PROFESSIONALS in CARDIAC SCIENCES AUSTRALIA Inc.

Cardiac Implantable Electronic Devices (CIED) Competency

Acknowledgements

Professionals in Cardiac Sciences Australia (PiCSA) acknowledges with gratitude the contributions of the individual board members and working group participants who provided expert input during the development of this competency standards document.

Their collective expertise, professional insight, and commitment to advancing the standards of practice for Cardiac Device Physiologists have been integral to this work. Their contributions reflect a nation-wide, shared commitment to excellence in cardiac care and to the ongoing development of a skilled, competent, and recognised clinical workforce.

A full list of these contributors is included in Appendix 2 – Document Contributors.

PiCSA welcomes ongoing feedback to ensure the document remains relevant, evidence-based, and reflective of best practice across diverse clinical settings.

Revision History

Version	Date	Pages Revised/Brief explanation
V1	August 2025	

Correspondence

secretary@picsa.org.au

PROFESSIONALS in CARDIAC SCIENCES AUSTRALIA Inc.
PiCSA

Contents

Abbreviations

ACCP – Australian Council for Clinical Physiologists

ADL – Activities of Daily Living

AF – Atrial Fibrillation

AHP – Allied Health Professional

AP – Anteroposterior (X-ray view)

AT – Atrial Tachycardia

ATP – Anti-Tachycardia Pacing

AV – Atrioventricular

CCDS – Certified Cardiac Device Specialist

CIED – Cardiac Implantable Electronic Device

CLS – Closed Loop Stimulation

CPD – Continuing Professional Development

CRT – Cardiac Resynchronisation Therapy

CSANZ – Cardiac Society of Australia and New Zealand

CSP – Conduction System Pacing

DF-1 / DF-4 – International standard defibrillator lead connector types

DFT – Defibrillation Threshold

ECG – Electrocardiogram

EGM – (Internal) Electrogram

EMI – Electromagnetic Interference

EMR – Electronic Medical Record

EOL– End of Life

EOS – End of Service

ERI – Elective Replacement Indicator

EV-ICD – Extravascular Implantable Cardioverter-Defibrillator

HBP – His Bundle Pacing

IBHRE – International Board of Heart Rhythm Examiners

ICD – Implantable Cardioverter-Defibrillator

IEAPs – Industry-Employed Allied Professionals

ILR – Implantable Loop Recorder

IS-1 / IS-4 – International standard pacing lead connector types

LBB – Left Bundle Branch

LBBAP – Left Bundle Branch Area Pacing

LV – Left Ventricle / Left Ventricular

LVAT – Left Ventricular Activation Time

MRI – Magnetic Resonance Imaging

NSQHS – National Safety and Quality Health Service

PMT – Pacemaker Mediated Tachycardia

PPM – Permanent Pacemaker

PVAB – Post-Ventricular Atrial Blanking

PVARP – Post-Ventricular Atrial Refractory Period

QRS – QRS Complex *(portion of ECG representing ventricular depolarisation)*

RA – Right Atrium / Right Atrial

RF – Radiofrequency

RM – Remote Monitoring

RNRVAS – Repetitive Non-Reentrant Ventriculoatrial Synchrony

RV – Right Ventricle / Right Ventricular

RWPT – R-wave Peak Time

S-ICD – Subcutaneous Implantable Cardioverter Defibrillator

TGA – Therapeutic Goods Administration

TWOS – T-wave Oversensing

VF – Ventricular Fibrillation

VT – Ventricular Tachycardia

VV delay – Interventricular Delay

Outcome Statement

This competency document outlines the specific skills, knowledge, and behaviours required of Cardiac Physiologists working with Cardiac Implantable Electronic Devices (CIEDs) in Australia. It serves as a comprehensive tool for assessing proficiency, guiding professional growth, and ensuring quality patient care.

For trainees who cannot access a formal CIED course*, the document facilitates the gradual progression from foundational skills to advanced competencies through supervised workplace training. This process typically spans at least 18-24 months**, depending on the trainee's background, aptitude, and training environment. Supervisors should use discussion and feedback to evaluate individual progress and initiate formal competency assessments based on this document.

For existing services with experienced Cardiac Device Physiologists, the CIED competency document is a tool for workplace induction and ongoing professional development.

The **CIED competency document** is designed to:

- **Support Quality Care:** Ensure all Cardiac Device Physiologists meet high standards of patient care and safety.
- **Benchmark Performance:** Establish clear criteria for evaluating competency during training, workplace induction, and professional reviews.
- **Promote Professional Growth:** Highlight areas requiring further training and development to support continuous learning.
- **Supplement Certification:** Address limitations of existing certifications, such as the lack of on-site assessment or logbook requirements, while aligning with recognised post-graduate qualifications.
- **Support relevant position statements:** Translate national and international position statements into practice (see table 1).

Table 1 General requirements for cardiac device interrogation programming and testing.

Cardiac Device	Interrogation, Programming and Testing
ILR	• Evaluation of wound site for in-person checks • Battery status • Evaluation of recorded episodes, data and trends in context of reported symptoms and clinical presentation • Evaluation and optimisation of all programmed parameters (including assessment of criteria used for automatic events e.g., bradycardia/tachycardia intervals and pauses, AF) • Creation of a detailed report to be sent to managing physician. • Storage of all relevant data
PPM	• As per ILR above with the following additional checks • Assessment of presenting and underlying rhythms • Evaluation of lead integrity, including pacing and sensing thresholds and lead impedances • Assessment and optimisation of chronotropic "rate" response
ICD/S-ICD	• As per ILR and PPM above with the following additional checks • Morphology template if applicable • Review tachycardia therapy settings and events
Conduction System Pacing and CRT	• As per ILR, PPM and ICD above • Additionally, these devices usually require greater input with more complex programming. Reviews often involve extended clinical evaluation, utilising additional resources e.g., 12-lead ECG

Abbreviations: ILR, implantable loop recorders; PPM, permanent pacemaker; ICD, implantable cardioverter-defibrillators; S-ICD, subcutaneous implantable cardioverter-defibrillators; ECG, electrocardiogram; AF, atrial fibrillation; CRT, cardiac resynchronisation therapy.

Reproduced with permission. Leitch J, et al. Cardiac Society of Australia and New Zealand (CSANZ) Position Statement on the follow-up of cardiovascular implantable electronic devices 2022. Heart Lung Circ. 2022;31(8):1054-1063

* Students enrolled in an approved CIED course may follow that course's assessment protocols instead of the CIED competency standards during their enrolment.
** Training durations may vary and are based on the assumption of a vocational foundation in ECG before starting CIED training.

This document is not a replacement for formal certification or training programs, however, it provides a robust framework for designing and evaluating educational pathways. PiCSA strongly recommends that all Cardiac Device Physiologists complete a recognised postgraduate qualification/certification in CIEDs, as outlined in the Australian Guidelines for Entry and Practice in the Field of Cardiac Physiology (available at https://picsa.org.au/about/#core-documents).

Competency signoff may occur in stages to reflect individual progress and centre-specific practices. PiCSA suggests a sequential approach to completing competencies, gradually introducing each component to support trainees and prevent them from feeling overwhelmed.

Available technologies and care models vary across centres, influencing the relevance of certain competencies in different settings. If a competency falls outside a centre's scope of practice, assessors should mark it as N/A (not applicable).

Competency assessors: Assessors should have at least 3 years' post-certification experience in CIEDs. Certification refers to a recognised credential in cardiac devices—such as CCDS (IBHRE) or an equivalent certification or postgraduate qualification recognised under the *Australian Guidelines for Entry and Practice in the Field of Cardiac Physiology*.

Clarification Regarding Relevance of this Document to Industry Employed Cardiac Device Physiologists (Company Representatives): In accordance with international consensus statements, PiCSA recognises that industry-employed allied professionals (IEAPs) play an essential technical support role in the safe and effective use of cardiac implantable electronic devices (CIEDs). While the knowledge base and recognised credentialling examinations (e.g. IBHRE) are much the same for both industry and non-industry professionals, the roles and responsibilities differ*.

- This competency standards document is primarily designed to support those who are in a non-industry role.
- Education and training provided by device manufacturers is highly valued and forms an important part of multidisciplinary learning, however it does not substitute for credentialling, supervision, and assessment of clinical competency.
- IEAPs are welcome to use the document to inform their own development and to strengthen collaboration with non-industry colleagues.
- This document may also assist skilled individuals transitioning between industry and non-industry roles (or vice versa) by providing a clear framework for recognising and developing relevant competencies in the new workplace.

