat as desired and compare the number displayed to the PEAK value in the table below to determine if the unit is delivering energy within AAMI specifications.

Energy Selected	PEAK	Allowable Range	Approximate Current
2J	10	0 - 18	4.3A
3J	12	0 - 19	5.3A
5J	16	7 - 22	6.8A
7J	19	12 - 24	8.1A
10J	22	17 - 27	9.7A
20J	32	28 - 35	13.7A
30J	39	35 - 42	16.7A
50J	50	46 - 54	21.6A
100J	71	65 - 76	30.6A
150J	87	79 - 93	37.4A
200J	100	92 - 108	43.2A
300J	122	112 - 132	52.9A
360J	134	123 - 144	58.0A

Note: *The PD 1200 self-test circuit should be periodically tested against a calibrated defibrillator tester. Instructions for performing this test are in the Service Manual.*

SECTION X

TROUBLESHOOTING GUIDES

The troubleshooting guides provided on the following pages are intended for use by non-technical medical personnel during PD 1200 operations. This section answers many of the common problems or questions that arise during operation.

If trouble persists after consulting this guide, call your Biomedical Engineering department or ZMI Service Operations. A more technical troubleshooting guide is found in the *PD 1200 Service Manual.*

MONITOR

Symptom	Recommended Action
1. No battery charging light when plugged into wall outlet.	1.0 Check red circuit breakers on rear panel (push in). 1.1 Check that battery connection is secure. 1.2 Use another A/C wall outlet.
2. Unit does not turn on. (No 3 audible beeps).	2.0 Check red circuit breakers on rear panel (push in). 2.1 Check that battery connection is secure. 2.2 Check that power cord is plugged into wall outlet.
3. Unit turns on with 3 beeps, but no display on monitor.	3.0 Check red circuit breakers on rear panel (push in). 3.1 Press SYNC button, if green indicator in button comes on - call for service. 3.2 Have battery checked.
4. If any Error message appears on monitor display.	4.0 Call for Service.
5. Date/time message displayed on monitor when turning on unit.	5.0 Reset all values by first incrementing through all values, then set to correct value, i.e., day 1-31, then set to correct day.
6. Set clock is annotated on recorder chart paper.	6.0 Perform step 5.0.

Monitor, continued

Symptom	Recommended Action
7. ECG LEAD OFF message displayed on monitor.	7.0 Check that the ECG cable is connected to patient and instrument. 7.1 Check that ECG electrodes are not dry. 7.2 Replace ECG cable.
8. Noisy ECG display when using paddles as ECG source.	8.0 Ensure PADDLES is selected. 8.1 Clean paddle surface. 8.2 Check cable(s) for wear.
9. Poor ECG signal level, calibration pulse normal (10mm @ 1 mV.)	9.0 Set "size" to x2. 9.1 Change to another lead - I, II, III, Electrodes or Paddles. 9.2 Ensure ECG electrodes are not dried out and are making good contact. 9.3 Install new electrodes using different placement.
10. NO SYSTOLE SOUND (beat detection).	10.0 Increase beeper volume at front handle. 10.1 Change ECG lead selection. 10.2 Alter ECG electrode placement.
11. Heart rate and flashing heart are not being displayed on monitor.	11.0 Change ECG lead selection. 11.1 Alter ECG electrode placement. 11.2 Patient heart rate less than 20 BPM.
12. No SYNC MARKER displayed on ECG SIGNAL ON MONITOR, or intermittently displayed on R wave.	12.0 Ensure "SYNC" switch green light is lit (SYNC ON). 12.1 Change ECG lead selection. 12.2 Alter ECG electrode placement.
13. "LOW BATTERY" message displayed while plugged in A/C wall outlet.	13.0 Check circuit breakers on rear panel (push in). 13.1 Try another wall plug. 13.2 Check that wall plugs are not controlled by a wall switch.

RECORDER

Symptom	Recommended Action
14. No paper displayed on monitor.	14.0 Recorder out of paper. 14.1 Wrong type of paper used. 14.2 Recorder needs adjustment.
15. Paper won't feed into recorder.	15.0 Ensure green indicator light in START/STOP switch is lit. 15.1 Wait ten seconds after first failed attempt to reload. 15.2 Check to see if paper is jammed on feed roller. (see Operator's Guide, pg. 42). (Devices shipped after 11/89).
16. Recorder makes a stuttering sound when activated.	16.0 Check paper path of recorder. 16.1 Check paper feed roller for paper jam.
17. "SYNC" marker (˙) not annotating at top edge of paper.	17.0 Ensure "SYNC" switch green indicator is lit. 17.1 Ensure high intensity dot or line is displayed on ECG signal on monitor. 17.2 Change ECG lead selection. 17.3 Paper too narrow. It should be 50mm wide.
18. Light or poor quality tracings/annotations on paper.	18.0 Ensure correct paper is in use. 18.1 Ensure paper is installed thermal side down into lower slot of recorder. 18.2 Recorder print head requires cleaning by trained personnel.

