



Specifications

| | |
|---------------------------------------|-------------|
| Size (cm) | 6 x 5 x 3.2 |
| Volume (cc) | 80.4 |
| Weight (grams) | 120 |
| Specific Gravity | 1.5 |
| Current Pulse Amplitude (ma) | 6.0 |
| Voltage Pulse Amplitude (volts) | 4.2 |
| Pulse Width (msec) | 0.9 |
| Fixed Rate (ppm) | 72 |
| Life Expectancy (years) | 30 |

Plutonium – 238

Triply encapsulated medical grade plutonium in a sintered oxide form provides sufficient power to operate the pacemaker within specifications in excess of 30 years (based upon extrapolated data) with the ultimate in safety and reliability.

Shock Capability

The multi redundant system has been designed to withstand repetitive high level shocks without degrading reliability.

Titanium Case

The multi-redundant nuclear battery and the electronics assemblies are separately hermetically sealed in corrosion resistant commercially pure titanium cases.

High Reliability Circuitry

Fixed rate electronics are assembled using NASA level discrete components and proven reliable manufacturing techniques.

Low Specific Gravity

This pacemaker is the lightest nuclear pacemaker presently available and is also lighter than most conventional pacemakers. Its weight, 120 grams, provides specific gravity value of 1.5.

Leads

The model NU-5 is a unipolar pacemaker that can also be used with a bipolar lead arrangement. Most leads presently available can be directly coupled to the unit while adaptors are available for others.

EMI Resistant

The NU-5 fixed rate pacemaker is not affected by Electromagnetic Interference (EMI).

Life

Right of replacement – 60 months (100%).



Operation

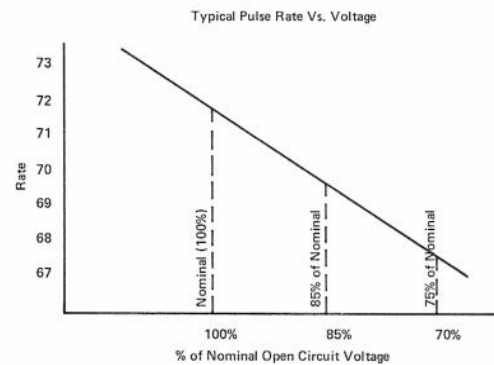
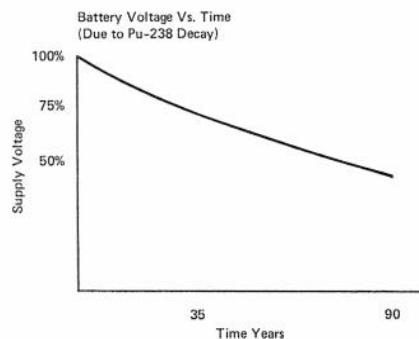
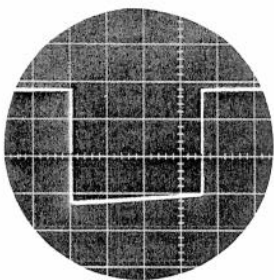
The PU-238 medical grade oxide fuel in the form of a sintered pellet is hermetically sealed in three encapsulations for maximum safety under all credible accident conditions. Six thermoelectric tapes are connected in multi-redundant arrangement and spiralled around the heat source. As the plutonium slowly decays, heat is given off as a by-product, the multi-redundant thermoelectric wires convert this heat by normal thermoelectric action into a DC voltage. The voltage is then supplied to the electronic circuit by means of a ceramic to metal hermetically sealed feedthrough.

Generating high voltage directly from the battery, eliminates the necessity to include a voltage step-up transformer or DC to DC voltage converter and thereby reduced circuitry complexity and increases reliability. The electronic circuit converts the DC voltage into a series of rectangular current pulses which are conducted to the heart lead by a ceramic to metal hermetically sealed feedthrough and the terminal block. The entire battery case then serves as the indifferent or positive electrode. Both the electronics and the battery are hermetically sealed in titanium cases to eliminate any possibility of corrosion or body fluid penetration.

