Summary of Safety and Clinical Performance (SSCP)

AtriCure Pens (MLP1, MAX3, MAX5, MCR1)

24 September 2024

CEM-279 Rev C

OVERVIEW

This Summary of Safety and Clinical Performance (SSCP) is intended to provide public access to an updated summary of the main aspects of the safety and clinical performance of the device.

The SSCP is not intended to replace the Instructions for Use as the main document to ensure the safe use of the device, nor is it intended to provide diagnostic or therapeutic suggestions to intended users or patients.

INFORMATION INTENDED FOR USERS/ HEALTHCARE PROFESSIONALS:

1. Device Identification and General Information

Product Name:	AtriCure Isolator® Linear Pen (MLP1) AtriCure Isolator® Transpolar Pen (MAX3) AtriCure Isolator® Long Pen TT (MAX5) AtriCure Coolrail® Linear Pen (MCR1)
Product Group/Family Basic UDI-DI	AtriCure Isolator Linear Pen (MLP1), AtriCure Isolator Transpolar Pen (MAX3), AtriCure Isolator Long Pen TT (MAX5), AtriCure Coolrail Linear Pen (MCR1): 08401439000000000000018ZU
Manufacturer Legal Name and Address: Single Registration Number (SRN)	AtriCure 7555 Innovation Way Mason, OH 45040 USA SRN: US-MF-000002974
EU Auth Representative: Single Registration Number (SRN)	AtriCure Europe B.V. De entree 260 1101 EE Amsterdam The Netherlands SRN: NL-AR-000000165
Medical Device Scope Expression and Code:	CND Code: C020301 Cardiac Tissue Ablation, Electrocatheters Radiofrequency EMDN Code: C020399 Cardiac Tissue Ablation Devices - Other
Product Classification and Rule (per MDR):	Class III Rule 6
Year when the first certificate (CE) was issued covering the device:	Isolator Linear Pen (MLP1): 2011 Isolator Transpolar Pen (MAX3): 2015 Isolator Long Pen TT MAX5): 2015 Coolrail Linear Pen (MCR1): 2015

Notified Body Name, Address & Number:	BSI Say Building John M. Keynesplein 9 1066 EP Amsterdam The Netherlands +31 20 346 0780 CE 2797

2. Intended Use of the Device

2.1. Intended Purpose

Isolator Linear Pen (MLP1)

The Isolator linear pen is a sterile, single use electrosurgery device intended to ablate cardiac tissue when connected to a compatible AtriCure radiofrequency generator. The Isolator linear pen may be used for temporary cardiac pacing, sensing, recording, and stimulation during the evaluation of cardiac arrhythmias when connected to a temporary external cardiac pacemaker or recording device.

Isolator Transpolar Pen (MAX3) and Long Pen TT (MAX5)

The Isolator pen is a sterile, single use electrosurgery device intended to ablate cardiac tissue when connected to a compatible AtriCure radiofrequency generator. The Isolator pen may be used for temporary cardiac pacing, sensing, recording, and stimulation during the evaluation of cardiac arrhythmias when connected to a temporary external cardiac pacemaker or recording device.

Coolrail Linear Pen (MCR1)

The Coolrail linear pen is a sterile, single use electrosurgery device intended to ablate cardiac tissue when connected to a compatible AtriCure radiofrequency generator.

2.2. Indication(s) and target populations

Isolator Linear Pen (MLP1)

- Indication: The Isolator linear pen is indicated for the Ablation of cardiac tissue for treatment of cardiac arrhythmias, including atrial fibrillation. Temporary cardiac pacing, sensing, recording, and stimulation during the evaluation of cardiac arrhythmias when connected to a temporary external cardiac pacemaker or recording device.

- Target Population: Adult patients with cardiac arrhythmias including atrial fibrillation

Isolator Transpolar Pen (MAX3) and Long Pen TT (MAX5)

- Indication: The Isolator pen is intended for the ablation of cardiac tissue for treatment of cardiac arrhythmias, including atrial fibrillation. Temporary cardiac pacing, sensing, recording, and stimulation during the evaluation of cardiac arrhythmias when connected to a temporary external cardiac pacemaker or recording device.

- Target Population: Adult patients with cardiac arrhythmias including atrial fibrillation

Coolrail Linear Pen (MCR1)

- Indication: The Coolrail linear pen is indicated for the ablation of cardiac tissue during treatment of cardiac arrhythmias, including atrial fibrillation

- Target Population: Adult patients with cardiac arrhythmias including atrial fibrillation

2.3. Contraindications and/ or limitations

Isolator Transpolar Pen (MAX3), Isolator Long Pen TT (MAX5); Coolrail Linear Pen (MCR1), and Isolator Linear Pen (MLP1)

- The device is not intended for contraceptive tubal coagulation (permanent female sterilization).

3. Device Description

3.1. Description of the device

Isolator Linear Pen (MLP1)

The Isolator pen System is comprised of an AtriCure RF GENERATOR (ASU3 and ASB3 or MAG™), Isolator pen, and Footswitch. The Pen is a single patient use electrosurgical device intended to ablate cardiac tissue when connected to a compatible AtriCure radiofrequency generator. When activated, the GENERATOR delivers radiofrequency (RF) energy to the internally cooled electrodes. The Operator controls the application of energy by pressing and holding the Footswitch or button. The Isolator pen may be used for temporary cardiac pacing, sensing, recording, and stimulation during the evaluation of cardiac arrhythmias when connected to a temporary external cardiac pacemaker or recording device.

Figure 1 Isolator Linear Pen (MLP1)

Isolator Transpolar Pen (MAX3) and Long Pen TT (MAX5)

The Isolator pen System is comprised of an AtriCure RF GENERATOR (ASU3 and ASB3 or MAG™), Isolator pen, and Footswitch. The Isolator pen is a sterile, single use electrosurgery device intended to ablate cardiac tissue when connected to a compatible

AtriCure radiofrequency generator. The Operator controls the application of this RF energy by pressing and holding the Footswitch or button. The Isolator linear pen may be used for temporary cardiac pacing, sensing, recording, and stimulation during the evaluation of cardiac arrhythmias when connected to a temporary external cardiac pacemaker or recording device.

Figure 2 Isolator Transpolar Pen (MAX3)

Figure 3 Isolator Long Pen TT (MAX5)

Coolrail Linear Pen (MCR1)

The AtriCure Coolrail linear pen System is comprised of is comprised of an AtriCure RF GENERATOR (ASU3 and ASB3 or MAG™), Coolrail linear pen, and Footswitch. The Coolrail linear pen is a sterile, single use electrosurgery device intended to ablate cardiac tissue when connected to a compatible AtriCure radiofrequency generator. When activated, the GENERATOR delivers radiofrequency (RF) energy to the internally cooled electrodes. The Operator controls the application of energy by pressing and holding the Footswitch or button.

Figure 4 Coolrail Linear Pen

3.2. A reference to previous generation(s) or variants if such exist, and a description of the differences

Isolator Linear Pen (MLP1)
- 2011: CE marking
- 2015: Enhanced shaft design to increase malleability/bending capability; alternate RF and sensing wire insulation material to improve manufacturability
- 2016: Equivalent shrink tube raw material replacement due to obsolescence by supplier
- 2020: CE certificate renewal; resin change due to obsolescence

Isolator Pen and Long Pen (MAX3, MAX5)
- 2015: CE marking
- 2015: Addition of laser spot weld to crimp joint (non-patient contacting) that is similar to solder joint without additional materials
- 2016: Tyvek manufacturing change to new latest flash-spinning technology
- 2017: MAX3: Change in thickness of blister tray raw stock sheet to improve manufacturing process capability
- 2020: CE certificate renewal; resin change due to obsolescence

Coolrail Linear Pen (MCR1)
- 2015: CE marking; incorporated RoHS compliant thermistor and modified fluid pump design to enhance pump performance
- 2016: Tyvek manufacturing change to new latest flash-spinning technology
- 2020: CE certificate renewal; resin change due to obsolescence; change in shaft materials to stiffen the shaft to allow the user to better apply pressure to tissue during ablation; PCB change to incorporate thermistor short detection
- 2021: Changes made to improve crimping operation (crimp location, wire strip length, magnification for product line)

3.3. Description of any accessories which are intended to be used in combination with the device

None

3.4. Description of any other devices and products which are intended to be used in

combination with the device

None

4. Risks and warnings

4.1. Residual risks and undesirable effects

Possible complications related to the creation of spot or linear lesions in cardiac and soft tissues are:

