

Information contained herein does not replace the recommendations of your healthcare professional. See the device manual for detailed information regarding the instructions for use, indications, contraindications, warnings, precautions, and potential adverse events. For further information, contact your Health Care Professional.

For applicable products, consult instructions for use on www.medtronic.com/manuals. Manuals can be viewed using a current version of any major internet browser. For best results, use Adobe Acrobat® Reader with the browser.

Important Reminder: This information is intended only for users in markets where Medtronic products and therapies are approved or available for use as indicated within the respective product manuals. Content on specific Medtronic products and therapies is not intended for users in markets that do not have authorization for use.



Medtronic

Answers to questions about implanted heart devices

Electromagnetic compatibility guide

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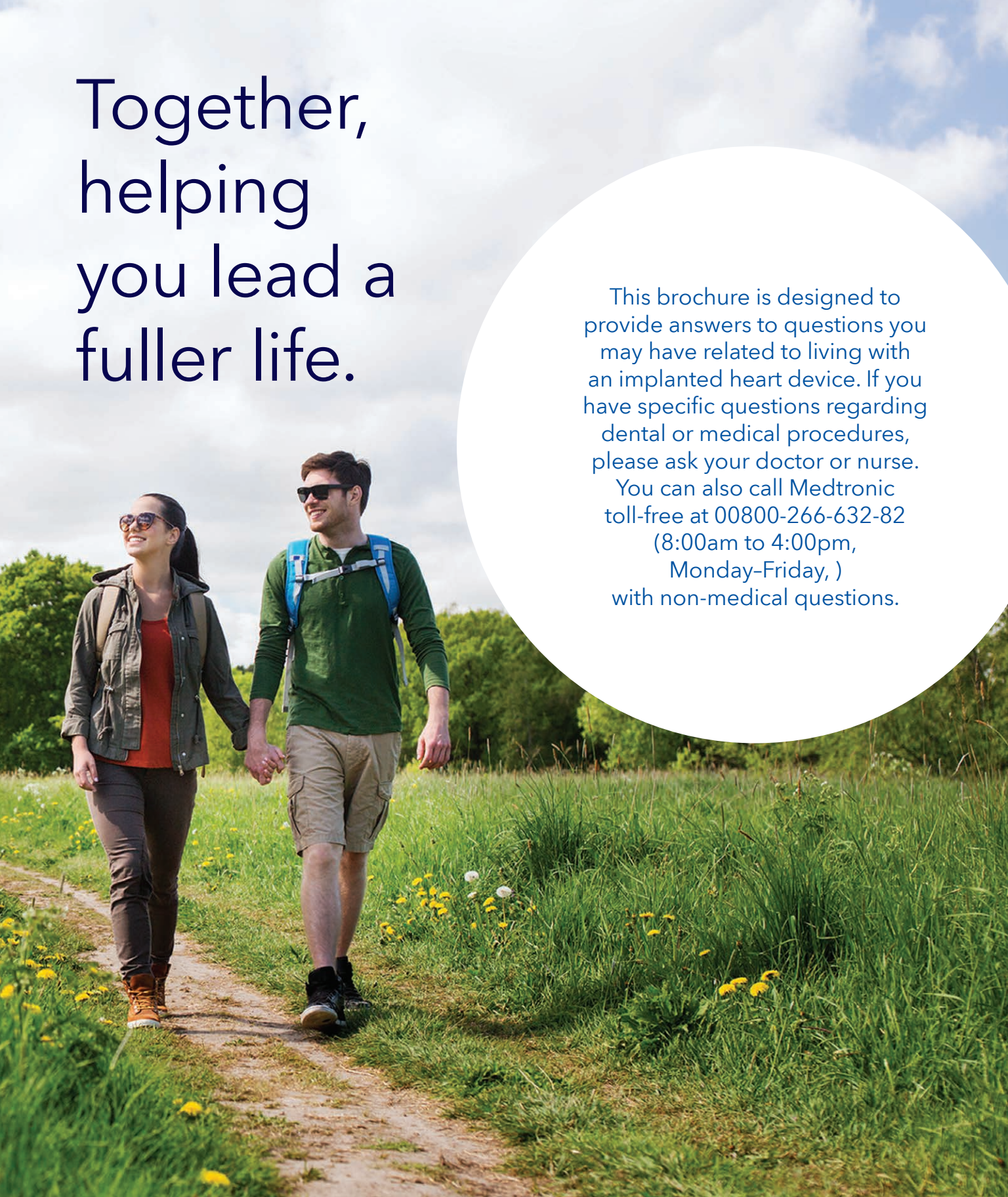
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Medtronic



Together, helping you lead a fuller life.