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* Wilkoff BL, et. al. *HRS/EHRA Expert Consensus on the Monitoring of Cardiovascular Implantable Electronic Devices (CIEDs): description of techniques, indications, personnel, frequency and ethical considerations*. Europace. 2008 Jun;10(6):707-25. doi: 10.1093/europace/eun122. Epub 2008 May 14. PMID: 18480075

* Haines DE, et al. *Heart Rhythm Society Policy Statement Update: Recommendations on the role of industry-employed allied professionals*. Heart Rhythm. 2023 Jan;20(1):157-162. doi: 10.1016/j.hrthm.2022.08.029. Epub 2022 Oct 28. PMID: 37264874.

Evaluation Method Abbreviations

Observation (O):	Facilitator watches the participant perform a task.
Return Demonstration (RD):	Participant repeats a demonstrated task to confirm understanding.
Written Test (T):	Knowledge is assessed through written responses.
Verbal Review (V):	Understanding is checked through spoken discussion.

Competency Terms

Expert/Mentor (E):	Acts as a resource to others. Demonstrates deep understanding and consistently applies advanced reasoning. May teach or assess others in this skill.
Independent (I):	The individual performs the task consistently, safely, and independently in a variety of settings. Minimal guidance required. Meets competency standards.
Supervised (S):	The individual demonstrates some understanding of this procedure or concept. Prompting was required. Some errors were noted and requires additional supervision, practice, and training.
Development Needed (D):	The individual does not yet perform the task at a safe or acceptable standard. Requires close supervision and further training or experience.
Not Assessed/Applicable (N/A):	This competency has not been assessed or is not relevant to the individual's current role or scope of practice.

NSQHS Standards Referenced in this Competency Evaluation

Standard 1	Governance for Safety and Quality in Health Service Organisations
Standard 2	Partnering with Consumers
Standard 3	Healthcare Associated Infections
Standard 4	Medication Safety
Standard 5	Patient ID and Procedure Matching
Standard 6	Clinical Handover
Standard 8	Pressure Injuries
Standard 9	Clinical Deterioration
Standard 10	Preventing Falls

Cardiac Implantable Electronic Device Competency Evaluation

Part 1 – Fundamentals of patient care

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Professional Conduct				
NSQHS Standard 1, 2, 3, 5, 6, 9, and 10				
It is expected that these competencies are **prior foundational skills** already established within the ECG/non-invasive cardiac physiology role or through an alternative approved entry pathway and are subsequently carried through to the CIED modality.				
Section A: Patient Interaction and Preparation				
1. Prepares the clinical environment to be organised in a professional manner, ensures essential supplies are stocked, and verifies the availability of emergency equipment.				
2. Correctly identifies the patient, introduces self and role.				
3. Observes privacy and confidentiality guidelines.				
4. Explains procedure and obtains consent where appropriate.				
5. Accommodates the cultural and emotional needs of the patient. Ensures patient care needs are addressed.				
6. Communicates appropriately with patients and their families, using communication aids and tools as needed.				
7. Ensures suitable education materials (printed and/or electronic) are available to support CIED patient understanding and self-care.				
8. Ensures all implanted device components are registered with the manufacturer and any failures or safety issues are reported as required by the Therapeutic Goods Administration (TGA).				

9. Ensures patients have an ID card with key details about their implanted cardiac device for use in emergencies, procedures, or security screening.				
10. Communicates appropriately with all members of the multidisciplinary team.				
11. Adheres to risk management policies for both staff and patient, including adhering to manual handling requirements.				
12. Facilitates shared decision making: Actively supports a collaborative process where both the clinician and the patient (or caregiver) work together to make informed healthcare decisions. Provides clear, balanced information about available options and engages the patient in discussion to ensure their values, preferences, and individual circumstances are incorporated into the care plan.				
Section B: Infection Control				
1. Checks notes and any relevant signage, labels, or alerts for infection risks or contact precautions.				
2. Practices appropriate hand hygiene.				
3. Correctly uses PPE when required.				
4. Disposes of clinical waste appropriately.				
5. Ensures equipment is reprocessed in accordance with universal Infection Control procedures.				
6. Understands and maintains aseptic technique whilst in procedure room.				

Part 2 – Physiology general knowledge

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

General Knowledge				
NSQHS Standard 1, 4, 6 and 9				
It is expected that these General Knowledge competencies are **prior skills** already established through tertiary studies and in the ECG/non-invasive cardiac physiology role, that are carried through to the CIED modality.				
Section A: Foundational ECG knowledge				
1. Exhibits a clear understanding of the key elements of the cardiac electrical system and their anatomical connections.				
2. Understands normal 12 lead and ambulatory ECG waveforms.				
3. Demonstrates ability to identify and differentiate: a) Bradyarrhythmias. b) Tachyarrhythmias. c) Atrial vs ventricular arrhythmias. d) Artifact/non physiological signals. e) Errors in automated analysis (e.g., undersensing and oversensing).				
4. Appropriately monitor patient during procedure.				
5. Recognises dangerous ECG findings and collaborates with colleagues to ensure timely and appropriate management.				
6. Recognises acutely unwell patients and collaborates with colleagues to ensure timely and appropriate management.				
Section B: Pathophysiology and Pharmacology				
1. Demonstrates understanding of autonomic syndromes and their relevance to bradyarrhythmias and syncope.				

2. Understands the basic mechanisms of antiarrhythmic medications, including the Vaughan-Williams classification.				
3. Identifies commonly used chronotropic and inotropic agents and their effects on cardiac function.				
4. Recognises medication-induced bradyarrhythmias and conduction abnormalities.				
5. Understands drug-device interactions that may influence pacing thresholds, sensing, or rhythm interpretation.				
6. Demonstrates awareness of how medications may influence interpretation of device data and subsequent programming decisions.				
7. Identifies patients who may require anticoagulation, particularly in the context of atrial arrhythmias.				

Part 3 – Follow-up and troubleshooting of CIEDs

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Clinical skills Proficiency				
NSQHS Standard 1, 4, 6 and 9				
Section A: Reporting and Communication *(see also Appendix 1)*				
Note that this section is applicable to all CIED device types				
1. Clinic records: Appropriately stores all relevant programmer raw data/PDF files, for technical reference and quality control, as per the CSANZ Position Statement (2022).				
2. Written report: Produces a formal written CIED Findings and Programming Summary that is: • Clear, concise, and easy to understand, using language suitable for a multidisciplinary audience. • Relevant and patient-centred, focusing on findings that impact care, including symptom correlation. • Structured and interpretive, with a logical layout (e.g. device function, findings, recommendations) and explanation of the clinical significance. • Compliant with local documentation standards and reporting policies. *Refer to Part 3 a) and Appendix 1 for more detail.*				
3. Ensures prompt delivery of the CIED Findings and Programming Summary to relevant healthcare providers (e.g. EMR, bedside notes, managing cardiologist) and is appropriately archived according to local protocols.				
4. Verbal report: When required, gives an effective verbal handover that supports – but does not replace – the written CIED Findings and Programming Summary. • Tailors language to the audience (e.g., cardiologist, nurse, emergency physician etc.). • Escalates urgent findings in line with local procedures.				

5. Communicates effectively with patients and family members: • Applies general principles as outlined in Part 1 (a) above. • Discusses relevant symptoms and history. • Provides clear, accurate, and empathetic explanations of device-related findings (including battery level). • Discusses relevant programming changes, and answers questions appropriately. • Offers basic education re living with a CIED (including driving, travel, and activity considerations). • Reinforces key messages from the clinical team and encourages adherence to follow-up and treatment plans.				