AtriCure Pens (MLP1, MAX3, MAX5, MCR1)	Peri-procedural residual risk occurrence estimates
Ablation or burns to non-targeted tissues (refer to atrio-esophageal signs and symptoms below)	<0.1%; Less than 1 in 1,000 patients
Tissue perforation	<0.1%; Less than 1 in 1,000 patients
Postoperative embolic complications	<0.1%; Less than 1 in 1,000 patients
Extension of extracorporeal bypass	Surgical ablation adds cardiopulmonary bypass time to concomitant procedures, however the American Association for Thoracic Surgery consensus guidelines report that this does not translate into increase patient risk.[1]
Perioperative heart rhythm disturbance (atrial and/or ventricular)	<0.1%; Less than 1 in 1,000 patients
Pericardial effusion or tamponade	<0.1%; Less than 1 in 1,000 patients
Damage to adjacent nerve and/or blood vessels	<0.5% to ≥0.1%; Less than 1 in 200 people to 1 in 1,000 patients
Valve leaflet damage	<0.1%; Less than 1 in 1,000 patients
Conduction disturbances (SA/AV node)	<0.1%; Less than 1 in 1,000 patients
Acute ischemic myocardial event	<0.1%; Less than 1 in 1,000 patients
Note: Estimated occurrence rates are after risk control measures based on AtriCure risk management files; estimated risks may be underestimated due to use of commercial rates.	

Additional residual risks reflected in IFU Warnings/Cautions are:

AtriCure Pens (MLP1, MAX3, MAX5, MCR1)	Peri-procedural residual risk occurrence estimates
Infection	<0.1%; Less than 1 in 1,000 patients
Bleeding resulting in death or permanent impairment	<0.1%; Less than 1 in 1,000 patients
Failure to complete standalone RF procedure	<0.5% to ≥0.1%; Less than 1 in 200 people to 1 in 1,000 patients
4th degree burn	<0.1%; Less than 1 in 1,000 patients
Systemic adverse reaction	<0.1%; Less than 1 in 1,000 patients
Note: Estimated occurrence rates are after risk control measures based on AtriCure risk management files; estimated risks may be underestimated due to use of commercial rates.	

ATRIO-ESOPHAGEAL FISTULA (AEF) SIGNS AND SYMPTOMS FOLLOWING

ABLATION SURGERY
• Fever
• Dysphagia (Painful or Difficulty Swallowing)
• Persistent Chest Pain (Different from Incisional Pain)
• Seizure(s)
• Change in Mental Status (Confusion)
• Sudden Weakness on One Side of the Body
• Vomiting Blood
• Blood in Stool
• Fainting
• Dyspnea (Shortness of Breath)
• Difficulty Speaking
• Numbness, Tingling Sensation, Dizziness, Double Vision

4.2. Warnings and precautions

Isolator Linear Pen (MLP1) Warnings

- Read all instructions carefully for the AtriCure Isolator linear pen, generator, and any compatible auxiliary device being used prior to using the devices. Failure to properly follow instructions may lead to electrical or thermal injury and may result in improper functioning of the device
- To avoid shock/burn hazards/ineffective cardioversion, always remove the Pen from the patient during defibrillation.
- Do not connect the generator cable to supply mains (line voltage) operated equipment without verifying isolation of the connected equipment to BS EN 60601-1-1. Supply mains operated equipment may introduce dangerous leakage currents into the heart
- Use of the Pen should be limited to properly trained and qualified medical personnel. Electrosurgery should be used with caution in the presence of internal or external pacemakers. Interference produced with the use of electrosurgical devices can cause devices such as a pacemaker to enter an asynchronous mode or can block the pacemaker entirely. Consult the pacemaker manufacturer or hospital Cardiology department for further information when use of electrosurgical appliances is planned in patients with cardiac pacemakers
- Do not use the Pen in the presence of flammable anesthetics, other flammable gases, flammable cleaning agents, near flammable fluids such as skin prepping agents and tinctures, flammable objects, or with oxidizing agents. Use near flammable agents may result in fire or explosion. Observe appropriate fire precautions at all times.
- Do not use the Pen for coagulation or ablation of veins or arteries.
- This device contains small amounts of Nickel (CAS# 7440-02-0) and Cobalt (CAS# 7440-48-4). Do not use the device if the patient has sensitivity to Nickel or Cobalt as this may result in an adverse patient reaction.
- To avoid the risk of patient infection, inspect the product packaging prior to opening to ensure that the sterility barrier is not breached. If the sterility barrier is breached, do not use the Pen.
- To avoid damage to the device or sterility breach do not drop the Pen. If the Pen is dropped, do not use. Replace with a new Pen.
- Use only connecting cables and auxiliary device identified in this Instruction for Use to avoid risk of patient injury, operator injury, or equipment damage.
- Ensure the electrodes are placed on the target tissue. Ablation of unintended tissues or structures can cause harm and damage to the patient. Applying pacing, stimulation, or sensing to unintended structures will give incorrect results.

- Do not place anything in front of or behind the target tissue (tissue being ablated). Any tissue within the RF energy field may experience heating and/or tissue damage. Ensure that non-target tissue is adequately separated from the RF field. Ensure non-target tissue is protected from the RF field by carefully placing and orienting the electrodes. Refer to Potential Complications list.
- Total duration of ablation(s) per lesion not to exceed recommended ablation time. Do not overlap ablations by more than 50%. Ablations exceeding recommended time and/or overlap may produce perforations in tissue.
- Use caution to avoid trauma to tissues not within the target area of ablation. Tissue and/or structures behind the targeted tissue should be protected from potential thermal spread.
- Ensure constant firm pressure is applied to the target tissue without movement and maintain full contact of the electrode surface with the tissue to avoid tissue damage
- Ensure the Footswitch or button is depressed fully and held down for the entirety of the desired RF energy delivery. To avoid incomplete lesions of ablation of unintended tissues or structures, use care to depress and hold the Footswitch or button only when desired and when the device is placed on target tissue
- Ensure adequate energy is applied to tissue, ablations are overlapped, electrodes are cooled between repeat ablations, and inspect surgical area to visually confirm lesion to avoid non-transmural lesions or undetected, incomplete lesions.
- The ablation and sensing electrodes must be kept clean of debris during surgery to avoid loss of power. Before activating the generator, inspect the electrodes of the Pen for foreign matter. Foreign matter captured on the tip will adversely affect the ablation.
- The Pen device is intended for single use only. Do not RESTERILIZE or REUSE. Re-sterilization may cause loss of function or injury to patient.

Isolator Linear Pen (MLP1) Cautions

- Do not touch the electrodes of the Pen to metal staples or clips, or to sutures while activating the generator. This may result in an error code or incorrect pacing and sensing
- Do not allow the connectors of the Pen to get wet, as this may affect the device performance.
- Do not immerse the entire pen in liquids as this may damage the device.
- Ablation with the Pen is only compatible with the AtriCure generator. Use of the Pen with another manufacturer’s ablation generator may damage the device.
- To avoid inconvenience or product damage, ensure ablation connector is fully seated in the Pen port, sensing connectors are fully seated in the red and black ports, and properly aligned.
- The ablation electrodes are not to be used for pacing, sensing, or stimulation. Use of the ablation electrodes and sensing electrodes simultaneously may produce erroneous data from the auxiliary device.
- Use caution during device insertion, removal, articulation, and if bending the malleable portion of the shaft with surgical tools to avoid device catching or failure to insert
- To avoid incorrect pacing and sensing, ensure electrodes are placed on target tissue
- Do not bend shaft past 25 degrees from neutral position. Only bend the shaft in the malleable zone.
- Do not grasp the end effector to articulate the device. Use lever to avoid breaking end effector connection to shaft.
- Do not touch the electrodes of the Pen while activating the generator. Touching the Pen electrodes during generator activation could result in a burn to the operator.
- Do not use abrasive cleaners or electrosurgical tip cleaners to clean debris...Use saline-soaked gauze for cleaning debris

- The Pen is intended for single use. To prevent re-use, Pen use is tracked by the Generator. The Pen will no longer function after 8 hours of use and the Generator will display a message that the Pen must be replaced.
- The useful life of the device is 30 individual ablations.