The circuits are manufactured in a clean room using the highest standards of aerospace technology and "NASA level" high reliability components that are 100% inspected and screened prior to assembly. The circuit has been specifically designed for optimum performance with the characteristics of the NU-5 nuclear battery and to assure long trouble free operation.

The circuit produces a regulated current output pulse whose amplitude is approximately rectangular in shape. The output stage contains a voltage pulse doubler and circuit protection against defibrillation procedures.

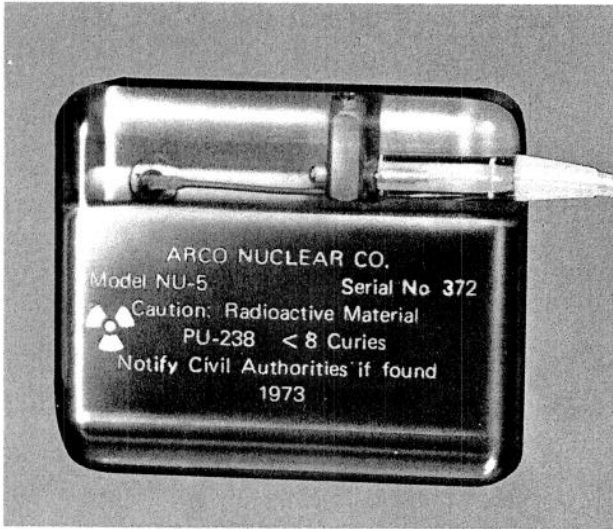
The pulse rate of the pacemaker will vary in a predictable manner due to radioactive decay of the fuel and consequent decrease in voltage from the energy source to the electronic circuit. Ambient temperature has only a slight effect on pulse rate; for example, if the pacemaker is taken from room temperature (72°F.) to body temperature the pulse rate increased by less than 1/2 ppm. Circuit performance is essentially not affected by changes in nuclear battery impedance or external load.



ARCO Nuclear Company

Subsidiary of AtlanticRichfieldCompany

P. O. BOX 546 / LEECHBURG, PENNSYLVANIA 15656, U.S.A. / PHONE (412) 845-8111



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|---|-------------|
| Size (cm) | 6 x 5 x 3.2 |
| Volume (cc) | 80.4 |
| Weight (grams) | 120 |
| Specific Gravity | 1.5 |
| Current Pulse Amplitude (ma) | 7.5 |
| Voltage Pulse Amplitude (volts) | 4.2 |
| Pulse Width (msec) | 0.9 |
| Automatic Rate (ppm) | 72 |
| Escape Rate (ppm) | 71 |
| Magnetic Test Rate (ppm) | 77 |
| Interference Rate (ppm) | 77 |
| Refractory Period (msec) | 250 |
| R-wave Sensitivity (±mv) | 2.0 |
| Life Expectancy (years) | 30 |

Plutonium – 238

Triply encapsulated medical grade plutonium in sintered oxide form provides sufficient power to operate the pacemaker within specifications in excess of 30 years (based upon extrapolated data) with the ultimate in safety and reliability.

Shock Capability

The system has been designed to withstand repetitive high level shocks without degrading reliability.

Titanium Case

The multi-redundant nuclear battery and the electronics assembly are separately hermetically sealed in corrosion resistant commercially pure titanium cases.

High Reliability Circuitry

The demand circuitry utilizes the latest CMOS technology to miniaturize the electronics, achieve maximum efficiency and the ultimate in reliability.

Low Specific Gravity

This pacemaker is the lightest nuclear pacemaker presently available and is also lighter than most conventional pacemakers. Its weight, 120 grams, provides specific gravity value of 1.5.

Leads

The model NU-5 is a unipolar pacemaker that can also be used with a bipolar lead arrangement. Most leads presently available can be directly coupled to the unit while adaptors are available for others.