This brochure is designed to provide answers to questions you may have related to living with an implanted heart device. If you have specific questions regarding dental or medical procedures, please ask your doctor or nurse.

You can also call Medtronic toll-free at 00800-266-632-82 (8:00am to 4:00pm, Monday-Friday,) with non-medical questions.



What you should know about electromagnetic compatibility (EMC)

Medtronic heart devices are built with protective shields, so the majority of items that you use or come into contact with will not affect the normal operation of your implanted heart device. However, items that generate or use electricity, or transmit wireless signals – such as a portable generator, power drill, or cell phone – have electromagnetic fields around them. Some of these fields may affect the normal operation of your heart device. Electromagnetic compatibility is the relationship between these electromagnetic fields and your heart device.

How items may affect your heart device

If the electromagnetic fields surrounding an item are too close to your implanted heart device – and your heart device happens to detect these fields – this may temporarily affect the normal function of your heart device. This same effect may also occur if the item being touched is not in good working order or properly wired, causing electrical current to flow into your body.

In either situation, this may temporarily cause your heart device to deliver a therapy that is not needed or withhold a therapy that is needed. In addition, maintain a minimum distance between certain items and your implanted heart device. This will help to avoid any temporary effect on your heart device.

What to do if you think an item is affecting your heart device

If you feel dizzy, lightheaded, a change in heart rate, or receive a shock while using an item, simply release whatever you're touching or move away from it. Any temporary effect is unlikely to cause reprogramming or damage to your heart device. Your heart device is designed to return to normal operation. Of course, if your symptoms continue or do not improve, contact your doctor as soon as possible.

Answers to the most commonly asked questions

This guide is divided into four main categories:

- ① [Household and Hobby Items](#)
- ② [Tools and Industrial Equipment](#)
- ③ [Communications and Office Equipment](#)
- ④ [Medical and Dental Procedures](#)

Each category is broken into sections that provide a recommended precaution or minimum distance you should keep from the items or products listed. If the item you're looking for isn't on the list or you have a specific question about an item, contact Medtronic at 00800-266-632-82.

1 Household and hobby items

Most household and hobby items are unlikely to affect your heart device when the items are in good working condition, used as intended, and the recommended distances are maintained. For items that transmit power through an antenna, follow the noted distances between the antenna and your implanted heart device. All items, regardless of distance restrictions, must be in good working condition and used as intended.

● Items with no distance restrictions

While there are no distance restrictions for the following, all items should be in good working condition and used as intended:

- Adjustable bed
- Air travel
- Battery charger – for household batteries
- Blender/food processor
- Blood pressure monitor
- Can opener
- Casino slot machine
- CD/DVD/DVR player or recorder, without speakers
- Clothes iron
- Curling iron
- Digital music player (for example, iPod®)
- Dishwasher
- Electric blanket or electric mattress pad
- Electric/gas stove
- Electric guitar
- Electric or hybrid vehicle, rider/passenger
- Electric toothbrush
- Electronic weight scale
- Flashlight
- Hair shaver/trimmer, battery powered
- Hair straightener
- Heating pad
- High-altitude hiking, trekking, skiing, vehicle travel, camping, or extended stays up to the 20,000-ft (6,000-m) limit
- Hot tub/swimming pool
- Ionized bracelet
- Low-voltage residential power lines
- Massage bed/chair/pad
- Microwave oven
- Motorcycle vest, heated
- Refrigerator
- Salon hair dryer
- Sauna
- Scuba diving, recreational diving up to 4.0 ATA (atmospheres absolute) or a seawater depth of 100 ft (30 m)
- Tanning bed/booth
- Toaster