Isolator Transpolar Pen (MAX3) and Long Pen TT (MAX5) Warnings

- To avoid shock/burn hazards/ineffective cardioversion, always remove the Pen from the patient during defibrillation.
- Use of the Pen should be limited to properly trained and qualified medical personnel. Proper surgical procedures and techniques are the responsibility of the medical professional. Understanding the proper use of the Oscor PACE 203 H temporary pacemaker equipment is also the responsibility of the medical professional. Each surgeon must evaluate the appropriateness of any procedure based on their own medical training and experience, and the type of surgical procedure
- Do not use the Pen in the presence of flammable anesthetics, other flammable gases, flammable cleaning agents, near flammable fluids such as skin prepping agents and tinctures, flammable objects, or with oxidizing agents. Use near flammable agents may result in fire or explosion. Observe appropriate fire precautions at all times
- Do not use the Pen for coagulation or ablation of veins or arteries.
- Read all instructions carefully for the AtriCure ASU or MAG, Isolator Transpolar Pen, ASU or MAG Source Switch, and any auxiliary device being used prior to using the devices. Failure to properly follow instructions may lead to electrical or thermal injury and may result in improper functioning of the device
- To avoid the risk of patient infection, inspect the product packaging prior to opening to ensure that the sterility barrier is not breached. If the sterility barrier is breached, do not use the Pen.
- To avoid damage to the device, do not drop or toss the Pen. If the Pen is dropped, do not use. Replace with a new Pen.
- Use only connecting cables and auxiliary device identified in this Instruction for Use to avoid risk of patient injury, operator injury, or equipment damage.
- Do not connect the generator cable to supply mains (line voltage) operated equipment without verifying isolation of the connected equipment to BS EN 60601-1-1. Supply mains operated equipment may introduce dangerous leakage currents into the heart
- Ensure constant firm pressure is applied to the tissue without movement. Application of light pressure, excessive pressure, uneven pressure, or movement of Pen can result in tissue damage or non-transmural lesions
- Use caution to avoid trauma to tissues not within the target area of ablation. Tissue and/or structures behind the targeted tissue should be protected from potential thermal spread.
- Ensure the electrodes are placed on the target tissue. Ablation of unintended tissues or structures can cause harm and damage to patient.
- Ensure stamping lesions are overlapping by 50% to ensure a continuous and complete lesion. Failure to overlap stamping lesions may result in an undetected, incomplete lesion. Overlapping by more than 50% may result in tissue perforation or unintended damage
- Total duration of ablation(s) per lesion not to exceed recommended ablation time. Do not overlap ablations by more than 50% to avoid tissue damage.
- Ensure the Footswitch or button is depressed fully and held down for the entirety of the desired RF energy delivery. To avoid incomplete lesions of ablation of

unintended tissues or structures, use care to depress Footswitch or button only when desired and when the device is placed on target tissue
- Ensure that energy is applied to tissue for the proper amount of time. Energy applied for an extended period of time may cause lateral lesion to spread or tissue damage. Energy applied for a shortened period of time may cause an incomplete lesion.
- Inspect the surgical area to ensure adequate ablation. Failure to inspect may result in an undetected, incomplete lesion
- The distal tip of the Pen must be kept clean of debris to avoid loss of power. Before activating the generator, inspect the area at the distal tip of the Pen for foreign matter. Foreign matter captured on the tip will adversely affect the ablation.
- The pen device is intended for single use only. Do not RESTERILIZE. Re-sterilization may cause loss of function or injury to patient. It is the responsibility of the user to dispose of this device in accordance with local regulations.

Isolator Transpolar Pen (MAX3) and Long Pen TT (MAX5) Cautions

- Do not touch the electrodes of the Pen to metal staples or clips, or to sutures while activating the generator. This may damage the Pen or tissue or result in an incomplete ablation.
- Do not immerse the Pen in liquids as this may damage the device.
- Do not allow the connectors of the Pen to get wet. Wet connectors may affect the device performance.
- The Pen is only compatible with the AtriCure ASU or MAG Generator. Use of the Pen with another manufacturer's generator may damage the device and result in patient injury.
- Use care when connecting the Pen. Ensure connector is fully and properly seated in the pen port.
- Ensure the electrodes are placed on the target tissue. Applying pacing, stimulation, or sensing to unintended structures will give incorrect results.
- Use caution during device insertion and removal.
- Excessive bending of the malleable stainless-steel shaft will cause the shaft to harden and may increase the potential for breakage.
- Do not touch the electrodes of the Pen while activating the generator. Touching the Pen electrodes during generator activation could result in an electrical shock or burn to the operator.
- Do not use abrasive cleaners or electrosurgical tip cleaners to clean debris from the Distal Tip. Do not activate the generator while cleaning the device. Use of abrasive cleaners or electrosurgical tip cleaners can damage the electrodes and result in device failure. Use saline-soaked gauze for cleaning debris.
- The Pen is intended for single use. To prevent re-use, Pen use is tracked by the Generator. The Pen will no longer function after 8 hours of use and the Generator will display a message that the Pen must be replaced.
- The useful life of the device is 30 individual ablations.

Coolrail Linear Pen Warnings

- Do not use the Coolrail linear pen for coagulation or ablation of veins or arteries. Do not perform ablations directly on the atrial appendage. Clotting and tissue damage may occur
- To avoid shock/burn hazards, always remove the Coolrail linear pen from the patient during defibrillation.
- Do not use the Coolrail linear pen in the presence of flammable materials, other flammable gases, flammable cleaning agents, near flammable fluids such as skin prepping agents and tinctures, flammable objects, or with oxidizing agents. Use near

flammable agents may result in fire or explosion. Observe appropriate fire precautions at all times.

- Use of the Coolrail linear pen should be limited to properly trained and qualified medical personnel. Electrosurgery should be used with caution in the presence of internal or external pacemakers. Interference produced with the use of electrosurgical devices can cause devices such as a pacemaker to enter an asynchronous mode or can block the pacemaker entirely. Consult the pacemaker manufacturer or hospital Cardiology department for further information when use of electrosurgical appliances is planned in patients with cardiac pacemakers.
- This device contains small amounts of Nickel (CAS# 7440-02-0) and Cobalt (CAS# 7440-48-4). Do not use the device if the patient has sensitivity to Nickel or Cobalt as this may result in an adverse patient reaction.
- To avoid damage to the device or sterility breach, use care when removing device from packaging. If the device is dropped, sterility and / or integrity of the device cannot be ensured. Replace with a new Coolrail linear pen.
- To avoid the risk of patient infection, inspect the product packaging prior to opening to ensure that the sterility barrier is not breached. If the sterility barrier is breached, do not use the Coolrail linear pen.
- Only use sterile water when filling the Pump Box. Other fluids may affect the performance of the device.
- Use only connecting cables and auxiliary device identified in this Instruction for Use to avoid risk of patient injury, operator injury, or equipment damage.
- Excessive bending of the malleable shaft will cause the shaft to harden and may increase the potential for breakage. Only bend the shaft in the malleable zone. Bending at end effector or the non-malleable rigid zone of the shaft may result in product damage
- Ensure the full lengths of both electrodes are in contact with the targeted tissue prior to and throughout RF activation. Partial contact of electrodes may produce perforations in the tissue.
- As with other unidirectional devices, do not place anything in front of or behind the target tissue (tissue being ablated). Any tissue within the RF energy field may experience heating and/or tissue damage. Ensure that non-target tissue such as the esophagus is adequately separated from the RF field. Ensure non-target tissue is protected from the RF field by carefully placing and orienting the electrodes.
- To ensure a continuous ablation, assure the full length of both electrodes is in full contact with the targeted tissue during RF activation
- Ensure the Footswitch or button is depressed fully and held down for the entirety of the desired RF energy delivery. To avoid incomplete lesions of ablation of unintended tissues or structures, use care to depress the Footswitch or button only when desired and when the device is placed on target tissue
- Total duration of ablation(s) per lesion not to exceed recommended ablation time. Do not overlap ablations by more than 50% to avoid tissue damage.
- Ensure adequate energy is applied to tissue, ablations are overlapped, and inspect surgical area to visually confirm lesion to avoid non-transmural lesions or undetected, incomplete lesions
- The Coolrail linear pen device is intended for single use only. Do not re-sterilize. Re-sterilization may cause loss of function or injury to patient. It is the responsibility of the user to dispose of this device in accordance with local regulations.

Coolrail Linear Pen Cautions

- The Pen is intended for single use. To prevent re-use, Pen use is tracked by the Generator. The Pen will no longer function after 8 hours of use and the Generator will display a message that the Pen must be replaced.
- The useful life of the device is 24 individual ablations.