EMI Resistant

The NU-5 demand pacemaker is effectively filtered and shielded from electromagnetic interference and is thus not affected by most common EMI such as microwave ovens, car ignitions, weapon detectors, etc.

Magnetic Test Rate

During normal sinus rhythm, the test magnet if placed over the skin in the vicinity of the NU-5 demand pacemaker, will cause reversion to fixed rate operation. The rate (magnetic rate) of the pacemaker under these conditions yields diagnostic information about the condition of the pacemaker power supply.

Life

Right of replacement – 60 months (100%).



Operation

The PU-238 medical grade oxide fuel in the form of a sintered pellet is hermetically sealed in three encapsulations for maximum safety under all credible accident conditions. Six thermoelectric tapes are connected in multi-redundant arrangement and spiralled around the heat source. As the plutonium slowly decays, heat is given off as a by-product, the multi-redundant thermoelectric wires convert this heat by normal thermoelectric action into a DC voltage. The voltage is then supplied to the electronic circuit by means of a ceramic to metal hermetically sealed feedthrough.

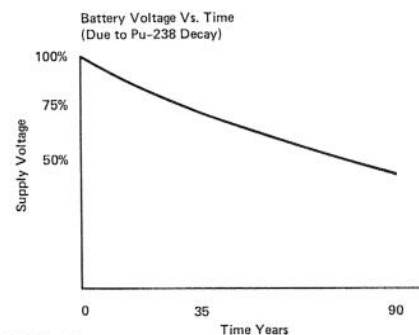
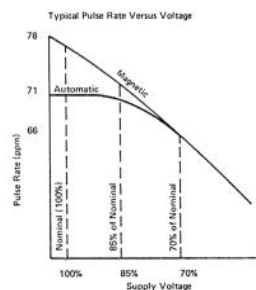
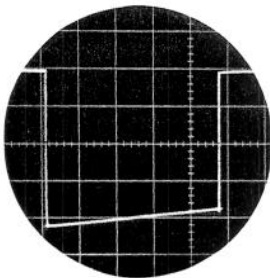
Generating high voltage directly from the battery, eliminates the necessity to include a voltage step-up transformer or DC to DC voltage converter and thereby reduces circuitry complexity and increases reliability. The electronic circuit converts the DC voltage into a series of rectangular current pulses which are conducted to the heart lead by a ceramic to metal hermetically sealed feedthrough and the terminal block. The entire battery case then serves as the indifferent or positive electrode. Both the electronics and the battery are hermetically sealed in titanium cases to eliminate any possibility of corrosion or body fluid penetration.

The demand electronic circuit is of the R-wave inhibited type and is powered by the same nuclear battery used for the fixed rate system. The demand circuits are manufactured in a clean room using the highest standards of aerospace technology. Proven CMOS technology is used to achieve the ultimate in reliability and efficiency. The demand circuit has been specifically designed for optimum performance with the nuclear battery characteristics and to assure long trouble free operation.

Many special features are included in the demand circuit design. A magnetic switch in the circuit can be closed by placing a magnet on the skin over the area of the pacer implant. This causes the circuit to operate in a fixed rate mode (magnetic rate). The magnetic rate is set at a higher value than the automatic rate and can be used to determine the supply voltage to the circuit. Supply voltage can also be determined by observing the difference between the automatic and magnetic rate. The refractory period is approximately the same for either the automatic or inhibited mode. In addition, the circuit is designed to revert to a fixed rate mode (interference rate) if it senses an abnormally high heart rate.

The output is a current regulated pulse, approximately rectangular in shape. The output stage in addition to containing a voltage pulse doubler, also contains circuit protection for defibrillation procedures. Ambient temperature, nuclear battery impedance and output impedance all have minor effects on circuit performance.