● Items with distance restrictions

Maintain at least the distance indicated between the item and your heart device:

6 inches or 15 centimeters

- Air filter, ionized
- Appliances – handheld
- CPAP mask with magnetic clips
- Earbuds/headphones, wireless/wired (these items contain tiny magnets to generate sound)
- Electric golf cart/personal scooter/grocery cart, from battery, during charging
- Electric guitar speakers
- Electric shaver – corded
- Electric toothbrush charging base
- Hair dryer – handheld
- Handheld massager
- Magnetic back brace or belt
- Magnetic case/cover for tablet computer or smartphone
- Magnetic chair pad
- Magnetic clasps
- Magnetic therapy products
- Qi inductive mobile telephone charger
- Sewing machine/serger – from motor
- Small magnet (household magnet)
- Speakers
- Tattoo machine
- Television, CD/DVD/DVR player – from speakers
- Toy train, electric, from transformer and rails
- Treadmill – from motor
- Ultrasonic pest control device
- Vacuum cleaner – from motor

12 inches or 30 centimeters

- Car/motorcycle – from components of ignition system
- Electric fence
- Electric vehicle charging station
- Transformer box (green box in yard)

24 inches or 60 centimeters

- Beach comber metal detector – from search head
- Induction cooktop stove

● Not recommended

Use of these products is not recommended:

- Electronic body fat scale
- Magnetic mattress pad/pillow
- PEMF (pulsed electromagnetic field) therapy products

2 Tools and industrial equipment

Your power tools and/or equipment should be in good working order and properly wired (three-prong plug, if applicable) and used as intended by the manufacturer of the product. Corded electrical items should be plugged into a safety outlet device called a ground fault circuit interrupter (GFCI or GFI). All items, regardless of distance restrictions, must be in good working condition and used as intended.

● Items with no distance restrictions

While there are no distance restrictions for the following, all items should be in good working condition and used as intended:

- Calipers – battery-powered
- Diesel engine
- Electrostatic spray gun (handheld)
- Flashlight – battery-powered
- Kiln, 115-120 V AC or 220-240 V AC
- Laser level
- Polygraph/lie detector test
- Soldering iron
- Stud finder

● Items with distance restrictions

Maintain at least the distance indicated between handheld tools, battery-powered or electric, and your heart device:

6 inches or 15 centimeters

- Circular saw – skill saw
- Drills – battery- and electric-powered
- Electric chainsaw
- Grinder (handheld)
- Hedge trimmer – electric-powered
- Lawn mower – electric-powered
- Leaf blower – electric-powered
- Magnetic extractor wand, for automobile mechanics
- Reciprocating saw (Sawzall®)
- Router
- Sander
- Screwdriver – battery-powered
- Weed whacker – electric-powered

● Items with distance restrictions (cont'd.)

12 inches or 30 centimeters

- Boat motor
- Car battery charger
- Degausser/demagnetizer
- Gasoline-powered tools – from components of ignition system (lawn mower, backpack leaf blower, snowblower, weed whacker, chainsaw)
- Gasoline ignition systems – from components of ignition system (ATV, automobile, boat motor, forklift, jet ski, motorcycle, snowmobile, truck, see FAQs)
- Generators, electric, portable AC/DC, up to 20 kW
- Soldering gun

24 inches or 60 centimeters

- Anti-theft tag deactivator
- Bench-mounted/freestanding tools – for motors 400 horsepower or less (air compressor, drill presses, grinder, pressure washer, table saw)
- Forklift, battery-powered, from motor
- Jumper cables
- Welding equipment (with currents under 160 amps, see FAQs)

● Not recommended

Use of these products is not recommended:

- Welding equipment (with currents over 160 amps, see FAQs)

3 Communications and office equipment

Guidelines for safe operation of communications and office equipment include such factors as transmitting power, frequency, and antenna type. For items that transmit wireless signals through an antenna, follow the noted distances between the antenna and your implanted heart device. All items, regardless of distance restrictions, must be in good working condition and used as intended.