- Ensure pump box is filled to capacity through the injection port and then hung on generator handle to avoid error codes.
- The Coolrail linear pen is only compatible with the AtriCure Generator. Use of the Coolrail linear pen with another manufacturer's generator may damage the device and result in patient injury.
- The ablation electrodes are not to be used for pacing, sensing, or stimulation. Use of the ablation electrodes and sensing electrodes simultaneously may produce erroneous data from the auxiliary device.
- Use caution during device insertion and removal
- Do not immerse the Coolrail linear pen or Coolrail pump box in liquids as this may damage the device.
- Do not allow the connectors of the Coolrail linear pen to get wet. Wet connectors may affect the device performance.
- Do not touch the electrodes of the Coolrail linear pen while activating the generator. Touching the Coolrail linear pen electrodes during generator activation could result in an electrical shock or burn to the operator. To avoid shock/burn hazards, always wear the appropriate surgical gloves when using the Coolrail linear pen and generator.
- Do not touch the electrodes of the Coolrail linear pen to metal staples or clips, or to sutures while activating the generator. This may damage the Coolrail linear pen or tissue or result in an incomplete ablation.
- Before activating the generator, inspect the electrodes for debris or foreign matter. Debris or foreign matter on the tip may adversely affect the ablation. Use saline-soaked gauze for cleaning debris. Do not activate the generator while cleaning the device. Do not use abrasive cleaners or electrosurgical tip cleaners to clean debris or foreign matter from the electrodes. Use of abrasive cleaners or electrosurgical tip cleaners can damage the electrodes and result in device failure.

4.3. Other relevant aspects of safety, including a summary of any field safety corrective action (FSCA including FSN) if applicable

In the United States, there was one recall for the MAX1 pen (MAX3 is the EU product code) initiated January 13, 2014 due to an incorrect IFU packaged with the device; this only impacted product in the United States. There was one field safety notice (FSN) on January 20, 2017 to inform users of Atrio-Esophageal Fistula cases that had occurred with the AtriCure Coolrail Linear Pen (MCR1); the FSN was made with the knowledge of the United States Food and Drug Administration.

5. Summary of clinical evaluation and post-market clinical follow-up (PMCF)

This section is intended to summarise, in a comprehensive manner, the clinical evaluation results and the clinical data forming the clinical evidence for the confirmation of conformity with relevant general safety and performance requirements, the evaluation of undesirable side-effects and the acceptability of the benefit-risk ratio. It shall be an objective and balanced summary of the clinical evaluation results of all the available clinical data related to the device in question, whether favourable, unfavourable, and/or inconclusive.

5.1. Summary of clinical data related to equivalent device, if applicable

The conformities of the Isolator Transpolar Pen MAX3 and Isolator Long Pen TT MAX5 were assessed and endorsed by the Notified Body on the basis of equivalency. Clinical data including the clinical trials and published literature, on these Isolator Linear Pens are described in this SSCP, in sections 5.2 and 5.3

5.2. Summary of clinical data from conducted investigations of the device before the CE-Marking, if applicable

Note: MAX1 is the product code in the United States for the MAX3 pen

Identity of the investigation/study	ABLATE; IDE: G070080; clinicaltrials.gov: NCT00560885; Philpott et al. Ann Thorac Surg 2015;100:1541-8.
Identity of the device	Isolator Synergy Clamps (OLL2/OSL2) Ablation and Sensing Unit and Source Switch (ASU2/ASB) Transpolar Pen (optional use, was used in 27.3% [15/55] cases)
Intended use of the device in the investigation	To ablate cardiac tissue for the treatment of patients with non-paroxysmal Atrial Fibrillation who are undergoing open concomitant cardiac surgery
Objectives of the study	The primary objective of the ABLATE study was to demonstrate the safety and efficacy of the AtriCure Radiofrequency Clamps in the treatment of subjects with permanent atrial fibrillation that were undergoing a cardiac surgery procedure primarily for significant structural and/or coronary heart disease indications.
Study design and duration of follow-up	Prospective, non-randomized multi-center clinical trial with Bayesian adaptive design. Follow-up was through discharge, 30-days, 3-months, 6 months, 12 months, 18 months, 2 years, and annually for 5 years
Primary and secondary endpoint(s)	The primary efficacy endpoint was defined as the rate of subjects that achieved successful obliteration of atrial fibrillation while off any antiarrhythmic medication (Class I or III) evaluated at six months post-procedure via Holter monitor assessment (or permanent pacemaker (PPM) interrogation in the case of those subjects that have a pacemaker implanted). The primary safety endpoint for the study was defined as the rate of Major Adverse Events (MAEs) occurring within the initial 30 days post procedure or discharge (whichever was later). The MAEs consist of: death, excessive bleeding (defined as >2 units of red blood cells requiring reoperation), stroke, trans-ischemic attack (TIA) or myocardial infarction (MI).

Inclusion/exclusion criteria for subject selection	Inclusion criteria: • Subject is greater than or equal to 18 years of age. • Subject has history of permanent atrial fibrillation as defined by the ACC/AHA/ESC Guidelines. • Subject is scheduled to undergo elective on-pump cardiac surgical procedure(s) for one or more of the following: Mitral valve repair or replacement; Aortic valve repair or replacement; Tricuspid valve repair or replacement; Coronary Artery Bypass procedures; Atrial Septal Defect Repair; Patent Foramen Ovale closure • Subject's Left Ventricular Ejection Fraction ≥ 30% • Subject is able and willing to provide written informed consent and comply with study requirements • Subject has life expectancy of at least 1 year • Exclusion criteria: Stand alone AF without indication(s) for concomitant CABG, valve surgery, ASD repair, or PFO closure • Previous cardiac ablation including catheter ablation, AV-nodal ablation, or surgical Maze procedure • Wolff-Parkinson-White syndrome • Prior cardiac surgery (Redo) • Class IV NYHA heart failure symptoms • Prior history of cerebrovascular accidents within 6 months or at any time if there is residual neurological deficit • Documented MI within 6 weeks prior to study enrollment • Need for emergent cardiac surgery (i.e. cardiogenic shock) • Known carotid artery stenosis greater than 80% • LA size greater than or equal to 8cm • Current diagnosis of active systemic infection • Severe peripheral arterial occlusive disease defined as claudication with minimal exertion

	• Pregnancy or desire to get pregnant within 12-months of the study enrollment • Preoperative need for an intra-aortic balloon pump or intravenous inotropes • Renal failure requiring dialysis or hepatic failure • Requires anti-arrhythmic drug therapy for the treatment of a ventricular arrhythmia • Therapy resulting in compromised tissue integrity including: thoracic radiation, chemotherapy, long term treatment with oral or injected steroids, or known connective tissue disorders
Number of enrolled patients	55 patients
Study population	N=55 Mean age: 70.5 ± 9.3 years Sex: 58% male; 42% female Left atrium size 5.93 ± 0.97 cm AF duration: 61.2 ± 49.5 months Paroxysmal AF: 7.3% Persistent AF: 27.3% Longstanding Persistent AF: 65.5% LVEF: 50.0 ± 10.3 $CHADS_2$ 0: 18.2%; 1: 27.3%; 2: 54.5%
Summary of study methods	A total of 57 subjects were screened and consented for enrollment in the multi-center, prospective, non-randomized study based on a Bayesian adaptive design to provide high probability of demonstrating non-inferiority of the AtriCure radiofrequency clamps for the treatment of permanent atrial fibrillation. Investigators were required to perform a near-complete CMP-IV lesion set concomitant with an open chest structural heart procedure.
Summary of results	At six months follow-up: • Seventy-four percent (74%) of patients were free of atrial fibrillation and off antiarrhythmic drugs. • Eighty-four percent (84%) of patients were free of atrial fibrillation. Long-term follow-up (median of 48.5 months post-procedure):

	• Sixty-two and a half percent (62.5%) of patients were free of atrial fibrillation and off antiarrhythmic drugs. • Seventy-five percent (75%) of patients were free of atrial fibrillation. Safety: • There were no device-related adverse events in the series. • There were 5 primary safety events within 30 days: 2 deaths; 2 excessive bleeds and 1 stroke
Study Limitations	Ablation at coronary sinus was not mandatory; number of radiofrequency/cryoablation applications was not recorded; relatively small number of patients and deviation from prescribed lesion set resulted in large 95% confidence intervals for several study endpoints
Any device deficiency or device replacements related to safety or performance during the study	In one case, the plug prongs of the initial OLL2 device were inadvertently bent when plugging into the generator; a second device was opened and used for the procedure