Method of Evaluation **Key:** Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	Validation of Competency			
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Section B: Implantable Loop Recorders (ILRs)				
Prior competencies: Capable across relevant components of the previous sections: **part 1** (fundamentals) and **part 2** (knowledge) above.				
i. Initial preparation				
1. Understands relevant implant indications, contra-indications, and associated risks.				
2. Reviews relevant history, including battery status, test results, medication, and related comments from previous interrogation reports. Notes and considers the context of any atypical programming.				
3. Identifies applicable Hazard Alerts or Product Advisories and follows manufacturer recommendations where appropriate to ensure safe device management.				
4. Demonstrates the ability to select appropriate programmer for the relevant CIED. Set up and operate the basic functions (including power control, programmer head and ECG cables).				
5. Evaluates the wound site and identifies signs of wound infection, dehiscence, or pre-erosion and escalates as appropriate.				
6. Ensures information in device is correct (patient demographics and system hardware details).				
7. Demonstrates awareness of common complications and post-implant considerations, such as infection, migration, sensing errors etc.				
8. Understands and supports relevant driving restrictions.				

ii. Testing and evaluating device function				
1. Correctly assesses and documents presenting rhythm.				
2. If required, attaches programmer surface ECG electrodes correctly and obtains and displays the best leads for viewing rhythm.				
3. Assesses battery status.				
4. Sensing: a) Demonstrates understanding of the principles of sensing in cardiac devices. b) Accurately performs sensing tests. Identifies normal vs. abnormal sensing test results (e.g. oversensing, undersensing, inadequate safety margins). c) Determines the source of any problems by performing additional tests if needed.				
iii. Evaluate Diagnostics and Stored Episodes				
1. Reviews and interprets all alerts.				
2. Assesses and documents any relevant patient symptoms and correlates these to arrhythmia findings.				
3. Assesses recorded trends and histograms in context of reported symptoms, indication, and clinical presentation. Further clarifies patient history as needed.				
4. Assesses accuracy and validity of automatic and symptom activated events using stored electrograms and markers.				
5. Recognises FALSE rhythm event recordings, such as noise, oversensing, or undersensing. Identifies likely mechanisms (including differentiation between EMI and myopotential oversensing) and explains clinical relevance.				
6. Correctly identifies genuine arrhythmia findings as per Part 2 (a) Foundational ECG knowledge competencies above.				
7. Atrial tachyarrhythmia findings: a) Reviews AT/AF diagnostics including burden, episode duration, onset patterns, and ventricular response rates. b) Recognises when findings may indicate the need for anticoagulation or rate/rhythm				

control medication or interventional procedures.				
8. Determines clinical relevance of incidental arrhythmia findings and recommends appropriate action (e.g. programming changes, further clinical review).				
9. Escalates significant findings or facilitates additional patient care as required, in accordance with local protocols.				
10. Demonstrates understanding of post-mortem interrogation, including device access, data interpretation, and reporting protocols.				
iv. Troubleshoot/Reprogram				
1. Considers and verifies any prior recommendations regarding programming changes have been considered ± implemented.				
2. Adjusts automatic event recording and alert settings (e.g., bradycardia/tachycardia detect intervals and pauses, AF) to suit patient requirements. Ensures remote monitoring settings are similarly optimised (if applicable).				
3. Ensures current **local** programming protocols have been applied.				
4. Aware of relevant national and international guidelines, and endeavours to align local protocols to these standards.				
5. Consults with additional experts where necessary, e.g., the responsible cardiologist, and manufacturer technical support services.				
6. Evaluates and optimises all final programmed parameters, ensuring any changes are intentional and justified.				
7. Saves relevant data and appropriately ends sessions and ensures diagnostics and histograms are cleared or reset as appropriate.				
8. Evaluates the need for CIED replacement, removal, upgrade, or downgrade in accordance with patient needs, manufacturer recommendations, and local policy.				
9. Follow-up planning: In consultation with the patient, determines and communicates the interval				

and format of the next CIED appointment, considering clinical guidelines, patient preferences, and individual circumstances.				
10. Seeks help/advice when needed, acknowledges knowledge limitations, and collaborates to maximise individual and team learning.				
v. Reporting and Communication				
Applies reporting and communication competencies as per Part 3 a) and Appendix 1 in the context of ILRs.				

Method of Evaluation **Key:** Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Outcome: Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	Validation of Competency			
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Section C: Permanent Pacemakers

Note: Additional considerations related to Conduction System Pacing (CSP) and Cardiac Resynchronisation Therapy (CRT/BiV pacing) are addressed in Section (e) *Physiological Pacing* below.

Leadless pacing is not covered in this document but may be included in a future revision.

i. General knowledge

Building on relevant shared competencies (see loop recorder section), the following additional skills apply to pacemakers.

1. Understands and adheres to relevant local and international guidelines regarding CIED programming.				
2. Demonstrates understanding of battery function including Elective Replacement Indicator (ERI) and End of Life (EOL)/End of Service (EOS) function specific to the make and model of device.				
3. Aware of reset behaviour, and able to identify and take appropriate action if reset occurs.				
4. Is aware of emergency pace button and when to use it.				
5. Correctly identifies position for external defibrillator pads with consideration of CIED location, surgical field, and optimal shock vector, and communicates clearly with the clinical team to ensure safe application.				
6. Understands pacing lead design features, including • coaxial vs. coradial configurations, • insulation properties (silicone vs polyurethane, vs hybrid copolymers), • slip and flexibility factors, • fixation mechanisms (passive vs. active), • connector pin configurations, • steroid elution, • porous tip, • epicardial vs endocardial.				
7. Understands normal pacing x-ray features, including • X-ray identifiers (brand). • Leads:				

○ Number. ○ Type (endocardial, epicardial, passive or active fixation). ○ Configuration (unipolar/bipolar/quadripolar). ○ Lead implant technique (subclavian, cephalic, other). ○ Position (RAA, RV apex etc). • Type of pulse generator – single/dual etc. ○ Manufacturer identifying markers. ○ Header block characteristics (polarity identifiers). • Port pins, suture sleeves, abandoned leads.				
8. Identifies abnormal pacing x-ray findings, including • Pneumothorax or haemothorax. • Pocket malposition. • Generator rotation, flipping or migration. • Incomplete pin insertion. • Suture sleeve ligature damage. • Subclavian crush. • Left sided superior vena cava. • Unusual lead trajectory or malposition. • Lead dislodgement, perforation or migration. • Inadequate or excessive slack (tightness or lead loops). • Other indicators of likely lead damage (visible discontinuity, abrupt kink or abnormal bend).				
9. Understands Ohms law and recognises characteristics of acute and chronic lead issues.				
10. Understands how polarity programming affects sensing.				
11. Understands basic principles of stimulation threshold including strength duration curve.				
12. Understands the use of voltage multipliers in pacemaker circuitry, and their implications for battery consumption at higher pacing outputs.				
13. Understands the different pacing modes, and their application.				
14. Understands the effect a magnet has on pacing mode and rate (including brand specific differences).				
15. Understands basic pacemaker features and their purpose, including: • Base rate. • Night rate, rest rate, hysteresis.				

• AV delays. • Blanking and refractory periods. • Upper track rate. • Automatic Mode Switch. • Algorithms which minimise ventricular pacing. • Pacemaker Mediated Tachycardia (PMT) detection and termination algorithms. • Magnet response. • Noise response. • Rate response including: a) Upper sensor rate. b) Sensor types. c) Indications and contraindications. d) Optimisation principles. e) Perioperative considerations.				
ii. Testing device function *Building on relevant shared competencies (see loop recorder section), the following additional skills apply to pacemakers.*				
1. Prior to interrogation, reviews relevant history including device type, recent test results/programming changes and underlying rhythm.				
2. Accurately assesses and documents the presenting rhythm, clearly describing sensing and pacing activity (e.g. A-sensed, V-paced at 65 bpm).				
3. Assesses and interprets battery parameters including predicted longevity, magnet rate, cell voltage and impedance.				
4. Communicates effectively and ensures patient comfort during pacemaker testing: • Checks history and auto-test trends and identifies when certain manual tests are inappropriate or unnecessary. • Selects test parameters that minimise patient discomfort, while achieving the required diagnostic outcome. • Explains anticipated rhythm changes in a clear, calm, and supportive manner to prepare the patient. • Monitors for symptoms throughout testing and responds appropriately. • Reassures the patient throughout the process and encourages feedback about symptoms or concerns.				
5. Evaluates presenting lead impedance and lead impedance trends.				

6. Ensures appropriate safety switch programming and impedance alert settings.				
7. Appropriately utilises polarity programming to evaluate and troubleshoot leads.				
8. Identifies the need for additional provocative lead testing, such as arm manoeuvres, and performs the necessary tests.				
9. Documents the patient's underlying native rhythm and any associated symptoms during testing. Clearly states whether the patient is pacemaker dependent.				
10. Performs and evaluates both automatic and manual capture threshold tests as required, ensuring the correct threshold data is saved in the programmer data file.				
11. Able to perform a retrograde conduction test when appropriate.				
12. Able to evaluate AV conduction (including sensed and paced AV delays) and perform A-V timing optimisation tests (e.g., quick-opt) when appropriate.				
13. Able to manually provoke far-field oversensing to assess Post-Ventricular Atrial Blanking (PVAB) period when appropriate.				
14. Able to identify header block issues (such as chatter/poor pin contact or reversed lead connections).				
iii. Evaluate Diagnostics and Stored Episodes *Building on relevant shared competencies (see loop recorder section), the following additional skills apply to pacemakers.*				
1. Evaluates the overall atrial and ventricular "% pacing" during follow-up and assesses its appropriateness in relation to the patient's clinical condition, native rhythm, and pacing indications.				
2. Identifies and investigates the occurrence of "safety switching" or "reset".				
3. Evaluates chronotropic diagnostics in context of patient presentation and history.				
4. Evaluates heart failure diagnostics, including congestion data in context of patient presentation and history.				