● Items with no distance restrictions

While there are no distance restrictions for the following, all items should be in good working condition and used as intended:

- Activity bands (FitBit™) with no magnets
- Barcode scanner
- Bluetooth® technology (Bluetooth-enabled items may have additional restrictions)
- Calculator
- Copy machine
- Digital music player (iPod®) – non-transmitting
- Fax machine
- Garage door opener, remote control
- Global positioning system (GPS)
- Heart rate monitor, chest band
- Home security system, infrared or ultrasonic
- Medical alert necklace or pendant, non-magnetic
- Pager, receiver only
- Printer
- Radio AM/FM
- Remote control, infrared, for CD/DVD player, television
- Satellite dish, receiving
- Scanner

● Items with distance restrictions

Maintain at least the distance indicated between the item and your heart device:

6 inches or 15 centimeters

- Amateur radio, Citizens band (CB) radio, ham radio, marine radio, walkie-talkie – 3 watts or less – from antenna
- Badge (name tag) with magnetic clasp
- Badge (security) with externally activated electronic circuit

- Cellular adaptor for laptop computer
- Computer keyboard, wireless
- Cordless headphone sending unit (i.e., TV Ears®)
- Cordless microphone, from transmitter
- Cordless telephone, < 3 W, from antenna and base station
- Digital music player (iPod®) – transmitting
- Disney Magic Bands (15 cm from band reader, band itself has no known risk)
- Electronic pet containment fence – from collar, remote and base antenna
- Electronic reader/reading devices
- Electronic tablets (i.e., Kindle™)
- Home security system, microwave motion sensor, from transmitter
- Home wireless electronics – from antenna
- Laser tag, from magnet or transmitter in vest
- Medical alert pendant
- Mobile telephones, cellular telephones, or smartphones
- Model cars, airplanes, video drones – from controller antenna
- OnStar™ technology – from antenna
- Pager, two-way, ≤ 3 W, from antenna
- Piconet wireless computer connector, from antenna
- Radiofrequency wireless charger
- Remote car starter
- Remote control, radiofrequency, for CD/DVD player, television
- Remote keyless entry – key fob (such as Smart Key)
- Security badge wall scanner
- Smartwatch – contains magnets (i.e., Apple Watch®, Samsung™ Watch, Fitbit™)
- Smart meter (utility companies)
- Smart speakers

Mobile telephones

Keep mobile telephones, cellular telephones, or smartphones at least 6 inches or 15 centimeters from an implanted pacemaker or ICD.

Keep magnetic accessories for mobile telephones at least 6 inches or 15 centimeters from an implanted pacemaker or ICD.

Accessories with magnets can include wireless earbuds, plug-in earbuds, or cases with magnetic clasps.

Do not carry a wireless device in a pocket or in a shoulder bag within 6 inches or 15 centimeters of a pacemaker or an ICD.

Communications and office equipment (cont'd.)

● Items with distance restrictions

6 inches or 15 centimeters

- Static electricity generator, "plasma ball" – do not touch
- Telephone headset, cordless
- Wireless communication devices (computers, headsets, modems, routers, smartphones)
- Wireless controllers (video game consoles, Xbox™, Playstation®, Nintendo™)
- Wireless earbuds

12 inches or 30 centimeters

- Amateur radio, ham radio, marine radio, walkie-talkie – between 3-15 watts – from antenna
- Citizens band (CB) radio – 5 watts or less – from antenna
- Uninterrupted power source (UPS)

24 inches or 60 centimeters

- Amateur radio, ham radio, marine radio, walkie-talkie – between 15-30 watts – from antenna
- Residential satellite dish, two-way

4 Medical and dental procedures

Many medical procedures will not affect your heart device; however, certain medical procedures can result in serious injury, damage to your heart device, or device malfunction. Before undergoing any medical procedure, advise your treating doctor or dentist that you have an implanted heart device and consult with your heart doctor to evaluate any possible associated risk. All items, regardless of distance restrictions, must be in good working condition and used as intended.