NON-INVASIVE PACING

WARNING: Be sure that pacer output current (mA) is set to **0** mA when connecting and disconnecting a patient from the PD 1200.

Symptom	Recommended Action
19. Pacer LEADS OFF message is displayed on monitor.	19.0 Ensure pacing electrodes or multi-function electrodes are connected to appropriate cables. 19.1 Ensure electrodes are not dry. *Do not use ECG or defibrillator gel.* Replace electrode if necessary. 19.2 Ensure good electrode-to-patient contact - no buckling or falling off. **CAUTION!** *Turn OUTPUTmA to "0" while checking.* 19.3 Check integrity of pacing cables. For multi-function cable - plug into load test connector on front handle. "Pacer Lead Off" should disappear. For standard Pace Cable - connect to Zoll NTP 4450 Pace Check - "Pacer Lead Off" should disappear. 19.4 Replace pace cables.
20. No stimulus marker ⊓ present on ECG trace displayed on monitor.	20.0 Ensure PD 1200 is in Pacer ON position. 20.1 Ensure Pacing Rate (ppm) dial is set greater than patient rate.
21. No ventricular capture beat after stimulus marker on ECG monitor display.	21.0 Increase output current level. 21.1 Change ECG Lead select. 21.2 Review pacing electrode placement. 21.3 Verify that pacemaker is delivering the proper current using the ZOLL Pace Check tester or have Biomedical Engineering check output. 21.4 Check for pulse of patient.

PACING

Symptom	Recommended Action
22. Patient on "Standby" pacing gets paced intermittently. NOTE: If ECG lead wire comes off, pacer will automatically pace asynchronously.	22.0 Ensure good ECG electrode and placement. 22.1 Check ECG cable for wear and tear or bad connections. 22.2 Patient R wave-to-R wave interval varying. Pace rate close to patient rate.
23. Heart rate is **0** with proper pacing capture displayed on ECG trace.	23.0 Change ECG Lead Selection. 23.1 Check patient's pulse, remembering check #23.
24. Bedside/Central Station monitor display becomes erratic when pacing.	24.0 Patients cannot be "double patch" ECG monitored while pacing. Use Zoll adapter cable NTP-3007.

DEFIBRILLATOR

Symptom	Recommended Action
25. PADDLE FAULT message on monitor.	25.0 Remove and reinstall paddle cable plug into receptacle on front of PD 1200.
26. Noisy ECG signal when paddles selected as ECG input.	26.0 Press and firmly hold paddles against patient. 26.1 Clean paddle surface. 26.2 Check cables for wear.
27. ANY ERROR displayed.	27.0 Have instrument serviced promptly by trained personnel.
28. Defibrillator won't charge (energy level does not increment on display).	28.0 Check that discharge switches in Paddles or in multi-function cable are not stuck in. 28.1 Have battery checked.
29. Charge time to 360J exceeds 10 seconds.	29.0 Normal, if operating in low battery condition. 29.1 Charge battery. 29.2 Have device serviced.
30. Energy will not discharge when both discharge buttons are pressed.	30.0 Device is in "SYNC" mode and no QRS complex is detected. 30.1 Sixty (60) seconds had elapsed after initial charge. Energy was internally discharged. 30.2 Energy internally discharged because energy selector dial was moved to another energy selection. 30.3 Wait for Charged and Ready tone.
31. Displayed energy value does not match energy selected.	31.0 Defibrillator is out of adjustment. Have it serviced promptly.
32. Unable to "SYNC" cardioversion discharge.	32.0 Ensure green indicator located in SYNC switch is lit. 32.1 Check for "SYNC" marker (high intensity dot or line on R wave). If not present, change ECG lead selection. 32.2 After ECG lead wire placement.

Defibrillator, continued

Symptom	Recommended Action
33. No apparent energy delivery to patient.	33.0 Perform defibrillator self test as described in Operator's Guide pages 40, 48. For devices shipped before 11/89, refer to page 34. 33.1 If test fails, have the unit serviced promptly. 33.2 If Defib/Pace electrodes are used, ensure proper placement and contact.

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