5. Evaluates respiratory and sleep data where applicable.				
6. Evaluates and documents atrial high rates (burden, duration, V rates etc), distinguishing true from false AT/AF episodes and identifying mechanisms of false detection (e.g. far-field oversensing, myopotentials, noise).				
7. Evaluates and documents high ventricular rate (HVR) episodes, including aetiology (e.g. SVT vs VT), rate, duration, symptoms, and clinical significance.				
8. Recognises fusion, pseudofusion, crosstalk, and far-field oversensing on ECG and/or EGM, and differentiates them from true pacing capture or arrhythmia.				
9. Identifies events such as magnet response, upper rate behaviour, pacemaker mediated tachycardia (PMT), Repetitive Non-Reentrant Ventriculoatrial Synchrony (RNRVAS).				
iv. Troubleshoot/Reprogramming *Building on relevant shared competencies (see loop recorder section), the following additional skills apply to pacemakers.*				
1. Takes appropriate action if pacemaker reset occurs.				
2. Ensures programming safety (e.g., appropriate sensing and pacing threshold safety margins).				
3. Adjusts polarity where appropriate, based on test results, when benefits (e.g. improved impedance or thresholds) outweigh potential risks.				
4. Ensures clinically appropriate mode, base rate, and upper track rate programming.				
5. Understands and appropriately uses various algorithms to minimise unnecessary pacing.				
6. Ensures appropriate rate response programming, conducting additional tests (such as walk tests) to evaluate adjustments. • Sensor type(s) where programmable. • The minimum level of physical activity required to *trigger* 4the rate response system. • response factor/slope (how *strongly* the pacemaker reacts to activity after it's already been detected). • Specific rate parameters (e.g., resting rate control for Biotronik CLS systems, ADL rate for Medtronic, Maximum sensor rate).				

• Recovery time.				
7. Ensures appropriate customised programming for neurocardiogenic syncope or autonomic dysfunction • "rate drop response" or "positive hysteresis" type algorithms. • CLS settings (Biotronik).				
8. Troubleshoots single chamber pacemaker timing cycles.				
9. Troubleshoots dual chamber pacemaker timing cycles: a) Optimises AV delay and 2:1 AV block rate. b) Minimises false mode switch events (e.g., PVAB adjustment). c) Optimises PMT detection and termination algorithms. d) Minimises PMT occurrence via Post-Ventricular Atrial Refractory Period (PVARP) adjustment. e) Troubleshoots RNRVAS.				
10. Reviews device settings to identify and address suboptimal programming. Ensures diagnostic and alert features are tailored to the patient's needs.				
11. Ensures final pacemaker programming is optimised—prioritising safety, followed by quality of life, and battery longevity.				
12. Demonstrates awareness of potential device-device interactions (e.g., other implanted stimulators, neuromodulation devices, or external telemetry systems) and evaluates clinical and technical implications. Takes appropriate steps to verify function and mitigate interference risks.				
13. Demonstrates understanding of pacemaker management in palliative and post-mortem contexts per local policy and legal/ethical guidelines.				
v. Reporting and Communication				
Applies reporting and communication competencies as per Part 3 a) and Appendix 1 in the context of cardiac pacemakers.				

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Outcome: Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	Validation of Competency			
		Method of Evaluation	E I S D N/A	Comments	Assessor Initials

Section D: Implantable Cardioverter Defibrillators (ICDs)

Note: Additional considerations related to Conduction System Pacing (CSP) and Cardiac Resynchronisation Therapy (CRT/BiV pacing) are addressed in Section E.

Extravascular ICDs are not covered in this document but may be included in a future revision.

i. General knowledge

Building on relevant shared competencies (see loop recorder and pacemaker sections above), the following additional skills apply to ICDs.

1. Explains the indications and contraindications for ICD implantation, distinguishing between primary and secondary indications.				
2. Understands and adheres to relevant local and international guidelines regarding defibrillator programming.				
3. Is aware of emergency shock button and when to use it.				
4. Safely and confidently uses the abort shock feature when clinically indicated.				
5. Ability to deliver manual atrial and ventricular ATP (burst, scan etc) as required.				
6. Understands the effect a magnet has on a defibrillator (and differences between brands).				
7. Understands shock lead design features, including • ICD lead pin types (DF1 vs DF4). • single vs dual coil configuration. • integrated bipolar vs. dedicated bipolar design. • Impedances.				
8. Understands normal and abnormal ICD x-ray features, including appearance of endocardial SVC and RV shock coils and epicardial defibrillation patches.				
9. Demonstrates understanding of theory of defibrillation, including shock configuration (vector,				

waveform, polarity and programmed vs delivered energy).				
10. Explains charge time and factors affecting capacitor reformation.				
11. Understands DFT testing including indications and contraindications.				
12. Understands the sensing features of ICDs and how they differ from pacemakers.				
13. Understands how sensing polarity programming (dedicated bipolar vs integrated bipolar) affects ICD sensing, and why unipolar pacing is contraindicated.				
14. Demonstrates understanding of anti tachycardia pacing (ATP). Identifies standard and more aggressive ATP optimisation approaches (burst, scan, ramp etc) and associated risks.				
15. Understands the use of detection and therapy zones based on arrhythmia history and patient-specific factors and guidelines.				
16. Understands the purpose of rhythm discrimination algorithms in preventing inappropriate therapy delivery.				
17. Understands common discriminator types used in ICDs, including: • Onset (sudden vs gradual rate increase). • Stability (irregularity of intervals). • A:V relationship (atrial vs ventricular rate comparison). • Morphology matching (template-based discrimination).				
18. Understands manufacturer-specific discrimination algorithm names and functions (e.g., PR Logic™, Rhythm ID™, SMART Detection™, etc).				
19. Recognises limitations of discrimination algorithms, particularly in cases of 1:1 SVTs (e.g. atypical AVNRT) or AF with rapid ventricular response.				
ii. Testing and evaluating device function *Building on relevant shared competencies (see loop recorder and pacemaker sections above), the following additional skills apply to ICDs.*				

1. Assesses and interprets battery parameters including longevity, magnet rate (MicroPort), charge time, cell voltage and impedance.				
2. Aware of ICD reset behaviour and able to identify and take appropriate action if reset occurs.				
3. Assesses high voltage lead impedance and ensures appropriate alert settings.				
4. Evaluates and optimises morphology template if required. Understands when morphology discriminator is inappropriate.				
5. Able to demonstrate and explain patient alert notifiers.				
iii. Evaluate Diagnostics and Stored Episodes *Building on relevant shared competencies (see loop recorder and pacemaker sections above), the following additional skills apply to ICDs.*				
1. Assesses the ICD's diagnostic accuracy in detecting and classifying arrhythmia events.				
2. Identifies appropriate vs inappropriate ICD therapy.				
3. Evaluates therapy outcomes.				
iv. Troubleshoot/Reprogramming *Building on relevant shared competencies (see loop recorder and pacemaker sections above), the following additional skills apply to ICDs.*				
1. Troubleshoots basic ICD features and algorithms including: • Sensing. • Electrogram sources. • Detection zones. • Interval number/time to detect. • Probabilistic/consecutive/sticking counters. • SVT discriminators. • Configuration of Anti Tachycardia Pacing. • Shock waveforms and vectors.				
2. Understands and applies manufacturer-specific algorithms designed to minimise inappropriate ICD shocks due to sensing abnormalities including: • Double counting [e.g., T-wave oversensing (TWOS) or Far-field oversensing]. • Myopotential oversensing. • Lead noise. • Electromagnetic interference.				

3. Demonstrates understanding of ICD reprogramming and deactivation requirements in the context of end-of-life care, palliation, and post-mortem management. Ensures that deactivation is discussed, actioned, and documented in accordance with relevant ethical principles, clinical guidelines, and local workplace policies. Recognises the importance of introducing this topic early, ideally at the time of implant, and ensures patients receive clear information about device management options across the lifespan.				
v. Reporting and Communication				
Applies reporting and communication competencies as per Part 3 a) and Appendix 1 in the context of ICDs.				