● Acceptable

While there are no distance restrictions for the following, all items should be in good working condition and used as intended:

- Acupuncture – no electrical stimulus
- Acupuncture DC – direct current
- Bone density test (X-ray)
- Bone density ultrasound – on heel or hand
- Bone growth stimulator direct current
- Cochlear implants
- Colonoscopy – diagnostic only
- Cryogenic ablation
- Eye surgery for pacemaker patients
- Dental apex locator (root locator)
- Dental drills
- Dental pulp tester
- Dental ultrasonic scalers/cleaners
- Dental X-ray
- Diagnostic ultrasound (sonogram)
- Diagnostic X-rays (fluoroscopy)
- Digital infrared thermal imaging (DITI)
- Echocardiogram
- EECF – enhanced external counter pulsation therapy
- Electrocardiogram (ECG/EKG)
- Electroencephalography – EEG
- Electronystagmography (audiology – ENG)
- Hearing aid (in or behind ear)
- Heart rate monitor
- Iontophoresis (drug patch)
- Laser surgery
- Mammography
- Medical helicopter
- Motion sickness relief band
- NEMG: needle electromyography
- Nuclear stress test
- PET (positron emission tomography)/SPECT (single photon emission computed tomography)
- SEMG: surface electromyography
- Sleep apnea machine

● Acceptable with precautions

Inform your treating physician that you have a heart device implanted and/or consult with your heart doctor/clinic. Medical procedures that require some precautions:

- Ablation (specifically, microwave ablation and radiofrequency ablation)
- Acupuncture with AC–alternating current
- Argon plasma cautery

Medical and dental procedures (cont'd.)

● Acceptable with precautions

- Blood bag dielectric sealing equipment
- Bone densitometry (dual-energy X-ray absorptiometry)
- Bone growth stimulator alternating magnetic field
- Capsule endoscopy
- Colonoscopy – polyp removal
- Computerized axial tomography (CT or CAT) scan
- Cut tissue or remove tissue
- ECT (electroconvulsive shock therapy)
- EECF (enhanced external counterpulsation therapy) before you administer EECF
- Elective cardioversion
- Electrolysis
- Electrosurgery and other procedures that use an electric probe to control bleeding
- EMG electromyography – automated sequence
- EMG electromyography – single stimulus
- Enteral magnetic navigation
- External defibrillation, AED and elective cardioversion
- Eye surgery for defibrillator patients
- Dysphagia treatment devices
- Hyfrecator
- Hyperbaric oxygen therapy (HBOT)
- Interferential electrical current therapy
- Lithotripsy
- Mechanical ventilation with a respiration rate monitor
- Medtronic PillCam
- NCS (nerve conduction study)
- Neutron radiation
- pH capsule
- Photodynamic therapy (PDT)
- Radiation therapy (external X-ray, Gamma Knife® or radiosurgery)
- Radiotherapy (including high-energy radiation therapy)
- RFID (radiofrequency identification devices)
- Stereotaxis
- Therapeutic ultrasound
- TMS (transcranial magnetic stimulation)

- Transmitting loop for digital hearing aid
- Transurethral needle ablation (TUNA™ therapy)
- TUMT (transurethral microwave thermotherapeutic device)
- TURP prostate test (transurethral resection of the prostate)
- Virtual colonoscopy performed with CAT scan (CT scan)

● Not recommended

- Bone growth stimulator introducing alternating current (AC) into the body
- Diathermy (high frequency, short wave, and microwave)
- MET (microcurrent electrical therapy)
- MRA (magnetic resonance angiography)* for non MR-conditional devices
- MRI*
- PEMF (pulsed electromagnetic field therapy)
- Transcutaneous electrical nerve stimulation (TENS) (including neuro muscular electrical stimulation (NMES))
- Virtual colonoscopy with MRI* for non MR-conditional devices

* Unless the device is MR conditional, then see MRI guidelines for that device. Visit mrisurescan.com for more information. See FAQs.

Activities and intimacy

The goal is for you to lead a normal life as soon as possible. Here are suggested precautions to follow during your recovery period. Your physician will provide you with specific directions based on your current medical condition and history.