All ARCO Nuclear Company's demand pacemakers incorporate shielding, high reliability filtering components and special circuit design techniques to essentially eliminate any susceptibility encountered under normal conditions to EMI radiation over the entire energy spectrum. Common sources of such energy to which ARCO Nuclear Company's pacers are impervious include microwave ovens, arc welders, automobile ignitions, and weapon detectors; all of which can easily be encountered by typical pacemaker patients. In the unlikely event of being subjected to strong enough EMI the NU-5 demand pacemaker reverts to a fixed rate mode and cannot be erroneously inhibited.



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Specifications

| | |
|---|--------------------|
| Size (cm) | 5.98 x 5.34 x 2.48 |
| Volume (cc) | 69.9 |
| Weight (grams) | 100 |
| Specific Gravity | 1.4 |
| Current Pulse Amplitude (ma) | 6.0 |
| Voltage Pulse Amplitude (volts) | 4.2 |
| Pulse Width (msec) | 0.9 |
| Fixed Rate (ppm) | 72 |
| Life Expectancy (years) | 30 |

Plutonium – 238

Triply encapsulated medical grade plutonium in a sintered oxide form provides sufficient power to operate the pacemaker within specifications in excess of 30 years (based upon extrapolated data) with the ultimate in safety and reliability.

Shock Capability

The multi-redundant system has been designed to withstand repetitive high level shocks without degrading reliability.

Titanium Case

The multi-redundant nuclear battery and the electronics assemblies are separately hermetically sealed in corrosion resistant commercially pure titanium cases.

High Reliability Circuitry

Fixed rate electronics are assembled using NASA level discrete components and proven reliable manufacturing techniques.

Low Specific Gravity

This pacemaker is the lightest nuclear pacemaker presently available and is also lighter than most conventional pacemakers. Its weight, 100 grams, provides specific gravity value of 1.4.

Leads

The model NU-6 is a unipolar pacemaker that can also be used with a bipolar lead arrangement. Most leads presently available can be directly coupled to the unit while adaptors are available for others.

EMI Resistant

The NU-6 fixed rate pacemaker is not affected by Electromagnetic Interference (EMI).

Life

Right of Replacement – 60 months (100%)



Operation

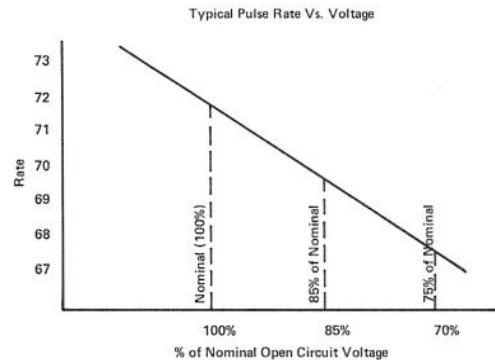
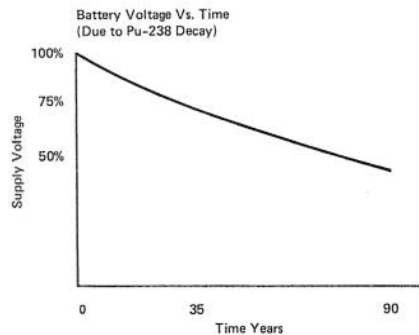
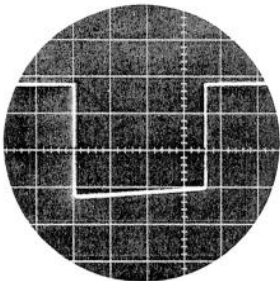
The PU-238 medical grade oxide fuel in the form of a sintered pellet is hermetically sealed in three encapsulations for maximum safety under all credible accident conditions. Four thermoelectric tapes are connected in multi-redundant arrangement and spiralled around the heat source. As the plutonium slowly decays, heat is given off as a by-product, the multi-redundant thermoelectric wires convert this heat by normal thermoelectric action into a DC voltage. The voltage is then supplied to the electronic circuit by means of a ceramic to metal hermetically sealed feedthrough.