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Outcome: Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	Validation of Competency			
		Method of Evaluation	E I S D N/A	Comments	Assessor Initials

Section E: Physiological Pacing - Cardiac Resynchronisation Therapy (CRT) and Conduction System Pacing (CSP)

Note that these devices usually require greater input with more complex programming. Reviews often involve extended clinical evaluation, utilising additional resources e.g., 12-lead ECG.

i. CRT general knowledge, troubleshooting and programming

Building on relevant shared competencies (see loop recorder, pacemaker and defibrillator sections above), the following additional skills apply to CRT systems.

1. Explains the clinical indications and contraindications for CRT, including its role in the prevention and treatment of dyssynchrony-related heart failure.				
2. Demonstrates understanding of the underlying concept and physiological basis of CRT.				
3. Understands programming goals related to maximising biventricular (Bi-V) or LV-only pacing and correctly interprets "% pacing" metrics.				
4. Understands CRT pacing configurations and timing strategies, including: • Header block connections. • Multi-point pacing, LV-only pacing, and programmable offset options. • CRT-specific timing cycles, including AV delay and VV delay. • CRT-specific algorithms, including triggered pacing (e.g., V sense response) and adaptive CRT modes. • Key differences in algorithm design and functionality across manufacturers.				
5. Interprets relevant waveform characteristics on surface ECG and intracardiac EGMs. Utilises a 12 lead ECG when required.				
6. Documents CRT QRS duration and morphology versus native QRS duration and morphology when indicated.				
7. Identifies signs of phrenic nerve stimulation and methods used to reproduce this in the clinical				

setting. Applies appropriate programming strategies to resolve it (e.g. vector change, output adjustment).				
8. Identifies anodal capture on ECG/EGM and implements programming adjustments to prevent or eliminate it.				
9. Understands available programming tools and applies a systematic approach to optimise CRT pace %, QRS morphology and duration.				
10. Incorporates patient-reported symptoms and physical ability that may relate to CRT response, and facilitates discussion and appropriate action.				
11. Identifies reasons why patients may not be responding to CRT (e.g., sub-optimal lead placement, distal conduction abnormalities, sub-therapeutic pacing %, etc).				
ii. CSP general knowledge troubleshooting and programming *Building on relevant shared competencies (see loop recorder, pacemaker and defibrillator sections above), the following additional skills apply to CSP systems.*				
1. Explains the clinical indications and contraindications for CSP, including its role in the prevention and treatment of dyssynchrony-related heart failure.				
2. Demonstrates understanding of the concept, physiological basis, and key differences between the two main types of conduction system pacing (CSP): (a) His bundle pacing (HBP), and (b) left bundle branch area pacing (LBBAP), including selective, non-selective, and left septal pacing variants.				
HBP considerations:				
1. Aware of header block connections (HBP lead may be in RA, RV or LV port).				
2. Determines HBP capture threshold relative to RV capture threshold, and ensures appropriate output to insure HBP capture (≥1V safety margin).				
3. Appropriately avoids autocapture (unless HBP and RV thresholds are similar).				
4. Customises AV delay parameters (30 – 50ms shorter than conventional programming).				
5. Configures sensitivity programming with reference to header block connections. Identifies and				

troubleshoots atrial oversensing and ventricular undersensing if present.				
6. Determines appropriate programming of all other parameters with reference to header block connections (VV delay, Ventricular safety pacing, ICD discriminators etc).				
7. Determines relative benefit of HBP in context of indications and pace vs native morphology, and programs accordingly (using algorithms to encourage or avoid ventricular pacing).				
LBBAP considerations:				
1. Aware of header block connections (LBBAP lead may be in RA, RV or LV port).				
2. Accurately identifies QRS morphology transitions and corresponding capture types during threshold testing, including: • Left bundle branch (LBB) capture (unipolar and bipolar). • Left ventricular (LV) septal capture (unipolar and bipolar). • Anodal capture (bipolar).				
3. Accurately measures, interprets, and documents the type of capture achieved, in accordance with current practice and evolving guidelines (e.g., selective or non-selective LBB pacing, or LV septal pacing).				
4. Documents the anatomical location of capture where possible (e.g., left bundle branch, or the specific fascicule captured).				
5. Optimises output settings to achieve effective capture, safety margins, and favourable QRS morphology, including the selective use of autocapture where appropriate.				
6. Customises AV delay parameters (20-30 ms shorter than conventional programming, considers rate responsive AV delay).				
7. Determines appropriate programming of all other parameters with reference to header block connections (VV delay, Ventricular safety pacing, ICD discriminators etc).				
8. Determines relative benefit of CSP pacing in context of indications and pace vs native morphology, and				

programs accordingly (using algorithms to encourage or avoid ventricular pacing).				
iii. Reporting and Communication				
Applies reporting and communication competencies as per Part 3 a) and Appendix 1.				

Part 4 – Other CIED Management

Method of Evaluation Key:	Outcome:	Validation of Competency			
Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Method of Evaluation**	**E I S D N/A**	**Comments**	**Assessor Initials**

Clinical skills Proficiency

NSQHS Standard 1, 4, 6 and 9

Section A: Remote Monitoring (RM)

Remote Monitoring Role Definitions (Contextual Overview)

Remote monitoring (RM) is an integral component of CIED follow-up, with increasing reliance on structured, scalable workflows. The detailed competencies in this section are intended to support **two professional scopes**:

- **Full CIED Specialist** – Involved in both in-person and remote device management, including programming, troubleshooting, and escalation decisions. RM responsibilities are integrated into broader device follow-up workflows.
- **Focussed Remote Monitoring Role** – Specialises in the review and **triage** of CIED transmissions only. This may occur in centralised RM hubs or support services where in-person programming is outside scope.

The following competencies apply to both scopes, with expectations adjusted according to the role, supervision, and level of escalation permitted by local protocols. Workplaces may prefer to stage training according to CIED type – e.g., starting with just ILR monitoring, and working up to monitoring more complex device types.

i. Initial Preparation Remote Monitoring

1. Understands available remote monitoring technologies (appliance- and mobile-based), and selects an appropriate platform tailored to the patient, manufacturer and device type.				

2. Understands the different RM types:
• Individual remote monitoring:
  ○ Continuous connectivity vs
  ○ Noncontinuous connectivity.
• Site based (shared transmitter in health centre).				

3. Understands and explains the benefits and limitations of RM in its different forms.				
4. Understands and is able to communicate to the patient that RM is not an emergency service.				
5. Obtains patient consent for RM.				
6. Demonstrates the ability to access and navigate relevant CIED remote monitoring platforms.				

7. Enrols patients, schedules transmissions, and ensures follow-up through appropriate transfer of care according to local protocol.				
8. Troubleshoots both manual and automatic connectivity issues, ensuring continuity of monitoring and timely data transmission.				
ii. Evaluation of auto-test data, diagnostics and stored episodes *Building on relevant shared competencies (see loop recorder, pacemaker, and defibrillator sections above)*				
1. Scheduled transmissions: • Adequately reviews and interprets all relevant data. • Evaluates transmission schedule and adjusts if required.				
2. Alert initiated transmissions: • Adequately reviews and interprets all relevant data. • Evaluates alert settings and adjusts if required.				
3. Reviews patient history as needed (e.g., alerts, prior arrhythmia events, medications, prior evaluation reports).				
4. Appropriately contacts the patient (via phone call, text, email, letter, or monitoring platform) to assess symptoms, discuss relevant findings, and outline any necessary actions.				
5. Identifies when to escalate CIED related issues to implanting/managing Cardiologist (in line with local policy).				
iii. Reporting and Communication *(see also Appendix 1)*				
1. Applies reporting and communication competencies as per Part 3 a) and Appendix 1 in the context of remote monitoring.				
2. Determines the necessity and appropriate format of reporting for each transmission, ensuring both clinical relevance and compliance with billing requirements. Reporting may range from: • None – No documentation required (e.g. dismissal of repeated, previously documented, non-actionable transmissions). • Brief – A simple clinical note added directly to the patient's EMR.				

• Detailed – A formal report, such as an annotated data summary page or a written CIED Findings and Programming Summary.				
3. Reports when remote monitoring is used in place of an in-person evaluation, reporting should state this and document any associated 1- or 2-way patient communication.				
4. Ensures any recommended actions are clearly and accurately documented.				
5. Ensures RM data and copies of associated reports/correspondence are appropriately archived.				