Identity of the investigation/study	ABLATE Post-Approval Study (ABLATE-PAS); clinicaltrials.gov NCT01694563; McCarthy et al. J Thorac Cardiovasc Surg. 2022 Aug;164(2):519-527.e4.
Identity of the device	Isolator Synergy Clamps (OLL2/OSL2) Ablation and Sensing Unit and Source Switch (ASU2/ASB) Isolator Transpolar Pen (optional; not used in all cases)
Intended use of the device in the investigation	The AtriCure Synergy Ablation System is intended to ablate cardiac tissue for the treatment of persistent atrial fibrillation (sustained beyond seven days, or lasting less than seven days but necessitating pharmacologic or electrical cardioversion) or longstanding persistent atrial fibrillation (continuous atrial fibrillation of greater than 12 months duration) in patients who are undergoing open concomitant coronary artery bypass grafting and/or valve replacement or repair.
Objectives of the study	The primary objective of this post-approval study was to evaluate clinical outcomes in a cohort of patients treated during commercial use of the AtriCure Synergy Ablation System by

	physicians performing the Maze IV procedure.
Study design and duration of follow-up	This prospective, open label, multi-center, observational, single arm registry was designed to monitor the AtriCure Synergy Ablation System continued safety and efficacy during the peri-procedural and long-term phase during commercial use in patients being treated for non- paroxysmal forms of atrial fibrillation (AF) who were undergoing a concomitant open, on-pump cardiac surgical procedure.
Primary and secondary endpoint(s)	Primary effectiveness: The number of participants free from AF, atrial flutter or atrial tachycardia while off Class I and Class III antiarrhythmic drugs for at least 4 weeks (Time Frame: 36 months post-operatively) Primary safety: The proportion of patients with any serious device or ablation procedure-related adverse events (excluding pacemaker implantation) within 30 days post-procedure or hospital discharge (whichever was later) as adjudicated by a Clinical Events Committee.
Inclusion/exclusion criteria for subject selection	Inclusion: • Age > or equal to 18 years of age • History of non-paroxysmal form of Atrial Fibrillation (AF) as defined by the Heart Rhythm Society/European Heart Rhythm Association/European Cardiac Arrhythmia Society Consensus Statement: o Persistent AF shall be defined as continuous AF that is sustained beyond seven days. Episodes of AF in which a decision is made to electrically or pharmacologically cardiovert the patient after greater than or equal to 48 hours of AF but prior to 7 days, should also be classified as persistent AF episodes. o Longstanding persistent AF shall be defined as

	continuous AF of greater than 12 months duration. The performance of a successful cardioversion (sinus rhythm >30 seconds) within 12 months of an ablation procedure with documented early recurrence of AF with 30 days should not alter the classification of AF as longstanding persistent. • Subject is scheduled to undergo elective open cardiac surgical procedure(s) to be performed on cardiopulmonary bypass for one or more of the following: Coronary Artery Bypass Grafting, Mitral valve repair or replacement, Aortic valve repair or replacement, Tricuspid valve repair or replacement. In conjunction with these procedure patent foramen ovale (PFO) or atrial septal defect (ASD) repair are allowed. • The patient (or their legally authorized representative) agrees to participate in this study by singing the Institutional Review Board (IRB) approved informed consent form. • Willing and able to return for scheduled follow up visits. Exclusion Criteria: • Stand along AF without indication(s) for concomitant cardiac surgery. • Need for emergent cardiac surgery (i.e., cardiogenic shock). • Preoperative need for an intra-aortic balloon pump or intravenous inotropes. • Pregnancy or desire to get pregnant for the duration of the study concomitant surgical procedure through the thirty six (36) month follow up period). • Enrolled in another clinical trial that could confound the results of this study.
Number of enrolled patients	N=365

Study population	N=365 Age (years): 69.8 ± 9.3 Male: 217 (59.5%) Duration of atrial fibrillation (months): 60.0 ± 84.2 Type of atrial fibrillation Paroxysmal: 1 (0.3%) Persistent: 207 (56.7%) Longstanding Persistent: 157 (43%) CHADs Score Risk Category Low Risk: (score=0) 0 Medium Risk: (score=1) 22 (6.1) High Risk: (score>=2) 340 (93.9) Not Assessed: 3 (0.8)
Summary of study methods	Descriptive analyses were provided for patient demographics, clinical device/procedural success, medical histories, and comorbidities. The primary safety hypothesis test was conducted using a 1-sided exact binomial test for proportions at the 0.05 overall level of significance. Serious device and ablation procedure-related AE rates and confidence intervals were summarized at discharge, 30 days, and 1 year with a hypothesis test per-formed on the cumulative 30-day serious device and ablation procedure-related AE rate. The efficacy outcome rate of freedom from AF, off antiarrhythmic drugs along with confidence intervals were summarized at 1, 2, and 3 years (ie,12-, 24-, 36-month follow-ups), with a hypothesis test performed on the3-year success outcome. The primary efficacy hypothesis test was conduct-ed using a 1-sided exact binomial test for proportions at the .05 overall level of significance. Secondary outcomes were summarized for the analysis population and certain subpopulations. Two-sided 95%confidence intervals were calculated for all presented rates. Overall survival since enrollment was estimated using the Kaplan–Meier estimator. Probabilities of stroke, cardioversion, or catheter ablation over time were estimated using the cumulative incidence functions calculated using semi-competing risks methodology.
Summary of results	Primary success rates were as follows: • 12-months: 66.2% (184/278) [95% CI: 60.6%, 71.8%] • 24-months: 64.9% (159/245) [95% CI: 58.9%, 70.9%] • 36-months: 62.9% (146/232) [p-value<0.0001; 95% CI: 56.7%,

	69.2%] The primary safety event rate was 1.1% (4/365) [p-value<0.0001; 95% CI: 0.3%, 2.8%]. The events reported included cardiac arrest, ventricular tachycardia, blood loss requiring transfusion, and pulmonary vein tear. • There were no device malfunctions or complications from the device. • There were no deaths attributable to the AtriCure Synergy Ablation System or the ablation procedure.
Study Limitations	Episodes of paroxysmal AF may have been missed; the decision to use anti-arrhythmic medications and oral anticoagulation was not mandated by the protocol. Surgeon preference directed the fashion in which the clamp was applied and number of applications.
Any device deficiency or device replacements related to safety or performance during the study	There were no device malfunctions.

Identity of the investigation/study	Feasibility Trial of a Staged Epicardial & Endocardial Approach for Treatment of Patients With Persistent or Long Standing Persistent Atrial Fibrillation With Radiofrequency Ablation (Staged DEEP); clinicaltrials.gov NCT01661205
Identity of the device	Isolator Synergy Clamps (EMR2, EML2, EMT) and Glidepath Tapes Ablation and Sensing Unit and Source Switch (ASU2/ASB) AtriCure Isolator Pens MAX1, MAX5, MCR1, MLP1 Dissector MID1 AtriCure AtriClip: LAA0, PRO1, CGG100 (Selection Guide)
Intended use of the device in the investigation	Cardiac ablation for persistent or longstanding persistent AF
Objectives of the study	To assess the safety and technical feasibility of treating subjects with persistent or longstanding persistent atrial fibrillation using a minimally invasive thoracoscopic ablation procedure utilizing the AtriCure Bipolar System.
Study design and duration of follow-up	Feasibility, open label, single arm
Primary and secondary endpoint(s)	The primary safety endpoint was a composite of the following adjudicated endpoint events that met the definition of a serious adverse event, and are attributed to any of the following:

	• AtriCure Bipolar System investigational devices; or • Epicardial surgical procedure; or • Endocardial procedure. These events must occur in the first 30 days post-index endocardial EP procedure or hospital discharge, whichever is longer (unless otherwise noted). Serious adverse events included: death (all-cause mortality); myocardial Infarction, stroke or TIA; excess bleeding, intra-procedure: conversion to sternotomy or cardiopulmonary bypass to control bleeding, post-operative excessive bleeding (≥ 2 units blood transfused in a 24 hour period, or reoperation to control bleed, in the first 7 days post-index surgical procedure); pulmonary vein stenosis (from the time of index surgical procedure through 12 month follow-up); atrio-esophageal fistula (from the time of index surgical procedure through 12 month follow-up); phrenic nerve paralysis; pericardial effusion requiring drainage or causing tamponade, vascular access complications including development of a hematoma, an arteriovenous fistula, or pseudoaneurysm that required surgical intervention or transfusion, prolonged hospital stay, or required hospital admission; injury to the specialized conduction system requiring permanent pacemaker implantation; and/or mediastinitis. The primary efficacy endpoint was absence of AF at 12- month follow-up assessment, based on continuous 14-day ECG monitoring (e.g., Holter, ILR, Zio Patch
Inclusion/exclusion criteria for subject selection	Inclusion Criteria: • Age > 18 year • Patients with symptomatic persistent or longstanding persistent AF refractory to a minimum of one Class I or III antiarrhythmic drug (AAD) • Patients with failed catheter ablation attempts are eligible if the patients are symptomatic with persistent or longstanding persistent AF. (catheter ablation procedure must be more than 3 months prior to index procedure) • Life expectancy of at least two years