Generating high voltage directly from the battery, eliminates the necessity to include a voltage step-up transformer or DC to DC voltage converter and thereby reduces circuitry complexity and increases reliability. The electronic circuit converts the DC voltage into a series of rectangular current pulses which are conducted to the heart lead by a ceramic to metal hermetically sealed feedthrough and the terminal block. The entire battery case then serves as the indifferent or positive electrode. Both the electronics and the battery are hermetically sealed in titanium cases to eliminate any possibility of corrosion or body fluid penetration.

The circuits are manufactured in a clean room using the highest standards of aerospace technology and "NASA level" high reliability components that are 100% inspected and screened prior to assembly. The circuit has been specifically designed for optimum performance with the characteristics of the NU-6 nuclear battery and to assure long trouble free operation.

The circuit produces a regulated current output pulse whose amplitude is approximately rectangular in shape. The output stage contains a voltage pulse doubler and circuit protection against defibrillation procedures.

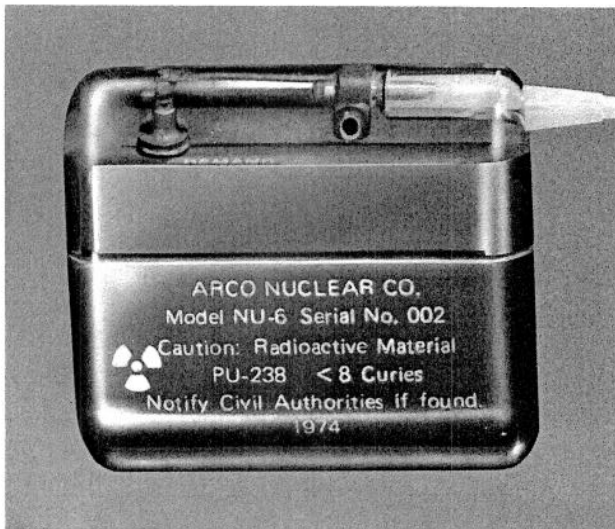
The pulse rate of the pacemaker will vary in a predictable manner due to radioactive decay of the fuel and consequent decrease in voltage from the energy source to the electronic circuit. Ambient temperature has only a slight effect on pulse rate; for example, if the pacemaker is taken from room temperature (72°F.) to body temperature the pulse rate increases by less than 1/2 ppm. Circuit performance is essentially not affected by changes in nuclear battery impedance or external load.



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| Escape Rate (ppm) | 71 |
| Magnetic Test Rate (ppm) | 77 |
| Interference Rate (ppm) | 77 |
| Refractory Period (msec) | 250 |
| R-Wave Sensitivity (\pm mv) | 2.0 |
| Life Expectancy (years) | 30 |

Plutonium – 238

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Shock Capability

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Titanium Case

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High Reliability Circuitry

The demand circuitry utilizes the latest CMOS technology to miniaturize the electronics, achieve maximum efficiency and the ultimate in reliability.

Low Specific Gravity

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Leads

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EMI Resistant

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Magnetic Test Rate

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Life

Right of replacement – 60 months (100%).

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Operation

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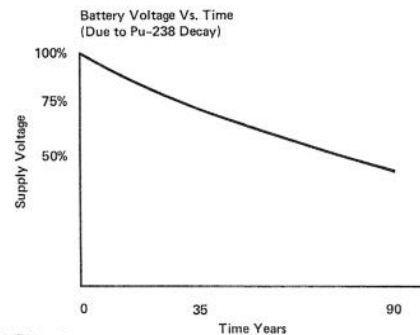
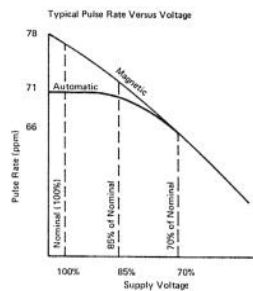
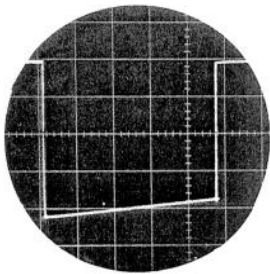
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