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Section B: Magnetic Resonance Imaging (MRI)				
1. Understands MRI-related risks associated with CIEDs, including potential effects on leads, generators, and surrounding tissues.				
2. Identifies MRI-conditional and non-MRI-conditional device systems, including manufacturer-specific labelling and system requirements.				
3. Evaluates relative risks of any system-specific restrictions to MRI in CIED patients (e.g. abandoned leads, recent implant, non-conditional system labelling).				
4. Familiar with local and international guidelines and protocols around MRI scanning of conditional and non-conditional device systems.				
5. Prescribes, tests, and implements patient specific temporary programming for MRI procedures (mode, ± rate, ± tachy therapy off).				
6. Understands and appropriately utilises auto-MRI features where available.				
7. Communicates confidently and clearly with staff (e.g., radiographers, nurses, and referring teams), providing an adequate written handover and, where needed, verbal communication to ensure a shared understanding of: • device programming. • expected rhythm. • monitoring requirements (pre, intra-, and post scan). • potential risks. • relative risk stratification. • relevant emergency response actions.				
8. Advises and reassures patients, clearly explaining MRI precautions, temporary device settings, and monitoring process.				
9. Verifies post-MRI device function, restores appropriate settings, and checks capture, sensing, and battery status.				

10. Documents all steps clearly, including device status pre- and post-scan, programming changes, and communication with clinical teams.				
11. Ensures programmer-generated data files, reports, and handover documentation are appropriately archived and shared with the patient's own CIED management team, as applicable.				

Method of Evaluation **Key:** Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Outcome: Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	Validation of Competency			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Section C: Perioperative Management				
1. Understands the importance of CIED management during surgical and interventional procedures, including potential risks associated with electromagnetic interference (EMI).				
2. Understands the clinical concerns of the surgical, anaesthesia, and perioperative care teams when managing patients with CIEDs.				
3. Describes the potential EMI effects of perioperative interventions on CIED function, including: • Ventilation. • Bipolar vs unipolar electrocautery. • Radiofrequency ablation. • Lithotripsy. • External Defibrillation/Cardioversion. • Electroconvulsive therapy (ECT). • Other procedures that may cause electromagnetic or mechanical interference.				
4. Understands the effects of magnet application, including: • Brand- and model-specific magnet responses. • Appropriate and inappropriate use of magnets (e.g. situations requiring no additional precautions vs those requiring a magnet or manual reprogramming). • How magnet application impacts device function and alerts.				
5. Consults with responsible cardiologist and perioperative team as required.				
6. Ensures follow-up history is current and reviews or repeats checks as needed, using the most recent remote monitoring or in-person evaluation to identify any relevant clinical or device-related issues.				
7. Recommends appropriate perioperative CIED management strategies, tailored to: • Device type and manufacturer. • Patient-specific pacing and defibrillation requirements.				

• Surgical location, procedure type, and use of electrosurgical equipment. • Relevant local and international guidelines.				
8. Communicates clearly and confidently with staff (surgical, anaesthetic, and nursing) both in written and verbal formats, including: • Use and effect of magnet application (or manual reprogramming if applicable). • Placement of electrocautery dispersive pads (return electrode). • Procedural technique considerations (e.g. use of short bursts, low wattage). • Current device programming and reset behaviours. • Monitoring recommendations and expected rhythm during procedure. • Specific risks and emergency response requirements. • Requirements for pre- and post-procedural device assessment.				
9. Effectively communicates with patients regarding perioperative CIED considerations, risks, and safety measures.				
10. Ensures adequate documentation of pre-operative planning, intraoperative support provided, and post-operative device evaluation.				

Method of Evaluation **Key:** Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	Validation of Competency			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Section D: Radiotherapy				

1. Understands the potential effects and risks of ionising radiation on CIEDs, including:
• Risk of device malfunction, reset, or failure.
• Cumulative radiation dose thresholds relevant to device components.
• Impact of:
  ○ Beam proximity.
  ○ Dose rate.
  ○ Energy type (e.g. neutron scatter).				

2. Identifies CIED patients at increased risk during radiotherapy, including: • ICDs and CRT-Ds (more sensitive than pacemakers). • Devices located in or near the treatment field. • Pacing-dependent patients.				
3. Communicates with oncology and medical physics teams to support individualised risk management for CIED patients, including: • Potential need for pre or post therapy interrogation. • Shielding, relocation, or programming requirements. • Monitoring recommendations.				

Part 5 – Implantation of CIEDs

Method of Evaluation Key:	Outcome:	Validation of Competency			
Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Method of Evaluation**	**E I S D N/A**	**Comments**	**Assessor Initials**

Scientific Knowledge				
NSQHS Standard 1, 4, 6 and 9				
Section A: General Knowledge Base for CIED implantation *Building on relevant shared competencies (see above sections), the following additional skills apply to implant support.*				
1. Understands the basic purpose and function of: • Temporary transvenous pacing. • Transcutaneous pacing. • External defibrillation/cardioversion.				
2. Understands radiation safety principles, including: • Basic radiation terminology. • Occupational and patient radiation risks. • Best practices for radiation protection during fluoroscopy-guided procedures.				
3. Aware of surgical complications associated with CIED implantation, both intraoperative and postoperative (acute and delayed presentation).				
4. Maintains appropriate surgical asepsis, including correct use of theatre attire and sterile technique.				
5. Understands and utilises haemodynamic monitoring systems, including interpretation of real-time vital signs during implantation.				
6. Applies ECG electrodes correctly and ensures high-quality signal acquisition; able to troubleshoot ECG tracing artefacts.				
7. If applicable, applies defibrillator pads correctly, with consideration of anticipated surgical field.				
8. Exhibits a sound understanding of surgical techniques and procedural steps involved in CIED implantation.				
9. Contributes to shared decision-making by offering evidence-based, patient-centred technical				

recommendations to support appropriate device selection.				
10. Selects the appropriate CIED programmer for the device being implanted, considering technology type (e.g. Bluetooth, RF, telemetry, or wireless).				
11. Operates the basic functions of the programmer and/or pacing system analyser (PSA) as applicable, including: • Lead testing. • Sensing and capture threshold measurement. • Impedance checks.				
12. Monitors patient status during implantation, recognises changes in rhythm or condition, and communicates promptly and clearly with the implanting team.				
13. Collaborates with the implanting physician to apply appropriate initial programming, with reference to the clinical indication and patient-specific needs.				
14. Ensures accurate device information is programmed, including: • Patient details. • Lead serial numbers and location if applicable. • Clinically relevant notes or alerts.				
15. Prepares and completes required documentation in accordance with local policy, including accurate clinical records of the procedure.				
16. Provides clear and relevant education to the patient and their family, covering post-procedural care, activity restrictions (including driving), wound care, symptoms to report, follow-up expectations, and living with their cardiac device.				

Section B: ILR Implantation				
1. Describes the correct anatomical location and orientation for ILR implantation, based on manufacturer guidance and optimal signal acquisition.				
2. Performs and interprets ILR sensing tests, ensuring adequate signal quality and confirming device position.				
3. Collaborates with the implanting physician to program the ILR appropriately, based on the patient's clinical indication and monitoring goals.				
4. Identifies and troubleshoots inappropriate detections or signal artefacts post-implant and adjusts settings where appropriate.				
5. Ensures accurate documentation and data transfer, including baseline ECG, device settings, and remote monitoring activation.				
6. Demonstrate use of patient symptom activator if applicable.				

Method of Evaluation	Outcome:	Validation of Competency			
Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Method of Evaluation**	**E I S D N/A**	**Comments**	**Assessor Initials**

Section C: Pacemaker implantation *Building on relevant shared competencies (see above), the following skills apply to pacemaker implantation.*				
1. Ensures all necessary equipment is available and functional prior to implantation, including: • Pulse generator. • Leads. • Introducers/Sheaths. • Testing cables. • Programmer, pacing system analyser, and power supply. • Ancillary tools such as guiding catheters, slippery wires, stylets, slitters, screwdrivers, and torque tools (“trousers”).				
2. Understands the use of contrast injection systems and techniques relevant to venous access or lead navigation.				
3. Monitors ECG and reports significant changes to rhythm.				
4. Assesses lead positioning using fluoroscopy and chest X-ray.				
5. Monitors and supports lead deployment, including interpreting fluoroscopic lead behaviour and ensuring appropriate slack and fixation.				
6. Performs all required intraoperative lead tests, including: • Sensing and capture thresholds. • Evaluation of current of injury. • Impedance measurements. • Management of temporary pacing systems if needed.				
7. Confirms lead connection to the device header, using: • ECG/EGM monitoring. • Lead impedance readings. • Serial number verification and mechanical inspection.				