	• Patient will and able to provide informed consent • Patient is willing and able to attend the scheduled follow-up visits Exclusion Criteria: • Prior Cardiothoracic Surgery • Patient has NYHA (New York Heart Association) Class IV heart failure • Evidence of underlying structural heart disease requiring surgical treatment • Surgical procedure within the 30 days prior to the index procedure • Ejection fraction < 30% • Measured left atrial diameter > 6.0 cm • Renal Failure • Stroke within previous 6 months • Known carotid artery stenosis greater than 80% • Evidence of significant active infection or endocarditis • Pregnant woman or women desiring to become pregnant in the next 24 months • Presence of thrombus in the left atrium determined by echocardiograph • History of blood dyscrasia • Contraindication to anticoagulation, based on Investigator's opinion • Mural thrombus or tumor • Moderate to Severe COPD
Number of enrolled patients	31 (26 treated)
Study population	Mean age : 61.7±9.5 years Male: 21 (80.8%) BMI: 30.8±3.9
Summary of study methods	The first subject was enrolled and treated in the Staged DEEP AF clinical study on September 11, 2012. In total, thirty-one (31) subjects were enrolled. Thirty (30) subjects signed thirty-one (31) consents from six (6) sites. All subjects treated in the Staged DEEP clinical study completed a 30-day follow-up visit and were followed through 24 months post index endocardial

	EP procedure, as outlined in the clinical protocol.
Summary of results	Primary adverse events occurred in 12% (3/25) of subjects. All three were adjudicated to be related to the epicardial procedure. • Death: one (1) subject at 35 days post-procedure • Phrenic nerve paralysis: two (2) subjects Primary efficacy: Primary efficacy was 78.3% (18/23 subjects).
Study Limitations	Feasibility study, small sample size
Any device deficiency or device replacements related to safety or performance during the study	Four device observations/malfunctions associated with the Coolrail linear pen (MCR1) were reported. • Two (2) Coolrail linear pens (MCR1) and two (2) AtriClips were observed to be contaminated or damaged during or prior to the procedure. • Mechanical breakage during the epicardial surgical procedure was reported for 2 additional Coolrail linear pens (MCR1). • In all instances an additional device was used. • No adverse event resulted from any of the observations

Identity of the investigation/study	Feasibility Trial of a Hybrid Approach for Treatment of Patients With Persistent or Longstanding Persistent Atrial Fibrillation With Radiofrequency Ablation (NCT01246466)
Identity of the device	AtriCure Synergy Ablation System: ASU2, ASB3, Isolator Synergy Clamps (EML2, EMR2, EMT1) and Glidepath Tape AtriCure Isolator Pens: MCR1, MAX3/MAX5, MLP1 Dissector MID1 AtriClip PRO1
Intended use of the device in the investigation	Cardiac ablation for persistent and longstanding persistent AF
Objectives of the study	The objective of the study was to assess the safety and technical feasibility of treating subjects with persistent atrial fibrillation or longstanding persistent atrial fibrillation procedure in a minimally invasive thoracoscopic ablation procedure utilizing the AtriCure Bipolar System, with

	mapping and optimization of lesions provided by currently approved catheter technology.
Study design and duration of follow-up	Prospective, multi-center, single arm, feasibility
Primary and secondary endpoint(s)	The primary endpoint for safety was a composite of adjudicated endpoints (e.g., adverse events) occurring within the first 30 days post-procedure or discharge (whichever is longer, unless otherwise noted). These events included death, major bleeding, stroke, transient ischemic attack, myocardial infarction, cardiac tamponade, pulmonary embolism, peripheral embolism, atrioesophageal fistula, diaphragmatic paralysis, pulmonary vein stenosis, serious skin burns, 2nd/3rd degree atrial-ventricular block requiring permanent pacemaker implantation, skin burns occurring within 48 hours after the procedure, emergency conversion to thoracotomy or sternotomy, and serious adverse events related to the catheter and/or the surgical procedure. The primary outcome for determining efficacy was absence of atrial fibrillation (AF) at twelve-month follow-up based on the 14-day auto trigger event monitor i.e., no episodes of AF, atrial flutter, or atrial tachycardia lasting > 30 continuous seconds, while off all Class I and III antiarrhythmic therapy for at least 4 weeks (except amiodarone which must be 12 weeks), prior to assessment.
Inclusion/exclusion criteria for subject selection	Inclusion Criteria: • Age > 18 years • Patients with symptomatic (e.g. palpitations, shortness of breath, fatigue) persistent or longstanding persistent AF Persistent • Patient is willing and able to provide written informed consent. • Patient has a life expectancy of at least 2 years. • Patient is willing and able to attend the scheduled follow-up visits. Exclusion Criteria:

	• Prior Cardiothoracic Surgery. • Patient has NYHA Class IV heart failure. • Evidence of underlying structural heart disease requiring surgical treatment. • Ejection fraction < 30% • Measured left atrial diameter > 6.0 cm • Renal Failure • Stroke within previous 6 months. • Known carotid artery stenosis greater than 80%. • Evidence of significant active infection or endocarditis. • Pregnant woman or women desiring to become pregnant in the next 24 months. • Presence of thrombus in the left atrium determined by echocardiography. • History of blood dyscrasia. • Contraindication to anticoagulation, based on Investigator's opinion. • Mural thrombus or tumor. • Moderate to Severe COPD
Number of enrolled patients	N=24
Study population	Age: 60.1±8.4 years Male: 22 (91.7%) BMI: 30.4±4.2
Summary of study methods	Subjects were followed through twenty-four (24) months with the primary efficacy endpoint evaluated at twelve (12) months.
Summary of results	Primary safety events (adverse event within 30 days post-procedure) occurred in 29.2% (7/24) of the subjects. 12.5% (3/24) were related to the catheter and its procedure. • Conversion to median sternotomy (1/24) • Stroke 20.8% (5/24) were related to the surgical procedure. • Bleeding during the epicardial procedure (1/24): conversion to mini-thoracotomy. • Stroke resulting in death on day 27 • Two subjects had infection at the port site; both were treated with antibiotics. • Vocal cord paralysis occurred in

	one subject Note: One patient experienced a myocardial infarction that was adjudicated to be due to both the endocardial catheter procedure and the epicardial ablation procedure. The primary efficacy endpoint was achieved in 68.4% (13/19) [95% CI 43.4, 87.4].
Study Limitations	Feasibility study, single arm, small sample size
Any device deficiency or device replacements related to safety or performance during the study	Device observations/malfunctions were observed in six (6) subjects: • Isolator Synergy Clamp (EML2) (n=1) - The Glidepath Tape (connection separated from the tip of the clamp jaw. A second EML2 device was used to complete the procedure without incident. • Isolator Transpolar Pen (n=1) - A 60 cycle (e.g., 60 Hertz) interference was noted and thought to be caused by a faulty pen. Use of the device with the associated observation was discontinued and replaced with an additional study device Isolator Transpolar Pen, which was used to complete the procedure without incident. • Coolrail Linear Pen (n=4): • Overheating (n=2) - Use of this device was discontinued and replaced with a commercially available Coolrail Linear Pen, which was used to successfully complete the procedure. • In one patient, a competitive device was used as a backup research device was not available. • In one patient, another Coolrail device from the investigational device inventory was used to complete the procedure without incident. • Mechanical breakage (n=2) – In both cases, the devices were replaced with another Coolrail Linear Pen from the investigational device inventory. • Note: None of these device observations/malfunctions was

	associated with an adverse event. Despite the temporary interruption of the procedure in these cases mentioned above, ablation of the specified lesion set was completed.