Q: What activities can I resume?

A: Generally, your device will not keep you from most activities and hobbies (such as bowling, golfing, playing tennis, gardening, and fishing).

Q: Will I be able to return to work?

A: Most patients are able to return to work after device implant. You and your doctor will make this decision. The timing will depend on many things, including the type of work you do.

Q: Will I be able to resume sexual intimacy?

A: Intimacy is a normal part of life. We understand patients resume sexual activity when they feel comfortable. However, if you have a question, it may be helpful to have a conversation with your doctor.

Q: Will my ICD deliver a shock during intimacy or daily activities?

A: It is rare. Your ICD is programmed to allow your heart rate to normally rise without treatment shocks being delivered. Your device should only deliver a shock when your heart rate meets the specific criteria programmed by your heart doctor. If you receive a shock during intimacy or other activities, contact your physician. Your doctor will then determine the cause of the shock and may also make adjustments in the programming of your heart device.

If in doubt about an activity, always discuss with your doctor or nurse.

MRI scan access

Q: Are heart devices MR-compatible?

A: Medtronic has CRT, ICD, and pacing systems which are approved for use in the MRI environment. These systems have a unique design, developed so that under specific conditions, patients may undergo MRI scans.

- Talk to your doctor about the pacemaker or ICD device options available to you and determine if your current or future cardiac system allows you access to an MRI scan.

Q: What if my device is not approved for use in the MRI environment?

A: Medtronic does not recommend the use of an MRI scan if your device is not approved for use in the MRI environment.

Visit [mrisurescan.com](https://www.mrisurescan.com) for more information about MRI and Medtronic heart devices.

Anti-theft detectors and airport security systems

Q: Can I go through store anti-theft detectors?

A: Yes. Anti-theft detectors in stores and libraries generate electromagnetic fields that can “sense” embedded “tags” on merchandise. It may be possible, under unique circumstances, for these fields to temporarily affect the operation of your heart device. Significant effects from interference are unlikely, but to further minimize the possibility:

- Be aware of anti-theft detectors
- Walk through at a “normal” walking speed
- Don’t linger close to the detection system equipment. If you are near an anti-theft system and feel symptoms, promptly move away from the equipment. Your heart device will resume its previous state of operation when you move away from the equipment.

Q: Can I go through security systems such as those found in airports and courthouses?

A: Given the short duration of security screening, it is unlikely that your Medtronic heart device will be affected by metal detectors (walk-through archways and handheld wands) or full-body imaging scanners (also called millimeter wave scanners and 3D imaging scanners) such as those found in airports, courthouses, and jails. The metal case of your heart device could set off a metal detector.

To minimize the potential for temporary interference with your heart device while going through the security screening process, avoid touching metal surfaces around any screening equipment. Do not stop or linger in a walk-through archway; simply walk through the archway at a normal pace.

If a handheld wand is used, ask the security operator not to hold it over your heart device and not to wave it back and forth over your heart device. You may also request a hand

search as an alternative. If you have concerns about these security screening methods, show your device ID card, request alternative screening, and then follow the instructions of the security personnel.

Household magnets

Q: Do magnets affect pacemakers and implantable defibrillators?

A: Even though most electromagnetic fields in the home environment will rarely affect the function of a pacemaker or implantable defibrillator. To further minimize the potential for temporary interference, keep any item containing magnets away (at least 15 cm) from your pacemaker or implantable defibrillator.

The reason for this is because there is a small magnetically activated sensor built into the electronics of pacemakers and implantable defibrillators. This internal sensor is designed to close when a magnet of enough strength is placed over it.

When the internal sensor is closed in the pacemaker, the pacemaker paces the heart at a continuous preset rate (which could be different than the rate your doctor programmed).

When the internal sensor is closed in an implantable cardiac defibrillator, it prevents it from delivering treatment therapies.

You may also hear a device tone in the presence of a magnet. The magnet tone is a steady tone lasting approximately for 10 seconds. It sounds when an implantable defibrillator senses a magnetic field. Magnets are designed into many consumer products, including clothing and clothing accessories. If you hear a magnet tone, look for a magnetic object on or near you. Move away from the magnetic source, or move to a different location if you cannot identify the magnetic source. If you hear other beeping tones from your heart device, call your doctor for instructions.