8. References the patient's clinical indication to ensure initial programming is appropriate for patient indication.				
9. Collaborates with the implanting physician as required re programming and patient care plan.				
10. Performs pre-discharge device evaluation, confirming appropriate function and stability of lead parameters.				
Pacemaker generator change / Lead removal / Extraction				
1. Pre-Procedural Assessment a) Reviews patient records to confirm ongoing indication for CIED therapy, ensuring the planned intervention remains clinically appropriate. b) Identifies the correct replacement generator, including model compatibility with existing leads and therapy requirements. c) Assesses the patient's underlying rhythm, including dependence on pacing, to inform procedural planning and risk mitigation. d) Demonstrates understanding of device programming considerations specific to generator change, including lead polarity, exercise sensor, pacing thresholds, and magnet response.				
2. Equipment Preparation: Ensures all required equipment is available and functional for revision/explant procedure.				
3. Understands potential diathermy interactions with CIEDs including CIEDs at ERI or under specific advisories.				
4. Identifies and prepares appropriate equipment for CIED explant and/or lead extraction, where applicable (only at sites where extraction is performed).				

Method of Evaluation **Key:** Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Section D: ICD implantation *Building on relevant shared competencies (see above), the following skills apply to ICD implantation.*				
1. Review patient history, particularly pertaining to any sustained tachyarrhythmias.				
2. Ensures availability of appropriate ICD system and accessories, including: • Single, dual, or other configuration. • Coil configuration (e.g. single vs dual-coil leads). • Programmer and telemetry system suited to device brand and technology.				
3. Performs all variations of intraoperative lead testing, including shock coil impedance.				
4. Programs initial tachyarrhythmia therapies, ensuring they align with: • Patient's indication. • Arrhythmia history. • Device capabilities. • Consensus within the implanting team. • Current clinical guidelines.				

5. Defibrillation Threshold (DFT) Testing (if performed)
• Demonstrates understanding of VF induction methods, including their respective advantages and limitations (e.g. burst pacing, T-wave shock, direct current Defibrillator).
• Conducts induction testing in a systematic and safe manner, ensuring:
  ○ Clear communication with the team.
  ○ Appropriate selection of induction method.
  ○ Defined shock sequence and backup plan.
  ○ External defibrillator prepared and manned.
  ○ Real-time assessment of sensing, detection, charging, shock delivery, and return to sinus rhythm.				

6. Performs post-implantation final ICD programming, ensuring: • High-voltage therapies are enabled and appropriately configured. • Bradycardia support and ATP settings match patient need.				
7. Communicates with team when high voltage therapies are ON.				
8. Ensures patients (and, where appropriate, their family) are informed about long-term device considerations — including the option of ICD deactivation if goals of care change. In accordance with international guidelines, this discussion should begin prior to or during the implant admission and continue as the patient's clinical condition evolves.				
ICD Generator Change / Extraction				
1. Pre-Procedural Assessment Reviews patient records to confirm that ICD therapy remains clinically indicated and appropriate.				
2. Identifies the correct replacement generator, including model compatibility with existing leads and therapy requirements.				
3. Assesses the patient's underlying rhythm, including dependence on pacing, to inform procedural planning and risk mitigation.				
4. Demonstrates understanding of device programming considerations specific to ICD generator replacement, including bradycardia, tachyarrhythmia, and ATP therapies, exercise sensor, pacing thresholds, and magnet response.				
5. Identifies all relevant equipment required for ICD generator change.				
6. Understands potential diathermy interactions with CIEDs including ICDs at ERI or under specific advisories.				
7. Identifies and prepares appropriate equipment for ICD explant and/or lead extraction, where applicable (only at sites where extraction is performed).				
8. Communicates with team when high voltage therapies are OFF.				

9. Communicates with team when high voltage therapies are ON.				
10. Ability to perform all variations of lead testing including managing temporary pacemaker as required.				
11. Collaborates with the implanting physician to program the replacement ICD appropriately, with specific attention to: • Any change in patient status or clinical indication. • Prior legacy device programming (e.g. older-generation devices or primary prevention settings). • Updated guidelines and risk stratification.				

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Section E: CRT system implantation *Building on relevant shared competencies (see above), these additional skills apply to CRT implantation.*				
1. Identifies existing leads and connector types relevant to CRT upgrade or downgrade procedures, including: • Lead pin and device header configuration and compatibility (DF1, DF4, IS-1, IS-4, LV-1). • Reusability of existing leads (e.g. RV, RA) based on functionality and compatibility.				
2. Demonstrates foundational knowledge of the coronary venous system, including anatomical variations relevant to LV lead delivery.				
3. Understands the range of leads, delivery sheaths, and guiding catheters used in CRT implantation, and their specific uses.				
4. Understands the use of contrast injection systems and techniques for coronary sinus cannulation and venography.				
5. Contributes to selection of an appropriate CRT device system, programmer, and accessories based on patient-specific needs.				
6. Identifies anodal capture during lead testing and assesses its implications for pacing strategy.				
7. Recognises phrenic nerve stimulation, differentiates it from myocardial capture, and assists in troubleshooting and repositioning strategies.				
8. Ensures appropriate post-op programming.				

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Section F: CSP implantation *Building on relevant shared competencies (see above), these additional skills apply to CSP implantation.*				
1. Reviews patient history with a focus on conduction system disease, including AV block, bundle branch block, and previous pacing or resynchronisation therapies.				
2. Demonstrates understanding of conduction system anatomy, with particular emphasis on the His-Purkinje network and the left bundle branch system.				
3. Selects appropriate CIED system and accessories for CSP, including: • Device platform suited to CSP delivery. • Dedicated delivery sheaths for His bundle or LBB pacing. • Programmer and analyser compatible with advanced CSP features.				
4. Correctly sets up all equipment required for CSP, including: • Programmer, analyser, and temporary pacing system. • 12-lead ECG display. • Filtered and unfiltered electrogram display for His or LBB signal identification.				
5. Performs comprehensive lead testing as per current guidelines.				
6. Accurately measures and interprets device-related intervals in line with current clinical practice and emerging guidelines. These may include: • QRS duration. • V6 Stim-to-QRS / R-wave peak time (RWPT) – used as a surrogate for LV activation time (LVAT). • V6–V1 interpeak intervals (as applicable).				
7. Engages with implanting physician to appropriately program CIED to ensure CSP is maintained.				

Part 6 – Practical logbook and Professional Development

Clinical Skills and Procedural Proficiency Log Book				
NSQHS Standard 1				
Note: The logbook requirements below reflect expert consensus on the *minimum* case numbers needed to be eligible for formal workplace assessment. The logbook format may be expanded in future updates or by local workplace frameworks, drawing on broader documentation standards such as the BHRS Practical Logbook (2024).				
Log Book requirements (Independently performed under supervision of senior)	**Minimum number required prior to assessment of competency**	**Number achieved Y/N or N/A**	**Comments**	**Assessor initials**
ILR implants	10			
PPM Implants	50			
ICD implants	30			
CRT-P/CRT-D implants*	20			
CSP implants*	30			
ILR follow-ups *(in person or remote)*	20			
PPM follow-ups	500			
ICD follow-ups	100			
CRT-P/CRT-D follow-ups*	75			
CSP follow-ups*	75			
Remote monitoring - **Full** CIED Specialist role – *see Part 4 (a) contextual overview above*	300			
Remote monitoring - **Focussed** Remote Monitoring role *see Part 4 (a) contextual overview above*	1200			

* CRT-P/CRT-D and CSP cases must be counted separately from PPM and ICD cases, and are *in addition to* the required numbers for those categories. Each case should be recorded *once only*, under the most appropriate device type — do not double-count.

Note: Implants and follow up logbook numbers should, where possible, represent a variety of vendors and models.

Part 7 – Competency Evaluation Summary and Action Plan Template

A standalone summary table and action plan template that can be used with any section of the competency document (and re-used as required).

Method of Evaluation Key: Observation in clinical setting (O) Return Demonstration (RD) Written Test (T) Verbal Review (V)	**Outcome:** Expert/Mentor (E) Independent (I) Supervised (S) Development needed (D) Not Applicable/Assessed (N/A)	**Validation of Competency**			
		Method of Evaluation	**E I S D N/A**	**Comments**	**Assessor Initials**

Professional Development				
NSQHS Standard 1-10				
Actively engages in reflective practice of clinical and professional performance.				
Actively seeks advice and responds appropriately to feedback.				
Completes continuing professional development (CPD) activities at regular intervals*.				