Identity of the investigation/study	Combined Endoscopic Epicardial and Percutaneous Endocardial Ablation Versus Repeated Catheter Ablation in Persistent and Longstanding Persistent Atrial Fibrillation (CEASE-AF) (NCT02695277)
Identity of the device	AtriCure Bipolar System (MAX5, ASU, ASB, GPT200, MID1, EMR2, EML2) AtriClip PRO LAA Exclusion System (PRO1/PRO2) and CGG100 (Selection Guide)
Intended use of the device in the investigation	Cardiac ablation
Objectives of the study	The objective of this study is to compare the efficacy and safety of two interventional approaches in preventing the recurrence of AF in symptomatic, drug-refractory patients with persistent or longstanding persistent atrial fibrillation.
Study design and duration of follow-up	The prospective 2:1 randomized study is designed to compare the effects of combined epicardial endoscopic surgical and endocardial catheter techniques versus standard endocardial catheter ablation strategies with regard to safety, efficacy, and quality of life. Effects on health economics of the two treatment strategies will also be evaluated. Duration of follow-up is 36 months.
Primary and secondary endpoint(s)	Primary effectiveness: • Number of subjects free from documented Atrial Fibrillation (AF), Atrial Flutter (AFL) or Atrial Tachycardia (AT) episodes >30 seconds in duration through 12-months follow-up, in the absence of Class I or III Antiarrhythmic Drugs (AADs). Secondary effectiveness: • Number of subjects free from documented AF, AFL or AT episodes > 30 seconds in duration through 24- and 36-months follow-up, in the absence of Class I or III AADs. [Time Frame: Through 24- and 36-months post the Endocardial procedure (Hybrid Procedure) or last allowed

	Catheter Ablation (Catheter Procedure)] Safety: Composite major complications and adverse events will be analyzed during follow-up, comparing cumulative complication rates occurring during the repeated procedures in the two study arms. Adverse events may include the following: death, stroke, transient ischemic attack, myocardial infarction in the context of AF Ablation, pericarditis, bleeding, wound infection, atrio-esophageal fistula, esophageal injury, permanent phrenic nerve paralysis, permanent pacemaker, pulmonary vein (PV) stenosis of >70%, cardiac tamponade/cardiac perforation, empyema, superficial wound infections or vascular access complications, pneumonia, and pneumothorax requiring intervention.
Inclusion/exclusion criteria for subject selection	Inclusion criteria: • Patient has a history of symptomatic Persistent AF and a left atrium (LA) > 4cm or Long Standing Persistent AF as defined by the HRS/EHRA/ECAS expert consensus statement • Patient is refractory to or intolerant of at least one antiarrhythmic drug (class I or III) • Patient is mentally able and willing to give informed consent Exclusion criteria: • Patient has longstanding persistent AF > 10 years • Patient presenting with paroxysmal AF • Patient with persistent AF and a LA-diameter ≤ 4cm • AF is secondary to electrolyte imbalance, thyroid disease, or other reversible or non-cardiovascular cause • Patient underwent previous ablation procedure or heart surgery • Patient needs other cardiac surgery procedures besides AF treatment (valve, coronary, others) • Contraindication for either catheter ablation or epicardial surgery (including, but not limited to: previous thoracic radiation, previous

	perimyocarditis, Previous cardiac tamponade, Pleural adhesions, Prior thoracotomy) • Body mass index > 35 • LA Diameter > 6 cm • Left ventricular ejection fraction < 30 % • Severe mitral regurgitation (>II) • Patient unable to undergo TransEsophageal Echocardiogram (TEE) • Presence of LA thrombus by TEE, CT scan, MRI or angiography • History of cerebrovascular disease, including stroke or transient ischemic attack (TIA) within 6 months prior to enrollment • Active infection or sepsis • Other clinical conditions precluding inclusion (e.g., organ disease, disturbances of hemostasis) • Contraindication to anticoagulant therapy, or inability to comply with anticoagulant therapy • Pregnancy, planned pregnancy or breastfeeding • Life expectancy is less than 12 months • Patient is involved in another study involving an investigational drug or device
Number of enrolled patients	N=170
Study population	N=154
Summary of study methods	From November 2015 to May 2020, 170 patients from 9 centers in Czechia (Czech Republic), Germany, the Netherlands, Poland, and the United Kingdom were enrolled and randomized 2:1 to Hybrid Ablation (N=114) or repeat Catheter Ablation (N=56). Of enrolled patients, 152 were treated with the index procedure (intention to treat, ITT, population). The modified ITT population consistent of 146 patients had at least one follow-up visit after T0 (6-months post index procedure).
Summary of results	Primary effectiveness (N=146 patients, n=95 Hybrid Ablation; n=51 Catheter Ablation) • Freedom from AF/AFL/AT in the absence of Class I/III AADs except

	those not exceeding previously failed doses through 12-months visit post-T0 was 71.6% (68/95) in the Hybrid Ablation arm versus 39.2% (20/51) in the repeat Catheter Ablation arm (absolute benefit increase 32.4%, p<0.001) • Persistent AF/enlarged left atrium subgroup: Freedom from AF/AFL/AT in the absence of Class I/III AADs except those not exceeding previously failed doses through 12-months visit post-T0 was 72.7% (56/77) in the Hybrid Ablation arm versus 41.9% (18/43) in the repeat Catheter Ablation arm (absolute benefit increase 30.9%, p<0.001). • Longstanding persistent AF subgroup: Freedom from AF/AFL/AT in the absence of Class I/III AADs except those not exceeding previously failed doses through 12-months visit post-T0 was 66.7% (12/18) in the Hybrid Ablation arm versus 25.0% (2/8) in the repeat Catheter Ablation arm (absolute benefit increase 41.7%, p=0.090). • Safety (N=154): Composite major complication rates through 30-days post-index and second stage/repeat endocardial catheter ablation were 7.8% (8/102) in the Hybrid Ablation arm and 5.8% (3/52) in the Catheter Ablation arm (n=0.751); Composite major complication rates through 1-year post index procedure were 8.8% (9/102) and 5.8% (3/52) (p=0.752). No device-related complications occurred per Clinical Events Committee adjudication
Study Limitations	• Minimal lesion sets were required in each arm, but additional epicardial or endocardial lesions could be made per institutional practice or physician discretion
Any device deficiency or device replacements related to safety or performance during the study	There was one (1) generator malfunction, which did not result in any adverse event or adverse outcome. The patient was treated by an alternative method and exited from the study protocol following the procedure.

Additional clinical study data outside of these manufacturer-sponsored clinical trials was identified through systematic literature searches as part of the Clinical Evaluations. This

data is summarised in section 5.3.

5.3. Summary of clinical data from other sources, if applicable

Based on a comprehensive, systematic literature search performed as part of the Clinical Evaluation for the subject devices, more than 15 published literature studies specifically describe the safety and/or performance of the AtriCure Pens in cardiac ablation procedures in patients with atrial fibrillation[2-17]. Based on published clinical data, the pooled incidence of major adverse events related to the device or procedure was <9% in >1500 patients with AF. For performance, restoration of sinus rhythm/freedom from atrial arrhythmias was >75% in >1000 patients.

5.4. An overall summary of the clinical performance and safety

The clinical benefits of the AtriCure Pens are return to normal sinus rhythm (i.e., freedom from atrial arrhythmia), reduce arrhythmia symptoms, and improve quality of life. Based on the totality of clinical data from published literature and clinical trials as well as equivalency (where applicable), the AtriCure Pens met the safety and performance objectives defined in the Clinical Evaluation. The overall rate of MAEs within 30 days met the safety objective of <19%. The overall freedom from AF/AFL/AT or normal sinus rhythm rates were >55% (performance objective) after cardiac ablation procedures with the AtriCure Pens in surgical ablation procedures, including hybrid procedures.

5.5. Ongoing or planned post-market clinical follow-up

The ongoing clinical trials CEASE-AF (mid- and long-term follow-up), DEEP Pivotal, and HEAL-IST will provide post-market clinical follow-up data for the AtriCure Isolator and Coolrail Pens, as well as the TRAC-AF registry. The information generated from these studies and registry and AtriCure's post-market surveillance program will be used to monitor and identify residual risks from use of the devices or performance-related impacts to the benefit-risk ratio.