Household magnets (cont'd.)

You may not always know if an item has a magnet in it. For example, clothing clasps, cell phones, cell phone accessories, jewelry, earphones, work badges, and sport watches may contain strong magnets.

If you mistakenly place a magnet too close to your heart device, simply move the item away.

Removing the magnet returns the pacemaker or implantable defibrillator to its previous, normal programming.

Do not use magnetic mattress pads and pillows since it would be difficult to keep a 6-inch (15 centimeters) separation from your heart device.

Welding

Q: I read in my patient manual that I should avoid welding. Why?

A: Unlike most other household power tools, welding with currents above 160 amps may have a higher tendency to temporarily affect the normal function of your pacemaker or implantable defibrillator.

Q: What if I may need to use a welder?

A: Avoid using welding currents above 160 amps. When welding with currents under 160 amps, follow the welding and safety precautions to minimize the risk of interference with your heart device.

Welding safety precautions

- Limit welding to currents less than 160 amps
- Work in a dry area with dry gloves and shoes
- Maintain a 2-foot (60-centimeters) distance between the welding arc and heart device
- Keep the welding cables close together and as far away as possible from your heart device. Place the welding unit approximately 5 feet or 150 centimeters from the work area.
- Connect the ground clamp to the metal as close

to the point of welding as possible. Arrange the work so the handle and rod will not contact the metal being welded if they are accidentally dropped.

- Wait several seconds between attempts when having difficulty starting a weld
- Work in an area that offers firm footing and plenty of room for movement
- Work with an informed person who understands these suggestions
- Immediately stop welding and step away from the area if you start feeling lightheaded or dizzy or if you believe your implantable defibrillator has delivered a shock

Since welding equipment may temporarily affect the normal operation of your heart device, the decision you make to use this equipment should be made in consultation with your heart doctor. Aprons or vests will not effectively shield your pacemaker or implantable defibrillator from the electromagnetic energy generated by welding equipment.

Chainsaws

Q: What special considerations are there for chainsaw use?

A: The electromagnetic energy generated by a chainsaw is similar to other electric and gasoline-powered tools. If electromagnetic interference occurs with your heart device and you experience symptoms such as becoming dizzy or lightheaded, a running chainsaw may present a higher risk of injury to you than other power tools. If you do need to use a chainsaw, follow the safety precautions below to minimize the risk of interfering with your heart device.

Chainsaw safety precautions

- Maintain a 6 inches or 15 centimeters distance between the motor of an electric chainsaw and your heart device. Also, be sure the equipment is properly grounded.
- Maintain a 12 inches or 30 centimeters distance between the components of the ignition system of a gas-powered chainsaw and your heart

Chainsaw safety precautions (cont'd.)

device. Also, it is better to use one that is built with the spark plug located away from the hand grips.

- Immediately stop cutting and turn off your chainsaw if you start feeling lightheaded or dizzy or if you believe your implantable defibrillator has delivered a shock
- Do not work on the engine while it is running
- Do not touch the coil, distributor, or spark plug cables of a running engine

Maintenance of vehicles or equipment with engines fueled by gasoline or petrol

Observe the following precautions when using vehicles fueled with gasoline/petrol:

- Do not repair or perform maintenance work on an engine while it is running or when its ignition switch is on. Repair or perform maintenance work on an engine when both the engine and its ignition switch are off.
- Maintain a 12-inch or 30 centimeters distance between the implanted cardiac device and an engine that is running or that has its ignition switch turned on.
- Do not touch the coil, distributor, or spark plug cables of a running engine

Note: Diesel engines will not affect the function of an implanted pacemaker or ICD.

Educational resources and support

Experts at Medtronic can give you answers and reassurance.

They can also point you to other resources and support groups.

00800-266-632-82*

Monday-Friday 8am-4pm**

* Free-of-charge number

** You can leave a voicemail if it is outside office hours