*PiCSA recommends that Cardiac Device Physiologists are publicly registered with the ACCP as Accredited Clinical Physiologists (Cardiac) and complete at least 20 CPD points per year (www.theaccp.org.au). Formal certification—such as CCDS (IBHRE) or another approved option listed in PiCSA's Australian Guidelines for Entry and Practice in the Field of Cardiac Physiology —is also strongly encouraged and should be maintained (https://picsa.org.au/about/#core-documents). In addition, PiCSA advocates for **protected educational time and financial support** to be made available through employers, ensuring that Cardiac Device Physiologists are resourced to maintain competence, pursue continuing education, and meet certification requirements.

Assessor's Comments:

_____

_____

_____

_____

Participant's Comments:

_____

_____

_____

_____

Overall Assessment: ☐ Competent / ☐ Requires Supervision* / ☐ Requires Development*

* If the assessed individual 'Requires supervision' or 'Development Required", please use the "Agreed Action Plan" on the next page

Agreed Action Plan				
GOAL	**STEPS TO ADDRESS GOAL**	**DEADLINE (date)**	**ACCOUNTABILITY (Staff member and/or supervisor involved)**	**OUTCOME / ACTION POINTS**

Assessor's Signature: _____ Date: _____

Participant's Signature: _____ Date: _____

References and Supporting Materials

The following resources were consulted in developing this competency document. Some are directly cited, while others provided broader guidance or contextual support. References are grouped by theme, with occasional intentional duplication where a resource is relevant to multiple areas.

Training and Credentialing Resources

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CIED Programming, Monitoring, Follow-Up, and Clinical Standards

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MRI, Radiation and Surgical Management of CIED Patients

22. Nazarian S, Hansford R, Rahsepar AA, et al. 2017 HRS consensus on MRI and radiation in CIED patients. *Heart Rhythm*. 2017;14(7):e97–e153. doi:10.1016/j.hrthm.2017.04.025
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End-of-Life and Ethical Considerations

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Role of Industry

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Other Relevant Guidelines

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Appendix 1. Elements to document in device clinic records and to include in reports and correspondence as required.

Reproduced with permission from Leitch J, et al. Cardiac Society of Australia and New Zealand (CSANZ) Position Statement on the follow-up of cardiovascular implantable electronic devices 2022. *Heart Lung Circ*. 2022;31(8):1054-1063.)

[1,2] **Patient details:**	ID number, name, date of birth
[1,2]**Date of follow-up:**	
[1,2]**CIED category:**	PPM, ICD, CRT-P, CRT-D, ILR
[1]**Manufacturer and Model:**	
[1]**Implant date** (of CIED):	
Subsequent device surgery:	Date and brief details [1]Are any of the leads <3 months old
[2]**Remotely monitored:**	**Y/N/pending**
[1,2]**Indication** for CIED:	**PPM**: sick sinus syndrome, AV block, syncope, etc.
	ICD: primary or secondary prevention.
	CRT: LBBB, HF, QRS width, ejection fraction
	Additional relevant history: e.g., other heart pathology such as cardiomyopathy, IHD, valve surgery, EP intervention history, ejection fraction etc.
[1,2]**FDA/TGA Safety alerts** on CIED generator or lead(s) if applicable:	Comment as required
Abandoned (capped) leads in situ?	**Y/N**
[2]**MRI conditional** hardware?	**Y/N**
[1,2]**Battery status:**	e.g., time remaining till ERI, battery voltage, battery impedance
[,2]**Presenting rhythm**:	e.g., *"A sense V pace at ~65 bpm"* • Store IEGM trace • Measure and document surface ECG QRS width when required
[1]**Underlying rhythm** (if present):	e.g., *"complete heart block, V rate ~ 38 bpm"* • store IEGM trace
[1,2]**Pace Dependant:**	**Y/N** • Store IEGM trace (if manually demonstrated)
[1,2]**Basic key parameters:**	• [1,2]Pacing **mode:** ○ Using the generic/standardised letter coding system • [1,2]Pacing **rate** parameters: ○ [1]**Lower rate**: base rate & below base rate settings such as rest rate/night rate/hysteresis rate ○ **Exercise sensor rate** if applicable ○ **Upper track rate** if applicable e.g. *"DDDR, 60-130 bpm, exercise sensor rate 120 bpm, hysteresis 50 bpm"*
	• **ICD therapy** settings: ○ Monitoring zone if applicable ○ [1,2]Lowest heart rate for **ATP** delivery ○ [1,2]Lowest heart rate for **shock** delivery
[1]**Exercise "rate" response** sensor type if applicable	G sensor, Minute Ventilator, Closed Loop Sensor

[1]**Magnet response**	Specific to the CIED type, battery level and programming • [1]**PPM**: Mode, rate, rate response off, and any additional magnet related considerations *(such as pulse amplitude changes, or limited duration of asynchronous pacing)* • [1]**ICD**: Tachy therapy disabled, rate response off, and any additional magnet related considerations *[such as expected audible magnet alert tone (Medtronic, Boston), or shocks reactivated after 8 hrs (Biotronik), or changes to rate and pulse amplitude (e.g. MicroPort)]*
[2]**Clinical history:**	Determined by **patient interview** and **clinical observation** • Document any concerns about the wound, the device, and any other relevant symptoms
[1,2]Are the **lead test** results **satisfactory** and **stable?**	**Y/N/see comments**
CIED history since previous check:	Determined by evaluating CIED **stored events, numerical data and graphs** • Describe and store IEGM examples of diagnostically relevant rhythm events
• [2]**Percent pacing:**	Record percentage of pacing by each lead (RA, RV, LV, BiV)
• [2]**AF history:**	• Any previously reported history of AF (Y/N) • Overall burden: • Longest episode: • Most recent episode: • V rate during AF: (mean and peak)
• **SVT/NSVT/VT/VF** event history:	• Number and description of events (arrhythmia rate, duration and details of any therapy delivered) • Acceptable to write "no actionable rhythm events" if a detailed description is not warranted
• **Other relevant events:**	e.g., PMT/noise/magnet response/RNRVAS/oversensing/ undersensing/congestion/sleep apnoea
Compare all findings with previous reports	Comment as required
Programming optimisation (if required):	Document any adjustments performed (to ensure appropriate **safety**, **quality of life** and **battery life** outcomes)
[2]**Final rhythm** (if different to presenting rhythm):	Store IEGM trace and document surface ECG QRS width if required
[2]**Discussions with patient:**	Document **key conversation points** re patient education and support, e.g., *"Advised to speak to GP about sleep symptoms"*, or *"instructions given re remote monitor troubleshooting"*.
Correspondence with other health professionals:	Document correspondence made to other health professionals if additional (actionable) patient needs were identified during the CIED review.

[3]**Programmer generated report including ALL advanced parameter settings:**	The **programmer generated PDF**, will not be useful to non-CIED specialists, but must be generated and archived for expert reference during future CIED follow-up. • **Lead details** (including abandoned leads)**:** manufacturer, model number and date of implant • All **initial** programmed parameters • All **final** programmed parameters • Any **changed** parameters • **Lead test results** for each lead/coil as applicable: ○ Sensed amplitude ○ [1]Pace threshold ○ Impedance ○ [1, 2]**Adequate safety margins for the above** *Ensure documentation of the actual tests for quality control (e.g. save test strip IEGMs, and/or daily test trends showing stability and standard deviation values if provided)* • All **additional test results**, **device diagnostics,** and **relevant rhythm history,** Including performance graphs, battery data, numerical findings and relevant IEGMs.

[1] Items of special interest to anaesthesiologists

[2]Items most likely to be useful to a GP.

[3]The full programmer PDF is analogous to the image and data files generated by an Echo machine. It contains data that is essential for reporting, expert reference, and quality control, and should be archived by the CIED team (not left on the programmer or deleted).

Appendix 2. Document Contributors.

PiCSA Board of Directors

Luke Shanahan, QLD (Project lead)
Miriam Norman, TAS (PiCSA Chair)
Jenny Fong, VIC (PiCSA Secretary)
Alicia Donovan, WA (Elected Board Member)

Competency Standards Working Group

Jason Caruso, SA
Ciara Devoy, NT
Alicia Donovan, WA
Kelly Kokot, TAS
Jason Riley, QLD
Clayton Sciberras, QLD
Jessica Simpson, NSW
Troy Watts (Royal Melbourne capacity only), VIC
Jade Whatley, QLD
Nick Youngs, VIC

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Please note that participation in the consultation process does not imply formal endorsement of the final document.