6. Possible diagnostic or therapeutic alternatives

Atrial fibrillation

Rhythm control can be pursued pharmacologically among some patients with AF. The 2020 ESC Guidelines recommend amiodarone for long-term rhythm control in all AF patients, but urge trying other AADs first due to the extracardiac toxicity[18]. These guidelines also recommend rhythm control be pursued by AF catheter ablation for pulmonary vein isolation after one failed or intolerant class I or class III anti-arrhythmic drug in patients with paroxysmal AF or persistent AF with or without major risk factors for AF recurrence ("Catheter or surgical ablation should be considered in patients with symptomatic persistent or long-standing persistent AF refractory to AAD therapy to improve symptoms")[18]. Although antiarrhythmic drugs are useful, the Journal of American College of Cardiology described AF ablation as the primary therapeutic strategy in their 2020 Council Perspective paper[19]. A variety of ablative procedures have been investigated as potentially curative approaches, or as modifiers of the arrhythmia such that drug therapy becomes more effective. Further, ablation may be a suitable treatment option in patients for whom AAD treatment has not been successful or is not well tolerated.

Ablative approaches focus on interruption of the electrical pathways that contribute to atrial fibrillation, through modifying the triggers of atrial fibrillation and/or the myocardial substrate

that maintains the aberrant rhythm. The most common types of energy for ablation include radiofrequency, high-intensity ultrasound, laser, cryoenergy, and microwave. These energy sources ablate the cardiac tissue by scarring and creating lesion sets which disrupt the electrical signals. Among the various energy sources, RF and cryothermal energy are the most applied to ablate cardiac tissue[19]. Various RF ablation devices are on the market, and several also have cardiac electrophysiology diagnostic capabilities; these devices enable the physician to monitor (e.g., sensing, pacing, and recording) the success of the lesions in real-time[20]. Surgical ablation can be performed as either part of an open-heart surgery with a concomitant cardiac procedure or as a standalone thoracoscopic procedure. Both types of procedures have been assessed for safety and performance outcomes in clinical trials, some of which are reviewed in this SSCP. The frequency of surgical ablation performance and durable rhythm success, as a primary or stand-alone procedure, has steadily increased. Current guidelines from multiple physician societies have evaluated the use of surgical ablation to treat AF[1, 18, 20, 21].

Inappropriate Sinus Tachycardia

Currently, there is no FDA approved therapy for the treatment of IST. According to the 2015 Heart Rhythm Society (HRS) Expert Consensus Statement, evidence-based treatment options for IST are limited and there is no standard of care therapy for this debilitating disease[22].

Drug treatments such as beta blockers or calcium channel blockers are generally chosen as the first line of treatment but have not proven effective. Ivabradine, an inhibitor of the hyperpolarizing sodium current, is a more recent drug that has exhibited better results. Data has suggested that a combination of ivabradine and metoprolol might be safe and effective or Ivabradine may also provide benefits when added to a beta-blocker therapy.
RF catheter ablation involving sinus node (SN) ablation has been a potential alternative in patients with IST refractory to medical therapy. Often, the symptoms worsen or necessitate a permanent pacemaker. Other complications include phrenic nerve damage or transient superior vena cava syndrome. It is generally felt that the risks involved outweigh the benefit of this treatment.

Because of the complex psychosocial relationship to IST, treatment often involves a multi-disciplinary approach. Managing the heart rate does not always relieve the distress the patient has been experiencing. Other treatment options have included, erythropoietin, fludrocortisone, volume expansion, compression garments, phenobarbital, clonidine, psychiatric evaluation, and exercise training.

7. Suggested profile and training for users

The intended users for the AtriCure Pens are licensed medical doctors who perform cardiac and/or thoracic surgical procedures. AtriCure offers additional comprehensive education and training on the use of the AtriCure Pens for cardiac ablation as per the device instructions for use. This may include didactic review with an experienced operator and optional simulator/cadaver lab.

8. Reference to any harmonized standards and CS applied

Standard	Compliance – Full, Partial, or No	Justification if Partial or No

BS EN ISO 13485: 2016 + A11 2021 Medical devices — Quality management systems – Requirements for regulatory purposes	Full	N/A
BS EN ISO 14971:2019+A11:2021 Medical devices - Application of Risk Management to Medical Devices	Full	N/A
BS EN ISO 14155: 2020 Clinical investigation of medical devices for human subjects - Good clinical practice	Full	N/A
BS EN IEC 62366-1: 2015 + A1 2020 Medical devices - Application of usability engineering to medical devices	Full	N/A
BS EN 60601-1: 2006+A2:2021 Medical electrical equipment Part 1: General requirements for basic safety and essential performance	Full	N/A
BS EN 60601-1-2: 2015+A1:2021 Medical electrical equipment Part 1-2: General requirements for basic safety and essential performance — Collateral Standard: Electromagnetic disturbances — Requirements and tests	Full	N/A
BS EN IEC 60601-1-6: 2010+A2:2021 Medical electrical equipment: Part 1-6: General requirements for basic safety and essential performance — Collateral standard: Usability	Full	N/A
BS EN 60601-2-2: 2018 Medical electrical equipment Part 2-2: Particular requirements for the basic safety and essential performance of high frequency surgical equipment and high frequency surgical accessories	Full	N/A
BS EN ISO 10993-1:2020 Biological evaluation of medical devices – Part 1: Evaluation and testing	Full	N/A
BS EN ISO 10993-4: 2017 Biological evaluation of medical devices – Part 4: interactions with Blood	Full	N/A
BS EN ISO 10993-5: 2009 Biological evaluation of medical devices – Part 5: Cytotoxicity	Full	N/A
BS EN ISO 10993-7: 2008 Biological evaluation of medical devices –Part 7 EO Residuals	Full	N/A
BS EN ISO 10993-10: 2013 Biological evaluation of medical devices – Part 10: Skin irritation/sensitization	Full	N/A
BS EN ISO 10993-11: 2018 Biological evaluation of medical devices – Part 11: Test for systemic toxicity	Full	N/A
BS EN ISO 10993-12: 2021 Biological evaluation of medical devices – Part 12: Sample Prep	Full	N/A
BS EN ISO 10993-18: 2020 Biological evaluation of medical devices – Chemical characterization	Full	N/A
BS EN ISO 10993-23 2021 Biological evaluation of medical devices — Part 23: Tests for irritation	Full	N/A
ISTA 3A: 2018 Performance testing of Shipping Containers and Systems	Full	N/A
BS EN ISO 11135:2014:+A1 2019 Sterilization of health-care products -Ethylene Oxide	Full	N/A
AAMI TIR28: Product adoption and process equivalency for Ethylene Oxide sterilization	Full	N/A
BS EN ISO 11607-1: 2020+A11:2022: Packaging for terminally sterilized medical devices – Part 1:	Full	N/A

Requirements for materials, sterile barrier Systems, and packaging Systems		
BS EN ISO 11607-2:2020+A11: 2022: Packaging for terminally sterilized medical devices – Part 2: Validation requirements for forming, sealing and assembly processes	Full	N/A
ASTM F1929-15: 2015 Standard Test Method for Detecting Seal Leaks in Porous Medical Packaging by Dye Penetration	Full	N/A
ASTM F1980: 2021 Standard Guide for Accelerated Aging of Sterile Barrier Systems for Medical Devices	Full	N/A
ASTM F88/F88M-21: 2021 Standard Test Method for Seal Strength of Flexible Barrier Materials	Full	N/A
BS EN ISO 15223-1: 2021 Medical devices – Symbols to be used with medical device labels, labelling and information to be supplied – Part 1: General requirements	Full	N/A
BS EN ISO 20417:2021 Medical Devices – Information to be supplied by the manufacturer	Full	N/A
EN IEC 63000: 2018 Technical documentation for the assessment for electrical and electronic products for the restriction of hazardous substances	Full	N/A
EN ISO 14644-1: 2015 Cleanrooms and Associated Controlled Environments – Classification	Full	N/A
EN ISO 14644-2: 2015 Cleanrooms and Associated Controlled Environments – Monitoring	Full	N/A
BS EN ISO 11737-1 2018/A1:2021 Sterilization of health care products. Microbiological methods	Full	N/A
BS EN ISO 11737-2: 2020 Sterilization of health care products. Microbiological methods	Full	N/A
N/A – not applicable		

9. Revision history

SSCP Revision Number	Date Issued	Change Description	Validated by Notified Body (Yes or No)	Validation Language
A	See AtriCure MasterControl CEM-279.A for release date	Initial Release	No	English
B	24 September 2024	- Update to align warnings and cautions to IFUs and to change validation status. Translations to be attached on Rev C.	Yes	English
C	See AtriCure MasterControl CEM-279.C for release date	- Revised to CEM-279.C to attach translations files. Cover page date reflects Rev B approval date.	Yes	English

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